Green Highland Renewables

Loch Etive Hydro Developments

Submarine Cable Marine Licence Application

Appendix 1 – Method Statement Including Schedule of Work

1.1 Introduction

This Method Statement describes how Green Highland Renewables would install a submarine cable across Loch Etive to connect a new hydro-electric installation on the Allt Easach river. The document has been prepared in support of a marine license application to MS-LOTS. Some additional information has also been provided on the operation, repair and de-commissioning of the cable should it no longer be required at some point in future.

1.2 The Proposed Submarine Cable / Route

Loch Etive is a natural sea loch on the west coast of Scotland with relatively low salinity due to the constriction at the entrance caused by the Falls of Lora. Connection of the Allt Easach hydro scheme will require the installation of a 33,000V cable on the seabed of Loch Etive. In choosing a route for the cable, GHR have looked at a number of options before deciding on the proposed route. Navigational charts and sonar surveys suggested a suitable route existed between the headland on the south side of Ardmaddy Bay and the beach immediately to the west of Rhubha Bharr, approximately 19km by sea from Connel Bridge, as shown in Figure 1. The Scottish Association of Marine Science were commissioned to carry out a bathymetric and ecological survey of the seabed over the proposed route. Based on these surveys the initial design was modified slightly to allow the proposed cable route to avoid areas of cobbles and boulders where possible. This should allow the cable to sink into the soft mud seabed in time over much of the route length.

