Appendix 14.1

Navigational Risk Assessment

Swansea Bay Tidal Lagoon Navigational Risk Assessment

Prepared by:	Anatec Limited
Presented to:	Tidal Lagoon (Swansea Bay) plc
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Abbreviations

AIS	-	Automatic Identification System
ALB	-	All-Weather Lifeboat
AtoN	-	Aid to Navigation
BMAPA	-	British Marine Aggregate Producers Association
BTA	-	British Tugowners Association
CA	-	Cruising Association
CAST	-	Coastguard Agreement on Salvage and Towage
CNIS	-	Channel Navigation Information Service
DECC	-	Department for Energy and Climate Change
ERCoP	-	Emergency Response Cooperation Plan
GIS	-	Geographical Information System
GLA	-	General Lighthouse Authority
GRT	-	Gross Registered Tonnes
GT	-	Gross Tonnage
HMCG	-	HM Coastguard
ILB	-	Inshore Lifeboat
LLA	-	Local Lighthouse Authority
MAIB	-	Marine Accident Investigation Branch
MCA	-	Maritime and Coastguard Agency
MEHRA	-	Marine Environmental High Risk Area
MGN	-	Marine Guidance Note
MHWN	-	Mean High Water Neaps
MHWS	-	Mean High Water Springs
MLWN	-	Mean Low Water Neaps
MLWS	-	Mean Low Water Springs
MMO	-	Marine Management Organisation
MOC	-	Maritime Operations Centre
MOD	-	Ministry of Defence
MRCC	-	Maritime Rescue Co-ordination Centre
MRSC	-	Maritime Rescue Sub-Centre
nm	-	Nautical Miles
OREI	-	Offshore Renewable Energy Installations
PEXA	-	Practice and Exercise Area
PLN	-	Port Letter and Number
REZ	-	Renewable Energy Zones
RNLI	-	Royal National Lifeboat Institution
RYA	-	Royal Yachting Association
SAR	-	Search and Rescue
SOSREP	-	Secretary of State's Representative for Salvage and Intervention
THLS	-	Trinity House Lighthouse Service
UCG	-	Underground Coal Gasification
UK	-	United Kingdom
UKHO	-	United Kingdom Hydrographic Office
VTS	-	Vessel Traffic Services

1.0 Introduction

1.1 Background

1.1.0.1 Anatec has been commissioned by Tidal Lagoon Swansea Bay plc (TLSB) to undertake a Navigation Risk Assessment (NRA) to support the application for development consent for the proposed tidal lagoon generating station (the "Project") to be situated in Swansea Bay, Wales.

1.2 Site overview and the Project

1.2.0.1 The Project is located within Swansea Bay, on the south coast of Wales. A major element of the Project (referred to as “Project area” in the figures contained within this report) is the construction of the Lagoon, which encloses an area of sea totalling approximately 3.4nm^2 (11.5 km^2). The Lagoon will be created by a seawall built from sediment, rock armour and potentially, Geotubes® as outlined in Chapter 4: Project Description. A turbine/sluice gate housing will contain a maximum of 16 turbines and 10 sluice gates, and will be located at the south western edge of the Lagoon.

1.2.0.2 A general chart overview of the Project area in the context of the Bristol Channel is presented in Figure 1-1.

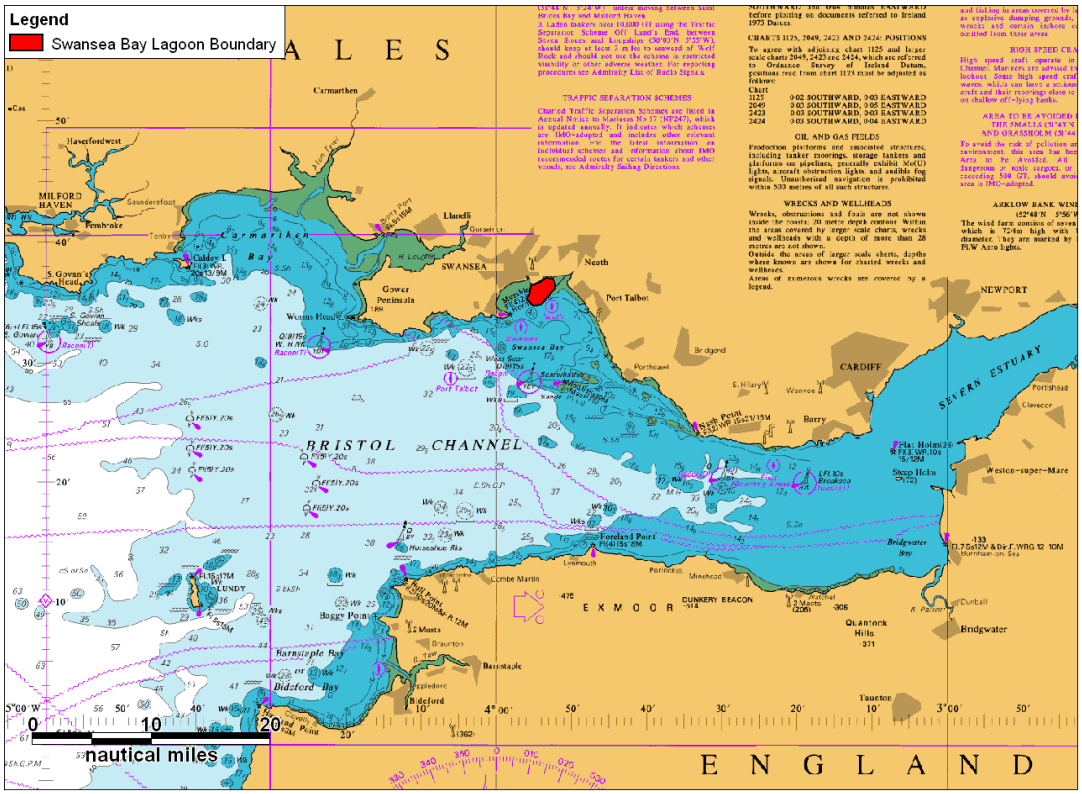

Figure 1- 1 General chart overview

1.2.0.3 A more detailed chart overview of the Project area is presented in Figure 1-2.

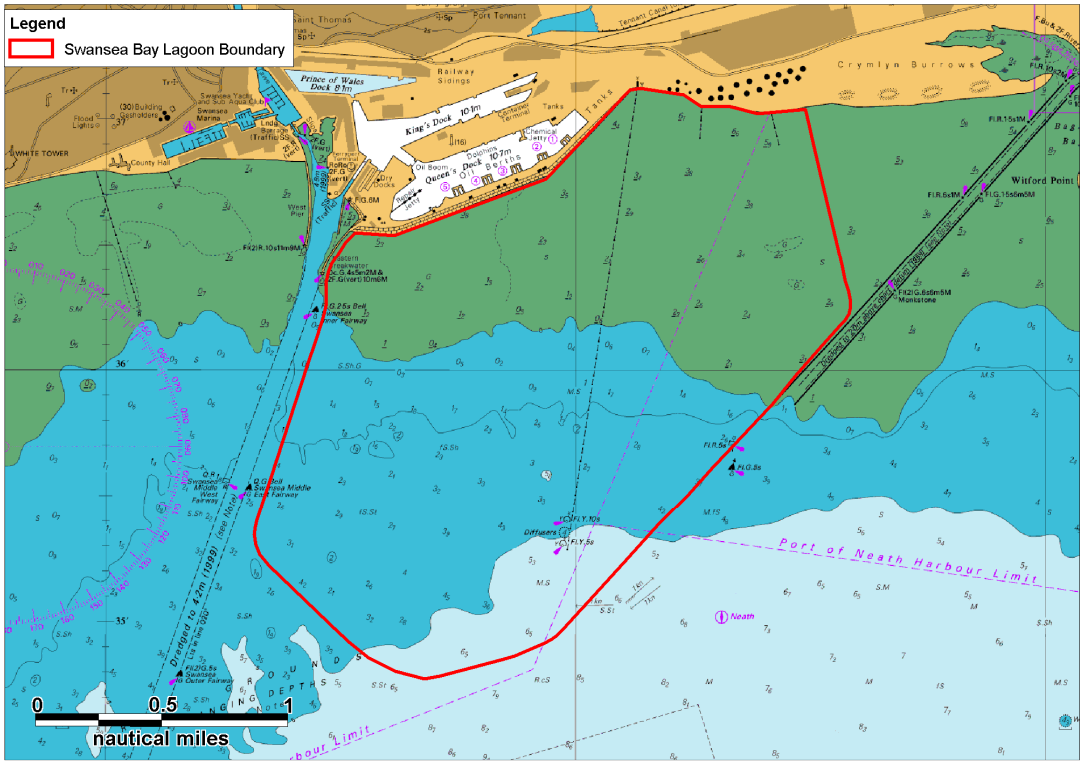

Figure 1- 2 Detailed chart overview of the Project area

1.3 Construction works and marine traffic

1.3.0.1 A description of the Project and its offshore structures is provided in Chapter 4: Project Description. The offshore works are briefly outlined below.

1.3.0.2 **Offshore works**: The offshore works during the construction and operation phases comprise the following (and their construction): turbines and sluice gates, their housing structure, gantry cranes and other facilities, such as generators and switchgear; temporary cofferdam to facilitate the construction of the turbine and sluice gate housing structure; temporary rock storage areas; seawalls and associated dredging works; dredging to create boating area; access road on the seawalls including public realm works, lighting structures and shelters; Offshore Building incorporating operation and maintenance (O&M) facilities, with integral visitor centre, leisure facilities and public realm; emergency facilities; works to Swansea Port Channel; demolition of existing eastern breakwater wall at the entrance to the Port of Swansea; works to Neath Harbour Channel including the widening of the entrance to the channel and replacement of its training wall; water quality enhancement works (if required or implemented); navigation facilities including lighting; reef habitat creation works, provision of oyster spatting ponds, herring mitigation, potential bird island/raft and Sabellaria habitat works; and necessary services.

1.3.0.3 It is anticipated that dolphin piles will be used to protect the turbine housing during operation and to mitigate the risk to vessels of an allision. If these are utilised, then they will be installed early in the construction phase when the temporary cofferdam is being constructed and thus provide protection throughout the various phases of the Project.

1.3.0.4 It is anticipated that construction will start in 2015 and with the main construction lasting for about three years. Further details of the construction programme are

included in Chapter 4. Although the main construction works will take place over 3 years, the actual periods of marine construction will be shorter, generally taking place within the dredging season (March to October).

1.3.0.5 The anticipated number of vessels required for the construction of the Project is presented in Table 1.1. Table 1.1 shows the estimated number of vessels for the installation of the temporary cofferdam which will be undertaken in year 1. Similar vessels will be required for its removal in year 3 of construction.

1.3.0.6 The working area of the vessels associated with the construction of the lagoon seawalls and the actual number of vessels working at any one time will vary depending on which section of seawall is being constructed and what activities are taking place.

Table 1.1 Summary of construction plant/vessels

Stage/Element of Marine Work	Offshore Plant/Vessels		Originating Location	Anchor Location when not in use
	Type	Anticipated Quantity		
Construction Lagoon Seawalls and Temporary Sand Cofferdam Bund (if this option were chosen)	Cutter dredger or hopper dredger	1 or 2	Rotterdam	During bad weather conditions – Local Port in consultation with the Harbour Master During fine weather conditions – Anchor at sea
	Backhoe dredger	2		
	Split barge	4 to 6		
	Side stone dumping vessel	2		
	Rock barge	4		
	Tug	4 or 5		
	Multicat	1 or 2		
	Survey launch	1		Mooring created within the Lagoon
	Crew launch	1		
	Safety boat	1	UK	Mooring created within the Lagoon
Construction of Temporary Twin Wall Sheet Pile Bund (if this option were chosen)	Jack-up barge	4	UK	Stay in position
	Tug	4		Mooring created within or adjacent to the Lagoon
	Supply/Spud barge	4		
	Work/Dive boat	4		
	Safety boat	3		
	Crew launch	3		
	100t Crawler crane (on jack-ups)	4		On jack-ups
	100t Crawler crane (on completed bund)	2		On completed bund
	30t Excavator	2		
	Wheeled articulated dumpers	4		
	100t Crawler crane (landside in Port)	2		In port

2.0 Guidance

2.1 Primary guidance

2.1.0.1 The primary guidance document which has been consulted in the preparation of this navigational risk assessment is the Maritime and Coastguard Agency (MCA), Marine Guidance Notice 371 (MGN 371 Merchant + Fishing) Offshore Renewable Energy Installations (OREI) Guidance on UK Navigational Practice, Safety and Emergency Response Issues (MCA, 2008).

2.1.0.2 MGN 371 provides guidance on the issues that should be taken into consideration when assessing the effect on navigational safety of offshore renewable energy developments proposed within United Kingdom (UK) internal waters, territorial sea or Renewable Energy Zones (REZ). Whilst the Project does not conform fully with the definition of an OREI under the Energy Act 2004, being connected with dry land by a permanent structure providing access at all times for all purposes, MCA guidance on OREIs remains the most appropriate against which to consider the Project, due to the marine nature of the development.

2.2 Secondary guidance

2.2.0.1 The following guidance documents have also been consulted in the preparation of the navigational risk assessment:

a) Royal Yachting Association (RYA), *The RYA's Position on Offshore Energy Developments: Paper 3 – Tidal Energy* (RYA, 2012); and

b) Department of Energy and Climate Change (DECC) in association with MCA, *Guidance on the Assessment of Offshore Wind Farms - Methodology for Assessing Marine Navigational Safety Risks of Offshore Wind Farms* (DECC, 2005).

3.0 Data sources

3.0.0.1 The main data sources used in assessing the baseline shipping and navigation activities in relation to the Project are listed below:

a) 14 days marine traffic survey (14th to 28 August 2013) - Automatic Identification System (AIS) data with the addition of radar/Automatic Radar Plotting Aid (ARPA) and supplemented by observations of vessels within visual range from the shore based survey crew;

b) AIS data gathered over 56 days (28 days in July 2012 and 28 days in October 2012). This time period was used to gather representative winter and summer data for the assessment and is an accepted Maritime and Coastguard Agency (MCA) method as outlined in MGN 371 (MCA, 2008);

c) Fishing Surveillance Satellite Data (2009) and Sightings Data (2005-2009), from Marine Management Organisation (MMO), shown as density grids;

d) Maritime Incident Data from the Marine Accident Investigation Branch (MAIB) (2002-2011) and Royal National Lifeboat Institution (RNLI) (2001-2010);

e) Admiralty Sailing Directions – West Coasts of England and Wales Pilot, NP 37, Eighteenth Edition (UKHO, 2011);

f) UK Admiralty Charts 1161-0 and 1179-0; and

g) UK Coastal Atlas of Recreational Boating, 2009 and 2010 Geographical Information System (GIS) Shape Files (RYA, 2009).

3.1 AIS data and commercial vessel movements

3.1.0.1 AIS is required since 31 May 2012 on board all vessels of more than 300 gross tonnage (GT) engaged on international voyages, cargo vessels of more than 500 GT not engaged on international voyages, passenger vessels irrespective of size built on or after 1st July 2002 and fishing vessels over 24m in length. On 31 May 2013 this was expanded and fishing vessels over 18m must now mandatorily carry AIS.

3.1.0.2 Two periods of AIS data, collected from shore based stations located in proximity to the Project have been used in this baseline report to demonstrate seasonal variation. These periods are as follows:

a) 28 days, July 2012; and
b) 28 days, October 2012.

3.1.0.3 These data have been cropped to 5 nautical miles ("nm") around the Project to provide a relevant and appropriate study area ("Study Area"). This distance has been used as it is considered to present a sufficient area to capture the relevant issues for the Project in terms of interactions with vessel movements, as well as considering historical marine accident data.

3.1.0.4 The Study Area has been extended to greater than the 5nm buffer where required, to show, for example when presenting dredging areas or navigational features.

3.1.0.5 With the agreement of the MCA, a 14 day marine traffic survey took place between 14 August and 28 August 2013. The findings of this survey are detailed within section 9.0 of this navigational risk assessment.

3.2 Recreational activity

3.2.0.1 Limited recreational vessel data was extracted from the AIS data recorded during the 28 day periods in July and October 2012. It should be noted that the majority of recreational vessels do not carry AIS. Therefore, additional data provided by the RYA and the CA has been used to represent the movements of recreational users, including yachting and motor cruising.

3.2.0.2 In 2005 the RYA, supported by THLS and the CA compiled and presented a comprehensive set of charts which defined the cruising routes, general sailing and racing areas used by recreational craft around the UK coast. This information was published as the UK Coastal Atlas of Recreational Boating and has been subsequently updated (RYA, 2009). The latest addition of GIS Shape files from 2010 showing cruising routes, sailing and racing areas has been used in this assessment**.**

3.3 Fishing activity

3.3.0.1 Fishing vessel data (as per AIS carriage requirements) were extracted from the AIS tracks recorded during 14 days in August 2013; 28 days in July 2012 and 28 days in October 2012. As noted above, there was no requirement for fishing vessels less than 24m in length to carry AIS in 2012, meaning that smaller fishing vessels may not be recorded in the data set.

3.3.0.2 In addition, fishing vessel sightings and satellite vessel monitoring data were obtained from the Marine Management Organisation (MMO) and presented in density grids to validate the survey data presented in the navigational risk assessment.

3.3.0.3 Sightings data were analysed from the 2005 to 2009 period (full annual analyses). This data has been collected by the MMO through the deployment of patrol vessels, surveillance aircraft and the sea fisheries inspectorate. Each patrol logged the position and details of fishing vessels within the area being patrolled. All vessels were logged, irrespective of size, provided that they could be identified by their Port Letter and Number (PLN).

3.3.0.4 Satellites record the positions of fishing vessels over 15m in length a minimum of every two hours. Data from 2009 (all nationalities) have been analysed on a full annual basis. Vessels under 15m in length were assessed by visual observation for this study (see Marine Traffic Survey).

3.4 Marine aggregate areas

3.4.0.1 Marine aggregates dredging data were supplied by the Crown Estate and passage plans of dredgers were supplied by the British Marine Aggregate Producers Association (BMAPA). A desk based study was carried out using this information to identify the commercial aggregates dredging activity in the area.

3.5 Other renewable energy developments

3.5.0.1 Details of offshore wind, wave and tidal sites were obtained from the Crown Estate as landowner.

3.6 Oil and gas installations

3.6.0.1 Details of offshore oil and gas installations were supplied by UK Deal and include wellheads. A desk top study was undertaken using these data to identify any installations in proximity to the Project.

3.7 Navigational features

3.7.0.1 Other navigational features have been considered in this assessment, and have been identified by using information from Admiralty charts and the Admiralty Sailing Directions NP37 West Coasts of England and Wales Pilot which cover the study area used for the Project (UKHO, 2011).

4.0 Baseline environment

4.1 Navigational features

4.1.0.1 Figure 1-3 presents an overview of the principal navigational features in close proximity to the Project.

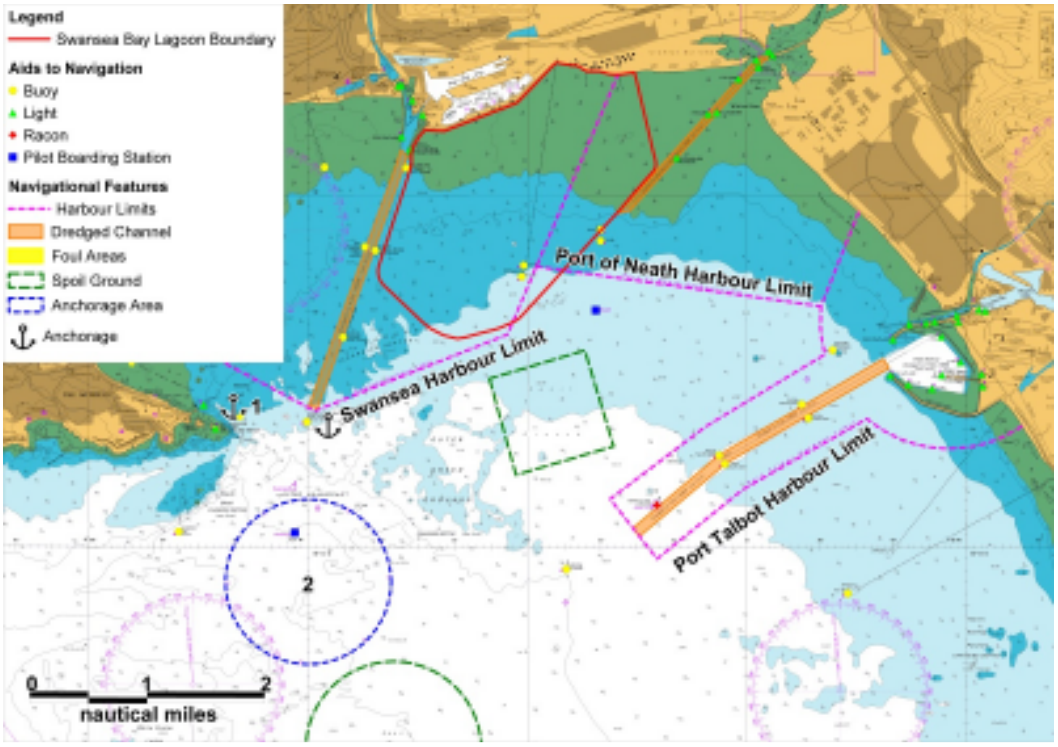

Figure 1- 3 Navigational features in close proximity to the Project

4.1.0.2 The Project area lies within the Swansea Harbour and Port of Neath Harbour Limits. Swansea, Port of Neath and Port Talbot Harbours all have a dredged channel in their approaches, although only the Neath channel has training walls (which were built in the Victorian era) along the channel's alignment. A description of these channels from the pilot book (UKHO, 2011) is as follows:

a) Port of Swansea: Depth is 4.2m in the entrance channel;

b) Port of Neath: The entrance channel is dredged to 2.0m above chart datum; and

c) Port Talbot: The entrance channel to the Tidal Harbour is dredged to 11.2m; that to Old Dock is dredged to 0.4m.

4.1.0.3 The Project is approximately 2.8nm north of a charted spoil ground which is used for the dumping of material from the maintenance dredging in the channels. There is also a second spoil ground 0.4nm from the Project although it is understood that this is not in use.

4.2 Ports in close proximity to the Project

4.2.0.1 The main ports closest to the Project are Port of Swansea and Port Talbot, both of which are operated by Associated British Ports (ABP); and the Port of Neath, which has access up the River Neath which is managed by the Neath Port Authority. The harbour limits for these ports are illustrated in Figure 1-3. The main ports are described in the pilot book (UKHO, 2011), and a description of Swansea Marina is provided below.

4.2.1 Port of Swansea

4.2.1.1 The Port of Swansea, which is accessed via the dredged channel to the River Tawe, handles containers, dry bulk, liquid bulk, timber, general cargo, steel and other metals. Pilotage is compulsory for all vessels or tows over 85m and all vessels or tows over 20m carrying dangerous or noxious liquids, passengers or explosives. The pilot boarding station is located 1 mile south-east of Mumbles Lighthouse.

4.2.2 Port of Neath

4.2.2.1 The Port of Neath handles vessels up to 6000 deadweight tonnage and comprises several wharves along both banks of the lower reaches of the River Neath. There is also a large yacht harbour, which is home to Monkstone Sailing and Cruising Club, on the western bank below the River Neath road bridge where there are approximately 75 boats. Pilotage is compulsory for all vessels within the port limits.

4.2.3 Port Talbot

4.2.3.1 Port Talbot handles general cargo, mineral and ores. Pilotage is provided by ABP South Wales.

4.2.4 Swansea Marina

4.2.4.1 Also accessed by the dredged channel to the River Tawe is Swansea Marina. Swansea Marina was originally opened in 1982 with 385 berths, and was later expanded to accommodate 780 boats. It is understood that the Marina is currently used by 550 permanent boats and approximately 500 visitors over the year (Meeting Swansea Marine 2 October 2012). After the Swansea Barrage was completed in 1992, 200 more berths were provided behind the lock associated with the barrage and outside the main marina. These berths are used by organisations including Swansea Yacht and Sub-Aqua Club and accommodate approximately 20 fishing and recreational boats. Further plans are proposed for the area, including the redevelopment of the Prince of Wales Dock. Although it is currently understood to be on-hold[1], once complete, the upgraded Prince of Wales Dock will provide 400 new berths, which will take the berthing capacity of Swansea's Marinas to over 1,000 boats.

4.3 Anchoring

4.3.0.1 Anchorage areas in the vicinity of the Project, have been identified from the Admiralty charts and the pilot book (UKHO, 2011). These are shown in Figure 1-4.

[1] http://www.bbc.co.uk/news/uk-wales-19443309

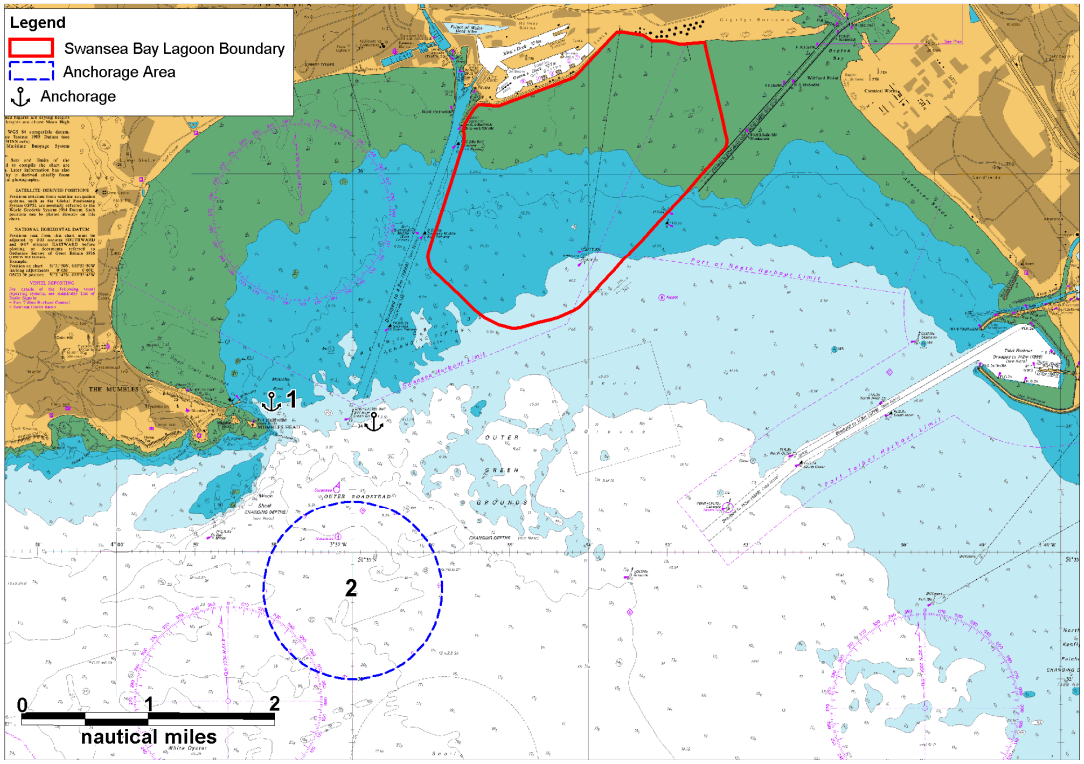

Figure 1- 4 Anchorage areas relative to Project area

4.3.0.2 A description of the anchorages from the Admiralty Sailing Directions NP37 West Coasts of England and Wales Pilot book (UKHO, 2011), where available, is presented below:

a) Mumbles Road: This anchorage is suitable for vessels of light draught and lies NE of Mumbles Head.; and

b) Outer Roadstead: This anchorage area is normally used by vessels awaiting entry to Port of Swansea or Port Talbot Old Dock.

4.3.0.3 An analysis of anchoring within 5nm of the Project is presented in Section 8.6.

4.4 Aids to Navigation (AtoN)

4.4.0.1 A plot of the main AtoN in the vicinity of the Project is presented in Figure 1-5.

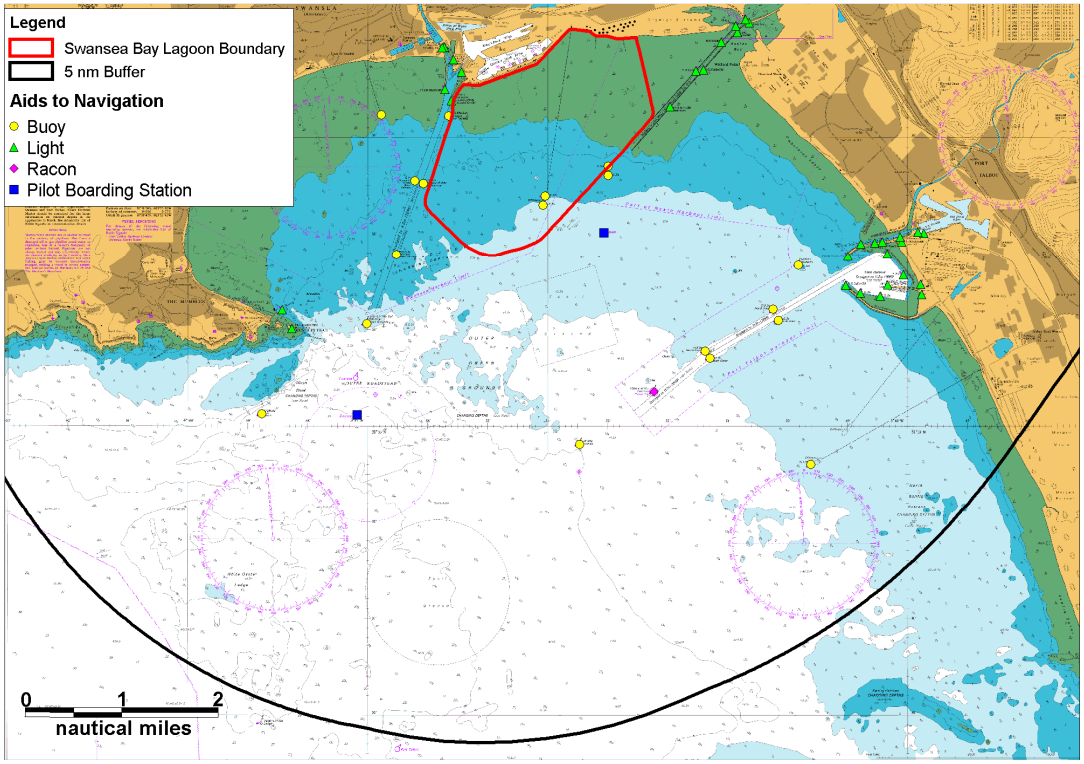

Figure 1- 5 Aids to Navigation within 5nm of the Project

4.5 Sailing Directions

4.5.0.1 Sailing directions for the study area used for the Project are detailed within the Admiralty Sailing Directions NP37 West Coasts of England and Wales Pilot book (UKHO, 2011). A plot of the routes relevant for all vessels in Swansea Bay is presented in Figure 1-6.

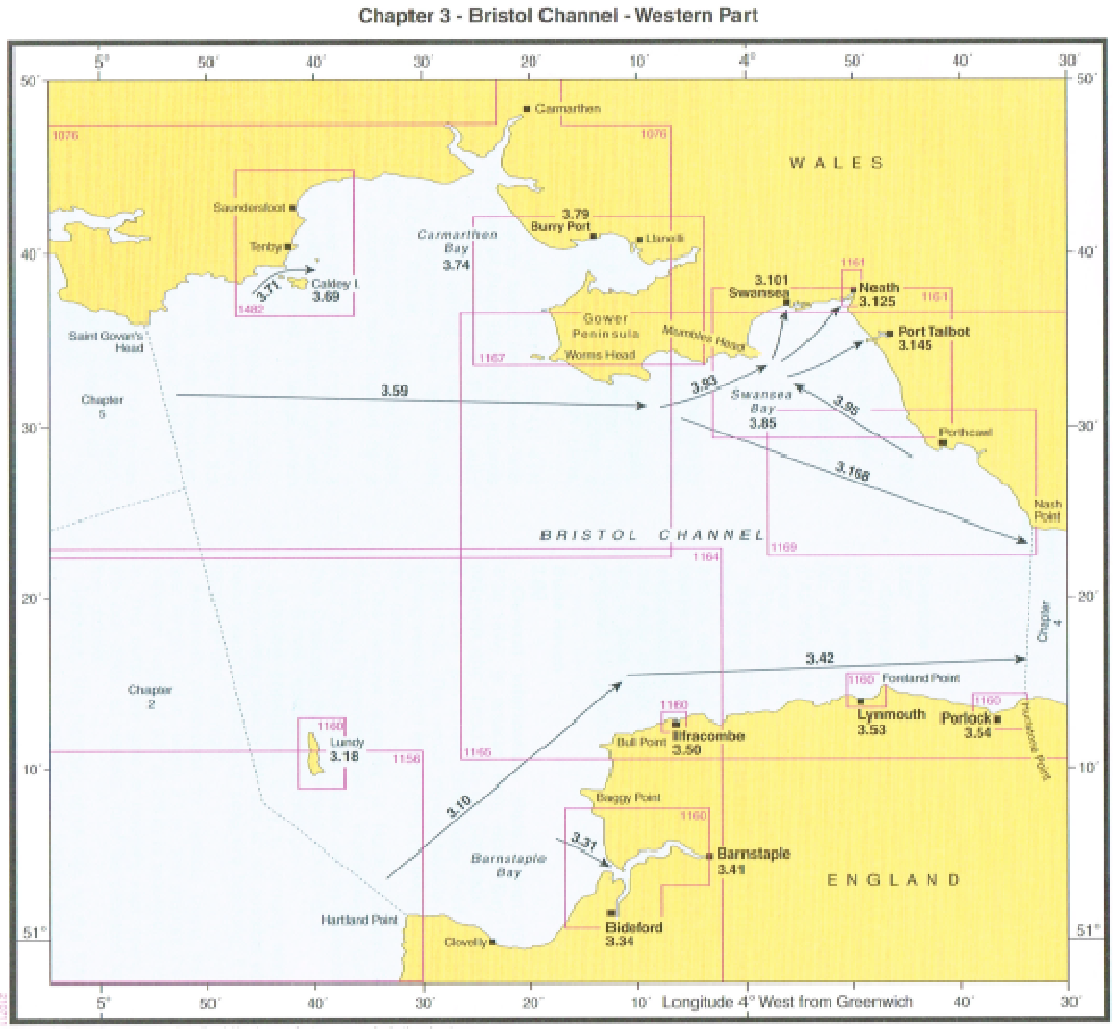

Figure 1- 6 Sailing directions (UKHO, 2011)

4.5.0.2 The arrows are not accurate if superimposed on a chart but are intended to illustrate the general passages used by ships.

