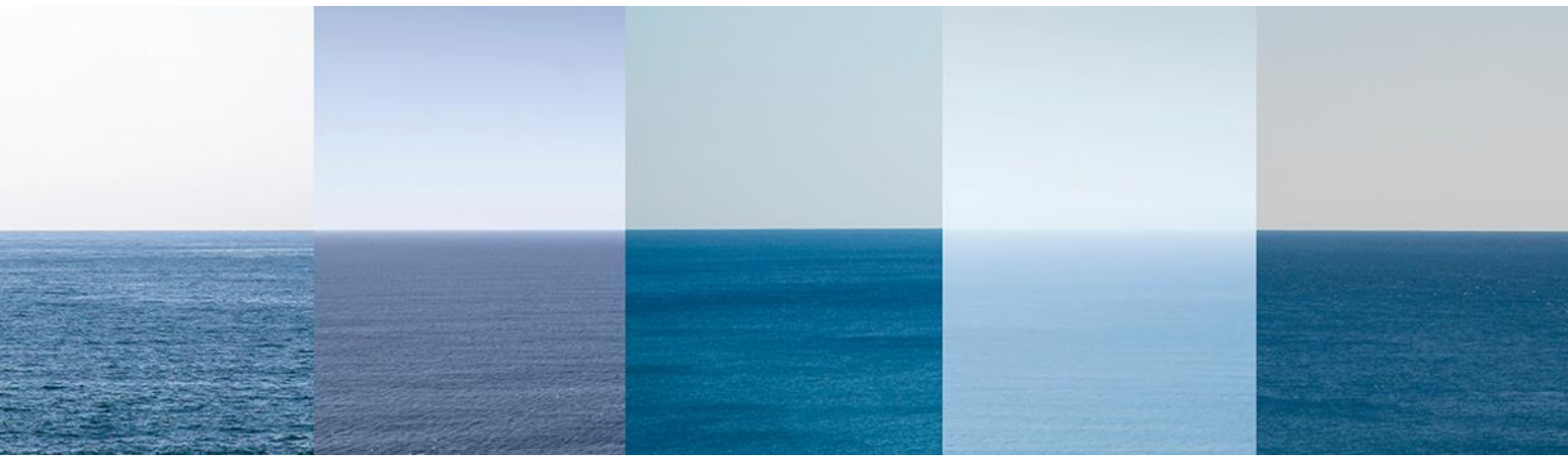

M4 Corridor around Newport

Navigation Risk Assessment

For Arcadis

GM-16-00052-476653

			Principal Mariner	**Senior Engineer**	**Principal Mariner**
DRAFT	13/12/2016	ISSUED FOR COMMENTS	GLOBAL MARITIME	GLOBAL MARITIME	GLOBAL MARITIME
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Rev	**Date**	**Document Status**	**Prepared by**	**Reviewed by**	**Approved by**

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1. SUMMARY

1.1.1 The Welsh Government proposes, as part of the M4 Corridor around Newport Project (from hereon in referred to as 'the Project' or 'the Scheme') to build a new section of motorway to the south of the city of Newport in South Wales.

1.1.2 The new section of motorway would run between Junction 29 at Castleton and Junction 23 at Magor. To the east of the Castleton, it would pass to the south of Duffryn before crossing the Rivers Ebbw and Usk to the south of the A48 at Newport Docks.

1.1.3 Global Maritime Consultancy (GMC) was instructed by the Welsh Government to assess the impact of the scheme to the users of the River Usk, River Ebbw and the Newport Docks. The assessment covers both the impact to navigation during the construction and operational phases of the scheme.

1.1.4 A navigation risk assessment (NRA) workshop was conducted on the 22nd November 2016. The workshop was attended by representatives from Newport Harbour Commissioners (NHC), Associated British Ports (ABP), the Royal Yachting Association (RYA), the Maritime and Coastguard Agency (MCA), SMS Towage, Hanson Aggregates and various members of the M4 CaN Project team.

1.1.5 In addition to the NRA workshop, separate meetings were held with Cargo Services (UK) Ltd. on 8th December 2016 and with the Corporation of Trinity House on 9th December 2016.

1.1.6 Newport Uskmouth Sailing Club (NUSC) were identified as a stakeholder and numerous attempts were made to invite them to the NRA workshop, however no response was received.

1.1.7 A HAZID (Hazard Identification) methodology was adopted for the assessment in line with the recommendations of the Port Marine Safety Code (PMSC) and associated guidance. The process allowed for a full and detailed discussion with stakeholders, in order to identify the areas of risk, assess the consequences of an event occurring as a result of the risk and to ensure that mitigations or actions are developed in order to reduce the risk. The overall aim was to ensure that all risks are acceptable and as low as reasonably practicable, in accordance with the ALARP principle.

1.1.8 During the construction of the crossings over the Ebbw, Usk and Newport Docks, the main risks to navigation were identified as follows:

1) Vessel collision with the bridges crossing the rivers Usk and Ebbw and Newport Docks
2) Collapse of bridge deck and/or a dropped bridge deck section
3) Other dropped objects (such as tools)
4) Pollution caused by the construction activities or floating debris
5) Congested navigation
6) Conflict with radio communications
7) Presence of background light from construction activities and/or road lighting
8) Congested Newport South dock during periods of restricted access to the North Dock

1.1.9 During the operational phase of the Scheme, the navigation risks were summarised as follows:

1) Vessel collision with the bridge
2) Dropped objects (such as tools) during maintenance activities
3) Pollution caused by maintenance activities and/or floating debris
4) Falling objects from the bridge
5) Congested Newport South Dock during periods of restricted vessel access to the North dock

1.1.10 The mitigation measures recommended for the construction and the operational phases of the Scheme are broadly defined under the following subheadings:

1) Promulgation of Marine Safety Information

- Navigation warnings and notices to mariners (NTMs) are to be promulgated to all river users in order to inform them of any construction activities and in particular periods when navigation will be restricted.
- Engagement by the project team with stakeholders, dock and river users in order to ensure that navigational warnings have been received and understood.
- Navigation lights to be installed on the river crossings, both upstream and downstream, in order to identify the best point of passage for mariners and river users.
- Safety signage to be in place on the river banks in order to warn river users of low bridge heights, the vertical clearance and identify best point of passage during the day.
- Major bridge maintenance works are to be communicated by Notices to Mariners and navigation warnings.

2) Vessel Traffic Management

- River access to be actively managed during deck launching/lifting over water, when restrictions on navigation may be imposed.
- Continual monitoring of traffic, with a guard vessel available in order to assist in enforcing any restrictions.
- Vessel movements and personnel access at Dallimore's Wharf, to be managed during bridge construction and maintenance operations.
- Small vessels using the River Ebbw are to be monitored by project personnel during construction and maintenance operations.
- No vessels and/or personnel are to be beneath a suspended load during any lifting operations.
- Tugs and small vessels presently berthing in the Newport North Dock in the vicinity of the 'Junction Cut' are to be relocated.

3) Management of Dropped Object Risk

- Dropped object prevention measures are to be implemented at the construction site and during maintenance works.
- Bridge design to include reasonable measures to prevent falling objects.
- Un-authorised access to be prevented by appropriate security controls.
- Dropped object recovery plan to be implemented.

- Mariners and stakeholders to be advised of any dropped objects and/or floating debris which may affect navigation.

4) Marine Safety Management Plan

- Develop interface document and a marine management plan to formalise interfaces, including the emergency primacy between parties.
- Clear communication plan between relevant parties during critical construction activities.

5) Pollution Control

- Construction Environmental Management Plan (CEMP) to include pollution containment procedures and good housekeeping practices.
- Harbour Authority Oil Pollution Preparedness and Response Plan (OPRC).
- Bridge maintenance manual to include pollution response procedures.

6) Direct Interference

- Consider interference of construction radio communications with vessel radio communications, dedicated channels to be in use.
- Construction site flood lighting equipment set-up to account for the possibility of impairing of mariners' night vision (i.e. positioning/direction of lighting).

2. INTRODUCTION

2.1 M4 Corridor around Newport

2.1.1 The Welsh Government (WG) proposes to build a new section of motorway to the south of the City of Newport in South Wales. The proposed scheme is referred to as the M4 Corridor around Newport (M4 CaN).

2.1.2 The proposed new section of motorway would run between Junction 29 at Castleton and Junction 23 at Magor. To the east of the Castleton junction, the proposed new section of motorway would depart from the route of the existing M4 motorway at Junction 29 and would pass to the south of Duffryn before crossing the Rivers Ebbw and Usk to the south of the A48 and across the 'Junction Cut' at Newport Docks.

2.1.3 The route for the proposed new section of motorway would cross the South Wales to London mainline railway to the south of Duffryn and to the west of Magor. In addition, the route would cross a number of existing highways, rights of way and private means of access. The proposed new section of motorway would also cross the River Usk, River Ebbw and Newport Docks at a point between the South Dock and the North Dock known as the 'Junction Cut' as can be seen in Figure 2-1.

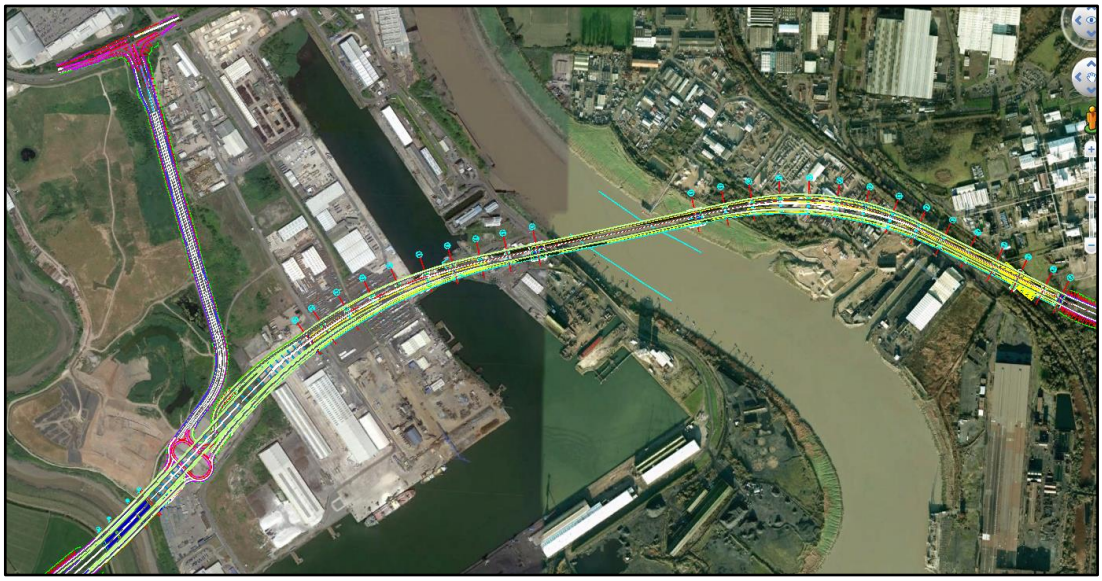

Figure 2-1 M4 Corridor - Usk, Ebbw and Newport docks crossing

2.1.4 Newport Docks, the rivers Ebbw and Usk are principally used by commercial vessels and recreational craft, therefore the Scheme may have an impact on the navigation of vessels using these waterways. Figure 2-2 shows an artist's impression of the proposed River Usk crossing.