Fig 1 – Location Plan for Proposed Cable Route Across Loch Etive

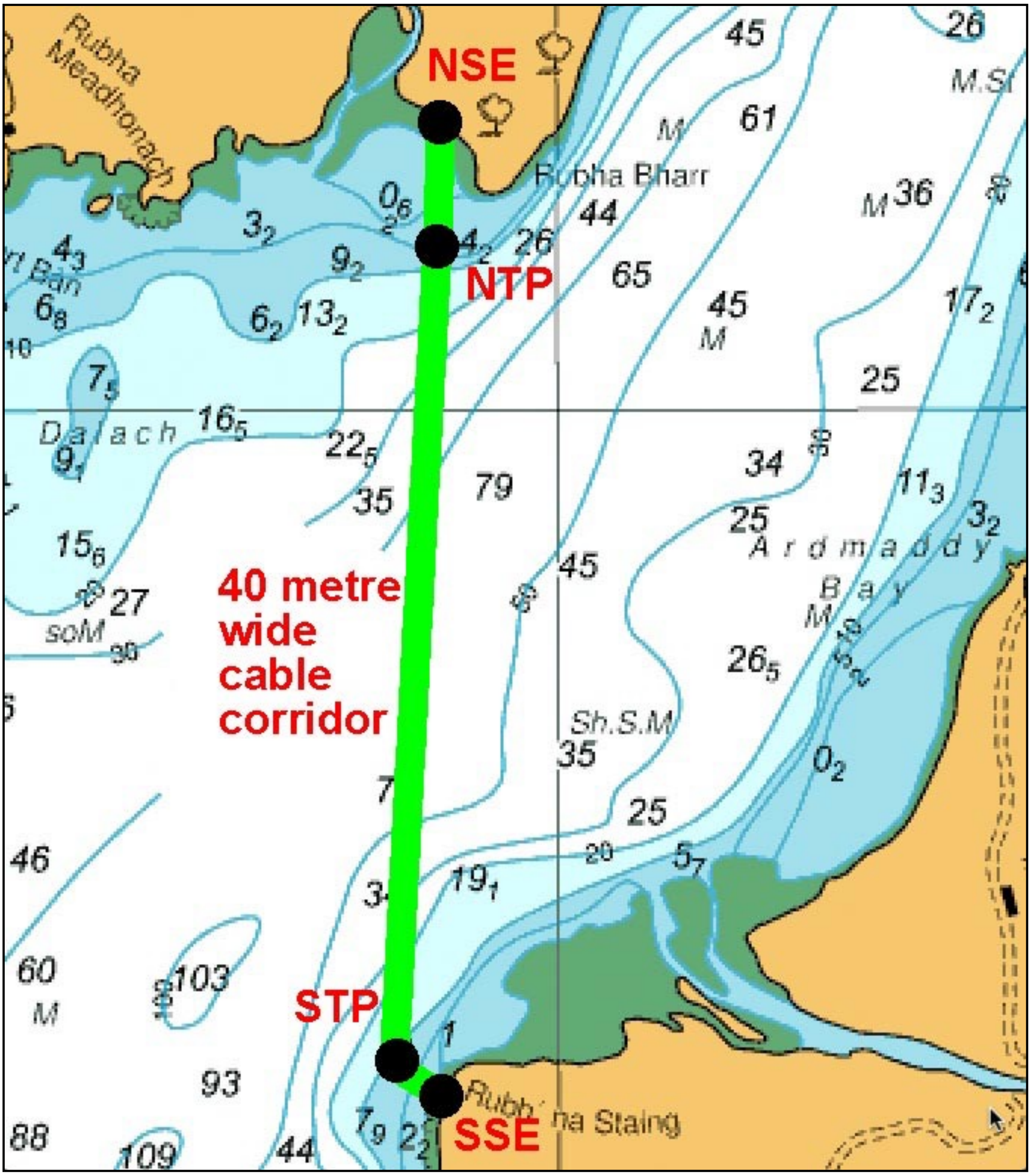

Figure 2 – Proposed Cable Route Across Loch Etive

The North Shore End Position (NSE) is 56° 30.260N   05° 08.183W.
The South Shore End Position (SSE) is 56° 29.372N   05° 08.193W.

The Cable Laying Vessel has to be positioned between 100m and 250m offshore to avoid grounding in shallow water. The vessels spud legs are deployed at these positions to hold position while the cable is being pulled ashore. The two positions are known as the North Transit Position and the South Transit Position.

The North Transit Position (NTP) is 56° 30.140N   05° 08.190W.
The South Transit Position (STP) is 56° 29.401N   05° 08.265W.

All positions relate to the WGS 84 chart datum.

The centre line of the proposed route can be projected between these four positions. The cable will be laid within a 40m corridor on the seabed, 20m on either side of the centre line.

1.3 Cable Design

The type of cable proposed for use in Loch Etive is a standard submarine cable design that has been used extensively around Scotland. The same cable was also used by GHR when they installed a private cable across Loch Tay during 2015 to connect a hydro scheme at Ardtalnaig. The cable is a 3 phase 33,000V cable with copper cores and crosslinked polyethylene insulation. The three cable cores are bundled together and held in place by polypropylene serving tape. A small 3 core communications cable is also included within the cable bundle and this cable will be used to open and close a circuit breaker at the Allt Easach site. The complete cable has a protective layer of galvanised steel wire armour laid over the outside to protect the cable from abrasion during installation and operation. A further layer of polypropylene is wound over the armour to give a black and yellow striped appearance which makes the cable easier to find on the seabed. The completed cable is approximately 95mm in diameter. The approximate weight of the cable is 15.5kg per metre. A cross section drawing of the proposed cable is included as Figure 3.