4.6 Other receptors

4.6.1 Energy infrastructure

4.6.1.1 There are no oil or gas surface platforms or subsurface infrastructure located in the vicinity of the Project.

4.6.1.2 A licence has been granted to Clean Coal Limited for Underground Coal Gasification (UCG) in Swansea Bay but no works have been commenced and details of the works in relation to potential navigational effects are not currently available.

4.6.2 Aggregates dredging areas

4.6.2.1 Figure 1-7 presents the aggregates dredging areas in the Bristol Channel**.**

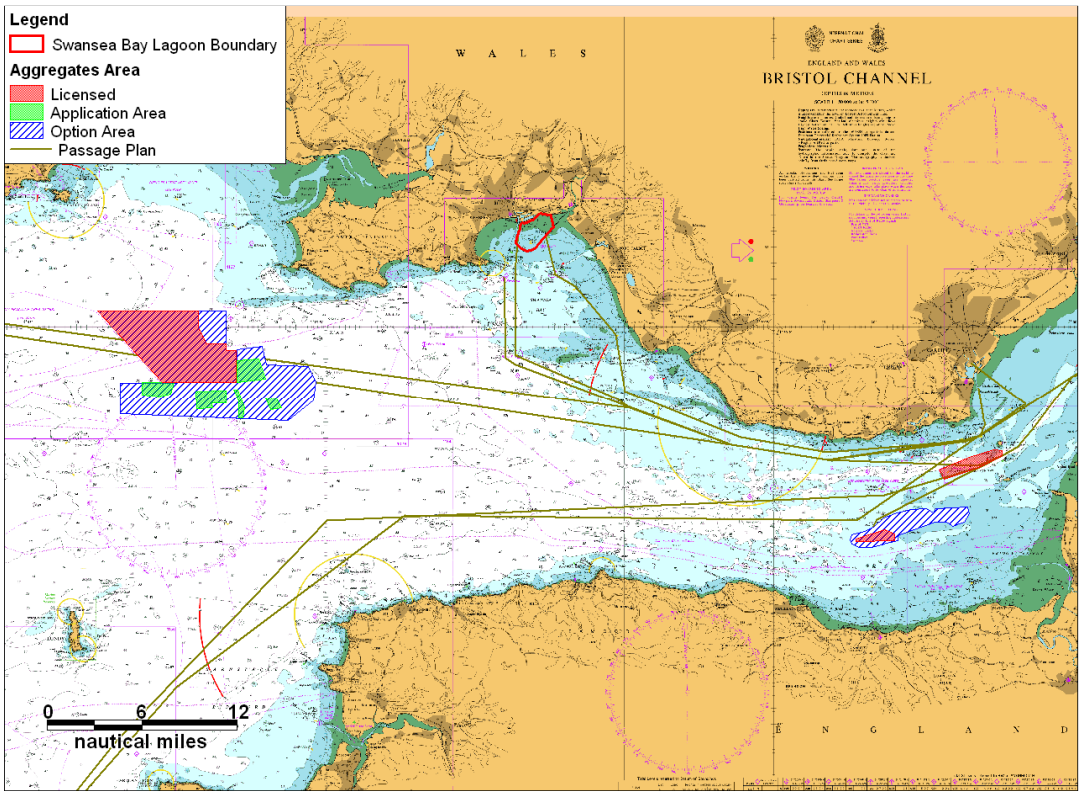

Figure 1- 7 Dredging sites in relation to the Project

4.6.2.2 There are no licenced, application or option areas within Swansea Bay. The closest areas are approximately 15nm to the south west of the Project. It can be seen from the BMAPA Passage Plans that dredgers transit in and out of Swansea Bay.

4.6.2.3 It should be noted that whilst no aggregate extraction is carried out within Swansea Bay, there is maintenance dredging in the dredged channels for Swansea, Port of Neath and Port Talbot. See Section 8 for tracks of dredgers recorded within 5nm of the Project. Charted spoil grounds are presented in Figure 1-7.

4.6.3 Other renewable energy developments

4.6.3.1 Other renewable energy developments in the vicinity of the Project are presented in Figure 1-8.

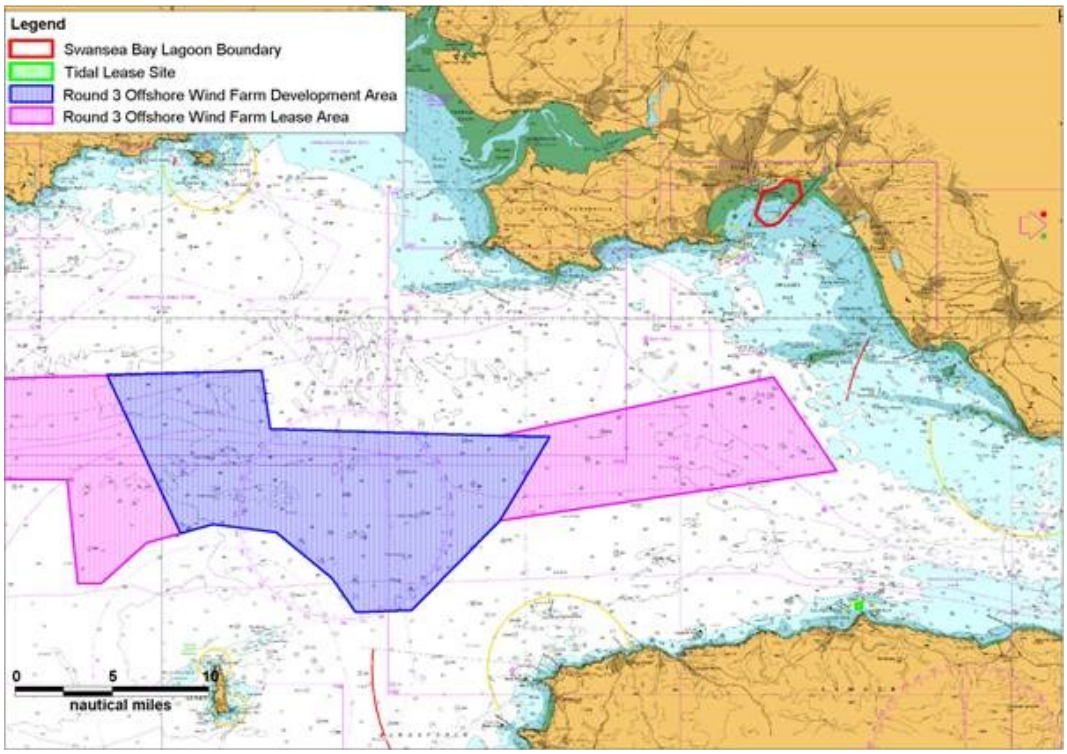

Figure 1- 8 Renewable energy developments

4.6.3.2 The Bristol Channel Round 3 Zone is approximately 15.6nm south west of the Project. Development of the Atlantic Array Wind Farm was planned to be within this zone, but the scheme was discontinued in November 2013. In terms of other renewable energy developments, there is a tidal site with an agreement for a lease which is located on the North Devon coastline approximately 20nm south of the Project study area. There are no wave energy sites proposed within the study area.

4.6.4 Marine Environmental High Risk Areas (MEHRA)

4.6.4.1 MEHRAs are areas that have been identified by the UK Government as an area of environmental sensitivity, at high risk of pollution from ships. There are no MEHRAs in proximity to the Project.

4.6.5 Military practice areas

4.6.5.1 There are no MOD practice and exercise areas (PEXAs) in proximity to the Project.

4.6.6 Charted wrecks

4.6.6.1 The locations of wrecks identified in the Admiralty charts the Study Area for the Project are presented in Figure 1-9.

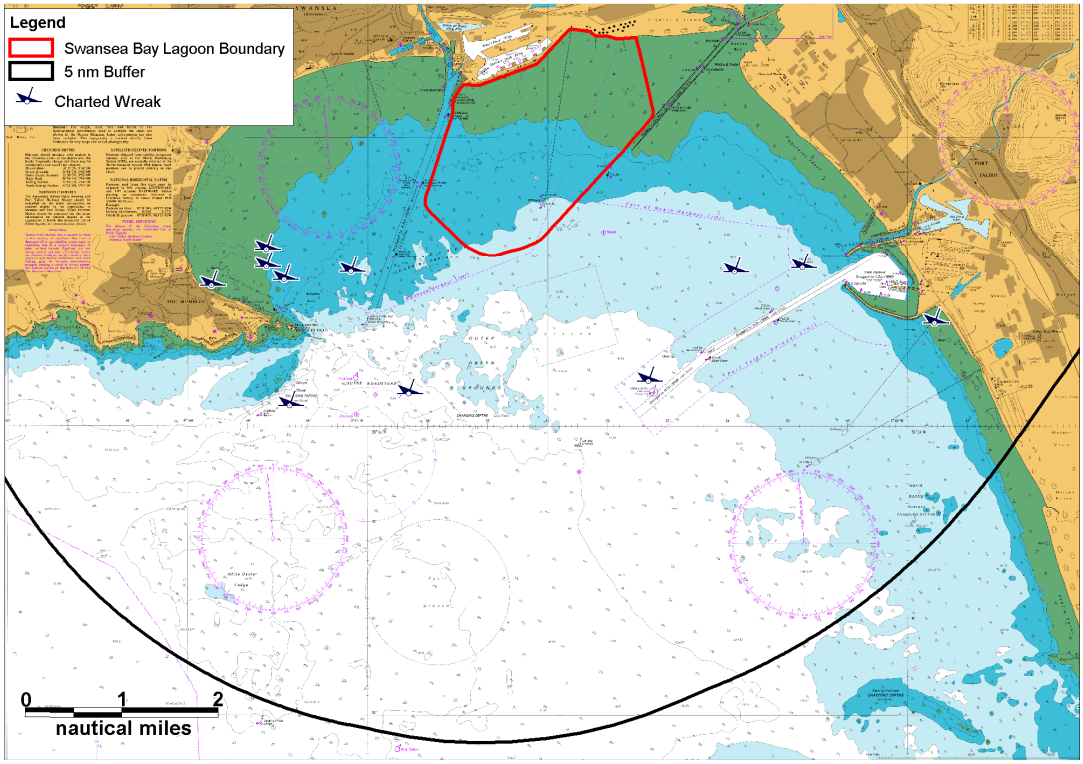

Figure 1- 9 Charted wrecks within 5nm to the Project

4.6.6.2 There are no charted wrecks within the Project area. The closest charted wreck is located approximately 1.0nm south west of the Project area boundary.

5.0 Metocean data

5.1 General situation

5.1.0.1 The climate in Swansea Bay is a mild maritime climate, which can become unsettled at times, with strong winds and rough seas, especially in winter months. Visibility is generally good. Fog at sea is most common in June, but also occurs relatively infrequently from November through to May. The predominant wind direction is from the south west (UKHO, 2011).

5.1.0.2 A description of the tidal streams in the Swansea Bay is provided below (UKHO, 2011):

"In the approaches to the Bristol Channel, the flow of water is largely determined by tidal forces. The in-going stream sets N towards Saint George's Channel. On the S side of the Bristol Channel, the streams set parallel with the coast; on the N side, the streams in Carmarthen Bay and Swansea Bay are irregular and on their E sides set strongly across the shoals which extend W from them".

5.2 Tides

5.2.0.1 Chart Datum and Ordnance Datum for the Project based on values recorded at Swansea are presented below.

Table 5-1 Chart Datum and Ordnance Datum figures for Project

Tidal Level	Height above Chart Datum
Mean High Water Neaps (MHWN)	7.2 m
Mean High Water Springs (MHWS)	9.5 m
Mean Low Water Springs (MLWS)	1.0 m
Mean Low Water Neaps (MLWN)	3.1 m

5.2.0.2 Admiralty Chart 1161-0 (Tidal Diamonds A approximately 1.8nm south of the Project area boundary (measured from the turbine house), and C approximately 3.5nm to the east) indicates that the currents in the Swansea Bay are set in a south westerly direction on the ebb and an easterly direction on the flood, with a peak spring tidal rate of 1.6 knots and peak neap rate of 0.8 knots. It should be noted that for Tidal Diamonds A and C, tidal streams refer to high water at Swansea.

5.2.0.3 Figure 1-10 presents the locations of charted tidal diamonds relative to the Project and Table 5-2 presents the stream direction and rates at spring/neap tides.

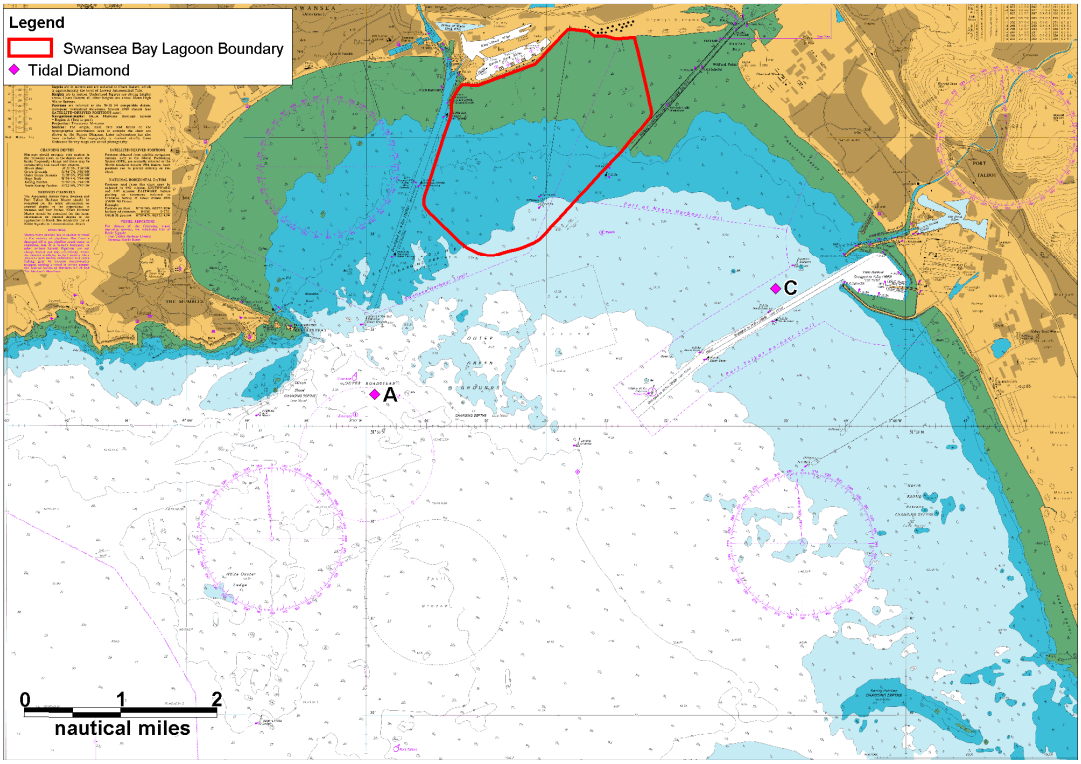

Figure 1- 10 Tidal Diamonds A and C on Admiralty Chart 1161-0

Table 5-2 Tidal Diamonds A and C (Referred to High Water at Swansea)

Hours		Directions of streams (degrees)	Rates at spring tides (knots)	Rates at neap tides (knots)	Tidal Diamond A			Tidal Diamond C		
Before High Water	6				110	0.1	0.0	090	0.3	0.1
	5				070	0.5	0.3	103	0.5	0.2
	4				060	1.0	0.5	109	0.4	0.2
	3				057	1.4	0.6	114	0.4	0.2
	2				060	1.3	0.6	122	0.2	0.1
	1				063	1.0	0.5	135	0.1	0.0
High Water					090	0.5	0.2	270	0.1	0.1
After High Water	1				230	0.7	0.4	274	0.3	0.1
	2				248	1.4	0.7	275	0.5	0.2
	3				246	1.6	0.8	289	0.5	0.2
	4				247	1.1	0.5	297	0.3	0.1
	5				244	0.7	0.4	350	0.1	0.0
	6				230	0.2	0.1	081	0.2	0.1

5.3 Coastal processes

5.3.0.1 Further modelling and explanation of wave, tidal and wind data is contained within the Environmental Statement Chapter 6: Coastal Processes, Sedimentation and Contamination. This includes modelling of the current tidal steam speeds at different stages of the tide.

6.0 Emergency Response Overview and Assessment

6.0.0.1 The following sections identify current response capabilities provided by UK emergency response providers: MCA including HM Coastguard (HMCG).

6.0.0.2 At the time of writing, the HMCG co-ordinates Search and Rescue (SAR) through a network of 16 Maritime Rescue Co-ordination Centres (MRCCs).

6.0.0.3 All of the MCA's operations, including SAR, are divided into three geographical regions. The Wales and West of England Region encompasses an area from the Dorset/Devon border to Southern Scotland, and therefore covers the Project.

6.0.0.4 Each region is divided into six districts with its own MRCC, which co-ordinates the SAR response for maritime and coastal emergencies within its district boundaries (East of England Region includes an additional station, London Coastguard, for co-ordinating SAR on the River Thames). Currently, the nearest rescue coordination centres to the Project are the Swansea and Milford Haven MRCCs. However, Swansea MRCC is set to be closed in 2014/15 under the new scheme (Revised HM Coastguard Proposals for Modernisation) and Milford Haven will become a Maritime Rescue Sub-Centre (MRSC – this is still a HM Coastguard station, the term has varied in line with the modernisation and alteration of the management of search and rescue).

6.2 SAR helicopters

6.2.0.1 A review of the assets in proximity to the Project indicates that the closest SAR helicopter base is located at Chivenor, approximately 31nm (measured from the turbine house) to the south of the Project. This base has two Sea King HAR3A helicopters (Figure 1-11) for SAR duties with a maximum speed of 110mph and a radius of action of approximately 250nm which covers the Project. The helicopters are available at 15 minutes' readiness during day time hours and 45 minutes readiness during night time hours.

Figure 1- 11 Sea King HAR3A Helicopter

6.2.0.2 Figure 1-12 presents the location of the SAR helicopter base relative to the Project.

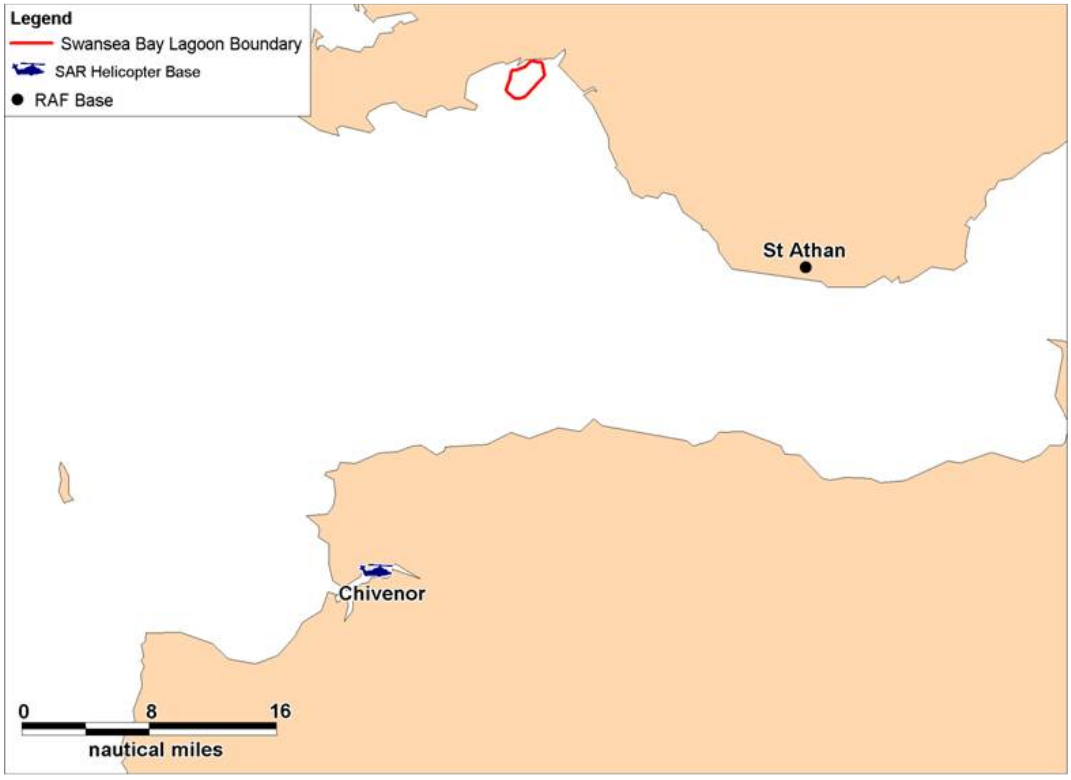

Figure 1- 12 SAR helicopter base relative to the Project

6.2.0.3 Based on the above information, the day time response time to an emergency in the area of the Project would be approximately 34 minutes. At night time, this will increase by 30 minutes to approximately 1 hour and 4 minutes due to the additional readiness time. It is noted that these calculations are based on calm conditions and response times will vary depending on the prevailing conditions.

6.2.0.4 It is understood that the location of the SAR helicopter base may change in the future. The SAR contract has been won by an alternative provider, who have indicated that they will move the SAR base location to St Athan (22nm) between 2015 and 2017. Nothing further can be estimated until this move is confirmed and the type of helicopters to be utilised are decided. The currently considered helicopters (Agusta Westland 189 and Sikorsky S-92) are faster aircraft and would, with the short distance to travel, further reduce response times (assuming present response standards remain the same).

6.3 Emergency towing vessels

6.3.0.1 The MCA has no dedicated emergency towing vessels in this area. Private towing companies may be tasked to assist a drifting vessel as well as wreck removal, cargo recovery, towage and pollution prevention. These private vessels are situated throughout UK waters and ports. Svitzer UK operate towage from the Port of Swansea.

6.3.1 Coastguard Agreement on Salvage and Towage (CAST)

6.3.1.1 Where there is a serious risk of harm to persons or property, or a significant risk of pollution, it may be necessary to initiate emergency towing arrangements. Such arrangements should be unambiguous, agreed by all parties where possible, and activated as swiftly as practicable.

6.3.1.2 The MCA has a framework agreement with the British Tugowners Association (BTA) for emergency chartering arrangements for harbour tugs. The agreement covers activation, contractual arrangements, liabilities and operational procedures, should the MCA request assistance from any local harbour tug as part of the response to an incident. Modern harbour tugs are often capable of providing an effective emergency service in all but the worst weather conditions, and to the largest vessels.

6.4 RNLI lifeboats

6.4.0.1 The RNLI maintains an active fleet of over 300 lifeboats (of various types ranging from 5m to 17m in length) and a relief fleet of around 100 boats at 235 stations round the coast of the UK and Ireland. The RNLI stations in the vicinity of the Project are presented in Figure 1-13.

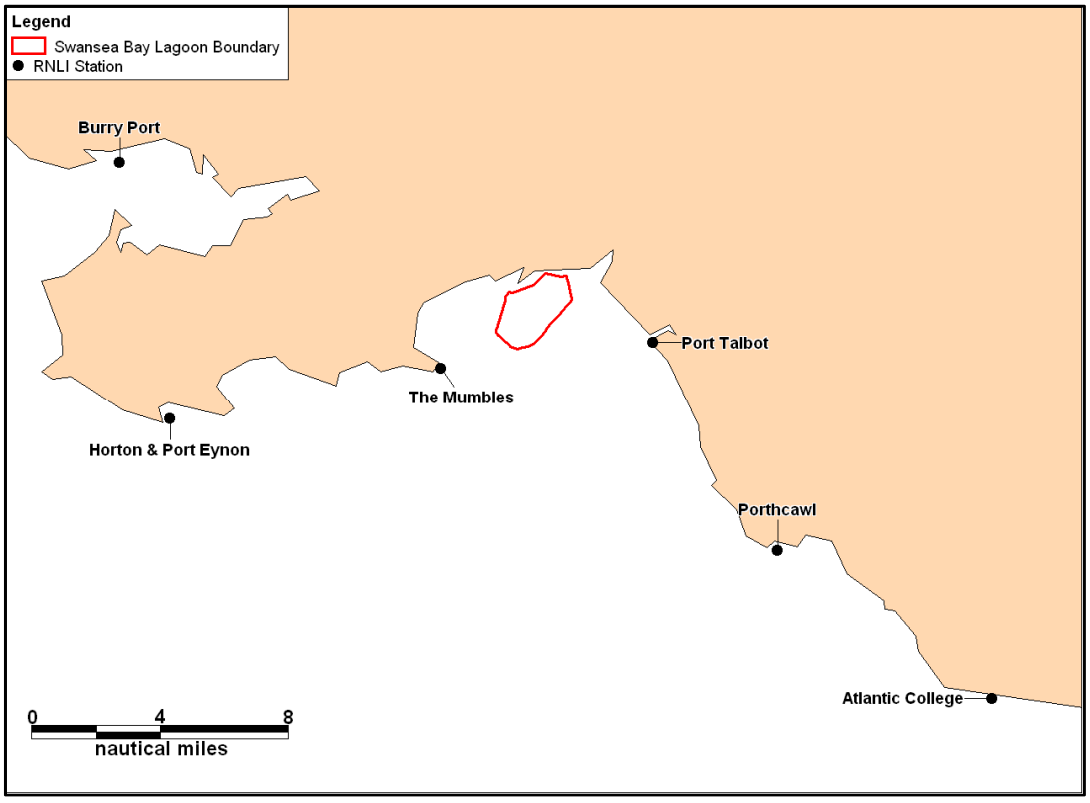

Figure 1- 13 RNLI stations in proximity to the Project

6.4.0.2 At each of these stations, crew and Inshore Lifeboats (ILB) and/or All Weather Lifeboats (ALB) are available on a 24-hour basis throughout the year. Table provides a summary of the facilities at the stations closest to the Project. With distances measured to the turbine housing.

Table 6.1 Lifeboats at nearby RNLI stations

Station	Lifeboats	ALB Spec	ILB Spec	Distance to Project
The Mumbles	ALB & ILB	Tyne Class	D Class	2nm
Port Talbot	ILB	-	D Class	4.7nm

6.4.0.3 A review of the RNLI data (Section 7.3) confirms that the majority of incidents [(see section [7.3.0.6])] were dealt with by lifeboats from these stations.

6.4.0.4 A new RNLI station at The Mumbles is currently being built as part of a pier regeneration project. This station will have a Tamar class lifeboat which is larger and faster than the current Tyne class lifeboat. Construction began in August 2012 and is scheduled to take 18 months.

6.5 SAR liaison

6.5.0.1 It is recognised as good practice (MCA) that OREI operators and the emergency services should liaise on matters of search and rescue. This may include periodic visits for each party to operations rooms/ control centres etc. to maintain close liaison and understanding between all parties.

6.5.0.2 The local RNLI stations and HMCG will be consulted about the devices to be deployed (i.e. the turbines and sluice gates) and provided with any further information requested to assist SAR efforts. This will include:

a) precise location details;

b) device details and illustrations;

c) information on the emergency stop procedure/timings;

d) information on the buoyancy of device parts; and

e) emergency contact details.

6.5.0.3 An Emergency Response Cooperation Plan (ERCoP) is proposed as part of the SAR liaison process for the Project which will be developed and agreed with the MCA prior to the operation phase[1].

[1] http://www.dft.gov.uk/mca/mcga07-home/shipsandcargoes/mcga-shipsregsandguidance/offshore-renewable_energy_installations/dops_-_all-newpage-26.htm

7.0 Maritime incidents

7.1 Introduction

7.1.0.1 This section reviews maritime incidents that have occurred in the vicinity of the Project in recent years.

7.1.0.2 The analysis is intended to provide a general indication as to whether the Project is in an area of low or high risk in terms of maritime incidents. Data from MAIB and RNLI has been analysed, and it should be noted that there may be some duplication, as the same incident may be recorded by both organisations.

7.2 Marine Accident Investigation Branch (MAIB)

7.2.0.1 All UK commercial vessels are required to report incidents to MAIB. Non-UK vessels do not have to report incidents to MAIB unless they are in a UK port or are in 12 mile territorial waters and carrying passengers to a UK port. There are no requirements for non-commercial recreational craft to report incidents to MAIB.

7.2.0.2 The locations of accidents, injuries and hazardous incidents reported to MAIB within 5nm of the Project for a ten year period (January 2002 to December 2011) are presented in Figure 1-14, colour-coded by type.

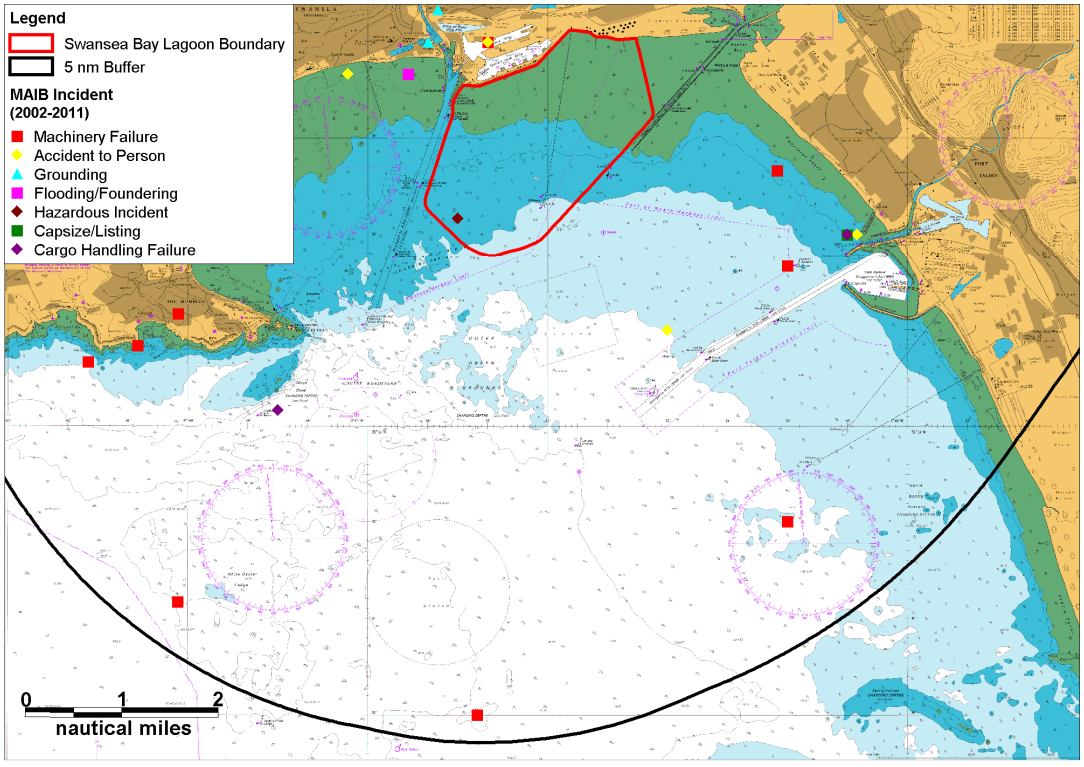

Figure 1- 14 MAIB incident locations by type within 5nm of the Project Jan 2002 - Dec 2011

7.2.0.3 It should be noted that the MAIB aim for 97% accuracy in reporting the locations of incidents.

7.2.0.4 Over the period analysed, 24 unique incidents involving 25 vessels were reported within 5nm of the Project, which corresponds to 2 to 3 incidents per year.

7.2.0.5 One incident (a hazardous incident involving a fish catching/processing vessel) was recorded within the Project area on 27 October 2006. Hazardous incidents are defined by the MAIB as *"unspecified events which might have led to an accident, e.g. near misses stemming from failure of procedures in shipboard operations, material defects, fatigue and human failures"*.

7.2.0.6 The most common incident types recorded within 5nm of the Project between 2002 and 2011 were machinery failure (36%), accident to person (20%) and grounding (12%).

7.3 RNLI

7.3.0.1 Data on RNLI lifeboat responses within 5nm of the Project in the ten year period between 2001 and 2010 have been analysed.

7.3.0.2 Over the period analysed, 544 unique incidents were recorded by the RNLI (excluding hoaxes and false alarms), which corresponds to an average of between 54 and 55 incidents per year. Figure 1-15 presents the geographical location of incidents colour-coded by casualty type.

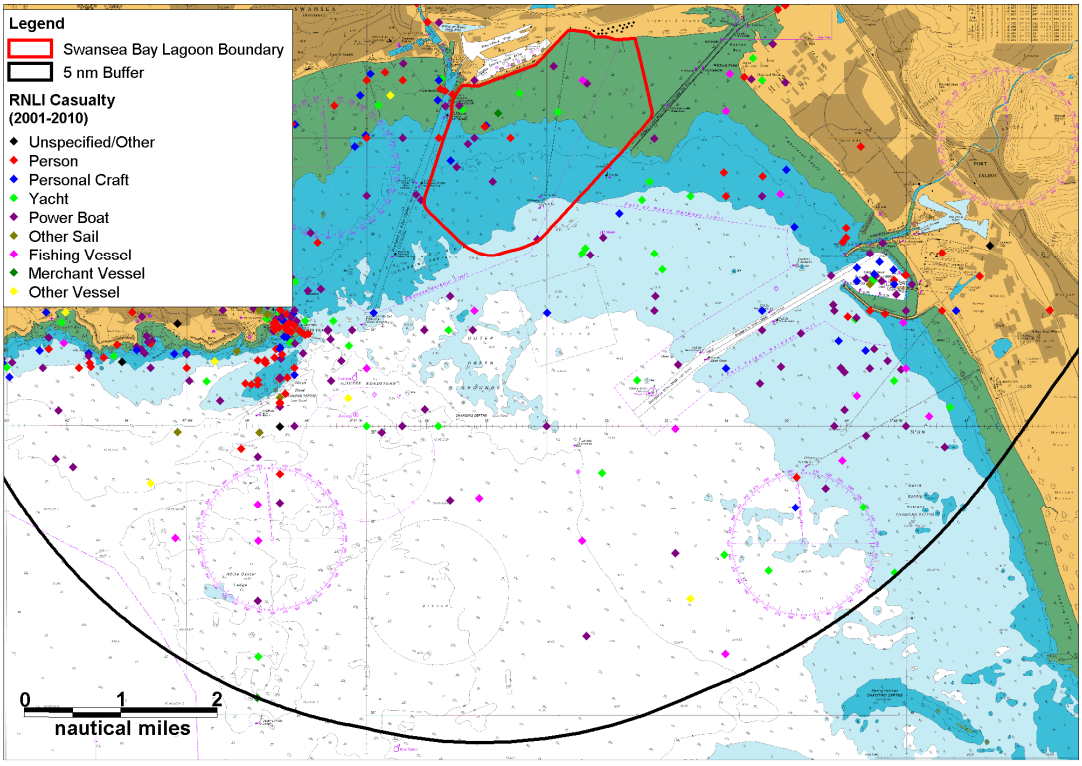

Figure 1- 15 RNLI incident locations by type within 5nm of the Project 2001 - 2010

7.3.0.3 54 incidents were recorded within the Project area in the 10 years analysed (although it should be noted that the co-ordinates provided often recorded multiple incidents in the same location so Figure 1-15 does not to show every incident).

