



Application for Development Consent

Application Reference Number: WWO10001

Navigational Issues and Preliminary Risk Assessment

Doc Ref: **7.20.09**

Victoria Embankment Foreshore - Annexes: Hazard Logs

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

Hard copy available in
Box **73** Folder **A**
January 2013

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Annexes

List of annexes in order

Annex A: Hazard log introduction

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

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

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

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

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

Annex G: Summary worst credible hazard log - Phase B: Construction of drop shaft/culvert/connection

Annex H: Worst credible hazard list - Phase C: Removal of cofferdam

**Annex I: Worst credible hazard log - Phase D: Construction of cofferdam
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 cofferdam

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

Hazard Id	Hazard Title	Hazard Description	People	Environment	Operational	Media
1A	Emergency Arch closure - Arch No 2 or 3	There may be an emergency requirement to close Arch No 2 or 3	8	4	6	6
2A	Planned arch closure - Arch No 2 or 3	There may be a requirement to close Arch No 2 or 3 for maintenance.	8	4	6	6
3A	Planned Arch closure - Arch No 1	During construction/use/Deconstruction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	12	6	12	6
4A	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Hungerford Bridge.	9	6	6	9
5A	Contact - High Speed Passenger Vessel with work site	A High Speed Passenger Vessel comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	8	4	6	8
6A	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	8	4	6	8
7A	Contact - private leisure vessel with work site	A private leisure vessel comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	8	4	6	8
8A	Contact - commercial freight operator with work site	A commercial freight operator comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	6	4	6	6

9A	Contact - tug and tow with work site	A tug and tow comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	6	4	6	6
10A	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
11A	Mooring Breakout	A vessel involved in Thames Tunnel activities breaks free from moorings	6	4	6	4
12A	Collision - High Speed Passenger Vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment	6	4	6	8
13A	Collision - Class V passenger vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment.	6	4	6	8
14A	Collision - private leisure vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a private leisure vessel in the vicinity of Victoria Embankment.	9	6	9	9
15A	Collision - commercial freight operator (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a commercial freight operator in the vicinity of Victoria Embankment.	6	9	6	9

16A	Collision - tug and tow (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a tug and tow in the vicinity of Victoria Embankment.	6	9	6	9
17A	Contact with Hungerford Bridge (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure.	6	9	6	9
18A	Collision - High Speed Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment	N/A	N/A	N/A	N/A
19A	Collision - Class V passenger vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A

20A	Collision - private leisure vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a private leisure vessel in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
21A	Collision - commercial freight operator (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a commercial freight operator in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
22A	Collision - tug and tow (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a tug and tow in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
23A	Contact with Hungerford Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure.	N/A	N/A	N/A	N/A

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

1A - LTTVE - Emergency Arch Closure - Arch No. 2 or Arch No. 3

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
1A - LTTVE	Emergency Arch Closure - Arch No. 2 or No. 3	During Thames tunnel works there may be an emergency requirement to close Arch No. 2 or No. 3 of Charing Cross Railway Bridge.	<ul style="list-style-type: none"> Emergency Bridge Arch Closure River Incident 	<ul style="list-style-type: none"> Multiple Major Injuries Minor Damage - Barge Minor Damage - Tug Moderate Damage - Passenger Vessel Moderate Damage - High Speed Craft Moderate Damage - Private Leisure Vessel Moderate Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Minor Pollution 	<ul style="list-style-type: none"> VTS Navigational Broadcast VHF Communications Aids to Navigation Thames AIS COLREGs Other arch (2 or 3) would likely remain open) 	

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

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
3	3	9	Moderate

Relevant PLA Guidance
<ul style="list-style-type: none"> 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

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
3	2	6	Moderate

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

Assessment Notes
<ul style="list-style-type: none"> This hazard is covered in more detail within the main Victoria Embankment Foreshore - Maritime Issues and Navigational Risk Assessment Report. The location of the temporary and permanent works structures pose no additional navigational impact to that of the Tattershall Castle and Hispaniola and it is therefore assessed that the Thames Tunnel works do not add any additional navigational risk when there is a requirement to close arches 2 or 3.

2A - LTTVE - Planned Arch Closure - Arch No 2 or 3

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
2A - LTTVE	Planned Arch Closure - Arch No 2 or 3	During construction of the temporary cofferdam there may be a scheduled requirement to close No 2 or 3 arch.	<ul style="list-style-type: none"> Planned Bridge arch closure Maintenance and Inspection routines 	<ul style="list-style-type: none"> Multiple Major Injuries Minor Damage - Barge Minor Damage - Tug Moderate Damage - Passenger Vessel Moderate Damage - High Speed Craft Moderate Damage - Private Leisure Vessel Moderate Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Minor Pollution 	<ul style="list-style-type: none"> Permanent / Temporary Notice to Mariners VTS Navigational Broadcast VHF Communications Aids to Navigation Bridge Special Signal Lights VTS Qualification Other arch (2 or 3) would likely remain open) 	<ul style="list-style-type: none"> Scheduling of arch closures in order to facilitate minimum disruption to river users

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

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
3	3	9	Moderate

Relevant PLA Guidance
<ul style="list-style-type: none"> 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

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
3	2	6	Moderate

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

Assessment Notes
<ul style="list-style-type: none"> This hazard is covered in more detail within the main Victoria Embankment Foreshore - Maritime Issues and Navigational Risk Assessment Report. The location of the temporary and permanent works structures pose no additional navigational impact to that of the Tattershall Castle and Hispaniola and it is therefore assessed that the Thames Tunnel works do not add any additional navigational risk when there is a requirement to close arches 2 or 3.

3A - LTTVE - Planned Arch Closure - Arch No 1

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
3A - LTTVE	Planned Arch Closure - Arch No 1	During construction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	<ul style="list-style-type: none"> Planned Bridge arch closure 	<ul style="list-style-type: none"> Multiple Major Injuries Minor Damage - Barge Minor Damage - Tug Moderate Damage - Passenger Vessel Moderate Damage - High Speed Craft Moderate Damage - Private Leisure Vessel Moderate Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Minor Pollution 	<ul style="list-style-type: none"> Permanent / Temporary Notice to Mariners VTS Navigational Broadcast VHF Communications Aids to Navigation Bridge Special Signal Lights VTS Qualification Other arch (2 or 3) would likely remain open) 	<ul style="list-style-type: none"> Scheduling of arch closures in order to facilitate minimum disruption to river users Arch No 4 available for navigation of outbound larger and reporting vessels (in the event of an emergency). A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect

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

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

Relevant PLA Guidance
<ul style="list-style-type: none"> 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

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

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
2	3	6	Moderate

Assessment Notes
<ul style="list-style-type: none"> It is proposed that Arch No 1 is closed to all navigation for the duration of Phase 1. This hazard is covered in more detail within the main Victoria Embankment Foreshore - Maritime Issues and Navigational Risk Assessment Report

4A - LTTVE - Increased Flow

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
4A - LTTVE	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Hungerford Bridge.	<ul style="list-style-type: none"> Shape and position of temporary cofferdam 	<ul style="list-style-type: none"> Multiple Major Injuries Minor Damage - Barge Minor Damage - Tug Moderate Damage - Passenger Vessel Moderate Damage - High Speed Craft Moderate Damage - Private Leisure Vessel Moderate Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Minor Pollution 	<ul style="list-style-type: none"> None identified for this hazard 	<ul style="list-style-type: none"> 3D and computational modelling A Notice to Mariners to advise of any increases in river flow: A Notice to Mariners to advise of any increases in river flow: NTM to advise that for example: In Arch No3 the maximum flow may increase by up to 1/2 knot during temporary works with the flow moving towards the south side of the bridge arch.

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
2	3	6	Moderate

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

Relevant PLA Guidance
<ul style="list-style-type: none"> 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

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
2	3	6	Moderate

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

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>

5A - LTTVE - Contact - High Speed Passenger Vessel with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
5A - LTTVE	Contact - High Speed passenger vessel with work site	A High Speed passenger vessel comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures 	<ul style="list-style-type: none"> • Closure of Arch No 1 to all traffic • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

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

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"> • 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 • Code of Practice Passenger Vessel Operations on the 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	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 & 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							

6A - LTTVE - Contact - Class V Passenger Vessel with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
6A - LTTVE	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures 	<ul style="list-style-type: none"> • Closure of Arch No 1 to all traffic • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

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

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"> •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 •Code of Practice Passenger Vessel Operations on the 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	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

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

7A - LTTVE - Contact - Private Leisure Vessel with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
7A - LTTVE	Contact - Private leisure vessel with work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Moderate Damage - Private Leisure Vessel • Capsized Private Leisure Vessel • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Aids to Navigation • VHF Communications • COLREGs • General Directions • Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast 	<ul style="list-style-type: none"> • Closure of Arch No 1 to all traffic • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area • Information provided to local recreational clubs and marinas providing an overview of the works being conducted and expected duration

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

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

8A - LTTVE - Contact - Commercial freight with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
8A - LTTVE	Contact - commercial freight with work site	Commercial freight comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Major Injury • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures 	<ul style="list-style-type: none"> • Closure of Arch No 1 to all traffic • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

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
3	3	9	Moderate

Relevant PLA Guidance
<ul style="list-style-type: none"> •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	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 & 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 - LTTVE - Contact - Tug and Tow with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
9A - LTTVE	Contact - Tug and Tow with work site	A Tug and Tow comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Major Injury • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures 	<ul style="list-style-type: none"> • Closure of Arch No 1 to all traffic • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

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
3	3	9	Moderate

Relevant PLA Guidance
<ul style="list-style-type: none"> •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	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 & 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							

10A - LTTVE - 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
10A - LTTVE	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"> • Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Major Injury • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Moderate Damage - Passenger Vessel • Moderate Damage - Private Leisure Vessel • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • MCA Guidance document 	

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

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

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

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

Relevant PLA Guidance
<ul style="list-style-type: none"> •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	2	6	Moderate

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

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 & 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 - LTTVE - Mooring breakout

Hazard ID	Hazard Title	Hazard Description	Likely Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
11A - LTTVE	Mooring breakout	A vessel involved in Thames Tunnel activities breaks free temporary/layup moorings.	<ul style="list-style-type: none"> Misjudgement Inattention Adverse weather conditions Machinery breakdown Collision avoidance 	<ul style="list-style-type: none"> Single Major Injury Moderate Damage - House Boat Moderate Structural Damage - Marina Minor Damage - Barge Minor Damage - Jetty (Thames Water) Minor Structural Damage - Bridge Minor Structural Damage - Jetty (Other) Minor Pollution 	<ul style="list-style-type: none"> Tug Operator Procedures Emergency Plans & Procedures Mooring Inspections Inspection Routine Qualified Crew 	<ul style="list-style-type: none"> Use of reputable marine contractors

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
2	3	6	Moderate

Relevant PLA Guidance
<ul style="list-style-type: none"> Code of Practice for the Safe Mooring of Vessels on the Thames 2010

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
2	2	4	Minor

Assessment Notes

12A - LTTVE - Collision with High Speed Passenger Vessel (construction/deconstruction)

<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>
12A - LTTVE	Collision with High Speed Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Minor Damage - Barge • Minor Damage - High Speed Craft • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • General Directions • Tug Operator Procedures • Passage Planning • VTS Navigational Broadcast • Qualified Crew • Vessel Master Experience • Thames AIS • HSC Code • VHF Communications • COLREGs 	<ul style="list-style-type: none"> • Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Use of reputable and experienced marine contractor • Berth Co-ordinator • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • Berth Co-ordinator to monitor VHF • CCTV to provide additional information to Berth Co-ordinator

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"> • 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

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 & 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: 33%;">Working at height</td> <td style="width: 33%;">Loading / Unloading operations</td> <td style="width: 33%;">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								

13A - LTTVE- Collision with Class V Passenger Vessel (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
13A - LTTVE	Collision with Class V Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> Reduced effective river width Misjudgement Inattention Improper lookout Lack of communications Adverse weather conditions Machinery breakdown High density of leisure traffic Inadequate training and experience Tidal set Collision avoidance Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> Multiple Major Injuries Minor Damage - Barge Moderate Damage - Passenger Vessel Minor Damage - Tug Bridge Arch Closure - Temporary Minor Pollution 	<ul style="list-style-type: none"> Boat Masters Licence Qualified Crew BML Local Knowledge Endorsement Thames AIS Passage Planning VHF Communications Tug Operator Procedures General Directions Vessel Master Experience VTS Navigational Broadcast COLREGs Emergency Plans & Procedures 	<ul style="list-style-type: none"> Light Warnings - providing visual warning that barge is about to depart berth Sound Warnings - providing audio warning that barge is about to depart berth Sub-Contractors Risk Assessment Closure of Arch No 1 to all traffic Use of reputable and experienced marine contractor Berth Co-ordinator Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity Berth Co-ordinator to monitor VHF CCTV to provide additional information to Berth Co-ordinator

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

14A - LTTVE - Collision with Private Leisure Vessel (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
14A LTTVE	Collision with Private Leisure Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a private leisure vessel in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge 	<ul style="list-style-type: none"> • Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Private Leisure Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Vessel Master Experience • Qualified Crew • VHF Communications • VTS Navigational Broadcast • Ship Towing Code of Practice • Tug Operator Procedures • COLREGs • General Directions • Admiralty Charts • Perm / Temp Notice to Mariners • Emergency Plans & Procedures • Aids to Navigation 	<ul style="list-style-type: none"> • Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Berth Co-ordinator • Berth Co-ordinator to monitor VHF • CCTV to provide additional information to Berth Coordinator

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"> • 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
3	3	9	Moderate

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							

15A - LTTVE - Collision with Commercial Freight Operator (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
15A - LTTVE	Collision with commercial freight operator (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a commercial freight operator in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> Reduced effective river width Misjudgement Inattention Non Compliance with procedures Improper lookout Lack of communications Machinery breakdown Collision avoidance High density of leisure traffic Leisure traffic impedes the passage of vessel navigating the channel Change in river flow due to new in-river structure Tidal set 	<ul style="list-style-type: none"> Single Major Injury Minor Damage - Barge Moderate Damage - Tug Bridge Arch Closure - Temporary Minor Pollution 	<ul style="list-style-type: none"> Boat Masters Licence Qualified Crew Bridge Special Signal Lights Emergency Plans & Procedures VTS Navigational Broadcast Thames AIS Passage Planning Ship Towing Code of Practice BML Local Knowledge Endorsement Tug Operator Procedures Perm / Temp Notice to Mariners COLREGS General Directions 	<ul style="list-style-type: none"> Light Warnings - providing visual warning that barge is about to depart berth Sound Warnings - providing audio warning that barge is about to depart berth Use of reputable and experienced marine contractor Sub-Contractors Risk Assessment Berth Co-ordinator Berth Co-ordinator to monitor VHF Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity CCTV to provide additional information to Berth Co-ordinator Closure of Arch No 1 to certain vessels types / operators

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

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"> 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
2	3	6	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									
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Working at height	Loading / Unloading operations	Welfare Amenities							
Lifting operations	Movement of materials	Fire safety							
Slips and trips	Mooring								

16A - LTTVE - Collision with Tug and Tow (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
16A - LTTVE	Collision with tug and tow (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a tug and tow in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • Qualified Crew • Bridge Special Signal Lights • Emergency Plans & Procedures • VTS Navigational Broadcast • Thames AIS • Passage Planning • Ship Towage Code of Practice • BML Local Knowledge Endorsement • Perm / Temp Notice to Mariners • Tug Operator Procedures • General Directions • COLREGS 	<ul style="list-style-type: none"> • Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Berth Co-ordinator • Berth Co-ordinator to monitor VHF • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • CCTV to provide additional information to Berth Co-ordinator • Closure of Arch No 1 to certain vessels types / operators

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

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"> • 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
2	3	6	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 & 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 - LTTVE - Contact with Hungerford Bridge (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
17A - LTTVE	Contact with Hungerford Bridge (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Major Injury • Minor Structural Damage - Bridge • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • General Directions • PLA Bridge Guide • Passage Planning • Accurate Tidal Information • Qualified Crew • Vessel Master Experience • Tug Operator Procedures • COLREGs • Ship Towage Code of Practice • Emergency Plans & Procedures 	<ul style="list-style-type: none"> • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment