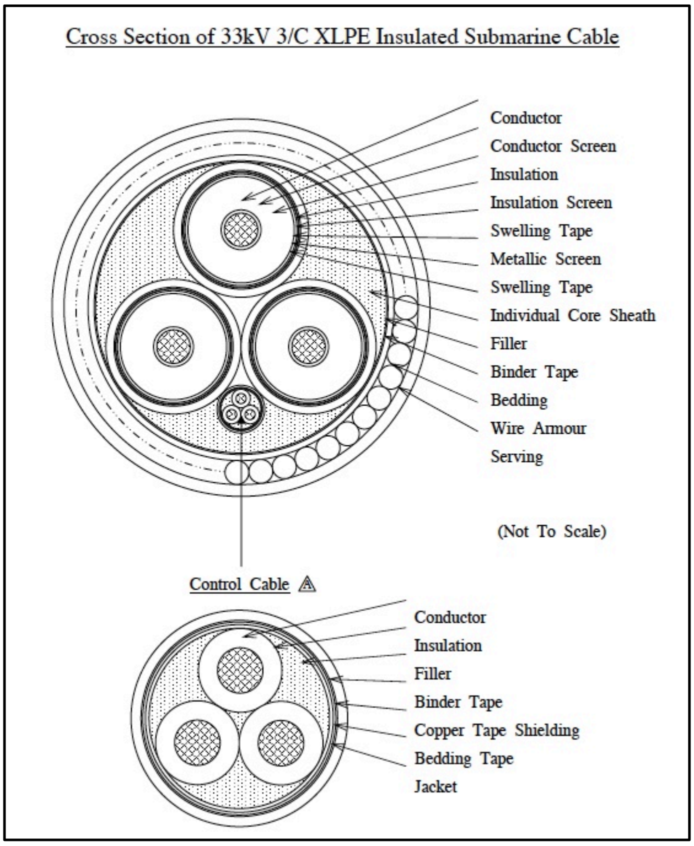

Figure 3 – Proposed Submarine Cable Cross Section

1.4 Cable Delivery, Load Out and Transit to Site

The submarine cable type used by GHR is currently manufactured in Japan. The completed cable will be shipped to the UK in October 2019 and delivered by a low load heavy goods vehicle to Corpach Boatyard, Fort William. Briggs Marine will be contracted to install the cable using their cable installation vessel "Forth Guardsman". The vessel will be fitted out to receive the cable drum at Corpach Boatyard, and once complete the cable will be loaded aboard using a 300T mobile crane. A Marine Warranty Survey will inspect the loaded vessel and once satisfied will issue a Certificate of Approval, verifying that the installation meets the insurers requirements.

The Guardsman will then sail down Loch Linnie and the Lynne of Lorne and pass below Connel Bridge into Loch Etive, arriving late on the flood tide to avoid the worst effects of the Falls of Lora. The vessel will then sail up Loch Etive to the installation site. The total journey from Corpach to site will take approximately 8 hours. Once on site the vessel will make a number of transits over the cable route before positioning at the southern Rhuba na Staing shore end.

1.5 Cable Installation

The Guardsman can be fitted with two retractable piles which can be lowered to the seabed in water less than 10 metres deep to hold the vessel in place, without any need for setting a pattern of anchors and moorings. This saves time during the cable installation process and avoids the need for additional vessels to handle anchors, minimising the hazards associated with this type of work. At Rubha na Staing the vessel will be positioned approximately 100m from the shore in water with a depth of between 5m – 10m. The "spud legs" will be deployed to hold her in position. One end of the submarine cable will be pulled ashore by a small winch previously installed onshore. The cable will have floats attached to prevent it touching the seabed. This operation takes approximately 2 hours. Having completed the shore end the vessel raises the spud legs and then transits across the loch paying out the cable as she goes, to the other shore end at Rhubha Bhar. This transit closely follows the agreed cable route and the actual "as laid" position of the cable is recorded. The maximum depth likely to be encountered is approximately 70m over the proposed route. The transit across the Loch will take approximately 2 hours. Once the vessel is in position at the second shore end the spud legs are once again deployed. The vessel will be approximately 100m offshore. A measurement is made between the cable drum on the vessel and a suitable position well above the high-water mark ashore. The same length of cable is then taken off the drum and coiled on the deck before the cable is cut. This cable is then winched ashore with floats just like the other shore end. The second shore end will take approximately 2 hours to install giving a total of 6 hours for the complete installation.