Figure 2-2 Artists Impression of the River Usk Crossing

2.2 Scope of work

2.2.1 Global Maritime (GMC) was instructed by the Welsh Government (WG) in June 2016 to facilitate a formal risk assessment of the potential impact, in terms of navigation, that the proposed Scheme may have on users of the rivers Usk, Ebbw and Newport Docks.

2.3 Acronyms

ABP	Associated British Ports
ACD	Admiralty Chart Datum
ALARP	As Low as Reasonably Practicable
AOD	Above Ordnance Datum
CEMP	Construction Environmental Management Plan
CHA	Competent Harbour Authority
CSL	Cargo Services Ltd.
DWT	Dead Weight Tonne
GLA	General Lighthouse Authority

GMC	Global Maritime Consultancy
GTGP	Guide to Good Practice
HAZID	Hazard Identification
IALA	International Association to Marine Aids to Navigation and Lighthouse
IMO	International Maritime Organisation
LOA	Length Overall
LPS	Local Port Services
MCA	Maritime and Coastguard Agency
MHWS	Mean High Water Springs
M4 CaN	M4 Corridor Around Newport
NAASBA	Not Always Afloat but Safely Aground
NRA	Navigation Risk Assessment
NHC	Newport Harbour Commissioners
NUSC	Newport Uskmouth Sailing Club
NTMs	Notices to Mariners
OPRC	Oil Pollution Preparedness and Response Plan
PEC	Pilot Exemption Certificate
PMSC	Port Marine Safety Code
RMT	Risk Management Tool
RPS	RPS Group
RYA	Royal Yachting Association
SAR	Search and Rescue
SHA	Statutory Harbour Authority
UKHO	United Kingdom Hydrographic Office
VHF	Very High Frequency
WG	Welsh Government

3. SHIPPING ACTIVITY

3.1 Overview

3.1.1 Figure 3-1 below, shows the route for the proposed M4 motorway within the Newport area and shows the proposed crossing points over Newport Docks and the Usk. The plan also shows the active and disused berths on the river and operations presently active within the dock system.

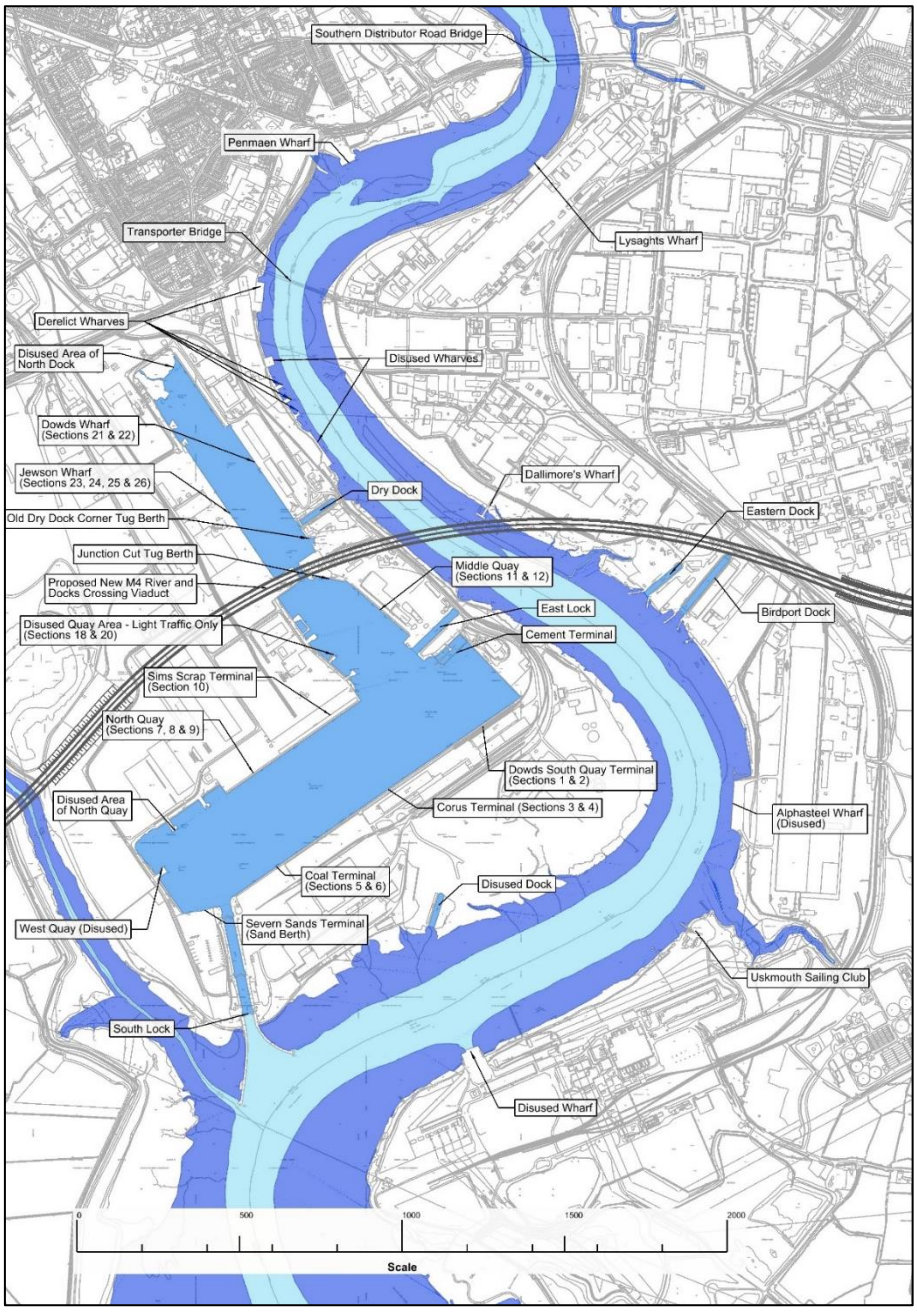

Figure 3-1 Rivers Ebbw and Usk and Newport Docks

3.2 River Usk

3.2.1 Marine traffic on the River Usk comprises of both commercial and recreational vessel activity.

3.2.2 The construction of the new Southern Distributor Road (SDR) Bridge over the River Usk upstream of Lysaght's Wharf (see Figure 3-1) has restricted the air draft clearance above the river channel. Therefore, the disused berths upstream of the SDR Bridge have not been considered for this risk assessment.

3.2.3 As can be seen in the Figure 3-1 above, the proposed crossing is to be located in close proximity to Dallimore's Wharf on the eastern side of the river Usk. Dallimore's wharf is situated up stream of the proposed bridge and is presently used to discharge aggregate cargoes. Lysaght's and Penmaen wharves are presently not in use.

3.2.4 A cable stay bridge has been designed to cross the River Usk, as shown in Figure 3-2 below. The design of the bridge is such that the bridge piers are outside the wetted channel. The minimum clearance taken from Mean High Water Springs (MHWS) level to the underside soffit of the bridge is 33.54 m.

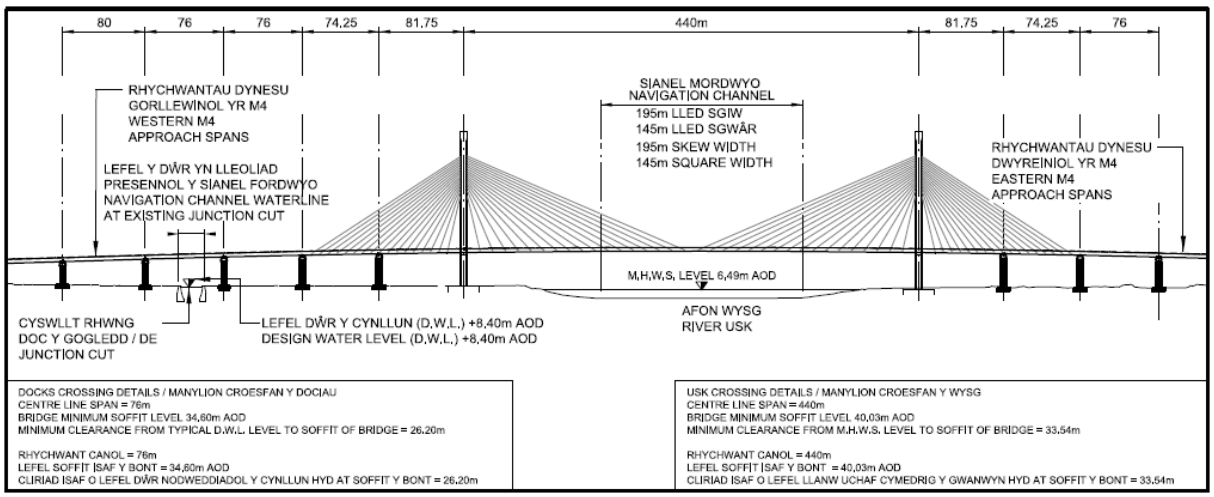

Figure 3-2 River Usk Crossing

3.3 ABP Newport Docks

3.3.1 Newport Docks are situated on the western side of the river Usk and comprise of the North and South docks as can be seen in Figure 3-3. The two docks are joined by the Junction Cut.

3.3.2 Newport Docks handle a wide variety cargo such as timber, bulk cargoes, agri-bulk cargoes, steel products, scrap steel, coal, explosives, aggregates and project cargoes.

3.3.3 Under the proposed Scheme it is intended to construct a road bridge crossing the Newport Docks at the access point between the North and South Docks known as the Junction Cut.

3.3.4 The bridge design allows for a 26.2m vertical clearance between the maximum retained dock water level of 8.40m(AOD) and the underside of the soffit of the proposed bridge of 34.60 m (AOD).

Figure 3-3 Newport Docks

3.4 River Ebbw

3.4.1 River Ebbw is not navigable by the larger commercial vessels that typically serve the Newport Docks and the river Usk. The river Ebbw is however used by small privately owned recreational vessels such as dinghies, kayaks and small motor cruisers.

