



# Nova Innovation Ltd

---

## Environmental Monitoring and Mitigation Plan

### Shetland Tidal Array, Bluemull Sound

Clockhouse, Bonnington Mill

72 Newhaven Road

Leith, Edinburgh

EH6 5QG

Tel: +44 (0)131 554 2242

[www.novainnovation.com](http://www.novainnovation.com)

Author:	Gavin McPherson
Version:	1.1
Release Date:	30/07/2015
Total Number of Pages:	13 (including appendices)

Confidential

# CONTENTS

<b>1</b>	<b>INTRODUCTION .....</b>	<b>3</b>
<b>2</b>	<b>THE LOCATION – BLUEMULL SOUND.....</b>	<b>4</b>
<b>3</b>	<b>ENVIRONMENTAL MONITORING PLAN .....</b>	<b>5</b>
3.1	PRE-DEPLOYMENT BIRD AND MAMMAL SURVEY – OLD METHODOLOGY .....	5
3.2	UPDATED SURVEY METHODOLOGY .....	6
3.3	PRE-DEPLOYMENT BENTHIC SURVEY .....	8
3.4	POST-DEPLOYMENT ENVIRONMENTAL SURVEYING & MONITORING .....	8
3.5	SHUTDOWN PROCEDURE .....	11
3.6	REPORTING .....	11
<b>4</b>	<b>ENVIRONMENTAL MANAGEMENT .....</b>	<b>12</b>
<b>APPENDIX A</b>	<b>EXAMPLE SITE SURVEY REPORT .....</b>	<b>13</b>