Fig 4 - Forth Guardsman with Spud Legs Deployed (yellow capped piles)

1.6 Cable Protection

Once the cable has been installed the shore ends will be buried to below the low water mark to hide it from view and remove any tripping hazard for shore users. A yellow diamond beacon will be installed on both shorelines to mark where the cable comes ashore. The as laid position of the cable will be notified to the UK Hydrographic Office who mark the position on Admiralty Charts and advise other suppliers of marine mapping software of the new cable. The European Subsea Cables Association and The Crown Estate will also be notified.

Over a hundred similar submarine cable installations exist in NW Scotland where electricity cables cross sea lochs or provide connections to the Scottish Islands. These cables are simply laid on the seabed and their locations marked on charts to avoid damage from other users. Where the cables are laid in harbours, or on rocky shorelines, where damage from wave action is possible, additional protection is sometimes provided using cast steel cable protectors. These interlocking units are fitted around the cable once it is installed, usually at low tide in the inter-tidal zone, or by using divers when the cable is installed below the low water mark. In preparing the contract documentation for the installation, an option has been included for fitting steel cable protectors at one or both shore ends down to a depth of 10m below chart datum.

In recent years there has been growing interest in the possible impacts that the operation of submarine cables might have on marine organisms as a result of electro-magnetic fields or EMFs produced by cables. In preparing this application Green Highland Renewables have taken advice from a fisheries scientist who has produced a report which is included as part of Appendix 7.4 of this application. Electric fields are very unlikely to be generated outside the screened cable type being used for this application. It is likely that magnetic fields will be present outside the cable although it is not clear whether these would have any negative effect on marine organisms. It is possible to reduce the magnetic field which surrounds a cable by encasing it in a ferromagnetic material like steel or cast iron. The steel wire armour covering of the proposed cable will therefore reduce the magnetic field, but by an unknown amount. It would be reasonable to assume that adding steel cable protectors to completely surround the cable will further reduce the magnetic field. On this project, the plan is to retrofit steel cable protectors using divers down to a depth of 10m to provide additional protection in the nearshore area. As a result, any magnetic field produced by the cable is likely to be reduced in the shallow water. Many of the marine organisms found in Loch Etive tend to swim close to the surface, and this additional protection in the shallow water should eliminate any impact to these organisms. Retrofitting cable protectors in depths exceeding 10m can be challenging for divers due to the limitations on productive seabed time caused by the need to de-compress. It is not practical to fit the protectors to the cable aboard the vessel during the cable lay process without risking damage to the cable.

Figure 5 – Steel Submarine Cable Protectors before burial on the foreshore.

Any additional activity associated with the cable lay will extend the time taken to conduct the operation. This means the size of weather window required increases which could result in the vessel having to spend longer on site waiting on weather. These delays are factored into the contractor's costs which will rise as a result. Burying the cable has a further impact on costs, largely dependent on the burial method employed and the depth at which burial takes place. The following tables give details of four burial techniques and gives an estimate of the likely additional costs and any other consideration. All of these methods will increase the environmental impact of the project.

Mass Flow Excavation - This technique would be the most suitable as there is no contact between the burial equipment and the cable, so the risk of damage is reduced. Large impellors fitted on the device are used to force sea-water downwards into the seabed which fluidises, allowing the cables or pipelines to sink. The excavated trench is approximately 4m wide but it can be difficult to control the depth of the excavation. This method can also be quite destructive to the seabed with a relatively large disturbed area around the trench	This burial method would require a separate multi-cat vessel with a large crane to deploy the rig. The vessel should be able to pass below the Connel Bridge. This type of burial would add approximately £190k to the projected cable installation costs of £470k, a total of £660k, a 40% increase.