3.4.2 Figure 3-5 shows the minimum vertical clearance from the Mean High Water Springs (MHWS) level to underside of the bridge soffit is 4.01 metres.

Figure 3-4 River Ebbw

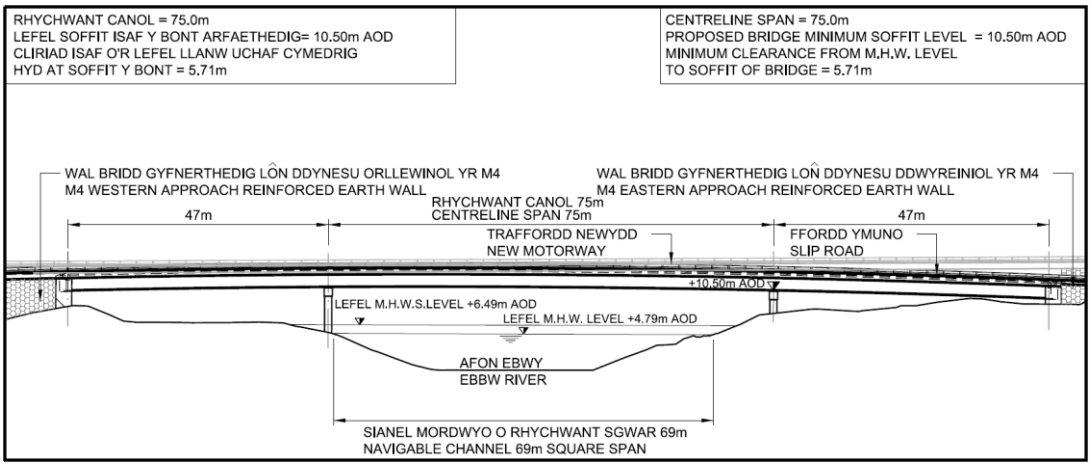

Figure 3-5 River Ebbw Crossing

4. STAKEHOLDERS

4.1 Newport Harbour Commissioners

4.1.1 The Newport Harbour Commissioners are the Statutory and Competent Harbour Authority for the Port of Newport. The NHC's area of jusrisdiction does not include Newport Docks and is shown on the navigation chart in Figure 4-1 below:

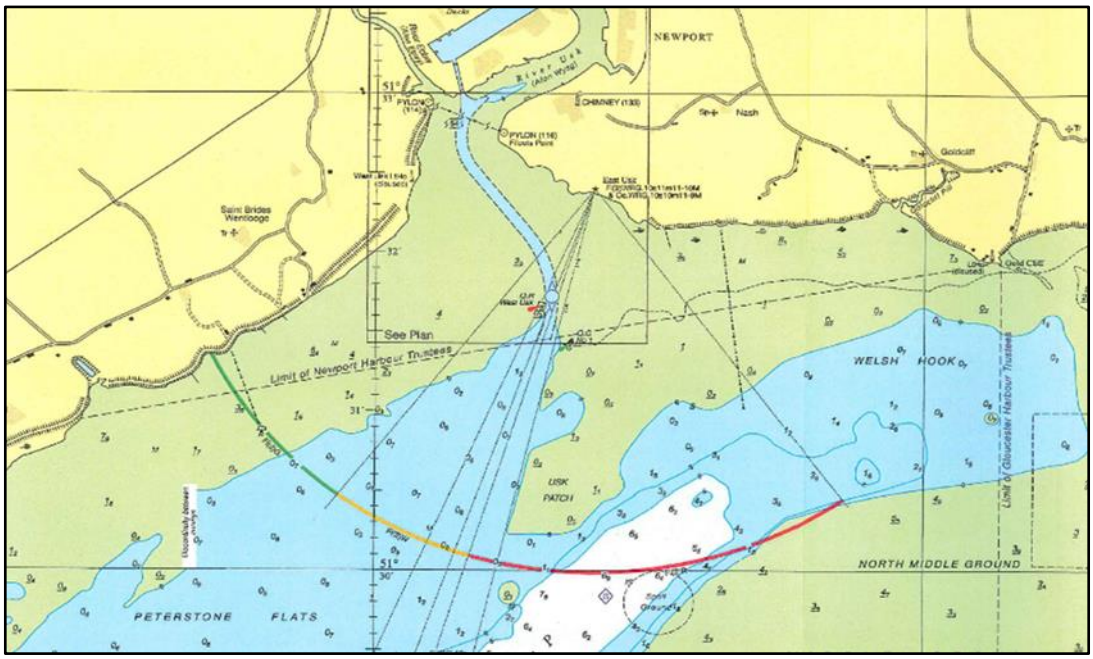

Figure 4-1 The extent of NHC's Jurisdiction as SHA

4.1.2 Their responsibilities include, but are not limited to:

- Regulation of navigation within statutory harbour limits.
- Provision of a pilotage service.
- Local lighthouse authority establishing and maintaining lights and marks.
- Hydrographic surveying of harbour area.
- Removal of wrecks.
- To make and enforce byelaws relating to the conduct of vessels and promulgate that information by appropriate means, as required to ensure all harbour users are aware of the requirement for safe navigation in the harbour area.
- To act upon observations of contracted Marine staff and stakeholders to ensure compliance with byelaws.
- Advising stakeholders port waste reception facilities.
- Development of harbour oil spill contingency plans as required by the Merchant Shipping (Oil Pollution Preparedness Response and Co-operation Convention) Regulations 1998.

4.1.3 Many of the NHC's responsibilities, such as pilotage, are carried out by ABP under contract.

4.2 Associated British Ports

4.2.1 Associated British Ports (ABP) own and operate the Newport Docks and are the Statutory and Competent Harbour Authority for the docks.

4.2.2 As the Competent Harbour Authority the company has been conferred statutory powers under enabling legislation (principally the Harbours Act 1964, the Pilotage Act 1987, the Marine Navigation Act 2013 and local legislation) to, amongst other things, create bylaws, provide a pilot service and direct shipping.

4.2.3 ABP's jurisdiction in the above role extends for a distance of 100 yards beyond the Newport Docks boundary as can be seen in Figure 4-2.

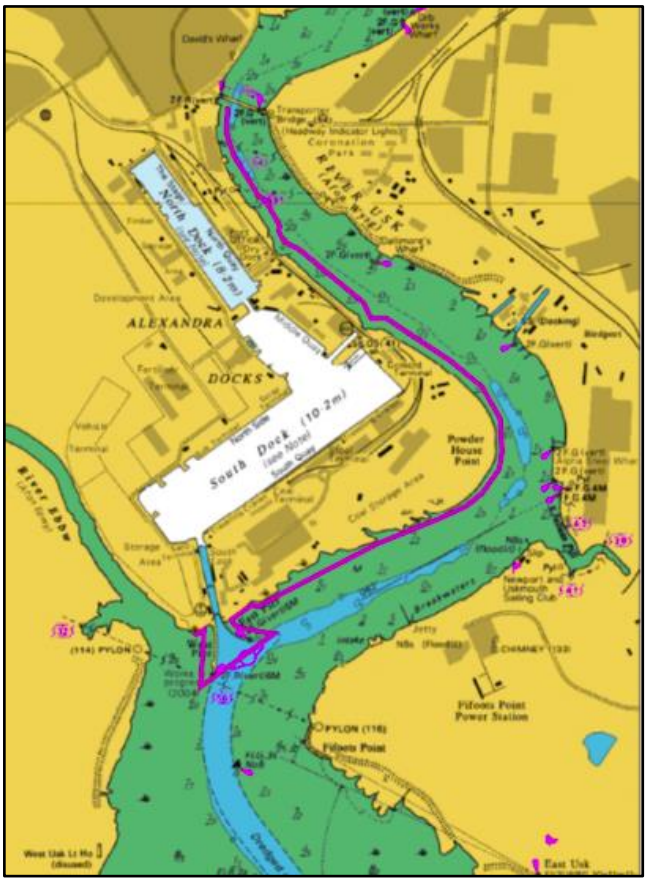

Figure 4-2 Extent of ABP's Jurisdiction as SHA

4.3 The Royal Yachting Association

4.3.1 The Royal Yachting Association (RYA) is the national body for all forms of boating, including dinghy and yacht racing, motor and sail cruising, RIBs, powerboat racing, windsurfing, canal boats, river boat cruising and personal watercraft.

4.3.2 The RYA were invited to participate in the navigation risk assessment workshop as a key stakeholder in the interests of recreational boat owners within the Newport area and to communicate the findings of the workshop to its members.

4.4 The Corporation of Trinity House

4.4.1 Trinity House is a charity dedicated to the safeguarding of shipping and seafarers, providing education, support and welfare to the seafaring community. The corporation also has a statutory duty as a General Lighthouse Authority (GLA) to deliver reliable, efficient and cost-effective aids to navigation for the benefit and safety of all mariners.

4.5 Maritime and Coastguard Agency

4.5.1 With their main headquarters in Southampton, UK, the Maritime Coastguard Agency (MCA) is an executive agency, sponsored by the Department for Transport and is set up in order to prevent the loss of life on the UK coast and at sea.

4.5.2 The MCA advises on legislation, produce guidance on maritime matters, and provide certification to seafarers.

4.5.3 The MCA are mainly responsible for:

- The provision of a 24-hour maritime search and rescue (SAR) service.
- The safety of all persons on a vessel in UK waters.
- Ensuring all vessels and their equipment meet UK and International standards.
- UK ship registration.
- Seafarers' standards, certification, health and safety.
- The environmental safety of the UK coast and waters.
- The accuracy of hydrographic data on UK charts.
- Overseeing the port state control inspection regime.
- The arrest and detention of substandard and unseaworthy vessels.

4.6 Hanson Aggregates

4.6.1 Hanson Aggregate Marine operate a fleet of trailing suction hopper dredgers and are Europe's largest producer of marine dredged sand and gravel.

4.6.2 Their operation in the Newport area is run from their facility at Dallimore's Wharf situated on the river Usk, see Figure 4-3 below.

4.6.3 Their suction hopper dredgers the Arco Dart and Welsh Piper are regular visitors to Dallimore's Wharf, berthing port side alongside in order to discharge aggregate cargoes.

4.6.4 The vessel's berthing at Dallimore's wharf are in the region of 68 metres in length (LOA) and therefore overhang the berth by a considerable amount, resulting in their bows positioned close to the proposed river Usk crossing.

Figure 4-3 Dallimore's Wharf

4.7 Cargo Services (U.K) Limited

4.7.1 Cargo Services (U.K) Limited operate Birdport which is situated on the eastern side of the river Usk approximately 0.3 nm downstream from the proposed River Usk crossing as depicted in Figure 4-4.

