

Project Title/ Location	MeyGen Tidal Energy Project, Phase 1a. Inner Sound.
Date:	15/06/2016

MeyGen Tidal Energy Project Phase 1a Marine Licence Application – Seabed Preparation Works Addendum



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EXECUTIVE SUMMARY

This document provides information to support an application for a Marine Licence for seabed preparation works that are required to support Turbine Support Structure No.4 (TSS#4) for the AR 1500 Tidal Turbine Generator (TTG) that is being installed as part of the MeyGen Phase 1a Project.

The requirement for seabed preparation works emerged following a video survey carried out to confirm the suitability of the selected TTS locations. The video survey found the present location for TSS#4 to be very rough and covered with a number of fractures and loose boulders rendering it unsuitable on the basis that the 1250Te TSS#4 foundation would be unstable without seabed preparation works.

A number of alternative locations were then assessed for TSS#4. Unfortunately, none of the alternative locations identified met all of the technical requirements for the TSS installation criteria.

Given that there are no alternative suitable sites, the options available to MeyGen is to either (i) carry out seabed preparation works at the present location, or (ii) at an alternative revised location within the Phase 1 boundary (co-ordinates below) with or without seabed preparation, the exact location will be confirmed after detailed micro-siting assessment by MeyGen and the Marine Contractor.

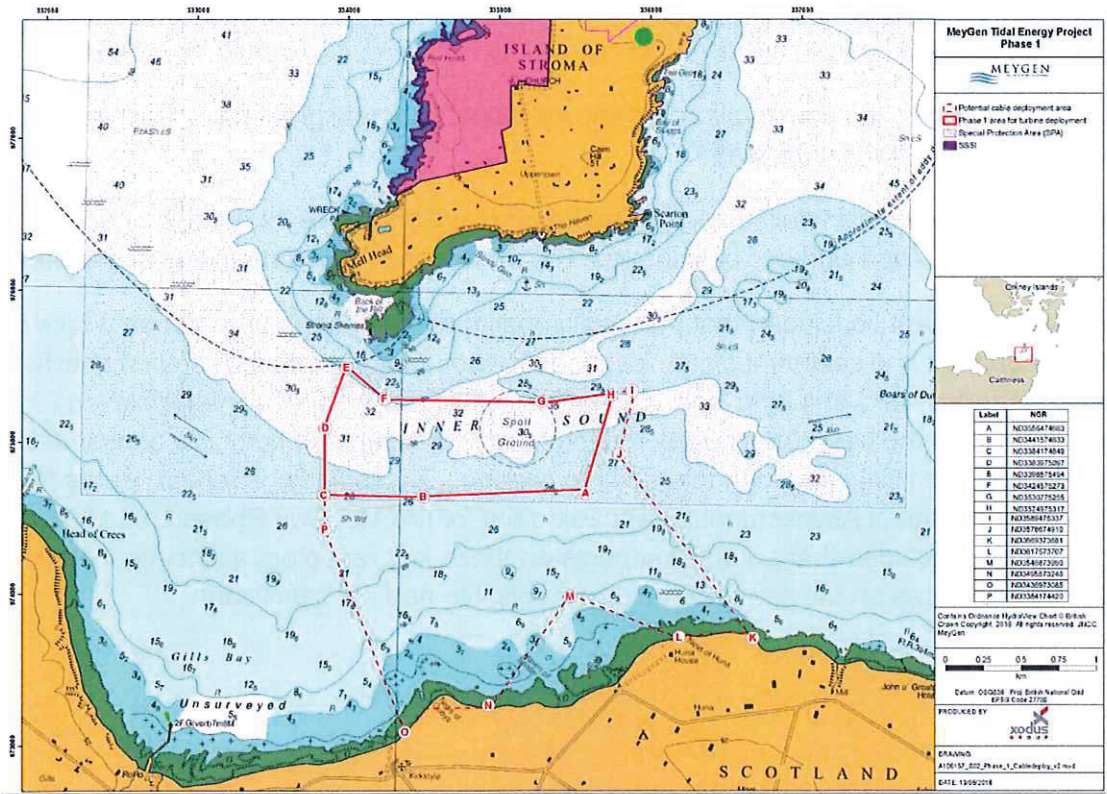


Figure 1 MeyGen Phase 1 Boundary

Label	NGR
A	ND3556474683
B	ND3441574633
C	ND3384174649
D	ND3383975097
E	ND3398575494
F	ND3424575273
G	ND3530775255
H	ND3574975317
I	ND3589475337
J	ND3578674910
K	ND3669373681
L	ND3617573707
M	ND3546873990
N	ND3495573248
O	ND3436973085
P	ND3384174420

Figure 2 Co-ordinates (National Grid Reference) Phase 1 boundary

The seabed preparation works will involve:

- Raising the level of the seabed locally under the TSS feet locations to provide additional seabed clearance; and
- Creating a level bearing surface upon which the AR 1500 TSS would be deployed.

These works will involve the construction of three individual concrete grout pads, each of which will support one of the three TSS feet.

In order to meet the overall installation programme for MeyGen Phase 1a, it will be necessary for the seabed preparation works to be completed by the second August neap tide at the latest.

The impact assessment concluded that potential impacts of the seabed preparation works on physical environment and sediment dynamics; benthic habitats and species; fish and shellfish; commercial fisheries; and shipping and navigation concluded would be negligible and not significant. This is on the basis that the key receptors are considered to be of low conservation value / are of low sensitivity and high tolerance to change. These findings reflect results from the Environmental Impact Assessment (EIA) carried out for the MeyGen Phase 1 86 MW tidal array which also concluded that potential impacts on these key receptors associated with the installation of structures on the seabed would be negligible and not significant.