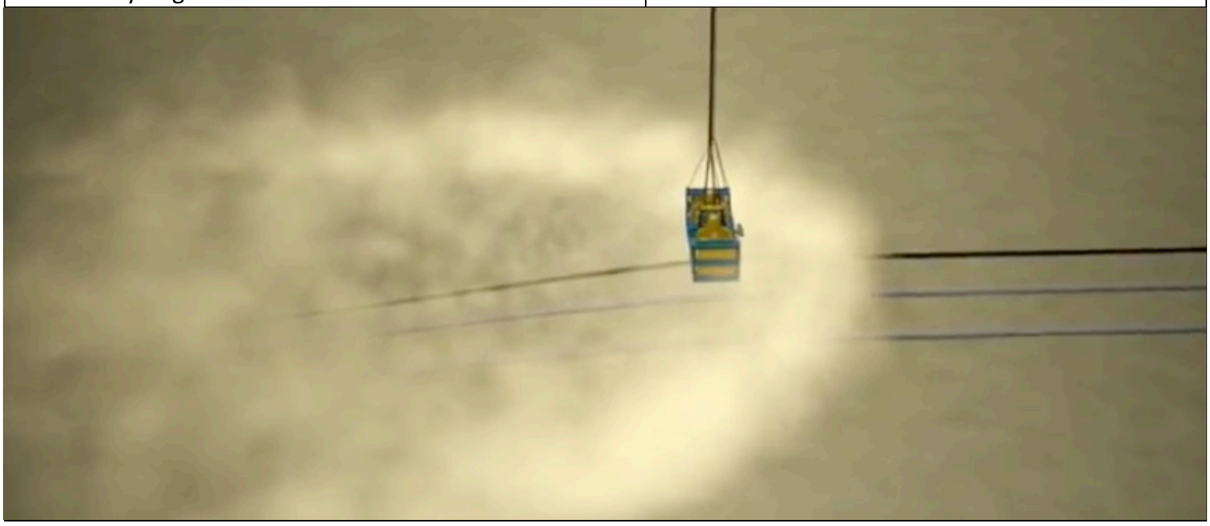

Table 1 – Mass Flow Excavation Details

Trencher - This technique is more hi-tech and installs the cable more precisely than MFE using water jets at each end of the rig Cable trench is approx. 0.5m wide with much less environmental impact as a result. There is contact between the device and the cable using this method however, which increases the risk of damage.	A larger DP2 vessel is required and a smaller vessel may be also required for burial in the shallower water. It is unlikely the vessel would be able to pass below the Connel bridge. This type of burial would add approximately £476k to the projected cable installation costs of £470k, a total of £946k, a 101% increase.