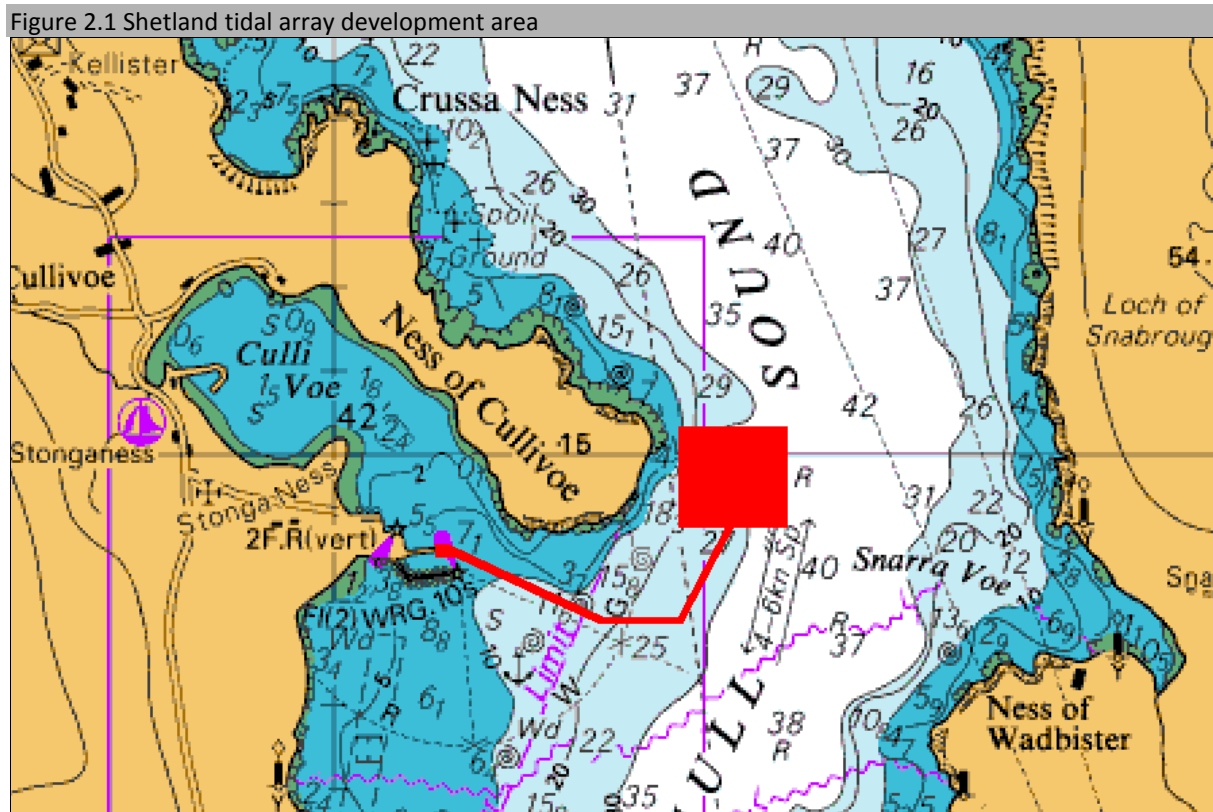
## 1 Introduction

Nova Innovation implements an integrated Health, Safety and Environmental (HSE) policy that underpins everything we do. For individual projects the company produces an Environmental Monitoring and Mitigation Plan (EMMP) specific to the project. This document details our EMMP for the Shetland Tidal Array project in the Bluemull Sound. It outlines how we will meet our environmental requirements with particular reference to the conditions set down by Marine Scotland.

## 2 The location – Bluemull Sound in Shetland

The Bluemull Sound is situated between the islands of Yell and Unst in the north of the Shetland Islands. The site for the proposed array is approximately 200 metres east of the Ness of Cullivoe. The array will be located in water 25-40m deep with a separate sub-sea cable running from each device back to land via Cullivoe pier.

Figure 2.1 illustrates the location of the array. The turbines will be located in the area delineated by the red box, as per the Shetland Island Council Works License and Crown Estate Lease. The exact location of each turbine within the development area will be decided after a final detailed site survey undertaken prior to deployment. The red line shows the approximate route of the subsea cables from the array back to the Cullivoe pier.



Source: Copyright © Nova Innovation 2015 and Ordnance Survey

### 3 Environmental Monitoring Plan

#### 3.1 Pre-deployment bird and mammal survey – old methodology

Conditions set down by Shetland Islands Council (SIC) and Marine Scotland included the requirement for Nova Innovation to conduct pre-installation surveys as described below. The surveys started in November 2010 and are currently on-going.

