25 ENVIRONMENTAL MANAGEMENT AND MONITORING

25.1 Introduction

25.1 The purpose of this section is to provide a summary of mitigation, monitoring and management measures proposed within the Environmental Statement (ES).

25.2 The Project will use tidal power to produce sustainable electricity through the deployment of tidal turbines in the marine environment. The electricity is exported to shore where it is converted at the Power Conversion Centre (PCC) prior to export to the grid. This type of project has the potential to impact on the environment and other users of the area. The potential effects have been assessed through the Environmental Impact Assessment (EIA) and Navigation Risk Assessment (NRA) and the results presented in the ES and accompanying NRA report. The EIA and NRA have indicated that it is necessary to manage the Project and implement mitigation to ensure the Project is sustainable and to minimise or mitigate any ongoing effects on the environment resulting from the Project.

25.2 Environmental Management Plan

25.3 Environmental assessment, including consultation with stakeholders, is an iterative process and will continue beyond ES submission. The primary mechanism for ensuring environmental assessment continues and that all environmental issues are addressed is through the Project Operational Management System. This management system will ensure that ES mitigation commitments, consent conditions and environmental monitoring requirements are taken through to implementation.

25.4 A full Environmental Management Plan (EMP) will be implemented in agreement with the relevant regulators following the successful award of project consents. The EMP will consist of a working document which details consent conditions, the commitments outlined in the ES and compliance monitoring requirements (i.e. monitoring required to assess the performance of mitigation measures). It will also highlight the parties responsible for the implementation of the contents of the EMP.

25.5 The EMP will include details on the proposed mitigation and compliance monitoring.

25.2.1 Mitigation

25.6 Where the EIA has identified potentially significant impacts (i.e. those ranked moderate or higher) that cannot be avoided, mitigation measures have been proposed. Such measures should remove, reduce or manage the effect to a point where the residual significance of that impact is reduced to an acceptable level. Mitigation has also been recommended in order to ensure impacts remain insignificant.

25.7 All mitigation measures committed to during the EIA and detailed in topic specific ES sections are summarised in the table overleaf (Table 25.1).

25.8 These commitments will be implemented as part of the Project through communication with the Project team and any contractors with whom MeyGen engages. Details of mitigation can be found in Table 25.1. The EMP will be included in the overall Construction Environment Management Document (CEMD). Contractors will implement the requirements of the CEMD through their own Construction Environment Management Plan (CEMP).

25.2.2 Compliance monitoring

25.9 A monitoring program will be designed to enable MeyGen to track and assess the performance of the mitigation measures, ensuring MeyGen meets its regulatory and corporate requirements and to update and improve the program if necessary.

ES section / topic	Commitment
Physical environment and sediment morphology	▪ Minimise as far as practicable the depth and diameter of the turbine foundation piles (without compromising technical performance); ▪ Minimise as far as practicable the volume of drill cuttings released into the marine environment during breakthrough of Horizontal Direction Drill (HDD) bores, by implementing a closed loop recycling system to return drill cuttings and fluid from the HDD to shore.
Benthic ecology	▪ The area of kelp that may need cleared will be restricted to as small as practicable around the cable and only larger plants will be removed if possible; and ▪ Installation layout will be clearly defined and communicated to any personnel involved in kelp clearance. ▪ Minimise as far as practicable the depth and diameter of the turbine foundation piles (without compromising technical performance); ▪ Lubricant used in the compressor to drive air into the drilled piles will be non-toxic and seawater will be used as a drilling fluid, negating the need for any additional chemical input; and ▪ Minimise as far as practicable the volume of drill cuttings released into the marine environment during breakthrough of HDD bores, by implementing a closed loop recycling system to return drill cuttings and fluid from the HDD to shore. ▪ All vessels involved in all stages of the project will adhere to all relevant guidance (including the IMO guidelines) regarding ballast water and transfer on non-native marine species. ▪ Where cables are not within boreholes attempts will be made to lay cables within natural crevices and cracks in the seabed to reduce cable wear. This will ensure that the majority of the cable is not exposed; ▪ The voltage of the cables will be up to 6.6kV (as opposed to the 132kV) which will considerably reduce the electromagnetic fields (EMF) emitted by the cables; ▪ The length of the drilled boreholes for the cable will be maximised (as far as technically and commercially practicable) to increase the length of cable under the seabed, and ▪ Ongoing research by Marine Scotland and their advisors will be monitored for potentially successful mitigation strategies.
Marine mammals	▪ The principles of the JNCC guidance on protection of marine European protected species from injury and disturbance (JNCC, 2010) and of relevant guidelines on minimising the risk of injury to marine mammals will be adopted as necessary (for example, reducing the duration of noise emitting activities). ▪ MeyGen commit to undertaking frequent reviews of the literature regarding spiral injuries in seals and ducted propellers and to regularly discuss advances in understanding of this topic with relevant regulatory and advisory bodies. MeyGen will apply appropriate mitigation, as deemed necessary in consultation with Marine Scotland and SNH, should vessels with ducted propellers be used, to avoid any significant impacts. ▪ All vessels associated with Project operations will comply with IMO/MCA codes for prevention of oil pollution and any vessels over 400 GT will have onboard SOPEPs. ▪ All vessels associated with Project operations will carry onboard oil and chemical spill mop up kits. ▪ Where possible vessels with a proven track record for operating in similar conditions will be employed. ▪ Vessel activities associated with installation, operation, routine maintenance and decommissioning will occur in suitable conditions to reduce the chance of an oil spill resulting from the influence of unfavourable weather conditions. ▪ Operational monitoring will be implemented in order to confirm the assessment of noise and physical barriers to movement (see Section 25.3.6). ▪ MeyGen propose, in line with the Scottish Government Survey, Deploy and Monitor Policy that the monitoring of the deployments in years 1 and 2. This will allow for a better definition collision risk and avoidance rates and to better understand the possible impact of the full 86 turbine array. It will also inform the potential requirement for future mitigation and ensure no significant impacts on marine mammals.
Ornithology	▪ All vessels associated with Project operations will comply with International Maritime Organisation (IMO)/Maritime and Coastguard Agency (MCA) codes for prevention of oil pollution and any vessels over 400 GT will have onboard Ship Oil Pollution Emergency Plans (SOPEPs). ▪ All vessels associated with Project operations will carry onboard oil and chemical spill mop up kits. ▪ Where possible vessels with a proven track record for operating in similar conditions will be employed. ▪ Vessel activities associated with installation, operation, routine maintenance and decommissioning will occur in suitable conditions to reduce the chance of an oil spill resulting from the influence of unfavourable weather conditions. ▪ Only recognised marine standard fluids and substances will be used in the turbine hydraulic systems. ▪ Hydraulic fluids will be mostly water based, biodegradable and be of low aquatic toxicity. ▪ Project specific emergency response procedures will be implemented and include contingency arrangements in the unlikely event of a pollution incident. ▪ Once specific onshore Project areas are known, further, targeted investigation will be undertaken to ascertain the status, distribution and habitat use of birds within the Project footprint and surrounding environment. The results of the survey will be used to confirm the impact assessment.
Fish ecology	▪ Where possible the use of soft start (gradual ramping up) of operations that will emit noise into the Project area will be used. ▪ MeyGen accepts that there is some uncertainty over the noise generated during drilling and turbine operation and as a result commits to conducting noise monitoring for the initial turbines installed and candidate turbine technology to validate the noise modelling. ▪ Minimise as far as possible the amount of material that will be deposited at the seaward end at breakthrough locations of directional drilling holes. ▪ Minimise as far as possible the depth and diameter of the turbine foundation piles (without compromising technical performance) in order to minimise the volume of drill cutting discharges. ▪ Minimise as far as possible the amount of material that will be deposited at the seaward end at breakthrough locations of directional drilling holes. ▪ All vessels associated with Project operations will comply with IMO/MCA codes for prevention of oil pollution and any vessels over 400 GT will have onboard SOPEP's. ▪ All vessels associated with Project operations will carry onboard oil and chemical spill mop up kits. ▪ Where possible vessels with a proven track record for operating in similar conditions will be employed. ▪ Vessel activities associated with installation, operation, routine maintenance and decommissioning will occur in suitable conditions to reduce the chance of an oil spill resulting from the influence of unfavourable weather conditions.

