12 Navigation risk assessment

12.1 Introduction

The assessment of navigation risk is normally included in the Material Assets Chapter of the EIS but given the importance of this topic in the marine environment it has been included as a separate chapter.

Wave energy converter (WECs) will be placed in the test areas which in turn will be marked by cardinal marks and special buoys. Deep sea shipping, fishing vessels and pleasure craft routinely operate along the Irish West coast. In this context, there is a potential for interaction with the test site as the marker buoys and WECs could constitute a hazard to vessels transiting or operating in the area.

As part of the preparation of an Environmental Impact Statement for the project, Arup performed a 'Shipping and navigation risk assessment' of the proposed AMETS site (see **Appendix 9:** Navigation Risk Assessment). This chapter provides a summary of the findings.

12.2 Approach and methodology

12.2.1 Approach

Information was gathered relating to navigation in the area to support the navigation risk assessment. This included information on local ports and harbours, standard sailing routes, existing Aids to Navigation, existing navigation aids, known navigation hazards, industry activity, weather and sea conditions, bathymetry, fishing grounds, and so on. On assessment of the existing environment, no significant impact on navigation was identified.

The information gathered in relation to existing fishing activities in the area of AMETS has also been used separately to review the test site's impact on fishing grounds in the area. The possible impacts on fishing grounds have been considered during the selection of the location and size of both test areas which is discussed in greater detail in Chapter 3 of the EIS: Project alternatives.

There is currently no Irish guidance or regulations for this type of navigation risk study in relation to ocean energy developments (particularly wave energy sites). Hence, the assessment was carried out in accordance with the UK Department of Trade & Industry's (UK DTI) methodology for offshore wind farms, taking into account the UK Maritime and Coastguard Agency's *Guidance MGN 371*. These are considered authoritative in the sector, and advice has been received from statutory bodies (including the Commissioners of Irish Lights) on how to use this methodology

12.2.2 Methodology

The navigation risk assessment is primarily based on:

- Investigation of the existing environment
- Consultations with stakeholders, users of the area and relevant national authorities
- A semi-quantitative analysis of the traffic data in the area, based on 28 days of vessel traffic survey data collected in the area in 2010/2011
- Data for the months of January and July 2010 sourced from the Irish Coastguard

Consultations were carried out with all groups, organisations and agencies with a stake and/or interest in the waters off the west coast of Ireland, in particular the region off the Mayo coast. The following was concluded from all consultations carried out:

- Standard navigation routes to areas north and south of the AMETS location follow the coastline with change points west of Eagle Island. Navigation routes are likely to be altered slightly as a result of the AMETS development; however, it is not envisaged that this will have a significant impact on users of the area.
- Local navigation is arbitrary. The AMETS development will cause vessels to sail around the area; however, this is not regarded as a significant issue by users of the area.
- Search and rescue (SAR) response in the area will not be negatively impacted upon by the AMETS development.
- The AMETS development should be appropriately marked using Aids to Navigation and other navigation aids (buoys, AIS, racon and so on) and included in navigation charts and notices to mariners. The navigation buoys used should be suitable for the sea conditions in the area.

Using all the information gathered from investigations, consultations and the collection of navigation data, a risk assessment using quantitative techniques has been performed. This risk assessment is provided in **Appendix 9**. The risk assessment process was carried out by project personnel with input from consultees and a panel of experts for the project. A comprehensive hazard log has been developed and was used to document the hazards that are likely to arise for navigation during all stages of the development (construction, operation and decommissioning). The navigation risks outlined in the log were assessed to quantify their likelihood and consequence, and to identify potential mitigation/control measures. Items required to support any mitigation or control measures (for example, navigation marking or search and rescue resources) were investigated further to provide understanding of the issues and potential constraints.

The wave energy converters (WEC) that will be tested at the site are as yet unspecified. For that reason, each device will require its own device-specific risk assessment before installation. Device-specific assessments will need to be submitted to the relevant stakeholders prior to consent (with respect to navigation issues) being given (by AMETS Management Organisation) for a specific device to be installed in the AMETS.

12.2.3 Consultation with stakeholders

The main topics consulted on is provided in Table 12-1. A complete list of consultees is provided in Table 2 of the navigation risk assessment report (**Appendix 9**). A summary of the consultation responses is provided in Section 12.3.9 .

Table 12-1: Consultation topics

Marine traffic in the area	Type of vessels – commercial, leisure, authorities
	Size of vessels – small/large fishing vessels, small/large sailing vessels, rigid inflatable boats (RIBs)
	Local ports, destinations and sailing routes around and through the area
	Tide and weather influence on traffic
	Traffic seasonal changes, present traffic and future traffic
	Duration at sea – overnight traffic in the area, availing of shelter

Sea and weather conditions	Worst sea conditions Currents and waves Visibility Rocks, breakers, sand banks/bars, headlands Navigation in bad weather – Aids to Navigation and other navigation aids
AMETS site	Influence on navigation and sailing routes Influence on navigation of cable laying works to the site
Accidents	Historical records Cause – poor visibility, engine failures and so on Response – drifting/anchor Rescue procedures – Royal National Lifeboat Institute (RNLI) or other, response time, towing

A summary of the consultation responses is provided in Section 12.3.9

12.2.4 Maritime traffic survey

A 28-day maritime survey was carried out in the vicinity of the test site. To take account of seasonality, the survey was carried out over two separate survey periods as follows:

- Winter Survey – 26 November 2010 to 10 December 2010
- Summer Survey – 23 May 2011 to 14 June 2011

The Winter Survey was carried out from a location at Doonamoe blowhole to the NW of Belmullet, Co. Mayo (54° 15' 53.96"N, -10° 4' 34.10"E). The Summer Survey was carried out from Eagle Island lighthouse off the coast of Co. Mayo (54°16.991'N, -10°5.573'E). The location of both the Winter and Summer Surveys relative to the AMETS can be seen in Figure 12-2 and Figure 12-3 respectively.

The traffic analysis was limited to the area within a 10 nautical mile radius of the site. Traffic beyond that would normally be considered not to be affected.

In the case of the AMETS a slightly larger limit was chosen in some areas in order to extend the validity of the assessment. The Area of Interest upon which the traffic analysis was carried out extends for a minimum of 10 nautical miles from any point on the boundary of Test Area A – see Figure 12-1. This Area of Interest is sufficient for assessing the impact of the AMETS installation.

The survey data was collated using a combination of three main sources including:

- Automatic Identification Systems (AIS)
- Shore-based radar
- Visual observations

Vessel Monitoring Service (VMS) data was received for the area in the vicinity of AMETS. However due to the large time interval (2 hours between successive recordings of location points of a vessel, it was felt that that data would not be of value for this navigation risk assessment.

Shore-based radar offers reliable detection of small maritime vessels. Radar provides information on the position and course of vessels. Using microwave radars, it is possible to carry out continuous offshore surveillance to establish the location of vessels within a

certain distance of the on-shore survey site. As shore-based microwave radars operate in line-of-sight mode, they cannot detect and track vessels beyond a certain range.

The shore-based radar detection which took place during both survey periods detected accurately the position of vessels. However the detection range of the radar was limited by sea conditions, as can be seen in Figure 12-2 and Figure 12-3. The radar during both surveys also detected some of the large vessels carrying AIS at greater ranges than seen in Figure 12-2 and Figure 12-3 .

The maximum approximate range in which a vessel was recorded by radar during the Winter Survey was 20 nautical miles – see Figure 12-2. The vessels with the longer ranges are almost exclusively in transit through the area. They have been defined as fishing vessels; however, they are not actually engaged in fishing.

During the surveys, the radar was sectored (detection not taking place through full 360° rotation) to focus the scan area over the water only. Because of this, the area to the north-east of the AMETS was not within the radar detection area.

During the Summer Survey, the maximum radar detection range within which a vessel was detected was approximately 12 nautical miles.

Figure 12-2 shows that the zone containing radar tracks is less than previously achieved during the Winter Survey. This is because transits through the area by large fishing trawlers, which because of their size were recorded at greater ranges during the Winter Survey, appear to be seasonal and are not present during the Summer Survey. Figure 12-4 shows that there was a lot more local fishing activity present along the inshore area during the Summer Survey period. The radar was again sectored while carrying out the Summer Survey radar monitoring.

Visual observations were undertaken on an hourly basis during daylight hours if weather conditions permitted. These were used to supplement the information acquired by the shore-based radar monitoring system and also to validate the data recorded by the AIS and shore-based radar. All of the visual observations were also picked up by radar.

12.3 Environmental baseline

12.3.1 Local ports and harbours

There are no merchant shipping ports near to the proposed AMETS deployment area. The closest commercial ports include Galway to the south east and Sligo to the north east (shown in Figure 12-5). There is a fisheries harbour at Rossaveal, west of Galway and another large, deep-water fisheries harbour at Killybegs, north of Sligo. Killybegs is also used by non-fishing vessels working from the port. This includes offshore supply vessels and an increasing number of passenger liners.

There is also a large number of smaller harbours, piers and slipways dotted along the coast in the area. A number of these are used by smaller fishing vessels, pleasure craft and small ferries serving islands. The approximate locations of these berthing facilities are shown in (shown in Figure 12-7).

12.3.2 Routing measures

There are no vessel routing measures in place in the locality of the AMETS.

12.3.3 Aids to Navigation and other navigational aides

There are a number of navigation lights in the vicinity of the AMETS as shown in . The closest light to Test Areas A and B is on Eagle Island to the north-east.