4.7.2 The port handles a wide range of commodities such as steel products, bulk cargoes and timber.

4.7.3 The port consists of a gated dock which is capable of handling vessels of up to 8,000 DWT.

Figure 4-4 Birdport

4.8 SMS Towage

4.8.1 SMS Towage provides harbour towage facilities for vessels in the Bristol Channel and operate from the South Wales Ports of Cardiff, Barry and Newport.

4.8.2 SMS Towage harbour tugs are regularly berthed on the north eastern side of the Junction Cut as can be seen in Figure 4-5 below, in order to load bunkers and fresh water, rest crews, change out crew members, carry out maintenance and stand-by awaiting call-out.

4.8.3 Tug crew members live on board their vessels during their period of engagement.

Figure 4-5 Tug berthed at the Junction Cut – North Dock.

5. NAVIGATION RISK WORKSHOP

5.1 Overview

5.1.1 The approach adopted for this formal risk assessment was a HAZID (Hazard Identification). The process allows for a full and detailed discussion with main stakeholders in order to identify the areas of risk and to assess the consequences of an event occurring as a result of the risk. From this, mitigations or measures are introduced in order to reduce the risk to an acceptable level.

5.1.2 The methodology satisfies the requirements of a Formal Safety Assessment (FSA), as set out by the International Maritime Organisation (IMO), and recommended by the Port Marine Safety Code (PMSC) and associated guides to good practice (GTGP).

5.1.3 An FSA is defined by the IMO as "a structured and systematic methodology, aimed at enhancing maritime safety, including protection of life, health, the marine environment and property, by using risk analysis and cost benefit assessment. FSA can be used as a tool to help in the evaluation of new regulations for maritime safety and protection of the marine environment or in making a comparison between existing and possibly improved regulations, with a view to achieving a balance between the various technical and operational issues, including the human element, and between maritime safety or protection of the marine environment and costs".

5.1.4 A Formal Risk Assessment consists of a five steps approach as detailed below:

1) Identification of hazards (a list of all relevant accident scenarios with potential causes and outcomes);
2) Assessment of risks (evaluation of risk factors);
3) Risk control options (devising regulatory measures to control and reduce the identified risks);
4) Cost benefit assessment (determining cost effectiveness of each risk control option); and
5) Recommendations for decision-making (information about the hazards, their associated risks and the cost effectiveness of alternative risk control options is provided).

5.1.5 The approach adopted for this navigation risk assessment incorporates steps 1, 2 and 3. Steps 4 and 5 are outside the scope of this assessment and are considered in the construction risk assessment.

5.2 Boundaries and Assumptions

5.2.1 The risk assessment focussed on the risk to navigation during both the construction and operational phases of the Scheme. Risks associated with the construction activities are covered in the relevant construction risk register prepared by the project team.

5.2.2 In order to focus the assessment on navigational issues only, it was necessary to define the study area, with all parties taking an objective approach to the exercise.

5.2.3 The boundaries of the assessment were defined as follows:

- Newport Harbour Commissioners – Statutory Harbour Authority limits of jurisdiction
- Newport Docks – ABP Statutory Harbour Authority limits of jurisdiction

5.2.4 The assumptions adopted during the HAZID process were:

- All vessels using the navigable waterways at issue in this study are seaworthy. However, it is recognised that errant vessels may not be in a seaworthy condition and vessel issues may not have been reported by the vessel master to the pilot and or harbour authority.
- The relevant harbour authority would be responsible for managing the response to an incident that occurs within their jurisdiction.
- Crews would be well trained and competent in compliance with industry standards and regulations. However, it is recognised that human error can be a contributory factor in marine accidents and incidents.
- Pilots and Pilot Exemption Certificate (PEC) holders are competent and experienced in ship handling. However, it is recognised that human error can be a contributory factor in marine accidents and incidents.
- When used, tugs have the minimum bollard pull and capabilities as required. However, it is recognised that in some circumstances tugs' equipment and/or machinery can fail, and that human error can be a further contributory factor in marine accidents and incidents.
- Recreational users of the waterways are not always safety conscious, well trained, experienced, nor are they always affiliated to local clubs or the RYA.

5.3 Attendees

5.3.1 The formal risk assessment on the impact to navigation as a result of the proposed Scheme was carried out at the M4 CaN Project office at Longcross Court in Cardiff.

5.3.2 The attendees comprised of members of the M4 CaN project team and stakeholders with an interest in any potential impact the Scheme may have on navigation safety.

5.3.3 A signed attendance sheet is included in Appendix A.

Name	Position	Company
Miles Chidlow	Harbour Master	Newport Harbour Commissioners
Rod Lewis	Marine Operations Manager	Associated British Ports
Sean Hunter	Project Manager	Hanson Aggregates
Charlie Smith	First mate	Hanson Aggregates
Peter Baker	M.C.A Surveyor	Maritime and Coastguard Agency
Peter Ireland	Environmental Coordinator	RPS Group
Eunince Stephenson	Environmental Consultant	RPS Group
Patrick Lyon	Managing Director	SMS Towage
Mike Butterfield	Chairman, Cyrmu Wales	Royal Yachting Association
Jonathan Vine	Principal Mariner	Global Maritime
Lovinash Bonomaully	Senior Engineer	Global Maritime
Dave Ritchie	QHSE Manager	Global Maritime
Martin Bates	Project Director	Welsh Government
Peter Allott	Civil Engineer	Arup
Barry Woodman	Project Director	Vinci-Costain JV
Matthew Jones	Project Engineer	Welsh Government

Table 5-1 List of attendees

5.4 Risk acceptance criteria

5.4.1 GMC's risk scoring matrix has been developed based on guidance from the International Marine Contractors Association (IMCA); and the International Maritime Organization (IMO) in line with the requirements of the PMSC and associated guidance.

5.4.2 The risk scoring matrix is presented in Figure 5-1, and shows a standard 5 x 5 risk matrix. The levels of risk and their significance for decision making are presented in Figure 5-2. The definitions for the different Severity Categories and Probability Ratings are presented in Figure 5-3 and Figure 5-4.

Severity Category	Probability				
	A (Very Unlikely)	B (Unlikely)	C (Possible)	D (Likely)	E (Very Likely)
1 (Negligible)	L	L	L	M	M
2 (Minor)	L	L	M	M	M
3 (Significant)	L	M	M	M	H
4 (Serious)	M	M	M	H	H
5 (Critical)	M	M	H	H	H

Figure 5-1 Matrix

Risk Level		
LOW	As a guide, when a LOW risk level is calculated, then no additional controls are required. However monitoring should take place to ensure that the controls are implemented and where possible, improved.	**Acceptable** Task/ Activity may be carried out by those authorised to do so
MEDIUM	Where a risk level has been calculated to be MEDIUM, further controls should be identifed where possible, in order to reduce the risk to As Low As Reasonably Practical (ALARP).	**Tolerable** Task/ Activity may only proceed with Management authorisation
HIGH	A HIGH risk level is considered intolerable, and work must not commence or continue until the risk has been reduced significantly. If it is not possible to reduce the risk, work is not permitted	**Unacceptable** Work must not proceed change task or further control measures required to reduce risk

Figure 5-2 Risk Levels

Severity Category	
1 (Negligible)	- Minimal injury or health implications requiring no treatment; no absence from work; requires first aid treatment only (First Aid Case FAC) - Minimal or limited pollution effect/impact; negligible recovery work (spills of up to 1 litre) - Insignificant or slight property/equipment damaged (<USD $10,000) - Negligible damage to reputation, including some minor negative feedback
2 (Minor)	- Minor injury or illness requiring medical treatment (Medical Treatment Case - MTC) - An Environmental incident contained within the site boundary; short-term impact; recovery work by worksite personnel (spills of up to <10 litres) - Minor repairs required for damaged property/equipment (USD $10,000 - <USD $100,000) - Formal complaint by a Client or 3rd party (reputation damage)
3 (Significant)	- Restricted Work Case (RWC) injury; without long term disablement - An Environmental incident went beyond the site boundary, moderate short-term impact, recovery may requires external assistance (Up to <100 litres) - Damage to property/equipment requiring significant repair with costs up to USD $500,000 - Local media coverage, and local community complaint
4 (Serious)	- Serious injury/illness leading to days away from work or involving a single lost work day case (LWDC) - Serious medium-term environmental effects; recovery requires external assistance; pollution incurring significant restitution costs (spills between 100 litres to <100 m3) - Damage to property/equipment resulting in major loss of operational capability; costs up to USD $1,000,000 - Regional-level negative publicity/ media coverage
5 (Critical)	- A fatality(s) or multiple serious injuries leading to permanent disability or terminal disease - Extensive pollution with long-term implications or massive site impact and recovery work; very high restitution costs resulting in serious economic liability on the business; spill in excess of 100m3 - Damage with major long-term implications on operational capability; extensive costs in excess of USD $1,000,000 - International negative publicity/ media coverage

Figure 5-3 Definitions of severity categories

	Probability Rating
A (Very Unlikely)	- Never happened at GM or known to GM to have happened within the industry - A freak combination of factors would be required for an incident to occur
B (Unlikely)	- Unlikely to occur - May have happened once at GM, or in the industry - A rare combination of factors would be required for an incident to occur
C (Possible)	- Could possibly occur - Additional factors to be combined/ present for an incident to occur
D (Likely)	- Has happened more often than once, at GM, or known to have happened multiple times within the industry - An additional factor may be required to result in an incident
E (Very Likely)	- A regular occurrence in the industry - Almost inevitable that an incident may happen

Figure 5-4 Definition of Probability ratings

5.5 Hazard Assessment

5.5.1 The attendees were given a presentation on the Scheme and the proposed construction methodology. The HAZID methodology was also explained to all participants with particular reference to the requirement for an objective approach to be taken during the workshop.

5.5.2 The International Maritime Organisation (IMO) define a hazard as 'something with the potential to cause harm, loss or injury'. It therefore follows that a risk is the measure of the frequency and consequence of a potential hazard.

5.5.3 Risks for the Usk, Ebbw and Newport Docks were all assessed separately. The assessment was further separated in order to capture the risk during both the construction and operational phases of the Scheme.

5.5.4 Each hazard and the identified potential impact was assessed against the following criteria: Injury to personnel (life), Damage to bridge and/or port infrastructure, Damage to a vessel and Environmental impact.

5.5.5 Existing measures and standard marine practice which would mitigate the probability of the event were identified. Project specific mitigation measures were also identified by parties present at the workshop.

5.5.6 Finally, the residual risk identified for each risk category providing the project specific mitigation measures are adopted have been estimated. Where identified, actions have been recorded and are reported in this document.