ES section / topic	Commitment
	▪ Lubricant used in the compressor to drive air into the drilled piles will be non-toxic and seawater will be used as a drilling fluid, negating the need for any additional chemical input; and ▪ Minimise as far as practicable the volume of drill cuttings released into the marine environment during breakthrough of HDD bores, by implementing a closed loop recycling system to return drill cuttings and fluid from the HDD to shore. ▪ All vessels involved in all stages of the project will adhere to all relevant guidance and legislation (including the IMO guidelines and the International Convention for the Prevention of Pollution from Ships (MARPOL)) regarding ballast water and transfer on non-native marine species. ▪ Where cables are not within boreholes they will be laid where possible within natural crevices and cracks within the seabed ensuring that the majority of the cable is below the seabed. ▪ The length of the drilled boreholes for the cable will be (as far as technically and commercially possible) to increase the length of cable under the seabed. ▪ Cables will be bundled into groups of three minimising the magnetic field by placing the cables close together, allowing the field vectors to cancel each other out. ▪ In addition ongoing research by Marine Scotland and their advisors which will be monitored for further indications of successful mitigation strategies. ▪ MeyGen accepts that there is uncertainty about some potential impacts from the Project and is committed to undertaking a post installation monitoring programme in order to determine the nature of those impacts. Appropriate monitoring will be agreed with Marine Scotland. ▪ To the extent further mitigation is required over and above the first mitigation proposed for Impact 13.15, MeyGen is committed to working with the regulator to identify reasonable measures to mitigated against this impact. ▪ As a result no specific mitigation measures for this impact have been identified but ongoing research by Marine Scotland and their advisors which will be monitored for further indications of successful mitigation strategies.
Commercial fisheries	▪ Ensure consultation with fishermen, which may involve the appointment of a Fisheries Liaison Officer (FLO) to ensure fishermen are informed in advance of installation plans and to promptly answer any queries from fishermen. ▪ Details of the Project will be included in updated Kingfisher fishermen's awareness charts and FishSAFE ▪ Ensure consultation with fishermen, which may involve the appointment of a Fisheries Liaison Officer to ensure fishermen are informed in advance of installation plans, and to promptly answer any queries from fishermen. ▪ All vessels associated with Project operations will comply with IMO/MCA codes for prevention of oil pollution and any vessels over 400 GT will have onboard SOPEPs. ▪ All vessels associated with Project operations will carry onboard oil and chemical spill mop up kits. ▪ Where possible vessels with a proven track record for operating in similar conditions will be used. ▪ Vessel activities associated with installation, operation, routine maintenance and decommissioning will occur in suitable conditions to reduce the chance of an oil spill resulting from the influence of unfavourable weather conditions. ▪ Further consultation with the local fishing fleet to ensure the safe continuation of fishing effort in the cable deployment area once cables are installed. ▪ Consultation with the local fishing fleet, to ensure fishermen are aware of turbine locations. ▪ Provision of offshore Project area location data to local fishermen and Kingfisher Information Services (marine safety authority), to enable incorporation of offshore Project area location data into plotters. ▪ Despite the overall likelihood of an accidental spill being an extremely remote one-off event, an accidental spillage management plan will be employed to ensure emergency response systems and procedures are in place should an accidental spillage occur. ▪ Ensure fishermen are aware of decommissioning activities and schedule.
Navigation	▪ Experience and lessons learned from other marine renewables projects will be taken into account. ▪ Workshops will be held before the activity takes place involving the Construction company and maritime stakeholders to review the hazards and plan how the work can be safely conducted. ▪ Marine Safety Information broadcasts will be issued by HM Coastguard to inform mariners of the activity at the Project area (8 broadcasts per day covering Fair Isle, Cromarty and Hebrides Areas). ▪ Navtex and Notices to Mariners will be issued including details of the MeyGen work. ▪ Information on the work activity at the site will be circulated directly to local ports, ferry operators (e.g., Pentland Ferries), fishermen and recreational clubs. ▪ Details of the Project will be included in updated Kingfisher fishermen's awareness charts and FishSAFE. ▪ Details of the Project will be included in updated Sailing Directions. ▪ There will be liaison with local Harbour Masters to ensure they are aware of the activity and can notify visitors to their port. ▪ A working VHF channel will be provided to local users. ▪ Safety zone of appropriate dimensions will be applied for to protect working vessels on the site when restricted in manoeuvrability. ▪ Operating procedures will be established to ensure work vessels do not block the channel when they are not actively working on the site. If it is not practicable for the work vessel to depart from the site they will use AIS and marks to indicate that any safety zone is not operational if they are not restricted in manoeuvrability. ▪ Collision risk management procedures will be developed to be used by working vessels specifying traffic monitoring and emergency response procedures. ▪ An Emergency Response Cooperation Plan (ERCoP) will be prepared for the Project following the template provided by the MCA in Marine Guidance Note (MGN) 371. This will be submitted to the MCA for comment and approval. Emergency response would include informing HM Coastguard, Royal National Lifeboat Institution (RNLI), Harbours and local users (e.g., Pentland Ferries) so that vessels in the area are alerted to the potential hazard. ▪ There will be a dedicated watchkeeper onboard working vessel(s) or onshore. ▪ Local knowledge will be used during the work whenever possible.

ES section / topic	Commitment
	▪ Local harbours will be used for the work where practicable. ▪ Radio broadcasts will be given as necessary to warn approaching vessels about the work activity. ▪ Further consultation will be carried out on the safety zone dimensions with Marine Scotland, the MCA, Department Energy and Climate Change (DECC), the appointed contractor and local stakeholders prior to the application being made to DECC. ▪ Safety zones will be established on a 'rolling' basis, covering only the area of the site in which activity is taking place at a given time. Once that activity has been completed in that specific location, the safety zone will then 'roll on' to cover the next specific location (not the whole Project area). ▪ Work vessels will indicate their status on Automatic Identification System (AIS) and using appropriate marks/lights, e.g., if restricted in manoeuvrability. This will signify to passing traffic whether a Safety Zones is in place or not. ▪ Working vessels are selected and audited based on suitability for the job and the conditions in the Pentland Firth. ▪ Marine operating procedures are developed specifying allowable wave, tide and weather criteria. ▪ Procedures specify that work vessels should seek shelter (or return to base) when not working at the site. ▪ Working personnel are trained in offshore survival and have suitable Personal Protective Equipment (PPE). ▪ The Construction company operates a Safety Management System. ▪ Passage plans are developed for vessels routeing between the Project area and the onshore base. ▪ Work vessel movements are monitored from an onshore control centre, e.g., on AIS and VHF (Very High Frequency). ▪ The turbines will have a minimum under water clearance of 8m relative to Lowest Astronomical Tide (LAT) which means a proportion of vessels will not need to re-route as they will have safe under keel clearances when passing over the turbines. ▪ Marking and lighting of the site will be decided by Northern Lighthouse Board (NLB) once they have reviewed the NRA and consulted as appropriate. Discussions to date have indicated that they consider the Project area is effectively marked by the southern part of the island of Stroma and the whole coastline is conspicuous on radar. Therefore, they do not foresee a need for additional marking and lighting. Floating aids to navigation are not considered suitable given the strong tides. ▪ Deploy and monitor strategy, i.e., turbines will be installed over a number of years which allows the effect on vessel navigation to be monitored. ▪ Turbines could be stopped to maximise under water clearance. ▪ Vessels will have increased awareness of the Project area due to the notification measures carried out before and during Installation (described under the mitigation of Impact 15.1). ▪ The turbines have been subjected to engineering design and third-party verification to ensure they are suitable for deployment in the Inner Sound. ▪ The Project will be using tried and tested equipment and techniques to minimise the risks associated with the high tidal flow environment. ▪ Most parts will be negatively buoyant. ▪ Turbine nacelle designs that use buoyancy as part of the installation and maintenance strategy have failsafe locking systems for the connection between the nacelle and the Turbine Support Structures (TSSs) to prevent accidental release. ▪ On-site monitoring via SCADA (Supervisory Control and Data Acquisition) will alert the 24-hour control room operations team of turbine failure or an object hitting the turbine. ▪ Project area will be depicted on charts. Turbine and cables areas will be depicted on appropriate scale charts. ▪ Cables will be grouped (where feasible) to minimise the overall footprint area on the seabed. ▪ Horizontal Directional Drilling (HDD) bores will provide protection for at least part of the cable length from shore. ▪ Natural crevices will be used to avoid exposed cables being on the seabed surface as far as practicable. ▪ Additional material weighting will be used where necessary to ensure cable stability on the seabed. ▪ Cable route coordinates will be circulated to Kingfisher and the local skippers. ▪ Cables will be grouped (where feasible) to minimise the overall footprint area on the seabed. ▪ In addition to the Project-specific mitigation, the following measures have been identified to minimise potential cumulative impacts: o Liaison with ScottishPower Renewables UK Limited should installation or decommissioning activities overlap at the Ness of Duncansby site. o Consultation with stakeholders and development of appropriate procedures should MeyGen Phase 1 and 2 be decommissioned simultaneously resulting in increased work vessel activity in the Inner Sound.
Marine cultural heritage	▪ The following mitigations are proposed if practicable for sites of moderate and major impact significance within 100m of the development. o Avoidance. o ROV survey of the geophysical anomalies by Remote Operated Vehicle (ROV) in an appropriate manner by specialists in marine archaeology so they can be positively identified. o Detailed wreck survey and salvage. If the ROV survey reveals cultural heritage, plans/elevations will be made with a full photographic record prior to impact. Wrecks should be recorded in an appropriate manner by specialists in marine archaeology. Attempts will be made to retrieve and conserve representative examples of the fabric. If the feature is of high archaeological potential the strategies below may be implemented. o Intrusive archaeological assessment. This response will be implemented for all sites and wrecks with high archaeological potential and where there will be intrusive works. Intrusive assessments would groundtruth geophysical survey results and assess the nature, extent and preservation of identified remains. o Full archaeological excavation. This level of mitigation may be deemed necessary as a result of evidence gathered by other levels and should be conducted by specialists in marine archaeology. Provision should be made for the examination and possible conservation of any artefacts recovered. Provision should be made for post-excavation work bringing the results together in a report of publication standard.