12.3.4 Wrecks

No wrecks were identified during the seabed survey carried out for the Site Evaluation and Selection report. Admiralty maps for the area close to the AMETS location show no record of the presence of a wreck.

12.3.5 Oil and gas infrastructure

There is a large natural gas field currently under development 83km off the Mayo coast. The offshore pipeline will run from the Corrib Gas Field to a landing point near Ballinaboy, Co. Mayo via Broadhaven Bay. The Corrib Gas Field is approximately 70km from the AMETS's most western test area. The pipe route submitted with the 2001 EIS for the gas project with the approximate location of AMETS superimposed is shown in Figure 12-11. Once construction is complete, the pipeline will be fully buried. While the gas field is a considerable distance away, the proposed pipeline linking the gas field to the coast will be approximately 2.9 nautical miles to the north of Test Area A.

12.3.6 Dredging activity

There is no dredging activity in the surrounding area close to the location of AMETS.

12.3.7 Exercise areas

The Department of Defence confirms that there are no military exercise areas in the vicinity of the AMETS.

12.3.8 Metocean data

According to the *Admiralty Sailing Directions – Irish Coast Pilot*, Irish coastal waters enjoy 'a mild maritime climate although it is also a boisterous one with strong winds and high seas. Higher seas are experienced off the west coast of Ireland than in any other coastal region of the British Isles. Gales can occur in any month but are frequent in winter months especially in the West and along the north coasts. Winds reach storm to hurricane strength on some occasions'.

'Rainfall is also plentiful and well distributed throughout the year.'

'Cloudy conditions predominate in all seasons. Coasts are obscured at times by low cloud and driving rain.'

'Fog at sea is infrequent from November to May; it is most prevalent in June. Land fog, commonly the result of radiation cooling on calm nights, is most frequent in autumn and winter in the hours around dawn and can sometimes extend to inshore waters.'

'Good visibility is encountered more frequently off the south coast of Ireland than off the north coast.'

The metocean conditions are described fully in the Shipping and Navigation Risk Assessment in **Appendix 9**. Metocean data has been obtained from Met Éireann weather station at Belmullet and two Marine Institute weather buoys (M1 and M4) off the west coast of Ireland. The Marine Institute has also located a wave rider and wave scan buoy on site at AMETS – these were used to assess wind and wave height in the area. Wave climatology research carried out in the area by Numerics Warehouse Ltd on behalf of SEAI also proved

useful when assessing the wave conditions. The following is a summary of the metocean data:

Wind roses for weather buoys M1 and M4 show the predominant wind direction is west-south-west (W-SW) with an average wind speed of 15 knots at the location of buoy M1 with 1.1% frequency of winds in excess of 33 knots (Beaufort Force 8: gale force). At buoy M4 the average wind speed is 15.5 knots with 1.18% frequency of winds in excess of 33 knots.

The wind rose at the AMETS Wavescan buoy shows the predominant wind direction is south-south-west (S-SW) direction with average wind of 12.7 knots with 0.16% frequency of winds in excess of 33 knots. This buoy has only operated for a limited period in winter, which explains the relatively low record of winds in excess of 33 knots.

Over the 24-year period from 1983-2006, there were an average of 17 days with fog recorded per year at the Belmullet meteorological station, where fog is defined as occurring when visibility is less then 1km (0.54 nautical miles)

The predominant current is approximately NE-SW. The average current velocity in the area was observed as 0.4 knots with a maximum current velocity of 1.5 knots (SEAI Current Profiler).

Tide ranges from +3.7m to +0.5m at Broadhaven Bay (Chart Datum).

A fifteen year numerical based wave climatological study for the AMETS has been performed by Numerics Warehouse Ltd. for SEAI. This study confirmed that the AMETS has a world class wave energy resource right up to the coastline.

12.3.9 Consultation summary

Fishing grounds

Inshore fishing is the principal type of fishing in the region of the AMETS and is carried out along the entire coast. There is also whitefish or pelagic fishing with larger vessels to the west of the AMETS in deeper waters.

Generally inshore vessels do not travel more than 25 miles west of the mainland when fishing. The fishing effort is largely focused on crab and lobster potting, with some gill-netting and trawling. Local trawlers fish within the inshore fishing area.

The inshore fishing season extends from March to November, with the busiest time and the best crab catches being during the summer months. A typical lobster boat in the region spends about 120 days at sea whereas a crab boat averages 140 days over the fishing season. Areas generally fished around the AMETS site are shown in Figure 12-13.

In the past on rare occasions some smaller vessels have trawled in the area west of the AMETS Test Area B, in Annagh Bay. This is not a regularly trawled area and will not be affected by the location of the test areas. Vessels will be able to pass north or south of the Test Area B to access Annagh Bay.

Navigation of inshore vessels

Navigation routes are variable within this region off the Mayo coast. Inshore fishing vessels generally travel a direct route from port straight to where their fishing gear is located. According to the inshore fishermen consulted, the AMETS is not considered to be of a major significance to navigation in the area, provided it is adequately marked by Aids to Navigation, and is marked on charts, and so on. Vessels will divert their course and travel around both test site areas.

Larger offshore fishing vessels also fish and transit off the west coast of Mayo. These fishing vessels would include larger whitefish and pelagic vessels (25–40 meters) that operate all year round.

The fishing areas for these vessels are predominantly to the west of the outer Test Area A. There are also some trawling grounds adjacent (to the west) and within the area chosen for Test Site A.

International fishing vessels also travel and fish in deeper waters to the west of Test Area A. These vessels may transit past the site but are unlikely to fish close to the shore.

Visibility and hazards

Visibility in the area changes with the environmental conditions. In summer, extremely heavy fog is common but this is not common in winter. The biggest hazard to navigation in the area is Edye Rock (known locally as Mainistir) around Annagh Head (Figure 12-15). Other navigation hazards include all of the islands along the Mullet peninsula (Eagle Island, Inishglora, Inishkeeragh, Inishkea North and Inishkea South) and the Usborne Shoal. These hazards are noted on all navigation charts.

Accidents/breakdowns

Fouling of propellers by ropes or nets is the main cause of breakdowns reported by fishermen and is normally dealt with through local assistance and generally goes unrecorded. Requesting assistance from the Coastguard and RNLI is regarded as the last resort.

Near collisions between smaller inshore vessels and larger offshore fishing vessels and cargo ships have been reported. The large cargo ships (and offshore shipping vessels) commonly work on autopilot using a way point system where crew is notified when the vessel needs to change heading.

Marine industry (excluding fishing)

There is some marine traffic in the area – for example, vessels travelling from Broadhaven and Killybegs to the Corrib Gas Field. There are also small to medium size vessels that trade from port to port, close to the coast in the European area (referred to as 'coasters') and large ocean-going vessels or deep-sea vessels (usually larger than coasters). These larger ships operate on an autopilot system following standard routes with waypoints at different locations, for example to the west of Eagle Island, near the AMETS. The waters in this area would be considered relatively and ships' crews may be less vigilant.

Marine leisure

The area has some marine leisure traffic including:

- Boating and sailing
- Sea angling and diving
- Water sports – surfing, rowing, kayaking, and so on

Boating and sailing

There are a number of local sailing clubs in the area, located mainly within Blacksod Bay and other sheltered bays to the east of the Belmullet peninsula. Larger sailing yachts, both Irish and international, traverse the area. These are generally in the 30–70ft (9-20m) range. Frenchport Bay is a popular anchorage for yachts going round the coast. There is also a round Ireland race that takes place every two years. The Irish Sailing Association (ISA) and the Irish Cruising Club (ICC) publish information on sailing routes and areas used by leisure

craft. Figure 12-17 below shows the ISA-ICC sailing information for the area of interest off north Mayo.

Sea angling and diving

Sea angling and diving associations in the area have noted that there is some use of the area. However, this is not deemed significant and would not be affected by the AMETS project in terms of navigation.

Water sports

The site will not affect navigation for water sports in the area. The cable laying construction works may have an impact on users of the beach at Annagh.

National authorities / Government agencies / Search & Rescue

Consultation with the Coastguard indicates that there is sufficient ship passing room in the region either inside or outside the location of Test Area A. There is a large gap (approximately 4.2 nautical miles) between Test Area A and Test Area B, and this is considered more than enough for a ship to pass through.

There will be a requirement to include the AMETS. on Admiralty charts. The Marine Survey Office (MSO) will update the location of the AMETS on navigation charts and they can also publish notices to mariners in relation to the site if required.

There is no traffic segregation or separation scheme in place, and sailing routes in the area are as preferred by each vessel. The proposed Test Area A may be on a commonly-used sailing route. However, the Coastguard feels that attempts to move the Test Area A towards the coast would increase navigation risk as it would create a narrower sailing channel on the land-side of the site.

In the course of an emergency operation the RNLI have no specific routes – they travel directly to any incident and for that reason, they in order to avoid collisions, they need to know the exact locations of all objects in the waters. Although the test areas represent an obstacle to Search & Rescue, this is not seen as a major issue.

12.3.10 Maritime traffic survey

The radar and AIS receiver recorded vessels passing within the area of interest surrounding AMETS during each period. These were analysed in terms of vessel type, daily numbers, shipping density and encounters.

The data indicated that there are a considerable number of vessels classified as cargo and 'other' travelling from E-W and W-E to the north of AMETS. These vessels were more than likely involved in the construction of a gas installation at the Corrib Gas Field and contribute to the increased number of vessels identified during the summer survey period

Table 12-1summarises the number of tracks associated with each category of ship identified within the area of Interest around the AMETS, as recorded by the summer and winter surveys.

