



## Application for Development Consent

Application Reference Number: WWO10001

# Navigational Issues and Preliminary Risk Assessment

Doc Ref: **7.20.02**

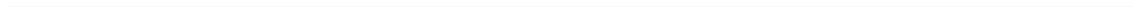
## Blackfriars Bridge Forshore - Annexes: Hazard Logs

APFP Regulations 2009: Regulation **5(2)(q)**

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January 2013

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## Annexes

### List of annexes in order

**Annex A: Hazard log introduction**

**Annex B: Most likely hazard list – Phase A: Construction of cofferdam**

**Annex C: Most likely hazard list – Phase B: Construction of drop shaft/culvert/connections**

**Annex D: Most likely hazard list - Phase C: Removal of cofferdam**

**Annex E: Most likely hazard list - Phase D: Permanent work site**

## Annex A – Hazard log introduction

### A.1 Construction Phases

A.1.1 The assessment has been divided into 4 distinct project phases to allow for assessment of hazards and the proposal of risk reduction measures commensurate with the risk posed by different operations associated with the project. These are:

- Phase A - Construction of cofferdam
- Phase B - Construction of drop shaft/culvert/connections
- Phase C - Removal of cofferdam
- Phase D – Permanent works site.

### A.2 Risk assessment criteria

A.2.1 **Risk Matrix** - The following risk matrix has been used to provide a risk score that combines severity of a particular consequence together with the probability of the consequence occurring.

Likelihood	1 - Rare	1	2	3	4	5
	2 - Unlikely	2	4	6	8	10
	3 - Possible	3	6	9	12	15
	4 - Likely	4	8	12	16	20
	5 - Almost Certain	5	10	15	20	25
Severity		Level 1	Level 2	Level 3	Level 4	Level 5

A.2.2 **Risk Classification** – The risk score indicates the magnitude and acceptability of the risk in accordance with the ALARP principle.

Score	Classification	Definition
1 - 2	Slight	No Action is required
3 - 4	Minor	No additional controls are required, monitoring is required to ensure no changes in circumstances
5 - 9	Moderate	Efforts should be made to reduce risk to 'As Low As Reasonably Practicable' (ALARP). Job can be performed under direct supervision of Senior Officer
10 - 14	High	Efforts should be made to reduce risk to 'As Low As Reasonably Practicable' (ALARP). Job can only be performed after authorisation from Harbour Master and after further additional

		controls required under the circumstances
15 - 25	Extreme	Intolerable risk. Job is not authorised

A.2.3 **Severity** – The criteria used throughout this assessment has been provided by the Port of London Authority. It identifies four distinct areas of risk with the probable consequences associated with each hazard assessed in terms of harm or loss to:

- People (life);
- Environment;
- Operational Impact, and;
- Media Attention.

People	Level
First aid case / Medical treatment case	1
Restricted work case	2
Lost Time Injury / Moderate permanent partial disability injury	3
Single Fatality / Severe permanent partial disability	4
Multiple fatalities	5

Operational Impact	Level
Insignificant or no damage to vessel / equipment	1
Minor or superficial damage to vessel / equipment	2
Moderate damage to vessel / equipment requiring immediate repairs	3
Major damage to vessel / equipment and detention	4
Very serious damage to vessel or equipment possible criminal proceedings	5

Environment	Level
Low impact with no lasting effect	1
Temporary effect / Minor effect to small area	2
Short to medium term impact	3
Medium to long term effect / large area affected	4
Long term impact / severe impact on sensitive area	5

Media Attention	Level
No Coverage	1
Local coverage	2
Regional coverage	3
National coverage	4
International coverage	5

## Annex B – Most likely hazard log: Phase A - Construction of cofferdam

### B.1 Most likely summary hazard list: Phase A - Construction of cofferdam

Hazard Id	Hazard Title	Hazard Description	People	Environment	Operational	Media
1A	Restricted Working - Work intrudes into authorised channel and constrains traffic	During construction of temporary cofferdam, associated infrastructure (cofferdam, jack up rig etc) extends into the authorised channel, therefore constraining available water space for existing traffic. Due to the reduced channel width a river incident occurs.	12	6	9	12
2A	Emergency Arch closure - Arch No 3	During construction of the temporary cofferdam there may be an emergency requirement to close No 3 arch.	9	6	9	9
3A	Planned arch closure - Arch No 3	During construction of the temporary cofferdam there may be a requirement to close No 3 arch for maintenance.	6	4	6	8
4A	Planned Arch closure - Arch No 2	During construction of the temporary cofferdam it is proposed that Arch No 2 is closed to all navigation.	9	6	12	12
5A	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Blackfriars Bridges.	9	6	6	9
6A	Collision with High Speed Passenger Vessel	A vessel conducting Thames Tunnel construction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Blackfriars	6	4	6	8
7A	Collision with Class V passenger vessel	A vessel conducting Thames Tunnel construction activities collides with a Class V passenger vessel in the vicinity of Blackfriars Embankment.	6	4	6	8
8A	Collision with private leisure vessel	A vessel conducting Thames Tunnel construction activities collides with a private leisure vessel in the vicinity of Blackfriars Embankment.	9	6	9	9

9A	Collision with commercial freight operator	A vessel conducting Thames Tunnel construction activities collides with a commercial freight operator in the vicinity of Blackfriars Embankment.	9	9	6	9
10A	Collision with tug and tow	A vessel conducting Thames Tunnel construction activities collides with a tug and tow in the vicinity of Blackfriars Embankment.	9	6	9	9
11A	Contact with Blackfriars Bridge (Road & Rail)	A vessel conducting Thames Tunnel construction activities makes contact with Blackfriars Road or Rail Bridge, including arches, abutments and any associated bridge superstructure.	6	3	6	6
12A	Contact - High Speed Craft / Class V passenger vessel with Temporary work site	A High Speed Craft / Class V passenger vessel comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction / removal of temporary cofferdam.	6	4	6	6
13A	Contact - Tug and Tow with Temporary work site	A Tug and Tow comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction / removal of temporary cofferdam.	6	4	6	6
14A	Contact - Private leisure vessel with Temporary work site	Private leisure vessels, including narrow boats, come into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction / removal of temporary cofferdam.	8	2	8	6
15A	Contact with moored vessel in vicinity of Blackfriars (President / Cory barges/ Passenger boat moorings etc)	A vessel in transit makes contact with a moored vessel (E.g. Moored Barge, President or moored passenger boat) in the vicinity of Blackfriars Embankment.	8	4	6	8

16A	Vessels subject to increased interaction during periods of low water	Due to the intrusion of the temporary works into the authorised channel, the available water space for vessels to manoeuvre in is reduced. At periods of low water this is particularly relevant	6	2	6	6
17A	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	6	2	6	6
18A	Contact with moored vessel at relocated Blackfriars Millennium Pier	A vessel in transit makes contact with a vessel moored at the relocated Blackfriars Millennium Pier.	8	2	8	8

## B.2 Most likely hazard list – Phase A: Construction of cofferdam

### 1A - LTTBF - Restricted Working - Work Intrudes into Authorised Channel and Constrains Traffic

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
1A - LTTBF	Restricted Working	Temporary works site, including cofferdam and associated infrastructure extends into the authorised channel, therefore constraining available water space for existing traffic.  Intrusion into authorised channel constrains available water space for existing traffic. Due to the reduced channel width a river incident occurs.	<ul style="list-style-type: none"> <li>Reduced effective river width</li> <li>Misjudgement</li> <li>Inattention</li> <li>Adverse weather conditions</li> <li>Machinery breakdown</li> <li>Collision avoidance</li> <li>Tidal set</li> <li>Change in river flow due to new in-river structure</li> <li>River Incident</li> </ul>	<ul style="list-style-type: none"> <li>Single Fatality / Severe permanent partial disability</li> <li>Temporary effect / Minor effect to small area</li> <li>Moderate damage to vessel / equipment requiring immediate repairs</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>Boat Masters Licence</li> <li>BML Local Knowledge Endorsement</li> <li>Qualified Crew</li> <li>Vessel Master Experience</li> <li>Thames AIS</li> <li>VHF Communications</li> <li>VTS Navigational Broadcast</li> <li>Permanent / Temporary Notice to Mariners</li> <li>Tug Operator Procedures</li> <li>Ship Towing Code of Practice</li> <li>Aids to Navigation</li> <li>General Directions</li> <li>Emergency Plans &amp; Procedures</li> <li>COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>Minimise the footprint of the temporary works and therefore encroachment into the channel</li> <li>Close Arch No 2 to all inward bound freight traffic</li> <li>Restrict access through Arch No 2 to certain vessels at different phases of construction</li> <li>Vessel Traffic Control Co-ordinator</li> <li>Scheduling of barge movements to assist with existing river events</li> <li>Communication and schedule planning - PLA / Thames Tunnel / Marine Sub Contractor</li> <li>Safety Work Boat in attendance during periods of restricted working</li> <li>Suspend Thames Tunnel barge operations in event of emergency arch closure</li> <li>Relocate Cory Environmental Ltd Coin Street moorings</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Code of Practice Passenger Vessel Operations on the Thames</li> <li>River Thames Recreational Users Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> <li>Ship Towing Operations on the Thames</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Assessment Notes
<ul style="list-style-type: none"> <li>Emergency closure of Arch No 3 assessed separately.</li> </ul>

## 2A - LTTBF - Emergency Arch Closure - Arch No 3

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
2A - LTTBF	Emergency Arch Closure - Arch No 3	<p>During construction of the temporary cofferdam there may be an emergency requirement to close No 3 arch.</p> <p>Due to the temporary works site intrusion into the authorised channel navigable water space will be constrained with an increase in probability of a river incident.</p>	<ul style="list-style-type: none"> <li>Emergency Bridge Arch Closure</li> <li>River Incident</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Temporary effect / Minor effect to small area</li> <li>Moderate damage to vessel / equipment requiring immediate repairs</li> <li>Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>VTS Navigational Broadcast</li> <li>VHF Communications</li> <li>Aids to Navigation</li> <li>Thames AIS</li> <li>COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>Safety boat to be in attendance maintaining a continuous VHF watch on Channel 14 in the event of Arch No 3 closure</li> <li>Navigational warning broadcast on VHF</li> <li>Suspend Thames Tunnel barge operations in event of emergency arch closure</li> <li>Maintain Arch No 4 for navigation</li> <li>Open Arch No 2 with restricted operating procedures for freight</li> <li>Relocate Cory Environmental Ltd Coin Street moorings</li> </ul>

## Pre Control - People

Severity	Probability	Risk Score	Risk Band
3	4	12	High

## Pre Control - Environment

Severity	Probability	Risk Score	Risk Band
2	4	8	Moderate

## Pre Control - Operational Impact

Severity	Probability	Risk Score	Risk Band
3	4	12	High

## Pre Control - Media Attention

Severity	Probability	Risk Score	Risk Band
3	4	12	High

## Post Control - People

Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

## Post Control - Environment

Severity	Probability	Risk Score	Risk Band
2	3	6	Moderate

## Post Control - Operational Impact

Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

## Post Control - Media Attention

Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

## Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- Port Entry Guide
- Mariners Guide to Bridges on the Tidal Thames

## Assessment Notes

- This hazard is covered in more detail within the main Blackfriars Foreshore - Maritime Issues and Navigational Risk Assessment Report.

## 3A - LTTBF - Planned Arch Closure - Arch No 3

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
3A - LTTBF	Planned Arch Closure - Arch No 3	<p>During construction of the temporary cofferdam there may be a scheduled requirement to close No 3 arch.</p> <p>Due to the temporary works site intrusion into the authorised channel navigable water space will be constrained with an increase in probability of a river incident.</p>	<ul style="list-style-type: none"> <li>Planned Bridge arch closure</li> <li>Maintenance and Inspection routines</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Temporary effect / Minor effect to small area</li> <li>Major damage to vessel / equipment and detention</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>Permanent / Temporary Notice to Mariners</li> <li>VTS Navigational Broadcast</li> <li>VHF Communications</li> <li>Aids to Navigation</li> <li>Bridge Special Signal Lights</li> <li>VTS Qualification</li> </ul>	<ul style="list-style-type: none"> <li>Scheduling of arch closures in order to facilitate minimum disruption to river users</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	6	Moderate

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	Extreme

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Port Entry Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	Minor

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	Moderate

Assessment Notes
<ul style="list-style-type: none"> <li>Inspection Routine - Road &amp; Rail Bridge <ul style="list-style-type: none"> <li>General Inspection - every 2 years</li> <li>Principal Inspection - every 6<sup>th</sup> year - requires full inspection within touching distance of all elements and therefore inspection from below is required - Arch Closure as a result.</li> </ul> </li> <li>Principal Inspection to be conducted immediately prior to work commencing</li> </ul>

## 4A - LTTBF - Planned Arch Closure - Arch No 2

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
4A - LTTBF	Planned Arch Closure - Arch No 2	<p>During construction of the temporary cofferdam it is proposed that Arch No 2 is closed to all navigation.</p> <p>Due to the temporary works site intrusion into the authorised channel navigable water space will be constrained with an increase in probability of a river incident.</p>	<ul style="list-style-type: none"> <li>Planned Bridge arch closure</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Temporary effect / Minor effect to small area</li> <li>Major damage to vessel / equipment and detention</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>Permanent / Temporary Notice to Mariners</li> <li>VTS Navigational Broadcast</li> <li>VHF Communications</li> <li>Aids to Navigation</li> <li>Bridge Special Signal Lights</li> <li>VTS Qualification</li> </ul>	<ul style="list-style-type: none"> <li>Scheduling of arch closures in order to facilitate minimum disruption to river users</li> <li>Maintain Arch No 4 to allow for navigation inbound &amp; outbound for larger and reporting vessels (in the event of an emergency).</li> <li>A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect</li> <li>Relocate the Cory Environmental moorings (currently opposite the proposed permanent works)</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	6	Moderate

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	Extreme

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	Extreme

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Port Entry Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	Moderate

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Assessment Notes
<ul style="list-style-type: none"> <li>Inspection Routine - Road &amp; Rail Bridge <ul style="list-style-type: none"> <li>General Inspection - every 2 years</li> <li>Principal Inspection - every 6<sup>th</sup> year - requires full inspection within touching distance of all elements and therefore inspection from below is required - Arch Closure as a result.</li> </ul> </li> <li>Principal Inspection to be conducted immediately prior to work commencing</li> </ul>

## 5A - LTTBF - Increased Flow

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
5A - LTTBF	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Blackfriars Bridges.	<ul style="list-style-type: none"> <li>Shape and position of temporary cofferdam</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Temporary effect / Minor effect to small area</li> <li>Moderate damage to vessel / equipment requiring immediate repairs</li> <li>Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>None identified for this hazard</li> <li>To be investigated further</li> </ul>	<ul style="list-style-type: none"> <li>3D and computational modelling</li> <li>A Notice to Mariners to advise of any increases in river flow: NTM to advise that for example: In Arch No3 the maximum flow will increase by approximately 1/2 knot during temporary works with the flow moving towards the south side of the bridge arch.</li> <li>Review and re-design temporary work structure to reduce hydrodynamic affects</li> <li>Close Arch No 2 to all inward bound freight traffic</li> <li>Restrict access through Arch No 2 to certain vessels at different phases of construction</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	6	<b>Moderate</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Port Entry Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Assessment Notes
<p>Fluvial modelling (numerical and physical) have been used to develop the design of the structure.</p> <p>Analysis of HR Wallingford fluvial modelling report indicates minimum change in flow in this area.</p> <p>Further investigation is required in order to assess latest structure design.</p>

## 6A - LTTBF - Collision with High Speed Passenger Vessel

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
6A - LTTBF	Collision with High Speed Passenger Vessel	A vessel conducting Thames Tunnel construction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Blackfriars Embankment during the construction of the temporary cofferdam.	<ul style="list-style-type: none"> <li>Reduced effective river width</li> <li>Misjudgement</li> <li>Inattention</li> <li>Non Compliance with procedures</li> <li>Lack of communications</li> <li>Adverse weather conditions</li> <li>Machinery breakdown</li> <li>Inadequate training and experience</li> <li>Tug or line failure</li> <li>Collision avoidance</li> <li>Tidal set</li> <li>Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Temporary effect / Minor effect to small area</li> <li>Moderate damage to vessel / equipment requiring immediate repairs</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>Boat Masters Licence</li> <li>BML Local Knowledge Endorsement</li> <li>General Directions</li> <li>Tug Operator Procedures</li> <li>Passage Planning</li> <li>VTS Navigational Broadcast</li> <li>Qualified Crew</li> <li>Vessel Master Experience</li> <li>Thames AIS</li> <li>HSC Code</li> <li>VHF Communications</li> <li>COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>Light Warnings - providing visual warning that barge is about to depart berth</li> <li>Sound Warnings - providing audio warning that barge is about to depart berth</li> <li>Sub-Contractors Risk Assessment</li> <li>Closure of Arch No 2 to all inward bound freight traffic</li> <li>Use of reputable and experienced marine contractor</li> <li>Berth Master</li> <li>Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity</li> <li>Berth Master to monitor VHF</li> <li>CCTV to provide additional information to Berth Master</li> </ul>

## Pre Control - People

Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

## Pre Control - Environment

Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

## Pre Control - Operational Impact

Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

## Pre Control - Media Attention

Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

## Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towing Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Code of Practice Passenger Vessel Operations on the Thames

## Post Control - People

Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

## Post Control - Environment

Severity	Probability	Risk Score	Risk Band
2	2	4	<b>Minor</b>

## Post Control - Operational Impact

Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

## Post Control - Media Attention

Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

## Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations	Welfare Amenities
Lifting operations	Movement of materials	Fire safety
Slips and trips	Mooring	

### 7A - LTTBF- Collision with Class V Passenger Vessel

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
7A - LTTBF	Collision with Class V Passenger Vessel	A vessel conducting Thames Tunnel construction activities collides with a Class V passenger vessel in the vicinity of Blackfriars Embankment, during the construction of the temporary cofferdam.	<ul style="list-style-type: none"> <li>Reduced effective river width</li> <li>Misjudgement</li> <li>Inattention</li> <li>Improper lookout</li> <li>Lack of communications</li> <li>Adverse weather conditions</li> <li>Machinery breakdown</li> <li>High density of leisure traffic</li> <li>Inadequate training and experience</li> <li>Tidal set</li> <li>Collision avoidance</li> <li>Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Temporary effect / Minor effect to small area</li> <li>Moderate damage to vessel / equipment requiring immediate repairs</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>Boat Masters Licence</li> <li>Qualified Crew</li> <li>BML Local Knowledge Endorsement</li> <li>Thames AIS</li> <li>Passage Planning</li> <li>VHF Communications</li> <li>Tug Operator Procedures</li> <li>General Directions</li> <li>Vessel Master Experience</li> <li>VTS Navigational Broadcast</li> <li>COLREGs</li> <li>Emergency Plans &amp; Procedures</li> </ul>	<ul style="list-style-type: none"> <li>Light Warnings - providing visual warning that barge is about to depart berth</li> <li>Sound Warnings - providing audio warning that barge is about to depart berth</li> <li>Use of reputable and experienced marine contractor</li> <li>Sub-Contractors Risk Assessment</li> <li>Closure of Arch No 2 to all inward bound freight traffic</li> <li>Berth Master</li> <li>Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity</li> <li>Berth Master to monitor VHF</li> <li>CCTV to provide additional information to Berth Master</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	Moderate

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> <li>Port Entry Guide</li> <li>Code of Practice Passenger Vessel Operations on the Thames</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	Minor

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	Moderate

Sub Contractors Risk Assessment												
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> <td>Welfare</td> </tr> <tr> <td>Amenities</td> <td></td> <td></td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> <td>Fire safety</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> <td></td> </tr> </table>	Working at height	Loading / Unloading operations	Welfare	Amenities			Lifting operations	Movement of materials	Fire safety	Slips and trips	Mooring	
Working at height	Loading / Unloading operations	Welfare										
Amenities												
Lifting operations	Movement of materials	Fire safety										
Slips and trips	Mooring											

## 8A - LTTAE - Contact - Commercial freight with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
8A LTTBF	Collision with Private Leisure Vessel	A vessel conducting Thames Tunnel construction activities collides with a private leisure vessel in the vicinity of Blackfriars Embankment, during the construction of the temporary cofferdam.	<ul style="list-style-type: none"> <li>Reduced effective river width</li> <li>Misjudgement</li> <li>Inattention</li> <li>Non Compliance with procedures</li> <li>Improper lookout</li> <li>Lack of communications</li> <li>Leisure traffic impedes the passage of vessel navigating the channel</li> <li>Collision avoidance</li> <li>High density of leisure traffic</li> <li>Machinery breakdown</li> <li>Change in river flow due to new in-river structure</li> <li>General lack of marine knowledge</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Temporary effect / Minor effect to small area</li> <li>Moderate damage to vessel / equipment requiring immediate repairs</li> <li>Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>Boat Masters Licence</li> <li>BML Local Knowledge Endorsement</li> <li>Vessel Master Experience</li> <li>Qualified Crew</li> <li>VHF Communications</li> <li>VTS Navigational Broadcast</li> <li>Ship Towage Code of Practice</li> <li>Tug Operator Procedures</li> <li>COLREGs</li> <li>General Directions</li> <li>Admiralty Charts</li> <li>Perm / Temp Notice to Mariners</li> <li>Emergency Plans &amp; Procedures</li> <li>Aids to Navigation</li> </ul>	<ul style="list-style-type: none"> <li>Light Warnings - providing visual warning that barge is about to depart berth</li> <li>Sound Warnings - providing audio warning that barge is about to depart berth</li> <li>Use of reputable and experienced marine contractor</li> <li>Sub-Contractors Risk Assessment</li> <li>Closure of Arch No 2 to all inward bound freight traffic</li> <li>Berth Master</li> <li>Berth Master to monitor VHF</li> <li>CCTV to provide additional information to Berth Master</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	Moderate

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>River Byelaws 1978 (as amended)</li> <li>Permanent Notice to Mariners</li> <li>River Thames Recreational Users Guide</li> <li>Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> <li>Port Entry Guide</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	Moderate

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

### 9A - LTTBF - Collision with Commercial Freight Operator

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
9A - LTTBF	Collision with commercial freight operator	A vessel conducting Thames Tunnel construction activities collides with a commercial freight operator in the vicinity of Blackfriars Embankment, during the construction of the temporary cofferdam.	<ul style="list-style-type: none"> <li>Reduced effective river width</li> <li>Misjudgement</li> <li>Inattention</li> <li>Non Compliance with procedures</li> <li>Improper lookout</li> <li>Lack of communications</li> <li>Machinery breakdown</li> <li>Collision avoidance</li> <li>High density of leisure traffic</li> <li>Leisure traffic impedes the passage of vessel navigating the channel</li> <li>Change in river flow due to new in-river structure</li> <li>Tidal set</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Short to medium term impact</li> <li>Moderate damage to vessel / equipment requiring immediate repairs</li> <li>Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>Boat Masters Licence</li> <li>Qualified Crew</li> <li>Bridge Special Signal Lights</li> <li>Emergency Plans &amp; Procedures</li> <li>VTS Navigational Broadcast</li> <li>Thames AIS</li> <li>Passage Planning</li> <li>Ship Towing Code of Practice</li> <li>BML Local Knowledge Endorsement</li> <li>Tug Operator Procedures</li> <li>Perm / Temp Notice to Mariners</li> <li>COLREGS</li> <li>General Directions</li> </ul>	<ul style="list-style-type: none"> <li>Light Warnings - providing visual warning that barge is about to depart berth</li> <li>Sound Warnings - providing audio warning that barge is about to depart berth</li> <li>Use of reputable and experienced marine contractor</li> <li>Sub-Contractors Risk Assessment</li> <li>Berth Master</li> <li>Berth Master to monitor VHF</li> <li>Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity</li> <li>CCTV to provide additional information to Berth Master</li> <li>Closure of Arch No 2 to all inward bound freight traffic</li> </ul>

#### Pre Control - People

Severity	Probability	Risk Score	Risk Band
3	4	12	High

#### Pre Control - Environment

Severity	Probability	Risk Score	Risk Band
3	4	12	High

#### Pre Control - Operational Impact

Severity	Probability	Risk Score	Risk Band
2	4	8	Moderate

#### Pre Control - Media Attention

Severity	Probability	Risk Score	Risk Band
3	4	12	High

#### Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towing Operations on the Thames
- Code of Practice for Craft Towing Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

#### Post Control - People

Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

#### Post Control - Environment

Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

#### Post Control - Operational Impact

Severity	Probability	Risk Score	Risk Band
2	3	6	Moderate

#### Post Control - Media Attention

Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

#### Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations	Welfare
Amenities	Movement of materials	Fire safety
Lifting operations	Mooring	
Slips and trips		

**10A - LTTBF - Collision with Tug and Tow**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
10A - LTTBF	Collision with tug and tow	A vessel conducting Thames Tunnel construction activities collides with a tug and tow in the vicinity of Blackfriars Embankment, during the construction of the temporary cofferdam.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Non Compliance with procedures</li> <li>• Improper lookout</li> <li>• Lack of communications</li> <li>• Machinery breakdown</li> <li>• Collision avoidance</li> <li>• High density of leisure traffic</li> <li>• Leisure traffic impedes the passage of vessel navigating the channel</li> <li>• Change in river flow due to new in-river structure</li> <li>• Tidal set</li> </ul>	<ul style="list-style-type: none"> <li>• Lost Time Injury / Moderate permanent partial disability injury</li> <li>• Temporary effect / Minor effect to small area</li> <li>• Moderate damage to vessel / equipment requiring immediate repairs</li> <li>• Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• Qualified Crew</li> <li>• Bridge Special Signal Lights</li> <li>• Emergency Plans &amp; Procedures</li> <li>• VTS Navigational Broadcast</li> <li>• Thames AIS</li> <li>• Passage Planning</li> <li>• Ship Towing Code of Practice</li> <li>• BML Local Knowledge Endorsement</li> <li>• Perm / Temp Notice to Mariners</li> <li>• Tug Operator Procedures</li> <li>• General Directions</li> <li>• COLREGS</li> </ul>	<ul style="list-style-type: none"> <li>• Light Warnings - providing visual warning that barge is about to depart berth</li> <li>• Sound Warnings - providing audio warning that barge is about to depart berth</li> <li>• Use of reputable and experienced marine contractor</li> <li>• Sub-Contractors Risk Assessment</li> <li>• Berth Master</li> <li>• Berth Master to monitor VHF</li> <li>• Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity</li> <li>• CCTV to provide additional information to Berth Master</li> <li>• Closure of Arch No 2 to all inward bound freight traffic</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	Moderate

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Pilotage Directions</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•Ship Towing Operations on the Thames</li> <li>•Code of Practice for Craft Towing Operations on the Thames</li> <li>•Port Entry Guide</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	Moderate

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

### 11A - LTTBF - Contact with Blackfriars Bridge (Road & Rail)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
11A - LTTBF	Contact with Blackfriars Bridge (Road & Rail)	A vessel conducting Thames Tunnel construction activities makes contact with Blackfriars Road or Rail Bridge, including arches, abutments and any associated bridge superstructure.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Non Compliance with procedures</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• Inadequate training and experience</li> <li>• Tug or line failure</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Restricted work case</li> <li>• Low impact with no lasting effect</li> <li>• Minor or superficial damage to vessel / equipment</li> <li>• Local coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• General Directions</li> <li>• PLA Bridge Guide</li> <li>• Passage Planning</li> <li>• Accurate Tidal Information</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Tug Operator Procedures</li> <li>• COLREGs</li> <li>• Ship Towage Code of Practice</li> <li>• Emergency Plans &amp; Procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Use of reputable and experienced marine contractor</li> <li>• Sub-Contractors Risk Assessment</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	3	3	<b>Minor</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Ship Towage Operations on the Thames</li> <li>•Code of Practice for the Safe Mooring of Vessels on the Thames</li> <li>•Code of Practice for Craft Towage Operations on the Thames</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> <li>•Port Entry Guide</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	3	3	<b>Minor</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

## 12A - LTTBF - Contact - High Speed Craft / Class V Passenger Vessel with Temporary Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
12A - LTTBF	Contact - High Speed Craft / Class V passenger vessel with Temporary work site	A High Speed Craft / Class V passenger vessel comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment.	<ul style="list-style-type: none"> <li>Reduced effective river width</li> <li>Misjudgement</li> <li>Inattention</li> <li>Adverse weather conditions</li> <li>Machinery breakdown</li> <li>High density of leisure traffic</li> <li>Collision avoidance</li> <li>Leisure traffic impedes the passage of vessel navigating the channel</li> <li>Tidal set</li> <li>Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Short to medium term impact</li> <li>Moderate damage to vessel / equipment requiring immediate repairs</li> <li>Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>Boat Masters Licence</li> <li>BML Local Knowledge Endorsement</li> <li>Qualified Crew</li> <li>Vessel Master Experience</li> <li>Permanent / Temporary Notice to Mariners</li> <li>Aids to Navigation</li> <li>VTS Navigational Broadcast</li> <li>HSC Code</li> <li>Passage Planning</li> <li>COLREGs</li> <li>VHF Communications</li> <li>Emergency Plans &amp; Procedures</li> </ul>	<ul style="list-style-type: none"> <li>Closure of Arch No 2 to all inward bound freight traffic</li> <li>Inward bound vessels use Arch No 3</li> <li>Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	Moderate

