

HAMMERSMITH TEMPORARY FERRY – NAVIGATION RISK ASSESSMENT



06-Jul-2021

Uber Boat by Thames Clipper

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Navigation Risk Assessment for operation of the Hammersmith
Temporary Ferry on the River Thames in central London

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1. INTRODUCTION

This report has been prepared by NASH Maritime on behalf of Uber Boat by Thames Clippers (UBTC) and documents the findings of Navigation Risk Assessment (NRA) for the establishment and operation of the proposed Hammersmith Temporary Ferry, located to the east of Hammersmith Bridge in central London, which will operate between two dedicated temporary piers.

The report is an evolution from the preliminary assessment “Hammersmith Temporary Ferry: Preliminary Hazard Analysis Report” (see **Annex A**) to a comprehensive full NRA.

The NRA has been undertaken to accompany the application for the proposed project which will include a River Works License (RWL) application to the Port of London Authority (PLA) and is therefore undertaken in line with the PLA Risk Assessment Methodology.

1.1. STUDY OBJECTIVE

The objective of this study is to provide a NRA for the construction and operation of the Hammersmith Temporary Ferry project and any impact it may have on the safety of navigation. The study will ensure the baseline disposition of marine users is defined, hazards are identified, risks are assessed (in terms of likelihood and consequence) and propose control measures to ensure that the residual levels of risks are acceptable.

1.2. SUMMARY OF PRELIMINARY HAZARD ANALYSIS FINDINGS

The Preliminary Navigation Hazard Analysis Report assessed, at a provisional level, the navigational impact of constructing the two piers and the temporary ferry service operation. The work sought to identify, at an early stage, any key issues requiring consideration for engineering design and operational planning. A review of the proposed pier designs and ferry operation was undertaken together with limited provisional data analysis and consultation with key stakeholders including the PLA, Thames Marine Services (TMS) and Thames Regional Rowing Council (TRRC).

The conclusions of the assessment were:

- That the pier locations and designs had been optimised sufficiently to mitigate navigational risk as much as possible and no further amendments to the pier locations were proposed.
- Minimal alterations to the existing pier designs were recommended (including markings/signage to provide information and highlight key features together with riparian lifesaving equipment).
- The potential for a number of, as yet undefined, future operational river scenarios necessitates the requirement for periodic update to the NRA throughout the lifetime of the project. Stakeholder consultation was seen as key to NRA updates, ensuring that the interface of the project with relevant users is considered and to support the revision and update of the NRA (including the update and assessment of additional hazards, and determination of risk control mitigations); and

- That the first NRA (this report - covering the construction of the proposed piers and initial operation of the ferry) should be undertaken on the basis of the current and expected river situation, i.e. controlled transits through the Hammersmith Bridge (as specified in PLA Notice To Mariners U3/2021¹).

The primary recommendation of the preliminary navigation hazard assessment was that a full NRA be undertaken in line with PLA requirements for the installation, operation and decommissioning of the proposed piers and Hammersmith Temporary Ferry operation.

The Preliminary Hazard Analysis also determined that the assessment scenario adopted for the NRA (this report) would be as per PLA NTM U3/2021, and the NRA will need to be updated periodically as part of future phases of work, should there be a change to the current navigational disposition (e.g. if Hammersmith Bridge transit restrictions are revised).

In order to facilitate the development and implementation of risk controls, enable periodic consultation, assessment of future assessment scenarios and to provide feedback of the effectiveness of implemented risk control measures it was recommended that a River User Liaison Group (RULG) should be formed at the earliest opportunity (the formation of a RULG was also recommended as a key risk control).

1.3. HAMMERSMITH BRIDGE CLOSURE, RESTRICTIONS AND EXCLUSION ZONE

The Hammersmith Temporary Ferry has an entwined relationship with the status of Hammersmith Bridge which has been closed to pedestrians, cyclists and river traffic since August 2020 due to concerns regarding the structural integrity of the bridge resulting from corrosion of the iron work. Following an initial closure of the river under the bridge to all transits, and (at the date of this report) essential transits of the bridge can currently be booked via the PLA subject to a number of key criteria being met, as defined in PLA Notice To Mariners (NTM) U3 of 2021. Arches #1 and #3 are closed to navigation and the bridge is closed to all recreational traffic including unpowered craft. In addition a 15m navigation exclusion zone is in place to the east and west of the bridge and a guard vessel is in place.

The navigable status of arch # 2 is indicated by a traffic light system installed on the bridge above the authorised channel. The traffic lights display the following symbols:

- A red X – indicates the bridge is closed to all traffic;
- An amber X – indicates the bridge is available to navigate on a controlled transit basis:
 - In order for vessels to arrange a pre-booked controlled passage through arch #2 the following conditions must be met:

¹ <http://www.pla.co.uk/assets/u3of2021-barnelmsreach-hammersmithbridge-closedtonavigationexclusionzonecontrolledtransits.pdf> [Accessed on 16-Jun-2021]

- The transit is necessary and essential²;
 - Transit may be cancelled at short notice;
 - The vessels master has a suitable passage plan in place;
 - The vessels master confirms the safest minimum number of crew are onboard; and
 - The vessel monitors VHF channel 14 at all times.
- A green arrow – arch # 2 is available for navigation and there are no restrictions. However, arch #1 and arch #3 remain closed.

The restrictions imposed by NTM U3 of 2021 therefore mean that transits under the bridge are significantly reduced and will remain so until such a time that the current Notice To Mariners is amended or lifted.

Refurbishment options for the bridge range from stabilisation to complete restoration although at present there is no confirmed timeframe as to when the bridge will be fully reopened, although it is anticipated that varying restrictions to navigation will be required through this timeframe and therefore the baseline navigation of the river may likely change and evolve significantly over the project lifecycle of the Hammersmith temporary ferry.

1.4. NAVIGATION RISK ASSESSMENT AND MANAGEMENT OVER PROJECT LIFECYCLE

As outlined in Sections 1.2 and 1.3, it is recognised that there's uncertainty in how the baseline navigation environment will vary over the project lifecycle, this will influence potential future assessment scenarios i.e. due to changes in the restrictions to navigation that are currently in place for Hammersmith Bridge and the changes in river usage associated with the Covid-19 pandemic.

Following from the Preliminary Hazard Analysis Assessment, NASH Maritime further developed the NRA strategy over the project lifecycle allowing for the delivery of an initial NRA (this document) that will satisfy the requirements of a River Works Licence application and is a basis for continued evolution (including regular meetings of the RULG) in response to changing assessment scenarios.

Figure 1 summarises the strategic approach to the NRA developed by NASH Maritime.

This NRA report 'NRA 1' focuses on the current controlled transit assessment scenario (as per NTM U3/2021) and the construction and operation phases of the project. A review of the decommissioning phase of the project is not covered in this NRA report as it is anticipated that the assessment river scenario may likely have changed by the time it is necessary to conduct an assessment of the decommissioning project phase.

² An essential transit is defined as a transit where "the requirement cannot be delayed to a later date or conducted elsewhere".

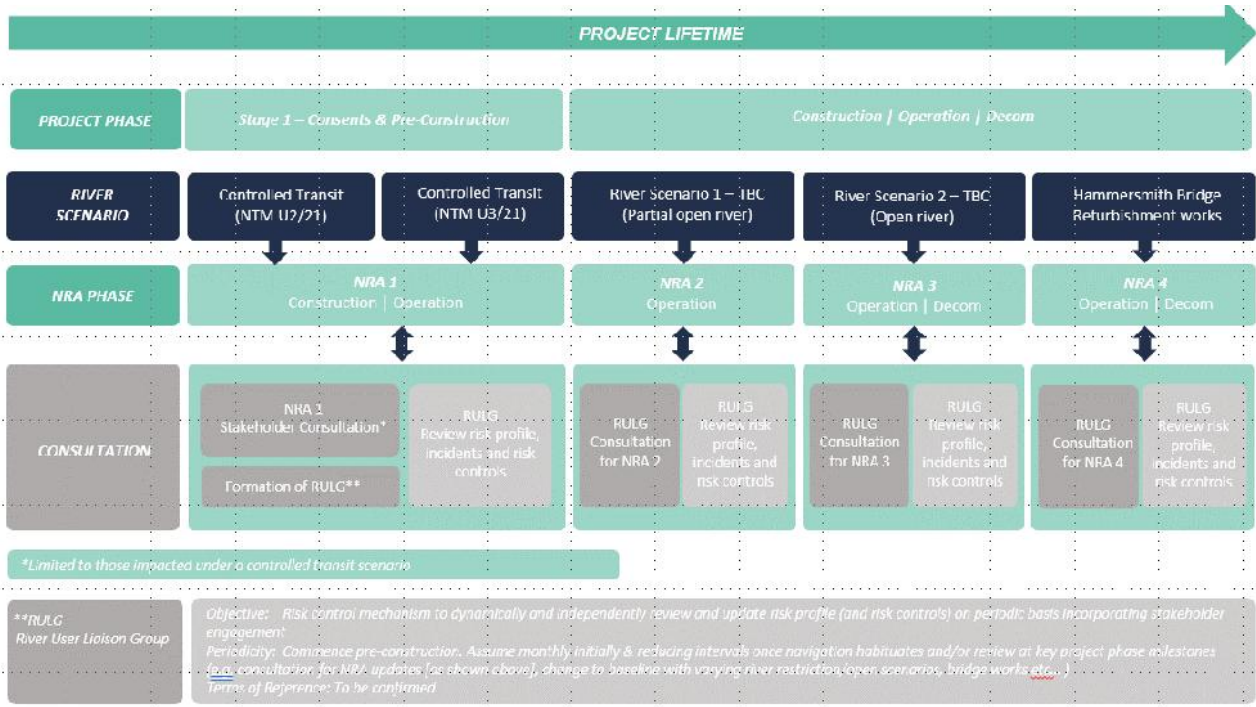


Figure 1: Approach to NRA over Project Lifecycle.

2. PROJECT LOCATION - BARN ELMS REACH

2.1. HAMMERSMITH BRIDGE

Hammersmith Bridge is a historical bridge on the river Thames, which was constructed in 1887 and further strengthened in 1973 (see **Figure 2**). The bridge has three arches with arch #2, the central arch, lit for navigation with the PLA authorised channel passing underneath. Arch #1 (to the left of arch #2 in **Figure 2**) and Arch #3 (to the right of arch #2 in **Figure 2**) are intertidal and therefore only navigable by small craft over periods of high water when there is sufficient depth of water and headway available.

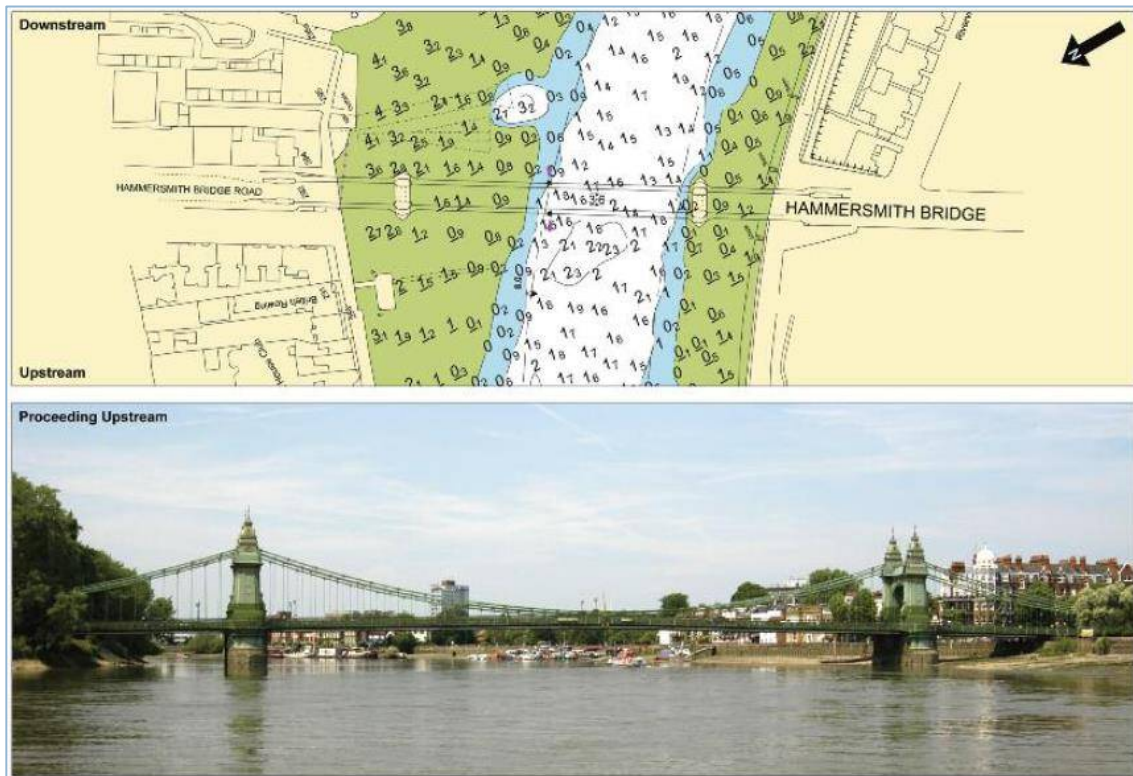


Figure 2: Extract from PLA Guide to Bridges 2012 showing Hammersmith Bridge.

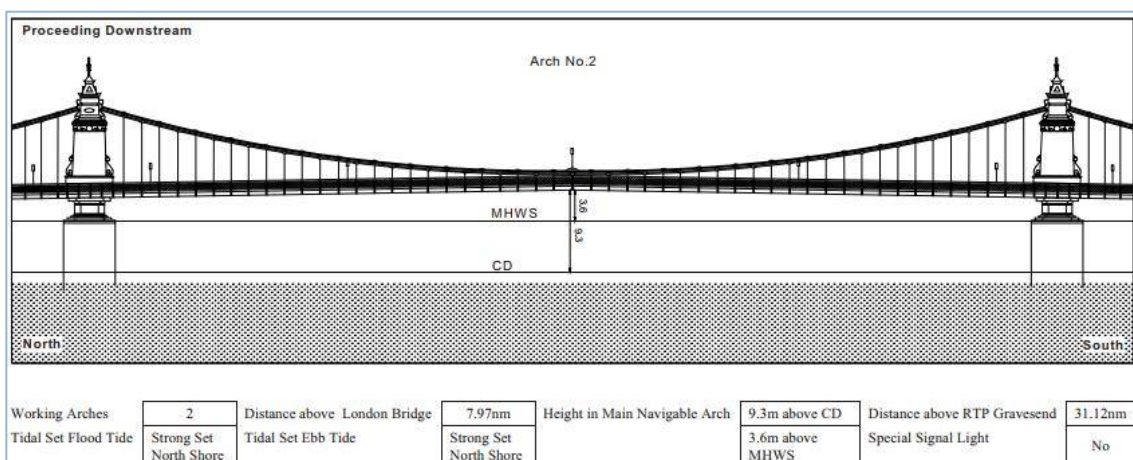


Figure 3: Section drawing of Hammersmith Bridge in relation to Tidal Heights.

A section drawing of Hammersmith Bridge is shown at **Figure 3**, which identifies the locations of existing bridge infrastructure.

The PLA Guide to Bridges 2012 notes that:

“The bridge is built on a sharp bend in the river and has one working arch and navigation at all states of the tide is to the south side of the centreline. The tide sets strongly to the north shore (Middlesex) on both the flood and ebb tides. On the north shore are several rowing and dinghy sailing clubs that should be passed with caution. Hammersmith Pier has an assortment of residential and active craft moored on and around it. On the south shore opposite Hammersmith Pier is a busy rowing club used for teaching and training schools, so one can expect activity from rowers throughout the day as well as during the early evening. Scullers and rowers can be out in the hours of darkness and may be difficult to detect before a mariner knows they are close by.

Hammersmith Bridge is the lowest of the bridges spanning the tidal Thames. Suitable passage planning taking into account the vessels air draught, and available headroom should be completed before navigating this bridge to ensure safe passage.”

When vessels transit under a navigable bridge the master must consider both water draught (the available depth of water for the vessel to navigate), and the air draught (the available “headway” for the vessel to safely pass underneath the bridge).

Hammersmith Bridge “headway” levels are given in **Table 1**, and show the available headway of arch #2 relative to tidal characteristics. It is important to note for Hammersmith Bridge that the greatest headway, which is located at the mid-point of arch #2, does not correspond to the deepest available water within the PLA authorised channel, which is located approximately 1/3 the way across arch from the south bridge pier.

Table 1: Hammersmith Bridge Arch #2 Headway Characteristics³

Minimum Headway Characteristics [m]	Hammersmith (Arch #2)
Chart Datum - CD	9.3
Mean High Water Springs - MHWS	3.6
Mean High Water Neaps - MHWN	4.7
Mean Low Water Springs - MLWS	8.7
Mean Low Water Neaps - MLWN	9.1
Highest Astronomic Tide - HAT	3.0

2.2. PORT OF LONDON AUTHORITY

The PLA is the Statutory Harbour Authority (SHA) for the River Thames, responsible for “defining and enforcing the regulations needed to support and manage the safety of navigation on the 95 miles of the tidal River Thames”.

2.2.1. REGULATORY CONTROL AND RISK MANAGEMENT

³ <https://www.pla.co.uk/assets/platidetables2021webversion.pdf>

Navigation safety in the project area is managed through legislation, guidance, procedures and practices as partially summarised in the Preliminary Hazard Analysis report and extracted below where considered as risk controls of relevance to the Hammersmith Temporary Ferry operation:

- General Directions for Navigation in the Port of London 2021;
- Port of London Pilotage Directions 2017 (as amended);
- Port of London Marine Safety Management System
- Code of Practice including the PLA Tideway Code - A code of practice for rowing and paddling on the tidal Thames;
- Recreational Users Guide
- Bye laws;
- Aids to Navigation;
- Emergency Preparedness and Response;
- Harbour Service Launch and Patrols;
- Vessel Traffic Services and vessel traffic management; and
- Promulgation of information – e.g. Notices to Mariners, Navigation Warning.

3. PROJECT DESCRIPTION – HAMMERSMITH TEMPORARY FERRY

The purpose of the proposed Hammersmith Temporary Ferry service is to provide a relief crossing whilst the existing Hammersmith Bridge is closed or restricted to users and consists of a ferry operation between two new piers to be constructed and remain in place for the duration of the operation.

Figure 4 shows the locations of the proposed Barnes and Hammersmith ferry piers along with Hammersmith Bridge and the exclusion zone currently in operation. The proposed ferry pier locations, size and orientation have been optimised to ensure that the potential impact on navigation is minimised as much as possible and are offset to lessen the impact of the structures on the navigable width and authorised channel.

The proposed pier, designs, locations and orientations were reviewed as part of the Preliminary Hazard Analysis Report (See **Annex A**) conducted prior to this NRA, it was concluded that the design and positioning of the piers had been optimised sufficiently to mitigate navigational risk as much as possible.

3.1. BARNES PIER DESIGN

Barnes Pier is situated on the southern side of the river and has been designed to allow two vessels to be moored at any state of tide (i.e. during off-peak operational times one ferry will be moored on the Barnes Pier whilst the other ferry operates).

Barnes Pier has been located at a point where the width of the river at low tide (in the immediate vicinity) is at its widest (see **Figure 4**). It is acknowledged that the location of Barnes Pier will impact the unpowered recreational route specified in the Tideway Code. Should the current restrictions, preventing non-essential (i.e. recreational craft) from transiting under the bridge be lifted during the lifetime of the proposed Hammersmith Temporary Ferry operation, recreational craft will again look to utilise the inshore route passing beneath arch #3 and the “backspan” of Barnes Pier. For this reason, the pier has been located and orientated to align, as far as possible with the existing Hammersmith Bridge pier and arch #3 to minimise any additional restriction on usage of arch#3 and allow for the maximum possible tidal window during which recreational craft can navigate the backspan of Barnes Pier.

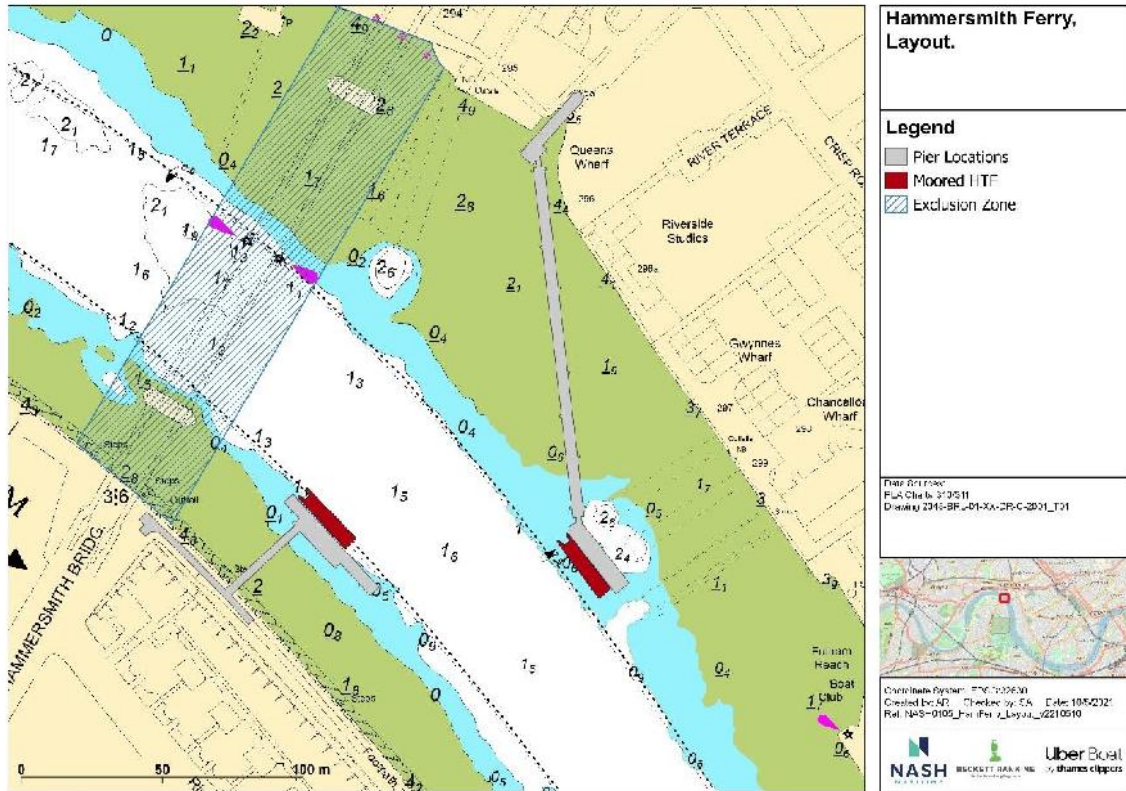


Figure 4: Pier locations, Hammersmith bridge and Exclusion Zone.

In order to allow recreational craft to navigate the backspan, Barnes Pier is linked to the shore by a brow rather than a floating pontoon. **Figure 5** shows the available water depth, headway and navigable width available to vessels navigating the backspan at Mean Low Water Springs (MLWS), Optimum Tidal Level and Mean High Water Springs (MHWS). Other than at MLWS (when Arch #3 is also restricted due to comparable bathymetry) there is a theoretical window where vessels will be able to navigate under the pier brow. Further consultation will be conducted with the River User Liaison Group as part of future iterations of the NRA to determine the exact parameters in which it is deemed safe for vessels to utilise this route.

Working on the assumption that a minimum air draught of 1.5m and a minimum draught of 0.35m will be required to allow a rowing vessel to pass under the brow of Barnes Pier, then theoretical navigable widths have been calculated and are presented in **Table 2** and **Figure 5**.

Table 2: Theoretical Navigable width under Barnes Pier Brow.

State of tide	Navigable width available under brow (metres)
Mean Low Water Springs (MLWS)	7.2
Optimum tidal level for maximum navigable width	17.3
Mean High Water Springs (MHWS)	29.0

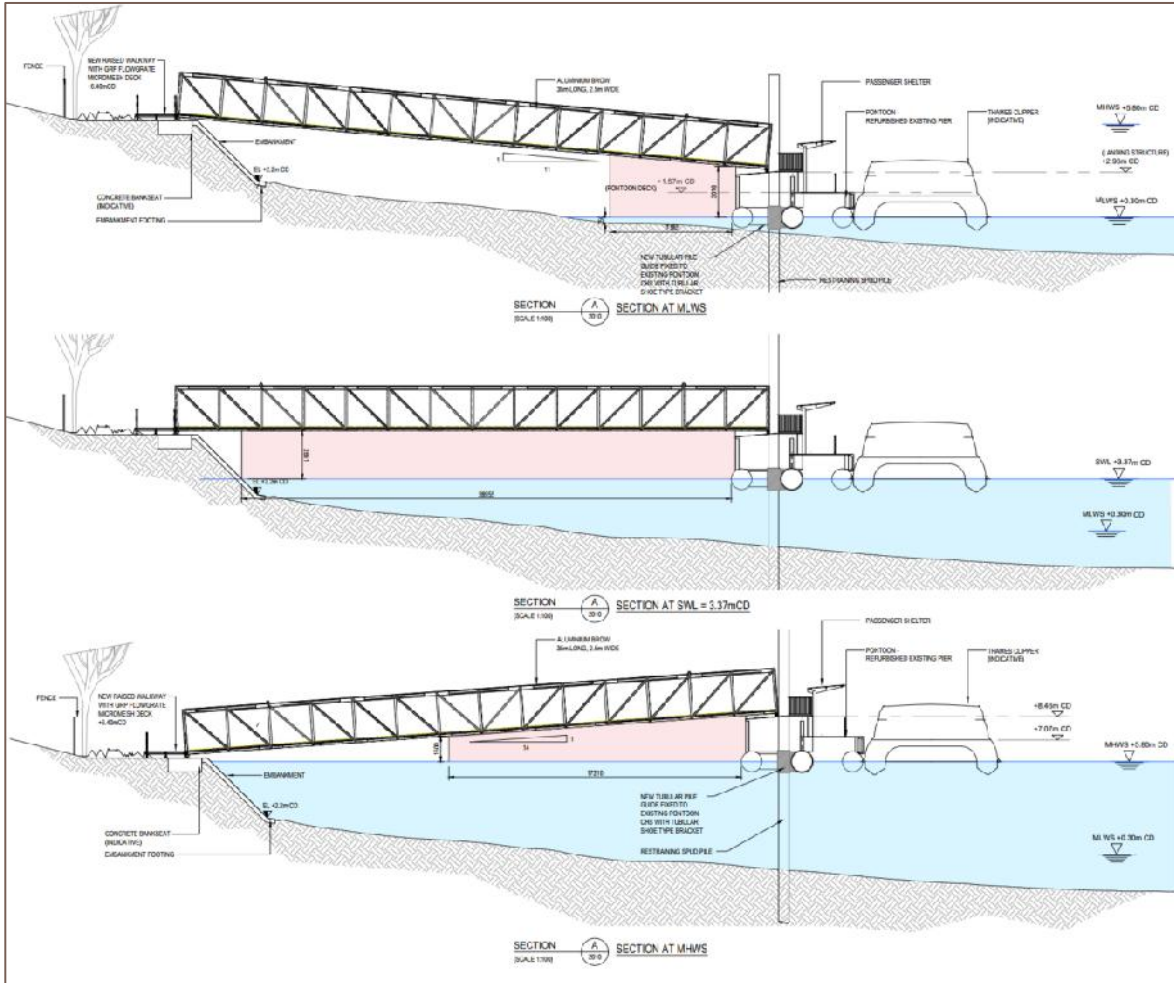


Figure 5: Barnes Pier Cross Section and Navigable width under Backspan.

3.2. HAMMERSMITH PIER DESIGN

Hammersmith Pier is located on the northern side of the Thames and has been located in an area where the low water width of the river is comparatively greater than other locations in the immediate vicinity. The location of the pier ensures that the maximum navigable width possible is retained balancing the length of the floating pontoon connecting the pier with the shore. In addition the pier has been deliberately located in an area of deeper water to mitigate the risk of project vessels grounding during low spring tides and to mitigate its intrusion on the authorised channel. The Hammersmith Pier has also been located further downstream than Barnes Pier rather than directly opposite. The intention of this staggered offset is to reduce the restriction on overall river width at each pier and also increases the room for safe navigation of those vessels navigating though the bridge at the point of maximum headway.

A floating walkway pontoon links the Hammersmith Pier to the shore which is designed to safely take the ground at low water conditions over the intertidal zone. Navigation within the backspan of Hammersmith Pier is therefore not possible.

An overview plot of Hammersmith Pier is shown in **Figure 6** with a cross sectional view of the floating walkway shown in **Figure 7**.



Figure 6: Overview of Hammersmith Pier.

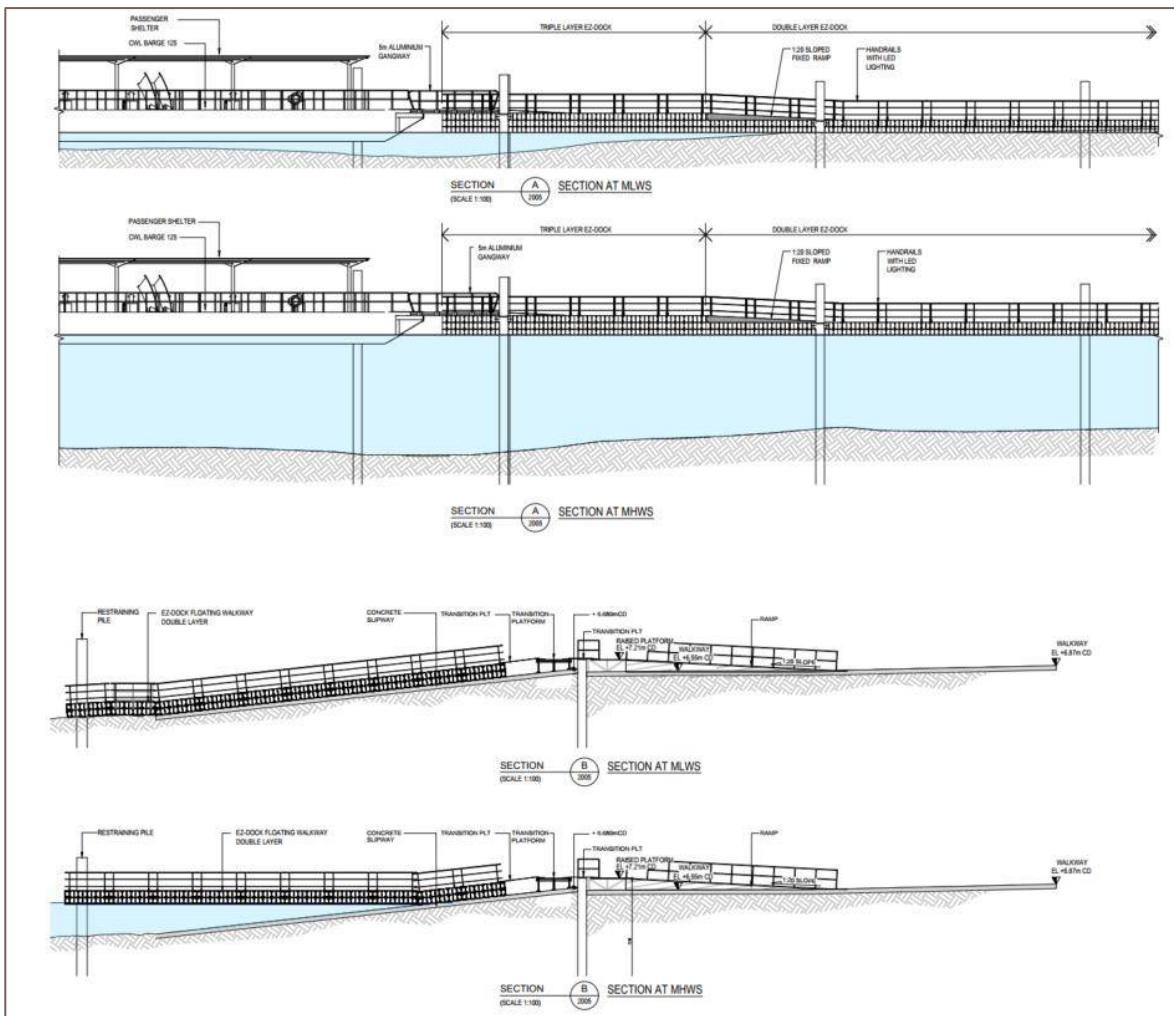


Figure 7: Cross Sectional view of Hammersmith Pier and Floating Pontoon Walkway at MLWS and MHWS.

3.3. CONSTRUCTION METHODOLOGY

3.3.1. CONSTRUCTION PLANT

There are three key construction vessels that will work on site throughout the construction process, these include:

- *Haven Seaforth*, this crane barge will be utilised to lift the piles in to position, act as a mooring platform for other vessels / the pier head pontoons and for the installation of the Barnes Pier brow.
- *Haven Seajack*, this Jack Up Barge (JUB) will work primarily as a platform for the onsite excavator to allow for the installation of the piles that cannot be reached by the excavator working from the foreshore in intertidal areas.
- *Jumbo*, is a multicat vessel equipped with a HIAB. The vessel will transport and assemble sections of the EZ dock pontoon walkway leading to Hammersmith Pier.

In addition to the construction vessels, an excavator will be utilised throughout the operation to assist with the installation of the piles. During the initial stages of the piling operation the excavator will work from the foreshore alongside the crane barge. As this cease to become possible as the piling operation progresses to the south (and therefore beyond intertidal areas) the excavator will transfer to work directly from the JUB.



Figure 8: Key Construction Plant (left: Excavator, centre left: multicat, centre right, Haven Seajack (JUB), right: Haven Seaforth (Crane Barge). Source: RED7MARINE RAMS versions R7M-520038-MST-003 and-R7M-520038-MST-001-Construction Sequence

The construction of the piers will take approximately 6 weeks and will be carried out as per the following sequence:

- Bathymetric, UXO survey and proof dig at pile line to be conducted before pile installation commences;
- Piles for the Hammersmith Pier pontoon walkway will be installed working from the shore toward the authorised channel;
- Installation of the EZ⁴ dock walkway will commence;
- At the same time as the EZ dock installation begins the piles for the Hammersmith Pier head will be driven in and the pier head pontoon installed;
- Following the installation of the Hammersmith Pier the construction operation will relocate to the southern side of the river and the Barnes Pier piles and pier head will be installed; and
- Finally the Barnes Pier brow will be lifted in to place.

3.3.2. HAMMERSMITH WALKWAY PONTOON PILE INSTALLATION

⁴ A modular dock system comprised of connected rotomolded marine-grade polyethylene flotation chambers.

The construction sequence for the installation of the piles to retain the Hammersmith Pier pontoon walkway will be as follows:

- Crane barge to arrive onsite with plant (180 T crawler crane), equipment and project accessories (4no berthing piles and 12no pin piles);
- Excavator will be delivered via the roadside adjacent to the slipway to enable tracking onto the beach front;
- Crane barge moved up the north beach as far as practicable to enable sufficient crane radius to pitch piles to the excavator;
- The excavator is moved into position and works in conjunction with crawler crane to install the first pin pile;
- The excavator has an arm attachment that will act as a piling gate;
- The first 4 pin piles will be installed with excavator located on the beach;
- JUB will arrive to site with four jacking legs fastened to its deck and will be manoeuvred next to the crane barge;
- Crawler crane on crane barge will lift and install jacking legs on the JUB;
- The excavator will relocate from the beach onto the JUB using tracking mats;
- Both barges will reposition accordingly to install the remaining pin piles with the excavator on the JUB acting as piling gate and the crawler crane on the Flat-Top barge pitching the pin piles; and
- The remaining pin piles will then be installed.

3.3.3. HAMMERSMITH PIER WALKWAY PONTOON INSTALLATION

Once the installation of the pontoon walkway piles is complete the installation of the EZ dock will commence as follows, (see **Figure 9** (Note, the exclusion zone illustrated in this Figure is shown as 50m either side of Hammersmith Bridge, this is incorrect. The exclusion zone should extend 15m east and west of Hammersmith Bridge)):

- A barge with the EZ dock equipment will arrive on site, the crane barge will then install the barges spud anchors. The multicat will then assist in dropping the spud anchor legs;
- Once the barge is secure the multicat will be used to assemble the first section of EZ dock;
- The multicat then floats the assembled section of EZ dock in to position; and
- This process is then repeated until the pontoon walkway has been completed.

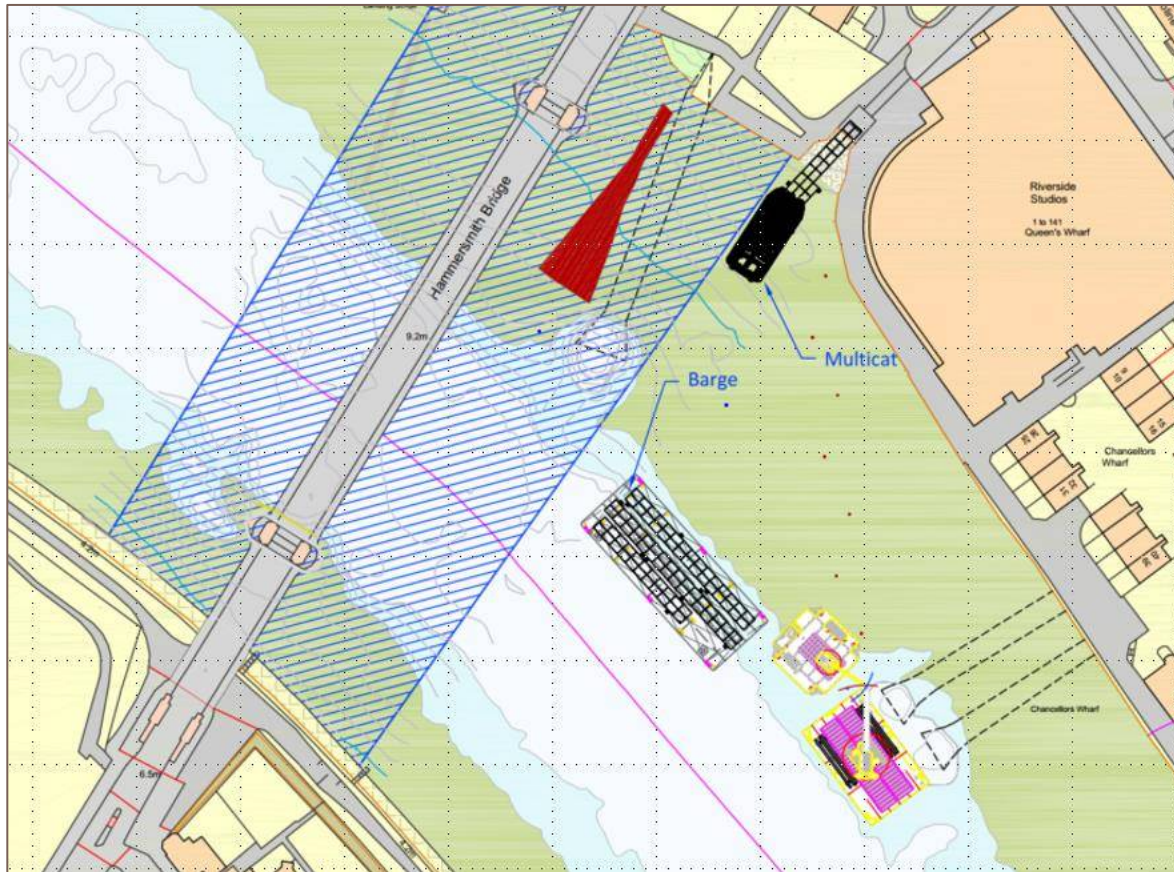


Figure 9: EZ Dock Installation Process. Source: Marine and Civil Services Ltd “EZ Dock Pontoon Installation Via River” 001 12-May-21 Pier Head Pontoon Installation

Whilst the multicat vessel works to install the EZ dock pontoon the JUB and Crane Barge continue with the pile installation for the Hammersmith Pier pier head pontoon, the construction sequence for this element of the works is as follows:

- Crane barge positioned to allow tugs delivering Hammersmith Pier head pontoon to utilise it as a berth;
- Crane will pitch restraint pile and hold in position; tugs will then manoeuvre crane barge into position;
- Excavator located on JUB shall extend arm over pontoon with piling gate attachment;
- Crane barge will manoeuvre pile over piling gate and lower down to the riverbed, pile will then be driven in using a vibro-piling hammer; and
- The Pier head pontoon will then be moored alongside the crane barge and the JUB repositioned. The installation process is then repeated for the second pile, (see **Figure 10**).