2 SEABED PREPARATION MEASURES

2.1 Background

The locations for the four TSSs for MeyGen Phase 1a were determined by micro-siting using the high definition bathymetry data. The requirement to carry out seabed preparation works emerged following a video survey carried out to confirm all the TSS locations identified during micro-siting are suitable. The video survey highlighted that the location proposed for the deployment of TSS#4 is very rough and covered with a number of fractures and loose boulders (Figure 3: Image TSS#4 SE foot location) and therefore is not suitable as the 1250Te TSS#4 foundation would be unstable without seabed preparation works.

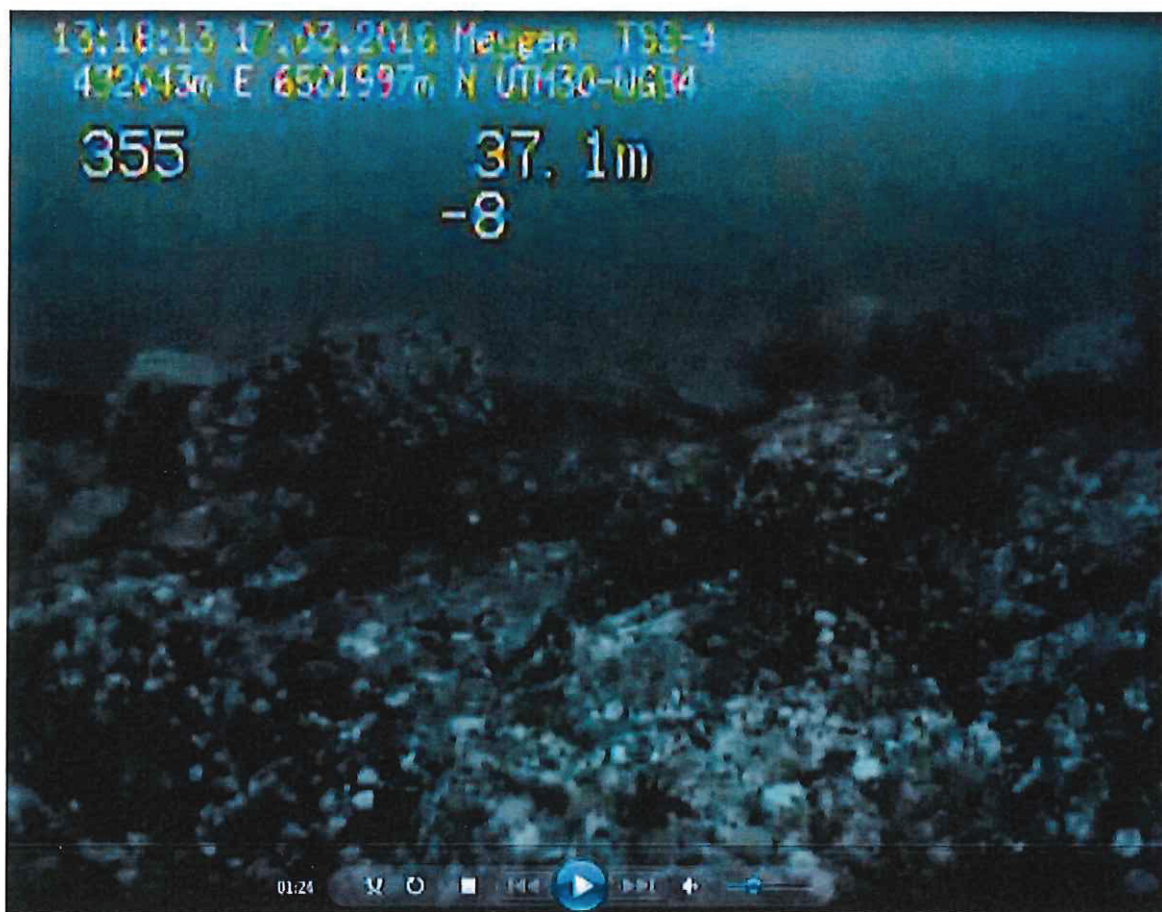


Figure 3: Image TSS#4 SE foot location

Given that there are no alternative suitable sites, the options available to MeyGen are to either (i) carry out seabed preparation works at the present location, or (ii) at an alternative revised location within the Phase 1 boundary with or without seabed preparation works.

1 INTRODUCTION

This document is an addendum to the Marine Licence application, prepared under The Marine (Scotland) Act 2010, for seabed preparation measures required to support one of the Turbine Support Structures (TSSs) for the AR 1500 Tidal Turbine Generator (TTG) being installed as part of the MeyGen Tidal Energy Project Phase 1a.

The MeyGen Phase 1 Tidal Energy Project already has consent under Section 36 and a Marine Licence for up to 61 Tidal Turbine Generators (TTG), Turbine Support Structures (TSS) and Turbine Subsea Cables (TSC) in the Inner Sound of the Pentland Firth.

Phase 1a of the MeyGen Project is a 6 MW, 4 tidal turbines initial phase to be installed and operated under the restriction placed on the Project by Condition 2 of the Section 36 Consent.

2.2 Requirement for an alternative TSS location:

The technical requirements for a suitable revised re-location of the TSS#4 are as follows:

1. Homogeneous founding surface; competent bedrock without loose boulders;
2. Location within reach of the already installed export cable;
3. Max slope of 2.5 degrees of the plane joining the three TSS feet locations;
4. Max seabed slope of 6.5 degrees under the individual TSS feet; and
5. A minimum of 100 mm clearance between the seabed and everywhere underside of the TSS structure.

Unfortunately, a suitable site that satisfied all of the above criteria was not identified. Therefore, it has been necessary to select a least worse location. A potential revised location for TSS#4 is shown in Table 1 below:

Present location	492036.6 / 6502003
Potential revised location	492008 / 6502020

Table 1: Present and potential revised locations for TSS#4

Please note the exact location for TSS#4 and its associated seabed preparation within Phase 1 boundary will be confirmed after a detailed micro-siting assessment by MeyGen and the Marine Contractor.