7.3.0.4 The majority of casualties within the Project area were persons (33%) and power boats (33%) with yachts and personal craft accounting for 19% and 9% respectively.

7.3.0.5 The main reported incidents were person in danger (48%) and machinery failure (28%).

7.3.0.6 The vast majority of incidents within the 5nm buffer area (as shown on Figure 1-16) were responded to by the inshore lifeboats (ILBs) from either Mumbles (65%) or Port Talbot (20%) or the ALB from Mumbles (13%).

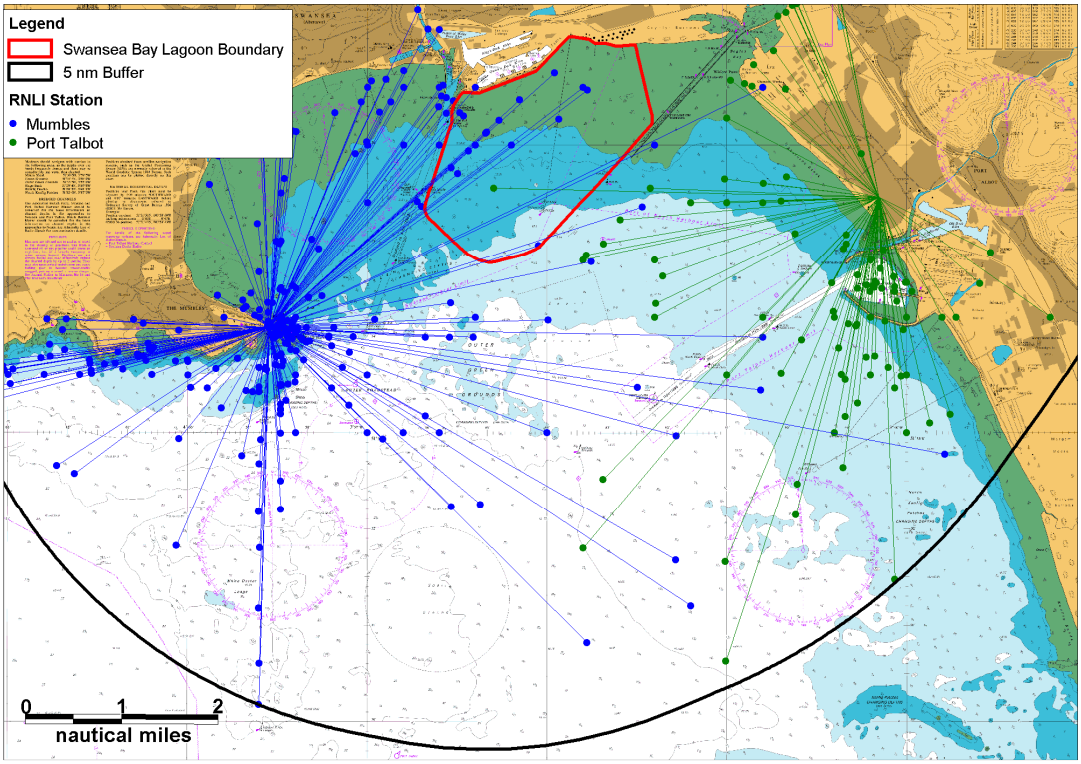

Figure 1- 16 Incidents by RNLI station attending 2001 - 2010

7.3.0.7 In general, when looking at the incidents, including the type of vessels involved, recorded at other coastal areas using data from the RNLI and expert opinion, it has been concluded that the level of maritime incidents in the 5nm buffer around the Project is relatively high, due to the popularity of the location for water based sports.

8.0 Marine traffic analysis

8.1 Introduction

8.1.0.1 The following section presents and analyses vessel tracks recorded on AIS within 5nm of the Project. The charts show those vessel tracks8.1.0.2 The limitations of utilising AIS data alone is detailed within Section 3.1. This AIS is illustrative of traffic operating with Swansea Bay which carry AIS. To ensure full coverage was obtained, a marine traffic survey was also conducted, which captures AIS, radar tracks and visually observed vessels. The marine traffic survey is outlined in Section 9.

8.1.0.3 While the majority of AIS ship types are clearly apparent, the type 'Other Ships' requires further explanation. This category includes pilot vessels, search and rescue craft, port tenders, government vessels. In the examples below the majority of this category was pilot vessel traffic.

8.1.0.4 Plots of the AIS vessel tracks recorded during 28 days in July 2012 and 28 days in October 2012 within 5nm of the Project are presented in Figure 1-17 and Figure 1-18, colour coded by vessel type. Tracks of any spurious transmissions from vessels operating in the area have been removed and excluded from further analysis (i.e. a small number of corrupt GPS inputs were screened out).

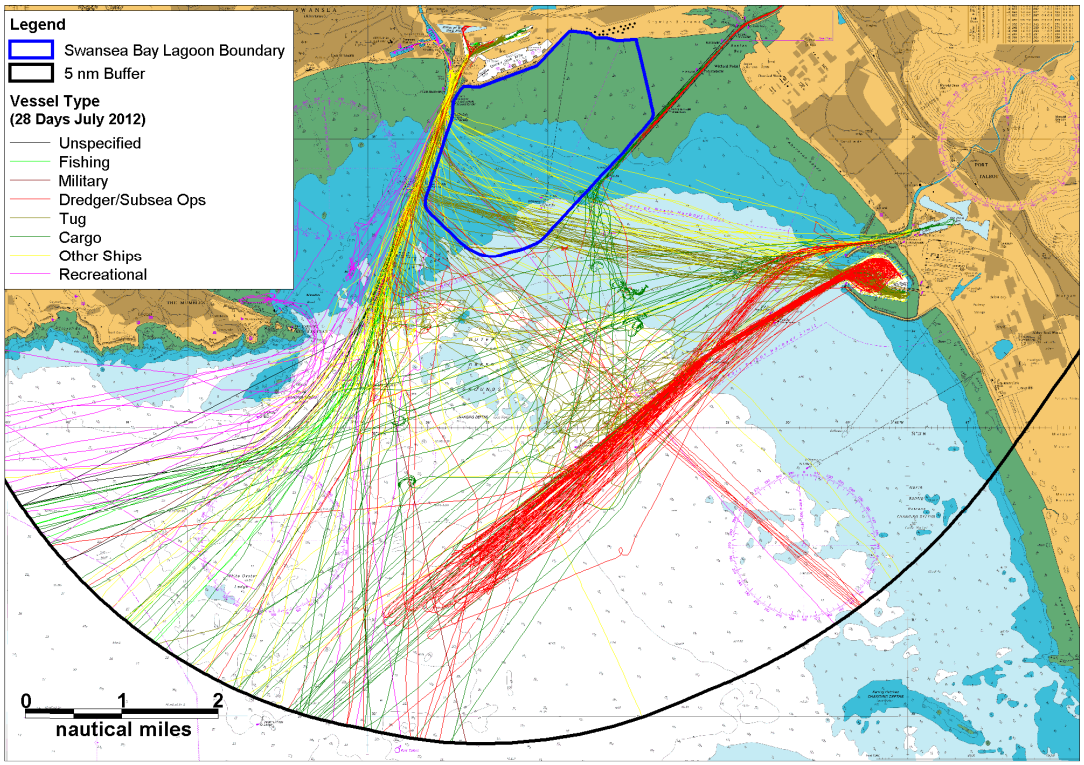

Figure 1- 17 AIS data within 5nm buffer (28 days July 2012)

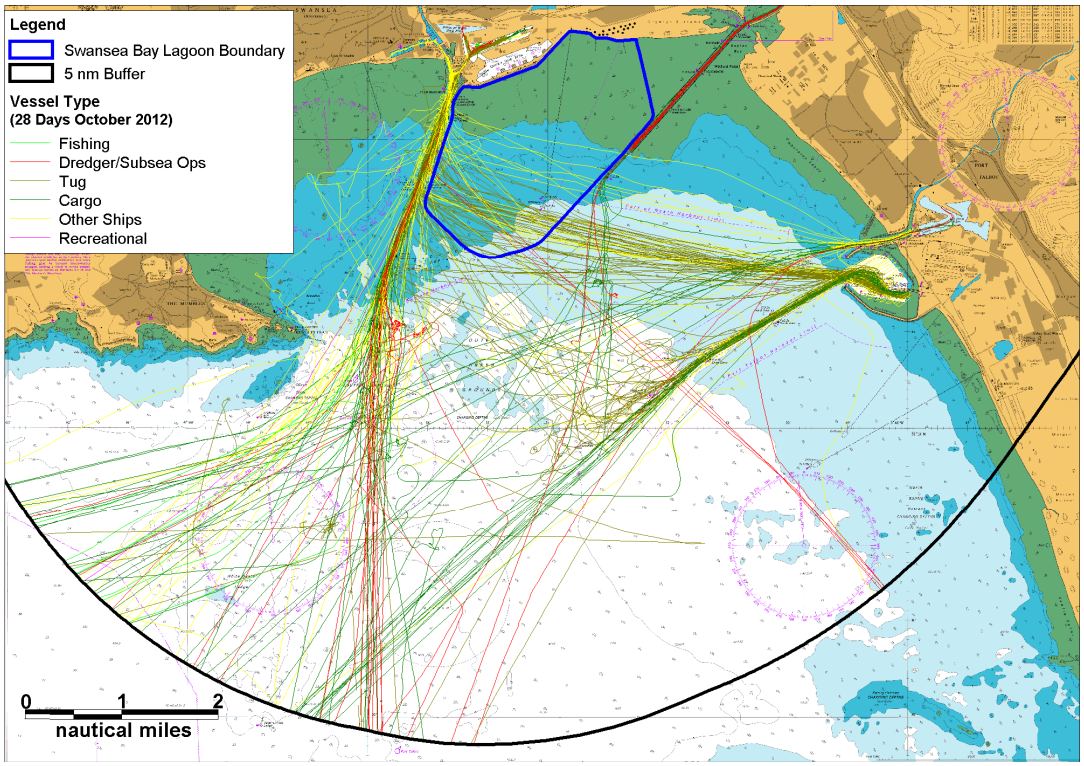

Figure 1- 18 AIS data within 5nm buffer (28 days October 2012)

8.1.0.5 During the 28 days in July 2012, an average of 6 unique vessels per day were recorded on AIS passing within 5nm of the Project. In terms of vessels actually crossing the Project area, there were an average of 2 unique vessels per day (recorded on AIS), the majority of which were tugs and pilot vessels associated with the ports of Port of Swansea and Port Talbot. Figure 1-19 presents the daily number of vessels crossing the Project area and the daily number of vessels within the 5nm buffer (recorded on AIS).

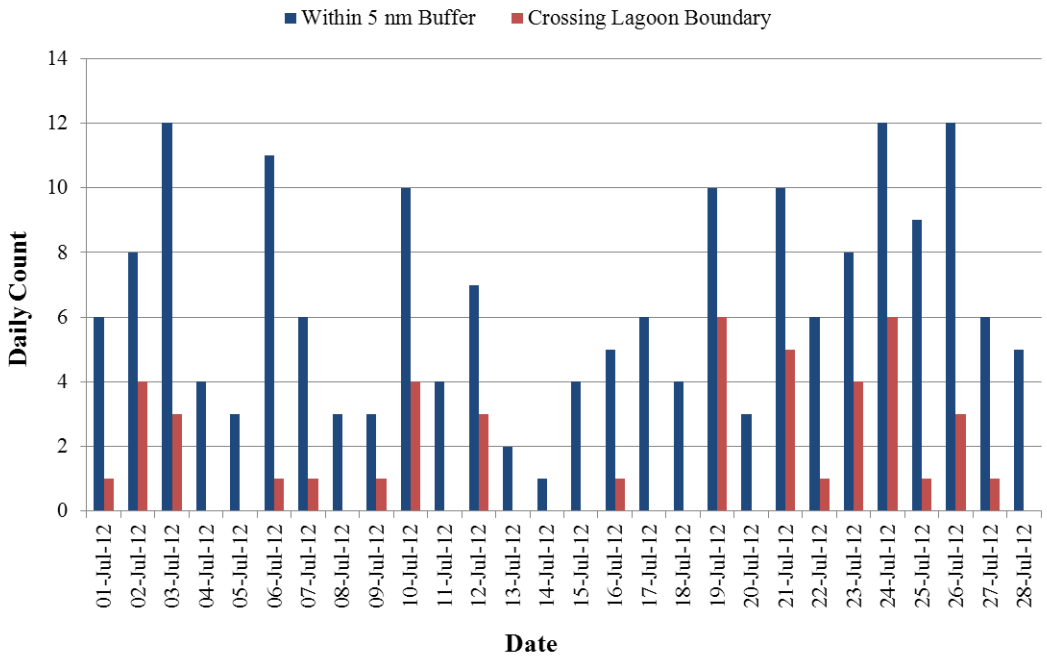

Figure 1- 19 Daily number of unique vessels (28 days July 2012)

8.1.0.6 During the 28 days in October 2012, an average of 6 unique vessels were recorded on AIS per day passing within 5nm of the Project. In terms of vessels actually crossing the Project area, there were an average of 2 unique vessels per day (recorded on AIS), the majority of which were tugs and pilot vessels associated with port activities. Figure 1-20 presents the daily number of vessels crossing the Port area and within the 5nm buffer (recorded on AIS). The loss of data on 17 October was caused by receiver downtime.

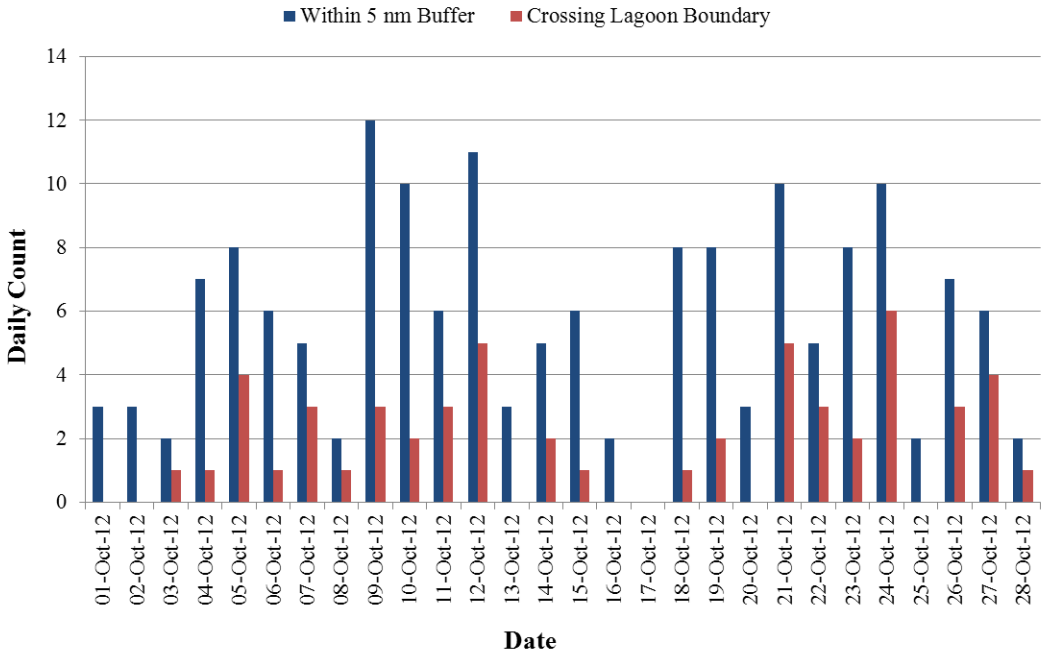

Figure 1- 20 Daily number of unique vessels (28 days October 2012)

8.1.0.7 Of the 56 days analysed, the busiest days were 3 July, 24 July, 26 July and 9 October 2012. The highest number of unique vessels were recorded within 5nm of the Project was 12. Vessel tracks recorded on one of the busiest days (3 July) are presented in Figure 1-21.

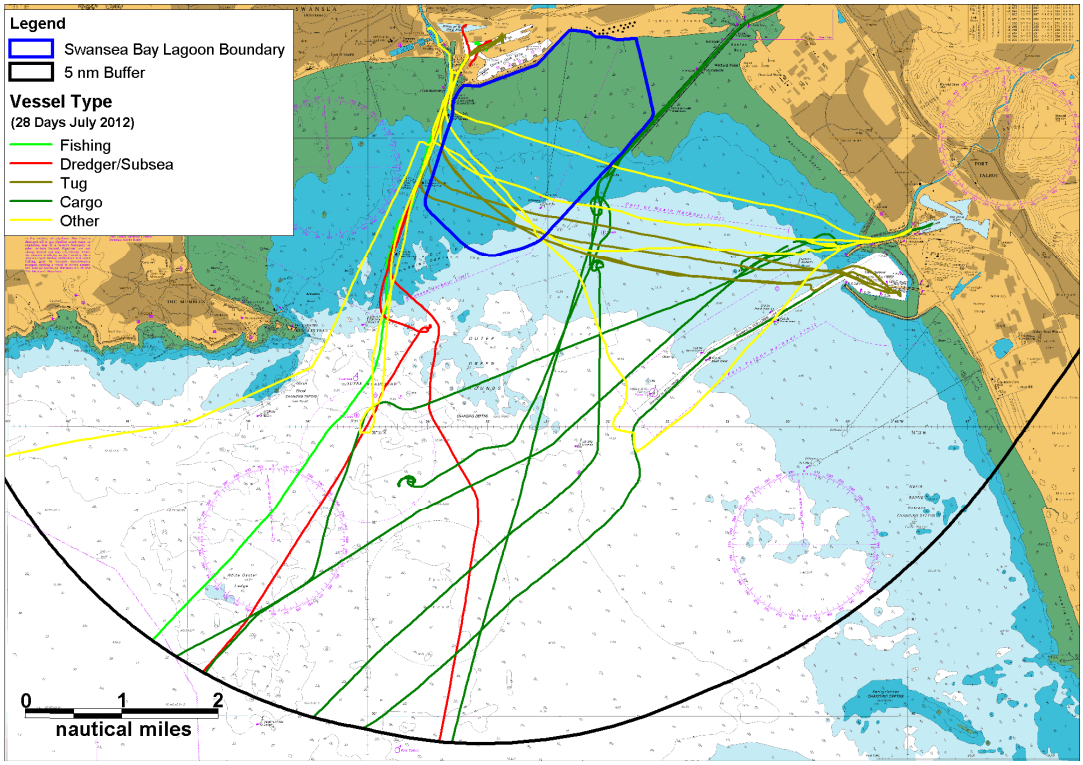

Figure 1-21 AIS vessel tracks busiest day (3 July 2012)

8.1.0.8 Analysis of the vessel types recorded within the 5nm buffer around the Project during 28 days in July 2012 and 28 days in October 2012 are presented in Figure 1-22 and Figure 1-23.

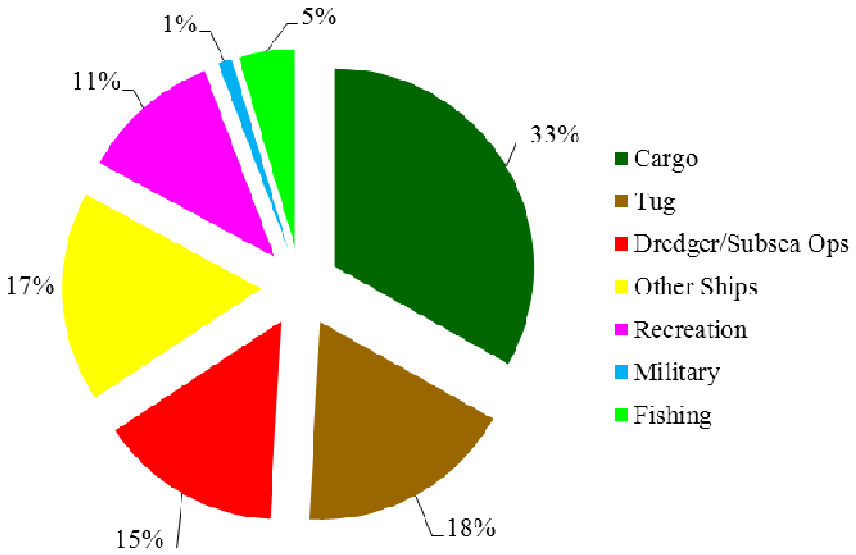

Figure 1-22 Vessel types identified within 5nm buffer (28 days July 2012)

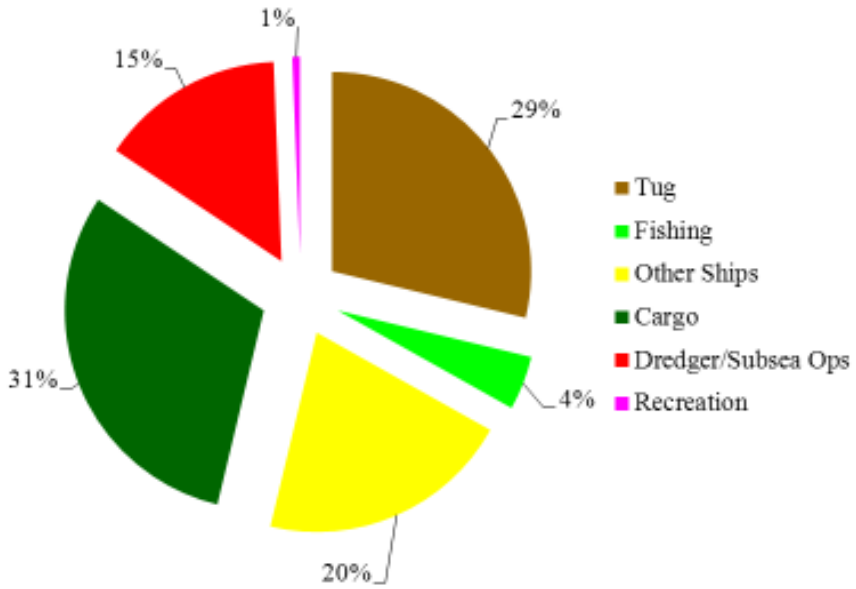

Figure 1- 23 Vessel types identified within 5nm buffer (28 days October 2012)

8.1.0.9 In July 2012, the majority of vessels recorded by AIS were cargo vessels (33%), tugs (18%) and other ships (17%). Tracks of these three vessel types are presented in Figure 1-24 to Figure 1-26.

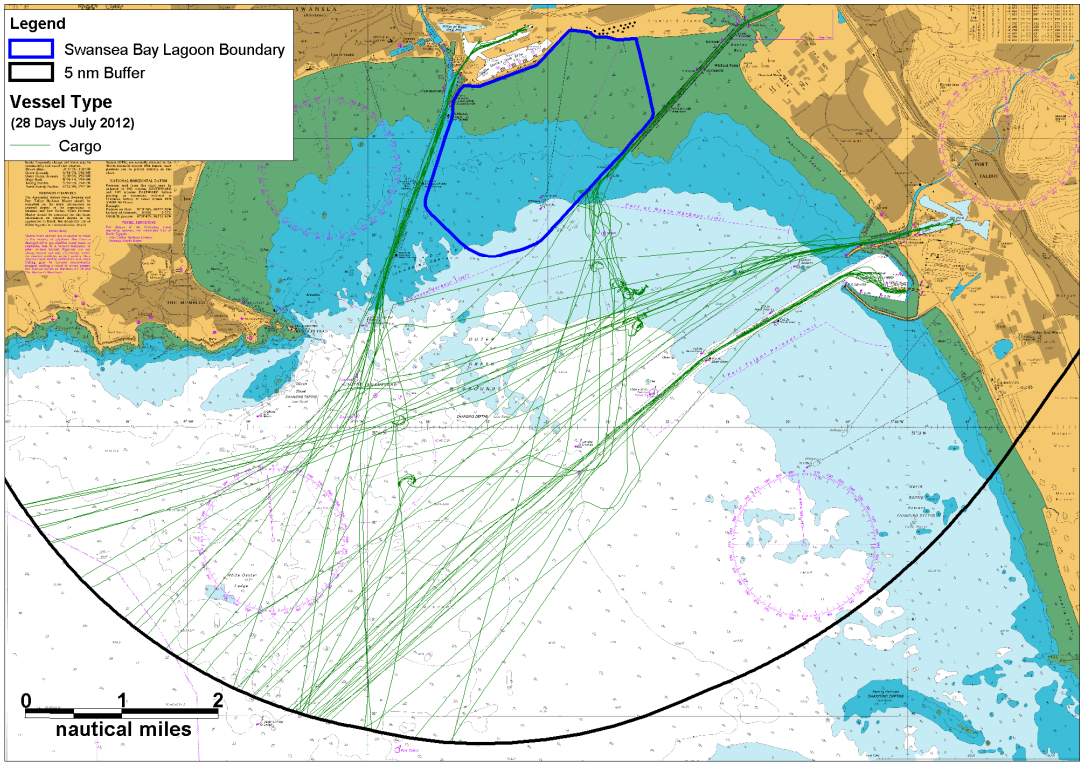

Figure 1-24 AIS cargo tracks (28 days July 2012)

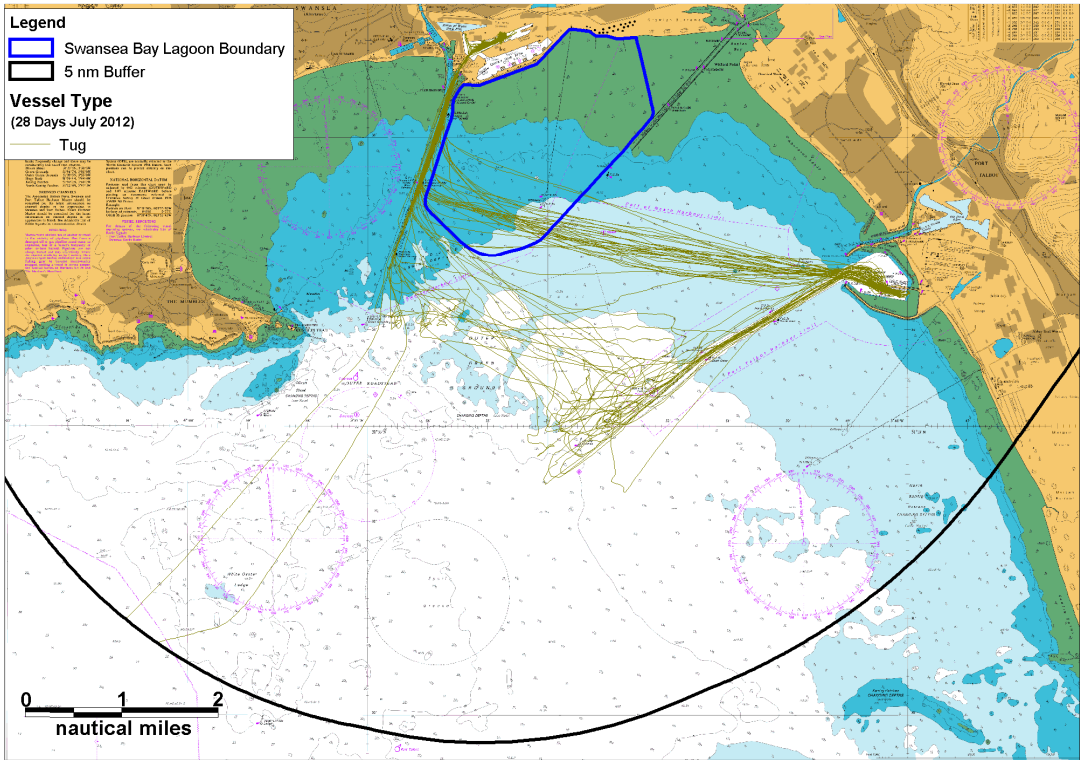

Figure 1-25 AIS tug tracks (28 days July 2012)

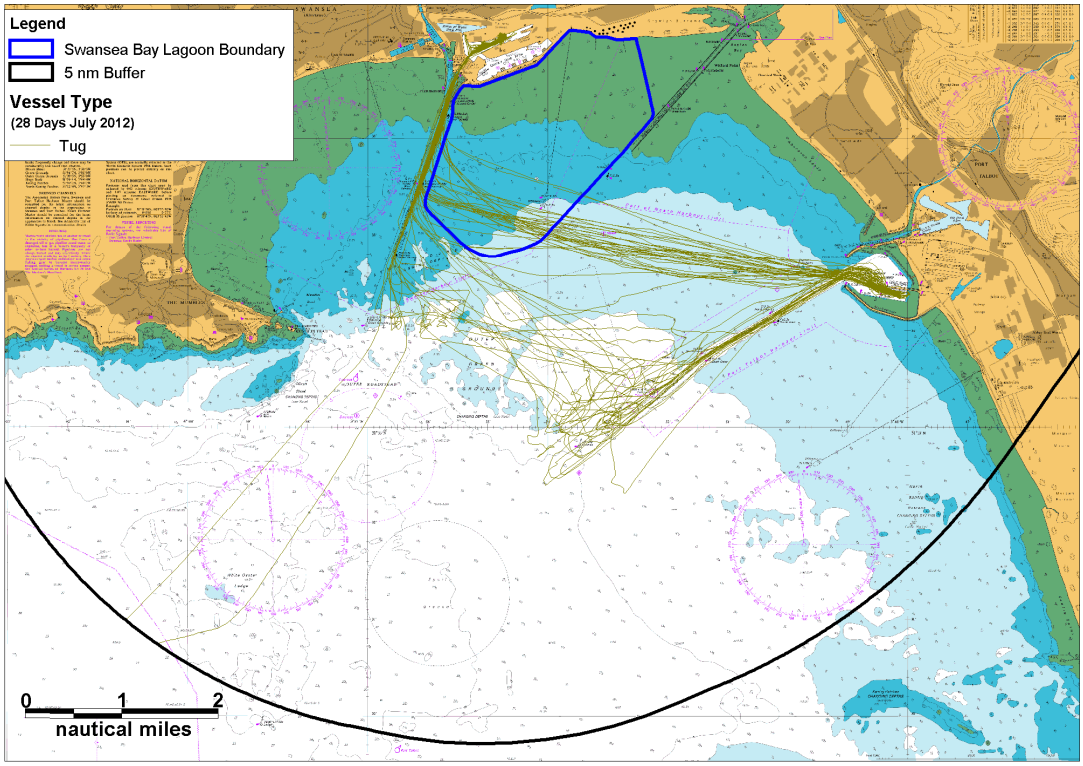

Figure 1-26 Vessel AIS tracks other ships (28 days July 2012)

8.1.0.10 In October 2012, the majority of vessels tracked by AIS were cargo vessels (31%), tugs (29%) and other ships (20%). Tracks of these three vessel types are presented in Figure 1-27 to Figure 1-29.

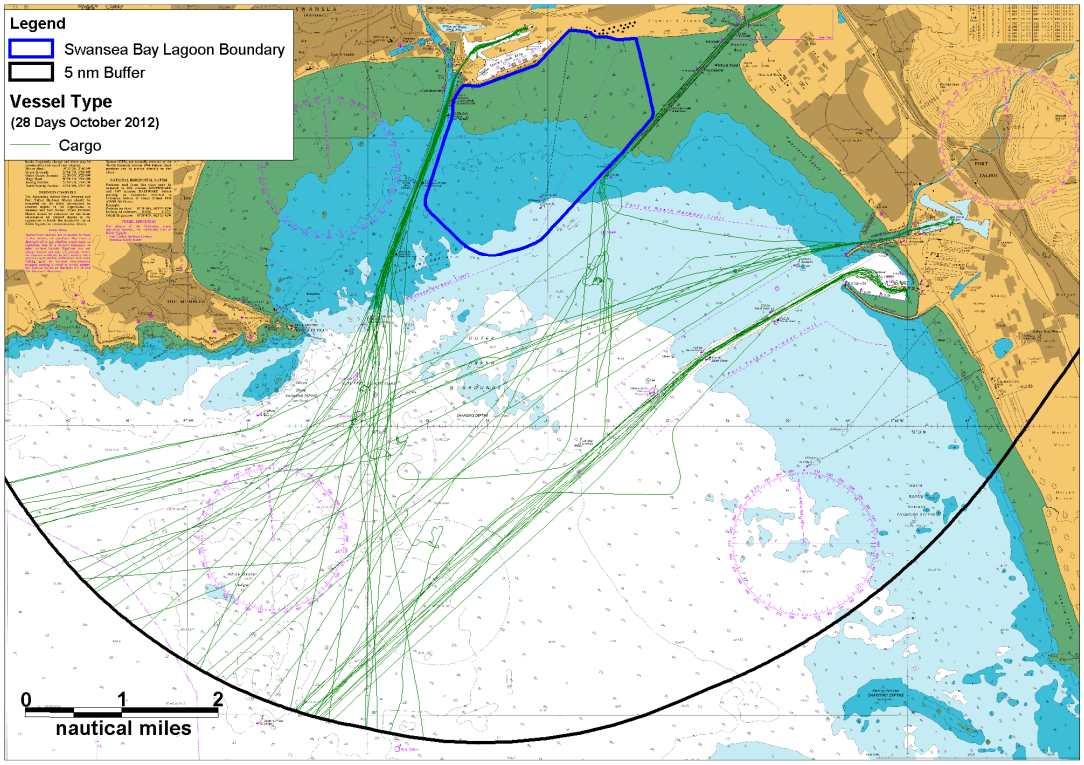

Figure 1- 27 AIS cargo vessel tracks (28 days October 2012)

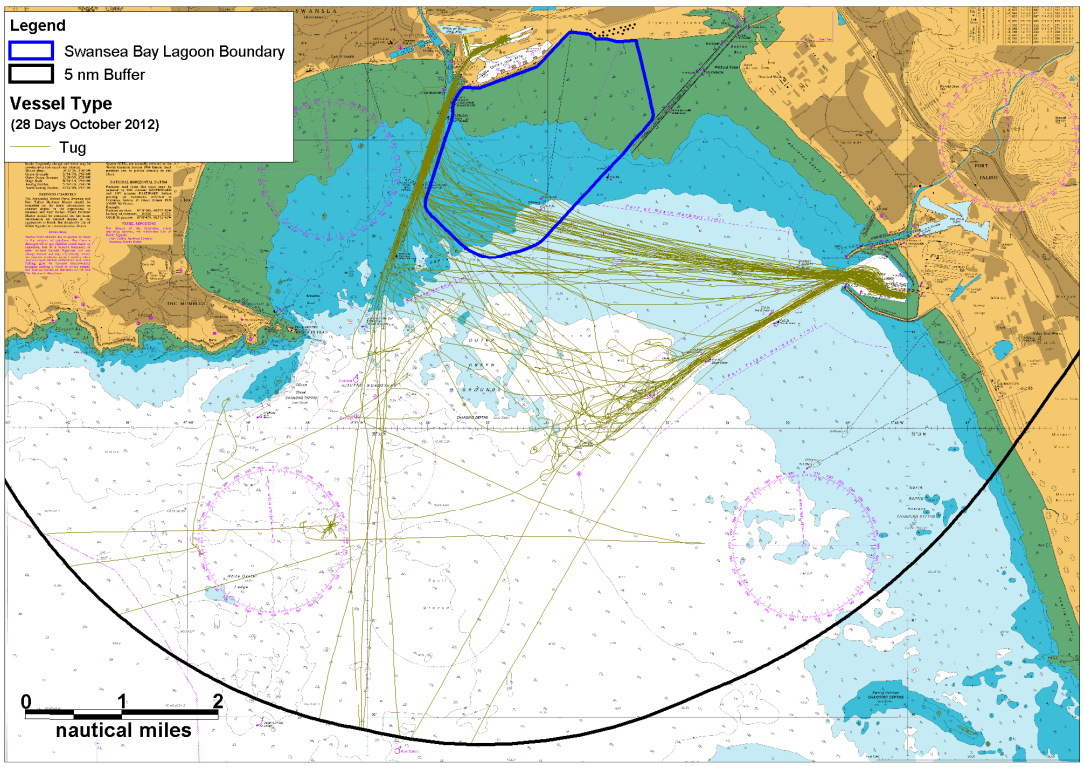

Figure 1- 28 AIS tug tracks (28 days October 2012)

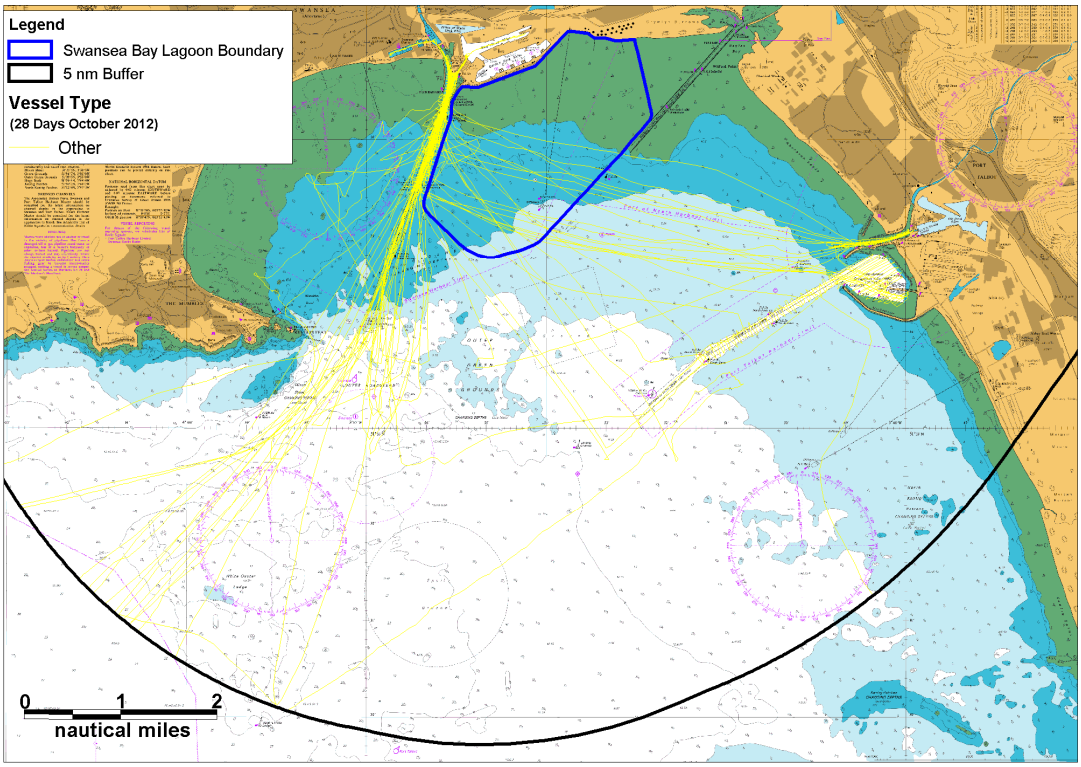

Figure 1-29 AIS Other ships tracks (28 Days October 2012)

8.2 Vessel length

8.2.0.1 Figure 1-30 presents the distribution of vessel length within the 5nm buffer around the Project (excluding those which did not specify a length).

