Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Navigational Issues and Preliminary Risk Assessment

Doc Ref: **7.20.03**

Albert Embankment Foreshore - Annexes: Hazard Logs

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

Thames Tideway Tunnel

Creating a cleaner, healthier River Thames

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Annexes

List of annexes in order

Annex A: Hazard log introduction

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

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

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Annex H: Worst credible hazard log – Phase C: Removal of cofferdam

Annex I: Worst credible hazard log – Phase D: Permanent work site

Annex A – Hazard log introduction

A.1 Construction Phases

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

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

A.2 Risk assessment criteria

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

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

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

Score	Classification	Definition
1 - 2	**Slight**	No Action is required
3 - 4	**Minor**	No additional controls are required, monitoring is required to ensure no changes in circumstances
5 - 9	**Moderate**	Efforts should be made to reduce risk to ‘As Low As Reasonably Practicable’ (ALARP). Job can be performed under direct supervision of Senior Officer
10 - 14	**High**	Efforts should be made to reduce risk to ‘As Low As Reasonably Practicable’ (ALARP). Job can only be performed after authorisation from Harbour Master and after further additional controls required under the circumstances
15 - 25	**Extreme**	Intolerable risk. Job is not authorised

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

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

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

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

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

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

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

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

Hazard Id	Hazard Title	Hazard Description	People	Environment	Operational	Media
1A	Emergency Arch closure - Arch No 3 or 4	There may be an emergency requirement to close No 3 or 4 arch.	8	4	6	6
2A	Planned arch closure - Arch No 3 or 4	There may be a requirement to close No 3 or 4 arch for maintenance.				
3A	Planned Arch closure - Arch No 5	During construction/use/Deconstruction of the temporary cofferdam it is proposed that Arch No 5 is closed to all navigation.	N/A	N/A	N/A	N/A
4A	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Vauxhall 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 Albert 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 Albert 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 Albert 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 Albert 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 Albert Embankment.	6	4	6	6
10A	Contact - London Duck aquatic vehicle with Work Site	A London Duck aquatic vehicle comes into contact with Thames Tunnel temporary or permanent work site at Albert Embankment.	9	6	9	9
11A	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
12A	Mooring Breakout	A vessel involved in Thames Tunnel activities breaks free from moorings	6	4	6	4
13A	Collision - London Duck aquatic vehicle collides with another vessel	A London Duck aquatic vehicle collides with another non Thames Tunnel vessel due to effects of the Thames Tunnel works	12	9	9	12
14A	Collision - High Speed Passenger Vessel (construction/decon struction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Albert Embankment	6	4	6	8
15A	Collision - Class V passenger vessel (construction/decon struction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a Class V passenger vessel in the vicinity of Albert Embankment.	6	4	6	8
16A	Collision - private leisure vessel (construction/decon struction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a private leisure vessel in the vicinity of Albert Embankment.	9	6	9	9
17A	Collision - commercial freight operator (construction/decon struction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a commercial freight operator in the vicinity of Albert Embankment.	6	9	6	9

18A	Collision - tug and tow (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a tug and tow in the vicinity of Albert Embankment.	6	9	6	9
9A	Collision - London Duck aquatic vehicle (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a London Duck aquatic vehicle in the vicinity of Albert Embankment.	9	6	9	9
20A	Contact with Vauxhall Bridge (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Vauxhall Bridge, including arches, abutments and any associated bridge superstructure.	6	9	6	9
21A	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 Albert Embankment	N/A	N/A	N/A	N/A
22A	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 Albert Embankment.	N/A	N/A	N/A	N/A
23A	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 Albert Embankment.	N/A	N/A	N/A	N/A
24A	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 Albert Embankment.	N/A	N/A	N/A	N/A
25A	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 Albert Embankment.	N/A	N/A	N/A	N/A
26A	Collision - London Duck aquatic vehicle (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a London Duck aquatic vehicle in the vicinity of Albert Embankment.	N/A	N/A	N/A	N/A
27A	Contact with Vauxhall Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities makes contact with Vauxhall 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 - LTTAE - Emergency Arch Closure - Arch No 3 or 4

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
1A - LTTAE	Emergency Arch Closure - Arch No 3 or 4	During Thames tunnel works there may be an emergency requirement to close No 3 or 4 arch of Vauxhall Bridge.	• Emergency Bridge Arch Closure • River Incident	• 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	• VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Thames AIS • COLREGs • Other arch (3 or 4) would likely remain open	• In the event of an incident Thames Tunnel plant to be moved from 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
2	3	6	**Moderate**

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

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	2	6	**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
• 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 Albert Embankment - Maritime Issues and Navigational Risk Assessment Report.

2A - LTTAE - Planned Arch Closure - Arch No 3 or 4

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
2A - LTTAE	Planned Arch Closure - Arch No 3 or 4	During construction of the temporary cofferdam there may be a scheduled requirement to close No 3 or 4 Arch.	• Planned bridge arch closure • Maintenance and inspection routines	• 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	• Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Bridge Special Signal Lights • VTS Qualification • Other arch (3 or 4) would likely remain open	• 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**

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

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

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

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	2	6	**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
• 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 Albert Embankment - Maritime Issues and Navigational Risk Assessment Report.

3A - LTTAE - Planned Arch Closure - Arch No 5

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
3A - LTTAE	Planned Arch Closure - Arch No 5	During construction of the temporary cofferdam it is proposed that Arch No 5 is closed to all navigation.	• Planned Bridge arch closure	• 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
• 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
• It is proposed that Arch No 5 is closed to all navigation during all Phases, however this is not a change to the current situation as Arch 5 is not currently lit for navigation due to being entirely on the foreshore. •This hazard is not considered relevant due to arch not being navigable.

4A - LTTAE - Increased Flow

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
4A - LTTAE	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Vauxhall Bridge.	• Shape and position of Works structures	• 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	• Arch No 5 closed to 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

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
2	3	6	**Moderate**

Post 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**

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

Relevant PLA Guidance
• General Directions for Navigation in the Port of London • Schedule to the General Directions for Navigation in the Port of London • Pilotage Directions • Port Entry Guide • Mariners Guide to Bridges on the Tidal Thames

Assessment Notes
• Fluvial modelling (numerical and physical) have been used to develop the design of the structure. • Analysis of HR Wallingford fluvial modelling report indicates minimum change in flow in this area.

