



SAFETY MANAGEMENT PLAN (MARINE)

COMMERCIAL VESSEL PASSAGE PLANNING FOR THE GLOUCESTER HARBOUR



August 2018

Version History

Version	Reason for Change		Date
1.0	Original Document		June 2011
1.1	Inclusion of Lydney and Old Dock procedures		January 2015
1.2	Review and amendments to formatting		24 August 2018

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I. Passage Planning

Commercial Vessels

The attention of Owners, Masters and Operators of all vessels is drawn to the requirement for passage planning.

The Admiralty charts available for use in the Bristol Channel, Severn Estuary and approaches to Sharpness are as follows:

BA 1179 - The Bristol Channel

BA 1176 - The Severn Estuary - Steep Holm to Avonmouth

BA 1166 - River Severn - Avonmouth to Sharpness and Hock Cliff

Before arrival, ships' masters should consult the following Admiralty publications:

Admiralty Tidal Stream Atlas NP256 - Irish Sea and Bristol Channel

Admiralty Sailing Directions NP37 - West Coast of England and Wales Pilot

Admiralty List of Lights and Fog Signals NP74 Vol. A

Admiralty List of Radio Signals NP287 (1) Vol. 6

Relevant Notices to Mariners may be viewed through the 'Notices to Mariners' menu. Other information is readily available through the various menus on the website.

All vessels whose length overall is 30 metres or more are subject to compulsory pilotage and the arrangements for ordering pilotage services are set out in the Pilotage Directions.

Upon boarding, the pilot will discuss the passage plan with the bridge team and complete the attached planning information sheets.

2. General Navigational Procedures for all vessels subject to Pilotage Directions (Gloucester Harbour) and all vessels engaged in towing operations.

2.1 Vessel arriving at Lock or Basin

Prior to entering the basin the pilot should seek permission to enter from Sharpness Radio having due regard to:

- Required under keel clearance:

Beam	Min. Clearance
< 10.3m	0.61m
10.36 – 13.71m	0.76m
13.72 – 16.76m	0.91m

- Other traffic in vicinity
- Manoeuvrability of vessel
- The readiness of the port to accept the vessel

2.2 Vessel Departing Lock or Basin

Prior to departing the lock or basin the pilot should seek permission to depart from Sharpness Radio having due regard to:

- Required under keel clearance:

Beam	Min. Clearance
< 10.3m	0.61m
10.36 – 13.71m	0.76m
13.72 – 16.76m	0.91m

- Other traffic in vicinity
- Manoeuvrability of vessel
- Any constraints imposed by the port infrastructure, repairs thereto or other works

And in addition should:

- Establish communications with any inbound vessel inward of Hayward Beacon and agree a plan to pass

2.3 Vessels Passing within District

When two or more vessels are to navigate within the district at the same time communication should be established to confirm details of passing or overtaking manoeuvres.

2.4 Vessels navigating with minimum under keel clearance

Vessels navigating with an expected under keel clearance of less than 1.5m on the sill at Sharpness should before arrival pay particular regard to factors such as:

The performance of previous tides at Sharpness (height, timing)

The performance of tide at Avonmouth

Meteorological conditions (wind speed and direction, barometric pressure)

Manoeuvrability of vessel

3. PRE-ARRIVAL PLANNING FOR LARGER VESSELS

It is generally agreed that the dimensions of vessels engaged in coastal and near-European shipping are gradually increasing. Many of the smaller and older vessels that were once commonplace at ports such as Sharpness are no longer competitive compared with modern larger vessels.

The majority of modern vessels are generally very manoeuvrable and most are equipped with bowthrusters and effective “high lift” rudders. However, vessels with a higher DWT are likely to be restricted by their increased beam and/or draft to movements on fewer tides, and hence a reduced “window” for entry to the port.

The older and larger vessels may not be so well-equipped and may require tug assistance in order to expedite entry on a particular tide. This, in itself, raises questions concerning the availability, suitability and cost of tugs in the Severn estuary.