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

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

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"> • General Directions for Navigation in the Port of London • Schedule to the General Directions for Navigation in the Port of London • Ship Towage Operations on the Thames • Code of Practice for the Safe Mooring of Vessels on the Thames • Code of Practice for Craft Towage Operations on the Thames • 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
2	3	6	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 & 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 - LTTVE - Collision with High Speed Passenger Vessel (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
18A - LTTVE	Collision with High Speed Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Minor Damage - Barge • Minor Damage - High Speed Craft • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	Not relevant for this phase of the project	Not relevant for this phase of the project

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

- 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

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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

19A - LTTVE- Collision with Class V Passenger Vessel (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
19A - LTTVE	Collision with Class V Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Passenger Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	Not relevant for this phase of the project	Not relevant for this phase of the project

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

- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

20A - LTTVE - Collision with Private Leisure Vessel (delivery/material removal)

<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>
20A LTTVE	Collision with Private Leisure Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a private leisure vessel in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge 	<ul style="list-style-type: none"> • Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Private Leisure Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	Not relevant for this phase of the project	Not relevant for this phase of the project

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

- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

21A - LTTVE - Collision with Commercial Freight Operator (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
21A - LTTVE	Collision with commercial freight operator (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a commercial freight operator in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

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

- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

22A - LTTVE - Collision with Tug and Tow (delivery/material removal)

<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>
22A - LTTVE	Collision with tug and tow (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a tug and tow in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

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

- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

23A - LTTVE - Contact with Hungerford Bridge (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
23A - LTTVE	Contact with Hungerford Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Major Injury • Minor Structural Damage - Bridge • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

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

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Ship Towage Operations on the Thames
- Code of Practice for the Safe Mooring of Vessels on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

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	Emergency Arch closure - Arch No 2 or 3	There may be an emergency requirement to close No 2 or 3 Arch.	8	4	6	6
2B	Planned arch closure - Arch No 2 or 3	There may be a requirement to close No 2 or 3 Arch for maintenance.	8	4	6	6
3B	Planned Arch closure - Arch No 1	During construction/use/Deconstruction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	12	6	12	6
4B	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Hungerford Bridge.	9	6	6	9
5B	Contact - High Speed Passenger Vessel with work site	A High Speed Passenger Vessel comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	8	4	6	8
6B	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	8	4	6	8
7B	Contact - private leisure vessel with work site	A private leisure vessel comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	8	4	6	8
8B	Contact - commercial freight operator with work site	A commercial freight operator comes into contact with Tunnel temporary or permanent work site at Victoria Embankment.	6	4	6	6
9B	Contact - tug and tow with work site	A tug and tow comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	6	4	6	6

10B	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
11B	Mooring Breakout	A vessel involved in Thames Tunnel activities breaks free from moorings	6	4	6	4
12B	Collision - High Speed Passenger Vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment	N/A	N/A	N/A	N/A
13B	Collision - Class V passenger vessel (construction/deconstruction)	A vessel conducting Tunnel construction/deconstruction activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
14B	Collision - private leisure vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a private leisure vessel in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
15B	Collision - commercial freight operator (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a commercial freight operator in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
16B	Collision - tug and tow (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a tug and tow in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A

17B	Contact with Hungerford Bridge (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure.	N/A	N/A	N/A	N/A
18B	Collision - High Speed Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment	6	4	6	8
19B	Collision - Class V passenger vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment.	6	4	6	8
20B	Collision - private leisure vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a private leisure vessel in the vicinity of Victoria Embankment.	9	6	9	9

21B	Collision - commercial freight operator (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a commercial freight operator in the vicinity of Victoria Embankment.	6	9	6	9
22B	Collision - tug and tow (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a tug and tow in the vicinity of Victoria Embankment.	6	9	6	9
23B	Contact with Hungerford Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure.	6	3	6	6

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

1B - LTTVE - Emergency Arch Closure - Arch No 2 or 3

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
1B - LTTVE	Emergency Arch Closure - Arch No 2 or 3	During Thames tunnel works there may be an emergency requirement to close No 2 or 3 arch.	<ul style="list-style-type: none"> Emergency Bridge Arch Closure River Incident 	<ul style="list-style-type: none"> Multiple Major Injuries Minor Damage - Barge Minor Damage - Tug Moderate Damage - Passenger Vessel Moderate Damage - High Speed Craft Moderate Damage - Private Leisure Vessel Moderate Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Minor Pollution 	<ul style="list-style-type: none"> VTS Navigational Broadcast VHF Communications Aids to Navigation Thames AIS COLREGs Other arch (2 or 3) would likely remain open) 	

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

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
3	3	9	Moderate

Relevant PLA Guidance
<ul style="list-style-type: none"> 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

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
3	2	6	Moderate

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

Assessment Notes
<ul style="list-style-type: none"> This hazard is covered in more detail within the main Victoria Embankment Foreshore - Maritime Issues and Navigational Risk Assessment Report. The location of the temporary and permanent works structures pose no additional navigational impact to that of the Tattershall Castle and Hispaniola and it is therefore assessed that the Thames Tunnel works do not add any additional navigational risk when there is a requirement to close arches 2 or 3.

2B - LTTVE - Planned Arch Closure - Arch No 2 or 3

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
2B - LTTVE	Planned Arch Closure - Arch No 2 or 3	During construction of the temporary cofferdam there may be a scheduled requirement to close No 2 or 3 arch.	<ul style="list-style-type: none"> Planned Bridge arch closure Maintenance and Inspection routines 	<ul style="list-style-type: none"> Multiple Major Injuries Minor Damage - Barge Minor Damage - Tug Moderate Damage - Passenger Vessel Moderate Damage - High Speed Craft Moderate Damage - Private Leisure Vessel Moderate Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Minor Pollution 	<ul style="list-style-type: none"> Permanent / Temporary Notice to Mariners VTS Navigational Broadcast VHF Communications Aids to Navigation Bridge Special Signal Lights VTS Qualification Other arch (2 or 3) would likely remain open) 	<ul style="list-style-type: none"> Scheduling of arch closures in order to facilitate minimum disruption to river users

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

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
3	3	9	Moderate

Relevant PLA Guidance
<ul style="list-style-type: none"> 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

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
3	2	6	Moderate

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

Assessment Notes
<ul style="list-style-type: none"> This hazard is covered in more detail within the main Victoria Embankment Foreshore - Maritime Issues and Navigational Risk Assessment Report. The location of the temporary and permanent works structures pose no additional navigational impact to that of the Tattershall Castle and Hispaniola and it is therefore assessed that the Thames Tunnel works do not add any additional navigational risk when there is a requirement to close arches 2 or 3.

3B - LTTVE - Planned Arch Closure - Arch No 1

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
3B - LTTVE	Planned Arch Closure - Arch No 1	During construction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	<ul style="list-style-type: none"> Planned Bridge arch closure 	<ul style="list-style-type: none"> Multiple Major Injuries Minor Damage - Barge Minor Damage - Tug Moderate Damage - Passenger Vessel Moderate Damage - High Speed Craft Moderate Damage - Private Leisure Vessel Moderate Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Minor Pollution 	<ul style="list-style-type: none"> Permanent / Temporary Notice to Mariners VTS Navigational Broadcast VHF Communications Aids to Navigation Bridge Special Signal Lights VTS Qualification 	<ul style="list-style-type: none"> Scheduling of arch closures in order to facilitate minimum disruption to river users Arch No 4 available for navigation of outbound larger and reporting vessels (in the event of an emergency). A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect

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

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

Relevant PLA Guidance
<ul style="list-style-type: none"> 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

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

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
2	3	6	Moderate

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

4B - LTTVE - Increased Flow

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
4B - LTTVE	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Hungerford Bridge.	<ul style="list-style-type: none"> Shape and position of temporary cofferdam 	<ul style="list-style-type: none"> Multiple Major Injuries Minor Damage - Barge Minor Damage - Tug Moderate Damage - Passenger Vessel Moderate Damage - High Speed Craft Moderate Damage - Private Leisure Vessel Moderate Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Minor Pollution 	<ul style="list-style-type: none"> None identified for this hazard 	<ul style="list-style-type: none"> A Notice to Mariners to advise of any increases in river flow: NTM to advise that for example: In Arch No3 the maximum flow may increase by up to 1/2 knot during temporary works with the flow moving towards the south side of the bridge arch.

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
2	3	6	Moderate

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

Relevant PLA Guidance
<ul style="list-style-type: none"> 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

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
2	3	6	Moderate

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

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>

5B - LTTVE - Contact - High Speed Passenger Vessel with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
5B - LTTVE	Contact - High Speed passenger vessel with work site	A High Speed passenger vessel comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures 	<ul style="list-style-type: none"> • Closure of Arch No 1 to certain vessels types / operators • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

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

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"> • 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 • Code of Practice Passenger Vessel Operations on the 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	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 & 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							

6B - LTTVE - Contact - Class V Passenger Vessel with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
6B - LTTVE	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures 	<ul style="list-style-type: none"> • Closure of Arch No 1 to certain vessels types / operators • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

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

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"> •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 •Code of Practice Passenger Vessel Operations on the 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	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								
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Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

7B - LTTVE - Contact - Private Leisure Vessel with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
7B - LTTVE	Contact - Private leisure vessel with work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Moderate Damage - Private Leisure Vessel • Capsized Private Leisure Vessel • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Aids to Navigation • VHF Communications • COLREGs • General Directions • Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast 	<ul style="list-style-type: none"> • Closure of Arch No 1 to certain vessels types / operators • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area • Information provided to local recreational clubs and marinas providing an overview of the works being conducted and expected duration

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

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

8B - LTTVE - Contact - Commercial freight with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
8B - LTTVE	Contact - commercial freight with work site	Commercial freight comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Major Injury • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures 	<ul style="list-style-type: none"> • Closure of Arch No 1 to certain vessels types / operators • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

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
3	3	9	Moderate

Relevant PLA Guidance
<ul style="list-style-type: none"> • 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	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 & 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							

9B - LTTVE - Contact - Tug and Tow with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
9B - LTTVE	Contact - Tug and Tow with work site	A Tug and Tow comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Major Injury • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures 	<ul style="list-style-type: none"> • Closure of Arch No 1 to certain vessels types / operators • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

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
3	3	9	Moderate

Relevant PLA Guidance
<ul style="list-style-type: none"> • 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	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								
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Working at height	Loading / Unloading operations							
Lifting operations	Movement of materials							
Slips and trips	Mooring							
Fire safety	Welfare Amenities							

10B - LTTVE - 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
10B - LTTVE	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"> • Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Major Injury • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Moderate Damage - Passenger Vessel • Moderate Damage - Private Leisure Vessel • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • MCA Guidance document 	

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

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

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

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

Relevant PLA Guidance
<ul style="list-style-type: none"> •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	2	6	Moderate

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

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

11B - LTTVE - Mooring breakout

Hazard ID	Hazard Title	Hazard Description	Likely Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
11B - LTTVE	Mooring breakout	A vessel involved in Thames Tunnel activities breaks free temporary/layup moorings.	<ul style="list-style-type: none"> Misjudgement Inattention Adverse weather conditions Machinery breakdown Collision avoidance 	<ul style="list-style-type: none"> Single Major Injury Moderate Damage - House Boat Moderate Structural Damage - Marina Minor Damage - Barge Minor Damage - Jetty (Thames Water) Minor Structural Damage - Bridge Minor Structural Damage - Jetty (Other) Minor Pollution 	<ul style="list-style-type: none"> Tug Operator Procedures Emergency Plans & Procedures Mooring Inspections Inspection Routine Qualified Crew 	<ul style="list-style-type: none"> Use of reputable marine contractors

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
2	3	6	Moderate

Relevant PLA Guidance
<ul style="list-style-type: none"> Code of Practice for the Safe Mooring of Vessels on the Thames 2010

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
2	2	4	Minor

Assessment Notes

12B - LTTVE - Collision with High Speed Passenger Vessel (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
12B - LTTVE	Collision with High Speed Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Minor Damage - Barge • Minor Damage - High Speed Craft • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

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

- 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

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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

13B - LTTVE- Collision with Class V Passenger Vessel (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
13B - LTTVE	Collision with Class V Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Passenger Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

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

- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

14B - LTTVE - Collision with Private Leisure Vessel (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
14B - LTTVE	Collision with Private Leisure Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a private leisure vessel in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge 	<ul style="list-style-type: none"> • Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Private Leisure Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

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

- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

15B - LTTVE - Collision with Commercial Freight Operator (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
15B - LTTVE	Collision with commercial freight operator (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a commercial freight operator in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

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

- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

16B - LTTVE - Collision with Tug and Tow (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
16B - LTTVE	Collision with tug and tow (construction/Deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a tug and tow in the vicinity of Victoria Embankment, during the construction/deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

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

- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

17B - LTTVE - Contact with Hungerford Bridge (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
17B - LTTVE	Contact with Hungerford Bridge (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Major Injury • Minor Structural Damage - Bridge • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

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

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Ship Towage Operations on the Thames
- Code of Practice for the Safe Mooring of Vessels on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

18B - LTTVE - Collision with High Speed Passenger Vessel (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
18B - LTTVE	Collision with High Speed Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Minor Damage - Barge • Minor Damage - High Speed Craft • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • General Directions • Tug Operator Procedures • Passage Planning • VTS Navigational Broadcast • Qualified Crew • Vessel Master Experience • Thames AIS • HSC Code • VHF Communications • COLREGs 	<ul style="list-style-type: none"> • Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Use of reputable and experienced marine contractor • Berth Master • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • Berth Master to monitor VHF • CCTV to provide additional information to Berth Master

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"> • 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

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 & 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								

19B - LTTVE- Collision with Class V Passenger Vessel (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
19B - LTTVE	Collision with Class V Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> Reduced effective river width Misjudgement Inattention Improper lookout Lack of communications Adverse weather conditions Machinery breakdown High density of leisure traffic Inadequate training and experience Tidal set Collision avoidance Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> Multiple Major Injuries Minor Damage - Barge Moderate Damage - Passenger Vessel Minor Damage - Tug Bridge Arch Closure - Temporary Minor Pollution 	<ul style="list-style-type: none"> Boat Masters Licence Qualified Crew BML Local Knowledge Endorsement Thames AIS Passage Planning VHF Communications Tug Operator Procedures General Directions Vessel Master Experience VTS Navigational Broadcast COLREGs Emergency Plans & Procedures 	<ul style="list-style-type: none"> Light Warnings - providing visual warning that barge is about to depart berth Sound Warnings - providing audio warning that barge is about to depart berth Use of reputable and experienced marine contractor Sub-Contractors Risk Assessment Closure of Arch No 1 to all traffic Berth Master Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity Berth Master to monitor VHF CCTV to provide additional information to Berth Master

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"> 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
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 & 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								

20B - LTTVE - Collision with Private Leisure Vessel (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
20B - LTTVE	Collision with Private Leisure Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a private leisure vessel in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge 	<ul style="list-style-type: none"> • Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Private Leisure Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Vessel Master Experience • Qualified Crew • VHF Communications • VTS Navigational Broadcast • Ship Towing Code of Practice • Tug Operator Procedures • COLREGs • General Directions • Admiralty Charts • Perm / Temp Notice to Mariners • Emergency Plans & Procedures • Aids to Navigation 	<ul style="list-style-type: none"> • Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Berth Master • Berth Master to monitor VHF • CCTV to provide additional information to Berth Master

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

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

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

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

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

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

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

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

Relevant PLA Guidance
<ul style="list-style-type: none"> • 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

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 & 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							

21B - LTTVE - Collision with Commercial Freight Operator (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
21B - LTTVE	Collision with commercial freight operator (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a commercial freight operator in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • Qualified Crew • Bridge Special Signal Lights • Emergency Plans & Procedures • VTS Navigational Broadcast • Thames AIS • Passage Planning • Ship Towage Code of Practice • BML Local Knowledge Endorsement • Tug Operator Procedures • Perm / Temp Notice to Mariners • COLREGS • General Directions 	<ul style="list-style-type: none"> • Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Berth Master • Berth Master to monitor VHF • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • CCTV to provide additional information to Berth Master • Closure of Arch No 1 to all traffic