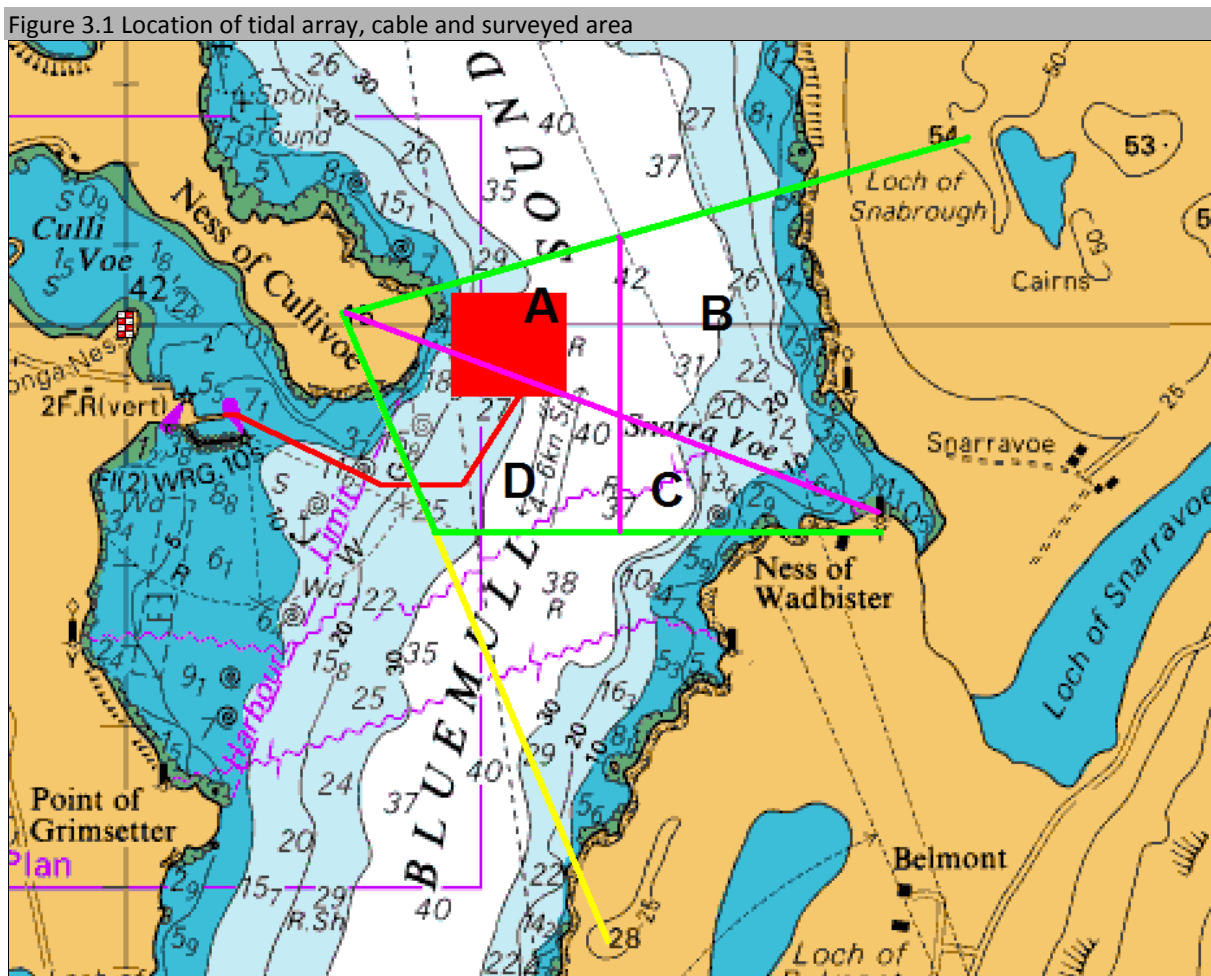
In light of feedback from statutory consultees, we propose to change this survey methodology in future. The updated survey methodology is described in Section 3.2 below.

##### 3.1.1 Aim

The aim was to survey bird and mammal activity on the site of the tidal energy array. The survey covers diving birds, cetaceans, seals and other natural activity as detailed in the Marine Scotland License.

##### 3.1.2 Survey Area

Cullivoe is situated on the island of Yell in the north east of the Shetland Islands. The map in Figure 3.1 shows the proposed site of the tidal array. The red square illustrates the area within which the tidal array is licensed to be deployed. The red line back to shore shows the proposed route of the cable. The green lines outline the area covered by the survey. The pink lines divide this survey area into four areas: A, B, C and D. The yellow line illustrates the trajectory of the marking point for the survey boundary.



As recommended by SNH, the area being surveyed was larger than the deployment area. This was to improve the survey data for diving birds and mammals and allow for future deployment of additional turbines.

### 3.1.3 Duration and times

The surveys started in November 2010 for the deployment of the Nova 30 turbine on the same site in April 2014 and have been ongoing since. Surveys will continue up to commissioning of the array and for a period following using a new methodology, as described in Section 3.2 below.

Initial surveys were carried out weekly for the first four weeks in November 2010. Each survey lasted for a period of 4 hours. After the first month, the surveys were carried out three times a month (12 hours total) covering all daylight hours and tidal states (slack/stream). The surveys have continued at this frequency (three times a month) and will continue at this rate until August 2015, from which time the methodology described in Section 3.2 will be employed. Observations were recorded in 10(birds)/20(mammals) minute periods and cover all relevant species. Bird surveys were not carried out in sea states greater than 4. Mammal surveys were not carried out in a sea state greater than 3.

### 3.1.4 Method of Observation

The recordings were made on a pro-forma and categorised into two zones:

Zone 1 (array zone): The area within the immediate vicinity of the proposed array.

Zone 2 (survey zone): The survey area surrounding the array delineated by the green lines across the Sound in Figure 3.1. Zone 2 is further divided into areas A, B, C & D.