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Permanent Notice to Mariners</li> <li>Code of Practice Passenger Vessel Operations on the Thames</li> <li>Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	Minor

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	Moderate

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">Working at height</td> <td style="width: 50%;">Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

### 13A - LTTBF - Contact - Tug and Tow with Temporary Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
13A - LTTBF	Contact - Tug and Tow with Temporary work site	A Tug and Tow comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction of temporary cofferdam.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Leisure traffic impedes the passage of vessel navigating the channel</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Lost Time Injury / Moderate permanent partial disability injury</li> <li>• Short to medium term impact</li> <li>• Moderate damage to vessel / equipment requiring immediate repairs</li> <li>• Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• Passage Planning</li> <li>• Ship Towing Code of Practice</li> <li>• COLREGs</li> <li>• Oil Spill Contingency Plan</li> <li>• Tug Operator Procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Closure of Arch No 2 to all inward bound freight traffic</li> <li>• Inward bound vessels use Arch No 3</li> <li>• Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area</li> </ul>

#### Pre Control - People

Severity	Probability	Risk Score	Risk Band
3	4	12	High

#### Pre Control - Environment

Severity	Probability	Risk Score	Risk Band
2	4	8	Moderate

#### Pre Control - Operational Impact

Severity	Probability	Risk Score	Risk Band
3	4	12	High

#### Pre Control - Media Attention

Severity	Probability	Risk Score	Risk Band
3	4	12	High

#### Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towing Operations on the Thames
- Code of Practice for Craft Towing Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

#### Post Control - People

Severity	Probability	Risk Score	Risk Band
3	2	6	Moderate

#### Post Control - Environment

Severity	Probability	Risk Score	Risk Band
2	2	4	Minor

#### Post Control - Operational Impact

Severity	Probability	Risk Score	Risk Band
3	2	6	Moderate

#### Post Control - Media Attention

Severity	Probability	Risk Score	Risk Band
3	2	6	Moderate

#### Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

- |                    |                                |
|--------------------|--------------------------------|
| Working at height  | Loading / Unloading operations |
| Lifting operations | Movement of materials          |
| Slips and trips    | Mooring                        |
| Fire safety        | Welfare Amenities              |

### 14A - LTTBF - Contact - Private Leisure Vessel with Temporary Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
14A - LTTBF	Contact - Private leisure vessel with Temporary work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction of temporary cofferdam.	<ul style="list-style-type: none"> <li>Reduced effective river width</li> <li>Misjudgement</li> <li>Inattention</li> <li>Improper lookout</li> <li>Lack of communications</li> <li>Adverse weather conditions</li> <li>Machinery breakdown</li> <li>High density of leisure traffic</li> <li>Collision avoidance</li> <li>Tidal set</li> <li>Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>Single Fatality / Severe permanent partial disability</li> <li>Low impact with no lasting effect</li> <li>Major damage to vessel / equipment and detention</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>Aids to Navigation</li> <li>VHF Communications</li> <li>COLREGs</li> <li>General Directions</li> <li>Permanent / Temporary Notice to Mariners</li> <li>VTS Navigational Broadcast</li> </ul>	<ul style="list-style-type: none"> <li>Closure of Arch No 2 to all inward bound freight traffic</li> <li>Inward bound vessels use Arch No 3</li> <li>Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area</li> <li>Information provided to local recreational clubs and marinas providing an overview of the works being conducted and expected duration</li> </ul>

#### Pre Control - People

Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

#### Pre Control - Environment

Severity	Probability	Risk Score	Risk Band
1	4	4	<b>Minor</b>

#### Pre Control - Operational Impact

Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

#### Pre Control - Media Attention

Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

#### Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Permanent Notice to Mariners
- Mariners Guide to Bridges on the Tidal Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

#### Post Control - People

Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

#### Post Control - Environment

Severity	Probability	Risk Score	Risk Band
1	2	2	<b>Slight</b>

#### Post Control - Operational Impact

Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

#### Post Control - Media Attention

Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

#### Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

- |                    |                                |
|--------------------|--------------------------------|
| Working at height  | Loading / Unloading operations |
| Lifting operations | Movement of materials          |
| Slips and trips    | Mooring                        |
| Fire safety        | Welfare Amenities              |

### 15A - LTTBF - Contact with Moored Vessel in Vicinity of Blackfriars (President / Cory Barges / Passenger Boat Moorings etc.)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Safeguards
15A - LTTBF	Contact with moored vessel in vicinity of Blackfriars (President / Cory barges / Passenger boat moorings etc)	A vessel in transit makes contact with a moored vessel (E.g. Moored Barge, President or moored passenger boat) in the vicinity of Blackfriars Embankment.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Single Fatality / Severe permanent partial disability</li> <li>• Short to medium term impact</li> <li>• Major damage to vessel / equipment and detention</li> <li>• National coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• Passage Planning</li> <li>• Ship Towing Code of Practice</li> <li>• Admiralty Charts</li> <li>• COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>• Relocate HMS President</li> <li>• Relocate Cory Coin Street moorings</li> <li>• Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

<b>Relevant PLA Guidance</b>
<ul style="list-style-type: none"> <li>• General Directions for Navigation in the Port of London</li> <li>• Schedule to the General Directions for Navigation in the Port of London</li> <li>• Pilotage Directions</li> <li>• River Byelaws 1978 (as amended)</li> <li>• Permanent Notice to Mariners</li> <li>• Ship Towing Operations on the Thames</li> <li>• Code of Practice for Craft Towing Operations on the Thames</li> <li>• Port Entry Guide</li> <li>• Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	<b>Minor</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

<b>Sub Contractors Risk Assessment</b>								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">Working at height</td> <td style="width: 50%;">Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

### 16A - LTTBF - Vessels subject to increased interaction during periods of low water

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Safeguards
16A - LTTBF	Vessels subject to increased interaction during periods of low water.	Due to the intrusion of the temporary works into the authorised channel, the available water space for vessels to manoeuvre in is reduced. At periods of low water this is particularly relevant.	<ul style="list-style-type: none"> <li>Reduced effective river width</li> <li>Misjudgement</li> <li>Inattention</li> <li>Lack of communications</li> <li>Adverse weather conditions</li> <li>Collision avoidance</li> <li>Tidal set</li> <li>Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Low impact with no lasting effect</li> <li>Moderate damage to vessel / equipment requiring immediate repairs</li> <li>Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>Boat Masters Licence</li> <li>BML Local Knowledge Endorsement</li> <li>Qualified Crew</li> <li>Vessel Master Experience</li> <li>Permanent / Temporary Notice to Mariners</li> </ul>	

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	3	3	<b>Minor</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>River Byelaws 1978 (as amended)</li> <li>Permanent Notice to Mariners</li> <li>Ship Towing Operations on the Thames</li> <li>Code of Practice for Craft Towing Operations on the Thames</li> <li>Port Entry Guide</li> <li>Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	2	2	<b>Slight</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

### 17A - LTTBF - Vessels subject to increased interaction during periods of low water

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Safeguards
17A - LTTBF	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Lost Time Injury / Moderate permanent partial disability injury</li> <li>• Low impact with no lasting effect</li> <li>• Moderate damage to vessel / equipment requiring immediate repairs</li> <li>• Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• MCA Guidance document</li> </ul>	

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	3	3	<b>Minor</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>• General Directions for Navigation in the Port of London</li> <li>• Schedule to the General Directions for Navigation in the Port of London</li> <li>• Pilotage Directions</li> <li>• River Byelaws 1978 (as amended)</li> <li>• Permanent Notice to Mariners</li> <li>• Ship Towing Operations on the Thames</li> <li>• Code of Practice for Craft Towing Operations on the Thames</li> <li>• Port Entry Guide</li> <li>• Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	2	2	<b>Slight</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

### 18A - LTTBF – Contact with moored vessel at relocated Blackfriars Millennium Pier

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Safeguards
18A - LTTBF	Contact with moored vessel at relocated Blackfriars Millennium Pier	A vessel in transit makes contact with a vessel moored at the relocated Blackfriars Millennium Pier.	<ul style="list-style-type: none"> <li>Misjudgement</li> <li>Inattention</li> <li>Lack of communications</li> <li>Adverse weather conditions</li> <li>Machinery breakdown</li> <li>High density of leisure traffic</li> <li>Collision avoidance</li> </ul>	<ul style="list-style-type: none"> <li>Single Fatality / Severe permanent partial disability</li> <li>Low impact with no lasting effect</li> <li>Major damage to vessel / equipment and detention</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>Boat Masters Licence</li> <li>BML Local Knowledge Endorsement</li> <li>Qualified Crew</li> <li>Vessel Master Experience</li> <li>Permanent / Temporary Notice to Mariners</li> <li>Aids to Navigation</li> <li>Passage Planning</li> <li>Ship Towing Code of Practice</li> <li>Admiralty Charts</li> <li>COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>Restrictions on number of barges permitted to be towed in this area in the event that arch No2 is closed.</li> <li>Provide facilities for vessels using the pier to moor at the eastern end to allow them to be further from the authorised channel.</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	3	3	Minor

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>River Byelaws 1978 (as amended)</li> <li>Permanent Notice to Mariners</li> <li>Ship Towing Operations on the Thames</li> <li>Code of Practice for Craft Towing Operations on the Thames</li> <li>Port Entry Guide</li> <li>Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	2	2	Slight

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	Moderate

Sub Contractors Risk Assessment
<p>The proposed new location for Blackfriars Millennium Pier takes into consideration a number of stakeholder requirements.</p> <p>After consultation with the PLA, the outer face of the pier pontoon has been set back from the authorised channel by at least 15m.</p>

## Annex C– Most likely hazard log: Phase B - Construction of drop shaft/culvert/connection

### C.1 Summary most likely hazard list: Phase B - Construction of drop shaft/culvert/connections

Hazard Id	Hazard Title	Hazard Description	People	Environment	Operational	Media
1B	Restricted Working - Work intrudes into authorised channel and constrains traffic	During construction of shaft & culvert, works extend into the authorised channel, therefore constraining available water space for existing traffic. Due to the reduced channel width a river incident occurs.	12	6	9	12
2B	Emergency Arch Closure - Arch No 3	During construction of the temporary cofferdam there may be an emergency requirement to close No 3 arch	9	6	9	9
3B	Planned arch closure - Arch No 3	During shaft/culvert construction activities here may be a requirement to close No 3 arch for maintenance. This would leave No 4 arch as the only available navigable arch.	8	4	8	8
4B	Planned Arch closure - Arch No 2	During shaft/culvert construction activities there may be a requirement to close No 2 arch for maintenance.	9	6	12	12
5B	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Blackfriars Bridges.	9	6	6	9
6B	Collision with High Speed Passenger Vessel	A vessel conducting Thames Tunnel construction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Blackfriars	9	6	9	12
7B	Collision with Class V passenger vessel	A vessel conducting Thames Tunnel construction activities collides with a Class V passenger vessel in the vicinity of Blackfriars Embankment.	9	6	9	12
8B	Collision with private leisure vessel	A vessel conducting Thames Tunnel construction activities collides with a private leisure vessel in the vicinity of Blackfriars Embankment.	9	6	9	12

9B	Collision with commercial freight operator	A vessel conducting Thames Tunnel construction activities collides with a commercial freight operator in the vicinity of Blackfriars Embankment.	9	9	6	9
10B	Collision with tug and tow	A vessel conducting Thames Tunnel construction activities collides with a tug and tow in the vicinity of Blackfriars Embankment.	9	9	9	9
11B	Contact with Blackfriars Bridge (Road & Rail)	A vessel conducting Thames Tunnel construction activities makes contact with Blackfriars Road or Rail Bridge, including arches, abutments and any associated bridge superstructure.	6	3	6	6
12B	Contact - High Speed Craft / Class V passenger vessel with Temporary work site	A High Speed Craft / Class V passenger vessel comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction / removal of temporary cofferdam.	9	6	9	9
13B	Contact - Tug and Tow with Temporary work site	A Tug and Tow comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction / removal of temporary cofferdam.	N/A	N/A	N/A	N/A
14B	Contact - Private leisure vessel with Temporary work site	Private leisure vessels, including narrow boats, come into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction / removal of temporary cofferdam.	N/A	N/A	N/A	N/A
15B	Contact with moored vessel in vicinity of Blackfriars (President / Cory barges/ Passenger boat moorings etc)	A vessel in transit makes contact with a moored vessel (E.g. Moored Barge, President or moored passenger boat) in the vicinity of Blackfriars Embankment.	8	4	6	8

16B	Vessels subject to increased interaction during periods of low water	Due to the intrusion of the temporary works into the authorised channel, the available water space for vessels to manoeuvre in is reduced. At periods of low water this is particularly relevant	9	3	9	9
17B	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	9	3	9	9
18B	Contact with moored vessel at relocated Blackfriars Millennium Pier	A vessel in transit makes contact with a vessel moored at the relocated Blackfriars Millennium Pier.	12	3	12	12

## C.2 Most likely hazard list – Phase B: Construction of drop shaft/culvert/connections

### 1B - LTTBF - Restricted Working - Work Intrudes into Authorised Channel and Constrains Traffic

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
1B - LTTBF	Restricted Working	Short notice / emergency closure of bridge arch resulting in a restricted operating area and an increase in vessel congestion.  Intrusion into authorised channel constrains available water space for existing traffic. Due to the reduced channel width a river incident occurs.	<ul style="list-style-type: none"> <li>Reduced effective river width</li> <li>Misjudgement</li> <li>Inattention</li> <li>Adverse weather conditions</li> <li>Machinery breakdown</li> <li>Collision avoidance</li> <li>Tidal set</li> <li>Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>Single Fatality / Severe permanent partial disability</li> <li>Temporary effect / Minor effect to small area</li> <li>Moderate damage to vessel / equipment requiring immediate repairs</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>Boat Masters Licence</li> <li>BML Local Knowledge Endorsement</li> <li>Qualified Crew</li> <li>Vessel Master Experience</li> <li>Thames AIS</li> <li>VHF Communications</li> <li>VTS Navigational Broadcast</li> <li>Permanent / Temporary Notice to Mariners</li> <li>Tug Operator Procedures</li> <li>Ship Towage Code of Practice</li> <li>Aids to Navigation</li> <li>General Directions</li> <li>Emergency Plans &amp; Procedures</li> <li>COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>Minimise the footprint of the temporary works and therefore encroachment into the channel</li> <li>Closure of Arch No 2 to all inward bound larger and reporting vessels</li> <li>Vessel Traffic Control Co-ordinator</li> <li>Scheduling of barge movements to assist with existing river events</li> <li>Communication and schedule planning - PLA / Thames Tunnel / Marine Sub Contractor</li> <li>Suspend Thames barge operations in event of emergency arch closure</li> <li>Safety Work Boat in attendance during periods of restricted working</li> <li>Relocate Cory Environmental Ltd Coin Street moorings</li> </ul>

#### Pre Control - People

Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

#### Pre Control - Environment

Severity	Probability	Risk Score	Risk Band
2	4	8	<b>Moderate</b>

#### Pre Control - Operational Impact

Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

#### Pre Control - Media Attention

Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

#### Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- Code of Practice Passenger Vessel Operations on the Thames
- River (Amendment) Byelaws 2006 - Thames AIS Byelaws and Revocation of River Byelaws 6, 8 and 41
- River Thames Recreational Users Guide
- Mariners Guide to Bridges on the Tidal Thames
- Ship Towage Operations on the Thames

#### Post Control - People

Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

#### Post Control - Environment

Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

#### Post Control - Operational Impact

Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

#### Post Control - Media Attention

Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

#### Assessment Notes

- Inbound smaller, non reporting vessels to use Arch No 2 during Phase 2
- Inbound larger, reporting vessels to use Arch No 3
- Emergency closure of Arch No 3 covered as separate hazard

## 2B - LTTBF - Emergency Arch Closure - Arch No 3

<b>Hazard ID</b>	<b>Hazard Title</b>	<b>Hazard Description</b>	<b>Hazard Causes</b>	<b>Consequence(s) Most Likely</b>	<b>Existing Safeguards</b>	<b>Proposed Additional Mitigation</b>
<b>2B - LTTBF</b>	Emergency Arch Closure - Arch No 3	<p>During construction of the shaft and culvert there may be an emergency requirement to close No 3 arch.</p> <p>Intrusion into authorised channel constrains available water space for existing traffic. Due to the reduced channel width a river incident occurs.</p>	<ul style="list-style-type: none"> <li>Emergency Bridge Arch Closure</li> <li>River Incident</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Temporary effect / Minor effect to small area</li> <li>Moderate damage to vessel / equipment requiring immediate repairs</li> <li>Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>VTS Navigational Broadcast</li> <li>VHF Communications</li> </ul>	<ul style="list-style-type: none"> <li>Safety boat to be in attendance maintaining a continuous VHF watch on Channel 14 in the event of Arch No 3 closure</li> <li>Navigational warning broadcast on VHF</li> <li>Suspend Thames barge operations in event of emergency arch closure</li> <li>Maintain Arch No 4 for navigation</li> <li>Open Arch No 2 with restricted operating procedures for freight</li> <li>Relocate Cory Environmental Ltd Coin Street moorings</li> </ul>

<b>Pre Control - People</b>			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

<b>Pre Control - Environment</b>			
Severity	Probability	Risk Score	Risk Band
2	4	8	<b>Moderate</b>

<b>Pre Control - Operational Impact</b>			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

<b>Pre Control - Media Attention</b>			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

<b>Relevant PLA Guidance</b>
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Port Entry Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> </ul>

<b>Post Control - People</b>			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

<b>Post Control - Environment</b>			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

<b>Post Control - Operational Impact</b>			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

<b>Post Control - Media Attention</b>			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

<b>Assessment Notes</b>
<ul style="list-style-type: none"> <li>This hazard is covered in more detail within the main Blackfriars Foreshore - Maritime Issues and Navigational Risk Assessment Report.</li> </ul>

## 3B - LTTBF - Planned Arch Closure - Arch No 3

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
3B - LTTBF	Planned Arch Closure - Arch No 3	During construction of the shaft and culvert there may be a scheduled requirement to close No 3 arch.	<ul style="list-style-type: none"> <li>Planned Bridge arch closure</li> <li>Maintenance and Inspection routines</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Temporary effect / Minor effect to small area</li> <li>Major damage to vessel / equipment and detention</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>Permanent / Temporary Notice to Mariners</li> <li>VTS Navigational Broadcast</li> <li>VHF Communications</li> <li>Aids to Navigation</li> <li>Bridge Special Signal Lights</li> <li>VTS Qualification</li> </ul>	<ul style="list-style-type: none"> <li>Scheduling of arch closures in order to facilitate minimum disruption to river users</li> <li>Safety boat to be in attendance maintaining a continuous VHF watch on Channel 14 in the event of Arch No 3 closure</li> <li>Navigational warning broadcast on VHF</li> <li>Suspend Thames barge operations in event of arch closure</li> <li>Maintain Arch No 4 for navigation</li> <li>Open Arch No 2 with restricted operating procedures for freight</li> <li>Relocate Cory Environmental Ltd Coin Street moorings</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
2	4	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	6	Moderate

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	Extreme

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	Extreme

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Port Entry Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	Minor

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	Moderate

Assessment Notes
<ul style="list-style-type: none"> <li>Inspection Routine - Road &amp; Rail Bridge <ul style="list-style-type: none"> <li>General Inspection - every 2 years</li> <li>Principal Inspection - every 6<sup>th</sup> year - requires full inspection within touching distance of all elements and therefore inspection from below is required - Arch Closure as a result.</li> </ul> </li> <li>Principal Inspection to be conducted immediately prior to work commencing</li> </ul>

## 4B - LTTBF - Planned Arch Closure - Arch No2

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
4B - LTTBF	Planned Arch Closure - Arch No 2	During construction of the shaft and culvert there may be a scheduled requirement to close Arch No 2.  Due to the reduced channel width a river incident occurs.	<ul style="list-style-type: none"> <li>Planned Bridge arch closure</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Temporary effect / Minor effect to small area</li> <li>Major damage to vessel / equipment and detention</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>Permanent / Temporary Notice to Mariners</li> <li>VTS Navigational Broadcast</li> <li>VHF Communications</li> <li>Aids to Navigation</li> <li>Bridge Special Signal Lights</li> <li>VTS Qualification</li> </ul>	<ul style="list-style-type: none"> <li>Scheduling of arch closures in order to facilitate minimum disruption to river users</li> <li>Maintain Arch No 4 to allow for navigation inbound &amp; outbound for larger and reporting vessels</li> <li>A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect</li> <li>Relocate the Cory Environmental moorings (currently opposite the proposed permanent works)</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	6	Moderate

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	Extreme

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	Extreme

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Port Entry Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	Moderate

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Assessment Notes
<ul style="list-style-type: none"> <li>Inspection Routine - Road &amp; Rail Bridge <ul style="list-style-type: none"> <li>General Inspection - every 2 years</li> <li>Principal Inspection - every 6<sup>th</sup> year - requires full inspection within touching distance of all elements and therefore inspection from below is required - Arch Closure as a result.</li> </ul> </li> <li>Principal Inspection to be conducted immediately prior to work commencing</li> <li>It is proposed that Arch No 2 is closed to freight and larger reporting vessels during phase 2.</li> <li>It is proposed that Arch No 2 is open for smaller vessels during phase 2.</li> </ul>

## 5B - LTTBF - Increase in Flow

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
5B - LTTBF	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Blackfriars Bridges.	<ul style="list-style-type: none"> <li>Shape and position of temporary cofferdam</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Temporary effect / Minor effect to small area</li> <li>Moderate damage to vessel / equipment requiring immediate repairs</li> <li>Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>None identified for this hazard</li> </ul>	<ul style="list-style-type: none"> <li>3D and computational modelling</li> <li>Review and re-design temporary work structure to reduce hydrodynamic affects</li> <li>A Notice to Mariners to advise of any increases in river flow: NTM to advise that for example: In Arch No3 the maximum flow will increase by approximately 1/2 knot during temporary works with the flow moving towards the south side of the bridge arch.</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Port Entry Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Assessment Notes
<ul style="list-style-type: none"> <li>Fluvial modelling (numerical and physical) have been used to develop the design of the structure.</li> <li>Analysis of HR Wallingford fluvial modelling report indicates minimum change in flow in this area.</li> <li>Further investigation is required in order to assess latest structure design.</li> </ul>

## 6B - LTTBF - Collision with High Speed Passenger Vessel

<b>Hazard ID</b>	<b>Hazard Title</b>	<b>Hazard Description</b>	<b>Hazard Causes</b>	<b>Consequence(s) Most Likely</b>	<b>Existing Safeguards</b>	<b>Proposed Additional Mitigation</b>
<b>6B - LTTBF</b>	Collision with High Speed Passenger Vessel	A vessel conducting Thames Tunnel construction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Blackfriars Embankment during the construction of the shaft and culvert.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Non Compliance with procedures</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• Inadequate training and experience</li> <li>• Tug or line failure</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Lost Time Injury / Moderate permanent partial disability injury</li> <li>• Temporary effect / Minor effect to small area</li> <li>• Moderate damage to vessel / equipment requiring immediate repairs</li> <li>• National coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• General Directions</li> <li>• Tug Operator Procedures</li> <li>• Passage Planning</li> <li>• VTS Navigational Broadcast</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Thames AIS</li> <li>• HSC Code</li> <li>• VHF Communications</li> <li>• COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>• Light Warnings - providing visual warning that barge is about to depart berth</li> <li>• Sound Warnings - providing audio warning that barge is about to depart berth</li> <li>• Sub-Contractors Risk Assessment</li> <li>• Closure of Arch No 2 to all inward bound larger and reporting vessels</li> <li>• Use of reputable and experienced marine contractor</li> <li>• Berth Master</li> <li>• Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity</li> <li>• Berth Master to monitor VHF</li> <li>• CCTV to provide additional information to Berth Master</li> </ul>

<b>Pre Control - People</b>			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

<b>Pre Control - Environment</b>			
Severity	Probability	Risk Score	Risk Band
2	4	8	<b>Moderate</b>

<b>Pre Control - Operational Impact</b>			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

<b>Pre Control - Media Attention</b>			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

<b>Relevant PLA Guidance</b>
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•Ship Towing Operations on the Thames</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> <li>•Code of Practice Passenger Vessel Operations on the Thames</li> </ul>

<b>Post Control - People</b>			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

<b>Post Control - Environment</b>			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

<b>Post Control - Operational Impact</b>			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

<b>Post Control - Media Attention</b>			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

<b>Sub Contractors Risk Assessment</b>								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">Working at height</td> <td style="width: 50%;">Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

## 7B - LTTBF- Collision with Class V Passenger Vessel

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
7B - LTTBF	Collision with Class V Passenger Vessel	A vessel conducting Thames Tunnel construction activities collides with a Class V passenger vessel in the vicinity of Blackfriars Embankment, during the construction of the shaft and culvert.	<ul style="list-style-type: none"> <li>Reduced effective river width</li> <li>Misjudgement</li> <li>Inattention</li> <li>Non Compliance with procedures</li> <li>Improper lookout</li> <li>Lack of communications</li> <li>Leisure traffic impedes the passage of vessel navigating the channel</li> <li>Collision avoidance</li> <li>High density of leisure traffic</li> <li>Machinery breakdown</li> <li>Change in river flow due to new in-river structure</li> <li>General lack of marine knowledge</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Temporary effect / Minor effect to small area</li> <li>Moderate damage to vessel / equipment requiring immediate repairs</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>Boat Masters Licence</li> <li>BML Local Knowledge Endorsement</li> <li>Vessel Master Experience</li> <li>Qualified Crew</li> <li>VHF Communications</li> <li>VTS Navigational Broadcast</li> <li>Ship Towing Code of Practice</li> <li>Tug Operator Procedures</li> <li>COLREGS</li> <li>General Directions</li> <li>Admiralty Charts</li> <li>Perm / Temp Notice to Mariners</li> <li>Emergency Plans &amp; Procedures</li> <li>Aids to Navigation</li> </ul>	<ul style="list-style-type: none"> <li>Light Warnings - providing visual warning that barge is about to depart berth</li> <li>Sound Warnings - providing audio warning that barge is about to depart berth</li> <li>Sub-Contractors Risk Assessment</li> <li>Closure of Arch No 2 to all inward bound larger and reporting vessels</li> <li>Use of reputable and experienced marine contractor</li> <li>Berth Master</li> <li>Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity</li> <li>Berth Master to monitor VHF</li> <li>CCTV to provide additional information to Berth Master</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	Moderate

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	Extreme

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> <li>Port Entry Guide</li> <li>Code of Practice Passenger Vessel Operations on the Thames</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	Moderate

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">Working at height</td> <td style="width: 50%;">Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

## 8B - LTTBF - Collision with Private Leisure Vessel

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
8B LTTBF	Collision with Private Leisure Vessel	A vessel conducting Thames Tunnel construction activities collides with a private leisure vessel in the vicinity of Blackfriars Embankment, during the construction of the shaft and culvert.	<ul style="list-style-type: none"> <li>Reduced effective river width</li> <li>Misjudgement</li> <li>Inattention</li> <li>Non Compliance with procedures</li> <li>Improper lookout</li> <li>Lack of communications</li> <li>Leisure traffic impedes the passage of vessel navigating the channel</li> <li>Collision avoidance</li> <li>High density of leisure traffic</li> <li>Machinery breakdown</li> <li>Change in river flow due to new in-river structure</li> <li>General lack of marine knowledge</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Temporary effect / Minor effect to small area</li> <li>Moderate damage to vessel / equipment requiring immediate repairs</li> <li>Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>Boat Masters Licence</li> <li>BML Local Knowledge Endorsement</li> <li>Vessel Master Experience</li> <li>Qualified Crew</li> <li>VHF Communications</li> <li>VTS Navigational Broadcast</li> <li>Ship Towing Code of Practice</li> <li>Tug Operator Procedures</li> <li>COLREGs</li> <li>General Directions</li> <li>Perm / Temp Notice to Mariners</li> <li>Emergency Plans &amp; Procedures</li> <li>Aids to Navigation</li> </ul>	<ul style="list-style-type: none"> <li>Light Warnings - providing visual warning that barge is about to depart berth</li> <li>Sound Warnings - providing audio warning that barge is about to depart berth</li> <li>Use of reputable and experienced marine contractor</li> <li>Sub-Contractors Risk Assessment</li> <li>Berth Master</li> <li>Berth Master to monitor VHF</li> <li>CCTV to provide additional information to Berth Master</li> </ul>

## Pre Control - People

Severity	Probability	Risk Score	Risk Band
3	4	12	High

## Pre Control - Environment

Severity	Probability	Risk Score	Risk Band
2	4	8	Moderate

## Pre Control - Operational Impact

Severity	Probability	Risk Score	Risk Band
3	4	12	High

## Pre Control - Media Attention

Severity	Probability	Risk Score	Risk Band
4	4	16	Extreme

## Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- River Thames Recreational Users Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Port Entry Guide

