



Chapter 19.0

Navigation and Marine Transport

19.0 Navigation and Marine Transport

19.1 Overview of existing situation

19.1.1 Overview of Commercial Shipping Activity

- 19.1.1.1 The Bristol Channel and Severn Estuary is an important shipping area with large ships from national and international destinations using the estuary's ports and anchorages. The wider study area (as defined by the extent of Figure 19.1) is home to a number of significant commercial ports, in particular Bristol (Avonmouth and Royal Portbury Dock), Cardiff, Newport and Barry, with circa 8 smaller ports including Bristol City Docks and Bridgwater. Collectively these ports are an important part of the regional and national economy; in 2013 they handled around 15.5 million tonnes of cargo. This represents approximately 4% of the UK total (DfT, 2014).
- 19.1.1.2 Commercial vessels enter the Severn Estuary from the south-west via the deep water approaches in the Bristol Channel. Those bound for Cardiff navigate to the northwest of Flat Holm whilst those transiting to Newport, Bristol or locations up-estuary of the Severn Bridge crossings take the deep water channel between Flat Holm and Steep Holm (Figure 19.2). Vessels bound for Newport usually transit north of Flat Holm and south of Monkstone, then transit towards the Newport Channel. Vessels bound for Bristol and Sharpness navigate through the Bristol Deep and King Road channels, with vessels continuing to Sharpness on the tidal River Severn (STP, 2010).
- 19.1.1.3 Port access is tidally restricted, with water levels at Bristol, Newport, Cardiff and Barry controlled by lock gates. Navigation to the ports is typically governed by the state of the tide with lock gates to the ports generally only operated for a number of hours on either side of the high tide, for example, ABP South Wales ports operate within an 8 hour tidal window (i.e. 4 hours either side of high tide).
- 19.1.1.4 The latest ship movement data collated by the Department for Transport (DfT) from port data submissions (for 2013) indicates that together the main ports in the study area (i.e. Bristol, Cardiff, Newport and Barry) received approximately 3,800 commercial vessels, with combined daily averages ranging between approximately 7 and 15 vessels (DfT, 2014). Pilotage to the main commercial ports within the estuary is compulsory for the majority of large vessels (defined as vessels of 85 m Length Overall (LOA)), with pilots generally boarding in an area located to the south west of Barry (Figure 19.1).
- 19.1.1.5 Other important commercial vessel activities include MW Marine Ferry Services (based in Weston-Super-Mare) which currently transports around 1,000 passengers a year between Weston-Super-Mare, Cardiff and Flat Holm Island. There is also a well-established charter angling sector operating within the inner

Bristol Channel. Waverley Excursions Limited operates the historic paddle steamer 'Waverley' in the Bristol Channel in the summer months.

19.1.1.6 The operation of the ports requires regular survey and dredging of navigation channels to allow access of the largest ships (draught up to 14.5 m) to pass through the locks. Material dredge for navigation purposes through maintenance dredging is disposed of locally at licensed disposal sites within the Severn Estuary system (Figure 19.3). Vessel movements associated with dredge activity form part of the navigational baseline. In 2012, the total amount dredged by the ports was approximately 1.5 million tonnes although the long-term annual average is approximately 3.3 million tonnes (Cefas, 2013). In addition, a range of dredging vessels operate in licensed marine aggregate areas located within, and adjacent to the study area (Figure 19.3).

19.1.2 Overview of Harbour Authorities

19.1.2.1 Statutory Harbour Authorities have a range of duties, roles and responsibilities within their jurisdictional area; typically this includes marine safety, managing marine traffic, Aids to Navigation, moorings, anchorage areas and maintaining channel depth. In addition, some harbour authorities also have Competent Harbour Authority status which relates to the provision of pilotage services.

19.1.2.2 The Statutory Harbour Authority areas for the principal Harbour Authorities are shown in Figure 19.1. In summary, these are:

- i. The Bristol Port Company is the Authority for the eastern side of the Severn Estuary from Avonmouth to the island of Steep Holm and up the tidal River Avon to Bristol;
- ii. Associated British Ports (ABP) is the Statutory Harbour Authority, Competent Harbour Authority and Local Lighthouse Authority for the ports of Barry, Cardiff and Newport. ABP has jurisdiction immediately to the south and southwest from the Port of Barry; to the south of the Port of Cardiff and immediately seaward of the Port of Newport. In summary, this equates to an area of responsibility from Lundy in the west, to Goldcliff in the east. It is noted that the potential alignment of the Project passes through the limits of ABP Cardiff;
- iii. Gloucester Harbour Trustees is the Statutory and the Competent Harbour Authority for the tidal River Severn downstream of the weirs at Maisemore to Goldcliff;
- iv. Sedgemoor District Council acts as the Competent Harbour Authority for the Port of Bridgwater. It has jurisdiction within Bridgwater Bay and along the southern margin of Weston Bay, into the River Axe; and

- v. Newport Harbour Commissioners is the Statutory and the Competent Harbour Authority for Newport Harbour. The main duties and responsibilities of the Commissioners, are the provision and maintenance of navigation aids and generally to ensure the safety of navigation within the Newport Harbour. They are also responsible for the provision of Pilotage, currently under a joint arrangement with ABP. Since 1 February 2005, ABP carry out the functions of Harbour Master (NHC, 2014). It is noted that the potential alignment of the Project passes through the limits of the Newport Harbour Commissioners.

19.1.2.3 The location of the Project therefore lies partially within the Port of Cardiff and Newport Harbour Commissioners Harbour Limits.