5.6 GM's Risk Management Tool

5.6.1 Global Maritime Proprietary tool GM Risk Management Tool (Appendix B), specifically developed for facilitating risk assessment workshops was employed for this assessment.

5.6.2 The tool has been built to focus all prepared information into one application, displayed on one screen. It is possible to upload videos, drawings and documents to a specific chapter under discussion. By using this approach it is easy to keep control, stay on track and for all participants to follow the discussion.

5.6.3 The GM risk management tool (RMT) has been developed in order to facilitate risk assessment workshops including HAZOP, HAZID, ALARP, SWIFT, feasibility analysis, concept selection, layout analysis and design reviews.

5.7 Results

5.7.1 The results of the Navigation Risk HAZID are contained in the risk registers in Appendix C.

5.8 Events

5.8.1 The number of credible hazards were identified by the participants of the NRA workshop and are tabulated in Table 5-2.

Location	Phase	No of identified Hazards
River Usk	Scheme construction	11
River Usk	Scheme in operation	6
River Ebbw	Scheme construction	5
River Ebbw	Scheme in operation	3
Newport Dock	Scheme construction	10
Newport Dock	Scheme in operation	6

Table 5-2 Table of Hazards

5.8.2 During construction of the river and dock crossings, the main risks to navigation were identified as follows:

1) Vessel collision with bridges.
2) Collapse of bridge deck/dropped deck section.
3) Dropped objects (for example, tools).
4) Construction Pollution/floating debris.
5) Congested navigation/increased traffic density.
6) Conflict with radio communications.
7) Presence of background light.
8) Congested Newport South dock during restricted access to the North dock.

5.8.3 During operation of the scheme, the navigation risks can be summarised as follows:

1) Vessel collision with bridges.
2) Dropped objects, such as tools, during maintenance.
3) Maintenance pollution/ floating debris.
4) Falling objects from bridge.
5) Congested Newport South dock during restricted access to the North dock.

5.9 Consequence

5.9.1 The consequences of interaction between the Scheme and navigation can be summarised as follows:

1) Injury to personnel.
2) Damage to bridge and/or infrastructure.
3) Damage to vessel.
4) Environmental impact.

5.10 Collision with the bridge within Newport Docks

5.10.1 The representatives from Associated British Ports (ABP), the owner, operator and statutory harbour authority for the Newport Docks, declined to participate in the discussions regarding the risk of collision with the proposed bridge over the docks. In the draft risk register (Appendix C), this potential risk corresponds to Hazard ID 3.1.1 and 3.2.1

5.10.2 ABP's decision not to participate in the discussions regarding a vessel to bridge impact was driven in part by their objection to the Scheme. However, as the Statutory and Competent Harbour Authority for the docks, their contribution to the NRA would be valued.

5.10.3 A Quantitative Risk Assessment (QRA) is presently being undertaken by the Welsh Government, in order to consider all causal factors, their frequency of occurrence and their potential consequences of a ship collision with the bridge. Therefore, the assessment of a potential vessel collision with the bridge within the docks will be revisited at a later date. Engagement with ABP in that regard will continue.

6. MEETINGS WITH OTHER STAKEHOLDERS

6.1 The Corporation of Trinity House

6.1.1 A representative from Trinity House was unable to attend the NRA workshop, therefore a meeting was held with Trinity House on the 9th December 2016 at Trinity House in London. The meeting attendees are provided in Table 6-1 below, a signed attendance sheet is attached in Appendix D.

Name	Position	Company
Nick Dodson	Navigation Manager	Trinity House
Martin Thomas	Navigation Support Officer	Trinity House
Trevor Baker	Local AtoN Manager	Trinity House
Jonathan Vine	Principal Mariner	Global Maritime
Lovinash Bonomaully	Senior Engineer	Global Maritime
Peter Allott	Civil Engineer	Arup

Table 6-1 List of attendees

6.1.2 The meeting was conducted as below:

1) Introductions.
2) A short safety presentation was delivered by GMC.
3) An overview of the Scheme and the proposed construction methodology was presented.
4) Trinity House participants were invited to comment on the navigational risk registers.

6.1.3 It should be noted that Trinity House did not wish to discuss the crossing for the Newport Docks, as they are privately owned and were therefore not discussed.

6.1.4 The risk register (see Appendix C) was updated to include the comments from Trinity House, see below:

- Consider close vessel control utilising the marine control at Newport Docks as Cardiff LPS does not have full visual of Newport Docks and the rivers Ebbw and Usk.
- Navigation lights and signage to be installed on the river crossings, both upstream and downstream, in order to identify the best point of passage for mariners and other river users.
- Directional construction lighting to be considered in order to avoid impairment of mariners' night vision and to ensure navigation lights are readily identifiable.
- Admiralty charts to be updated to include river and dock crossings.

- With regards to Dallimore's wharf consideration must be given to the scenario where a different vessel visits the wharf.
- Following a possible dropped object, such as a bridge deck section, issues relating to the available depth of navigable water are to be addressed.

6.1.5 Cardiff LPS have a distribution list for promulgating navigation warnings.

6.1.6 Comments from Trinity House have been included in the navigation risk register.

6.1.7 River Ebbw crossing to indicate clearance height of bridge using signage as recommended by IALA.

6.1.8 River Usk and Ebbw to be lit as per IALA recommendations in order to indicate both the up and downstream best points of passage.

6.2 Cargo Services (UK) Ltd

6.2.1 Cargo Services (UK) Ltd operates Birdport, which is located on the River Usk.

6.2.2 A meeting was held with Cargo Services Ltd on 8th December 2016. The list of attendees are provided in Table 6-2 below and a signed attendance sheet is provided in Appendix E.

Name	Position	Company
John Davey	Managing Director	Cargo Services Ltd
Jonathan Vine	Principal Mariner	Global Maritime
Lovinash Bonomaully	Senior Engineer	Global Maritime

Table 6-2 List of attendees

6.2.3 The meeting was conducted as below:

1) Introductions
2) A short safety presentation was delivered by GMC.
3) An overview of the Scheme and the proposed construction methodology was presented
4) The representative from Cargo Services (UK) Ltd was invited to comment on the navigational risk registers.

6.2.4 It should be noted, that Birdport is situated in the River Usk, the River Ebbw and the Newport Dock crossings were not relevant to this particular stakeholder and as such were not discussed.

6.2.5 The CSL representative was in agreement with the hazards identified and the measures identified to be implemented.

7. RECOMMENDATIONS

7.1.1 A number of recommendations have been made as a result of the formal risk assessment in order to mitigate the identified risks. With regard to the rivers Usk and Ebbw, the recommendations were discussed in detail with the relevant stakeholders and the recommendations from the discussions are detailed below.

7.1.2 With regards to the risk of vessel collision with the bridge within the Newport Docks, ABP declined to participate to participate in discussions regarding this particular risk. The Welsh Government is presently considering the risk of vessel/bridge collision further by conducting a Quantitative Risk Assessment (QRA). This assessment will consider all causal factors and their frequency of occurrence to inform the project team of the likelihood of such an event. Engagement with ABP regarding this matter will continue.

7.1.3 The recommendations in terms of the navigational risk are generic for the Newport Docks and both the rivers Usk and Ebbw and are listed below:

1) Promulgation of Marine Safety Information

- Navigation warnings and notices to mariners (NTMs) are to be promulgated to all river users in order to inform them of any construction activities and in particular periods when navigation will be restricted.
- Engagement by the project team with stakeholders, dock and river users in order to ensure that navigational warnings have been received and understood.
- Navigation lights to be installed on the river crossings, both upstream and downstream, in order to identify the best point of passage for mariners and river users.
- Safety signage to be in place on the river banks in order to warn river users of low bridge heights, the vertical clearance and identify best point of passage during the day.
- Major bridge maintenance works are to be communicated by Notices to Mariners and navigation warnings.

2) Vessel Traffic Management

- River access to be actively managed during deck launching/lifting over water, when restrictions on navigation may be imposed.
- Continual monitoring of traffic, with a guard vessel available in order to assist in enforcing any restrictions.
- Vessel movements and personnel access at Dallimore's Wharf, to be managed during bridge construction and maintenance operations.
- Small vessels using the River Ebbw are to be monitored by project personnel during construction and maintenance operations.
- No vessels and/or personnel are to be beneath a suspended load during any lifting operations.
- Tugs and small vessels presently berthing in the Newport North Dock in the vicinity of the 'Junction Cut' are to be relocated.

3) Management of Dropped Object Risk

- Dropped object prevention measures are to be implemented at the construction site and during maintenance works.
- Bridge design to include reasonable measures to prevent falling objects.
- Un-authorised access to be prevented by appropriate security controls.
- Dropped object recovery plan to be implemented.

- Mariners and stakeholders to be advised of any dropped objects and/or floating debris which may affect navigation.

4) Marine Safety Management Plan

- Develop interface document and a marine management plan to formalise interfaces, including the emergency primacy between parties.
- Clear communication plan between relevant parties during critical construction activities.

5) Pollution Control

- Construction Environmental Management Plan (CEMP) to include pollution containment procedures and good housekeeping practices.
- Harbour Authority Oil Pollution Preparedness and Response Plan (OPRC).
- Bridge maintenance manual to include pollution response procedures.

6) Direct Interference

- Consider interference of construction radio communications with vessel radio communications, dedicated channels to be in use.
- Construction site flood lighting equipment set-up to account for the possibility of impairing of mariners' night vision (i.e. positioning/direction of lighting).