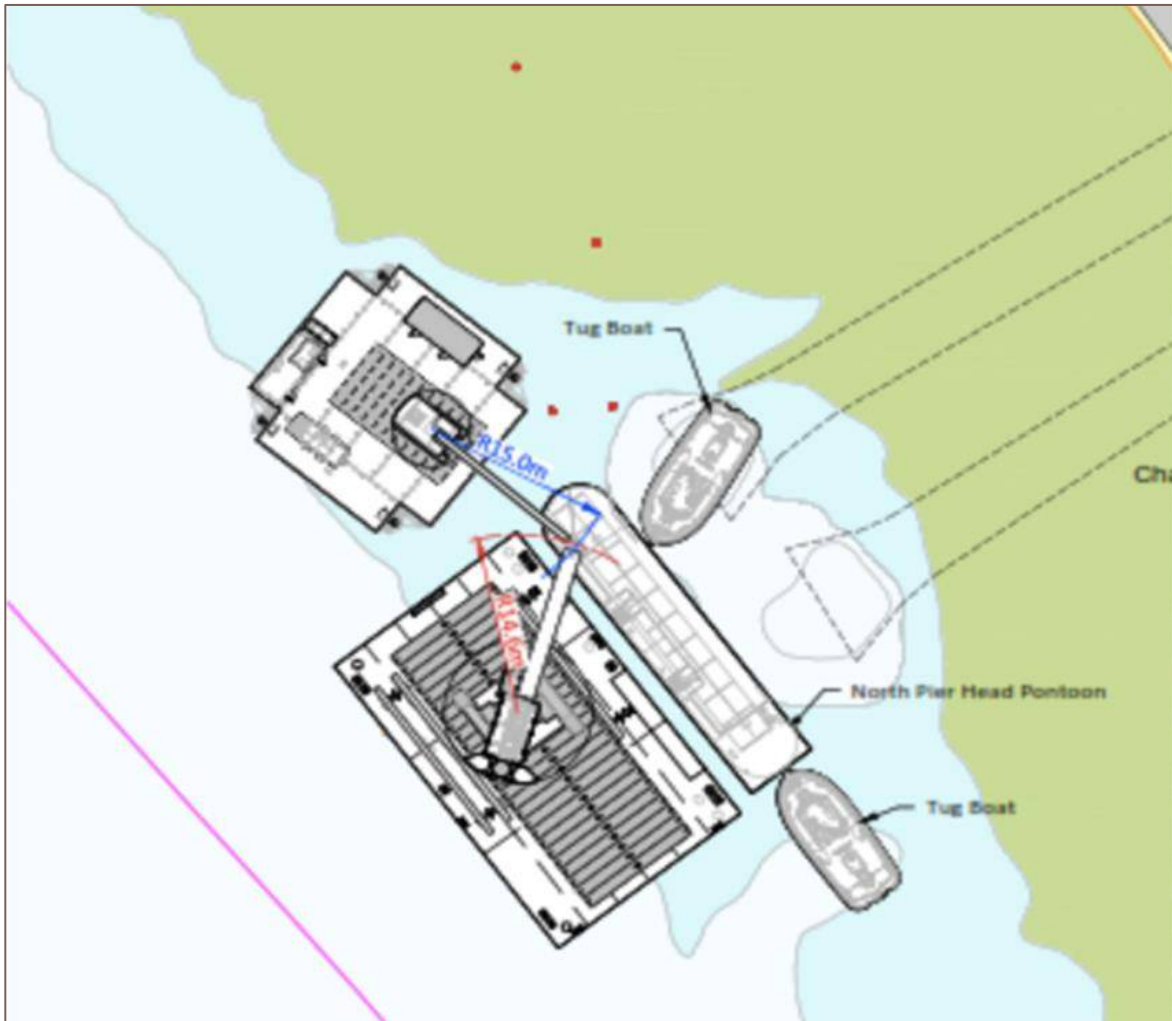


Figure 10: Hammersmith Pier: Pier Head Pontoon Installation. Source: Marine and Civil Services Ltd “River Works Licence Method Statement: Pier Head Pontoon Installation” Rev 1 18-May-21

The same process is then repeated for the Barnes Pier, once this element of the operation is complete the Barnes Pier brow is installed, (see **Figure 11**)

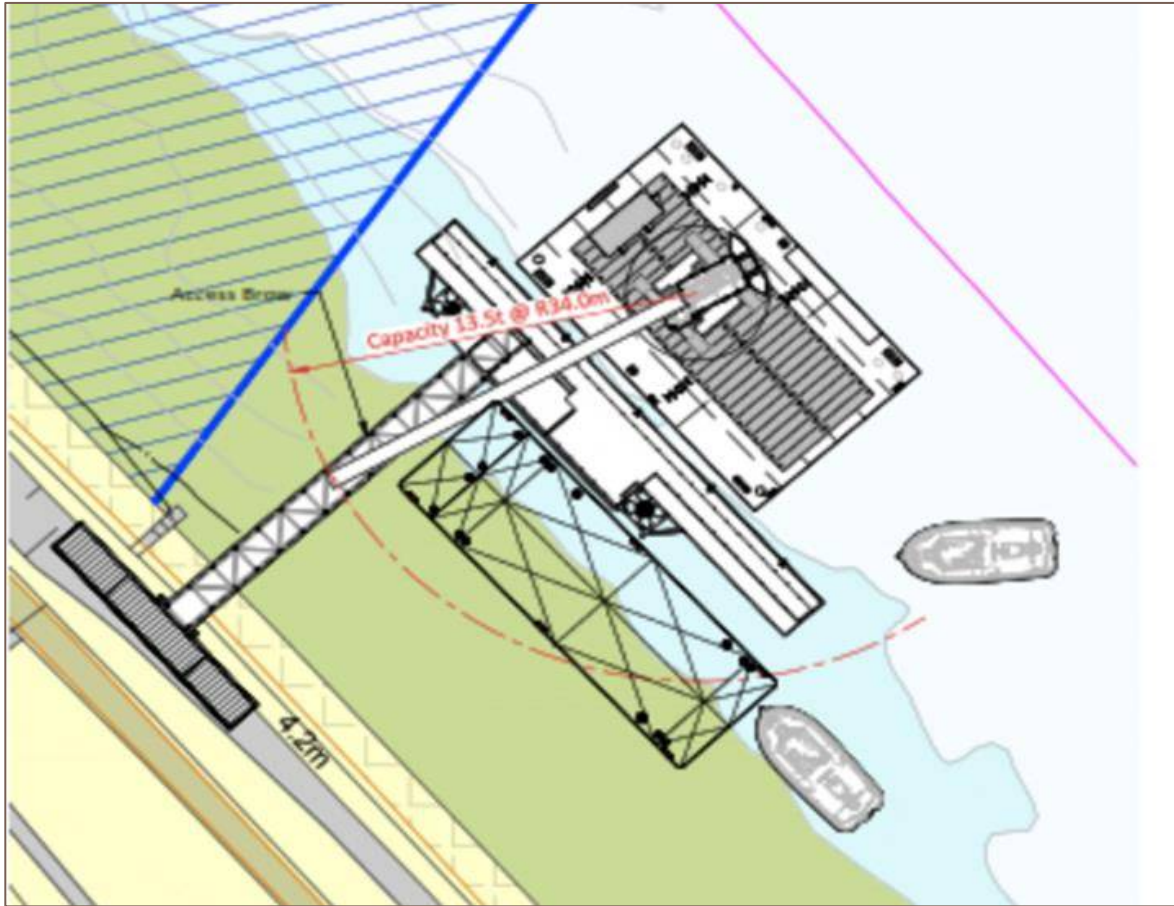


Figure 11: Installation of Barnes Pier Brow. Source: Marine and Civil Services Ltd “River Works Licence Method Statement: Pier Head Pontoon Installation” Rev 1 18-May-21

3.4. FERRY SERVICE AND OPERATION

The proposed Hammersmith Temporary Ferry operation will take place between 06:00 and 22:00 on weekends and 08:00 – 22:00 at weekdays, with a peak and off-peak service being operated - as summarised in **Table 3**. Two vessels will be permanently deployed on the service, with one moored on the Barnes Pier and the other moored on the Hammersmith Pier outside hours of operation. During hours of off-peak operation (when only one vessel is operated) the non-operational vessel will be moored on the Barnes Pier. A third vessel will be based at Plantation Wharf (approx. 25mins transit away) and will be on standby at a pre-determined state of readiness as a relief vessel.

Table 3: Summary of Service Provision.

	Peak Service	Off Peak Service
Operating times	06:00 – 10:00 & 15:00 – 19:00	10:00 – 15:00 & 19:00 – 22:00
Frequency (from each pier)	Every 5 – 7 mins	Every 10 – 12 mins
Number of vessels in operation	2 vessels	1 vessel (Spare vessel to layby on Barnes Pier)
Crossings per hour	18 – 24	10 – 12

Transit time in each direction	3 mins	3 mins
--------------------------------	--------	--------

Uber boat will utilise the Thames Clippers, *Sky* (see **Figure 12**), *Storm* and *Star*. These Hydrocat vessels are well suited to the Hammersmith Temporary Ferry operation and are highly manoeuvrable. The vessels utilise two fully independent water jet propulsion systems and have a minimal draught of 0.80m making them suitable for operation in the comparable shallow waters. The vessels are able to accommodate a maximum of 62 passengers.



Figure 12: Image of Sky.

During hours of peak operation the two vessels will operate simultaneously with crossings made head to tide in an anticlockwise direction. This operation will occur during both the flood and ebb tides (and was developed as part of an onsite trial) with both vessels utilising the tidal stream as they ferry glide between the pontoons. On the ebb tide the vessel departing Hammersmith Pier will push forward in to the tidal stream with the vessel departing Barnes Pier dropping back with the tidal flow (see **Figure 13**). On the flood tide the vessels will face downstream with the vessel departing Barnes Pier pushing forward in to the tidal flow with the vessel departing the Hammersmith Pier dropping back with the tidal flow (see **Figure 14**).

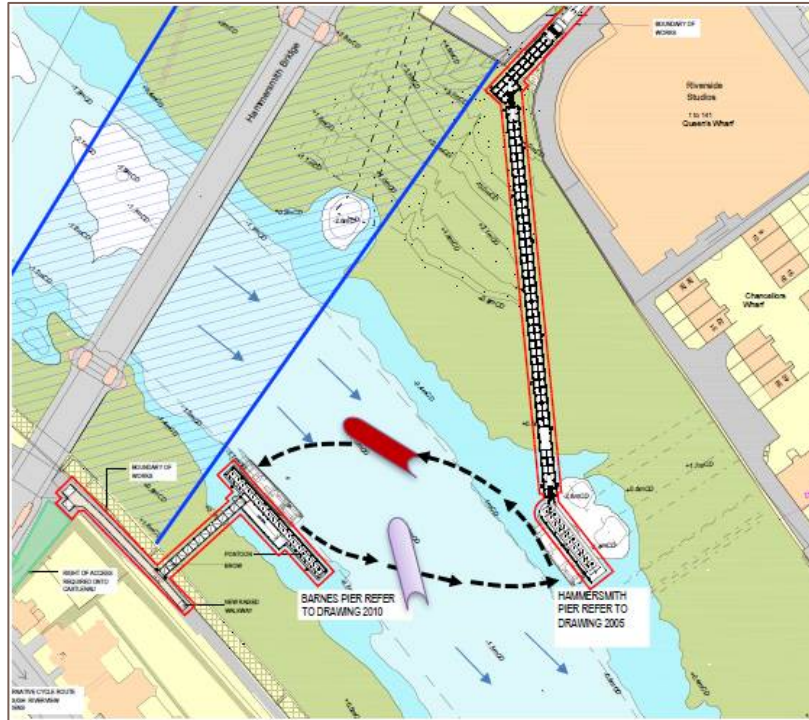


Figure 13: Peak Operation – Ebb Tide.

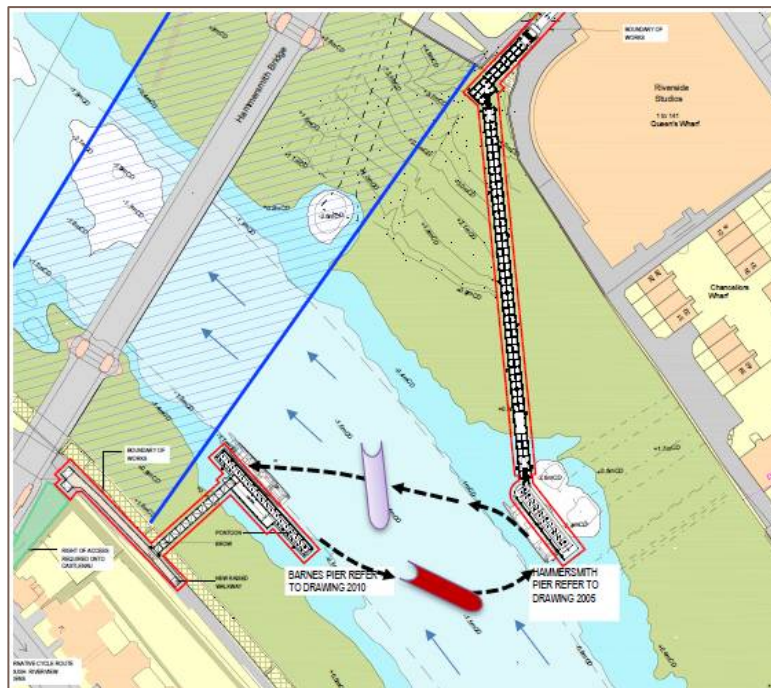


Figure 14: Peak Operation – Flood tide.

4. BASELINE VESSEL TRAFFIC CHARACTERISATION

This section presents an overview of the baseline vessel traffic characterisation in a normal “open river” scenario i.e. with no restrictions relating to transits of Hammersmith Bridge as currently in place and described in **section 1.3**). Therefore the analysis presented below does not present an overview of the current navigational disposition, rather it shows a realistic overview of the traffic levels and temporal/spatial nature of navigational transits in a normal open river scenario and as a basis for future NRA updates albeit precautionary given the current restrictions in place.

The vessel traffic activity in the project area can be classified into two major groups:

- 1.) Powered commercial vessels which make up the larger vessels and includes passenger vessels, port service vessels and cargo vessels such as tugs.
- 2.) Recreational vessels made up of powered (e.g. cabin cruisers) and unpowered craft (e.g. rowing sculls, canoes, paddle boarders and sailing dinghies).

Analysis of group 1 (powered commercial vessels) was undertaken using Thames Automatic Information System (AIS) transponder data (commercial vessels are mandated to transmit various vessel characteristics, such as position, speed, size and name at prescribed intervals, which can be converted to create vessel tracks).

As AIS is not required on small recreational vessels (although some larger recreational craft voluntarily carry AIS) analysis of group 2 vessels (powered and unpowered recreational craft) is more qualitative in nature. Whilst information is available in publications such as the PLA Tideway Code, consultation with river users is necessary to ascertain detailed information on how they utilise the river.

The following sections provide an overview of vessel traffic in the vicinity of the Hammersmith Temporary Ferry between 10-Sep-18 and 23-Sep-18. This data set has been chosen in agreement with the PLA because September was considered a seasonally representative months in terms of vessel traffic and because Hammersmith Bridge was open to navigation during this time period. In addition this data set was collated prior to the Covid-19 pandemic so vessel traffic numbers are considered representative.

4.1. GROUP 1 VESSELS: POWERED COMMERCIAL VESSELS

Figure 15 shows tracks of all vessel transits of the project area, together with a gate between the Barnes and Hammersmith Piers (showing lateral distribution of transit numbers and directions), between 10-Sep-18 and 23-Sep-18. The number of vessel transits in this two-week period has been annualised.

Figure 16 shows the density of all vessel transits on a daily basis providing an indication of the spatial spread and intensity of the identified transits.

The plots demonstrate a number of Group 1 vessels transiting on the north side of the authorised channel as they pass the piers. This is because vessels heading in either an upstream or downstream direction will be aligning with the centre point of Hammersmith Bridge where there is the greatest headway.

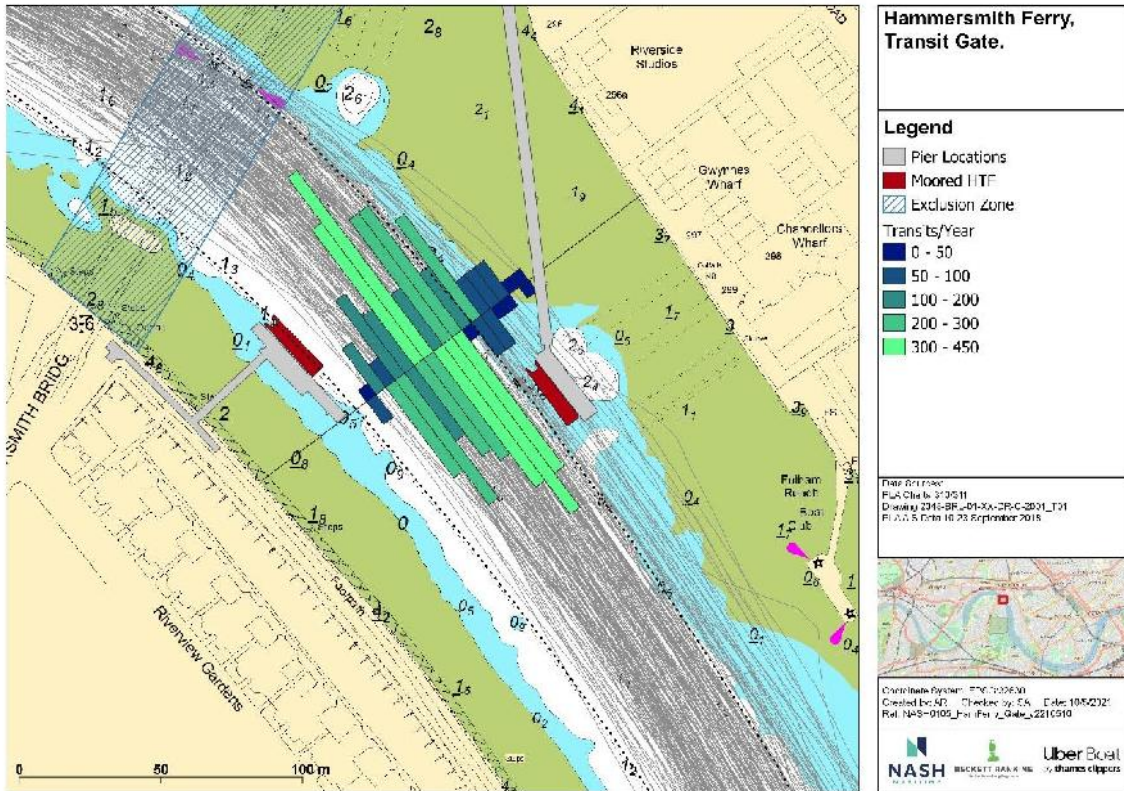


Figure 15: Hammersmith Temporary Ferry Gate Analysis (AIS Sep 2018 Annualised).

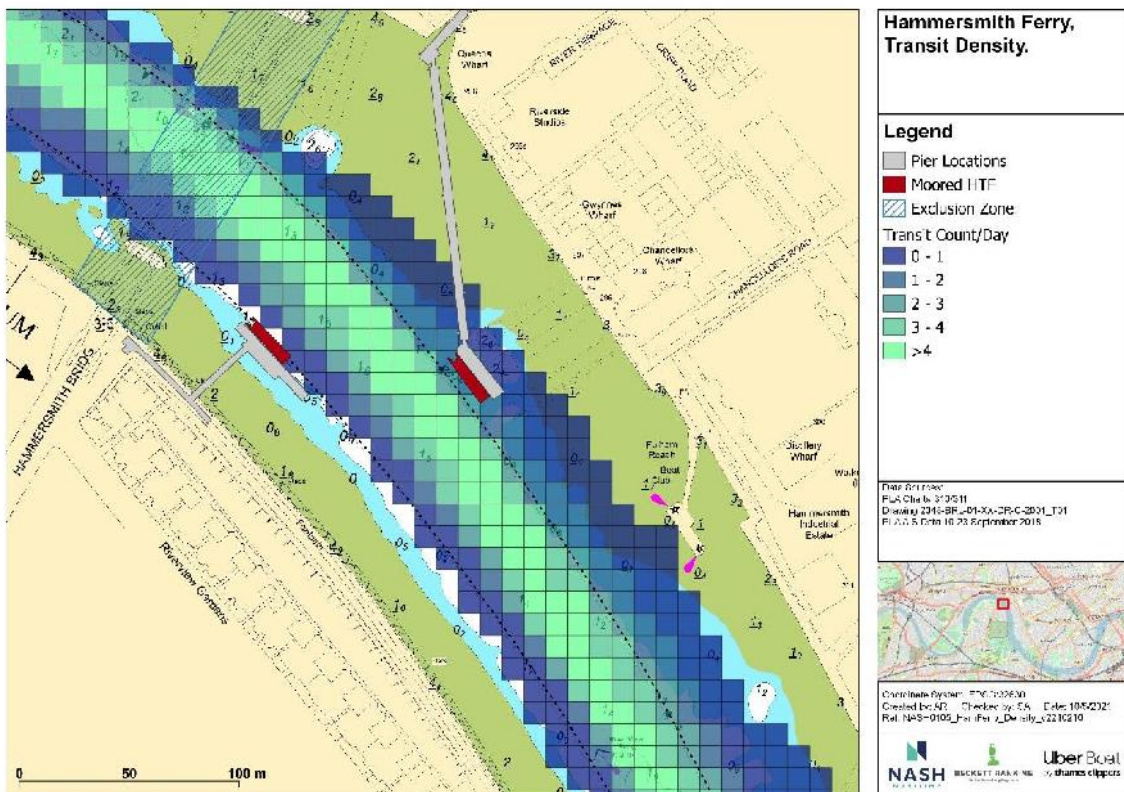


Figure 16: All Vessel Transits Density Plot (AIS Sep 2018).

4.1.1. PASSENGER VESSEL TRACKS

Passenger vessel tracks (shown in **Figure 18**), are comprised of Traditional Class V vessels and High-Speed Craft / Manoeuvrable Class V vessels.

Traditional Class V vessels make up the majority of vessel traffic transiting past the Hammersmith Temporary Ferry site and include the following vessels. Lengths and estimates of air draught have been provided in appreciation of headway restrictions under Hammersmith Bridge (images of those marked with * are shown in **Figure 17**):

- *Clifton Castle** Length 39m Estimated Air Draught Approx. 3.5m
- *Connaught** Length 34m Estimated Air Draught Approx. 4.5m
- *Pride of London** Length 29m Estimated Air Draught Approx. 5.5m
- *Royalty* Length 29m Estimated Air Draught Approx. 5.0m
- *Henley* Length 25m Estimated Air Draught Approx. 3.0m
- *Golden Salamander* Length 20m Estimated Air Draught Approx. 5.0m
- *Princess Freda* Length 19m Estimated Air Draught Approx. 4.0m
- *Cockney Sparrow** Length 16m Estimated Air Draught Approx. 5.0m

Passenger vessel track analysis in the vicinity of Hammersmith Bridge shows that passenger vessels transit almost entirely within the authorised channel (clear of both piers in all other than two isolated transits) and the very southern edge of the authorised channel is typically avoided which is likely associated with the reduced headway under the Hammersmith Bridge.

A single high-speed vessel was recorded as passing the site, which was the *Orion Clipper* a small passenger vessel.



Figure 17: Photos of River Tour vessels from Marinetravell.com, top left Clifton Castle, top right Cockney Sparrow, bottom left - Connaught, and bottom right Pride of London.

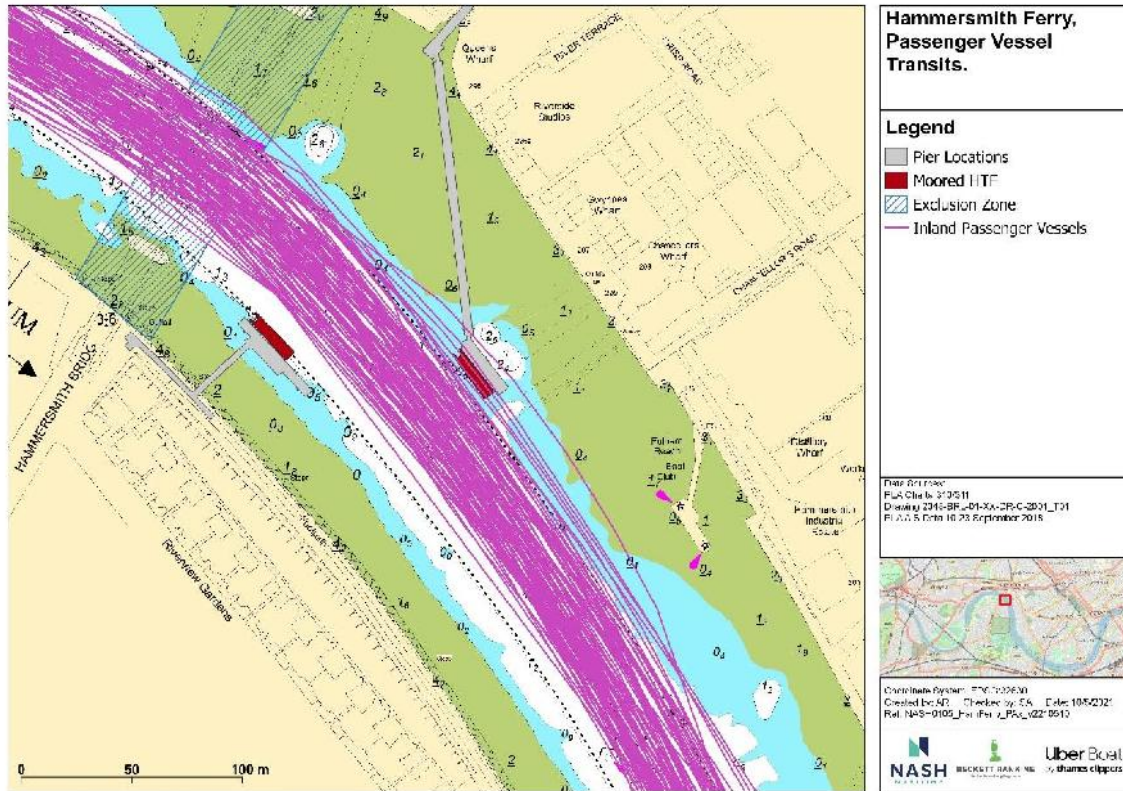


Figure 18: Passenger Vessel Transits (AIS Sep 2018).

4.1.2. SERVICE VESSEL TRACKS

Service vessel tracks are presented in **Figure 21** and include vessels of the following categories (images of those marked with * are shown in **Figure 19**):

- Law Enforcement Vessel (e.g. *Thames Guardian**);
- Port Tender (e.g. *Crane, Londinium 3, Richmond, Roker*);
- Search And Rescue Vessel (e.g. *RNLI Lifeboat E-07, RNLI Lifeboat E-08, RNLI Lifeboat E-09*); and
- Tug (e.g. *Dancha, Sanfiona, Speedwell, TLM Plashy**)

Analysis of service vessel tracks shows this class of vessel to be amongst the most numerous Group 1 vessel types transiting Hammersmith Bridge and between the proposed pier locations. Vessels of this type use the entire width of authorised channel (and on occasions outside to the north when sufficient tidal depth allows) although show a tendency to navigate in the northern side of the authorised channel which is likely due to aligning with the centre of Hammersmith Bridge and the point of maximum headway.



Figure 19: Images of Selected Service Vessels, Top Right: Plashy, Top Left: Londinium, Bottom Centre: Thames Guardian.

4.1.3. INTRA PORT FREIGHT

There was only one intra port freight vessel observed transiting in the vicinity of the proposed ferry piers between 10-Sep-18 and 23-Sep-18. This was the vessel *Conquestor*, a tanker vessel operated by Thames Marine Services which transited past the proposed pier sites 6 times during the two-week period in which AIS data was collected, (see **Figure 22**). Analysis of the tracks shows the *Conquestor* navigating predominately in the northern portion of the authorised channel. The *Conquestor* has continue to transit the area through restrictions due to the nature of its operation delivering bunkering services.



Figure 20: Conquestor

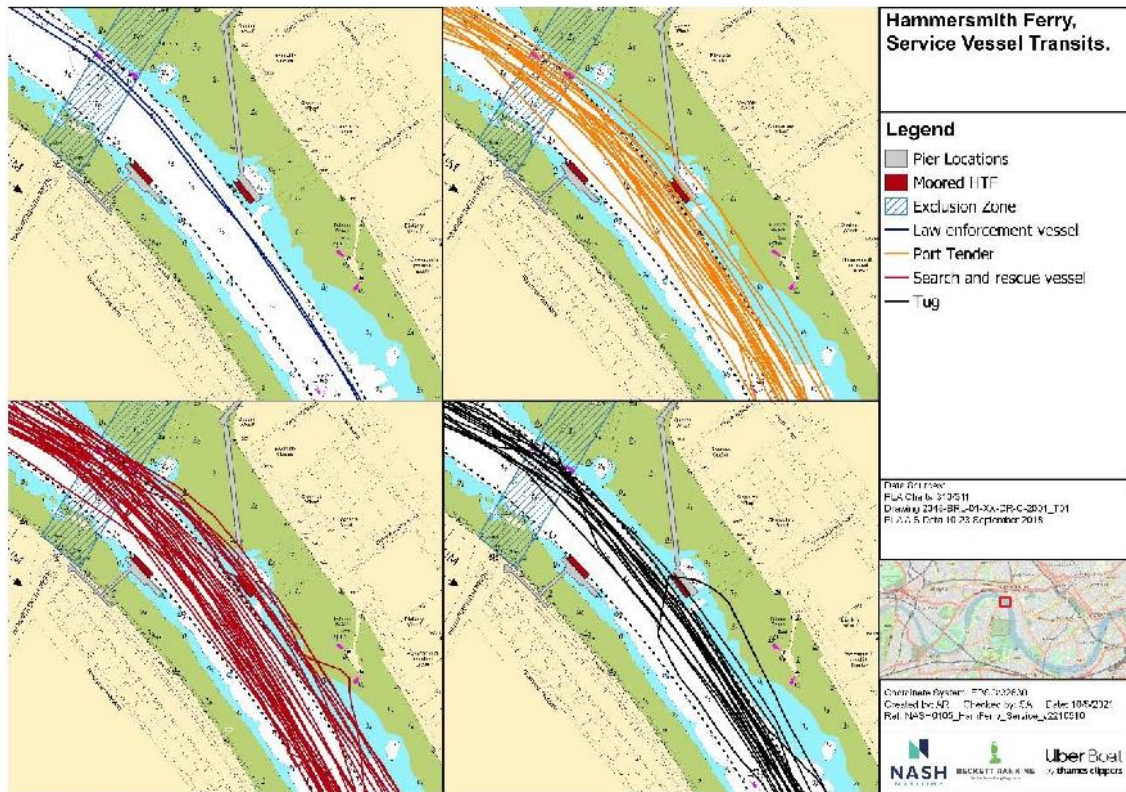


Figure 21: Service Vessel Transits (AIS Sep 2018)

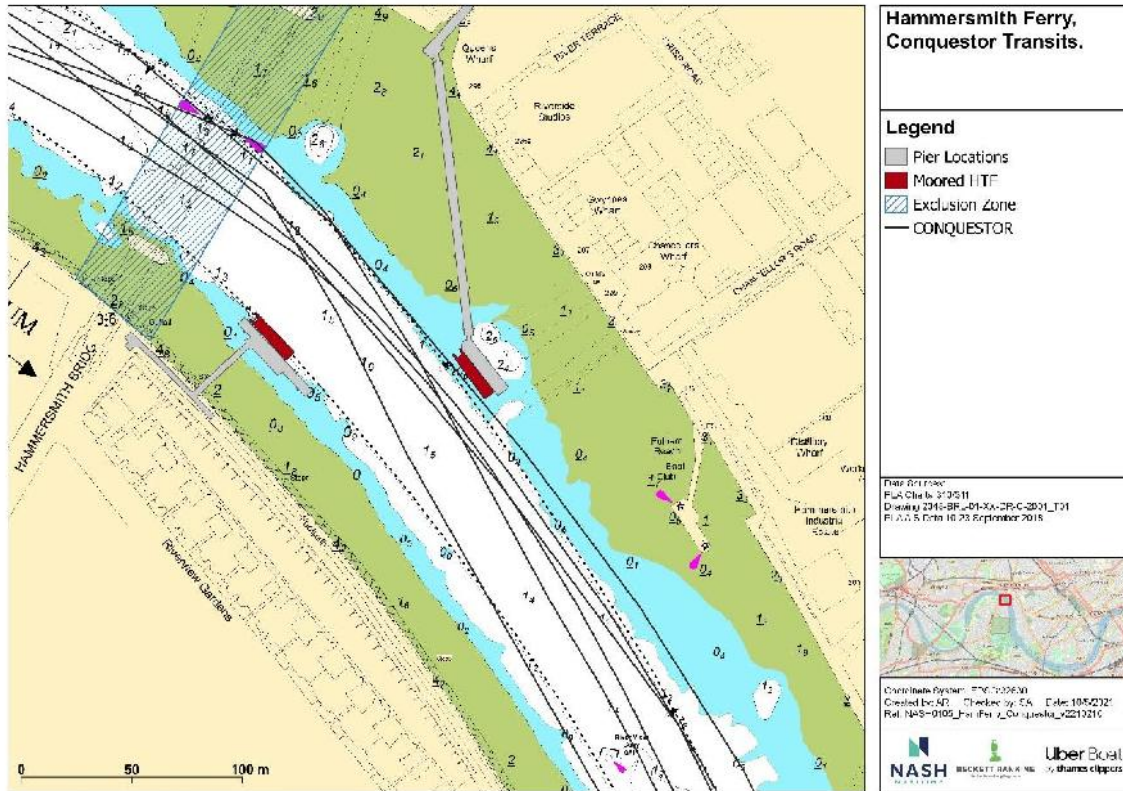


Figure 22: Intra Port Trade Vessel Tracks, Conquestor

4.2. GROUP 2 VESSELS RECREATIONAL CRAFT

Analysis of recreational vessel transits is difficult as most recreational vessels do not carry Thames AIS, a small number of vessels were identified in the AIS data set, these were:

- *Ascension* Length 19m Beam 4m
- *Whistler* Length 10m Beam 4m
- *Joker* Length 14m Beam 4m
- *Lady Lou* Length 12m Beam 4m

Analysis of the limited tracks shows these recreational vessels navigating across the full width of the authorised channel (see **Figure 23**).

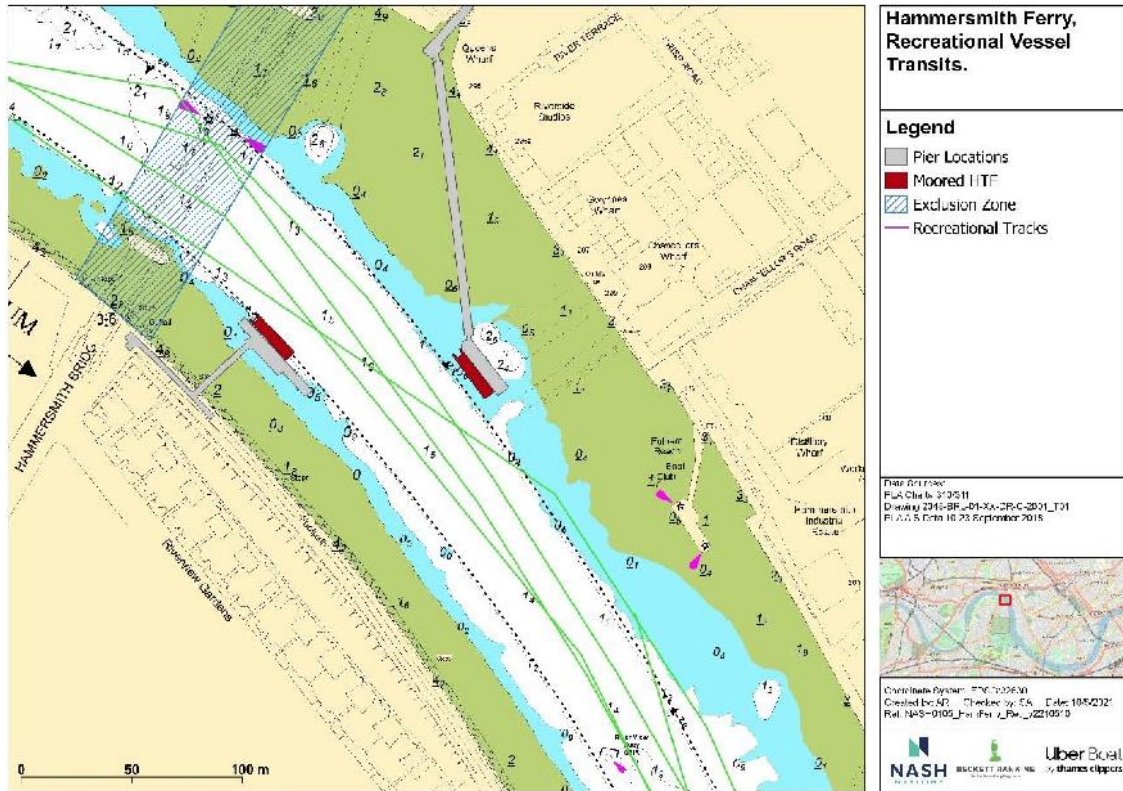


Figure 23: Recreational Vessel Transits (AIS Sep 2018).

In order to characterise recreational craft activity and corresponding navigational disposition whilst transiting through Hammersmith Bridge, the PLA Tideway code was reviewed for rowing and paddling activity, **Figure 24** shows the recommended Tideway code route on the ebb tide and **Figure 25** the recommended route on the flood tide.

As discussed in **section 1.3** the proposed location of the Barnes Pier will impact the recommended Tideway code route.

To obtain a greater understanding of the feasibility of unpowered recreational craft continuing to transit Arch #3 (and under the brow in the backspan of Barnes Pier) and recreational craft activity as a whole, detailed consultation and/or a visual survey will be required to inform later iterations of this NRA. This works has not been carried out as part of this initial NRA because at present arch # 1 and arch # 3 are closed to recreational traffic. Further detailed conversation also include sailing craft and, where possible, unorganised activity (i.e. activity not affiliated to a club or association).