ES section / topic	Commitment
	○ Further documentary research and archiving. This response includes further detailed examination of unusual archival sources that would not routinely be consulted. ○ No recommendations are made for anomalies of low potential. This is due to them being interpreted as natural features. ○ A reporting protocol will be instigated for the accidental discovery of marine cultural material during development, maintenance and monitoring. ○ Avoidance. Should cultural material be accidentally discovered, it is proposed that the site be avoided. ▪ If it is not practicable to avoid the material a detailed wreck survey will be undertaken. If the ROV survey reveals cultural heritage, plans/elevations will be made with a full photographic record prior to impact. Wrecks will be recorded in an appropriate manner by specialists in marine archaeology. Attempts will be made to retrieve and conserve representative examples of the fabric. If the feature is of high archaeological potential the strategies below may be implemented. ▪ Full archaeological excavation. This level of mitigation may be deemed necessary as a result of evidence gathered by other levels and should be conducted by specialists in marine archaeology. Provision should be made for the examination and possible conservation of any artefacts recovered. Provision should be made for post-excavation work bringing the results together in a report of publication standard. ▪ Further documentary research and archiving. This response includes further detailed examination of unusual archival sources that would not routinely be consulted. ▪ Avoid placing the turbines on the sandy substrate on the northeast corner of the proposed turbine deployment area.
Geology, hydrology and hydrogeology	▪ All infrastructure will be located 50m or more from surface watercourses or waterbodies where possible. ▪ Concrete will not be batched on site. ▪ Use of wet concrete near watercourses will be minimised and carefully controlled. ▪ Water-based lubricants and drill fluid will be used where possible and drill fluid will be recycled throughout the drilling process to minimise total volume required. Any surplus drill fluid will be disposed of as controlled waste at the end of construction. ▪ Waste water and sewage will be disposed of in accordance with Pollution Prevention Guidelines (PPG) 4. Where ground conditions permit, disposal to ground will be considered as the preferred option. Locations of existing private septic tanks and associated pipework will be identified prior to undertaking any ground moving activity and will be avoided as far as possible to minimise the risk of damaging this infrastructure. ▪ Waste materials including drill cuttings generated during HDD (apart from the final 5-10m which will be discharged to sea), will be reused or recycled, and where this is not possible will be disposed of appropriately. A Construction Waste Management Plan will be produced by the appointed principal contractors and will follow guidelines similar to the ones set out in Scottish Environment Protection Agency (SEPA) (2006). ▪ All equipment, materials and chemicals will be stored well away from watercourses, with at least a 50m separation. Chemical, fuel and oil stores will be stored safely in accordance with PPG2. ▪ Machinery standing for several days or longer will have drip trays placed underneath to prevent oil and fuel leaks causing pollution. ▪ Where practicable, refuelling of vehicles and machinery will be carried out in a designated area, on an impermeable surface and well away from any watercourse. ▪ Only emergency maintenance will be carried out within the project area, on an impermeable surface and well away from watercourses. If vehicles have broken down, necessitating maintenance at the point of breakdown, special precautions will be taken. ▪ Construction traffic movements will be limited as far as practicable, to reduce the risk of accidental spillage. ▪ Washing-out of vehicles used to transport concrete, grout or drilling fluid will not be undertaken on site. ▪ Contingency plans will be in place to ensure that emergency equipment, such as spill kits and absorbent materials, is available on site and will include advice on actions to be taken and personnel to be informed in the event of a pollution incident. ▪ All relevant staff and site personnel will be trained in normal operating and emergency procedures and will be made aware of highly sensitive areas on site. ▪ All activity occurring within the Burn of Horsegrow catchment will be undertaken with particular care to minimise pollution risk to the Loch of Mey Site of Special Scientific Interest (SSSI)/Ramsar site and its tributary watercourses. Additional protection measures will be installed if necessary to ensure the site is adequately safeguarded. ▪ A suitably qualified Environmental Clerk of Works will be appointed who will have responsibility for ensuring mitigation measures are in place and are operating effectively. ▪ All earth-moving operations will be undertaken in compliance with British Standards Institution (BSI) Code of Practice for Earthworks, BS 6031:2009. This will include halting of all earthworks during and immediately after heavy rainfall events. ▪ All heavily sediment-laden discharges will be routed through balancing tanks and one or more suitable filters or silt-busters in series as necessary, to reduce the sediment load. ▪ Water with light sediment load and supernatant water following treatment to remove heavy sediment load will be discharged onto vegetated surfaces and directed away from surface watercourses and ditches to avoid direct entry into the surface water system. ▪ In areas where it is necessary to run cable trenches and working width parallel to and within 20m of roadside or field drainage ditches, additional sediment control measures may be required to ensure the existing drainage network continues to operate at its current level. Additional control measures may take the form of silt fences, bunds, straw bales or other suitable barrier as appropriate to local conditions. ▪ Measures to control surface water runoff will be instigated prior to topsoil stripping. These may include retention of vegetation cover on watercourse banks, installation of straw bales or alternative barrier to intercept runoff or the installation of new land drains. ▪ Sediment control measures and temporary drainage will remain in place until vegetation cover has been re-established on the working width, to prevent reinstated soils being carried into nearby watercourses. ▪ Where open-cut cable crossings of watercourses are proposed, preference will be given to isolated open-cut techniques to minimise any potential release of sediment to the watercourse. Watercourse bed and bank material will be fully reinstated prior to the restoration of flow in the channel. ▪ All activity occurring within the Burn of Horsegrow catchment will be undertaken with particular care to minimise the risk of sediment release to the Loch of Mey SSSI/Ramsar site and its tributary watercourses. Additional protection measures will be installed if necessary to ensure the site is adequately safeguarded. ▪ Vehicle movements on site will be restricted as far as practicable, especially on temporary tracks and within the working width, to restrict soil compaction. ▪ Specialist low ground pressure vehicles will be considered for construction work, to minimise the requirement for temporary tracks. ▪ For the working width and cable trenches, topsoil will be stripped on a field-by-field basis and stored in a mound running alongside the working width on unstripped land. Where possible, topsoil will be stripped in reasonably dry conditions and stored in a mound no more than 2m high.