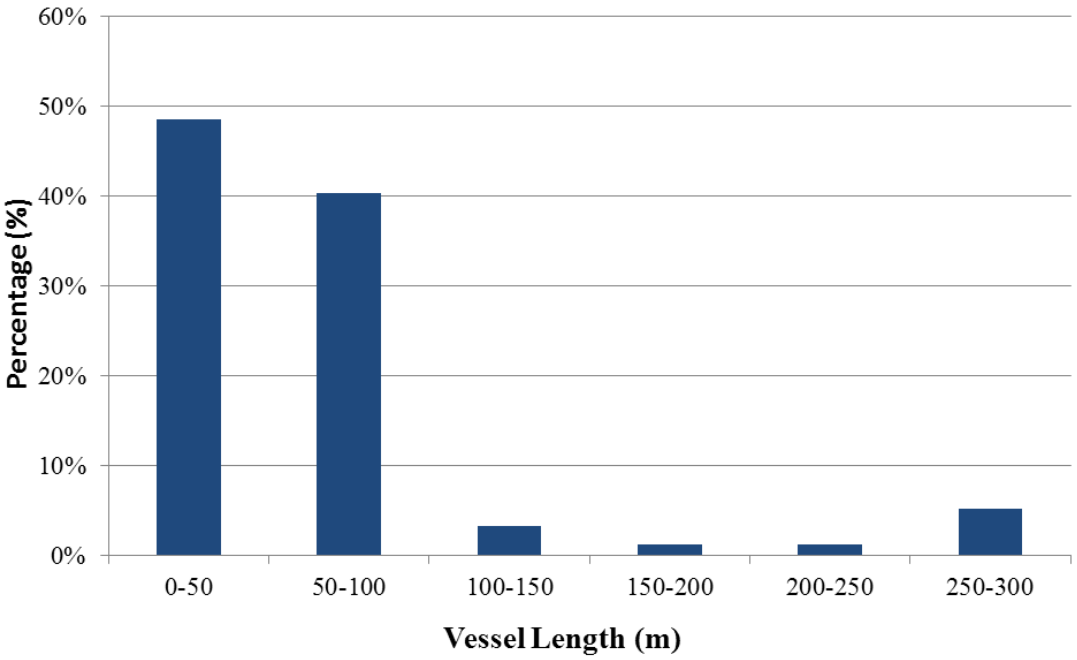

Figure 1- 30 Vessel length distribution (56 days over July and October 2012)

8.2.0.2 Overall, the longest length of vessel recorded was 292m. There were five vessels recorded at this length, bulk carriers bound for Port Talbot. The tracks of these vessels are presented in Figure 1-31.

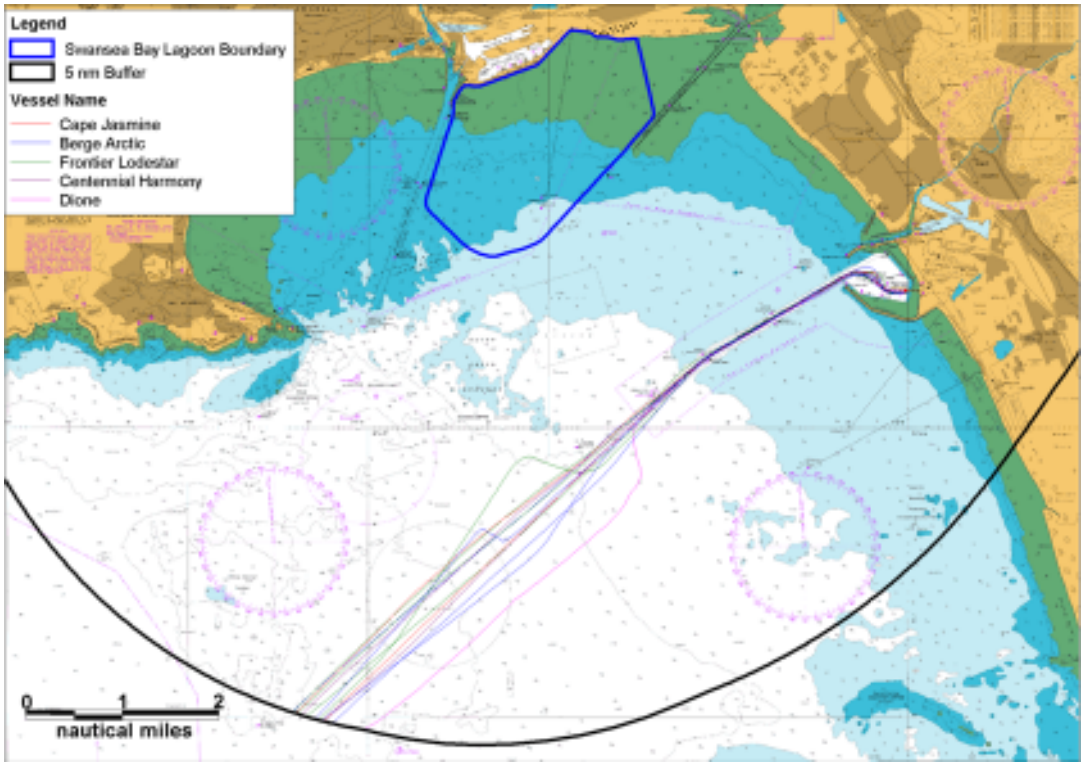

Figure 1- 31 AIS tracks for vessels with the greatest lengths

8.3 Vessel draught

8.3.0.1 Figure 1-32 presents the distribution of vessel draught within the 5nm buffer around the Project (excluding those which did not specify their draught).

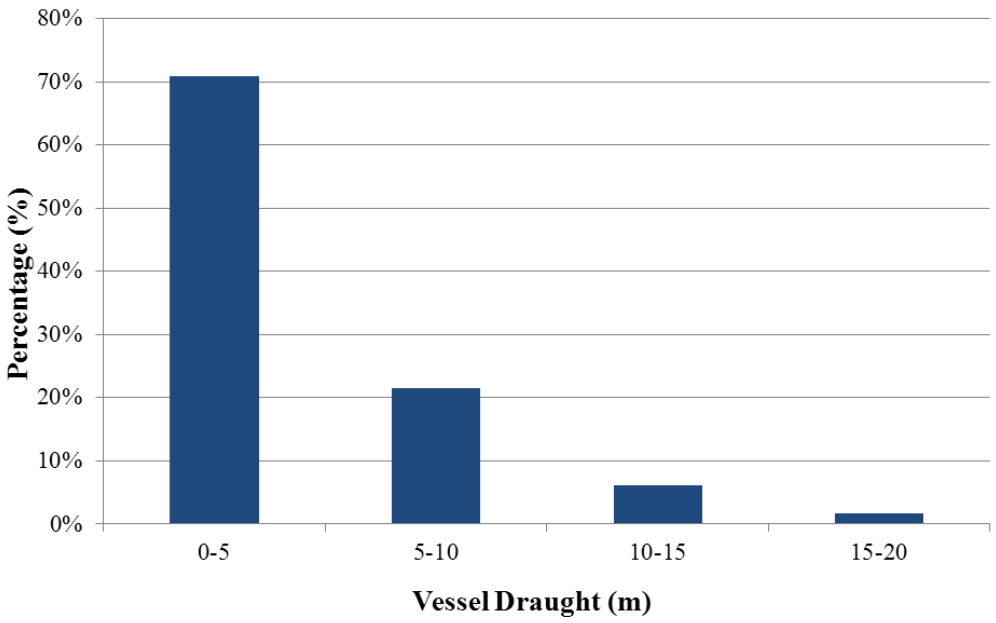

Figure 1- 32 Vessel draught distribution (56 days over July and October 2012)

8.3.0.2 Overall, the deepest draught of vessels recorded was 17m and there were two vessels recorded with this draught. The tracks of these two vessels are presented in Figure 1-33.

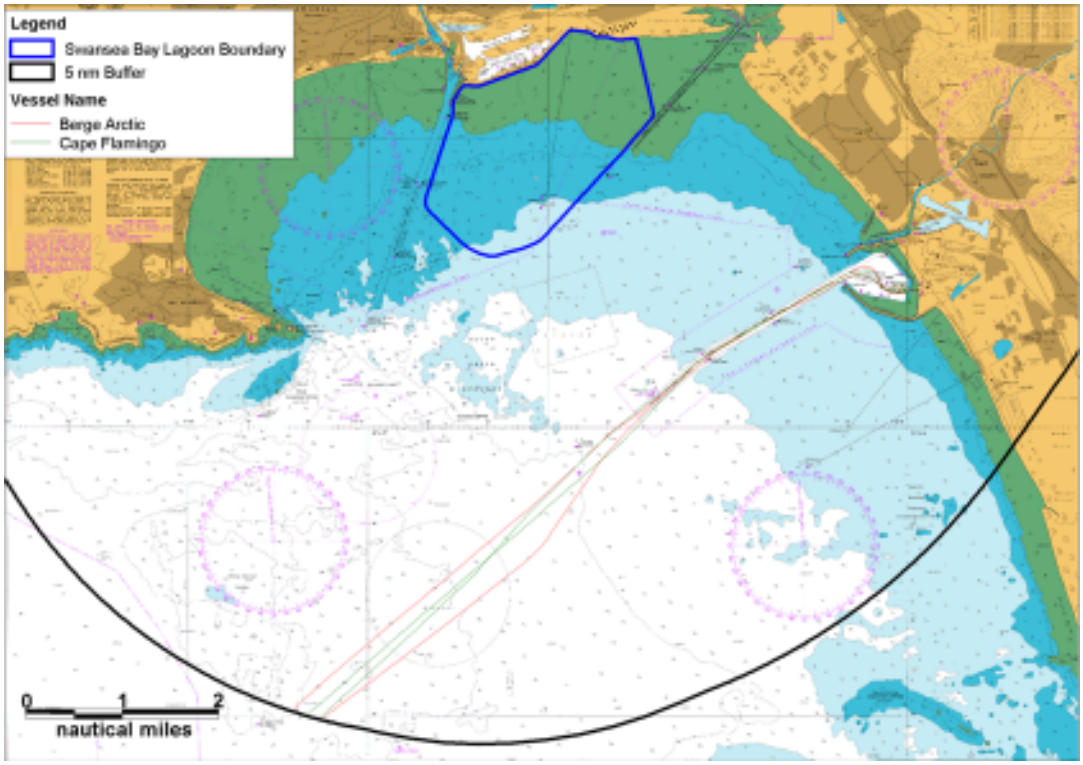

Figure 1- 33 AIS tracks for vessels with the deepest draughts

8.4 Vessel courses

8.4.0.1 From analysing vessel courses, it was identified that in July 2012, 46% of traffic was headed eastbound and 54% westbound. In October 2012, the same breakdown was observed: 46% traffic was headed eastbound and 54% westbound.

8.5 Vessel speed

8.5.0.1 The speed distribution of the vessels tracked within the 5nm buffer during 56 days over July 2012 and October 2012 is presented in Figure 1-34. Overall, the majority of vessels in the area were slow moving, with around 43% transiting at 4 knots or less. Only a few vessels (approximately 8%) were travelling at greater than 10 knots.

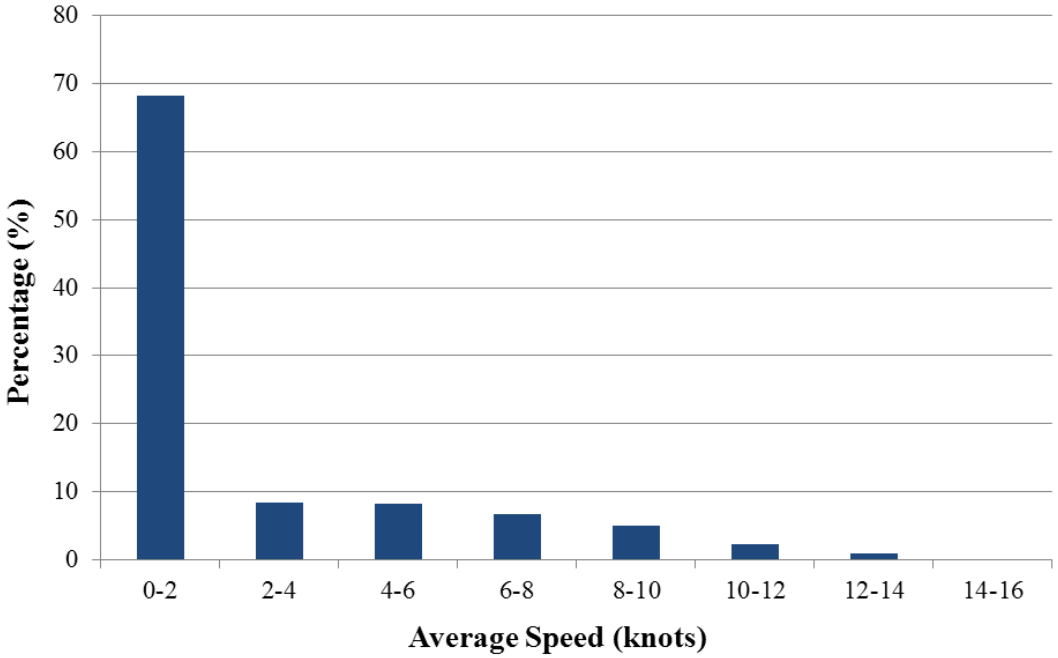

Figure 1- 34 Average speed (56 days over July and October 2012)

8.6 Anchored vessels

8.6.0.1 Anchored vessels can be identified based on the AIS navigational status which is set on the AIS transmitter on board a vessel. Information is manually entered into the AIS; therefore, it is common for vessels not to update their navigational status if they are anchored for only a short period of time. For this reason, for the purpose of this study, those vessels which travelled at a speed of less than 1 knot for more than 30 minutes were assumed to be at anchor for a period of time.

8.6.0.2 No vessels were recorded at anchor within the Project area during the periods analysed. Figure 1-35 presents a plot of anchored vessels within the 5nm buffer during 56 days over July and October 2012.

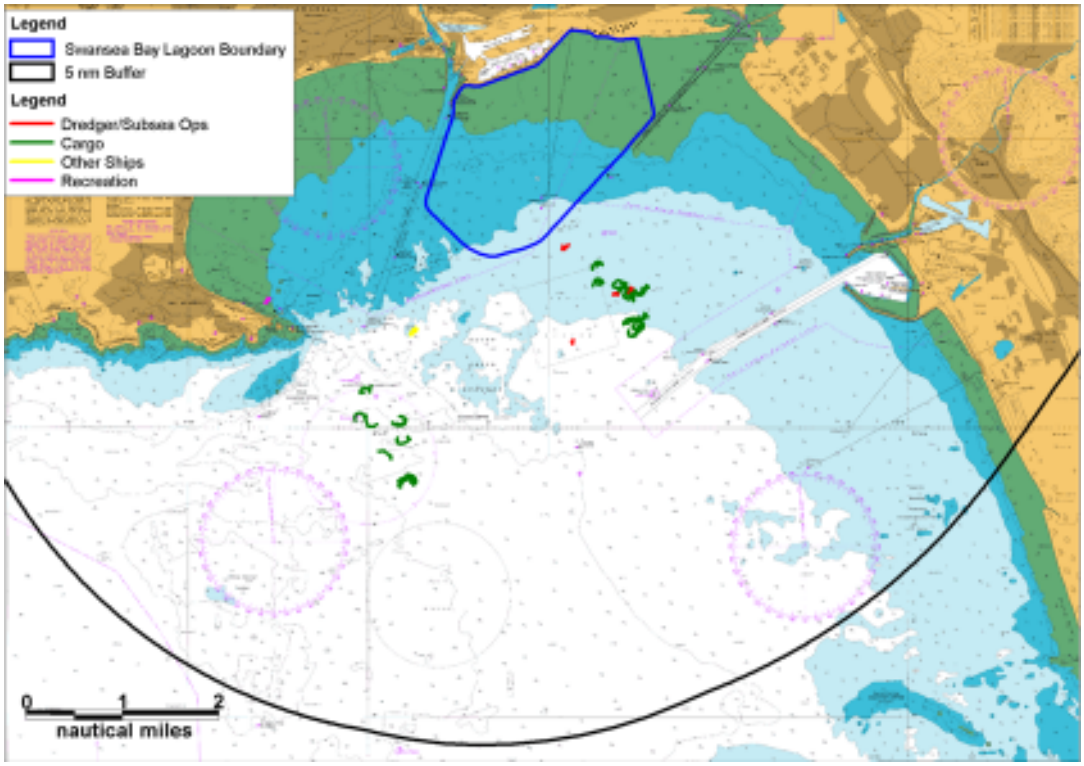

Figure 1- 35 Plots of anchored vessels (56 days over July and October 2012)

8.6.0.3 It can be seen that the majority of vessels anchoring were cargo vessels and dredgers. The vessel anchoring closest to the Project area was the suction dredger *Arco Dart,* which was recorded at anchor for approximately 6 hours on 25 July 2012, 0.2nm from the Project area.

8.7 Recreational vessel activity

8.7.0.1 This section reviews recreational vessel activity in the vicinity of the Project based on information published by the RYA, and AIS tracking of recreational vessels.

8.7.1 Survey tracks

8.7.1.1 Recreational vessel activity was recorded on AIS in July 2012 and October 2012, as presented in Figure 1-36 and Figure 1-37 respectively.

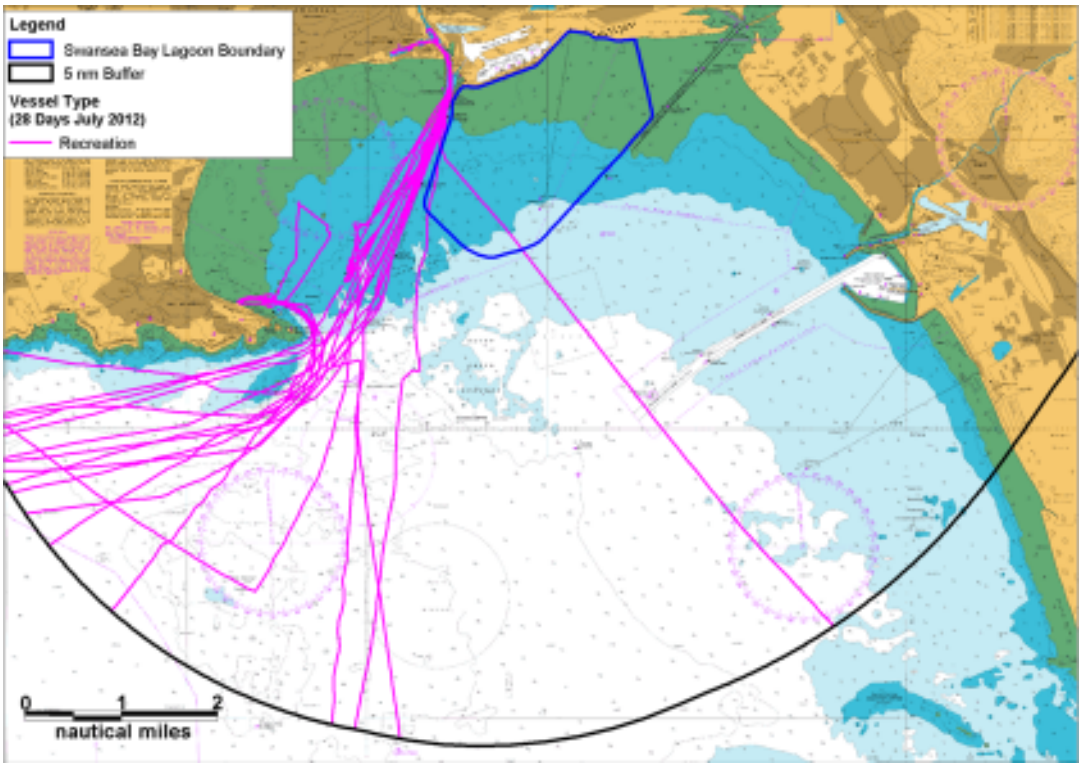

Figure 1- 36 Tracks for recreational vessels (28 days July 2012)

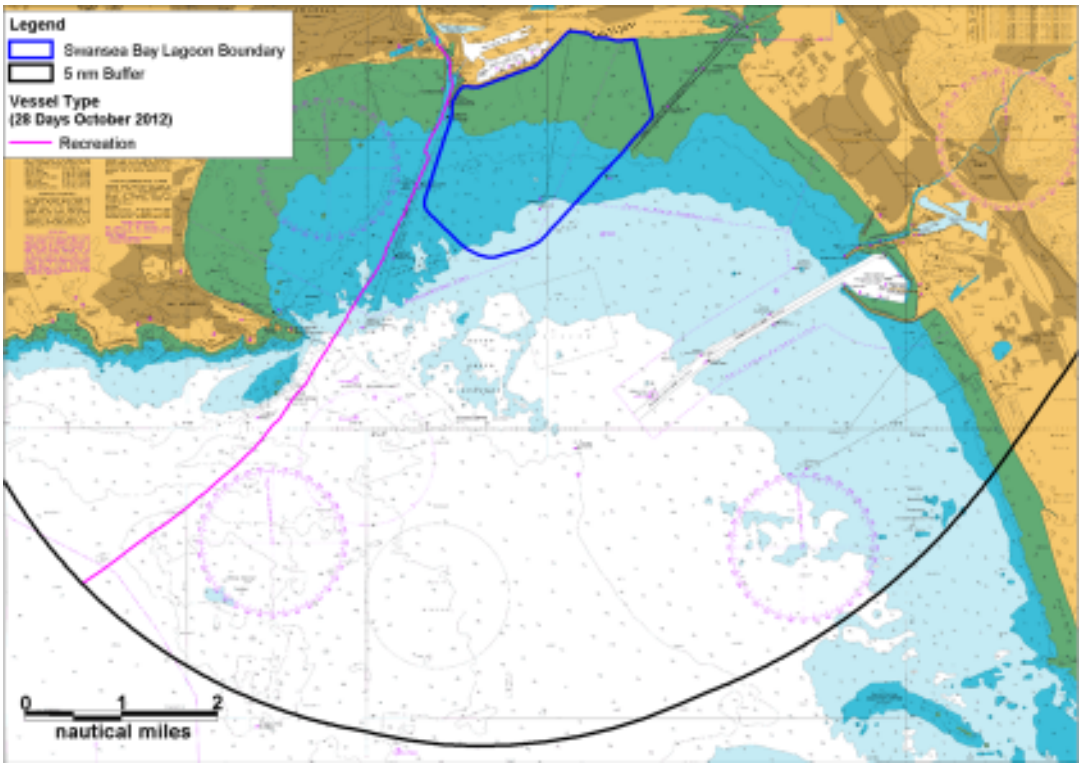

Figure 1- 37 AIS Vessel tracks for recreational vessels (28 days October 2012)

8.7.1.2 It can be seen that recreational vessels were recorded transiting in and out of Swansea port, to the west of the Project area. The greater number of vessels was recorded in summer compared to winter. Two examples of the type of recreational vessels recorded during the surveys are presented in Figure 1-38 and Figure 1-39.

Figure 1-38 Recreational vessel *Scorpio*

Figure 1- 39 Recreational vessel *Riverdance*

8.7.2 Recreational cruising routes

8.7.2.1 Historically, there has not been a database showing recreational use of the UK's marine environment. As a response to the lack of information, the RYA, supported by the Cruising Association (CA), started to identify recreational cruising routes, general sailing and racing areas (RYA, 2010). This work was based on extensive consultation and qualitative data collection by RYA and CA members, through the organisations' specialist and regional committees and through the RYA affiliated clubs. The consultation was also sent to berth holder associations and marinas.

8.7.2.2 The results of this work were published in "Sharing the Wind" (RYA & CA, 2004) and updated GIS layers published in the Coastal Atlas (RYA, 2009). "Sharing the Wind" notes that recreational boating, both under sail and power, is highly seasonal and highly diurnal. The report divides recreational craft routes into Heavy, Medium and Light Use based on the following classification:

a) Heavy Use: very popular routes on which a minimum of six or more recreational vessels will probably be seen at all times during summer daylight hours. These also include the entrances to harbours, anchorages and places of refuge;

b) Medium Use: popular routes on which some recreational craft will be seen at most times during summer daylight hours; and

c) Light Use: routes known to be in common use but which do not qualify for medium or heavy classification.

8.7.2.3 The routes are not designated courses but are general indications of known recreational routes between specific destinations popular with recreational craft.

8.7.3 Recreational data

8.7.3.1 A plot of the recreational cruising routes and facilities in Swansea Bay is presented in Figure 1-40.

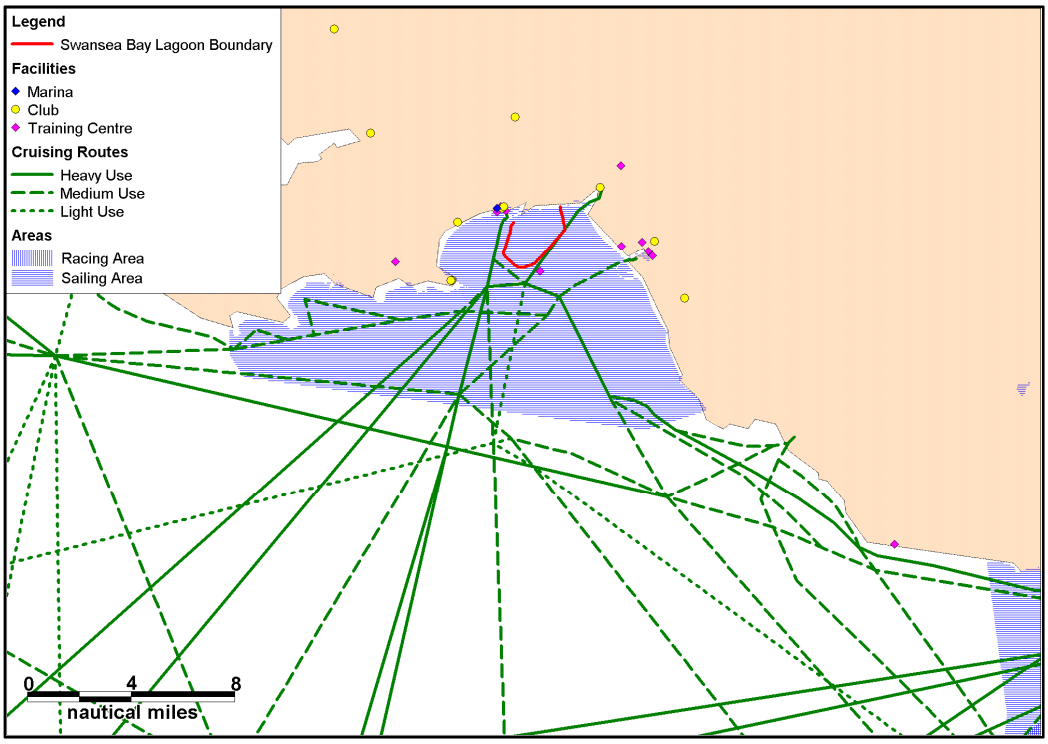

Figure 1- 40 RYA recreational routes overview

8.7.3.2 There is one heavy use cruising route near to the eastern side of the Project area associated with the Port of Neath and one to the west of the Project area. Each heavy use cruising route follows the channel leading to the respective ports of Neath and Swansea respectively. There is also a medium use route to the south of the Project area. The Lagoon is located within a general sailing area and there are a number of recreational facilities located within Swansea Bay as a whole. The pink diamond to the south east of the Project area indicates a general location where training courses take place, but there is no fixed infrastructure at this location.

8.8 Fishing vessel activity

8.8.0.1 This section reviews the fishing vessel activity in the vicinity of the Project based on AIS data and sightings/satellite data.

8.8.1 Survey tracks

8.8.1.1 Fishing vessel activity was recorded on AIS in July 2012 and October 2012, as presented in Figure 1-41 and Figure 1-42 respectively.

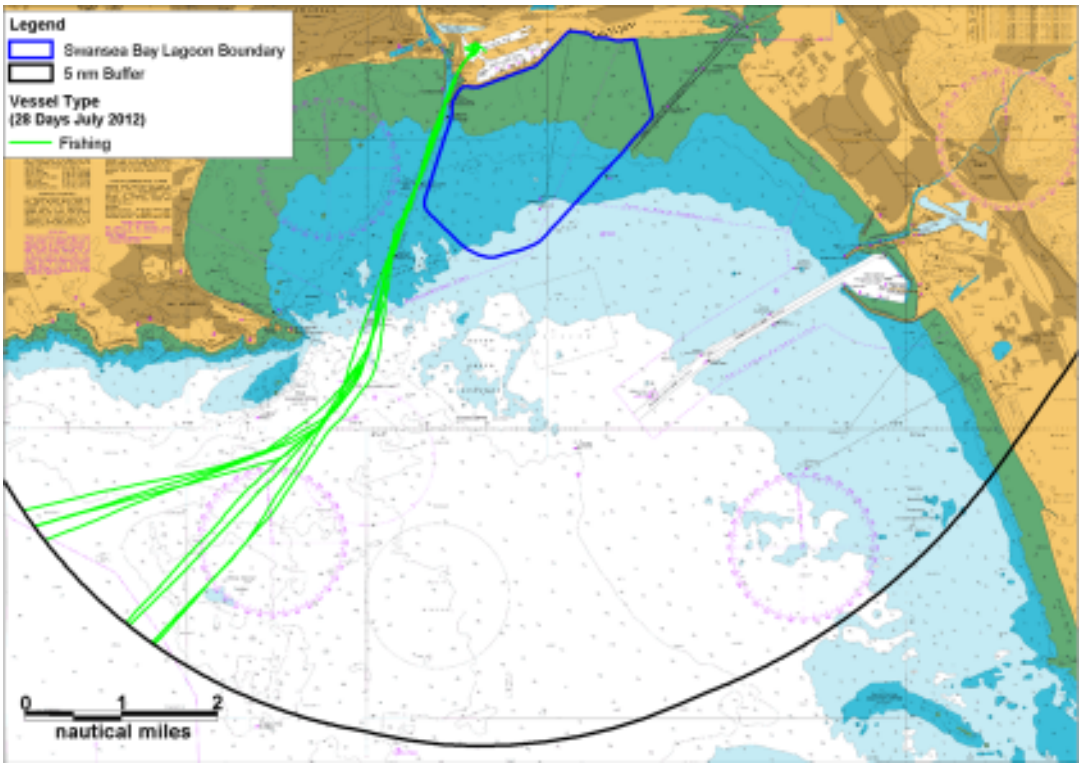

Figure 1- 41 AIS tracks fishing vessels (28 days July 2012)

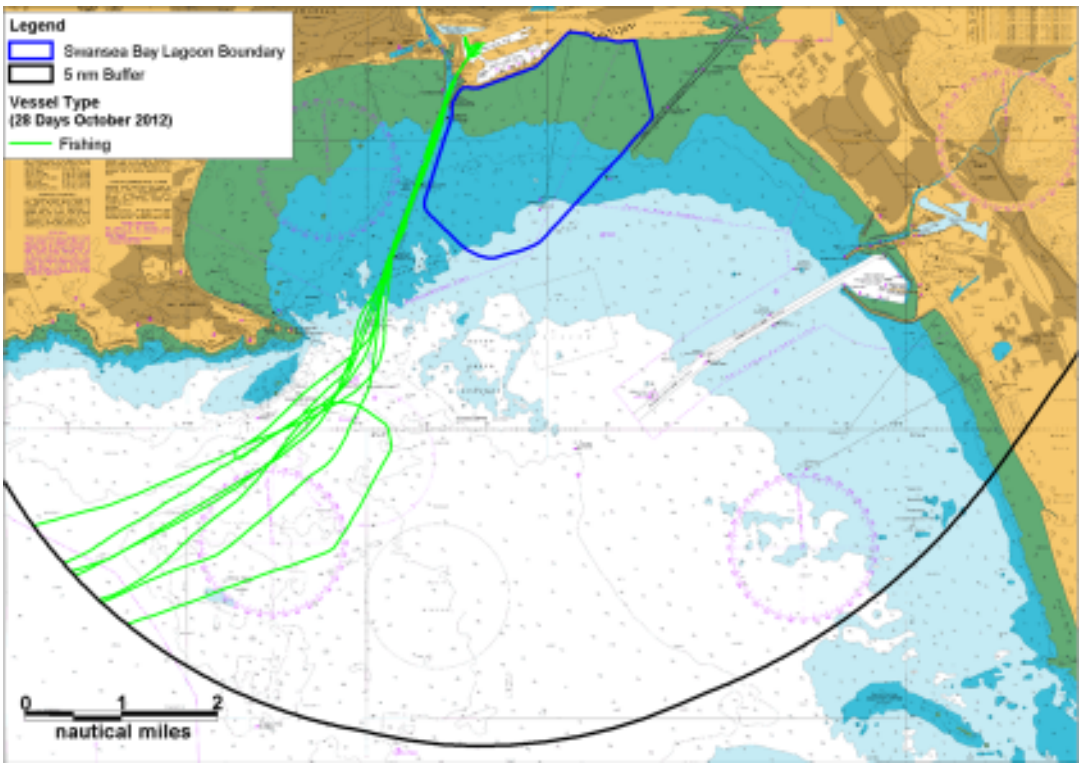

Figure 1- 42 AIS tracks fishing vessels (28 days October 2012)

8.8.1.2 It can be seen that all fishing vessels (recorded on AIS) were recorded to the west of the Project area, using the dredged channel in and out of Swansea marina. Three unique vessels were recorded during the 28 days in July 2012, with three unique vessels also being recorded during the 28 days in October 2012 (only one vessel was recorded in

both periods). Two examples of the types of fishing vessels recorded (on AIS) transiting the area are presented in Figure 1-43 and Figure 1-44.