5A - LTTAE - 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 - LTTAE	Contact - High Speed passenger vessel with work site	A High Speed passenger vessel comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Multiple Major Injuries • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• 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	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
3	2	6	**Moderate**

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	2	8	**Moderate**

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

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

6A - LTTAE - 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 - LTTAE	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Multiple Major Injuries • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• 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	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
3	2	6	**Moderate**

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	2	8	**Moderate**

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

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

7A - LTTAE - 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 - LTTAE	Contact - Private leisure vessel with work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Multiple Major Injuries • Moderate Damage - Private Leisure Vessel • Capsized Private Leisure Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• Aids to Navigation • VHF Communications • COLREGs • General Directions • Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast • Arch No 5 closed to traffic	• 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**

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

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

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

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	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

- 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

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

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

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
8A - LTTAE	Contact - commercial freight with work site	Commercial freight comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Single Major Injury • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• 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	2	6	**Moderate**

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

Post 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**

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

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

9A - LTTAE - 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 - LTTAE	Contact - Tug and Tow with work site	A Tug and Tow comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Single Major Injury • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• 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	2	6	**Moderate**

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

Post 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**

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

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

10A - LTTAE - Contact - London Duck with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
10A - LTTAE	Contact - London Duck aquatic vehicle with Work Site	A London Duck aquatic vehicle comes into contact with Thames Tunnel temporary or permanent work site at Albert Embankment.	• 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 • Reduced Visibility	• Single Major Injury • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• Provision of a 'watchkeepers hut' during the construction phases of the project. • Provision of a safety boat for periods when London Duck Tours are in operation. • Fendering, ladders, safety grab chains and associated lifesaving equipment to be included in the design of the temporary and permanent works structure • Liaison and dialogue between Thames Tunnel and London Duck operator with early notification of any large scale plant movement that is likely to have an impact on Duck operations. • Emergency response exercises and training

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

- 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

11A - LTTAE - 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*
11A - LTTAE	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.	• 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	• Single Major Injury • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Moderate Damage - Passenger Vessel • Moderate Damage - Private Leisure Vessel • Minor Pollution	• 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**

Post 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**

Post 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**

Post 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**

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

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

12A - LTTAE - Mooring breakout

Hazard ID	*Hazard Title*	*Hazard Description*	*Likely Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
12A - LTTAE	Mooring breakout	A vessel involved in Thames Tunnel activities breaks free temporary/layup moorings.	• Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • Collision avoidance	• 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	• Tug Operator Procedures • Emergency Plans & Procedures • Mooring Inspections • Inspection Routine • Qualified Crew	• Use of reputable marine contractors

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

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

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

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

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	2	6	**Moderate**

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

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Relevant PLA Guidance
• Code of Practice for the Safe Mooring of Vessels on the Thames 2010

Assessment Notes

13B - LTTAE - Collision Between London Duck and other non Thames Tunnel vessel

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
13B - LTTAE	Collision - London Duck aquatic vehicle collides with another vessel	A London Duck aquatic vehicle collides with another non Thames Tunnel vessel due to effects of the Thames Tunnel works	• 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 • Reduced Visibility	• Multiple Major Injuries • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• Provision of a 'watchkeepers hut' during the construction phases of the project. • Provision of a safety boat for periods when London Duck Tours are in operation. • Fendering, ladders, safety grab chains and associated lifesaving equipment to be included in the design of the temporary and permanent works structure • Liaison and dialogue between Thames Tunnel and London Duck operator with early notification of any large scale plant movement that is likely to have an impact on Duck operations. • Emergency response exercises and training

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

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

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

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**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
4	4	16	**Extreme**

Post 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
- 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

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

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

14A - LTTAE - 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*
14A - LTTAE	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 Albert Embankment during the construction/ deconstruction of the temporary cofferdam.	• 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	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - High Speed Craft • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• 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 • 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**

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

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

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

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	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

- 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

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

15A - LTTAE- 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*
15A - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Passenger Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• 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 • 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**

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

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

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

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	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

- 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

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

16A - LTTAE - Collision with Private Leisure Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
16A LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Private Leisure Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• 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 • CCTV to provide additional information to Berth Coordinator

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

- 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

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

17A - LTTAE - Collision with Commercial Freight Operator (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
17A - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• 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

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

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

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

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

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

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

- 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	Welfare
Amenities		
Lifting operations	Movement of materials	Fire safety
Slips and trips	Mooring	

18A - LTTAE - Collision with Tug and Tow (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
18A - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• 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

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

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

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

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

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

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

- 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

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

19A - LTTAE - Collision with London Duck (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
19A - LTTAE	Collision - London Duck aquatic vehicle (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a London Duck aquatic vehicle in the vicinity of Albert Embankment.	• 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 • Reduced Visibility	• Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Passenger Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• 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	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

- 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

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

20A - LTTAE - Contact with Vauxhall Bridge (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
20A - LTTAE	Contact with Vauxhall Bridge (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities makes contact with Vauxhall Bridge, including arches, abutments and any associated bridge superstructure during the construction/ deconstruction of the temporary cofferdam.	• 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	• Single Major Injury • Minor Structural Damage - Bridge • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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	• Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment

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

Post 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**

Post 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**

Post 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**

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

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

21A - LTTAE - 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*
21A - LTTAE	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 Albert Embankment during the delivery/ material removal of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

22A - LTTAE- 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*
22A - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

23A - LTTAE - 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*
23A LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

24A - LTTAE - 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*
24A - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• Single Major Injury • Minor Damage - Barge • Moderate 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

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

Assessment Notes
Not relevant for this phase of the project

25A - LTTAE - 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*
25A - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• Single Major Injury • Minor Damage - Barge • Moderate 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

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

Assessment Notes
Not relevant for this phase of the project

26A - LTTAE - Collision with London Duck (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
26A - LTTAE	Collision - London Duck aquatic vehicle (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a London Duck aquatic vehicle in the vicinity of Albert Embankment.	• 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 • Reduced Visibility	• 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

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

Assessment Notes
Not relevant for this phase of the project

27A - LTTAE - Contact with Vauxhall Bridge (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
27A - LTTAE	Contact with Vauxhall Bridge (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities makes contact with Vauxhall Bridge, including arches, abutments and any associated bridge superstructure during the delivery/ material removal of the temporary cofferdam.	• 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	• Single Major Injury • Minor Structural Damage - Bridge • Minor Damage - Barge • 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

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

Assessment Notes
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 3 or 4	There may be an emergency requirement to close No 3 or 4 arch.	8	4	6	6
2B	Planned arch closure - Arch No 3 or 4	There may be a requirement to close No 3 or 4 arch for maintenance.	8	4	6	6
3B	Planned Arch closure - Arch No 5	During construction/use/Deconstruction of the temporary cofferdam it is proposed that Arch No 5 is closed to all navigation.	N/A	N/A	N/A	N/A
4B	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Vauxhall 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 Albert 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 Albert 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 Albert Embankment.	8	4	6	8
8B	Contact - commercial freight operator with work site	A commercial freight operator comes into contact with Thames Tunnel temporary or permanent work site at Albert 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 Albert Embankment.	6	4	6	6
10B	Contact - London Duck amphibious vehicle with Work Site	A London Duck amphibious vehicle comes into contact with Thames Tunnel temporary or permanent work site at Albert Embankment.	9	6	9	9
11B	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
12B	Mooring Breakout	A vessel involved in Thames Tunnel activities breaks free from moorings	6	4	6	4
13B	Collision - London Duck amphibious vehicle collides with another vessel	A London Duck amphibious vehicle collides with another non Thames Tunnel vessel due to effects of the Thames Tunnel works	12	9	9	12
14B	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 Albert Embankment	N/A	N/A	N/A	N/A
15B	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 Albert Embankment.	N/A	N/A	N/A	N/A
16B	Collision - private leisure vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a private leisure vessel in the vicinity of Albert Embankment.	N/A	N/A	N/A	N/A
17B	Collision - commercial freight operator (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a commercial freight operator in the vicinity of Albert Embankment.	N/A	N/A	N/A	N/A