## Post Control - People

Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

## Post Control - Environment

Severity	Probability	Risk Score	Risk Band
2	3	6	Moderate

## Post Control - Operational Impact

Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

## Post Control - Media Attention

Severity	Probability	Risk Score	Risk Band
4	3	12	High

## Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

- |                    |                                |
|--------------------|--------------------------------|
| Working at height  | Loading / Unloading operations |
| Lifting operations | Movement of materials          |
| Slips and trips    | Mooring                        |
| Fire safety        | Welfare Amenities              |

## 9B - LTTBF - Collision with Commercial Freight Operator

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
9B - LTTBF	Collision with commercial freight operator	A vessel conducting Thames Tunnel construction activities collides with a commercial freight operator in the vicinity of Blackfriars Embankment, during the construction of the shaft and culvert.	<ul style="list-style-type: none"> <li>Reduced effective river width</li> <li>Misjudgement</li> <li>Inattention</li> <li>Non Compliance with procedures</li> <li>Improper lookout</li> <li>Lack of communications</li> <li>Machinery breakdown</li> <li>Collision avoidance</li> <li>High density of leisure traffic</li> <li>Leisure traffic impedes the passage of vessel navigating the channel</li> <li>Change in river flow due to new in-river structure</li> <li>Tidal set</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Short to medium term impact</li> <li>Moderate damage to vessel / equipment requiring immediate repairs</li> <li>Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>Boat Masters Licence</li> <li>Qualified Crew</li> <li>Bridge Special Signal Lights</li> <li>Emergency Plans &amp; Procedures</li> <li>VTS Navigational Broadcast</li> <li>Thames AIS</li> <li>Passage Planning</li> <li>Ship Towage Code of Practice</li> <li>BML Local Knowledge Endorsement</li> <li>Tug Operator Procedures</li> <li>Perm / Temp Notice to Mariners</li> <li>COLREGS</li> <li>General Directions</li> </ul>	<ul style="list-style-type: none"> <li>Light Warnings - providing visual warning that barge is about to depart berth</li> <li>Sound Warnings - providing audio warning that barge is about to depart berth</li> <li>Use of reputable and experienced marine contractor</li> <li>Sub-Contractors Risk Assessment</li> <li>Berth Master</li> <li>Berth Master to monitor VHF</li> <li>Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity</li> <li>CCTV to provide additional information to Berth Master</li> <li>Closure of Arch No 2 to all inward bound larger and reporting vessels</li> </ul>

### Pre Control - People

Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

### Pre Control - Environment

Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

### Pre Control - Operational Impact

Severity	Probability	Risk Score	Risk Band
2	4	8	<b>Moderate</b>

### Pre Control - Media Attention

Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

### Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

### Post Control - People

Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

### Post Control - Environment

Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

### Post Control - Operational Impact

Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

### Post Control - Media Attention

Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

### Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

- |                    |                                |
|--------------------|--------------------------------|
| Working at height  | Loading / Unloading operations |
| Lifting operations | Movement of materials          |
| Slips and trips    | Mooring                        |
| Fire safety        | Welfare Amenities              |

**10B - LTTBF - Collision with Tug and Tow**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
10B - LTTBF	Collision with tug and tow	A vessel conducting Thames Tunnel construction activities collides with a tug and tow in the vicinity of Blackfriars Embankment, during the construction of the shaft and culvert.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Non Compliance with procedures</li> <li>• Improper lookout</li> <li>• Lack of communications</li> <li>• Machinery breakdown</li> <li>• Collision avoidance</li> <li>• High density of leisure traffic</li> <li>• Leisure traffic impedes the passage of vessel navigating the channel</li> <li>• Change in river flow due to new in-river structure</li> <li>• Tidal set</li> </ul>	<ul style="list-style-type: none"> <li>• Lost Time Injury / Moderate permanent partial disability injury</li> <li>• Temporary effect / Minor effect to small area</li> <li>• Moderate damage to vessel / equipment requiring immediate repairs</li> <li>• Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• Qualified Crew</li> <li>• Bridge Special Signal Lights</li> <li>• Emergency Plans &amp; Procedures</li> <li>• VTS Navigational Broadcast</li> <li>• Thames AIS</li> <li>• Passage Planning</li> <li>• Ship Towage Code of Practice</li> <li>• BML Local Knowledge Endorsement</li> <li>• Perm / Temp Notice to Mariners</li> <li>• Tug Operator Procedures</li> <li>• General Directions</li> <li>• COLREGS</li> </ul>	<ul style="list-style-type: none"> <li>• Light Warnings - providing visual warning that barge is about to depart berth</li> <li>• Sound Warnings - providing audio warning that barge is about to depart berth</li> <li>• Use of reputable and experienced marine contractor</li> <li>• Sub-Contractors Risk Assessment</li> <li>• Berth Master</li> <li>• Berth Master to monitor VHF</li> <li>• Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity</li> <li>• CCTV to provide additional information to Berth Master</li> <li>• Closure of Arch No 2 to all inward bound larger and reporting vessels</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Pilotage Directions</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•Ship Towage Operations on the Thames</li> <li>•Code of Practice for Craft Towage Operations on the Thames</li> <li>•Port Entry Guide</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**11B - LTTBF - Contact with Blackfriars Bridge (Road & Rail)**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
11B - LTTBF	Contact with Blackfriars Bridge (Road & Rail)	A vessel conducting Thames Tunnel construction activities makes contact with Blackfriars Road or Rail Bridge, including arches, abutments and any associated bridge superstructure.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Non Compliance with procedures</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• Inadequate training and experience</li> <li>• Tug or line failure</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Restricted work case</li> <li>• Low impact with no lasting effect</li> <li>• Minor or superficial damage to vessel / equipment</li> <li>• Local coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• General Directions</li> <li>• PLA Bridge Guide</li> <li>• Passage Planning</li> <li>• Accurate Tidal Information</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Tug Operator Procedures</li> <li>• COLREGs</li> <li>• Ship Towage Code of Practice</li> <li>• Emergency Plans &amp; Procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Sub-Contractors Risk Assessment</li> <li>• Use of reputable and experienced marine contractor</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	3	3	<b>Minor</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Ship Towage Operations on the Thames</li> <li>•Code of Practice for the Safe Mooring of Vessels on the Thames</li> <li>•Code of Practice for Craft Towage Operations on the Thames</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> <li>•Port Entry Guide</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	3	3	<b>Minor</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**12A - LTTBF - Contact - High Speed Craft / Class V Passenger Vessel with Temporary Work Site**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
12A - LTTBF	Contact - High Speed Craft / Class V passenger vessel with Temporary work site	A High Speed Craft / Class V passenger vessel comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment, during the construction of the shaft and culvert.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> <li>• Leisure traffic impedes the passage of vessel navigating the channel</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Lost Time Injury / Moderate permanent partial disability injury</li> <li>• Short to medium term impact</li> <li>• Moderate damage to vessel / equipment requiring immediate repairs</li> <li>• Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• VTS Navigational Broadcast</li> <li>• HSC Code</li> <li>• Passage Planning</li> <li>• COLREGs</li> <li>• VHF Communications</li> <li>• Emergency Plans &amp; Procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Closure of Arch No 2 to all inward bound larger and reporting vessels</li> <li>• Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	Moderate

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Permanent Notice to Mariners</li> <li>•Code of Practice Passenger Vessel Operations on the Thames</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	Moderate

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**13B - LTTBF - Contact - Tug and Tow with Temporary Work Site**

<i>Hazard ID</i>	<i>Hazard Title</i>	<i>Hazard Description</i>	<i>Hazard Causes</i>	<i>Consequence(s) Most Likely</i>	<i>Existing Safeguards</i>	<i>Proposed Additional Mitigation</i>
<b>13B - LTTBF</b>	Contact - Tug and Tow with Temporary work site	A Tug and Tow comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during the construction of the shaft and culvert.	<ul style="list-style-type: none"> <li>Not applicable to this stage of the project</li> </ul>	<ul style="list-style-type: none"> <li>Not applicable to this stage of the project</li> </ul>	<ul style="list-style-type: none"> <li>Not applicable to this stage of the project</li> </ul>	<ul style="list-style-type: none"> <li>Not applicable to this stage of the project</li> </ul>

<b>Pre Control - People</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Post Control - People</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Pre Control - Environment</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Post Control - Environment</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Pre Control - Operational Impact</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Post Control - Operational Impact</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Pre Control - Media Attention</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Post Control - Media Attention</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<i>Relevant PLA Guidance</i>

<i>Risk Assessment Notes</i>

**14B - LTTBF - Contact - Private Leisure Vessel with Temporary Work Site**

<i>Hazard ID</i>	<i>Hazard Title</i>	<i>Hazard Description</i>	<i>Hazard Causes</i>	<i>Consequence(s) Most Likely</i>	<i>Existing Safeguards</i>	<i>Proposed Additional Mitigation</i>
<b>14B - LTTBF</b>	Contact - Private leisure vessel with Temporary work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during the construction of the shaft and culvert.	<ul style="list-style-type: none"> <li>Not applicable to this stage of the project</li> </ul>	<ul style="list-style-type: none"> <li>Not applicable to this stage of the project</li> </ul>	<ul style="list-style-type: none"> <li>Not applicable to this stage of the project</li> </ul>	<ul style="list-style-type: none"> <li>Not applicable to this stage of the project</li> </ul>

<b>Pre Control - People</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Post Control - People</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Pre Control - Environment</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Post Control - Environment</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Pre Control - Operational Impact</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Post Control - Operational Impact</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Pre Control - Media Attention</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Post Control - Media Attention</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Relevant PLA Guidance</b>

<b>Risk Assessment Notes</b>

### 15B - LTTBF - Contact with Moored Vessel in Vicinity of Blackfriars (President / Cory Barges / Passenger Boat Moorings etc.)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Safeguards
15B - LTTBF	Contact with moored vessel in vicinity of Blackfriars (President / Cory barges / Passenger boat moorings etc)	A vessel in transit makes contact with a moored vessel (E.g. Moored Barge, President or moored passenger boat) in the vicinity of Blackfriars Embankment during the construction of the shaft and culvert.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Single Fatality / Severe permanent partial disability</li> <li>• Short to medium term impact</li> <li>• Major damage to vessel / equipment and detention</li> <li>• National coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• Passage Planning</li> <li>• Ship Towing Code of Practice</li> <li>• Admiralty Charts</li> <li>• COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>• Relocate HMS President</li> <li>• Relocate Cory Coin Street moorings</li> <li>• Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

<b>Relevant PLA Guidance</b>
<ul style="list-style-type: none"> <li>• General Directions for Navigation in the Port of London</li> <li>• Schedule to the General Directions for Navigation in the Port of London</li> <li>• Pilotage Directions</li> <li>• River Byelaws 1978 (as amended)</li> <li>• Permanent Notice to Mariners</li> <li>• Ship Towing Operations on the Thames</li> <li>• Code of Practice for Craft Towing Operations on the Thames</li> <li>• Port Entry Guide</li> <li>• Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	<b>Minor</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

<b>Sub Contractors Risk Assessment</b>								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">Working at height</td> <td style="width: 50%;">Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

## 16B - LTTBF - Vessels subject to increased interaction during periods of low water

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Safeguards
16B - LTTBF	Vessels subject to increased interaction during periods of low water.	Due to the intrusion of the temporary works into the authorised channel, the available water space for vessels to manoeuvre in is reduced. At periods of low water this is particularly relevant.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Lost Time Injury / Moderate permanent partial disability injury</li> <li>• Low impact with no lasting effect</li> <li>• Moderate damage to vessel / equipment requiring immediate repairs</li> <li>• Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	4	4	Minor

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>• General Directions for Navigation in the Port of London</li> <li>• Schedule to the General Directions for Navigation in the Port of London</li> <li>• Pilotage Directions</li> <li>• River Byelaws 1978 (as amended)</li> <li>• Permanent Notice to Mariners</li> <li>• Ship Towing Operations on the Thames</li> <li>• Code of Practice for Craft Towing Operations on the Thames</li> <li>• Port Entry Guide</li> <li>• Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	3	3	Minor

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

## 17B - LTTBF - Vessels subject to increased interaction during periods of low water

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Safeguards
17B - LTTBF	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	<ul style="list-style-type: none"> <li>Reduced effective river width</li> <li>Misjudgement</li> <li>Inattention</li> <li>Lack of communications</li> <li>Adverse weather conditions</li> <li>Collision avoidance</li> <li>Tidal set</li> <li>Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Low impact with no lasting effect</li> <li>Moderate damage to vessel / equipment requiring immediate repairs</li> <li>Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>Boat Masters Licence</li> <li>BML Local Knowledge Endorsement</li> <li>Qualified Crew</li> <li>Vessel Master Experience</li> <li>Permanent / Temporary Notice to Mariners</li> <li>MCA Guidance document</li> </ul>	<ul style="list-style-type: none"> <li></li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	4	4	Minor

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>River Byelaws 1978 (as amended)</li> <li>Permanent Notice to Mariners</li> <li>Ship Towage Operations on the Thames</li> <li>Code of Practice for Craft Towage Operations on the Thames</li> <li>Port Entry Guide</li> <li>Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	3	3	Minor

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

### 18B - LTTBF – Contact with moored vessel at relocated Blackfriars Millennium Pier

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Safeguards
18B - LTTBF	Contact with moored vessel at relocated Blackfriars Millennium Pier	A vessel in transit makes contact with a vessel moored at the relocated Blackfriars Millennium Pier.	<ul style="list-style-type: none"> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> </ul>	<ul style="list-style-type: none"> <li>• Single Fatality / Severe permanent partial disability</li> <li>• Low impact with no lasting effect</li> <li>• Major damage to vessel / equipment and detention</li> <li>• National coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• Passage Planning</li> <li>• Ship Towage Code of Practice</li> <li>• Admiralty Charts</li> <li>• COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>• Restrictions on number of barges permitted to be towed in this area in the event that arch No2 is closed.</li> <li>• Provide facilities for vessels using the pier to moor at the eastern end to allow them to be further from the authorised channel.</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	4	4	<b>Minor</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Pilotage Directions</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•Ship Towage Operations on the Thames</li> <li>•Code of Practice for Craft Towage Operations on the Thames</li> <li>•Port Entry Guide</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	3	3	<b>Minor</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Sub Contractors Risk Assessment
<p>The proposed new location for Blackfriars Millennium Pier takes into consideration a number of stakeholder requirements.</p> <p>After consultation with the PLA, the outer face of the pier pontoon has been set back from the authorised channel by at least 15m.</p>

## Annex D– Most likely hazard log: Phase C – Removal of cofferdam

### D.1 Most likely hazard list: Phase C - Removal of cofferdam

Hazard Id	Hazard Title	Hazard Description	People	Environment	Operational	Media
1C	Restricted Working - Work intrudes into authorised channel and constrains traffic	During removal of temporary cofferdam, associated infrastructure (cofferdam, jack up rig etc) extends into the authorised channel, therefore constraining available water space for existing traffic. Due to the reduced channel width a river incident occurs.	12	6	9	12
2C	Emergency Arch closure - Arch No 3	During construction of the temporary cofferdam there may be an emergency requirement to close No 3 arch.	9	6	9	9
3C	Planned arch closure - Arch No 3	During construction of the temporary cofferdam there may be a requirement to close No 3 arch for maintenance.	6	4	6	8
4C	Planned Arch closure - Arch No 2	During construction of the temporary cofferdam it is proposed that Arch No 2 is closed to all navigation.	9	6	12	12
5C	Increased Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Blackfriars Bridges.	9	6	6	9
6C	Contact - High Speed Craft / Class V passenger vessel with Temporary work site	A High Speed Craft / Class V passenger vessel comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction / removal of temporary cofferdam.	6	4	6	8
7C	Contact - Tug and Tow with Temporary work site	A Tug and Tow comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction / removal of temporary cofferdam.	6	4	6	6

8C	Contact - Private leisure vessel with Temporary work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction / removal of temporary cofferdam (section A).	9	6	9	9
9C	Collision with commercial freight operator	A vessel conducting Thames Tunnel construction activities collides with a commercial freight operator in the vicinity of Blackfriars Embankment.	9	9	6	9
10C	Collision with tug and tow	A vessel conducting Thames Tunnel construction activities collides with a tug and tow in the vicinity of Blackfriars Embankment.	9	6	9	9
11C	Contact with Blackfriars Bridge (Road & Rail)	A vessel conducting Thames Tunnel construction activities makes contact with Blackfriars Road or Rail Bridge, including arches, abutments and any associated bridge superstructure.	6	3	6	6
12C	Contact - High Speed Craft / Class V passenger vessel with Temporary work site	A High Speed Craft / Class V passenger vessel comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction / removal of temporary cofferdam.	6	4	6	6
13C	Contact - Tug and Tow with Temporary work site	A Tug and Tow comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction / removal of temporary cofferdam.	6	4	6	6
14C	Contact - Private leisure vessel with Temporary work site	Private leisure vessels, including narrow boats, come into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction / removal of temporary cofferdam.	8	2	8	6

15C	Contact with moored vessel in vicinity of Blackfriars (President / Cory barges/ Passenger boat moorings etc)	A vessel in transit makes contact with a moored vessel (E.g. Moored Barge, President or moored passenger boat) in the vicinity of Blackfriars Embankment.	8	4	6	8
16C	Vessels subject to increased interaction during periods of low water	Due to the intrusion of the temporary works into the authorised channel, the available water space for vessels to manoeuvre in is reduced. At periods of low water this is particularly relevant	6	2	6	6
17C	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	6	2	6	6
18C	Contact with moored vessel at relocated Blackfriars Millennium Pier	A vessel in transit makes contact with a vessel moored at the relocated Blackfriars Millennium Pier.	8	2	8	8

## D.2 Most likely hazard list – Phase C: Removal of cofferdam

### 1C - LTTBF - Restricted Working - Work Intrudes into Authorised Channel and Constrains Traffic

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
1C - LTTBF	Restricted Working	Temporary works site, including cofferdam and associated infrastructure extends into the authorised channel, therefore constraining available water space for existing traffic.  Intrusion into authorised channel constrains available water space for existing traffic. Due to the reduced channel width a river incident occurs.	<ul style="list-style-type: none"> <li>Reduced effective river width</li> <li>Misjudgement</li> <li>Inattention</li> <li>Adverse weather conditions</li> <li>Machinery breakdown</li> <li>Collision avoidance</li> <li>Tidal set</li> <li>Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>Single Fatality / Severe permanent partial disability</li> <li>Temporary effect / Minor effect to small area</li> <li>Moderate damage to vessel / equipment requiring immediate repairs</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>Boat Masters Licence</li> <li>BML Local Knowledge Endorsement</li> <li>Qualified Crew</li> <li>Vessel Master Experience</li> <li>Thames AIS</li> <li>VHF Communications</li> <li>VTS Navigational Broadcast</li> <li>Permanent / Temporary Notice to Mariners</li> <li>Tug Operator Procedures</li> <li>Ship Towage Code of Practice</li> <li>Aids to Navigation</li> <li>General Directions</li> <li>Emergency Plans &amp; Procedures</li> <li>COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>Minimise the footprint of the temporary works and therefore encroachment into the channel</li> <li>Close Arch No 2 to all inward bound freight traffic</li> <li>Restricted access through Arch No 2 to certain vessels at different phases of site restoration</li> <li>Vessel Traffic Control Co-ordinator</li> <li>Scheduling of barge movements to assist with existing river events</li> <li>Communication and schedule planning - PLA / Thames Tunnel / Marine Sub Contractor</li> <li>Safety Work Boat in attendance during periods of increased restricted working</li> <li>Suspend Thames Tunnel barge operations in event of emergency arch closure</li> <li>Relocate Cory Environmental Ltd Coin Street moorings</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	12	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Code of Practice Passenger Vessel Operations on the Thames</li> <li>River Thames Recreational Users Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> <li>Ship Towage Operations on the Thames</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Assessment Notes
<ul style="list-style-type: none"> <li>Emergency closure of Arch No 3 assessed separately.</li> </ul>

## 2C - LTTBF - Emergency Arch Closure - Arch No 3

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
2C - LTTBF	Emergency Arch Closure - Arch No 3	<p>During the removal of the temporary cofferdam there may be an emergency requirement to close No 3 arch.</p> <p>Due to the temporary works site intrusion into the authorised channel navigable water space will be constrained with an increase in probability of a river incident.</p>	<ul style="list-style-type: none"> <li>Emergency Bridge Arch Closure</li> <li>River Incident</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Temporary effect / Minor effect to small area</li> <li>Moderate damage to vessel / equipment requiring immediate repairs</li> <li>Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>VTS Navigational Broadcast</li> <li>VHF Communications</li> </ul>	<ul style="list-style-type: none"> <li>Safety boat to be in attendance maintaining a continuous VHF watch on Channel 14 in the event of Arch No 3 closure</li> <li>Navigational warning broadcast on VHF</li> <li>Suspend Thames barge operations in event of emergency arch closure</li> <li>Maintain Arch No 4 for navigation</li> <li>Open Arch No 2 with restricted operating procedures for freight</li> <li>Relocate Cory Environmental Ltd Coin Street moorings</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	Moderate

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Port Entry Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	Moderate

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Assessment Notes
<ul style="list-style-type: none"> <li>This hazard is covered in more detail within the main Blackfriars Foreshore - Maritime Issues and Navigational Risk Assessment Report.</li> </ul>

## 3C - LTTBF - Planned Arch Closure - Arch No 3

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
3C - LTTBF	Planned Arch Closure - Arch No 3	<p>During removal of the temporary cofferdam there may be a scheduled requirement to close No 3 arch.</p> <p>Due to the temporary works site intrusion into the authorised channel navigable water space will be constrained with an increase in probability of a river incident.</p>	<ul style="list-style-type: none"> <li>Planned Bridge arch closure</li> <li>Maintenance and Inspection routines</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Temporary effect / Minor effect to small area</li> <li>Major damage to vessel / equipment and detention</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>Permanent / Temporary Notice to Mariners</li> <li>VTS Navigational Broadcast</li> <li>VHF Communications</li> <li>Aids to Navigation</li> <li>Bridge Special Signal Lights</li> <li>VTS Qualification</li> </ul>	<ul style="list-style-type: none"> <li>Scheduling of arch closures in order to facilitate minimum disruption to river users</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	6	Moderate

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	Extreme

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Port Entry Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	Minor

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	Moderate

Assessment Notes
<ul style="list-style-type: none"> <li>Inspection Routine - Road &amp; Rail Bridge <ul style="list-style-type: none"> <li>General Inspection - every 2 years</li> <li>Principal Inspection - every 6<sup>th</sup> year - requires full inspection within touching distance of all elements and therefore inspection from below is required - Arch Closure as a result.</li> </ul> </li> <li>Principal Inspection to be conducted immediately prior to work commencing</li> </ul>

**4C - LTTBF - Planned Arch Closure - Arch No 2**

<i>Hazard ID</i>	<i>Hazard Title</i>	<i>Hazard Description</i>	<i>Hazard Causes</i>	<i>Consequence(s) Most Likely</i>	<i>Existing Safeguards</i>	<i>Proposed Additional Mitigation</i>
4C - LTTBF	Planned Arch Closure - Arch No 2	<p>During the removal of the temporary cofferdam it is proposed that Arch No 2 is closed to all navigation.</p> <p>Due to the temporary works site intrusion into the authorised channel navigable water space will be constrained with an increase in probability of a river incident.</p>	<ul style="list-style-type: none"> <li>Planned Bridge arch closure</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Temporary effect / Minor effect to small area</li> <li>Major damage to vessel / equipment and detention</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>Permanent / Temporary Notice to Mariners</li> <li>VTS Navigational Broadcast</li> <li>VHF Communications</li> <li>Aids to Navigation</li> <li>Bridge Special Signal Lights</li> <li>VTS Qualification</li> </ul>	<ul style="list-style-type: none"> <li>Scheduling of arch closures in order to facilitate minimum disruption to river users</li> <li>Maintain Arch No 4 to allow for navigation inbound &amp; outbound for larger and reporting vessels (in the event of an emergency).</li> <li>A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect</li> <li>Relocate the Cory Environmental moorings (currently opposite the proposed permanent works)</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	6	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

<i>Relevant PLA Guidance</i>
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Port Entry Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> </ul>

<i>Assessment Notes</i>
<ul style="list-style-type: none"> <li>Inspection Routine - Road &amp; Rail Bridge                             <ul style="list-style-type: none"> <li>General Inspection - every 2 years</li> <li>Principal Inspection - every 6<sup>th</sup> year - requires full inspection within touching distance of all elements and therefore inspection from below is required - Arch Closure as a result.</li> </ul> </li> <li>Principal Inspection to be conducted immediately prior to work commencing</li> </ul>

## 5C - LTTBF - Increased Flow

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
5C - LTTBF	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Blackfriars Bridges.	<ul style="list-style-type: none"> <li>Shape and position of temporary cofferdam</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Temporary effect / Minor effect to small area</li> <li>Moderate damage to vessel / equipment requiring immediate repairs</li> <li>Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>None identified for this hazard</li> </ul>	<ul style="list-style-type: none"> <li>Closure of Arch No 2 to all inward bound freight traffic</li> <li>3D and computational modelling</li> <li>A Notice to Mariners to advise of any increases in river flow: NTM to advise that for example: In Arch No 3 the maximum flow will increase by approximately 1/2 knot during temporary works with the flow moving towards the south side of the bridge arch.</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Port Entry Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Assessment Notes
<ul style="list-style-type: none"> <li>Fluvial modelling (numerical and physical) have been used to develop the design of the structure.</li> <li>Analysis of HR Wallingford fluvial modelling report indicates minimum change in flow in this area.</li> <li>Further investigation is required in order to assess latest structure design.</li> </ul>

### 6C - LTTBF - Contact - High Speed Craft / Class V Passenger Vessel with Temporary Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
6C - LTTBF	Contact - High Speed Craft / Class V passenger vessel with Temporary work site	A High Speed Craft / Class V passenger vessel comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> <li>• Leisure traffic impedes the passage of vessel navigating the channel</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Lost Time Injury / Moderate permanent partial disability injury</li> <li>• Temporary effect / Minor effect to small area</li> <li>• Moderate damage to vessel / equipment requiring immediate repairs</li> <li>• National coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• VTS Navigational Broadcast</li> <li>• HSC Code</li> <li>• Passage Planning</li> <li>• COLREGs</li> <li>• VHF Communications</li> <li>• Emergency Plans &amp; Procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Closure of Arch No 2 to all inward bound freight traffic</li> <li>• Inward bound vessels use Arch No 3</li> <li>• Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	Moderate

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	Extreme

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>• General Directions for Navigation in the Port of London</li> <li>• Schedule to the General Directions for Navigation in the Port of London</li> <li>• Permanent Notice to Mariners</li> <li>• Code of Practice Passenger Vessel Operations on the Thames</li> <li>• Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	Minor

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	Moderate

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**7C - LTTBF - Contact - Tug and Tow with Temporary Work Site**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
7C - LTTBF	Contact - Tug and Tow with Temporary work site	A Tug and Tow comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during removal of temporary cofferdam.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Leisure traffic impedes the passage of vessel navigating the channel</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Lost Time Injury / Moderate permanent partial disability injury</li> <li>• Temporary effect / Minor effect to small area</li> <li>• Moderate damage to vessel / equipment requiring immediate repairs</li> <li>• National coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• Passage Planning</li> <li>• Ship Towage Code of Practice</li> <li>• COLREGs</li> <li>• Oil Spill Contingency Plan</li> <li>• Tug Operator Procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Closure of Arch No 2 to all inward bound freight traffic</li> <li>• Inward bound vessels use Arch No 3</li> <li>• Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	Moderate

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Pilotage Directions</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•Ship Towage Operations on the Thames</li> <li>•Code of Practice for Craft Towage Operations on the Thames</li> <li>•Port Entry Guide</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	Minor

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	Moderate

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

### 8C - LTTBF - Contact - Private Leisure Vessel with Temporary Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
8C - LTTBF	Contact - Private leisure vessel with Temporary work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during removal of temporary cofferdam.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Improper lookout</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Lost Time Injury / Moderate permanent partial disability injury</li> <li>• Temporary effect / Minor effect to small area</li> <li>• Moderate damage to vessel / equipment requiring immediate repairs</li> <li>• Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Aids to Navigation</li> <li>• VHF Communications</li> <li>• COLREGs</li> <li>• General Directions</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• VTS Navigational Broadcast</li> </ul>	<ul style="list-style-type: none"> <li>• Closure of Arch No 2 to all inward bound freight traffic</li> <li>• Inward bound vessels use Arch No 3</li> <li>• Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area</li> <li>• Information provided to local recreational clubs and marinas providing an overview of the works being conducted and expected duration</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	Moderate

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>• General Directions for Navigation in the Port of London</li> <li>• Schedule to the General Directions for Navigation in the Port of London</li> <li>• Permanent Notice to Mariners</li> <li>• Mariners Guide to Bridges on the Tidal Thames</li> <li>• Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	Moderate