Figure 1- 43 Fishing vessel *MFV Z39 Zuiderzee*

Figure 1- 44 Fishing vessel *Z.19*

8.8.2 Vessel sightings data

8.8.2.1 Figure 1-45 presents a density grid based on the MMO 2005-2009 sightings data, to highlight the "hot spots" of fishing vessel activity within 5nm of the Project.

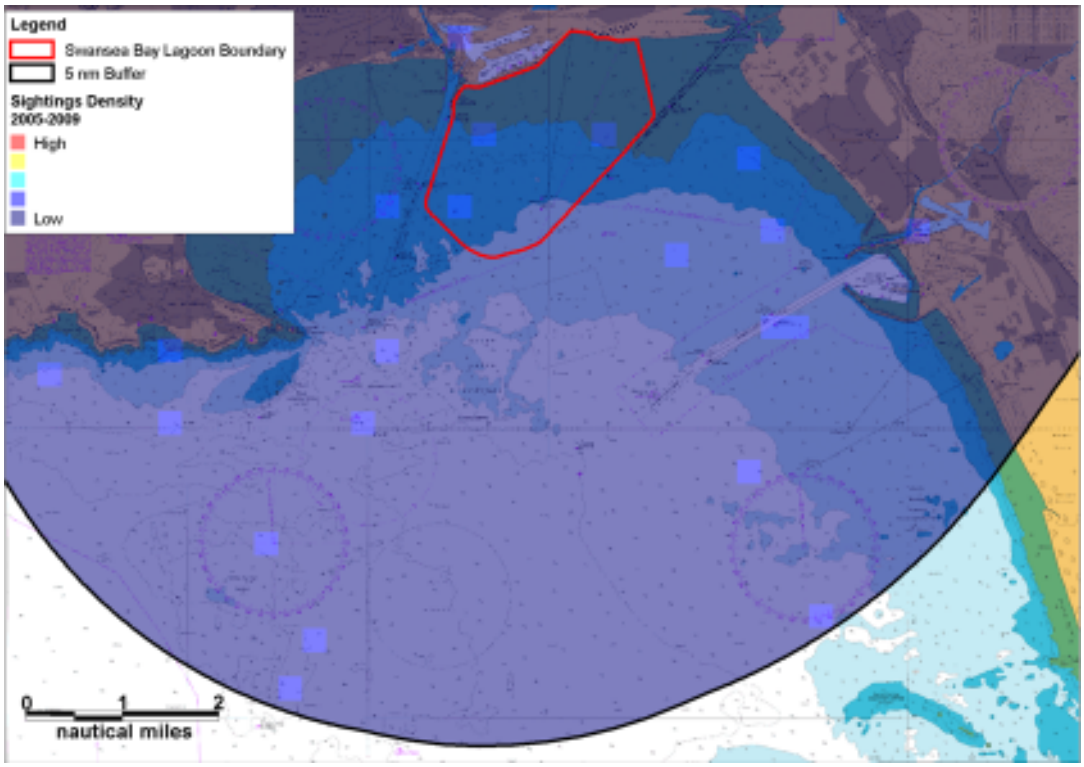

Figure 1- 45 Fishing vessel sightings data (2005-2009)

8.8.2.2 From the fishing vessel sightings data, it can be seen that the level of fishing vessel activity within 5nm of the Project is very low with no areas having a medium or high density (note: densities have been based on vessel numbers within the study area, with the majority of the area recording zero density (low density), and the remaining areas, only one vessel). From analysis of the fishing vessel sightings data, it has been confirmed that all of the fishing vessels recorded in the vicinity of the Project were registered in the UK or Ireland.

8.8.2.3 The gear type used by fishing vessels from the sightings data is presented Figure 1-46.

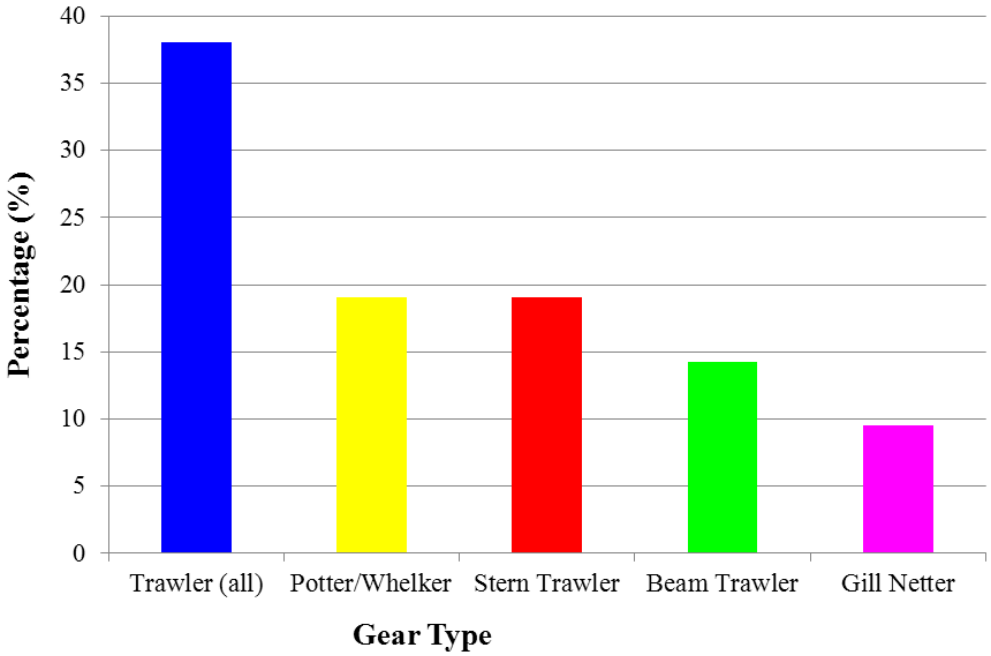

Figure 1-46 Gear type from sightings fishing data (2005-2009)

8.8.2.4 The main gear types recorded with 5nm of the Project were trawlers (38%), potters/whelkers (19%) and stern trawlers (19%).

8.8.2.5 The fishing vessel activity is presented in Figure 1-47.

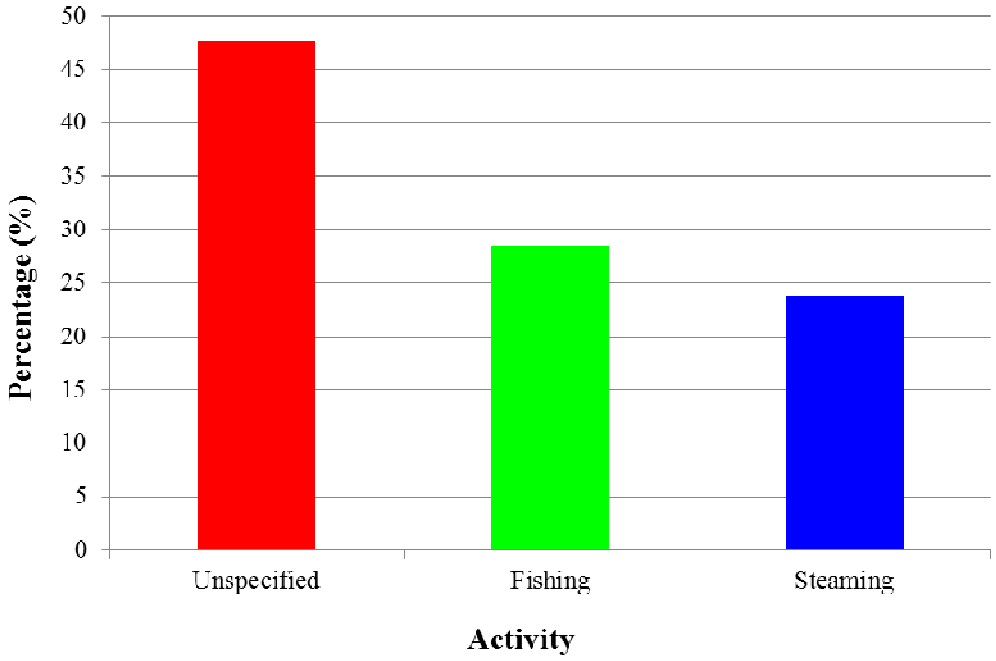

Figure 1- 47 Activity from sightings fishing data (2005-2009)

8.8.2.6 Of the fishing vessel activity which could be specified from the sightings data, 29% was recorded as engaged in fishing and 24% was recorded as steaming (transiting to/from fishing grounds).

8.8.3 Satellite data

8.8.3.1 MMO satellite data covers fishing vessels of 15m length and over. The latest satellite data set analysed is from 2009 and the data includes vessels registered in Belgium, the United Kingdom, Ireland and the Netherlands of 15m length and over. Plots of vessel positions (received at least every 2 hours) have been converted to a 1 x 1nm density grid and are presented in Figure 1-48.

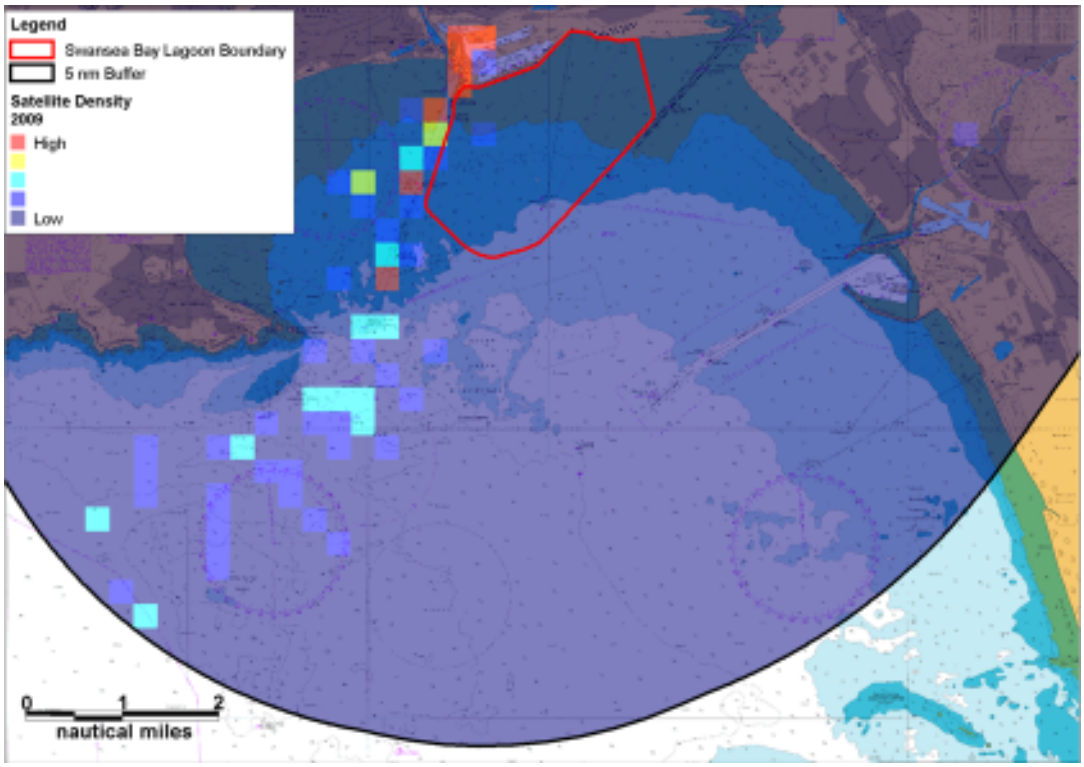

Figure 1- 48 Fishing vessel satellite data (2009)

8.8.3.2 In terms of gear type for fishing vessels within 5nm of the Project, the majority did not specify their type but those which did were recorded as beam trawlers.

8.8.3.3 It should be noted that the areas of medium and high density (Figure 1-48) (note: the densities are relative to the numbers of vessels recorded in the Project area) are due to vessels being in port or transiting into port, rather than fishing in the area.

9.0 Marine traffic survey

9.1 Introduction

9.1.0.1 This section presents the marine traffic recorded by survey. The surveyors utilised AIS, radar and visual observation during the 14 day period, 14 August to 28 August 2013. This additional survey was provided to update and supplement, the traffic survey data, as agreed with the MCA.

9.1.0.2 The AIS receiver tracks vessels over a greater range than radar, and provides more accurate information on position and ship characteristics. Therefore, the AIS track has been preferred where a vessel has been tracked by both systems. The radar-only tracks were then combined with the AIS data to create a single data set of all vessels. Tracks have been colour-coded by vessel type. This information was available from the vast majority of vessels fitted with AIS.

9.1.0.3 Vessels not broadcasting over AIS or able to be tracked by radar were manually plotted and their location was logged. The manual targets which are included in the data set have been colour-coded based on visual observations where available. This traffic is mostly made up of small recreational vessels and small fishing vessels that are not required to carry AIS as outlined in Section 3.1. These vessel are not carrying AIS or radar reflectors significant enough to ensure detection by these means. They were however clearly visible from the marine traffic survey position, where they were recorded for assessment.

9.1.0.4 An overview of marine traffic within 5nm of the Project is presented, and analysis has been completed on all vessels passing within 5nm of the Project and those vessels recorded as passing through the Project.

9.2 Marine traffic

9.2.0.1 Plots of the AIS vessel tracks, radar-only tracked vessels and manual targets, recorded during the 14 day survey period in August 2013, within 5nm of the Project are presented in Figure 1-49. Figure 1-50 illustrates the tracks in close proximity to the Project more clearly. These are colour coded by vessel type.

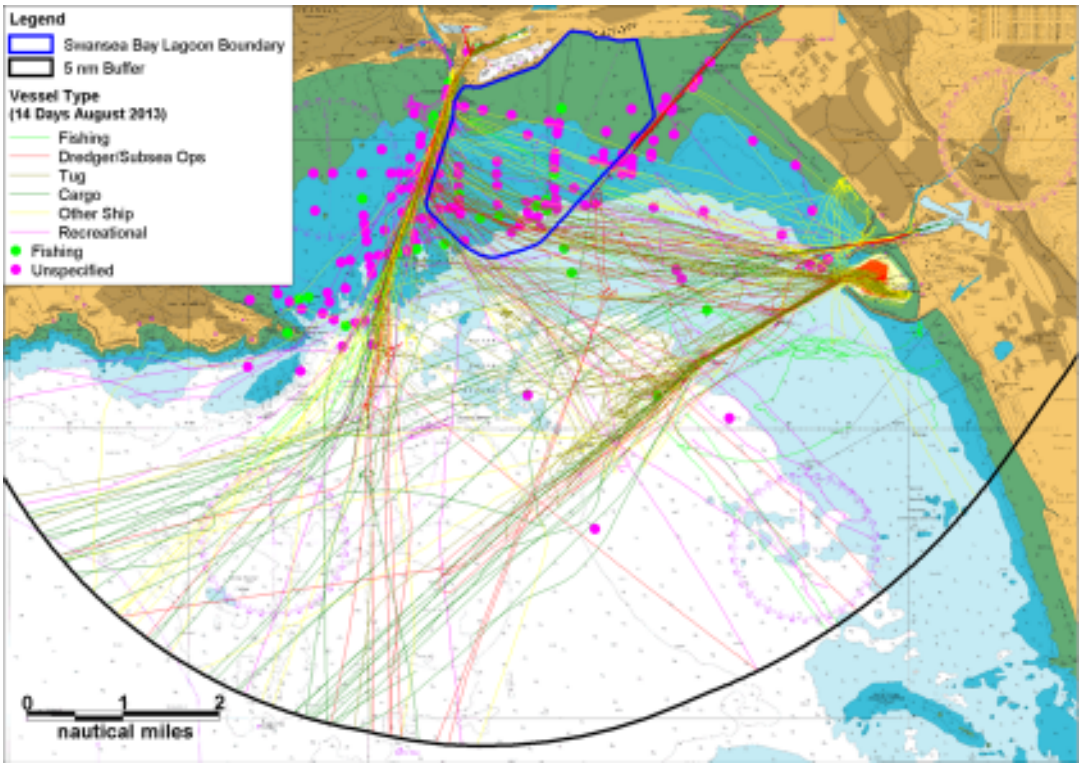

Figure 1- 49 Overview of tracks within 5nm of the Project

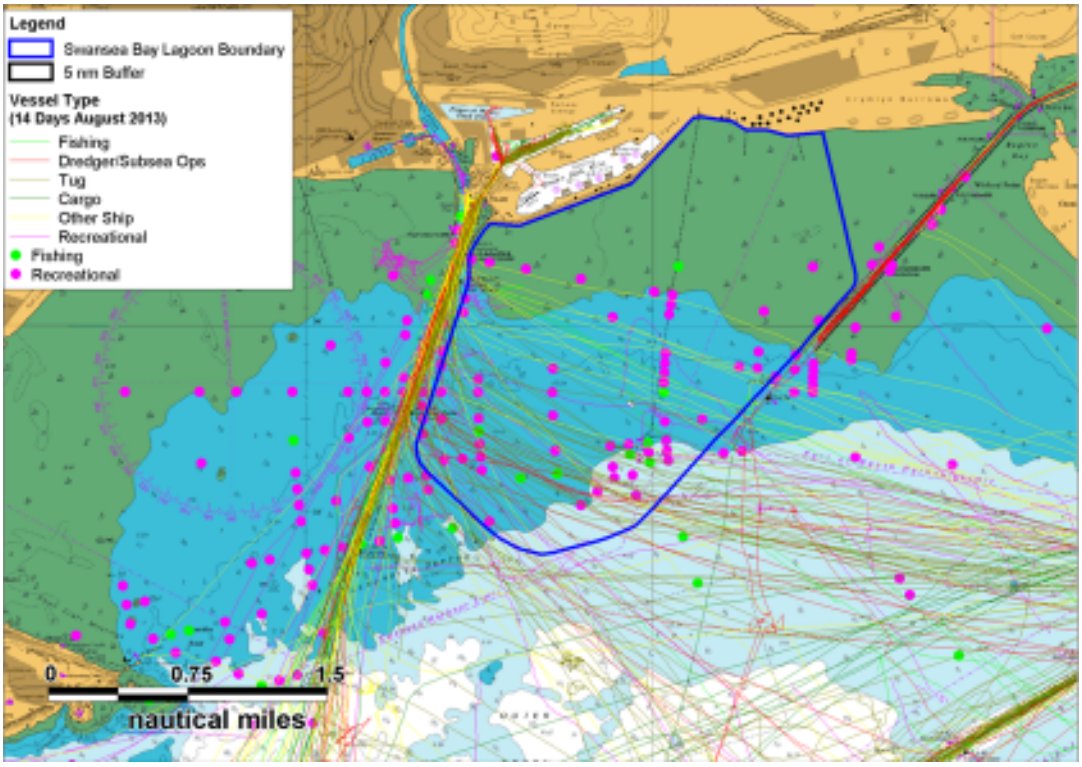

Figure 1- 50 Detailed overview of tracks within the Project area

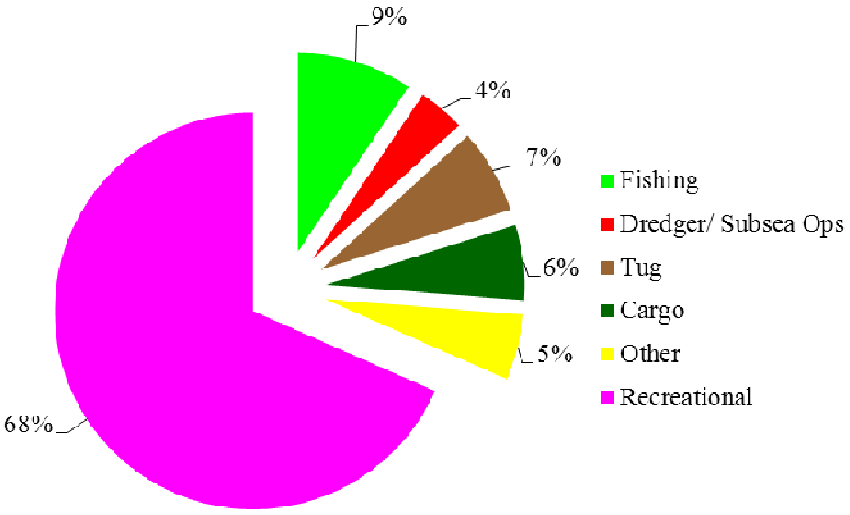

Figure 1- 51 Vessel type distribution identified during August 2013

9.2.0.2 Figure 1-51 illustrates vessel type distribution. The most common vessel types recorded within 5nm of the Project were recreational vessels operating out of Port of Neath and the Port of Swansea, (68%), fishing vessels (9%) and tug vessels accounted for 7%.

9.2.0.3 The main type of vessel recorded during the survey period as passing through the Project area were recreational (76%), tugs (13%) and other vessels (5%) (pilot vessels operating in the area).

9.2.0.4 Figure 1-52 resents the daily number of vessels passing through the Project area and recorded within the 5nm buffer. (Note: the 14th August and 28th August are part days due to survey equipment set-up and removal).

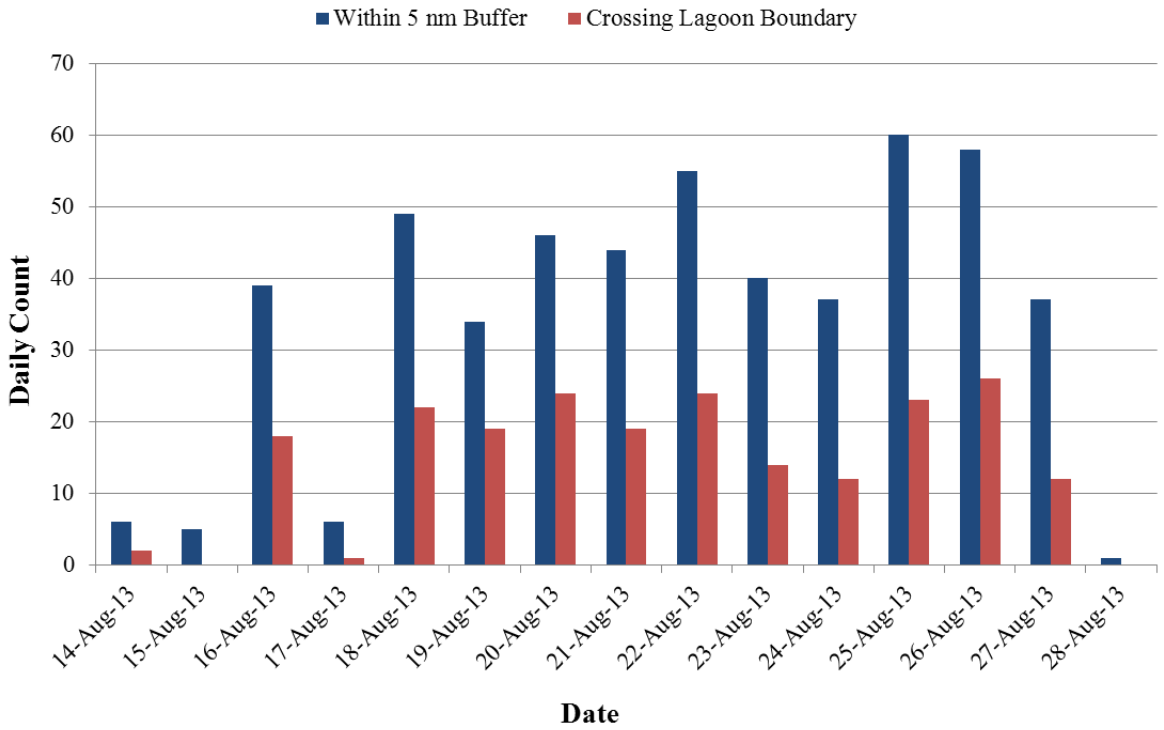

Figure 1- 52 Unique vessels per day within 5nm and crossing the Project area

9.2.0.5 Over the 14 days analysed, the busiest day was 25 August 2013 when 60 unique vessels were recorded within 5nm of the Project. Vessel tracks recorded on the busiest day are presented in Figure 1-53. The busiest day for vessels passing through the Project area was 26 August 2013, when 26 vessels were recorded (Figure 1-54).

9.2.0.6 The quietest full day was 15 August 2013, when 5 unique vessels were recorded passing within 5nm of the Project and zero vessels were recorded, by all methods of observation, passing through the Project area (Figure 1-55).

9.2.0.7 There was an average of 34 (11 by AIS/radar and 23 visual) unique vessels per day passing within 5nm of the Project and an average of 14 vessels per day were tracked passing through the Project area.

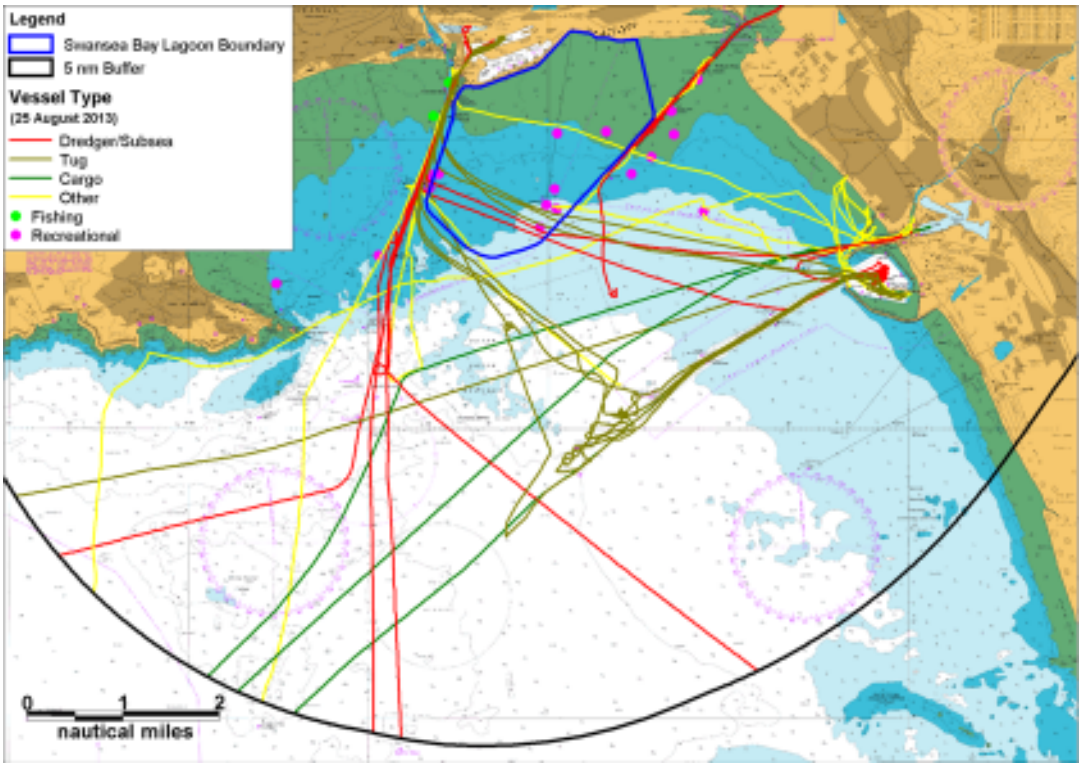

Figure 1- 53 Busiest day within 5nm buffer (25 August 2013)

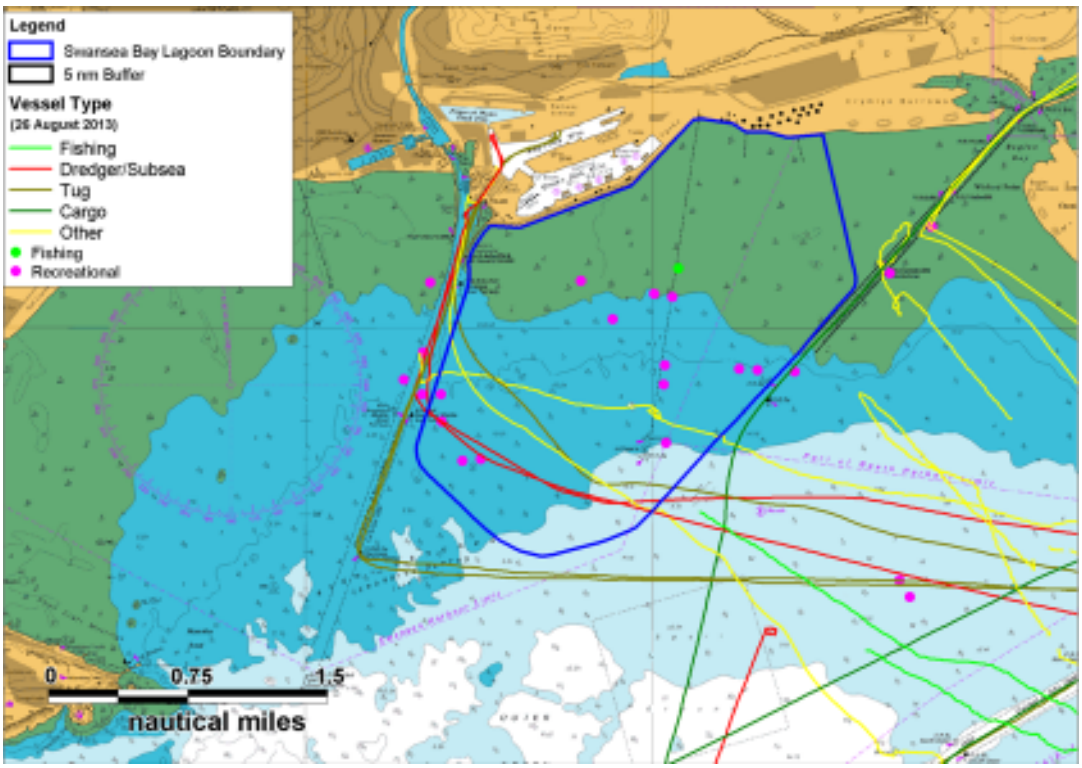

Figure 1- 54 Busiest day within the Project area (26 August 2013)

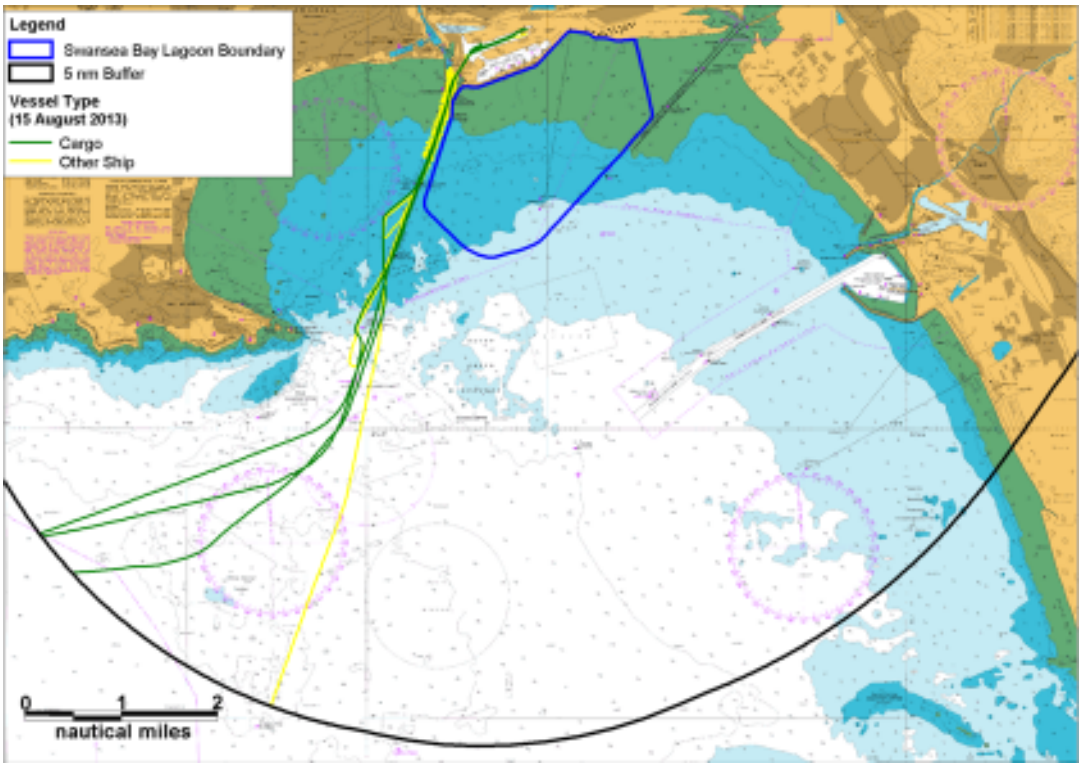

Figure 1- 55 Quietest day (15 August 2013)

9.2.0.8 Analysis of the vessel types recorded within the 5nm buffer around the Project during 14 days in August 2013 is presented in Figure 1-56 to Figure 1-58.