18B	Collision - tug and tow (construction/decon struction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a tug and tow in the vicinity of Albert Embankment.	N/A	N/A	N/A	N/A
19B	Collision - London Duck amphibious vehicle (construction/decon struction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a London Duck amphibious vehicle in the vicinity of Albert Embankment.	N/A	N/A	N/A	N/A
20B	Contact with Vauxhall Bridge (construction/decon struction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Vauxhall Bridge, including arches, abutments and any associated bridge superstructure.	N/A	N/A	N/A	N/A
21B	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 Albert Embankment	6	4	6	8
22B	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 Albert Embankment.	6	4	6	8
23B	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 Albert Embankment.	9	6	9	9
24B	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 Albert Embankment.	6	9	6	9
25B	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 Albert Embankment.	6	9	6	9
26B	Collision - London Duck amphibious vehicle (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a London Duck amphibious vehicle in the vicinity of Albert Embankment.	9	6	9	9
27B	Contact with Vauxhall Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities makes contact with Vauxhall 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 - LTTAE - 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 - LTTAE	Emergency Arch Closure - Arch No 3 or 4	During Thames tunnel works there may be an emergency requirement to close No 3 or 4 arch of Vauxhall Bridge.	• Emergency Bridge Arch Closure • River Incident	• 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	• VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Thames AIS • COLREGs • Other arch (3 or 4) would likely remain open	• In the event of an incident Thames Tunnel plant to be moved from 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
2	3	6	**Moderate**

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

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	2	6	**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
• 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 Albert Embankment - Maritime Issues and Navigational Risk Assessment Report.

2B - LTTAE - 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 - LTTAE	Planned Arch Closure - Arch No 3 or 4	During construction of the temporary cofferdam there may be a scheduled requirement to close No 3 or 4 arches.	• Planned Bridge arch closure • Maintenance and Inspection routines	• 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	• Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Bridge Special Signal Lights • VTS Qualification • Other arch (3 or 4) would likely remain open	• 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**

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

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

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

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	2	6	**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
• 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 Albert Embankment - Maritime Issues and Navigational Risk Assessment Report.

3B - LTTAE - Planned Arch Closure - Arch No 5

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
3B - LTTAE	Planned Arch Closure - Arch No 5	During construction of the temporary cofferdam it is proposed that Arch No 5 is closed to all navigation.	• Planned Bridge arch closure	• 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
• 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
•It is proposed that Arch No 5 is closed to all navigation during all Phases, however this is not a change to the current situation as Arch 5 is not currently available for navigation due to available water depth. •This hazard is not considered relevant due to arch not generally being navigable.

4B - LTTAE - Increased Flow

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
4B - LTTAE	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Vauxhall Bridge.	• Shape and position of Works structures	• 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	• Arch No 5 closed to traffic	• 3D and computational modelling • A Notice to Mariners to advise of any increases in river flow

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
2	3	6	**Moderate**

Post 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**

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

Relevant PLA Guidance
• General Directions for Navigation in the Port of London • Schedule to the General Directions for Navigation in the Port of London • Pilotage Directions • Port Entry Guide • Mariners Guide to Bridges on the Tidal Thames

Assessment Notes
•Fluvial modelling (numerical and physical) have been used to develop the design of the structure. •Analysis of HR Wallingford fluvial modelling report indicates minimum change in flow in this area.

5B - LTTAE - 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 - LTTAE	Contact - High Speed passenger vessel with work site	A High Speed passenger vessel comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Multiple Major Injuries • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• 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	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
3	2	6	**Moderate**

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	2	8	**Moderate**

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

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

6B - LTTAE - 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 - LTTAE	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Multiple Major Injuries • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• 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	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
3	2	6	**Moderate**

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	2	8	**Moderate**

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

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

7B - LTTAE - 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 - LTTAE	Contact - Private leisure vessel with work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Multiple Major Injuries • Moderate Damage - Private Leisure Vessel • Capsized Private Leisure Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• Aids to Navigation • VHF Communications • COLREGs • General Directions • Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast • Arch No 5 closed to traffic	• 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**

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

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

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

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	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

- 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

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

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

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
8B - LTTAE	Contact - commercial freight with work site	Commercial freight comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Single Major Injury • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• 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	2	6	**Moderate**

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

Post 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**

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

Sub Contractors Risk Assessment

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

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

9B - LTTAE - 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 - LTTAE	Contact - Tug and Tow with work site	A Tug and Tow comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Single Major Injury • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• 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	2	6	**Moderate**

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

Post 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**

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

Sub Contractors Risk Assessment

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

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

10B - LTTAE - Contact - London Duck with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
10B - LTTAE	Contact - London Duck amphibious vehicle with Work Site	A London Duck amphibious vehicle comes into contact with Thames Tunnel temporary or permanent work site at Albert Embankment.	• 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 • Reduced Visibility	• Single Major Injury • Moderate Damage - London Duck vessel • Minor Pollution	• 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 • Arch No 5 closed to traffic	• Provision of a 'watchmans hut' during the construction phases of the project. • Provision of a safety boat for periods when London Duck Tours are in operation. • Fendering, ladders, safety grab chains and associated lifesaving equipment to be included in the design of the temporary and permanent works structure • Liaison and dialogue between Thames Tunnel and London Duck operator with early notification of any large scale plant movement that is likely to have an impact on Duck operations. • Emergency response exercises and training

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
•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 •Port Entry Guide •Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Additional Notes
Provision of a 'watchman's hut' during the construction phases of the project. There are a number of operational and responsibility issues associated with providing such a facility. Operating policy and procedures will require to be written, taking into account overall lines of responsibility and stakeholder operating requirements. Consideration should be given to providing such a facility, the issue of responsibility in the event of an incident will need to be investigated, with final responsibility of vessel movements and therefore safety falling on the vessel master.