Notable observations outside the survey zone were also recorded. The observations were carried out from the Ness of Cullivoe by suitably qualified personnel. The area surveyed was marked out using transit sticks from the observation point as well as markers on the Unst shore. Observation was by means of binoculars backed up with telescopes. Observations of diving birds, cetaceans, seals and other natural activity were recorded. Only diving or surface birds were recorded – no flying birds. The location and direction of movement of mammals was also recorded. Bird behaviour (i.e. surface / diving) was only recorded in Zone 1. All relevant species were recorded.

## 3.2 Updated survey methodology

Following feedback received from statutory consultees during the consenting process, the survey methodology described in Section 3.1 above has been modified as detailed below. The new survey methodology will be put into place in August 2015.

### 3.2.1 Aim

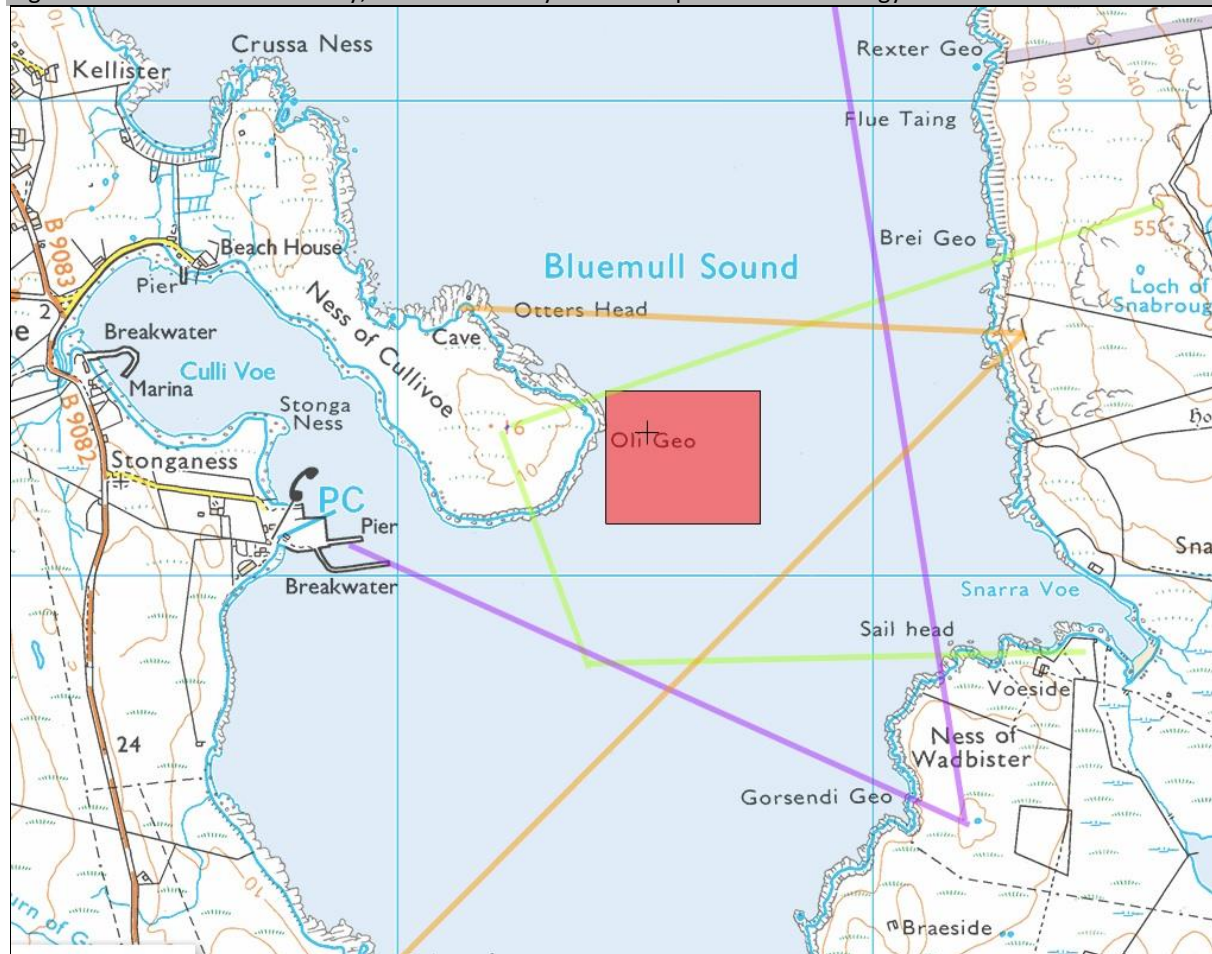
The aim of the survey is to capture the presence and activity of birds and mammals in the area of the tidal array. The survey covers diving birds, cetaceans, seals, otters and other natural activity as detailed in the Marine Scotland License. The methodology has been updated to improve the quality of the survey outputs.