The current Pilotage Directions set out the minimum level of information that is required by the pilot in order to assist in planning a safe and expeditious passage to or from Sharpness. The required information is summarised below:

- (a) ETA or ETD
- (b) Summer Dead Weight
- (c) Forward draft in fresh water
- (d) Aft draft in fresh water
- (e) Maximum beam
- (f) Speed
- (g) Maximum height of mast above keel
- (h) Type of rudder (e.g. standard, high-lift, Kort nozzle)
- (i) Status of bowthruster (if fitted)
- (j) Any other information relevant to the navigational status of the vessel (e.g. significantly reduced visibility due to configuration of cargo, defects in compass or radar equipment) that is brought to the attention of the agent
- (k) Destination (if known) for departing vessels

A vessel whose dimensions exceed any of the following criteria may trigger a pre-arrival conference (involving the agent/shipowner, CRT, GPP and GHT) to agree how the arrival of the vessel will be managed (including a discussion on whether there is a requirement for additional assistance):

- 5000DWT
- 100m loa
- 16m maximum beam
- 6m maximum freshwater draft
- or are known to have an unusual or non-standard hull or superstructure configuration

4.0 PROCEDURES IN RESTRICTED VISIBILITY

4.1 Overview

Restricted visibility elevates risk which may be mitigated by appropriate procedures and the increase in safety margins. It may be necessary in the interests of safety and following appropriate risk assessment to increase the minimum underkeel clearance for vessels by at least 0.5m if it is deemed that visibility is generally restricted to less than 0.5 mile in order to provide a greater navigational envelope in the river.

NB: No tug should be made fast to a vessel when unable to maintain sight of the adjacent shore or point of navigational relevance or significance.

4.2 Definitions

Restricted visibility procedures will be implemented when the general visibility is deemed to be less than 1 mile

4.3 Initial Action

When it is apparent that visibility is restricted to less than 1 mile then the docking and sailing of vessels should be reassessed. Consultation should be made, but not restricted to, between:-

- Pilots
- Master of vessel
- Bristol VTS
- GHT Harbourmaster
- Canal & River Trust Harbourmaster/Responsible Person

Consultation should include but not be restricted to the following points:-

- Passage plans
- Draft in relation to the available depth of water
- Whether vessel in ballast or loaded condition
- Availability and status of navigational equipment on board vessel (e.g. chart plotters)
- Competence of crew with particular regard to steering ability
- Other vessel movements within district
- Ability to manoeuvre vessel
- Ability to work mooring lines

- Available space in dock
- Likelihood of visibility improving within the tidal window
- Other temporary restrictions within the dock, entrance or river
- Operational status of shore side navigational aids (e.g. radar)
- Contingency plans

4.4 Subsequent Actions

Consideration to be given to delaying arrivals and departures.

Consideration should be given to delaying movements if:

- Visibility at the Second Severn Crossing is less than 0.5 mile and
- The visibility at Sharpness is reported to be such that:
 - Panthurst Light is not visible from Pierhead (0.5 mile)
 - Pier lights are not visible from Watch House
 - An inbound vessel is already in the river
 - Reports from the river indicate visibility of less than 2 cables
 - Reports from other points in the river do not indicate significant improvement.

In severely restricted visibility, the pilotage service may be halted.

4.5 Further considerations

If a vessel encounters restricted visibility during an inbound passage and the circumstances are such that the Master and pilot in consultation with the parties listed in section 4.3 consider it safe to proceed to Sharpness rather than abort the passage, then this shall be the preferred course of action.

GLOUCESTER HARBOUR – PASSAGE PLANNING

Vessel Details		Passage Details	
Ship name	<input type="text"/>	Date	<input type="text"/>
In from / out to	<input type="text"/>	Pilot	<input type="text"/>
Summer DWT	<input type="text"/>	Boarding time	<input type="text"/>
Length	<input type="text"/>	HW Sharpness	<input type="text"/>
Maximum beam	<input type="text"/>	ETA/ATD Sharpness	<input type="text"/>
Max. Fresh Water Draft	<input type="text"/>	ETA Sheperdine	<input type="text"/>
Max. Air Draft	<input type="text"/>	ETA Severn Bridge	<input type="text"/>
Speed	<input type="text"/>	ETA SSC	<input type="text"/>
Fuel oil type	<input type="text"/>	ETA Portishead	<input type="text"/>
Fuel oil quantity	<input type="text"/>	ETA Pilot Station	<input type="text"/>
Persons on board	<input type="text"/>	Expected depth at ETA Sharpness*	<input type="text"/>

*The minimum under keel clearance whilst on passage through the harbour should be no less than one metre based on predicted tidal information. UKC may be reduced in the approaches to the port. The required UKC will be increased by 0.5m during periods when visibility is less (or expected to be less) than 0.5 Nautical Miles.