11B - LTTAE - 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*
11B - LTTAE	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.	• 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	• Single Major Injury • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Moderate Damage - Passenger Vessel • Moderate Damage - Private Leisure Vessel • Minor Pollution	• 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**

Post 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**

Post 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**

Post 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**

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

Assessment Notes

12B - LTTAE - Mooring breakout

Hazard ID	*Hazard Title*	*Hazard Description*	*Likely Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
12B - LTTAE	Mooring breakout	A vessel involved in Thames Tunnel activities breaks free temporary/layup moorings.	• Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • Collision avoidance	• 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	• Tug Operator Procedures • Emergency Plans & Procedures • Mooring Inspections • Inspection Routine • Qualified Crew	• Use of reputable marine contractors

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

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

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

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

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	2	6	**Moderate**

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

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Relevant PLA Guidance
• Code of Practice for the Safe Mooring of Vessels on the Thames 2010

Assessment Notes

13B - LTTAE - Collision Between London Duck and other non Thames Tunnel vessel

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
13B - LTTAE	Collision - London Duck amphibious vehicle collides with another vessel	A London Duck amphibious vehicle collides with another non Thames Tunnel vessel due to effects of the Thames Tunnel works	• 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 • Reduced Visibility	• Multiple Major Injuries • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• Provision of a 'watchman's hut' during the construction phases of the project. • Provision of a safety boat for periods when London Duck Tours are in operation. • Fendering, ladders, safety grab chains and associated lifesaving equipment to be included in the design of the temporary and permanent works structure • Liaison and dialogue between Thames Tunnel and London Duck operator with early notification of any large scale plant movement that is likely to have an impact on Duck operations. • Emergency response exercises and training

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

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

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

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**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
4	4	16	**Extreme**

Post 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 •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

Assessment Notes

14B - LTTAE - 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*
14B - LTTAE	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 Albert Embankment during the construction/ deconstruction of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

15B - LTTAE- 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*
15B - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

16B - LTTAE - Collision with Private Leisure Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
16B - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

17B - LTTAE - Collision with Commercial Freight Operator (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
17B - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• Single Major Injury • Minor Damage - Barge • Moderate 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

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

Assessment Notes
Not relevant for this phase of the project

18B - LTTAE - Collision with Tug and Tow (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
18B - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• Single Major Injury • Minor Damage - Barge • Moderate 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

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

Assessment Notes
Not relevant for this phase of the project

19B - LTTAE - Collision with London Duck (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
19B - LTTAE	Collision - London Duck amphibious vehicle (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a London Duck amphibious vehicle in the vicinity of Albert Embankment.	• 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 • Reduced Visibility	• 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

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

Assessment Notes
Not relevant for this phase of the project

20B - LTTAE - Contact with Vauxhall Bridge (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
20B - LTTAE	Contact with Vauxhall Bridge (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities makes contact with Vauxhall Bridge, including arches, abutments and any associated bridge superstructure during the construction/ deconstruction of the temporary cofferdam.	• 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	• Single Major Injury • Minor Structural Damage - Bridge • Minor Damage - Barge • 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

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

Assessment Notes
Not relevant for this phase of the project

21B - LTTAE - 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*
21B - LTTAE	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 Albert Embankment during the delivery/ material removal of the temporary cofferdam.	• 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	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - High Speed Craft • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• 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 • 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**

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

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

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

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	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

- 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

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	

22B - LTTAE- 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*
22B - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Passenger Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• 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 • 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**

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

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

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

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	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

- 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

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	

23B - LTTAE - 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*
23B - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Private Leisure Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• 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 • 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	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

- 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

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

24B - LTTAE - 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*
24B - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• 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

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

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

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

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

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

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

- 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

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	

25B - LTTAE - 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*
25B - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• 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

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

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

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

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

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

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

- 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

26B - LTTAE - Collision with London Duck (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
26B - LTTAE	Collision - London Duck amphibious vehicle (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a London Duck amphibious vehicle in the vicinity of Albert Embankment.	• 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 • Reduced Visibility	• Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - London Duck Vessel • Minor Damage - Tug • Minor Pollution	• 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 • Arch No 5 closed to traffic	• 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

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

- 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

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

27B - LTTAE - Contact with Vauxhall Bridge (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
27B - LTTAE	Contact with Vauxhall Bridge (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities makes contact with Vauxhall Bridge, including arches, abutments and any associated bridge superstructure during the delivery/ material removal of the temporary cofferdam.	• 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	• Single Major Injury • Minor Structural Damage - Bridge • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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	• Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment

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

Post 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**

Post 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**

Post 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**

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

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

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 3 or 4	There may be an emergency requirement to close No 3 or 4 arch.	8	4	6	6
2C	Planned arch closure - Arch No 3 or 4	There may be a requirement to close No 3 or 4 arch for maintenance.	8	4	6	6
3C	Planned Arch closure - Arch No 5	During construction/use/Deconstruction of the temporary cofferdam it is proposed that Arch No 5 is closed to all navigation.	N/A	N/A	N/A	N/A
4C	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Vauxhall 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 Albert 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 Albert 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 Albert 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 Albert 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 Albert Embankment.	6	4	6	6
10C	Contact - London Duck amphibious vehicle with Work Site	A London Duck amphibious vehicle comes into contact with Thames Tunnel temporary or permanent work site at Albert Embankment.	9	6	9	9
11C	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
12C	Mooring Breakout	A vessel involved in Thames Tunnel activities breaks free from moorings	6	4	6	4
13C	Collision - London Duck amphibious vehicle collides with another vessel	A London Duck amphibious vehicle collides with another non Thames Tunnel vessel due to effects of the Thames Tunnel works	12	9	9	12
14C	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 Albert Embankment	6	4	6	8
15C	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 Albert Embankment.	6	4	6	8
16C	Collision - private leisure vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a private leisure vessel in the vicinity of Albert Embankment.	9	6	9	9
17C	Collision - commercial freight operator (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a commercial freight operator in the vicinity of Albert Embankment.	6	9	6	9

18C	Collision - tug and tow (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a tug and tow in the vicinity of Albert Embankment.	6	9	6	9
19C	Collision - London Duck amphibious vehicle (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a London Duck amphibious vehicle in the vicinity of Albert Embankment.	9	6	9	9
20C	Contact with Vauxhall Bridge (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Vauxhall Bridge, including arches, abutments and any associated bridge superstructure.	6	3	6	6
21C	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 Albert Embankment	N/A	N/A	N/A	N/A
22C	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 Albert Embankment.	N/A	N/A	N/A	N/A
23C	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 Albert Embankment.	N/A	N/A	N/A	N/A
24C	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 Albert Embankment.	N/A	N/A	N/A	N/A
25C	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 Albert Embankment.	N/A	N/A	N/A	N/A
26C	Collision - London Duck amphibious vehicle (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a London Duck amphibious vehicle in the vicinity of Albert Embankment.	N/A	N/A	N/A	N/A
27C	Contact with Vauxhall Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities makes contact with Vauxhall 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 - LTTAE - 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 - LTTAE	Emergency Arch Closure - Arch No 3 or 4	During Thames Tunnel works there may be an emergency requirement to close No 3 or 4 arch of Vauxhall Bridge.	• Emergency Bridge Arch Closure • River Incident	• 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	• VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Thames AIS • COLREGs • Other arch (3 or 4) would likely remain open	• In the event of an incident Thames Tunnel plant to be moved from 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
2	3	6	**Moderate**

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

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	2	6	**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
• 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 Albert Embankment - Maritime Issues and Navigational Risk Assessment Report.