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

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"> • 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
2	3	6	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 & 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: 33%;">Working at height</td> <td style="width: 33%;">Loading / Unloading operations</td> <td style="width: 33%;">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								

22B - LTTVE - Collision with Tug and Tow (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
22B - LTTVE	Collision with tug and tow (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a tug and tow in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • Qualified Crew • Bridge Special Signal Lights • Emergency Plans & Procedures • VTS Navigational Broadcast • Thames AIS • Passage Planning • Ship Towage Code of Practice • BML Local Knowledge Endorsement • Perm / Temp Notice to Mariners • Tug Operator Procedures • General Directions • COLREGS 	<ul style="list-style-type: none"> • Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Berth Master • Berth Master to monitor VHF • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • CCTV to provide additional information to Berth Master • Closure of Arch No 1 to all traffic

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

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"> • 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
2	3	6	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 & 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							

23B - LTTVE - Contact with Hungerford Bridge (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
23B - LTTVE	Contact with Hungerford Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Major Injury • Minor Structural Damage - Bridge • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • General Directions • PLA Bridge Guide • Passage Planning • Accurate Tidal Information • Qualified Crew • Vessel Master Experience • Tug Operator Procedures • COLREGs • Ship Towage Code of Practice • Emergency Plans & Procedures 	<ul style="list-style-type: none"> • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment

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"> •General Directions for Navigation in the Port of London •Schedule to the General Directions for Navigation in the Port of London •Ship Towage Operations on the Thames •Code of Practice for the Safe Mooring of Vessels on the Thames •Code of Practice for Craft Towage Operations on the Thames •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
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 & 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							

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

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

Hazard Id	Hazard Title	Hazard Description	People	Environment	Operational	Media
1C	Emergency Arch closure - Arch No 2 or 3	There may be an emergency requirement to close No 2 or 3 arch.	8	4	6	6
2C	Planned arch closure - Arch No 2 or 3	There may be a requirement to close No 2 or 3 arch for maintenance.	8	4	6	6
3C	Planned Arch closure - Arch No 1	During construction/use/Deconstruction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	12	6	12	6
4C	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Hungerford Bridge.	9	6	6	9
5C	Contact - High Speed Passenger Vessel with work site	A High Speed Passenger Vessel comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	8	4	6	8
6C	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	8	4	6	8
7C	Contact - private leisure vessel with work site	A private leisure vessel comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	8	4	6	8
8C	Contact - commercial freight operator with work site	A commercial freight operator comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	6	4	6	6

9C	Contact - tug and tow with work site	A tug and tow comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	6	4	6	6
10C	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
11C	Mooring Breakout	A vessel involved in Thames Tunnel activities breaks free from moorings	6	4	6	4
12C	Collision - High Speed Passenger Vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment	6	4	6	8
13C	Collision - Class V passenger vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment.	6	4	6	8
14C	Collision - private leisure vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a private leisure vessel in the vicinity of Victoria Embankment.	9	6	9	9
15C	Collision - commercial freight operator (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a commercial freight operator in the vicinity of Victoria Embankment.	6	9	6	9

16C	Collision - tug and tow (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a tug and tow in the vicinity of Victoria Embankment.	6	9	6	9
17C	Contact with Hungerford Bridge (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure.	6	3	6	6
18C	Collision - High Speed Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment	N/A	N/A	N/A	N/A
19C	Collision - Class V passenger vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A

20C	Collision - private leisure vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a private leisure vessel in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
21C	Collision - commercial freight operator (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a commercial freight operator in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
22C	Collision - tug and tow (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a tug and tow in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
23C	Contact with Hungerford Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure.	N/A	N/A	N/A	N/A

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

1C - LTTVE - Emergency Arch Closure - Arch No 2 or 3

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
1C - LTTVE	Emergency Arch Closure - Arch No 2 or 3	During Thames tunnel works there may be an emergency requirement to close No 2 or 3 arch.	<ul style="list-style-type: none"> Emergency Bridge Arch Closure River Incident 	<ul style="list-style-type: none"> Multiple Major Injuries Minor Damage - Barge Minor Damage - Tug Moderate Damage - Passenger Vessel Moderate Damage - High Speed Craft Moderate Damage - Private Leisure Vessel Moderate Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Minor Pollution 	<ul style="list-style-type: none"> VTS Navigational Broadcast VHF Communications Aids to Navigation Thames AIS COLREGs Other arch (2 or 3) would likely remain open) 	

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

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
3	3	9	Moderate

Relevant PLA Guidance
<ul style="list-style-type: none"> 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

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
3	2	6	Moderate

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

Assessment Notes
<ul style="list-style-type: none"> This hazard is covered in more detail within the main Victoria Embankment Foreshore - Maritime Issues and Navigational Risk Assessment Report. The location of the temporary and permanent works structures pose no additional navigational impact to that of the Tattershall Castle and Hispaniola and it is therefore assessed that the Thames Tunnel works do not add any additional navigational risk when there is a requirement to close arches 2 or 3.

2C - LTTVE - Planned Arch Closure - Arch No 2 or 3

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
2C - LTTVE	Planned Arch Closure - Arch No 2 or 3	During removal of the temporary cofferdam there may be a scheduled requirement to close No 2 or 3 arch.	<ul style="list-style-type: none"> Planned Bridge arch closure Maintenance and Inspection routines 	<ul style="list-style-type: none"> Multiple Major Injuries Minor Damage - Barge Minor Damage - Tug Moderate Damage - Passenger Vessel Moderate Damage - High Speed Craft Moderate Damage - Private Leisure Vessel Moderate Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Minor Pollution 	<ul style="list-style-type: none"> Permanent / Temporary Notice to Mariners VTS Navigational Broadcast VHF Communications Aids to Navigation Bridge Special Signal Lights VTS Qualification Other arch (2 or 3) would likely remain open) 	<ul style="list-style-type: none"> Scheduling of arch closures in order to facilitate minimum disruption to river users Arch No 4 available for navigation of outbound larger and reporting vessels (in the event of an emergency). A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect

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

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
3	3	9	Moderate

Relevant PLA Guidance
<ul style="list-style-type: none"> 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

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
3	2	6	Moderate

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

Assessment Notes
<ul style="list-style-type: none"> This hazard is covered in more detail within the main Victoria Embankment Foreshore - Maritime Issues and Navigational Risk Assessment Report. The location of the temporary and permanent works structures pose no additional navigational impact to that of the Tattershall Castle and Hispaniola and it is therefore assessed that the Thames Tunnel works do not add any additional navigational risk when there is a requirement to close arches 2 or 3.

3C - LTTVE - Planned Arch Closure - Arch No 1

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
3C - LTTVE	Planned Arch Closure - Arch No 1	During construction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	<ul style="list-style-type: none"> Planned Bridge arch closure 	<ul style="list-style-type: none"> Multiple Major Injuries Minor Damage - Barge Minor Damage - Tug Moderate Damage - Passenger Vessel Moderate Damage - High Speed Craft Moderate Damage - Private Leisure Vessel Moderate Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Minor Pollution 	<ul style="list-style-type: none"> Permanent / Temporary Notice to Mariners VTS Navigational Broadcast VHF Communications Aids to Navigation Bridge Special Signal Lights VTS Qualification 	<ul style="list-style-type: none"> Scheduling of arch closures in order to facilitate minimum disruption to river users Arch No 4 available for navigation of outbound larger and reporting vessels (in the event of an emergency). A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect

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

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

Relevant PLA Guidance
<ul style="list-style-type: none"> 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

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

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
2	3	6	Moderate

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

4C - LTTVE - Increased Flow

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
4C - LTTVE	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Hungerford Bridge.	<ul style="list-style-type: none"> • Shape and position of temporary cofferdam 	<ul style="list-style-type: none"> • Multiple Major Injuries • Minor Damage - Barge • Minor Damage - Tug • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Moderate Damage - Private Leisure Vessel • Moderate Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • None identified for this hazard 	<ul style="list-style-type: none"> • A Notice to Mariners to advise of any increases in river flow: NTM to advise that for example: In Arch No3 the maximum flow may increase by up to 1/2 knot during temporary works with the flow moving towards the south side of the bridge arch.

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
2	3	6	Moderate

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

Relevant PLA Guidance
<ul style="list-style-type: none"> • 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

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
2	3	6	Moderate

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

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>

5C - LTTVE - Contact - High Speed Passenger Vessel with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
5C - LTTVE	Contact - High Speed passenger vessel with work site	A High Speed passenger vessel comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures 	<ul style="list-style-type: none"> • Closure of Arch No 1 to all traffic • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

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

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"> •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 •Code of Practice Passenger Vessel Operations on the 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	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 & 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							

6C - LTTVE - Contact - Class V Passenger Vessel with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
6C - LTTVE	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures 	<ul style="list-style-type: none"> • Closure of Arch No 1 to all traffic • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

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

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"> • 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 • Code of Practice Passenger Vessel Operations on the 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	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 & 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 - LTTVE - Contact - Private Leisure Vessel with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
7C - LTTVE	Contact - Private leisure vessel with work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Moderate Damage - Private Leisure Vessel • Capsized Private Leisure Vessel • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Aids to Navigation • VHF Communications • COLREGs • General Directions • Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast 	<ul style="list-style-type: none"> • Closure of Arch No 1 to all traffic • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area • Information provided to local recreational clubs and marinas providing an overview of the works being conducted and expected duration

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

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"> •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	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 & 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 - LTTVE - Contact - Commercial freight with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
8C - LTTVE	Contact - commercial freight with work site	Commercial freight comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Major Injury • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towing Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures 	<ul style="list-style-type: none"> • Closure of Arch No 1 to all traffic • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

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
3	3	9	Moderate

Relevant PLA Guidance
<ul style="list-style-type: none"> • 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								
<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 & 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 - LTTVE - Contact - Tug and Tow with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
9C - LTTVE	Contact - Tug and Tow with work site	A Tug and Tow comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Major Injury • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures 	<ul style="list-style-type: none"> • Closure of Arch No 1 to all traffic • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

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
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
- 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	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 |

10C - LTTVE - 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
10C - LTTVE	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"> • Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Major Injury • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Moderate Damage - Passenger Vessel • Moderate Damage - Private Leisure Vessel • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • MCA Guidance document 	

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

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

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

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

Relevant PLA Guidance
<ul style="list-style-type: none"> •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	2	6	Moderate

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

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 & 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 - LTTVE - Mooring breakout

Hazard ID	Hazard Title	Hazard Description	Likely Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
11C - LTTVE	Mooring breakout	A vessel involved in Thames Tunnel activities breaks free temporary/layup moorings.	<ul style="list-style-type: none"> Misjudgement Inattention Adverse weather conditions Machinery breakdown Collision avoidance 	<ul style="list-style-type: none"> Single Major Injury Moderate Damage - House Boat Moderate Structural Damage - Marina Minor Damage - Barge Minor Damage - Jetty (Thames Water) Minor Structural Damage - Bridge Minor Structural Damage - Jetty (Other) Minor Pollution 	<ul style="list-style-type: none"> Tug Operator Procedures Emergency Plans & Procedures Mooring Inspections Inspection Routine Qualified Crew 	<ul style="list-style-type: none"> Use of reputable marine contractors

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
2	3	6	Moderate

Relevant PLA Guidance

- Code of Practice for the Safe Mooring of Vessels on the Thames 2010

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
2	2	4	Minor

Assessment Notes

12C - LTTVE - Collision with High Speed Passenger Vessel (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
12C - LTTVE	Collision with High Speed Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Minor Damage - Barge • Minor Damage - High Speed Craft • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • General Directions • Tug Operator Procedures • Passage Planning • VTS Navigational Broadcast • Qualified Crew • Vessel Master Experience • Thames AIS • HSC Code • VHF Communications • COLREGs 	<ul style="list-style-type: none"> • Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Use of reputable and experienced marine contractor • Berth Co-ordinator • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • Berth Co-ordinator to monitor VHF • CCTV to provide additional information to Berth Co-ordinator

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

- 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	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

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	

13C - LTTVE- Collision with Class V Passenger Vessel (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
13C - LTTVE	Collision with Class V Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Passenger Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • Qualified Crew • BML Local Knowledge Endorsement • Thames AIS • Passage Planning • VHF Communications • Tug Operator Procedures • General Directions • Vessel Master Experience • VTS Navigational Broadcast • COLREGs • Emergency Plans & Procedures 	<ul style="list-style-type: none"> • Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Use of reputable and experienced marine contractor • Berth Co-ordinator • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • Berth Co-ordinator to monitor VHF • CCTV to provide additional information to Berth Co-ordinator

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"> • 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
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 & 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								

14C - LTTVE - Collision with Private Leisure Vessel (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
14C - LTTVE	Collision with Private Leisure Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a private leisure vessel in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge 	<ul style="list-style-type: none"> • Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Private Leisure Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Vessel Master Experience • Qualified Crew • VHF Communications • VTS Navigational Broadcast • Ship Towage Code of Practice • Tug Operator Procedures • COLREGs • General Directions • Admiralty Charts • Perm / Temp Notice to Mariners • Emergency Plans & Procedures • Aids to Navigation 	<ul style="list-style-type: none"> • Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Berth Co-ordinator • Berth Co-ordinator to monitor VHF • CCTV to provide additional information to Berth Coordinator

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"> • 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
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 & 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							

15C - LTTVE - Collision with Commercial Freight Operator (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
15C - LTTVE	Collision with commercial freight operator (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a commercial freight operator in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> Reduced effective river width Misjudgement Inattention Non Compliance with procedures Improper lookout Lack of communications Machinery breakdown Collision avoidance High density of leisure traffic Leisure traffic impedes the passage of vessel navigating the channel Change in river flow due to new in-river structure Tidal set 	<ul style="list-style-type: none"> Single Major Injury Minor Damage - Barge Moderate Damage - Tug Bridge Arch Closure - Temporary Minor Pollution 	<ul style="list-style-type: none"> Boat Masters Licence Qualified Crew Bridge Special Signal Lights Emergency Plans & Procedures VTS Navigational Broadcast Thames AIS Passage Planning Ship Towing Code of Practice BML Local Knowledge Endorsement Tug Operator Procedures Perm / Temp Notice to Mariners COLREGS General Directions 	<ul style="list-style-type: none"> Light Warnings - providing visual warning that barge is about to depart berth Sound Warnings - providing audio warning that barge is about to depart berth Use of reputable and experienced marine contractor Sub-Contractors Risk Assessment Berth Co-ordinator Berth Co-ordinator to monitor VHF Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity CCTV to provide additional information to Berth Co-ordinator Closure of Arch No 1 to all traffic

Pre Control - People

Severity	Probability	Risk Score	Risk Band
2	4	8	Moderate

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
2	3	6	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
Lifting operations	Movement of materials	Fire safety
Slips and trips	Mooring	

16C - LTTVE - Collision with Tug and Tow (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
16C - LTTVE	Collision with tug and tow (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a tug and tow in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> Reduced effective river width Misjudgement Inattention Non Compliance with procedures Improper lookout Lack of communications Machinery breakdown Collision avoidance High density of leisure traffic Leisure traffic impedes the passage of vessel navigating the channel Change in river flow due to new in-river structure Tidal set 	<ul style="list-style-type: none"> Single Major Injury Minor Damage - Barge Moderate Damage - Tug Bridge Arch Closure - Temporary Minor Pollution 	<ul style="list-style-type: none"> Boat Masters Licence Qualified Crew Bridge Special Signal Lights Emergency Plans & Procedures VTS Navigational Broadcast Thames AIS Passage Planning Ship Towing Code of Practice BML Local Knowledge Endorsement Perm / Temp Notice to Mariners Tug Operator Procedures General Directions COLREGS 	<ul style="list-style-type: none"> Light Warnings - providing visual warning that barge is about to depart berth Sound Warnings - providing audio warning that barge is about to depart berth Use of reputable and experienced marine contractor Sub-Contractors Risk Assessment Berth Co-ordinator Berth Co-ordinator to monitor VHF Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity CCTV to provide additional information to Berth Co-ordinator Closure of Arch No 1 to all traffic