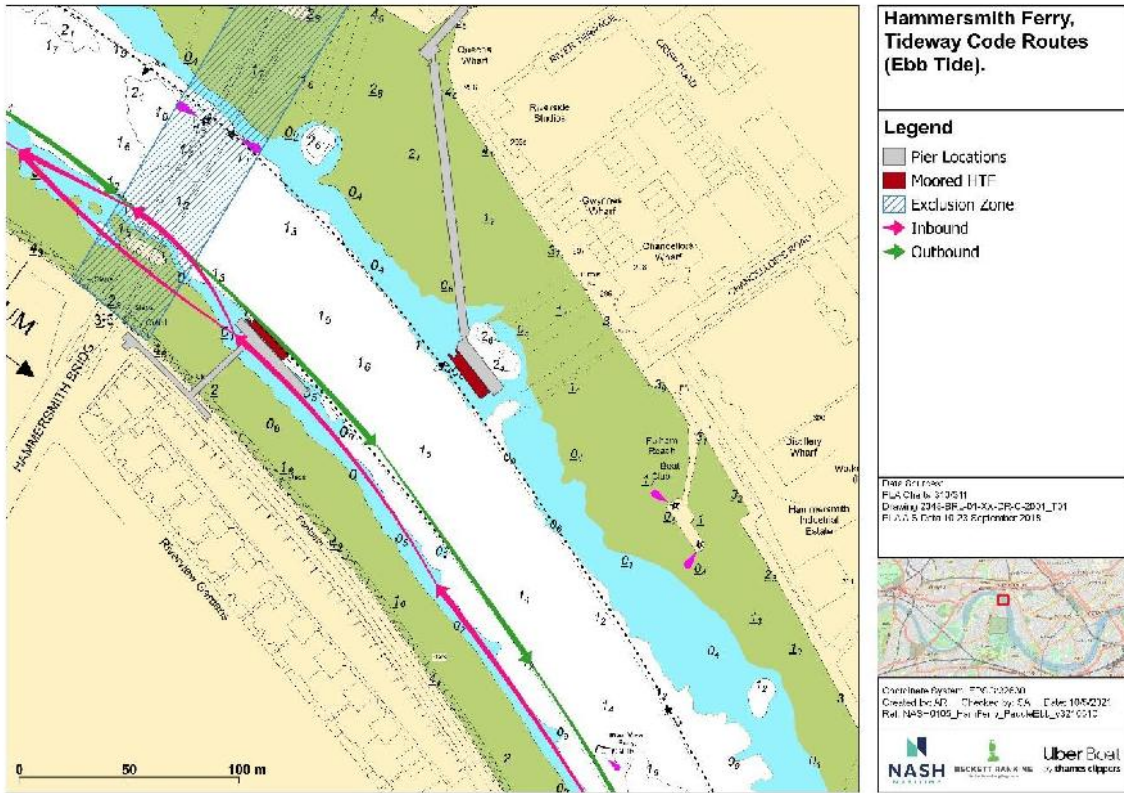


Figure 24: Tideway Code Route – Ebb Tide.

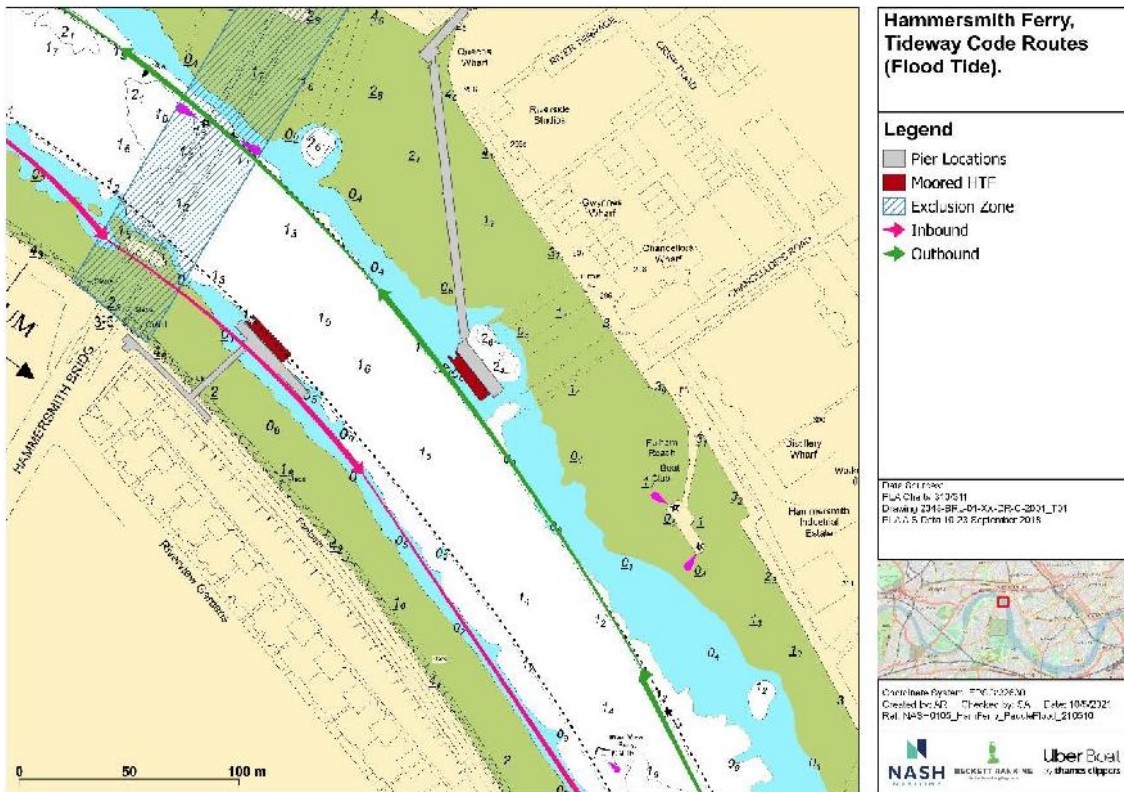


Figure 25: Tideway Code Route – Flood Tide.

4.3. INCIDENT ANALYSIS

The PLA Incident Database was provided and reviewed to gain an understanding of historic incidents within the vicinity of the project area. Analysis of historic incident data helps in the identification of:

- Hazards frequency by hazard type;
- Hazard likelihood;
- Hazard consequence; and
- The identification of common themes i.e. the time of day when certain hazards are more likely to occur.

All incidents that have occurred between 2010 and 2020 within Barn Elms Reach and Corney Reach were extracted as part of the analysis. In total 143 unique incidents were identified. The incident types are identified are summarised in **Figure 26**.

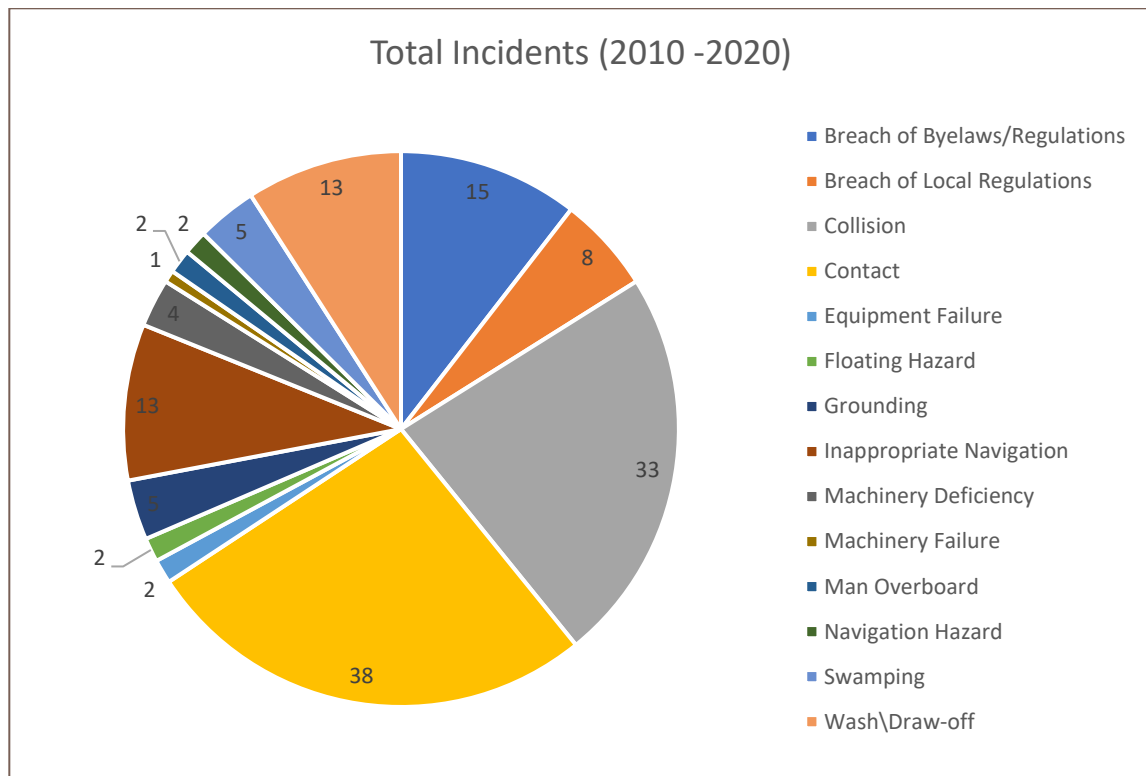


Figure 26: Summary of Incident types (2010-2020)

The most common incident types were contacts (38) and collisions (33). Recreational craft accounted for the majority of incidents (72%), with passenger and tug/service vessels accounting for the remaining 18%. All collisions involved recreational craft.

At the location of Hammersmith Bridge, ten incidents are recorded during the 10 years of data (one incident per year):

- Four breaches of byelaws – generally involving speeding and navigating on the wrong side of the channel.
- Two collisions – one incident involving two rowing boats, and one incident involving a coach boat and a rower.
- One contact – of a Dutch barge and Hammersmith Bridge.

- One mechanical failure – engine failure on a narrowboat.
- Two other incidents – capsized of a rowing boat and breakout of a coach boat.

The incident involving the Dutch barge contacting Hammersmith bridge was reported in the PLA database as follows:

“Dutch Barge HOOP OP WAARVELD on an inward bound passage from Chelsea to Teddington called London VTS to advise them that they made contact with Hammersmith Bridge. HSL RICHMOND attended and interviewed the Master, who was apologetic and admitted that he had made a mistake in calculating his air draught. The Master of the barge showed the Duty MRI the damage to his vessel which included some broken hinges and smashed Perspex windows. Hammersmith and Fulham Council, owners of the bridge was [sic] contacted by the Duty Officer and notified of the incident.”

Figure 27 shows the hour of incident occurrence, with most incidents occurring during daytime hours and between 1000 and 1100. Figure 28 shows the month of incident occurrence with most incidents occurring in July and August when the river is historically busiest.

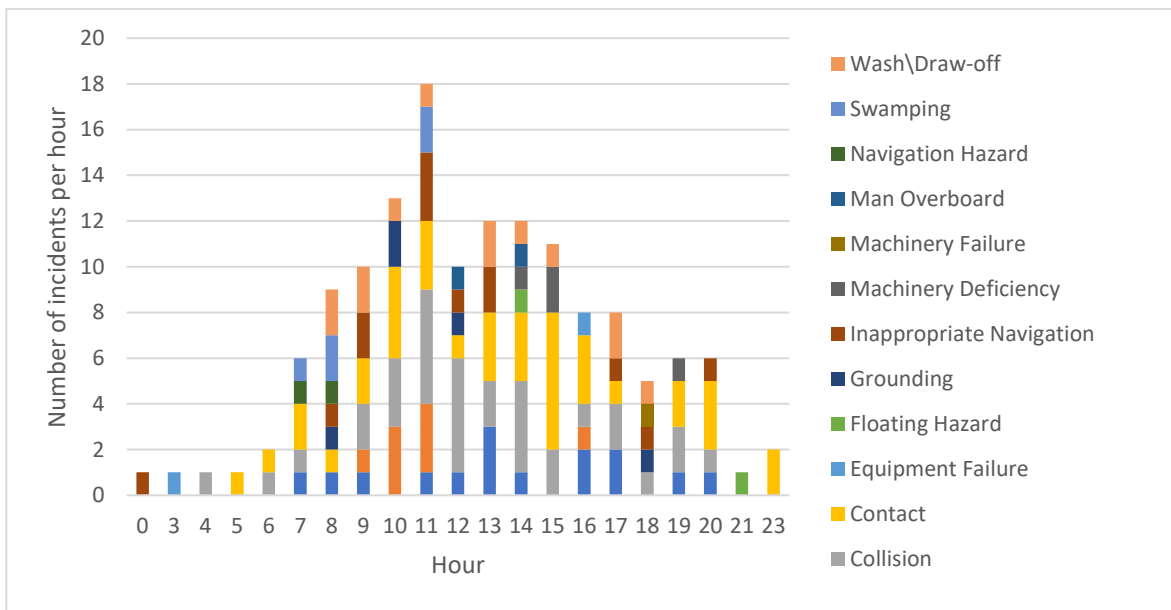


Figure 27: Number of Incidents Per Hour of the Day.

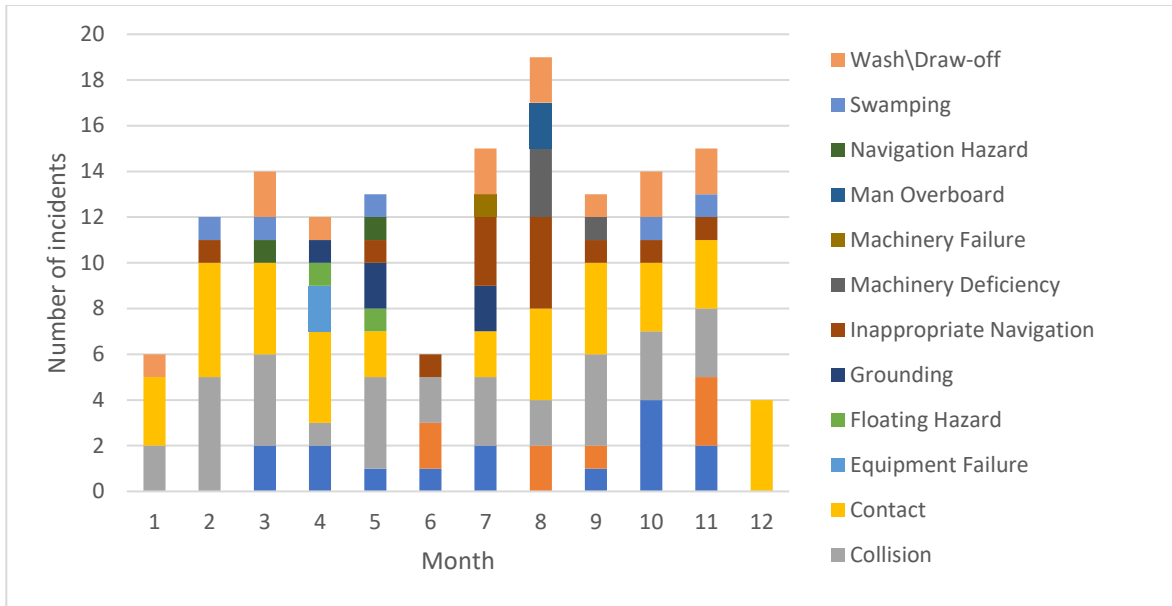


Figure 28: Number of Incidents Per Month of the Year.

4.4. FUTURE VESSEL TRAFFIC

The duration of operation for the Hammersmith Temporary Ferry is limited and therefore the requirement to assess future vessel traffic is not considered necessary as the variance or increase in any traffic profiles is not considered to be significant within the lifecycle of the project.

5. STAKEHOLDER CONSULTATION

The purpose of stakeholder consultation was to inform the NRA and define hazards and appropriate risk control measures to reduce risk associated with the current assessment scenario described in (**section 1.3**). Stakeholder views were ascertained in relation to:

- New navigation-related hazards that could emerge during the construction and operation phase of the Hammersmith Temporary Ferry project (e.g. collision, contact, breakout, grounding)
- Likelihood and the potential consequence of hazards (i.e. risks) to people, property, business and the environment.
- Views on suitable means to mitigate the risks (e.g. risk controls such as buoyage and markings, procedures, communication).

Targeted consultation was undertaken in order to inform this NRA which considers a controlled transit assessment scenario. The organisations invited to take part in the stakeholder consultation exercise are listed below:

- Port of London Authority (PLA)
- Thames Regional Rowing Council (TRRC)
- Fulham Reach Boat Club (FRBC)
- RNLI Chiswick
- Association of Thames Motor Yacht Clubs (ATYC)
- Thames Marine Services (TMS)

A number of the consultees identified (PLA Harbour Master, Thames Regional Rowing Council and Thames Marine Services Ltd) had already contributed substantially to the Preliminary Navigation Hazards Analysis and confirmed that points arising from this consultation remained valid. A risk control review and hazard scoring workshop was conducted with PLA Harbour Master Ryan Hall on Wed-16-Jun-2021.

A summary of the main discussion points from the stakeholder consultation meetings conducted as part of this NRA assessment is included in the remainder of this section. The detailed minutes can be viewed in **Annex B**.

A summary of the stakeholder consultation carried out during the Preliminary Hazard Analysis can be viewed in **Annex A** along with the detailed minutes from these meetings.

5.1. FULHAM REACH BOAT CLUB

A meeting was held with Fulham Reach Boat Club in order to further understand the impact the construction of the proposed piers and operation of the Hammersmith Temporary Ferry would have on club activities (rowing and kayaking).

The meeting was held on 07-Jun-2021 and attended by:

- Fulham Reach Boat Club
 - Steve O'Connor - SO
- NASH Maritime Ltd:

- Jamie Holmes - JJH
- Sam Anderson-Brown – SAB

The Meeting included the following agenda points:

- An overview of the approach to the NRA over the project lifecycle.
- A summary of the construction methodology and pier designs.
- A review of the identified hazards and hazard risk mitigation measures.

The main discussion points from the meeting are summarised below:

- In order to mitigate risk in the event that a rowing vessel became pinned against the Hammersmith Pontoon walkway a Safety Boat should be provided to offer cover to third parties during the construction phase.
- An early warning buoy warning rowers transiting upstream on a flood tide of the presence of the construction works would not be desirable as this would impact on the day-to-day activities of FRBC and likely create an additional contact hazard.
- Instead of a buoy a Guard Boat could be provided to warn any rowers that looked to be at risk of making contact with the installation or construction craft. This vessel should be more appropriate size than the vessel currently on station and could fulfil a combined remit of Safety Boat and Guard Boat.
- The Guard Boat would be best positioned to the west of FRBC and east of the construction works.
- SO commented that an email message (weekly frequency) to all river users warning of planned construction vessel movements would be beneficial as an additional risk control measure. This could also include a social media feed/ WhatsApp group.
- Discussion held on RULG and benefits of this during Fulham Western Riverside stand construction phases.
- SO felt that hazards and risk controls discussed were appropriate for the current assessment scenario.

5.2. RNLI CHISWICK

A meeting was held with RNLI Chiswick in order to further understand the impact the construction of the proposed piers and operation of the Hammersmith Temporary Ferry would have on navigation in the immediate vicinity.

The meeting was held on 08-Jun-2021 and attended by:

- RNLI Chiswick
 - Wayne Bellamy - WB
- NASH Maritime Ltd:
 - Jamie Holmes - JJH
 - Sam Anderson-Brown – SAB

The Meeting included the following agenda points:

- An overview of the approach to the NRA over the project lifecycle.
- A summary of the construction methodology and pier designs.
- A review of the identified hazards and hazard risk mitigation measures.

The main discussion points from the meeting are summarised below:

- River User Liaison Group:
 - WB commented that in due course it would make sense to involve representatives of houseboat and narrowboat owners and suggested Libby Bradshaw from the Inland Waterways Association would be a good contact.
 - WB suggested that Latymer and St Paul's schools rowing clubs be invited to join the RULG as their activity takes place at different time to the other rowing clubs and the user risk profile is different.
- A tide gauge board showing whether arch no. 3 is navigable could be affixed to the downstream pile of the Hammersmith pier providing real time information for rowers approaching the area. This board should be simple and easy to interpret, e.g. green/red depending on whether the limiting feature (assume depth in arch no. 3 is safe to navigate).
- WB commented that it would be desirable to have an additional gauge board further downstream marked in the same way. Rowers face backwards and may not notice the gauge board on the pier until too late. JJH commented that Thames Regional Rowing Council (TRRC) and Fulham Reach Boat Club (FRBC) had indicated that additional obstructions in the navigation were undesirable. However, WB pointed out that there are existing piles that could be utilised. *
- WB agreed that a Guard Boat would be an effective risk control measure and would likely be proportionate to the level or risk during the construction phase and future operational scenarios.
- WB suggested that the Ferry vessels display an orange flashing light to make them more visible*

**Subsequent consultation with PLA Harbourmaster determined that neither of these proposed risk control measures were desirable.*

5.3. PLA RISK CONTROL REVIEW AND HAZARD SCORING WORKSHOP

A meeting was held with PLA Harbour Master Ryan Hall on 16-Jun 2021 in order to discuss in detail:

- The approach to the NRA throughout the project lifecycle;
- Give an overview on the construction methodology; and
- Discuss the risk controls identified as part of the Preliminary Hazard Analysis Report and the subsequent refinement of these controls as a result of further stakeholder consultation.

The workshop was attended by:

- PLA
 - Ryan Hall - RH
- NASH Maritime Ltd:
 - Jamie Holmes - JJH
 - Sam Anderson-Brown – SAB

The main discussion points from the meeting are summarised below:

- RH was in agreement with the approach to the NRA outlined and viewed the RULG as an essential mechanism to enable regular review of hazards and risk controls throughout the project lifecycle.
- RH confirmed that it was appropriate to base the initial NRA on the current controlled transit scenario (as per NTM U3/2021).
- A discussion was held on the membership of the RULG and RH was of the opinion that:
 - The organisers of the boat race should be included;
 - It was not necessary to consult with all rowing clubs in the area as TRRC can provide a coordinated response. The exception being Fulham Reach Boat Club because of proximity to the project area;
 - London Corinthians Sailing Club should be added to the membership along with Putney Kayak club; and
 - Regular attendance by UBTC is essential.
- A discussion in relation to the suitability and effectiveness of the risk controls, identified during the Preliminary Hazard Analysis Report, was then held. It was noted that the applicability of the risk controls should be reviewed and considered in respect of a controlled transit scenario.
 - **CCTV viewing upriver to improve visibility** – RH commented that Hammersmith Council have an existing CCTV camera positioned toward the centre of Hammersmith Bridge and that the project could make enquiries as to whether access to the feed could be obtained. It was agreed that this risk control measure is unlikely to be required in a controlled transit scenario but will be effective in an open river scenario.
 - **Tidal Gauge Board (at berth)** – RH felt this risk control was of limited use for third parties. If UBTC deem this control unnecessary for the operation then alternate measures to mitigate the risk of a project vessel grounding when coming alongside either of the pier heads will need to be included in a detailed passage plan
 - **Gauge boards (brow headway and arch #3), Paint underside of Brow** – This control was not deemed necessary under a controlled transit scenario but should be implemented when arch # 3 becomes available to recreational vessels for navigation.
 - **Removal of foreshore boulders** – RH did not feel this was a necessary risk control as the boulders have been in situ for some time without incident. RH advised that the gauge board planned to be installed to indicate whether navigation of arch # 3 was possible should be calibrate to the height of the protruding boulders rather than the riverbed.
 - **Signage warning of presence of Hammersmith Pier or notification when booking bridge transit** – RH indicated that signage would be beneficial if an appropriate location could be found and that a notification / warning of the pier's presence would be an important risk control during construction and operation.
 - **Marker buoy downstream of Hammersmith pier (north side)** – SAB and JJH relayed comments made by Steve O'Connor to the effect that an additional marker buoy would create a further

- contact hazard. RH agreed and was not in favour of this risk control in a controlled transit scenario or in a future assessment scenario. It was agreed a Guard Boat would be a more effective option.
- RH advised that the controls relating to the inclusion of **access and egress ladders** and **grab chains** should be combined under Riparian Lifesaving Equipment. SAB explained that Riparian Lifesaving Equipment had now been incorporated in to the designs, therefore this should no longer be considered an additional risk control measure.
 - **Alternate mooring** – RH felt it was sensible to explore options for an alternate mooring site for the spare vessel intended to be moored on the Barnes Pier during off-peak operational hours. It was agreed that this risk control was not relevant to a controlled transit scenario.
 - **Notice to Mariners** – A NTM will be issued when the construction works commence and any NTM issued as part of the operational phase is likely to be an extension of the existing NTM. The extended NTM will likely be withdrawn once vessel traffic and risk profile has habituated. This extended NTM will now form part of a wider additional risk control measure focussed on the dissemination and promulgation of information.
 - **Controlled transit list to be provided** – RH viewed this as an effective and highly important risk control measure applicable to both the construction phase and operation phase of the project.
 - **Local Navigation Protocol** – It was agreed that this risk control will be essential for future operational scenarios but not in a controlled transit assessment scenario.
 - **Calling out point at Chiswick Eyot (vessels navigating downstream)** – RH explained that the traffic light system currently in place was partially introduced to minimise VHF noise / traffic.
 - **Provision of a Rescue Boat** – RH felt that the provision of a vessel to perform a dual function as a Guard Boat and Safety Boat would be an important risk control measure during the construction phase and whilst vessel traffic and risk profile habituated during the first months of the operation. A further discussion was held in relation to this and RH specified that a Guard Boat equipped to Safety Boat standards should be:
 - Operational between sunrise and two hours after sunset;
 - Be positioned downstream of Hammersmith Pier or works on a flood tide to alert unpowered recreational vessels to the presence of the pier or works;
 - Be positioned upstream of Hammersmith Pier or works on an ebb tide to alert vessels of the requirement to remain clear of the pier/works;
 - The vessel should be on site (between the times specified) throughout the construction phase and for the first month of the operation phase or until vessel traffic and risk profile habituates; and
 - There is likely to be a requirement for the vessel in future assessment scenarios and the boat may well need to be recalled during events or at selected peak times as the river opens to navigation.

- Further to the review / consolidation of the risk controls identified as part of the Preliminary Hazard Analysis a number of further additional risk controls were discussed these included:
 - The requirement for a detailed passage plan to be produced for the PLA's approval. The passage plan should give consideration to:
 - Byelaws 34.2 and 52 in relation to the marking of a ferry vessel.
 - The inclusion of restricted visibility operational guidelines based on a precautionary approach that each pier should be visible from the other before departure;
 - Guidance to ferry Masters in relation to measures to be taken to avoid grounding when coming alongside the pier heads at low water;
 - Appropriate and proportionate use of sound signals when departing pier heads. Potential relaxation of sound signals during peak periods of low traffic; and
 - Contingency plans in the event of a mechanical breakdown / failure.
 - Aids to Navigation (lights) two fixed red lights and two fixed green lights to be positioned on the respective piers.
- An overview of the hazard likelihood and consequence scores was undertaken with RH broadly in agreement with the scores presented.

6. HAZARD IDENTIFICATION AND EMBEDDED RISK CONTROLS

6.1. INTRODUCTION

The following section outlines the identification and assessment of navigation hazards utilising the PLA's standard risk assessment methodology for river developments. The following definitions apply:

- **Hazard** - an unwanted event resulting in adverse consequences;
- **Likelihood** - a determination of how likely a hazard is to occur;
- **Severity** – the magnitude of the consequences should a hazard occur;
- **Risk** - a non-dimensional measure of hazard severity and likelihood;
- **Embedded risk control measures** – a risk control measure that is already in place;
- **Additional risk control measures** – a risk control measure that is put in place specifically for the project scheme under consideration;
- **Inherent Assessment of Navigation Risk** – an assessment of hazard risk with the project / scheme / development in place including existing risk control or mitigation measures; and
- **Residual Assessment of Navigation Risk** – an assessment of hazard risk with the project / scheme / development in place including existing risk control or mitigation measures, and additional project / scheme / development risk control or mitigation measures.

6.2. PLA RISK ASSESSMENT METHODOLOGY

The PLA risk assessment methodology requires that navigation hazards be identified and assessed in relation to hazard likelihood and hazard consequence to generate a hazard risk score:

$$\text{Navigation Risk} = \text{likelihood of hazard occurrence} \times \text{consequence of hazard occurrence}$$

The assessment of navigation risk is made for two risk scenarios – “inherent” and “residual” assessment.

The inherent and residual assessment enables the determination of hazard risk reduction brought about by either an additional individual project risk control or in most cases a suite of project related risk control measures.

In order to determine hazard likelihood assessments, the PLA use a likelihood classification table to allocate likelihood scores to hazards – see **Table 4**.

Hazard consequence classifications are as shown in **Table 5** and relate in broad terms to hazard impact too:

- People
- Environment
- Property
- Reputation
- Port Impact

Table 4: Hazard Likelihood Classifications

Hazard Likelihood Classifications
Rare: Very unusual - not common or frequent
Unlikely: Not probable or likely to happen
Possible: Not certain – might or might not happen
Likely: Will probably happen or is expected
Almost Certain: More than likely / in all likelihood

Table 5: PLA Hazard Consequence Classifications

Consequence Classifications	People	Environment	Property	Reputation	Port Impact
Minor:	-Minor or No injuries.	-Insignificant impact on environment and port operation.	-Insignificant or no damage to vessel / equipment / structure.	-Little or no risk to company image.	-Insignificant port costs. Guidance: up to approx. £5,000
Moderate:	-Moderate injuries.	-Minor impact on environment and port operation with no lasting effects	-Vessel / equipment / structure incurs minor damage but remains in service / safe to use. Some adjustments to working / operational methods may be required.	-Local news coverage and control measures required to manage publicity.	-Moderate cost implications for Port. Guidance approx. between £5,000 & £50,000
Serious:	-Major / life changing injuries.	-Limited impact on environment and port operation with short term or long-term effects.	-Vessel / Equipment / structure un-operational and in need of repairs.	-Regional news coverage with potential for reputational damage.	-Serious cost implications for Port. Guidance approx. between £50,000 & £250,000
Very Serious:	-Single Fatality.	-Significant impact on environment and Port operation with short term or long-term effects	-Vessel / Equipment / Structure un-operational and in need of extensive repairs / dry docking.	-National news coverage with significant potential for reputational damage	-Very Serious cost implications for Port. Guidance approx. between £250,000 & £500,000
Severe:	-Multiple fatalities.	-Serious long-term impact on environment and / or permanent damage.	-Vessel / equipment / structure unsalvageable. -Serious long-term impact on port operational effectiveness.	-International news coverage with severe potential for reputational damage.	-Severe cost implications for Port. Guidance approx. over £500,000

A risk matrix is then used to combine the likelihood and consequence scores for each hazard to generate an inherent assessment of risk.

Based on the evaluation of the impact of the development each hazard is scored using the matrix as defined in **Table 6**.

Table 6: PLA's Risk Score Matrix.

Risk Score					
Almost Certain	5	10	15	20	25
Likely	4	8	12	16	20
Possible	3	6	9	12	15
Unlikely	2	4	6	8	10
Rare	1	2	3	4	5
Likelihood	Minor	Moderate	Serious	Very Serious	Severe

6.3. ACCEPTABILITY

The PLA methodology does not state the acceptability of risk scores. However, it is assumed that risk scored at “Moderate” and “Minor” would be deemed acceptable, which puts the acceptability threshold at risk scores lower than 9.0 / 25 (see **Table 7** for PLA risk score classifications). Where inherent hazard risk scores are greater than 9/25 (Serious, Very Serious or Severe), risk controls are identified and allocated to hazards. Hazard risk scores are then recalculated using the same method as above and a residual assessment of risk determined. Where inherent hazard risk scores are deemed acceptable, applicable additional risk controls are still applied to demonstrate the conceivable reduction in hazard risk.

Table 7: PLA Hazard risk score Classifications.

Total Risk Score	
Minor	1-3.9
Moderate	4-8.9
Serious	9-14.9
Very Serious	15-19.9
Severe	20-25

6.4. RISK ASSESSMENT DEFINITIONS

Table 8 summarises the terms used throughout the hazard identification and risk assessment process to refer to categories of vessels.

Table 8: Summary of NRA Vessel Categorisation

	Vessel Types	NRA Categorisation
Third Party Vessels	Sailing Dinghies	Unpowered recreational vessels
	Rowing Vessels	
	Kayaks / Canoes	
	Stand Up Paddleboard	
	Powered Recreational Vessel	Powered Third-Party Vessels
	Service vessel	
	Intra-port freight	
Project Vessels	Thames Clipper Hydrocat	Project (Operation) Vessel
	Crane barge	Project Construction vessel
	Jack-Up-Barge	
	Tug	
	Safety Boat and / or Guard Boat	
	Barge	
	Multi-Cat	

In addition the following terms are used to provide consistency throughout the risk assessment process;

- **Project infrastructure** - The installed / partially installed works including the Hammersmith and Barnes Pier heads, Hammersmith pontoon walkway and Barnes Pier brow and associated piles; and
- **Construction Works** - The Crane barge, Jack-Up-Barge and any other craft held in situ by spud anchors.

6.5. CONSTRUCTION PHASE HAZARD IDENTIFICATION

Navigation hazards were identified based on the vessel types navigating passed and in the vicinity of the Hammersmith Temporary Ferry works area in a controlled transit scenario. Hazards were identified for the construction phase of the project and are summarised in **Table 9**.

Table 9: Summary of Hazards Identified as part of the Construction phase of the Project.

Hazard ID	Hazards
Haz Id #:1	Project construction vessel makes contact with Hammersmith Bridge
Haz Id #:2	Powered third party vessel makes contact with project infrastructure / construction works
Haz Id #:3	Unpowered recreational vessel makes contact with project infrastructure / construction works
Haz Id #:4	Project construction vessel grounds during works
Haz Id #:5	Third party vessel (inc unpowered recreational) grounds as a result of avoiding collision with project construction vessel or construction works.

Hazard ID	Hazards
Haz Id #:6	Collision between project construction vessels
Haz Id #:7	Collision between project construction vessel and third party powered vessel.
Haz Id #:8	Collision between project construction vessel and unpowered recreational vessel
Haz Id #:9	Unpowered recreational vessel pinned against project infrastructure / construction works

6.6. CONSTRUCTION PHASE EMBEDDED RISK CONTROL MEASURES

Key embedded risk control measures that will significantly reduce the navigation risk posed by the construction phase of the Hammersmith Ferry Project were discussed with key stakeholders and are summarised in **Table 10**. These risk controls are in addition to the baseline, river wide, risk controls measures overseen by the PLA as SHA identified in **section 2.2.1** are taken in to consideration when scoring inherent risk likelihood and consequence.

Table 10: Construction Phase: Key Embedded Risk Control Measures

Title	Summary
Communication	PLA Harbour Control (VTS) to be advised of all vessel movements prior to operation commencement.
Passage plan	Passage plan for non-routine tows to be approved in advance by PLA.
Lights, signs and flags	Appropriate signs lights and flags to be displayed on barges.
Clearly defined operational tidal window	Multi-cat vessel will only be able to operate in inshore areas when tidal levels permit and risks grounding outside these defined times. The project has clearly defined an operational tidal work when the multicat will be able to operate without risking grounding.
Use of appropriately qualified personnel	All passage plans to be produced by a competent and appropriately qualified Tow Master. All Barge Masters and Tug Masters to be appropriately qualified.
Use of appropriate equipment	Spud Anchors and JUB deployed to create stable construction platforms and to minimise risk of breakout due to wash / adverse weather conditions.

6.7. CONSTRUCTION PHASE HAZARD DESCRIPTION

The following sections provides a narrative overview of the navigation hazards identified as part of the construction phase.

6.7.1. PROJECT CONSTRUCTION VESSEL MAKES CONTACT WITH HAMMERSMITH BRIDGE

Project construction vessel makes contact with Hammersmith Bridge, the most likely cause of such an event would be a mechanical failure or breakout as a result of wash created by passing traffic or adverse weather conditions.

6.7.2. POWERED THIRD PARTY VESSEL MAKES CONTACT WITH PROJECT INFRASTRUCTURE / CONSTRUCTION WORKS

Hammersmith Pier / Pontoon Walkway - A powered third party vessel navigating downstream on an ebb tide could be taken off course by the tidal set (which will push vessels toward the northern bank) and could make contact with partially installed pile, Hammersmith Pier and/or floating walkway. It is likely that such a vessel would aim for the centre of arch #2 Hammersmith Bridge in order to pass under the bridge at the point of maximum headway. A significant alteration of course to starboard (and management of speed/power) may be required to pass the pier infrastructure and or construction works at a safe distance and avoid being pushed onto it by the tidal set. This hazard is likely most applicable to large unpowered recreational vessels such as Dutch barges, narrowboats or houseboats.

Barnes Pier - The likelihood of a powered third-party vessel making contact with the Barnes Pier infrastructure or construction works is considered to be less significant as the tidal set will push vessels north and away from the pier. The point of greatest headway under Hammersmith Bridge is at the centre span of arch # 2 and aligned with the northern extremity of the authorised channel. Vessels aligning with the centre point of arch #2 are likely to remain well clear of Barnes Pier.

6.7.3. UNPOWERED RECREATIONAL VESSEL MAKES CONTACT WITH PROJECT INFRASTRUCTURE / CONSTRUCTION WORKS

Hammersmith Pier / Pontoon Walkway - Unpowered craft approaching Fulham Reach Boat Club from the east and transiting upstream on the Flood tide (as per the Tideway Code) may be pushed on to the partially installed project infrastructure (most likely the floating walkway) or construction works by the flood tide set.

Barnes Pier - The risk of unpowered craft making contact with the partially installed Barnes infrastructure is considered to be far less significant as unpowered craft are currently not permitted to transit Hammersmith Bridge and therefore are not frequently navigating in the immediate vicinity of Barnes Pier. In addition the tidal set will push vessels to the north, away from the location of the Barnes pier construction works.

6.7.4. PROJECT CONSTRUCTION VESSEL GROUNDS DURING WORKS

The works involve vessels navigating close to the shore in shallow water. Certain parts of the operation such as the installation of the Hammersmith EZ dock walkway will only be possible at high tide for a limited tidal window. Project construction vessels risk grounding in these shallow waters.

6.7.5. THIRD PARTY VESSEL (INC UNPOWERED RECREATIONAL) GROUNDS AS A RESULT OF AVOIDING COLLISION WITH PROJECT CONSTRUCTION VESSEL OR CONSTRUCTION WORKS.

Hammersmith Bridge is closed to navigation other than essential transits that are permitted on a controlled transit basis. Therefore there will be limited traffic passing the site. In all likelihood vessels needing to take avoiding action would already have deviated from the authorised channel potentially as a result of a mechanical failure, Master / Skipper error or action of the tidal stream.

6.7.6. COLLISION BETWEEN PROJECT CONSTRUCTION VESSELS

Project construction vessels collide whilst transiting construction site area.

6.7.7. COLLISION BETWEEN PROJECT CONSTRUCTION VESSEL AND THIRD PARTY POWERED VESSEL.

Hammersmith Bridge is closed to navigation other than essential transits that are permitted on a controlled transit basis. Therefore there will be limited traffic passing the site. As the works are taking place predominantly outside the authorised channel a third party powered vessel would likely have deviated from a normal course in order for a collision with a construction vessel to occur. Collisions are most likely to occur on a strong ebb tide when a third-party vessel is transiting downstream and a construction vessel is crossing between the Hammersmith and Barnes Pier sites. Line of site from the Barnes side is particularly and it is possible that a tug master looking to cross the river may not see an oncoming vessel.