The normal minimum UKC for entry to the port is dependent upon the vessels maximum beam:

Max. Fresh Water draft + 0.61 / 0.76 / 0.91 = Required Height of Tide m

PRE-PASSAGE ACTIONS**YES NO****COMMENTS**

Is the pilot card available and have the handling characteristics of the vessel been discussed?

Are there any defects which may affect the safe navigation of the vessel?
(If 'YES' notify defects to harbour authority)

Are the anchors ready for immediate use?

Have general passage and docking procedures been discussed with the Master?

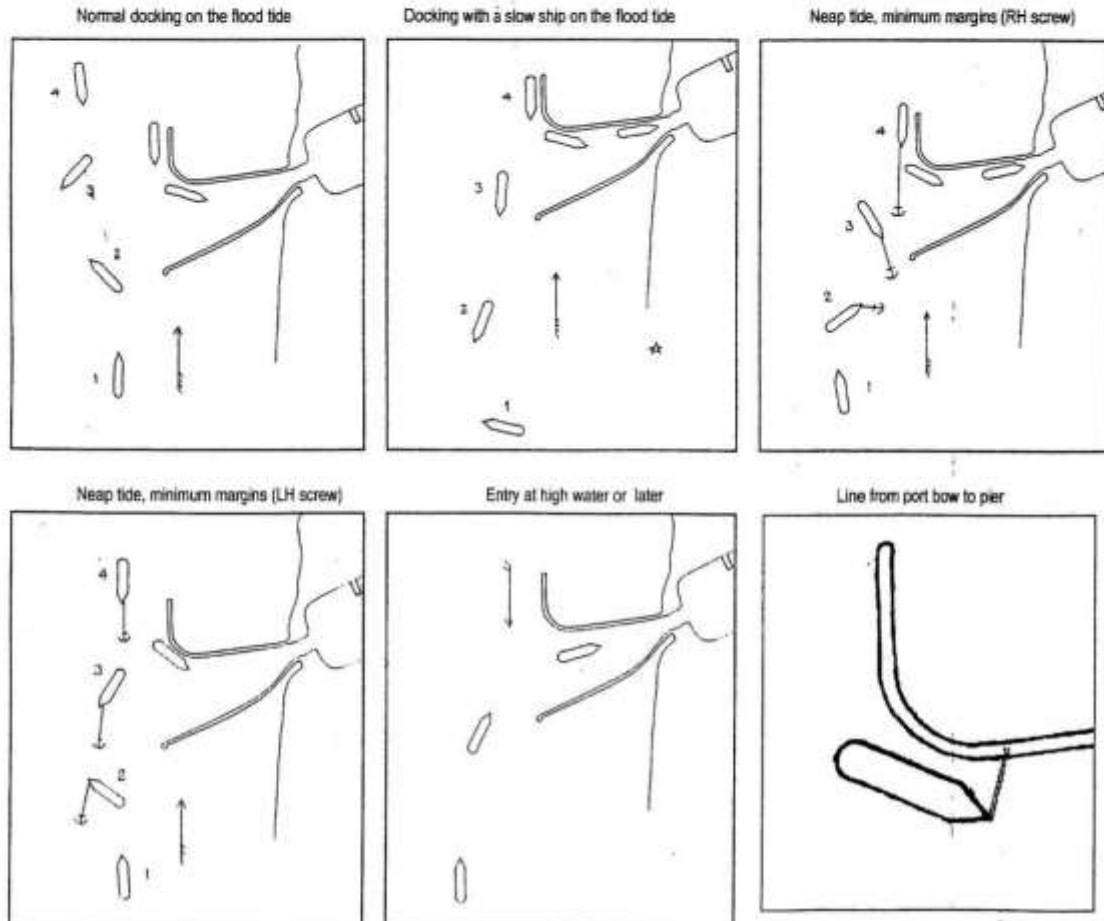
Have restricted visibility and required UKC procedures been agreed with the Master?

Is hazardous cargo carried?