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

### 9C - LTTBF - Collision with Commercial Freight Operator

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
9C - LTTBF	Collision with commercial freight operator	A vessel conducting Thames Tunnel construction activities collides with a commercial freight operator in the vicinity of Blackfriars Embankment, during the construction of the temporary cofferdam.	<ul style="list-style-type: none"> <li>Reduced effective river width</li> <li>Misjudgement</li> <li>Inattention</li> <li>Non Compliance with procedures</li> <li>Improper lookout</li> <li>Lack of communications</li> <li>Machinery breakdown</li> <li>Collision avoidance</li> <li>High density of leisure traffic</li> <li>Leisure traffic impedes the passage of vessel navigating the channel</li> <li>Change in river flow due to new in-river structure</li> <li>Tidal set</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Short to medium term impact</li> <li>Moderate damage to vessel / equipment requiring immediate repairs</li> <li>Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>Boat Masters Licence</li> <li>Qualified Crew</li> <li>Bridge Special Signal Lights</li> <li>Emergency Plans &amp; Procedures</li> <li>VTS Navigational Broadcast</li> <li>Thames AIS</li> <li>Passage Planning</li> <li>Ship Towing Code of Practice</li> <li>BML Local Knowledge Endorsement</li> <li>Tug Operator Procedures</li> <li>Perm / Temp Notice to Mariners</li> <li>COLREGS</li> <li>General Directions</li> </ul>	<ul style="list-style-type: none"> <li>Light Warnings - providing visual warning that barge is about to depart berth</li> <li>Sound Warnings - providing audio warning that barge is about to depart berth</li> <li>Use of reputable and experienced marine contractor</li> <li>Sub-Contractors Risk Assessment</li> <li>Berth Master</li> <li>Berth Master to monitor VHF</li> <li>Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity</li> <li>CCTV to provide additional information to Berth Master</li> <li>Closure of Arch No 2 to all inward bound freight traffic</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	4	8	Moderate

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>River Byelaws 1978 (as amended)</li> <li>Permanent Notice to Mariners</li> <li>Ship Towing Operations on the Thames</li> <li>Code of Practice for Craft Towing Operations on the Thames</li> <li>Port Entry Guide</li> <li>Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Sub Contractors Risk Assessment												
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> <td>Welfare</td> </tr> <tr> <td>Amenities</td> <td>Movement of materials</td> <td>Fire safety</td> </tr> <tr> <td>Lifting operations</td> <td>Mooring</td> <td></td> </tr> <tr> <td>Slips and trips</td> <td></td> <td></td> </tr> </table>	Working at height	Loading / Unloading operations	Welfare	Amenities	Movement of materials	Fire safety	Lifting operations	Mooring		Slips and trips		
Working at height	Loading / Unloading operations	Welfare										
Amenities	Movement of materials	Fire safety										
Lifting operations	Mooring											
Slips and trips												

## 10C - LTTBF - Collision with Tug and Tow

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
10C - LTTBF	Collision with tug and tow	A vessel conducting Thames Tunnel construction activities collides with a tug and tow in the vicinity of Blackfriars Embankment, during the construction of the temporary cofferdam.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Non Compliance with procedures</li> <li>• Improper lookout</li> <li>• Lack of communications</li> <li>• Machinery breakdown</li> <li>• Collision avoidance</li> <li>• High density of leisure traffic</li> <li>• Leisure traffic impedes the passage of vessel navigating the channel</li> <li>• Change in river flow due to new in-river structure</li> <li>• Tidal set</li> </ul>	<ul style="list-style-type: none"> <li>• Lost Time Injury / Moderate permanent partial disability injury</li> <li>• Temporary effect / Minor effect to small area</li> <li>• Moderate damage to vessel / equipment requiring immediate repairs</li> <li>• Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• Qualified Crew</li> <li>• Bridge Special Signal Lights</li> <li>• Emergency Plans &amp; Procedures</li> <li>• VTS Navigational Broadcast</li> <li>• Thames AIS</li> <li>• Passage Planning</li> <li>• Ship Towing Code of Practice</li> <li>• BML Local Knowledge Endorsement</li> <li>• Perm / Temp Notice to Mariners</li> <li>• Tug Operator Procedures</li> <li>• General Directions</li> <li>• COLREGS</li> </ul>	<ul style="list-style-type: none"> <li>• Light Warnings - providing visual warning that barge is about to depart berth</li> <li>• Sound Warnings - providing audio warning that barge is about to depart berth</li> <li>• Use of reputable and experienced marine contractor</li> <li>• Sub-Contractors Risk Assessment</li> <li>• Berth Master</li> <li>• Berth Master to monitor VHF</li> <li>• Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity</li> <li>• CCTV to provide additional information to Berth Master</li> <li>• Closure of Arch No 2 to all inward bound freight traffic</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	Moderate

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>• General Directions for Navigation in the Port of London</li> <li>• Schedule to the General Directions for Navigation in the Port of London</li> <li>• Pilotage Directions</li> <li>• River Byelaws 1978 (as amended)</li> <li>• Permanent Notice to Mariners</li> <li>• Ship Towing Operations on the Thames</li> <li>• Code of Practice for Craft Towing Operations on the Thames</li> <li>• Port Entry Guide</li> <li>• Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	Moderate

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**11C - LTTBF - Contact with Blackfriars Bridge (Road & Rail)**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
11C - LTTBF	Contact with Blackfriars Bridge (Road & Rail)	A vessel conducting Thames Tunnel construction activities makes contact with Blackfriars Road or Rail Bridge, including arches, abutments and any associated bridge superstructure.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Non Compliance with procedures</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• Inadequate training and experience</li> <li>• Tug or line failure</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Restricted work case</li> <li>• Low impact with no lasting effect</li> <li>• Minor or superficial damage to vessel / equipment</li> <li>• Local coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• General Directions</li> <li>• PLA Bridge Guide</li> <li>• Passage Planning</li> <li>• Accurate Tidal Information</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Tug Operator Procedures</li> <li>• COLREGs</li> <li>• Ship Towage Code of Practice</li> <li>• Emergency Plans &amp; Procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Use of reputable and experienced marine contractor</li> <li>• Sub-Contractors Risk Assessment</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
2	3	6	Moderate

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	3	3	Minor

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	Moderate

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
2	3	6	Moderate

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Ship Towage Operations on the Thames</li> <li>•Code of Practice for the Safe Mooring of Vessels on the Thames</li> <li>•Code of Practice for Craft Towage Operations on the Thames</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> <li>•Port Entry Guide</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
2	3	6	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	3	3	Minor

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
2	3	6	Moderate

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**12C - LTTBF - Contact - High Speed Craft / Class V Passenger Vessel with Temporary Work Site**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
12C - LTTBF	Contact - High Speed Craft / Class V passenger vessel with Temporary work site	A High Speed Craft / Class V passenger vessel comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> <li>• Leisure traffic impedes the passage of vessel navigating the channel</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Lost Time Injury / Moderate permanent partial disability injury</li> <li>• Short to medium term impact</li> <li>• Moderate damage to vessel / equipment requiring immediate repairs</li> <li>• Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• VTS Navigational Broadcast</li> <li>• HSC Code</li> <li>• Passage Planning</li> <li>• COLREGs</li> <li>• VHF Communications</li> <li>• Emergency Plans &amp; Procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Closure of Arch No 2 to all inward bound freight traffic</li> <li>• Inward bound vessels use Arch No 3</li> <li>• Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	Moderate

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Permanent Notice to Mariners</li> <li>•Code of Practice Passenger Vessel Operations on the Thames</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	Minor

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	Moderate

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**13C - LTTBF - Contact - Tug and Tow with Temporary Work Site**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
13C - LTTBF	Contact - Tug and Tow with Temporary work site	A Tug and Tow comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction of temporary cofferdam.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Leisure traffic impedes the passage of vessel navigating the channel</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Lost Time Injury / Moderate permanent partial disability injury</li> <li>• Short to medium term impact</li> <li>• Moderate damage to vessel / equipment requiring immediate repairs</li> <li>• Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• Passage Planning</li> <li>• Ship Towage Code of Practice</li> <li>• COLREGs</li> <li>• Oil Spill Contingency Plan</li> <li>• Tug Operator Procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Closure of Arch No 2 to all inward bound freight traffic</li> <li>• Inward bound vessels use Arch No 3</li> <li>• Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	Moderate

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Pilotage Directions</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•Ship Towage Operations on the Thames</li> <li>•Code of Practice for Craft Towage Operations on the Thames</li> <li>•Port Entry Guide</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	Minor

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	Moderate

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

### 14C - LTTBF - Contact - Private Leisure Vessel with Temporary Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
14C - LTTBF	Contact - Private leisure vessel with Temporary work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction of temporary cofferdam.	<ul style="list-style-type: none"> <li>Reduced effective river width</li> <li>Misjudgement</li> <li>Inattention</li> <li>Improper lookout</li> <li>Lack of communications</li> <li>Adverse weather conditions</li> <li>Machinery breakdown</li> <li>High density of leisure traffic</li> <li>Collision avoidance</li> <li>Tidal set</li> <li>Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>Single Fatality / Severe permanent partial disability</li> <li>Low impact with no lasting effect</li> <li>Major damage to vessel / equipment and detention</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>Aids to Navigation</li> <li>VHF Communications</li> <li>COLREGs</li> <li>General Directions</li> <li>Permanent / Temporary Notice to Mariners</li> <li>VTS Navigational Broadcast</li> </ul>	<ul style="list-style-type: none"> <li>Closure of Arch No 2 to all inward bound freight traffic</li> <li>Inward bound vessels use Arch No 3</li> <li>Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area</li> <li>Information provided to local recreational clubs and marinas providing an overview of the works being conducted and expected duration</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	4	4	<b>Minor</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Permanent Notice to Mariners</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> <li>Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	2	2	<b>Slight</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Sub Contractors Risk Assessment								
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Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**15C - LTTBF - Contact with Moored Vessel in Vicinity of Blackfriars (President / Cory Barges / Passenger Boat Moorings etc.)**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Safeguards
15C - LTTBF	Contact with moored vessel in vicinity of Blackfriars (President / Cory barges / Passenger boat moorings etc)	A vessel in transit makes contact with a moored vessel (E.g. Moored Barge, President or moored passenger boat) in the vicinity of Blackfriars Embankment.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Single Fatality / Severe permanent partial disability</li> <li>• Short to medium term impact</li> <li>• Major damage to vessel / equipment and detention</li> <li>• National coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• Passage Planning</li> <li>• Ship Towage Code of Practice</li> <li>• Admiralty Charts</li> <li>• COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>• Relocate HMS President</li> <li>• Relocate Cory Coin Street moorings</li> <li>• Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Pilotage Directions</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•Ship Towage Operations on the Thames</li> <li>•Code of Practice for Craft Towage Operations on the Thames</li> <li>•Port Entry Guide</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	<b>Minor</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Sub Contractors Risk Assessment								
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Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

### 16C - LTTBF - Vessels subject to increased interaction during periods of low water

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Safeguards
16C - LTTBF	Vessels subject to increased interaction during periods of low water.	Due to the intrusion of the temporary works into the authorised channel, the available water space for vessels to manoeuvre in is reduced. At periods of low water this is particularly relevant.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Lost Time Injury / Moderate permanent partial disability injury</li> <li>• Low impact with no lasting effect</li> <li>• Moderate damage to vessel / equipment requiring immediate repairs</li> <li>• Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> </ul>	

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	3	3	<b>Minor</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>• General Directions for Navigation in the Port of London</li> <li>• Schedule to the General Directions for Navigation in the Port of London</li> <li>• Pilotage Directions</li> <li>• River Byelaws 1978 (as amended)</li> <li>• Permanent Notice to Mariners</li> <li>• Ship Towage Operations on the Thames</li> <li>• Code of Practice for Craft Towage Operations on the Thames</li> <li>• Port Entry Guide</li> <li>• Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	2	2	<b>Slight</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Sub Contractors Risk Assessment								
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Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

### 17C - LTTBF - Vessels subject to increased interaction during periods of low water

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Safeguards
17C - LTTBF	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	<ul style="list-style-type: none"> <li>Reduced effective river width</li> <li>Misjudgement</li> <li>Inattention</li> <li>Lack of communications</li> <li>Adverse weather conditions</li> <li>Collision avoidance</li> <li>Tidal set</li> <li>Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Low impact with no lasting effect</li> <li>Moderate damage to vessel / equipment requiring immediate repairs</li> <li>Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>Boat Masters Licence</li> <li>BML Local Knowledge Endorsement</li> <li>Qualified Crew</li> <li>Vessel Master Experience</li> <li>Permanent / Temporary Notice to Mariners</li> <li>MCA Guidance document</li> </ul>	

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	3	3	<b>Minor</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>River Byelaws 1978 (as amended)</li> <li>Permanent Notice to Mariners</li> <li>Ship Towage Operations on the Thames</li> <li>Code of Practice for Craft Towage Operations on the Thames</li> <li>Port Entry Guide</li> <li>Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	2	2	<b>Slight</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

### 18C - LTTBF – Contact with moored vessel at relocated Blackfriars Millennium Pier

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Safeguards
18C - LTTBF	Contact with moored vessel at relocated Blackfriars Millennium Pier	A vessel in transit makes contact with a vessel moored at the relocated Blackfriars Millennium Pier.	<ul style="list-style-type: none"> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> </ul>	<ul style="list-style-type: none"> <li>• Single Fatality / Severe permanent partial disability</li> <li>• Low impact with no lasting effect</li> <li>• Major damage to vessel / equipment and detention</li> <li>• National coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• Passage Planning</li> <li>• Ship Towage Code of Practice</li> <li>• Admiralty Charts</li> <li>• COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>• Restrictions on number of barges permitted to be towed in this area in the event that arch No2 is closed.</li> <li>• Provide facilities for vessels using the pier to moor at the eastern end to allow them to be further from the authorised channel.</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	3	3	Minor

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Pilotage Directions</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•Ship Towage Operations on the Thames</li> <li>•Code of Practice for Craft Towage Operations on the Thames</li> <li>•Port Entry Guide</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	2	2	Slight

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	Moderate

Sub Contractors Risk Assessment
<p>The proposed new location for Blackfriars Millennium Pier takes into consideration a number of stakeholder requirements.</p> <p>After consultation with the PLA, the outer face of the pier pontoon has been set back from the authorised channel by at least 15m.</p>

## Annex E– Most likely hazard log: Phase D – Permanent work site

### E.1 Most likely hazard list: Phase D –Permanent work site

Hazard Id	Hazard Title	Hazard Description	People	Environment	Operational	Media
1D	Restricted Working - Work intrudes into authorised channel and constrains traffic	Intrusion into authorised channel by permanent works structure constrains available water space for existing traffic. Due to the reduced channel width a river incident occurs.	12	6	9	12
2D	Emergency Arch Closure - Arch No 3	With the permanent work structure in place, there may be an emergency requirement to close No 3 arch.	9	6	9	9
3D	Planned Arch Closure - Arch No 3	With the permanent work structure in place there will be requirements for scheduled maintenance of No 3 arch resulting in arch closure.	6	6	6	6
4D	Planned Arch closure - Arch No 2	With the permanent work structure in place there will be requirements for scheduled maintenance of No 2 arch resulting in arch closure.	N/A	N/A	N/A	N/A
5D	Emergency Arch closure - Arch No 2	With the permanent work structure in place, there may be an emergency requirement to close No 2 arch.	N/A	N/A	N/A	N/A
6D	Change in River Flow	The permanent structure is of sufficient area and shape to have an effect on the fluvial flow of the river in the area around Blackfriars.	9	6	9	9
7D	Contact - High Speed Craft / Class V passenger vessel with Permanent work site	A High Speed Craft / Class V passenger vessel comes into contact with Thames Tunnel Permanent work site at Blackfriars Embankment.	9	6	9	12

8D	Contact - Tug and Tow with permanent work site	A Tug and Tow comes into contact with Thames Tunnel permanent work site at Blackfriars Embankment.	9	9	9	9
9D	Contact - Private leisure vessel with Permanent work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel permanent work site at Blackfriars Embankment.	12	3	12	12
10D	Contact with moored vessel in vicinity of Blackfriars (President / Cory barges / Passenger boat moorings etc)	A vessel in transit makes contact with a moored vessel (E.g. Moored Barge, President or moored passenger boat) in the vicinity of Blackfriars Embankment during the construction of the shaft and culvert.	N/A	N/A	N/A	N/A
11D	Vessels subject to increased interaction during periods of low water	Due to the intrusion of the permanent works into the authorised channel, the available water space for vessels to manoeuvre in is reduced. At periods of low water this is particularly relevant	9	3	9	9
12D	Contact with moored vessel at relocated Blackfriars Millennium Pier	A vessel in transit makes contact with a vessel moored at the relocated Blackfriars Millennium Pier.	12	3	12	12

## E.2 Most likely hazard list – Phase D: Permanent work site

### 1D - LTTBF - Restricted Working

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
1D - LTTBF	Restricted Working	Intrusion into authorised channel by permanent works structure constrains available water space for existing traffic.  Due to the reduced channel width a river incident occurs.	<ul style="list-style-type: none"> <li>Reduced effective river width</li> <li>River Incident</li> <li>Misjudgement</li> <li>Inattention</li> <li>Adverse weather conditions</li> <li>Machinery breakdown</li> <li>Collision avoidance</li> <li>Tidal set</li> <li>Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>Single Fatality / Severe permanent partial disability</li> <li>Temporary effect / Minor effect to small area</li> <li>Moderate damage to vessel / equipment requiring immediate repairs</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>Boat Masters Licence</li> <li>BML Local Knowledge Endorsement</li> <li>Vessel Master Experience</li> <li>Qualified Crew</li> <li>VTS Navigational Broadcast</li> <li>VTS Qualification</li> <li>VHF Communications</li> <li>Bridge Special Signal Lights</li> <li>General Directions</li> <li>Emergency Plans and Procedures</li> <li>COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>Minimise the footprint of the permanent works structure and therefore encroachment into the channel</li> <li>Relocate Cory Environmental Ltd Coin Street moorings</li> <li>See assessment notes</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>Moderate</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Code of Practice Passenger Vessel Operations on the Thames</li> <li>River (Amendment) Byelaws 2006 - Thames AIS Byelaws and Revocation of River Byelaws 6, 8 and 41</li> <li>River Thames Recreational Users Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> <li>Ship Towage Operations on the Thames</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Assessment Notes
<p>Phase 4 – Permanent works</p> <p>Arch 2 – Open to smaller, non reporting inbound vessels. Standby arch for inbound reporting vessels, may have operating restrictions in place; number of barges to be towed through for example</p> <p>Arch 3 – Preferred arch for inbound and outbound reporting vessels. Possible planned closures throughout life of works, to be assessed in Navigational Risk Assessment</p> <p>Arch 4 – Preferred arch for outbound smaller vessels – standby arch for outbound reporting vessels</p>

## 2D - LTTBF - Emergency Arch Closure - Arch No 3

<b>Hazard ID</b>	<b>Hazard Title</b>	<b>Hazard Description</b>	<b>Hazard Causes</b>	<b>Consequence(s) Most Likely</b>	<b>Existing Safeguards</b>	<b>Proposed Additional Mitigation</b>
<b>2D - LTTBF</b>	Emergency Arch Closure - Arch No 3	<p>With the permanent work structure in place, there may be an emergency requirement to close No 3 arch.</p> <p>The permanent works structure intrudes into the authorised channel and therefore navigable water space will be constrained with an increase in the probability of a river incident.</p>	<ul style="list-style-type: none"> <li>Emergency Bridge Arch Closure</li> <li>River Incident</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Temporary effect / Minor effect to small area</li> <li>Moderate damage to vessel / equipment requiring immediate repairs</li> <li>Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>VTS Navigational Broadcast</li> <li>VHF Communications</li> <li>Aids to Navigation</li> <li>Thames AIS</li> <li>COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>Safety boat to be in attendance maintaining a continuous VHF watch on Channel 14 in the event of Arch No 3 closure</li> <li>Navigational warning broadcast on VHF</li> <li>Restricted operating procedures for freight services through Arch No 2 (1 x barge per tug)</li> </ul>

<b>Pre Control - People</b>			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

<b>Pre Control – Environment</b>			
Severity	Probability	Risk Score	Risk Band
2	4	8	<b>Moderate</b>

<b>Pre Control - Operational Impact</b>			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

<b>Pre Control - Media Attention</b>			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

<b>Post Control - People</b>			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

<b>Post Control - Environment</b>			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

<b>Post Control - Operational Impact</b>			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

<b>Post Control - Media Attention</b>			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

<b>Relevant PLA Guidance</b>
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Port Entry Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> </ul>

<b>Assessment Notes</b>
<p>Phase 4 – Permanent works</p> <p>Arch 2 – Open to smaller, non reporting inbound vessels. Standby arch for inbound reporting vessels, may have operating restrictions in place; number of barges to be towed for example</p> <p>Arch 3 – Preferred arch for inbound and outbound reporting vessels. Possible planned closures throughout life of works, to be assessed in Navigational Risk Assessment</p> <p>Arch 4 – Preferred arch for outbound smaller vessels – standby arch for outbound reporting vessels</p>

## 3D - LTTBF - Planned Arch Closure - Arch No 3

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
3D - LTTBF	Planned Arch Closure - Arch No 3	With the permanent work structure in place there will be requirements for scheduled maintenance of No 3 arch resulting in arch closure.	<ul style="list-style-type: none"> <li>Planned Bridge arch closure</li> <li>Maintenance and Inspection routines</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Temporary effect / Minor effect to small area</li> <li>Moderate damage to vessel / equipment requiring immediate repairs</li> <li>Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>Permanent / Temporary Notice to Mariners</li> <li>VTS Navigational Broadcast</li> <li>VHF Communications</li> <li>Aids to Navigation</li> <li>Bridge Special Signal Lights</li> <li>VTS Qualification</li> </ul>	<ul style="list-style-type: none"> <li>Restricted operating procedures for freight services through Arch No 2 (1 x barge per tug)</li> <li>Safety boat to be in attendance maintaining a continuous VHF watch on Channel 14 in the event of Arch No 3 closure</li> <li>Navigational warning broadcast on VHF</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Port Entry Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Assessment Notes
<ul style="list-style-type: none"> <li>Inspection Routine - Road &amp; Rail Bridge <ul style="list-style-type: none"> <li>General Inspection - every 2 years</li> <li>Principal Inspection - every 6<sup>th</sup> year - requires full inspection within touching distance of all elements and therefore inspection from below is required - Arch Closure as a result.</li> </ul> </li> <li>Principal Inspection to be conducted immediately prior to work commencing</li> </ul>

## 4D - LTTBF - Planned Arch Closure - Arch No 2

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
4D - LTTBF	Planned Arch closure - Arch No 2	With the permanent work structure in place there will be requirements for scheduled maintenance of No 2 arch resulting in arch closure.	<ul style="list-style-type: none"> <li>Planned Bridge arch closure</li> <li>Maintenance and Inspection routines</li> </ul>	•		• See assessment notes

## Pre Control - People

Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

## Pre Control - Environment

Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

## Pre Control - Operational Impact

Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

## Pre Control - Media Attention

Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

## Post Control - People

Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

## Post Control - Environment

Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

## Post Control - Operational Impact

Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

## Post Control - Media Attention

Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

## Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Code of Practice Passenger Vessel Operations on the Thames

## Assessment Notes

Closure of Arch No 2, once the permanent works is in place, makes no change to the current river operations.

Arch No 2 has been required to be closed for durations of the Networks Rail Blackfriars Bridge works.

A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect.

### 5D - Emergency Arch Closure - Arch No 2

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
5D - LTTBF	Emergency Arch closure - Arch No 2	With the permanent work structure in place, there may be an emergency requirement to close No 2 arch.	<ul style="list-style-type: none"> <li>Planned Bridge arch closure</li> <li>Maintenance and Inspection routines</li> </ul>	<ul style="list-style-type: none"> <li></li> </ul>		<ul style="list-style-type: none"> <li>See assessment notes</li> </ul>

#### Pre Control - People

Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

#### Pre Control - Environment

Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

#### Pre Control - Operational Impact

Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

#### Pre Control - Media Attention

Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

#### Post Control - People

Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

#### Post Control - Environment

Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

#### Post Control - Operational Impact

Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

#### Post Control - Media Attention

Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

#### Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Code of Practice Passenger Vessel Operations on the Thames

#### Assessment Notes

Closure of Arch No 2, once the permanent works is in place, makes no change to the current river operations.

Arch No 2 has been required to be closed for durations of the Networks Rail Blackfriars Bridge works.

A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect.

## 6D – LTTBF - Change in River Flow

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
6D - LTTBF	Change in River Flow	The permanent structure is of sufficient area and shape to have an effect on the fluvial flow of the river in the area around Blackfriars.  Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Blackfriars Bridges.	<ul style="list-style-type: none"> <li>Shape and position of temporary cofferdam</li> </ul>	<ul style="list-style-type: none"> <li>Lost Time Injury / Moderate permanent partial disability injury</li> <li>Temporary effect / Minor effect to small area</li> <li>Moderate damage to vessel / equipment requiring immediate repairs</li> <li>Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>None identified for this hazard</li> </ul>	<ul style="list-style-type: none"> <li>Fluvial modelling studies have helped to inform the shape of the structure, including the rounded edge of the upstream corner</li> <li>NTM to advise that for example: In Arch No3 the maximum flow will increase by approximately 1/2 knot during temporary works with the flow moving towards the south side of the bridge arch</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> <li>Port Entry Guide</li> <li>Code of Practice Passenger Vessel Operations on the Thames</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Assessment Notes
<p>Fluvial modelling (numerical and physical) have been used to develop the design of the structure.</p> <p>Analysis of HR Wallingford fluvial modelling report indicates minimum change in flow in this area.</p> <p>Further investigation is required in order to assess latest structure design.</p>

## 7D - LTTBF - Contact - High Speed Craft / Class V Passenger Vessel with Permanent Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
7D - LTTBF	Contact - High Speed Craft / Class V passenger vessel with Permanent work site	A High Speed Craft / Class V passenger vessel comes into contact with Thames Tunnel Permanent work site at Blackfriars Embankment.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> <li>• Leisure traffic impedes the passage of vessel navigating the channel</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Lost Time Injury / Moderate permanent partial disability injury</li> <li>• Temporary effect / Minor effect to small area</li> <li>• Moderate damage to vessel / equipment requiring immediate repairs</li> <li>• National coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• VTS Navigational Broadcast</li> <li>• HSC Code</li> <li>• Passage Planning</li> <li>• COLREGs</li> <li>• VHF Communications</li> <li>• Emergency Plans &amp; Procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Update PLA guidance and charts with new structure location</li> <li>• Notice to Mariners</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	Moderate

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	Extreme

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Permanent Notice to Mariners</li> <li>•Code of Practice Passenger Vessel Operations on the Thames</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	Moderate

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Assessment Notes

## 8D - LTTBF - Contact - Tug and Tow with Permanent Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
8D - LTTBF	Contact - Tug and Tow with permanent work site	A Tug and Tow comes into contact with Thames Tunnel permanent work site at Blackfriars Embankment.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Improper lookout</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Lost Time Injury / Moderate permanent partial disability injury</li> <li>• Short to medium impact</li> <li>• Moderate damage to vessel / equipment requiring immediate repairs</li> <li>• Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• Passage Planning</li> <li>• Ship Towage Code of Practice</li> <li>• COLREGs</li> <li>• Oil Spill Contingency Plan</li> <li>• Tug Operator Procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Update PLA guidance and charts with new structure location</li> <li>• Notice to Mariners</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>• General Directions for Navigation in the Port of London</li> <li>• Schedule to the General Directions for Navigation in the Port of London</li> <li>• Pilotage Directions</li> <li>• River Byelaws 1978 (as amended)</li> <li>• Permanent Notice to Mariners</li> <li>• Ship Towage Operations on the Thames</li> <li>• Code of Practice for Craft Towage Operations on the Thames</li> <li>• Port Entry Guide</li> <li>• Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Assessment Notes

### 9D - LTTBF - Contact - Private Leisure Vessel with Permanent Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
9D - LTTBF	Contact - Private leisure vessel with Permanent work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel permanent work site at Blackfriars Embankment.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Improper lookout</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Lost Time Injury / Moderate permanent partial disability injury</li> <li>• Low impact with no lasting effect</li> <li>• Major damage to vessel / equipment and detention</li> <li>• National coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Aids to Navigation</li> <li>• VHF Communications</li> <li>• COLREGs</li> <li>• General Directions</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• VTS Navigational Broadcast</li> </ul>	<ul style="list-style-type: none"> <li>• Information provided to local recreational clubs and marinas providing an overview of the new works layout.</li> <li>• Update PLA guidance and charts with new structure location</li> <li>• Notice to Mariners</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	4	16	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	4	4	Minor

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	Extreme

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	Extreme

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Permanent Notice to Mariners</li> <li>•Mariners Guide to Bridges on the Tidal Thames</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	3	3	Minor