19.1.3 Overview of Port Activity

19.1.3.1 The Port of Bristol is the largest port facility in the Bristol Channel and comprises Avonmouth and Royal Portbury Docks which together consist of 35 berths. The port is owned by The Bristol Port Company and handles a range of cargoes including forest products, containers, motor vehicles, metals and steel, fresh products and bulk cargo including coal, animal feeds, grain and liquids (Ship Technology, 2014). In 2013, the port handled approximately 10.6 million tonnes of cargo with dry and liquid bulk comprising the majority (85%) of handled freight (DfT, 2014). A naturally deep navigational channel enables deep draught vessels to reach Portishead Point at most states of the tide with localised dredging in the port entrance providing access for deep draught vessels throughout some 70% of the tidal cycle. The harbour and its operations are designed to accept Capesize vessels of up to 130,000 Deadweight Tonnage (DWT). However, The Bristol Port Company is planning to build a £600m Deep Sea Container Terminal (DSCT) at Avonmouth Dock. The DSCT will handle large container vessels and next-generation ultra large container ships with a draught of up to 16 m and a capacity in excess of 150,000 DWT.

19.1.3.2 The commercial docks at Barry, Newport and Cardiff are owned by ABP. The largest of these facilities (in terms of freight handled) is Newport which has a typical annual tonnage of around 2.5 million tonnes (DfT, 2014). The variety of cargoes handled at Newport includes fresh produce, forest products, general cargo, steel and various dry bulk commodities. Newport can accept vessels of up to 40,000 DWT at its deep water berths; the limits on vessel size are 244 m length, 30.1 m beam and 10.4 m draught (ABP 2014a).

19.1.3.3 Cardiff typically handles around 2 million tonnes of freight annually. Principal cargoes include fresh produce, liquid bulks, forest products and steel. Cardiff is also home to ABP's Cardiff Container Line, which offers two sailings a week of containerised cargoes to Warrenpoint in Northern Ireland. The container terminal also handles a weekly service to East and West Mediterranean countries. The port can accept vessels up to 35,000 DWT with limits of 198 m length, 27 m beam and 10 m draught (ABP, 2014b).

- 19.1.3.4 The Port of Barry is located nine miles to the west of Cardiff and is a key facility for the region's chemical industry via the handling of liquid bulks. A total freight tonnage of 266,000 tonnes was handled in 2013 (ABP, 2014c; DfT, 2014). The maximum size of vessel accepted is 23,000 DWT with limits of 178 m length, 23.8 m beam and 9.0 m draught (ABP, 2014c).
- 19.1.3.5 The Port of Bridgwater has a typical annual tonnage of around 40,000 tonnes (DfT, 2014). The Port is used mainly for the landing of aggregates and dry bulks. Very occasionally it plays an important strategic role in the transport of heavy loads for Hinkley Point Power Station (Sedgemoor District Council, 2014).

19.1.4 Overview of Fishing Vessel Navigation

- 19.1.4.1** The Severn Estuary and Bristol Channel fish community comprises over 100 recorded species of fish, including a number of internationally and nationally designated estuarine and migratory fish species. Further details of the fish present, including recreational and commercial fisheries are given in Chapter 13 Fish, including Recreational and Commercial Fisheries. In the vicinity of the Project, recreational angling accounts for almost all fishing with anecdotal evidence suggesting that the commercial fishery operating out of Cardiff collapsed around the turn of the century (circa 2000). However, there is a thriving charter angling sector based in Cardiff Bay with approximately 15 charter boat operators using the area. It is unknown at this stage whether these charter boats operate within the footprint of the lagoon.

Overview of Recreational Vessel Navigation

- 19.1.4.2 A range of recreational boating activities take place in the vicinity of the Project including keel boat racing/cruising, motor boating and dinghy sailing. Many of these activities are formally carried out through Royal Yachting Association (RYA) training centres and yacht/sailing clubs, of which there are several located in the study area. These include Cardiff Bay Yacht Club, Cardiff Yacht Club, Penarth Yacht Club, Newport and Uskmouth Sailing Club, Rhymney River Motor Boat Sail and Angling Club, Clevedon Sailing Club and Portishead Yachting and Sailing Club. The proposed location of the Project lies within or near to known boating areas and sail cruising routes (Thomson, 2007). For principal routes and areas, see Figure 19.4.
- 19.1.4.3 By far the largest concentration of pleasure craft within the study area are found in Cardiff Bay, within the area impounded by the Cardiff Bay Barrage. In total, approximately 1,200 berths are available, with Cardiff Bay Yacht Club (500 berths), Cardiff Marina (350 berths) and Penarth Marina (340 berths) the primary locations for vessel mooring. Other large marinas in the area include Bristol (450 berths) and Portishead (250 berths).
- 19.1.4.4 Maritime search and rescue within the study area is carried out by the Royal National Lifeboat Institute (RNLI), Her Majesty's Coastguard and the Severn Area Rescue Association (SARA). The location of stations is shown in Figure 19.3. Other

uses of the sea area within the wider study area include military exercises and firing ranges; a dedicated firing range is located in Bridgwater Bay and further area is located down-estuary of the Severn Bridge crossing (see Figure 19.3).