The seabed preparation works that are outlined below for this potential revised location are representative of the extent of the works that will be conducted at the preferred finalised location derived from the micro-siting assessment.

Figure 4 shows the relative orientation of the present location to the potential revised location 492008/6502020, located 33m distance and WNW from the present location.

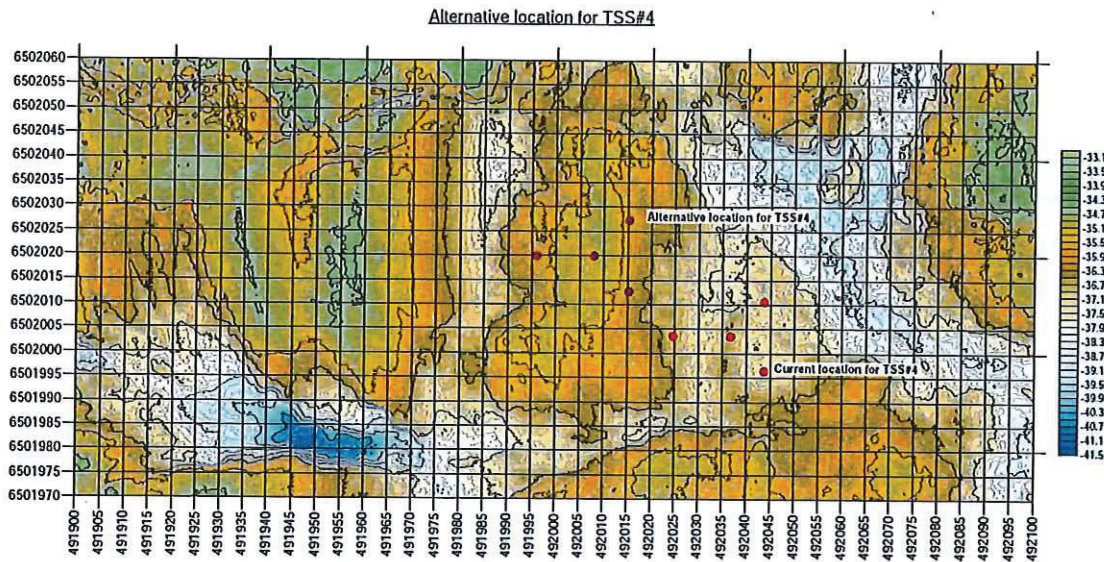


Figure 4: TSS#4 Present and potential revised locations (402008_6502020_Elevation)

2.3 Design requirement and seabed topography

This potential revised location has a suitable seabed composition. However, there are issues with the seabed topography in that the TSS would need to straddle a low ridge (Figure 3). The consequence of this is that this potential revised location conflicts with the following design requirements:

	Design requirement	Revised location
Slope	TSS feet have to be within 6.5 degrees of parallel to the underside of the TSS.	The rear slope is up to 17 degrees.
Underside clearance	100 mm clearance between the seabed and the underside of the TSS structure between the feet locations.	Ridge exceeds the underside clearance of the TSS.