2C - LTTAE - 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 - LTTAE	Planned Arch Closure - Arch No 3 or 4	During construction of the temporary cofferdam there may be a scheduled requirement to close No 3 or 4 arch.	• Planned Bridge arch closure • Maintenance and Inspection routines	• 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	• Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Bridge Special Signal Lights • VTS Qualification • Other arch (3 or 4) would likely remain open	• 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**

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

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

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

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	2	6	**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
• 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 Albert Embankment - Maritime Issues and Navigational Risk Assessment Report.

3C - LTTAE - Planned Arch Closure - Arch No 5

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
3C - LTTAE	Planned Arch Closure - Arch No 5	During construction of the temporary cofferdam it is proposed that Arch No 5 is closed to all navigation.	• Planned Bridge arch closure	• 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
• 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
•It is proposed that Arch No 5 is closed to all navigation during all Phases, however this is not a change to the current situation as Arch 5 is not currently available for navigation due to available water depth. •This hazard is not considered relevant due to arch not generally being navigable.

4C - LTTAE - Increased Flow

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
4C - LTTAE	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Vauxhall Bridge.	• Shape and position of Works structures	• 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	• Arch No 5 closed to traffic	• 3D and computational modelling • A Notice to Mariners to advise of any increases in river flow

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
2	3	6	**Moderate**

Post 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**

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

Relevant PLA Guidance
• General Directions for Navigation in the Port of London • Schedule to the General Directions for Navigation in the Port of London • Pilotage Directions • Port Entry Guide • Mariners Guide to Bridges on the Tidal Thames

Assessment Notes
• Fluvial modelling (numerical and physical) have been used to develop the design of the structure. • Analysis of HR Wallingford fluvial modelling report indicates minimum change in flow in this area.

5C - LTTAE - 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 - LTTAE	Contact - High Speed passenger vessel with work site	A High Speed passenger vessel comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Multiple Major Injuries • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• Temporary Notice to Mariners - providing notice that site restoration activities are being conducted in the area

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
3	2	6	**Moderate**

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	2	8	**Moderate**

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

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

6C - LTTAE - 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 - LTTAE	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Multiple Major Injuries • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• Temporary Notice to Mariners - providing notice that site restoration activities are being conducted in the area

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
3	2	6	**Moderate**

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	2	8	**Moderate**

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

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

7C - LTTAE - 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 - LTTAE	Contact - Private leisure vessel with work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Multiple Major Injuries • Moderate Damage - Private Leisure Vessel • Capsized Private Leisure Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• Aids to Navigation • VHF Communications • COLREGs • General Directions • Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast • Arch No 5 closed to traffic	• Temporary Notice to Mariners - providing notice that site restoration 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**

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

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

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

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	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

- 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

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

8C - LTTAE - Contact - Commercial freight with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
8C - LTTAE	Contact - commercial freight with work site	Commercial freight comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Single Major Injury • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• Temporary Notice to Mariners - providing notice that site restoration activities are being conducted in the area

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

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

Post 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**

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

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

9C - LTTAE - 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 - LTTAE	Contact - Tug and Tow with work site	A Tug and Tow comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Single Major Injury • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• Temporary Notice to Mariners - providing notice that site restoration activities are being conducted in the area

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

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

Post 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**

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

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 - LTTAE - Contact - London Duck with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
10C - LTTAE	Contact - London Duck amphibious vehicle with Work Site	A London Duck amphibious vehicle comes into contact with Thames Tunnel temporary or permanent work site at Albert Embankment.	• 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 • Reduced Visibility	• Single Major Injury • Moderate Damage - London Duck vessel • Minor Pollution	• 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 • Arch No 5 closed to traffic	• Provision of a 'watchkeepers hut' during the construction phases of the project. • Provision of a safety boat for periods when London Duck Tours are in operation. • Fendering, ladders, safety grab chains and associated lifesaving equipment to be included in the design of the temporary and permanent works structure • Liaison and dialogue between Thames Tunnel and London Duck operator with early notification of any large scale plant movement that is likely to have an impact on Duck operations. • Emergency response exercises and training

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
•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 •Port Entry Guide •Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Additional Notes
Provision of a 'watchkeepers hut' during the construction phases of the project. There are a number of operational and responsibility issues associated with providing such a facility. Operating policy and procedures will require to be written, taking into account overall lines of responsibility and stakeholder operating requirements. Consideration should be given to providing such a facility, the issue of responsibility in the event of an incident will need to be investigated, with final responsibility of vessel movements and therefore safety falling on the vessel master.

11C - LTTAE - 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*
11C - LTTAE	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.	• 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	• Single Major Injury • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Moderate Damage - Passenger Vessel • Moderate Damage - Private Leisure Vessel • Minor Pollution	• 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**

Post 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**

Post 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**

Post 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**

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

Assessment Notes

12C - LTTAE - Mooring breakout

Hazard ID	*Hazard Title*	*Hazard Description*	*Likely Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
12C - LTTAE	Mooring breakout	A vessel involved in Thames Tunnel activities breaks free temporary/layup moorings.	• Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • Collision avoidance	• 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	• Tug Operator Procedures • Emergency Plans & Procedures • Mooring Inspections • Inspection Routine • Qualified Crew	• Use of reputable marine contractors

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

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

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

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

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	2	6	**Moderate**

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

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Relevant PLA Guidance
• Code of Practice for the Safe Mooring of Vessels on the Thames 2010

Assessment Notes

13C - LTTAE - Collision Between London Duck and other non Thames Tunnel vessel

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
13C - LTTAE	Collision - London Duck amphibious vehicle collides with another vessel	A London Duck amphibious vehicle collides with another non Thames Tunnel vessel due to effects of the Thames Tunnel works	• 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 • Reduced Visibility	• Multiple Major Injuries • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• Provision of a 'watchkeepers hut' during the construction phases of the project. • Provision of a safety boat for periods when London Duck Tours are in operation. • Fendering, ladders, safety grab chains and associated lifesaving equipment to be included in the design of the temporary and permanent works structure • Liaison and dialogue between Thames Tunnel and London Duck operator with early notification of any large scale plant movement that is likely to have an impact on Duck operations. • Emergency response exercises and training

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

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

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

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**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
4	4	16	**Extreme**

Post 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
•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

Assessment Notes

14C - LTTAE - 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*
14C - LTTAE	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 Albert Embankment during the construction/ deconstruction of the temporary cofferdam.	• 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	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - High Speed Craft • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• 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 • 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**

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

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

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

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	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

- 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

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

15C - LTTAE- 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*
15C - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Passenger Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic •	• 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 • 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**

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

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

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

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	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

- 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

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

16C - LTTAE - Collision with Private Leisure Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
16C - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Private Leisure Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• 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 • CCTV to provide additional information to Berth Coordinator

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

- 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

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

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
17C - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• 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

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

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

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

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

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

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

- 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

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	

18C - LTTAE - Collision with Tug and Tow (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
18C - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• 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

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

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

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

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

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

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

- 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

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

19C - LTTAE - Collision with London Duck (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
19C - LTTAE	Collision - London Duck amphibious vehicle (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a London Duck amphibious vehicle in the vicinity of Albert Embankment.	• 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 • Reduced Visibility	• Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Passenger Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• 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