19.2 Scope of potential impact to be assessed

19.2.0.1 The EIA will identify and assess the degree of the potential impact during all phases of the Project including construction, operational and decommissioning. The wider study area (see Figure 19.1) provides a context for the Navigational chapter. With respect to the Navigational Risk Assessments (NRAs) and supporting marine traffic survey, a detailed study area will be evaluated covering the footprint of the tidal lagoon and a sea area from Lavernock Point to the Port of Bristol. The EIA will assess potential impacts on the following receptors:

- i. Commercial shipping, including ferry activity, into the study area ports;
- ii. Maritime search and rescue;
- iii. Dredging and aggregate operations;
- iv. Other marine operations e.g. military use, access to any offshore facilities (e.g. outfalls, intakes);
- v. Fishing vessel navigation; and
- vi. Recreational vessel navigation.

19.2.0.2 A series of preliminary scoping meetings have already been held with key stakeholders. During these meetings a number of potential issues were identified. Key issues which the EIA process will need to evaluate are summarised below. These can be divided into 'direct' and 'indirect' impacts:

Direct Impacts

- i. Increased transit times due to the physical presence of structures. There are three distinct themes to consider:
 - a. Tugs used at the Port of Cardiff are also used at the Port of Newport and other ABP South Wales ports, such as Barry and Swansea. ABP South Wales is run as a business unit administered from Cardiff. Tugs servicing the ABP South Wales ports will move along the coast in the vicinity of Cardiff and Newport as shown in Figure 19.2. If the coastal route is relocated further offshore as a result of the Project, the increased journey times will have an impact on port procedures and resources, particularly as these journeys are often constrained by the operational tidal regimes at each Port.
 - b. Vessels with shallow draughts pass to the north of Monkstone Lighthouse to save time on inward and outward bound voyages to and from Newport (Figure 19.2). The Project would impede this route.

- c. Transit times to spoil grounds will require evaluation, especially in the case of the Cardiff Grounds disposal site which will be enclosed by the Project, thereby making it unviable. Similar consideration will be required for aggregate dredgers although this element is being considered separately within Chapter 24 Socio-economics.
- ii. Increase in collision risk due to reduced sea area and space for manoeuvring. This is especially relevant (i) during the construction phase where construction craft will be operating and submerged infrastructure will be present; and (ii) for recreational navigation which currently transits outside of shipping routes. This will include an assessment of the increase in risk during restricted visibility (i.e., fog).
- iii. Contact risk between vessels and the physical presence of structures. This is particularly relevant for vessels transiting along the Cardiff navigational channel as the Project is leeward (downwind) with respect to the prevailing wind direction.
- iv. Explosive anchorages (i.e. locations where vessels with explosives on board can anchor safely, which is an activity licensed by the Health and Safety Executive's (HSE) Explosives Inspectorate). The footprint of the Project may impinge upon the nominated explosive anchorages to the south of Newport (see Figure 19.3).
- v. Recreational concerns. The footprint of the Project overlaps with established racing areas and cruising grounds (see Thomson, 2007). This may potentially have socio-economic consequences. (Potential socio-economic impacts will be informed by outcomes from the navigation assessment but will be considered in a separate EIA chapter (Chapter 24 Socio-economics)).
- vi. Light pollution (background light levels). The potential effects of lighting lagoon structures on navigation.

Indirect Impacts

- i. Lagoon inflow and outflow close to the turbines. This could have an effect upon the directional stability of passing vessels and potentially those using lock gates. This is particularly relevant for small vessels and recreational craft.
- ii. Tidal range. Evaluation of the effect of tidal changes to lock gate operation. Vessels unable to lock in may not be able to return to deep water and ground in the approach channels. Changes in tidal range may also affect the risk of grounding.
- iii. Tidal speed and direction. This may affect ship manoeuvring and pilotage, including room for manoeuvre in tidal conditions; vessels at anchor waiting for a clear lock; in an abort situation; or suffering a navigational emergency.

- iv. Wave reflection. This may affect ship manoeuvring in the vicinity of the lagoon seawalls.
- v. Sediment deposits. Consideration will need to be given to potential changes in long-term siltation patterns caused by the Project. The EIA will assess how this could affect navigational requirement through maintaining navigable depths and subsequent changes to maintenance dredge requirements/disposal operations.
- vi. Height and shape of the lagoon. Evaluation of any effects on radar, including radar reflection causing second trace echoes or the Project masking smaller vessels which will increase marine risk.
- vii. Locks in the lagoon. Small craft using these locks wishing to access the Rhymney River may present an obstruction to other vessels navigating in the area. This could impede the safe navigation of passing vessels.
- viii. Sheltered anchorage. Cardiff Pool, to the south of Cardiff, is a sheltered anchorage used by vessels which cannot anchor off Barry in strong South Westerly winds. The Project is close to the limits of this anchorage area.
- ix. Effects on aids to navigation. Buoyage is currently based upon existing deep water channels; new buoyage will need installing. Existing fixed aids to navigation may need to be moved or changed in character to accommodate new navigation channels.

19.2.0.3 The cumulative effects of the Project together with other projects will also be considered. Potential cumulative projects are listed in Chapter 3 Structure of the Environmental Statement and of particular importance to navigation will include Bristol Port's plans to develop a new deep sea container terminal (DSCT) at Avonmouth; the proposed tidal lagoon in Swansea Bay and the proposed Longbay Seapower West Somerset lagoon.

19.2.0.4 Cumulative effects will be considered through an evaluation of each individual scheme, in relation to commercial shipping and recreational navigational activities. The cumulative assessment will consider the degree of the combined impact(s) during all phases of the Project development including construction, operation and decommissioning.