ES section / topic	Commitment
	▪ Stored topsoil will be kept free from the passage of vehicles and will be prevented from intermixing with other materials. Erosion protection will be placed around stockpiles if required to minimise soil loss to surface runoff. ▪ Subsoils removed from the cable trenches will be stored on the opposite side of the working width from stored topsoil and will be laid on undisturbed subsoil. ▪ Topsoil reinstatement will be carried out under suitably dry conditions in order to limit compaction. Soil loosening may be required in areas where compaction is a problem, such as under the running track or under temporary track routes. ▪ All temporary tracks and hardstanding areas will be removed and fully reinstated upon completion of the construction work. ▪ All temporary excavations associated with excavations will be fully reinstated upon completion of the construction work once vegetation has been re-established on previously stripped ground. ▪ Where permanent modifications to land drainage are required, such as around the Power Conversion Centre (PCC) site, alternative drainage will be installed prior to construction to provide continuity of flow capacity in the affected area. ▪ All crossings will be constructed taking account of guidance and good practice detailed in SEPA's *Engineering in the Water Environment Good Practice Guide: River Crossings* (2010) and Scottish Executive's *River crossings & migratory fish: Design guidance* (2000). ▪ Ground levels around temporary and permanent watercourse crossings and along the line of the cable trench will not be raised and care will be taken to ensure that bed reinstatement above cable trench crossings does not impede water flow within the channel. ▪ Permanent infrastructure will be located outwith the 1-in-200 year flood risk area and at least 5 m AOD to minimise risk from coastal flooding. ▪ Where possible, siting of the PCC and associated infrastructure will avoid the existing field drainage network. If this is not possible, alternative field drainage will be installed prior to construction work to provide continuity of flow capacity in the affected area. ▪ Track crossings of watercourses, including field and roadside drainage ditches, will be sized appropriately to ensure flow is not restricted. A programme of inspection and maintenance will be put in place to ensure their continued effective operation throughout the lifetime of the project. ▪ Should excess spoil arise from engineering works, this will be disposed of outwith the floodplain area to avoid loss of flood storage capacity. ▪ Cable trench backfill will be compacted to an appropriate degree to minimise along-trench groundwater flow without compromising the required technical performance. ▪ Where the cables are required to be seated on sand, use of cement-bound sand or appropriate alternative impermeable barrier will be considered to divert groundwater from the trench. ▪ If groundwater discharges are identified during construction, cable trenches and infrastructure will be microsited where possible to avoid the identified discharge location. ▪ In the event that the cable route running from Upper Gills to the Hill of Rigifa' is selected as the preferred option, cables will be located as close to the road as possible in order to minimise disruption to the identified groundwater dependent terrestrial ecosystem in this corridor. Consideration will be given to locating the cable trenches across the road from the identified habitat area to avoid further disruption to groundwater flow. ▪ Excavated material from road surface and sub-base may need appropriate disposal as hazardous waste. Testing will be required to determine if this is required. Disposal would be subject to agreement and licensing by The Highland Council (THC) and SEPA. ▪ Water ingress to the excavation may contain contaminants and would require collection and appropriate treatment to remove contaminant prior to discharge. This may be subject to agreement and licensing by SEPA. ▪ It has been assumed that all operations and maintenance activity will be undertaken in accordance with the good practice and mitigation measures set out above with relation to Impact 17.1. ▪ A programme of regular inspection and maintenance for all permanent drainage features will be put in place and carried out regularly. ▪ Excavation and ground-disturbing work will be kept to a minimum as far as practicable, to minimise the potential for mobilising sediment.
Terrestrial ecology	▪ Employment of best working practices during construction works, including restoration of affected habitats to an original condition, where conditions allow. ▪ Submission of Construction Environmental Management Plan (CEMP), including details of measures to reduce construction disturbance to terrestrial habitats and species where possible. ▪ Further ecological investigation in relation to otter and water vole status (once onshore Project specifics are confirmed), to ascertain protected species licensing requirements. ▪ Application for a European Protected Species (EPS) licence in relation to disturbance of otter habitat and application for a water vole habitat disturbance licence, if either licensing requirement is deemed necessary. ▪ Where ecologically sensitive habitat loss does occur, compensatory measures (such as replanting of lost tress) will be considered as part of completion of construction and restoration of habitats to an original condition (where project operations allow). ▪ Where otter habitat is disturbed (particularly in the vicinity of the PCC location where long term disturbance may occur), application for a EPS Licence will be undertaken and a programme of relevant mitigation will be implemented where necessary. ▪ Once specific Project details are known, further targeted investigation will be undertaken to ascertain the status, distribution and habitat use of otters within the Project footprint and surrounding environment. ▪ Where it is ascertained that disturbance to otters will be likely, application for a European Protected Species licence will be made. ▪ As part of the licence, implementation of on otter management plan may be necessary; this will outline best industry practices to minimise disturbance to otters where possible. ▪ Where increased otter road fatality risk is identified, specific mitigation measures will be put in place; this may include otter culverts (for new access tracks), steering fences and wildlife reflectors. It is recognised that installation of such measures may comprise a condition of (European Protected Species) licence, if deemed necessary and should be implemented as part of the CEMP. ▪ Once specific Project details are known, further ecological investigation will be undertaken to ascertain the status of water vole within the onshore Project footprint and surrounding environment. ▪ Should water vole be present within the Project footprint, application for a relevant licence will be necessary and habitat protection measures will be implemented during the construction phase to prevent causing disturbance to water voles and water vole habitat. This will likely be included as part of a water vole mitigation plan and / or CEMP. ▪ Should water vole habitat be impacted by construction, affected areas will be restored to an original condition to minimise long term impacts on the local water vole population. ▪ Should sensitive habitats (i.e. otter holts and resting sites) be located in close proximity to where onshore maintenance and operational activities are taking place (including near shore vessel activities), best industry practices and relevant mitigation measures will be implemented, to avoid causing unnecessary disturbance.

ES section / topic	Commitment
	▪ Where disturbance impacts from small scale construction activities involved in the operations and maintenance of the PCC cannot be avoided, acquisition of a EPS licence will be undertaken to ensure potentially disturbing works are legally permitted. ▪ Employment of industry best practise during decommissioning works, including restoration of affected terrestrial habitats to an original condition. ▪ Adherence to the Environmental Management Plan (and where relevant, working method statements) throughout the decommissioning phase, aiming to reduce disturbance to terrestrial habitats where possible. ▪ Should sensitive habitats (i.e. otter holts and resting sites) be located in close proximity to where onshore and inshore decommissioning activities are taking place, best working practices and relevant mitigation measures will be implemented to avoid causing unnecessary disturbance to otters where practicably possible. ▪ Where disturbance impacts to otters from decommissioning activities cannot be avoided, acquisition of an EPS licence will be undertaken, to ensure potentially disturbing works are legally permitted. ▪ Long term mitigation against increased risk of otter road fatality will likely be in place from the construction phase onwards; it is anticipated that mitigation measures such as otter culverts (for new access tracks), steering fences and wildlife reflectors will remain effective at deterring otters from crossing roads, throughout the duration of the Project and beyond.
Landscape, seascape and visual	▪ Reduction of overall site footprint to minimise loss of physical landscape and seascape elements. ▪ Limiting PCUB height and lowering the buildings by taking away superficial soil layers. ▪ Siting of main Power Conversion Unit Buildings (PCUBs), Control Building, and other physical infrastructure within the PCC use natural topographic screening to minimise visibility – in terms of both overall visual envelope (Zone of Theoretical Visibility (ZTV)) and actual visibility from key viewpoints. ▪ Building orientation designed to minimise impact in key viewpoints: e.g. orientation of the main PCUBs has been harmonised with the open vistas when viewed from both the Canisbay Kirk and from the ferry route between Gills Bay and Orkney. ▪ Siting, non-alignment and spacing of PCUBs to minimise additional visual confusion and avoid conflict with existing adjacent historic features and buildings. ▪ Building scale designed to be compatible with scale of landscape and seascape character of site and wider context. ▪ Distinctive building form creates strong identity and clear rationale relating to renewable marine energy source. ▪ A curved roof to reflect the surrounding landscape. ▪ Building form and finishes, include use of natural materials, designed to reflect aesthetic qualities associated with landscape and seascape character of site and wider context. ▪ Use of local stone walling in harmony with existing uses to help screen control building .
Onshore cultural heritage	▪ *Avoidance.* All sites of major significance will be avoided and the cable route will be designed to avoid most cultural heritage assets. Assets in the Ness of Quoys and Ness of Huna will be avoided where possible by the design and layout of the development. ▪ *Targetted geophysical survey* has already been conducted to identify the presence / absence and extent of archaeological remains at the Ness of Quoys and Ness of Huna in order to manage potential impact. The design will avoid these where possible and intrusive evaluations will be conducted as the next step where it is not. Further survey is recommended at the east end of the Gills to Kirkstyle cable route to identify whether remains extend into it from the prehistoric mound (54) below Canisbay Kirk. ▪ *Survey.* A detailed topographic / photographic and / or standing building survey of an appropriate level will be conducted for earthworks or vernacular buildings if they cannot be avoided. ▪ *Intrusive archaeological evaluation* will be conducted if appropriate on remains that cannot be avoided, including those identified by geophysical survey, or to assess the nature and significance of sites that may be of archaeological importance so that appropriate action can be taken. ▪ *Archaeological Watching Brief.* This will be conducted during ground-breaking construction works if there is a significant potential for but no conclusive proof of archaeological remains, or as a precautionary measure if a site has been identified nearby. The works will allow opportunity for salvage excavation on remains that cannot be avoided. ▪ *Archaeological Excavation* may be necessary as a result of evidence gathered by other mitigation strategies if archaeological remains cannot be avoided and if required by THC Historic Environment Team (HET). Agreement should be made with HC HET on the standards and extent of excavation and the provisions for post-excavation work and reporting. ▪ A *Reporting Protocol* for the accidental discovery of archaeological remains will be instated, the nature of which will be agreed with THC HET. ▪ MeyGen will ensure that construction contractors have cultural heritage site maps and lists so that they know what is to be avoided; that the construction teams have a cultural heritage induction, especially if reporting protocols are to be used; and that the construction works manager or Environmental Clerk of Works marks off all sites within or close to edge of the development areas to ensure that they are avoided and not accidentally run over or otherwise impacted. ▪ Reduction of overall site footprint to minimise loss of setting of cultural heritage assets ▪ Siting of main PCUBs, Control Building, and other physical infrastructure within the PCC use natural topographic screening to minimise visibility – in terms of both overall visual envelope (ZTV) and actual visibility from key heritage assets. ▪ Building orientation designed to minimise impact in key view: e.g. orientation of the main PCUBs has been harmonised with the open vistas when viewed from both the Canisbay Kirk and from Stroma. ▪ Siting, non-alignment and spacing of PCUBs to minimise additional visual confusion and avoid conflict with existing adjacent historic features and buildings. ▪ Building scale designed to be compatible with scale of landscape and seascape character of site and wider landscape setting. ▪ Distinctive building form creates strong identity and clear rationale relating to renewable marine energy source. ▪ Building form and finishes, include use of natural materials, designed to reflect aesthetic qualities associated with landscape and seascape character of site and wider landscape setting. ▪ Use of local stone walling in harmony with existing uses to help screen buildings. ▪ Design ensures that the prominence of Canisbay Kirk and its dominance of the local landscape is not challenged by the size and height of the buildings and ensuring that the buildings do not break the horizon when looking to them from the sea. ▪ Design ensures that the key view between the kirk and the manse is not interrupted.
Socio-economics, tourism and	▪ There are a number of national, regional and local initiatives involving the Scottish Government, regional and local development agencies and the Caithness and North Sutherland Regeneration Partnership with the