CONFIRMATION**MASTER** _____

PASSAGE DETAILS

- 1 **BOARDING:**
The pilot will normally embark or disembark in the vicinity of boarding area 'C' (chart 1182), at the lock or basin at Sharpness Dock or at the berth if dock pilotage has been requested.
- 2 **ROUTE:**
The recommended tracks for the passage between Sharpness Dock and seaward of the Second Severn Crossing are generally defined by the series of leading lines shown on Admiralty Chart nos. 1166 and 1176. Regular monitoring of the harbour area is carried out at low water periods in order to establish the route of the best channel and the extent of any changes to sandbanks or other natural features.
- 3 **DOCKING:**
Inbound vessels will normally swing to stern the tide before passing between the piers at the entrance to Sharpness Dock. Vessels will normally be swung to port off the dock entrance and may be required to put lines ashore on the port side (see diagrams below).
Outbound vessels will normally depart directly to the river without need for further handling of lines once cast off in the lock.
- 4 **UNDERKEEL CLEARANCE:**
The minimum underkeel clearance whilst on passage through the harbour should be no less than one metre based on the predicted tidal information. UKC may be reduced whilst manoeuvring in the approaches to the port. Regular reports of tidal and weather conditions at Sharpness are received whilst in vhf range which enable the pilot to advise of any alterations to course and speed which may be required to maintain a safe underkeel clearance whilst on passage. Increased UKC may be required in restricted visibility or under certain other conditions.
- 5 **RESTRICTED VISIBILITY:**
An additional 0.5m UKC will be required when visibility in any part of the harbour is reduced (or expected to reduce) to 0.5 nautical mile or less.
- 6 **DURING THE PASSAGE:**
The Master is expected to ensure that adequate steps are taken to maintain a correct record of the passage.
The Master is expected to ensure that members of the bridge team have an adequate understanding of instructions given in English.
- 7 **COMMUNICATION AND REPORTING:**
All vessels must report to BRISTOL VTS (VHF channel 12) as indicated in ALRS Vol. 6.
Vessels on passage between Sharpness and the Second Severn Crossing may communicate with SHARPNESS RADIO (VHF channel 13).
Where known, Sharpness Radio will advise of any traffic movements.
- 8 **ABORT PROCEDURE:**
If necessary, the pilot will advise where, dependent upon tidal and draught constraints, the passage may be suspended or aborted.
- 9 **ANCHORAGE:**
In an emergency, vessels may be directed to anchor in deep water at Northwick or in King Road over a low water period.



**Passenger (and other) vessel visits to river berths
at Lydney Dock and Sharpness Old Dock**

Periodic visits are presently made by the paddle steamer 'Waverley' (operated by Waverley Excursions Ltd) and the motor vessel 'Balmoral' (operated by White Funnel Ltd).

These vessels visit Lydney and Sharpness infrequently to embark passengers at dock entrance piers and river berths which are not presently used by other vessels for this or any other purpose.

The locations used for this purpose are exposed to significant and sometimes unpredictable tidal flows, particularly during high spring tides.

The locations also present limited mooring options, with careful consideration being required to make effective and safe use of the available mooring bollards. There is also a requirement to consider public safety in the vicinity of mooring zones and during the embarkation process.

The following information is provided to assist in ensuring that operational and reputational risk is reduced to a level that is as low as reasonably practicable.

1. Passage Planning sheet.
2. Operational Procedures, Sharpness.
3. Operational Procedures, Lydney.
4. Risk Assessment (relevant sections of the Trustees' Safety Management System have been reviewed and those parts amended as indicated) which shows the initial risk, the control measures in place and the residual risk.
5. Useful references.

I. Passage Planning Sheet.

GLOUCESTER HARBOUR – PASSAGE PLANNING FOR PASSENGER VESSEL VISITS TO LYDNEY AND SHARPNESS OLD DOCK

Vessel Details		Passage Details	
Ship name	<input style="width: 250px;" type="text"/>	Date	<input style="width: 230px;" type="text"/>
Summer DWT	<input style="width: 150px;" type="text"/>	Pilot	<input style="width: 230px;" type="text"/>
Length	<input style="width: 150px;" type="text"/>	Boarding time	<input style="width: 150px;" type="text"/>
Max. Fresh Water Draft	<input style="width: 150px;" type="text"/>	HW Sharpness	<input style="width: 150px;" type="text"/>
Max. Air Draft	<input style="width: 150px;" type="text"/>	ETA Lydney	<input style="width: 150px;" type="text"/>
Speed	<input style="width: 150px;" type="text"/>	ATD Lydney	<input style="width: 150px;" type="text"/>
Fuel oil type	<input style="width: 150px;" type="text"/>	ETA Sharpness	<input style="width: 150px;" type="text"/>
Fuel oil quantity	<input style="width: 150px;" type="text"/>	ATD Sharpness	<input style="width: 150px;" type="text"/>
Crew on board	<input style="width: 150px;" type="text"/>	Expected depth at Lydney Dock*	<input style="width: 50px;" type="text"/>
Passengers on board (pre arrival)	<input style="width: 150px;" type="text"/>	Expected depth at Sharpness Old Dock*	<input style="width: 50px;" type="text"/>
Passengers on board (ex Lydney)	<input style="width: 150px;" type="text"/>	ETA Lower Shoots (Outbound)	<input style="width: 100px;" type="text"/>
Passengers on board (ex Sharpness)	<input style="width: 150px;" type="text"/>		