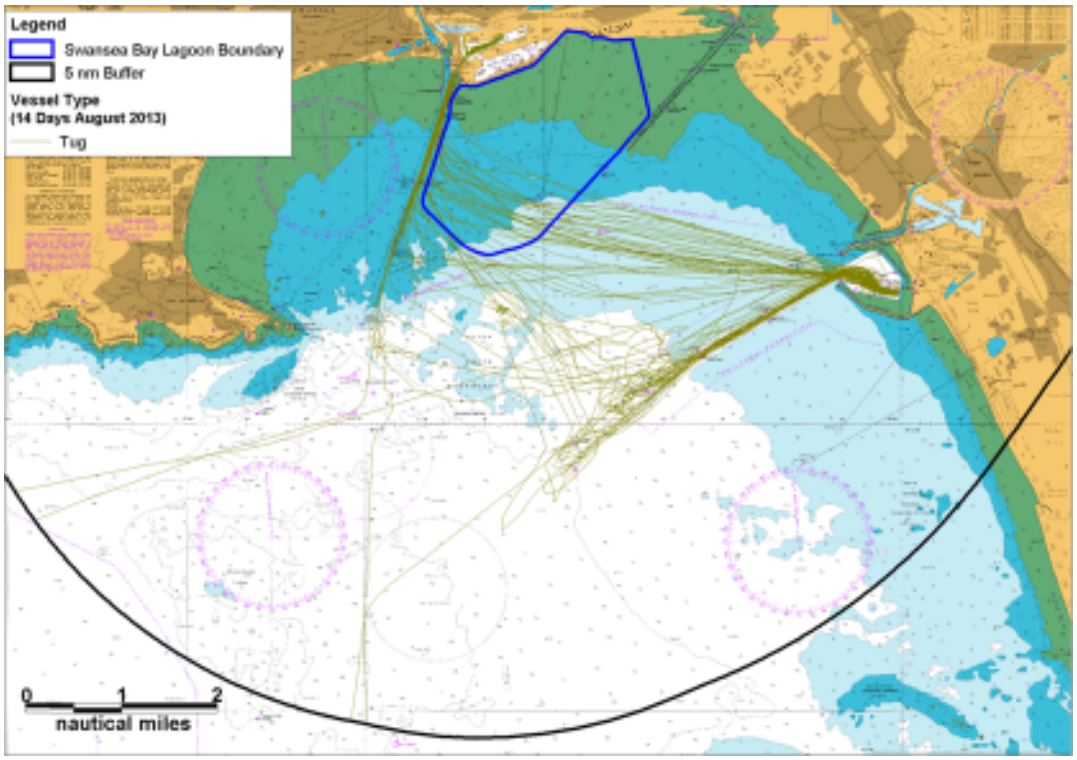

Figure 1-56 Tugs (14 days August 2013)

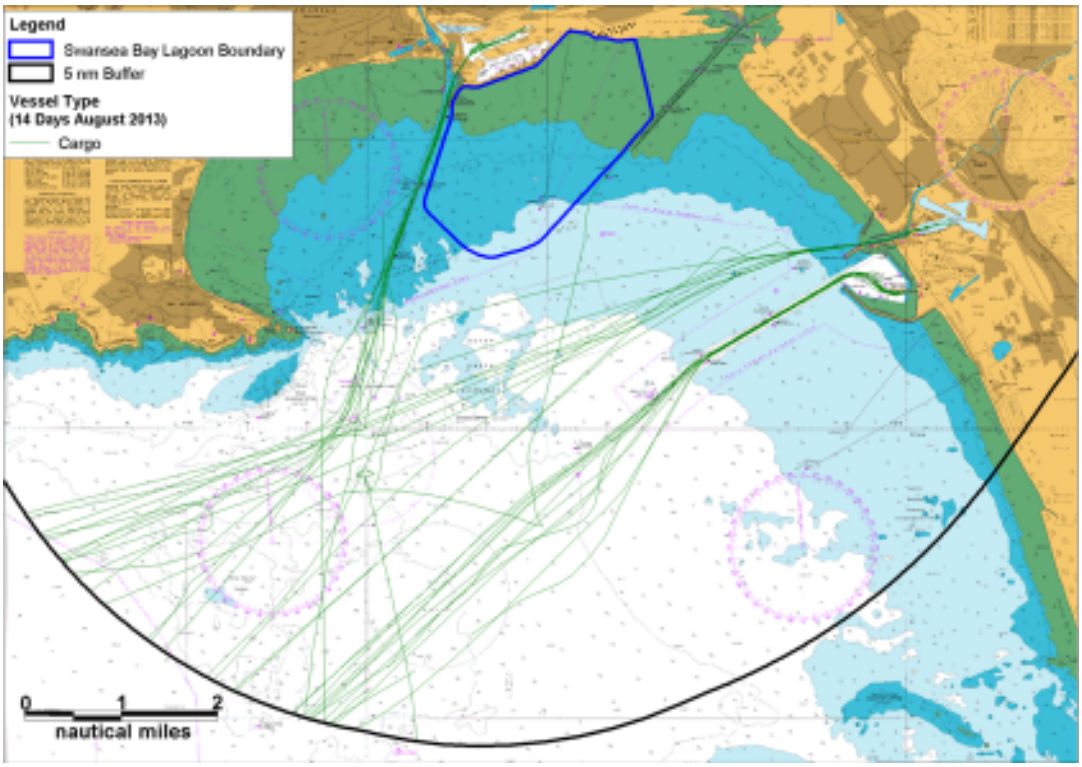

Figure 1-57 Cargo vessels (14 days August 2013)

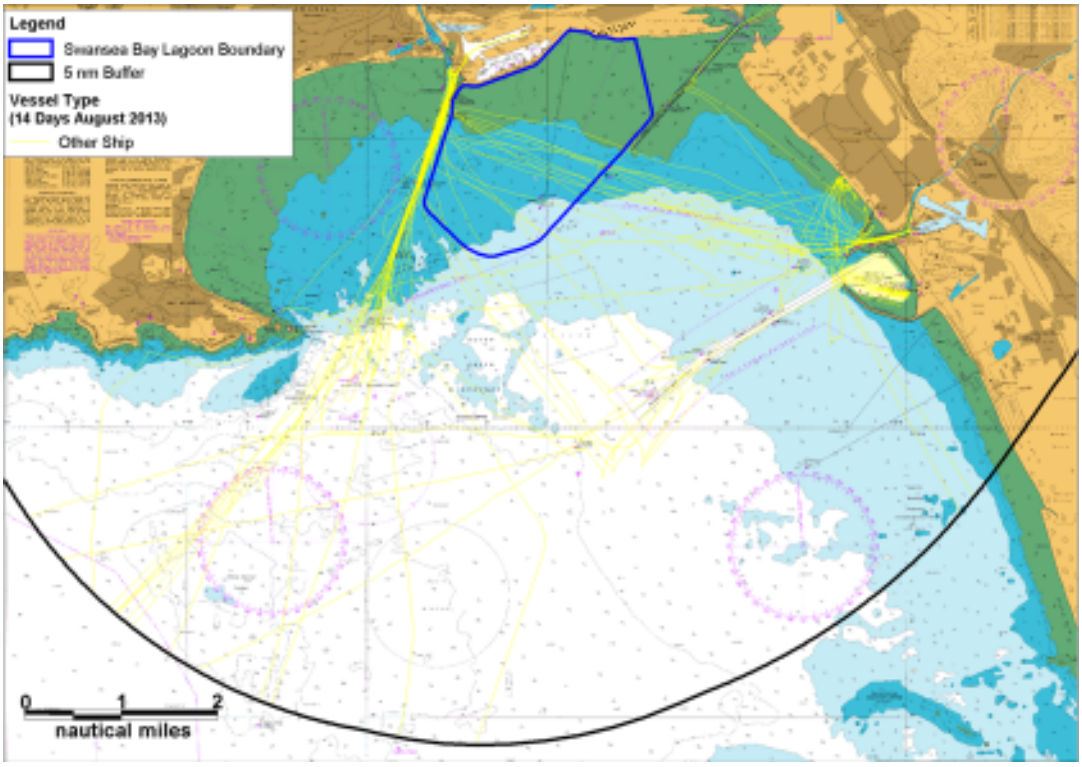

Figure 1- 58 Other vessels (14 days August 2013)

9.3 Vessel length

9.3.0.1 Figure 1-59 presents the distribution of vessel length within the 5nm buffer around the Project (excluding those which did not specify a length). Manual targets have been excluded from the review as ship length is unspecified.

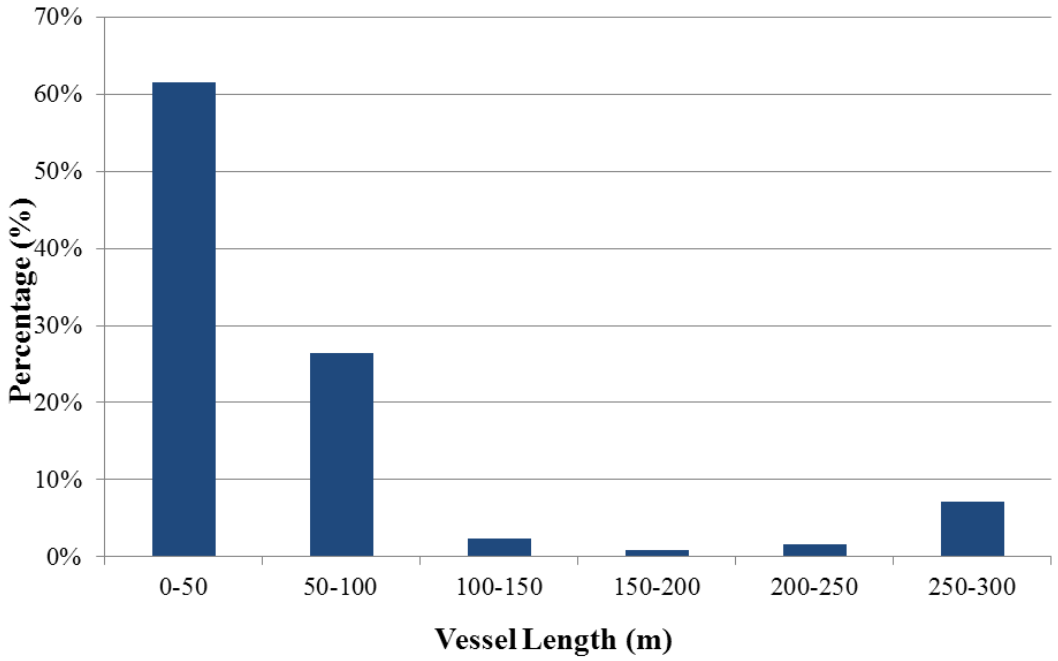

Figure 1- 59 Vessel length distribution (14 days August 2013)

9.3.0.2 The routes transited by vessels of varying lengths are detailed within Figure 1-60 to Figure 1-61.

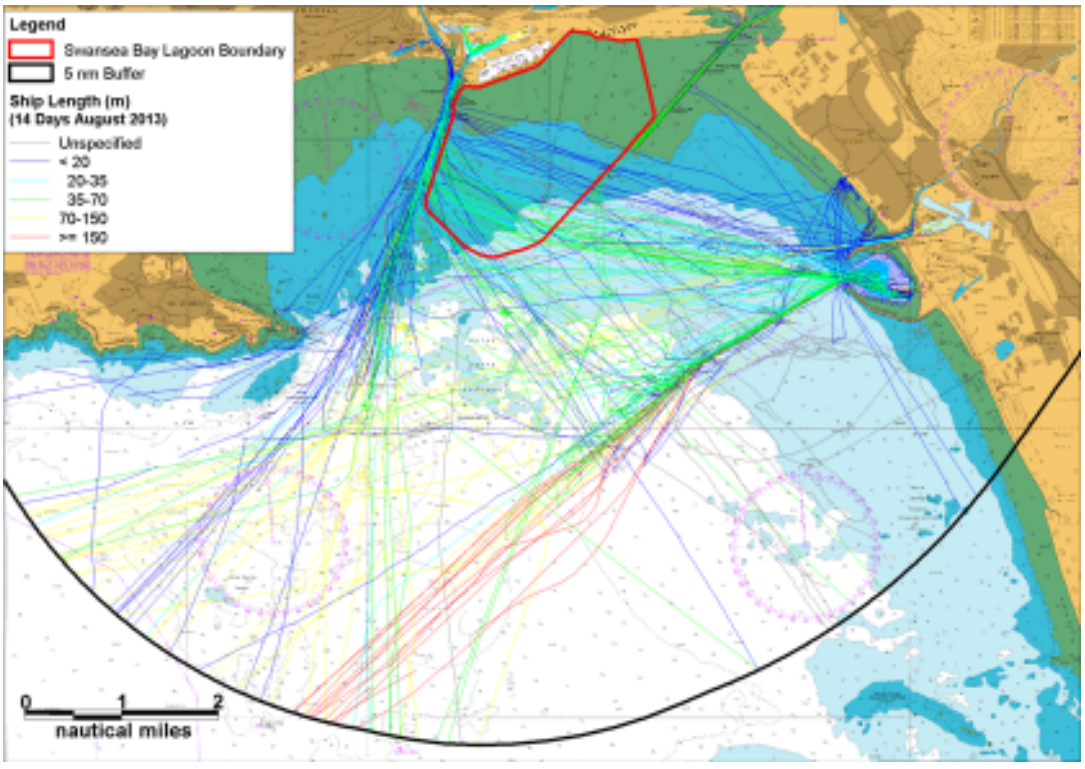

Figure 1- 60 Vessel length thematic map (14 days August 2013)

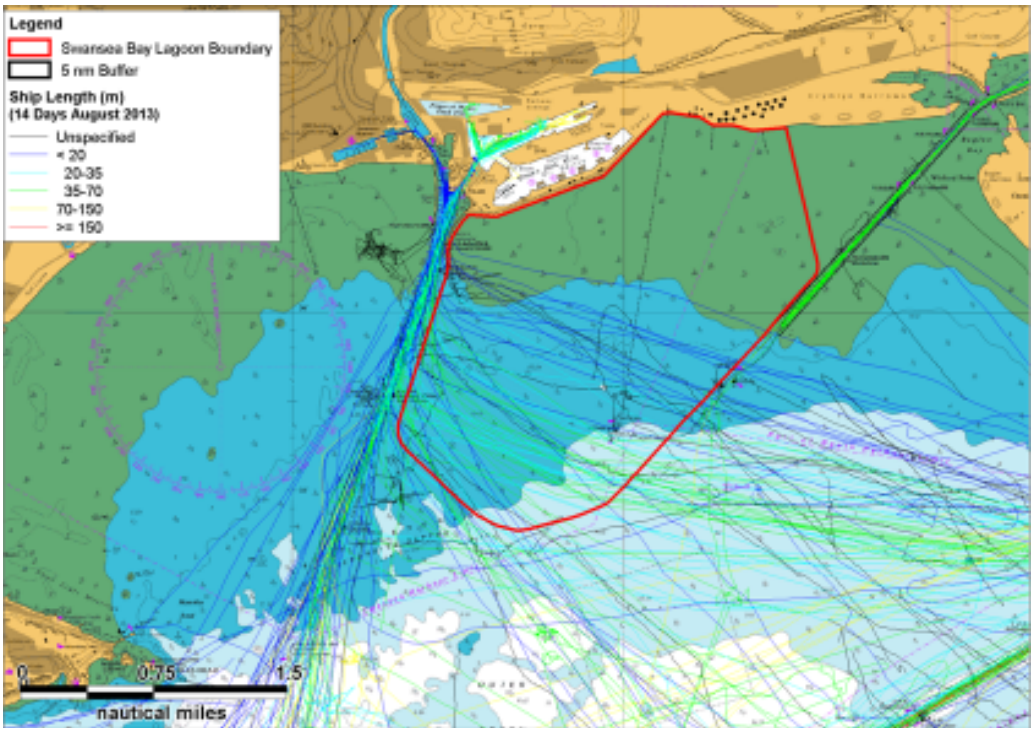

Figure 1- 61 Vessel length thematic map detailed view (14 days August 2013)

9.3.0.3 Overall, the longest length of vessel recorded was 292m. There were 3 vessels recorded of this length. The tracks of these vessels are presented in Figure 1-62.

9.3.0.4 The vessels passed within the 5nm buffer of the Project, they were the 292m bulk carriers *Lilac*, *Tenshu Maru* and *Centennial Harmony*. The vessels were recorded travelling to Port Talbot. A photo of the *Tenshu Maru* is shown in Figure 1-63.

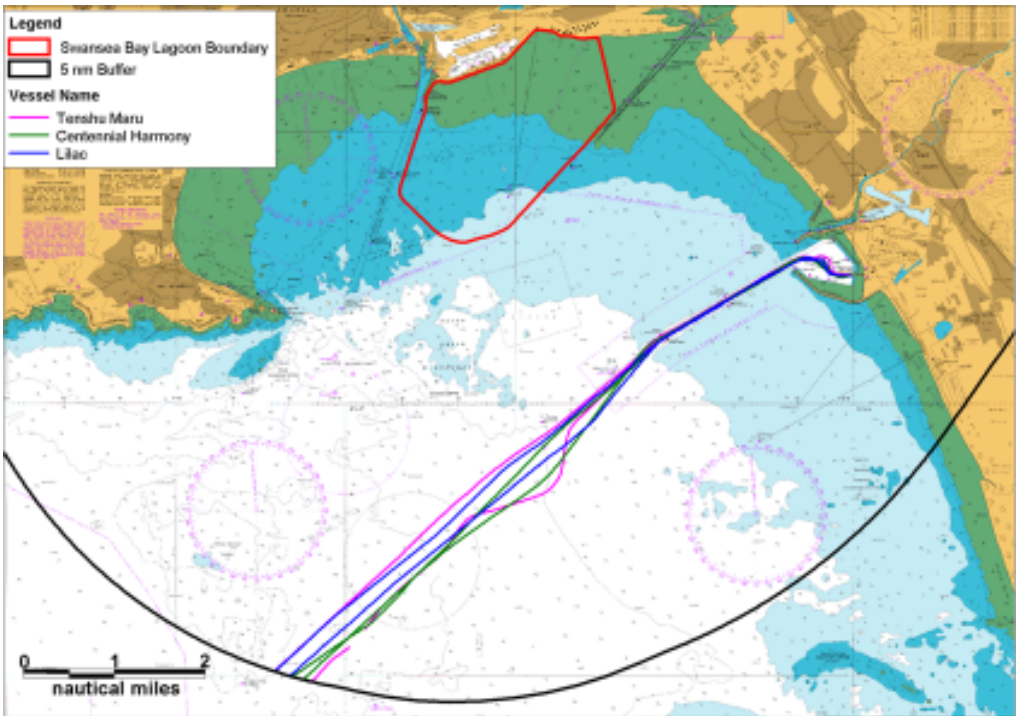

Figure 1- 62 Vessels with the greatest length

Figure 1- 63 Photo of the bulk carrier Tenshu Maru taken on 20 August 2013

9.4 Vessel draught

9.4.0.1 Figure 1- 64 presents the distribution of draughts on vessels within the 5nm buffer around the Project (excluding those which did not specify their draught).

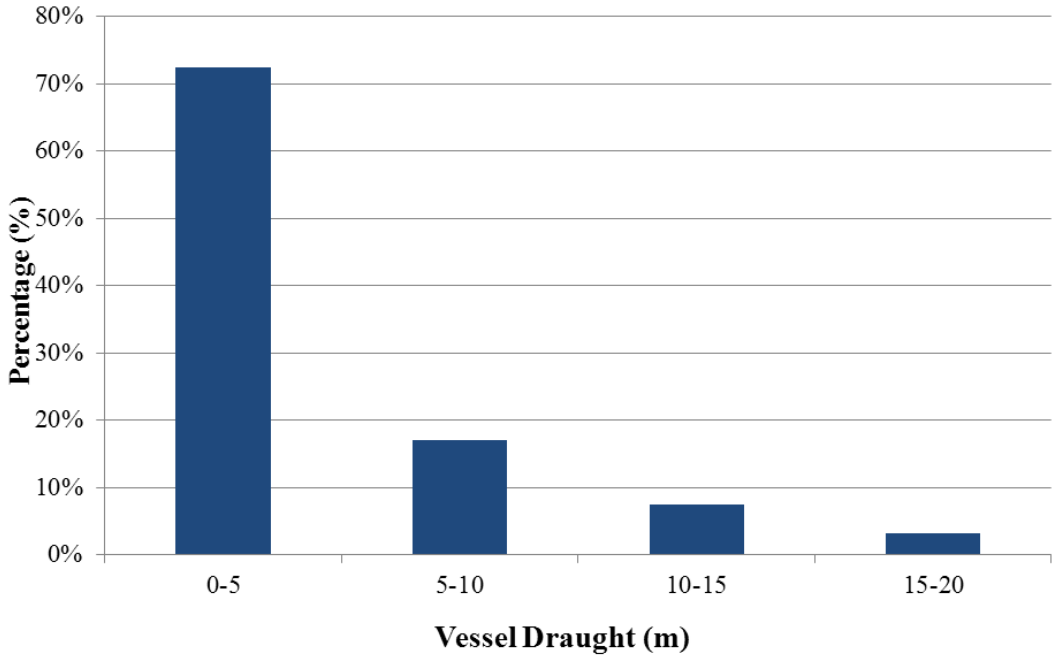

Figure 1- 64 Vessel draught distribution (14 days August 2013)

9.4.0.2 The vessel with the largest broadcast draught was the bulk carrier *CIC Captain Veniamis* which broadcast a draught of 17m. The vessel was bound for Port Talbot. A photo of the *CIC Captain Veniamis* is presented in Figure 1- 65 with the vessel track presented in Figure 1-66.

Figure 1- 65 Photo of the bulk carrier *CIS Captain Veniamis* taken on 21 August 2013

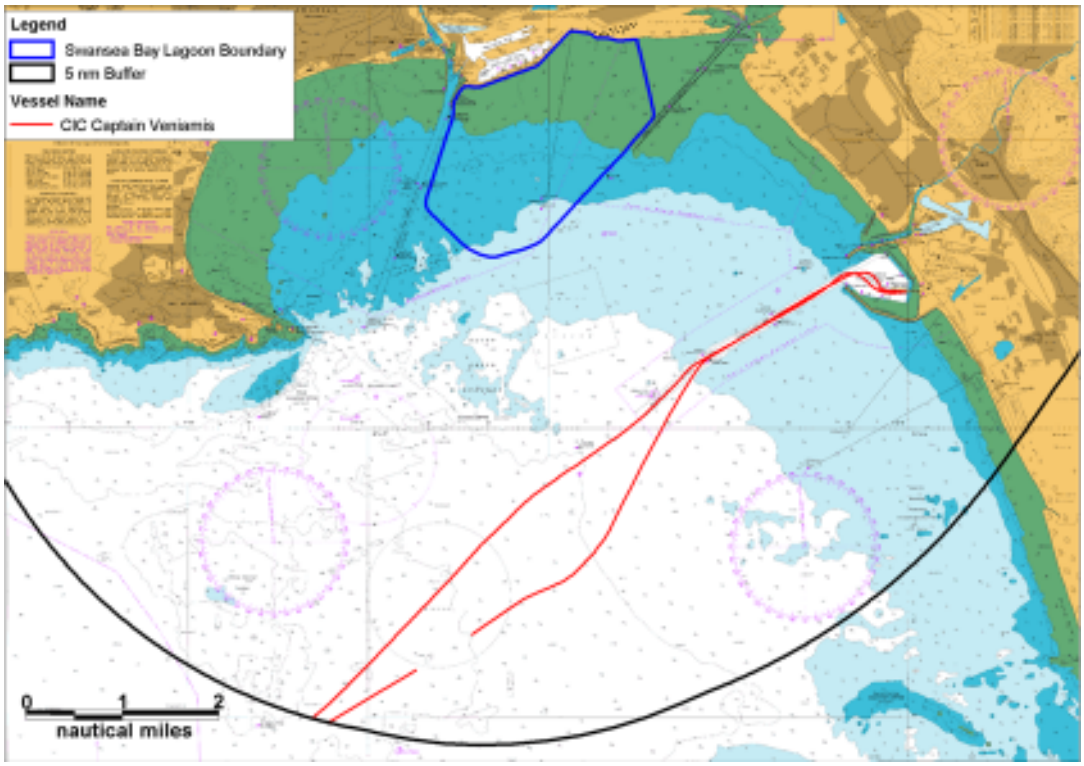

Figure 1- 66 Deepest vessel draught track

9.5 Vessel course

9.5.0.1 From analysing vessel courses it was identified that in August 2013, 48% traffic was headed eastbound and 52% westbound.

9.6 Vessel speed

9.6.0.1 The speed distribution of the vessels tracked within the 5nm buffer during 14 days in August 2013 is presented in Figure 1-67. Overall, the majority of vessels in the area were

relatively slow moving with around 72% transiting at 6 knots or less. Only a few vessels (approximately 8%) were travelling at greater than 10 knots.

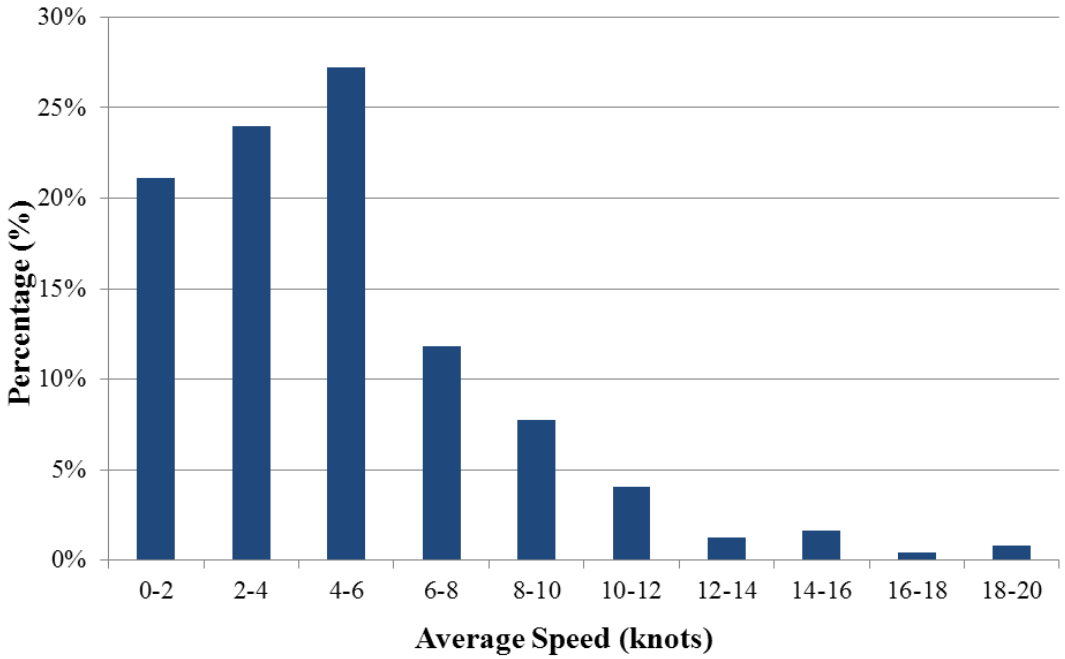

Figure 1- 67 Average speed (14 days August 2013)

9.6.0.2 This reflects the fact that the majority of vessels were travelling towards the ports within the Bay. The fastest vessel tracked passing within 5nm of the Project was the RNLI lifeboat D-725, with an average speed of 19.8 knots. This vessel was recorded heading south towards an incident involving a broken down yacht, which was reported off Sker Point on 26 August 2013. A photograph of the lifeboat is shown in Figure 1-68.

Figure 1- 68 Library photograph of the RNLI Lifeboat *D-725 (© RNLI)*

9.7 Anchored vessels

9.7.0.1 Anchored vessels can be identified from the AIS navigational status which is set on the AIS transmitter on board a vessel. Information is manually entered into the AIS; therefore, it is common for vessels not to update the navigational status if they are anchored for only a short period of time. For this reason, for the purpose of this study, those vessels which travelled at a speed of less than 1 knot for more than 30 minutes were assumed to be at anchor for a period of time.

9.7.0.2 No vessels were recorded at anchor within the Project area during the period analysed. A fishing vessel anchored at the boundary (1m from the lagoon wall) of the Project area. Figure 1- 69 presents a plot of anchored vessels within the 5nm buffer during 14 days in August 2013.

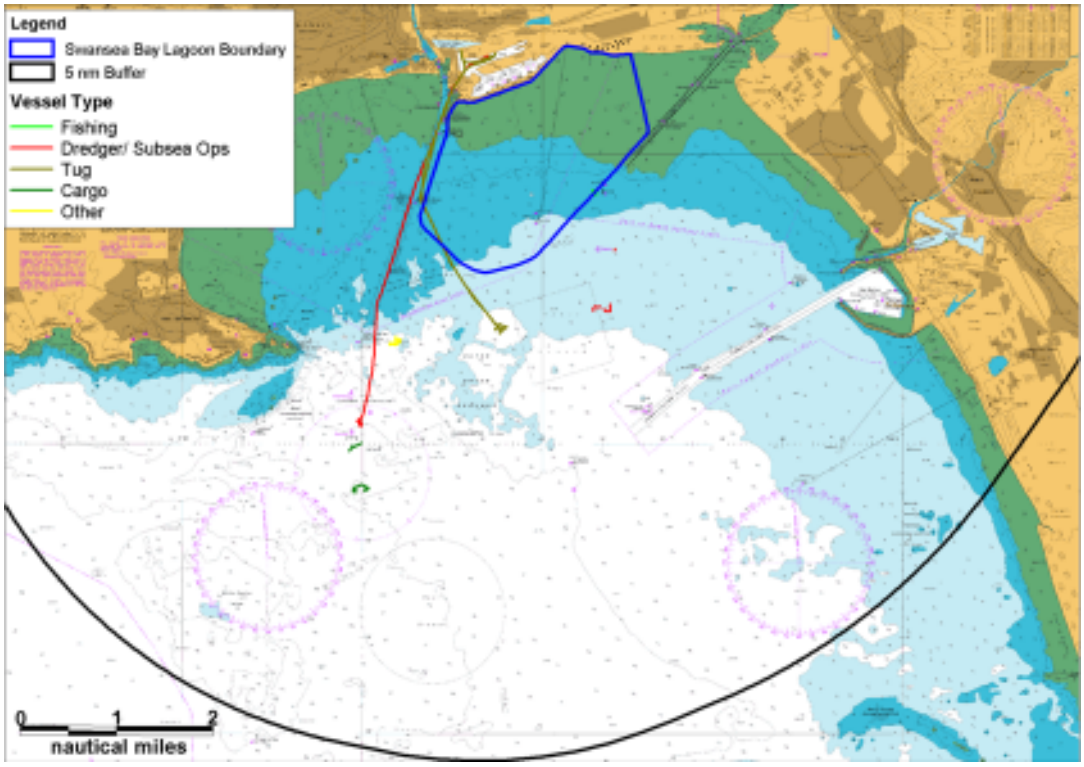

Figure 1- 69 Anchored vessels (14 days August 2013)

9.8 Recreational vessel activity

9.8.0.1 This section reviews recreational vessel activity in the vicinity of the Project based on information from AIS, radar and visual tracking of recreational vessels. Recreational vessel activity was recorded in August 2013, as presented in Figure 1-70.

9.8.0.2 Over the two week survey period 325 visual observations (manually plotted) were made of recreational vessels. The busiest day for recreational vessels was again the 25 August, with 45 manual targets and 2 AIS targets recorded. Approximately 50% of these small craft passed through the Project area.

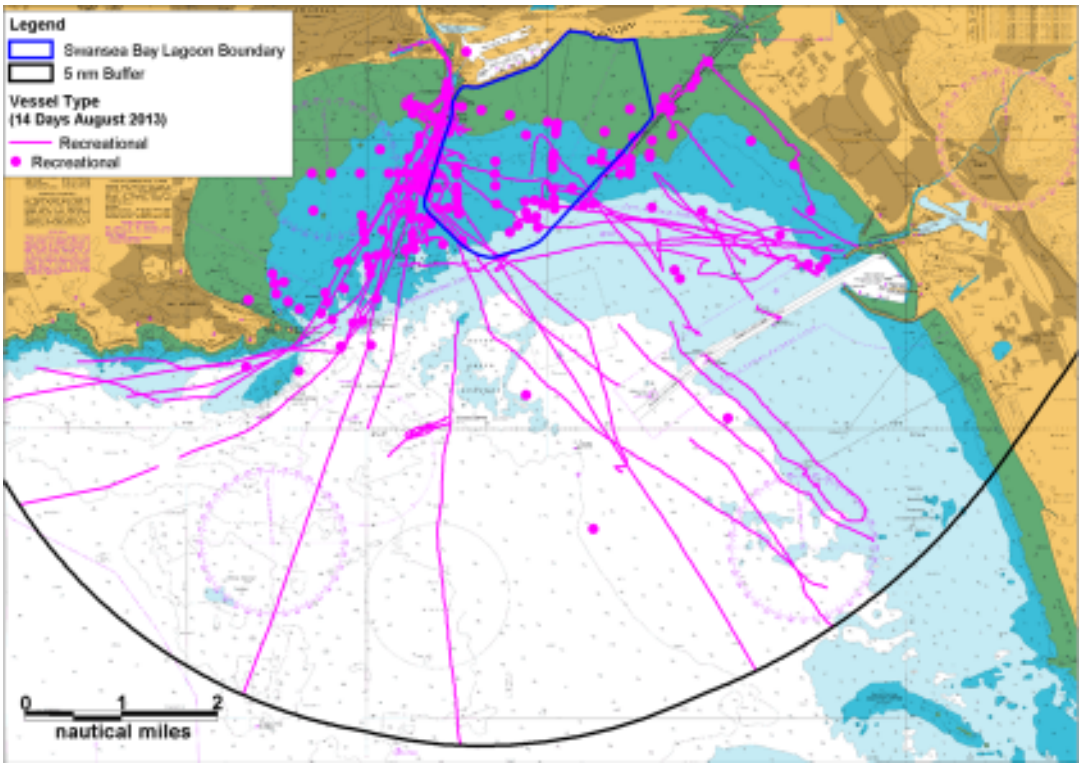

Figure 1- 70 Recreational vessels (14 days August 2013)

9.9 Fishing vessel activity

9.9.0.1 This section reviews the fishing vessel activity in the vicinity of the Project based on AIS, radar and visual tracking data. Fishing vessel activity was recorded in August 2013, as presented in Figure 1-71. Over the two week survey period 28 visual observations (manually plotted) were made of fishing vessels. The busiest day was the 21 August, with 9 manual targets and 1 AIS target recorded. Approximately 15 fishing vessels transited the Project area.