Table 2: Design requirement conflicts at potential revised location for TSS#4

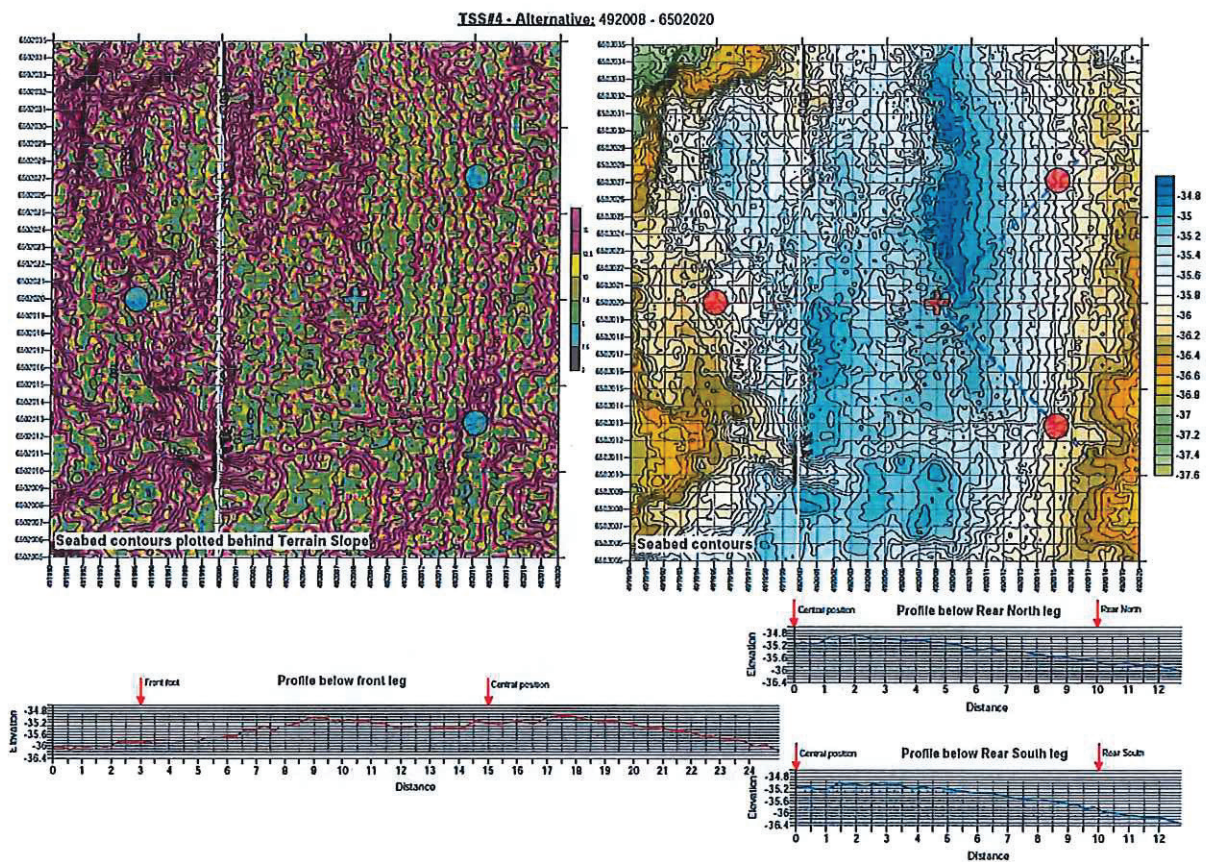


Figure 5: TSS#4 – 492008_6502020_Terrain

2.4 Proposed solution

MeyGen are proposing to carry out seabed preparation works which will include:

- Raising the level of the seabed locally under the TSS feet locations to provide additional seabed clearance; and
- Creating a level bearing surface upon which the AR 1500 TSS would be deployed.

A detailed installation method is still under development by the Marine Contractor. The seabed preparation works will entail the construction of three individual concrete grout pads. Each pad will comprise:

- Permanent steel frame supporting a steel or fabric formwork with approximate overall dimension 6m x 4m x 1.0m (average) (but less than 1.5m at any point);
- Steel reinforcement within the shutter to confine the concrete grout; and
- Steel or fabric formwork filled with concrete grout.

The fabric formwork would be of a material similar to a grout bag.

The layout of pads is shown in Figure 6: MEY-1A-70-DWG-015-I-TSSFootOnly.

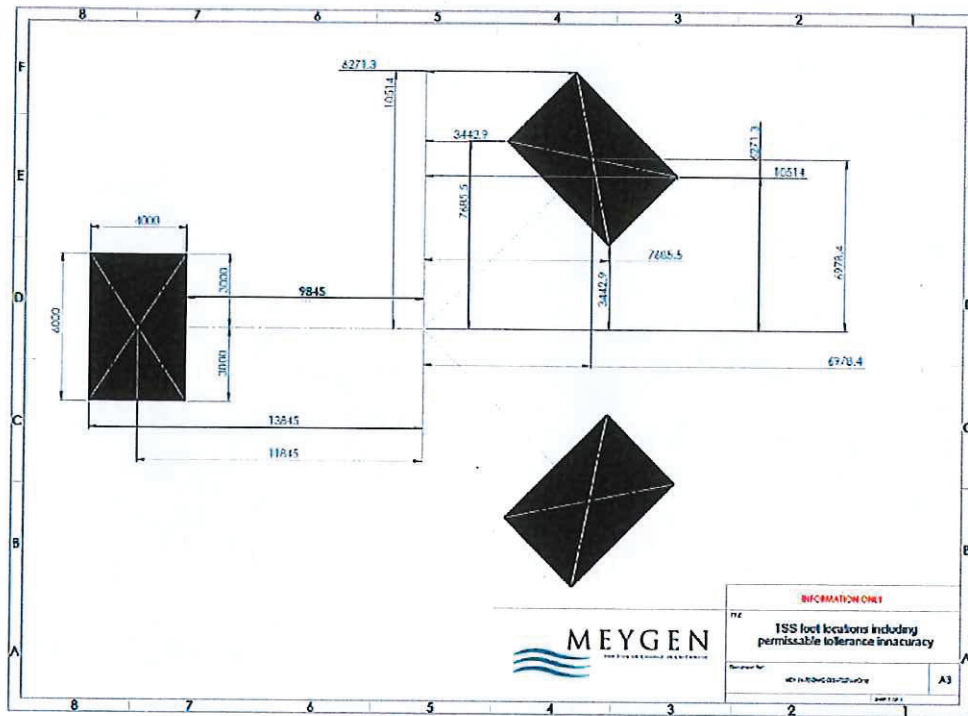


Figure 6: MEY-1A-70-DWG-015-I-TSSFootOnly

Further details of the pads in plan and side elevation are shown diagrammatically in Figure 7.