Pre Control - People

Severity	Probability	Risk Score	Risk Band
2	4	8	Moderate

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
2	3	6	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 |
| Lifting operations | Movement of materials |
| Slips and trips | Mooring |
| Fire safety | Welfare Amenities |

17C - LTTVE - Contact with Hungerford Bridge (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
17C - LTTVE	Contact with Hungerford Bridge (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Major Injury • Minor Structural Damage - Bridge • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • General Directions • PLA Bridge Guide • Passage Planning • Accurate Tidal Information • Qualified Crew • Vessel Master Experience • Tug Operator Procedures • COLREGs • Ship Towage Code of Practice • Emergency Plans & Procedures 	<ul style="list-style-type: none"> • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment

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"> •General Directions for Navigation in the Port of London •Schedule to the General Directions for Navigation in the Port of London •Ship Towage Operations on the Thames •Code of Practice for the Safe Mooring of Vessels on the Thames •Code of Practice for Craft Towage Operations on the Thames •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
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 & 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 - LTTVE - Collision with High Speed Passenger Vessel (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
18C - LTTVE	Collision with High Speed Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Minor Damage - Barge • Minor Damage - High Speed Craft • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

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

- 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

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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

19C - LTTVE- Collision with Class V Passenger Vessel (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
19C - LTTVE	Collision with Class V Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Passenger Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	Not relevant for this phase of the project	Not relevant for this phase of the project

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

- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

20C - LTTVE - Collision with Private Leisure Vessel (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
20C - LTTVE	Collision with Private Leisure Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a private leisure vessel in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge 	<ul style="list-style-type: none"> • Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Private Leisure Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	Not relevant for this phase of the project	Not relevant for this phase of the project

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

- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

21C - LTTVE - Collision with Commercial Freight Operator (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
21C - LTTVE	Collision with commercial freight operator (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a commercial freight operator in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

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

- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

22C - LTTVE - Collision with Tug and Tow (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
22C - LTTVE	Collision with tug and tow (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a tug and tow in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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"> •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

Sub Contractors Risk Assessment
Not relevant for this phase of the project

23C - LTTVE - Contact with Hungerford Bridge (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
23C - LTTVE	Contact with Hungerford Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Major Injury • Minor Structural Damage - Bridge • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

Pre Control - People

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

Pre Control - Environment

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

Pre Control - Operational Impact

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

Pre Control - Media Attention

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
- Ship Towing Operations on the Thames
- Code of Practice for the Safe Mooring of Vessels on the Thames
- Code of Practice for Craft Towing Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Port Entry Guide

Sub Contractors Risk Assessment

Not relevant for this phase of the project

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

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

Hazard Id	Hazard Title	Hazard Description	People	Environment	Operational	Media
1D	Emergency Arch closure - Arch No 2 or 3	There may be an emergency requirement to close No 2 or 3 arch.	8	4	6	6
2D	Planned arch closure - Arch No 2 or 3	There may be a requirement to close No 2 or 3 arch for maintenance.	N/A	N/A	N/A	N/A
3D	Planned Arch closure - Arch No 1	During construction/use/Deconstruction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	N/A	N/A	N/A	N/A
4D	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Hungerford Bridge.	9	6	6	9
5D	Contact - High Speed Passenger Vessel with work site	A High Speed Passenger Vessel comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	9	6	9	12
6D	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	9	6	9	12
7D	Contact - private leisure vessel with work site	A private leisure vessel comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	9	6	9	12
8D	Contact - commercial freight operator with work site	A commercial freight operator comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	6	4	6	6

9D	Contact - tug and tow with work site	A tug and tow comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	6	4	6	6
10D	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
11D	Mooring Breakout	A vessel involved in Thames Tunnel activities breaks free from moorings	N/A	N/A	N/A	N/A
12D	Collision - High Speed Passenger Vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment	N/A	N/A	N/A	N/A
13D	Collision - Class V passenger vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
14D	Collision - private leisure vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a private leisure vessel in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
15D	Collision - commercial freight operator (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a commercial freight operator in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A

16D	Collision - tug and tow (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a tug and tow in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
17D	Contact with Hungerford Bridge (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure.	N/A	N/A	N/A	N/A
18D	Collision - High Speed Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment	N/A	N/A	N/A	N/A
19D	Collision - Class V passenger vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A

20D	Collision - private leisure vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a private leisure vessel in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
21D	Collision - commercial freight operator (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a commercial freight operator in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
22D	Collision - tug and tow (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a tug and tow in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
23D	Contact with Hungerford Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure.	N/A	N/A	N/A	N/A

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

1D - LTTVE - Emergency Arch Closure - Arch No 2 or 3

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
1D - LTTVE	Emergency Arch Closure - Arch No 2 or 3	During Thames tunnel works there may be an emergency requirement to close No 2 or 3 arch.	<ul style="list-style-type: none"> Emergency Bridge Arch Closure River Incident 	<ul style="list-style-type: none"> Multiple Major Injuries Minor Damage - Barge Minor Damage - Tug Moderate Damage - Passenger Vessel Moderate Damage - High Speed Craft Moderate Damage - Private Leisure Vessel Moderate Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Minor Pollution 	<ul style="list-style-type: none"> VTS Navigational Broadcast VHF Communications Aids to Navigation Thames AIS COLREGs Other arch (2 or 3) would likely remain open) 	<ul style="list-style-type: none"> See Assessment Notes

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

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
3	3	9	Moderate

Relevant PLA Guidance
<ul style="list-style-type: none"> 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

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
3	2	6	Moderate

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

Assessment Notes
<ul style="list-style-type: none"> This hazard is covered in more detail within the main Victoria Embankment Foreshore - Maritime Issues and Navigational Risk Assessment Report. The location of the temporary and permanent works structures pose no additional navigational impact to that of the Tattershall Castle and Hispaniola and it is therefore assessed that the Thames Tunnel works do not add any additional navigational risk when there is a requirement to close arches 2 or 3.

2D - LTTVE - Planned Arch Closure - Arch No 2 or 3

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
2D - LTTVE	Planned Arch Closure - Arch No 2 or 3	During construction of the temporary cofferdam there may be a scheduled requirement to close No 2 or 3 arch.	<ul style="list-style-type: none"> Planned Bridge arch closure Maintenance and Inspection routines 	<ul style="list-style-type: none"> Multiple Major Injuries Minor Damage - Barge Minor Damage - Tug Moderate Damage - Passenger Vessel Moderate Damage - High Speed Craft Moderate Damage - Private Leisure Vessel Moderate Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Minor Pollution 	Not relevant for this phase of the project	Not relevant for this phase of the project

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"> 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

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
<ul style="list-style-type: none"> This hazard is covered in more detail within the main Victoria Embankment Foreshore - Maritime Issues and Navigational Risk Assessment Report. The location of the temporary and permanent works structures pose no additional navigational impact to that of the Tattershall Castle and Hispaniola and it is therefore assessed that the Thames Tunnel works do not add any additional navigational risk when there is a requirement to close arches 2 or 3.

3D - LTTVE - Planned Arch Closure - Arch No 1

<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>
3D - LTTVE	Planned Arch Closure - Arch No 1	During construction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	<ul style="list-style-type: none"> Planned Bridge arch closure 	<ul style="list-style-type: none"> Multiple Major Injuries Minor Damage - Barge Minor Damage - Tug Moderate Damage - Passenger Vessel Moderate Damage - High Speed Craft Moderate Damage - Private Leisure Vessel Moderate Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Minor Pollution 	Not relevant for this phase of the project	Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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"> 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
<ul style="list-style-type: none"> Not relevant for this phase

4D - LTTVE - Increased Flow

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
4D - LTTVE	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Hungerford Bridge.	<ul style="list-style-type: none"> • Shape and position of temporary cofferdam 	<ul style="list-style-type: none"> • Multiple Major Injuries • Minor Damage - Barge • Minor Damage - Tug • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Moderate Damage - Private Leisure Vessel • Moderate Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • None identified for this hazard 	<ul style="list-style-type: none"> • A Notice to Mariners to advise of any increases in river flow: NTM to advise that for example: In Arch No3 the maximum flow may increase by up to 1/2 knot with the permanent structure in place, with the flow moving towards the south side of the bridge arch.

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
2	3	6	Moderate

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

Relevant PLA Guidance
<ul style="list-style-type: none"> • 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

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
2	3	6	Moderate

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

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>

5D - LTTVE - Contact - High Speed Passenger Vessel with Permanent Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
5D - LTTVE	Contact - High Speed passenger vessel with work site	A High Speed passenger vessel comes into contact with Thames Tunnel permanent work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures 	<ul style="list-style-type: none"> • Permanent structure does not intrude into the river any further than existing moored vessels at this location.

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"> •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 •Code of Practice Passenger Vessel Operations on the Thames •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
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

6D - LTTVE - Contact - 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
6D - LTTVE	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel permanent work site at Victoria Embankment.	<ul style="list-style-type: none"> Reduced effective river width Misjudgement Inattention Adverse weather conditions Machinery breakdown High density of leisure traffic Collision avoidance Leisure traffic impedes the passage of vessel navigating the channel Tidal set Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> Multiple Major Injuries Moderate Damage - Passenger Vessel Moderate Damage - High Speed Craft Bridge Arch Closure - Temporary Minor Pollution 	<ul style="list-style-type: none"> Boat Masters Licence BML Local Knowledge Endorsement Qualified Crew Vessel Master Experience Permanent / Temporary Notice to Mariners Aids to Navigation VTS Navigational Broadcast HSC Code Passage Planning COLREGs VHF Communications Emergency Plans & Procedures 	<ul style="list-style-type: none"> Permanent structure does not intrude into the river any further than existing moored vessels at this location.

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"> 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 Code of Practice Passenger Vessel Operations on the Thames 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
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

7D - LTTVE - 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
7D - LTTVE	Contact - Private leisure vessel with work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel permanent work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Moderate Damage - Private Leisure Vessel • Capsized Private Leisure Vessel • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Aids to Navigation • VHF Communications • COLREGs • General Directions • Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast 	<ul style="list-style-type: none"> • Permanent structure does not intrude into the river any further than existing moored vessels at this location.

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"> •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
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

8D - LTTVE - Contact - Commercial freight with Permanent Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
8D - LTTVE	Contact - commercial freight with work site	Commercial freight comes into contact with Thames Tunnel permanent work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Major Injury • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures 	<ul style="list-style-type: none"> • Permanent structure does not intrude into the river any further than existing moored vessels at this location.

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
3	3	9	Moderate

Relevant PLA Guidance
<ul style="list-style-type: none"> •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	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

9D - LTTVE - 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
9D - LTTVE	Contact - Tug and Tow with work site	A Tug and Tow comes into contact with Thames Tunnel permanent work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Major Injury • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures 	<ul style="list-style-type: none"> • Permanent structure does not intrude into the river any further than existing moored vessels at this location.

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
3	3	9	Moderate

Relevant PLA Guidance
<ul style="list-style-type: none"> • 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	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

10D - LTTVE - 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
10D - LTTVE	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"> • Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Major Injury • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Moderate Damage - Passenger Vessel • Moderate Damage - Private Leisure Vessel • Minor Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • MCA Guidance document 	

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

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

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

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

Relevant PLA Guidance
<ul style="list-style-type: none"> •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	2	6	Moderate

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

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 & 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							

11D - LTTVE - Mooring breakout

Hazard ID	Hazard Title	Hazard Description	Likely Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
11D - LTTVE	Mooring breakout	A vessel involved in Thames Tunnel activities breaks free temporary/layup moorings.	<ul style="list-style-type: none"> • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • Collision avoidance 	<ul style="list-style-type: none"> • Single Major Injury • Moderate Damage - House Boat • Moderate Structural Damage - Marina • Minor Damage - Barge • Minor Damage - Jetty (Thames Water) • Minor Structural Damage - Bridge • Minor Structural Damage - Jetty (Other) • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

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

- Code of Practice for the Safe Mooring of Vessels on the Thames 2012

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

- Not relevant for this phase of the project

12D - LTTVE - Collision with High Speed Passenger Vessel (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
12D - LTTVE	Collision with High Speed Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Minor Damage - Barge • Minor Damage - High Speed Craft • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

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

- 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

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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

13D - LTTVE- Collision with Class V Passenger Vessel (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
13D - LTTVE	Collision with Class V Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Passenger Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

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

- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

14D - LTTVE - Collision with Private Leisure Vessel (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
14D - LTTVE	Collision with Private Leisure Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a private leisure vessel in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge 	<ul style="list-style-type: none"> • Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Private Leisure Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

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

- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

15D - LTTVE - Collision with Commercial Freight Operator (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
15D - LTTVE	Collision with commercial freight operator (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a commercial freight operator in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

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

- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

16D - LTTVE - Collision with Tug and Tow (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
16D - LTTVE	Collision with tug and tow (construction/Deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a tug and tow in the vicinity of Victoria Embankment, during the construction/deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

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

- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

17D - LTTVE - Contact with Hungerford Bridge (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
17D - LTTVEV	Contact with Hungerford Bridge (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Major Injury • Minor Structural Damage - Bridge • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

Pre Control - People

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

Pre Control - Environment

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

Pre Control - Operational Impact

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

Pre Control - Media Attention

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
- Ship Towage Operations on the Thames
- Code of Practice for the Safe Mooring of Vessels on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Port Entry Guide

Sub Contractors Risk Assessment

Not relevant for this phase of the project

18D - LTTVE - Collision with High Speed Passenger Vessel (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
18D - LTTVE	Collision with High Speed Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Minor Damage - Barge • Minor Damage - High Speed Craft • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

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

- 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

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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

19D - LTTVE- Collision with Class V Passenger Vessel (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
19D - LTTVE	Collision with Class V Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Passenger Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

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

- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

20D - LTTVE - Collision with Private Leisure Vessel (delivery/material removal)

<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>
20D - LTTVE	Collision with Private Leisure Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a private leisure vessel in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge 	<ul style="list-style-type: none"> • Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Private Leisure Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

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

- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

21D - LTTVE - Collision with Commercial Freight Operator (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
21D - LTTVE	Collision with commercial freight operator (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a commercial freight operator in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

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

- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

22D - LTTVE - Collision with Tug and Tow (delivery/material removal)

<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>
22D - LTTVE	Collision with tug and tow (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a tug and tow in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

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

- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

23D - LTTVE - Contact with Hungerford Bridge (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Most Likely	Existing Safeguards	Proposed Additional Mitigation
23D - LTTVE	Contact with Hungerford Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Major Injury • Minor Structural Damage - Bridge • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

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

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Ship Towage Operations on the Thames
- Code of Practice for the Safe Mooring of Vessels on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

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	Emergency Arch closure - Arch No 2 or 3	There may be an emergency requirement to close No 2 or 3 arch.	5	3	4	4
2E	Planned arch closure - Arch No 2 or 3	There may be a requirement to close No 2 or 3 arch for maintenance.	5	3	4	4
3E	Planned Arch closure - Arch No 1	During construction/use/Deconstruction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	10	6	10	6
4E	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Hungerford Bridge.	12	9	9	12
5E	Contact - High Speed Passenger Vessel with work site	A High Speed Passenger Vessel comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	10	6	8	10
6E	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	10	6	8	10
7E	Contact - private leisure vessel with work site	A private leisure vessel comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	10	6	8	8
8E	Contact - commercial freight operator with work site	A commercial freight operator comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	8	6	8	6

9E	Contact - tug and tow with work site	A tug and tow comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	8	6	8	6
10E	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	4	8	8
11E	Mooring Breakout	A vessel involved in Thames Tunnel activities breaks free from moorings	8	6	8	6
12E	Collision - High Speed Passenger Vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment	6	4	6	8
13E	Collision - Class V passenger vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment.	6	4	6	8
14E	Collision - private leisure vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a private leisure vessel in the vicinity of Victoria Embankment.	8	6	8	8
15E	Collision - commercial freight operator (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a commercial freight operator in the vicinity of Victoria Embankment.	9	12	9	9

16E	Collision - tug and tow (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a tug and tow in the vicinity of Victoria Embankment.	9	12	9	9
17E	Contact with Hungerford Bridge (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure.	9	6	9	9
18E	Collision - High Speed Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment	N/A	N/A	N/A	N/A
19E	Collision - Class V passenger vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A

20E	Collision - private leisure vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a private leisure vessel in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
21E	Collision - commercial freight operator (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a commercial freight operator in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
22E	Collision - tug and tow (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a tug and tow in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
23E	Contact with Hungerford Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure.	N/A	N/A	N/A	N/A

F.2 Most credible hazard list – Phase A: Construction of cofferdam

1E - LTTVE - Emergency Arch Closure - Arch No 2 or 3

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
1E - LTTVE	Emergency Arch Closure - Arch No 2 or 3	During Thames tunnel works there may be an emergency requirement to close No 2 or 3 arch.	<ul style="list-style-type: none"> Emergency Bridge Arch Closure River Incident 	<ul style="list-style-type: none"> Single Fatality Multiple Major Injuries Major Damage - Barge Major Damage - Tug Major Damage - Passenger Vessel Major Damage - High Speed Craft Major Damage - Private Leisure Vessel Major Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Major Pollution 	<ul style="list-style-type: none"> VTS Navigational Broadcast VHF Communications Aids to Navigation Thames AIS COLREGs Other arch (2 or 3) would likely remain open) 	

Pre Control - People

Severity	Probability	Risk Score	Risk Band
5	2	10	High

Pre Control - Environment

Severity	Probability	Risk Score	Risk Band
3	2	6	Moderate

Pre Control - Operational Impact

Severity	Probability	Risk Score	Risk Band
4	2	8	Moderate

Pre Control - Media Attention

Severity	Probability	Risk Score	Risk Band
4	2	8	Moderate

Post Control - People

Severity	Probability	Risk Score	Risk Band
5	1	5	Moderate

Post Control - Environment

Severity	Probability	Risk Score	Risk Band
3	1	3	Minor

Post Control - Operational Impact

Severity	Probability	Risk Score	Risk Band
4	1	4	Minor

Post Control - Media Attention

Severity	Probability	Risk Score	Risk Band
4	1	4	Minor

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 Victoria Embankment Foreshore - Maritime Issues and Navigational Risk Assessment Report.
- The location of the temporary and permanent works structures pose no additional navigational impact to that of the Tattershall Castle and Hispaniola and it is therefore assessed that the Thames Tunnel works do not add any additional navigational risk when there is a requirement to close arches 2 or 3..