ES section / topic	Commitment
recreation	aim to work towards enhanced skills training, supply chain enhancement, and support for business improvement working in the marine renewables industry, including Caithness. These will assist in realising and maximising the opportunities in the local and wider areas and where appropriate MeyGen will support these initiatives. ▪ Consultation with local businesses to manage traffic flow during major local events. ▪ During the temporary HDD activities, screening measures may be implemented to reduce impacts on passing visitors. ▪ For the potential positive construction impacts there are a number of national, regional and local initiatives involving the Scottish Government, regional and local development agencies and the Caithness and North Sutherland Regeneration Partnership with the aim to work towards enhanced skills training, supply chain enhancement, and support for business improvement working in the marine renewables industry, including Caithness. These will assist in realising and maximising the opportunities in the local and wider areas and where appropriate MeyGen will support these initiatives. ▪ Temporary interruption of recreation routes during construction will be carefully managed and any diversions clearly sign-posted; information on construction works circulated to recreational businesses and public notices distributed ▪ During the temporary HDD activities, screening measures may be implemented to reduce impacts on passing recreational users or from recreational focal points. ▪ Marine Safety Information broadcasts will be issued by HM Coastguard to inform mariners of the activity at the MeyGen site. ▪ The Project will be depicted on Admiralty Charts produced by UKHO. ▪ Navtex and Notice to Mariners will be issued including details of MeyGen works. ▪ Information on the work activity at the site will be circulated directly to local ports, ferry operators and recreational clubs and businesses. ▪ For the potential positive decommissioning impacts mitigation as above for economic impacts will increase the likelihood of occurrence.
Onshore transport and access	▪ During the onshore construction phase Project contractors will preferentially use the A836. ▪ Liaison with the local community and users of the area regarding overall construction activities such as details of types, levels, timing and routing of traffic will help to reduce the sensitivity of the receptors to change. ▪ The layout of the site has a large pull in area for large vehicles to avoid blocking the road. ▪ The large deliveries will be planned and marshalled so they so not coincide with each other and to avoid the peak traffic times on the local roads infrastructure. ▪ A member of the construction management team will liaise and co-ordinate with the local community to ensure that deliveries do not coincide with significant local events. ▪ The construction team will publicise when deliveries using large or slow moving equipment is planned to inform local road users. ▪ The local community will be kept informed of when and where restrictions in traffic flow during cable installation and construction of the permanent access road to the PCC will occur, and identify measures to limit restrictions. ▪ If turbine components are to be transported to the Caithness area by road, a traffic management plan should be developed in discussion with Transport Scotland and Scotland Transerv who is responsible for the management of the north west Scotland trunk road network. The traffic management plan will include provision for: o Deliveries using large or slow moving equipment will be planned to avoid peak traffic times o Deliveries using large or slow moving equipment will be planned so they do not coincide with each other. o The operations team will publicise when deliveries using large or slow moving equipment is planned to inform local road users and communities along the route.
Noise and dust	▪ Submission of CEMP detailing predicted construction and HDD noise levels and mitigation measures to be used and detailing measures to ensure dust emissions are kept to a minimum. ▪ Limit construction working times to minimise noise during sensitive periods. ▪ Noise limit of 65 dB $L_{Aeq,1h}$ for construction noise. ▪ Implementation of noise monitoring scheme to verify compliance with noise limits. ▪ The local community should be kept informed of overall construction activities including details of types, levels and routes of traffic. ▪ Installation of noise control engineering measures to rig and ancillary equipment. ▪ Use of enclosures, barriers and baffle mounds. ▪ Noise limit of 45 dB L_{Aeq} and 60 dB LA_{Fmax} for night-time drilling operations at the nearest noise sensitive receptor. ▪ Use of acoustic materials to clad the PCC buildings. ▪ Acoustically absorbent lining on inner façade of building. ▪ Installation of acoustic louvers for building ventilation. ▪ Orientation of PCC buildings so that any vent extracts point away from noise sensitive properties.
Accidental events	▪ Vessels associated with all Project operations will comply with IMO/MCA codes for prevention of oil pollution and any vessels over 400 GT will have onboard SOPEP's. ▪ Vessels associated with all Project operations will carry onboard oil and chemical spill mop up kits. ▪ Where possible vessels with a proven track record for operating in similar conditions will be employed. ▪ Vessel activities associated with installation, operation, routine maintenance and decommissioning will occur in suitable conditions to reduce the chance of an oil spill resulting from the influence of unfavourable weather conditions. ▪ Only recognised marine standard fluids and substances will be used in the pin pile drilling equipment. ▪ Consideration will be given to CIRIA guidance on the use of concrete in maritime engineering – a good practice guide.

ES section / topic	Commitment
	▪ Operations will only take place during suitable weather windows. ▪ A fibre optic cable will be used to monitor the level of cement, when the cement reaches seabed level pumping of cement will cease immediately. ▪ During cementing operations the cement will be separated from the open sea conductor casing which is only removed once the cement has reached sufficient strength to withstand current forces. ▪ Dry cement will be stored in strong bags made of appropriate material to avoid loss of any kind; empty bags will be stored in an appropriate container and disposed of accordingly onshore. ▪ In the event of any unplanned discharges to sea during HDD activities the drilling contractor would activate its emergency response plan to ensure discharges were minimised. ▪ All vehicles used will have up to date MOTs and will be operated by suitably qualified personnel. ▪ Due attention will be given to weather conditions and appropriate action will be taken i.e. vehicles will not be used when the weather is deemed to present dangerous conditions e.g. severe ice and snow. ▪ The plan for the construction phase will take into the account the capacity of the local road network. ▪ Only recognised marine standard fluids and substances will be used in the turbine hydraulic systems. ▪ Hydraulic fluids will be mostly water based, biodegradable and be of low aquatic toxicity. ▪ Turbine sensors will detect loss of fluid pressure and leaks enabling maintenance operatives to reduce the risk of further leaks. ▪ The design of the building which be such to allow good ventilation. ▪ Due regard will be given to the Fire Safety Scotland (Regulations) 2006 and Part 3 of the Fire Scotland Act 2005 which details the provision for fire safety in non domestic premises. ▪ Alarms and fire detection measures will be included in the design of the PCC. ▪ A fire risk assessment should be carried out for the PCC. ▪ In regard to the storage of fuel, SEPA PP2 ‘above ground storage tanks’ will be followed. In particular the fuel tank will be chosen and positioned with fire risk in mind and will be located with sufficient space around it or a physical fire barrier. The base will also be suitably designed as to minimise fire risk. ▪ The power conversion equipment will be water or air cooled to avoid overheating and will contain very little combustible material. The equipment will be self-extinguishing and a fire/smoke alarm system will be installed in each power conversion container. ▪ Industry standard switches will be used to turn off source of energy in the event of fire detection and there will be a container provided fire and smoke containment. ▪ The transformer is F1 certified and meets standard IEC 60076-11. A vacuum cast dry type transformer (significantly lower risk of fire compared to oil filled transformers) will be used. The transformers will be self-extinguishing. ▪ The gas insulated switch gear (virtually no fire risk) meets requirements of standard IEC 60694.