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Assessment Notes

**10D - LTTBF - Contact with Moored Vessel in Vicinity of Blackfriars (President / Cory Barges / Passenger Boat Moorings etc.)**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Safeguards
10D - LTTBF	Contact with moored vessel in vicinity of Blackfriars (President / Cory barges / Passenger boat moorings etc)	A vessel in transit makes contact with a moored vessel (E.g. Moored Barge, President or moored passenger boat) in the vicinity of Blackfriars Embankment during the construction of the shaft and culvert.	<ul style="list-style-type: none"> <li>Not applicable to this stage of the project</li> </ul>	<ul style="list-style-type: none"> <li>Not applicable to this stage of the project</li> </ul>	<ul style="list-style-type: none"> <li>Not applicable to this stage of the project</li> </ul>	<ul style="list-style-type: none"> <li>Not applicable to this stage of the project</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>River Byelaws 1978 (as amended)</li> <li>Permanent Notice to Mariners</li> <li>Ship Towing Operations on the Thames</li> <li>Code of Practice for Craft Towing Operations on the Thames</li> <li>Port Entry Guide</li> <li>Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Assessment Notes

### 11D - LTTBF - Vessels subject to increased interaction during periods of low water

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Safeguards
11D - LTTBF	Vessels subject to increased interaction during periods of low water.	Due to the intrusion of the permanent works into the authorised channel, the available water space for vessels to manoeuvre in is reduced. At periods of low water this is particularly relevant.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Lost Time Injury / Moderate permanent partial disability injury</li> <li>• Low impact with no lasting effect</li> <li>• Moderate damage to vessel / equipment requiring immediate repairs</li> <li>• Regional coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> </ul>	

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	4	4	Minor

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Pilotage Directions</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•Ship Towing Operations on the Thames</li> <li>•Code of Practice for Craft Towing Operations on the Thames</li> <li>•Port Entry Guide</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	3	3	Minor

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

## 12D - LTTBF - Contact with moored vessel at relocated Blackfriars Millennium Pier

<b>Hazard ID</b>	<b>Hazard Title</b>	<b>Hazard Description</b>	<b>Hazard Causes</b>	<b>Consequence(s) Most Likely</b>	<b>Existing Safeguards</b>	<b>Proposed Additional Safeguards</b>
<b>12D - LTTBF</b>	Contact with moored vessel at relocated Blackfriars Millennium Pier	A vessel in transit makes contact with a vessel moored at the relocated Blackfriars Millennium Pier.	<ul style="list-style-type: none"> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> </ul>	<ul style="list-style-type: none"> <li>• Single Fatality / Severe permanent partial disability</li> <li>• Low impact with no lasting effect</li> <li>• Major damage to vessel / equipment and detention</li> <li>• National coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• Passage Planning</li> <li>• Ship Towing Code of Practice</li> <li>• Admiralty Charts</li> <li>• COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>• Restrictions on number of barges permitted to be towed in this area in the event that arch No2 is closed.</li> <li>• Provide facilities for vessels using the pier to moor at the eastern end to allow them to be further from the authorised channel.</li> </ul>

<b>Pre Control - People</b>			
Severity	Probability	Risk Score	Risk Band
4	4	12	<b>High</b>

<b>Pre Control - Environment</b>			
Severity	Probability	Risk Score	Risk Band
1	4	4	<b>Minor</b>

<b>Pre Control - Operational Impact</b>			
Severity	Probability	Risk Score	Risk Band
4	4	12	<b>High</b>

<b>Pre Control - Media Attention</b>			
Severity	Probability	Risk Score	Risk Band
4	4	12	<b>High</b>

<b>Relevant PLA Guidance</b>
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Pilotage Directions</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•Ship Towing Operations on the Thames</li> <li>•Code of Practice for Craft Towing Operations on the Thames</li> <li>•Port Entry Guide</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

<b>Post Control - People</b>			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

<b>Post Control - Environment</b>			
Severity	Probability	Risk Score	Risk Band
1	3	3	<b>Minor</b>

<b>Post Control - Operational Impact</b>			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

<b>Post Control - Media Attention</b>			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

<b>Risk Assessment Notes</b>
<p>Assessment assumes that the Pier will remain in its proposed new location.</p> <p>The proposed new location for Blackfriars Millennium Pier takes into consideration a number of stakeholder requirements.</p> <p>After consultation with the PLA, the outer face of the pier pontoon has been set back from the authorised channel by at least 15m.</p>

## Annex F– Worst credible hazard log: Phase A - Construction of cofferdam

### F.1 Worst credible summary hazard list: Phase A - Construction of cofferdam

Hazard Id	Hazard Title	Hazard Description	People	Environment	Operational	Media
1E	Restricted Working - Work intrudes into authorised channel and constrains traffic	During construction of temporary cofferdam, associated infrastructure (cofferdam, jack up rig etc.) extends into the authorised channel, therefore constraining available water space for existing traffic. Due to the reduced channel width a river incident occurs.	15	9	15	12
2E	Emergency Arch closure - Arch No 3	During construction of the temporary cofferdam there may be an emergency requirement to close No 3 arch.	15	9	15	12
3E	Planned arch closure - Arch No 3	During construction of the temporary cofferdam there may be a requirement to close No 3 arch for maintenance.	10	6	10	8
4E	Planned Arch closure - Arch No 2	During construction of the temporary cofferdam it is proposed that Arch No 2 is closed to all navigation.	10	6	10	10
5E	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Blackfriars Bridges.	15	9	15	12
6E	Collision with High Speed Passenger Vessel	A vessel conducting Thames Tunnel construction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Blackfriars	10	6	10	10
7E	Collision with Class V passenger vessel	A vessel conducting Thames Tunnel construction activities collides with a Class V passenger vessel in the vicinity of Blackfriars Embankment.	10	6	10	10
8E	Collision with private leisure vessel	A vessel conducting Thames Tunnel construction activities collides with a private leisure vessel in the vicinity of Blackfriars Embankment.	15	6	15	15
9E	Collision with commercial freight operator	A vessel conducting Thames Tunnel construction activities collides with a commercial freight operator in the vicinity of Blackfriars Embankment.	15	9	15	15
10E	Collision with tug and tow	A vessel conducting Thames Tunnel construction activities collides with a tug and tow in the vicinity of Blackfriars Embankment.	15	9	15	15

11E	Contact with Blackfriars Bridge (Road & Rail)	A vessel conducting Thames Tunnel construction activities makes contact with Blackfriars Road or Rail Bridge, including arches, abutments and any associated bridge superstructure.	8	6	8	8
12E	Contact - High Speed Craft / Class V passenger vessel with Temporary work site	A High Speed Craft / Class V passenger vessel comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction / removal of temporary cofferdam.	15	9	15	15
13E	Contact - Tug and Tow with Temporary work site	A Tug and Tow comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction / removal of temporary cofferdam.	10	6	8	8
14E	Contact - Private leisure vessel with Temporary work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction / removal of temporary cofferdam.	10	2	8	10
15E	Contact with moored vessel in vicinity of Blackfriars (President / Cory barges/ Passenger boat moorings etc)	A vessel in transit makes contact with a moored vessel (E.g. Moored Barge, President or moored passenger boat) in the vicinity of Blackfriars Embankment.	10	6	6	10
16E	Vessels subject to increased interaction during periods of low water	Due to the intrusion of the temporary works into the authorised channel, the available water space for vessels to manoeuvre in is reduced. At periods of low water this is particularly relevant	8	6	8	8
17E	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	8	6	8	8
18E	Contact with moored vessel at relocated Blackfriars Millennium Pier	A vessel in transit makes contact with a vessel moored at the relocated Blackfriars Millennium Pier.	10	2	10	10

## F.2 Most credible hazard list – Phase A: Construction of cofferdam

### 1E - LTTBF - Restricted Working - Work Intrudes into Authorised Channel and Constrains

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
1E - LTTBF	Restricted Working	Temporary works site, including cofferdam and associated infrastructure extends into the authorised channel, therefore constraining available water space for existing traffic.  Intrusion into authorised channel constrains available water space for existing traffic. Due to the reduced channel width a river incident occurs.	<ul style="list-style-type: none"> <li>Reduced effective river width</li> <li>Misjudgement</li> <li>Inattention</li> <li>Adverse weather conditions</li> <li>Machinery breakdown</li> <li>Collision avoidance</li> <li>Tidal set</li> <li>Change in river flow due to new in-river structure</li> <li>River Incident</li> </ul>	<ul style="list-style-type: none"> <li>Multiple fatalities</li> <li>Short to medium term impact</li> <li>Very serious damage to vessel or equipment possible criminal proceedings</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>Boat Masters Licence</li> <li>BML Local Knowledge Endorsement</li> <li>Qualified Crew</li> <li>Vessel Master Experience</li> <li>Thames AIS</li> <li>VHF Communications</li> <li>VTS Navigational Broadcast</li> <li>Permanent / Temporary Notice to Mariners</li> <li>Tug Operator Procedures</li> <li>Ship Towing Code of Practice</li> <li>Aids to Navigation</li> <li>General Directions</li> <li>Emergency Plans &amp; Procedures</li> <li>COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>Minimise the footprint of the temporary works and therefore encroachment into the channel</li> <li>Close Arch No 2 to all inward bound freight traffic</li> <li>Restrict access through Arch No 2 to certain vessels at different phases of construction</li> <li>Vessel Traffic Control Co-ordinator</li> <li>Scheduling of barge movements to assist with existing river events</li> <li>Communication and schedule planning - PLA / Thames Tunnel / Marine Sub Contractor</li> <li>Safety Work Boat in attendance during periods of restricted working</li> <li>Suspend Thames Tunnel barge operations in event of emergency arch closure</li> <li>Relocate Cory Environmental Ltd Coin Street moorings</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	Extreme

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	4	20	Extreme

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	Extreme

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Code of Practice Passenger Vessel Operations on the Thames</li> <li>River Thames Recreational Users Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> <li>Ship Towing Operations on the Thames</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Assessment Notes
<ul style="list-style-type: none"> <li>Emergency closure of Arch No 3 assessed separately.</li> </ul>

## 2E - LTTBF - Emergency Arch Closure - Arch No 3

<b>Hazard ID</b>	<b>Hazard Title</b>	<b>Hazard Description</b>	<b>Hazard Causes</b>	<b>Consequence(s) Worst Credible</b>	<b>Existing Safeguards</b>	<b>Proposed Additional Mitigation</b>
<b>2E - LTTBF</b>	Emergency Arch Closure - Arch No 3	<p>During construction of the temporary cofferdam there may be an emergency requirement to close No 3 arch.</p> <p>Due to the temporary works site intrusion into the authorised channel navigable water space will be constrained with an increase in probability of a river incident.</p>	<ul style="list-style-type: none"> <li>Emergency Bridge Arch Closure</li> <li>River Incident</li> </ul>	<ul style="list-style-type: none"> <li>Multiple fatalities</li> <li>Short to medium term impact</li> <li>Very serious damage to vessel or equipment possible criminal proceedings</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>VTS Navigational Broadcast</li> <li>VHF Communications</li> <li>Aids to Navigation</li> <li>Thames AIS</li> <li>COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>Safety boat to be in attendance maintaining a continuous VHF watch on Channel 14 in the event of Arch No 3 closure</li> <li>Navigational warning broadcast on VHF</li> <li>Suspend Thames Tunnel barge operations in event of emergency arch closure</li> <li>Maintain Arch No 4 for navigation</li> <li>Open Arch No 2 with restricted operating procedures for freight</li> <li>Relocate Cory Environmental Ltd Coin Street moorings</li> </ul>

<b>Pre Control - People</b>			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

<b>Pre Control - Environment</b>			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

<b>Pre Control - Operational Impact</b>			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

<b>Pre Control - Media Attention</b>			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

<b>Relevant PLA Guidance</b>
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Port Entry Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> </ul>

<b>Post Control - People</b>			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

<b>Post Control - Environment</b>			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

<b>Post Control - Operational Impact</b>			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

<b>Post Control - Media Attention</b>			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

<b>Assessment Notes</b>
<ul style="list-style-type: none"> <li>This hazard is covered in more detail within the main Blackfriars Foreshore - Maritime Issues and Navigational Risk Assessment Report.</li> </ul>

**3E - LTTBF - Planned Arch Closure - Arch No 3**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
3E - LTTBF	Planned Arch Closure - Arch No 3	<p>During construction of the temporary cofferdam there may be a scheduled requirement to close No 3 arch.</p> <p>Due to the temporary works site intrusion into the authorised channel navigable water space will be constrained with an increase in probability of a river incident.</p>	<ul style="list-style-type: none"> <li>Planned Bridge arch closure</li> <li>Maintenance and Inspection routines</li> </ul>	<ul style="list-style-type: none"> <li>Multiple fatalities</li> <li>Short to medium term impact</li> <li>Very serious damage to vessel or equipment possible criminal proceedings</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>Permanent / Temporary Notice to Mariners</li> <li>VTS Navigational Broadcast</li> <li>VHF Communications</li> <li>Aids to Navigation</li> <li>Bridge Special Signal Lights</li> <li>VTS Qualification</li> </ul>	<ul style="list-style-type: none"> <li>Scheduling of arch closures in order to facilitate minimum disruption to river users</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	20	<b>Extreme</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Port Entry Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> </ul>

Assessment Notes
<ul style="list-style-type: none"> <li>Inspection Routine - Road &amp; Rail Bridge                             <ul style="list-style-type: none"> <li>General Inspection - every 2 years</li> <li>Principal Inspection - every 6<sup>th</sup> year - requires full inspection within touching distance of all elements and therefore inspection from below is required - Arch Closure as a result.</li> </ul> </li> <li>Principal Inspection to be conducted immediately prior to work commencing</li> <li>Due to the mitigations proposed it is assessed that the probability of a planned arch closure is 'Unlikely'.</li> </ul>

## 4E - LTTBF - Planned Arch Closure - Arch No 2

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
4E - LTTBF	Planned Arch Closure - Arch No 2	<p>During construction of the temporary cofferdam it is proposed that Arch No 2 is closed to all navigation.</p> <p>Due to the temporary works site intrusion into the authorised channel navigable water space will be constrained with an increase in probability of a river incident.</p>	<ul style="list-style-type: none"> <li>Planned Bridge arch closure</li> </ul>	<ul style="list-style-type: none"> <li>Multiple fatalities</li> <li>Short to medium term impact</li> <li>Very serious damage to vessel or equipment possible criminal proceedings</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>Permanent / Temporary Notice to Mariners</li> <li>VTS Navigational Broadcast</li> <li>VHF Communications</li> <li>Aids to Navigation</li> <li>Bridge Special Signal Lights</li> <li>VTS Qualification</li> </ul>	<ul style="list-style-type: none"> <li>Scheduling of arch closures in order to facilitate minimum disruption to river users</li> <li>Maintain Arch No 4 to allow for navigation inbound &amp; outbound for larger and reporting vessels (in the event of an emergency).</li> <li>A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect</li> <li>Relocate the Cory Environmental moorings (currently opposite the proposed permanent works)</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Port Entry Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Assessment Notes
<ul style="list-style-type: none"> <li>Inspection Routine - Road &amp; Rail Bridge <ul style="list-style-type: none"> <li>General Inspection - every 2 years</li> <li>Principal Inspection - every 6<sup>th</sup> year - requires full inspection within touching distance of all elements and therefore inspection from below is required - Arch Closure as a result.</li> </ul> </li> <li>Principal Inspection to be conducted immediately prior to work commencing</li> <li>Due to the mitigations proposed it is assessed that the probability of a planned arch closure is 'Unlikely'.</li> </ul>

## 5E - LTTBF - Increased Flow

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
5E - LTTBF	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Blackfriars Bridges.	<ul style="list-style-type: none"> <li>Shape and position of temporary cofferdam</li> </ul>	<ul style="list-style-type: none"> <li>Multiple fatalities</li> <li>Short to medium term impact</li> <li>Very serious damage to vessel or equipment possible criminal proceedings</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>None identified for this hazard</li> </ul>	<ul style="list-style-type: none"> <li>3D and computational modelling</li> <li>A Notice to Mariners to advise of any increases in river flow: NTM to advise that for example: In Arch No3 the maximum flow will increase by approximately 1/2 knot during temporary works with the flow moving towards the south side of the bridge arch.</li> <li>Review and re-design temporary work structure to reduce hydrodynamic affects</li> <li>Close Arch No 2 to all inward bound freight traffic</li> <li>Restrict access through Arch No 2 to certain vessels at different phases of construction</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Port Entry Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Assessment Notes
<p>Fluvial modelling (numerical and physical) have been used to develop the design of the structure.</p> <p>Analysis of HR Wallingford fluvial modelling report indicates minimum change in flow in this area.</p> <p>Further investigation is required in order to assess latest structure design.</p>

**6E - LTTBF - Collision with High Speed Passenger Vessel**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
6E - LTTBF	Collision with High Speed Passenger Vessel	A vessel conducting Thames Tunnel construction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Blackfriars Embankment during the construction of the temporary cofferdam.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Non Compliance with procedures</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• Inadequate training and experience</li> <li>• Tug or line failure</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Short to medium term impact</li> <li>• Very serious damage to vessel or equipment possible criminal proceedings</li> <li>• International coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• General Directions</li> <li>• Tug Operator Procedures</li> <li>• Passage Planning</li> <li>• VTS Navigational Broadcast</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Thames AIS</li> <li>• HSC Code</li> <li>• VHF Communications</li> <li>• COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>• Light Warnings - providing visual warning that barge is about to depart berth</li> <li>• Sound Warnings - providing audio warning that barge is about to depart berth</li> <li>• Sub-Contractors Risk Assessment</li> <li>• Closure of Arch No 2 to all inward bound freight traffic</li> <li>• Use of reputable and experienced marine contractor</li> <li>• Berth Master</li> <li>• Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity</li> <li>• Berth Master to monitor VHF</li> <li>• CCTV to provide additional information to Berth Master</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•Ship Towage Operations on the Thames</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> <li>•Code of Practice Passenger Vessel Operations on the Thames</li> </ul>

Sub Contractors Risk Assessment									
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> <td>Welfare Amenities</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> <td>Fire safety</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> <td></td> </tr> </table>	Working at height	Loading / Unloading operations	Welfare Amenities	Lifting operations	Movement of materials	Fire safety	Slips and trips	Mooring	
Working at height	Loading / Unloading operations	Welfare Amenities							
Lifting operations	Movement of materials	Fire safety							
Slips and trips	Mooring								

**7E - LTTBF- Collision with Class V Passenger Vessel**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
7E - LTTBF	Collision with Class V Passenger Vessel	A vessel conducting Thames Tunnel construction activities collides with a Class V passenger vessel in the vicinity of Blackfriars Embankment, during the construction of the temporary cofferdam.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Improper lookout</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Inadequate training and experience</li> <li>• Tidal set</li> <li>• Collision avoidance</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Short to medium term impact</li> <li>• Very serious damage to vessel or equipment possible criminal proceedings</li> <li>• International coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• Qualified Crew</li> <li>• BML Local Knowledge Endorsement</li> <li>• Thames AIS</li> <li>• Passage Planning</li> <li>• VHF Communications</li> <li>• Tug Operator Procedures</li> <li>• General Directions</li> <li>• Vessel Master Experience</li> <li>• VTS Navigational Broadcast</li> <li>• COLREGs</li> <li>• Emergency Plans &amp; Procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Light Warnings - providing visual warning that barge is about to depart berth</li> <li>• Sound Warnings - providing audio warning that barge is about to depart berth</li> <li>• Use of reputable and experienced marine contractor</li> <li>• Sub-Contractors Risk Assessment</li> <li>• Closure of Arch No 2 to all inward bound freight traffic</li> <li>• Berth Master</li> <li>• Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity</li> <li>• Berth Master to monitor VHF</li> <li>• CCTV to provide additional information to Berth Master</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>• General Directions for Navigation in the Port of London</li> <li>• Schedule to the General Directions for Navigation in the Port of London</li> <li>• Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> <li>• Port Entry Guide</li> <li>• Code of Practice Passenger Vessel Operations on the Thames</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Sub Contractors Risk Assessment									
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> <td>Welfare Amenities</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> <td>Fire safety</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> <td></td> </tr> </table>	Working at height	Loading / Unloading operations	Welfare Amenities	Lifting operations	Movement of materials	Fire safety	Slips and trips	Mooring	
Working at height	Loading / Unloading operations	Welfare Amenities							
Lifting operations	Movement of materials	Fire safety							
Slips and trips	Mooring								

## 8E - LTTBF - Collision with Private Leisure Vessel

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
8E LTTBF	Collision with Private Leisure Vessel	A vessel conducting Thames Tunnel construction activities collides with a private leisure vessel in the vicinity of Blackfriars Embankment, during the construction of the temporary cofferdam.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Non Compliance with procedures</li> <li>• Improper lookout</li> <li>• Lack of communications</li> <li>• Leisure traffic impedes the passage of vessel navigating the channel</li> <li>• Collision avoidance</li> <li>• High density of leisure traffic</li> <li>• Machinery breakdown</li> <li>• Change in river flow due to new in-river structure</li> <li>• General lack of marine knowledge</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Temporary effect / Minor effect to small area</li> <li>• Very serious damage to vessel or equipment possible</li> <li>• Criminal proceedings</li> <li>• International coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Vessel Master Experience</li> <li>• Qualified Crew</li> <li>• VHF Communications</li> <li>• VTS Navigational Broadcast</li> <li>• Ship Towing Code of Practice</li> <li>• Tug Operator Procedures</li> <li>• COLREGs</li> <li>• General Directions</li> <li>• Admiralty Charts</li> <li>• Perm / Temp Notice to Mariners</li> <li>• Emergency Plans &amp; Procedures</li> <li>• Aids to Navigation</li> </ul>	<ul style="list-style-type: none"> <li>• Light Warnings - providing visual warning that barge is about to depart berth</li> <li>• Sound Warnings - providing audio warning that barge is about to depart berth</li> <li>• Use of reputable and experienced marine contractor</li> <li>• Sub-Contractors Risk Assessment</li> <li>• Closure of Arch No 2 to all inward bound freight traffic</li> <li>• Berth Master</li> <li>• Berth Master to monitor VHF</li> <li>• CCTV to provide additional information to Berth Master</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	Extreme

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	Moderate

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	4	20	Extreme

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	4	20	Extreme

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>• General Directions for Navigation in the Port of London</li> <li>• Schedule to the General Directions for Navigation in the Port of London</li> <li>• River Byelaws 1978 (as amended)</li> <li>• Permanent Notice to Mariners</li> <li>• River Thames Recreational Users Guide</li> <li>• Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> <li>• Port Entry Guide</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	Moderate

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**9E - LTTBF - Collision with Commercial Freight Operator**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
9E - LTTBF	Collision with commercial freight operator	A vessel conducting Thames Tunnel construction activities collides with a commercial freight operator in the vicinity of Blackfriars Embankment, during the construction of the temporary cofferdam.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Non Compliance with procedures</li> <li>• Improper lookout</li> <li>• Lack of communications</li> <li>• Machinery breakdown</li> <li>• Collision avoidance</li> <li>• High density of leisure traffic</li> <li>• Leisure traffic impedes the passage of vessel navigating the channel</li> <li>• Change in river flow due to new in-river structure</li> <li>• Tidal set</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Short to medium term impact</li> <li>• Very serious damage to vessel or equipment possible</li> <li>• Criminal proceedings</li> <li>• International coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• Qualified Crew</li> <li>• Bridge Special Signal Lights</li> <li>• Emergency Plans &amp; Procedures</li> <li>• VTS Navigational Broadcast</li> <li>• Thames AIS</li> <li>• Passage Planning</li> <li>• Ship Towage Code of Practice</li> <li>• BML Local Knowledge Endorsement</li> <li>• Tug Operator Procedures</li> <li>• Perm / Temp Notice to Mariners</li> <li>• COLREGS</li> <li>• General Directions</li> </ul>	<ul style="list-style-type: none"> <li>• Light Warnings - providing visual warning that barge is about to depart berth</li> <li>• Sound Warnings - providing audio warning that barge is about to depart berth</li> <li>• Use of reputable and experienced marine contractor</li> <li>• Sub-Contractors Risk Assessment</li> <li>• Berth Master</li> <li>• Berth Master to monitor VHF</li> <li>• Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity</li> <li>• CCTV to provide additional information to Berth Master</li> <li>• Closure of Arch No 2 to all inward bound freight traffic</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Pilotage Directions</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•Ship Towage Operations on the Thames</li> <li>•Code of Practice for Craft Towage Operations on the Thames</li> <li>•Port Entry Guide</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Sub Contractors Risk Assessment												
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> <td>Welfare</td> </tr> <tr> <td>Amenities</td> <td>Movement of materials</td> <td>Fire safety</td> </tr> <tr> <td>Lifting operations</td> <td>Mooring</td> <td></td> </tr> <tr> <td>Slips and trips</td> <td></td> <td></td> </tr> </table>	Working at height	Loading / Unloading operations	Welfare	Amenities	Movement of materials	Fire safety	Lifting operations	Mooring		Slips and trips		
Working at height	Loading / Unloading operations	Welfare										
Amenities	Movement of materials	Fire safety										
Lifting operations	Mooring											
Slips and trips												

**10E - LTTBF - Collision with Tug and Tow**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
10E - LTTBF	Collision with tug and tow	A vessel conducting Thames Tunnel construction activities collides with a tug and tow in the vicinity of Blackfriars Embankment, during the construction of the temporary cofferdam.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Non Compliance with procedures</li> <li>• Improper lookout</li> <li>• Lack of communications</li> <li>• Machinery breakdown</li> <li>• Collision avoidance</li> <li>• High density of leisure traffic</li> <li>• Leisure traffic impedes the passage of vessel navigating the channel</li> <li>• Change in river flow due to new in-river structure</li> <li>• Tidal set</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Short to medium term impact</li> <li>• Very serious damage to vessel or equipment possible</li> <li>• International coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• Qualified Crew</li> <li>• Bridge Special Signal Lights</li> <li>• Emergency Plans &amp; Procedures</li> <li>• VTS Navigational Broadcast</li> <li>• Thames AIS</li> <li>• Passage Planning</li> <li>• Ship Towing Code of Practice</li> <li>• BML Local Knowledge Endorsement</li> <li>• Perm / Temp Notice to Mariners</li> <li>• Tug Operator Procedures</li> <li>• General Directions</li> <li>• COLREGS</li> </ul>	<ul style="list-style-type: none"> <li>• Light Warnings - providing visual warning that barge is about to depart berth</li> <li>• Sound Warnings - providing audio warning that barge is about to depart berth</li> <li>• Use of reputable and experienced marine contractor</li> <li>• Sub-Contractors Risk Assessment</li> <li>• Berth Master</li> <li>• Berth Master to monitor VHF</li> <li>• Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity</li> <li>• CCTV to provide additional information to Berth Master</li> <li>• Closure of Arch No 2 to all inward bound freight traffic</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	Extreme

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	4	20	Extreme

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	4	20	Extreme

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Pilotage Directions</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•Ship Towing Operations on the Thames</li> <li>•Code of Practice for Craft Towing Operations on the Thames</li> <li>•Port Entry Guide</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

Sub Contractors Risk Assessment								
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Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

### 11E - LTTBF - Contact with Blackfriars Bridge (Road & Rail)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
11E - LTTBF	Contact with Blackfriars Bridge (Road & Rail)	A vessel conducting Thames Tunnel construction activities makes contact with Blackfriars Road or Rail Bridge, including arches, abutments and any associated bridge superstructure.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Non Compliance with procedures</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• Inadequate training and experience</li> <li>• Tug or line failure</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Single Fatality / Severe permanent partial disability</li> <li>• Short to medium term impact</li> <li>• Major damage to vessel / equipment and detention</li> <li>• National coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• General Directions</li> <li>• PLA Bridge Guide</li> <li>• Passage Planning</li> <li>• Accurate Tidal Information</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Tug Operator Procedures</li> <li>• COLREGs</li> <li>• Ship Towage Code of Practice</li> <li>• Emergency Plans &amp; Procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Use of reputable and experienced marine contractor</li> <li>• Sub-Contractors Risk Assessment</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	9	<b>Moderate</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>• General Directions for Navigation in the Port of London</li> <li>• Schedule to the General Directions for Navigation in the Port of London</li> <li>• Ship Towage Operations on the Thames</li> <li>• Code of Practice for the Safe Mooring of Vessels on the Thames</li> <li>• Code of Practice for Craft Towage Operations on the Thames</li> <li>• Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> <li>• Port Entry Guide</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**12E - LTTBF - Contact - High Speed Craft / Class V Passenger Vessel with Temporary Work Site**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
12E - LTTBF	Contact - High Speed Craft / Class V passenger vessel with Temporary work site	A High Speed Craft / Class V passenger vessel comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> <li>• Leisure traffic impedes the passage of vessel navigating the channel</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Short to medium term impact</li> <li>• Very serious damage to vessel or equipment possible criminal proceedings</li> <li>• International coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• VTS Navigational Broadcast</li> <li>• HSC Code</li> <li>• Passage Planning</li> <li>• COLREGs</li> <li>• VHF Communications</li> <li>• Emergency Plans &amp; Procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Closure of Arch No 2 to all inward bound freight traffic</li> <li>• Inward bound vessels use Arch No 3</li> <li>• Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Permanent Notice to Mariners</li> <li>•Code of Practice Passenger Vessel Operations on the Thames</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Sub Contractors Risk Assessment								
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Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