2E - LTTVE - Planned Arch Closure - Arch No 2 or 3

<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>
2E - LTTVE	Planned Arch Closure - Arch No 2 or 3	During construction of the temporary cofferdam there may be a scheduled requirement to close No 2 or 3 arch.	<ul style="list-style-type: none"> Planned Bridge arch closure Maintenance and Inspection routines 	<ul style="list-style-type: none"> Single Fatality Multiple Major Injuries Major Damage - Barge Major Damage - Tug Major Damage - Passenger Vessel Major Damage - High Speed Craft Major Damage - Private Leisure Vessel Major Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Major Pollution 	<ul style="list-style-type: none"> Permanent / Temporary Notice to Mariners VTS Navigational Broadcast VHF Communications Aids to Navigation Bridge Special Signal Lights VTS Qualification Other arch (2 or 3) would likely remain open) 	<ul style="list-style-type: none"> Scheduling of arch closures in order to facilitate minimum disruption to river users

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	High

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

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

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

Relevant PLA Guidance
<ul style="list-style-type: none"> 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

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	1	5	Moderate

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

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	1	4	Minor

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	1	4	Minor

Assessment Notes
<ul style="list-style-type: none"> This hazard is covered in more detail within the main Victoria Embankment Foreshore - Maritime Issues and Navigational Risk Assessment Report. The location of the temporary and permanent works structures pose no additional navigational impact to that of the Tattershall Castle and Hispaniola and it is therefore assessed that the Thames Tunnel works do not add any additional navigational risk when there is a requirement to close arches 2 or 3.

3E - LTTVE - Planned Arch Closure - Arch No 1

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
3E - LTTVE	Planned Arch Closure - Arch No 1	During construction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	<ul style="list-style-type: none"> Planned Bridge arch closure 	<ul style="list-style-type: none"> Single Fatality Multiple Major Injuries Major Damage - Barge Major Damage - Tug Major Damage - Passenger Vessel Major Damage - High Speed Craft Major Damage - Private Leisure Vessel Major Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Major Pollution 	<ul style="list-style-type: none"> Permanent / Temporary Notice to Mariners VTS Navigational Broadcast VHF Communications Aids to Navigation Bridge Special Signal Lights VTS Qualification 	<ul style="list-style-type: none"> Scheduling of arch closures in order to facilitate minimum disruption to river users Arch No 4 available for navigation of outbound larger and reporting vessels (in the event of an emergency). A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

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

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

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

Relevant PLA Guidance
<ul style="list-style-type: none"> 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

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	High

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

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	2	10	High

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

Assessment Notes
<ul style="list-style-type: none"> It is proposed that Arch No 1 is closed to all navigation for the duration of Phase 1. This hazard is covered in more detail within the main Victoria Embankment Foreshore - Maritime Issues and Navigational Risk Assessment

4E - LTTVE - Increased Flow

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
4E - LTTVE	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Hungerford Bridge.	<ul style="list-style-type: none"> Shape and position of temporary cofferdam 	<ul style="list-style-type: none"> Single Fatality Multiple Major Injuries Major Damage - Barge Major Damage - Tug Major Damage - Passenger Vessel Major Damage - High Speed Craft Major Damage - Private Leisure Vessel Major Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Major Pollution 	<ul style="list-style-type: none"> None identified for this hazard 	<ul style="list-style-type: none"> Closure of Arch No 1 to all traffic 3D and computational modelling A Notice to Mariners to advise of any increases in river flow: A Notice to Mariners to advise of any increases in river flow: NTM to advise that for example: In Arch No3 the maximum flow may increase by up to 1/2 knot during temporary works with the flow moving towards the south side of the bridge arch.

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
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"> 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

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

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
4	3	12	High

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>

5E - LTTVE- Contact - High Speed Passenger Vessel with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
5E - LTTVE	Contact - High Speed passenger vessel with work site	A High Speed passenger vessel comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Fatalities • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Loss of Hull Integrity - Passenger Vessel • Loss of Hull Integrity - Passenger Vessel • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures 	<ul style="list-style-type: none"> • Closure of Arch No 1 to all traffic • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

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
5	3	15	Extreme

Relevant PLA Guidance
<ul style="list-style-type: none"> •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 •Code of Practice Passenger Vessel Operations on the 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	High

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

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 & 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							

6E - LTTVE - Contact - Class V Passenger Vessel with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
6E - LTTVE	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Fatalities • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Loss of Hull Integrity - Passenger Vessel • Loss of Hull Integrity - Passenger Vessel • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures 	<ul style="list-style-type: none"> • Closure of Arch No 1 to all traffic • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

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
5	3	15	Extreme

Relevant PLA Guidance
<ul style="list-style-type: none"> •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 •Code of Practice Passenger Vessel Operations on the 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	High

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

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 & 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							

7E - LTTVE - Contact - Private Leisure Vessel with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
7E - LTTVE	Contact - Private leisure vessel with work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Fatality • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Aids to Navigation • VHF Communications • COLREGs • General Directions • Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast 	<ul style="list-style-type: none"> • Closure of Arch No 1 to all traffic • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area • Information provided to local recreational clubs and marinas providing an overview of the works being conducted and expected duration

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

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

Relevant PLA Guidance
<ul style="list-style-type: none"> •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	High

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

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 & 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							

8E - LTTVE - Contact - Commercial freight with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
8E - LTTVE	Contact - commercial freight with work site	Commercial freight comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures 	<ul style="list-style-type: none"> • Closure of Arch No 1 to all traffic • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

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
3	3	9	Moderate

Relevant PLA Guidance
<ul style="list-style-type: none"> •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
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
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 & 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 - LTTVE - Contact - Tug and Tow with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
9E - LTTVE	Contact - Tug and Tow with work site	A Tug and Tow comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures 	<ul style="list-style-type: none"> • Closure of Arch No 1 to all traffic • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

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
3	3	9	Moderate

Relevant PLA Guidance
<ul style="list-style-type: none"> •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
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
3	2	6	Moderate

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							

10E - LTTVE - 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
10E - LTTVE	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"> • Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • MCA Guidance document 	

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

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

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

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

Relevant PLA Guidance
<ul style="list-style-type: none"> • 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
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

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 & 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							

11E - LTTVE - Mooring breakout

<i>Hazard ID</i>	<i>Hazard Title</i>	<i>Hazard Description</i>	<i>Likely Hazard Causes</i>	<i>Consequence(s) Worst Credible</i>	<i>Existing Safeguards</i>	<i>Proposed Additional Mitigation</i>
11E - LTTVE	Mooring breakout	A vessel involved in Thames Tunnel activities breaks free temporary/layup moorings.	<ul style="list-style-type: none"> • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • Collision avoidance 	<ul style="list-style-type: none"> • Multiple Major Injuries • Moderate Damage - House Boat • Moderate Structural Damage - Marina • Minor Damage - Barge • Minor Damage - Jetty (Thames Water) • Minor Structural Damage - Bridge • Minor Structural Damage - Jetty (Other) • Minor Pollution 	<ul style="list-style-type: none"> • Tug Operator Procedures • Emergency Plans & Procedures • Mooring Inspections • Inspection Routine • Qualified Crew 	<ul style="list-style-type: none"> • Use of reputable marine contractors

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
3	3	9	Moderate

Relevant PLA Guidance
<ul style="list-style-type: none"> • Code of Practice for the Safe Mooring of Vessels on the Thames 2010

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
3	2	6	Moderate

Assessment Notes

12E - LTTVE - Collision with High Speed Passenger Vessel (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
12E - LTTVE	Collision - High Speed Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Fatalities • Moderate Damage - Barge • Major Damage - High Speed Craft • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • General Directions • Tug Operator Procedures • Passage Planning • VTS Navigational Broadcast • Qualified Crew • Vessel Master Experience • Thames AIS • HSC Code • VHF Communications • COLREGs 	<ul style="list-style-type: none"> • Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Use of reputable and experienced marine contractor • Berth Co-ordinator • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • Berth Co-ordinator to monitor VHF • CCTV to provide additional information to Berth Co-ordinator

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

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	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

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

13E - LTTVE- Collision with Class V Passenger Vessel (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
13E - LTTVE	Collision with Class V Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Fatalities • Moderate Damage - Barge • Major Damage - Passenger Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • Qualified Crew • BML Local Knowledge Endorsement • Thames AIS • Passage Planning • VHF Communications • Tug Operator Procedures • General Directions • Vessel Master Experience • VTS Navigational Broadcast • COLREGs • Emergency Plans & Procedures 	<ul style="list-style-type: none"> • Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Use of reputable and experienced marine contractor • Berth Co-ordinator • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • Berth Co-ordinator to monitor VHF • CCTV to provide additional information to Berth Co-ordinator

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

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
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

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

14E - LTTVE - Collision with Private Leisure Vessel (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
14E - LTTVE	Collision with Private Leisure Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a private leisure vessel in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge 	<ul style="list-style-type: none"> • Multiple Fatalities • Moderate Damage - Barge • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Vessel Master Experience • Qualified Crew • VHF Communications • VTS Navigational Broadcast • Ship Towing Code of Practice • Tug Operator Procedures • COLREGs • General Directions • Admiralty Charts • Perm / Temp Notice to Mariners • Emergency Plans & Procedures • Aids to Navigation 	<ul style="list-style-type: none"> • Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Berth Co-ordinator • Berth Co-ordinator to monitor VHF • CCTV to provide additional information to Berth Coordinator

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

Relevant PLA Guidance
<ul style="list-style-type: none"> • 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
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

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 - LTTVE - Collision with Commercial Freight Operator (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
15E - LTTVE	Collision with commercial freight operator (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a commercial freight operator in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> Reduced effective river width Misjudgement Inattention Non Compliance with procedures Improper lookout Lack of communications Machinery breakdown Collision avoidance High density of leisure traffic Leisure traffic impedes the passage of vessel navigating the channel Change in river flow due to new in-river structure Tidal set 	<ul style="list-style-type: none"> Single Fatality Moderate Damage - Barge Major Damage - Tug Loss of Hull Integrity - Tug Loss of Hull Integrity - Barge Bridge Arch Closure - Temporary Major Pollution 	<ul style="list-style-type: none"> Boat Masters Licence Qualified Crew Bridge Special Signal Lights Emergency Plans & Procedures VTS Navigational Broadcast Thames AIS Passage Planning Ship Towing Code of Practice BML Local Knowledge Endorsement Tug Operator Procedures Perm / Temp Notice to Mariners COLREGS General Directions 	<ul style="list-style-type: none"> Light Warnings - providing visual warning that barge is about to depart berth Sound Warnings - providing audio warning that barge is about to depart berth Use of reputable and experienced marine contractor Sub-Contractors Risk Assessment Berth Co-ordinator Berth Co-ordinator to monitor VHF Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity CCTV to provide additional information to Berth Co-ordinator Closure of Arch No 1 to all traffic

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

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	4	16	Extreme

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"> 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
4	3	12	High

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

16E - LTTVE - Collision with Tug and Tow (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
16E - LTTVE	Collision with tug and tow (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a tug and tow in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • Qualified Crew • Bridge Special Signal Lights • Emergency Plans & Procedures • VTS Navigational Broadcast • Thames AIS • Passage Planning • Ship Towage Code of Practice • BML Local Knowledge Endorsement • Perm / Temp Notice to Mariners • Tug Operator Procedures • General Directions • COLREGS 	<ul style="list-style-type: none"> • Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Berth Co-ordinator • Berth Co-ordinator to monitor VHF • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • CCTV to provide additional information to Berth Co-ordinator • Closure of Arch No 1 to all traffic

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

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	4	16	Extreme

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"> • 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	Moderate

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

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 & 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 - LTTVE - Contact with Hungerford Bridge (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
17E - LTTVE	Contact with Hungerford Bridge (construction/Deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure during the construction/deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Fatality • Major Structural Damage - Bridge • Major Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • General Directions • PLA Bridge Guide • Passage Planning • Accurate Tidal Information • Qualified Crew • Vessel Master Experience • Tug Operator Procedures • COLREGs • Ship Towage Code of Practice • Emergency Plans & Procedures 	<ul style="list-style-type: none"> • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment

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
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
- Ship Towage Operations on the Thames
- Code of Practice for the Safe Mooring of Vessels on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- 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
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 |
| Lifting operations | Movement of materials |
| Slips and trips | Mooring |
| Fire safety | Welfare Amenities |

18E - LTTVE - Collision with High Speed Passenger Vessel (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
8E - LTTVE	Collision - High Speed Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Fatalities • Moderate Damage - Barge • Major Damage - High Speed Craft • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	Not relevant for this phase of the project	Not relevant for this phase of the project

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

- 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

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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

19E - LTTVE- Collision with Class V Passenger Vessel (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
19E - LTTVE	Collision with Class V Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Fatalities • Moderate Damage - Barge • Major Damage - Passenger Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	Not relevant for this phase of the project	Not relevant for this phase of the project

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

- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

20E - LTTVE - Collision with Private Leisure Vessel (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
20E - LTTVE	Collision with Private Leisure Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a private leisure vessel in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge 	<ul style="list-style-type: none"> • Multiple Fatalities • Moderate Damage - Barge • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	Not relevant for this phase of the project	Not relevant for this phase of the project

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

- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

21E - LTTVE - Collision with Commercial Freight Operator (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
21E - LTTVE	Collision with commercial freight operator (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a commercial freight operator in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution 	Not relevant for this phase of the project	Not relevant for this phase of the project

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

- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

22E - LTTVE - Collision with Tug and Tow (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
22E - LTTVE	Collision with tug and tow (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a tug and tow in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution 	Not relevant for this phase of the project	Not relevant for this phase of the project

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

- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

23E - LTTVE - Contact with Hungerford Bridge (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
23E - LTTVE	Contact with Hungerford Bridge (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Fatality • Major Structural Damage - Bridge • Major Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