Table 25.1: MeyGen Tidal Energy Project, Phase 1 commitments

25.3 Environmental Monitoring Strategy

25.3.1 Survey, Deploy and Monitor

25.10 Due to the emerging nature of the tidal energy industry there are some potential impacts that have yet to be verified by operational monitoring in the industry. Where single turbines have been installed and potential environmental impacts monitored, MeyGen has made use of the available data. However, MeyGen recognises that there is little data currently available and its application to the assessment of a commercial array of turbines is limited. MeyGen therefore propose to implement a Survey, Deploy and Monitor strategy to reduce the uncertainty around particular impacts with the installation and operation of the first small array installed within the Project.

25.11 The Survey, Deploy and Monitor strategy is recognised by the Scottish Government as an important mechanism for the development of marine renewable energy in Scotland. Marine Scotland has produced guidance for Survey, Deploy and Monitor strategies and MeyGen has, and will continue to, consult with the regulatory body to ensure the project strategy is properly aligned.

25.12 MeyGen will develop an appropriate monitoring and reporting programme to cover the installation, operations and maintenance of the Project.

25.13 As the MeyGen Tidal Energy Project will be developed in a series of phases, which supports the Scottish Government policy, the initial small array of turbines will be monitored to provide information on the interactions between the turbines and the environment. This will increase the knowledge and reduce assessment uncertainty for subsequent build out of the Project and for future consent applications.

25.14 Based on the installation program outlined in Section 5, monitoring of the year 1 turbines will be used to verify the conclusions of the impact assessment, which will inform the year 3 installation and also provide information for the subsequent consent applications and EIA for future phases of the project.

25.15 The overall length of the monitoring program will be dependent on the success of monitoring strategies used and whether the data gathered is able to answer the questions posed with a given level of confidence.

25.16 Monitoring will be designed to be appropriate to the scale of the Project and will take into account what is feasible at this level. MeyGen will use best available practices to monitor potential impacts, but recognises that at the present time, for certain impacts, there are no established and/or recognised standard monitoring protocols.

25.17 It is proposed that an advisory group is set up to oversee the monitoring program involving the relevant regulators and stakeholders, including Marine Scotland and Scottish Natural Heritage (SNH). The monitoring advisory group would review the objectives, outputs and timescales of the program and ultimately have the ability to amend the program based on how successful it is.

25.18 Where monitoring indicates that additional mitigating measures may be reasonably required, MeyGen is committed to put these in place.

25.3.2 Project and strategic research and monitoring

25.19 Through the environmental impact assessment (EIA) process, MeyGen has recognised that being the first application for a commercial scale tidal stream project in Scotland and the first from The Crown Estate's Pentland Firth and Orkney Waters (PFOW) leasing round, means there is some uncertainty with the impact assessment due to the nascent status of the industry and in some cases a lack of data on a particular receptor at a regional, national or international scale.

25.20 For example, the potential collisions between bird, marine mammal and fish species and tidal turbines represents the single greatest knowledge gap in the industry. These uncertainties encompass ones which need to be addressed across the industry and are not regarded as something individual developers are able to adequately resource.

25.21 The current situation means that MeyGen has identified two approaches to monitoring:

- Where MeyGen identifies a monitoring requirement for a Project specific issue, monitoring protocols will be developed in consultation with the regulators and stakeholders.
- Where uncertainties in the assessment are identified that are considered of strategic importance to the development of the tidal steam industry, MeyGen would look to a collaborative effort between the Project, wider industry, regulatory and stakeholders to reduce the uncertainty in this area. In the monitoring program MeyGen would wish to engage the wider community and industry in discussions in how best to take this forward in the most efficient way for the interest of the Project and future projects elsewhere in Scotland and the UK.

25.22 The monitoring program will be closely linked to the strategic research currently being carried out and proposed for the future by regulators and academia.

25.3.3 Current government/PFOW strategic research

25.23 Marine Scotland (either on its own or in partnership with other organisations e.g. SNH has a significant research programme which it considers is required to inform further development of offshore renewable energy in Scotland's seas. The research is specifically investigating potential impacts between seabirds, marine mammals, habitats and marine renewables, as well as generic research into the potential effects on the marine environment as a whole.

25.24 The current research programme for 2011/12 includes:

- A significant research programme for marine renewables through the Scottish Government Marine Energy Spatial Planning Group (MESPG) Environmental Research sub-group. SNH's involvement in the Marine Scotland research programme is directly linked their own Research Strategy (2010-2013), Theme 5 'Working with Renewable Energy' and Theme 12 'Coasts and Seas';
- There are also a number of projects being undertaken to inform the Pentland Firth Marine Spatial Plan pilot project and the development of a Sectoral Plan for Marine Renewables, including projects on shipping and navigation, tourism and recreation and fishing; and
- The Crown Estate (TCE) is also involved in Marine Scotland research for the marine renewables. TCE Pentland Firth and Orkney Waters Enabling Actions Fund has been set up to accelerate and de-risk development of the marine renewables projects including research into potential environmental impacts in conjunction with Marine Scotland's strategy.

25.25 Strategic research includes the following areas:

- Develop guidance on survey and monitoring;
- Supporting monitoring of deployed devices;
- Commissioning or contributing to resource surveys, to inform site selection and subsequent assessments;
- Supporting development of techniques or technologies to detect and record species present around turbines;
- Supporting the development of locational guidance;
- Understanding the significance of potential impacts upon species and habitats and their conservation status; and

- Identifying approaches for device management and operation that will minimise or avoid environmental impacts.

25.3.4 Other research

25.26 Monitoring programs could include highly specialised research techniques. There is therefore likely to be an opportunity to involve universities and research institutes in some aspects of monitoring.

25.27 There are a number of research projects currently investigating the tidal stream environment and the potential environmental impacts of marine renewables. The most applicable to the Project is Environmental Research Institute's (ERI) Marine Renewable Energy and the Environment (MaREE) project. MeyGen holds a position on the MaREE project advisory board and has an interest in the existing research and the potential to take it forward to look at environmental monitoring of array scale projects.

25.28 Other relevant university research projects include:

- MReds (Marine Renewable Energy Development in Scotland), led by Heriot Watt University and the University of the Highlands and Islands (UHI), which includes a theme on environmental and ecological impacts;
- SUPERGEN, now in its third phase this project has a core consortium which now consists of the University of Edinburgh, the University of Strathclyde, Queen's University Belfast and the University of Exeter. Work Pack 12 investigates The Economic, Environmental and Social Impact of New Marine Technologies for the Production of Electricity; and
- PRIMaRE (The Peninsula Research Institute for Marine Renewables Energy) research to understand and quantify and mitigate the environmental and biodiversity impacts of marine renewables energy extraction.

25.29 A new funding opportunity has also been jointly announced by the Natural Environmental Research Council (NERC), Technology Strategy Board (TSB) and Scottish Enterprise. The £10.5M funding round for industry led research titled 'Marine energy: Supporting array technologies'.

25.30 The funding is designed to overcome new technical barriers at commercial array scale projects that are common across the industry.

25.31 NERC is keen to facilitate working collaborations between industry and environmental scientists to help 'design out' environmental impacts early on and will provide funds for the 'translation' of previous NERC-funded environmental science into industry-led projects.

25.32 MeyGen will look for opportunities to collaborate with research institutes in designing and implementing the monitoring program.