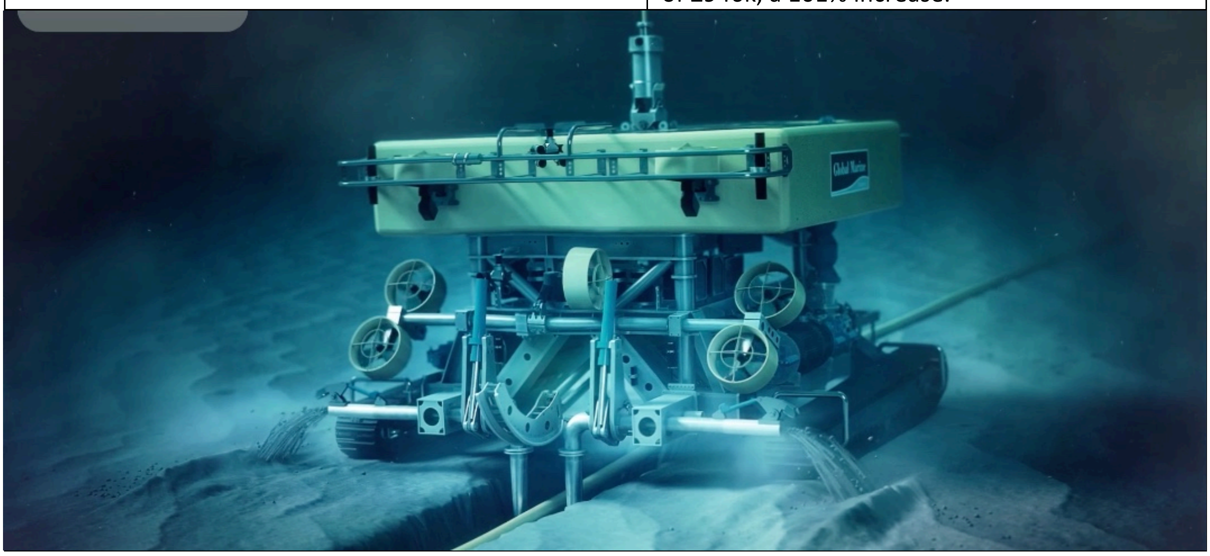

Table 2 – Trencher Details

Jetting by Divers - This technique is a very focussed method of burying cable using air lances to fluidise the seabed and allowing the cable to sink in. Practical solution down for shorter lengths of cable down to a depth of 20m. There is no contact with the cable but the method does tend to put a lot of sediment into the water column.	The operation could be conducted from a DP Multi-cat vessel equipped for use by divers. There would be no issue with getting under the Coonel Bridge. This type of burial would add approximately £100k to the projected cable installation costs of £470k, a total of £570k, a 21% increase. The cable would only be partially buried however.

Table 3 – Jetting by Divers

Concrete Mats – This technique uses a vessel mounted crane to lower concrete mats on top of the cable to protect it. Mats are usually only used to protect short sections of cable for pipeline crossing etc. To protect the entire route would mean laying approx. 250 6m x 3 mats weighing 8 tonnes each onto the cable. placing this amount of new material on the seabed would be intrusive and difficult to justify.	This method would use a delivery barge and a DP Multi-cat vessel with a drum crane and lifting frame to place up to 3 mats at a time on the sea bed. The vessels should be able to pass below the Connel Bridge. This type of protection would add approximately £430k to the projected cable installation costs of £470k, a total of £906k, a 92% increase.