Vessel track density is a measure of the number of tracks that entered each square nautical mile in a grid. For the summer and winter surveys, see and .

During the Winter Survey the highest Vessel Track Density area occurs in the inshore area along the coast, between the two proposed test areas, as the vessels travel around Erris Head.

The Vessel Track Density plot for the Summer Survey shows most occurring close to the test site areas. This is partly caused by the reduced radar range. The higher activity to the north of the site is related to traffic travelling to the Corrib Gas Field installation.

Table 12-1: Number of AIS tracks per ship type during winter and summer survey

Number of AIS tracks per category	Winter survey	Summer survey
Fishing	84	58
General Cargo	10	17
Recreational	1	15
Fish Processing	7	0
Naval	0	2
Tanker	0	1
Other	0	12
Undefined	3	4
Total	**105**	**109**

12.4 Impacts of the development

An initial assessment of the traffic near the site indicated that the shipping activity off the coast of Belmullet was low compared to other areas where similar offshore developments have been constructed.

The UK's Department of Trade and Industry (DTI) guidance states that the scope and depth of the risk assessment, together with the tools and techniques necessary to carry this out, should be proportionate to the scale of the development and the magnitude of the risks. On this basis, the AMETS development is a 'low risk, small scale development ... a development in an area where the potential risks are low, and/or a small scale development'.

12.4.1 Impacts on fishing vessels

Rerouting of vessels around the AMETS will be required once the test areas are established. A number of fishing vessel tracks passed through the AMETS Test Area A during the winter survey period. Almost all tracks appeared to indicate vessels transiting rather than actually fishing in the area of the AMETS. Based on the data collected, the impact of rerouting vessels to avoid the Test Area A is likely to be small as there is substantial sea-room to the east and west of Test Area A.

The intensity of fishing traffic in the vicinity of the AMETS was also low during the summer survey. Based on the data observed, the impact that the test sites will have on fishing traffic in the region is likely to be minimal.

Some fishing activity (predominantly potting) is carried out within the proposed Test Area A, as identified during the summer survey. Access to test areas will no longer be available once the development is in place..

The overall navigational impact on fishing traffic in the area is not considered significant. Local users will be the most up to date with the development of the site and have in general confirmed that, once that the site is indicated on charts, they will sail and fish around it.

12.4.2 Potential impacts on commercial vessels

Commercial shipping may be required to deviate around the AMETS test areas. In the context of the typical voyages of commercial vessels on the routes affected and the relatively small displacement of the routes, there is not considered to be a significant commercial impact as a result of the AMETS development.

The promulgation of information to international users and marking on Admiralty charts will be critical to minimising risk of collision. Many larger ships sail on autopilot, making it paramount that the site is input to their systems when calculating the route.

12.4.3 Potential impacts on recreational vessels

Based on the data collected and consultations with recreational users of this area, it is considered that the proposed location of AMETS will have a minimal impact on the recreational vessel activity in the area. Marking of the test site with navigation buoys and on navigation charts is critical for recreational users.

During the construction phase of the site, the presence of construction vessels and the likely additional vessel movements to the operations bases in order to supply and re-crew the operations, will pose an additional navigational risk.

12.4.4 Outcome of assessment of hazards during installation and decommissioning of WEC

The hazards identified during the assessment process are listed in table 12-2.

Table 12-2: Outcome of assessment of hazards

Hazard type	Description	Risk assessment
Collision impact	Includes collisions between any vessels in the or around AMETS.	The risk tolerability was quantified as 'broadly acceptable' in all instances relating to collision.
Contact	Potential hazards included a vessel under control or a vessel drifting making contact with WEC or buoy	The risk tolerability was quantified as 'tolerable with monitoring' in both instances. While likely consequence is seen as minor, the possible frequency has been seen as remote in both cases.
Grounding and foundering	Vessel grounding or becoming stranded due to restricted manoeuvring because of AMETS was identified as a hazard.	The risk tolerability was quantified as 'broadly acceptable' once risk control measures in place.
Foundering and capsizing	A potential hazard may exist if a vessel towing fishing equipment snags a sub-sea obstacle causing the vessel to founder or capsize	The risk tolerability was quantified as 'broadly acceptable' once risk control measures in place.
Machinery related accidents	WEC failure resulting in debris entering seaways and failure of WEC navigation aids resulting in non detection of AMETS.	These risks were quantified as 'broadly acceptable' based on the risk control measures that can be implemented.
Accidents to personnel	Accidents caused by transfer to/from servicing vessel to a WEC or another vessel requiring Search & Rescue response , accidents onboard WEC requiring emergency	The risk tolerability relating to transferring between vessels and WEC and relating to person in water were defined as 'tolerable with monitoring'. This was mainly due to the fact that the

Hazard type	Description	Risk assessment
	rescue of servicing personnel and accident resulting in person in water requiring rescue	frequency of these hazards occurring over the course of the licence period was felt to be reasonably probable. The tolerability of the risk of accident onboard a WEC requiring emergency rescue has been quantified as 'broadly acceptable' as the frequency has been described as extremely remote with little chance of an accident occurring requiring emergency rescue
Electrocution	There are a number of potential hazards that could cause electrocution. A vessel hitting a WEC sufficiently hard to pierce and breach cable insulation and an anchoring vessel dragging up export cable and shorts cable to anchor are the hazards identified.	Both have been quantified as 'broadly acceptable'.
Search & Rescue	The presence of AMETS is cited as a hazard increasing the risk of an accident requiring Search & Rescue and also may hinder Search & Rescue operations	The risk tolerability has been quantified as 'tolerable with monitoring'. While the likely consequence is seen as minor, the possible frequency has been seen as remote.
Emergency response	The presence of AMETS is cited as a hazard increasing the need for emergency response and also may hinder ability to provide emergency response	The risk tolerability has been quantified as 'tolerable with monitoring'. The typical consequence is seen as minor and the possible frequency has been seen as remote.

12.5 Mitigation

The following mitigation measures have been developed based on the risk assessment carried out in consultation with key stakeholders.

12.5.1 General mitigation measures

- Control measures for frequent users of the area around the test site should be defined and managed by the test site management organisation. This may include measures such as defining and agreeing with fishermen a procedure for retrieving any fishing gear that enters the site.
- Position monitoring of WECs and buoys to ensure position stationary.
- Salvage response planning to outline the procedures in place in the event of emergency; salvage asset provision planning in order to ensure necessary salvage equipment in place.
- A separate device-specific risk assessment outlining the hazards associated with the WEC will be prepared by the WEC developer before WECs are installed in the AMETS. The device-specific risk assessments will be considered by the test site management organisation and read in conjunction with the findings of the Navigation Risk Assessment.

12.5.2 Construction phase mitigation measures

- Notices are required to be issued in advance of works on the AMETS development, including work on the construction, installation or decommissioning of any device; These include:
    - A marine notice approved by the Maritime Safety Division of the Department of Transport – this should describe the works, and give commencement and completion dates . The notice must be published at least four months prior to work commencing.
    - Site location to be communicated to fishing organisations.
    - Marking of the site on navigation charts in order to inform fishing vessels of site and to give them the opportunity to plan alternative fishing routes.
- All vessels employed in relation to the development will comply with all statutory regulations and will be of sufficient size to cope with the works and ambient weather conditions.
- The construction and decommissioning work should be planned and managed to ensure the safety of those involved and of other maritime users in this area. This should include the selection of contractors and the working vessels to ensure they are competent and capable of undertaking the works required, and that they are in compliance with offshore industry guidance and best practices.
- Guard vessel during construction/decommissioning to protect vessels and to alert navigating vessels to operations in progress.
- Electricity cables will require to be buried or alternatively be protected sufficiently with rock armour in order to minimise the risk of damage by fishing vessels or mooring operations.

12.5.3 Operation phase

The site will need to be adequately marked (appropriately sized navigation buoys with AIS, equipped with radar reflection panels and so on), noted on navigation charts and included in radio navigation warnings and notices to mariners as necessary. The scheme design marking of the test site areas will need to be finalised on consultation with national authorities and in line with guidance documents.

Marking and lighting of individual structures will be as required to make all structures clearly visible during night and day.

The outline of the test areas, as marked on the navigation charts, will form the boundary of a safety zone. Vessels will not be allowed to sail within the safety zone.

A reliable inspection, maintenance and casualty response regime will need to be implemented to ensure that the required reliability targets for navigation aids (as specified by IALA standards) are met

It is important that both the RNLI and other emergency services understand the layout and workings of the site and are involved in emergency exercises for the site. Search & Rescue should also be covered by each device-specific risk assessment.

Personal protective equipment should be compulsory for all personal on site to ensure safety. site personnel should be trained appropriately to assist in the event of accident.

Adverse weather working conditions policy must be in place to prevent work being carried out in inappropriate weather and to reduce the likelihood of accidents as a result of bad weather.

WEC and navigation buoys should be properly designed and installed in order to reduce the need for maintenance and service vessel activity at the test site.

12.5.4 Decommissioning phase

The risks and potential impacts during decommissioning will be similar to those for the construction phase.

12.5.5 Conclusion

The AMETS risk assessment carried out in line with the UK DTI guidance indicates that the majority of the risks identified are 'broadly acceptable' provided the risk control measures outlined within the risk assessment hazard log are put in place. A technical review by industry experts carried out as part of this report confirmed that the risk assessment is reasonable **(Appendix 9:** Navigation Risk Assessment). Therefore, once all the outlined control measures are in place, these risks require no further action.