*The minimum under keel clearance whilst on passage through the harbour should be no less than one metre based on predicted tidal information. UKC may be reduced in the approaches to the berths. Passages will not be undertaken during periods when visibility is less (or expected to be less) than 1.0 Nautical Miles.

PRE-PASSAGE ACTIONS

YES NO

COMMENTS

Is the pilot card available and have the handling characteristics of the vessel been discussed?

Are there any defects which may affect the safe navigation of the vessel?
(If 'YES' notify defects to harbour authority)

Are the anchors ready for immediate use?

Have general passage and docking procedures been discussed with the Master?

Have restricted visibility and required UKC procedures been agreed with the Master?

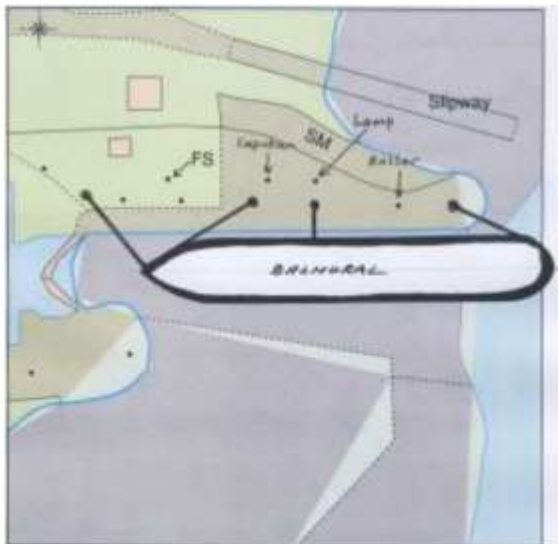
Is hazardous cargo carried?