19.3 Existing baseline data, consultation and need for survey

19.3.0.1 Key information on navigation and marine transport within the study area will be collected through consultation with local stakeholders. These include:

Table 19.1 Navigation consultees

Port Operators and Harbour Authorities		
The Bristol Port Company Associated British Ports (Newport, Cardiff and Barry)	Cardiff Harbour Authority Newport Harbour Commissioners Gloucester Harbour Trustees Bristol City Council	Sedgemoor District Council (Port of Bridgwater) Canal & River Trust (Sharpness Port Authority)
Commercial Marine Interests		
British Marine Aggregate Producers Association (BMAPA), Lafarge Tarmac and Severn Sands	MW Marine (Weston Ferry) Fishing (Welsh Assembly Government, Inshore Fisheries and Conservation Authorities)	Penarth Quays Marina Cardiff Bay Marina Bristol Marina. Portishead Quays Marina
Organisations Associated with Navigation and Safety		
Maritime and Coastguard Agency (MCA) Royal National Lifeboat Institution (RNLI)	Trinity House The Severn Area Rescue Association (SARA)	Her Majesty's Coastguard (HM Coastguard)
Recreational User Groups		
The Royal Yachting Association (RYA) Bristol Channel Yachting Association The Welsh Yachting Association (RYA Cymru Wales) Cardiff Bay Yacht Club Cardiff Yacht Club Chepstow and District Yacht Club Chepstow Boat Club Cabot Cruising Club	Newport and Uskmouth Sailing Club Penarth Yacht Club Lydney Yacht Club Thornbury Sailing Club Shirehampton Sailing Club Portishead Cruising Club Bristol City Harbour Office Bristol Avon Sailing Club Bristol Cruising Club	Rhymney River Motor Boat Sail and Angling Club Portishead Yachting and Sailing Club Canoe Wales Weston Bay Yacht Club Burnham Sailing Club Watchet Harbour Marina Clevedon Sailing Club

19.3.0.2 This information will be augmented by public domain datasets e.g. Department for Transport (DfT) shipping and port statistics and MCA Automatic Identification System (AIS) data, provided through planning authorities (for example, the Marine Management Organisation) providing key information regarding:

- i. Number of ship/port calls;
- ii. Vessel type and draughts;
- iii. Vessel transit tracks; and
- iv. Vessel voyage information (including port of origin and destination).

19.3.0.3 Data on existing dredging activities for port access channels, frequency and quality of sediments will be requested from The Bristol Port Company, ABP (for Cardiff, Newport and Barry) and from Cardiff Harbour Authority (who also dredge the seaward approach channel to Cardiff Bay Barrage at least once a year). Data will also be requested from the aggregate companies (including those listed in Table

19.1) regarding the nature of vessel movements to, at and from aggregate licence areas.

19.3.0.4 Marine accident-incident statistics are required for the NRAs. This information will be collected from the Marine Accident Investigation Branch (MAIB), the RNLI, SARA, and the local Harbour Authorities.

19.3.0.5 The MCA guidance note '*Offshore Renewable Energy Installations (OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response Issues*' Marine Guidance Note (MGN) 371 (M+F) advises that: "An up to date traffic survey of the area should be undertaken within 12 months prior to submission of the Environmental Statement" (MCA, 2008a). Accordingly, the following surveys will be carried out covering the detailed study area:

- i. An AIS survey of at least 42 days, covering selected weeks to characterise annual movements. This data will be up-scaled to create a dataset covering a one-year period; and
- ii. A Radar survey, covering a winter and summer period.

19.4 Proposed assessment methodology

Navigational Risk Assessments

19.4.0.1 A set of NRAs will be undertaken to evaluate the Project and its effects. These assessments will be prepared using industry best practice and nationally accepted standards for the production of such assessments including:

- i. Section 4 of the '*Guide to Good Practice on Port Marine Operations, prepared in conjunction with the Port Marine Safety Code (PMSC)*' providing guidance on Risk Assessment type and content (DfT, 2013);
- ii. International Maritime Organization (IMO) Formal Safety Assessment processes (IMO, 2013); and
- iii. Industry best practice on Marine Navigational Risk Assessment applying the principles of 'As Low As Reasonably Practicable' (ALARP).

19.4.0.2 The NRAs will also take into account guidance provided in the:

- i. MCA guidance document MGN 371 (M+F), '*Offshore Renewable Energy Installations (OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response Issues*' (MCA, 2008a); and
- ii. '*Offshore Renewable Energy Installations (OREIs) - Guidance to Mariners operating in the vicinity of UK OREIs*' MCA, 2008b.

- 19.4.0.3 The assessments will involve ongoing consultation with stakeholders; this will include hazard identification and risk assessment workshops. This will be particularly important for Harbour Authorities who have to discharge their statutory obligations in respect of managing marine risk, pilotage and aids to navigation through the phases of the Project.
- 19.4.0.4 The assessment will draw upon findings from other topics, most notably Chapter 8 Coastal Processes, Sediment Transport and Contamination. This chapter will provide details of possible environmental changes within the study area (including potential changes to water levels, flow velocity, sediment transport and morphological evolution of the coast and seabed). Findings from the Navigation and Marine Transport topic will also help inform the assessment of potential Socio-economic impacts in Chapter 24 Socio-economics, arising from any changes to commercial fishing and marine aggregate operations, as well as recreation/tourism (specifically sailing/ boating activities).
- 19.4.0.5 If required, hydrodynamic ship simulation studies will be undertaken, in consultation with stakeholders, to evaluate if changes in the physical environment will adversely affect shipping.