6.7.8. COLLISION BETWEEN PROJECT CONSTRUCTION VESSEL AND UNPOWERED RECREATIONAL VESSEL

Unpowered recreational vessels are not permitted to transit Hammersmith Bridge. As a result vessels of this category are not likely to navigate passed or in the immediate vicinity of the construction site. Most rowing craft turn downstream of the construction site near the River View buoy. However, a strong ebb tide could push an inexperienced crew or a crew that has experienced equipment failure into the path of a project construction vessel.

6.7.9. UNPOWERED RECREATIONAL VESSEL PINNED AGAINST PROJECT INFRASTRUCTURE / CONSTRUCTION WORKS

Unpowered craft approaching Hammersmith Pier from the east and transiting upstream on the Flood tide may be pushed on to the Hammersmith infrastructure or construction works (most likely the floating walkway) by the flood tide set, once contact is made it is possible the vessel will then be pinned against the walkway and could capsize resulting in a potential multiple MOB.

This hazard is differentiated from Haz ID 3 as a result of concern raised by the local rowing community that contact by an unpowered recreational vessel may result in pinning of the vessel against the project infrastructure or construction works.

6.8. OPERATION PHASE HAZARD IDENTIFICATION

Navigation hazards were identified based on the vessel types navigating passed and in the vicinity of the Hammersmith Temporary Ferry site area in a controlled transit assessment scenario. Hazards were identified for the operational phase of the project and are summarised in **Table 11**.

Table 11: Summary of Hazards Identified as part of the Construction phase of the Project.

Hazard ID	Hazards
Haz Id #:1	Project vessel makes contact with Hammersmith Bridge, Barnes Pier or Hammersmith Pier (inc piles)
Haz Id #:2	Powered third party vessel makes contact with project infrastructure
Haz Id #:3	Unpowered recreational vessel makes contact with project infrastructure

Hazard ID	Hazards
Haz Id #:4	Project vessel grounds whilst in operation
Haz Id #:5	Third party vessel grounds as a result of avoiding collision with project vessel
Haz Id #:6	Collision between project vessels
Haz Id #:7	Collision between project vessel and third party powered vessel.
Haz Id #:8	Collision between project vessel and unpowered recreational vessel
Haz Id #:9	Unpowered recreational vessel pinned against project infrastructure

6.9. OPERATION PHASE EMBEDDED RISK CONTROL MEASURES

Key embedded risk control measures that will significantly reduce the navigation risk posed by the construction phase of the Hammersmith Ferry Project were discussed with key stakeholders and are summarised in **Table 12**. These risk controls are in addition to the baseline, river wide, risk controls measures overseen by the PLA as SHA and identified in **section 2.2.1** are taken in to consideration when scoring inherent risk likelihood and consequence.

Table 12: Construction Phase: Key Embedded Risk Control Measures

Title	Detail
Riparian lifesaving equipment	Including access/ egress ladders and grab chains incorporated in to design.
Use of appropriately qualified personnel	Qualified and suitably experienced Ferry Masters

6.10. OPERATION PHASE HAZARD DESCRIPTION

The following sections provide a narrative overview on the navigation hazards identified as part of the construction phase.

6.10.1. PROJECT VESSEL MAKES CONTACT WITH HAMMERSMITH BRIDGE, BARNES PIER OR HAMMERSMITH PIER (INC PILES)

Project vessel makes contact with Hammersmith Bridge, Barnes Pier or Hammersmith Pier. The most likely causes of such an event would be a mechanical failure, master skipper error or reduced visibility due to navigation at nigh/ fog / adverse weather conditions.

6.10.2. POWERED THIRD PARTY VESSEL MAKES CONTACT WITH PROJECT INFRASTRUCTURE

Hammersmith Pier and Walkway - A powered third party vessel navigating downstream on an ebb tide could be taken off course by the tidal set (which will push vessels toward the northern bank) and could make contact with the Hammersmith Pier and/or floating walkway. It is likely that such a vessel would aim for the centre of arch #2 Hammersmith Bridge in order to pass under the bridge at the point of maximum headway. A significant alteration of course to starboard (and management of speed/power) may be required to pass the pier at a safe distance and avoid being pushed onto it by the tidal set. This hazard is likely most applicable to large unpowered recreational vessels such as Dutch barges, narrowboats or houseboats.

Barnes Pier - The likelihood of a powered third-party vessel making contact with the Barnes Pier is considered to be less significant as the tidal set will push vessels north and away from the pier. The point of greatest headway under Hammersmith Bridge is at the centre span of arch # 2 and aligned with the northern extremity of the authorised channel. Vessels aligning with the centre point of arch #2 are likely to remain well clear of Barnes Pier.

6.10.3. UNPOWERED RECREATIONAL VESSEL MAKES CONTACT WITH PROJECT INFRASTRUCTURE

Hammersmith Pier and Walkway - Unpowered craft approaching Fulham Reach Boat Club from the east and transiting upstream on the Flood tide (as per the Tideway Code) may be pushed on to the Hammersmith Pier and/or floating walkway (more likely the floating walkway) by the flood tide set.

Barnes Pier - The risk of unpowered craft making contact with the Barnes Pier is considered to be far less significant as unpowered craft are currently not permitted to transit Hammersmith Bridge and therefore are not frequently navigating in the immediate vicinity of Barnes Pier. In addition the tidal set will push vessels to the north, away from the location of the Barnes pier.

6.10.4. PROJECT VESSEL GROUNDS WHILST IN OPERATION

Depths alongside Hammersmith and Barnes Pier are limited and there is a risk that project vessels could ground when coming alongside at low water.

6.10.5. THIRD PARTY VESSEL GROUNDS AS A RESULT OF AVOIDING COLLISION WITH PROJECT VESSEL

Hammersmith Bridge is closed to navigation other than essential transits that are permitted on a controlled transit basis. Therefore there will be limited traffic passing the site. Vessels transiting downstream on an ebb tide will be traveling at a relatively high speed and line of site beyond Hammersmith Bridge is poor. Line of site for the Ferry Master looking to depart Barnes Pier is poor when looking for approaching traffic to the west as Hammersmith Bridge obscures the view upstream. Passing vessels may be forced to take avoiding action which could result in grounding.

6.10.6. COLLISION BETWEEN PROJECT VESSELS

The ferry vessels will be working in close proximity and at low speed as they utilise the tidal stream to transit between the two piers. During peak times two vessels will operate, in the event of a mechanical breakdown or that a project vessel has to take avoiding action to avoid a third-party vessel it is possible that a collision will occur between the two project vessels.

6.10.7. COLLISION BETWEEN PROJECT VESSEL AND THIRD PARTY POWERED VESSEL.

Hammersmith Bridge is closed to navigation other than essential transits that are permitted on a controlled transit basis. Therefore there will be limited traffic passing the site. Vessels transiting downstream on an ebb tide will be traveling at a relatively high speed and line of site beyond Hammersmith Bridge is poor. Line of site for the Ferry Master looking to depart Barnes pier is poor when looking for approaching traffic to the west as Hammersmith Bridge obscures the view upstream.

6.10.8. COLLISION BETWEEN PROJECT VESSEL AND UNPOWERED RECREATIONAL VESSEL

Unpowered recreational craft are not permitted to transit Hammersmith Bridge. As a result unpowered recreational vessels are not likely to navigate passed or in the immediate vicinity of the construction site. Most rowing craft turn downstream of the construction site near the River View buoy. However, a strong ebb tide could push an inexperienced crew or a crew that has experienced equipment failure in to the path of a project vessel, this could result in a collision event.

6.10.9. UNPOWERED RECREATIONAL VESSEL PINNED AGAINST PROJECT INFRASTRUCTURE

Unpowered craft approaching Hammersmith Pier from the east and transiting upstream on the Flood tide may be pushed on to the Hammersmith Pier or floating walkway (most likely the floating walkway) by the flood tide set, once contact is made it is possible the vessel will then be pinned against the walkway and could capsize resulting in a potential multiple MOB.

This hazard is differentiated from Haz ID 3 as a result of concern raised by the local rowing community that contact by an unpowered recreational vessel may result in pinning of the vessel against the project infrastructure.

7. INHERENT NAVIGATION RISK ASSESSMENT RESULTS

The results of the NRA are contained in full in the “*Risk Assessment Logs*” which can be viewed in **Annex C** and **Annex D** are based on the PLA template and consider hazard risk in terms of:

- Hazard ID
- Inherent Hazard Risk Rank (based on inherent severity score)
- Residual Hazard Risk Rank ((based on residual severity score)
- Hazard Area (project study area)
- Hazard Comments on Disposition - overview of vessel disposition
- Hazard Causes
- Hazard Consequences (broken down into “*Most Likely Consequences*” and “*Reasonable Worst Credible Consequences*”)
- Inherent Risk Assessment (no project risk controls in place):
 - Hazard Likelihood Score
 - Hazard Consequence Score
 - Hazard Severity Score
- Control Measures – project risk control or mitigation measures:
- Residual Risk (project risk controls in place)
 - Hazard Likelihood Score
 - Hazard Consequence Score
 - Hazard Severity Score

7.1. CONSTRUCTION PHASE INHERENT RISK ASSESSMENT RESULTS

The results of the inherent assessment of risk for the construction phase of the project are contained in **Table 13** which relates to an assessment of risk for the construction phase without additional control measures - but includes both SHA embedded risk control measures (see **section 2.2.1**) and project embedded risk control measures (see **Table 10**)

Based on the PLA risk score classifications for the inherent assessment of risk for the construction phase of the project there were three hazards which scored as intolerable / unacceptable, these were:

- Haz Id #:3 - Unpowered recreational vessel makes contact with project infrastructure / construction works;
- Haz Id #:8 - Collision between project construction vessel and unpowered recreational vessel; and
- Haz Id #:9 - Unpowered recreational vessel pinned against project infrastructure / construction works.

The remaining hazards scored as “moderate” risks, with the exception of Haz Id #:4 which scores as “minor”. Two hazards were scored at the higher end of the “moderate” risk category, these being:

- Haz Id #:2 – Powered third party vessel makes contact with project infrastructure / construction works.
- Haz Id #:7- Collision between project construction vessel and third party powered vessel.

Hazards scoring in the “Serious” risk category and above require additional risk control measures to mitigate the risk score to acceptable levels, but it is also strongly advised that all hazards are reduced to as low as reasonably practical (ALARP). Therefore, where appropriate, additional control measures have been utilised to bring all hazards down to as low as reasonably practical.

Table 13: Construction Inherent Assessment of Risk

Hazard ID	Inherent Risk Rank	Hazard	Inherent Risk		
			Likelihood	Severity	Score
Haz Id #:3	1	Unpowered recreational vessel makes contact with project infrastructure / construction works	2	5	10
Haz Id #:8	1	Collision between project construction vessel and unpowered recreational vessel	2	5	10
Haz Id #:9	1	Unpowered recreational vessel pinned against project infrastructure / construction works	2	5	10
Haz Id #:2	4	Powered third party vessel makes contact with project infrastructure / construction works	2	4	8
Haz Id #:7	4	Collision between project construction vessel and third party powered vessel.	2	4	8
Haz Id #:1	6	Project construction vessel makes contact with Hammersmith Bridge	2	2	4
Haz Id #:5	6	Third party vessel (inc unpowered recreational) grounds as a result of avoiding collision with project construction vessel or construction works.	2	2	4
Haz Id #:6	6	Collision between project construction vessels	2	2	4
Haz Id #:4	9	Project construction vessel grounds during works	3	1	3

7.2. OPERATION PHASE INHERENT RISK ASSESSMENT RESULTS

The results of the inherent assessment of risk for the operation phase of the project are contained in **Table 14** which relates to an assessment of risk for the operation phase without additional control measures - but includes both SHA embedded risk control measures (see **section 2.2.1**) and project embedded risk control measures (see **Table 12**)

Based on the PLA risk score classifications then for the inherent assessment of risk for the operation phase of the project there were four hazards which scored as intolerable / unacceptable, these were:

- Haz Id #:7 – Collision between project vessel and third party powered vessel.
- Haz Id #:8 – Collision between project vessel and unpowered recreational vessel
- Haz Id #:3 – Unpowered recreational vessel makes contact with project infrastructure.
- Haz Id #:9 - Unpowered recreational vessel pinned against project infrastructure.

Four hazards scored as “moderate” risks, with one, hazards scored at the higher end of the “moderate” risk category, this being Haz Id #:2, Powered third party vessel makes contact with project infrastructure.

Haz Id #:9 - Project vessel grounds whilst in operation, scored as “minor”.

Hazards scoring in the “Serious” risk category and above require additional risk control measures to mitigate the risk score to acceptable levels, but it is also strongly advised that all hazards are reduced to as low as reasonably practical (ALARP). Therefore, where appropriate, additional control measures have been utilised to bring all hazards down to as low as reasonably practical.

Table 1 4: Operation: Inherent Assessment of Risk

Hazard ID	Inherent Risk Rank	Hazard	Inherent Risk		
			Likelihood	Severity	Score
Haz Id #:7	1	Collision between project vessel and third party powered vessel.	3	4	12
Haz Id #:8	2	Collision between project vessel and unpowered recreational vessel	2	5	10
Haz Id #:3	2	Unpowered recreational vessel makes contact with project infrastructure	2	5	10
Haz Id #:9	2	Unpowered recreational vessel pinned against project infrastructure	2	5	10
Haz Id #:2	5	Powered third party vessel makes contact with project infrastructure	2	4	8
Haz Id #:6	6	Collision between project vessels	3	2	6
Haz Id #:1	7	Project vessel makes contact with Hammersmith Bridge, Barnes Pier or Hammersmith Pier (inc. piles)	2	2	4
Haz Id #:5	7	Third party vessel grounds as a result of avoiding collision with project vessel	2	2	4
Haz Id #:4	9	Project vessel grounds whilst in operation	3	1	3

8. ADDITIONAL RISK CONTROLS

8.1. CONSTRUCTION PHASE: ADDITIONAL RISK CONTROL MEASURES

Following stakeholder consultation, which included a detailed review of the preliminary risk controls identified as part of the Preliminary Hazard Analysis Report with the PLA Harbour Master, (see **section 5**). A review of the existing embedded risk control measures and drawing on the expertise of the project team, additional risk control measures, as detailed in **Table 15** were identified. These are over and above the control measures mandated by the SHA and the embedded risk control measures specified in **Table 10** and could be used to reduce hazard risk scores.

Table 15: Construction Phase Recommended Additional Risk Control Measures

Additional Risk Controls: Construction Phase		
RC Id #	Title	Detail
1	Promulgation and dissemination of information	<p>Information on location of the construction works and infrastructure, advice on the navigation of Hammersmith Bridge should be issued as widely as possible to relevant users and include:</p> <ul style="list-style-type: none"> Regulator - PLA to utilise communications channels including Tidal Thames News, social media, public events and relevant meetings Operator – UBTC and TfL to share information via social media and other media outlets. <p>Social media channels could include twitter/LinkedIn/Facebook/Instagram with link/sharing between above parties.</p> <p>Information to be circulated and shared amongst the RULG membership (See Risk Control 2)</p>
2	River User Liaison Group	<p>This is recommended given that the navigational disposition will change over the lifetime of the project (and possibly infrastructure installation and construction works) as a result of amendments to the current restrictions to navigation and any bridge works etc. In such an event a further assessment of navigational risk will need to be carried out, this will include dissipation of information further stakeholder consultation and development of additional risk control measures that will need to be adopted and implemented to manage navigational risk during the works. This forum will also sensibly develop/amend operational protocols/ existing risk controls.</p>

Additional Risk Controls: Construction Phase		
RC Id #	Title	Detail
3	Guard Boat (equipped to also perform the function of a safety boat)	<p>The Guard Boat shall also be equipped to Safety Boat standard and should satisfy the PLA specification (See report section 8.2) for both functions. The vessel will warn third party users of works and hazards and provide assistance/recovery response to contractor and third parties in the event of incident. In addition the Guard Boat should be:</p> <ul style="list-style-type: none"> • Of appropriate air draught to allow for transit under Hammersmith Bridge at all states of tide (headway is 3.6m at MHWS see report Figure 3) • Of appropriate draft to navigate within shallow intertidal areas of 0.75m water depth. • Be operational from between sunrise to 2 hours after sunset. <p>On a flood tide be positioned to the west of Fulham Reach Boat Club and to the east of the construction site to warn unpowered craft at risk of making contact with the Hammersmith Pier and walkway (and construction works) due to the flood tidal set.</p> <p>On an ebb tide be positioned to the west of the construction site and to the east of Hammersmith Bridge in order that any craft transiting downstream can be alerted to the requirement to keep clear of the construction works. The Guard Boat crew should be provided with a list of scheduled controlled transits so that it can proactively position for these transits.</p>
4	Controlled transit list provided	Controlled transit list to be provided by PLA to onsite construction team to allow for anticipation of passing transits.
5	Information provided to vessels booking a downstream Hammersmith Bridge transit	A notification warning of the presence of the Hammersmith Pier construction works and partially installed infrastructure to be issued to vessels planning to transit Hammersmith Bridge arch #2. Vessels transiting downstream on an ebb tide will need to turn hard to starboard once the bridge is cleared.
6	Communication of construction vessel movements and programme	The construction manager should regularly update all river users (including RULG members) via email and through social media platforms regarding the ongoing construction programme, vessel movements any restrictions to the navigation channel etc.
7	Signage warning of Hammersmith Pier infrastructure and construction works	Signage warning of the presence of Hammersmith Pier and construction works and the need for craft transiting Hammersmith Bridge arch #2 downstream on an ebb tide to turn hard to starboard once the bridge is cleared.
8	Project Incident log	A project marine incident log detailing any navigational near misses or incidents should be kept by the Guard Boat crew and construction team. This log will enable evidence-based decision making when reviewing the need/effectiveness of the risk controls in place as well as any requirement for additional risk controls.

The risk controls identified in **Table 15** were allocated to hazards where they would mitigate risk, to determine the residual risk assessment. Details of the hazards these risk controls were applied to are summarised in **Table 16**.

It should be noted that the residual assessment of risk therefore considers the cumulative reduction in risk brought about by all risk control measures applied to the hazard, and individual risk control effectiveness cannot be determined from the assessment methodology without re-scoring hazards with individual controls applied cumulatively.

Table 16: Construction Phase: Risk Controls Applied to Hazards

Additional Risk Controls: Construction Phase		Risk Control Hazard Mitigation Type								
RC Id #	Title	Project construction vessel makes contact with Hammersmith Bridge	Powered third party vessel makes contact with project infrastructure / construction works	Unpowered recreational vessel makes contact with project infrastructure / construction works	Project construction vessel grounds during works	Third party vessel (inc unpowered recreational) grounds as a result of avoiding collision with project construction vessel or construction works.	Collision between project construction vessels	Collision between project construction vessel and third party powered vessel.	Collision between project construction vessel and unpowered recreational vessel	Unpowered recreational vessel pinned against project infrastructure / construction works
1	Promulgation and dissemination of information		✓	✓		✓	✓	✓	✓	✓
2	River User Liaison Group		✓	✓		✓		✓	✓	✓
3	Guard Boat (equipped to also perform the function of a safety boat)		✓	✓		✓		✓	✓	✓
4	Controlled transit list provided						✓	✓	✓	
5	Information provided to vessels booking a downstream Hammersmith Bridge transit		✓					✓		
6	Communication of Construction vessel movements and programme		✓	✓		✓	✓	✓	✓	✓
7	Signage warning of Hammersmith Pier infrastructure and construction works		✓					✓		
8	Incident log		✓	✓		✓		✓	✓	✓

8.2. OPERATION PHASE: ADDITIONAL RISK CONTROL MEASURES

Following the same process as outlined in **section 8.1**, in relation to the refinement and identification of proportionate additional risk control measures, nine additional risk control measures, as detailed in **Table 17**

were identified for the operation phase of the project. Risk controls ID1 to ID7 are evolutions of those identified during the construction phase and have been refined where necessary to effectively mitigate risk during the operational phase. Additional Risk Control measures ID8 and ID9 are unique controls developed in consultation with the PLA and other stakeholders for the operational phase.

Table 17: Operationa Phase Recommended Additional Risk Control Measures

RC Id #	Title	Detail
1	Promulgation and dissemination of information	<p>Information on location of the piers, ferry operation and advice on the navigation of Hammersmith Bridge should be issued as widely as possible to relevant users and include:</p> <ul style="list-style-type: none"> • Notice to Mariners (NTM), this NTM may be an extension/link to the NTM issued during construction phase and will be removed once ferry operation is established and traffic and risk profile has habituated. • Regulator - PLA to utilise communications channels including Tidal Thames News, social media, public events and relevant meetings. • Operator - UBTC and TfL to share information via social media and other media outlets. • Corrected charts to be issued showing the locations of piers and relevant operational information. <p>Social media channels could include twitter/LinkedIn/Facebook/Instagram with link/sharing between above parties.</p> <p>Information to be circulated and shared amongst the RULG membership (See Risk Control 2)</p>
2	River User Liaison Group	<p>The navigational disposition will change over the lifetime of the project as a result of amendments to the current restrictions to navigation and any bridge works etc. In such an event a further assessment of navigational risk will need to be carried out, this will include dissipation of information further stakeholder consultation and development of additional risk control measures that will need to be adopted and implemented to manage navigational risk. This forum will also sensibly develop/amend operational protocols/ existing risk controls.</p>
3	Guard Boat (equipped to also perform the function of a safety boat)	<p>The Guard Boat must be in position for the first week of the operation. The PLA Harbourmaster will review the requirement for the Guard Boat beyond 1 week to determine whether traffic and risk profile has habituated. The Harbourmaster will refer to the project incident log (see risk control ID8) in order to:</p> <ol style="list-style-type: none"> 1. review any near misses / navigational incidents recorded during the construction phase (and first week of the operation phase) to aid evidence-based decision making.

RC Id #	Title	Detail
		<p>2. understand the need/effectiveness of the Guard Boat as a risk control measure</p> <p>3. consult with members of the RULG (ID 2) as required/relevant.</p> <p>If it is determined that the Guard Boat will be required beyond the first week of operation then the PLA Harbourmaster will review the need for the vessel on an ongoing and periodic basis (minimum monthly) in consultation with the RULG (See risk control 2) and ferry operator.</p> <p>The Guard Boat shall also be equipped to Safety Boat standard and should satisfy the PLA specification (See section 8.2.1) for both functions. The vessel will warn third party users of hazards and provide assistance/recovery response to third parties in the event of incident.</p> <p>In addition the Guard boat should be:</p> <ul style="list-style-type: none"> • of appropriate air draught to allow for transit under Hammersmith Bridge at all states of tide (headway is 3.6m at MHWS see report Figure 3) • of appropriate draft to navigate within shallow intertidal areas of 0.75m water depth. • operational between sunrise to 2 hours after sunset. <p>On a flood tide be positioned to the west of Fulham Reach Boat Club and to the east of the ferry operation site to warn unpowered craft at risk of making contact with the Hammersmith Pier and walkway due to the flood tidal set.</p> <p>On an ebb tide be positioned to the west of the ferry operation and to the east of Hammersmith Bridge in order that any craft transiting downstream can be alerted to the requirement to keep clear of Hammersmith Pier. The Guard Boat crew should be provided with a list of scheduled controlled transits so that it can proactively position for these transits.</p>
4	Controlled transit list provided	Controlled transit list to be provided by PLA to ferry Master and Guard Boat crew to allow for anticipation of passing transits.
5	Information provided to vessels booking a downstream Hammersmith Bridge transit	A notification warning of the presence of the Hammersmith Pier to be issued to vessels planning to transit Hammersmith Bridge arch #2. Vessels transiting downstream on an ebb tide will need to turn hard to starboard once the bridge is cleared.

RC Id #	Title	Detail
6	Aids to Navigation (lighting)	Navigation lights to be installed on Hammersmith and Barnes piers to facilitate navigation at night and in periods of restricted visibility. The Barnes Pier should be marked by two fixed red lights (one upstream and one downstream) and the Hammersmith Pier with two fixed green lights.
7	Signage warning of Hammersmith Pier	Signage warning of the presence of Hammersmith Pier and the need for craft transiting Hammersmith Bridge arch #2 downstream on an ebb tide to turn hard to starboard once the bridge is cleared.
8	Project Incident log	A project marine incident log detailing any navigational near misses or incidents should be kept by the Guard Boat crew and ferry operator. This log will enable evidence-based decision making when reviewing the need/effectiveness of the risk controls in place as well as any requirement for additional risk controls.
9	Detailed passage plan submitted to PLA	<p>UBTC will produce a detailed passage plan covering the temporary ferry operation, this passage plan will need to be approved by the PLA prior to operations commencing. The following points should be given particular consideration:</p> <ul style="list-style-type: none"> • Operational limitations, including minimum safe restricted visibility protocols (reference should be made to the PLA General Directions and Byelaws) and consideration of cessation of operations when either pier is not visible from the other (circa 180m) • Guidelines to ferry Masters on avoiding grounding incidents when coming alongside the pier heads at low water. appropriate and proportionate use of sound signals when departing pier heads. • Potential relaxation of sound signals during peak periods of low traffic. • Contingency plans in the event of a mechanical failure / breakdown.
10	Tidal Gauge Boards (depth alongside)	Tide Gauge boards should be installed on Hammersmith and Barnes Pier to give a true indication of depth alongside the piers

The risk controls identified in **Table 17** were allocated to hazards where they would mitigate risk, to determine the residual risk assessment. Details of the hazards these risk controls were applied to are identified in **Table 18**.

It should be noted that the residual assessment of risk therefore considers the cumulative reduction in risk brought about by all risk control measures applied to the hazard, and individual risk control effectiveness cannot be determined from the assessment methodology without re-scoring hazards with individual controls applied cumulatively.

Table 18: Operation Phase: Risk Controls Applied to Hazards

RC Id #	Title	Project vessel makes contact with Hammersmith Bridge, Barnes Pier or Hammersmith Pier (inc piles)	Powered third party vessel makes contact with project infrastructure	Unpowered recreational vessel makes contact with project infrastructure	Project vessel grounds whilst in operation	Third party vessel grounds as a result of avoiding collision with project vessel	Collision between project vessels	Collision between project vessel and third party powered vessel	Collision between project vessel and unpowered recreational vessel	Unpowered recreational vessel pinned against project infrastructure
1	Promulgation and dissemination of information		✓	✓		✓	✓	✓	✓	✓
2	River User Liaison Group		✓	✓		✓		✓	✓	✓
3	Guard Boat (equipped to also perform the function of a safety boat)		✓	✓		✓		✓	✓	✓
4	Controlled transit list provided				✓					
5	Information provided to vessels booking a downstream Hammersmith Bridge transit					✓	✓	✓	✓	
6	Aids to Navigation (lighting)	✓	✓	✓	✓					✓
7	Signage warning of Hammersmith Pier									
8	Incident log		✓	✓		✓	✓	✓	✓	✓
9	Detailed passage plan submitted to PLA	✓			✓		✓	✓	✓	
10	Tidal Gauge Boards (depth alongside)				✓					

8.2.1. PLA SPECIFICATION IN RELATION TO GUARD BOATS AND SAFETY BOATS

Safety Boats and Guard Boats serve different purposes and the functional specification of these two vessels types is defined in this section based on guidance provided by the PLA.

Individual Guard Boats and Safety Boats can be provided as specific dedicated functions or dual role from the one boat in order to reduce likelihood (through warning/intercept) or consequence (through emergency response) of a hazard. Whilst there is potential for crossover of roles when undertaking a specific tasking (in respect of safety or guard duty) then the loss of the other tasking capability for that period should be considered in the risk assessment.

8.2.1.1. Safety Boat

Based on a PLA supplied specification a Safety Boat would be:

- Focused on the alerting of Category 1 and Category 2 responders in event of persons or objects falling into river from the works / operation.
- To provide a recovery response for falling persons.
- Not to provide local control navigation.
- In full communication with works contractors and the appropriate PLA VTS Control Centre
- To alert works contractors of impending breach of non-intrusion area by errant craft
- Generally sited downstream of the protected works or moored downstream of the protected works with an agreed response time from notification to deployment.
- Shallow draught, low freeboard (for rescue of recreational craft and persons) and equipped with basic safety equipment.
- Crewed by 2 persons with the minimum qualifications of RYA Safety Boat Certificate for the helmsman/person in charge and the second person being RYA Power Boat Level 2 or International Certificate of Competence (ICC)

8.2.1.2. Guard Boat

Based on a PLA supplied specification a Guard Boat would be:

- Focused on preventing errant vessels entering work site or within proximity of works/movements.
- To act as escort to the tug & tow operation whilst proceeding between the layby mooring and the works and providing visual/verbal warning and localised safety cover during this period.
- Reinforces, by physical presence, requirements of exclusion areas and/or prohibitions published in NTM.
- Requires to be readily available to manoeuvre and intercept perceived intruders.
- Provides a rapid intercept service as required.
- Does not provide local traffic control (active direction of traffic can only be provided by the PLA – using a Harbour Service Launch)
- To be in full communication with works contractors and the appropriate PLA VTS Control Centre.
- Alert works contractors of impending breach / intrusion area by errant craft.

R02-00

- Generally stationed on the navigational side (starboard channel concept) of the works irrespective of flood or ebb or on the uptide.
- Shallow draught, low freeboard (for rescue of recreational craft and persons) and equipped with basic safety equipment.
- Crewed by 2 persons with the minimum qualifications of RYA Safety Boat Certificate for the helmsman/person in charge and the second person being RYA Power Boat Level 2 or International Certificate of Competence (ICC)

9. RESIDUAL RISK ASSESSMENT RESULTS

9.1. CONSTRUCTION PHASE: RESIDUAL RISK ASSESSMENT

The residual risk assessment rescores the inherent risk scores (see section 7.1) by including the additional risk control measures (presented in **Table 15**)

The summary residual risk assessment results are presented in **Table 19**.

Table 19: Construction Phase: Summary Residual Risk Assessment Results

Hazard ID	Residual Risk Rank	Hazard	Residual Risk		
			Likelihood	Severity	Score
Haz Id #:8	1	Collision between project construction vessel and unpowered recreational vessel	1	5	5
Haz Id #:3	2	Unpowered recreational vessel makes contact with project infrastructure / construction works	1	4	4
Haz Id #:9	2	Unpowered recreational vessel pinned against project infrastructure / construction works	1	4	4
Haz Id #:2	2	Powered third party vessel makes contact with project infrastructure / construction works	1	4	4
Haz Id #:7	2	Collision between project construction vessel and third party powered vessel.	1	4	4
Haz Id #:1	2	Project construction vessel makes contact with Hammersmith Bridge	2	2	4
Haz Id #:6	2	Collision between project construction vessels	2	2	4
Haz Id #:4	8	Project construction vessel grounds during works	3	1	3
Haz Id #:5	9	Third party vessel (inc unpowered recreational) grounds as a result of avoiding collision with project construction vessel or construction works.	1	2	2

The application of the additional risk controls to the project construction phase hazards results in all risk scores now being within the acceptable zone, with seven hazards classified as “moderate” risk and two classified as “minor” risk. Haz Id #:8 - Collision between project construction vessel and unpowered recreational vessel, has the highest residual score of five. Six hazards have a residual risk score of four, these are:

- Haz Id #:3 - Unpowered recreational vessel makes contact with project infrastructure / construction works;
- Haz Id #:9 - Unpowered recreational vessel pinned against project infrastructure / construction works;
- Haz Id #:2 - Powered third party vessel makes contact with project infrastructure / construction works;
- Haz Id #:7 - Collision between project construction vessel and third party powered vessel.;
- Haz Id #:1 - Project construction vessel makes contact with Hammersmith Bridge; and
- Haz Id #:6 - Collision between project construction vessels.

The two hazards classified as “minor” risk are Haz Id #:4 - Project construction vessel grounds during works and Haz Id #:5 - Third party vessel (inc unpowered recreational) grounds as a result of avoiding collision with project construction vessel or construction works.

The following general observations are made in relation to the impact of introducing additional risk controls to mitigate hazard risk scores:

- Collision likelihood and consequence scores are reduced by a combination of the introduction of risk control measures designed to increase awareness of the infrastructure and construction works (ID1,2, and 6) as well as an onsite presence in the form of the Guard Boat (ID3) to help alert traffic to dangers. The sharing of the controlled transit list with the onsite works team (ID 4) allows for project construction vessel movements to be timed to deconflict with already scheduled transits and thus reduces the likelihood of collision occurrence.
- Contact likelihood and consequence risk scores are again reduced by the introduction of risk control measures designed to increase awareness of the infrastructure and construction works (ID1,2 and,5) The provision of a Guard Boat reduces the likelihood of a powered vessel transiting downstream on an ebb tide making contact with the Hammersmith Pier infrastructure and construction works, the same risk control also helps to alert unpowered recreational vessels transiting upstream on a flood tide to the danger of posed by the flood tide set. Risk control ID 7 provides a further visual reminder to vessels transiting downstream on an ebb tide through the bridge to remain well clear of the hammersmith pier infrastructure and construction works
- Additional risk controls reduce the likelihood of third-party vessels grounding as a result of taking action to avoid a project construction vessel or the construction works by allowing for controlled transits and construction vessel movements to be deconflicted (ID4), increasing awareness of the works (ID1, 2,5) and the onsite presence of a Guard Boat to draw attention to the works. Risk control ID 6 allows for the deconfliction of project construction vessel movements and controlled transits and mitigates the chance of an encounter occurring.
- The provision of a Guard Boat (ID 3) combined with risk controls designed to increase awareness of the works (ID 1 and 2) reduces the likelihood of a pinning incident occurring whilst the Guard Boats ability to also act as a Safety Boat mitigates the consequences score should a pinning incident occur, as the likelihood of multiple major injuries and fatalities occurring is mitigated by the Safety Boat provision.

9.2. OPERATION PHASE: RESIDUAL RISK ASSESSMENT

The residual risk assessment rescoring the inherent risk scores (see **section 7.2**) by including the additional risk control measures (presented in **Table 17**) the summary residual risk assessment results are presented in **Table 20**.

Table 20: Operation Phase: Summary Residual Risk Assessment Results

Hazard ID	Residual Risk Rank	Hazard	Residual Risk		
			Likelihood	Severity	Score
Haz Id #:7	1	Collision between project vessel and third party powered vessel.	2	4	8
Haz Id #:8	2	Collision between project vessel and unpowered recreational vessel	1	5	5
Haz Id #:9	2	Unpowered recreational vessel pinned against project infrastructure	1	5	5
Haz Id #:3	4	Unpowered recreational vessel makes contact with project infrastructure	1	4	4
Haz Id #:2	4	Powered third party vessel makes contact with project infrastructure	1	4	4
Haz Id #:6	4	Collision between project vessels	2	2	4
Haz Id #:1	4	Project vessel makes contact with Hammersmith Bridge, Barnes Pier or Hammersmith Pier (inc piles)	2	2	4
Haz Id #:5	8	Third party vessel grounds as a result of avoiding collision with project vessel	1	2	2
Haz Id #:4	8	Project vessel grounds whilst in operation	2	1	2

The application of the additional risk controls to the project operation phase hazards results in all risk scores now being within the acceptable zone, with seven hazards classified as “moderate” risk and two classified as minor risk. Haz Id #:7 Collision between project vessel and third party powered vessel., has the highest residual score of eight. Two hazards have a risk score of five, these are:

- Haz Id #:8 - Collision between project vessel and unpowered recreational vessel; and
- Haz Id #:9 - Unpowered recreational vessel pinned against project infrastructure.

There are four hazards with a risk score of four, these are:

- Haz Id #:3 - Unpowered recreational vessel makes contact with project infrastructure;
- Haz Id #:2 - Powered third party vessel makes contact with project infrastructure;
- Haz Id #:6 - Collision between project vessels; and
- Haz Id #:1- Project vessel makes contact with Hammersmith Bridge, Barnes Pier or Hammersmith Pier (inc piles)

The two hazards classified as “minor” risk Haz Id #:5 Third party vessel grounds as a result of avoiding collision with project vessel and Haz Id #:4 Project vessel grounds whilst in operation.

The following general observations are made in relation to the impact of introducing additional risk controls to mitigate hazard risk scores:

- Collision likelihood and consequence scores are reduced by a combination of the introduction of risk control measures designed to increase awareness of the infrastructure and construction works (ID1,2, and 6) as well as an onsite presence in the form of the Guard Boat (ID3) to help alert traffic to dangers. The sharing of the controlled transit list with the onsite works team (ID 4) allows for project vessels to exercise caution at times when controlled transits are scheduled. Collisions between project vessels are further mitigated by the provision of a detailed passage plan (ID 9)
- Contact likelihood and consequence risk scores are again reduced by the introduction of risk control measures designed to increase awareness of the infrastructure and construction works (ID1,2 and,5) The provision of a Guard Boat reduces the likelihood of a powered vessel transiting downstream on an ebb tide making contact with Hammersmith Pier, the same risk control also helps to alert unpowered recreational vessels transiting upstream on a flood tide to the danger of posed by the flood tide set. Risk control ID 7 provides a further visual reminder to vessels transiting downstream on an ebb tide through the bridge to remain well clear of Hammersmith Pier.
- Risk control ID 10 mandates the installation of gauge boards to provide the ferry Master with real time depths alongside the piers, this mitigates the risk of project vessel grounding when coming alongside. Additional risk controls reduce the likelihood of third-party vessels grounding as a result of taking action to avoid a project construction vessel or the construction works by allowing for controlled transits and construction vessel movements to be deconflicted (ID4), increasing awareness of the works (ID1, 2,5) and the onsite presence of a Guard Boat to draw attention to the works. Risk control ID 6 allows for the project vessels to exercise caution at times when controlled transits are scheduled.
- The provision of a Guard Boat (ID 3) combined with risk controls designed to increase awareness of the works (ID 1 and 2) reduces the likelihood of a pinning incident occurring whilst the Guard Boats ability to also act as a Safety Boat mitigates the consequences score should a pinning incident occur, as the likelihood of multiple major injuries and fatalities occurring is mitigated by the Safety Boat provision.

10. STUDY FINDINGS

10.1. CONCLUSIONS

A NRA has been undertaken for the proposed construction and operation phases of the proposed Hammersmith Temporary Ferry located in Barn Elms Reach on the River Thames in London. The assessment has been undertaken in accordance with the PLA authorised methodology, encompassing analysis of traffic data, review of historical incident data, consultation with identified stakeholders and qualified judgement in order to identify and assess navigation hazards for the proposed works. The assessment has also been undertaken in consideration of the current restrictions to navigation although these may change through the project lifecycle.

A total of 9 hazards were identified for both the construction and operation phases of the project. These hazards were categorised in to collision, contact, grounding and pinning. The analysis of the inherent risk assessment (i.e. the proposed works and operation with no additional risk controls in place) demonstrated:

- For the construction phase three hazards scored as “serious” and were therefore considered to be intolerable:
 - Haz Id #:3 - Unpowered recreational vessel makes contact with project infrastructure / construction works;
 - Haz Id #:8 - Collision between project construction vessel and unpowered recreational vessel; and
 - Haz Id #:9 - Unpowered recreational vessel pinned against project infrastructure / construction works.
- For the operation phase four hazards scored as “serious” and were therefore considered to be intolerable:
 - Haz Id #:7 – Collision between project vessel and third party powered vessel;
 - Haz Id #:8 – Collision between project vessel and unpowered recreational vessel;
 - Haz Id #:3 – Unpowered recreational vessel makes contact with project infrastructure; and
 - Haz Id #:9 - Unpowered recreational vessel pinned against project infrastructure.