### 13E - LTTBF - Contact - Tug and Tow with Temporary Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
13E - LTTBF	Contact - Tug and Tow with Temporary work site	A Tug and Tow comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction of temporary cofferdam.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Leisure traffic impedes the passage of vessel navigating the channel</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Short to medium term impact</li> <li>• Major damage to vessel / equipment and detention</li> <li>• National coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• Passage Planning</li> <li>• Ship Towage Code of Practice</li> <li>• COLREGs</li> <li>• Oil Spill Contingency Plan</li> <li>• Tug Operator Procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Closure of Arch No 2 to all inward bound freight traffic</li> <li>• Inward bound vessels use Arch No 3</li> <li>• Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>High</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>• General Directions for Navigation in the Port of London</li> <li>• Schedule to the General Directions for Navigation in the Port of London</li> <li>• Pilotage Directions</li> <li>• River Byelaws 1978 (as amended)</li> <li>• Permanent Notice to Mariners</li> <li>• Ship Towage Operations on the Thames</li> <li>• Code of Practice for Craft Towage Operations on the Thames</li> <li>• Port Entry Guide</li> <li>• Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Sub Contractors Risk Assessment								
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Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

### 14E - LTTBF - Contact - Private Leisure Vessel with Temporary Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
14E - LTTBF	Contact - Private leisure vessel with Temporary work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction of temporary cofferdam.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Improper lookout</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Low impact with no lasting effect</li> <li>• Major damage to vessel / equipment and detention</li> <li>• International coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Aids to Navigation</li> <li>• VHF Communications</li> <li>• COLREGs</li> <li>• General Directions</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• VTS Navigational Broadcast</li> </ul>	<ul style="list-style-type: none"> <li>• Closure of Arch No 2 to all inward bound freight traffic</li> <li>• Inward bound vessels use Arch No 3</li> <li>• Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area</li> <li>• Information provided to local recreational clubs and marinas providing an overview of the works being conducted and expected duration</li> </ul>

#### Pre Control - People

Severity	Probability	Risk Score	Risk Band
5	4	16	<b>Extreme</b>

#### Pre Control - Environment

Severity	Probability	Risk Score	Risk Band
1	4	4	<b>Moderate</b>

#### Pre Control - Operational Impact

Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

#### Pre Control - Media Attention

Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

#### Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Permanent Notice to Mariners
- Mariners Guide to Bridges on the Tidal Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

#### Post Control - People

Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

#### Post Control - Environment

Severity	Probability	Risk Score	Risk Band
1	2	2	<b>Minor</b>

#### Post Control - Operational Impact

Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

#### Post Control - Media Attention

Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

#### Sub Contractors Risk Assessment

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- |                    |                                |
|--------------------|--------------------------------|
| Working at height  | Loading / Unloading operations |
| Lifting operations | Movement of materials          |
| Slips and trips    | Mooring                        |
| Fire safety        | Welfare Amenities              |

**15E - LTTBF - Contact with Moored Vessel in Vicinity of Blackfriars (President / Cory Barges / Passenger Boat Moorings etc.)**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Safeguards
15E - LTTBF	Contact with moored vessel in vicinity of Blackfriars (President / Cory barges / Passenger boat moorings etc)	A vessel in transit makes contact with a moored vessel (E.g. Moored Barge, President or moored passenger boat) in the vicinity of Blackfriars Embankment.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Short to medium term impact</li> <li>• Major damage to vessel / equipment and detention</li> <li>• International coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• Passage Planning</li> <li>• Ship Towing Code of Practice</li> <li>• Admiralty Charts</li> <li>• COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>• Relocate HMS President</li> <li>• Relocate Cory Coin Street moorings</li> <li>• Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	8	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	4	16	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Pilotage Directions</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•Ship Towing Operations on the Thames</li> <li>•Code of Practice for Craft Towing Operations on the Thames</li> <li>•Port Entry Guide</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	6	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

### 16E - LTTBF - Vessels subject to increased interaction during periods of low water

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Safeguards
16E - LTTBF	Vessels subject to increased interaction during periods of low water.	Due to the intrusion of the temporary works into the authorised channel, the available water space for vessels to manoeuvre in is reduced. At periods of low water this is particularly relevant.	<ul style="list-style-type: none"> <li>Reduced effective river width</li> <li>Misjudgement</li> <li>Inattention</li> <li>Lack of communications</li> <li>Adverse weather conditions</li> <li>Collision avoidance</li> <li>Tidal set</li> <li>Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>Single Fatality / Severe permanent partial disability</li> <li>Short to medium term impact</li> <li>Major damage to vessel / equipment and detention</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>Boat Masters Licence</li> <li>BML Local Knowledge Endorsement</li> <li>Qualified Crew</li> <li>Vessel Master Experience</li> <li>Permanent / Temporary Notice to Mariners</li> </ul>	

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	20	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>River Byelaws 1978 (as amended)</li> <li>Permanent Notice to Mariners</li> <li>Ship Towing Operations on the Thames</li> <li>Code of Practice for Craft Towing Operations on the Thames</li> <li>Port Entry Guide</li> <li>Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

### 17E - LTTBF - Vessels subject to increased interaction during periods of low water

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Safeguards
17E - LTTBF	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Single Fatality / Severe permanent partial disability</li> <li>• Short to medium term impact</li> <li>• Major damage to vessel / equipment and detention</li> <li>• National coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• MCA Guidance document</li> </ul>	

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>• General Directions for Navigation in the Port of London</li> <li>• Schedule to the General Directions for Navigation in the Port of London</li> <li>• Pilotage Directions</li> <li>• River Byelaws 1978 (as amended)</li> <li>• Permanent Notice to Mariners</li> <li>• Ship Towing Operations on the Thames</li> <li>• Code of Practice for Craft Towing Operations on the Thames</li> <li>• Port Entry Guide</li> <li>• Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

### 18E - LTTBF – Contact with moored vessel at relocated Blackfriars Millennium Pier

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Safeguards
18E - LTTBF	Contact with moored vessel at relocated Blackfriars Millennium Pier	A vessel in transit makes contact with a vessel moored at the relocated Blackfriars Millennium Pier.	<ul style="list-style-type: none"> <li>Misjudgement</li> <li>Inattention</li> <li>Lack of communications</li> <li>Adverse weather conditions</li> <li>Machinery breakdown</li> <li>High density of leisure traffic</li> <li>Collision avoidance</li> </ul>	<ul style="list-style-type: none"> <li>Multiple fatalities</li> <li>Short to medium term impact</li> <li>Very serious damage to vessel or equipment possible</li> <li>International coverage</li> </ul>	<ul style="list-style-type: none"> <li>Boat Masters Licence</li> <li>BML Local Knowledge Endorsement</li> <li>Qualified Crew</li> <li>Vessel Master Experience</li> <li>Permanent / Temporary Notice to Mariners</li> <li>Aids to Navigation</li> <li>Passage Planning</li> <li>Ship Towing Code of Practice</li> <li>Admiralty Charts</li> <li>COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>Restrictions on number of barges permitted to be towed in this area in the event that arch No2 is closed.</li> <li>Provide facilities for vessels using the pier to moor at the eastern end to allow them to be further from the authorised channel.</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	3	3	<b>Minor</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>River Byelaws 1978 (as amended)</li> <li>Permanent Notice to Mariners</li> <li>Ship Towing Operations on the Thames</li> <li>Code of Practice for Craft Towing Operations on the Thames</li> <li>Port Entry Guide</li> <li>Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	2	2	<b>Slight</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Sub Contractors Risk Assessment
<p>The proposed new location for Blackfriars Millennium Pier takes into consideration a number of stakeholder requirements.</p> <p>After consultation with the PLA, the outer face of the pier pontoon has been set back from the authorised channel by at least 15m.</p>

## Annex G– Worst credible hazard log: Phase B - Construction of drop shaft/culvert/connection

### G.1 Summary worst credible hazard list: Phase B - Construction of drop shaft/culvert/connections

Hazard Id	Hazard Title	Hazard Description	People	Environment	Operational	Media
1F	Restricted Working - Work intrudes into authorised channel and constrains traffic	During construction of shaft & culvert, works extend into the authorised channel, therefore constraining available water space for existing traffic. Due to the reduced channel width a river incident occurs.	15	12	15	15
2F	Emergency Arch Closure - Arch No 3	During construction of the temporary cofferdam there may be an emergency requirement to close No 3 arch	12	12	15	15
3F	Planned arch closure - Arch No 3	During shaft/culvert construction activities here may be a requirement to close No 3 arch for maintenance. This would leave No 4 arch as the only available navigable arch.	8	8	10	10
4F	Planned Arch closure - Arch No 2	During shaft/culvert construction activities there may be a requirement to close No 2 arch for maintenance.	12	12	15	15
5F	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Blackfriars Bridges.	12	12	12	15
6F	Collision with High Speed Passenger Vessel	A vessel conducting Thames Tunnel construction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Blackfriars	15	9	12	12
7F	Collision with Class V passenger vessel	A vessel conducting Thames Tunnel construction activities collides with a Class V passenger vessel in the vicinity of Blackfriars Embankment.	15	9	12	15
8F	Collision with private leisure vessel	A vessel conducting Thames Tunnel construction activities collides with a private leisure vessel in the vicinity of Blackfriars Embankment.	15	9	12	15
9F	Collision with commercial freight operator	A vessel conducting Thames Tunnel construction activities collides with a commercial freight operator in the vicinity of Blackfriars Embankment.	15	12	15	15
10F	Collision with tug and tow	A vessel conducting Thames Tunnel construction activities collides with a tug and tow in the vicinity of Blackfriars Embankment.	15	12	15	15

11F	Contact with Blackfriars Bridge (Road & Rail)	A vessel conducting Thames Tunnel construction activities makes contact with Blackfriars Road or Rail Bridge, including arches, abutments and any associated bridge superstructure.	12	9	12	12
12F	Contact - High Speed Craft / Class V passenger vessel with Temporary work site	A High Speed Craft / Class V passenger vessel comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction / removal of temporary cofferdam.	15	9	15	15
13F	Contact - Tug and Tow with Temporary work site	A Tug and Tow comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction / removal of temporary cofferdam.	N/A	N/A	N/A	N/A
14F	Contact - Private leisure vessel with Temporary work site	Private leisure vessels, including narrow boats, come into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction / removal of temporary cofferdam.	N/A	N/A	N/A	N/A
15F	Contact with moored vessel in vicinity of Blackfriars (President / Cory barges/ Passenger boat moorings etc)	A vessel in transit makes contact with a moored vessel (E.g. Moored Barge, President or moored passenger boat) in the vicinity of Blackfriars Embankment.	8	6	6	10
16F	Vessels subject to increased interaction during periods of low water	Due to the intrusion of the temporary works into the authorised channel, the available water space for vessels to manoeuvre in is reduced. At periods of low water this is particularly relevant	8	6	8	10
17F	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	8	6	8	8
18F	Contact with moored vessel at relocated Blackfriars Millennium Pier	A vessel in transit makes contact with a vessel moored at the relocated Blackfriars Millennium Pier.	10	3	10	10

## G.2 Worst credible hazard list – Phase B: Construction of drop shaft/culvert/connections

### 1F - LTTBF - Restricted Working - Work Intrudes into Authorised Channel and Constrains Traffic

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
1F - LTTBF	Restricted Working	<p>Short notice / emergency closure of bridge arch resulting in a restricted operating area and an increase in vessel congestion.</p> <p>Intrusion into authorised channel constrains available water space for existing traffic. Due to the reduced channel width a river incident occurs.</p>	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Medium to long term effect / large area affected</li> <li>• Very serious damage to vessel or equipment possible criminal proceedings</li> <li>• International coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Thames AIS</li> <li>• VHF Communications</li> <li>• VTS Navigational Broadcast</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Tug Operator Procedures</li> <li>• Ship Towing Code of Practice</li> <li>• Aids to Navigation</li> <li>• General Directions</li> <li>• Emergency Plans &amp; Procedures</li> <li>• COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>• Minimise the footprint of the temporary works and therefore encroachment into the channel</li> <li>• Closure of Arch No 2 to all inward bound larger and reporting vessels</li> <li>• Vessel Traffic Control Co-ordinator</li> <li>• Scheduling of barge movements to assist with existing river events</li> <li>• Communication and schedule planning - PLA / Thames Tunnel / Marine Sub Contractor</li> <li>• Suspend Thames barge operations in event of emergency arch closure</li> <li>• Safety Work Boat in attendance during periods of restricted working</li> <li>• Relocate Cory Environmental Ltd Coin Street moorings</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	Extreme

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	4	16	Extreme

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	4	20	Extreme

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	4	20	Extreme

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>• General Directions for Navigation in the Port of London</li> <li>• Schedule to the General Directions for Navigation in the Port of London</li> <li>• Pilotage Directions</li> <li>• Code of Practice Passenger Vessel Operations on the Thames</li> <li>• River (Amendment) Byelaws 2006 - Thames AIS Byelaws and Revocation of River Byelaws 6, 8 and 41</li> <li>• River Thames Recreational Users Guide</li> <li>• Mariners Guide to Bridges on the Tidal Thames</li> <li>• Ship Towing Operations on the Thames</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

Assessment Notes
<ul style="list-style-type: none"> <li>• Inbound smaller, non reporting vessels to use Arch No 2 during Phase 2</li> <li>• Inbound larger, reporting vessels to use Arch No 3</li> <li>• Emergency closure of Arch No 3 covered as separate hazard</li> </ul>

**2F - LTTBF - Emergency Arch Closure - Arch No 3**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
2F- LTTBF	Emergency Arch Closure - Arch No 3	During construction of the shaft and culvert there may be an emergency requirement to close No 3 arch.  Intrusion into authorised channel constrains available water space for existing traffic. Due to the reduced channel width a river incident occurs.	<ul style="list-style-type: none"> <li>Emergency Bridge Arch Closure</li> <li>River Incident</li> </ul>	<ul style="list-style-type: none"> <li>Single Fatality / Severe permanent partial disability</li> <li>Medium to long term effect / large area affected</li> <li>Very serious damage to vessel or equipment possible criminal proceedings</li> <li>International coverage</li> </ul>	<ul style="list-style-type: none"> <li>VTS Navigational Broadcast</li> <li>VHF Communications</li> </ul>	<ul style="list-style-type: none"> <li>Safety boat to be in attendance maintaining a continuous VHF watch on Channel 14 in the event of Arch No 3 closure</li> <li>Navigational warning broadcast on VHF</li> <li>Suspend Thames barge operations in event of emergency arch closure</li> <li>Maintain Arch No 4 for navigation</li> <li>Open Arch No 2 with restricted operating procedures for freight</li> <li>Relocate Cory Environmental Ltd Coin Street moorings</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Port Entry Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> </ul>

Assessment Notes
<ul style="list-style-type: none"> <li>This hazard is covered in more detail within the main Blackfriars Foreshore - Maritime Issues and Navigational Risk Assessment Report.</li> </ul>

**3F - LTTBF - Planned Arch Closure - Arch No 3**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
3F - LTTBF	Planned Arch Closure - Arch No 3	During construction of the shaft and culvert there may be a scheduled requirement to close No 3 arch.	<ul style="list-style-type: none"> <li>Planned Bridge arch closure</li> <li>Maintenance and Inspection routines</li> </ul>	<ul style="list-style-type: none"> <li>Single Fatality / Severe permanent partial disability</li> <li>Medium to long term effect / large area affected</li> <li>Very serious damage to vessel or equipment possible criminal proceedings</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>Permanent / Temporary Notice to Mariners</li> <li>VTS Navigational Broadcast</li> <li>VHF Communications</li> <li>Aids to Navigation</li> <li>Bridge Special Signal Lights</li> <li>VTS Qualification</li> </ul>	<ul style="list-style-type: none"> <li>Scheduling of arch closures in order to facilitate minimum disruption to river users</li> <li>Safety boat to be in attendance maintaining a continuous VHF watch on Channel 14 in the event of Arch No 3 closure</li> <li>Navigational warning broadcast on VHF</li> <li>Suspend Thames barge operations in event of arch closure</li> <li>Maintain Arch No 4 for navigation</li> <li>Open Arch No 2 with restricted operating procedures for freight</li> <li>Relocate Cory Environmental Ltd Coin Street moorings</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	20	<b>Extreme</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Port Entry Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> </ul>

Assessment Notes
<ul style="list-style-type: none"> <li>Inspection Routine - Road &amp; Rail Bridge                             <ul style="list-style-type: none"> <li>General Inspection - every 2 years</li> <li>Principal Inspection - every 6<sup>th</sup> year - requires full inspection within touching distance of all elements and therefore inspection from below is required - Arch Closure as a result.</li> </ul> </li> <li>Principal Inspection to be conducted immediately prior to work commencing</li> </ul>

**4F - LTTBF - Planned Arch Closure - Arch No2**

<i>Hazard ID</i>	<i>Hazard Title</i>	<i>Hazard Description</i>	<i>Hazard Causes</i>	<i>Consequence(s) Worst Credible</i>	<i>Existing Safeguards</i>	<i>Proposed Additional Mitigation</i>
<b>4F - LTTBF</b>	Planned Arch Closure - Arch No 2	During construction of the shaft and culvert there may be a scheduled requirement to close Arch No 2.  Due to the reduced channel width a river incident occurs.	<ul style="list-style-type: none"> <li>Planned Bridge arch closure</li> </ul>	<ul style="list-style-type: none"> <li>Single Fatality / Severe permanent partial disability</li> <li>Medium to long term effect / large area affected</li> <li>Very serious damage to vessel or equipment possible criminal proceedings</li> <li>International coverage</li> </ul>	<ul style="list-style-type: none"> <li>Permanent / Temporary Notice to Mariners</li> <li>VTS Navigational Broadcast</li> <li>VHF Communications</li> <li>Aids to Navigation</li> <li>Bridge Special Signal Lights</li> <li>VTS Qualification</li> </ul>	<ul style="list-style-type: none"> <li>Scheduling of arch closures in order to facilitate minimum disruption to river users</li> <li>Maintain Arch No 4 to allow for navigation inbound &amp; outbound for larger and reporting vessels</li> <li>A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect</li> <li>Relocate the Cory Environmental moorings (currently opposite the proposed permanent works)</li> </ul>

<b>Pre Control - People</b>			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

<b>Post Control - People</b>			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

<b>Pre Control - Environment</b>			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

<b>Post Control - Environment</b>			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

<b>Pre Control - Operational Impact</b>			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

<b>Post Control - Operational Impact</b>			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

<b>Pre Control - Media Attention</b>			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

<b>Post Control - Media Attention</b>			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

<b>Relevant PLA Guidance</b>
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Port Entry Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> </ul>

<b>Assessment Notes</b>
<ul style="list-style-type: none"> <li>Inspection Routine - Road &amp; Rail Bridge                             <ul style="list-style-type: none"> <li>General Inspection - every 2 years</li> <li>Principal Inspection - every 6<sup>th</sup> year - requires full inspection within touching distance of all elements and therefore inspection from below is required - Arch Closure as a result.</li> </ul> </li> <li>Principal Inspection to be conducted immediately prior to work commencing</li> <li>It is proposed that Arch No 2 is closed to freight and larger reporting vessels during phase 2.</li> <li>It is proposed that Arch No 2 is open for smaller vessels during phase 2.</li> </ul>

**5F - LTTBF - Increase in Flow**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
5F - LTTBF	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Blackfriars Bridges.	<ul style="list-style-type: none"> <li>Shape and position of temporary cofferdam</li> </ul>	<ul style="list-style-type: none"> <li>Single Fatality / Severe permanent partial disability</li> <li>Medium to long term effect / large area affected</li> <li>Major damage to vessel / equipment and detention</li> <li>International coverage</li> </ul>	<ul style="list-style-type: none"> <li>None identified for this hazard</li> </ul>	<ul style="list-style-type: none"> <li>3D and computational modelling</li> <li>Review and re-design temporary work structure to reduce hydrodynamic affects</li> <li>A Notice to Mariners to advise of any increases in river flow: NTM to advise that for example: In Arch No3 the maximum flow will increase by approximately 1/2 knot during temporary works with the flow moving towards the south side of the bridge arch.</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Port Entry Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> </ul>

Assessment Notes
<ul style="list-style-type: none"> <li>Fluvial modelling (numerical and physical) have been used to develop the design of the structure.</li> <li>Analysis of HR Wallingford fluvial modelling report indicates minimum change in flow in this area.</li> <li>Further investigation is required in order to assess latest structure design.</li> </ul>

## 6F - LTTBF - Collision with High Speed Passenger Vessel

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
6F - LTTBF	Collision with High Speed Passenger Vessel	A vessel conducting Thames Tunnel construction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Blackfriars Embankment during the construction of the shaft and culvert.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Non Compliance with procedures</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• Inadequate training and experience</li> <li>• Tug or line failure</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple Fatalities</li> <li>• Short to medium term impact</li> <li>• Major damage to vessel / equipment and detention</li> <li>• National coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• General Directions</li> <li>• Tug Operator Procedures</li> <li>• Passage Planning</li> <li>• VTS Navigational Broadcast</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Thames AIS</li> <li>• HSC Code</li> <li>• VHF Communications</li> <li>• COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>• Light Warnings - providing visual warning that barge is about to depart berth</li> <li>• Sound Warnings - providing audio warning that barge is about to depart berth</li> <li>• Sub-Contractors Risk Assessment</li> <li>• Closure of Arch No 2 to all inward bound larger and reporting vessels</li> <li>• Use of reputable and experienced marine contractor</li> <li>• Berth Master</li> <li>• Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity</li> <li>• Berth Master to monitor VHF</li> <li>• CCTV to provide additional information to Berth Master</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	Extreme

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	Extreme

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	Extreme

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>• General Directions for Navigation in the Port of London</li> <li>• Schedule to the General Directions for Navigation in the Port of London</li> <li>• River Byelaws 1978 (as amended)</li> <li>• Permanent Notice to Mariners</li> <li>• Ship Towage Operations on the Thames</li> <li>• Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> <li>• Code of Practice Passenger Vessel Operations on the Thames</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**7F - LTTBF- Collision with Class V Passenger Vessel**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
7F - LTTBF	Collision with Class V Passenger Vessel	A vessel conducting Thames Tunnel construction activities collides with a Class V passenger vessel in the vicinity of Blackfriars Embankment, during the construction of the shaft and culvert.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Non Compliance with procedures</li> <li>• Improper lookout</li> <li>• Lack of communications</li> <li>• Leisure traffic impedes the passage of vessel navigating the channel</li> <li>• Collision avoidance</li> <li>• High density of leisure traffic</li> <li>• Machinery breakdown</li> <li>• Change in river flow due to new in-river structure</li> <li>• General lack of marine knowledge</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple Fatalities</li> <li>• Short to medium term impact</li> <li>• Major damage to vessel / equipment and detention</li> <li>• International coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Vessel Master Experience</li> <li>• Qualified Crew</li> <li>• VHF Communications</li> <li>• VTS Navigational Broadcast</li> <li>• Ship Towage Code of Practice</li> <li>• Tug Operator Procedures</li> <li>• COLREGs</li> <li>• General Directions</li> <li>• Admiralty Charts</li> <li>• Perm / Temp Notice to Mariners</li> <li>• Emergency Plans &amp; Procedures</li> <li>• Aids to Navigation</li> </ul>	<ul style="list-style-type: none"> <li>• Light Warnings - providing visual warning that barge is about to depart berth</li> <li>• Sound Warnings - providing audio warning that barge is about to depart berth</li> <li>• Sub-Contractors Risk Assessment</li> <li>• Closure of Arch No 2 to all inward bound larger and reporting vessels</li> <li>• Use of reputable and experienced marine contractor</li> <li>• Berth Master</li> <li>• Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity</li> <li>• Berth Master to monitor VHF</li> <li>• CCTV to provide additional information to Berth Master</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> <li>•Port Entry Guide</li> <li>•Code of Practice Passenger Vessel Operations on the Thames</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Sub Contractors Risk Assessment								
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Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**8F - LTTBF - Collision with Private Leisure Vessel**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
8F LTTBF	Collision with Private Leisure Vessel	A vessel conducting Thames Tunnel construction activities collides with a private leisure vessel in the vicinity of Blackfriars Embankment, during the construction of the shaft and culvert.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Non Compliance with procedures</li> <li>• Improper lookout</li> <li>• Lack of communications</li> <li>• Leisure traffic impedes the passage of vessel navigating the channel</li> <li>• Collision avoidance</li> <li>• High density of leisure traffic</li> <li>• Machinery breakdown</li> <li>• Change in river flow due to new in-river structure</li> <li>• General lack of marine knowledge</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple Fatalities</li> <li>• Short to medium term impact</li> <li>• Major damage to vessel / equipment and detention</li> <li>• International coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Vessel Master Experience</li> <li>• Qualified Crew</li> <li>• VHF Communications</li> <li>• VTS Navigational Broadcast</li> <li>• Ship Towing Code of Practice</li> <li>• Tug Operator Procedures</li> <li>• COLREGs</li> <li>• General Directions</li> <li>• Perm / Temp Notice to Mariners</li> <li>• Emergency Plans &amp; Procedures</li> <li>• Aids to Navigation</li> </ul>	<ul style="list-style-type: none"> <li>• Light Warnings - providing visual warning that barge is about to depart berth</li> <li>• Sound Warnings - providing audio warning that barge is about to depart berth</li> <li>• Use of reputable and experienced marine contractor</li> <li>• Sub-Contractors Risk Assessment</li> <li>• Berth Master</li> <li>• Berth Master to monitor VHF</li> <li>• CCTV to provide additional information to Berth Master</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•River Thames Recreational Users Guide</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> <li>•Port Entry Guide</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Sub Contractors Risk Assessment								
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Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenitie							

### 9F - LTTBF - Collision with Commercial Freight Operator

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
9F - LTTBF	Collision with commercial freight operator	A vessel conducting Thames Tunnel construction activities collides with a commercial freight operator in the vicinity of Blackfriars Embankment, during the construction of the shaft and culvert.	<ul style="list-style-type: none"> <li>Reduced effective river width</li> <li>Misjudgement</li> <li>Inattention</li> <li>Non Compliance with procedures</li> <li>Improper lookout</li> <li>Lack of communications</li> <li>Machinery breakdown</li> <li>Collision avoidance</li> <li>High density of leisure traffic</li> <li>Leisure traffic impedes the passage of vessel navigating the channel</li> <li>Change in river flow due to new in-river structure</li> <li>Tidal set</li> </ul>	<ul style="list-style-type: none"> <li>Multiple fatalities</li> <li>Short to medium term impact</li> <li>Very serious damage to vessel or equipment possible criminal proceedings</li> <li>International coverage</li> </ul>	<ul style="list-style-type: none"> <li>Boat Masters Licence</li> <li>Qualified Crew</li> <li>Bridge Special Signal Lights</li> <li>Emergency Plans &amp; Procedures</li> <li>VTS Navigational Broadcast</li> <li>Thames AIS</li> <li>Passage Planning</li> <li>Ship Towing Code of Practice</li> <li>BML Local Knowledge Endorsement</li> <li>Tug Operator Procedures</li> <li>Perm / Temp Notice to Mariners</li> <li>COLREGS</li> <li>General Directions</li> </ul>	<ul style="list-style-type: none"> <li>Light Warnings - providing visual warning that barge is about to depart berth</li> <li>Sound Warnings - providing audio warning that barge is about to depart berth</li> <li>Use of reputable and experienced marine contractor</li> <li>Sub-Contractors Risk Assessment</li> <li>Berth Master</li> <li>Berth Master to monitor VHF</li> <li>Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity</li> <li>CCTV to provide additional information to Berth Master</li> <li>Closure of Arch No 2 to all inward bound larger and reporting vessels</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>River Byelaws 1978 (as amended)</li> <li>Permanent Notice to Mariners</li> <li>Ship Towing Operations on the Thames</li> <li>Code of Practice for Craft Towing Operations on the Thames</li> <li>Port Entry Guide</li> <li>Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

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Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**10F - LTTBF - Collision with Tug and Tow**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
10F - LTTBF	Collision with tug and tow	A vessel conducting Thames Tunnel construction activities collides with a tug and tow in the vicinity of Blackfriars Embankment, during the construction of the shaft and culvert.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Non Compliance with procedures</li> <li>• Improper lookout</li> <li>• Lack of communications</li> <li>• Machinery breakdown</li> <li>• Collision avoidance</li> <li>• High density of leisure traffic</li> <li>• Leisure traffic impedes the passage of vessel navigating the channel</li> <li>• Change in river flow due to new in-river structure</li> <li>• Tidal set</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Short to medium term impact</li> <li>• Very serious damage to vessel or equipment possible criminal proceedings</li> <li>• International coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• Qualified Crew</li> <li>• Bridge Special Signal Lights</li> <li>• Emergency Plans &amp; Procedures</li> <li>• VTS Navigational Broadcast</li> <li>• Thames AIS</li> <li>• Passage Planning</li> <li>• Ship Towing Code of Practice</li> <li>• BML Local Knowledge Endorsement</li> <li>• Perm / Temp Notice to Mariners</li> <li>• Tug Operator Procedures</li> <li>• General Directions</li> <li>• COLREGS</li> </ul>	<ul style="list-style-type: none"> <li>• Light Warnings - providing visual warning that barge is about to depart berth</li> <li>• Sound Warnings - providing audio warning that barge is about to depart berth</li> <li>• Use of reputable and experienced marine contractor</li> <li>• Sub-Contractors Risk Assessment</li> <li>• Berth Master</li> <li>• Berth Master to monitor VHF</li> <li>• Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity</li> <li>• CCTV to provide additional information to Berth Master</li> <li>• Closure of Arch No 2 to all inward bound larger and reporting vessels</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>• General Directions for Navigation in the Port of London</li> <li>• Schedule to the General Directions for Navigation in the Port of London</li> <li>• Pilotage Directions</li> <li>• River Byelaws 1978 (as amended)</li> <li>• Permanent Notice to Mariners</li> <li>• Ship Towing Operations on the Thames</li> <li>• Code of Practice for Craft Towing Operations on the Thames</li> <li>• Port Entry Guide</li> <li>• Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