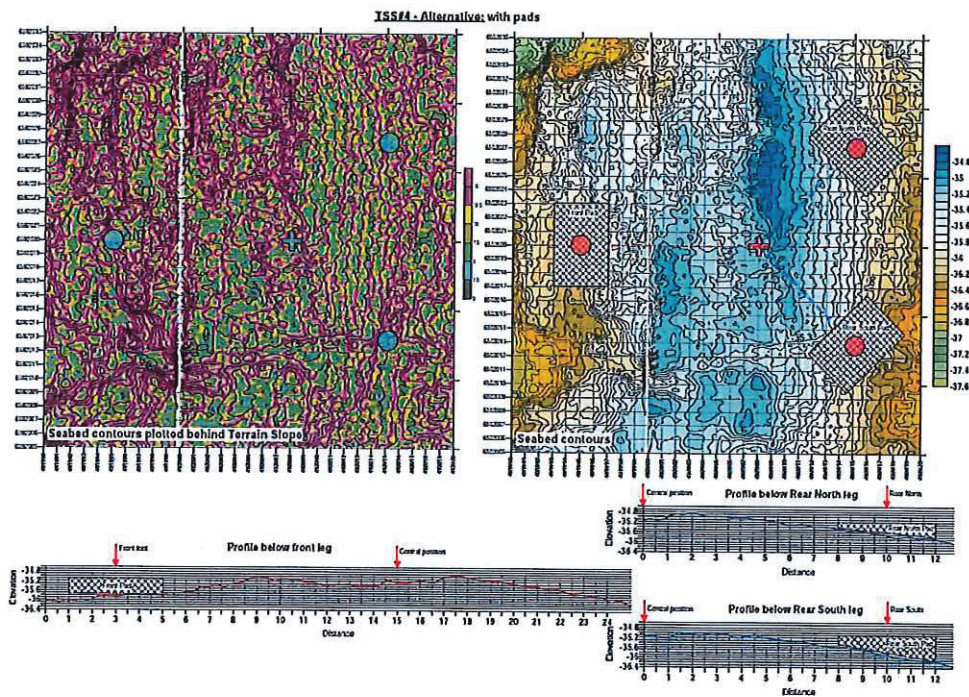


Figure 7: TSS#4-492008_6502020_with pads

2.5 Quantities of materials

The present Marine Licence (Reference: 04577/15/0) authorises the deposit of the undernoted substances and objects required in connection with the works for no more than 61 turbines, subject to the maximum amounts specified below:

- Steel – 140,180 tonnes
- Concrete - 17,200 m³
- Cable - 111,800 m

The estimated quantities of materials for all three pads compared with quantities included in the Marine Licence are summarised below:

Materials	Quantities (per pad)	% materials included in Marine Licence
Frame / formwork	< 5t steel	0.02 %
Reinforcement	4.5t steel	
Concrete grout	24 m ³	0.42 %

Table 3: Quantities of seabed preparation materials

2.6 Timings

The installation programme for Phase 1a is summarised in Table 4 below.

Component	Delivery Date
Enabling Works for TSS#4	08 th August 2016 – 26 th August 2016
Installation of TSS#1, TSS#2, TSS#3 and TSS#4	11 th September 2016 – 20 th September 2016
Installation of TTG#1 and TTG#4	12 th September 2016 – 10 th October 2016
Installation of TTG#2 and TTG#3	13 th October 2016 – 10 th November 2016

Table 4: MeyGen Phase 1a installation programme

The seabed preparation works will need to be completed ahead of the installation of TSS#4 and can only be carried out during a neap tide. Therefore, in order to achieve the installation programme set out above, the latest possible date for completion of the seabed preparation works is the second August neap tide.

The consequence of not achieving these dates is that the TSS installation will be delayed. The knock on effect of which would be that installation of MeyGen Phase 1a TSS#4 and TTG#4 could be delayed until the following year which will have a significant impact upon the viability of the MeyGen Project.

3 POTENTIAL ENVIRONMENTAL IMPACTS

3.1 Introduction

The seabed preparation works will involve the deposition of materials directly onto the seabed. With regard to potential impacts on the environment key sensitive receptors include:

- Physical environment and sediment dynamics;
- Benthic habitats and species;
- Fish and shellfish;
- Commercial fisheries; and
- Shipping and navigation.

Potential impacts on these receptors are described below. These reflect findings from the Environmental Impact Assessment (EIA) of the full 86 MW tidal array with regard to impacts associated with the installation of structures (TSSs and cables) on the seabed.

3.2 Physical environment

Potential impacts on the seabed and sediment dynamics associated with the seabed preparation works include:

- Direct physical changes in seabed morphology; and
- Changes in sediment dynamics.

The majority of the seabed within the Project area for the full 86 MW array comprises scoured bedrock with deep fissures, cracks and boulders. Sediment is only present across 1.8% of the entire Project area.

With regard to physical changes in seabed morphology, the seabed preparation works will result in the introduction of hard structures to the seabed. Although there is potential for these structures to physically alter the structure and topography of the seabed these changes will be highly localised, affecting a total area of 72 m² (approximately 0.006% of the total seabed within the Project area). As discussed in the Environmental Statement (ES), due to its character, the seabed within the Project area is considered to be highly tolerable to physical change. Therefore, given the highly localised nature of changes to the seabed any potential direct physical impacts on seabed morphology will be negligible and not significant.

As part of the EIA, hydrodynamic modelling was carried out to inform the assessment of potential impacts on sediment dynamics associated with the presence and operation of the TTGs. The modelling concluded that due to a lack of net sediment transport in the Project area, potential impacts on the sediment dynamics for the full 86 MW array were negligible and not significant.

Based on these conclusions, and given that the seabed is highly fractured and irregular it is extremely unlikely that introduction of the pads at the location for TSS#4 would have any impact on sediment processes in the Project area.

3.3 Benthic habitats and species

Potential impacts on benthic habitats and species associated with the seabed preparation works include:

- Direct habitat loss and disturbance; and
- Introduction of new hard structures.

Results from the benthic survey carried out as part of the EIA of 86 MW array conclude that there are no habitats or species of conservation importance present in the Project area. The species that are present are generally common and widespread (ASML, 2011).

Given that sediment is only present across 1.8% of the project area potential impacts associated with suspended sediment and re-settlement resulting from seabed disturbance were scoped out of the EIA and therefore also do not require assessment as part of this Marine Licence application.

With regard to potential impacts resulting from direct habitat loss and disturbance, as described in the ES, the conservation importance of any habitats and species present in the Project area is considered to be low and expected to recover rapidly from any direct impacts. Given that the proposed seabed preparation works will be highly localised (restricted to the location for TSS#4 only), potential impacts on benthic habitats and species will be negligible and not significant. These reflect findings from the EIA for the full 86 MW array which also concluded that direct impacts on, and loss of, benthic habitats and species would be negligible and not significant.

The proposed seabed preparation works will result in the introduction of new hard structures into the Project area. However, given that these structures will present a habitat similar to the hard bedrock and boulders already present in the area, where colonisation of the pads occurs this is likely to be by epifauna and encrusting animals typical of the area rather than new species. The habitats and species in the area are considered to be of low conservation value. Therefore, given the small footprint of the seabed preparation works any potential impacts resulting from the colonisation of the pads will be negligible and not significant. These findings reflect the conclusion from the EIA for the 86 MW array which were also assessed to be negligible and not significant.