The remaining hazards, for both the construction phase scored as either “moderate” risk or “minor” risk.

Risk control measures were identified through the consultation process and by project personnel, that could be utilised to mitigate any increase in navigation risk brought about by the project. Application of these risk controls reduced the ‘Serious’ hazards identified as unacceptable to ‘Moderate’ and provided for a range of general further reductions to those hazards scoring “Moderate” in the baseline assessment.

10.2. RECOMMENDATIONS

It is recommended that each of the risk controls identified within **section 8**, for both the construction and operation phase of the project be reviewed by UBTC with NASH Maritime in order to identify those risk control measures that UBTC elect to progress with. A final table of risk controls will then be included in **section 0**. Note, the removal of certain risk controls will increase the residual risk scores associated with the relevant hazards, potentially to unacceptable levels.

This NRA will need to be updated in response to future assessment scenarios as outlined in **section 1.4**. In order to facilitate the development and implementation of risk controls, enable periodic consultation, assessment of future assessment scenarios and to provide feedback of the effectiveness of implemented risk control measures it is recommended that the River User Liaison Group (RULG) be established within a month of the date of this report.

10.3. AGREED RISK CONTROL MEASURES

A meeting with NASH Maritime Ltd, UBTC and the PLA Harbourmaster Ryan Hall was held on 29-Jun-2021 in order to discuss the draft NRA (R01-00 issued on 19-Jun-2021) and address the status of the outputs and risk controls to be adopted. The purpose of the meeting was to refine the risk controls to ensure that they met the requirements of the Harbourmaster and could be implemented by UBTC and the wider Hammersmith Temporary Ferry project team.

The meeting was attended by:

- NASH Maritime Ltd:
 - Jamie Holmes - JJH
 - Sam Anderson-Brown – SAB
- UBTC
 - Sean Collins (SC)
 - Paul Day (PD)
- PLA
 - Ryan Hall (RH)

The following points were agreed:

- A Guard Boat should be provided throughout the construction phase as per risk control ID 3 in **Table 15**.
- The requirement for the Guard Boat during the operation phase should be reviewed after one week of the operations commencement. The Harbourmaster will review available incident data and consult with the RULG when determining the effectiveness of the Guard Boat as a risk control measure and consider whether vessel traffic has habituated to accommodate the Hammersmith Temporary Ferry operation. The Harbourmaster will then take a view on, with discussion with the Operator, whether the vessel will need to remain in place for a further duration.
- An additional risk control measure requiring a detailed project incident log to be kept during both the construction phase and operation phase should be added. The recording of navigational near misses and incidents will enable evidence-based decision making when reviewing the effectiveness/need for additional risk controls.
- Discussion was also held on the proposed CCTV risk control (to enable a clear line of sight upstream for ferry Masters). Whilst not required during a controlled transit assessment scenario the requirement was reviewed due to the need to consider the procurement timeline to implement it.

- UBTC were internally querying whether CCTV may negatively impact on the bridge team capacity
- It was agreed that UBTC would develop an appropriate operational protocol (as an alternative to CCTV) that would allow for the ferry Master to gain a clear view/understanding of any oncoming traffic obscured by the bridge. A number of options (including using pier staff/ferry crew to undertake a line of sight check) were discussed.
- It was agreed that UBTC would consider options and propose their preferred solution for PLA review and approval.
- It was agreed that the risk control would be re-named to clarify the objective it is seeking (to provide clear line of sight upstream) and therefore keep the actual manner of its implementation flexible (CCTV, protocol or other)
- The potential use/interface with existing CCTV (being implemented by the council) was discussed.

As a result of the meeting, risk control ID 8 (Provision of Incident log) was added to the list of additional risk controls for both the construction phase and operation phase, (see **Table 15** and **Table 17** respectively).

Table 21 summarises the risk control measures agreed for the operational phase a part of a controlled transit assessment scenario and the potential future risk controls required in an open river assessment scenario.

Table 21: Summary of Risk Control measures relevant to operational assessment scenario. Open River risk controls shown are provisional and subject to NRA

		Controlled Transit (U3/2021)	Open River (Provisional)
Hammersmith Bridge Transit Authorised	Class V Passenger Vessel		✓
	High Speed Passenger Vessel		✓
	Service Vessel	✓	✓
	Intra Port Freight	✓	✓
	Powered Recreational	✓	✓
	Unpowered Craft transiting as part of an organised group		✓
	Unpowered Craft not part of an organised group		✓
Risk Control ID 1	Promulgation and dissemination of information	Yes	Yes
Risk Control ID 2	River User Liaison Group	Yes	Yes
Risk Control ID 3	Guard Boat (equipped to also perform the function of a safety boat)	Yes	Yes
Risk Control ID 4	Controlled transit list provided	Yes	Yes
Risk Control ID 5	Information provided to vessels booking a downstream Hammersmith Bridge transit	Yes	Yes
Risk Control ID 6	Aids to Navigation (lighting)	Yes	Yes

		Controlled Transit (U3/2021)	Open River (Provisional)
Risk Control ID 7	Signage warning of Hammersmith Pier	Yes	Yes
Risk Control ID 8	Project Incident log	Yes	Yes
Risk Control ID 9	Detailed passage plan submitted to PLA	Yes	Yes
Risk Control ID 10	Tidal gauge boards (depth alongside	Yes	Yes
Proposed future Risk Control	Clear line of sight [replacing CCTV]	No	Yes
Proposed future Risk Control	Local Navigation Protocol	No	Yes
Proposed future Risk Control	Calling out point-Chiswick Eyot (navigating downstream)	No	Requirement under review with RULG
Proposed future Risk Control	Alternate Mooring	No	Requirement under review with RULG

10.4. SUMMARY RISK STATEMENT

In consideration of all of the evidence collected and assessed in this report, the conclusions are that the construction and operation phase of the Hammersmith Temporary Ferry project does not pose an unacceptable risk to navigation in the area during the current controlled transit operational scenario, provided that the majority of the risk controls developed are taken forward. All hazards can be reduced to As Low As Reasonably Practicable (ALARP) through application of the identified risk controls.

ANNEX A – PRELIMINARY HAZARD ANALYSIS REPORT

HAMMERSMITH TEMPORARY FERRY – PRELIMINARY NAVIGATION HAZARD ANALYSIS REPORT



10-May-2021

Uber Boat by Thames Clipper

Ref: 20-NASH-105-100-R02-00

Preliminary Navigation Hazard Analysis report for operation of the Hammersmith Temporary Ferry on the River Thames in central London

Author(s): SAB

Checked: EJR, JJH

Issue R02-00

REPORT TITLE: HAMMERSMITH TEMPORARY FERRY – PRELIMINARY NAVIGATION HAZARD ANALYSIS REPORT

CLIENT: UBER BOAT BY THAMES CLIPPER

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ANNEX A – STAKEHOLDER CONSULTATION MINUTES

1. INTRODUCTION

This report documents the findings of a preliminary navigation hazard analysis for the operation of the proposed Hammersmith Temporary Ferry, to the east of Hammersmith Bridge, in central London.

The report precedes a full Navigation Risk Assessment (NRA) which will be undertaken to accompany the application for the proposed project which will include a River Works License (RWL) application to the Port of London Authority (PLA). The full NRA will assess the potential effects of the development on safety of navigation, to the requirements of the PLA, and will be issued prior to the conclusion of the RWL process. The NRA will be required to cover the construction, operation and decommission phases of proposed project lifecycle.

1.1. OBJECTIVE

The purpose of the preliminary navigation hazard analysis work is to identify key navigation issues to validate the pier designs and overarching ferry operational principles and also identify any mitigations for further consideration, if required, based on PLA and stakeholder consultation.

This preliminary analysis focussed on assessment of the operational phase (i.e the 'as built' pier and associated infrastructure) of the project recognising there is also some uncertainty in how the baseline navigation environment will vary over the project lifecycle which will influence potential future assessment scenarios i.e. due to changes in the restrictions to navigation that are currently in place for Hammersmith Bridge and the changes in river usage associated with the Covid-19 pandemic (see **section 2.2**).

2. BARN ELMS REACH

2.1. HAMMERSMITH BRIDGE

Hammersmith Bridge is a historical bridge on the river Thames, which was constructed in 1887 and further strengthened in 1973 (see **Figure 1**). The bridge has three arches with arch #2, the central arch, lit for navigation and has the PLA authorised channel passing underneath. Arch #1 (to the left of arch #2 in **Figure 1**) and Arch #3 (to the right of arch #2 in **Figure 1**) are intertidal and therefore only navigable by small craft over periods of high water when there is sufficient depth of water and headway available.

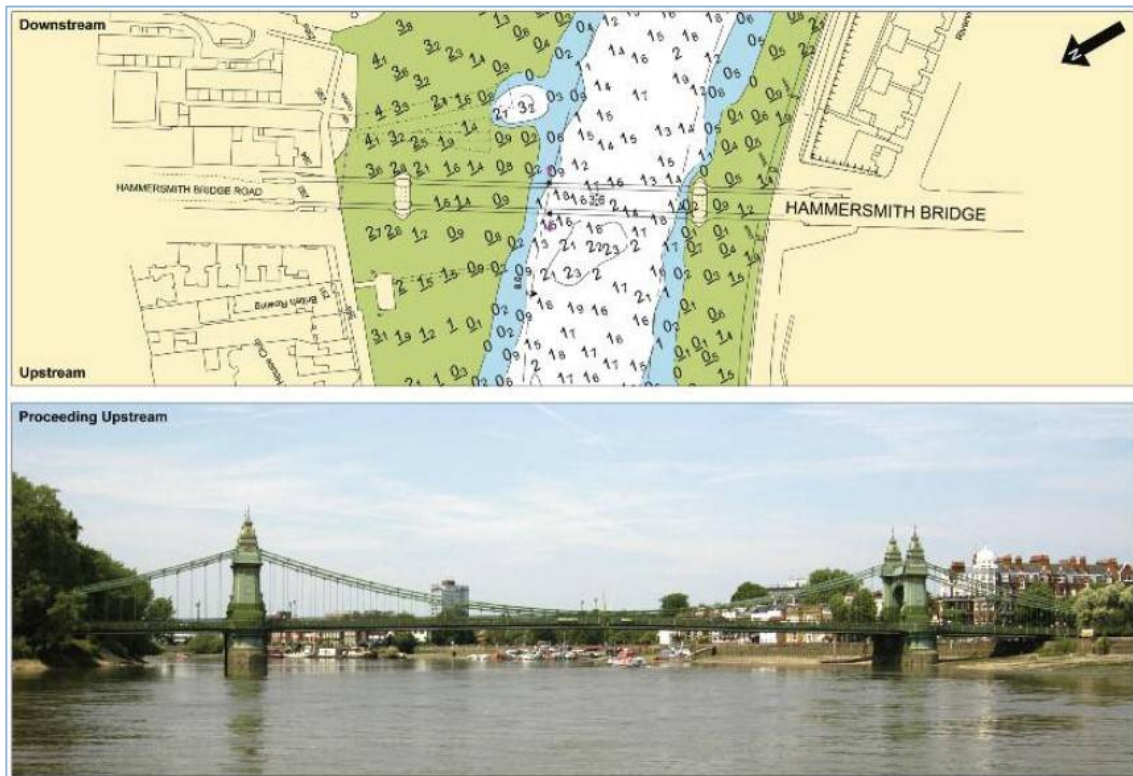


Figure 1: Extract from PLA Guide to Bridges 2012 showing Hammersmith Bridge.

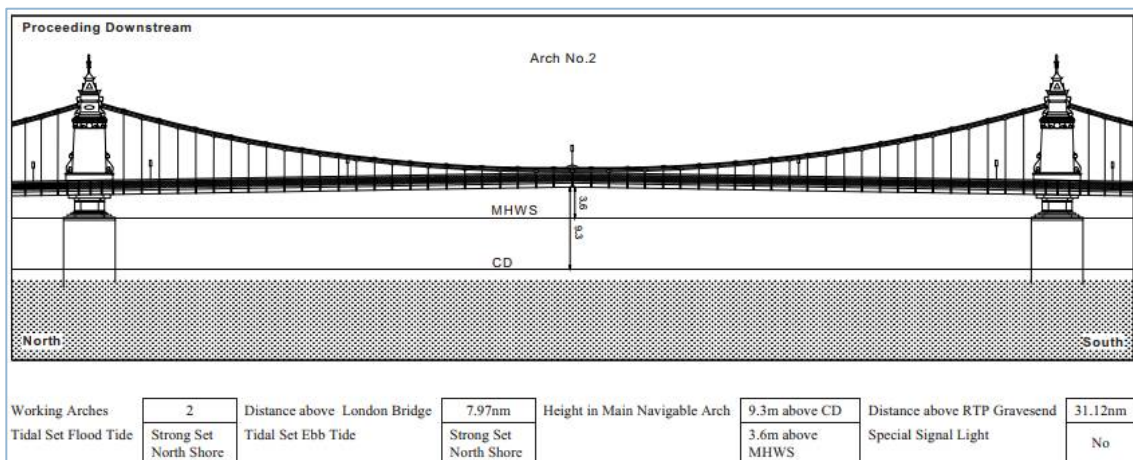


Figure 2: Section drawing of Hammersmith Bridge in relation to tidal heights.

An section drawing of Hammersmith Bridge is shown at **Figure 2**, which identifies the locations of existing bridge infrastructure.

The PLA Guide to Bridges 2012 notes that:

“The bridge is built on a sharp bend in the river and has one working arch and navigation at all states of the tide is to the south side of the centreline. The tide sets strongly to the north shore (Middlesex) on both the flood and ebb tides. On the north shore are several rowing and dinghy sailing clubs that should be passed with caution. Hammersmith Pier has an assortment of residential and active craft moored on and around it. On the south shore opposite Hammersmith Pier is a busy rowing club used for teaching and training schools, so one can expect activity from rowers throughout the day as well as during the early evening. Scullers and rowers can be out in the hours of darkness and may be difficult to detect before a mariner knows they are close by.

Hammersmith Bridge is the lowest of the bridges spanning the tidal Thames. Suitable passage planning taking into account the vessels air draught, and available headroom should be completed before navigating this bridge to ensure safe passage.”

When vessels transit under a navigable bridge the master must consider both water draught (the available depth of water for the vessel to navigate), and the air draught (the available “headway” for the vessel to safety pass underneath the bridge).

Hammersmith Bridge “headway” levels are given in **Table 1**, and show the available headway of arch #2 relative to tidal characteristics. It is important to note for Hammersmith Bridge that the greatest headway, which is located at the mid-point of arch #2, does not correspond to the deepest available water within the PLA authorised channel, which is located approximately 1/3 the way across arch from the south bridge pier.

Table 1: Hammersmith Bridge Arch #2 Headway Characteristics¹

Minimum Headway Characteristics [m]	Hammersmith (Arch #2)
Chart Datum - CD	9.3
Mean High Water Springs - MHWS	3.6
Mean High Water Neaps - MHWN	4.7
Mean Low Water Springs - MLWS	8.7
Mean Low Water Neaps - MLWN	9.1
Highest Astronomic Tide - HAT	3.0

2.2. HAMMERSMITH BRIDGE CLOSURE, RESTRICTIONS AND EXCLUSION ZONE

Hammersmith Bridge has been closed to pedestrians, cyclists and river traffic since August 2020 due to concerns regarding the structural integrity of the bridge resulting from corrosion of the iron work. Refurbishment options range from stabilisation to complete restoration although at present there is no known timeframe as to when the

¹ <https://www.pla.co.uk/assets/PLA-Tide-Tables-2019.pdf>

bridge will be fully reopened although it is anticipated that varying restrictions to navigation will be required through this timeframe.

Currently (at the date of this report) essential transits of the bridge can be booked via the PLA subject to a number of key criteria being met, as defined in PLA Notice To Mariners (NTM) U2 of 2021.² Arches #1 and #3 are closed to navigation and the bridge is closed to all recreational traffic including unpowered craft. In addition a 15m navigation exclusion zone is in place to the east and west of the bridge and a guard vessel is in place.

In order for vessels to arrange a pre-booked controlled passage through arch #2 the following conditions must be met:

- The transit is necessary and essential³;
- Transit may be cancelled at short notice;
- The vessels master has a suitable passage plan in place;
- The vessels master confirms the safest minimum number of crew are onboard; and
- The vessel monitors VHF channel 14 at all times.

The restrictions imposed by NTM U2 of 2021 mean that transits under the bridge are significantly reduced and will remain so until such a time that the current restrictions are amended or lifted.

²<http://www.pla.co.uk/assets/u2of2021-barnelmsreach-hammersmithbridge-closedtonavigationexclusionzonecontrolledtransits.pdf> (accessed 27-Apr-2021)

³ An essential transit is defined by NTM U2 of 2021 as a transit where “the requirement cannot be delayed to a later date or conducted elsewhere.”

3. HAMMERSMITH TEMPORARY FERRY

The purpose of the proposed Hammersmith Temporary Ferry service is to provide a relief crossing whilst the existing Hammersmith Bridge is closed or restricted to users and consists of a ferry operation between two new piers to be constructed and remain in place for the duration of the operation.

Figure 3 shows the locations of the proposed Barnes and Hammersmith ferry piers along with Hammersmith Bridge and the exclusion zone currently in operation. The proposed ferry pier locations, size and orientation have been optimised to ensure that the potential impact on navigation is minimised as much as possible and are offset to lessen the impact of the structures on the navigable width and authorised channel.

3.1. BARNES PIER DESIGN

Barnes Pier is situated on the southern side of the river and has been designed to allow two vessels to be moored at any state of tide (i.e. during off-peak operational times one ferry will be moored on the Barnes Pier whilst the other ferry operates).

Barnes Pier has been located at a point where the width of the river at low tide (in the immediate vicinity) is at its widest (see **Figure 3**). It is acknowledged that the location of Barnes Pier will impact the unpowered recreational route specified in the Tideway Code. Should the current restrictions, preventing non-essential (i.e recreational craft) from transiting under the bridge be lifted during the lifetime of the proposed Hammersmith Temporary Ferry operation, recreational craft will again look to utilise the inshore route passing beneath arch #3 and the “backspan” of Barnes Pier. For this reason, the pier has been located and orientated to align, as far as possible with the existing Hammersmith Bridge pier and arch #3 to minimise any additional restriction on usage of arch#3 and allow for the maximum possible tidal window during which recreational craft can navigate the backspan of Barnes Pier.

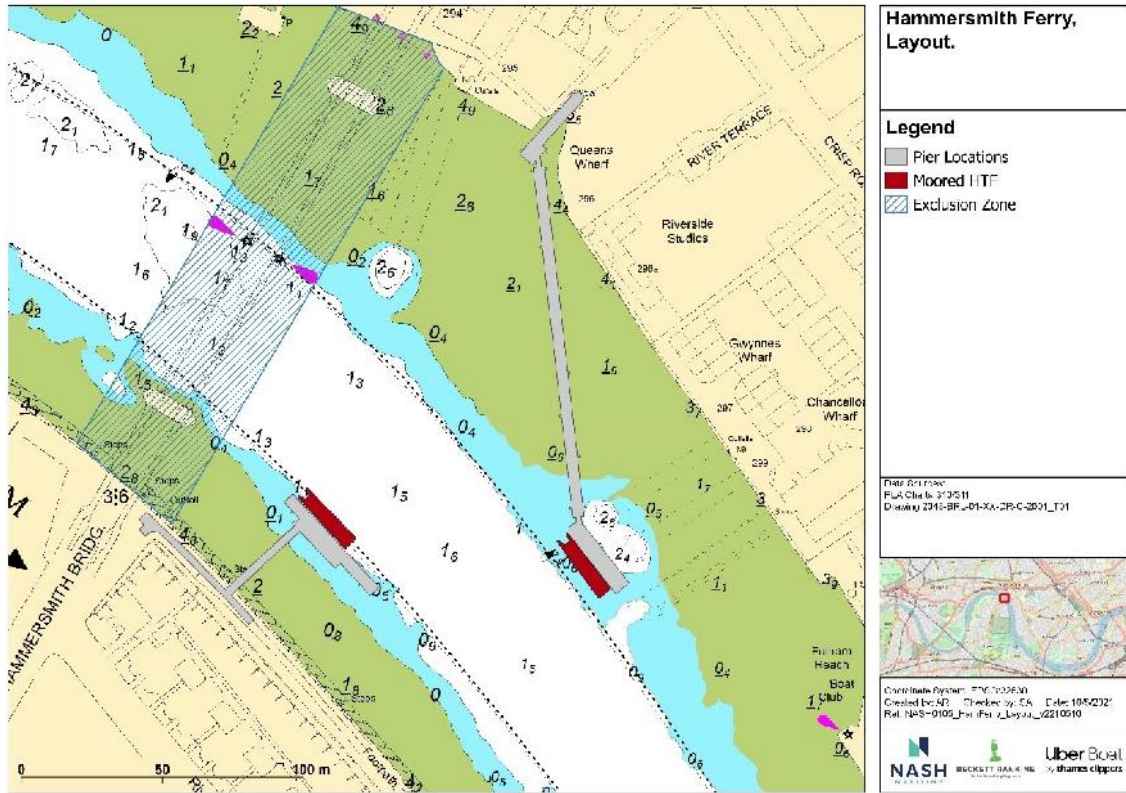


Figure 3: Pier locations, Hammersmith bridge and Exclusion Zone.

In order to allow recreational craft to navigate the backspan, Barnes Pier is linked to the shore by a brow rather than a floating pontoon. **Figure 4** shows the available water depth, headway and navigable width available to vessels navigating the backspan at Mean Low Water Springs (MLWS), Optimum Tidal Level and Mean High Water Springs (MHWS). Other than at MLWS (when Arch #3 is also restricted due to comparable bathymetry) there is a theoretical window where vessels will be able to navigate under the pier brow. Further consultation with local stakeholders will be essential in determining the exact parameters in which it is deemed safe for vessels to utilise this route.

Working on the assumption that a minimum air draught of 1.5m and a minimum draught of 0.35m will be required to allow a rowing vessel to pass under the brow of Barnes Pier, then theoretical navigable widths have been calculated and are presented in **Table 2** and **Figure 4**.

Table 2: Theoretical Navigable width under Barnes Pier Brow.

State of tide	Navigable width available under brow (metres)
Mean Low Water Springs (MLWS)	7.2
Optimum tidal level for maximum navigable width	17.3
Mean High Water Springs (MHWS)	29.0

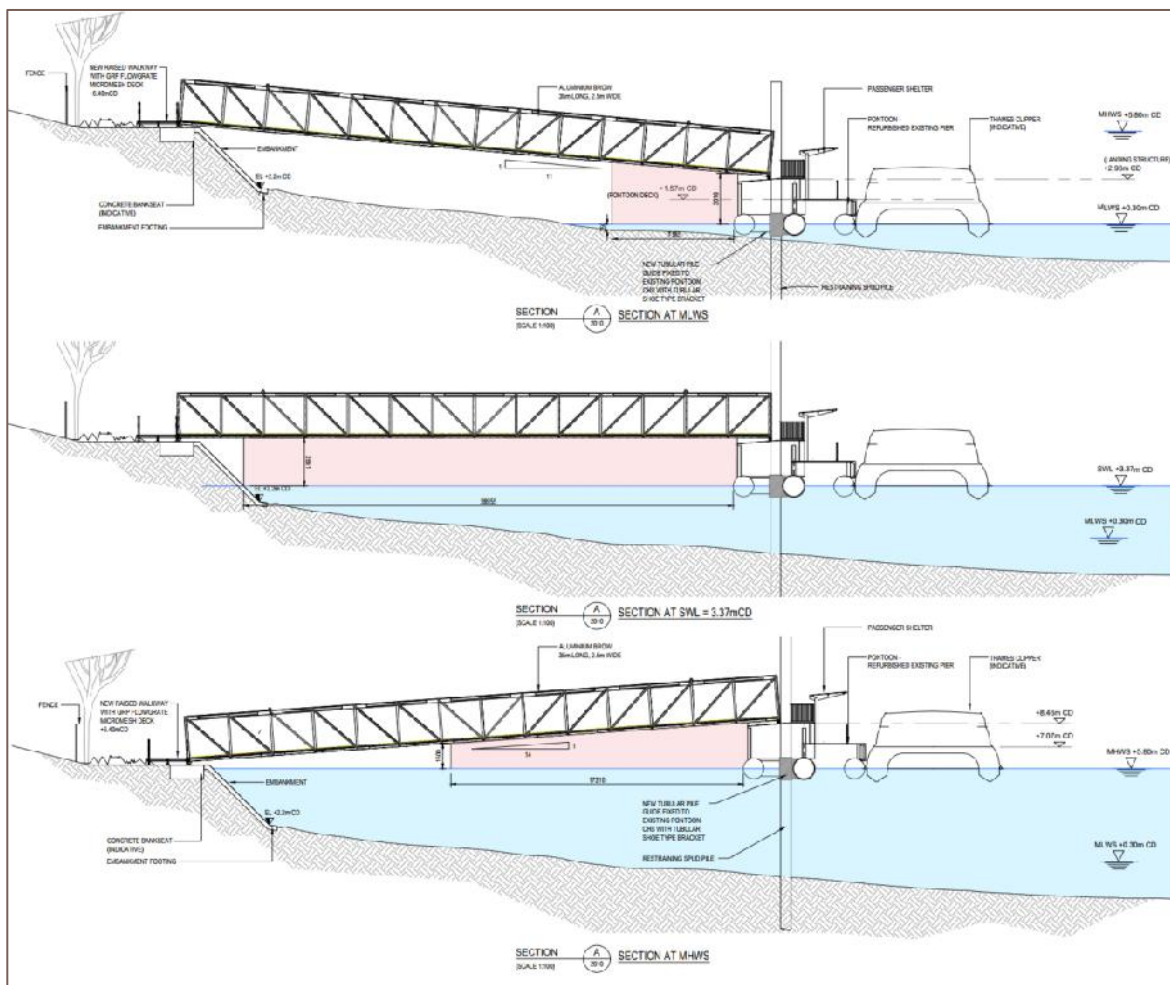


Figure 4: Barnes Pier Cross Section and Navigable width under Backspan.

3.2. HAMMERSMITH PIER DESIGN

Hammersmith Pier is located on the northern side of the Thames and has been located in an area where the low water width of the river is comparatively greater than other locations in the immediate vicinity. The location of the pier ensures that the maximum navigable width possible is retained balancing the length of the floating pontoon connecting the pier with the shore. In addition the pier has been deliberately located in an area of deeper water to mitigate the risk of project vessels grounding during low spring tides and to mitigate its intrusion on the authorised channel. The Hammersmith Pier has also been located further downstream than Barnes Pier rather than directly opposite. The intention of this staggered offset is to reduce the restriction on overall river width at each pier and also increases the room for safe navigation of those vessels navigating though the bridge at the point of maximum headway.

A floating walkway pontoon links the Hammersmith Pier to the shore which is designed to safely take the ground at low water conditions over the intertidal zone. Navigation within the backspan is therefore not possible.

An overview plot of Hammersmith Pier is shown in **Figure 5** with a cross sectional view of the floating walkway shown in **Figure 6**.



Figure 5: Overview of Hammersmith Pier.

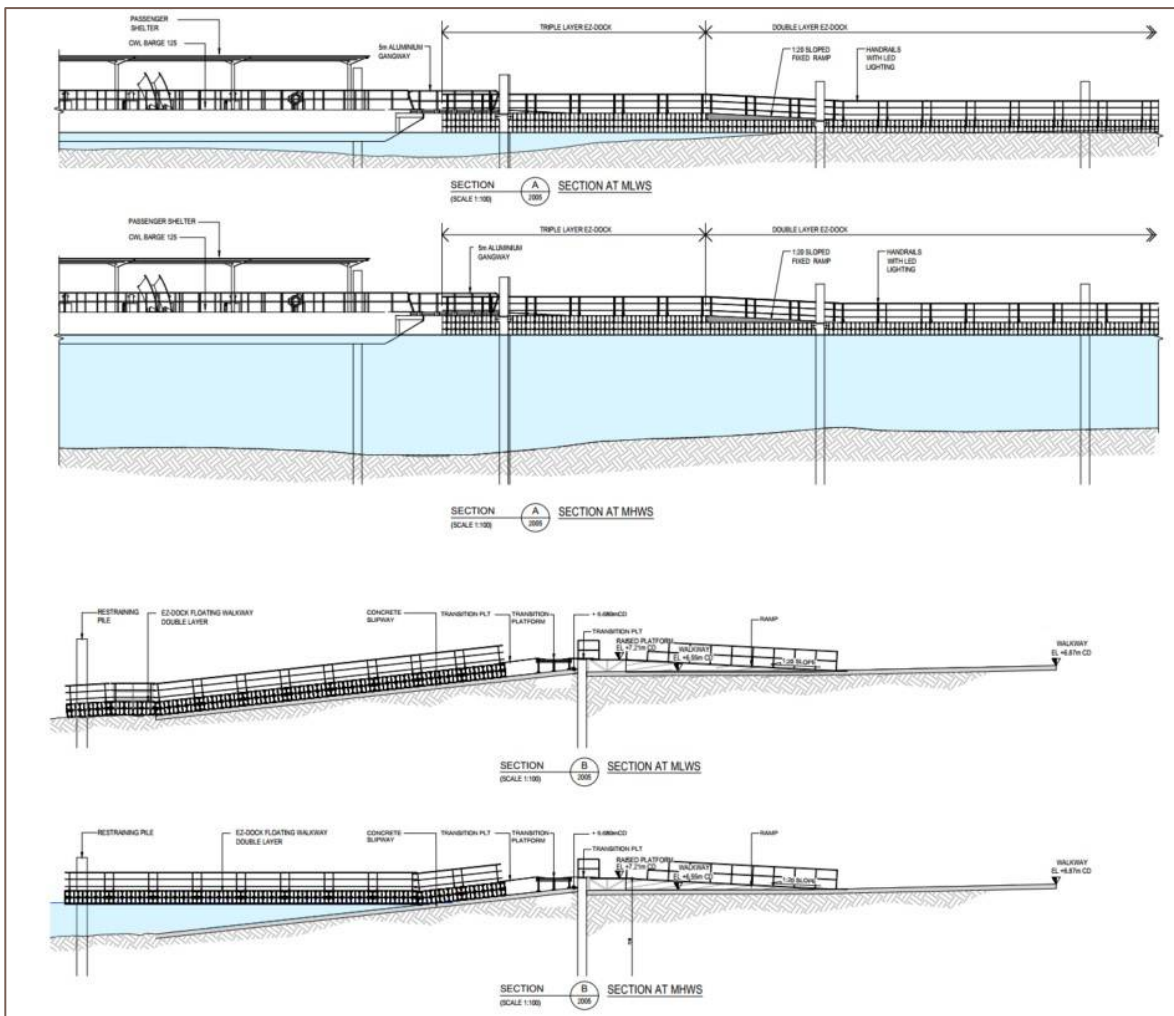


Figure 6: Cross Sectional view of Hammersmith Pier and Floating Pontoon Walkway at MLWS and MHWS.

3.3. FERRY SERVICE AND OPERATION

The proposed Hammersmith Temporary Ferry operation will take place between 06:00 and 22:00 on weekends and 08:00 – 22:00 at weekdays, with a peak and off-peak service being operated - as summarised in **Table 3**. Two vessels will be permanently deployed on the service, with one moored on the Barnes Pier and the other moored on the Hammersmith Pier outside hours of operation. During hours of off-peak operation (when only one vessel is operated) the non operational vessel will be moored on the Barnes Pier. A third vessel will be based at Plantation Wharf (approx. 25mins transit away) and will be on standby at a pre-determined state of readiness as a relief vessel.

Table 3: Summary of Service Provision.

	Peak Service	Off Peak Service
Operating times	06:00 – 10:00 & 15:00 – 19:00	10:00 – 15:00 & 19:00 – 22:00
Frequency (from each pier)	Every 5 – 7 mins	Every 10 – 12 mins
Number of vessels in operation	2 vessels	1 vessel (Spare vessel to layby on Barnes Pier)
Crossings per hour	18 – 24	10 – 12
Transit time in each direction	3 mins	3 mins

Uber boat will utilise the Thames Clippers, *Sky* (see **Figure 7**), *Storm* and *Star*. These Hydrocat vessels are well suited to the Hammersmith Temporary Ferry operation and are highly manoeuvrable. The vessels utilise two fully independent water jet propulsion systems and have a minimal draught of 0.80m making them suitable for operation in the comparable shallow waters. The vessels are able to accommodate a maximum of 62 passengers.



Figure 7: Image of Sky.

During hours of peak operation the two vessels will operate simultaneously with crossings made head to tide in an anticlockwise direction. This operation will occur during both the flood and ebb tides (and was developed as part of an onsite trial) with both vessels utilising the tidal stream as they ferry glide between the pontoons. On

the ebb tide the vessel departing Hammersmith Pier will push forward in to the tidal stream with the vessel departing Barnes Pier dropping back with the tidal flow (see **Figure 8**). On the flood tide the vessels will face downstream with the vessel departing Barnes Pier pushing forward in to the tidal flow with the vessel departing the Hammersmith Pier dropping back with the tidal flow (see **Figure 9**).

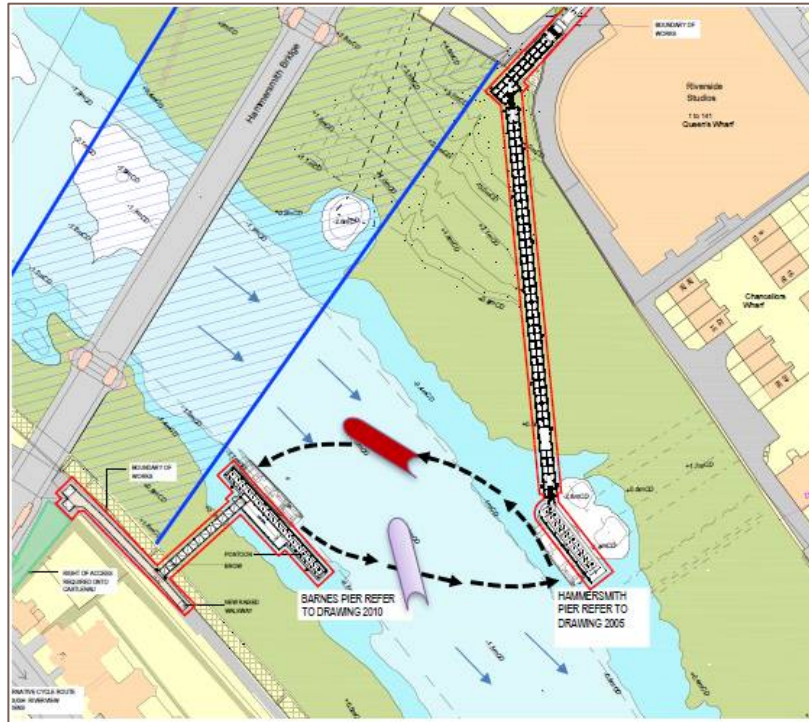


Figure 8: Peak Operation – Ebb Tide.

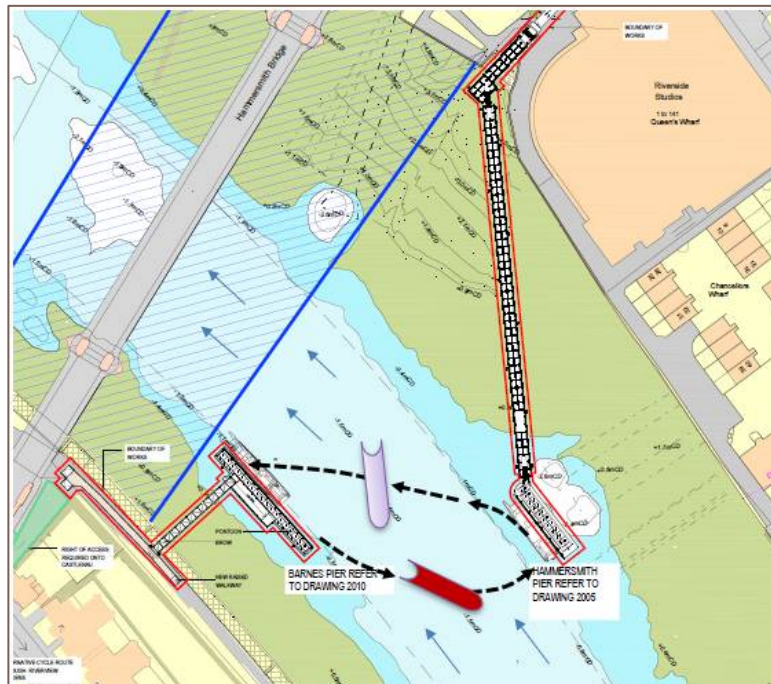


Figure 9: Peak Operation – Flood tide.

3.4. PORT OF LONDON AUTHORITY

The PLA is the Statutory Harbour Authority for the River Thames, responsible for “defining and enforcing the regulations needed to support and manage the safety of navigation on the 95 miles of the tidal River Thames”.

Risk controls of interest to the Hammersmith Temporary Ferry operation include:

- Pilotage Directions;
- General Directions – including Reporting vessel requirements including Isophase lights;
- Bye Laws;
- Code of Practice including the PLA Tideway Code - A code of practice for rowing and paddling on the tidal Thames;
- Aids to Navigation;
- Emergency Preparedness and Response;
- Harbour Service Launch and Patrols;
- Vessel Traffic Services and vessel traffic management; and
- Promulgation of information – e.g. Notices to Mariners, Navigation Warning.

4. BASELINE VESSEL TRAFFIC CHARACTERISATION

The vessel traffic activity in the project area can be classified into two major groups:

- 1.) Powered commercial vessels which make up the larger vessels and includes passenger vessels, port service vessels and cargo vessels such as tugs.
- 2.) Recreational vessels made up of powered (e.g. cabin cruisers) and unpowered craft (e.g. rowing sculls, canoes, paddle boarders and sailing dinghies).

Analysis of group 1 (powered commercial vessels) was undertaken using Thames Automatic Information System (AIS) transponder data (commercial vessels are mandated to transmit various vessel characteristics, such as position, speed, size and name at prescribed intervals, which can be converted to create vessel tracks).

As AIS is not required on small recreational vessels (although some larger recreational craft voluntarily carry AIS) analysis of group 2 vessels (powered and unpowered recreational craft) is more qualitative in nature. Whilst information is available in publications such as the PLA Tideway Code, consultation with river users is necessary to ascertain detailed information on how they utilise the river

The following sections provide an overview of vessel traffic in the vicinity of the Hammersmith Temporary Ferry between 10-Sep-18 and 23-Sep-18. This data set has been chosen in agreement with the PLA because September was considered seasonally representative months in terms of vessel traffic and because Hammersmith Bridge was open to navigation during this time period. In addition this data set was collated prior to the Covid-19 pandemic so vessel traffic numbers are considered representative.

Note, currently navigation is restricted in the area due to ongoing concerns regarding the safety of Hammersmith Bridge, (see **section 2.2**). Therefore the analysis presented below does not present an overview of the current navigational disposition, rather it shows a realistic overview of the traffic levels and temporal/spatial nature of navigational transits in a normal open river scenario.