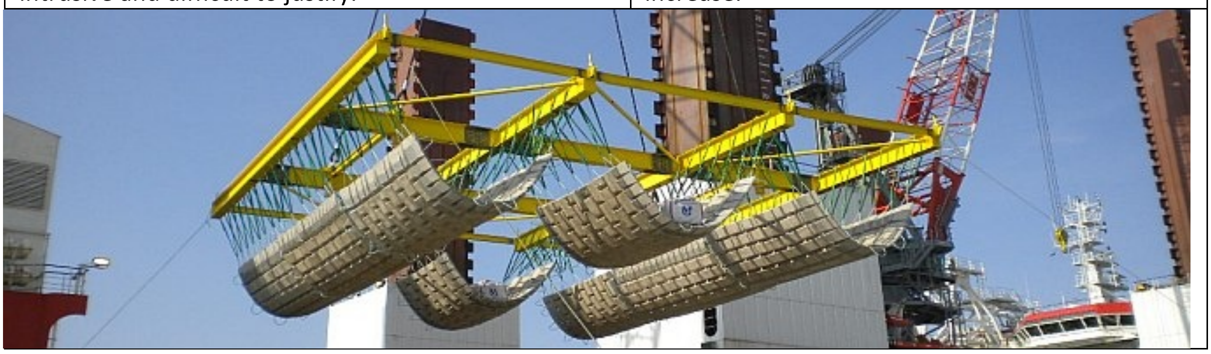

Table 4 – Concrete Cable Protection Mats

1.7 Cable Repair or Replacement

Submarine cables do occasionally become faulty with most damage actually caused during installation or attempted burial. The type of repair carried out on a faulted cable depends on the age and condition of the cable and whereabouts on the cable route the fault has occurred. If a cable has faulted relatively close to shore then it would be normal practice to renew the section of cable from the fault back to the shore. Were the cable to fault near the middle of the route and the point of fault can be clearly identified, then it may be possible to cut the cable on the seabed and bring the faulted end to the surface. The faulty section of cable is removed and a piece of new cable jointed on. The other end is then retrieved from the seabed and jointed on to the new “pieced in” section. The complete cable is then returned to the seabed and re-energised. Where the cable is in very deep water or cannot be cut for whatever reason then the only option is to abandon the cable and lay a new one on a similar route. This is obviously expensive and would mean the output from the Allt Easach scheme could not be exported until the circuit was restored. The delivery and installation time for a new cable from when an order is placed would be approximately 1 year.

1.8 Decommissioning

Submarine cables have been in use around the UK for 150 years and some cables owned by SSE are still operational after 60 years. GHR cannot imagine circumstances which would result in a hydro scheme being closed down. Normally a scheme is refurbished after 40 years or so, giving it a new lease of life. If for some reason the cable did become surplus to requirements then the cable could be removed in a similar way to how it was installed. It may also be acceptable to leave the cable disconnected but still in position on the seabed and this has until now been the generally accepted practice. Discussions with Marine Scotland and The Crown Estate would occur at the time to agree on a solution but the schemes around Loch Etive are expected to deliver renewable energy to the grid indefinitely.

1.9 Project Schedule

This marine licence application was submitted during July 2018. The planning applications for the three hydro schemes were submitted during May 2018, with construction work planned to commence in December 2018. The submarine cable will be ordered during December 2018 and will be delivered to the UK in October 2019. The cable installation will take place during October 2019. The high-level project schedule is shown in Figure 6.