APPENDICES

APPENDIX A WORKSHOP ATTENDANCE SHEET

APPENDIX B RISK MANAGEMENT TOOL

APPENDIX C NAVIGATION RISK REGISTER

APPENDIX D MEETING WITH TRINITY HOUSE, 9TH DECEMBER 2016

APPENDIX E MEETING WITH CARGO SERVICES (UK) LTD, 8TH DECEMBER 2016

APPENDIX A WORKSHOP ATTENDANCE SHEET

Meeting Attendance Sheet

GLOBAL MARITIME

Meeting:	Navigation Risk Assessment M4 CaN	Venue:	Longcross Court	Date:	22nd November 2016

	Name	Position	Company	Email Address	Signature
1	MARTIN BATES	PROJECT DIRECTOR	WELSH GOVERNMENT	Martin.bates@wales.gsi.gov.uk	
2	MATT JONES	PROJECT ENGINEER	"	Matthew.Jones@wales.gsi.gov.uk	
3	Rob Lewis	ABP	ABP	rlewis@abports.co.uk	
4	MILES CHADLOW	NHC HARBOUR MASTER	NHC / ABP	mchadlow@abports.co.uk	
5	PETER BAKER	M.C.A SURVEYOR	MCA	peter.baker@mcga.gov.uk	
6	Michael Butterfield PD	RYA Director	RYA	pmbutterfield@msn.com	
7	PATRICK LYON.	MD	SMS TOWAGE	PLYON@SMSTOWAGE.com	
8	SEAN HUNTER	PROJECT MANAGER	HANSON	Seanhunter@hanson.com	
9	CHARLIE SMITH.	FIRST MATE	HANSON.	CHARLIE.SMITH@HANSON.BIZ	
10	Lovnash Boromaully	Senior Engineer	GM	lovnash.boromaully@[illegible].com	
11	JP VINE	PRINCIPAL MARINE	"	jonathan.vine@globalmaritime.com	
12	Barry Woodman	Project Director	CMJV	barry.woodman@costain.com	
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APPENDIX B RISK MANAGEMENT TOOL

Ports and Shipping (Eagle Lyon Pope)

Risk Management Tool

GLOBAL MARITIME

blue sea thinking

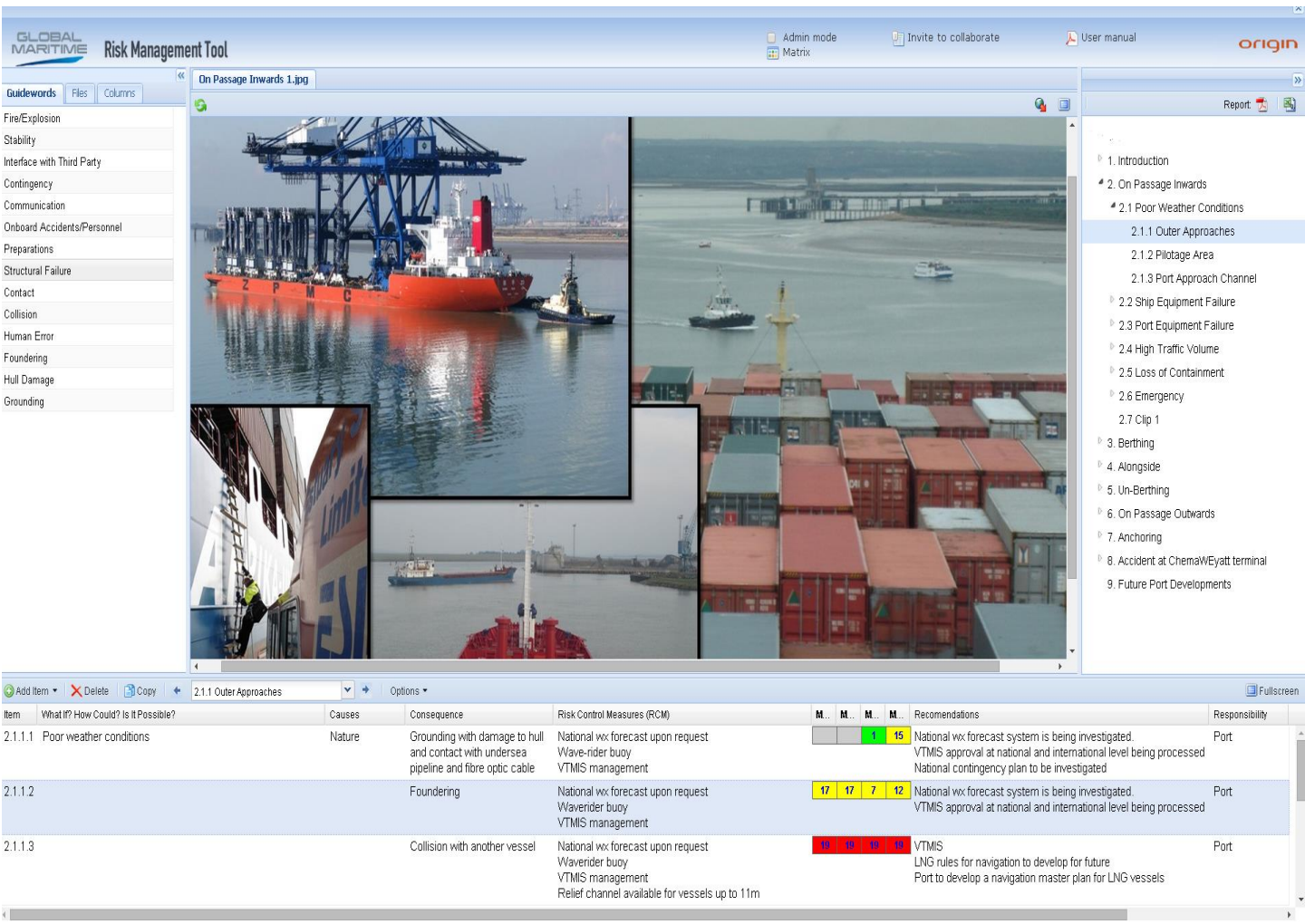
Risk Management Tool

Ports and Shipping (Eagle Lyon Pope) uses the GM Risk Management Tool (RMT) to ensure efficient risk workshop facilitations, reporting, communication and follow-up actions are delivered to best practice. It is based on industry standard HAZOP methodology but facilitates greater flexibility for project specific requirements.

The tool has been built to focus all prepared information into one application, displayed on one screen. It is possible to upload videos, drawings and documents to a specific chapter under discussion. By using this approach it is easy to keep control, stay on track and for all participants to follow the discussion. GM RMT has been built to handle most common risk workshops including HAZOP, HAZID, ALARP, SWIFT, feasibility analysis, concept selection, layout analysis and design reviews.

Expertise

Our staff have extensive experience of facilitating and recording risk workshops and preparing Hazard and Effects Registers for projects that include port developments, subsea pipeline installations and vessel traffic system (VTS) studies.



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APPENDIX C NAVIGATION RISK REGISTER

Session: Navigation Risk Assessment - M4 CaN 1 River Usk DRAFT

1.1 Bridge Construction

Item	Activity	Hazards	Consequences	Injury/Illness	Environmental Impact	Financial Loss/ Property damage/ Reputation	Existing Measures/ Standard Marine Practice	Project Specific Mitigation Measures	Residual Injury/ Illness	Residual Environmental Impact	Residual Financial Loss/ Property damage/ Reputation	Actions	Action Party / Due Date
1.1.1	Navigation by merchant vessels	Collision with bridge during navigation, or by errant vessel	- Damage to bridge - Damage to vessel - Fatality/ Injury to personnel - Environmental impact	H	M	H	1. Large passage plan vessels for the south dock to arrive just before high water, with aid of tugs/ aid of pilots. 2. Vessel anchors to be clear and ready for deployment. 3. Ship Oil Pollution Emergency Plan (SOPEP) in place onboard merchant vessels. 4. Natural Resources Wales (NRW) to be notified of all spills.	1. During construction activities, navigation warnings and notices to mariners to be promulgated to all river users 2. Develop interface document/ marine management plan to formalise interfaces, including emergency primacy, between parties 3. Navigation lights on bridge. 4. Clearance provided in bridge design	M	M	M	Develop Marine Management Plan	

Item	Activity	Hazards	Consequences	Injury/Illness	Environmental Impact	Financial Loss/ Property damage/ Reputation	Existing Measures/ Standard Marine Practice	Project Specific Mitigation Measures	Residual Injury/ Illness	Residual Environmental Impact	Residual Financial Loss/ Property damage/ Reputation	Actions	Action Party / Due Date
1.1.2	Navigation by all river users (merchant vessels, recreational vessels, dredgers)	Collapse/ dropped deck sections during construction/ gantry operations/ lifting operations	- Damage to vessel - Fatality/ Injury to personnel	H	L	H	1. Continual monitoring and control of marine traffic by Cardiff Local Port Service (LPS)/ Newport Harbour Commissioners (NHC)	1. During construction activities, navigation warnings and notices to mariners to be promulgated to all river users 2. River access managed during deck launching/ lifting over water, as required 3. Continual monitoring of marine traffic during deck launching, and guard vessel/ craft to be available to enforce restricted access 4. Good communication between parties during critical construction activities 5. Develop interface document/ marine management plan to formalise interfaces, including emergency primacy, between parties	M	L	M		
1.1.3	Navigation by all river users (merchant vessels, recreational vessels, dredgers)	Dropped tools/ objects during construction activities	- Damage to vessel - Fatality/ Injury to personnel	H	L	M	1. Continual monitoring and control of marine traffic by Cardiff LPS/ NHC	1. Implementation of dropped objects prevention measures at construction site 2. During construction activities, navigation warnings and notices to mariners to be promulgated to all river users	M	L	L		

Item	Activity	Hazards	Consequences	Injury/Illness	Environmental Impact	Financial Loss/ Property damage/ Reputation	Existing Measures/ Standard Marine Practice	Project Specific Mitigation Measures	Residual Injury/ Illness	Residual Environmental Impact	Residual Financial Loss/ Property damage/ Reputation	Actions	Action Party / Due Date
1.1.4	Navigation by all river users (cargo vessels, recreational vessels, dredgers)	Construction pollution/ floating debris	- Damage to vessel - Environmental impact/ pollution	L	M	M	1. Pollution/ debris to be reported immediately, and recovered where possible 2. Cardiff LPS/ NHC notified, and navigational warning issued 3. Natural Resources Wales (NRW) to be notified of all spills	1. Construction Environmental Management Plan - CEMP, in place: pollution containment equipment and procedure; storage requirements; good housekeeping 2. Bridge construction activities over water powered by electric supply (eg. no generators)	L	L	L		
1.1.5	Navigation by all river users (cargo vessels, recreational vessels, dredgers)	Congested navigation channel/ increased vessel to vessel encounters, during construction (causing collision/ grounding)	- Damage to vessels - Fatality/ Injury to personnel - Environmental impact	M	M	M	1. Continual monitoring and control of marine traffic by Cardiff LPS/ NHC 2. Natural Resources Wales (NRW) to be notified of all spills	1. During construction activities, navigation warnings and notices to mariners to be promulgated to all river users	M	M	M		
1.1.6	Navigation by all river users (cargo vessels, recreational vessels, dredgers)	Conflict with radio communications/ communication breakdown (causing collision/ grounding)	- Damage to vessels - Fatality/ Injury to personnel - Environmental impact	M	M	M	1. Dedicated VHF/UHF channels used by vessels 2. Natural Resources Wales (NRW) to be notified of all spills	1. Construction radio communications to consider interference with vessel communications 2. Develop interface document/ marine management plan to formalise interfaces/ communications	M	M	M		
1.1.7	Navigation by all river users (cargo vessels, recreational vessels, dredgers)	Presence of background light from construction sites/ vehicles (causing collision/ grounding)	- Damage to vessels - Fatality/ Injury to personnel - Environmental impact	M	M	M		1. Construction site flood lighting equipment set-up to consider vessel navigation (ie. positioning/ direction of lighting) 2. Develop interface document/ marine management plan to formalise interfaces/ communications	M	M	M		