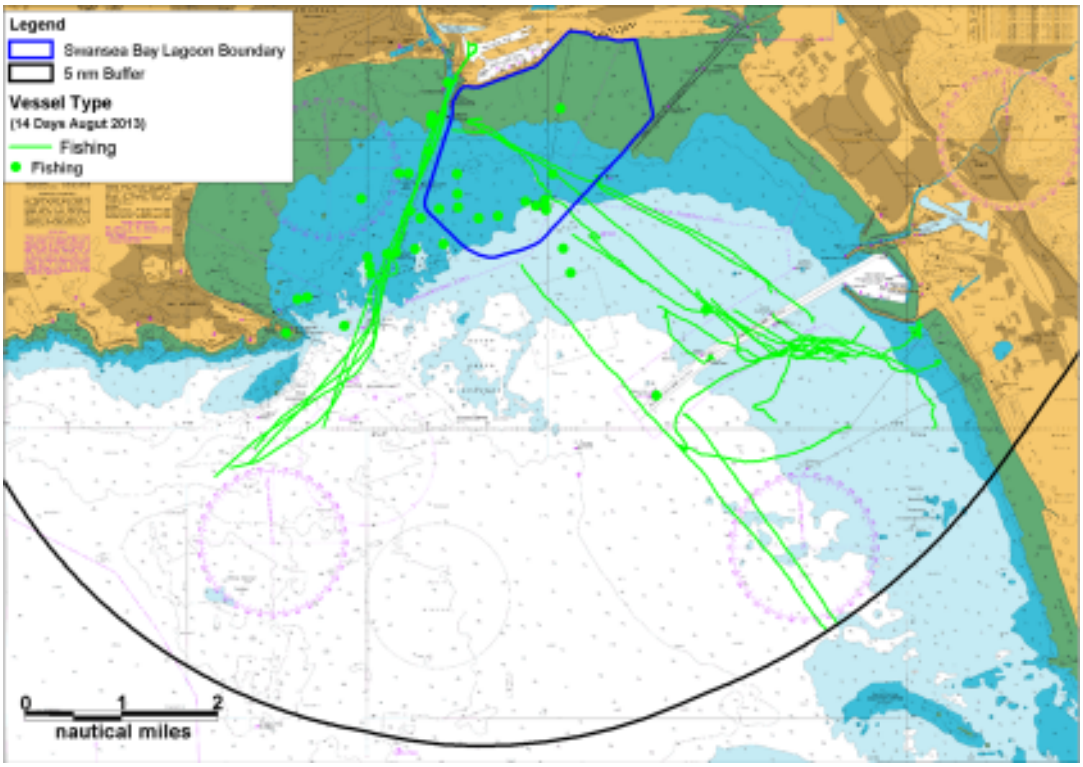

Figure 1-71 Fishing vessels (14 days August 2013)

9.10 Vessels transiting the Project area

9.10.0.1 There were 24 unique vessels recorded passing through the Project area during the 14 day survey period, as tracked by AIS and radar (i.e. not including manual targets). Details of the vessels are presented in Table 9.1.

9.10.0.2 The majority of tracks passing within the Project area were made by the pilot vessel *Beaufort*, the tugs operating between Swansea and Port Talbot and the dredger *UKD Sealion.*

9.10.0.3 The visually observed vessels (manually plotted) have been screened out of this record because the vessels were unidentifiable, due to their small size. It is estimated that approximately 50% (163) of the manual recreational vessel targets crossed the Project area and 15 of the manual fishing vessel targets.

Table 9.1 Unique vessels passing within the Project area (AIS/radar only)

Name	Type	Number of Transits	Length (m)	Draught (m)	AIS
Beaufort	Pilot	10	19	N/A	Yes
Dalegarth	Tug	8	38	4.3	Yes
Svitzer Pembroke	Tug	7	36	7.3	Yes
Svitzer Brenda	Tug	7	36	3.6	Yes
Svitzer Melton	Tug	7	32	4.4	Yes
UKD Sealion	Dredger	5	26	2.8	Yes
Welsh Piper	Dredger	2	69	4.5	Yes
Arga Bay	Dredger	2	58	4.2	Yes
Lesley M	Dredger	1	19	1.3	Yes
Serica of Wood Bridge	Yacht	1	13	N/A	Yes
Yacht - No ID	Yacht	1	N/A	N/A	No
Yacht - No ID	Yacht	1	N/A	N/A	No
Small Potter - No ID	Fishing	1	N/A	N/A	No
Black Trawler - No ID	Fishing	1	N/A	N/A	No
Blue Trawler - No ID	Fishing	1	N/A	N/A	No
Yacht - No ID	Yacht	1	N/A	N/A	No
Black Trawler - No ID	Fishing	1	N/A	N/A	No
Pilot Vessel - No ID	Pilot	1	N/A	N/A	No
White Yacht - No ID	Yacht	1	N/A	N/A	No
Ketch Rig Yacht - No ID	Yacht	1	N/A	N/A	No
Two Masted Schooner - No ID	Yacht	1	N/A	N/A	No
Motor Boat - No ID	Pleasure Craft	1	N/A	N/A	No
Black Launch Vessel - No ID	Pleasure Craft	1	N/A	N/A	No
Red and White Hulled Yacht - No ID	Yacht	1	N/A	N/A	No

10.0 Hazard workshop

10.1 Introduction

10.1.0.1 A hazard workshop, attended by maritime stakeholders, was held in Swansea on 30 April 2013. The workshop was organised in order to gain and enhance local knowledge of the area and identify the key navigational safety concerns relative to the Project. During the workshop, a presentation was given of the available baseline data and brainstorming exercises were carried out to identify potential hazards associated with the Project. A total of 20 hazards were identified during the workshop and used to create the hazard log, which was then circulated to attendees and invitees for review. The hazard log, which was used to inform the ES, can be found in Appendix 14.2, Volume 3 of the ES.

10.2 Attendance

10.2.0.1 The maritime stakeholder attendees to the hazard workshop are outlined in Table 10-1. This list was drawn from known stakeholders and those that were identified from the marine traffic analyses/local consultation. This list is not exhaustive, but is representative of those with interests in the area. Others were invited but were not able to attend on the day.

Table 10-1 Hazard workshop attendees

Name	Organisation
Gill Lock	Tidal Lagoon Swansea Bay
Rebecca Smith	Tidal Lagoon Swansea Bay
Ton Fijen	Tidal Lagoon Swansea Bay
Sam Westwood	Anatec
Jenny Brown	Anatec
Miles Chidlow	ABP
Steve Daniel	ABP
Adrian Lester	Chamber of Shipping
Sam Naylor	County and City of Swansea
Ted Osborn	Cruising Association
Dave Bulley	Local Fisherman
Steve Jones	MCA
Ralph Raymont	Monkstone Cruising and Sailing Club
Bob Minty	Neath Port Authority
Godfrey Pullen	Neath Port Authority
R.W. Hemming	Neath Port Authority
Stephen Bosher	Neath Port Authority
Christos Andreau	Neath Port Authority
Alana Murphy	RYA
Ian Lloyd Owen	Swansea Dry Docks
Karl Dunn	Swansea Dry Docks
Bill Arnold	Swansea Port Health Authority
Tom Bona	Swansea Yacht and Sub Aqua Club
Ian Thomas	Tawe Boat club
Colin Thomas	Thomas Shellfish Limited

10.3 Hazard workshop process

10.3.0.1 As part of the workshop, key maritime hazards associated with the structures created by the Project were discussed and noted. Where appropriate, vessel types were considered separately to ensure the risk levels were assessed for each and so that the control options could be identified on a type-specific basis, for example, risk control measures for fishing vessels differ to those for commercial vessels. Other general hazards associated with the construction, operational and decommissioning phases, such as dropped objects, man overboard, pollution incidents and SAR operations, were also discussed.

10.3.0.2 After the workshop, the risks associated with the hazards were ranked based on the discussions held during the workshop and mitigation measures were identified. A total of 20 hazards were identified during the workshop. The hazards were:

a) change to current SAR responses;

b) a person falling from vessel drifting into the turbines;

c) drifting vessel allision with turbine housing or Lagoon seawall;

d) vessel allision with Lagoon seawall at high water during severe adverse weather;

e) grounding due to reduced water depth in navigational channels and rivers;

f) the Lagoon lights not being visible against shore based lights;

g) the effects of light pollution during construction and operation;

h) increased vessel to vessel collision risk;

i) vessel to vessel collision risk with work vessels on site;

j) wave reflection affecting vessel navigation in normal weather conditions;

k) wave reflection affecting vessel navigation during adverse weather conditions;

l) impacts on vessels current emergency plans;

m) vessels towed in with no rudder or not under own power;

n) impacts on commercial ferries bound to/from Swansea Port;

o) impacts on use of existing pilot boarding stations;

p) vessel displacement;

q) vessel allision with Lagoon seawall in adverse weather;

r) vessel stuck on Lagoon seawall;

s) siltation within Lagoon reducing water depth; and

t) loss of transit routes.

10.3.0.3 These have been used to create the hazard log, which was then circulated to attendees and invitees for review. The hazard log which has been used to inform the ES and in particular the impacts, can be found in Appendix 14.2, Volume 3.

10.3.0.4 From the 20 hazards identified above, the attendees together with Anatec Ltd. ranked hazards according to their acceptability. Of the 20 hazards, 6 were ranked by the workshop as unacceptable in the worst case scenario, when considering only standard mitigation measures. These were:

a) change to current SAR responses;

b) drifting vessel allision with turbine housing or Lagoon seawall;

c) increased vessel to vessel collision risk;

d) wave reflection affecting vessel navigation in normal weather conditions;

e) vessel allision with Lagoon seawall in adverse weather; and

f) vessel stuck on Lagoon seawall.

10.3.0.5 These are considered further in the formal safety assessment (and EIA impact assessment in Chapter 14 of the ES) which follows in Section 12 for the various phases of the Project.

11.0 Consultation

11.1 Introduction

11.1.0.1 Key marine navigational stakeholders were consulted as part of the navigational risk assessment. The following stakeholders were consulted:

a) City and County of Swansea;

b) Maritime and Coastguard Agency;

c) Planning Inspectorate;

d) Port Operators;

e) Recreational clubs;

f) Royal Yachting Association and the Cruising Association;

g) Trinity House Lighthouse Services; and

h) Welsh Yachting Association.

11.2 Key points/observations

11.2.0.1 Table 11.1 presents an overview of key points relevant to shipping and navigation from informal consultation with stakeholders, from the Scoping Opinion (The Planning Inspectorate, 2012).

Table 11-1 Summary of shipping and navigation informal consultation and the Scoping Opinion

Stakeholder	Overview of key points/observations
Associated British Ports Meeting **(**Aug 2011)	• Preliminary meeting to discuss the Project concept and to gain an understanding of potential issues.
Neath Estuary Group Meeting (Feb 2012)	• In the findings of a recent survey, it was observed that sand can spill over the training wall into the Neath navigation channel. • All early Lagoon options had a nib which extended out to the Neath Channel and this would block or hinder large shipping access. This has been considered in the further work that has taken place on design of the Project.
Mumbles Motorboat and Fishing Club Meeting (Mar 2012)	• Concerns were raised about the Lagoon seawall causing an obstruction in the Bay and increasing transit times for commercial fishermen. • Questions were raised about whether the proposed Lagoon is inside or outside the harbour limits of Swansea and Neath and how close it is to the dredged shipping channels leading into the harbours. • It was confirmed that there will be navigational lighting associated with the Lagoon to guide vessels.
Monkstone Sailing and Cruising Club Meeting (May 2012)	• Concerns were raised about the flow coming down the Neath and if fine silts depositing in the marina besides the M4 bridge crossing the Neath will increase. • A question was raised over what is the safe area beyond the turbines that vessels can approach without being affected by the wake of the turbines. • It was noted that commercial fishing for lobster, whelks and crabs is undertaken in the area of the Lagoon (on diffuser section of long sea outfall). • It was commented that River Neath commercial boat activity has been increasing – especially to the scrap metal yard upstream of marina. • Comment that Monkstone marina used to have 38ft boats but due to the marina silting and their deeper keels they have now moved to Swansea marina.

Stakeholder	Overview of key points/observations
Welsh Yachting Association and Royal Yachting Association Meeting (Jun 2012)	• Nothing material to add beyond their position statement, namely their concerns would be about navigational safety and community interest/impacts on local use. • Questioned the level of traffic that crosses that area of the bay. • Recommended that TLSB should speak to as many local sailing and sub-aqua clubs as possible. • Internal use of the Lagoon would potentially require internal rescue craft. • Questioned whether the Lagoon will impact the space that yacht clubs currently have for events.
Royal Yachting Association Email (Jun 2012)	• Concerns have been raised to them that the Lagoon may cause unusual currents and turbulent water adjacent to the main channel into Swansea and that the general pattern of Swansea Bay will be affected in terms of sands shifting and possibly deeper areas becoming shallower.
Swansea Port Health Authority Meeting (Sep 2012)	• TLSB should cumulatively consider the proposed gasification project under the Lagoon. • The issue of safety of water sports and turbines should be considered. • Discussions should include fishing patterns in the area.
Swansea Marina Meeting (Oct 2012)	• Concerns were raised about turbulence, access to the marina, boats losing power and being pushed onto the Lagoon seawall and the effect on local wave climate.
Trinity House Lighthouse Service Scoping Opinion (Nov 2012)	• The applicant, during the cumulative impact assessment of the Project should pay particular attention to the possible impact on the surrounding harbours: Neath, Swansea and Port Talbot. • We would expect this Project to have a considerable impact on the proliferation of aids to navigation within Swansea Bay, both during the construction phase and upon the Project's completion. • In order to address specific mitigation measures concerning this project, we would suggest that, upon completion of the Navigation Risk Assessment, the applicant meets with Trinity House to discuss all matters relating to mariner safety in connection with this project.
Neath Port Authority Scoping Opinion (Nov 2012)	• In principal supports Project on condition the construction and operation do not interfere with safe passage of vessels to and from the port. • Ports are concerned about long term drifting of sand accumulating against the outside of the structure, plus the impact it would similarly have on altering the sand movement on the adjoining Crymlyn Burrows beach. Both these represent a serious future hazard for safe navigation of vessels.
City and County of Swansea Scoping Opinion (Nov 2012)	• How will the western seawall will affect the wave patterns along the entrance to the existing docks. This is particularly important for smaller craft using Swansea Marina and potentially the new Prince of Wales dock Marina. Traditionally the entrance to the River Tawe estuary has been well protected and is well aligned for running into the harbour in bad weather conditions. Given the proposed height of the lagoon seawalls the wave patterns outside could become difficult for smaller craft entering during bad weather. This could clearly have a negative impact in socio-economic terms for the marina operators.

Stakeholder	Overview of key points/observations
Associated British Ports Meeting (Nov 2012**)**	• Navigation and coastal process were the main key areas of concerns for ABP. • Potential for Swansea Cork Ferry to be re-instated should be taken into consideration. • Bi-weekly meetings set up with ABP to maintain feedback on Project progress and discuss key issues.
Planning Inspectorate Scoping Opinion (Nov 2012)	• Consider the cumulative impact of the Lagoon with underground coal gasification within Swansea Bay. • The ES should define the dredging requirements of Swansea Port and Neath Port along the dredged channels to maintain a safe passage for vessels. • The Neath Port Authority has raised concerns that the changing coastal processes could result in a larger amount of sediment drifting into the dredged channels resulting in a safety hazard for vessels using the channel. The ES should include an assessment of the effects of sediment changes to navigation and safety. • It is noted that the impact on the pilotage of both commercial and recreational vessels, for example from the changing local wave conditions and changes to sediment levels on the seabed will be informed by the coastal process modelling. The interrelationship between these chapters must therefore tie in. • The ES should identify whether the area of the Bay that would be lost as a result of the development is currently used by recreational vessels, and the impacts of displacing such vessels elsewhere in the Bay. • It is advisable that the lighting requirements (navigational lighting on the seawall which may be required) are investigated with Trinity House at an early stage to ensure that these can be modelled into the seascape and visual assessment. • Access for RNLI is required during construction and operation. • The SoS notes that a Navigation Risk Assessment will be carried out as part of the EIA. Mitigation measures proposed to address impacts on navigation and safety should be detailed in this assessment. It is advisable that this is developed with the prescribed consultees. • Should consider lighting equipment/requirements and navigational aids as part of the requirements.
Neath Port Authority Meeting (Jan 2013)	• TLSB provided an update of the Project and discussions were held regarding relocating the Neath dredge channel. • NPA confirmed that they are in principle in support of the proposed Lagoon, as long as it does not have a detrimental effect on the operation of the Neath Estuary or the NPA. • NPA confirmed that the existing channel suffers from a buildup of sand on the western Crymlyn Burrows side and this overspills into the channel. • It was agreed that careful consideration of the option would need to be undertaken and information provided to the Committee for consideration.

Stakeholder	Overview of key points/observations
Maritime and Coastguard Agency and Trinity House Lighthouse Service Meeting (Apr 2013)	• Due to the proximity of the Lagoon seawall to the channel and the operation of vessels in and out of the Neath Estuary, MCA and THLS recommended consulting pilots in the area to get their views. • Need to address concerns such as coastal processes (scouring) resulting in rocks falling into the channel (if the wall is built too close to the channel). • MCA recommended a 14 day Radar, AIS and visual survey is carried out during summer to cover the small craft activity in the area. • Discussion of emergency response provision and how it would be carried out within the Lagoon. • Issues such as the additional traffic relating to aggregates in and out of the ports should be considered. • False or spurious lights will need to be avoided during construction (e.g. use shielded lighting etc.).
Neath Port Authority Meeting (Apr 2013)	• Agreement that the proposed section of wall running parallel with the Crymlyn Burrows training wall would be brought forward to form the Ports new training wall. • Discussion on movement of buoys and lights regarding navigational channel. • NPA confirmed that most vessels come in at high tide, and are cargo vessels. The guidance for the maximum draft is approximately 6m and maximum length is 125m. • NPA requested that the mouth of the channel should be increased to 100m to allow pilots to manoeuvre because the approach would be different with the positioning of the Lagoon seawall. • NPA commented that it may be necessary to dredge a new wider channel between the starboard buoy and the Monkstone light. • There should be no issues with port operation during construction, if the east wall was constructed first and the widening of the channel mouth was in place.

Royal Yachting Association
Email
(Jul 2013)
	• Broadly content with the mitigation measures suggested in the hazard log.
	• Keen to see more information about the risk reduction measures in the log.
	  ○ Detailed siltation modelling;
	  ○ Further understanding of currents at different depths; and
	  ○ Wave reflection modelling.
	• Preference for layout option D (PEIR table 3.1).
	• A 400m operational safety zone would force boats navigating from the River Neath to the River Tawe (or vice versa) to take an unnatural path should they choose to skirt the edge of the lagoon wall.
	• The overlapping wall in option D created a natural enclosure of the turbine housing, thus negating the need for a "marked exclusion area around turbines (with wire/buoy system)" as detailed in the hazard log.

Trinity House Lighthouse Service Email (Aug 2013)	• Beneficial to discuss this matter with both Associated British Ports South Wales and Neath Port Authority, before submitting any risk mitigation plans.

Stakeholder	Overview of key points/observations
Maritime and Coastguard Agency and Trinity House Lighthouse Service Meeting (Oct 2013)	• Question of channels silting up and charted depths being maintained. • Given the profile of the walls of the Lagoon, then aids to navigation (AtoN) should mark the edge of the navigable channels into Neath and Swansea, these AtoN may not necessarily be on the bund wall or rock armour. • All aids to navigation will require to be approved by THLS. • Back eddies may make it more difficult and less predictable than is currently the case for vessels entering Swansea where they generally experience 1.5 knots across the channel. • Concerned about turbine wash, indicating that a 500m safety zone (if approved) marked by buoys and floating cables would be inappropriate, suggesting that something more substantial and prominent is required and that this should be included within the project envelope. • If a safety zone is to be applied for then this application will require to be made to DECC. • Noted that different AtoN (marking and temporary lights) will be required during the construction phase. THLS should be consulted on this and approval sought. • With respect to lighting, any lights on the wall/shore should not interfere with the lighting in the channel.

11.3 Comments

11.3.0.1 Table 11-2 presents received from stakeholders concerning the navigation and marine transport information provided in the Preliminary Environmental Information Report (PEIR) prepared by TLSB in 2013.

Table 11-2 Summary of PEIR comments

Consultee	Overview of key points/observations
Welsh Government (Jul 2013)	• The Project area falls within the Harbour limits of Swansea Port and Port of Neath, if works have the potential to impact on Port operations they may need to review their Port Marine Safety Code risk assessments. • We welcome your maritime stakeholder engagement and recommend on-going dialogue. • We would expect the ES to cover navigation in detail and clearly propose mitigation measures, if required. • The ES should include details of the design capacity for repairs and maintenance should the lagoon be damaged by passing shipping. • If the roll on-roll off ferry terminal on the Project is being considered as an option, it should be fully assessed within the ES. • We would expect to see a contingency/emergency plan form part of the ES to address what will happen in the event of any emergency/collision arising.
City and County of Swansea (Aug 2013)	• Should the change of use of the Prince of Wales Dock to commercial marina be progressed the channel would lead to this provision also. • Large waves / surf developing along the western Lagoon seawall during certain tide / wind conditions could possibly cause difficulties for craft trying to navigate into Swansea. • The western Lagoon seawall is immediately adjacent to the dredged approach channel, leaving little time for a boat owner to react in the event of loss of power. • There will be a reduction in useable space on eastern side of the dredged channel, interaction between pleasure craft and large commercial vessels may increase. • Would the suction / discharge effect of the turbines be sufficient to cause difficulties for small craft? • Reflected waves from the Lagoon seawalls could be a problem.
Associated British Ports (Aug 2013)	• Require the right to require or approve measures to mark the works for navigational purposes; in particular the placing of lights and buoys and compliance with any requirements of THLS in that regard. • Such works or measures (for example the provision of breasting dolphins) as ABP may consider necessary for the purpose of the protecting the entrances to the Ports of Swansea and Port Talbot and vessels navigating into and out of the port entrances. • No arrangements to be implemented for the alteration of the jurisdiction of ABP as Harbour Authority or for the management of the impounded Lagoon, including the making of byelaws without the approval of ABP.

12.0 Formal safety assessment

12.0.0.1 This section documents the formal safety assessment. Where the Project area is noted, it indicates both the proposed physical area of the lagoon and the waters surrounding it.

12.0.0.2 This formal safety assessment proceeds on the basis of the outline construction programme as discussed in Chapter 4, Section 4.5.2, which anticipates construction starting in 2015 and with the main construction lasting for about three years. The assessments contained in this NRA are not materially sensitive to works commencing within the anticipated validity of the Development Consent Order (see Chapter 1), which is five years, or to an extension of (say) a further year-or-so.

12.2 Significance criteria

12.2.0.1 Impacts on shipping and navigation receptors, that were formulated based on hazards identified at the workshop, were assessed using a consistent scale of sensitivity and magnitude, as described in the following sections.

Sensitivity

12.2.0.2 A shipping and navigation receptor can only be sensitive if there is a pathway through which an impact can be transmitted between the source activity and the receptor. When a receptor is exposed to an impact, the overall sensitivity of the receptor is determined and that process incorporates a degree of subjectivity. Sensitivity assessments for shipping and navigation receptors used the following sources, and applied expert opinion (Anatec Ltd who have prepared this assessment), to define the sensitivity of a receptor:

a) Outputs of the hazard workshop;

b) Level of stakeholder concern;

c) Number of transits of specific vessel and/or vessel type; and

d) Lessons learnt from existing renewable energy developments.

12.2.0.3 For the purposes of assessing the impact to marine receptors a sensitivity must be judged. The criteria is ranged from neutral (sensitivity) to very high. The greater the safety impact and/or the lower the ability to adapt to the impact, the greater the sensitivity. A safety impact is classified as any impact that may influence the navigational safety of the marine receptor. Once a sensitivity is defined the assessment is made to the magnitude, which is defined by geographical extent, frequency of occurrence and duration. These are then used in the significance matrix to define the impact significance.

12.2.0.4 Table 12.1 presents the definitions of sensitivity used in this assessment.

Table 12.1 Sensitivity Criteria for Shipping and Navigation

Sensitivity	Definition
Very High	• Very high level of safety impact for shipping and navigation receptors • Very limited ability to adapt to impact
High	• High level of safety impact for shipping and navigation receptors • Limited ability to adapt to impact
Medium	• Medium level of safety impact for shipping and navigation receptors • Some ability to adapt to impact
Low	• Low level of safety impact for shipping and navigation receptors • Ability to adapt to majority of impact
Negligible	• Negligible level of safety impact for shipping and navigation receptors • Ability to adapt to all of impact
Neutral	• No impact for shipping and navigation receptors

Magnitude

12.2.0.5 When assessing the magnitude of an impact, the geographical extent, the duration and the frequency of occurrence are considered.

12.2.0.6 Determining the overall magnitude of shipping and navigation impacts also incorporates a degree of subjectivity, as decisions are based on expert opinion, as identified above, in combination with baseline data and the following inputs:

a) Consultation feedback from stakeholders;

b) Outputs of the Hazard Workshop in particular where 'unacceptable' ranked impacts were identified; and

c) Lessons learnt or research from previous renewable energy developments.

12.2.0.7 Table 12.2 presents the definitions of magnitude used in this assessment. The potential "effects" of the Project are identified on a project basis through the hazard workshop and stakeholder feedback.

Table 12.2 Magnitude Criteria for Shipping and Navigation

Magnitude	Definition
Major Negative	• Impact geographical area beyond the extent of Swansea Bay • Impact present on a permanent basis throughout the operation of the Lagoon • Impact occurs very frequently to constantly/permanently
Moderate Negative	• Impact localised to geographical extent of Swansea Bay • Impact present on a permanent basis throughout the operation of the Lagoon • Impact occurs frequently
Minor Negative	• Impact localised to geographical extent of Lagoon boundary • Impact present on a temporary basis • Impact relatively infrequent
Neutral	• No impact on shipping and navigation receptors
Positive	• Shipping and navigation receptors benefit as a result of the impact

Impact significance

12.2.0.8 Based on the sensitivity of the receptor and the magnitude of the potential impact, the significance of the impact is determined according to the risk matrix presented in Table 12.3.

Table 12.3 Impact Significance

		Magnitude				
		Major Negative	**Moderate Negative**	**Minor Negative**	**Neutral**	**Positive**
Sensitivity	**Very High**	Major Adverse	Major Adverse	Moderate to Minor Adverse	No Impact	Major to minor beneficial
	High	Major Adverse	Major to Moderate Adverse	Minor Adverse	No Impact	Major to minor beneficial
	Medium	Moderate Adverse	Moderate to Minor Adverse	Minor Adverse	No Impact	Moderate beneficial
	Low	Minor Adverse	Minor Adverse	Insignificant	No Impact	Minor beneficial
	Negligible	Minor/ Insignificant	Insignificant	Insignificant	No Impact	Insignificant
	Neutral	No impact	No impact	No impact	No impact	No impact

12.2.0.9 This assessment of significance will assume that the following embedded mitigation measures are in place:

a) Compliance with MGN 371 (MCA, 2008);

b) Recommendations outlined IALA (International Association of Marine Aids to Navigation and Lighthouse Authorities) O-139 for lighting and marking (IALA, 2008) and consultation with THLS on final lighting and marking for the development; and

c) Vessel compliance with COLREGS (International Regulations for Preventing Collisions at Sea).

12.2.0.10 Where possible, appropriate mitigation measures have been incorporated into the design of the Project as embedded mitigation.

12.2.0.11 The following provides details of the assessment undertaken for each potential impact without mitigation for the construction, operation and decommissioning phases of the Project. The assessments then outline specific mitigation proposed for the potential impacts identified, and these, together with standard mitigation developed based on the expert opinion of Anatec Ltd. presented in Section 14, are used to identify the residual risk. A summary of residual impacts is provided in Section 15.

12.2.0.12 Cumulative and in-combination developments are assessed in Section 13.

12.3 Construction impacts

12.3.0.1 Based on the potential hazards identified during the hazard workshop, input from consultees and the Project construction works and the vessels required, the following potential impact pathways have been identified for shipping and navigation receptors:

a) increased vessel to vessel collision risk (including with construction work vessels on site, some of which may be restricted in their ability to manoeuvre);

b) additional vessel to structure allision risk with partially constructed structure;

c) displacement of pilot vessels/tugs associated with ports in the local area due to construction activities; and

d) impact of increased lighting during construction.

12.3.0.2 The potential impact on SAR operations and vessels emergency plans will be relevant for at the final stage of the construction phase when the Lagoon is finally sealed with the completion of the seawalls. Until this time, access will be possible into the waters that will eventually be impounded within the Lagoon. This potential impact is therefore assessed under the operational phase.

12.3.1 Increased vessel to vessel collision risk

12.3.1.1 During the construction phase of the Project, when the Lagoon seawalls and cofferdam around the turbine and sluice gates will be constructed, there will be an increased risk of vessel to vessel collisions. This is due to vessels being displaced from their normal routes into potentially reduced sea areas, combined with the presence of construction vessels on site. Some of these construction vessels will be restricted in their ability to manoeuvre/adapt (e.g. the dredger). It is expected that a number of vessels will be involved during the construction phase of the Project as detailed in Table 1.1. There will also be a number of rock barges, which will transport rock for the Lagoon seawalls from Dean Quarry.

12.3.1.2 This potential impact would have a medium level of sensitivity due to the potential for safety impacts and vessels with limited ability to manoeuvre/adapt. The potential impact will also be localised to the extent of the Project area and will be present for the construction period. However, the impact will occur infrequently, which leads to an assessed magnitude of minor negative and an overall ranking of **minor adverse**.

12.3.1.3 Standard mitigation measures, outlined in Section 14, will be implemented, together with the following specific measures:

a) additional temporary Aids to Navigation (AtoN);

b) extensive promulgation of information including receptor specific;

c) appropriate work procedures and planning with respect to other users in the Bay;

d) appropriate safety zones around construction works; and

e) guard vessels in the area of construction works.

12.3.1.4 Following the implementation of mitigation measures, the residual effect will be **minor adverse** (unchanged).

12.3.2 Increased vessel to structure allision risk

12.3.2.1 There will be an increased vessel to structure allision risk during the construction phase of the Project due to the presence of a new structure in a previously open sea area. This risk will be increased if parts of the Lagoon seawall are built below the water line and not adequately marked or lit until fully installed. The risk will also be amplified during times of adverse weather when overtopping or fog may mean the Lagoon seawall is less visible. The greatest risk factor in relation to this impact is the potential effect of a vessel allision with the cofferdam, which will be used for the construction of the turbine housing and sluice gates. This structure will be in place from the first year of construction and may contain up to 500 workers at the peak of its construction.

12.3.2.2 Without mitigation, the potential impact of vessel to structure allision and the limited ability of vessels (particularly larger vessels) to adapt/manoeuvre could present a high level of safety impact if access channels to the ports were restricted, resulting in a sensitivity of high. This potential effect will be localised to the extent of the Project area, which is in close proximity to the Swansea and Neath navigational channels, and present for the construction period, giving a magnitude of moderate negative without mitigation, and a ranking of **major to moderate adverse**.

12.3.2.3 Standard mitigation measures, outlined in Section 14, will be implemented, together with the following specific measures:

a) additional temporary AtoN;

b) extensive promulgation of information including receptor specific;

c) safety zones around construction works

d) dolphin piles and floating boom around temporary cofferdam and operational turbine housing and sluice gate structure;

e) guard vessels during the period of construction activity protecting vessels from dangerous areas of the construction.

12.3.2.4 To protect the turbine and sluice gate structure and to ensure a more visible demarcation, a number of dolphin piles will be installed. These will be placed approximately 500m from the turbine and sluice gate housing on the seaward side of the Lagoon. An indicative arrangement of these is shown below in Figure 1-72. The dolphin piles will be approximately 2m diameter hollow steel piles set 50 to 100m apart. There will be floating booms between the piles and they will be appropriately painted and lit.

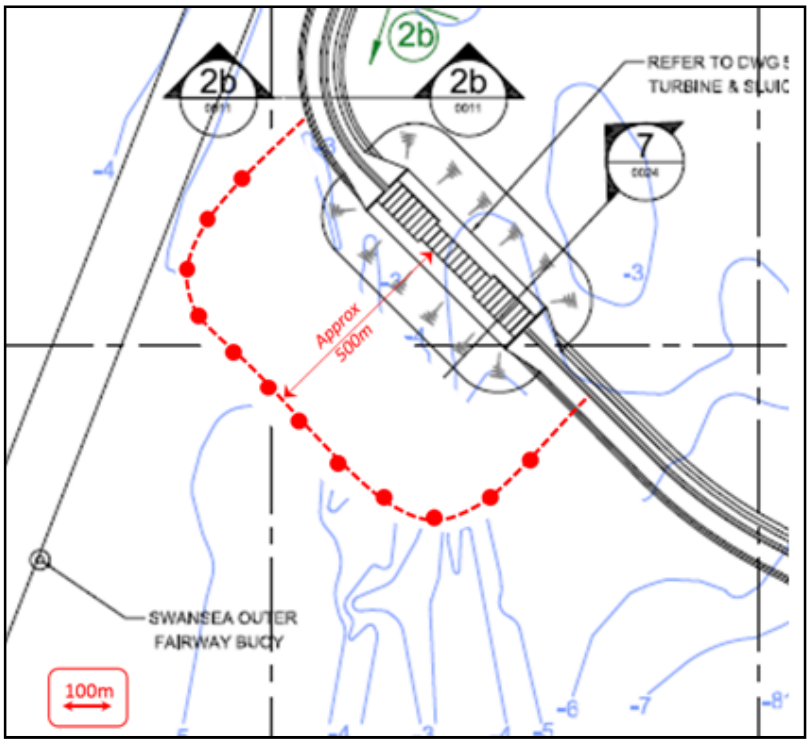

Figure 1- 72 Indicative layout of dolphin piles

12.3.2.5 On the lagoon side of the turbines and sluice gate structure there will be a floating boom to demarcate a similar safety zone and an example of these are shown below in Figure 1-73.

Figure 1- 73 Indicative layout of dolphin piles

12.3.2.6 Following the implementation of mitigation measures, particularly the use of dophin piles and floating boom, the residual effect will be **minor adverse**.

12.3.3 Displacement of pilot vessels/tugs

12.3.3.1 Analysis of marine traffic data has identified that the majority of vessels crossing the Project area are pilot vessels and tugs associated with the ports of Swansea and Port Talbot. The presence of the Lagoon seawall and construction traffic will displace these vessels from their current more direct routes. Furthermore, the Neath Pilot Boarding Station is only 0.1nm at the closest point to the Lagoon seawall (1.6nm from the turbine housing), which could have the potential to impact on pilot vessel operations at this location (i.e. sea room to board).