### 3.2.2 Survey Area

Figure 3.2 shows that the survey area is the same as before. However, there will now be two vantage points located at either side of the Sound:

- Green lines (Ness of Cullivoe) show the existing vantage point and coverage
- Purple (Ness of Wadbister) and orange (Loch of Snarsborough) lines show two additional vantage points
- The red box shows the development footprint

Figure 3.2 Location of tidal array, cable and surveyed area – updated methodology



Source: Marine Scotland

All surveys will include an observer at Ness of Cullivoe. An additional observer will be located at one of the vantage points on the other side of the Sound. This will improve the coverage and accuracy of the survey, and allow correction of bias.

### 3.2.3 Frequency and duration

Initial surveys will be carried out weekly for the first four weeks following deployment of the first turbine. Each survey will last for a period of 4 hours; surveys will cover all daylight hours and tidal states (slack/stream). Observations will be recorded in consecutive 20 minute intervals: first for birds, then for mammals, covering all relevant species. Bird surveys will not be carried out in sea states greater than 4. Mammal surveys will not be carried out in a sea state greater than 3. Survey sessions will be separated by at least 3 days.

After the first month a power analysis will be conducted to determine the number of surveys required to provide sufficient data. Subsequent surveys will be carried out for a further 5 months. At this point a report will be produced for Marine Scotland, including analysis and findings from initial post-installation surveys. Surveys will continue for a period of one year following the installation of the final turbine in the array. Since deployment is planned to occur in two phases in 2015 and 2016, surveys will be undertaken for a total of two years.

After a period of testing the simultaneous surveys it may be possible to calculate correction factors that allow single vantage point surveys to be adjusted to take account of imperfect detection due to distance. Any changes to the survey methodology will be agreed with Marine Scotland.

### 3.2.4 Reporting

Reports will be provided to Marine Scotland at a frequency of 6 months following implementation of the new survey methodology. Each report will include analysis of data and findings from the preceding survey period.



### 3.2.5 Method of Observation

Each 4 hour survey will be split into a twenty minute bird sweeps (count) followed by a twenty minute marine mammal sweep. Each survey period therefore has six, twenty minute bird observations and six, twenty minute mammal observations. Each marine animal count will be a 'sweep' in the direction against the flow of the tidal stream.

Observations of diving birds, cetaceans, seals and all relevant species will be recorded. Only diving or surface birds will be recorded – no flying birds. The number and activity of animals (on or in water), the size of groups, the bearing and distance to individual or group will all be recorded on a pro-forma sheet. The tidal flow will be recorded during each 20 minute sweep. An example sheet showing what will actually be recorded for each observation period is included in Appendix A.

Occasional surveys will include estimates of dive times from the species encountered under specific conditions, in order to enable compensation for availability bias and improve the estimates of densities of seabirds and marine animals.

The observations will be carried out by suitably qualified personnel. The area surveyed will be marked out using transit sticks from the observation point as well as markers on the opposite shore. Suitable equipment for the survey will be determined by the qualified surveyor selected for the work, with reference to the advice provided by Marine Scotland on 26 May 2015 (*Recommendations for improvements to survey methods for the array*).

### 3.3 Pre-deployment benthic survey

A video survey of the site and cable route will be conducted using a subsea camera sled lowered from a survey vessel. The survey will identify the location and extent of any benthic habitat or species on the recommended Marine Priority Features list. The survey will be used to inform the precise location for device and cable deployment.