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

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Ship Towage Operations on the Thames
- Code of Practice for the Safe Mooring of Vessels on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

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	Emergency Arch closure - Arch No 2 or 3	There may be an emergency requirement to close No 2 or 3 Arch.	5	3	4	4
2F	Planned arch closure - Arch No 2 or 3	There may be a requirement to close No 2 or 3 Arch for maintenance.	5	3	4	4
3F	Planned Arch closure - Arch No 1	During construction/use/Deconstruction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	10	6	10	6
4F	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Hungerford Bridge.	12	9	9	12
5F	Contact - High Speed Passenger Vessel with work site	A High Speed Passenger Vessel comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	10	6	8	10
6F	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	10	6	8	10
7F	Contact - private leisure vessel with work site	A private leisure vessel comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	10	6	8	8
8F	Contact - commercial freight operator with work site	A commercial freight operator comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	8	6	8	6

9F	Contact - tug and tow with work site	A tug and tow comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	8	6	8	6
10F	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	4	8	8
11F	Mooring Breakout	A vessel involved in Thames Tunnel activities breaks free from moorings	8	6	8	6
12F	Collision - High Speed Passenger Vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment	N/A	N/A	N/A	N/A
13F	Collision - Class V passenger vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
14F	Collision - private leisure vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a private leisure vessel in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
15F	Collision - commercial freight operator (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a commercial freight operator in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A

16F	Collision - tug and tow (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a tug and tow in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
17F	Contact with Hungerford Bridge (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure.	N/A	N/A	N/A	N/A
18F	Collision - High Speed Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment	6	4	6	8
19F	Collision - Class V passenger vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment.	6	4	6	8

20F	Collision - private leisure vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a private leisure vessel in the vicinity of Victoria Embankment.	8	6	8	8
21F	Collision - commercial freight operator (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a commercial freight operator in the vicinity of Victoria Embankment.	9	12	9	9
22F	Collision - tug and tow (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a tug and tow in the vicinity of Victoria Embankment.	9	12	9	9
23F	Contact with Hungerford Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure.	9	6	9	9

G.2 Worst credible hazard list – Phase B: Construction of drop shaft/culvert/connections

1F - LTTVE - Emergency Arch Closure - Arch No 2 or 3

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
1F - LTTVE	Emergency Arch Closure - Arch No 2 or 3	During Thames tunnel works there may be an emergency requirement to close No 2 or 3 arch.	<ul style="list-style-type: none"> Emergency Bridge Arch Closure River Incident 	<ul style="list-style-type: none"> Single Fatality Multiple Major Injuries Major Damage - Barge Major Damage - Tug Major Damage - Passenger Vessel Major Damage - High Speed Craft Major Damage - Private Leisure Vessel Major Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Major Pollution 	<ul style="list-style-type: none"> VTS Navigational Broadcast VHF Communications Aids to Navigation Thames AIS COLREGs Other arch (2 or 3) would likely remain open) 	

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	High

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

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

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

Relevant PLA Guidance
<ul style="list-style-type: none"> 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

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	1	5	Moderate

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

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	1	4	Minor

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	1	4	Minor

Assessment Notes
<ul style="list-style-type: none"> This hazard is covered in more detail within the main Victoria Embankment Foreshore - Maritime Issues and Navigational Risk Assessment Report. The location of the temporary and permanent works structures pose no additional navigational impact to that of the Tattershall Castle and Hispaniola and it is therefore assessed that the Thames Tunnel works do not add any additional navigational risk when there is a requirement to close arches 2 or 3.

2F - LTTVE - Planned Arch Closure - Arch No 2 or 3

<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>
2F - LTTVE	Planned Arch Closure - Arch No 2 or 3	During construction of the temporary cofferdam there may be a scheduled requirement to close No 2 or 3 arch.	<ul style="list-style-type: none"> Planned Bridge arch closure Maintenance and Inspection routines 	<ul style="list-style-type: none"> Single Fatality Multiple Major Injuries Major Damage - Barge Major Damage - Tug Major Damage - Passenger Vessel Major Damage - High Speed Craft Major Damage - Private Leisure Vessel Major Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Major Pollution 	<ul style="list-style-type: none"> Permanent / Temporary Notice to Mariners VTS Navigational Broadcast VHF Communications Aids to Navigation Bridge Special Signal Lights VTS Qualification Other arch (2 or 3) would likely remain open) 	<ul style="list-style-type: none"> Scheduling of arch closures in order to facilitate minimum disruption to river users

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	High

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

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

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

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	1	5	Moderate

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

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	1	4	Minor

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	1	4	Minor

Relevant PLA Guidance
<ul style="list-style-type: none"> 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
<ul style="list-style-type: none"> This hazard is covered in more detail within the main Victoria Embankment Foreshore - Maritime Issues and Navigational Risk Assessment Report. The location of the temporary and permanent works structures pose no additional navigational impact to that of the Tattershall Castle and Hispaniola and it is therefore assessed that the Thames Tunnel works do not add any additional navigational risk when there is a requirement to close arches 2 or 3.

3F - LTTVE - Planned Arch Closure - Arch No 1

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
3F - LTTVE	Planned Arch Closure - Arch No 1	During construction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	<ul style="list-style-type: none"> Planned Bridge arch closure 	<ul style="list-style-type: none"> Single Fatality Multiple Major Injuries Major Damage - Barge Major Damage - Tug Major Damage - Passenger Vessel Major Damage - High Speed Craft Major Damage - Private Leisure Vessel Major Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Major Pollution 	<ul style="list-style-type: none"> Permanent / Temporary Notice to Mariners VTS Navigational Broadcast VHF Communications Aids to Navigation Bridge Special Signal Lights VTS Qualification 	<ul style="list-style-type: none"> Scheduling of arch closures in order to facilitate minimum disruption to river users Arch No 4 available for navigation of outbound larger and reporting vessels (in the event of an emergency). A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

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

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

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

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	High

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

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	2	10	High

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

Relevant PLA Guidance
<ul style="list-style-type: none"> 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
<ul style="list-style-type: none"> This hazard is covered in more detail within the main Victoria Embankment Foreshore - Maritime Issues and Navigational Risk Assessment Report

4F - LTTVE - Increased Flow

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
4F - LTTVE	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Hungerford Bridge.	<ul style="list-style-type: none"> • Shape and position of temporary cofferdam 	<ul style="list-style-type: none"> • Single Fatality • Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution 	<ul style="list-style-type: none"> • None identified for this hazard 	<ul style="list-style-type: none"> • A Notice to Mariners to advise of any increases in river flow: NTM to advise that for example: In Arch No3 the maximum flow may increase by up to 1/2 knot during temporary works with the flow moving towards the south side of the bridge arch.

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
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"> • 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

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

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
4	3	12	High

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>

5F - LTTVE - Contact - High Speed Passenger Vessel with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
5F - LTTVE	Contact - High Speed passenger vessel with work site	A High Speed passenger vessel comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Fatalities • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Loss of Hull Integrity - Passenger Vessel • Loss of Hull Integrity - Passenger Vessel • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures 	<ul style="list-style-type: none"> • Closure of Arch No 1 to certain vessels types / operators • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	High

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

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

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

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

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	2	10	High

Relevant PLA Guidance
<ul style="list-style-type: none"> •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 •Code of Practice Passenger Vessel Operations on the Thames •Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

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 & 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							

6F - LTTVE - Contact - Class V Passenger Vessel with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
6F - LTTVE	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Fatalities • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Loss of Hull Integrity - Passenger Vessel • Loss of Hull Integrity - Passenger Vessel • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures 	<ul style="list-style-type: none"> • Closure of Arch No 1 to certain vessels types / operators • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

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
5	3	15	Extreme

Relevant PLA Guidance
<ul style="list-style-type: none"> •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 •Code of Practice Passenger Vessel Operations on the 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	High

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

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							

7F - LTTVE - Contact - Private Leisure Vessel with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
7F - LTTVE	Contact - Private leisure vessel with work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Fatality • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Aids to Navigation • VHF Communications • COLREGs • General Directions • Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast 	<ul style="list-style-type: none"> • Closure of Arch No 1 to certain vessels types / operators • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area • Information provided to local recreational clubs and marinas providing an overview of the works being conducted and expected duration

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

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

Relevant PLA Guidance
<ul style="list-style-type: none"> •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	High

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

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 - LTTVE - Contact - Commercial freight with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
8F - LTTVE	Contact - commercial freight with work site	Commercial freight comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towing Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures 	<ul style="list-style-type: none"> • Closure of Arch No 1 to certain vessels types / operators • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

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
3	3	9	Moderate

Relevant PLA Guidance
<ul style="list-style-type: none"> •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
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
3	2	6	Moderate

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							

9F - LTTVE - Contact - Tug and Tow with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
9F - LTTVE	Contact - Tug and Tow with work site	A Tug and Tow comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towing Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures 	<ul style="list-style-type: none"> • Closure of Arch No 1 to certain vessels types / operators • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

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
3	3	9	Moderate

Relevant PLA Guidance
<ul style="list-style-type: none"> •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
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
3	2	6	Moderate

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							

10F - LTTVE - 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
10F - LTTVE	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"> • Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • MCA Guidance document 	

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

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

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

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

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

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

Pre Control - Media Attention			
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"> •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

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

11F - LTTVE - Mooring breakout

<i>Hazard ID</i>	<i>Hazard Title</i>	<i>Hazard Description</i>	<i>Likely Hazard Causes</i>	<i>Consequence(s) Worst Credible</i>	<i>Existing Safeguards</i>	<i>Proposed Additional Mitigation</i>
11F - LTTVE	Mooring breakout	A vessel involved in Thames Tunnel activities breaks free temporary/layup moorings.	<ul style="list-style-type: none"> • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • Collision avoidance 	<ul style="list-style-type: none"> • Multiple Major Injuries • Moderate Damage - House Boat • Moderate Structural Damage - Marina • Minor Damage - Barge • Minor Damage - Jetty (Thames Water) • Minor Structural Damage - Bridge • Minor Structural Damage - Jetty (Other) • Minor Pollution 	<ul style="list-style-type: none"> • Tug Operator Procedures • Emergency Plans & Procedures • Mooring Inspections • Inspection Routine • Qualified Crew 	<ul style="list-style-type: none"> • Use of reputable marine contractors

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
3	3	9	Moderate

<i>Relevant PLA Guidance</i>
<ul style="list-style-type: none"> • Code of Practice for the Safe Mooring of Vessels on the Thames 2010

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
3	2	6	Moderate

<i>Assessment Notes</i>

12F - LTTVE - Collision with High Speed Passenger Vessel (construction/deconstruction)

<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>
12F - LTTVE	Collision - High Speed Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Fatalities • Moderate Damage - Barge • Major Damage - High Speed Craft • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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"> •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

Sub Contractors Risk Assessment
Not relevant for this phase of the project

13F - LTTVE- Collision with Class V Passenger Vessel (construction/deconstruction)

<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>
13F - LTTVE	Collision with Class V Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Fatalities • Moderate Damage - Barge • Major Damage - Passenger Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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"> •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

Sub Contractors Risk Assessment
Not relevant for this phase of the project

14F - LTTVE - Collision with Private Leisure Vessel (construction/deconstruction)

<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>
14F - LTTVE	Collision with Private Leisure Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a private leisure vessel in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge 	<ul style="list-style-type: none"> • Multiple Fatalities • Moderate Damage - Barge • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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"> •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

Sub Contractors Risk Assessment
Not relevant for this phase of the project

15F - LTTVE - Collision with Commercial Freight Operator (construction/deconstruction)

<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>
15F - LTTVE	Collision with commercial freight operator (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a commercial freight operator in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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"> •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

Sub Contractors Risk Assessment
Not relevant for this phase of the project

16F - LTTVE - Collision with Tug and Tow (construction/deconstruction)

<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>
16F - LTTVE	Collision with tug and tow (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a tug and tow in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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"> •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

Sub Contractors Risk Assessment
Not relevant for this phase of the project

17F - LTTVE - Contact with Hungerford Bridge (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
17F - LTTVE	Contact with Hungerford Bridge (construction/Deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure during the construction/deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Fatality • Major Structural Damage - Bridge • Major Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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"> •General Directions for Navigation in the Port of London •Schedule to the General Directions for Navigation in the Port of London •Ship Towage Operations on the Thames •Code of Practice for the Safe Mooring of Vessels on the Thames •Code of Practice for Craft Towage Operations on the Thames •Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners •Port Entry Guide

Sub Contractors Risk Assessment
Not relevant for this phase of the project

18F - LTTVE - Collision with High Speed Passenger Vessel (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
8F - LTTVE	Collision - High Speed Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Fatalities • Moderate Damage - Barge • Major Damage - High Speed Craft • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • General Directions • Tug Operator Procedures • Passage Planning • VTS Navigational Broadcast • Qualified Crew • Vessel Master Experience • Thames AIS • HSC Code • VHF Communications • COLREGs 	<ul style="list-style-type: none"> • Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Use of reputable and experienced marine contractor • Berth Co-ordinator • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • Berth Co-ordinator to monitor VHF • CCTV to provide additional information to Berth Co-ordinator

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

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

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

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

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

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

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

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

Relevant PLA Guidance
<ul style="list-style-type: none"> • 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

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 & 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								

19F - LTTVE- Collision with Class V Passenger Vessel (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
19F - LTTVE	Collision with Class V Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Fatalities • Moderate Damage - Barge • Major Damage - Passenger Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • Qualified Crew • BML Local Knowledge Endorsement • Thames AIS • Passage Planning • VHF Communications • Tug Operator Procedures • General Directions • Vessel Master Experience • VTS Navigational Broadcast • COLREGs • Emergency Plans & Procedures 	<ul style="list-style-type: none"> • Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Berth Co-ordinator • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • Berth Co-ordinator to monitor VHF • CCTV to provide additional information to Berth Co-ordinator

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

Relevant PLA Guidance
<ul style="list-style-type: none"> • 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
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 & 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								

20F - LTTVE - Collision with Private Leisure Vessel (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
20F - LTTVE	Collision with Private Leisure Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a private leisure vessel in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge 	<ul style="list-style-type: none"> • Multiple Fatalities • Moderate Damage - Barge • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Vessel Master Experience • Qualified Crew • VHF Communications • VTS Navigational Broadcast • Ship Towing Code of Practice • Tug Operator Procedures • COLREGs • General Directions • Admiralty Charts • Perm / Temp Notice to Mariners • Emergency Plans & Procedures • Aids to Navigation 	<ul style="list-style-type: none"> • Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Berth Co-ordinator • Berth Co-ordinator to monitor VHF • CCTV to provide additional information to Berth Master

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

Relevant PLA Guidance
<ul style="list-style-type: none"> • 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
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

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 & 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							

21F - LTTVE - Collision with Commercial Freight Operator (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
21F - LTTVE	Collision with commercial freight operator (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a commercial freight operator in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> Reduced effective river width Misjudgement Inattention Non Compliance with procedures Improper lookout Lack of communications Machinery breakdown Collision avoidance High density of leisure traffic Leisure traffic impedes the passage of vessel navigating the channel Change in river flow due to new in-river structure Tidal set 	<ul style="list-style-type: none"> Single Fatality Moderate Damage - Barge Major Damage - Tug Loss of Hull Integrity - Tug Loss of Hull Integrity - Barge Bridge Arch Closure - Temporary Major Pollution 	<ul style="list-style-type: none"> Boat Masters Licence Qualified Crew Bridge Special Signal Lights Emergency Plans & Procedures VTS Navigational Broadcast Thames AIS Passage Planning Ship Towage Code of Practice BML Local Knowledge Endorsement Tug Operator Procedures Perm / Temp Notice to Mariners COLREGS General Directions 	<ul style="list-style-type: none"> Light Warnings - providing visual warning that barge is about to depart berth Sound Warnings - providing audio warning that barge is about to depart berth Use of reputable and experienced marine contractor Sub-Contractors Risk Assessment Berth Co-ordinator Berth Co-ordinator to monitor VHF Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity CCTV to provide additional information to Berth Co-ordinator Closure of Arch No 1 to all traffic

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

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	4	16	Extreme

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"> 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	Moderate