Environmental Impact Assessment

- 19.4.0.6 Following the completion of the NRA, an evaluation of the significance of potential impacts identified will be undertaken based on the following methodology.

Significance criteria

- 19.4.0.7 Impacts on shipping and navigation receptors, formulated during the NRA process, will be assessed during the EIA using a consistent scale of sensitivity and magnitude, as described in the following sections.

Sensitivity

- 19.4.0.8 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 will use the following sources, information gathered during the NRA, and applied expert opinion to define the sensitivity of a receptor:
- i. Outputs of the hazard workshops;
 - ii. Level of stakeholder concern;
 - iii. Number of transits of specific vessel and/or vessel type; and
 - iv. Lessons learnt from existing renewable energy developments.

19.4.0.9 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. The sensitivity is then used in the significance matrix to define the impact significance.

19.4.0.10 Table 19.2 presents the definitions of sensitivity that are proposed for the assessment.

Table 19.2 Sensitivity Criteria for Shipping and Navigation

Sensitivity	Definition
Very High	<ul style="list-style-type: none"> • Very high level of safety impact for shipping and navigation receptors • Very limited ability to adapt to impact
High	<ul style="list-style-type: none"> • High level of safety impact for shipping and navigation receptors • Limited ability to adapt to impact
Medium	<ul style="list-style-type: none"> • Medium level of safety impact for shipping and navigation receptors • Some ability to adapt to impact
Low	<ul style="list-style-type: none"> • Low level of safety impact for shipping and navigation receptors • Ability to adapt to majority of impact
Negligible	<ul style="list-style-type: none"> • Negligible level of safety impact for shipping and navigation receptors • Ability to adapt to all of impact
Neutral	<ul style="list-style-type: none"> • No impact for shipping and navigation receptors

Magnitude

19.4.0.11 Once a sensitivity is defined, an assessment is made of the magnitude of an effect, which is defined by geographical extent, frequency of occurrence and duration.

19.4.0.12 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:

- i. Consultation feedback from stakeholders;
- ii. Outputs of the hazard workshops in particular where ‘unacceptable’ ranked impacts were identified; and
- iii. Lessons learnt or research from previous renewable energy developments.

19.4.0.13 Table 19.3 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 19.3 Magnitude Criteria for Shipping and Navigation

Magnitude	Definition
Major Negative	<ul style="list-style-type: none"> Impact geographical area beyond the extent of Cardiff and Newport Impact present on a permanent basis throughout the operation of the Lagoon Impact occurs very frequently to constantly/permanently
Moderate Negative	<ul style="list-style-type: none"> Impact localised to geographical extent of Cardiff and Newport Impact present on a permanent basis throughout the operation of the Lagoon Impact occurs frequently
Minor Negative	<ul style="list-style-type: none"> Impact localised to geographical extent of Lagoon boundary Impact present on a temporary basis Impact relatively infrequent
Neutral	<ul style="list-style-type: none"> No impact on shipping and navigation receptors
Positive	<ul style="list-style-type: none"> Shipping and navigation receptors benefit as a result of the impact

Impact significance

- 19.4.0.14 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 19.4.

Table 19.4 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

- 19.4.0.15 This assessment of significance will assume that the following embedded mitigation measures are in place:
- i. Compliance with MGN 371 (MCA, 2008);
 - ii. Recommendations outlined IALA (International Association of Lighthouse Authorities) O-139 for lighting and marking (IALA, 2008) and consultation with Trinity House on lighting and marking for the development;
 - iii. Harbour Authority Marine-SMS, which includes plans and processes to manage marine emergencies; and
 - iv. Professional/trained mariners application of:
 - a) International Maritime Organisation conventions of Safety of Life and Sea;
 - b) International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW); and
 - c) International Regulations for Preventing Collisions at Sea (COLREGS), 1972.
- 19.4.0.16 Where possible, other appropriate mitigation measures will be incorporated into the design of the Project as embedded mitigation.
- 19.4.0.17 Following the assessment of significance of each impact (assuming embedded mitigation measures are in place), additional mitigation measures to further reduce the risk will be identified. Finally, the residual risk is stated.