### 3.4 Post-deployment Environmental Surveying & Monitoring

The environmental surveys carried out pre-deployment will continue to be carried out during installation and post deployment for a period as described in Section 3.2.3.

Both manual and automated monitoring of the array will be carried out during the initial post-deployment period of the array. Manual monitoring will consist of a Nova Innovation member of staff directly overseeing the operation of the turbine and environmental monitoring. Automated environmental monitoring will comprise impact sensors and motion-triggered video capture to detect and review any collisions (see Section 3.4.1).

Monitoring levels will be phased to correspond to confidence levels in the array after deployment. Both manual and automated monitoring, backed up by the ongoing surveys, will be used to evaluate the array and to cross-check and verify the validity of each monitoring method used. The phased post-deployment monitoring levels can be broken down into the following:

#### Phase 1 – First Month (Automated & Manual Monitoring)

For the first month following deployment of each turbine the automated monitoring system described above will be operated alongside an observer to verify operational integrity. Should any detrimental environmental impact be observed then the device concerned will be shut down manually.

#### Phase 2 – Normal Operation (Automated Monitoring)

After one month of operation and assuming no adverse effects, it is anticipated that the standard operational procedures for monitoring the array will be adopted – i.e. the systems will be able to be monitored remotely from the Nova Innovation office in Leith, 24 hours a day, 365 days a year. Should any adverse effect be recorded by the impact and visual sensors, notification will be sent to Nova personnel. An inspection of the impact profile is then made and the device concerned or the array will be operated as deemed appropriate.



### 3.4.1 Video monitoring

#### Objectives

The objectives of video monitoring from the perspective of this EMMP are:

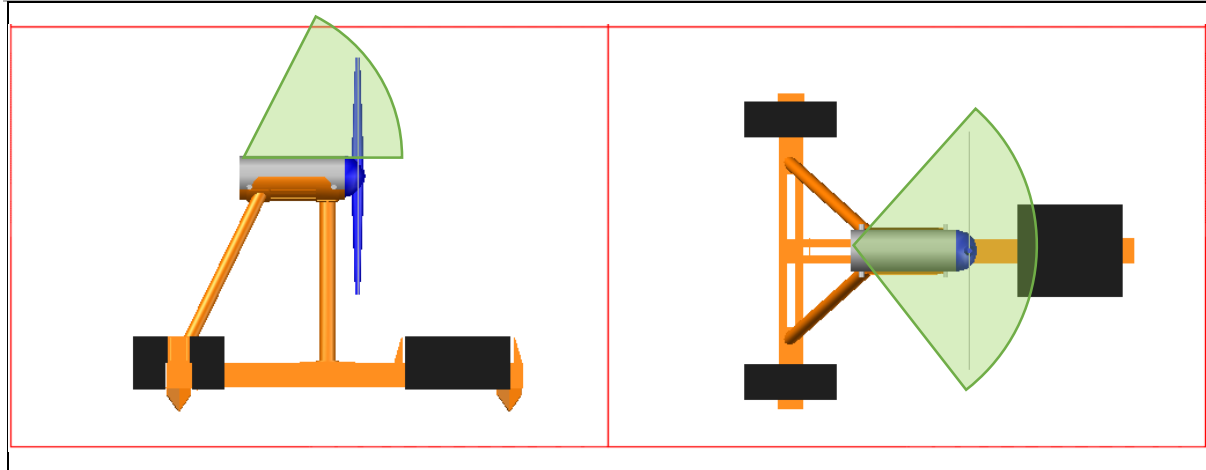
1. to observe interactions of the turbine with wildlife;
2. to identify interaction between wildlife and the rotor (if any)
3. to understand the nature of the interaction, and identify whether an animal has been harmed.

#### Camera placement

Video monitoring will take place using a camera located on the top of the turbine nacelle, as shown in Figure 3.3. The turbine is not illuminated, so video monitoring will only be effective during daylight hours.