3.4 Fish and shellfish

Potential impacts on fish and shellfish associated with the seabed preparation works include:

- Direct impact on, and loss of, shellfish and shellfish habitat; and
- Direct impact on fish spawning and nursery habitats.

There are a number of fish species likely to pass through or be present in the Inner Firth and therefore the Project area while the seabed preparation works are taking place. However, due to the mobile nature of these species and the highly localised, small scale and limited duration of the seabed preparation works (e.g. few days) there will not be any impacts on these species.

In terms of potential direct impacts on shellfish species and habitat, key species identified as being present in the Project area include lobster, brown crab and velvet crab (MeyGen, 2011 and ASML, 2011). Seabed preparation works may result in the direct loss of habitat for these species. However, given the mobility of these species, and the highly localised nature of the proposed works, it is expected that any affected shellfish species will be readily able to find alternative suitable habitat elsewhere within the Project area and wider Inner Sound. Potential impacts on shellfish will therefore be negligible and not significant. These conclusions reflect findings from the 86 MW array EIA which concluded that direct impacts on shellfish and shellfish habitat for the full array would be negligible and not significant.

In terms of potential impacts on spawning and nursery grounds, the fish species most at risk from the deposition of materials on the seabed are demersal spawners, herring and sandeel which release eggs directly on / in the seabed. Both species have very specific requirements with regard to suitable spawning habitat, requiring either gravelly or sandy seabed respectively. Given that the Project area does not support either of these seabed types, it is highly unlikely either species will spawn in this area. Therefore, there will be no impact on either species from the proposed seabed preparation works.

3.5 Commercial fisheries

Potential impacts on commercial fisheries associated with the seabed preparation works include:

- Direct impact on target species; and
- Temporary exclusion from fishing ground.

Consultation with local fishermen carried out as part of the EIA for the 86 MW array confirmed that the key species targeted in the Project area are lobster, brown crabs and velvet crabs. However, the intensity of fishing is low as fishermen are reluctant to deploy static gear in the Project area due to the strong and rapidly changeable tidal conditions.

As identified previously with respect to fish and shellfish, potential direct impacts on target species (lobster, brown crab and velvet crab) are highly unlikely due to the highly localised nature of the proposed seabed preparation works, mobile nature of the target species and availability of suitable habitat for these species elsewhere in the Project area and Inner Sound.

There will be a requirement for fishermen to adhere to safety zones that will be put in place around the offshore construction vessels involved in the seabed preparation works. These safety zones will result in a temporary exclusion of fishermen from the area. However, seabed preparation works are only expected to last for a few days and potential impacts associated with this temporary exclusion will therefore be minimal and not significant. Further information on the safety zones that will be required for the seabed preparation works and other construction works required for MeyGen Phase 1a project are included in the Navigational Safety Plan (NSP) (Document Reference: MEY-1A-40-HSE-005-F-NSPConstructionWorks_Rev 1) that has been prepared by MeyGen to discharge Condition 17 of the Section 36 Consent received for the 86 MW project.

This document is available to view at:

<http://www.gov.scot/Topics/marine/Licensing/marine/scoping/MeyGen>

3.6 Shipping and navigation

The main potential impact on shipping and navigation associated with the seabed preparation works is an increased risk of collision with construction vessels.

As described in the MeyGen Phase 1 ES, the Pentland Firth is well known as a challenging environment for mariners, with Admiralty Charts including general recommendations on navigation through the firth, including specific advice for laden tankers, due to strong tidal streams which give rise to eddies and races. The Pentland Firth is also an internationally important shipping route, with the Outer Sound between the islands of Stroma and Swona experiencing consistently heavy east-west traffic. The number of vessels using the Outer Sound averaged 14 per day. A number of these include cargo ships and oil tankers.

Compared to the Outer Sound, the intensity of vessel movements through the Inner Sound is considerably lower, ranging from low to moderate (Figure 8 and Figure 9). However, given the importance of the Pentland Firth as an International shipping channel coupled with the challenging nature of the Pentland Firth, potential impacts on navigational safety were identified as a key consideration for the 86 MW tidal array.