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

- 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
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

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

20C - LTTAE - Contact with Vauxhall Bridge (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
20C - LTTAE	Contact with Vauxhall Bridge (construction/ deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities makes contact with Vauxhall Bridge, including arches, abutments and any associated bridge superstructure during the construction/ deconstruction of the temporary cofferdam.	• 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	• Single Major Injury • Minor Structural Damage - Bridge • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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	• Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment

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

Post 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**

Post 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**

Post 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**

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

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

21C - LTTAE - 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*
21C - LTTAE	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 Albert Embankment during the delivery/ material removal of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

22C - LTTAE- 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*
22C - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

23C - LTTAE - 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*
23C - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

24C - LTTAE - 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*
24C - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• Single Major Injury • Minor Damage - Barge • Moderate 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

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

Assessment Notes
Not relevant for this phase of the project

25C - LTTAE - 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*
25C - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• Single Major Injury • Minor Damage - Barge • Moderate 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

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

Assessment Notes
Not relevant for this phase of the project

26C - LTTAE - Collision with London Duck (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
26C - LTTAE	Collision - London Duck amphibious vehicle (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a London Duck amphibious vehicle in the vicinity of Albert Embankment.	• 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 • Reduced Visibility	• 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

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

Assessment Notes
Not relevant for this phase of the project

27C - LTTAE - Contact with Vauxhall Bridge (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
27C - LTTAE	Contact with Vauxhall Bridge (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities makes contact with Vauxhall Bridge, including arches, abutments and any associated bridge superstructure during the delivery/ material removal of the temporary cofferdam.	• 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	• Single Major Injury • Minor Structural Damage - Bridge • Minor Damage - Barge • 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

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

Assessment Notes
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 3 or 4	There may be an emergency requirement to close No 3 or 4 arches.	8	4	6	6
2D	Planned arch closure - Arch No 3 or 4	There may be a requirement to close No 3 or 4 arches for maintenance.	N/A	N/A	N/A	N/A
3D	Planned Arch closure - Arch No 5	During construction/use/Deconstruction of the temporary cofferdam it is proposed that Arch No 5 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 Vauxhall 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 Albert 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 Albert 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 Albert 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 Albert 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 Albert Embankment.	6	4	6	6
10D	Contact - London Duck amphibious vehicle with Work Site	A London Duck amphibious vehicle comes into contact with Thames Tunnel temporary or permanent work site at Albert Embankment.	9	6	6	6
11D	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
12D	Mooring Breakout	A vessel involved in Thames Tunnel activities breaks free from moorings	N/A	N/A	N/A	N/A
13D	Collision - London Duck amphibious vehicle collides with another vessel	A London Duck amphibious vehicle collides with another non Thames Tunnel vessel due to effects of the Thames Tunnel works	12	9	9	12
14D	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 Albert Embankment	N/A	N/A	N/A	N/A
15D	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 Albert Embankment.	N/A	N/A	N/A	N/A
16D	Collision - private leisure vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a private leisure vessel in the vicinity of Albert Embankment.	N/A	N/A	N/A	N/A
17D	Collision - commercial freight operator (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a commercial freight operator in the vicinity of Albert Embankment.	N/A	N/A	N/A	N/A

18D	Collision - tug and tow (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a tug and tow in the vicinity of Albert Embankment.	N/A	N/A	N/A	N/A
19D	Collision - London Duck amphibious vehicle (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a London Duck amphibious vehicle in the vicinity of Albert Embankment.	N/A	N/A	N/A	N/A
20D	Contact with Vauxhall Bridge (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Vauxhall Bridge, including arches, abutments and any associated bridge superstructure.	N/A	N/A	N/A	N/A
21D	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 Albert Embankment	N/A	N/A	N/A	N/A
22D	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 Albert Embankment.	N/A	N/A	N/A	N/A
23D	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 Albert Embankment.	N/A	N/A	N/A	N/A
24D	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 Albert Embankment.	N/A	N/A	N/A	N/A
25D	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 Albert Embankment.	N/A	N/A	N/A	N/A
26D	Collision - London Duck amphibious vehicle (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a London Duck amphibious vehicle in the vicinity of Albert Embankment.	N/A	N/A	N/A	N/A
27D	Contact with Vauxhall Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities makes contact with Vauxhall 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 - LTTAE - 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 - LTTAE	Emergency Arch Closure - Arch No 3 or 4	During Thames tunnel works there may be an emergency requirement to close No 3 or 4 arch of Vauxhall Bridge.	• Emergency Bridge Arch Closure • River Incident	• 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	• VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Thames AIS • COLREGs • Other arch (3 or 4) would likely remain open	• In the event of an incident Thames Tunnel plant to be moved from 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
2	3	6	**Moderate**

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

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	2	6	**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
• 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 Albert Embankment - Maritime Issues and Navigational Risk Assessment Report.

2D - LTTAE - 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 - LTTAE	Planned Arch Closure - Arch No 3 or 4	During construction of the temporary cofferdam there may be a scheduled requirement to close No 3 or 4 arch.	• Planned Bridge arch closure • Maintenance and Inspection routines	• 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

Assessment Notes
Not relevant for this phase of the project

3D - LTTAE - Planned Arch Closure - Arch No 5

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
3D - LTTAE	Planned Arch Closure - Arch No 5	During construction of the temporary cofferdam it is proposed that Arch No 5 is closed to all navigation.	• Planned Bridge arch closure	• 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

Assessment Notes
•This hazard is not considered relevant due to Arch No 5 not generally being navigable.

4D - LTTAE - Increased Flow

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
4D - LTTAE	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Vauxhall Bridge.	• Shape and position of Works structures	• 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	• Arch No 5 closed to traffic	• 3D and computational modelling • A Notice to Mariners to advise of any increases in river flow

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
2	3	6	**Moderate**

Post 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**

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

Relevant PLA Guidance
• General Directions for Navigation in the Port of London • Schedule to the General Directions for Navigation in the Port of London • Pilotage Directions • Port Entry Guide • Mariners Guide to Bridges on the Tidal Thames

Assessment Notes
• Fluvial modelling (numerical and physical) have been used to develop the design of the structure. • Analysis of HR Wallingford fluvial modelling report indicates minimum change in flow in this area.

5D - LTTAE - 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 - LTTAE	Contact - High Speed passenger vessel with work site	A High Speed passenger vessel comes into contact with Thames Tunnel permanent work site at Albert Embankment.	• 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	• Multiple Major Injuries • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• Update of PLA Charts • Provision of life saving equipment such as grab chains to be located on permanent works structure

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
4	3	12	**High**

Post 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
- 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

Assessment Notes

- The permanent works at this site will be set back greater than 15m from the authorised channel.
- Passenger vessels using St Georges Wharf are not expected to navigate through Arch No.5 and therefore can be expected to be clear of the permanent works structure.
- Passenger vessels proceeding up stream are expected to be navigating within the authorised channel and are therefore also expected to be clear of the permanent works structures.