19.5 References

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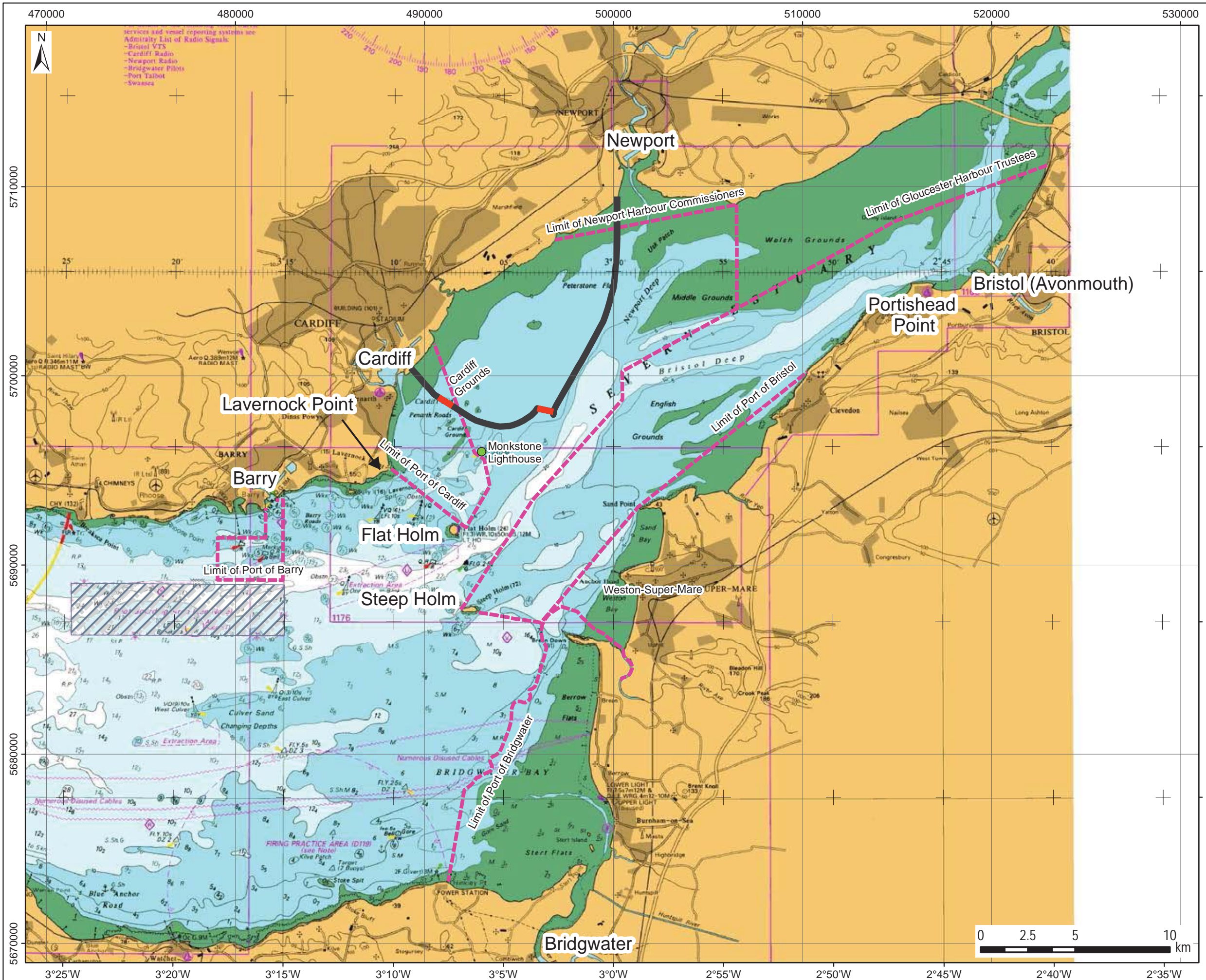
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Figures



- Proposed lagoon location
- Sluice & turbine locations
- Harbour Authority limits
- Pilot boarding area

Date	By	Size	Version
Feb 15	AJB	A4	1
Coordinate System	WGS 1984 UTM Zone 30N		
Projection	Transverse Mercator		
Scale	1:275,000		
QA	DRAFT		
001_Fig19.1_Location_Map.mxd			
Produced by ABPmer			



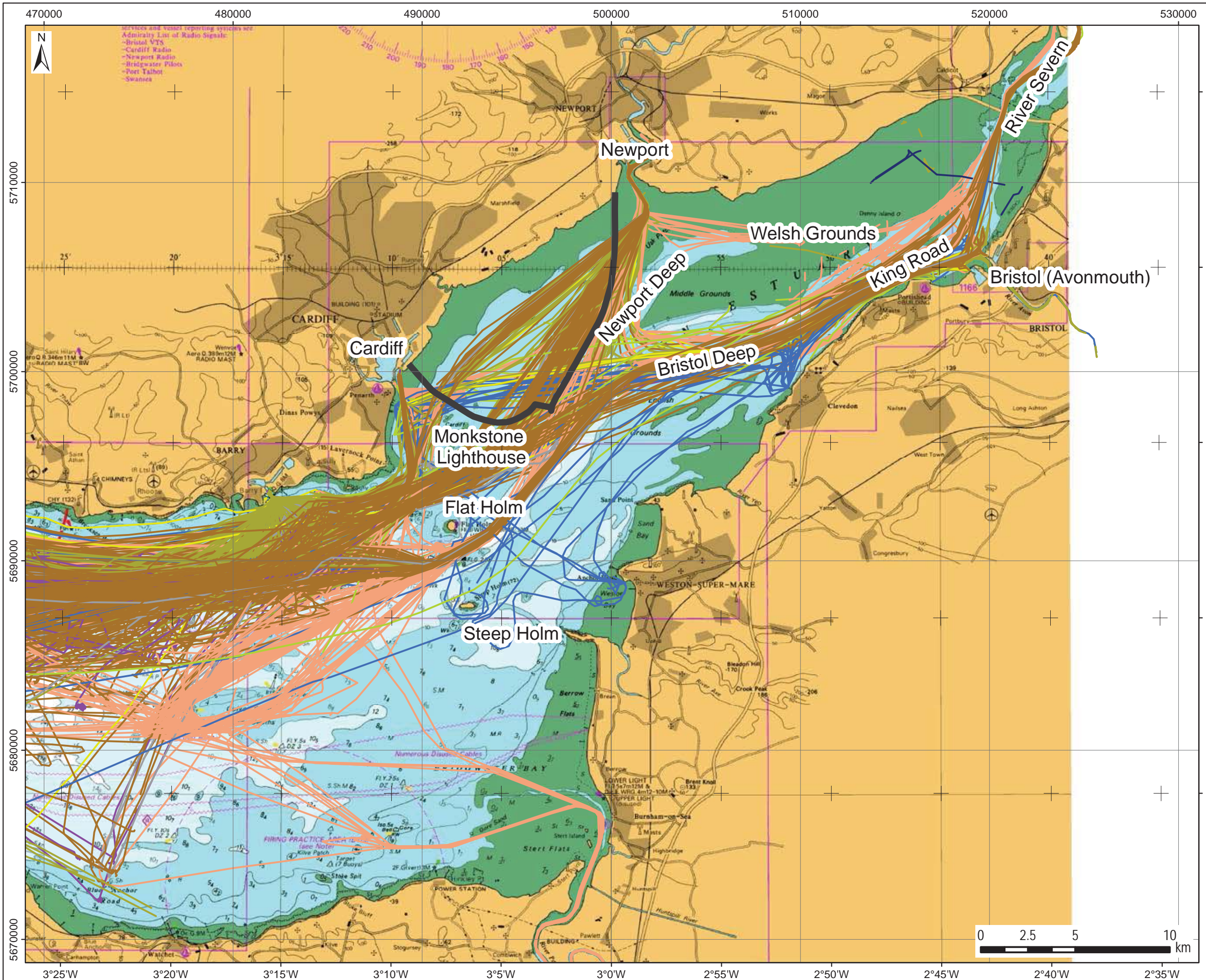
© ABPmer, All rights reserved, 2014
 [Data Sources and Licences]
 NOT TO BE USED FOR NAVIGATION