4.1. GROUP 1 VESSELS: POWERED COMMERCIAL VESSELS

Figure 10 shows tracks of all vessel transits of the project area, together with a gate between the Barnes and Hammersmith Piers (showing lateral distribution of transit numbers and directions), between 10-Sep-18 and 23-Sep-18. The number of vessel transits in this two-week period has been annualised.

Figure 11 shows the density of all vessel transits on a daily basis providing an indication of the spatial spread and intensity of the identified transits.

The plots demonstrate a number of Group 1 vessels transiting on the north side of the authorised channel as they pass the piers. This is because vessels heading in either an upstream or downstream direction will be aligning with the centre point of Hammersmith Bridge where there is the greatest headway.

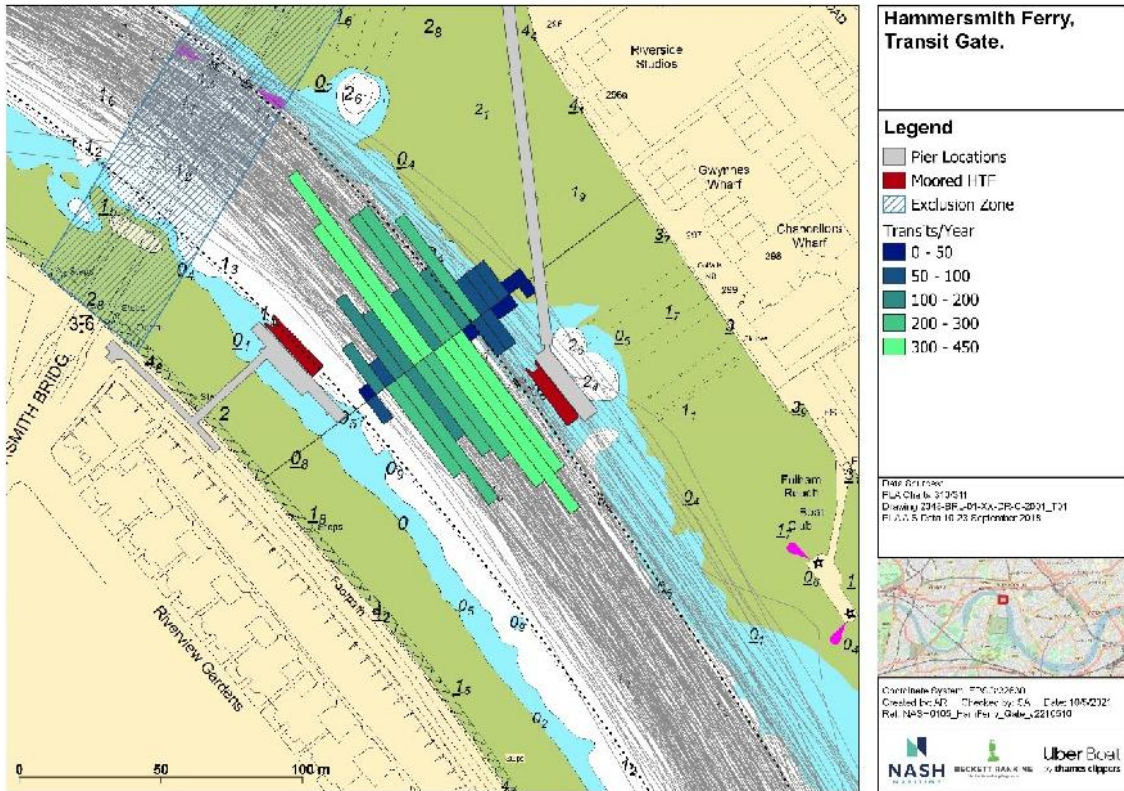


Figure 10: Hammersmith Temporary Ferry Gate Analysis (AIS Sep 2018 Annualised).

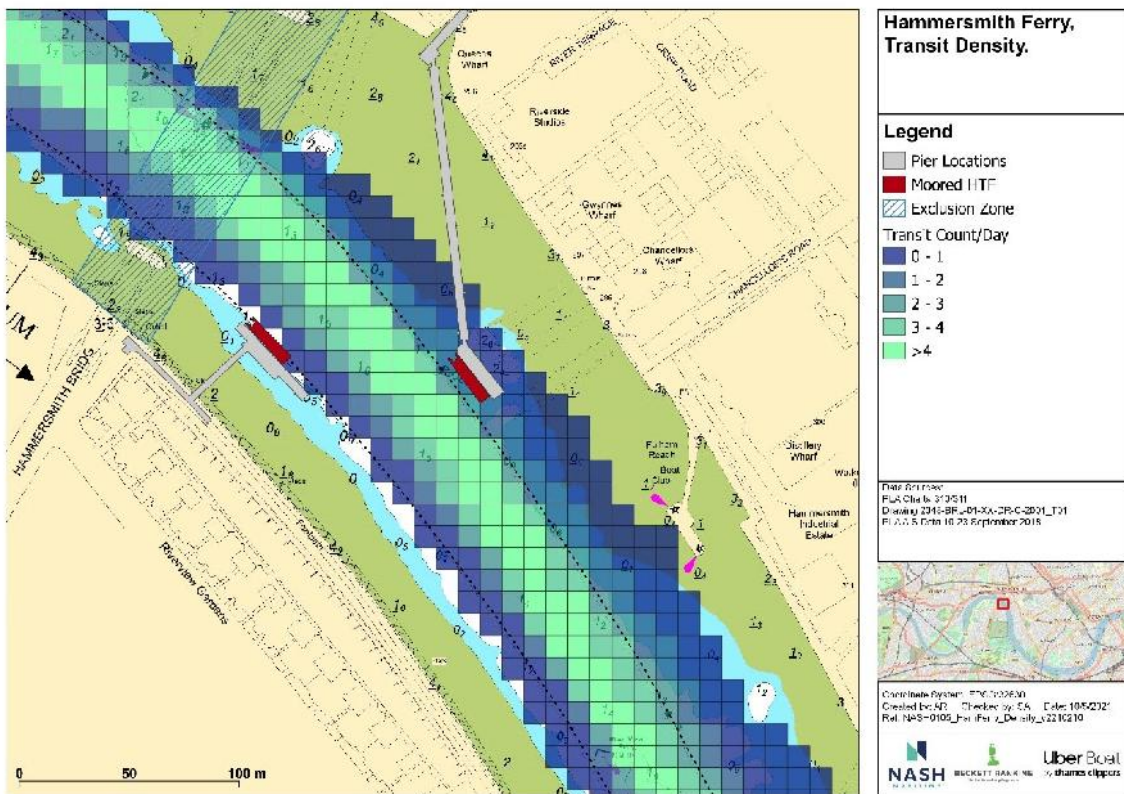


Figure 11: All Vessel Transits Density Plot (AIS Sep 2018).

4.1.1. PASSENGER VESSEL TRACKS

Passenger vessel tracks (shown in **Figure 13**), are comprised of Traditional Class V vessels and High-Speed Craft / Manoeuvrable Class V vessels.

Traditional Class V vessels make up the majority of vessel traffic transiting past the Hammersmith Temporary Ferry site and include the following vessels. Lengths and estimates of air draught have been provided in appreciation of headway restrictions under Hammersmith Bridge (images of those marked with * are shown in **Figure 12**):

- *Clifton Castle** Length 39m Estimated Air Draught Approx. 3.5m
- *Connaught** Length 34m Estimated Air Draught Approx. 4.5m
- *Pride of London** Length 29m Estimated Air Draught Approx. 5.5m
- *Royalty* Length 29m Estimated Air Draught Approx. 5.0m
- *Henley* Length 25m Estimated Air Draught Approx. 3.0m
- *Golden Salamander* Length 20m Estimated Air Draught Approx. 5.0m
- *Princess Freda* Length 19m Estimated Air Draught Approx. 4.0m
- *Cockney Sparrow** Length 16m Estimated Air Draught Approx. 5.0m

Passenger vessel track analysis in the vicinity of Hammersmith Bridge shows that passenger vessels transit almost entirely within the authorised channel (clear of both piers in all other than two isolated transits) and the very southern edge of the authorised channel is typically avoided which is likely associated with the reduced headway under the Hammersmith Bridge.

A single high-speed vessel was recorded as passing the site, which was the *Orion Clipper* a small passenger vessel.



Figure 12: Photos of River Tour vessels from Marinetravica.com, top left Clifton Castle, top right Cockney Sparrow, bottom left - Connaught, and bottom right Pride of London.

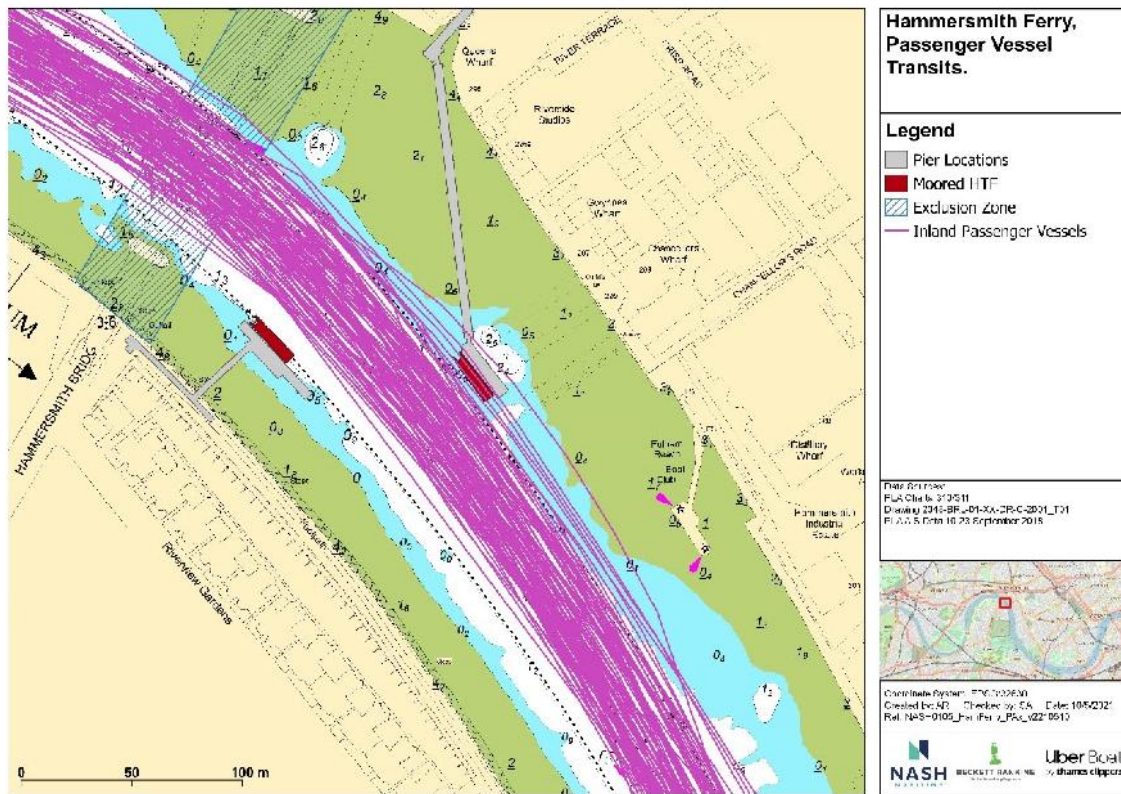


Figure 13: Passenger Vessel Transits (AIS Sep 2018).

4.1.2. SERVICE VESSEL TRACKS

Service vessel tracks are presented in **Figure 16** and include vessels of the following categories (images of those marked with * are shown in **Figure 14**):

- Law Enforcement Vessel (e.g. *Thames Guardian**);
- Port Tender (e.g. *Crane, Londinium 3, Richmond, Roker*);
- Search And Rescue Vessel (e.g. *RNLI Lifeboat E-07, RNLI Lifeboat E-08, RNLI Lifeboat E-09*); and
- Tug (e.g. *Dancha, Sanfiona, Speedwell, TLM Plashy**)

Analysis of service vessel tracks shows this class of vessel to be amongst the most numerous Group 1 vessel types transiting Hammersmith Bridge and between the proposed pier locations. Vessels of this type use the entire width of authorised channel (and on occasions outside to the north when sufficient tidal depth allows) although show a tendency to navigate in the northern side of the authorised channel which is likely due to aligning with the centre of Hammersmith Bridge and point of maximum headway.



Figure 14: Images of Selected Service Vessels, Top Right: Plashy, Top Left: Londinium, Bottom Centre: Thames Guardian.

4.1.3. INTRA PORT FREIGHT

There was only one intra port freight vessel observed transiting in the vicinity of the proposed ferry piers between 10-Sep-18 and 23-Sep-18. This was the vessel *Conquestor*, a tanker vessel operated by Thames Marine Services which transited past the proposed pier sites 6 times during the two-week period in which AIS data was collected, (see **Figure 17**). Analysis of the tracks shows the *Conquestor* navigating predominately in the northern portion of the authorised channel.



Figure 15: Conquestor

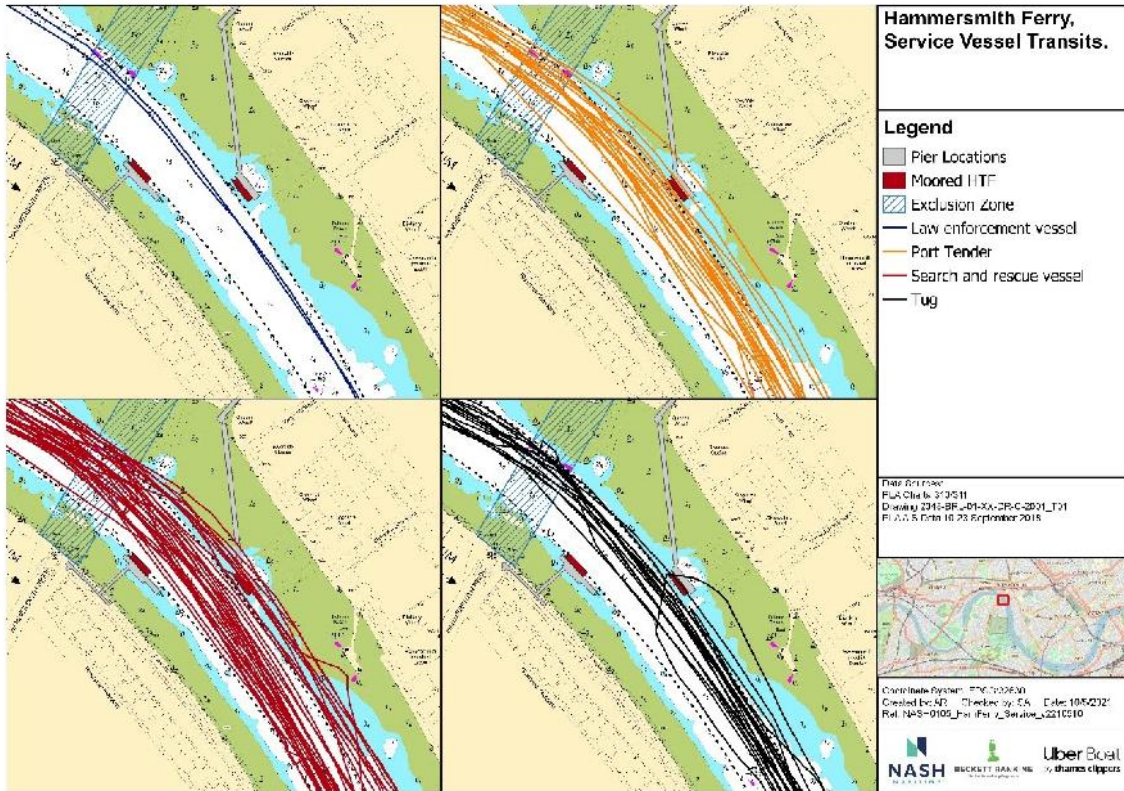


Figure 16: Service Vessel Transits (AIS Sep 2018)

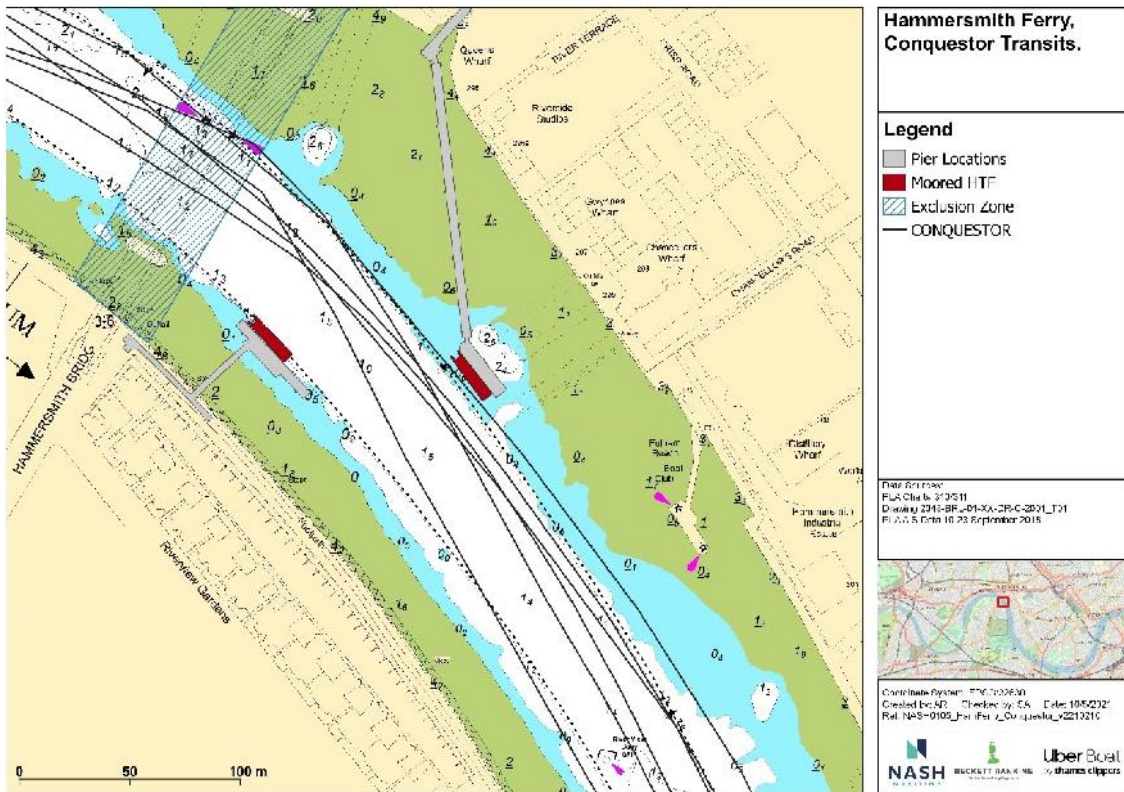


Figure 17: Intra Port Trade Vessel Tracks, Conquestor

4.2. GROUP 2 VESSELS RECREATIONAL CRAFT

Analysis of recreational vessel transits is difficult as most recreational vessels do not carry Thames AIS, a small number of vessels were identified in the AIS data set, these were:

- *Ascension* Length 19m Beam 4m
- *Whistler* Length 10m Beam 4m
- *Joker* Length 14m Beam 4m
- *Lady Lou* Length 12m Beam 4m

Analysis of the limited tracks shows these recreational vessels navigating across the full width of the authorised channel (see **Figure 18**).

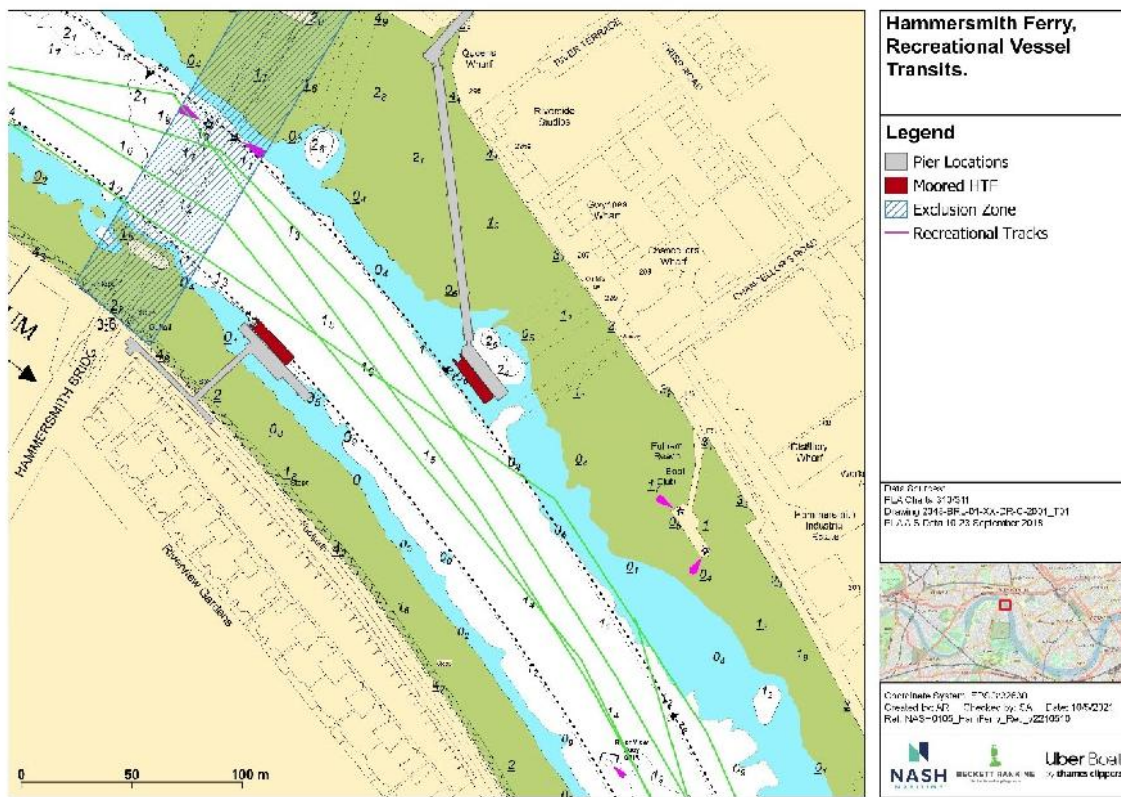


Figure 18: Recreational Vessel Transits (AIS Sep 2018).

In order to characterise recreational craft activity and corresponding navigational disposition whilst transiting through Hammersmith Bridge, the PLA Tideway code was reviewed for rowing and paddling activity, **Figure 19** shows the recommended Tideway code route on the ebb tide and **Figure 20** the recommended route on the flood tide.

As discussed in **section 2.2** the proposed location of the Barnes Pier will impact the recommended Tideway code route.

To obtain a greater understanding of the feasibility of unpowered recreational craft continuing to transit Arch #3 (and under the brow in the backspan of Barnes Pier) and recreational craft activity as a whole, detailed

consultation and/or a visual survey will be required to inform the full NRA. This should also include sailing craft and, where possible, unorganised activity (i.e. activity not affiliated to a club or association).

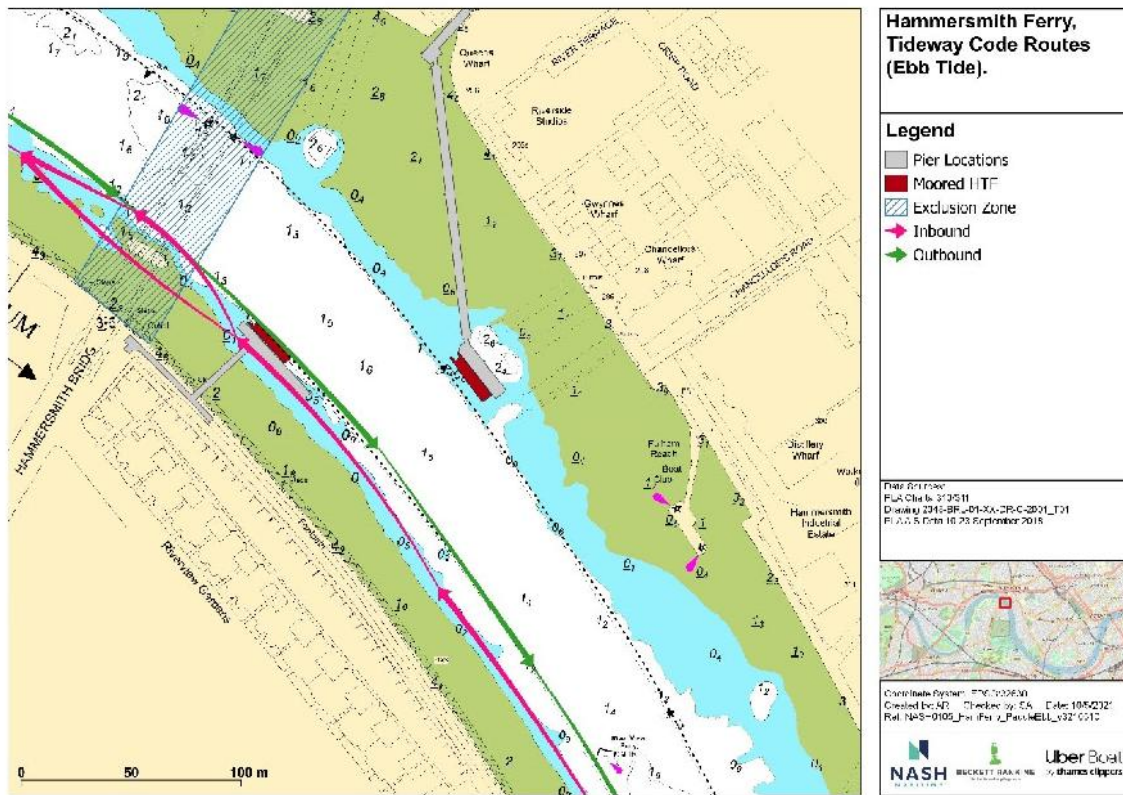


Figure 19: Tideway Code Route – Ebb Tide.

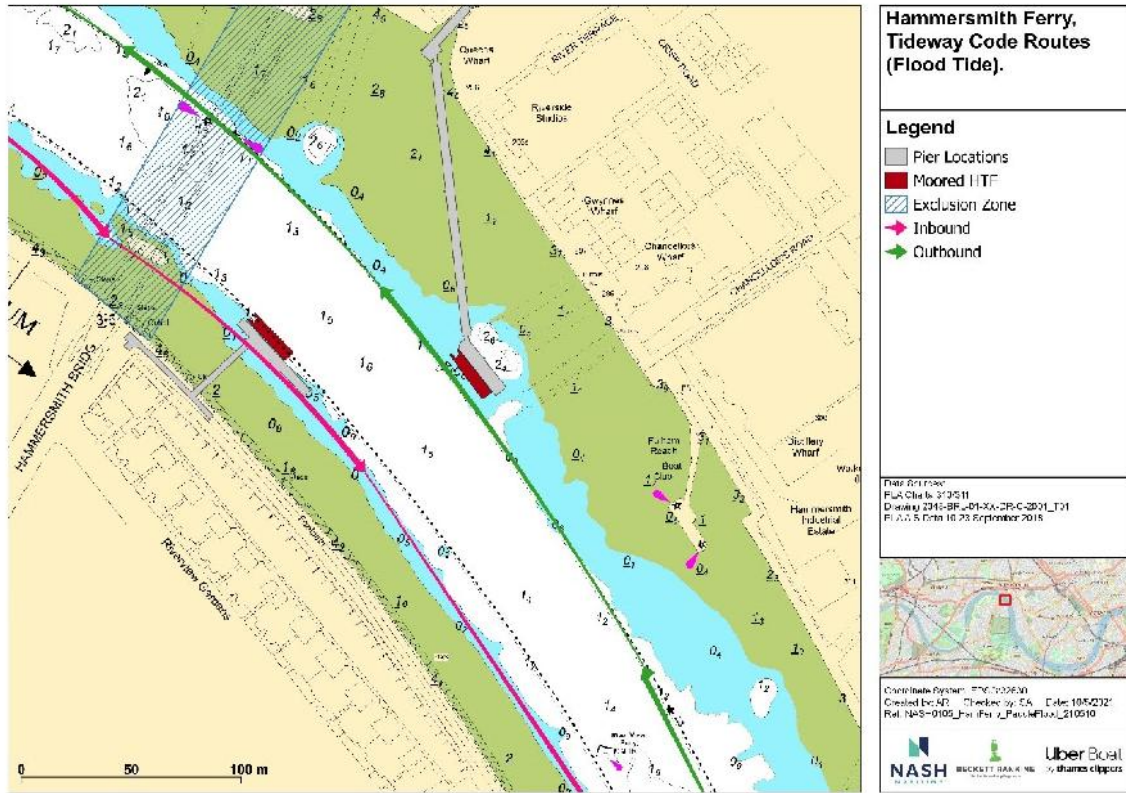


Figure 20: Tideway Code Route – Flood Tide.

5. STAKEHOLDER CONSULTATION

Consultation for the Preliminary Navigation Hazards Analysis was undertaken with the PLA Harbour Master, Thames Regional Rowing Council and Thames Marine Services Ltd. The purpose of this consultation was to:

- identify any key navigation issues/hazards and potential risk control mitigation measures for incorporation into the final scheme design and operation
- review the scope and requirement for the full NRA

A summary of each of the consultation meetings undertaken as part of this study is provided within this section. Full minutes for each of the consultation meetings can be viewed in **Annex A**.

5.1. PLA CONSULTATION

An initial meeting was held with Ryan Hall (PLA Harbour Master) on 16-Apr-2021 to introduce the project team and provide information for the Harbourmasters consideration ahead of more formal NRA consultation meetings to be undertaken at a later date. The meeting also presented an opportunity to introduce some of the key navigational issues at an early stage. The meeting was attended by:

- PLA
 - Ryan Hall – RH
- Uber Boat by Thames Clippers
 - Sean Collins – SC
 - Leva Sabone – IS
 - Mitchell Thorpe – MT
 - Derek Mann – DM
 - Jude McGrane – JM
 - Craig Brown – CB
- Beckett Rankine
 - Graham Gathergood - GG
 - Tim Beckett – TB
- Transport for London (TfL)
 - Jordan Knight – JK
- NASH Maritime Ltd.
 - Jamie Holmes – JJH
 - Sam Anderson-Brown – SAB

The meeting included the following agenda:

- Introductions and Meeting Objectives;
- NRA Approach;
- Proposed Design Layout and Design Geometry;

- Proposed Operation;
- Operational Scenario;
- Data Sources;
- Proposed Consultation; and
- Key Issues.

Key points raised in the meeting were:

- Consideration should be given to giving absolute clarity as to the circumstances in which vessels can navigate the brow of the Barnes Pier.
- It was recognised that the navigational disposition will likely change over the lifetime of the project depending on factors as yet unknown including the refurbishment works associated with Hammersmith Bridge and amendments to the current restrictions to navigation in place e.g. exclusion zone and booked passages, and therefore any risk assessment will need to be updated accordingly to ensure it remains current.
- It was confirmed by RH that the full NRA should be based on the current operational scenario of restricted navigation as per PLA NTM U2 of 2021.
- It was agreed that Thames Regional Rowing Council and Thames Marine Services should be consulted as part of the Preliminary Navigation Hazard Analysis Study as key user group representatives; and
- A number of potential risk control measures were discussed for consideration including:
 - Tidal boards situated on the piers to present actual water depth and headway;
 - A CCTV feed to assist ferry Master's in early identification of passing vessels;
 - Marker buoys to be placed a suitable distance downstream of Hammersmith Pier to warn rowers that they are approaching the ferry operation area; and
 - Details of booked transits could be made in advance to give the ferry Master advanced warning of when to expect passing traffic.

5.2. THAMES MARINE SERVICES CONSULTATION

A meeting was held with Thames Marine Services in order to further understand the impact the proposed piers may have on service vessels and intra port freight vessels such as *Conquestor* (which is a small bunker barge operated by Thames Marine Services). The meeting was held on 22-Apr-2021 and attended by:

- Thames Marine Services
 - Robert Dwan - RD
 - Nicholas Dwan - ND
- Nash Maritime Ltd:
 - Jamie Holmes - JJH
 - Sam Anderson-Brown – SAB

The Meeting included the following agenda points:

R02-00

- Objectives;
- NRA Approach;
- Proposed Site Design Layout;
- Proposed Operation;
- Operational Scenarios; and
- Key Issues.

Key points raised in the meeting were:

- RD and ND felt there would be little to no impact on Thames Marine Services operations as a result of the piers. However, ND raised concerns that a houseboat or Dutch barge navigating downstream on an ebb tide could be taken off course by the tidal set (which will push vessels toward the northern bank) and could make contact with the Hammersmith Temporary Ferry Pier and/or floating walkway. It is likely that such a vessel would aim for the centre of Arch #2 in order to pass under the bridge at the point of maximum headway. The skipper would then have to turn hard to starboard sufficiently early to avoid being pushed on to the pier by the tidal set. Adequate warning will therefore be needed for vessels passing downstream on the ebb tide.
- Concerns were also raised about site lines upstream from the Barnes pier.
- RD and ND suggested that transit times and service frequency times were realistic. *Conquestor* is likely to transit through the bridge at approximately 8 knots so would clear the operational area relatively quickly.
- Thames Marine Services operations are unlikely to differ substantially should the restrictions currently imposed by PLA NTM U2 of 2021 be lifted.
- RD observed that on a high spring tide flotsam and jetsam is picked up and deposited on the northern shore in and around the proposed Hammersmith Pier and pontoon walkway. RD raised the possible issue of debris collecting against or floating directly under the pontoon walkway, causing it to destabilise when it settles on to the bed or damaging it.

5.3. THAMES REGIONAL ROWING COUNCIL CONSULTATION

A meeting was held with Tony Reynolds and Bill Mitchell who represent Thames Regional Rowing Council on 23-Apr-21. The purpose of the meeting was to further understand the impact the proposed piers and ferry operation will have on rowing activity in the area.

Present at the meeting where:

- Thames Regional Rowing Council
 - Tony Reynolds - TR
 - Bill Mitchell - BM
- Nash Maritime Ltd
 - Jamie Holmes - JJH

- Sam Anderson-Brown -SAB

Key points raised in the meeting were:

- The following assumptions are considered a reasonable basis of required room for rowing craft: headroom (1.5m) depth (0.4m) and beam (7m) based on a rowing 8.
- The premise of maintaining navigation in arch #3 is desirable, where safe, to maintain the basis of the existing Tideway code and separate rowers from other navigation (and the ferry) within the authorised channel.
- TR observed that although the backspan would be navigable at most states of tide the existing constraints of arch #3 remain. JJH agreed that the combined 'window' of both arch #3 and backspan will be examined in the NRA. TR noted a potential that rowing vessels could navigate the backspan and then need to navigate back north to the navigation channel in order to pass through arch #2 as per the Tideway Code (with a large alteration of course within the space between the Barnes Pier and Hammersmith Bridge Pier).
- During off-peak periods, the non-operational ferry would be moored on the Barnes Pier which will force rowing craft further out and into the authorised channel when navigating upstream on the ebb tide.
 - Alternate mooring locations such as Dove or Hope pier should be explored.
 - If no alternative can be found a review will need to be conducted once unpowered recreational craft are able to transit Hammersmith Bridge.
- During times when significant rowing activity is carried out, for example on a Saturday peak time it will be difficult for the ferry Master(s) to find an available gap in traffic to make a crossing. It was agreed that should Hammersmith Bridge be opened to unpowered recreational traffic a clear and well communicated operational protocol will have to be developed collaboratively between the ferry operation and local rowing clubs.
- TR commented that it would be of benefit for the Hammersmith Temporary Ferry project team to engage with the rowing clubs in the area (all users meeting) prior to formal consultation as part of the NRA process. This would help pave the way for future discussions regarding operational protocols and improve lines of communication. TRRC would be happy to assist.

6. REVIEW OF DESIGN AND OPERATION

The Preliminary Navigation Hazard Analysis was conducted based on a review of the proposed Hammersmith and Barnes Pier designs, vessel traffic analysis, consultation with the PLA, Thames Marine Services, TRRC and the expertise of the project team.

The following section documents the preliminary hazard analysis and identifies (at a high level) potential risk control measures that could be implemented to mitigate navigation risk. The hazards presented below assumes an “open river” assessment scenario whereby there are no restrictions on navigation. It is recognised that it is possible such an assessment scenario may not occur within the lifetime of the project. However, as the remit of this preliminary hazard analysis is to identify potential design mitigations and as such all future assessment scenarios are considered at this high level in order to future proof the pier designs as much as is practicable.

6.1. DESIGN REVIEW

6.1.1. BARNES PIER AND BROW

In order to minimise the risk of contact and collision to passing vessels the Barnes Pier is well set back from the authorised channel and has been located in order to promote continued use of arch #3 of Hammersmith Bridge. A review of the design, by key hazard type is presented below and with potential risk controls identified in the narrative:

- Contact
 - The pier impinges the unpowered recreational craft route recommended in the Tideway Code although the proposed design has, so far as reasonably possible, been optimised to allow this route to continue by enabling unpowered recreational craft to navigate the under the brow.
 - The risk remains that these vessels could make contact with the pier or brow as they navigate the backspan. In order to mitigate this hazard it is recommended that the underside of the brow be painted in a bright colour to draw attention to its presence. Gauge boards indicating the available headway under the brow and the navigable state of arch # 3 of Hammersmith Bridge will inform unpowered craft users as to whether an attempt to navigate the pier brow and arch #3 is appropriate.
- Collision
 - There is poor line of site when looking for approaching traffic to the west as Hammersmith Bridge obscures the view upstream, and therefore there is a risk that a vessel transiting downstream will not be seen (until too late) by the ferry Master. Vessels transiting downstream with the ebb tide will be moving quickly and will struggle to take avoiding action should a ferry be crossing at the same time; such an instance could result in a collision between the passing vessel and ferry. It is recommended that measures be taken to improve site lines from the Barnes Pier. The installation of a CCTV camera facing west on the Hammersmith Pier with a live feed to the Barnes Pier (and Hammersmith Pier) would allow the ferry Master a clear view upstream of any approaching vessels. In addition a “calling out point” at Chiswick Eyot (or another appropriate location) could

be instated so that passing large vessels can give advanced warning of their intention to transit Hammersmith Bridge. Whilst controlled transits are still required the PLA should provide the ferry Master with an approved transit schedule so that passing traffic can be anticipated in advance and caution exercised.

- Grounding
 - Depths alongside Barnes Pier are limited and gauge boards indicating the available depth alongside will assist the ferry Master in avoiding a grounding incident.
 - Unpowered recreational craft transiting under the pier brow will be able to do so at most states of tide, some smaller craft may even be able to transit under the brow at low tide (even when arch #3 of Hammersmith Bridge is unnavigable). However, consultation with TRRC has revealed the presence of a number of large boulders on the foreshore protruding approximately 10cm above bed level. The removal of these boulders will improve navigation of Arch #3 and the backspan at low tide and reduce grounding risk as well as reduce the volume of unpowered recreational traffic having to utilise the authorised channel at low water.

6.1.2. HAMMERSMITH PIER AND FLOATING WALKWAY

Hammersmith Pier has been offset from Barnes Pier to avoid the piers being directly opposite each other and a narrowing of the available navigable width of the river. It is also positioned a sufficient distance away from Hammersmith Bridge to increase the distance to the centre span of arch #2 (point of highest headway) to maximise searoom for larger navigating vessels. This is balanced with maintaining enough distance from Fulham Reach Boat Club (FRBC) downstream to the east. The proposed location of the pier also seeks to utilise the naturally deeper pocket of water in which it is located to minimise intrusion into the authorised channel.