12.3.3.2 This impact has been assessed to have, without mitigation, a potentially very high level of safety impact due to the restrictions to operations and limited ability to adapt, resulting in a sensitivity of very high. It extends across the extent of Swansea Bay and will be present on a very frequent basis during the construction period (vessels based in Kings Dock, but cross the Lagoon footprint between Ports, resulting in a magnitude of major negative. Overall, the impact without mitigation has been ranked as **major adverse**.

12.3.3.3 Standard mitigation measures, outlined in Section 14, will be implemented, together with the following specific measures:

a) access to ports will be maintained along navigational channels,

b) pilot boarding station will be moved further south, in agreement with port operators, to increase distance between pilot boarding station and Lagoon seawalls.

12.3.3.4 Following the implementation of mitigation measures, the residual effect will be **minor adverse**.

12.3.4 Impact of increased lights during construction

12.3.4.1 Although the Swansea Bay and Port area already have night time lighting, during the construction period of the Project, there will be further lights present associated with the Project such as lighting from construction vessels, on structures and other activities. This has the potential to cause visual confusion for vessels coming into Swansea Bay and transiting towards one of the ports.

12.3.4.2 It is anticipated that vessels arriving at the ports will mostly be able to adapt this effect by using other navigational aids, and so the sensitivity is assessed as being low. The impact will be infrequent due to the fact that the temporary cofferdam which will be built for the construction of the turbine and sluice gate housing, will provide a shield around the works. Vehicles will access the construction area along the haul road throughout the construction period and this, together with residual light around the cofferdam, results in a magnitude of moderate negative. Overall, the impact has been assessed as being **minor adverse**.

12.3.4.3 Standard mitigation measures, outlined in Section 14, will be implemented, together with the following specific measures:

a) adopting work procedures and planning to ensure spurious lighting is shielded from approaching vessels; and

b) extensive promulgation of information so receptors are fully aware of the construction activities.

12.3.4.4 Following the implementation of mitigation measures, the residual effect will be **minor adverse**.

12.4 Operational impacts

12.4.0.1 Chapter 4: Project Description of the Environmental Statement provides details of the components and operation of the Project. Based on the hazards identified during the hazard workshop, consultee input and details of the Project design, operation and maintenance, the following impacts have been identified for shipping and navigation receptors:

a) increased vessel to vessel collision risk;

b) increased vessel to structure allision risk (including vessels Not Under Command (NUC) and during times of severe adverse weather);

c) increased vessel to structure allision risk for recreational vessels;

d) change to transit routes for fishing vessels;

e) change to transit routes for recreational vessels;

f) impact on persons in water after falling from vessel in the vicinity of the turbines;

g) impact on navigable water depth in rivers/channels in the Project area and within the Lagoon;

h) impact on vessel navigation due to wave reflection (during normal and adverse weather conditions);

i) impact on SAR operations and vessels emergency plans;

j) impact on the pilot boarding station and the displacement of pilot vessels/tugs associated with ports in the local area; and

k) impact of Lagoon lighting during operation.

12.4.0.2 The following provides details of the assessment undertaken for each potential impact without mitigation. The assessments then outline specific mitigation proposed for the potential impacts identified, and these, together with standard mitigation developed based on the expert opinion of Anatec Ltd. presented in Section 14, are used to identify the residual risk. A summary of residual impacts is provided in Section 15.

12.4.1 Increased vessel to vessel collision risk

12.4.1.1 During the operational phase of the Project, with the Lagoon seawalls in place, there will be an increase to vessel to vessel collision risk due to the potential displacement from current routes. This will result in more vessels transiting in a reduced sea area. Although the Lagoon seawalls will not encroach onto the navigational channels there will also be an increased collision risk for those vessels transiting in the channels due to the Lagoon seawall restricting them from taking some of the potential corrective action

that they may currently be able take. This risk will be amplified during times of adverse weather.

12.4.1.2 Although all vessels entering and leaving the marina/Swansea Port would be slow moving, there would also be a potential increased risk of collision through the operation of the Lagoon water shuttle. This risk would be minimised through abiding by navigation and operation procedures in this area.

12.4.1.3 Due to the risk of increased collision and allision incidents, there could be an increased need for emergency response actions, when compared to baseline levels. The potential effects on emergency response actions are dealt with under the operational impact: *impact on SAR operations and vessels emergency plans* below.

12.4.1.4 Based on the current traffic levels and patterns observed within 5nm of the Lagoon, the number of vessels being displaced is expected to be low, resulting in medium safety impacts and a sensitivity of low. The impact will extend across Swansea Bay and will be present for the lifetime of the project, giving a magnitude of moderate negative and a ranking of **minor adverse**.

12.4.1.5 Standard mitigation measures, outlined in Section 14, will be implemented, together with the following specific measures:

a. extensive promulgation of information; and

b. works vessel coordination and guard vessels during major maintenance.

12.4.1.6 Following the implementation of mitigation measures, the residual effect will be **minor adverse** (unchanged).

12.4.2 Additional vessel to structure allision risk

12.4.2.1 The presence of the Lagoon in a previously open sea area has the potential to create additional vessel to structure allision risk. This risk will be increased during times of adverse weather when overtopping or reduced visibility could mean the Lagoon seawall is less visible than usual.

12.4.2.2 Due to the risk of increased collision and allision incidents, there could be an increased need for emergency response actions, when compared to baseline levels. The potential effects on emergency response actions are dealt with under the operational impact: impact on SAR operations and vessels emergency plans below.

12.4.2.3 The sensitivity of receptors to this impact has been assessed to be medium. It is localised to the Lagoon seawall but will last the entire lifetime of the project, giving a magnitude of moderate negative and an overall ranking, without mitigation, of **moderate to minor adverse**.

12.4.2.4 Standard mitigation measures, outlined in Section 14, will be implemented, together with the following specific measures:

a) the Lagoon seawalls have been positioned relative to the navigation channels following consultation with ABP and Neath Port Authority. The western Lagoon seawall is positioned 100m from the Tawe dredged channel and the southern

Lagoon seawall will abut the Neath dredged channel. The entrance to the Neath channel will be widened;

b) promulgation of information and AtoN;

c) lighting and marking of Lagoon as per Local Lighthouse Authority (LLA) and General Lighthouse Authority (GLA) requirements;

d) establishment of a safety zone around turbine housing and sluice gate structure;

e) dolphin piles and floating boom around outside of turbine housing and sluice gate structure; floating boom inside Lagoon around turbine housing and sluice gate structure (see construction impact assessed previously: additional vessel to structure allision risk previously)

f) hydrographic surveys in channels and additional dredging in channels, where necessary, to maintain manoeuvrability;

g) promulgation of information to notify of any changes in water depth or maintenance dredging taking place; and

h) development of procedures for reducing the increased risk caused by significant adverse weather.

12.4.2.5 Following the implementation of mitigation measures, including the installation of dolphin piles and the floating boom around the operational turbine and sluice gate housing, the residual effect will be **moderate to minor adverse** (unchanged).

12.4.3 Additional vessel to structure allision risk for recreational vessels

12.4.3.1 The presence of the Lagoon in a previously open sea area has the potential to create an additional recreational vessel to structure allision risk. This risk will be increased during times of adverse weather when overtopping or fog could mean the Lagoon seawall is less visible than usual. The risk is potentially greater for recreational vessels as they are more likely to be transiting closer to the Lagoon (i.e. outside the Swansea channel) and more likely to be severely damaged or become stuck, if an allision incident was to occur.

12.4.3.2 The sensitivity of receptors to this impact has been assessed to be high. It is localised to the Lagoon seawall but will last the entire lifetime of the project, giving a magnitude of minor negative and an overall ranking of **minor adverse**.

12.4.3.3 Standard mitigation measures, outlined in Section 14, will be implemented, together with the following specific measures:

a) the Lagoon seawalls have been positioned following consultation with ABP and Neath Port Authority. The entrance to the Neath channel will be widened;

b) extensive promulgation of information;

c) lighting and marking of Lagoon as per LLA and GLA requirements;

d) dolphin piles and floating boom around the outside of the turbine housing and sluice gate structure and floating boom within the Lagoon; and

e) coordination with event organisers to ensure site support vessels during busy periods (e.g. sporting events).

12.4.3.4 Following the implementation of mitigation measures, the residual effect will be **minor adverse** (unchanged).

12.4.4 Change to transit routes for fishing vessels

12.4.4.1 Analysis of marine traffic data and sightings/satellite data has identified that the majority of fishing vessels in the vicinity of the Project transit in and out of the Swansea channel and do not cross the Project area. Any vessels which would cross the Project area at present will be impacted and will have to deviate to avoid the site, which would result in increased voyage times and fuel costs.

12.4.4.2 Due to the relatively low level of commercial fishing activity in the area and the fact that few fishing vessels cross the Project area (the majority appear to head west from the Bay), the sensitivity has been assessed as being low. The impact is localised to the geographical extent of the Project area and out of the direct line of more frequently used routes, although it will be present for the lifetime of the project which results in a magnitude of moderate negative. Overall the impact has been assessed as being **minor adverse**.

12.4.4.3 Standard mitigation measures, outlined in Section 14, will be implemented, together with the following specific measures:

a) promulgation of information to fishing receptors, including Notices to Mariners and Notices to Fishermen.

12.4.4.4 Following the implementation of mitigation measures, the residual effect will be **minor adverse** (unchanged).

12.4.5 Change to transit routes for recreational vessels

12.4.5.1 Analysis of marine traffic data and RYA cruising routes indicate that there is recreational traffic around the Project area, but the traffic does not generally transit through the Project area itself. Any recreational vessels which currently use a route that crosses the Project area will be required to deviate once it is built, resulting in increased voyage times and fuel costs.

12.4.5.2 Due to the fact that recreational vessels have not been observed regularly crossing the Project area, the sensitivity has been assessed as being low. The impact is localised to the geographical extent of the Project area and out of the direct line of more frequently used routes, although it will be present for the lifetime of the project which results in a magnitude of moderate negative. Overall the impact has been assessed as being **minor adverse**.

12.4.5.3 Standard mitigation measures, outlined in Section 14, will be implemented, together with the following specific measures:

a) promulgation of information to recreational receptors, including contacting local clubs and marinas, who can pass the information on to their members.

12.4.5.4 Following the implementation of mitigation measures, the residual effect will be **minor adverse** (unchanged).

12.4.6 Impact on persons in the water after falling from vessel

12.4.6.1 The presence of the Project in proximity to marine traffic means that there is a potential risk that people may enter the water, either accidentally or intentionally, in proximity to the turbine and sluice gate housing.

12.4.6.2 Due to the level of the impact the sensitivity has been assessed as being high. The impact is localised to the geographical extent of the turbine and sluice housing. It will be present for the lifetime of the project, but would be infrequent in occurring, which results in a magnitude of moderate negative. Overall, the impact has been assessed as being **major to moderate adverse**, without mitigation.

12.4.6.3 Standard mitigation measures, outlined in Section 14, will be implemented, together with the following specific measures:

a) Access and boat platform outside turbine safety zone, with inside the lagoon wall a jetty/floating pontoon and steps;

b) marked safety zone around turbines (floating boom inside Lagoon, dolphin piles and floating boom outside Lagoon);

c) extensive promulgation of information to receptors;

d) AtoN, where appropriate;

e) coordination with the event organiser to ensure site support vessels during busy periods (eg sporting events);

f) develop emergency shutdown procedure for turbines, from manned facility on turbine housing;

g) quick response time for shutting down turbines;

h) enforcement of wearing lifejackets for relevant activities within the Lagoon.

12.4.6.4 Following the implementation of mitigation measures, the residual effect will be **minor adverse**.

12.4.7 Impact on navigable water depth

12.4.7.1 There is a potential for changes in current coastal processes resulting from the operation of the Project to cause increased siltation in channels and within the Project area which would impact on the water depth available for safe navigation. At present, the channels are maintained at the following depths: Swansea 4.2m (below chart datum) in the entrance channel, Port of Neath 2.0m (above chart datum) in the entrance channel and Port Talbot 11.2m (below chart datum).

12.4.7.2 The Project is predicted to potentially increase average annual maintenance dredge volumes by 20 to 34% along the Swansea Channel, and by 1.2 to 2.0% at Port Talbot (along the approach channel and within the Outer Harbour - although it is considered that this predicted change in deposition will be generally indistinguishable from the natural variation in annual dredge volumes) The ranges of potential annual sedimentation have been calculated based upon measured summer/ winter

sedimentation variability within the channels as part of the coastal processes assessment (Chapter 6 of the Environmental Statement). As shown in Figure 6.50 (Volume 2), the majority of the increased Swansea dredging would need to be undertaken within the inshore half of the channel, whilst increases within the Port Talbot approach channel is predominantly within patches along its length. It should be emphasised, however, that these predicted potential changes to maintenance dredging are based upon average annual dredging rates, therefore these changes will be considerably less during years when the existing maintenance dredging requirements within the channels is considerably greater.

12.4.7.3 Siltation is also predicted within the Lagoon. It is anticipated that maintenance dredging within the Lagoon will not need to start until 10 to 15 years after the completion of construction and then be performed approximately every two years. However, the need to do so will be monitored. Based on this monitoring a dredging strategy will be developed and a licence for disposal will be discussed and agreed with the Marine Licencing Team.

12.4.7.4 It has been assessed that shipping and navigation receptors will have a medium sensitivity towards this impact (Appendix 14.2, hazard log). The potential for siltation will be present within areas along the extent of Swansea channel and Port Talbot channel for the lifetime of the project and could be frequent in occurrence, resulting in a magnitude of moderate negative and an overall ranking, without mitigation, of **moderate to minor adverse**.

12.4.7.5 Standard mitigation measures, outlined in Section 14, will be implemented, together with the following specific measures:

1. maintenance dredging in the channels and the Lagoon when required;
2. regular hydrographic surveys in the channels; and
3. promulgation of information to notify of any changes in water depth or maintenance dredging taking place.

12.4.7.6 Following the implementation of mitigation measures, the residual effect will be **insignificant**.

12.4.8 Impact on vessel navigation due to wave reflection

12.4.8.1 Wave reflection from the Lagoon seawall could have a potential impact on vessels within the vicinity of the Project. This impact could have safety implications and could be amplified during times of adverse weather.

12.4.8.2 In addition, the influence of increased flows arising from operation of the turbine and sluice gates has also been considered in relation to its potential effects on navigation. The influence of the lagoon development on tidal flows has been modelled within the coastal processes chapter (chapter 6). It is recognised that any flow may influence and therefore affect the navigational safety of the nearby channel. Flood and ebb flow rates for the channel are noted within Table 14.6, below. At 500m distant from the turbine house, within Swansea channel, flows are predicted to be a maximum of 2.33 knots, for a period spanning 15 minutes. Consultation with an experienced master mariner operating locally indicates that a vessel may generally experience a rate of 1.5 knots across the channel. This is supported by data recorded during the metocean survey

(Titan, 2012) where a maximum baseline flow of 0.52m/s (1 knot) was recorded at the offshore survey site (site 2) which is located to the east of the turbine and sluice gate house. Baseline flows increase to the west of the turbine and sluice gate house as shown on Figure 6.4, Volume 2. The difference in speed and time span duration, that this maximum predicted flow would be experienced for, indicates that this would not present an impact to vessels already safely navigating in the flows currently experienced across the Swansea Channel. Micro-siting of the turbine and sluice gate housing further south east would further reduce the effect of the flows from the operation of the lagoon on the Swansea Channel.

Table 12.4 Predicted flows within Swansea channel in the vicinity of the turbines

Location	Flood Current Speed (Knots)	Ebb Current Speed (Knots)
Swansea Channel - Nearest point (500m) from turbine housing	< 0.5 knots*	2.33 knots*
Swansea Channel - Directly opposite (950m) from turbine housing	<0.5 knots*	2.19 knots*

* Worst case estimates, this peak spans only 15 minutes.

12.4.8.3 Design wave conditions have been assessed at various locations along the Lagoon seawall. Information with respect to climate change and resulting sea level rise has also been taken into account. The walls of the lagoon will be designed with a reflection coefficient in the region of 0.3 reflection for the exposed western arm of the seawall (absorbing 70% of the wave energy), running out to the turbine and sluice gate house, and 0.4 for the eastern seawall, running from the turbine and sluice gate house along the Neath channel. The sloping walls and rock armour of the lagoon seawalls will assist in absorbing wave energy, and reduce wave reflection when compared to vertical walls. The vertical walls of the turbine and sluice housing structure will produce some additional wave reflection.

12.4.8.4 Modelling of the waves has been undertaken in Chapter 6. The results show that for a 10 in 1 year wave event arriving from the SW (the predominant wave direction into Swansea Bay), the presence of the Lagoon structure leads to an increase in wave height of up to 0.22 m off the south-western facing side of the Lagoon (Figure 6.44, Volume). These increases are predominantly the result of wave reflection against the seawall and turbine/sluice gate housing. Within the Swansea Channel there is slight increase in waves at the offshore extreme, for a relatively small area. The waves are then predicted to be similar to the baseline, before the sheltering effect of the Lagoon reduces wave heights in the channel for approximately the last 2km of approach to the Tawe. To the east of the Lagoon, decreases in significant wave height of up to 0.5m are predicted immediately in the lee of the Lagoon across the intertidal fronting Crymlyn Burrows (north side of the Neath Channel) for a 1 in 10 year event; particularly in the vicinity of the Monkstone Light. This change decreases to less than 0.2m at a distance of approximately 1.3 km from the structure, i.e. within the entrance of the Neath Channel, as the sheltering effect diminishes radially.

12.4.8.5 Under south east wind conditions the sheltering effect of the Lagoon on the Swansea Channel is more pronounced (Figure 6.48, Volume 2). The channel has reduced wave height circa 0.2 to 0.5m (for a 10 in 1 year event) found along the inner section of the Swansea Channel; with this reduction increasing to approximately 0.5 to 1.2m for a 1 in

10 year extreme wave event (Figure 6.49, Volume 2). In the Neath Channel under south east wind conditions (for a 10 in 1 year event) there is predicted to be no significant change with a 0.04m height increase in the offshore section and a -0.01m change in the inner part of the channel. Overall the effect of the Lagoon will not significantly affect the approaches to either channel and in fact the Lagoon will afford some sheltering to the Tawe approach under SW and SE wind conditions.

12.4.8.6 The safety impacts due to wave reflection are low and vessels can adapt to the impact by increasing their distance from the Lagoon seawall, resulting in a sensitivity of medium. The impact has the potential to affect vessels beyond the Project area and will occur frequently giving a magnitude of moderate negative. Overall, without the embedded mitigation of wave reflection designed into the Project, the impact has been ranked as **moderate to minor adverse**.

12.4.8.7 Standard mitigation measures, outlined in Section 14.8, will be implemented, together with the following specific measures:

a) wave reflection has been considered in the design of the Lagoon seawall.

12.4.8.8 Following the implementation of mitigation measures, the residual effect on navigation as a result of wave reflection will be **minor adverse** in the outer reaches of the Swansea channel, with **minor beneficial** effects elsewhere in sheltered areas of the Neath and Swansea channels.

12.4.9 Impact on SAR operations and vessels emergency plans

12.4.9.1 Emergency response cover within the Swansea Bay area is currently provided by RNLI lifeboats from The Mumbles and Port Talbot, with SAR helicopters based at Chivenor (changing to St Athan between 2015 and 2017). Vessels undertaking emergency response operations will be unable to access casualties within the Project area by the quickest route which would lead to a slower response time. Also, due to the aforementioned risk of increased collision and allision incidents, there could be an increased need for emergency response actions, when compared to baseline levels.

12.4.9.2 This impact has a high level of safety impact (for example, if an accident occurs within the Lagoon and the RNLI was unable to quickly access the area) and receptors have a limited ability to adapt, resulting in a sensitivity of high. It will be present for the lifetime of the Project and cover the extent of Swansea Bay. Analysis of RNLI and MAIB data has indicated that emergency response actions within the bay are relatively frequent, but within the Project area are infrequent, resulting in a magnitude of moderate negative. Overall, without mitigation, the impact has been assessed as being **major to moderate adverse**.

12.4.9.3 Standard mitigation measures, outlined in Section 14, will be implemented, together with the following specific measures:

a) a slipway with emergency response RIB within the Lagoon;
b) coordination with events organisers to ensure site support vessels during sporting events; and
c) consultation with emergency responders and provision of an ERCoP.

12.4.9.4 As identified previously, the local RNLI stations and HMCG will be consulted about the devices to be deployed (i.e. the turbines and sluice gates) and provided with any further information requested to assist SAR efforts. This will include:

f) precise location details;

g) device details and illustrations;

h) information on the emergency stop procedure/timings;

i) information on the buoyancy of device parts; and

j) emergency contact details.

12.4.9.5 An ERCoP is proposed as part of the SAR liaison process for the Project which will be developed and agreed with the MCA prior to the operation phase[1]**.**

12.4.9.6 Following the implementation of mitigation measures, the residual effect will be **minor adverse**.

12.4.10 Impact on pilot boarding station and displacement of pilot vessels/tugs

12.4.10.1 The presence of the Lagoon will displace pilot vessels and tugs which currently transit in a direct line between Swansea and Port Talbot. This will increase journey times and may therefore have commercial implications. The Neath Pilot Boarding Station, which is located approximately 0.45nm from the Lagoon seawalls, may also be impacted.

12.4.10.2 This impact has been assessed to have a very high level of safety impact, resulting in a sensitivity of very high. It extends across the extent of Swansea Bay and will be present on a very frequent basis for the duration of the project, resulting in a magnitude of major negative. Overall, without mitigation, the impact has been ranked as **major adverse**.

12.4.10.3 Standard mitigation measures, outlined in Section 14, will be implemented, together with the following specific measure which has been incorporated within the Project design:

a) pilot boarding station moved further south to increase distance between the pilot boarding station and Lagoon seawall.

12.4.10.4 Following the implementation of mitigation measures, the residual effect will be **minor adverse.**

12.4.11 Impact of lagoon lighting during operation

12.4.11.1 Permanent lighting associated with the Project could have a potential impact by creating visual confusion for vessels coming into Swansea Bay and transiting towards one of the ports.

12.4.11.2 Lighting has been designed for the Project with consideration given to shipping and navigation receptors and to ensure that spurious white lights do not impact on a vessels

[1] http://www.dft.gov.uk/mca/mcga07-home/shipsandcargoes/mcga-shipsregsandguidance/offshore-renewable_energy_installations/dops_-_all-newpage-26.htm

ability to navigate. In addition, the Lagoon will be lit and marked during operation in line with THLS guidance.

12.4.11.3 It is anticipated that vessels will be able to adapt to the effect of lighting on the Lagoon by using other navigational aids, which will result in a low sensitivity. The impact will be frequent, last for the lifetime of the Project and cover the extent of Swansea Bay, resulting in a magnitude of moderate negative. Overall, the risk has been assessed as being **minor adverse,** with the residual impact remaining as **minor adverse.**

12.4.12 Impacts during decommissioning

12.4.12.1 After 120 years of operation, two options have been proposed for the future of the Project:

12.4.12.2 In terms of decommissioning, as identified in Chapter 4, Project Description, at the end of the operational life of the Project (estimated at some 120 years) two potential options are under consideration:

a) to replace, upgrade and extend the operational life of the power generating station (in which case, the above impacts could be expected to continue); and

b) removal of the turbines and sluice gates from the turbine/sluice gate housing to leave the openings, through which the natural tide will flow.

12.4.12.3 If the second option were progressed removal work will be undertaken within the confines of the turbine and sluice gate housing using the gantry crane and thus marine works are not anticipated. Vessels may then be able to access the lagoon for recreational and fishing use.

12.4.12.4 In respect of the first option, the impacts will continue as for the general operational and maintenance phase assessed above. In respect of the second option, access to the lagoon may be feasible for fishing or recreation vessels through the opening in the seawall which previously housed the turbines and sluice gates. Impacts will also be similar to those identified for the operational phase, except that changes in hydrodynamics (e.g. increased flows) which resulted from the operation of the turbines will be reduced. However, impacts will remain in respect of changes in navigational depths, particularly within the lagoon, as it is anticipated that maintenance dredging would still be required to retain use of the area for recreational sailing and sporting events. The same mitigation measures will apply as described previously.

13.0 Cumulative impacts

13.1.1 Introduction

13.1.1.1 Based on the projects identified for cumulative/in-combination assessment in Chapter 2 of the Environmental Statement, the following activities and projects have been identified as having the potential to impact the Project in relation to shipping and navigation:

a) Port Talbot Harbour Redevelopment;
b) Underground Coal Gasification (under Swansea Bay); and
c) Navigational Dredging.

13.1.1.2 These identified projects and activities have been assessed in Table 13.1, which describes the potential cumulative and in-combination impacts for shipping and navigation.

Table 13-1 Cumulative and in-combination impacts

Cumulative Impact	
Atlantic Array Offshore Wind Farm (Round 3)	**Not Considered** since the project is not proceeding.
Port Talbot Harbour Redevelopment	Potential future activities associated with the redevelopment of the harbour, the current status of which is unknown. If this takes place then some changes in traffic would be anticipated. However, while there is no information currently available, an assessment cannot be undertaken at this stage.
Underground Coal Gasification (under Swansea Bay)	The development's provisional license has been extended, but at this early stage no further information is available. Therefore, no cumulative impact assessment can be undertaken at this time.
Navigational Dredging	Channel dredging for the Tawe, Neath and Port Talbot. Access dredging at Swansea Marina and Monkstone Cruising and Sailing Club. Also existing/proposed dredging in the Bristol Channel. The status of these is on-going. The current level of dredging traffic is known, having been assessed within the marine traffic assessment and survey.
Ro-Ro Ferry	**Not Considered**: Ferry not anticipated to recommence in the foreseeable future. No cumulative assessment undertaken. However, use of Port of Swansea generally is considered in this NRA and Chapter 14, Navigation and Marine Transport.

14.0 Review of mitigation measures

14.1 Introduction

14.1.0.1 Specific mitigation measures have been identified for the potential effects predicted in Section 12. In addition to these specific measures, a number of standard mitigations have been identified by Anatec Ltd. as relevant for the Project based on their expert opinion. These standard mitigation measures are presented below:

a) application and use of safety zones around construction works and operational turbines and sluice gate housing (see Section 14).

b) ensuring compliance with International Maritime Organisation Conventions;

c) adopting emergency response and co-operation plan;

d) ensuring compliance with International Association of Lighthouse Authorities (IALA) Guidance and Aids to Navigation (AtoN);

e) adopting marine pollution contingency planning (see Chapter 7 Marine Water Quality of the Environmental Statement);

f) Compliance with MGN 371;

g) Personal Protective Equipment;

h) Standard promulgation of information;

i) Use of guard vessels during construction; and

j) Development charting - e.g. structures associated with the Project to be marked on navigational and Admiralty Charts.

14.1.0.2 Construction safety will be detailed within a Construction Code of Conduct/Health, Safety and Environmental Management Plan (HASEMP). Safety boats will be available during all marine works. An Operational Environmental Management Plan will be prepared for the operational phase of the Project (see Chapter 4: Project Description of the Environmental Statement).

14.1.0.3 When determining safety zones for construction and operation, minimum safety zones are required to ensure the safety of working vessels and other shipping. These will be implemented based on consultation with MCA and local stakeholders (e.g. port and marina authorities).

14.1.0.4 It is expected that the safety zone applied for will be up to a 300m around construction activities and some construction vessels during the construction phase. For working vessels, the safety zones would only apply temporarily during activity on site when the vessels are restricted in manoeuvrability. This will be indicated on the vessels by their display of appropriate marks and lights, and by the vessels updating their navigational status on AIS

14.1.0.5 To minimise any impacts, procedures will be in place to ensure that working vessels do not restrict passing traffic and local vessels when not actively engaged in working on the construction site. If it is not practicable for the working vessel to depart from the construction site in between operations, the vessel would use appropriate day marks and lights, and update its status on AIS.This would indicate to passing vessels that the

vessels were not restricted in manoeuvrability and hence any safety zone would not be operational at that time.

14.1.0.6 During construction activity, information will be circulated to local stakeholders to ensure that they are kept informed of the activity on a day-to-day basis. This will be achieved by setting up a contact list for distributing this information. Various measures area available and will be used as appropriate:

a) Navtex (navigational telex);

b) Notices to Mariners;

c) Coastguard Marine Safety Information broadcasts;

d) Fishermen's awareness charts (issued by Kingfisher Information Services);

e) Updated Sailing Directions; and

f) Port Notices and Liaison with Harbour Masters.

14.1.0.7 The proliferation of AtoN will be avoided by consulting with THLS in relation to those currently used within the Bay, for both the temporary AtoN during the construction phase and the permanent AtoN during the operational phase of the Project.

15.0 Residual impacts

15.0.0.1 This section presents the residual impacts following implementation of mitigation measures for significant impacts on shipping and navigation identified for the construction (Table 15.1), operational and decommissioning (Table 15.2) phases of the Project.

15.0.0.2 It is worth noting that some residual impacts remain unchanged from the initially assessed impact. While this may appear to offer no actual change to the impact through mitigation, in actual fact the impact is reduced and made safer by the mitigation measures. But the residual impact is still assessed as having an impact that, when measured by the sensitivity and magnitude matrixes, warrants classification within the result it previously held. So while the impact is safer by a number of degrees, it may still be classified at the same level.

Table 15.1 Residual impact construction

Impact	Impact significance pre mitigation	Mitigation	Residual impact
Increased vessel to vessel collision risk - with work vessels or with displaced vessels	Minor adverse	Additional Aids to Navigation (AtoN), work procedures and planning with respect to other users in the Bay, promulgation of information Notice to Mariners (NtoM), guard vessel; appropriate safety zones during construction.	Minor adverse (Unchanged)
Increased vessel to structure allision risk	Major to moderate adverse	Additional AtoN, promulgation of information, appropriate safety zones, dolphin piles and floating boom around temporary cofferdam, guard vessel on site during construction.	Minor adverse
Displacement of pilot vessels/tugs	Major adverse	Maintain access to Ports along navigation channels. Move pilot boarding station further south in consultation with relevant harbour authorities to increase distance between pilot boarding station and Lagoon seawall.	Minor adverse
Impact of increased lights during construction	Minor adverse	Work procedure and vessel planning to ensure spurious lighting is shielded from approaching vessel, promulgation of information	Minor adverse

Table 15.2 Residual impact operation and decommissioning (removal of turbines/sluice gates)

Impact	Impact significance pre-mitigation	Mitigation	Residual Impact
Increased vessel to vessel collision risk	Minor adverse	Promulgation of information, works vessel co-ordination and guard vessels during any offshore maintenance works.	Minor adverse (unchanged)
Increased vessel to structure allision risk	Moderate to minor adverse	Positioning of Lagoon seawalls in agreement with Port Authorities. Lighting and marking of Lagoon, promulgation of information, additional AtoN, development of procedures for adverse weather, safety zone around turbine/ sluice gate housing, dolphin piles and floating boom around outside of turbine/ sluice gate housing, floating boom inside Lagoon around turbine/sluice gate housing, additional maintenance dredging of channels where necessary.	Moderate to minor adverse (unchanged)
Increased vessel to structure allision risk for recreational vessels	Minor adverse	Positioning of Lagoon seawalls in agreement with Port Authorities. Lighting and marking of Lagoon, promulgation of information, safety zones around turbine/sluice gate structure, dolphin piles and floating boom around outside of turbine/ sluice gate housing, floating boom inside Lagoon around turbine/sluice gate housing coordination with event organiser to ensure site support vessels during busy periods (e.g. sporting events).	Minor adverse (unchanged)
Change to transit routes for fishing vessels	Minor adverse	Promulgation of information to specific receptors.	Minor adverse (Unchanged)
Change to transit routes for recreation vessels	Minor adverse	Promulgation of information to specific receptors.	Minor adverse (Unchanged)
Impact on persons in the water after falling from vessel	Major to moderate adverse	a. Access and boat platform outside turbine safety zone, with inside the lagoon wall a jetty/floating pontoon and steps b. Marked exclusion area around turbines (floating boom inside Lagoon, dolphin piles and floating boom outside Lagoon) c. Extensive promulgation of information d. Additional aids to navigation e. Develop emergency shutdown procedure for turbines, from manned facility on turbine housing f. Quick response time for shutting down turbines g. Coordination with event organiser to ensure site support vessels	Minor adverse

Impact	Impact significance pre-mitigation	Mitigation	Residual Impact
		during busy periods (e.g. sporting events); h. Enforcement of wearing lifejackets for relevant activities within the Lagoon.	
Impact on navigable water depth - silting in channels or within Lagoon boundary because of a change in current patterns	Moderate to minor adverse	maintenance dredging in channel and lagoon when required, hydrographic surveys, promulgation of information about any water depth changes	Insignificant
Impact on vessel navigation due to wave reflection.	Moderate to minor adverse	The walls of the lagoon have been designed with an appropriate reflection coefficient to minimise wave reflection	Minor adverse to minor beneficial
Impact on search and rescue operations and vessels emergency plans	Major to moderate adverse	Slipway within Lagoon, consultation with emergency responders, ERCoP, coordination with event organiser to ensure site support vessels during sporting events.	Minor adverse
Impact on pilot boarding station and displacement of pilot vessels/tugs	Major adverse	Move pilot boarding station slightly further south in consultation with relevant harbour authorities to increase distance between pilot boarding station and Lagoon seawall.	Minor adverse
Impact of Lagoon lighting during operation	Minor adverse	Lighting has been designed with consideration given to shipping and navigation.	Minor adverse (Unchanged)

16.0 Summary

16.0.0.1 In accordance with Maritime and Coastguard Agency practices, a NRA has been prepared and also a checklist for the satisfactory completion of the NRA which is presented within Appendix 14.3, Volume 3. All areas, as outlined by the MCA guidance, have been completed within the NRA.

16.0.0.2 This NRA presents the assessment carried out for the construction, operation and decommissioning phases of the Project on shipping and navigation receptors. The baseline environment concerning navigation and marine traffic within the Swansea Bay area has been determined using 56 days of AIS data (summer and winter) and 14 days of marine traffic survey, capturing AIS, radar and visual observation data. Relevant guidance and information published by industry bodies and stakeholders has also been reviewed.

16.0.0.3 The baseline environment information, including information provided by relevant stakeholders, has informed the identification of potential impacts concerning the Project.

16.0.0.4 Four impacts were identified for the construction phase and eleven impacts identified for the operation and decommissioning phases of the Project. The identification of mitigation measures, both those recommended by industry bodies and those enhanced by best practice are outlined in the assessment. Following implementation of appropriate mitigation, the residual impacts were reduced to one insignificant impact, thirteen minor adverse and one moderate to minor adverse (allision). This demonstrates that the application of mitigation measures would reduce impacts of the Project on navigation receptors to a level where the risk is acceptable for the fifteen impacts.

17.0 References

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