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Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**11F - LTTBF - Contact with Blackfriars Bridge (Road & Rail)**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
11F - LTTBF	Contact with Blackfriars Bridge (Road & Rail)	A vessel conducting Thames Tunnel construction activities makes contact with Blackfriars Road or Rail Bridge, including arches, abutments and any associated bridge superstructure.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Non Compliance with procedures</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• Inadequate training and experience</li> <li>• Tug or line failure</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Single Fatality / Severe permanent partial disability</li> <li>• Short to medium term impact</li> <li>• Major damage to vessel / equipment and detention</li> <li>• National coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• General Directions</li> <li>• PLA Bridge Guide</li> <li>• Passage Planning</li> <li>• Accurate Tidal Information</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Tug Operator Procedures</li> <li>• COLREGs</li> <li>• Ship Towage Code of Practice</li> <li>• Emergency Plans &amp; Procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Sub-Contractors Risk Assessment</li> <li>• Use of reputable and experienced marine contractor</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Ship Towage Operations on the Thames</li> <li>•Code of Practice for the Safe Mooring of Vessels on the Thames</li> <li>•Code of Practice for Craft Towage Operations on the Thames</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> <li>•Port Entry Guide</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**12F - LTTBF - Contact - High Speed Craft / Class V Passenger Vessel with Temporary Work Site**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
12F - LTTBF	Contact - High Speed Craft / Class V passenger vessel with Temporary work site	A High Speed Craft / Class V passenger vessel comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment, during the construction of the shaft and culvert.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> <li>• Leisure traffic impedes the passage of vessel navigating the channel</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Short to medium term impact</li> <li>• Very serious damage to vessel or equipment possible</li> <li>• Criminal proceedings</li> <li>• International coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• VTS Navigational Broadcast</li> <li>• HSC Code</li> <li>• Passage Planning</li> <li>• COLREGs</li> <li>• VHF Communications</li> <li>• Emergency Plans &amp; Procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Closure of Arch No 2 to all inward bound larger and reporting vessels</li> <li>• Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>• General Directions for Navigation in the Port of London</li> <li>• Schedule to the General Directions for Navigation in the Port of London</li> <li>• Permanent Notice to Mariners</li> <li>• Code of Practice Passenger Vessel Operations on the Thames</li> <li>• Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Sub Contractors Risk Assessment								
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Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**13F - LTTBF - Contact - Tug and Tow with Temporary Work Site**

<i>Hazard ID</i>	<i>Hazard Title</i>	<i>Hazard Description</i>	<i>Hazard Causes</i>	<i>Consequence(s) Worst Credible</i>	<i>Existing Safeguards</i>	<i>Proposed Additional Mitigation</i>
<b>13F - LTTBF</b>	Contact - Tug and Tow with Temporary work site	A Tug and Tow comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during the construction of the shaft and culvert.	<ul style="list-style-type: none"> <li>Not applicable to this stage of the project</li> </ul>	<ul style="list-style-type: none"> <li>Not applicable to this stage of the project</li> </ul>	<ul style="list-style-type: none"> <li>Not applicable to this stage of the project</li> </ul>	<ul style="list-style-type: none"> <li>Not applicable to this stage of the project</li> </ul>

<b>Pre Control - People</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Post Control - People</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Pre Control - Environment</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Post Control - Environment</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Pre Control - Operational Impact</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Post Control - Operational Impact</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Pre Control - Media Attention</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Post Control - Media Attention</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<i>Relevant PLA Guidance</i>

<i>Risk Assessment Notes</i>

**14F - LTTBF - Contact - Private Leisure Vessel with Temporary Work Site**

<i>Hazard ID</i>	<i>Hazard Title</i>	<i>Hazard Description</i>	<i>Hazard Causes</i>	<i>Consequence(s) Worst Credible</i>	<i>Existing Safeguards</i>	<i>Proposed Additional Mitigation</i>
<b>14F - LTTBF</b>	Contact - Private leisure vessel with Temporary work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during the construction of the shaft and culvert.	<ul style="list-style-type: none"> <li>Not applicable to this stage of the project</li> </ul>	<ul style="list-style-type: none"> <li>Not applicable to this stage of the project</li> </ul>	<ul style="list-style-type: none"> <li>Not applicable to this stage of the project</li> </ul>	<ul style="list-style-type: none"> <li>Not applicable to this stage of the project</li> </ul>

<b>Pre Control - People</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Post Control - People</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Pre Control - Environment</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Post Control - Environment</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Pre Control - Operational Impact</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Post Control - Operational Impact</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Pre Control - Media Attention</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Post Control - Media Attention</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<i>Relevant PLA Guidance</i>

<i>Risk Assessment Notes</i>

**15F - LTTBF - Contact with Moored Vessel in Vicinity of Blackfriars (President / Cory Barges / Passenger Boat Moorings etc.)**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Safeguards
15F - LTTBF	Contact with moored vessel in vicinity of Blackfriars (President / Cory barges / Passenger boat moorings etc)	A vessel in transit makes contact with a moored vessel (E.g. Moored Barge, President or moored passenger boat) in the vicinity of Blackfriars Embankment during the construction of the shaft and culvert.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Temporary effect / Minor effect to small area</li> <li>• Major damage to vessel / equipment and detention</li> <li>• International coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• Passage Planning</li> <li>• Ship Towage Code of Practice</li> <li>• Admiralty Charts</li> <li>• COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>• Relocate HMS President</li> <li>• Relocate Cory Coin Street moorings</li> <li>• Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Pilotage Directions</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•Ship Towage Operations on the Thames</li> <li>•Code of Practice for Craft Towage Operations on the Thames</li> <li>•Port Entry Guide</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	6	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

### 16F - LTTBF - Vessels subject to increased interaction during periods of low water

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Safeguards
16F - LTTBF	Vessels subject to increased interaction during periods of low water.	Due to the intrusion of the temporary works into the authorised channel, the available water space for vessels to manoeuvre in is reduced. At periods of low water this is particularly relevant.	<ul style="list-style-type: none"> <li>Reduced effective river width</li> <li>Misjudgement</li> <li>Inattention</li> <li>Lack of communications</li> <li>Adverse weather conditions</li> <li>Collision avoidance</li> <li>Tidal set</li> <li>Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>Single Fatality / Severe permanent partial disability</li> <li>Short to medium term impact</li> <li>Major damage to vessel / equipment and detention</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>Boat Masters Licence</li> <li>BML Local Knowledge Endorsement</li> <li>Qualified Crew</li> <li>Vessel Master Experience</li> <li>Permanent / Temporary Notice to Mariners</li> </ul>	

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>River Byelaws 1978 (as amended)</li> <li>Permanent Notice to Mariners</li> <li>Ship Towing Operations on the Thames</li> <li>Code of Practice for Craft Towing Operations on the Thames</li> <li>Port Entry Guide</li> <li>Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Sub Contractors Risk Assessment								
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Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**17F - LTTBF - Vessels subject to increased interaction during periods of low water**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Safeguards
17F - LTTBF	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Single Fatality / Severe permanent partial disability</li> <li>• Short to medium term impact</li> <li>• Major damage to vessel / equipment and detention</li> <li>• National coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• MCA Guidance document</li> </ul>	

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Pilotage Directions</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•Ship Towage Operations on the Thames</li> <li>•Code of Practice for Craft Towage Operations on the Thames</li> <li>•Port Entry Guide</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Sub Contractors Risk Assessment								
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Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**18F - LTTBF – Contact with moored vessel at relocated Blackfriars Millennium Pier**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Safeguards
18F - LTTBF	Contact with moored vessel at relocated Blackfriars Millennium Pier	A vessel in transit makes contact with a vessel moored at the relocated Blackfriars Millennium Pier.	<ul style="list-style-type: none"> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Short to medium term impact</li> <li>• Very serious damage to vessel or equipment possible</li> <li>• Criminal proceedings</li> <li>• International coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• Passage Planning</li> <li>• Ship Towing Code of Practice</li> <li>• Admiralty Charts</li> <li>• COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>• Restrictions on number of barges permitted to be towed in this area in the event that arch No2 is closed.</li> <li>• Provide facilities for vessels using the pier to moor at the eastern end to allow them to be further from the authorised channel.</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	4	4	<b>Minor</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Pilotage Directions</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•Ship Towing Operations on the Thames</li> <li>•Code of Practice for Craft Towing Operations on the Thames</li> <li>•Port Entry Guide</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	2	3	<b>Slight</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Sub Contractors Risk Assessment
<p>The proposed new location for Blackfriars Millennium Pier takes into consideration a number of stakeholder requirements.</p> <p>After consultation with the PLA, the outer face of the pier pontoon has been set back from the authorised channel by at least 15m.</p>

## Annex H– Worst credible hazard log: Phase C – Removal of of cofferdam

### H.1 Worst credible summary hazard list: Phase C - Removal of cofferdam

Hazard Id	Hazard Title	Hazard Description	People	Environment	Operational	Media
1G	Restricted Working - Work intrudes into authorised channel and constrains traffic	During removal of temporary cofferdam, associated infrastructure (cofferdam, jack up rig etc) extends into the authorised channel, therefore constraining available water space for existing traffic. Due to the reduced channel width a river incident occurs.	15	9	15	12
2G	Emergency Arch closure - Arch No 3	During construction of the temporary cofferdam there may be an emergency requirement to close No 3 arch.	15	9	15	12
3G	Planned arch closure - Arch No 3	During construction of the temporary cofferdam there may be a requirement to close No 3 arch for maintenance.	8	6	10	8
4G	Planned Arch closure - Arch No 2	During construction of the temporary cofferdam it is proposed that Arch No 2 is closed to all navigation.	10	6	10	10
5G	Increased Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Blackfriars Bridges.	15	9	15	12
6G	Contact - High Speed Craft / Class V passenger vessel with Temporary work site	A High Speed Craft / Class V passenger vessel comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction / removal of temporary cofferdam.	10	6	10	10
7G	Contact - Tug and Tow with Temporary work site	A Tug and Tow comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction / removal of temporary cofferdam.	10	6	10	10

8G	Contact - Private leisure vessel with Temporary work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction / removal of temporary cofferdam (section A).	15	6	15	15
9G	Collision with commercial freight operator	A vessel conducting Thames Tunnel construction activities collides with a commercial freight operator in the vicinity of Blackfriars Embankment.	15	9	15	15
10G	Collision with tug and tow	A vessel conducting Thames Tunnel construction activities collides with a tug and tow in the vicinity of Blackfriars Embankment.	15	9	15	15
11G	Contact with Blackfriars Bridge (Road & Rail)	A vessel conducting Thames Tunnel construction activities makes contact with Blackfriars Road or Rail Bridge, including arches, abutments and any associated bridge superstructure.	8	6	8	8
12G	Contact - High Speed Craft / Class V passenger vessel with Temporary work site	A High Speed Craft / Class V passenger vessel comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction / removal of temporary cofferdam.	15	9	15	15
13G	Contact - Tug and Tow with Temporary work site	A Tug and Tow comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction / removal of temporary cofferdam.	10	6	8	8
14G	Contact - Private leisure vessel with Temporary work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction / removal of temporary cofferdam.	10	2	8	10

15G	Contact with moored vessel in vicinity of Blackfriars (President / Cory barges/ Passenger boat moorings etc)	A vessel in transit makes contact with a moored vessel (E.g. Moored Barge, President or moored passenger boat) in the vicinity of Blackfriars Embankment.	10	6	6	10
16G	Vessels subject to increased interaction during periods of low water	Due to the intrusion of the temporary works into the authorised channel, the available water space for vessels to manoeuvre in is reduced. At periods of low water this is particularly relevant	8	6	8	8

17G	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	8	6	8	8
18G	Contact with moored vessel at relocated Blackfriars Millennium Pier	A vessel in transit makes contact with a vessel moored at the relocated Blackfriars Millennium Pier.	10	6	10	10

## H.2 Worst credible hazard list – Phase C: Removal of cofferdam

### 1G - LTTBF - Restricted Working - Work Intrudes into Authorised Channel and Constrains Traffic

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
1G - LTTBF	Restricted Working	<p>Temporary works site, including cofferdam and associated infrastructure extends into the authorised channel, therefore constraining available water space for existing traffic.</p> <p>Intrusion into authorised channel constrains available water space for existing traffic. Due to the reduced channel width a river incident occurs.</p>	<ul style="list-style-type: none"> <li>Reduced effective river width</li> <li>Misjudgement</li> <li>Inattention</li> <li>Adverse weather conditions</li> <li>Machinery breakdown</li> <li>Collision avoidance</li> <li>Tidal set</li> <li>Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>Multiple fatalities</li> <li>Short to medium term impact</li> <li>Very serious damage to vessel or equipment possible criminal proceedings</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>Boat Masters Licence</li> <li>BML Local Knowledge Endorsement</li> <li>Qualified Crew</li> <li>Vessel Master Experience</li> <li>Thames AIS</li> <li>VHF Communications</li> <li>VTS Navigational Broadcast</li> <li>Permanent / Temporary Notice to Mariners</li> <li>Tug Operator Procedures</li> <li>Ship Towage Code of Practice</li> <li>Aids to Navigation</li> <li>General Directions</li> <li>Emergency Plans &amp; Procedures</li> <li>COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>Minimise the footprint of the temporary works and therefore encroachment into the channel</li> <li>Close Arch No 2 to all inward bound freight traffic</li> <li>Restricted access through Arch No 2 to certain vessels at different phases of site restoration</li> <li>Vessel Traffic Control Co-ordinator</li> <li>Scheduling of barge movements to assist with existing river events</li> <li>Communication and schedule planning - PLA / Thames Tunnel / Marine Sub Contractor</li> <li>Safety Work Boat in attendance during periods of increased restricted working</li> <li>Suspend Thames Tunnel barge operations in event of emergency arch closure</li> <li>Relocate Cory Environmental Ltd Coin Street moorings</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	Extreme

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	High

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	4	20	Extreme

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	Extreme

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Code of Practice Passenger Vessel Operations on the Thames</li> <li>River Thames Recreational Users Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> <li>Ship Towage Operations on the Thames</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Assessment Notes
<ul style="list-style-type: none"> <li>Emergency closure of Arch No 3 assessed separately.</li> </ul>

## 2G - LTTBF - Emergency Arch Closure - Arch No 3

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
2G - LTTBF	Emergency Arch Closure - Arch No 3	<p>During the removal of the temporary cofferdam there may be an emergency requirement to close No 3 arch.</p> <p>Due to the temporary works site intrusion into the authorised channel navigable water space will be constrained with an increase in probability of a river incident.</p>	<ul style="list-style-type: none"> <li>Emergency Bridge Arch Closure</li> <li>River Incident</li> </ul>	<ul style="list-style-type: none"> <li>Multiple fatalities</li> <li>Short to medium term impact</li> <li>Very serious damage to vessel or equipment possible criminal proceedings</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>VTS Navigational Broadcast</li> <li>VHF Communications</li> </ul>	<ul style="list-style-type: none"> <li>Safety boat to be in attendance maintaining a continuous VHF watch on Channel 14 in the event of Arch No 3 closure</li> <li>Navigational warning broadcast on VHF</li> <li>Suspend Thames barge operations in event of emergency arch closure</li> <li>Maintain Arch No 4 for navigation</li> <li>Open Arch No 2 with restricted operating procedures for freight</li> <li>Relocate Cory Environmental Ltd Coin Street moorings</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	Extreme

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	Extreme

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	4	20	Extreme

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	Extreme

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Port Entry Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Assessment Notes
<ul style="list-style-type: none"> <li>This hazard is covered in more detail within the main Blackfriars Foreshore - Maritime Issues and Navigational Risk Assessment Report.</li> </ul>

**3G - LTTBF - Planned Arch Closure - Arch No 3**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
3G - LTTBF	Planned Arch Closure - Arch No 3	<p>During removal of the temporary cofferdam there may be a scheduled requirement to close No 3 arch.</p> <p>Due to the temporary works site intrusion into the authorised channel navigable water space will be constrained with an increase in probability of a river incident.</p>	<ul style="list-style-type: none"> <li>Planned Bridge arch closure</li> <li>Maintenance and Inspection routines</li> </ul>	<ul style="list-style-type: none"> <li>Multiple fatalities</li> <li>Short to medium term impact</li> <li>Very serious damage to vessel or equipment possible criminal proceedings</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>Permanent / Temporary Notice to Mariners</li> <li>VTS Navigational Broadcast</li> <li>VHF Communications</li> <li>Aids to Navigation</li> <li>Bridge Special Signal Lights</li> <li>VTS Qualification</li> </ul>	<ul style="list-style-type: none"> <li>Scheduling of arch closures in order to facilitate minimum disruption to river users</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Port Entry Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> </ul>

Assessment Notes
<ul style="list-style-type: none"> <li>Inspection Routine - Road &amp; Rail Bridge                             <ul style="list-style-type: none"> <li>General Inspection - every 2 years</li> <li>Principal Inspection - every 6<sup>th</sup> year - requires full inspection within touching distance of all elements and therefore inspection from below is required - Arch Closure as a result.</li> </ul> </li> <li>Principal Inspection to be conducted immediately prior to work commencing</li> </ul>

**4G - LTTBF - Planned Arch Closure - Arch No 2**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
4G - LTTBF	Planned Arch Closure - Arch No 2	During the removal of the temporary cofferdam it is proposed that Arch No 2 is closed to all navigation.  Due to the temporary works site intrusion into the authorised channel navigable water space will be constrained with an increase in probability of a river incident.	<ul style="list-style-type: none"> <li>Planned Bridge arch closure</li> </ul>	<ul style="list-style-type: none"> <li>Multiple fatalities</li> <li>Short to medium term impact</li> <li>Very serious damage to vessel or equipment possible criminal proceedings</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>Permanent / Temporary Notice to Mariners</li> <li>VTS Navigational Broadcast</li> <li>VHF Communications</li> <li>Aids to Navigation</li> <li>Bridge Special Signal Lights</li> <li>VTS Qualification</li> </ul>	<ul style="list-style-type: none"> <li>Scheduling of arch closures in order to facilitate minimum disruption to river users</li> <li>Maintain Arch No 4 to allow for navigation inbound &amp; outbound for larger and reporting vessels (in the event of an emergency).</li> <li>A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect</li> <li>Relocate the Cory Environmental moorings (currently opposite the proposed permanent works)</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Port Entry Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> </ul>

Assessment Notes
<ul style="list-style-type: none"> <li>Inspection Routine - Road &amp; Rail Bridge                             <ul style="list-style-type: none"> <li>General Inspection - every 2 years</li> <li>Principal Inspection - every 6<sup>th</sup> year - requires full inspection within touching distance of all elements and therefore inspection from below is required - Arch Closure as a result.</li> </ul> </li> <li>Principal Inspection to be conducted immediately prior to work commencing</li> </ul>

**5G - LTTBF - Increased Flow**

<i>Hazard ID</i>	<i>Hazard Title</i>	<i>Hazard Description</i>	<i>Hazard Causes</i>	<i>Consequence(s) Worst Credible</i>	<i>Existing Safeguards</i>	<i>Proposed Additional Mitigation</i>
5G - LTTBF	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Blackfriars Bridges.	<ul style="list-style-type: none"> <li>• Shape and position of temporary cofferdam</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Short to medium term impact</li> <li>• Very serious damage to vessel or equipment possible criminal proceedings</li> <li>• National coverage</li> </ul>	<ul style="list-style-type: none"> <li>• None identified for this hazard</li> </ul>	<ul style="list-style-type: none"> <li>• 3D and computational modelling</li> <li>• A Notice to Mariners to advise of any increases in river flow: NTM to advise that for example: In Arch No3 the maximum flow will increase by approximately 1/2 knot during temporary works with the flow moving towards the south side of the bridge arch.</li> <li>• Review and re-design temporary work structure to reduce hydrodynamic affects</li> <li>• Close Arch No 2 to all inward bound freight traffic</li> <li>• Restrict access through Arch No 2 to certain vessels at different phases of construction</li> </ul>

<b>Pre Control - People</b>			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

<b>Post Control - People</b>			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

<b>Pre Control - Environment</b>			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

<b>Post Control - Environment</b>			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

<b>Pre Control - Operational Impact</b>			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

<b>Post Control - Operational Impact</b>			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

<b>Pre Control - Media Attention</b>			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

<b>Post Control - Media Attention</b>			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

<b>Relevant PLA Guidance</b>
<ul style="list-style-type: none"> <li>• General Directions for Navigation in the Port of London</li> <li>• Schedule to the General Directions for Navigation in the Port of London</li> <li>• Pilotage Directions</li> <li>• Port Entry Guide</li> <li>• Mariners Guide to Bridges on the Tidal Thames</li> </ul>

<b>Assessment Notes</b>
<ul style="list-style-type: none"> <li>• Fluvial modelling (numerical and physical) have been used to develop the design of the structure.</li> <li>• Analysis of HR Wallingford fluvial modelling report indicates minimum change in flow in this area.</li> <li>• Further investigation is required in order to assess latest structure design.</li> </ul>

**6G - LTTBF - Contact - High Speed Craft / Class V Passenger Vessel with Temporary Work Site**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
6G - LTTBF	Contact - High Speed Craft / Class V passenger vessel with Temporary work site	A High Speed Craft / Class V passenger vessel comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> <li>• Leisure traffic impedes the passage of vessel navigating the channel</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Short to medium term impact</li> <li>• Very serious damage to vessel or equipment possible criminal proceedings</li> <li>• International coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• General Directions</li> <li>• Tug Operator Procedures</li> <li>• Passage Planning</li> <li>• VTS Navigational Broadcast</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Thames AIS</li> <li>• HSC Code</li> <li>• VHF Communications</li> <li>• COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>• Light Warnings - providing visual warning that barge is about to depart berth</li> <li>• Sound Warnings - providing audio warning that barge is about to depart berth</li> <li>• Sub-Contractors Risk Assessment</li> <li>• Closure of Arch No 2 to all inward bound freight traffic</li> <li>• Use of reputable and experienced marine contractor</li> <li>• Berth Master</li> <li>• Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity</li> <li>• Berth Master to monitor VHF</li> <li>• CCTV to provide additional information to Berth Master</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Permanent Notice to Mariners</li> <li>•Code of Practice Passenger Vessel Operations on the Thames</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**7G - LTTBF - Contact - Tug and Tow with Temporary Work Site**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
7G - LTTBF	Contact - Tug and Tow with Temporary work site	A Tug and Tow comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during removal of temporary cofferdam.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Leisure traffic impedes the passage of vessel navigating the channel</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Short to medium term impact</li> <li>• Very serious damage to vessel or equipment possible</li> <li>• International coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• Passage Planning</li> <li>• Ship Towage Code of Practice</li> <li>• COLREGs</li> <li>• Oil Spill Contingency Plan</li> <li>• Tug Operator Procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Closure of Arch No 2 to all inward bound freight traffic</li> <li>• Inward bound vessels use Arch No 3</li> <li>• Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Pilotage Directions</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•Ship Towage Operations on the Thames</li> <li>•Code of Practice for Craft Towage Operations on the Thames</li> <li>•Port Entry Guide</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Sub Contractors Risk Assessment								
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Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**8G - LTTBF - Contact - Private Leisure Vessel with Temporary Work Site**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
8G - LTTBF	Contact - Private leisure vessel with Temporary work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during removal of temporary cofferdam.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Improper lookout</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Temporary effect / Minor effect to small area</li> <li>• Very serious damage to vessel or equipment possible</li> <li>• International coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Aids to Navigation</li> <li>• VHF Communications</li> <li>• COLREGs</li> <li>• General Directions</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• VTS Navigational Broadcast</li> </ul>	<ul style="list-style-type: none"> <li>• Closure of Arch No 2 to all inward bound freight traffic</li> <li>• Inward bound vessels use Arch No 3</li> <li>• Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area</li> <li>• Information provided to local recreational clubs and marinas providing an overview of the works being conducted and expected duration</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Permanent Notice to Mariners</li> <li>•Mariners Guide to Bridges on the Tidal Thames</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Sub Contractors Risk Assessment								
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Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**9G - LTTBF - Collision with Commercial Freight Operator**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
9G - LTTBF	Collision with commercial freight operator	A vessel conducting Thames Tunnel construction activities collides with a commercial freight operator in the vicinity of Blackfriars Embankment, during the construction of the temporary cofferdam.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Non Compliance with procedures</li> <li>• Improper lookout</li> <li>• Lack of communications</li> <li>• Machinery breakdown</li> <li>• Collision avoidance</li> <li>• High density of leisure traffic</li> <li>• Leisure traffic impedes the passage of vessel navigating the channel</li> <li>• Change in river flow due to new in-river structure</li> <li>• Tidal set</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Short to medium term impact</li> <li>• Very serious damage to vessel or equipment possible</li> <li>• Criminal proceedings</li> <li>• International coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• Qualified Crew</li> <li>• Bridge Special Signal Lights</li> <li>• Emergency Plans &amp; Procedures</li> <li>• VTS Navigational Broadcast</li> <li>• Thames AIS</li> <li>• Passage Planning</li> <li>• Ship Towage Code of Practice</li> <li>• BML Local Knowledge Endorsement</li> <li>• Tug Operator Procedures</li> <li>• Perm / Temp Notice to Mariners</li> <li>• COLREGS</li> <li>• General Directions</li> </ul>	<ul style="list-style-type: none"> <li>• Light Warnings - providing visual warning that barge is about to depart berth</li> <li>• Sound Warnings - providing audio warning that barge is about to depart berth</li> <li>• Use of reputable and experienced marine contractor</li> <li>• Sub-Contractors Risk Assessment</li> <li>• Berth Master</li> <li>• Berth Master to monitor VHF</li> <li>• Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity</li> <li>• CCTV to provide additional information to Berth Master</li> <li>• Closure of Arch No 2 to all inward bound freight traffic</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>• General Directions for Navigation in the Port of London</li> <li>• Schedule to the General Directions for Navigation in the Port of London</li> <li>• Pilotage Directions</li> <li>• River Byelaws 1978 (as amended)</li> <li>• Permanent Notice to Mariners</li> <li>• Ship Towage Operations on the Thames</li> <li>• Code of Practice for Craft Towage Operations on the Thames</li> <li>• Port Entry Guide</li> <li>• Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Sub Contractors Risk Assessment									
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Working at height	Loading / Unloading operations	Welfare Amenities							
Lifting operations	Movement of materials	Fire safety							
Slips and trips	Mooring								

**10G - LTTBF - Collision with Tug and Tow**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
10G - LTTBF	Collision with tug and tow	A vessel conducting Thames Tunnel construction activities collides with a tug and tow in the vicinity of Blackfriars Embankment, during the construction of the temporary cofferdam.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Non Compliance with procedures</li> <li>• Improper lookout</li> <li>• Lack of communications</li> <li>• Machinery breakdown</li> <li>• Collision avoidance</li> <li>• High density of leisure traffic</li> <li>• Leisure traffic impedes the passage of vessel navigating the channel</li> <li>• Change in river flow due to new in-river structure</li> <li>• Tidal set</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Short to medium term impact</li> <li>• Very serious damage to vessel or equipment possible criminal proceedings</li> <li>• International coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• Qualified Crew</li> <li>• Bridge Special Signal Lights</li> <li>• Emergency Plans &amp; Procedures</li> <li>• VTS Navigational Broadcast</li> <li>• Thames AIS</li> <li>• Passage Planning</li> <li>• Ship Towage Code of Practice</li> <li>• BML Local Knowledge Endorsement</li> <li>• Perm / Temp Notice to Mariners</li> <li>• Tug Operator Procedures</li> <li>• General Directions</li> <li>• COLREGS</li> </ul>	<ul style="list-style-type: none"> <li>• Light Warnings - providing visual warning that barge is about to depart berth</li> <li>• Sound Warnings - providing audio warning that barge is about to depart berth</li> <li>• Use of reputable and experienced marine contractor</li> <li>• Sub-Contractors Risk Assessment</li> <li>• Berth Master</li> <li>• Berth Master to monitor VHF</li> <li>• Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity</li> <li>• CCTV to provide additional information to Berth Master</li> <li>• Closure of Arch No 2 to all inward bound freight traffic</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>• General Directions for Navigation in the Port of London</li> <li>• Schedule to the General Directions for Navigation in the Port of London</li> <li>• Pilotage Directions</li> <li>• River Byelaws 1978 (as amended)</li> <li>• Permanent Notice to Mariners</li> <li>• Ship Towage Operations on the Thames</li> <li>• Code of Practice for Craft Towage Operations on the Thames</li> <li>• Port Entry Guide</li> <li>• Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Sub Contractors Risk Assessment								
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Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**11G - LTTBF - Contact with Blackfriars Bridge (Road & Rail)**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
11G - LTTBF	Contact with Blackfriars Bridge (Road & Rail)	A vessel conducting Thames Tunnel construction activities makes contact with Blackfriars Road or Rail Bridge, including arches, abutments and any associated bridge superstructure.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Non Compliance with procedures</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• Inadequate training and experience</li> <li>• Tug or line failure</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Single Fatality / Severe permanent partial disability</li> <li>• Short to medium term impact</li> <li>• Major damage to vessel / equipment and detention</li> <li>• National coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• General Directions</li> <li>• PLA Bridge Guide</li> <li>• Passage Planning</li> <li>• Accurate Tidal Information</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Tug Operator Procedures</li> <li>• COLREGs</li> <li>• Ship Towage Code of Practice</li> <li>• Emergency Plans &amp; Procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Use of reputable and experienced marine contractor</li> <li>• Sub-Contractors Risk Assessment</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	9	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Ship Towage Operations on the Thames</li> <li>•Code of Practice for the Safe Mooring of Vessels on the Thames</li> <li>•Code of Practice for Craft Towage Operations on the Thames</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> <li>•Port Entry Guide</li> </ul>