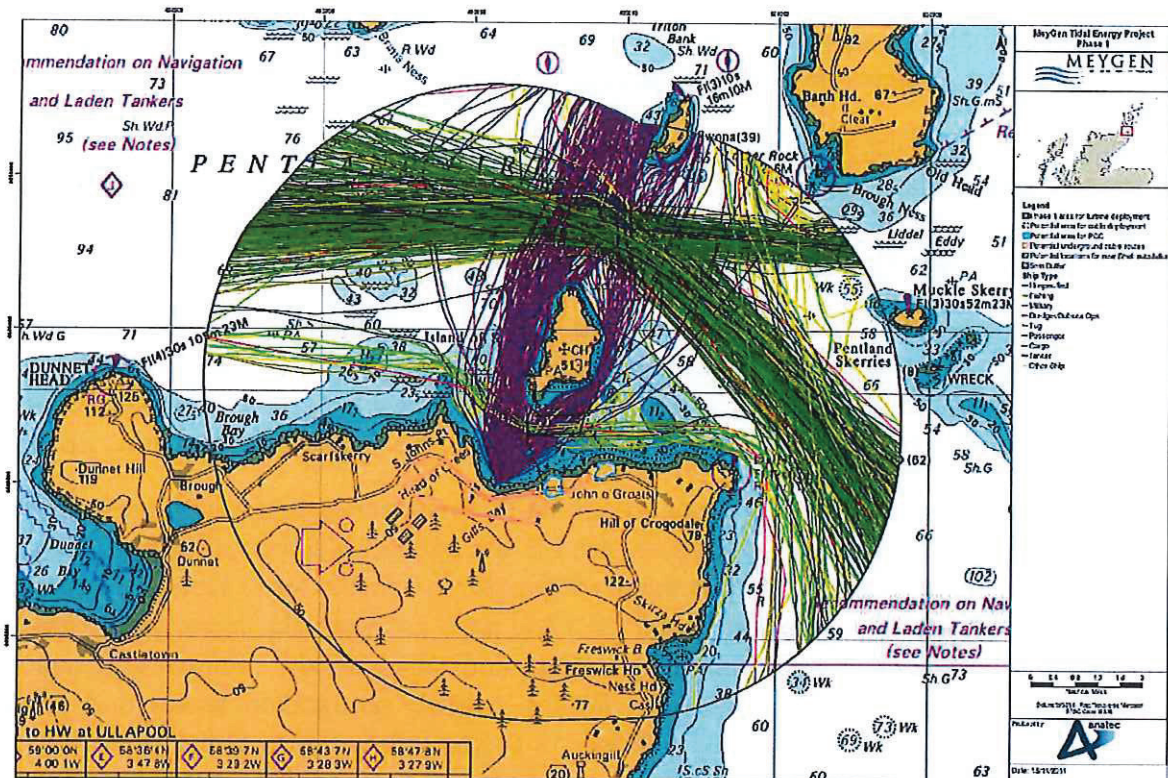


Figure 8: AIS tracks by ship type within 5nm of the Development (Summer, 2011)

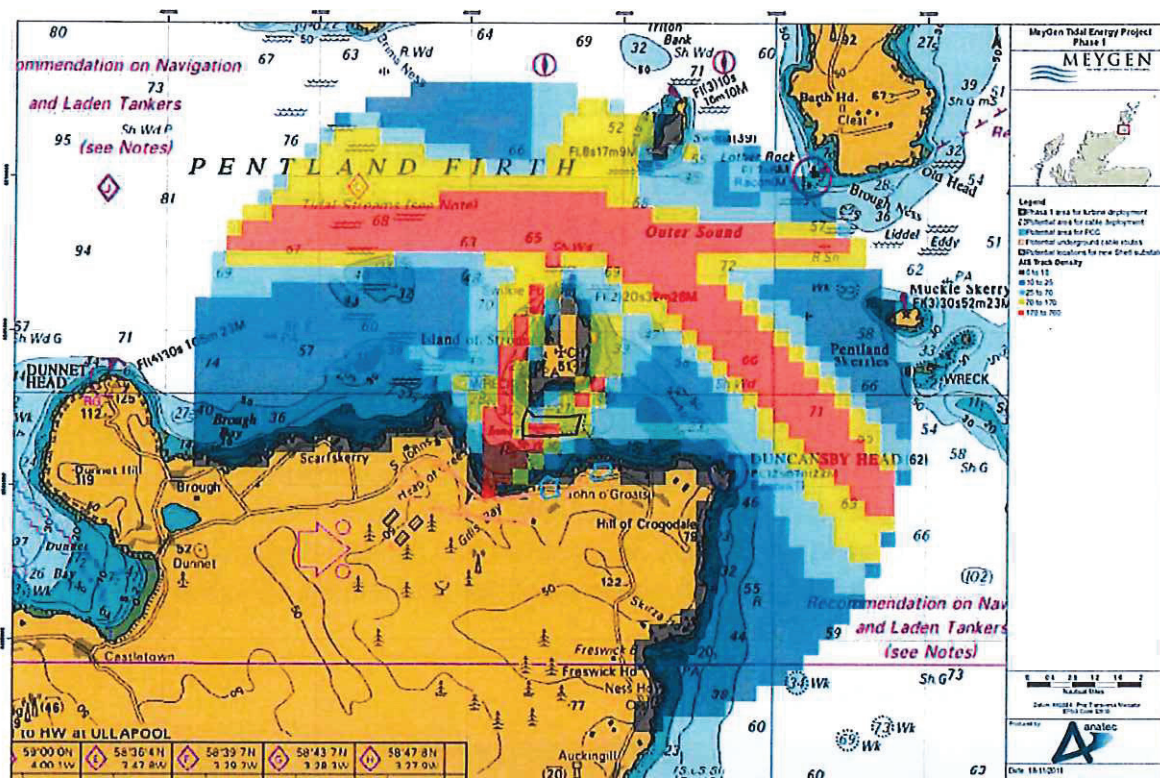


Figure 9: AIS density (2010 and 2011)

In acknowledging key impacts such as collision risk with construction vessels and collision with submerged TTGs, MeyGen was required to prepare a Navigational Safety Plan (NSP) (see reference above) in order for Scottish Ministers to discharge Condition 17 of the Section 36 consent for the MeyGen Tidal Energy Project Phase 1. This NSP includes a series of measures required to mitigate the navigational risk to the Project and other legitimate users of the sea.

Vessels involved in the seabed preparation works will include similar vessels to those that will be used during installation of the TSSs and TTGs (DP offshore construction vessel and / or Jack-Up Vessel). In order to ensure that construction vessels involved in seabed preparation works do not pose an increased risk to navigational safety in the Inner Sound, all seabed preparation activities will be carried out in accordance with the NSP at all times.

The EIA for the 86 MW array also assessed the potential risk to navigational safety resulting from a collision with submerged TTGs. Based on all TTGs having a minimum underwater clearance of 8 m relative to Lowest Astronomical Tide (LAT), taking into account tidal height variations, vessel draughts and wave induced vessel motion, the potential risk of collision was assessed to be negligible and not significant.

Although the aim of the seabed preparation works is to raise the level of the seabed locally under the TSS feet locations to provide additional seabed clearance, the maximum local height increase will be less than 1.5 m. Following completion of the seabed preparation works at TSS#4, water depth is such that with both the TSS and TTG installed on the pads the minimum underwater clearance will be much greater than the required 8 m relative to LAT. Potential impacts in terms of collision risk with submerged turbines will therefore be negligible and not significant.