CONFIRMATION

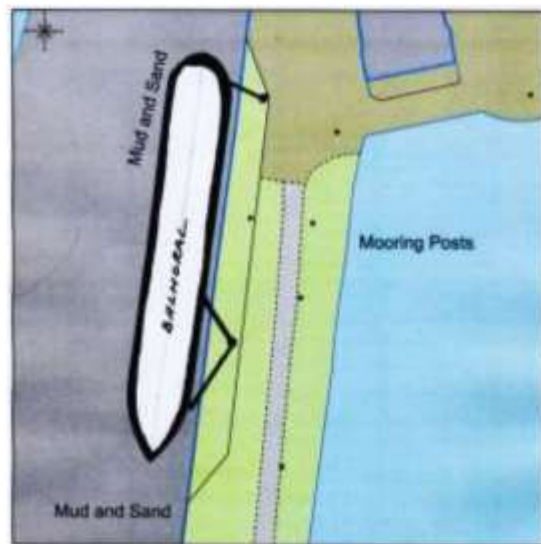
MASTER _____

PASSAGE DETAILS

- 1 **BOARDING:**
The pilot will normally embark and disembark at a pier, berth or port outside the Gloucester compulsory district.
- 2 **ROUTE:**
The recommended tracks for the passage between Sharpness, Lydney and seaward of the Second Severn Crossing are generally defined by the series of leading lines shown on Admiralty Chart nos. 1166 and 1176. Routeing may vary depending upon draft of vessel and other operational factors. Regular monitoring of the harbour area is carried out at low water periods in order to establish the route of the best channel and the extent of any changes to sandbanks or other natural features.
- 3 **DOCKING:**
The pilot and Masster will discuss berthing requirements and make these known to vessels' crew and to shore mooring personnel; typical mooring plans are provided below.
- 4 **UNDERKEEL CLEARANCE:**
The minimum underkeel clearance whilst on passage through the harbour should be no less than one metre based on the predicted tidal information. UKC may be reduced whilst manoeuvring in the approaches to the port. Regular reports of tidal and weather conditions at Sharpness are received whilst in vhf range which enable the pilot to advise of any alterations to course and speed which may be required to maintain a safe underkeel clearance whilst on passage. Increased UKC may be required in restricted visibility or under certain other conditions.
- 5 **RESTRICTED VISIBILITY:**
Passages will not be undertaken when visibility in any part of the harbour is reduced (or expected to reduce) to 1.0 nautical mile or less.
- 6 **DURING THE PASSAGE:**
The Master is expected to ensure that adequate steps are taken to maintain a correct record of the passage.
The Master is expected to ensure that members of the bridge team have an adequate understanding of instructions given in English.
- 7 **COMMUNICATION AND REPORTING:**
All vessels must report to BRISTOL VTS (VHF channel 12) as indicated in ALRS Vol. 6.
Vessels on passage between Sharpness and the Second Severn Crossing may communicate with SHARPNESS RADIO (VHF channel 13).
Where known, Sharpness Radio will advise of any traffic movements.
- 8 **ABORT PROCEDURE:**
If necessary, the pilot will advise where, dependent upon tidal and draught constraints, the passage may be suspended or aborted.
- 9 **ANCHORAGE:**
In an emergency, vessels may be directed to anchor in deep water at Northwick or in King Road over a low water period.



Typical mooring plan Lydney



Typical mooring plan Sharpness Old Dock

2. Planning and actions to be taken: Sharpness Old Dock



A long pier at the disused entrance to the 'old arm' of Sharpness Dock extends for a distance of approximately 110m in a north/south alignment. A protective fence is in place along the entire seaward edge of the pier. However, the fence has been set back from the edge over a length of 70m thereby making available three bollards for the use of vessels wishing to berth alongside for very limited periods on suitable tides.

The pier is the property of the Canal and River Trust (CRT) from which permission to use the pier must be sought.

The CRT and vessel operator shall carry out risk assessment of the shoreside activities associated with passenger-handling. Systems shall be in place to ensure that passengers are held at a safe distance during berthing operations, and for expediting the boarding of passengers once the vessel is safely moored.

Gloucester Harbour Trustees (GHT) has responsibility for navigational safety in the adjacent tidal waters.

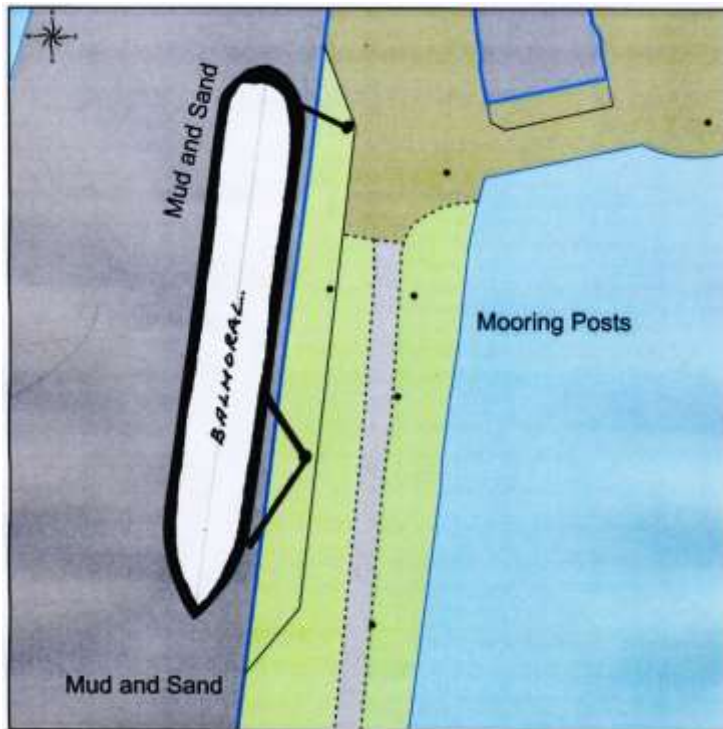
Strong tidal flows are a feature of the estuary in the vicinity of the old dock entrance. Strong counter-currents which may cause a vessel to react unpredictably are generated adjacent to the pier.