Study Area

Figure 19.1





- Proposed lagoon location
- AIS transit lines (2012)
- Unknown vessel type
- Non-port service craft
- Port service craft
- Dredging or underwater ops
- High speed craft
- Military or law enforcement
- Passenger vessels
- Cargo
- Tankers
- Fishing vessels
- Recreational vessels

Composite plot of 42 days of AIS-A and AIS-B data in 2012 for the following periods:
 3 - 9 Jan and 1 - 7 Mar, May, Jul, Sep and Nov 2012 (MMO, 2014).

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Date	By	Size	Version
Feb 15	AJB	A4	1
Coordinate System	WGS 1984 UTM Zone 30N		
Projection	Transverse Mercator		
Scale	1:40,000,000		
QA	DRAFT		
001_Fig19.2_MMO_Transit.mxd			
Produced by ABPmer			

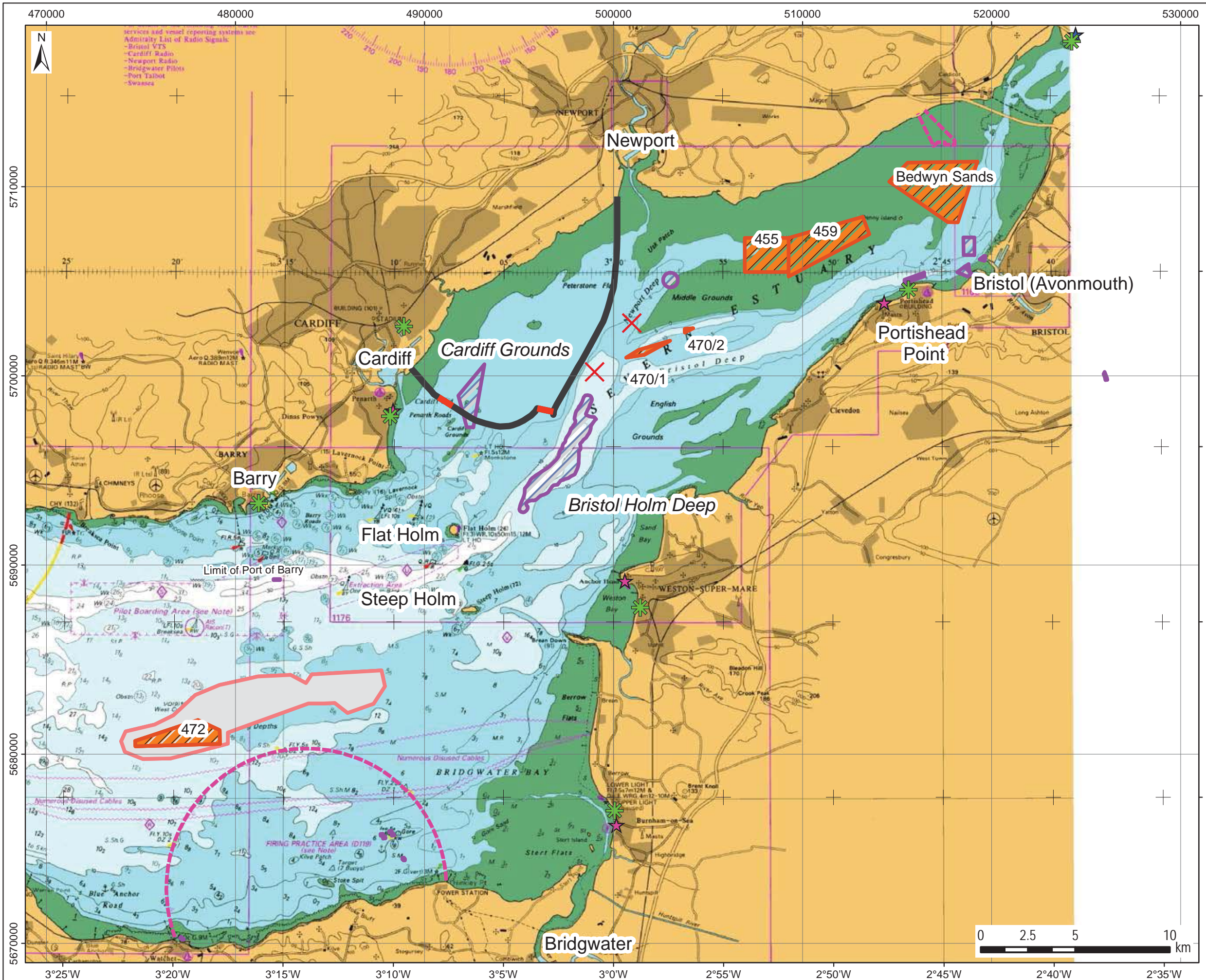


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Indicative Vessel Tracks

Figure 19.2



- Proposed lagoon location
- Sluice & turbine locations