3.7 Scotland National Marine Plan (NMP)

The National Marine Plan (NMP) covers the management of both Scottish inshore waters (out to 12 nautical miles) and offshore waters (12 to 200 nautical miles) (Scottish Government, 2014). The aim of the NMP is to help ensure the sustainable development of the marine area through informing and guiding regulation, management, use and protection of the Marine Plan areas. The proposed seabed preparation works have been assessed against the Marine Plan Objectives and policies, specifically general core policies and relating specifically to Offshore Wind and Marine Renewable Energy.

Key policies are summarised in Table 5.

Policy	Title	Details
GEN-1	General planning and principle	Development and use of the marine area should be consistent with the Marine Plan, ensuring activities are undertaken in a sustainable manner that protects and enhances Scotland's natural and historic marine environment.
GEN-4	Co-existence	Where conflict over space or resource exists or arises, marine planning should encourage initiatives between sectors to resolve conflict and take account of agreements where this is applicable.
GEN-5	Climate change	Marine planners and decision makers should seek to facilitate a transition to a low carbon economy. They should consider ways to reduce emissions of carbon and other greenhouse gasses.
GEN-9	Natural heritage	Development and use of the marine environment must: <ul style="list-style-type: none"> • Comply with legal requirements for protected areas and protected species. • Not result in significant impact on the national status of Priority Marine Features (PMFs). • Protect and, where appropriate, enhance the health of the marine area.

Policy	Title	Details
GEN-12	Water quality and resource	Developments and activities should not result in a deterioration of the quality of waters to which the Water Framework Directive, Marine Strategy Framework Directive or other related Directives apply.
GEN-21	Cumulative impacts	Cumulative impacts affecting the ecosystem of the marine plan area should be addressed in decision making and plan implementation.
Offshore wind and marine renewable energy objectives		
Objective 1	-	Sustainable development of offshore wind, wave and tidal renewable energy in the most suitable locations.
Objective 5	-	Contribute to achieving the renewables target to generate electricity equivalent to 100% of Scotland's gross annual electricity consumption from renewable sources by 2020.
Objective 7	-	Sustainable development and expansion of test and demonstration facilities for offshore wind and marine renewable energy devices.
Offshore wind and marine renewable energy policies		
Renewables 4	-	Applications for marine licences and consents relating to offshore wind and marine renewable energy projects should be made in accordance with the Marine Licensing Manual and Marine Scotland's Licensing Policy Guidance.

Table 5: NMP Policies

MeyGen will comply with all the new policies that have been introduced, including those listed in Table 5 and any potential impacts will be kept to a minimum, as detailed in this supporting document.

4 CONCLUSION

The total area affected by the seabed preparation works will be 72 m² which equates to 0.006 % of the total MeyGen Phase 1 (86 MW) Project area. Potential impacts on physical environment and sediment processes, benthic ecology, fish and shellfish and commercial fisheries have all be assessed as negligible and not significant on the basis that key receptors are considered to be of low conservation value / low sensitivity and / or have a high tolerance to change.

These conclusions reflect the findings from the EIA carried out for the 86 MW array which also concluded that impacts on physical environment and sediment processes, benthic ecology, fish and shellfish and commercial fisheries associated with the placement of structures on the seabed (TSSs and TSCs) would be negligible and not significant.

The Pentland Firth is a recognised international shipping route and known to be a challenging environment for maritime navigation. However, most shipping is concentrated in the Outer Sound, with the intensity of shipping traffic reducing to low-moderate in the Inner Sound. Given that the Inner Sound is used by vessels transiting the Pentland Firth, there is potential for the presence of vessels at the MeyGen site to present a risk to navigation, particularly where vessels are required to re-route in areas where the waters are harder to navigate. In order to mitigate potential risks on navigation through the Inner Sound during the seabed preparation works, all seabed preparation activities will be carried out in accordance with the NSP at all times.

Although the seabed preparation works will locally raise the height of the seabed in the location of TSS#4, the minimum underwater clearance following installation of the TSS and TGG will still be greater than 8m LAT. Potential impacts in terms of increase risk of collision with the submerged TTG due to an increase in the height of the seabed is therefore assessed as negligible and not significant.

5 REFERENCES

ASML (2011). Benthic survey for Phase 1 of the MeyGen tidal stream energy project, Inner Sound, Pentland Firth. Report to MeyGen Ltd, London, by Aquatic Survey & Monitoring Ltd, Frosterley.

MeyGen, 2012. MeyGen Tidal Energy Project – Phase 1. Environmental Statement.

The Scottish Government (2015) The Scottish National Marine Plan
<http://www.gov.scot/Resource/0047/00475466.pdf>

6 LIST OF ABBREVIATIONS

Abbreviation	
DP	Dynamic Positioning
ECoW	Ecological Clerk of Works
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ES	Environmental Statement
JUV	Jack-Up Vessel
NSP	Navigation Safety Plan
ML	Marine Licence under the Marine (Scotland) Act 2010
PEMP	Project Environmental Monitoring Programme
S36	Section 36 of the Electricity Act 1989
TSC	Turbine Submarine Cable
TSS	Turbine Support Structure
TTG	Tidal Turbine Generator

Abbreviation	
CMS	Construction Method Statement
HDD	Horizontal Directional Drilling
LAT	Lowest Astronomical Tide
ML	Marine Licence under the Marine (Scotland) Act 2010
MLWS	Mean Low Water Springs
SAC	Special Area of Conservation
SNH	Scottish Natural Heritage
TSC	Turbine Submarine Cable
TSS	Turbine Support Structure
TTG	Tidal Turbine Generator
UKHO	United Kingdom Hydrographic Office