6D - LTTAE - 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 - LTTAE	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel permanent work site at Albert Embankment.	• 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	• Multiple Major Injuries • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• Update of PLA Charts • Provision of life saving equipment such as grab chains to be located on permanent works structure

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
4	3	12	**High**

Post 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
- 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

Assessment Notes

- The permanent works at this site will be set back greater than 15m from the authorised channel.
- Passenger vessels using St Georges Wharf are not expected to navigate through Arch No.5 and therefore can be expected to be clear of the permanent works structure.
- Passenger vessels proceeding up stream are expected to be navigating within the authorised channel and are therefore also expected to be clear of the permanent works structures.

7D - LTTAE - 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 - LTTAE	Contact - Private leisure vessel with work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel permanent work site at Albert Embankment.	• 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	• Multiple Major Injuries • Moderate Damage - Private Leisure Vessel • Capsized Private Leisure Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• Aids to Navigation • VHF Communications • COLREGs • General Directions • Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast • Arch No 5 closed to traffic	• Update of PLA Charts • Provision of life saving equipment such as grab chains to be located on permanent works structure

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
4	4	16	**Extreme**

Post 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 •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

Assessment Notes
• The permanent works at this site will be set back greater than 15m from the authorised channel. • Private leisure / recreational craft proceeding upstream past the Albert Embankment Foreshore site can be expected to be navigating outside of the authorised channel.

8D - LTTAE - 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 - LTTAE	Contact - commercial freight with work site	Commercial freight comes into contact with Thames Tunnel permanent work site at Albert Embankment.	• 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	• Single Major Injury • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• Update of PLA Charts • Provision of life saving equipment such as grab chains to be located on permanent works structure

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

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

Post 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**

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

Assessment Notes
• The permanent works at this site will be set back greater than 15m from the authorised channel. • Commercial freight vessels proceeding up stream are expected to be navigating within the authorised channel and are therefore expected to be clear of the permanent works structures.

9D - LTTAE - Contact - Tug and Tow with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
9D - LTTAE	Contact - Tug and Tow with work site	A Tug and Tow comes into contact with Thames Tunnel permanent work site at Albert Embankment.	• 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	• Single Major Injury • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• Update of PLA Charts • Provision of life saving equipment such as grab chains to be located on permanent works structure

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

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

Post 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**

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

Assessment Notes
• The permanent works at this site will be set back greater than 15m from the authorised channel. • Commercial freight vessels proceeding up stream are expected to be navigating within the authorised channel and are therefore expected to be clear of the permanent works structures.

10D - LTTAE - Contact - London Duck with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
10D - LTTAE	Contact - London Duck amphibious vehicle with Work Site	A London Duck amphibious vehicle comes into contact with Thames Tunnel temporary or permanent work site at Albert Embankment.	• 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 • Reduced Visibility	• Single Major Injury • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• Update of PLA Charts • Provision of life saving equipment such as grab chains to be located on permanent works structure

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
2	4	8	**Moderate**

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

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

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

Assessment Notes
• The permanent works at this site will be set back greater than 15m from the authorised channel. • The London Duck Tour vessels will be operating from Lacks Dock throughout the period of construction at the Albert Embankment Foreshore site. During consultation London Duck Tours have indicated that they are content with the positioning of the temporary works structures.

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

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Safeguards*
11D - LTTAE	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.	• 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	• Single Major Injury • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Moderate Damage - Passenger Vessel • Moderate Damage - Private Leisure Vessel • Minor Pollution	• 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**

Post 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**

Post 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**

Post 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**

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

Assessment Notes

12D - LTTAE - Mooring breakout

Hazard ID	*Hazard Title*	*Hazard Description*	*Likely Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
12D - LTTAE	Mooring breakout	A vessel involved in Thames Tunnel activities breaks free temporary/layup moorings.	• Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • Collision avoidance	• 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	• 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

Assessment Notes
Not relevant for this phase of the project

13D - LTTAE - Collision between London Duck and other non Thames Tunnel vessel

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
13D - LTTAE	Collision - London Duck amphibious vehicle collides with another vessel	A London Duck amphibious vehicle collides with another non Thames Tunnel vessel due to effects of the Thames Tunnel works	• 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 • Reduced Visibility	• Multiple Major Injuries • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• Update of PLA Charts • Provision of life saving equipment such as grab chains to be located on permanent works structure

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

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

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

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**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
4	4	16	**Extreme**

Post 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 •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

Assessment Notes

14D - LTTAE - 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*
14D - LTTAE	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 Albert Embankment during the construction/ deconstruction of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

15D - LTTAE- 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*
15D - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

16D - LTTAE - Collision with Private Leisure Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
16D - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

17D - LTTAE - Collision with Commercial Freight Operator (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
17D - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• Single Major Injury • Minor Damage - Barge • Moderate 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

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

Assessment Notes
Not relevant for this phase of the project

18D - LTTAE - Collision with Tug and Tow (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
18D - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• Single Major Injury • Minor Damage - Barge • Moderate 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

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

Assessment Notes
Not relevant for this phase of the project

19D - LTTAE - Collision with London Duck (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
19D - LTTAE	Collision - London Duck amphibious vehicle (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a London Duck amphibious vehicle in the vicinity of Albert Embankment.	• 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 • Reduced Visibility	• 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

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

Assessment Notes
Not relevant for this phase of the project

20D - LTTAE - Contact with Vauxhall Bridge (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
20D - LTTAE	Contact with Vauxhall Bridge (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities makes contact with Vauxhall Bridge, including arches, abutments and any associated bridge superstructure during the construction/ deconstruction of the temporary cofferdam.	• 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	• Single Major Injury • Minor Structural Damage - Bridge • Minor Damage - Barge • 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

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

Assessment Notes
Not relevant for this phase of the project

21D - LTTAE - 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*
21D - LTTAE	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 Albert Embankment during the delivery/ material removal of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

22D - LTTAE - 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*
22D - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

23D - LTTAE - 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*
23D - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

24D - LTTAE - 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*
24D - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• Single Major Injury • Minor Damage - Barge • Moderate 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

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

Assessment Notes
Not relevant for this phase of the project

25D - LTTAE - 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*
25D - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• Single Major Injury • Minor Damage - Barge • Moderate 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

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

Assessment Notes
Not relevant for this phase of the project

26D - LTTAE - Collision with London Duck (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
26D - LTTAE	Collision - London Duck amphibious vehicle (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a London Duck amphibious vehicle in the vicinity of Albert Embankment.	• 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 • Reduced Visibility	• 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

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

Assessment Notes
Not relevant for this phase of the project

27D - LTTAE - Contact with Vauxhall Bridge (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
27D - LTTAE	Contact with Vauxhall Bridge (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities makes contact with Vauxhall Bridge, including arches, abutments and any associated bridge superstructure during the delivery/ material removal of the temporary cofferdam.	• 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	• Single Major Injury • Minor Structural Damage - Bridge • Minor Damage - Barge • 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