- Firing practice area
- HM coastguard station
- RNLI lifeboat station
- SARA station
- Aggregate licence
- Aggregates option
- Dredge disposal site
- Explosives anchorage

Date	By	Size	Version
Feb 15	AJB	A4	1
Coordinate System		WGS 1984 UTM Zone 30N	
Projection		Transverse Mercator	
Scale		1:275,000	
QA		DRAFT	
001_Fig19.3_Other_Sea_Uses.mxd			
Produced by ABPmer			



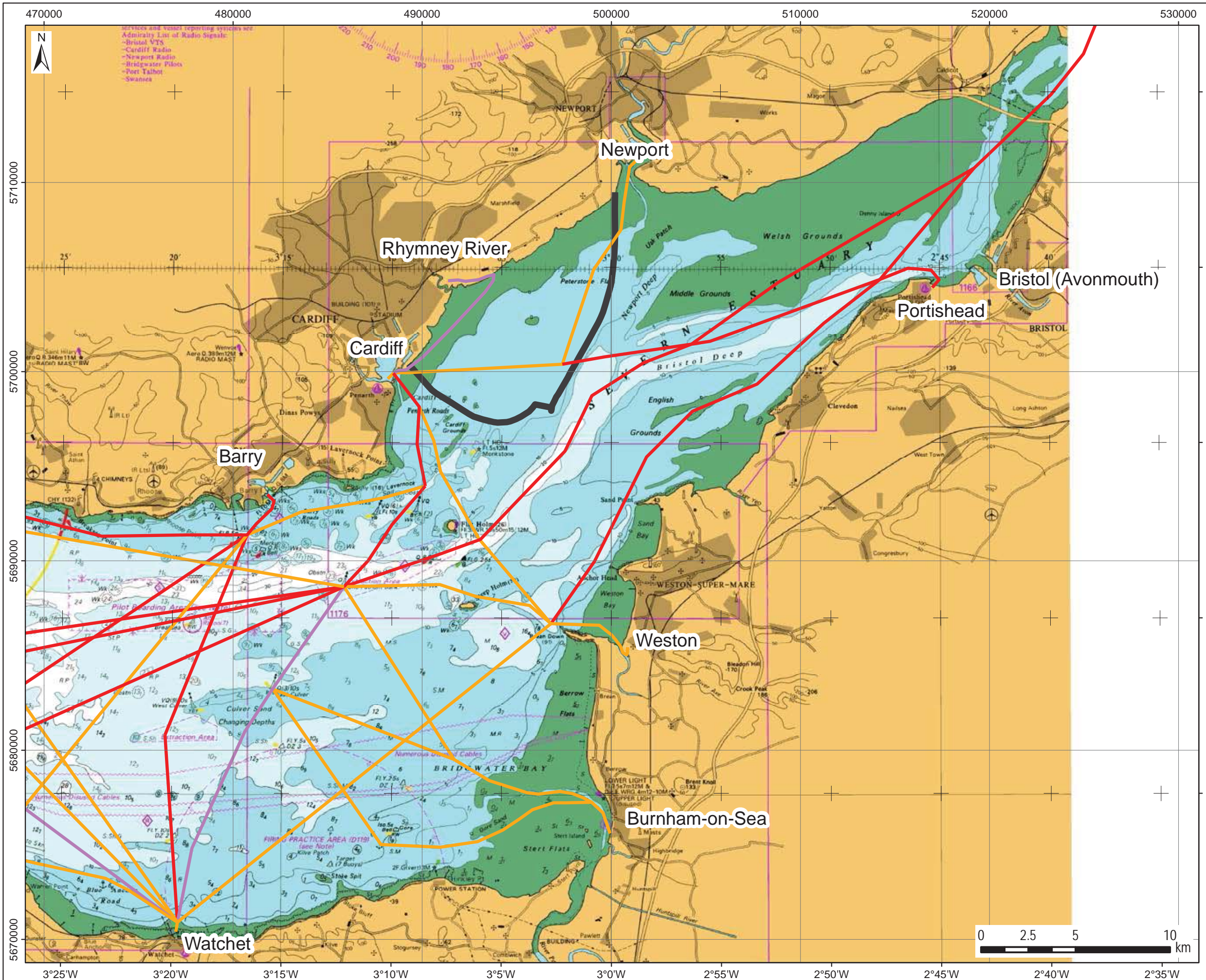
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Other Sea Uses



Figure 19.3



-  Proposed lagoon location
-  Heavy recreational use
-  Medium recreational use
-  Light recreational use

Date	By	Size	Version
Feb 15	AJB	A4	1
Coordinate System		WGS 1984 UTM Zone 30N	
Projection		Transverse Mercator	
Scale		1:40,000,000	
QA		DRAFT	
001_Fig19.4_RYA_Cruising.mxd			
Produced by ABPmer			



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Cruising Routes

Figure 19.4