The risks determined as 'Tolerable with Monitoring' (provided the necessary control measures are implemented as outlined within the hazard log) include:

- The risk of a vessel under control making contact with WEC or buoy
- The risk of a vessel not under command or drifting making contact with WEC or buoy
- The risk of accidents caused by transfer to or from a servicing vessel (or helicopter) to a WEC or another service vessel requiring SAR and/or emergency response
- The risk of a person in the water requiring rescue
- The presence of AMETS increasing the risk of an accident requiring Search & Rescue and also the potential of AMETS hindering Search & Rescue operations
- The presence of AMETS increasing the need for emergency response and also the potential of AMETS hindering the ability to provide emergency response.

WEC developers will include the hazards relevant to their device in a device-specific navigation risk assessment, which will be approved by the AMETS management before the WEC is installed.

The construction and operational work will be planned and managed to ensure the safety of those involved and the safety of other maritime users in this area. This will include the selection of contractors and working vessels that are competent or capable of undertaking the works required, and that comply with offshore industry guidance and best practices.

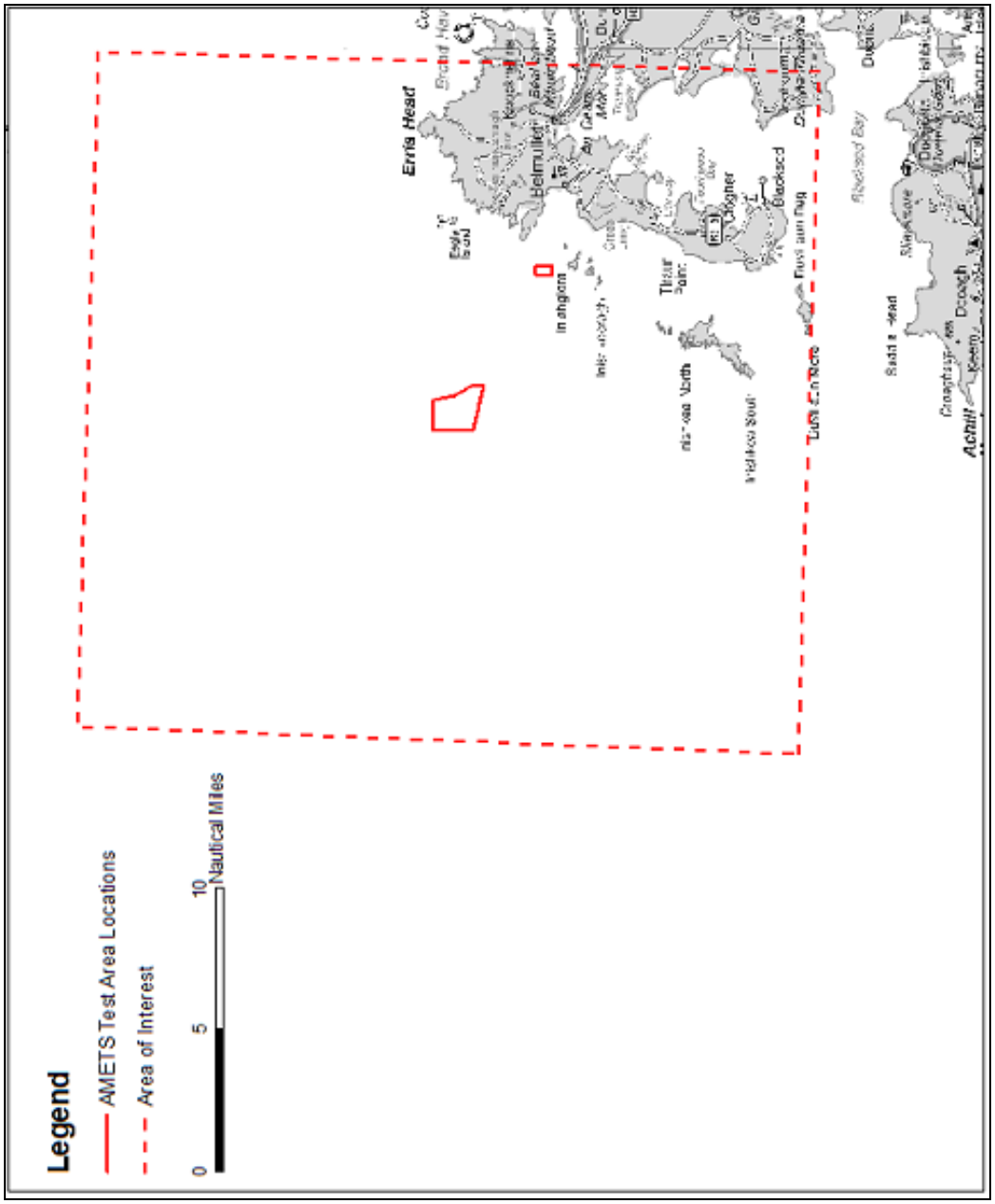

Figure 12-1: Area of Interest surrounding AMETS chosen for Analysis

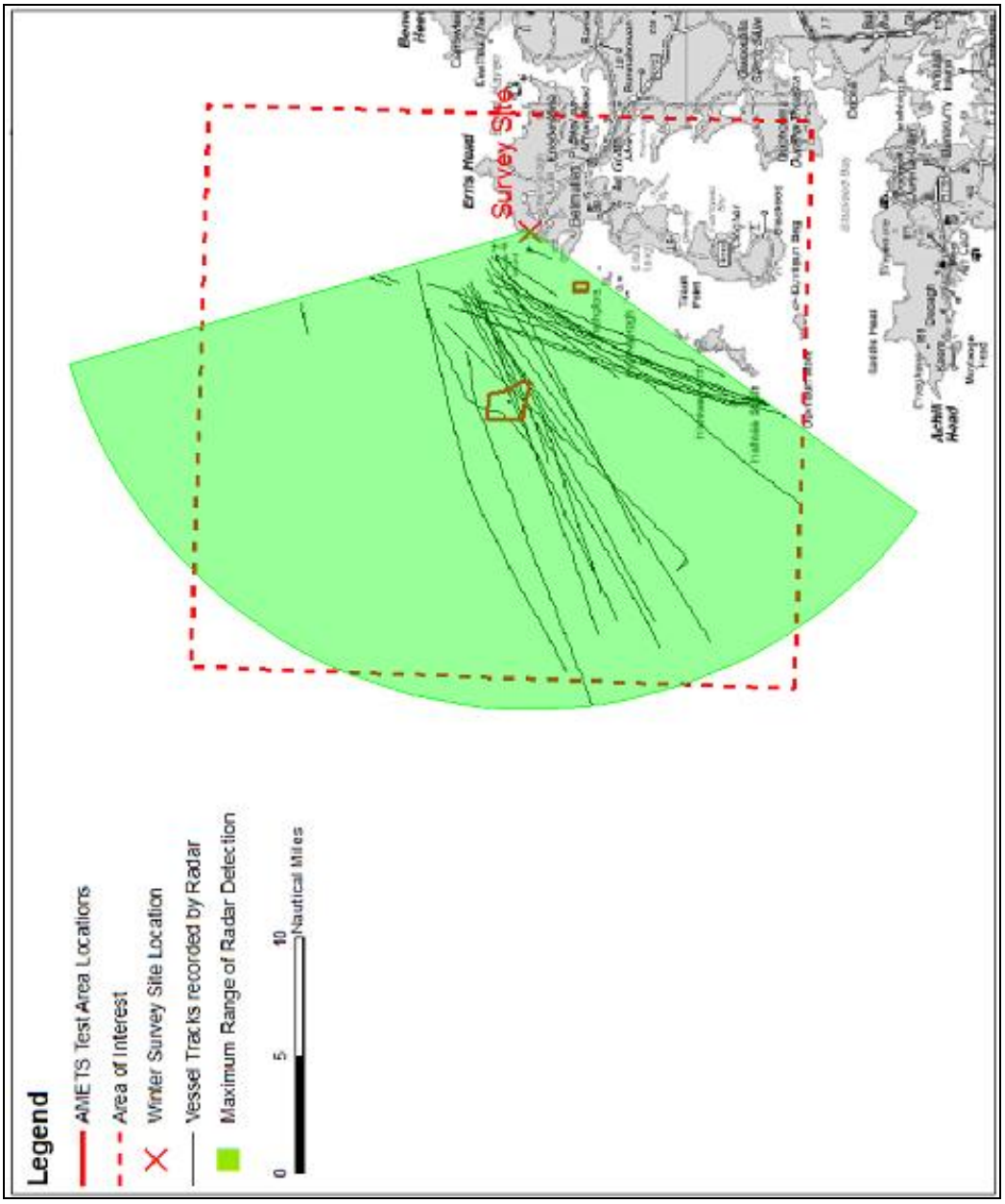

Figure 12-2 Maximum approximate range of radar detection during Winter Survey

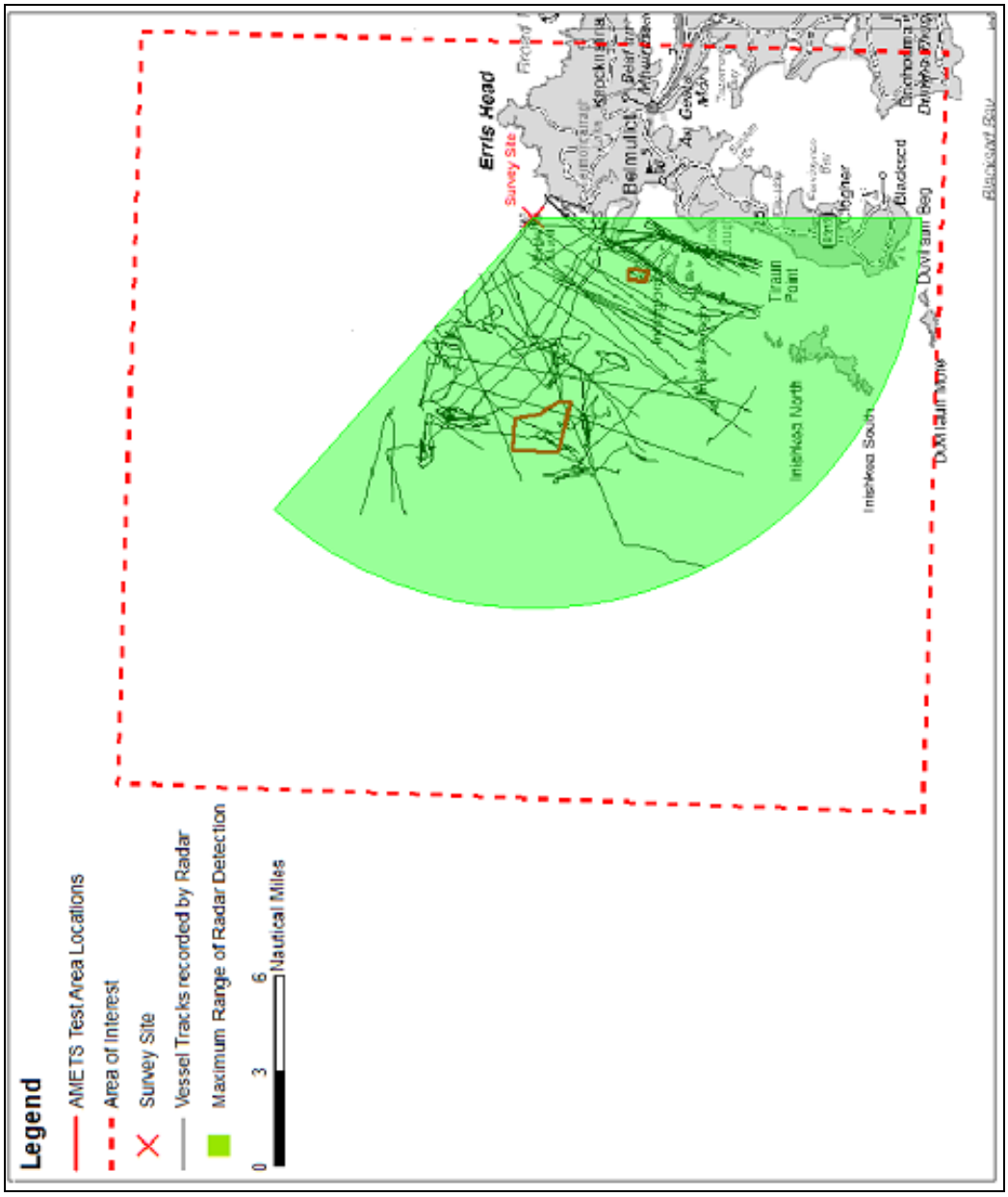

Figure 12-3: Approximate range of radar detection during Summer Survey

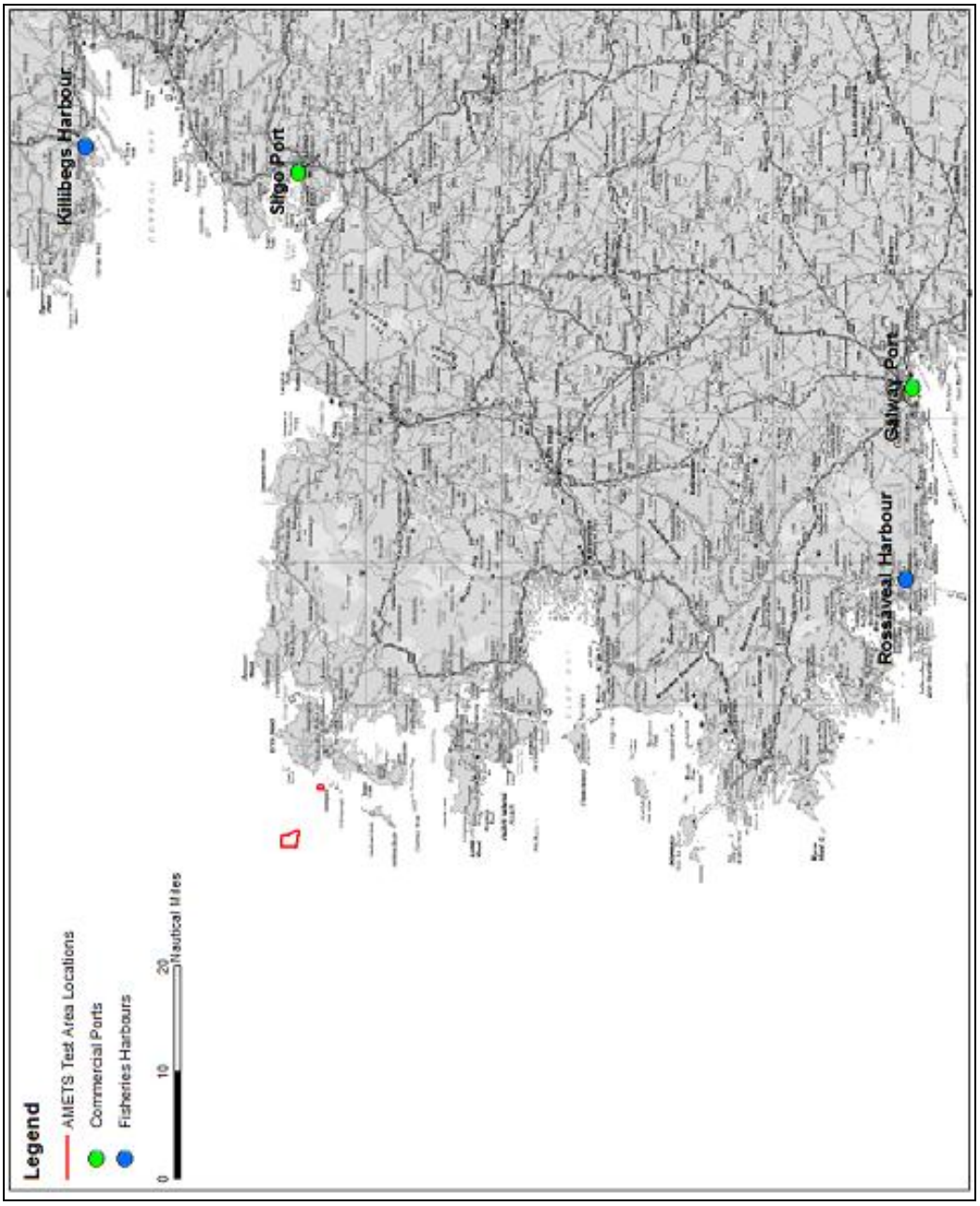

Figure 12-4: Ports and large fisheries harbours in the vicinity of the AMETS location

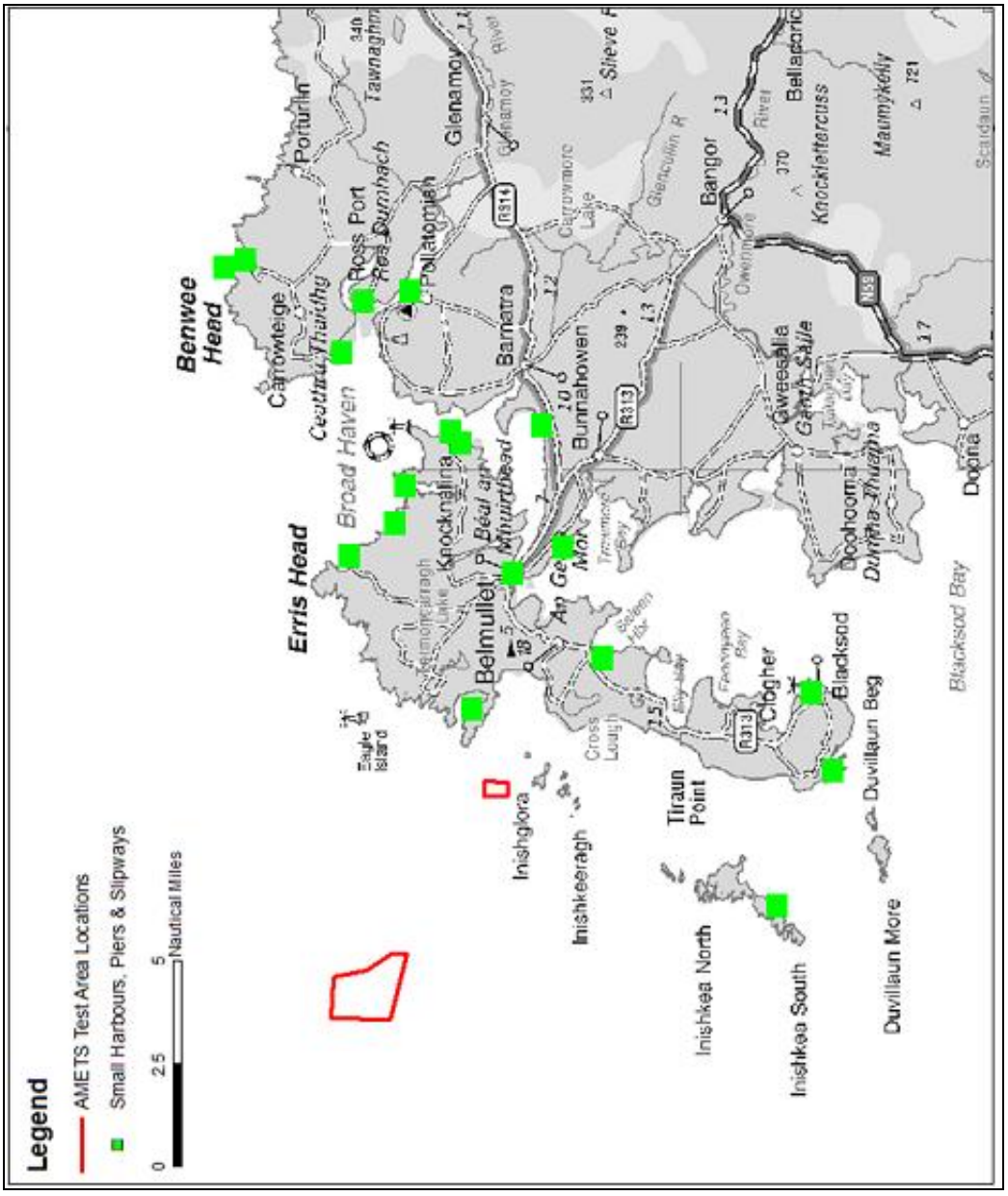

Figure 12-5: Smaller harbours, piers and slipways in the vicinity of the AMETS location