ReDAPT

25.33 TGL, one of the candidate tidal turbines for the MeyGen project, is planned as a vehicle for environmental monitoring through ReDAPT (Reliable Data Acquisition Platform for Tidal) project. The ReDAPT project is commissioned and funded by the ETI and aims to install and test a 1MW tidal turbine at the European Marine Energy Centre (EMEC) in Orkney, delivering detailed environmental and performance information never before achieved at this scale in real sea conditions. The performance data will be used to validate a variety of models include detailed Computational Fluid Dynamics (CFD) for the turbine, near field models of the turbulent water flow near the turbine and far field models of the EMEC test site. The project will provide substantial data on tidal resource and environmental assessment, tidal device performance, as well as supply chain assessment.

25.3.5 Pre-installation surveys

25.34 MeyGen will build on the baseline data surveys conducted for the EIA, producing a program for pre-installation surveys. The survey program will be designed as part of the proposed installation and operational monitoring. It will be important that the pre-installation surveys are designed to target the specific requirement of the monitoring and allow for the robust analysis of monitoring data and the power to detect potential change in the environment.

25.35 Surveys are also likely to be required onshore prior to construction to identify areas being actively used by particular species. Construction work will be planned to avoid or minimise disturbance.

25.3.6 Proposed monitoring for MeyGen Tidal Energy Project, Phase 1

25.36 The following summarises the proposed monitoring for the MeyGen Tidal Energy Project Phase 1. Monitoring is summarised on a topic by topic basis.

Physical Environment and Sediment Dynamics
MeyGen propose to deploy at least 1 ADCP with the initial turbines. Data collected will be used to validate the hydrodynamic modelling undertaken to inform the physical environment and sediment dynamics impact assessment. The sediment erosion/deposition and bedload transport results produced during this modelling study are directly dependant on the quality of the hydrodynamic and wave models, so by validating those underlying models, the morphology results will be partially validated by proxy.
Benthic Habitats and Ecology
Monitoring of benthic habitats and ecology is proposed in order to confirm impact predictions made in the ES; in particular in relation to: ▪ Dispersion of drill cuttings from potential TSS pile installation and HDD bore breakthrough; and ▪ To detect any significant changes in habitats due to the presence of the turbines. Surveys are expected to be required post installation and post decommissioning. Based on current knowledge of the site (extensive baseline surveys and hydrodynamic modelling) and building on the pre installation surveys, it is likely that the benthic monitoring programme would be based primarily on drop down video upstream / downstream of the project such that potential changes to the biotope mosaic in the area could be detected. Reference areas to either side of the turbine array and cable routes could also be sampled.
Marine Mammals
Potential impacts on marine mammals have been assessed as being negligible or minor. Although the results conclude that the Project does not pose a significant risk to marine mammals, MeyGen recognises that due to the emerging nature of the tidal energy industry there is uncertainty about some potential impacts especially where these have yet to be verified by operational monitoring. Where impacts cannot be fully quantified (e.g. turbine collision risk). MeyGen is committed to developing a marine mammal monitoring program. This program will be based on the 'Survey, Deploy and Monitor' strategy in accordance with Scottish Government policy (currently available in draft). MeyGen has recognised that being the first application for a commercial scale tidal stream project in Scotland and the first from The Crown Estate's Pentland Firth and Orkney Waters leasing round, has meant that there is potential for the Project to form part of an industry wide strategic monitoring program that will benefit future projects as well. Where strategic monitoring is appropriate, MeyGen would look to a collaborative effort between the Project, wider industry, regulators and stakeholders to take this forward in the most efficient way for the interest of the Project and future projects elsewhere in Scotland and the UK. As part of this EIA and the MeyGen commitment to post-installation monitoring, the draft SNH survey and monitoring guidance (MacLeod *et al*., 2011; Sparling *et al*., 2011) has been reviewed. Although this guidance does not, and cannot, give specific details of what marine mammal monitoring should take place, based on the general approaches described and on current knowledge of the site (obtained from the extensive baseline surveys), it is likely that the monitoring programme could include some or all of the following: <u>Disturbance and displacement</u> ▪ Targeted observations of all marine mammals to determine how area use or behaviour may have changed over time; ▪ Acoustic monitoring of harbour porpoise (and incidentally other echo-locating species) using static loggers to assist with determining area use; and ▪ Collection of underwater noise measurements of the candidate prototype tidal turbines. The data collected will be used to validate the underwater noise modelling completed to inform the impact assessment. <u>Collision risk</u> MeyGen believes that understanding marine mammal behaviour around tidal turbines and the risk of collisions occurring is fundamental for the industry to progress. It is therefore proposed that this potential impact is considered as strategic research and therefore monitoring development in cooperation with regulators, stakeholders and other developers. This impact

assessment has indicated seals as the species group of most concern. Monitoring could include::

- Continuation of ongoing seal tagging programme in the Inner Sound;
- Installation of one or more active monitoring systems on one or more tidal device to better understand the near-field response of marine mammals (and other marine species) to operating tidal devices, and
- Shoreline monitoring for marine mammal carcases and subsequent necropsy to determine if interaction between marine mammals and turbines/ducted propellers is occurring.

MeyGen will work with the regulator (Marine Scotland) and its advisory bodies (e.g. SNH) to agree the details of appropriate monitoring and will ensure that the monitoring programme is aligned with industry best practice. Methods for assessing disturbance and displacement impacts (including underwater noise) and collision risk can potentially be linked with similar effort required for Ornithology and Fish Ecology.

Where monitoring indicates that additional mitigation measures may be reasonably required, MeyGen is committed to put these in place.

Ornithology

Potential impacts on birds have been assessed as being negligible or minor. Although the results conclude that the Project does not pose a significant risk to birds, MeyGen recognises that due to the emerging nature of the tidal energy industry there is uncertainty about some potential impacts especially where these have yet to be verified by operational monitoring in the industry.

Where impacts cannot be fully quantified (e.g. turbine collision risk). MeyGen is committed to developing a bird monitoring program. This program will be based on the 'Survey, Deploy and Monitor' strategy in accordance with Scottish Government policy (currently available in draft).

MeyGen has recognised that being the first application for a commercial scale tidal stream project in Scotland and the first from The Crown Estate's Pentland Firth and Orkney Waters leasing round, has meant that there is potential for the Project to form part of an industry wide strategic monitoring program that will benefit future projects as well.

Where strategic monitoring is appropriate, MeyGen would look to a collaborative effort between the Project, wider industry, regulators and stakeholders to take this forward in the most efficient way for the interest of the Project and future projects elsewhere in Scotland and the UK.

As part of this EIA and the MeyGen commitment to post-installation monitoring, the draft SNH survey and monitoring guidance (MacLeod *et al*., 2011; Sparling *et al*., 2011) has been reviewed. Although this guidance does not, and cannot, give specific details of what ornithology monitoring should take place, based on the general approaches described and on current knowledge of the site (obtained from the extensive baseline surveys), it is likely that the monitoring programme could include some or all of the following:

<u>Disturbance and displacement (birds at sea)</u>

- Targeted boat or land-based observations of all bird species to determine how area use or behaviour may have changed over time. Critical periods of the year are the breeding season; and,
- Collection of underwater noise measurements of the candidate prototype tidal turbines. The data collected will be used to validate the underwater noise modelling completed to inform the impact assessment.

<u>Collision risk (birds at sea)</u>

MeyGen believes that understanding diving bird behaviour around tidal turbines and the risk of collisions occurring is fundamental for the industry to progress. It is therefore proposed that this potential impact is considered as strategic research and therefore monitoring approaches should be developed in cooperation with regulators, stakeholders and other developers. Monitoring could include:

- Installation of one or more active monitoring systems on one or more tidal device to better understand the near-field response of bird species) to operating tidal devices; and,
- Other strategic research such as expanding current research on the extent of connectivity between the site and local breeding colonies. Fitting individual birds with geo-locating tags and dive data loggers will provide information on this and would also contribute to collision risk monitoring.

MeyGen will work with the regulator (Marine Scotland) and its advisory bodies (e.g. SNH) to agree the details of appropriate monitoring and will ensure that the monitoring programme is aligned with industry best practice. Methods for assessing disturbance and displacement impacts and collision risk can potentially be linked with similar effort required for Marine Mammals and Fish Ecology.

Where monitoring indicates that additional mitigation measures may be reasonably required, MeyGen is committed to put these in place.