- Contact
 - A powered houseboat or Dutch barge navigating downstream on an ebb tide could be taken off course by the tidal set (which will push vessels toward the northern bank) and could make contact with the Hammersmith Pier and/or floating walkway or the ferry if alongside or in the area. It is likely that such a vessel would aim for the centre of arch #2 Hammersmith Bridge in order to pass under the bridge at the point of maximum headway. A significant alteration of course to starboard (and management of speed/power) may be required to pass the pier at a safe distance and avoid being pushed onto it by the tidal set. Adequate warning to vessels passing downstream on the ebb tide including consideration of visual markers on the bridge span and/or on the approaches to the west of the bridge warning of the Hammersmith Temporary Ferry (piers and vessels) and a requirement for a prompt turn to starboard could be installed.
 - Unpowered craft approaching Hammersmith Pier from the east and navigating upstream on a flood tide may be pushed north toward the pier by the tidal set. An early warning buoy could be placed to the east of the pier. This risk control will require further development during the full NRA in conjunction with stakeholder consultation with local clubs, notably Fulham Reach Boat Club, in order to ensure that such a buoy does not adversely impact current club activity.

- Grounding
 - Depths alongside Hammersmith Pier are limited and tide gauge boards indicating the available depth alongside will assist the ferry Master in avoiding grounding.
- Pinning
 - Unpowered craft approaching Hammersmith Pier from the east and transiting upstream on the Flood tide may be pushed on to the pier and more likely the floating walkway by the flood tide set. Access and egress points should be provided at regular intervals and incorporated into the floating walkway and pier design along with grabrails/chains to facilitate movement towards access/egress points. Signage on the access walkway alerting members of the public to call 999 and ask for the Coastguard if they notice anyone in the water in distress should be positioned at regular intervals along the walkway.
- Flotsam and Jetsam
 - On high spring tides, flotsam and jetsam is picked up and deposited on the northern shore in and around the Hammersmith Pier and pontoon walkway. There is a possibility of debris catching against/on the pontoon or under the pontoon walkway, causing it to sit at an angle when it settles on to the bed which risks damage or the walkway being unstable for pedestrian use. Regular clearance and inspections should be incorporated into standard operating procedures to ensure that any debris is identified and removed as quickly as possible.

6.2. OPERATION REVIEW

- Collision
 - During off peak operational periods, the ferry which is not in operation will be moored on the Barnes Pier and will protrude slightly into the authorised channel. At low water when navigation of the backspan is not possible unpowered recreational craft will be required to navigate to the north of the moored ferry and will encroach further into the authorised channel. This will increase the likelihood of a collision occurrence involving passing vessels. Alternate mooring locations such as Dove or Hope Pier should be investigated to limit any prolonged restriction of the authorised channel and the resulting constriction of navigation. If it is not possible to find an alternative mooring location the positioning of the non-operational vessel should be reviewed on a regular basis as part of the dynamic consultation intended to be carried out through a River Consultative Liaison Group.
 - During times when significant rowing activity is carried out (and in the event that current restrictions are lifted), for example on a Saturday morning, it will be difficult for the ferry Master's to find an available gap in traffic to make a crossing. Should Hammersmith Bridge be opened to unpowered recreational traffic a clear a well communicated operational protocol should be developed collaboratively between the ferry operation and local rowing clubs. The operational protocol will need to be developed collaboratively (in the event that transits of Hammersmith Bridge by unpowered craft are permitted) and could include the following:

- Rowing craft only navigate in single file and cease paddling as they navigate with the tide through the operational area;
- No racing within defined area;
- Proceed with careful lookout;
- Encourage individual clubs to risk assess novice rowers and coxes in the area; and
- It may be appropriate to station a safety/rescue boat in the area. This vessel could alert crews to the operational protocols in place. This measure would unlikely be in place for the duration of the operation but could be useful whilst the agreed operational protocols are “bedded in” and recreational users habituate to the ferry service.

6.3. RISK CONTROL MITIGATION

The following possible risk controls options have identified:

- **CCTV viewing upriver to improve visibility** - Installation of a CCTV camera on the Hammersmith Pier with a live link to the Barnes Pier, this will allow the ferry Master on the Barnes Pier (and Hammersmith Pier) to have an unobstructed view of traffic approaching from the west.
- **Tide Gauge Boards (depth alongside)** – Tide Gauge boards should be installed on Hammersmith and Barnes Pier to give a true indication of depth alongside the piers.
- **Gauge boards (brow headway and arch #3 navigable state)** - Gauge boards showing the available headway under the Barnes Pier brow and a tide gauge board showing whether arch #3 is navigable could be affixed to the downstream pile of the Barnes Pier providing real time information for rowers approaching the area. This board should be simple and easy to interpret at a glance, e.g. green/red depending on whether the limiting feature (assume critical depth is in arch # 3 and not the backspan) is safe to navigate.
- **Paint underside of brow**- The underside of the Barnes Pier brow should be painted in a bright colour to draw attention to it.
- **Remove foreshore boulders** - Boulders on the foreshore on the approach to the Barnes Pier brow and through Hammersmith Bridge Arch #3 should be removed where possible to reduce the likelihood of grounding occurrence and increase the low tide use. This will reduce unpowered recreational traffic utilising arch #2 towards low tide and decrease risk of collision.
- **Signage warning of Hammersmith Pier or notification when booking transit** - Signage warning of the presence of Hammersmith Pier and the need for craft transiting Hammersmith Bridge arch #2 downstream on an ebb tide to turn hard to starboard once the bridge is cleared. A notice could be issued when booking a transit warning of this hazard whilst operational.
- **Early warning marker buoy downstream of Hammersmith Pier** - There is potentially a need to place a buoy downstream of Hammersmith Pier to alert recreational craft (principally rowers) of the presence of the pier. Vessels not navigating with due care may be pushed on to the Pier/floating walkway by the flood tide which has a strong set to the north.

- **Access and egress points** should be provided at regular intervals along the Hammersmith Pier floating walkway and in accordance with PLA 'A Safer Riverside – Guidance for Development alongside and on the tidal River Thames' (Sep-2020).
- **Grab chains/rails** should be provided along the Hammersmith Pier walkway to facilitate movement towards access and egress points and in accordance with PLA 'A Safer Riverside – Guidance for Development alongside and on the tidal River Thames' (Sep-2020).
- **Notice to Mariners** to be issued giving information on the location of the piers, ferry operation, agreed operational protocols, advice on the navigation of Hammersmith Bridge etc.
- **Controlled transit list** to be provided by PLA to ferry Master's to allow for anticipation of passing transits.
- **River Liaison Group** This is particularly recommended given it is likely that the navigational disposition will change over the lifetime of the project as a result of amendments to the current restrictions to navigation and any bridge works etc. In such an event a further assessment of navigational risk will need to be carried out, this will include further stakeholder consultation and development of additional risk control measures that will need to be adopted and implemented to manage navigational risk. This forum would also sensibly develop/amend operational protocols.
- **Local Navigation Protocol** - Should Hammersmith Bridge be opened to unpowered recreational traffic clear and well communicated operational protocols will have to be developed collaboratively between the ferry operation, existing commercial operations, local rowing clubs and other users to ensure adequate and safe integration and deconfliction of associated activities.
- **Calling out point - Chiswick Eyot (navigating downstream)** - a "calling out point" at Chiswick Eyot (or another appropriate location) could be instated so that passing vessels can give advanced warning of their intention to transit Hammersmith Bridge.
- **Provision of Rescue/Safety Boat** - It may be appropriate to have a safety/rescue boat. This vessel could alert crews to the operational protocols in place. This measure would unlikely be in place for the duration of the operation but be useful whilst the agreed operational protocols "bedded in". It should be noted that the relationship between the proposed safety/rescue boat with any Hammersmith Bridge works guard boat currently onsite should be reviewed, (see minutes of discussion with TRRC for further detail in **Annex A**)

Table 4 summarises the provisional hazards identified as part of this assessment and the risk control measures that could be implemented in order to mitigate risk.

Table 4: Summary of Hazards and Applicable Risk Control Measures

Haz Type	Hazard Description	CCTV viewing upriver to improve visibility	Gauge boards (depth alongside)	Gauge boards (brow headway and arch #3)	Paint underside of brow	Remove foreshore boulders	Signage warning of presence of Hammersmith Pier or notification when backing bridge transit	Marker buoy downstream of Hammersmith pier (north side)	Access and Eggress	Alternate mooring	Grab rails / chains Hammersmith Pier	Notice to Mariners	Controlled transit list provided	River Liaison Group	Local Navigation Protocol	Calling out point-Chiswick Eyal (navigating downstream)	Provision of Rescue/safety boat
Contact	Powered recreational vessel transiting downstream on an Ebb tide makes contact with Hammersmith pier having been pushed to the north by the ebb tidal set.						✓					✓					
Contact	Commercial vessel makes contact with Hammersmith or Barnes pier.						✓					✓		✓			
Contact	Unpowered recreational vessel makes contact with Barnes pier or Barnes pier Brow whilst attempting to navigate backspan.		✓	✓	✓												
Contact	Unpowered recreational vessel makes contact with Hammersmith pier having been pushed off course by flood tidal set.							✓									✓
Collision	Collision between ferry and passing powered recreational craft.	✓								✓		✓	✓	✓	✓	✓	
Collision	Collision between ferry and passing unpowered recreational craft.	✓				✓		✓		✓		✓		✓	✓	✓	✓
Collision	Collision between ferry and passing commercial vessel.	✓								✓		✓	✓	✓	✓	✓	
Grounding	Grounding of ferry vessel on approach to Hammersmith or Barnes pier at low water.		✓			✓											
Grounding	Grounding of third-party vessel as a result of ferry operation.	✓	✓			✓		✓				✓		✓	✓		
Pinning	Pinning of unpowered recreational vessel against Hammersmith pier having been pushed off course by flood site set.						✓	✓			✓			✓	✓		✓

7. NAVIGATION RISK ASSESSMENT

The PLA as regulator for navigation safety on the River Thames requires that a Navigation Risk Assessment be appended to any River Works License, where the works are likely to have an effect on vessel navigation.

The Navigation Risk Assessment for the Hammersmith Temporary Ferry will cover the construction phase, operational phase and decommissioning phase of the project.

7.1. ASSESSMENT SCENARIO

At present, navigation through Hammersmith Bridge is restricted to controlled transits only (see further detail in **section 2.2**). Consultation with the PLA (see **section 5.1**) has revealed that there is no expected time frame for the lifting of these restrictions. At present there are no transits through the bridge by passenger vessels, unpowered recreational craft or any craft that is not transiting as part of a pre-booked controlled passage. This significantly reduces the number of transits passed the proposed Hammersmith Temporary Ferry operational area. The NRA will be based on this current operational scenario. However, it should be noted that the NRA will need to be periodically reviewed and updated throughout the lifetime of the project to accommodate any future change in navigational disposition resulting from a lifting of restrictions or commencement of work to refurbish Hammersmith Bridge. This will include continued stakeholder consultation to review navigation disposition, hazards risk levels, and identify additional risk mitigation measures:

Future operational scenarios may be influenced by (but are not limited to) changes to:

- Transition to controlled/uncontrolled transits of users through bridge (restriction removal);
- Removal/revision of exclusion zone;
- Impacts from the refurbishment work to Hammersmith Bridge;
- Events; and
- Variation in traffic trends (e.g. post Covid-19 influence/'bounce' and reported increased usage of area by non-organised users).

Table 5 summarises the preliminary risk control measures that may be required, the vessel types that would be able to transits Hammersmith Bridge if such a scenario came in to affect and the risk control measures (previously listed in **section 6.3**) that would need to be implemented in a “controlled transit” (current) assessment scenario and “open river” scenario.

Table 5: Indicative Future Assessment Scenarios and Risk Control Development Summary.

		Controlled Transit*	Open River**
Hammersmith Bridge Transit Authorised	Class V Passenger Vessel		✓
	High Speed Passenger Vessel		✓
	Service Vessel	✓	✓
	Intra Port Freight	✓	✓
	Powered Recreational	✓	✓
	Unpowered Craft transiting as part of an organised group		✓
	Unpowered Craft not part of an organised group		✓
Possible Risk Control 1	CCTV viewing upriver to improve visibility	X	✓
Possible Risk Control 2	Gauge boards (depth alongside)	✓	✓
Possible Risk Control 3	Gauge boards (brow headway and arch #3)	X	✓
Possible Risk Control 4	Paint underside of brow	X	✓
Possible Risk Control 5	Remove foreshore boulders	X	✓
Possible Risk Control 6	Signage warning of presence of Hammersmith Pier or notification when booking bridge transit	✓	✓
Possible Risk Control 7	Marker buoy downstream of Hammersmith pier (north side)	X	?
Possible Risk Control 8	Access and Egress	✓	✓
Possible Risk Control 9	Alternate mooring	X	?
Possible Risk Control 10	Grab rails / chains Hammersmith Pier	✓	✓
Possible Risk Control 11	Notice to Mariners	✓	✓
Possible Risk Control 12	Controlled transit list provided	✓	X
Possible Risk Control 13	River Liaison Group	✓	✓
Possible Risk Control 14	Local Navigation Protocol	X	✓
Possible Risk Control 15	Calling out point-Chiswick Eyot (navigating downstream)	X	?
Possible Risk Control 16	Provision of Rescue/safety boat	X	?

*Controlled transits as per U2/2021, exclusion zone in place.

**Open River Scenario - no restrictions on transits and exclusion zone removed.

7.2. NAVIGATION RISK ASSESSMENT METHODOLOGY

The NRA methodology will be as agreed with the PLA at the consultation meeting held on the 16-Apr-2021, and broken down into the following individual tasks:

- Task 1: Project Inception and Review
- Task 2: Baseline Vessel Traffic Characterisation
- Task 3: Consultation
- Task 4: Risk Assessment
- Task 5: Reporting

7.2.1. PROJECT INCEPTION AND REVIEW

A review of documentation, to be provided by Uber Boat by Thames Clippers, Beckett Rankine and TfL, will be made to ensure that the project parameters are fully documented which will include the items below.

- Pier Designs and layouts;
- Operational procedures and Standard Risk Assessments;
- Drawings including temporary in river/marine work layouts;
- Works Schedules;
- Review of Hazard Themes and Provisional Risk Mitigation measures; and
- Review of NRA work to date.

7.2.2. TASK 2: BASELINE VESSEL TRAFFIC CHARACTERISATION

Baseline vessel traffic analysis (as presented in **section 4** of this preliminary report) will be further developed based on existing data. The analysis will inform the appropriate identification and assessment of navigation hazards. This task will include:

- Vessel traffic analysis of AIS data:
 - Vessel track analysis by vessel type;
 - Density analysis; and
 - Gate analysis near proposed site - Analysis of gate data by vessel type, time of day, speed, etc.
- Vessel traffic analysis of non-AIS vessels through review of available documents such as the Tideway Code.
- Vessel bridge transit tidal analysis to determine tidal states of vessel passages.
- Analysis of PLA incident data to inform likelihood / consequence of hazard occurrence.

7.2.3. TASK 3: CONSULTATION

An important aspect to the risk assessment process is the elicitation of local knowledge from the regulators and users of the River Thames. The river has a diverse and widespread number of marine users from commercial freight operators, commuter and tourist passenger vessel services, as well as workboats engaged in a variety of different activities. Recreational mariners also use the river in a variety of craft from canal barges to kayaks.

The potential for a number of as yet undefined future assessment scenarios means periodic stakeholder consultation will be essential to allow for rapid revision of the NRA and assessment of additional hazards and risk control mitigations throughout the lifetime of the project. Therefore a stakeholder liaison group should be formed comprising representatives of the following organisations as agreed with the PLA at the Early Engagement Meeting (this list should be reviewed depending on changes such as the re-opening of Hammersmith Bridge):

- PLA;
- Thames Regional Rowing Club (TRRC);
- Adjacent local rowing club (FRBC to East) (Furnivall, AK to West);
- Local Sailing Clubs - Ranelagh and South Bank SC (to East) and London Corinthians SC (to West);
- SUP (via Active 360);
- Kayaking / canoeing community;

- Key Commercial Vessel Operators;
- Colliers Launches;
- Thames Marine Services; and
- RNLI Chiswick.

Summary minutes of each of the stakeholder liaison group meetings will be produced.

7.2.4. TASK 4: RISK ANALYSIS

The risk analysis task will collate findings of Task 1, Task 2 and Task 3, with the expert judgement of project personnel, to perform a detailed “*Hazard Identification and Scoring*” assessment and is based on vessel type, area, and hazard type. Typical categories may include:

- Vessel types – e.g. Group 1 Vessels – powered commercial vessels and Group 2 vessels – Recreational Craft, etc.)
- Geographic/Spatial Risk Areas; and
- Hazard types – e.g. collision, contact, grounding, breakout, etc.

Where key or critical hazards are identified, further analysis will be undertaken to provide an evidence basis for the assessment of risk. In many instances, key hazards or concerns are identified based on limited information, especially when there is likely to be a change in vessel traffic activity, and therefore further detailed analysis and interpretation can be used to determine the magnitude of any change or concern.

The task will deliver a finalised hazard list that can be scored for hazard likelihood and consequence.

In order to ascertain the risk of individual hazard occurrence for both hazard likelihood and hazard consequence the PLA “*Risk Assessment Matrix: Risk Criteria*” will be used (see **Figure 21**). The process includes a project personnel workshop where all hazards are individually assessed against the baseline traffic and incident data, the results of the stakeholder consultation, the expert judgement of the project team, and any detailed key hazard analysis undertaken.

	Risk Score Matrix					Total Risk Score	
Almost Certain	5	10	15	20	25	Minor	1-3
Likely	4	8	12	16	20	Moderate	4-8
Possible	3	6	9	12	15	Serious	9-14
Unlikely	2	4	6	8	10	V Serious	15-19
Rare	1	2	3	4	5	Severe	20-25
Likelihood	Minor	Moderate	Serious	Very Serious	Severe	Severity	

Figure 21: Port of London Authority Risk Assessment Matrix and Criteria⁴.

Where hazards are scored as serious or higher risk, risk controls aimed at eliminating the hazard or reducing the risk to acceptable levels will be identified. The process of risk control identification and effectiveness scoring will be documented in the hazard register.

7.2.5. TASK 5: REPORTING

A technical NRA report will be prepared as the deliverable. The report will present the results of the NRA and will be appended to a River Works License for PLA approval.

⁴ Provided by PLA Harbour Master Mark Towns on 24 Jan 2020.

8. STUDY FINDINGS

8.1. CONCLUSIONS

This Preliminary Navigation Hazard Analysis has assessed at a provisional level, the navigation impact of constructing two piers located immediately downstream of the current Hammersmith Bridge on the River Thames and the operation of a temporary ferry service. A review of the proposed pier designs and ferry operation, along with consultation with the PLA, Thames Marine Services TRRC, and analysis of vessel track data was conducted to provide an evidence basis for the conclusions.

The conclusions are:

- The pier locations and designs have been optimised sufficiently to mitigate navigational risk as much as possible and no amendments to the pier locations are recommended.
- Minimal alterations to the existing pier designs are required (see **Table 5**).
- Subject to risk assessment, the requirement for incorporation of risk control mitigation on the design and operation (as per **Table 5**) will require consideration.
- The potential for a number of as yet undefined future operational scenarios means periodic stakeholder consultation will be essential to allow for rapid revision and update of the NRA including the update and assessment of additional hazards, and determination of risk control mitigations throughout the lifetime of the project;
- The NRA will be undertaken on the basis of the current assessment scenario, i.e. controlled transits through the Hammersmith Bridge (PLA NTM U2/2021); and

8.2. RECOMMENDATIONS

The primary recommendation of this preliminary navigation hazard assessment is that a full NRA is undertaken in line with PLA requirements for the installation, operation and decommissioning of the proposed piers and Hammersmith Temporary Ferry operation.

It is recommended that the risk mitigation measures identified in **Table 5** are implemented as per the controlled transit assessment scenario prior to the commencement of the Hammersmith Temporary Ferry operation.

The assessment scenario adopted for the NRA will be as per PLA NTM U2/2021, and the NRA will need to be updated periodically as part of future phases of work, should there be a change to the current navigational disposition (e.g. if Hammersmith Bridge transit restrictions are revised). In order to facilitate the development and implementation of risk controls identified in this preliminary navigation hazard assessment, enable periodic consultation, assessment of future assessment scenarios and to provide feedback of the effectiveness of implemented risk control measures a River Liaison Group should be formed at the earliest convenience.

It is further recommended that the Hammersmith Temporary Ferry project team holds an open meeting with all local river stakeholders to introduce the project and to open lines of communication prior to the formal consultation regarding the NRA.

ANNEX A – STAKEHOLDER CONSULTATION MINUTES

Notes of Meeting

Hammersmith Ferry Phase One – Scheme Overview (20-NASH-105)

Client: Uber Boat by Thames Clipper
 Project: Hammersmith Ferry
 Venue: Video/telecon (MS Teams)
 Date of Meeting: 16-Apr-2021 (14:00– 15:00)

Present:

Port of London Authority (PLA)	Ryan Hall - RH
NASH Maritime	Jamie Holmes - JH
NASH Maritime	Sam Anderson-Brown - SAB
Uber Boat by Thames Clipper	Sean Collins - SC
Uber Boat by Thames Clipper	Ieva Sabone - IS
Uber Boat by Thames Clipper	Mitchell Thorpe - MT
Uber Boat by Thames Clipper	Derek Mann – DM
Uber Boat by Thames Clipper	Jude McGrane -JM
Uber Boat by Thames Clipper	Craig Brown - CB
Transport for London	Jordan Knight - JK
Beckett Rankine	Graham Gathergood - GG
Beckett Rankine	Tim Beckett - TB

1.	Introductions and Meeting Objectives
	<ul style="list-style-type: none"> - Brief introductions. - Objectives of the meeting: <ul style="list-style-type: none"> • Brief all on NRA plan (and phased approach). • Provide an initial briefing for the PLA for consideration ahead of a formal Phase 1 consultation meeting. • Identify any areas/key issues where further information is required
2.	NRA Approach
	<ul style="list-style-type: none"> - SAB outlined approach to the NRA, the purpose of Phase 1 is to identify key navigation issues/hazards and potential risk control mitigation measures for incorporation into the final scheme design (e.g. layout/design aspects) and is focused on the operational project phase. - Phase 2 will consist of a full Navigation Risk Assessment (NRA) to support the license application.
3.	Proposed Design layout and Design/Geometry: Barnes Pier Brow
	<ul style="list-style-type: none"> - Pier design locations have been optimised to minimise impact on the navigation channel where possible.

	<ul style="list-style-type: none"> - The brow linking Barnes Pier to the shore has been designed in such a way to allow unpowered recreational craft (principally rowers) to pass between the shore and pier (the backspan). - Further consultation will be carried out during Phase 1 with TRRC to further explore potential use of backspan and incorporate any design critical learnings. - RH commented that consideration should be given to giving absolute clarity as to the circumstances in which vessels could navigate the backspan. Short discussion on this held.
4.	Proposed Operation
	<ul style="list-style-type: none"> - SAB presented an overview of the proposed operation
t	Operational Scenario
	<ul style="list-style-type: none"> - It is recognised that navigational disposition may change over the lifetime of the project for various factors including: <ul style="list-style-type: none"> 1. Hammersmith bridge closure/partial closure with restrictions to navigation and exclusion zones. 2. Refurbishment works associated with Hammersmith Bridge. 3. Variation in traffic trends (events, post covid usage of rivers – e.g., potential increase in non organised usage), summer season etc...) - RH outlined that restrictions to navigation may be relaxed/removed during the lifetime of the project but at present navigation of Arch 2 is available via pre-booked controlled transits for essential and necessary transits only (NTM U2 of 2021). - NRA should be based on current operational scenario and reviewed as and when restrictions are lifted/amended.
6.	Data sources for NRA
	<ul style="list-style-type: none"> - SAB noted limitations in existing data sets given the Hammersmith Bridge Closure and Covid 19 pandemic. - Stakeholder engagement will be crucial to the NRA process.
7	Consultation
	<ul style="list-style-type: none"> - SAB outlined initial stakeholders identified for Phase 1 and Phase 2 consultation. - RH commented that operators of large commercial vessels currently undertaking controlled transits should be consulted during Phase 1. Considered likely to be Conquestor or Plashy. Noted also larger class V vessels (e.g. colliers) albeit currently/likely to be operating an alternative route not through Hammersmith bridge) - RH also commented that contact with recreational stakeholders will require sensitive communication regarding undefined timescale of reduction/removal of restrictions to recreational transits (and other non-essential transits) in vicinity of Hammersmith Bridge. - It was agreed that a river user liaison group should be established to allow for dynamic consultation throughout the lifetime of the project. This risk control measure is considered essential as it is likely that the navigational disposition will change over the lifetime of the project as a result of amendments to the current restrictions to navigation. In such an event a further assessment of navigational risk will need to be carried out, this will include further stakeholder consultation and development of additional risk control measures that will need to be adopted and implemented to manage navigational risk.
8	Key Issues
	<ul style="list-style-type: none"> - SAB outlined key issues identified by NASH so far and it was agreed these were appropriate. - RH asked if NRA would consider grounding risk to vessels, it was confirmed that the full NRA would consider grounding risk and the installation of a tidal board on one of the pontoons would be a sensible risk control measure. Noted that the NE Pier is in a

	<p>deeper pocket and so vessels approaching from downriver may ground before contact with works.</p> <ul style="list-style-type: none"> - SC asked if any special directions could be put in place by the PLA to deconflict ferry operation with passing recreational vessels (noting potential 'peak' periods when a slot for the ferry may take time to emerge). RH confirmed that temporary amendments could be made to documents such as the Tideway Code warning of ferry operation and possibly defining windows when recreational craft should avoid the operational area. Discussion on the point and the basis of operational protocols to be developed. - JH asked if booked transits could be communicated to project and ferry operator. RH commented that PLA could make details of booked transits available in advance. This would give ferry skippers prior warning of when to expect third party passing transits. - SC commented that marker buoys could be placed a suitable distance downstream of Hammersmith Pier to provide advance visual warning to rowers (backward facing) to warn them when approaching the ferry operation area. JH agreed to review on similar basis as used at Fulham Football Club. - Consider pinning hazard on the piers and northern access pontoon (marker buoys to help mitigate likelihood). - JH considered whether video/CCTV feed may help ferry Master view. - Consider tidal boards at site to present actual depth of water and air draught relative to key assets (e.g. Hammersmith Bridge, Barnes side at Arch 3 for draught & air draught))
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Notes of Meeting

Hammersmith Ferry Phase One – Scheme Overview (20-NASH-105)

Client: Uber Boat by Thames Clipper
 Project: Hammersmith Ferry
 Venue: Video/telecon (MS Teams)
 Date of Meeting: 20-Apr-2021 (15:00– 16:00)

Present:

Thames Marine Services Robert Dwan - RD
 Thames Marine Services Nicholas Dwan - ND
 NASH Maritime Jamie Holmes - JH
 NASH Maritime Sam Anderson-Brown - SAB

1.	Introductions and Meeting Objectives
	<ul style="list-style-type: none"> - Brief introductions. - NASH Maritime appointed by Uber Boat to undertake Navigation Risk Assessment (NRA) and management services for the ferry project. - Objectives of the meeting: <ul style="list-style-type: none"> • Provide an early outline of the NRA plan. • Give an opportunity to identify gaps/where information is required and flesh out any key issues as well as discuss potential risk mitigation measures for progression of design and consent process.
2.	NRA Approach
	<ul style="list-style-type: none"> - SAB outlined approach to the NRA being undertaken in 2 phases: <ul style="list-style-type: none"> • Phase 1 is an initial package of work in order to identify key navigation issues/hazards and potential risk control mitigation measures for the proposed scheme (as provided by Uber Boat during tender stage) so that any findings can be incorporated (e.g. layout/design aspects) at this early stage. • Phase 2 will consist of a full Navigation Risk Assessment (NRA) to support the license application. - JJH and SAB explained that whilst Hammersmith Bridge is currently closed to non-essential navigation it is recognised that TMS are operating the <i>Conquestor</i> (through the PLA booking system) and she is considered a 'critical' vessel for the assessment hence being engaged at this stage.
3.	Proposed Design layout and Design
	<ul style="list-style-type: none"> - JJH and SAB explained that the Barnes and Hammersmith Pier designs and locations have been optimised during the tender stage to minimise impact on navigation where possible. - The brow linking Barnes Pier to the shore has been designed in such a way to allow unpowered recreational craft (principally rowers) to pass between the shore and pier (the backspan) as per the existing Tideway code and to deconflict, as much as possible, rowers with users of the authorised channel.

	<ul style="list-style-type: none"> - Further consultation will be carried out during Phase 1 with TRRC to further explore potential use of backspan and incorporate any design critical learnings. - RD and ND felt there would be little to no impact on Thames Marine Services operations as a result of the piers. - ND raised observational concerns that a powered houseboat or Dutch barge navigating downstream on an ebb tide could be taken off course by the tidal set (which will push vessels toward the northern bank) and could make contact with the Hammersmith pier (north pier) and/or floating walkway or the ferry if alongside or in the area. It is likely that such a vessel would aim for the centre of Arch no. 2 in order to pass under the bridge at the point of maximum air draught. A significant alteration of course to starboard (and management of speed/power) may then be required to pass the pier at a safe distance and avoid being pushed onto it by the tidal set. Noted also the implication of power/steering gear failure. Risk controls were discussed for this possibility including: <ul style="list-style-type: none"> • Adequate warning to vessels passing downstream on the ebb tide including consideration of visual markers on the bridge span and/or on the approaches to the west of the bridge (warning of ferry, pier and requirement for prompt turn to starboard etc...). • PLA guidance should also be updated and a NTM issued to assist in promulgation of information. • Awareness to ferry and Pier crews regarding transiting vessels (particularly those on the Hammersmith Pier) so they can increase their readiness/monitor transits [also see below calling out point] - Concerns were also raised about sight lines upstream from the Barnes pier. Possible risk mitigation measures include: <ul style="list-style-type: none"> • A CCTV feed to the west of the bridge with a feed to the ferry Master(s) – could be mounted on Hammersmith pier viewing west. • Chiswick Eyot could be used a “calling out point” for vessels transiting downstream in order to give further warning to the ferry Master of their intention to transit Hammersmith bridge. • Whilst controlled passage arrangements are still in place the PLA could provide an advance schedule of booked passages to the ferry operation.
4.	Proposed Operation
	<ul style="list-style-type: none"> - SAB presented an overview of the proposed operation. - RD and ND suggested that transit times and service frequency times were realistic. Conquestor is likely to transit through the bridge at approximately 8 knots so would clear the operational area relatively quickly. - TMS confirmed that their operation typically: <ul style="list-style-type: none"> • Transit up on the flood and down on the ebb typically over a 3-4 hour period. • Uses spring tides where possible to provide a longer window upstream. • Summer: typically 1x wk or 1 x 2wk. • Winter: typically 3x wk. • Numbers of transits not impacted by bridge closure or COVID-19 and considered that the plots presented by NASH of their transits will remain representative. • RD and ND suggested that transit times and service frequency times were realistic. Conquestor is likely to transit through the bridge at approximately 8 knots so would clear the operational area relatively quickly. - RD and ND noted that other Class V vessels such as Collier Launches will be relevant although not currently navigating the area.
f	Operational Scenario
	<ul style="list-style-type: none"> - It is recognised that navigational disposition may change over the lifetime of the project for various factors including:

	<ul style="list-style-type: none"> - 1. Hammersmith bridge closure/partial closure with restrictions to navigation and exclusion zones. - 2. Refurbishment works associated with Hammersmith Bridge. - 3. Variation in traffic trends (events, post covid usage of rivers – e.g., potential increase in non organised usage), summer season etc...) - RD and ND agreed that the NRA should be based on current operational scenario and reviewed as and when restrictions are lifted/amended. - Thames Marine Services operations are unlikely to differ substantially should the restrictions currently imposed by PLA NTM U2 of 2021 be lifted.
7	Consultation
	<ul style="list-style-type: none"> - SAB outlined initial stakeholders identified for Phase 1 and Phase 2 consultation. - Thames Marine Services are keen to be involved in future consultation. - RD and ND observed that they had seen an increase in the use of unpowered recreational craft by members of the public, i.e. not part of organised club activity.
8	Other Comments
	<ul style="list-style-type: none"> - RD observed that on high spring tides, flotsam and jetsam is picked up and deposited on the northern shore in and around the Hammersmith pier and pontoon walkway. RD raised the possible issue of debris catching on the pontoon or under the pontoon walkway, causing it to sit at an angle when it settles on to the bed/damage. Regular clearances would be recommended

Notes of Meeting

Hammersmith Ferry Phase One – Scheme Overview (20-NASH-105)

Client: Uber Boat by Thames Clipper
 Project: Hammersmith Ferry
 Venue: Video/telecon (MS Teams)
 Date of Meeting: 23-Apr-2021 (10:00– 11:00)

Present:

Thames Regional Rowing Council Bill Mitchell - BM
 Thames Regional Rowing Council Tony Reynolds- TR
 NASH Maritime Jamie Holmes - JH
 NASH Maritime Sam Anderson-Brown - SAB

1.	Introductions and Meeting Objectives
	<ul style="list-style-type: none"> - Brief introductions. - NASH Maritime appointed by Uber Boat to undertake Navigation Risk Assessment (NRA) and management services for the ferry project. - Objectives of the meeting: <ul style="list-style-type: none"> • Provide an early outline of the NRA plan. • Give an opportunity to identify gaps/where information is required and flesh out any key issues as well as discuss potential risk mitigation measures for progression of design and consent process.
2.	NRA Approach
	<ul style="list-style-type: none"> - SAB outlined approach to the NRA being undertaken in 2 phases: <ul style="list-style-type: none"> • Phase 1 is an initial package of work in order to identify key navigation issues/hazards and potential risk control mitigation measures for the proposed scheme (as provided by Uber Boat during tender stage) so that any findings can be incorporated (e.g. layout/design aspects) at this early stage • Phase 2 will consist of a full Navigation Risk Assessment (NRA) to support the license application. - JJH and SAB explained that whilst Hammersmith Bridge is currently closed to non-essential navigation, and rowers are currently avoiding the project area (turning in the area of River View Buoy), the ferry project recognises that the design should consider the return of this activity at a stage during its operation. This will be considered in further detail during the NRA once the bridge/user restrictions are more defined.
3.	Proposed Design layout and Design
	<p>JJH and SAB explained that the Barnes and Hammersmith pier designs were optimised during the tender stage to minimise impact on navigation where possible.</p> <ul style="list-style-type: none"> - The premise of the proposed location and alignment of Barnes Pier seeks to enable continued use of the inshore/Surrey span (arch no. 3) of Hammersmith Bridge. For this reason, the brow (linking Barnes Pier to the shore) has also been designed to incorporate transits of unpowered recreational craft (principally rowers) to pass

	<p>between the shore and pier (the backspan). JJH and SAB invited TRRC to comment on this aspect of design:</p> <ul style="list-style-type: none"> • The following assumptions are considered a reasonable basis of required room: headroom (1.5m) depth (0.4m) and beam (7m) based on a rowing 8. • The premise of maintaining navigation in arch no. 3 is desirable, where safe, to maintain the basis of existing code and separate rowers from other navigation (and the ferry) within the authorised channel. • TR observed that although the backspan would be navigable at most states of tide the existing constraints of arch no. 3 remain. JJH agreed that the combined 'window' of both arch no. 3 and backspan will be examined in NRA. TR noted a potential that rowing vessels could navigate the backspan and then need to navigate back north to the navigation channel in order to pass through arch no. 2 as per the Tideway Code (with a large alteration of course within the space between the Barnes Pier and Hammersmith Bridge Pier). <p>- Hammersmith Pier was re-located offset from Barnes Pier to avoid the piers being directly opposite each other and a narrowing of the river. It was also spaced a sufficient distance away from Hammersmith Bridge to increase the distance to the centre span (point of highest air draught) and increase room for larger navigating vessels. This is balanced with maintaining enough distance from Fulham Reach Boat Club (FRBC). The Pier also seeks to utilise the naturally deeper pocket of water in which its located to minimise its intrusion into the authorised channel.</p> <p>Risk controls were discussed in association with navigation of the backspan of Barnes Pier:</p> <ul style="list-style-type: none"> - A tide gauge board showing whether arch no. 3 is navigable could be affixed to the downstream pile of the Hammersmith pier providing real time information for rowers approaching the area. This board should be simple and easy to interpret, e.g green/red depending on whether the limiting feature (assume depth in arch no. 3) is safe to navigate. - BM mentioned that there are several large boulders on the foreshore between Arch no. 3 and the backspan creating a grounding/damage hazard potential and effectively reducing the window of usage. If these could be cleared then the usable window of arch no. 3 could be increased resulting in improved deconfliction with other users - Underside of the brow should be painted in a bright paint to improve visibility - Padding/protection measures on the underside of the brow are not considered to be necessary. <p>Other risk controls discussed</p> <ul style="list-style-type: none"> - The merits of an early warning buoy were discussed on both sides of the river. - Early warning buoy - Surrey side: TR and BM did not consider it of benefit for vessels navigating upstream on the ebb tide. It was felt that the existing River View buoy located downstream provides adequate visual reference (of distance and lateral positioning). - Early warning buoy - Middlesex side: It may be beneficial (particularly for vessels navigating upstream on the flood tide approaching Hammersmith pier). TRRC recommended NASH consult with FRBC to optimize the buoy location and ensure the clubs activity is not adversely impacted. - Vessels navigating upstream on the flood tide could be pinned against the Hammersmith pier walkway if they enter that area. JJH noted this and that it would be depth dependent. Sufficient access and egress should be included in the walkway design and riparian lifesaving equipment (grabrails/ chains to move to egress points etc...) should be incorporated in to the design. - Signage on the access walkway alerting members of the public to call 999 and ask for the Coastguard if they notice a vessel in distress should positioned at regular intervals along the walkway.
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4.	<p>Proposed Operation</p>
	<ul style="list-style-type: none"> - SAB presented an overview of the proposed ferry operation to promote discussion in the event that navigation through the bridge is opened to recreational craft. - TR and BM raised concerns that the during off-peak period the non operational ferry would be moored on the Barnes pier which will force rowing craft further out and in to the authorised channel when navigating upstream on the ebb tide (and then have to return in so as to navigate under the yellow markers of the bridge. Discussion held on this: <ul style="list-style-type: none"> • TR and BM suggested alternative locations are explored - Dove or Hope pier. • If in place here they would wish to review once in place and consider if any issues present. - During times when significant rowing activity is carried out, for example on a Saturday peak time it will be difficult for the ferry Master(s) to find an available gap in traffic to make a crossing. It was agreed that should Hammersmith Bridge be opened to unpowered recreational traffic a clear and well communicated operational protocol will have to be developed collaboratively between the ferry operation and local rowing clubs. Likely to include: <ul style="list-style-type: none"> • Rowing craft only navigate in single file and cease paddling as they navigate with the tide through the operational area. • No racing within defined area • Proceed with careful lookout' • Encourage individual clubs to risk assess novice rowers and coxes in the area' • Operational protocols – to be determined and developed in risk assessment' - Noted that, during events, the ferry will cease operation and both vessels will need to relocate' - It may be appropriate to have a safety/rescue boat. This vessel could alert crews to the operational protocols in place. This measure would unlikely be in place for the duration of the operation but be useful whilst the agreed operational protocol "bedded in". - TR and BM noted the relationship of safety/rescue boat provision with any guard boat currently onsite should be reviewed (see also 'Other Comments') and NASH will review this together with potential to locate the guard capability onto land/piers.
†	<p>Operational Scenario</p>
	<ul style="list-style-type: none"> - It is recognised that navigational disposition may change over the lifetime of the project for various factors including: <ul style="list-style-type: none"> - 1. Hammersmith bridge closure/partial closure with restrictions to navigation and exclusion zones. - 2. Refurbishment works associated with Hammersmith Bridge. - 3. Variation in traffic trends (events, post covid usage of rivers – e.g., potential increase in non organised usage), summer season etc....) - NRA should be based on current operational scenario and reviewed as and when restrictions are lifted/amended.
7	<p>Consultation</p>
	<ul style="list-style-type: none"> - SAB outlined initial stakeholders identified for Phase 1 and Phase 2 consultation. - BM and TR agreed the establishment of a river user liaison group for dynamic consultation throughout the risk assessment and lifetime of the project would be recommended. This is particularly recommended given it is likely that the navigational disposition will change over the lifetime of the project as a result of amendments to the current restrictions to navigation and any bridge works etc.... In such an event a further assessment of navigational risk will need to be carried out, this will include further stakeholder consultation and development of additional risk control measures that will need to be adopted and implemented to manage navigational risk. This forum would also sensibly develop/amend operational protocols.