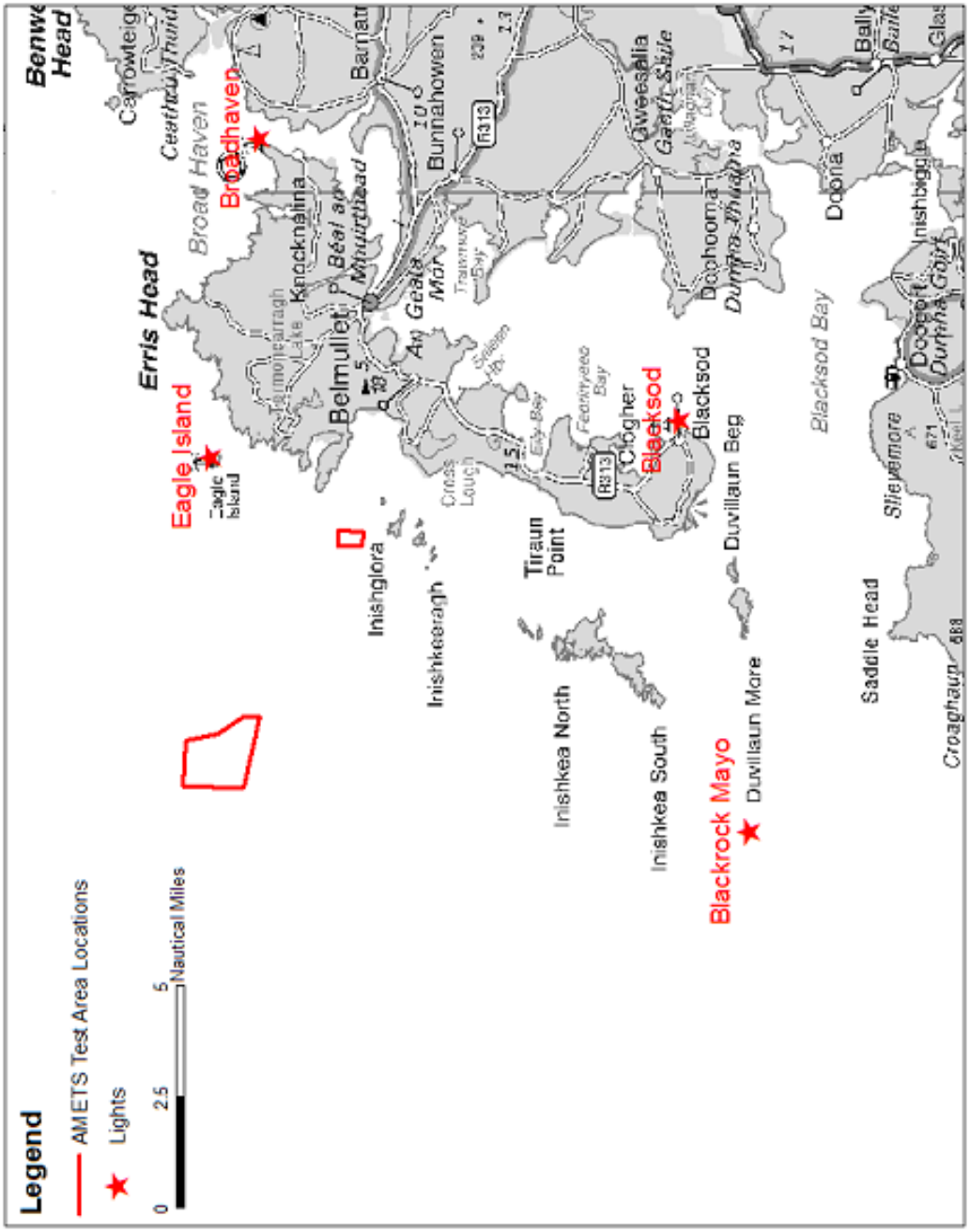

Figure 12-6: Aids to Navigation in the vicinity of the AMETS location

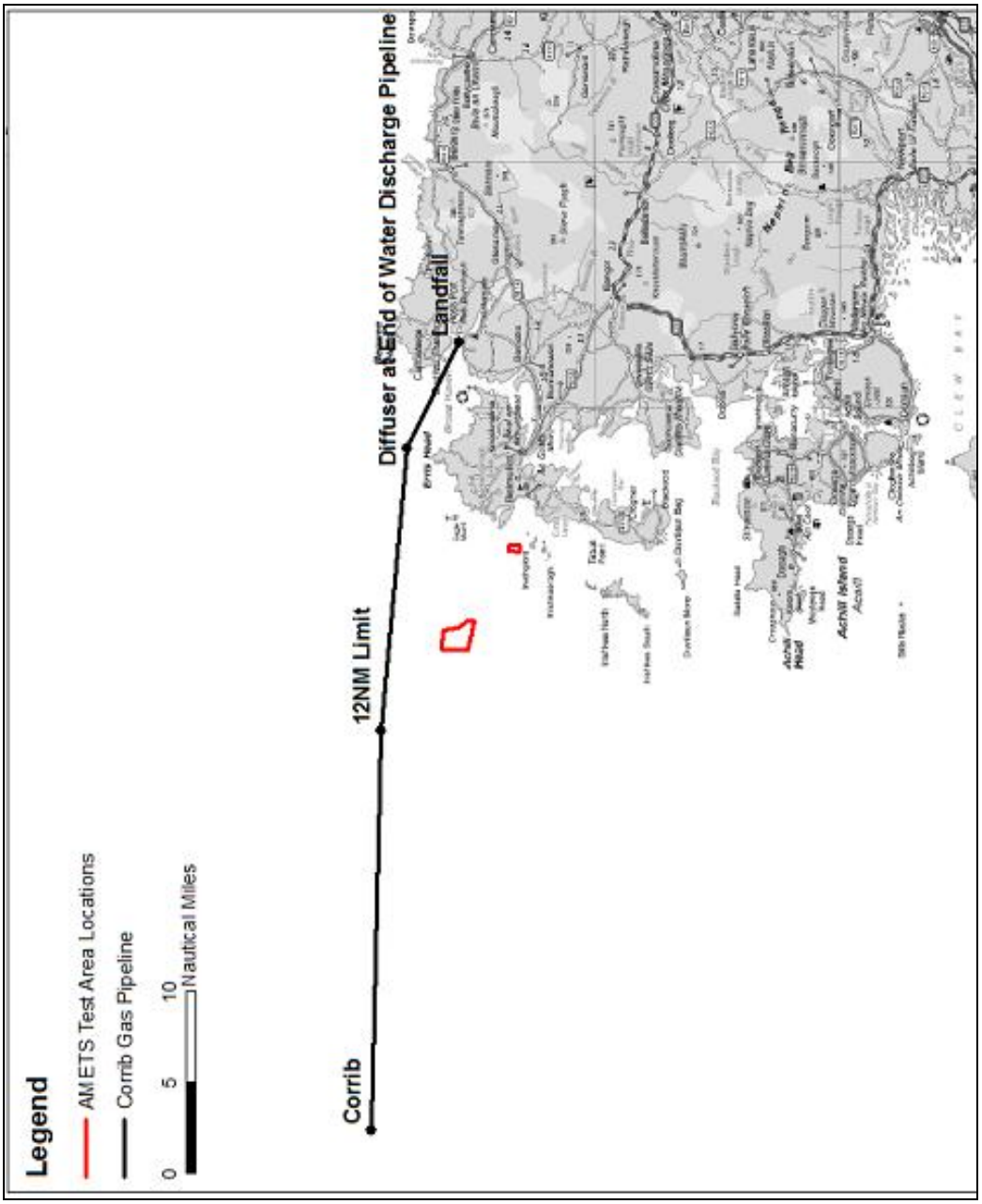

Figure 12-7: Proposed offshore pipeline route to Corrib Gas Field