With regards to the onshore aspects of the Project, once the final onshore development areas are known, a pre construction bird survey will be undertaken, the scope of which will be agreed with SNH.

Fish Ecology

The majority of potential impacts on fish have been assessed as being not significant. The potential impact of EMF impact was assessed to be potentially significant before mitigation. Although the results conclude that the Project does not pose a significant risk to fish, MeyGen recognises that due to the emerging nature of the tidal energy industry there is uncertainty about some potential impacts especially where these have yet to be verified by operational monitoring in the industry.

Where impacts cannot be fully quantified (e.g. turbine collision risk). MeyGen is committed to developing a fish monitoring program. This program will be based on the 'Survey, Deploy and Monitor' strategy in accordance with Scottish Government policy (currently available in draft).

MeyGen has recognised that being the first application for a commercial scale tidal stream project in Scotland and the first from The Crown Estate's Pentland Firth and Orkney Waters leasing round, has meant that there is potential for the Project to form part of an industry wide strategic monitoring program that will benefit future projects as well.

Where strategic monitoring is appropriate, MeyGen would look to a collaborative effort between the Project, wider industry, regulators and stakeholders to take this forward in the most efficient way for the interest of the Project and future projects elsewhere in Scotland and the UK.

With particular regard to diadromous (migratory routes and behaviour) and elasmobranch (behaviour) fish species, there is overarching lack of scientific data. MeyGen is aware of the strategic research being carried out by the Scottish Government and academic institutions will help reduce that knowledge gap which will help verify this EIA and give greater confidence in future assessments. However, based on the prohibitively high level of effort required and the non-site-specific nature it is not believed that this is something that an individual developer should be actively involved in.

As part of this EIA and the MeyGen commitment to post-installation monitoring, the draft SNH survey and monitoring guidance (MacLeod *et al*., 2011; Sparling *et al*., 2011) has been reviewed. Although this guidance does not, and cannot, give specific details of what fish monitoring should take place, based on the general approaches described and on current knowledge of the site (obtained from the extensive baseline surveys), it is likely that the monitoring programme could include the following:

<u>Disturbance and displacement</u>

- Collection of underwater noise measurements of the candidate prototype tidal turbines. The data collected will be used to validate the underwater noise modelling completed to inform the impact assessment.

<u>Collision Risk</u>

MeyGen believes that understanding fish behaviour around tidal turbines and the risk of collisions occurring is fundamental for the industry to progress. It is therefore proposed that this potential impact is considered as strategic research and therefore monitoring development in cooperation with regulators, stakeholders and other developers. Monitoring could include:

- Installation of one or more active monitoring systems on one or more tidal device to better understand the near-field response of fish species) to operating tidal devices.

The EIA has concluded that the project could have a potentially significant impact on elasmobranch species. The effect of EMF on these species is being researched by the Scottish Government and it is understood that this will give greater confidence in the assessment and the mitigation outlined. MeyGen does not propose any site-specific monitoring for EMF impacts.

MeyGen will work with the regulator (Marine Scotland) and its advisory bodies (e.g. SNH) to agree the details of appropriate monitoring and will ensure that the monitoring programme is aligned with industry best practice. Methods for assessing disturbance and displacement impacts and collision risk can potentially be linked with similar effort required for Marine Mammals and Ornithology.

Where monitoring indicates that additional mitigation measures may be reasonably required, MeyGen is committed to put these in place.

Commercial Fisheries

No monitoring specific to commercial fisheries is proposed. However, consultation with local fishermen will be ongoing throughout the duration of the Project to aid assessment of any long term project impacts, in addition to helping inform the decommissioning phase, ensuring disruption to the local fishing fleet is minimised where possible.

Vessel traffic behaviour will be monitored as described for Shipping and Navigation (see below).

Shipping and Navigation

Traffic will be monitored on AIS during construction and operation of the devices to assess the effect the Project has on passing traffic and the proportion of vessels that re route either within the Inner Sound or via the Outer Sound. Any other changes in vessel behaviour compared to the baseline traffic data will be reviewed, e.g. transit times relevant to tide.

Marine Cultural Heritage

A reporting protocol will be put in place in the event of discovery of previously unknown marine cultural heritage material. Depending on the significance of the find there may be a requirement for further investigation and recording in line with the mitigation proposed.

Geology, Hydrology and Hydrogeology

Monitoring is proposed of any surface water courses that could be affected by the Project, to provide baseline water quality prior to any construction and to provide reassurance that mitigation measures are effective.

Surface water monitoring will include regular visual inspections of identified locations, plus regular but less frequent water quality sampling.

The monitoring will include control sites outwith affected watercourse catchments and/or upstream of all proposed activity as well as areas within the MeyGen Project area and downstream of the proposed activity. The construction contractors Environmental Clerk of Works (or equivalent) will monitor the construction team to avoid any accidental damage to surface water courses.
Terrestrial Habitats and Ecology
Once specific onshore development areas are known, further investigation of potential species, specifically otter and water vole will required to ascertain the status of these protected species within the Project footprint and immediate surrounding environment. Targeted species surveys will be undertaken to determine otter and water vole presence and distribution to inform protected species licensing and monitoring requirements (should monitoring be deemed necessary), throughout the duration of the Project. The construction contractors Environmental Clerk of Works (or equivalent) will monitor the construction team to avoid any accidental damage to protected species.
Landscape, Seascape and visual amenity
No monitoring required.
Onshore Cultural Heritage
The construction contractors Environmental Clerk of Works (or equivalent) will monitor the construction team to avoid any accidental damage to identified cultural heritage assets. A reporting protocol will be put in place in the event of discovery of previously unknown marine cultural heritage material. Depending on the significance of the find there may be a requirement for further investigation and recording in line with the mitigation proposed.
Socio Economics, Tourism and Recreation
No monitoring required.
Onshore Transportation and Access
No monitoring required.
Onshore Noise and Dust
It is proposed to undertake surveys during construction and operational phases of the project to monitor noise emissions against consented levels.
Accidental Events
None required as part of routine operation of the project, however in the unlikely event of a pollution incident, appropriate post incident monitoring will be implemented as required and agreed with the regulator and their advisors.

25.4 Interface with Contractors

25.37 Contractor management is an important element of the Project and MeyGen expect contractors to demonstrate a high level of environmental awareness, including suitable management.

25.38 The EMP and responsibilities for environmental standards and procedures will be included as part of all contract invitations to tender. The EMP will be incorporated into an overall CEMD which the contractor will need to adhere to.

25.39 Pre mobilisation audits will be carried out as standard for any vessels, vehicles or equipment that will be used in the Project. This will ensure appropriate procedures, documentation is in place to meet measures identified during the EIA process and MeyGen's statutory obligations.

25.40 Environmental commitments, objectives and targets identified for the Project through the EIA process will be communicated to all contractors through contractual conditions. Contractor performance will be measured against these commitments.

25.5 Environmental Awareness and Training

25.41 MeyGen understand that trained and knowledgeable staff can help to prevent or reduce potential environmental impacts and are therefore committed to ensuring that all personnel who perform or manage Project work that may have the potential to have a significant impact on the environment are trained appropriately.

25.42 Any contractors appointed by MeyGen to undertake work which has the potential to impact on the environment are audited and monitored to ensure they have procedures in place to manage their environmental responsibilities.

25.6 Summary

25.43 Mitigation and environmental management is an iterative process and has been informed by the EIA process, consultation with stakeholders including regulators. Mitigation measures will be monitored to enable MeyGen to track and assess the performance of the EMP, ensuring improvements can be made if necessary.

25.44 With regards to environmental monitoring, MeyGen will use a Survey, Deploy and Monitor strategy to reduce the uncertainty around particular impacts with the installation and operation of the first small array installed within the Project. The monitoring program will be overseen by the proposed advisory board to ensure the objectives and outputs of the program are met.

25.45 Where monitoring indicates that further specific mitigating measures may be reasonably required, MeyGen is committed to put these in place.

25.7 References

Macleod, K., Lacey, C., Quick, N., Hastie, G. and Wilson J. (2011). Guidance on survey and monitoring in relation to marine renewables deployments in Scotland. Volume 2. Cetaceans and Basking Sharks. Unpublished draft report to Scottish Natural Heritage and Marine Scotland.

Sparling, C., Grellier, K., Philpott, E., Macleod, K., and Wilson, J. (2011). Guidance on survey and monitoring in relation to marine renewables deployments in Scotland. Volume 3. Seals. Unpublished draft report to Scottish Natural Heritage and Marine Scotland.

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