Item	Activity	Hazards	Consequences	Injury/Illness	Environmental Impact	Financial Loss/ Property damage/ Reputation	Existing Measures/ Standard Marine Practice	Project Specific Mitigation Measures	Residual Injury/ Illness	Residual Environmental Impact	Residual Financial Loss/ Property damage/ Reputation	Actions	Action Party / Due Date
1.1.8	Dallimore's wharf activities, including berthing/ unberthing	Dropped objects during construction activities/ deck launching, in vicinity of Dallimore's wharf	- Fatality/ injury to personnel (vessel crew and berthing personnel) - Damage to vessels - Damage to wharf	H	L	H	1. Continual monitoring and control of marine traffic by Cardiff LPS/ NHC	1. Manage access to wharf by vessels and personnel, during deck launching/ lifting operations, as required 2. Develop interface document/ marine management plan to formalise interfaces/ communications	M	L	M		
1.1.9	Navigation by all river users (cargo vessels, recreational vessels, dredgers)	Dropped deck section into river (collision/ grounding hazard, or restricted access)	- Damage to vessels - Commercial impact - Fatality/ Injury to personnel - Environmental impact	M	M	M	1. Natural Resources Wales (NRW) to be notified of any dropped objects impacting the environment	1. Navigation warnings and notices to mariners to be promulgated to all river users 2. Dropped objects to be recovered 3. Guard vessel to be available if required 4. Hazard to be marked using 'Special Marks' following IALA Guidelines. Special Marks must be available for use.	M	M	M		
1.1.10	Birdport vessel activities	Uncontrolled vessel approach to Birdport, resulting in bridge collision or exposure to dropped objects	- Damage to bridge - Damage to vessel - Fatality/ Injury to personnel - Environmental impact	M	M	M	1. Vessel anchors to be clear and ready for deployment 2. Ship Oil Pollution Emergency Plan (SOPEP) in place onboard merchant vessels 3. Vessel approach close to high water	1. River access managed during deck launching/ lifting over water, as required 2. During construction activities, navigation warnings and notices to mariners to be promulgated to all river users	M	M	M		
1.1.11	Liberty steel vessel activities	Uncontrolled vessel approach to Liberty Steel, resulting in bridge collision or exposure to dropped objects	- Damage to bridge - Damage to vessel - Fatality/ Injury to personnel - Environmental impact	M	M	M	1. Vessel anchors to be clear and ready for deployment 2. Ship Oil Pollution Emergency Plan (SOPEP) in place onboard merchant vessels 3. Vessel approach close to high water	1. River access managed during deck launching/ lifting over water, as required 2. During construction activities, navigation warnings and notices to mariners to be promulgated to all river users	M	M	M		

1 River Usk
1.2 Bridge Operation

Item	Activity	Hazards	Consequences	Injury/Illness	Environmental Impact	Financial Loss/ Property damage/ Reputation	Existing Measures/ Standard Marine Practice	Project Specific Mitigation Measures	Residual Injury/ Illness	Residual Environmental Impact	Residual Financial Loss/ Property damage/ Reputation	Actions	Action Party / Due Date
1.2.1	Navigation by merchant vessels	Collision with bridge during navigation, or by errant vessel	- Damage to bridge - Damage to vessel - Injury to personnel - Environmental impact	M	M	M	1. Large passage plan vessels for the south dock to arrive just before high water, with aid of tugs/ pilots 2. Vessel anchors to be clear and ready for deployment 3. Ship Oil Pollution Emergency Plan (SOPEP) in place onboard merchant vessels 4. NRW to be notified of all spills	1. Navigation lights and marks on bridge to conform to IALA guidelines. Point of best passage to be indicated. 2. Clearance provided in bridge design	M	M	M		
1.2.2	Navigation by all river users (merchant vessels, recreational vessels, dredgers)	Dropped tools/ objects during maintainence activities	- Damage to vessel - Fatality/ Injury to personnel	H	L	M		1. Implementation of dropped objects prevention measures during maintenance activities, to be addressed in bridge maintenance manual 2. Major bridge maintenance works to include promulgation of notice to mariners / navigational warnings	M	L	L		
1.2.3	Navigation by all river users (cargo vessels, recreational vessels, dredgers)	Maintanence pollution/ floating debris	- Environmental impact/ pollution - Damage to vessel	L	M	L	1. Pollution/ debris to be reported immediately, and recovered where possible 2. Cardiff LPS/ NHC notified, and navigational warning issued 3. Natural Resources Wales (NRW) to be notified of all spills	1. Pollution response procedures addressed in bridge maintenance manual	L	L	L		

Item	Activity	Hazards	Consequences	Injury/Illness	Environmental Impact	Financial Loss/ Property damage/ Reputation	Existing Measures/ Standard Marine Practice	Project Specific Mitigation Measures	Residual Injury/ Illness	Residual Environmental Impact	Residual Financial Loss/ Property damage/ Reputation	Actions	Action Party / Due Date
1.2.4	Dallimore's wharf activities, including berthing/ unberthing	Dropped objects during maintenance activities, in the vicinity of Dallimore's Wharf	- Fatality/ injury to personnel (vessel crew and berthing personnel) - Damage to vessels - Damage to wharf	H	L	L		1. Implementation of dropped objects prevention measures during maintenance activities, to be addressed in bridge maintenance manual 2. Major bridge maintenance works to include promulgation of notice to mariners / navigational warnings	M	L	L		
1.2.5	Birdport vessel activities	Uncontrolled vessel approach to Birdport, resulting in bridge collision or exposure to dropped objects	- Damage to bridge - Damage to vessel - Fatality/ Injury to personnel - Environmental impact	H	M	H	1. Vessel anchors to be clear and ready for deployment 2. Ship Oil Pollution Emergency Plan (SOPEP) in place onboard merchant vessels 3. Vessel approach close to high water		M	M	M		
1.2.6	Navigation by all river users, during normal bridge operations	Falling objects from bridge during operation (vehicles; people; debris)	- Damage to vessel - Fatality/ Injury to personnel	M	L	M		1. Bridge design includes barriers to prevent falling objects, and un-authorised personnel access	M	L	M		

2 River Ebbw
2.1 Bridge Construction

Item	Activity	Hazards	Consequences	Injury/Illness	Environmental Impact	Financial Loss/ Property damage/ Reputation	Existing Measures/ Standard Marine Practice	Project Specific Mitigation Measures	Residual Injury/ Illness	Residual Environmental Impact	Residual Financial Loss/Property damage/ Reputation	Actions	Action Party / Due Date
2.1.1	Navigation by small vessels/ recreational craft	Collision with bridge during navigation	- Damage to bridge - Damage to vessel - Injury to personnel - Environmental impact	M	L	M	1. River Ebbw is used by small vessels/ recreational users only	1. During construction activities, navigation warnings and notices to mariners to be promulgated to all river users 2. Signage on river banks (both banks/ both directions/ both sides of bridge) to warn river users 3. Continual monitoring from banks, during construction activities	L	L	L		
2.1.2	Navigation by small vessels/ recreational craft	Collapse/ dropped deck sections during construction/ deck launching	- Damage to vessel - Fatality/ Injury to personnel	H	L	M	1. River Ebbw is used by small vessels/ recreational users only	1. During construction activities, navigation warnings and notices to mariners to be promulgated to all river users 2. River access managed during deck launching/ lifting over water, as required 3. Continual monitoring of marine traffic during deck launching, and guard vessel/ craft to be available to enforce restricted areas 4. Signage on river banks (both banks/ both directions/ both sides of bridge) to warn river users	M	L	L		
2.1.3	Navigation by small vessels/ recreational craft	Dropped tools/ objects during construction activities	- Damage to vessel - Fatality/ Injury to personnel	H	L	M		1. Implementation of dropped objects prevention measures at construction site 2. During construction activities, navigation warnings and notices to mariners to be promulgated to all river users 3. Signage on river banks (both banks/ both directions/ both sides of bridge) to warn river users	M	L	L		

Item	Activity	Hazards	Consequences	Injury/Illness	Environmental Impact	Financial Loss/ Property damage/ Reputation	Existing Measures/ Standard Marine Practice	Project Specific Mitigation Measures	Residual Injury/ Illness	Residual Environmental Impact	Residual Financial Loss/Property damage/ Reputation	Actions	Action Party / Due Date
2.1.4	Navigation by small vessels/ recreational craft	Construction pollution/ floating debris	- Damage to vessel - Environmental impact/ pollution	L	M	L	1. Pollution/ debris to be reported immediately, and recovered where possible 2. Cardiff LPS/ NHC notified, and navigational warning issued 3. Natural Resources Wales (NRW) to be notified of all spills	1. Construction Environmental Management Plan - CEMP, in place: pollution containment equipment and procedure; storage requirements; good housekeeping 2. Bridge construction activities over water powered by electric supply (eg. no generators)	L	L	L		
2.1.5	Navigation by small vessels/ recreational craft	Presence of background light from construction sites/ vehicles	- Vessel collision - Injury to personnel	M	L	M		1. Construction site flood lighting equipment set-up to consider vessel navigation (ie. positioning/ direction of lighting)	M	L	L		

2 River Ebbw
2.2 Bridge Operation

Item	Activity	Hazards	Consequences	Injury/Illness	Environmental Impact	Financial Loss/ Property damage/ Reputation	Existing Measures/ Standard Marine Practice	Project Specific Mitigation Measures	Residual Injury/ Illness	Residual Environmental Impact	Residual Financial Loss/Property damage/ Reputation	Actions	Action Party / Due Date
2.2.1	Navigation by small vessels/ recreational crafts	Collision with bridge during navigation	- Damage to bridge - Damage to vessel - Injury to personnel - Environmental impact	M	L	M		1. Navigation lights on bridge 2. Permanent signage on river banks (warning of low bridge and indicating headroom clearance)	L	L	L	Redundancy for lighting on bridge	
2.2.2	Navigation by small vessels/ recreational craft	Dropped tools/ objects during maintainence activities	- Damage to vessel - Injury to personnel	L	L	L		1. Implementation of dropped objects prevention measures during maintenance activities, to be addressed in bridge maintenance manual 2. Major bridge maintenance works to include promulgation of notice to mariners / navigational warnings	M	L	L		

Item	Activity	Hazards	Consequences	Injury/Illness	Environmental Impact	Financial Loss/ Property damage/ Reputation	Existing Measures/ Standard Marine Practice	Project Specific Mitigation Measures	Residual Injury/ Illness	Residual Environmental Impact	Residual Financial Loss/Property damage/ Reputation	Actions	Action Party / Due Date
2.2.3	Navigation by small vessels/ recreational craft	Maintanence pollution/ floating debris	- Damage to vessel - Environmental impact	L	M	M	1. Pollution/ debris to be reported immediately, and recovered where possible 2. Cardiff LPS/ NHC notified, and navigational warning issued 3. Natural Resources Wales (NRW) to be notified of all spills	1. Pollution response procedures addressed in bridge maintenance manual	L	L	L		

3 Newport Docks
3.1 Bridge Construction

Item	Activity	Hazards	Consequences	Injury/Illness	Environmental Impact	Financial Loss/ Property damage/ Reputation	Existing Measures/ Standard Marine Practice	Project Specific Mitigation Measures	Residual Injury/ Illness	Residual Environmental Impact	Residual Financial Loss/ Property damage/ Reputation	Actions	Action Party / Due Date
3.1.1	Dock activites/ mooring operations/ Vessel movements within docks	Collision with bridge during vessel movements, or by errant vessel within docks		0	0	0			0	0	0	ABP have declined to participate in discussions for this hazard. This is probably due to their objection to this scheme which relates to air draft and the potential impact of shipping hitting the bridge. WG is presently considering this risk further in a Quantitative Risk Assessment. Engagement with ABP in that regard will continue.	