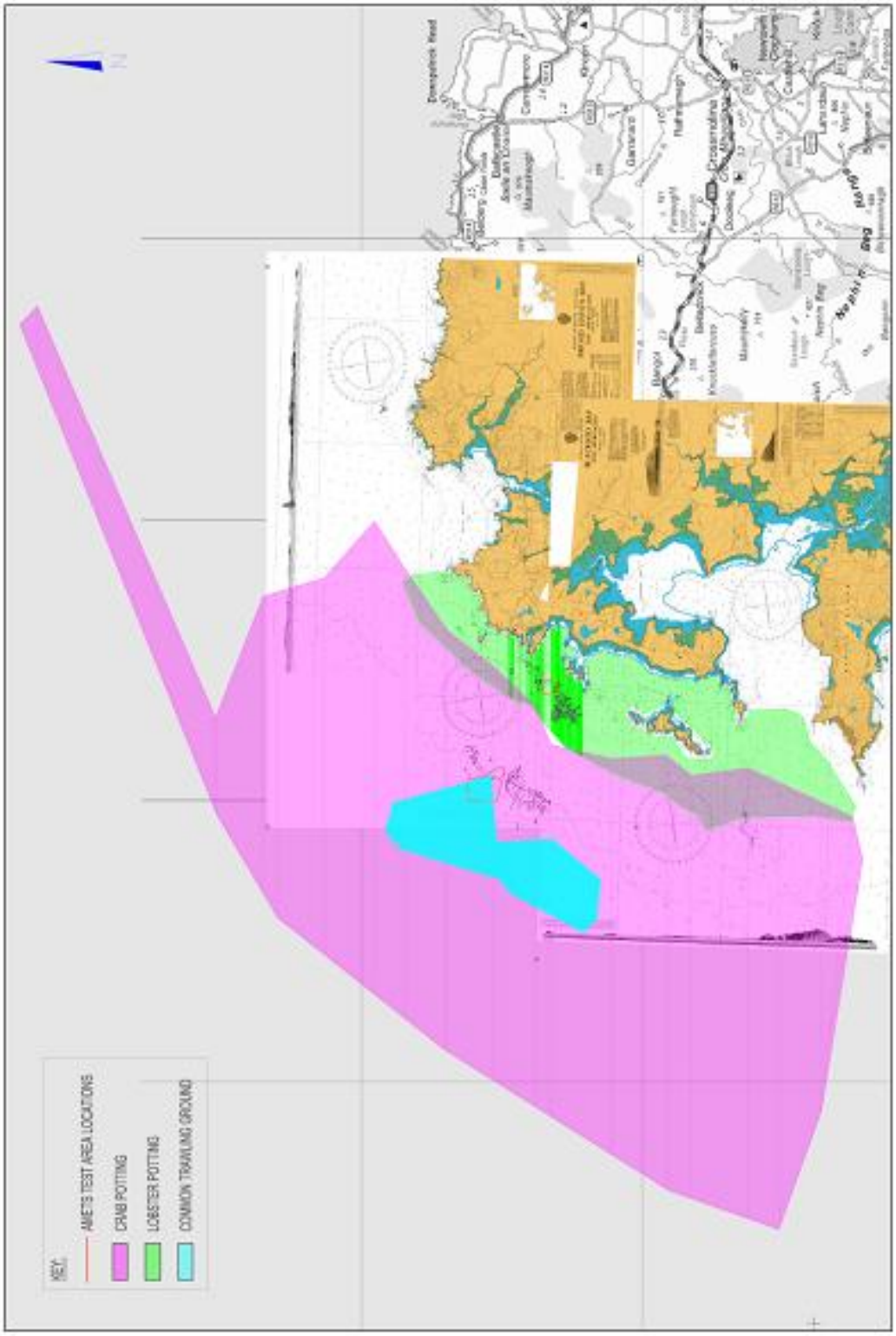

Figure 12-8: Fishing area west of Test Area A

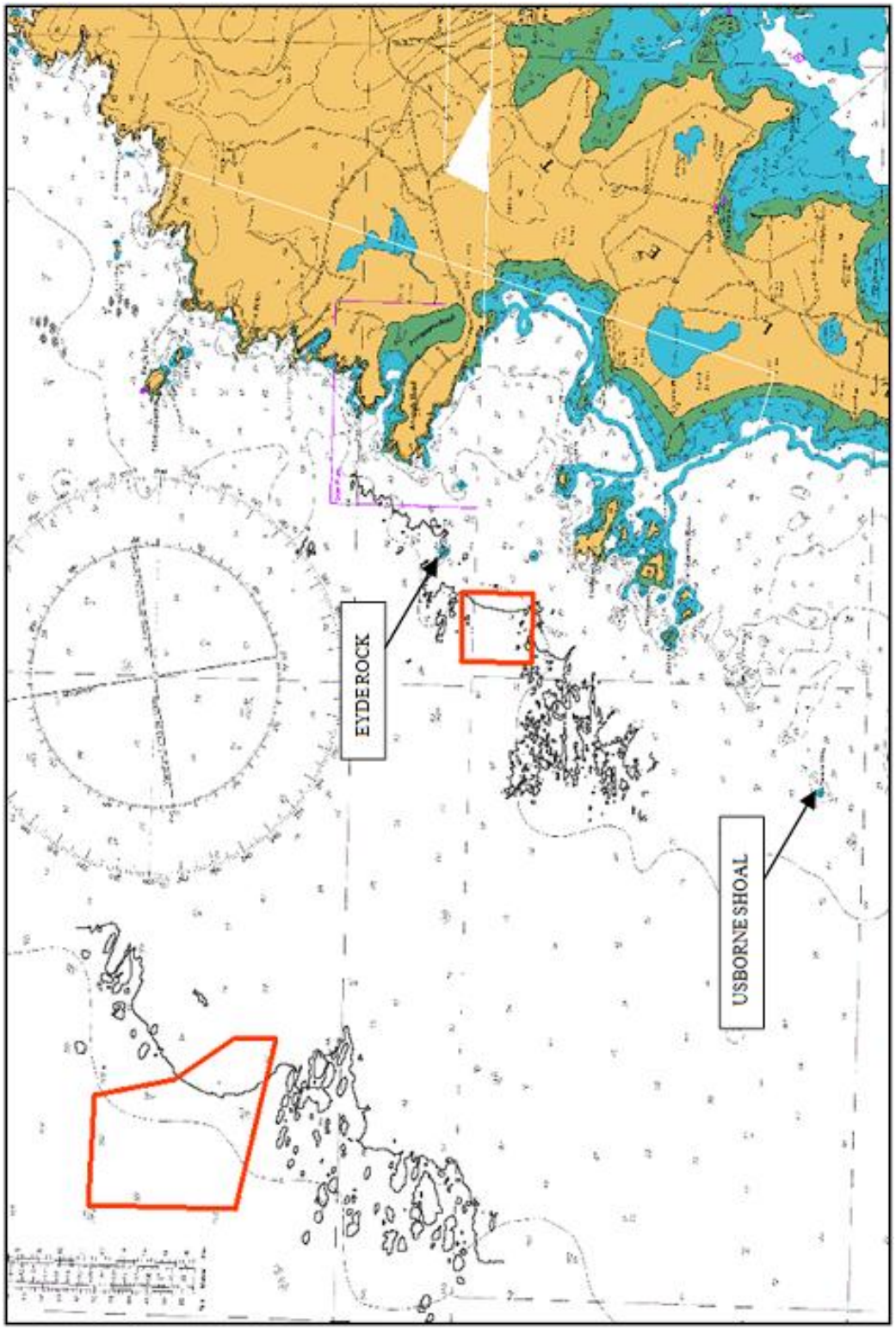

Figure 12-9: Location of Edye Rock close to Annagh Head.