Following risk assessment GHT and its professional advisors have determined that berthing at this location shall only be carried out in accordance with the following conditions:

1. Berthing shall only be carried out on tides of 9m (Sharpness Sill) or less;
2. Passage through the Gloucester Harbour will not be undertaken in conditions where visibility is less than 1 nautical mile;
3. Passage and mooring plans will be discussed and agreed between Master, Pilot and shore mooring personnel prior to arrival;
4. There shall be effective communication between Master and mooring stations aboard the vessel;

5. Early communication on vhf channel 13 (call: "Sharpness Old Dock") shall be established between the vessel and a responsible person ashore;
6. Pilot to be responsible for communicating with shore personnel;
7. A minimum of three trained and experienced mooring personnel shall be available ashore;
8. Berthing will not be commenced until the responsible person ashore has indicated to the vessel that flows and eddies in the vicinity of the pier are reduced (under normal circumstances this is unlikely to be before HW -20min) to a level which is unlikely to adversely affect manoeuvring and berthing of the vessel;
9. A visual inspection of the adjacent river bed shall have been carried out and plotted during a low water period immediately prior to the vessel's arrival and reported to the Master and pilot.

Mooring plan:



In all but exceptional circumstances it is envisaged that:

1. A bow (head) line will be put ashore first and passed over the southernmost bollard.
2. A breast line will then be put ashore and passed over the southernmost bollard.
NB: The bights of lines occupying the same bollard shall be “dipped” to ensure easy casting-off of either line.
3. A stern line will be put ashore to be passed over the northernmost bollard.
4. Should conditions dictate that an alternative arrangement is required this will be communicated in a timely manner to the responsible person ashore.
5. Casting-off to be at the direction of the Master or pilot aboard the vessel.

3. Planning and actions to be taken: Lydney Dock

A long pier at the entrance to Lydney Dock extends from the entrance gates for a distance of approximately 55m in an east/west alignment, of which approximately 45m (depending on tide height, draught of vessel and height of adjacent mud banks) is available for berthing and passenger embarkation operations. No edge protection is in place along the pier and six mooring bollards are available for use by visiting vessels. Mooring lines are not to be passed around rollers on the pier.



The pier is the property of the Environment Agency (EA) from which permission to use the pier must be sought.

Gloucester Harbour Trustees (GHT) has responsibility for navigational safety in the adjacent tidal waters.

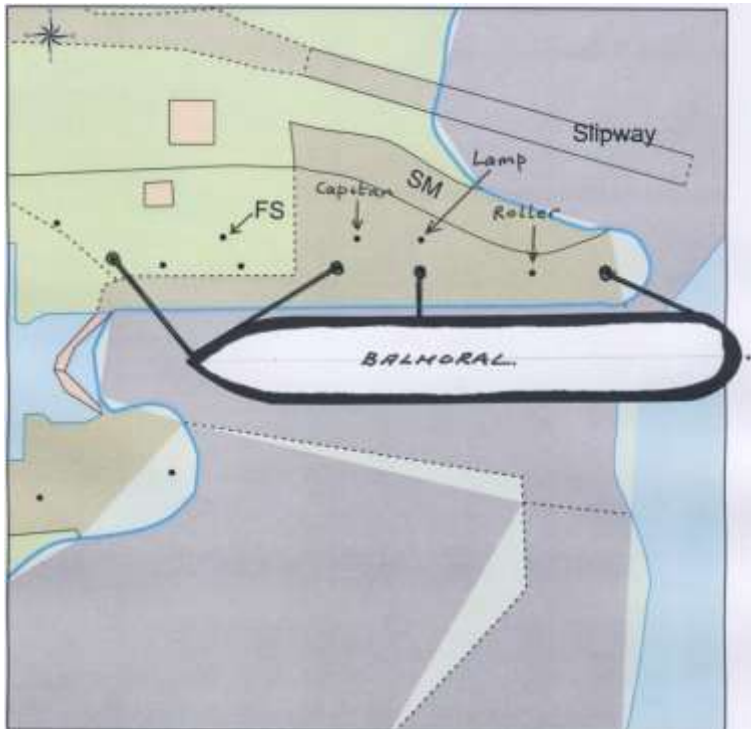
Strong tidal flows are a feature of the estuary in the vicinity of the pier and dock entrance. Strong counter-currents which may cause a vessel to react unpredictably are generated adjacent to the pier.