The camera installed on the first turbine deployed will have a more limited field of view than that shown in Figure 3.3. For subsequent turbines the camera system will be designed such that it covers approximately half the swept area of the rotor, as shown in Figure 3.3.

Figure 3.3 Video camera placement and view



Source: Marine Scotland

#### First level triggering

The camera will be connected to a standard CCTV system with a motion trigger. This system has been successfully installed and tested in the Nova 30 demonstrator turbine at the same site. This means that the camera will record continuously whilst the turbine is rotating, and so a second level trigger will be required to identify potential interaction events during this period.

#### First level trigger calibration

Calibration is required to identify the range and sensitivity of the triggering mechanism. Calibration will be conducted using a “dip test” where the camera is suspended underwater, objects of various sizes and colours are moved within the field of view of the camera and the triggering response of the system recorded. This test will either be conducted using a camera installed on a nacelle or using a stand-alone camera.

#### Live animal camera testing

Nova Innovation will collaborate with Marine Scotland to determine whether and how camera tests in the presence of marine animals can be undertaken. These tests would determine the sensitivity of the trigger to different animals at different ranges, and could also be used to assess how well different animals can be identified by the camera as a function of range.

#### Second level triggering

A post-processing trigger will be required to identify potential interaction events that occur whilst the turbine is rotating. Nova Innovation will work in collaboration with Marine Scotland to develop and test potential post processing algorithms designed for this purpose.

## Biofouling

During operation, biofouling will eventually render the video output unusable. For a previous deployment in Bluemull Sound usable footage was collected for approximately 10 weeks following deployment. Different methods for improving the longevity of useful footage will be explored in partnership with Marine Scotland; this could include (for example) novel lens coatings and physical protection methods. Cameras will be cleaned when the turbine nacelle is removed for maintenance.