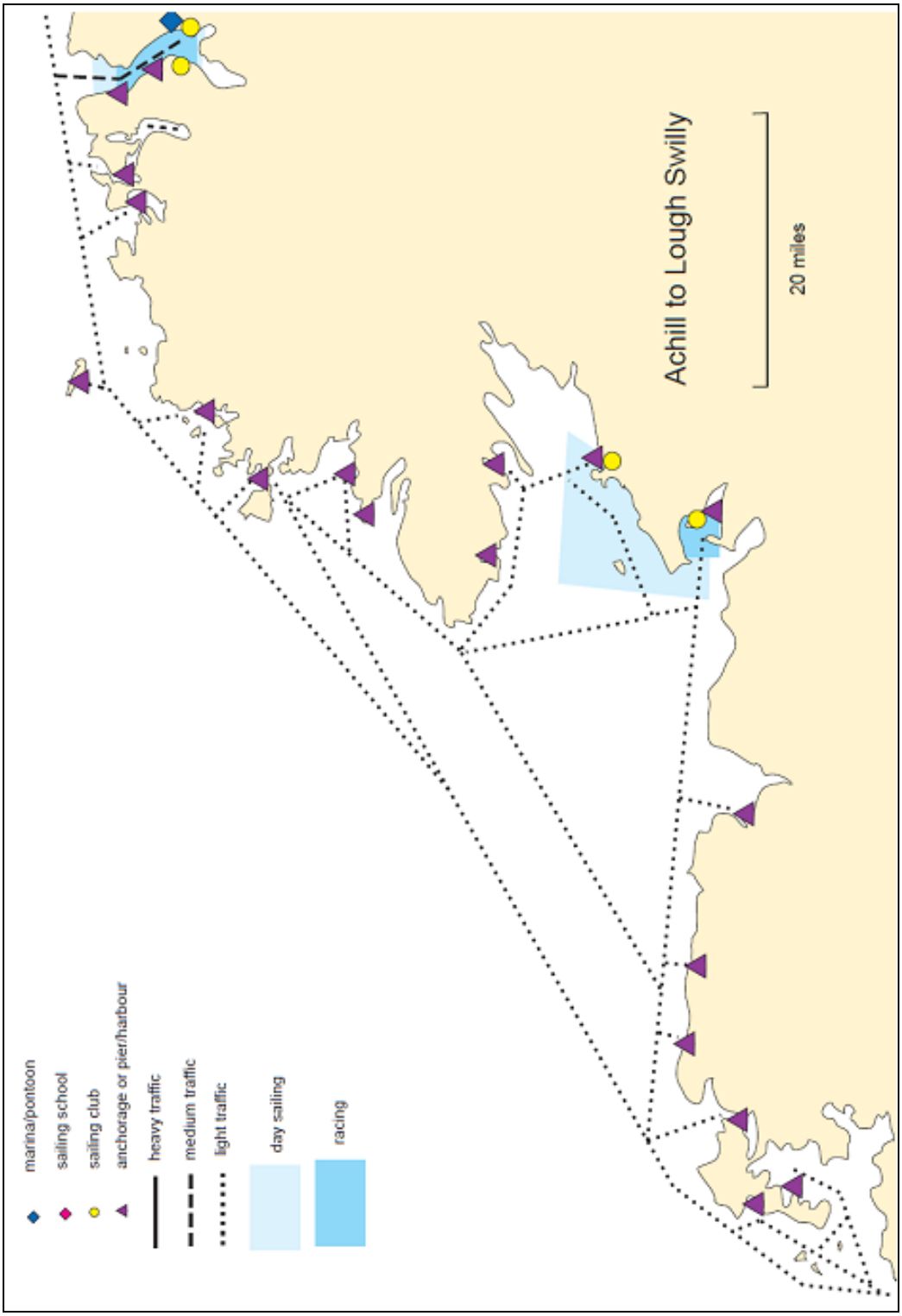

Figure 12-10: ISA-ICC Sailing Information for North Mayo

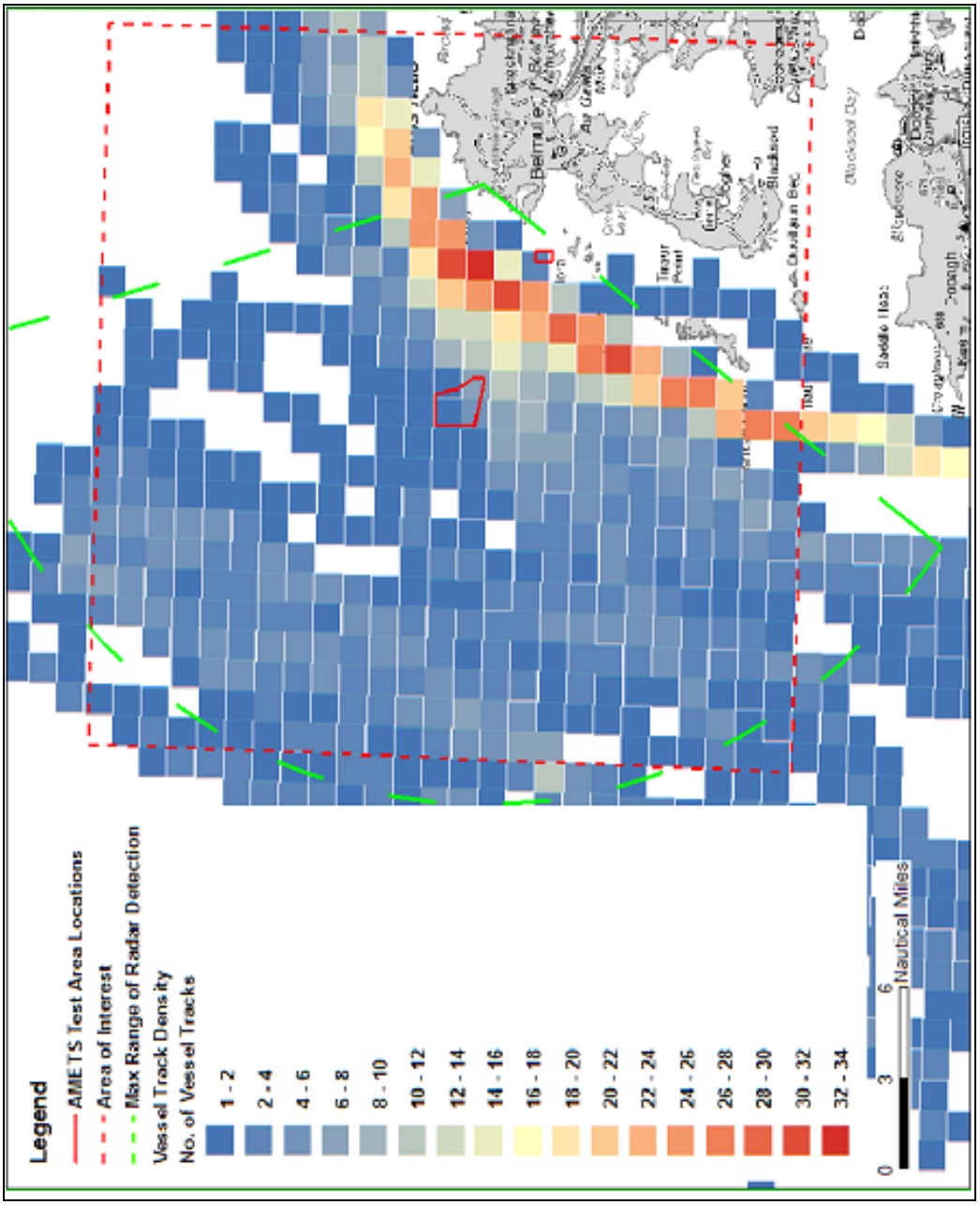

Figure 12-11: Vessel track density during the winter survey

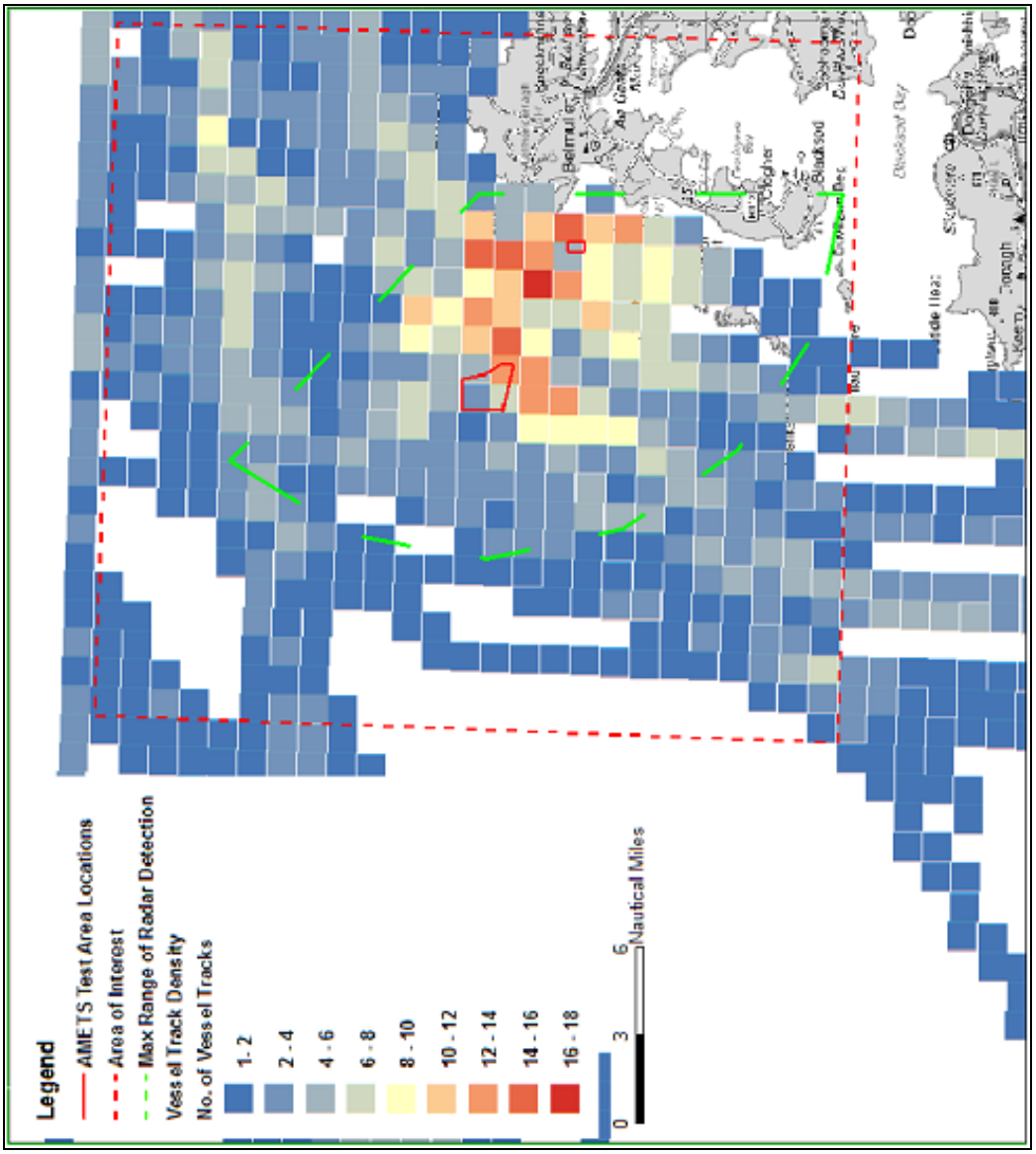

Figure 12-12: Vessel track density during the summer survey