NB: The Environment Agency has carried out risk assessment of the shoreside activities associated with passenger-handling. Systems are in place to ensure that passengers are prevented from accessing the pier during berthing operations, and the placing of cones and yellow chain provides separation of passengers from mooring bollards and lines during the embarkation period.

Following risk assessment GHT and its professional advisors have determined that berthing at this location shall only be carried out in accordance with the following conditions:

1. Berthing shall only be carried out on tides of 9m (Sharpness Sill) or less;
2. Passage through the Gloucester Harbour will not be undertaken in conditions where visibility is less than 1 nautical mile;
3. Passage and mooring plans will be discussed and agreed between Master, Pilot and shore mooring personnel prior to arrival;
4. There shall be effective communication between Master and mooring stations aboard the vessel;
5. Pilot to be responsible for communicating with shore personnel;
6. Early communication on vhf channel 37 (call: "Lydney Dock Radio") shall be established between the vessel and a responsible person ashore;
7. A minimum of two trained and experienced mooring personnel shall be available ashore;
8. If necessary (e.g. for visits on lower tides) a visual inspection of the adjacent river bed shall have been carried out and plotted during a low water period immediately prior to the vessel's arrival and reported to the Master and pilot.

Mooring Plan:



Standard procedure:

1. The first line to be put ashore will be passed over the easternmost bollard to enable the vessel to be “worked around” the end of the pier.
 2. Once alongside lines must be transferred between bollards to ensure that:
 - (a) embarking passengers do not step over any lines, and
 - (b) the gangway does not cross any mooring line.
 3. Mooring lines are not to be passed around rollers on the pier.
 4. Should conditions dictate that an alternative arrangement is required this will be communicated in a timely manner to the responsible person ashore.
 5. Casting-off to be at the direction of the Master or pilot aboard the vessel.
- NB: The bights of any lines occupying the same bollard shall be “dipped” to ensure easy casting-off of either line.



4. Risk Assessment.

All activities are subject to risk assessment. This process begins with hazard identification and where possible hazards are eliminated.

Where hazards cannot be wholly or partly eliminated, an assessment of the residual risks is undertaken. Control measures are then introduced to reduce risk to as low as is reasonably practicable (in accordance with the principles of ALARP).

For the purposes of this assessment of risk, three levels have been established – low, medium and high. These levels may be applied to how incidents may affect a variety of subjects, e.g. those affecting personnel, property, operations, the marine environment etc.

LOW – where the consequence causes minimal loss (taken year on year), no injuries requiring first aid or medical treatment, where good controls, monitoring and work procedures are in place, where there is no accident history etc; where an incident is unlikely to cause damage to a vessel or affect port operations and is not frequent; where the financial consequences are deemed tolerable by the Trustees or their insurers and where there is minimal risk to the marine environment.

MEDIUM – where injuries requiring first aid or medical treatment may occur; where accidents may have occurred at some stage in the past; where controls and hazard awareness are effective but could improve etc; where an incident may cause some damage (repairable) to a vessel or cause temporary short term interruption to port activities or where an incident could have limited short term effect on the local marine environment.

HIGH – where injuries could result in disease, loss of limbs, maiming or death, where hazards occur frequently or permanently and controls are inadequate or missing and accidents happen frequently etc; where irreparable damage may be caused to a vessel or long term or permanent interruption to port activities; where an event would threaten the commercial viability of the port or otherwise negate the Trustees' major responsibilities to users of the harbour, the port and its environs; when permanent damage could be caused to the total marine environment.

The Trustees' published Safety Management System includes series of risk assessments, each of which considers the various hazards which may be encountered within the harbour area and sets out mitigation measures which if followed will reduce risk to a level which is as low as reasonably practicable.

Risk assessments relevant to vessels visiting river berths at Lydney and Sharpness should include:

- Crowd management (berth operator and vessel operator)
- Mooring and unmooring (berth operator, vessel operator and GHT)
- Vessel safe manning during manoeuvres (vessel operator)
- Conditions relating to the acceptance of the vessel into the harbour (GHT)

The Trustees' SMS has been updated to take these operations into account.

5. Useful references.

<http://www.nautinst.org/en/forums/mars/mars-2013.cfm/201368>

<http://www.nautinst.org/en/forums/mars/mars-2012.cfm/201259>

<http://www.portoflarne.co.uk/download/23/>

http://www.portskillsandsafety.co.uk/sites/default/files/documents/sip005_-_guidance_on_mooring_operations_-_issue_1.pdf