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

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 & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 33%;">Working at height</td> <td style="width: 33%;">Loading / Unloading operations</td> <td style="width: 33%;">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								

22F - LTTVE - Collision with Tug and Tow (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
22F - LTTVE	Collision with tug and tow (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a tug and tow in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • Qualified Crew • Bridge Special Signal Lights • Emergency Plans & Procedures • VTS Navigational Broadcast • Thames AIS • Passage Planning • Ship Towing Code of Practice • BML Local Knowledge Endorsement • Perm / Temp Notice to Mariners • Tug Operator Procedures • General Directions • COLREGS 	<ul style="list-style-type: none"> • Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Berth Co-ordinator • Berth Co-ordinator to monitor VHF • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • CCTV to provide additional information to Berth Co-ordinator • Closure of Arch No 1 to all traffic

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

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	4	16	Extreme

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"> • 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
4	3	12	High

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 & 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							

23F - LTTVE - Contact with Hungerford Bridge (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
23F - LTTVE	Contact with Hungerford Bridge (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Fatality • Major Structural Damage - Bridge • Major Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • General Directions • PLA Bridge Guide • Passage Planning • Accurate Tidal Information • Qualified Crew • Vessel Master Experience • Tug Operator Procedures • COLREGs • Ship Towage Code of Practice • Emergency Plans & Procedures 	<ul style="list-style-type: none"> • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment

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

Post 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

Post 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

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

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

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 & 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							

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	Emergency Arch closure - Arch No 2 or 3	There may be an emergency requirement to close No 2 or 3 Arch.	5	3	4	4
2G	Planned arch closure - Arch No 2 or 3	There may be a requirement to close No 2 or 3 Arch for maintenance.	5	3	4	4
3G	Planned Arch closure - Arch No 1	During construction/use/Deconstruction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	10	6	10	6
4G	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Hungerford Bridge.	12	9	9	12
5G	Contact - High Speed Passenger Vessel with work site	A High Speed Passenger Vessel comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	10	6	8	10
6G	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	10	6	8	10
7G	Contact - private leisure vessel with work site	A private leisure vessel comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	10	6	8	8
8G	Contact - commercial freight operator with work site	A commercial freight operator comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	8	6	8	6

9G	Contact - tug and tow with work site	A tug and tow comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	8	6	8	6
10G	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	4	8	8
11G	Mooring Breakout	A vessel involved in Thames Tunnel activities breaks free from moorings	8	6	8	6
12G	Collision - High Speed Passenger Vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment	6	4	6	8
13G	Collision - Class V passenger vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment.	8	4	6	8
14G	Collision - private leisure vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a private leisure vessel in the vicinity of Victoria Embankment.	8	6	8	8
15G	Collision - commercial freight operator (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a commercial freight operator in the vicinity of Victoria Embankment.	9	12	6	6

16G	Collision - tug and tow (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a tug and tow in the vicinity of Victoria Embankment.	9	12	9	9
17G	Contact with Hungerford Bridge (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure.	9	6	9	9
18G	Collision - High Speed Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment	N/A	N/A	N/A	N/A
19G	Collision - Class V passenger vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A

20G	Collision - private leisure vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a private leisure vessel in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
21G	Collision - commercial freight operator (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a commercial freight operator in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
22G	Collision - tug and tow (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a tug and tow in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
23G	Contact with Hungerford Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure.	N/A	N/A	N/A	N/A

H.2 Worst credible hazard list – Phase C: Removal of cofferdam

1G - LTTVE - Emergency Arch Closure - Arch No 2 or 3

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
1G - LTTVE	Emergency Arch Closure - Arch No 2 or 3	During Thames tunnel works there may be an emergency requirement to close No 2 or 3 arch.	<ul style="list-style-type: none"> Emergency Bridge Arch Closure River Incident 	<ul style="list-style-type: none"> Single Fatality Multiple Major Injuries Major Damage - Barge Major Damage - Tug Major Damage - Passenger Vessel Major Damage - High Speed Craft Major Damage - Private Leisure Vessel Major Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Major Pollution 	<ul style="list-style-type: none"> VTS Navigational Broadcast VHF Communications Aids to Navigation Thames AIS COLREGs Other arch (2 or 3) would likely remain open) 	

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	High

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

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

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

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	1	5	Moderate

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

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	1	4	Minor

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	1	4	Minor

Relevant PLA Guidance
<ul style="list-style-type: none"> 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
<ul style="list-style-type: none"> This hazard is covered in more detail within the main Victoria Embankment Foreshore - Maritime Issues and Navigational Risk Assessment Report. The location of the temporary and permanent works structures pose no additional navigational impact to that of the Tattershall Castle and Hispaniola and it is therefore assessed that the Thames Tunnel works do not add any additional navigational risk when there is a requirement to close arches 2 or 3.

2G - LTTVE - Planned Arch Closure - Arch No 2 or 3

<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>
2G - LTTVE	Planned Arch Closure - Arch No 2 or 3	During construction of the temporary cofferdam there may be a scheduled requirement to close No 2 or 3 arch.	<ul style="list-style-type: none"> Planned Bridge arch closure Maintenance and Inspection routines 	<ul style="list-style-type: none"> Single Fatality Multiple Major Injuries Major Damage - Barge Major Damage - Tug Major Damage - Passenger Vessel Major Damage - High Speed Craft Major Damage - Private Leisure Vessel Major Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Major Pollution 	<ul style="list-style-type: none"> Permanent / Temporary Notice to Mariners VTS Navigational Broadcast VHF Communications Aids to Navigation Bridge Special Signal Lights VTS Qualification Other arch (2 or 3) would likely remain open) 	<ul style="list-style-type: none"> Scheduling of arch closures in order to facilitate minimum disruption to river users Arch No 4 available for navigation of outbound larger and reporting vessels (in the event of an emergency). A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	High

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

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

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

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	1	5	Moderate

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

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	1	4	Minor

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	1	4	Minor

Relevant PLA Guidance
<ul style="list-style-type: none"> 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
<ul style="list-style-type: none"> This hazard is covered in more detail within the main Victoria Embankment Foreshore - Maritime Issues and Navigational Risk Assessment Report. The location of the temporary and permanent works structures pose no additional navigational impact to that of the Tattershall Castle and Hispaniola and it is therefore assessed that the Thames Tunnel works do not add any additional navigational risk when there is a requirement to close arches 2 or 3.

3G - LTTVE - Planned Arch Closure - Arch No 1

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
3G - LTTVE	Planned Arch Closure - Arch No 1	During construction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	<ul style="list-style-type: none"> Planned Bridge arch closure 	<ul style="list-style-type: none"> Single Fatality Multiple Major Injuries Major Damage - Barge Major Damage - Tug Major Damage - Passenger Vessel Major Damage - High Speed Craft Major Damage - Private Leisure Vessel Major Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Major Pollution 	<ul style="list-style-type: none"> Permanent / Temporary Notice to Mariners VTS Navigational Broadcast VHF Communications Aids to Navigation Bridge Special Signal Lights VTS Qualification 	<ul style="list-style-type: none"> Scheduling of arch closures in order to facilitate minimum disruption to river users Arch No 4 available for navigation of outbound larger and reporting vessels (in the event of an emergency). A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	High

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

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

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	2	10	High

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

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

Relevant PLA Guidance
<ul style="list-style-type: none"> 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
<ul style="list-style-type: none"> This hazard is covered in more detail within the main Victoria Embankment Foreshore - Maritime Issues and Navigational Risk Assessment Report

4G - LTTVE - 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>
4G - LTTVE	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Hungerford Bridge.	<ul style="list-style-type: none"> • Shape and position of temporary cofferdam 	<ul style="list-style-type: none"> • Single Fatality • Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution 	<ul style="list-style-type: none"> • None identified for this hazard 	<ul style="list-style-type: none"> • A Notice to Mariners to advise of any increases in river flow: NTM to advise that for example: In Arch No3 the maximum flow may increase by up to 1/2 knot during temporary works with the flow moving towards the south side of the bridge arch.

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

Post 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

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

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

Post 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

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

Relevant PLA Guidance
<ul style="list-style-type: none"> • 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
<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>

5G - LTTVE - Contact - High Speed Passenger Vessel with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
5G - LTTVE	Contact - High Speed passenger vessel with work site	A High Speed passenger vessel comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Fatalities • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Loss of Hull Integrity - Passenger Vessel • Loss of Hull Integrity - Passenger Vessel • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures 	<ul style="list-style-type: none"> • Closure of Arch No 1 to all traffic • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

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
5	3	15	Extreme

Relevant PLA Guidance
<ul style="list-style-type: none"> •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 •Code of Practice Passenger Vessel Operations on the 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	High

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

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 & 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							

6G - LTTVE - Contact - Class V Passenger Vessel with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
6G - LTTVE	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Fatalities • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Loss of Hull Integrity - Passenger Vessel • Loss of Hull Integrity - Passenger Vessel • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures 	<ul style="list-style-type: none"> • Closure of Arch No 1 to all traffic • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

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
5	3	15	Extreme

Relevant PLA Guidance
<ul style="list-style-type: none"> •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 •Code of Practice Passenger Vessel Operations on the 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	High

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

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 & 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 - LTTVE - Contact - Private Leisure Vessel with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
7G - LTTVE	Contact - Private leisure vessel with work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Fatality • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Aids to Navigation • VHF Communications • COLREGs • General Directions • Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast 	<ul style="list-style-type: none"> • Closure of Arch No 1 to all traffic • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area • Information provided to local recreational clubs and marinas providing an overview of the works being conducted and expected duration

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

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

Relevant PLA Guidance
<ul style="list-style-type: none"> •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	High

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

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 & 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							

8G - LTTVE - Contact - Commercial freight with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
8G - LTTVE	Contact - commercial freight with work site	Commercial freight comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures 	<ul style="list-style-type: none"> • Closure of Arch No 1 to all traffic • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

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
3	3	9	Moderate

Relevant PLA Guidance
<ul style="list-style-type: none"> •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
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
3	2	6	Moderate

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 - LTTVE - Contact - Tug and Tow with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
9G - LTTVE	Contact - Tug and Tow with work site	A Tug and Tow comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures 	<ul style="list-style-type: none"> • Closure of Arch No 1 to all traffic • Inward bound vessels use Arch No 2 • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

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

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

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

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

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

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

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

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

Relevant PLA Guidance
<ul style="list-style-type: none"> •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

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							

10G - LTTVE - 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
10G - LTTVE	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"> • Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • MCA Guidance document 	

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

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

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

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

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

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

Pre Control - Media Attention			
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"> • 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

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 - LTTVE - Mooring breakout

<i>Hazard ID</i>	<i>Hazard Title</i>	<i>Hazard Description</i>	<i>Likely Hazard Causes</i>	<i>Consequence(s) Worst Credible</i>	<i>Existing Safeguards</i>	<i>Proposed Additional Mitigation</i>
11G - LTTVE	Mooring breakout	A vessel involved in Thames Tunnel activities breaks free temporary/layup moorings.	<ul style="list-style-type: none"> • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • Collision avoidance 	<ul style="list-style-type: none"> • Multiple Major Injuries • Moderate Damage - House Boat • Moderate Structural Damage - Marina • Minor Damage - Barge • Minor Damage - Jetty (Thames Water) • Minor Structural Damage - Bridge • Minor Structural Damage - Jetty (Other) • Minor Pollution 	<ul style="list-style-type: none"> • Tug Operator Procedures • Emergency Plans & Procedures • Mooring Inspections • Inspection Routine • Qualified Crew 	<ul style="list-style-type: none"> • Use of reputable marine contractors

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
3	3	9	Moderate

<i>Relevant PLA Guidance</i>
<ul style="list-style-type: none"> • •

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
3	2	6	Moderate

<i>Assessment Notes</i>
<ul style="list-style-type: none"> •

12G - LTTVE - Collision with High Speed Passenger Vessel (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
12G - LTTVE	Collision - High Speed Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Fatalities • Moderate Damage - Barge • Major Damage - High Speed Craft • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • General Directions • Tug Operator Procedures • Passage Planning • VTS Navigational Broadcast • Qualified Crew • Vessel Master Experience • Thames AIS • HSC Code • VHF Communications • COLREGs 	<ul style="list-style-type: none"> • Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Use of reputable and experienced marine contractor • Berth Co-ordinator • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • Berth Co-ordinator to monitor VHF • CCTV to provide additional information to Berth Co-ordinator

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

Relevant PLA Guidance
<ul style="list-style-type: none"> • 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	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									
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Working at height	Loading / Unloading operations	Welfare Amenities							
Lifting operations	Movement of materials	Fire safety							
Slips and trips	Mooring								

13G - LTTVE- Collision with Class V Passenger Vessel (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
13G - LTTVE	Collision with Class V Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Fatalities • Moderate Damage - Barge • Major Damage - Passenger Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • Qualified Crew • BML Local Knowledge Endorsement • Thames AIS • Passage Planning • VHF Communications • Tug Operator Procedures • General Directions • Vessel Master Experience • VTS Navigational Broadcast • COLREGs • Emergency Plans & Procedures 	<ul style="list-style-type: none"> • Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Use of reputable and experienced marine contractor • Berth Co-ordinator • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • Berth Co-ordinator to monitor VHF • CCTV to provide additional information to Berth Co-ordinator

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

Relevant PLA Guidance
<ul style="list-style-type: none"> • 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
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 & 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								

14G - LTTVE - Collision with Private Leisure Vessel (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
14G - LTTVE	Collision with Private Leisure Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a private leisure vessel in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge 	<ul style="list-style-type: none"> • Multiple Fatalities • Moderate Damage - Barge • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Vessel Master Experience • Qualified Crew • VHF Communications • VTS Navigational Broadcast • Ship Towage Code of Practice • Tug Operator Procedures • COLREGs • General Directions • Admiralty Charts • Perm / Temp Notice to Mariners • Emergency Plans & Procedures • Aids to Navigation 	<ul style="list-style-type: none"> • Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Berth Co-ordinator • Berth Co-ordinator to monitor VHF • CCTV to provide additional information to Berth Coordinator

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

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

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

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

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

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

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

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

Relevant PLA Guidance
<ul style="list-style-type: none"> • 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

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 & 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 - LTTVE - Collision with Commercial Freight Operator (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
15G - LTTVE	Collision with commercial freight operator (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a commercial freight operator in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • Qualified Crew • Bridge Special Signal Lights • Emergency Plans & Procedures • VTS Navigational Broadcast • Thames AIS • Passage Planning • Ship Towage Code of Practice • BML Local Knowledge Endorsement • Tug Operator Procedures • Perm / Temp Notice to Mariners • COLREGS • General Directions 	<ul style="list-style-type: none"> • Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Berth Co-ordinator • Berth Co-ordinator to monitor VHF • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • CCTV to provide additional information to Berth Co-ordinator • Closure of Arch No 1 to all traffic

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

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	4	16	Extreme

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"> • 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	Moderate

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

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

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	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 & 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								

16G - LTTVE - Collision with Tug and Tow (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
16G - LTTVE	Collision with tug and tow (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a tug and tow in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • Qualified Crew • Bridge Special Signal Lights • Emergency Plans & Procedures • VTS Navigational Broadcast • Thames AIS • Passage Planning • Ship Towing Code of Practice • BML Local Knowledge Endorsement • Perm / Temp Notice to Mariners • Tug Operator Procedures • General Directions • COLREGS 	<ul style="list-style-type: none"> • Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Berth Co-ordinator • Berth Co-ordinator to monitor VHF • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • CCTV to provide additional information to Berth Co-ordinator • Closure of Arch No 1 to all traffic

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

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	4	16	Extreme

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"> • 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
4	3	12	High

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 & 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 - LTTVE - Contact with Hungerford Bridge (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
17G - LTTVE	Contact with Hungerford Bridge (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Fatality • Major Structural Damage - Bridge • Major Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • General Directions • PLA Bridge Guide • Passage Planning • Accurate Tidal Information • Qualified Crew • Vessel Master Experience • Tug Operator Procedures • COLREGs • Ship Towage Code of Practice • Emergency Plans & Procedures 	<ul style="list-style-type: none"> • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment

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

Post 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

Post 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

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

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

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 & 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							