8	Other Comments
	<ul style="list-style-type: none"> - TR and BM observed that the current guard boat operated on behalf of Hammersmith & Fulham is frequently out of position and obstructs rowing craft turning between the River View buoy and the proposed ferry operation site. The suitability of the vessel currently used was questioned and whether a smaller more maneuverable vessel could be considered, particularly when the ferry service commences operation. - TR commented that it would be of benefit for the Hammersmith ferry project team to engage with the rowing clubs in the area (all users meeting) prior to formal consultation as part of the NRA process. This would help pave the way for future discussions regarding operational protocols and improve lines of communication. TRRC would be happy to assist.

ANNEX B – STAKEHOLDER CONSULTATION MINUTES

Notes of Meeting

Hammersmith Temporary Ferry Phase Two – Navigation Risk Assessment (20-NASH-0105)

Client:	Uber Boat by Thames Clipper
Project:	Hammersmith Temporary Ferry
Venue:	Video/telecon (MS Teams)
Date of Meeting:	07-Jun-2021 (14:00– 15:00)
Present:	
Fulham Reach Boat Club (FRBC)	Steve O'Connor – SO
NASH Maritime	Jamie Holmes - JH
NASH Maritime	Sam Anderson-Brown - SAB

1.	Introductions and Meeting Objectives
	<ul style="list-style-type: none"> - Brief introductions. - NASH Maritime appointed by Uber Boat by Thames Clipper to undertake Navigation Risk Assessment (NRA) and management services for the ferry project. - Objectives of the meeting: <ul style="list-style-type: none"> • Give an opportunity to identify gaps/where information is required and flesh out any key issues as well as discuss potential risk mitigation measures for the construction and operation phase of the project.
2.	NRA Approach
	<ul style="list-style-type: none"> - SAB outlined approach to the NRA being undertaken in 2 phases: <ul style="list-style-type: none"> • Phase 1 consisted of an initial package of work in order to identify key navigation issues/hazards and potential risk control mitigation measures for the proposed scheme (as provided by Uber Boat by Thames Clipper during tender stage) so that any findings could be incorporated (e.g. layout/design aspects) at an early stage • Phase 2 consists of a full Navigation Risk Assessment (NRA) to support the license application. - JJH and SAB explained that the initial project NRA will be based on the current operational river scenario, Hammersmith Bridge is currently closed to non-essential navigation, and rowers are currently avoiding the project area (turning in the area of River View Buoy). However, the ferry project recognises that this assessment scenario is likely to change throughout the lifecycle of the project and there will be a need to refresh and update the NRA with additional hazards and associated risk control measures in the future. - In order to facilitate dynamic consultation (in response to a change in assessment scenario) throughout the lifecycle of the project a River User Liaison Group (RULG) will be established. This group will assist in the identification of additional hazards and risk controls as well as providing feedback on the effectiveness of existing risk control measures. - SAB outlined the stakeholders that will be consulted during this initial NRA and those additional stakeholders that will be invited to join the RULG

3.	Proposed Design layout and Design
	<p>JJH explained that the Barnes and Hammersmith pier designs were optimised during the tender stage to minimise impact on navigation where possible.</p> <ul style="list-style-type: none"> • The premise of the proposed location and alignment of Barnes Pier seeks to enable continued use of the inshore/Surrey span (arch no. 3) of Hammersmith Bridge. For this reason, the brow (linking Barnes Pier to the shore) has also been designed to incorporate transits of unpowered recreational craft (principally rowers) to pass between the shore and pier (the backspan) • The following assumptions are considered a reasonable basis of required room: headroom (1.5m) depth (0.4m) and beam (7m) based on a rowing 8. • The backspan would be navigable at almost all states of tide. However, the limiting factor as to whether navigation of the backspan is practicable will be the available depth under arch no. 3 of Hammersmith Bridge. • A tide gauge board showing whether arch no. 3 is navigable could be affixed to the downstream pile of the Hammersmith pier providing real time information for rowers approaching the area. This board should be simple and easy to interpret, e.g green/red depending on whether the limiting feature (assume depth in arch no. 3) is safe to navigate.
4.	Proposed Temporary Ferry Operation
	<ul style="list-style-type: none"> - SO familiar with the proposed operation so this section of the presentation was not covered.
5	Construction
	<ul style="list-style-type: none"> - SAB gave an overview of the construction methodology and sequence.
6	Construction: Preliminary Hazards and Risk Controls
	<ul style="list-style-type: none"> - SAB shared a list of the risk controls included in the current construction methodology documents. - In order to mitigate risk in the event that a rowing vessel became pinned against the Hammersmith Pontoon walkway a safety boat should be provided to offer to cover third parties during the construction phase. - An early warning buoy warning rowers transiting upstream on a flood tide of the presence of the construction works would not be desirable as this would impact on the day to day activities of FRBC and likely create an additional contact hazard. - Instead of a buoy a guard boat could be provided to warn any rowers that looked to be at risk of making contact with the installation or construction craft. This vessel should be more appropriate size than the vessel currently on station and could fulfill a combined remit of safety boat and guard boat. - The guard boat would be best positioned to the west of FRBC and east of the construction works. - SO commented that an email message (weekly frequency) to all river users warning of planned construction vessel movements would be beneficial as an additional risk control measure. This could also include a social media feed/ WhatsApp group. - Discussion held on river user liaison group and benefits of this during Fulham Western Riverside stand construction phases. - SO felt that hazards and risk controls discussed were appropriate for the current assessment scenario.
7	Operation: Preliminary Hazards and Risk Controls
	<ul style="list-style-type: none"> - SAB shared a table of the hazards and risk control measures that were identified during phase 1 and explained that the table had been filtered down to the hazards and risk mitigation that were deemed relevant to the current assessment scenario.

	<ul style="list-style-type: none">- As with the construction phase it was felt that an early warning buoy to warn of Hammersmith Pier was undesirable.- SO confirmed a guard / safety boat would mitigate against risk posed by contact and pining hazards.- SO agreed that under the current assessment scenario Barnes Pier did not present the same level of contact/pining risk to rowing craft as Hammersmith Pier.
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Notes of Meeting

Hammersmith Temporary Ferry Phase Two – Navigation Risk Assessment (20-NASH-105)

Client:	Uber Boat by Thames Clipper
Project:	Hammersmith Temporary Ferry
Venue:	Video/telecon (MS Teams)
Date of Meeting:	08-Jun-2021 (11:30– 13:00)
Present:	
RNLI - Chiswick Lifeboat Station	Wayne Bellamy - WB
NASH Maritime	Jamie Holmes - JH
NASH Maritime	Sam Anderson-Brown - SAB

1.	Introductions and Meeting Objectives
	<ul style="list-style-type: none"> - Brief introductions. - NASH Maritime appointed by Uber Boat by Thames Clipper to undertake Navigation Risk Assessment (NRA) and management services for the ferry project. - Objectives of the meeting: <ul style="list-style-type: none"> • Give an opportunity to identify gaps/where information is required and flesh out any key issues as well as discuss potential risk mitigation measures for the construction and operation phase of the project.
2.	NRA Approach
	<ul style="list-style-type: none"> - SAB outlined approach to the NRA being undertaken in 2 phases: <ul style="list-style-type: none"> • Phase 1 consisted of an initial package of work in order to identify key navigation issues/hazards and potential risk control mitigation measures for the proposed scheme (as provided by Uber Boat by Thames Clipper during tender stage) so that any findings could be incorporated (e.g. layout/design aspects) at an early stage • Phase 2 consists of a full Navigation Risk Assessment (NRA) to support the license application. - JJH and SAB explained that the initial project NRA will be based on the current operational river scenario, Hammersmith Bridge is currently closed to non-essential navigation, and rowers are currently avoiding the project area (turning in the area of River View Buoy). However, the ferry project recognises that this assessment scenario is likely to change throughout the lifecycle of the project and there will be a need to refresh and update the NRA with additional hazards and associated risk control measures in the future. - In order to facilitate dynamic consultation (in response to a change in assessment scenario) throughout the lifecycle of the project a River User Liaison Group (RULG) will be established. This group will assist in the identification of additional hazards and risk controls as well as providing feedback on the effectiveness of existing risk control measures. - SAB outlined the stakeholders that will be consulted during this initial NRA and those additional stakeholders that will be invited to join the RULG.

	<ul style="list-style-type: none"> - WB commented that in due course it would make sense to involve representatives of houseboat and narrowboat owners and suggested Libby Bradshaw from the Inland Waterways Association would be a good contact. - WB suggested that Latymer and St Paul's schools rowing clubs be invited to join the RULG as their activity takes place at different time to the other rowing clubs and the user risk profile is different.
3.	Proposed Design layout and Design
	<ul style="list-style-type: none"> • JJH explained that the Barnes and Hammersmith pier designs were optimised during the tender stage to minimise impact on navigation where possible. • WB asked whether the existing Tideway Code would be amended once the pontoons were in position. JJH clarified that any amendments / appendages to the code would likely be developed as part of the work carried out by the RULG. • The premise of the proposed location and alignment of Barnes Pier seeks to enable continued use of the inshore/Surrey span (arch no. 3) of Hammersmith Bridge. For this reason, the brow (linking Barnes Pier to the shore) has also been designed to incorporate transits of unpowered recreational craft (principally rowers) to pass between the shore and pier (the backspan) • The following assumptions are considered a reasonable basis of required room: headroom (1.5m) depth (0.4m) and beam (7m) based on a rowing 8. • The backspan would be navigable at almost all states of tide. However, the limiting factor as to whether navigation of the backspan is practicable will be the available depth under arch no. 3 of Hammersmith Bridge. • A tide gauge board showing whether arch no. 3 is navigable could be affixed to the downstream pile of the Hammersmith pier providing real time information for rowers approaching the area. This board should be simple and easy to interpret, e.g green/red depending on whether the limiting feature (assume depth in arch no. 3) is safe to navigate. • WB commented that it would be desirable to have an additional gauge board further downstream marked in the same way. Rowers face backwards and may not notice the gauge board on the pier until too late. JJH commented that Thames Regional Rowing Council (TRRC) and Fulham Reach Boat Club (FRBC) had indicated that additional obstructions in the navigation were undesirable. However, WB pointed out that there are existing piles that could be utilised. • WB enquired as to whether the Hammersmith Pier could be utilised for casualty transfer. JJH and Sab advised that Beckett Rankine and Uber Boat by Thames Clippers would be best to advise on this matter and agreed to pass the request on to the relevant parties.
4.	Proposed Temporary Ferry Operation
	<ul style="list-style-type: none"> - WB familiar with the proposed operation. SAB presented a brief overview.
5	Construction
	<ul style="list-style-type: none"> - SAB gave an overview of the construction methodology and sequence.
6	Construction: Preliminary Hazards and Risk Controls
	<ul style="list-style-type: none"> - SAB shared a list of the risk controls included in the current construction methodology documents. - WB requested that the ferry vessels display their existing amber flashing lights during operational times to ensure they are easily seen when navigating at night and in poor visibility. - WB noted that (in scenario when bridge re-opens to rowers) when a vessel is alongside Barnes Pier the use of Arch 2 may change and discussion held on the principle that the Tideway Code may require temporary revision/amendment. WB

	<p>highlighted there was a risk that rowers heading upstream on a flood tide could be pushed on to the Hammersmith walkway by the tidal set and that lack of awareness from not looking over shoulder at upcoming works could exacerbate this risk. WB suggested that an early warning mark buoy or pile (similar to the mark warning of the presence of Dove Pier) be installed. SAB commented that consultation with FRBC had revealed that an additional mark in the vicinity of FRBC was considered to be undesirable because such a mark would create an additional contact hazard and impact on the clubs day to day activities. Instead of a buoy a guard boat could be provided to warn any rowers that looked to be at risk of making contact with the installation or construction craft. This vessel should be of a more appropriate size than the vessel currently on station and could fulfill a combined remit of safety boat and guard boat.</p> <ul style="list-style-type: none"> - WB agreed that a guard boat would be an effective risk control measure and would likely be proportionate to the level or risk during the construction phase and future operational scenarios.
7	<p>Operation: Preliminary Hazards and Risk Controls</p>
	<ul style="list-style-type: none"> - SAB shared a table of the hazards and risk control measures that were identified during phase 1 and explained that the table had been filtered down to the hazards and risk mitigation that were deemed relevant to the current assessment scenario.

ANNEX C – CONSTRUCTION HAZARD LOGS

Assessment Title	Hammersmith Temporary Ferry - Phase 1 NRA (Construction)
Assessment Date	14/06/2021
Version	001_00

Average Inherent	6.8
Average Residual	3.8

Risk Score Matrix						Total Risk Score
Almost	2	10	20	30	40	1-3
Likely	4	8	12	16	20	4-8
Possible	6	6	12	18	24	9-14
Unlikely	4	4	8	12	16	15-19
Rare	2	2	4	6	8	20-25
Likelihood	Minor	Moderate	Serious	Very Serious	Severe	Severity

Hazard ID #	Inherent Risk	Residual Risk	Hazard Description	Hazard type	Comments on Disposition	Cause	Consequence	Inherent Risk			Additional Risk Control Measures	Residual Risk		
								Likelihood	Severity	Score		Likelihood	Severity	Score
Haz Id #1	6	2	Project construction vessel makes contact with Hammersmith Bridge	Contact	Project construction vessel makes contact with Hammersmith Bridge, the most likely cause of such an event would be a mechanical failure or breakout as a result of wash created by passing traffic or adverse weather conditions.	Master / Skipper error Mechanical defect / failure Adverse weather conditions / reduced visibility Breakout due to passing vessel wash	MOST LIKELY OUTCOME - No injuries - Minor damage to vessel - No damage to Hammersmith Bridge - Negligible impact on the environment with no lasting effects - Unlikely to generate any adverse publicity REASONABLE WORST CREDIBLE OUTCOME - Possibility of major injuries to crew and workers - Moderate damage to vessel - Moderate damage to Hammersmith Bridge - Slight impact on the environment with no lasting effects (Tier 1) - Local / National adverse publicity	2	2	4	No additional risk controls applied	2	2	4
Haz Id #2	4	2	Powered third party vessel makes contact with project infrastructure / construction works	Contact	Hammersmith Pier / Pontoon Walkway - A powered third party vessel navigating downstream on an ebb tide could be taken off course by the tidal set (which will push vessels toward the northern bank) and could make contact with partially installed pile, Hammersmith Pier and/or floating walkway. It is likely that such a vessel would aim for the centre of arch #2 Hammersmith Bridge in order to pass under the bridge at the point of maximum headway. A significant alteration of course to starboard (and management of speed/power) may be required to pass the pier infrastructure and/or construction works at a safe distance and avoid being pushed onto it by the tidal set. This hazard is likely most applicable to large unpowered recreational vessels such as Dutch barges, narrowboats or houseboats. Barnes Pier - The likelihood of a powered third-party vessel making contact with the Barnes Pier infrastructure or construction works is considered to be less significant as the tidal set will push vessels north and away from the pier. The point of greatest headway under Hammersmith Bridge is at the centre span of arch #2 and aligned with the northern extremity of the authorised channel. Vessels aligning with the centre point of arch #2 are likely to remain well clear of Barnes Pier.	Master / Skipper error Mechanical defect / failure Adverse weather conditions / reduced visibility Action of the tidal stream Human error	MOST LIKELY OUTCOME - No injuries - Minor damage to vessel - No damage to Hammersmith Bridge - Negligible impact on the environment with no lasting effects - Unlikely to generate any adverse publicity REASONABLE WORST CREDIBLE OUTCOME - Possibility of major injuries and/or fatalities to crew and construction workers - Major damage to vessel - Major damage to Hammersmith pontoon / walkway - Slight impact on the environment with no lasting effects (Tier 1) - Local / National adverse publicity	2	4	8	1 Promulgation and dissemination of information 2 River User Liaison Group 3 Guard Boat (equipped to also perform the function of a safety boat) 5 Information provided to vessels booking a downstream Hammersmith Bridge transit 7 Signage warning of Hammersmith Pier infrastructure and construction works	1	4	4
Haz Id #3	1	2	Unpowered recreational vessel makes contact with project infrastructure / construction works	Contact	Hammersmith Pier / Pontoon Walkway - Unpowered craft approaching Fulham Reach Boat Club from the east and transiting upstream on the Flood tide (as per the Tideway Code) may be pushed on to the partially installed project infrastructure (most likely the floating walkway) or construction works by the flood tide set. Barnes Pier - The risk of unpowered craft making contact with the partially installed Barnes infrastructure is considered to be far less significant as unpowered craft are currently not permitted to transit Hammersmith Bridge and therefore are not frequently navigating in the immediate vicinity of Barnes Pier. In addition the tidal set will push vessels to the north, away from the location of the Barnes pier construction works.	Master / Skipper error Mechanical defect / failure Adverse weather conditions / reduced visibility Action of the tidal stream	MOST LIKELY OUTCOME - Minor injuries - Minor damage to vessel - No damage to Hammersmith Pier infrastructure. - Negligible impact on the environment with no lasting effects - Unlikely to generate any adverse publicity REASONABLE WORST CREDIBLE OUTCOME - Possibility of multiple major injuries and a fatality - Major damage to vessel / damage to vessel - Minimal damage to Hammersmith Pier infrastructure. - Slight impact on the environment with no lasting effects (Tier 1) - National adverse publicity	2	5	10	1 Promulgation and dissemination of information 2 River User Liaison Group 3 Guard Boat (equipped to also perform the function of a safety boat) 6 Communication of Construction vessel movements and programme	1	4	4
Haz Id #4	9	8	Project construction vessel grounds during works	Grounding	The works involve vessels navigating close to the shore in shallow water. Certain parts of the operation such as the installation of the Hammersmith EZ dock walkway will only be possible at high tide for a limited tidal window. Project construction vessels risk grounding in these shallow waters.	Master / Skipper error Mechanical defect / failure Adverse weather conditions / reduced visibility Action of the tidal stream Breakout due to passing vessel wash Human error	MOST LIKELY OUTCOME - No injuries - No damage to vessel - No damage to infrastructure - No impact on the environment with no lasting effects - Unlikely to generate any adverse publicity REASONABLE WORST CREDIBLE OUTCOME - No injuries to crew and workers - Moderate damage to vessel - No damage to infrastructure - Slight impact on the environment with no lasting effects (Tier 1) - No adverse publicity	3	1	4	No additional risk controls applied	3	1	4
Haz Id #5	6	9	Third party vessel (inc unpowered recreational) grounds as a result of avoiding collision with project construction vessel or construction works.	Grounding	Hammersmith Bridge is closed to navigation other than essential transits that are permitted on a controlled transit basis. Therefore there will be limited traffic passing the site. In all likelihood vessels needing to take avoiding action would already have deviated from the authorised channel potentially as a result of a mechanical failure, Master / Skipper error or action of the tidal stream.	Master / Skipper error Mechanical defect / failure Adverse weather conditions / reduced visibility Action of the tidal stream	MOST LIKELY OUTCOME - No injuries - No damage to vessel - No damage to infrastructure - No impact on the environment with no lasting effects - Unlikely to generate any adverse publicity REASONABLE WORST CREDIBLE OUTCOME - Minor injuries to crew and workers - Moderate damage to vessel - No damage to infrastructure - Slight impact on the environment with no lasting effects (Tier 1) - No adverse publicity	2	2	4	1 Promulgation and dissemination of information 2 River User Liaison Group 3 Guard Boat (equipped to also perform the function of a safety boat) 4 Controlled transit list provided 5 Information provided to vessels booking a downstream Hammersmith Bridge transit 6 Communication of Construction vessel movements and programme 7 Signage warning of Hammersmith Pier infrastructure and construction works	1	2	4
Haz Id #6	6	2	Collision between project construction vessels	Collision	Project construction vessels collide whilst transiting construction site area.	Master / Skipper error Mechanical defect / failure Adverse weather conditions / reduced visibility Action of the tidal stream Breakout due to passing vessel wash	MOST LIKELY OUTCOME - No injuries - No damage to vessel - No damage to infrastructure - No impact on the environment with no lasting effects - Unlikely to generate any adverse publicity REASONABLE WORST CREDIBLE OUTCOME - Minor injuries to multiple workers / MCS - Moderate damage to vessel - No damage to infrastructure - Slight impact on the environment with no lasting effects (Tier 1) - No adverse publicity	2	2	4	No additional risk controls applied	2	2	4

Inherent likelihood 2 or 1

Haz ID #7	4	2	Collision between project construction vessel and third party powered vessel.	Collision	Hammersmith Bridge is closed to navigation other than essential transits that are permitted on a controlled transit basis. Therefore there will be limited traffic passing the site. As the works are taking place predominantly outside the authorised channel a third party powered vessel would likely have deviated from a normal course in order for a collision with a construction vessel to occur. Collisions are most likely to occur on a strong ebb tide when a third-party vessel is transiting downstream and a construction vessel is crossing between the Hammersmith and Barnes Pier sites. Line of site from the Barnes side is particularly and it is possible that a tug master looking to cross the river may not see an oncoming vessel.	Master / Skipper error Mechanical defect / failure Adverse weather conditions / reduced visibility Action of the tidal stream Breakout due to passing vessel wash Avoidance of third party vessel Human error	<p>MOST LIKELY OUTCOME</p> <ul style="list-style-type: none"> - Minor injuries - Minor damage to vessel construction and third party vessels. - No damage to Hammersmith or Barnes Pier infrastructure. - Slight impact on the environment with no lasting effects (Tier 1) - Unlikely to generate any adverse publicity <p>REASONABLE WORST CREDIBLE OUTCOME</p> <ul style="list-style-type: none"> - Possibility of multiple major injuries to crew and workers / possible MOB. - Major damage to construction and third party vessel. - No Damage to Hammersmith or Barnes Pier infrastructure. - Limited impact on environment with short term impacts - Local / National adverse publicity 	2	4	8	<p>1 Promulgation and dissemination of information</p> <p>2 River User Liaison Group</p> <p>3 Guard Boat (equipped to also perform the function of a safety boat)</p> <p>4 Controlled transit list provided</p> <p>5 Information provided to vessels booking a downstream Hammersmith Bridge transit</p> <p>6 Communication of Construction vessel movements and programme</p> <p>7 Signage warning of Hammersmith Pier infrastructure and construction works</p>	1	4	4
Haz ID #8	1	1	Collision between project construction vessel and unpowered recreational vessel.	Collision	Unpowered recreational vessels are not permitted to transit Hammersmith Bridge. As a result vessels of this category are not likely to navigate passed or in the immediate vicinity of the construction site. Most rowing craft turn downstream of the construction site near the River View buoy. However, a strong ebb tide could push an inexperienced crew or a crew that has experienced equipment failure in to the path of a project construction vessel.	Master / Skipper error Mechanical defect / failure Adverse weather conditions / reduced visibility Action of the tidal stream Human error	<p>MOST LIKELY OUTCOME</p> <ul style="list-style-type: none"> - Minor injuries - Minor damage to unpowered - No damage to Hammersmith or Barnes Pier infrastructure. - No impact on the environment with no lasting effects (Tier 1) - local adverse publicity <p>REASONABLE WORST CREDIBLE OUTCOME</p> <ul style="list-style-type: none"> - Possibility of multiple severe injuries / multiple fatalities to crew. - Major damage to construction and third party vessel. - No Damage to Hammersmith or Barnes Pier infrastructure. - No impact on the environment with no lasting effects - Local / National adverse publicity 	2	5	10	<p>1 Promulgation and dissemination of information</p> <p>2 River User Liaison Group</p> <p>3 Guard Boat (equipped to also perform the function of a safety boat)</p> <p>4 Controlled transit list provided</p> <p>5 Information provided to vessels booking a downstream Hammersmith Bridge transit</p> <p>6 Communication of Construction vessel movements and programme</p> <p>7 Signage warning of Hammersmith Pier infrastructure and construction works</p> <p>No additional controls applied</p>	1	5	5
Haz ID #9	1	2	Unpowered recreational vessel pinned against project infrastructure / construction works	Pinning	Unpowered craft approaching Hammersmith Pier from the east and transiting upstream on the Flood tide may be pushed on to the Hammersmith infrastructure or construction works (most likely the floating walkway) by the flood tide set, once contact is made it is possible the vessel will then be pinned against the walkway and could capsize resulting in a potential multiple MOB. This hazard is differentiated from Haz ID 3 as a result of concern raised by the local rowing community that contact by a unpowered recreational vessel may result in pinning of the vessel against the project infrastructure or construction works.	Master / Skipper error Mechanical defect / failure Adverse weather conditions / reduced visibility Action of the tidal stream Avoidance of third party vessel Human error	<p>MOST LIKELY OUTCOME</p> <ul style="list-style-type: none"> - Minor injuries - Minor damage to unpowered - No damage to Hammersmith or Barnes Pier infrastructure. - No impact on the environment with no lasting effects (Tier 1) - local adverse publicity <p>REASONABLE WORST CREDIBLE OUTCOME</p> <ul style="list-style-type: none"> - Possibility of multiple severe injuries / multiple fatalities to crew. - Minimal damage to construction vessel major damage to third party recreational vessel. - No Damage to Hammersmith or Barnes Pier infrastructure. - No impact on the environment with no lasting effects - Local / National adverse publicity 	2	5	10	<p>1 Promulgation and dissemination of information</p> <p>2 River User Liaison Group</p> <p>3 Guard Boat (equipped to also perform the function of a safety boat)</p>	1	4	4

ANNEX D – OPERATION HAZARD LOGS

Assessment Title	Hammersmith Temporary Ferry - Phase 1 NBA (Operation)
Assessment Date	14/06/2021
Version	03.00

Average Likelihood	7.4
Average Residual	4.2

Risk Score Matrix					Total Risk Score	
Almost Certain	5	10	15	20	25	1-3
Likely	4	8	12	16	20	4-8
Possible	3	6	9	12	15	9-14
Unlikely	2	4	6	8	10	15-19
Rare	1	3	4	6	8	20-25
Likelihood	Minor	Moderate	Serious	Very Serious	Severe	Severity

Hazard ID	Inherent Risk	Residual Risk	Hazard Description	Hazard type	Comments on Disposition	Cause	Consequence	Inherent Risk			Additional Risk Control Measures	Residual Risk		
								Likelihood	Severity	Score		Likelihood	Severity	Score
Haz Id #1	7	4	Project vessel makes contact with Hammersmith Bridge, Barnes Pier or Hammersmith Pier (no piles)	Contact	Project vessel makes contact with Hammersmith Bridge, Barnes Pier or Hammersmith Pier. The most likely causes of such an event would be a mechanical failure, master skipper error or reduced visibility due to navigation at night fog / adverse weather conditions.	Master / Skipper error Mechanical defect / failure Adverse weather conditions / reduced visibility Action of the tidal stream	MOST LIKELY OUTCOME - No injuries - Minor damage to vessel - No damage to Hammersmith Bridge - Negligible impact on the environment with no lasting effects - Unlikely to generate any adverse publicity REASONABLE WORST CREDIBLE OUTCOME - Possibility of minor injuries to crew and passengers - Moderate damage to vessel - Moderate damage to Hammersmith Bridge - Slight impact on the environment with no lasting effects (Tier 1)	2	2	4	6 Aids to Navigation (lighting) 8 Detailed passage plan submitted to PLA	2	2	4
Haz Id #2	5	4	Powered third party vessel makes contact with project infrastructure	Contact	Hammersmith Pier and Walkway - A powered third party vessel navigating downstream on an ebb tide could be taken off course by the tidal set (which will push vessels toward the northern bank) and could make contact with the Hammersmith Pier and/or floating walkway. It is likely that such a vessel would aim for the centre of arch #2 Hammersmith Bridge in order to pass under the bridge at the point of maximum headway. A significant alteration of course to starboard (and management of speed/power) may be required to pass the pier at a safe distance and avoid being pushed onto it by the tidal set. The hazard is likely most applicable to large unpowered recreational vessels such as Dutch barges, narrowboats or houseboats Barnes Pier - The likelihood of a powered third-party vessel making contact with the Barnes Pier is considered to be less significant as the tidal set will push vessels north and away from the pier. The point of greatest headway under Hammersmith Bridge is at the centre span of arch #2 and aligned with the northern extremity of the authorised channel. Vessels aligning with the centre point of arch #2 are likely to remain well clear of Barnes Pier.	Master / Skipper error Mechanical defect / failure Adverse weather conditions / reduced visibility Action of the tidal stream	MOST LIKELY OUTCOME - no injuries - Minor damage to vessel - No damage to Hammersmith Bridge - Negligible impact on the environment with no lasting effects - Unlikely to generate any adverse publicity REASONABLE WORST CREDIBLE OUTCOME - Possibility of major injuries to crew / passengers - Major damage to vessel - Major damage to Hammersmith pontoon / walkway - Slight impact on the environment with no lasting effects (Tier 1) - Local / National adverse publicity	2	4	8	2 Promulgation and dissemination of information 2 River User Liaison Group 3 Guard boat (equipped to also perform the function of a safety boat) 5 Information provided to vessels booking a downstream Hammersmith Bridge transit 6 Aids to Navigation (lighting) 7 Signage warning of Hammersmith Pier	1	4	4
Haz Id #3	2	4	Unpowered recreational vessel makes contact with project infrastructure	Contact	Hammersmith Pier and Walkway - Unpowered craft approaching Fulham Reach Boat Club from the east and transiting upstream on the Flood tide (as per the Tideway Code) may be pushed on to the Hammersmith Pier and/or floating walkway (more likely the floating walkway) by the flood tide set. Barnes Pier - The risk of unpowered craft making contact with the Barnes Pier is considered to be far less significant as unpowered craft are currently not permitted to transit Hammersmith Bridge and therefore are not frequently navigating in the immediate vicinity of Barnes Pier. In addition the tidal set will push vessels to the north, away from the location of the Barnes Pier.	Master / Skipper error Action of the tidal stream Adverse weather conditions	MOST LIKELY OUTCOME - Minor damage to vessel - No damage to Hammersmith Pier infrastructure - Negligible impact on the environment with no lasting effects - Unlikely to generate any adverse publicity REASONABLE WORST CREDIBLE OUTCOME - Possibility of multiple major injuries and fatalities - Major damage to vessel damage to vessel - Minimal damage to Hammersmith Pier infrastructure - Slight impact on the environment with no lasting effects (Tier 1)	2	5	10	3 Promulgation and dissemination of information 2 River User Liaison Group 3 Guard boat (equipped to also perform the function of a safety boat) 6 Aids to Navigation (lighting)	1	4	4
Haz Id #4	3	3	Project vessel grounds whilst in operation	Grounding	Depths alongside Hammersmith and Barnes Pier are limited and there is a risk that project vessels could ground when coming alongside at low water.	Master / Skipper error Mechanical defect / failure Adverse weather conditions / reduced visibility Action of the tidal stream Avoidance of third party vessel Human error Adverse weather conditions	MOST LIKELY OUTCOME - No injuries - No damage to vessel - No damage to infrastructure - No impact on the environment with no lasting effects - Potential for adverse publicity REASONABLE WORST CREDIBLE OUTCOME - No injuries to crew or passengers - Minor damage to vessel - No damage to infrastructure - Slight impact on the environment with no lasting effects (Tier 1)	3	1		6 Aids to Navigation (lighting) 8 Detailed passage plan submitted to PLA 9 Tidal Gauge Boards (depth alongside)	2	1	
Haz Id #5	3	3	Third party vessel grounds as a result of avoiding collision with project vessel	Grounding	Hammersmith Bridge is closed to navigation other than essential transits that are permitted on a controlled transit basis. Therefore there will be limited traffic passing the site. Vessels transiting downstream on an ebb tide will be travelling at a relatively high speed and line of site beyond Hammersmith Bridge is poor. Line of site for the Ferry Master looking to depart Barnes Pier is poor when looking for approaching traffic to the west as Hammersmith Bridge obscures the view upstream. Passing vessels may be forced to take avoiding action which could result in grounding.	Master / Skipper error Adverse weather conditions / reduced visibility Action of the tidal stream Avoidance of third party vessel Human error	MOST LIKELY OUTCOME - No injuries - No damage to vessel - No damage to infrastructure - No impact on the environment with no lasting effects - Unlikely to generate any adverse publicity REASONABLE WORST CREDIBLE OUTCOME - No injuries to crew - Moderate damage to vessel - No damage to infrastructure - Slight impact on the environment with no lasting effects (Tier 1)	2	2	4	5 Promulgation and dissemination of information 2 River User Liaison Group 3 Guard boat (equipped to also perform the function of a safety boat) 4 Controlled transit list provided 5 Information provided to vessels booking a downstream Hammersmith Bridge transit 6 Aids to Navigation (lighting) 8 Detailed passage plan submitted to PLA	1	2	
Haz Id #6	4	4	Collision between project vessels	Collision	The ferry vessels will be working in close proximity and at low speed as they utilise the tidal stream to transit between the two piers. During peak times two vessels will operate. In the event of a mechanical breakdown or that a project vessel has to take avoiding action to avoid a third party vessel it is possible that a collision will occur between the two project vessels.	Master / Skipper error Mechanical defect / failure Adverse weather conditions / reduced visibility Action of the tidal stream Avoidance of third party vessel Adverse weather conditions	MOST LIKELY OUTCOME - No injuries - Minor damage to vessel - No damage to infrastructure - No impact on the environment with no lasting effects - Possible local adverse publicity REASONABLE WORST CREDIBLE OUTCOME - Minor injuries to passengers and/or crew - Moderate damage to vessel - No damage to infrastructure - Slight impact on the environment with no lasting effects (Tier 1)	3	2	6	4 Controlled transit list provided 8 Detailed passage plan submitted to PLA	2	2	4
Haz Id #7	1	1	Collision between project vessel and third party powered vessel.	Collision	Hammersmith Bridge is closed to navigation other than essential transits that are permitted on a controlled transit basis. Therefore there will be limited traffic passing the site. Vessels transiting downstream on an ebb tide will be travelling at a relatively high speed and line of site beyond Hammersmith Bridge is poor. Line of site for the Ferry Master looking to depart Barnes pier is poor when looking for approaching traffic to the west as Hammersmith Bridge obscures the view upstream. Passing vessels may be forced to take avoiding action which could result in grounding or contact.	Master / Skipper error Mechanical defect / failure Adverse weather conditions / reduced visibility Action of the tidal stream Avoidance of third party vessel Human error	MOST LIKELY OUTCOME - Minor injuries - Minor damage to vessel construction and third party vessels. - No damage to Hammersmith or Barnes Pier infrastructure - Slight impact on the environment with no lasting effects (Tier 1) - Unlikely to generate any adverse publicity REASONABLE WORST CREDIBLE OUTCOME - Possibility of multiple major injuries to passengers and crew / possible MOB. - Major damage to construction and third party vessel. - No Damage to Hammersmith or Barnes Pier infrastructure. - Limited impact on environment with short term impacts	3	4	12	7 Promulgation and dissemination of information 2 River User Liaison Group 3 Guard boat (equipped to also perform the function of a safety boat) 4 Controlled transit list provided 5 Information provided to vessels booking a downstream Hammersmith Bridge transit 6 Detailed passage plan submitted to PLA	2	4	8

Haz Id #8	2	2	Collision between project vessel and unpowered recreational vessel	Collision	Unpowered recreational craft are not permitted to transit Hammersmith Bridge. As a result unpowered recreational vessels are not likely to navigate passed or in the immediate vicinity of the construction site. Most rowing craft turn downstream of the construction site near the River View buoy. However, a strong ebb tide could push an inexperienced crew or a crew that has experienced equipment failure in to the path of a project vessel, this could result in a collision event.	Master / Skipper error Mechanical defect / failure Adverse weather conditions / reduced visibility Action of the tidal stream Avoidance of third party vessel Human error Adverse weather conditions	<p>MOST LIKELY OUTCOME</p> <ul style="list-style-type: none"> - Minor injuries - Minor damage to unpowered - No damage to Hammersmith or Barnes Pier infrastructure. - No impact on the environment with no lasting effects (Tier 1) - local diverse publicity <p>REASONABLE WORST CREDIBLE OUTCOME</p> <ul style="list-style-type: none"> - Possibility of multiple severe injuries / multiple fatalities to unpowered craft crew. - Minimal damage to construction vessel major damage to third party recreational vessel. - No Damage to Hammersmith or Barnes Pier infrastructure. 	2	5	10	<p>5 Promulgation and dissemination of information</p> <p>2 River User Liaison Group</p> <p>3 Guard boat (equipped to also perform the function of a safety boat)</p>	1	5	5
Haz Id #9	2	2	Unpowered recreational vessel pinned against project infrastructure	Pinning	Unpowered craft approaching Hammersmith Pier from the east and transiting upstream on the Flood tide may be pushed on to the Hammersmith Pier or floating walkway (most likely the floating walkway) by the flood tide set, once contact is made it is possible the vessel will then be pinned against the walkway and could capsize resulting in a potential multiple MOB. This hazard is differentiated from Haz ID 3 as a result of concern raised by the local rowing community that contact by an unpowered recreational vessel may result in pinning of the vessel against the project infrastructure.	Master / Skipper error Mechanical defect / failure Adverse weather conditions / reduced visibility Action of the tidal stream Avoidance of third party vessel Human error Adverse weather conditions	<p>MOST LIKELY OUTCOME</p> <ul style="list-style-type: none"> - Minor injuries - Minor damage to unpowered - No damage to Hammersmith or Barnes Pier infrastructure. - No impact on the environment with no lasting effects (Tier 1) - local diverse publicity <p>REASONABLE WORST CREDIBLE OUTCOME</p> <ul style="list-style-type: none"> - Possibility of multiple severe injuries / multiple fatalities to unpowered craft crew. - Major damage to construction and third party vessel. - No Damage to Hammersmith or Barnes Pier infrastructure. - No impact on the environment with no lasting effects 	2	5	10	<p>9 Promulgation and dissemination of information</p> <p>2 River User Liaison Group</p> <p>3 Guard boat (equipped to also perform the function of a safety boat)</p>	1	5	5