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Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**12G - LTTBF - Contact - High Speed Craft / Class V Passenger Vessel with Temporary Work Site**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
12G - LTTBF	Contact - High Speed Craft / Class V passenger vessel with Temporary work site	A High Speed Craft / Class V passenger vessel comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> <li>• Leisure traffic impedes the passage of vessel navigating the channel</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Short to medium term impact</li> <li>• Very serious damage to vessel or equipment possible criminal proceedings</li> <li>• International coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• VTS Navigational Broadcast</li> <li>• HSC Code</li> <li>• Passage Planning</li> <li>• COLREGs</li> <li>• VHF Communications</li> <li>• Emergency Plans &amp; Procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Closure of Arch No 2 to all inward bound freight traffic</li> <li>• Inward bound vessels use Arch No 3</li> <li>• Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Permanent Notice to Mariners</li> <li>•Code of Practice Passenger Vessel Operations on the Thames</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Sub Contractors Risk Assessment								
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Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**13G - LTTBF - Contact - Tug and Tow with Temporary Work Site**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
13G - LTTBF	Contact - Tug and Tow with Temporary work site	A Tug and Tow comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction of temporary cofferdam.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Leisure traffic impedes the passage of vessel navigating the channel</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Short to medium term impact</li> <li>• Major damage to vessel / equipment and detention</li> <li>• National coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• Passage Planning</li> <li>• Ship Towing Code of Practice</li> <li>• COLREGs</li> <li>• Oil Spill Contingency Plan</li> <li>• Tug Operator Procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Closure of Arch No 2 to all inward bound freight traffic</li> <li>• Inward bound vessels use Arch No 3</li> <li>• Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>High</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Pilotage Directions</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•Ship Towing Operations on the Thames</li> <li>•Code of Practice for Craft Towing Operations on the Thames</li> <li>•Port Entry Guide</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**14G - LTTBF - Contact - Private Leisure Vessel with Temporary Work Site**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
14G - LTTBF	Contact - Private leisure vessel with Temporary work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel temporary work site at Blackfriars Embankment during construction of temporary cofferdam.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Improper lookout</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Low impact with no lasting effect</li> <li>• Major damage to vessel / equipment and detention</li> <li>• International coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Aids to Navigation</li> <li>• VHF Communications</li> <li>• COLREGs</li> <li>• General Directions</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• VTS Navigational Broadcast</li> </ul>	<ul style="list-style-type: none"> <li>• Closure of Arch No 2 to all inward bound freight traffic</li> <li>• Inward bound vessels use Arch No 3</li> <li>• Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area</li> <li>• Information provided to local recreational clubs and marinas providing an overview of the works being conducted and expected duration</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	16	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	4	4	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Permanent Notice to Mariners</li> <li>•Mariners Guide to Bridges on the Tidal Thames</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	2	2	<b>Minor</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**15G - LTTBF - Contact with Moored Vessel in Vicinity of Blackfriars (President / Cory Barges / Passenger Boat Moorings etc.)**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Safeguards
15G - LTTBF	Contact with moored vessel in vicinity of Blackfriars (President / Cory barges / Passenger boat moorings etc)	A vessel in transit makes contact with a moored vessel (E.g. Moored Barge, President or moored passenger boat) in the vicinity of Blackfriars Embankment.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Short to medium term impact</li> <li>• Major damage to vessel / equipment and detention</li> <li>• International coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• Passage Planning</li> <li>• Ship Towage Code of Practice</li> <li>• Admiralty Charts</li> <li>• COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>• Relocate HMS President</li> <li>• Relocate Cory Coin Street moorings</li> <li>• Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	8	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	4	16	<b>Extreme</b>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	6	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Pilotage Directions</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•Ship Towage Operations on the Thames</li> <li>•Code of Practice for Craft Towage Operations on the Thames</li> <li>•Port Entry Guide</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**16G - LTTBF - Vessels subject to increased interaction during periods of low water**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Safeguards
16G - LTTBF	Vessels subject to increased interaction during periods of low water.	Due to the intrusion of the temporary works into the authorised channel, the available water space for vessels to manoeuvre in is reduced. At periods of low water this is particularly relevant.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Single Fatality / Severe permanent partial disability</li> <li>• Short to medium term impact</li> <li>• Major damage to vessel / equipment and detention</li> <li>• National coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> </ul>	

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	20	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Pilotage Directions</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•Ship Towing Operations on the Thames</li> <li>•Code of Practice for Craft Towing Operations on the Thames</li> <li>•Port Entry Guide</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**17G - LTTBF - Vessels subject to increased interaction during periods of low water**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Safeguards
17G - LTTBF	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Single Fatality / Severe permanent partial disability</li> <li>• Short to medium term impact</li> <li>• Major damage to vessel / equipment and detention</li> <li>• National coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• MCA Guidance document</li> </ul>	

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	<b>Moderate</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Pilotage Directions</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•Ship Towing Operations on the Thames</li> <li>•Code of Practice for Craft Towing Operations on the Thames</li> <li>•Port Entry Guide</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Sub Contractors Risk Assessment								
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Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**18G - LTTBF – Contact with moored vessel at relocated Blackfriars Millennium Pier**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Safeguards
18G - LTTBF	Contact with moored vessel at relocated Blackfriars Millennium Pier	A vessel in transit makes contact with a vessel moored at the relocated Blackfriars Millennium Pier.	<ul style="list-style-type: none"> <li>Misjudgement</li> <li>Inattention</li> <li>Lack of communications</li> <li>Adverse weather conditions</li> <li>Machinery breakdown</li> <li>High density of leisure traffic</li> <li>Collision avoidance</li> </ul>	<ul style="list-style-type: none"> <li>Multiple fatalities</li> <li>Short to medium term impact</li> <li>Very serious damage to vessel or equipment possible</li> <li>criminal proceedings</li> <li>International coverage</li> </ul>	<ul style="list-style-type: none"> <li>Boat Masters Licence</li> <li>BML Local Knowledge Endorsement</li> <li>Qualified Crew</li> <li>Vessel Master Experience</li> <li>Permanent / Temporary Notice to Mariners</li> <li>Aids to Navigation</li> <li>Passage Planning</li> <li>Ship Towage Code of Practice</li> <li>Admiralty Charts</li> <li>COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>Restrictions on number of barges permitted to be towed in this area in the event that arch No2 is closed.</li> <li>Provide facilities for vessels using the pier to moor at the eastern end to allow them to be further from the authorised channel.</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>River Byelaws 1978 (as amended)</li> <li>Permanent Notice to Mariners</li> <li>Ship Towage Operations on the Thames</li> <li>Code of Practice for Craft Towage Operations on the Thames</li> <li>Port Entry Guide</li> <li>Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Sub Contractors Risk Assessment
<p>The proposed new location for Blackfriars Millennium Pier takes into consideration a number of stakeholder requirements.</p> <p>After consultation with the PLA, the outer face of the pier pontoon has been set back from the authorised channel by at least 15m.</p>

## Annex I – Worst credible hazard log: Phase D – Permanent work site

### I.1 Worst credible summary hazard list: Phase D – Permanent work site

Hazard Id	Hazard Title	Hazard Description	People	Environment	Operational	Media
1H	Restricted Working - Work intrudes into authorised channel and constrains traffic	Intrusion into authorised channel by permanent works structure constrains available water space for existing traffic. Due to the reduced channel width a river incident occurs.	15	9	12	15
2H	Emergency Arch Closure - Arch No 3	With the permanent work structure in place, there may be an emergency requirement to close No 3 arch.	8	6	8	10
3H	Planned Arch Closure - Arch No 3	With the permanent work structure in place there will be requirements for scheduled maintenance of No 3 arch resulting in arch closure.	8	6	8	8
4H	Planned Arch closure - Arch No 2	With the permanent work structure in place there will be requirements for scheduled maintenance of No 2 arch resulting in arch closure.	N/A	N/A	N/A	N/A
5H	Emergency Arch closure - Arch No 2	With the permanent work structure in place, there may be an emergency requirement to close No 2 arch.	N/A	N/A	N/A	N/A
6H	Change in River Flow	The permanent structure is of sufficient area and shape to have an affect on the fluvial flow of the river in the area around Blackfriars.	15	9	12	12
7H	Contact - High Speed Craft / Class V passenger vessel with Permanent work site	A High Speed Craft / Class V passenger vessel comes into contact with Tideway Tunnel Permanent work site at Blackfriars Embankment.	10	6	10	10

8H	Contact - Tug and Tow with permanent work site	A Tug and Tow comes into contact with Tideway Tunnel permanent work site at Blackfriars Embankment.	15	9	12	12
9H	Contact - Private leisure vessel with Permanent work site	Private leisure vessels, including narrow boats, comes into contact with Tideway Tunnel permanent work site at Blackfriars Embankment.	15	9	12	12
10H	Contact with moored vessel in vicinity of Blackfriars (President / Cory barges / Passenger boat moorings etc)	A vessel in transit makes contact with a moored vessel (E.g. Moored Barge, President or moored passenger boat) in the vicinity of Blackfriars Embankment during the construction of the shaft and culvert.	N/A	N/A	N/A	N/A
11H	Vessels subject to increased interaction during periods of low water	Due to the intrusion of the temporary works into the authorised channel, the available water space for vessels to manoeuvre in is reduced. At periods of low water this is particularly relevant	15	9	12	12
12H	Contact with moored vessel at relocated Blackfriars Millennium Pier	A vessel in transit makes contact with a vessel moored at the relocated Blackfriars Millennium Pier.	12	6	12	15

## I.2 Worst credible hazard list – Phase D: Permanent work site

### 1H - LTTBF - Restricted Working

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
1H - LTTBF	Restricted Working	Intrusion into authorised channel by permanent works structure constrains available water space for existing traffic.  Due to the reduced channel width a river incident occurs.	<ul style="list-style-type: none"> <li>Reduced effective river width</li> <li>River Incident</li> <li>Misjudgement</li> <li>Inattention</li> <li>Adverse weather conditions</li> <li>Machinery breakdown</li> <li>Collision avoidance</li> <li>Tidal set</li> <li>Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>Multiple fatalities</li> <li>Short to medium term impact</li> <li>Major damage to vessel / equipment and detention</li> <li>International coverage</li> </ul>	<ul style="list-style-type: none"> <li>Boat Masters Licence</li> <li>BML Local Knowledge Endorsement</li> <li>Vessel Master Experience</li> <li>Qualified Crew</li> <li>VTS Navigational Broadcast</li> <li>VTS Qualification</li> <li>VHF Communications</li> <li>Bridge Special Signal Lights</li> <li>General Directions</li> <li>Emergency Plans and Procedures</li> <li>COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>Minimise the footprint of the permanent works structure and therefore encroachment into the channel</li> <li>Relocate Cory Environmental Ltd Coin Street moorings</li> <li>See assessment notes</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Code of Practice Passenger Vessel Operations on the Thames</li> <li>River (Amendment) Byelaws 2006 - Thames AIS Byelaws and Revocation of River Byelaws 6, 8 and 41</li> <li>River Thames Recreational Users Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> <li>Ship Towing Operations on the Thames</li> </ul>

Assessment Notes
<p>Phase 4 – Permanent works</p> <p>Arch 2 – Open to smaller, non reporting inbound vessels. Standby arch for inbound reporting vessels, may have operating restrictions place; number of barges to be towed through for example</p> <p>Arch 3 – Preferred arch for inbound and outbound reporting vessels. Possible planned closures throughout life of works, to be assessed in Navigational Risk Assessment</p> <p>Arch 4 – Preferred arch for outbound smaller vessels – standby arch for outbound reporting vessels</p>

**2H - LTTBF - Emergency Arch Closure - Arch No 3**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
2H - LTTBF	Emergency Arch Closure - Arch No 3	<p>With the permanent work structure in place, there may be an emergency requirement to close No 3 arch.</p> <p>The permanent works structure intrudes into the authorised channel and therefore navigable water space will be constrained with an increase in the probability of a river incident.</p>	<ul style="list-style-type: none"> <li>Emergency Bridge Arch Closure</li> <li>River Incident</li> </ul>	<ul style="list-style-type: none"> <li>Single Fatality / Severe permanent partial disability</li> <li>Short to medium term impact</li> <li>Major damage to vessel / equipment and detention</li> <li>International coverage</li> </ul>	<ul style="list-style-type: none"> <li>VTS Navigational Broadcast</li> <li>VHF Communications</li> <li>Aids to Navigation</li> <li>Thames AIS</li> <li>COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>Safety boat to be in attendance maintaining a continuous VHF watch on Channel 14 in the event of Arch No 3 closure</li> <li>Navigational warning broadcast on VHF</li> <li>Restricted operating procedures for freight services through Arch No 2 (1 x barge per tug)</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	9	Moderate

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	Moderate

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	2	10	High

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Port Entry Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> </ul>

Assessment Notes
<p>Phase 4 – Permanent works</p> <p>Arch 2 – Open to smaller, non reporting inbound vessels. Standby arch for inbound reporting vessels, may have operating restrictions in place; number of barges to be towed for example</p> <p>Arch 3 – Preferred arch for inbound and outbound reporting vessels. Possible planned closures throughout life of works, to be assessed in Navigational Risk Assessment</p> <p>Arch 4 – Preferred arch for outbound smaller vessels – standby arch for outbound reporting vessels</p>

### 3H - LTTBF - Planned Arch Closure - Arch No 3

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
3H - LTTBF	Planned Arch Closure - Arch No 3	With the permanent work structure in place there will be requirements for scheduled maintenance of No 3 arch resulting in arch closure.	<ul style="list-style-type: none"> <li>Planned Bridge arch closure</li> <li>Maintenance and Inspection routines</li> </ul>	<ul style="list-style-type: none"> <li>Single Fatality / Severe permanent partial disability</li> <li>Short to medium term impact</li> <li>Major damage to vessel / equipment and detention</li> <li>International coverage</li> </ul>	<ul style="list-style-type: none"> <li>Permanent / Temporary Notice to Mariners</li> <li>VTS Navigational Broadcast</li> <li>VHF Communications</li> <li>Aids to Navigation</li> <li>Bridge Special Signal Lights</li> <li>VTS Qualification</li> </ul>	<ul style="list-style-type: none"> <li>Restricted operating procedures for freight services through Arch No 2 (1 x barge per tug)</li> <li>Safety boat to be in attendance maintaining a continuous VHF watch on Channel 14 in the event of Arch No 3 closure</li> <li>Navigational warning broadcast on VHF</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	Moderate

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	High

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	Moderate

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	Moderate

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	Moderate

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	Moderate

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>Port Entry Guide</li> <li>Mariners Guide to Bridges on the Tidal Thames</li> </ul>

Assessment Notes
<ul style="list-style-type: none"> <li>Inspection Routine - Road &amp; Rail Bridge                             <ul style="list-style-type: none"> <li>General Inspection - every 2 years</li> <li>Principal Inspection - every 6<sup>th</sup> year - requires full inspection within touching distance of all elements and therefore inspection from below is required - Arch Closure as a result.</li> </ul> </li> <li>Principal Inspection to be conducted immediately prior to work commencing</li> </ul>

**4H - LTTBF - Planned Arch Closure - Arch No 2**

<i>Hazard ID</i>	<i>Hazard Title</i>	<i>Hazard Description</i>	<i>Hazard Causes</i>	<i>Consequence(s) Worst Credible</i>	<i>Existing Safeguards</i>	<i>Proposed Additional Mitigation</i>
<b>4H - LTTBF</b>	Planned Arch closure - Arch No 2	With the permanent work structure in place there will be requirements for scheduled maintenance of No 2 arch resulting in arch closure.	<ul style="list-style-type: none"> <li>Planned Bridge arch closure</li> <li>Maintenance and Inspection routines</li> </ul>	•	• See assessment notes	• See assessment notes

<b>Pre Control - People</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Post Control - People</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Pre Control - Environment</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Post Control - Environment</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Pre Control - Operational Impact</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Post Control - Operational Impact</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Pre Control - Media Attention</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Post Control - Media Attention</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Relevant PLA Guidance</b>
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•Ship Towage Operations on the Thames</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> <li>•Code of Practice Passenger Vessel Operations on the Thames</li> </ul>

<b>Assessment Notes</b>
<p>Closure of Arch No 2, once the permanent works is in place, makes no change to the current river operations.</p> <p>Arch No 2 has been required to be closed for durations of the Networks Rail Blackfriars Bridge works.</p> <p>A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect.</p>

## 5H - Emergency Arch Closure - Arch No 2

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
5H - LTTBF	Emergency Arch closure - Arch No 2	With the permanent work structure in place, there may be an emergency requirement to close No 2 arch.	<ul style="list-style-type: none"> <li>Planned Bridge arch closure</li> <li>Maintenance and Inspection routines</li> </ul>	<ul style="list-style-type: none"> <li></li> </ul>	<ul style="list-style-type: none"> <li>See assessment notes</li> </ul>	<ul style="list-style-type: none"> <li>See assessment notes</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>River Byelaws 1978 (as amended)</li> <li>Permanent Notice to Mariners</li> <li>Ship Towage Operations on the Thames</li> <li>Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> <li>Code of Practice Passenger Vessel Operations on the Thames</li> </ul>

Assessment Notes
<p>Closure of Arch No 2, once the permanent works is in place, makes no change to the current river operations.</p> <p>Arch No 2 has been required to be closed for durations of the Networks Rail Blackfriars Bridge works.</p> <p>A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect.</p>

## 6H - LTTBF- Change in River Flow

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
6H - LTTBF	Change in River Flow	The permanent structure is of sufficient area and shape to have an affect on the fluvial flow of the river in the area around Blackfriars.  Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Blackfriars Bridges.	<ul style="list-style-type: none"> <li>Shape and position of temporary cofferdam</li> </ul>	<ul style="list-style-type: none"> <li>Multiple fatalities</li> <li>Short to medium term impact</li> <li>Major damage to vessel / equipment and detention</li> <li>National coverage</li> </ul>	<ul style="list-style-type: none"> <li>None identified for this hazard</li> </ul>	<ul style="list-style-type: none"> <li>Fluvial modelling studies have helped to inform the shape of the structure, including the rounded edge of the upstream corner</li> <li>NTM to advise that for example: In Arch No3 the maximum flow will increase by approximately 1/2 knot during temporary works with the flow moving towards the south side of the bridge arch</li> </ul>

## Pre Control - People

Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

## Pre Control - Environment

Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

## Pre Control - Operational Impact

Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

## Pre Control - Media Attention

Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

## Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Port Entry Guide
- Code of Practice Passenger Vessel Operations on the Thames

## Post Control - People

Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

## Post Control - Environment

Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

## Post Control - Operational Impact

Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

## Post Control - Media Attention

Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

## Assessment Notes

Fluvial modelling (numerical and physical) have been used to develop the design of the structure.

Analysis of HR Wallingford fluvial modelling report indicates minimum change in flow in this area.

Further investigation is required in order to assess latest structure design.

**7H - LTTBF - Contact - High Speed Craft / Class V Passenger Vessel with Permanent Work Site**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
7H - LTTBF	Contact - High Speed Craft / Class V passenger vessel with Permanent work site	A High Speed Craft / Class V passenger vessel comes into contact with Tideway Tunnel Permanent work site at Blackfriars Embankment.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> <li>• Leisure traffic impedes the passage of vessel navigating the channel</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Short to medium term impact</li> <li>• Very serious damage to vessel or equipment possible</li> <li>• Criminal proceedings</li> <li>• International coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• VTS Navigational Broadcast</li> <li>• HSC Code</li> <li>• Passage Planning</li> <li>• COLREGs</li> <li>• VHF Communications</li> <li>• Emergency Plans &amp; Procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Update PLA guidance and charts with new structure location</li> <li>• Notice to Mariners</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>• General Directions for Navigation in the Port of London</li> <li>• Schedule to the General Directions for Navigation in the Port of London</li> <li>• Permanent Notice to Mariners</li> <li>• Code of Practice Passenger Vessel Operations on the Thames</li> <li>• Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	2	10	<b>High</b>

Assessment Notes

**8H - LTTBF - Contact - Tug and Tow with Permanent Work Site**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
8H - LTTBF	Contact - Tug and Tow with permanent work site	A Tug and Tow comes into contact with Tideway Tunnel permanent work site at Blackfriars Embankment.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Improper lookout</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Short to medium impact</li> <li>• Very serious damage to vessel or equipment possible</li> <li>• criminal proceedings</li> <li>• National coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• Passage Planning</li> <li>• Ship Towage Code of Practice</li> <li>• COLREGs</li> <li>• Oil Spill Contingency Plan</li> <li>• Tug Operator Procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Update PLA guidance and charts with new structure location</li> <li>• Notice to Mariners</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Pilotage Directions</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•Ship Towage Operations on the Thames</li> <li>•Code of Practice for Craft Towage Operations on the Thames</li> <li>•Port Entry Guide</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Assessment Notes

**9H - LTTBF - Contact - Private Leisure Vessel with Permanent Work Site**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
9H - LTTBF	Contact - Private leisure vessel with Permanent work site	Private leisure vessels, including narrow boats, comes into contact with Tideway Tunnel permanent work site at Blackfriars Embankment.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Improper lookout</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Short to medium impact</li> <li>• Very serious damage to vessel or equipment possible</li> <li>• Criminal proceedings</li> <li>• National coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Aids to Navigation</li> <li>• VHF Communications</li> <li>• COLREGs</li> <li>• General Directions</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• VTS Navigational Broadcast</li> </ul>	<ul style="list-style-type: none"> <li>• Information provided to local recreational clubs and marinas providing an overview of the new works layout.</li> <li>• Update PLA guidance and charts with new structure location</li> <li>• Notice to Mariners</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>• General Directions for Navigation in the Port of London</li> <li>• Schedule to the General Directions for Navigation in the Port of London</li> <li>• Permanent Notice to Mariners</li> <li>• Mariners Guide to Bridges on the Tidal Thames</li> <li>• Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Assessment Notes

**10H - LTTBF - Contact with Moored Vessel in Vicinity of Blackfriars (President / Cory Barges / Passenger Boat Moorings etc.)**

<i>Hazard ID</i>	<i>Hazard Title</i>	<i>Hazard Description</i>	<i>Hazard Causes</i>	<i>Consequence(s) Worst Credible</i>	<i>Existing Safeguards</i>	<i>Proposed Additional Safeguards</i>
<b>10H - LTTBF</b>	Contact with moored vessel in vicinity of Blackfriars (President / Cory barges / Passenger boat moorings etc)	A vessel in transit makes contact with a moored vessel (E.g. Moored Barge, President or moored passenger boat) in the vicinity of Blackfriars Embankment during the construction of the shaft and culvert.	<ul style="list-style-type: none"> <li>Not applicable to this stage of the project</li> </ul>	<ul style="list-style-type: none"> <li>Not applicable to this stage of the project</li> </ul>	<ul style="list-style-type: none"> <li>Not applicable to this stage of the project</li> </ul>	<ul style="list-style-type: none"> <li>Not applicable to this stage of the project</li> </ul>

<b>Pre Control - People</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Post Control - People</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Pre Control - Environment</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Post Control - Environment</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Pre Control - Operational Impact</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Post Control - Operational Impact</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Pre Control - Media Attention</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Post Control - Media Attention</b>			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

<b>Relevant PLA Guidance</b>
<ul style="list-style-type: none"> <li>General Directions for Navigation in the Port of London</li> <li>Schedule to the General Directions for Navigation in the Port of London</li> <li>Pilotage Directions</li> <li>River Byelaws 1978 (as amended)</li> <li>Permanent Notice to Mariners</li> <li>Ship Towing Operations on the Thames</li> <li>Code of Practice for Craft Towing Operations on the Thames</li> <li>Port Entry Guide</li> <li>Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

<b>Assessment Notes</b>

**11H - LTTBF - Vessels subject to increased interaction during periods of low water**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Safeguards
11H - LTTBF	Vessels subject to increased interaction during periods of low water.	Due to the intrusion of the temporary works into the authorised channel, the available water space for vessels to manoeuvre in is reduced. At periods of low water this is particularly relevant.	<ul style="list-style-type: none"> <li>• Reduced effective river width</li> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Collision avoidance</li> <li>• Tidal set</li> <li>• Change in river flow due to new in-river structure</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple fatalities</li> <li>• Short to medium impact</li> <li>• Very serious damage to vessel or equipment possible criminal proceedings</li> <li>• National coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Pilotage Directions</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•Ship Towage Operations on the Thames</li> <li>•Code of Practice for Craft Towage Operations on the Thames</li> <li>•Port Entry Guide</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Sub Contractors Risk Assessment								
<p>An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Tideway Tunnel Project Team to conduct tug &amp; barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0"> <tr> <td>Working at height</td> <td>Loading / Unloading operations</td> </tr> <tr> <td>Lifting operations</td> <td>Movement of materials</td> </tr> <tr> <td>Slips and trips</td> <td>Mooring</td> </tr> <tr> <td>Fire safety</td> <td>Welfare Amenities</td> </tr> </table>	Working at height	Loading / Unloading operations	Lifting operations	Movement of materials	Slips and trips	Mooring	Fire safety	Welfare Amenities
Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

**12H - LTTBF - Contact with moored vessel at relocated Blackfriars Millennium Pier**

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Safeguards
12H- LTTBF	Contact with moored vessel at relocated Blackfriars Millennium Pier	A vessel in transit makes contact with a vessel moored at the relocated Blackfriars Millennium Pier.	<ul style="list-style-type: none"> <li>• Misjudgement</li> <li>• Inattention</li> <li>• Lack of communications</li> <li>• Adverse weather conditions</li> <li>• Machinery breakdown</li> <li>• High density of leisure traffic</li> <li>• Collision avoidance</li> </ul>	<ul style="list-style-type: none"> <li>• Single Fatality / Severe permanent partial disability</li> <li>• Low impact with no lasting effect</li> <li>• Major damage to vessel / equipment and detention</li> <li>• National coverage</li> </ul>	<ul style="list-style-type: none"> <li>• Boat Masters Licence</li> <li>• BML Local Knowledge Endorsement</li> <li>• Qualified Crew</li> <li>• Vessel Master Experience</li> <li>• Permanent / Temporary Notice to Mariners</li> <li>• Aids to Navigation</li> <li>• Passage Planning</li> <li>• Ship Towing Code of Practice</li> <li>• Admiralty Charts</li> <li>• COLREGs</li> </ul>	<ul style="list-style-type: none"> <li>• Restrictions on number of barges permitted to be towed in this area in the event that arch No2 is closed.</li> <li>• Provide facilities for vessels using the pier to moor at the eastern end to allow them to be further from the authorised channel.</li> </ul>

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	<b>High</b>

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	<b>Extreme</b>

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	4	20	<b>Extreme</b>

Relevant PLA Guidance
<ul style="list-style-type: none"> <li>•General Directions for Navigation in the Port of London</li> <li>•Schedule to the General Directions for Navigation in the Port of London</li> <li>•Pilotage Directions</li> <li>•River Byelaws 1978 (as amended)</li> <li>•Permanent Notice to Mariners</li> <li>•Ship Towing Operations on the Thames</li> <li>•Code of Practice for Craft Towing Operations on the Thames</li> <li>•Port Entry Guide</li> <li>•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners</li> </ul>

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	6	<b>Moderate</b>

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	<b>High</b>

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	<b>Extreme</b>

Risk Assessment Notes
<p>Assessment assumes that the Pier will remain in it proposed new location.</p> <p>The proposed new location for Blackfriars Millennium Pier takes into consideration a number of stakeholder requirements.</p> <p>After consultation with the PLA, the outer face of the pier pontoon has been set back from the authorised channel by at least 15m.</p>

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