Item	Activity	Hazards	Consequences	Injury/Illness	Environmental Impact	Financial Loss/ Property damage/ Reputation	Existing Measures/ Standard Marine Practice	Project Specific Mitigation Measures	Residual Injury/ Illness	Residual Environmental Impact	Residual Financial Loss/ Property damage/ Reputation	Actions	Action Party / Due Date
3.1.2	Dock activites/ mooring operations/ Vessel movements within docks	Collapse/ dropped deck sections during construction/ deck launching	- Damage to vessel - Fatality/ Injury to personnel - Damage to dock infrastructure	H	L	H	1. Newport Dock marine control to monitor vessel movements within dock	1. During construction activities, navigation warnings and notices to mariners to be promulgated to all dock users 2. Continual monitoring of marine traffic during deck launching, and guard vessel/ craft to be available to enforce restricted access 3. Good communication between parties during critical construction activities 4. Develop interface document/ marine management plan to formalise interfaces, including emergency primacy, between parties 5. Manage vessel access between docks during critical construction activities 6. Manning of marine control centre at Newport, during construction activities over junction cut 7. Vessels to be berthed at safe location	M	L	M		

Item	Activity	Hazards	Consequences	Injury/Illness	Environmental Impact	Financial Loss/ Property damage/ Reputation	Existing Measures/ Standard Marine Practice	Project Specific Mitigation Measures	Residual Injury/ Illness	Residual Environmental Impact	Residual Financial Loss/ Property damage/ Reputation	Actions	Action Party / Due Date
3.1.3	Dock activites/ mooring operations/ Vessel movements within docks	Dropped tools/ objects during construction activities	- Damage to vessel - Fatality/ Injury to personnel	H	L	M	1. Newport Dock marine control to monitor vessel movements within dock	1. Implementation of dropped objects prevention measures at construction site 2. During construction activities, navigation warnings and notices to mariners to be promulgated to all dock users 3. Develop interface document/ marine management plan to formalise interfaces, including emergency primacy, between parties	M	L	L		
3.1.4	Dock activites/ mooring operations/ Vessel movements within docks	Presence of background light from construction sites/ vehicles (causing collision/ grounding)	- Damage to vessels - Fatality/ Injury to personnel - Environmental impact	M	M	M		1. Construction site flood lighting equipment set-up to consider vessel navigation (ie. positioning/ direction of lighting) 2. Develop interface document/ marine management plan to formalise interfaces/ communications	M	M	M		
3.1.5	Tug berthing and bunkering at Junction Cut	Dropped objects whilst tugs are berthed/ bunkering	- Damage to vessel - Fatality/ Injury to personnel - Environmental Impact/ pollution - Fire/ Explosion	H	M	M		1. Prevent access to tug berth during construction activities at Junction Cut, and identify suitable alternative location 2. Remove any bunkering related materials/ equipment	L	L	L		

Item	Activity	Hazards	Consequences	Injury/Illness	Environmental Impact	Financial Loss/ Property damage/ Reputation	Existing Measures/ Standard Marine Practice	Project Specific Mitigation Measures	Residual Injury/ Illness	Residual Environmental Impact	Residual Financial Loss/ Property damage/ Reputation	Actions	Action Party / Due Date
3.1.6	Dock activites/ mooring operations/ Vessel movements within docks	Congested docks during restricted access/ increased vessel to vessel encounters (causing collision)	- Damage to vessels - Fatality/ Injury to personnel - Environmental impact	M	M	M	1. Newport Dock marine control to monitor vessel movements within dock 2. Natural Resources Wales (NRW) to be notified of all spills 3. Ship Oil Pollution Emergency Plan (SOPEP) in place onboard merchant vessels	1. During construction activities, navigation warnings and notices to mariners to be promulgated to all river users 2. Construction activities to be planned in consideration of vessel arrival/ departure times 3. Manning of marine control centre at Newport, during critical construction activities, as required	M	M	M		
3.1.7	Dock activites/ mooring operations/ Vessel movements within docks	Construction pollution/ floating debris	- Damage to vessel - Environmental impact/ pollution	L	M	M	1. Pollution/ debris to be reported immediately, and recovered where possible 2. Newport Dock marine control to be notified 3. Natural Resources Wales (NRW) to be notified of all spills	1. Pollution containment equipment and procedure in place (as per Construction Environmental Management Plan - CEMP) 2. Bridge construction activities over water powered by electric supply (eg. no generators)	L	L	L		
3.1.8	Dock activites/ mooring operations/ Vessel movements within docks	Destabilizing dock wall during piling activiites	- Damage to dock	L	L	M		1. Risk has been mitigated during bridge design calculations 2. Construction methodology (bored piling) 2. Monitoring equipment in place during piling operations	L	L	M		

Item	Activity	Hazards	Consequences	Injury/Illness	Environmental Impact	Financial Loss/ Property damage/ Reputation	Existing Measures/ Standard Marine Practice	Project Specific Mitigation Measures	Residual Injury/ Illness	Residual Environmental Impact	Residual Financial Loss/ Property damage/ Reputation	Actions	Action Party / Due Date
3.1.9	Vessel access by crews and emergency vehicles during construction activities	Obstructed access to vessels	- Schedule / commercial impact	L	L	M		1. Traffic management plan in place to ensure designated/ continual access for dock users	L	L	L		
3.1.10	Dock activites/ mooring operations/ Vessel movements within docks	Conflict with radio communications/ communication breakdown (causing collision)	- Damage to vessels - Fatality/ Injury to personnel - Environmental impact	M	M	M	1. Dedicated VHF/UHF channels used by vessels	1. Construction radio communications to consider interference with vessel communications 2. Develop interface document/ marine management plan to formalise interfaces/ communications	M	M	M		

3 Newport Docks
3.2 Bridge Operation

Item	Activity	Hazards	Consequences	Injury/Illness	Environmental Impact	Financial Loss/ Property damage/ Reputation	Existing Measures/ Standard Marine Practice	Project Specific Mitigation Measures	Residual Injury/ Illness	Residual Environmental Impact	Residual Financial Loss/ Property damage/ Reputation	Actions	Action Party / Due Date
3.2.1	Dock activites/ mooring operations/ Vessel movements within docks	Collision with bridge during vessel movements, or by errant vessel within docks		0	0	0			0	0	0	ABP have declined to participate in discussions for this hazard. This is probably due to their objection to this scheme which relates to air draft and the potential impact of shipping hitting the bridge. WG is presently considering this risk further in a Quantitative Risk Assessment. Engagement with ABP in that regard will continue.	

Item	Activity	Hazards	Consequences	Injury/Illness	Environmental Impact	Financial Loss/ Property damage/ Reputation	Existing Measures/ Standard Marine Practice	Project Specific Mitigation Measures	Residual Injury/ Illness	Residual Environmental Impact	Residual Financial Loss/ Property damage/ Reputation	Actions	Action Party / Due Date
3.2.2	Dock activites/ mooring operations/ Vessel movements within docks	Dropped tools/ objects during maintainence activities	- Damage to vessel - Fatality/ Injury to personnel	H	L	M		1. Implementation of dropped objects prevention measures during maintenance activities, to be addressed in bridge maintenance manual 2. Major bridge maintenance works to include promulgation of notice to mariners / navigational warnings	M	L	L		
3.2.3	Dock activites/ mooring operations/ Vessel movements within docks	Maintanence pollution/ floating debris	- Environmental impact/ pollution - Damage to vessel	L	M	L	1. Pollution/ debris to be reported immediately, and recovered where possible 2. Newport Docks Marine notified, and navigational warning issued 3. Natural Resources Wales (NRW) to be notified of all spills	1. Pollution response procedures addressed in bridge maintenance manual	L	L	L		
3.2.4	Dock activites/ mooring operations/ Vessel movements within docks	Congested south dock, due to larger vessels unable to enter norh dock/ increased vessel to vessel encounters		0	0	0			0	0	0		
3.2.5	Vessels berthing and bunkering at Junction Cut, during bridge maintenance and operations	Dropped objects whilst vessels are berthed/ bunkering	- Damage to vessel - Fatality/ Injury to personnel	H	L	M		1. Implementation of dropped objects prevention measures during maintenance activities, to be addressed in bridge maintenance manual	M	L	L		

Item	Activity	Hazards	Consequences	Injury/Illness	Environmental Impact	Financial Loss/ Property damage/ Reputation	Existing Measures/ Standard Marine Practice	Project Specific Mitigation Measures	Residual Injury/ Illness	Residual Environmental Impact	Residual Financial Loss/ Property damage/ Reputation	Actions	Action Party / Due Date
3.2.6	Vessels berthing and bunkering at Junction Cut, during bridge maintenance and operations	Falling objects from bridge during operation (vehicles; people; debris)	- Damage to vessel - Fatality/ Injury to personnel	M	L	M		1. Bridge design includes barriers to prevent falling objects, and un-authorised personnel access	M	L	M		

APPENDIX D MEETING WITH TRINITY HOUSE, 9TH DECEMBER 2016

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GLOBAL MARITIME

Navigational Risk Assessment
Attendance Sheet

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APPENDIX E MEETING WITH CARGO SERVICES (UK) LTD, 8TH DECEMBER 2016

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Meeting	Navigation Risk Assessment M4 CaN	Venue	Cardiff Heliport	Date	8th December 2016

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