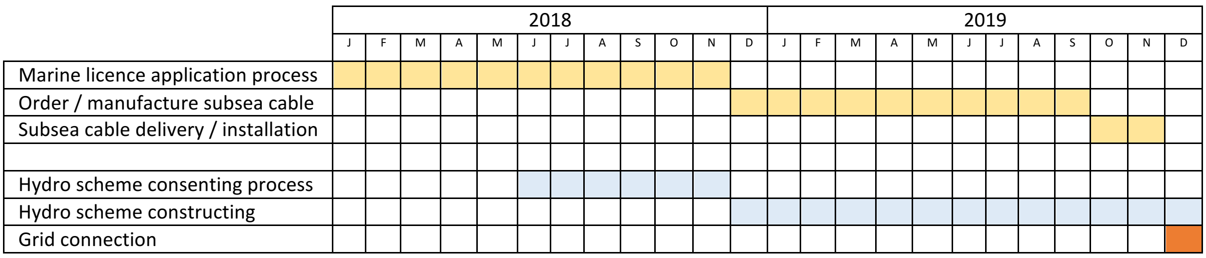

Figure 6 – High Level Project Schedule

1.10 Location Photographs

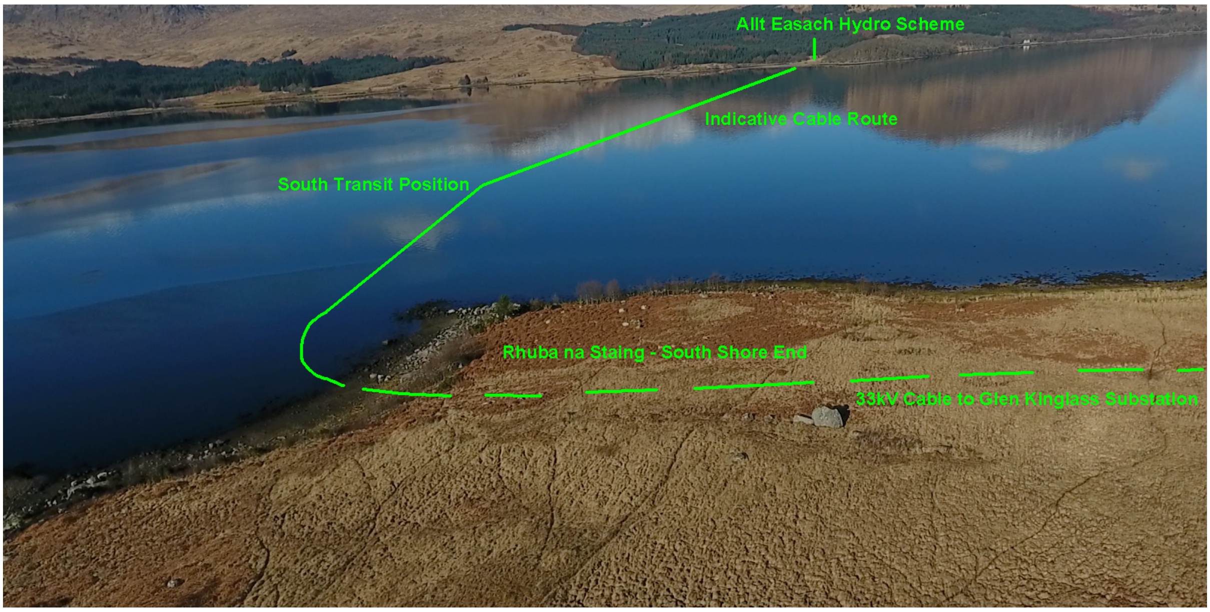

Figure 7 – South Shore End and Indicative Cable Route

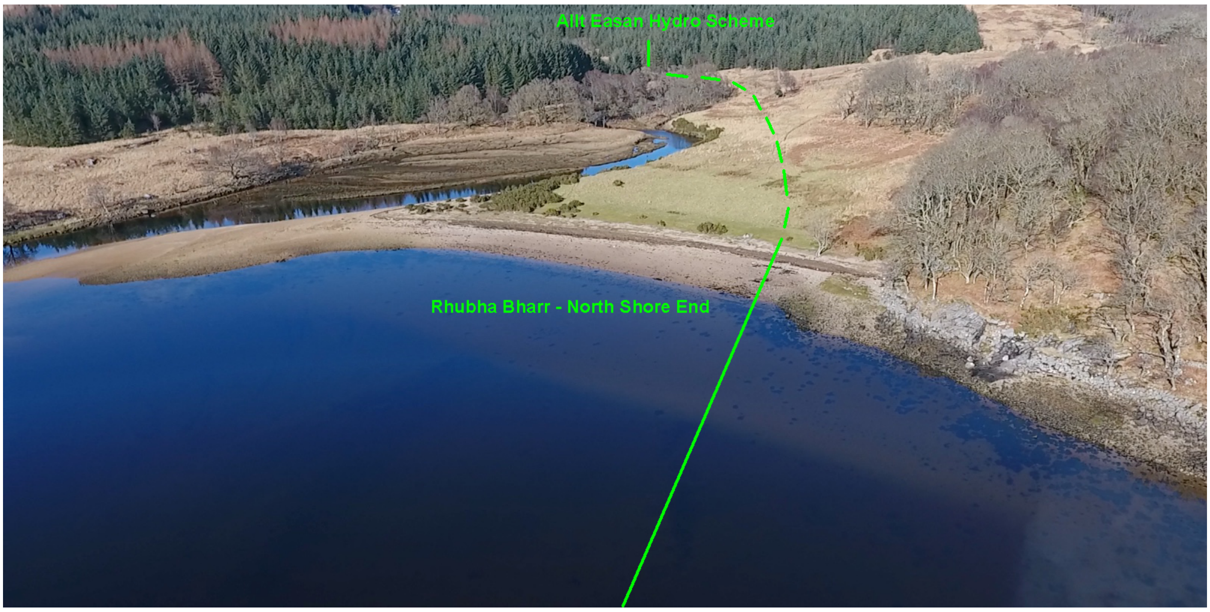

Figure 8 – North Shore End and Indicative Cable Route