18G - LTTVE - Collision with High Speed Passenger Vessel (delivery/material removal)

<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>
8G - LTTVE	Collision - High Speed Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Fatalities • Moderate Damage - Barge • Major Damage - High Speed Craft • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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"> •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

Sub Contractors Risk Assessment
Not relevant for this phase of the project

19G - LTTVE- Collision with Class V Passenger Vessel (delivery/material removal)

<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>
19G - LTTVE	Collision with Class V Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Fatalities • Moderate Damage - Barge • Major Damage - Passenger Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	Not relevant for this phase of the project	Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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"> •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

Sub Contractors Risk Assessment
Not relevant for this phase of the project

20G - LTTVE - Collision with Private Leisure Vessel (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
20G - LTTVE	Collision with Private Leisure Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a private leisure vessel in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge 	<ul style="list-style-type: none"> • Multiple Fatalities • Moderate Damage - Barge • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	Not relevant for this phase of the project	Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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"> •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

Sub Contractors Risk Assessment
Not relevant for this phase of the project

21G - LTTVE - Collision with Commercial Freight Operator (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
21G - LTTVE	Collision with commercial freight operator (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a commercial freight operator in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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"> •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

Sub Contractors Risk Assessment
Not relevant for this phase of the project

22G - LTTVE - Collision with Tug and Tow (delivery/material removal)

<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>
22G - LTTVE	Collision with tug and tow (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a tug and tow in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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"> • 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

Sub Contractors Risk Assessment
Not relevant for this phase of the project

23G - LTTVE - Contact with Hungerford Bridge (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
23G - LTTVE	Contact with Hungerford Bridge (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Fatality • Major Structural Damage - Bridge • Major Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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"> •General Directions for Navigation in the Port of London •Schedule to the General Directions for Navigation in the Port of London •Ship Towage Operations on the Thames •Code of Practice for the Safe Mooring of Vessels on the Thames •Code of Practice for Craft Towage Operations on the Thames •Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners •Port Entry Guide

Sub Contractors Risk Assessment
Not relevant for this phase of the project

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	Emergency Arch closure - Arch No 2 or 3	There may be an emergency requirement to close No 2 or 3 arch.	5	3	4	4
2H	Planned arch closure - Arch No 2 or 3	There may be a requirement to close No 2 or 3 arch for maintenance.	N/A	N/A	N/A	N/A
3H	Planned Arch closure - Arch No 1	During construction/use/Deconstruction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	N/A	N/A	N/A	N/A
4H	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Hungerford Bridge.	12	9	9	12
5H	Contact - High Speed Passenger Vessel with work site	A High Speed Passenger Vessel comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	10	6	8	10
6H	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	10	6	8	10
7H	Contact - private leisure vessel with work site	A private leisure vessel comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	10	6	8	8
8H	Contact - commercial freight operator with work site	A commercial freight operator comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	8	6	8	6

9H	Contact - tug and tow with work site	A tug and tow comes into contact with Thames Tunnel temporary or permanent work site at Victoria Embankment.	8	6	8	6
10H	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	4	8	8
11H	Mooring Breakout	A vessel involved in Thames Tunnel activities breaks free from moorings	N/A	N/A	N/A	N/A
12H	Collision - High Speed Passenger Vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment	N/A	N/A	N/A	N/A
13H	Collision - Class V passenger vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
14H	Collision - private leisure vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a private leisure vessel in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
15H	Collision - commercial freight operator (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a commercial freight operator in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A

16H	Collision - tug and tow (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a tug and tow in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
17H	Contact with Hungerford Bridge (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure.	N/A	N/A	N/A	N/A
18H	Collision - High Speed Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment	N/A	N/A	N/A	N/A
19H	Collision - Class V passenger vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
20H	Collision - private leisure vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a private leisure vessel in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A

21H	Collision - commercial freight operator (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a commercial freight operator in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
22H	Collision - tug and tow (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a tug and tow in the vicinity of Victoria Embankment.	N/A	N/A	N/A	N/A
23H	Contact with Hungerford Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure.	N/A	N/A	N/A	N/A

I.2 Worst credible hazard list – Phase D: Permanent work site

1H - LTTVE - Emergency Arch Closure - Arch No 2 or 3

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
1H - LTTVE	Emergency Arch Closure - Arch No 2 or 3	During Thames tunnel works there may be an emergency requirement to close No 2 or 3 arch.	<ul style="list-style-type: none"> Emergency Bridge Arch Closure River Incident 	<ul style="list-style-type: none"> Single Fatality Multiple Major Injuries Major Damage - Barge Major Damage - Tug Major Damage - Passenger Vessel Major Damage - High Speed Craft Major Damage - Private Leisure Vessel Major Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Major Pollution 	<ul style="list-style-type: none"> VTS Navigational Broadcast VHF Communications Aids to Navigation Thames AIS COLREGs Other arch (2 or 3) would likely remain open) 	<ul style="list-style-type: none"> See Assessment Notes

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	High

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

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

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

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	1	5	Moderate

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

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	1	4	Minor

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	1	4	Minor

Relevant PLA Guidance
<ul style="list-style-type: none"> 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
<ul style="list-style-type: none"> This hazard is covered in more detail within the main Victoria Embankment Foreshore - Maritime Issues and Navigational Risk Assessment Report. The location of the temporary and permanent works structures pose no additional navigational impact to that of the Tattershall Castle and Hispaniola and it is therefore assessed that the Thames Tunnel works do not add any additional navigational risk when there is a requirement to close arches 2 or 3.

2H - LTTVE - Planned Arch Closure - Arch No 2 or 3

<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>
2H - LTTVE	Planned Arch Closure - Arch No 2 or 3	During construction of the temporary cofferdam there may be a scheduled requirement to close No 2 or 3 arch.	<ul style="list-style-type: none"> Planned Bridge arch closure Maintenance and Inspection routines 	<ul style="list-style-type: none"> Single Fatality Multiple Major Injuries Major Damage - Barge Major Damage - Tug Major Damage - Passenger Vessel Major Damage - High Speed Craft Major Damage - Private Leisure Vessel Major Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Major Pollution 	Not relevant for this phase of the project	Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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

<i>Relevant PLA Guidance</i>
<ul style="list-style-type: none"> 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

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

3H - LTTVE - Planned Arch Closure - Arch No 1

<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>
3H - LTTVE	Planned Arch Closure - Arch No 1	During construction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	<ul style="list-style-type: none"> Planned Bridge arch closure 	<ul style="list-style-type: none"> Single Fatality Multiple Major Injuries Major Damage - Barge Major Damage - Tug Major Damage - Passenger Vessel Major Damage - High Speed Craft Major Damage - Private Leisure Vessel Major Damage - Sailing Boat / Small Vessel Bridge Arch Closure - Temporary Major Pollution 	Not relevant for this phase of the project	Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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

<i>Relevant PLA Guidance</i>
<ul style="list-style-type: none"> 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

<i>Assessment Notes</i>
<ul style="list-style-type: none"> Not relevant for this phase

4H - LTTVE - 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>
4H - LTTVE	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Hungerford Bridge.	<ul style="list-style-type: none"> • Shape and position of temporary cofferdam 	<ul style="list-style-type: none"> • Single Fatality • Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution 	<ul style="list-style-type: none"> • None identified for this hazard 	<ul style="list-style-type: none"> • A Notice to Mariners to advise of any increases in river flow: NTM to advise that for example: In Arch No3 the maximum flow may increase by up to 1/2 knot with the permanent structure in place, with the flow moving towards the south side of the bridge arch.

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

Post 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

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

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

Post 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

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

Relevant PLA Guidance
<ul style="list-style-type: none"> • 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
<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>

5H - LTTVE - Contact - High Speed Passenger Vessel with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
5H - LTTVE	Contact - High Speed passenger vessel with work site	A High Speed passenger vessel comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Fatalities • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Loss of Hull Integrity - Passenger Vessel • Loss of Hull Integrity - Passenger Vessel • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures 	<ul style="list-style-type: none"> • Permanent structure does not intrude into the river any further than existing moored vessels at this location.

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

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
5	3	15	Extreme

Relevant PLA Guidance
<ul style="list-style-type: none"> •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 •Code of Practice Passenger Vessel Operations on the 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	High

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

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 & 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							

6H - LTTVE - Contact - Class V Passenger Vessel with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
6H - LTTVE	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Fatalities • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Loss of Hull Integrity - Passenger Vessel • Loss of Hull Integrity - Passenger Vessel • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures 	<ul style="list-style-type: none"> • Permanent structure does not intrude into the river any further than existing moored vessels at this location.

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

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
5	3	15	Extreme

Relevant PLA Guidance
<ul style="list-style-type: none"> •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 •Code of Practice Passenger Vessel Operations on the 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	High

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

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 & 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							

7H - LTTVE - Contact - Private Leisure Vessel with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
7H - LTTVE	Contact - Private leisure vessel with work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Fatality • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Bridge Arch Closure - Temporary • Minor Pollution 	<ul style="list-style-type: none"> • Aids to Navigation • VHF Communications • COLREGs • General Directions • Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast 	<ul style="list-style-type: none"> • Permanent structure does not intrude into the river any further than existing moored vessels at this location.

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	Extreme

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	Extreme

Relevant PLA Guidance
<ul style="list-style-type: none"> •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	High

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

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 & 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							

8H - LTTVE - Contact - Commercial freight with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
8H - LTTVE	Contact - commercial freight with work site	Commercial freight comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures 	<ul style="list-style-type: none"> • Permanent structure does not intrude into the river any further than existing moored vessels at this location.

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
3	3	9	Moderate

Relevant PLA Guidance
<ul style="list-style-type: none"> •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
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
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 & 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							

9H - LTTVE - Contact - Tug and Tow with Work Site

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
9H - LTTVE	Contact - Tug and Tow with work site	A Tug and Tow comes into contact with Thames Tunnel work site at Victoria Embankment.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures 	<ul style="list-style-type: none"> • Permanent structure does not intrude into the river any further than existing moored vessels at this location.

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
3	3	9	Moderate

Relevant PLA Guidance
<ul style="list-style-type: none"> •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
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
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 & 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							

10H - LTTVE - 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
10H - LTTVE	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"> • Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution 	<ul style="list-style-type: none"> • Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • MCA Guidance document 	

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

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

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

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

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

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

Pre Control - Media Attention			
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"> • 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

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							

11H - LTTVE - Mooring breakout

<i>Hazard ID</i>	<i>Hazard Title</i>	<i>Hazard Description</i>	<i>Likely Hazard Causes</i>	<i>Consequence(s) Worst Credible</i>	<i>Existing Safeguards</i>	<i>Proposed Additional Mitigation</i>
11H - LTTVE	Mooring breakout	A vessel involved in Thames Tunnel activities breaks free temporary/layup moorings.	<ul style="list-style-type: none"> • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • Collision avoidance 	<ul style="list-style-type: none"> • Multiple Major Injuries • Moderate Damage - House Boat • Moderate Structural Damage - Marina • Minor Damage - Barge • Minor Damage - Jetty (Thames Water) • Minor Structural Damage - Bridge • Minor Structural Damage - Jetty (Other) • Minor Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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

<i>Relevant PLA Guidance</i>
<ul style="list-style-type: none"> • •

<i>Assessment Notes</i>
<ul style="list-style-type: none"> • Not relevant for this phase

12H - LTTVE - Collision with High Speed Passenger Vessel (construction/deconstruction)

<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>
12H - LTTVE	Collision - High Speed Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Fatalities • Moderate Damage - Barge • Major Damage - High Speed Craft • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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"> •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

Sub Contractors Risk Assessment
Not relevant for this phase of the project

13H - LTTVE- Collision with Class V Passenger Vessel (construction/deconstruction)

<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>
13H - LTTVE	Collision with Class V Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Fatalities • Moderate Damage - Barge • Major Damage - Passenger Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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"> •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

Sub Contractors Risk Assessment
Not relevant for this phase of the project

14H - LTTVE - Collision with Private Leisure Vessel (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
14H - LTTVE	Collision with Private Leisure Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a private leisure vessel in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge 	<ul style="list-style-type: none"> • Multiple Fatalities • Moderate Damage - Barge • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

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

- 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
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

Sub Contractors Risk Assessment

Not relevant for this phase of the project

15H - LTTVE - Collision with Commercial Freight Operator (construction/deconstruction)

<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>
15H - LTTVE	Collision with commercial freight operator (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a commercial freight operator in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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"> •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

Sub Contractors Risk Assessment
Not relevant for this phase of the project

16H - LTTVE - Collision with Tug and Tow (construction/deconstruction)

<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>
16H - LTTVE	Collision with tug and tow (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a tug and tow in the vicinity of Victoria Embankment, during the construction/ deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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"> • 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

Sub Contractors Risk Assessment
Not relevant for this phase of the project

17H - LTTVE - Contact with Hungerford Bridge (construction/deconstruction)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
17H - LTTVE	Contact with Hungerford Bridge (construction/Deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure during the construction/deconstruction of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Fatality • Major Structural Damage - Bridge • Major Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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"> •General Directions for Navigation in the Port of London •Schedule to the General Directions for Navigation in the Port of London •Ship Towage Operations on the Thames •Code of Practice for the Safe Mooring of Vessels on the Thames •Code of Practice for Craft Towage Operations on the Thames •Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners •Port Entry Guide

Sub Contractors Risk Assessment
Not relevant for this phase of the project

18H - LTTVE - Collision with High Speed Passenger Vessel (delivery/material removal)

<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>
8H - LTTVE	Collision - High Speed Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Victoria Embankment during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Fatalities • Moderate Damage - Barge • Major Damage - High Speed Craft • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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"> •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

Sub Contractors Risk Assessment
Not relevant for this phase of the project

19H - LTTVE- Collision with Class V Passenger Vessel (delivery/material removal)

<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>
19H - LTTVE	Collision with Class V Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a Class V passenger vessel in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Multiple Fatalities • Moderate Damage - Barge • Major Damage - Passenger Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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"> •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

Sub Contractors Risk Assessment
Not relevant for this phase of the project

20H - LTTVE - Collision with Private Leisure Vessel (delivery/material removal)

<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>
20H - LTTVE	Collision with Private Leisure Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a private leisure vessel in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge 	<ul style="list-style-type: none"> • Multiple Fatalities • Moderate Damage - Barge • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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"> •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

Sub Contractors Risk Assessment
Not relevant for this phase of the project

21H - LTTVE - Collision with Commercial Freight Operator (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
21H - LTTVE	Collision with commercial freight operator (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a commercial freight operator in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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"> •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

Sub Contractors Risk Assessment
Not relevant for this phase of the project

22H - LTTVE - Collision with Tug and Tow (delivery/material removal)

<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>
22H - LTTVE	Collision with tug and tow (delivery/material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a tug and tow in the vicinity of Victoria Embankment, during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set 	<ul style="list-style-type: none"> • Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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"> • 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

Sub Contractors Risk Assessment
Not relevant for this phase of the project

23H - LTTVE - Contact with Hungerford Bridge (delivery/material removal)

Hazard ID	Hazard Title	Hazard Description	Hazard Causes	Consequence(s) Worst Credible	Existing Safeguards	Proposed Additional Mitigation
23H - LTTVE	Contact with Hungerford Bridge (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities makes contact with Hungerford Bridge, including arches, abutments and any associated bridge superstructure during the delivery/ material removal of the temporary cofferdam.	<ul style="list-style-type: none"> • Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure 	<ul style="list-style-type: none"> • Single Fatality • Major Structural Damage - Bridge • Major Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Moderate Pollution 	<ul style="list-style-type: none"> • Not relevant for this phase of the project 	<ul style="list-style-type: none"> • Not relevant for this phase of the project

Pre Control - People			
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

Pre Control - Environment			
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

Pre Control - Operational Impact			
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

Pre Control - Media Attention			
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"> •General Directions for Navigation in the Port of London •Schedule to the General Directions for Navigation in the Port of London •Ship Towage Operations on the Thames •Code of Practice for the Safe Mooring of Vessels on the Thames •Code of Practice for Craft Towage Operations on the Thames •Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners •Port Entry Guide

Sub Contractors Risk Assessment
Not relevant for this phase of the project

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