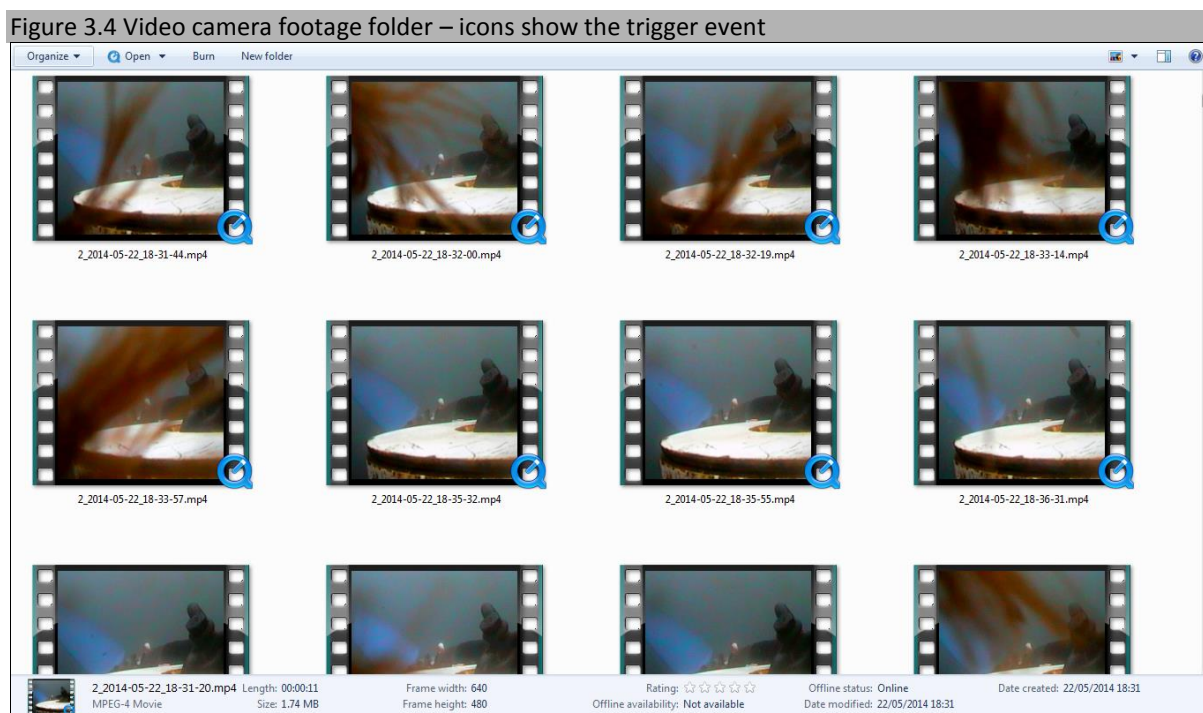
### 3.4.2 Video reporting

Recorded footage will consist of (A) triggered events whilst the device is not operational and (B) continual footage taken during operation. Once a working second level trigger is devised then a further sample will be available: (C) triggered events during operation (a subsample of B).

### 3.4.3 Sampling for the video report

#### Initial review of footage icons

An initial review will be made of all video footage by visually inspecting the file icons for each sample. The icons record the picture taken when the footage was triggered – a sample from Nova 30 footage is shown in Figure 3.4.



Source: Copyright © Nova Innovation 2015

All events in which animal interaction is suspected or for which the trigger event is not obvious will be viewed by a Nova Innovation engineer. Confirmed animal viewings or interaction events will be noted and included in the report to Marine Scotland.

#### Survey period review

All video footage taken during the same period as a bird and mammal survey (4 hour period) will be visually reviewed to see if any birds or mammals are picked up by the camera. The outcomes of this review will be summarised in reports to Marine Scotland.

#### Random sampling

Following initial review, collected footage will be randomly sampled for visual inspection. The samples will be representative of the device operational profile: i.e. if the device is operational for 20% of the reporting period

then at least 20% (by time) of the footage sampled will be from the operational period. The outcomes of this review will be summarised in reports to Marine Scotland.

**Observed collisions**

In accordance with the EPS and Basking Shark licenses for the project, should a collision of the turbine with a marine mammal or basking shark be observed then operation of the array will cease and Marine Scotland will be informed as soon as possible.

**3.5 Shutdown Procedure**

At any point in time all devices in the array will be capable of being rapidly and securely shut down – either remotely, or manually on-site.

**3.6 Reporting**

The survey methodology will continue during installation and after deployment for a period as described above. Reports will be submitted to Marine Scotland every six months following deployment.

## 4 Environmental management

A Construction Method Statement (CMS) has been prepared which details the offshore operations associated with the Shetland Tidal Array – please see associated document *Shetland Tidal Array CMS.doc*. We mention here some points from the CMS which are relevant to the environmental mitigation for the project.

### **Marine non-native species**

The risk of introducing marine non-native species in this project is very low:

- All project operations will be conducted by workboats based in UK waters.
- All subsea materials will be immersed only in Scottish waters.

### **Scottish Marine Wildlife Watching Code**

During all offshore operations we will adhere to the good practice guidelines associated with the Scottish Marine Wildlife Watching Code.

## Appendix A Example site survey report

Figure A.1 Example site survey report

<b>Date</b>	XXXX		<b>Sea/tide</b>		HT 1204. Falling. Weak S-N current		
<b>Start time</b>	XXXX		<b>Wind speed/direction</b>		SW4		
<b>Observer</b>	XXXX		<b>Cloud cover/precipitation</b>		cc8/8 dry		
<b>Location</b>	XXXX						
	<b>Time period</b>		<b>Direction from</b>	<b>Distance</b>	<b>Activity,</b>	<b>Direction of</b>	
	1-12: odd=bird,		observer,	from	S=Surface	movement,	
<b>Species</b>	even=mammal	<b>Number</b>	<b>bearing</b>	<b>observer, m</b>	<b>D=Diving</b>	<b>N,E,S,W</b>	<b>Comments</b>
Black guillemot		1	4	90	300 S	N	
European shag		1	1	120	500 D	N	
Common seal		2	2	85	700 S	S	
Great black-backed gull		3	1	110	400 D	N	
Black guillemot		3	3	80	1000 S	N	
...							
<b>Notes</b>							
160 mins - current strong S-N							

Source: Nova Innovation 2015