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

Assessment Notes
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 3 or 4	There may be an emergency requirement to close No 3 or 4 arch.	5	3	4	4
2E	Planned arch closure - Arch No 3 or 4	There may be a requirement to close No 3 or 4 arch for maintenance.	5	3	4	4
3E	Planned Arch closure - Arch No 5	During construction/use/Deconstruction of the temporary cofferdam it is proposed that Arch No 5 is closed to all navigation.	N/A	N/A	N/A	N/A
4E	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Vauxhall 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 Albert 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 Albert 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 Albert 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 Albert 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 Albert Embankment.	8	6	8	6
10E	Contact - London Duck aquatic vehicle with Work Site	A London Duck aquatic vehicle comes into contact with Thames Tunnel temporary or permanent work site at Albert Embankment.	12	9	12	12
11E	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
12E	Mooring Breakout	A vessel involved in Thames Tunnel activities breaks free from moorings	8	6	8	6
13E	Collision - London Duck aquatic vehicle collides with another vessel	A London Duck aquatic vehicle collides with another non Thames Tunnel vessel due to effects of the Thames Tunnel works	10	8	8	10
14E	Collision - High Speed Passenger Vessel (construction/decon struction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Albert Embankment	6	4	6	8
15E	Collision - Class V passenger vessel (construction/decon struction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a Class V passenger vessel in the vicinity of Albert Embankment.	6	4	6	8
16E	Collision - private leisure vessel (construction/decon struction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a private leisure vessel in the vicinity of Albert Embankment.	8	6	8	8
17E	Collision - commercial freight operator (construction/decon struction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a commercial freight operator in the vicinity of Albert Embankment.	9	12	9	9

18E	Collision - tug and tow (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a tug and tow in the vicinity of Albert Embankment.	9	12	9	9
19E	Collision - London Duck aquatic vehicle (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a London Duck aquatic vehicle in the vicinity of Albert Embankment.	12	9	12	12
20E	Contact with Vauxhall Bridge (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Vauxhall Bridge, including arches, abutments and any associated bridge superstructure.	9	6	9	9
21E	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 Albert Embankment	N/A	N/A	N/A	N/A
22E	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 Albert Embankment.	N/A	N/A	N/A	N/A
23E	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 Albert Embankment.	N/A	N/A	N/A	N/A
24E	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 Albert Embankment.	N/A	N/A	N/A	N/A
25E	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 Albert Embankment.	N/A	N/A	N/A	N/A
26E	Collision - London Duck aquatic vehicle (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a London Duck aquatic vehicle in the vicinity of Albert Embankment.				
27E	Contact with Vauxhall Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities makes contact with Vauxhall Bridge, including arches, abutments and any associated bridge superstructure.	N/A	N/A	N/A	N/A

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

1E - LTTAE - 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 - LTTAE	Emergency Arch Closure - Arch No 3 or 4	During Thames tunnel works there may be an emergency requirement to close No 3 or 4 arch of Vauxhall Bridge.	• Emergency Bridge Arch Closure • River Incident	• 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	• VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Thames AIS • COLREGs • Other arch (3 or 4) would likely remain open	• In the event of an incident, any Thames Tunnel works that may interfere with the remaining Arch are suspended.

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

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

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

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	1	3	**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	1	4	**Minor**

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	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 Albert Embankment - Maritime Issues and Navigational Risk Assessment Report.

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

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
2E - LTTAE	Planned Arch Closure - Arch No 3 or 4	During construction of the temporary cofferdam there may be a scheduled requirement to close No 3 or 4 arch.	• Planned Bridge arch closure • Maintenance and Inspection routines	• 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	• Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Bridge Special Signal Lights • VTS Qualification • Other arch (3 or 4) would likely remain open	• 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**

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

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

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	1	3	**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	1	4	**Minor**

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	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 Albert Embankment - Maritime Issues and Navigational Risk Assessment Report.

3E - LTTAE - Planned Arch Closure - Arch No 5

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
3E - LTTAE	Planned Arch Closure - Arch No 5	During construction of the temporary cofferdam it is proposed that Arch No 5 is closed to all navigation.	• Planned Bridge arch closure	• 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

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
•It is proposed that Arch No 5 is closed to all navigation during all Phases, however this is not a change to the current situation as Arch 5 is not currently lit for navigation due to being entirely on the foreshore. •This hazard is not considered relevant due to arch not being navigable.

4E - LTTAE - Increased Flow

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
4E - LTTAE	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Vauxhall Bridge.	• Shape and position of Works structures	• 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	• Arch No 5 closed to traffic	• 3D and computational modelling • A Notice to Mariners to advise of any increases in river flow

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
• 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
• Fluvial modelling (numerical and physical) have been used to develop the design of the structure. • Analysis of HR Wallingford fluvial modelling report indicates minimum change in flow in this area.

5E - LTTAE- 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 - LTTAE	Contact - High Speed passenger vessel with work site	A High Speed passenger vessel comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• 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	• 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 • Arch No 5 closed to traffic	• 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	2	10	**High**

Post 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**

Post 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**

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	2	10	**High**

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

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

6E - LTTAE - 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 - LTTAE	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• 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	• 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 • Arch No 5 closed to traffic	• 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	2	10	**High**

Post 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**

Post 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**

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	2	10	**High**

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

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

7E - LTTAE - 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 - LTTAE	Contact - Private leisure vessel with work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Single Fatality • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• Aids to Navigation • VHF Communications • COLREGs • General Directions • Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast • Arch No 5 closed to traffic	• 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**

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
4	3	12	**High**

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

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

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

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
8E - LTTAE	Contact - commercial freight with work site	Commercial freight comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• 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 • Arch No 5 closed to traffic	• 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	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
3	2	6	**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	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
3	2	6	**Moderate**

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

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

9E - LTTAE - 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 - LTTAE	Contact - Tug and Tow with work site	A Tug and Tow comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• 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 • Arch No 5 closed to traffic	• 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	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
3	2	6	**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	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
3	2	6	**Moderate**

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

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 - LTTAE - Contact - London Duck with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
10E - LTTAE	Contact - London Duck aquatic vehicle with Work Site	A London Duck aquatic vehicle comes into contact with Thames Tunnel temporary or permanent work site at Albert Embankment.	• 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 • Reduced Visibility	• Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• 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 • Arch No 5 closed to traffic	• Provision of a 'waterman's hut' during the construction phases of the project. • Provision of a safety boat for periods when London Duck Tours are in operation. • Fendering, ladders, safety grab chains and associated lifesaving equipment to be included in the design of the temporary and permanent works structure • Liaison and dialogue between Thames Tunnel and London Duck operator with early notification of any large scale plant movement that is likely to have an impact on Duck operations. • Emergency response exercises and training

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

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

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

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

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

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

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

Post 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
- 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

11E - LTTAE - 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*
11E - LTTAE	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.	• 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	• 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	• 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

- 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
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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

12E - LTTAE - Mooring breakout

Hazard ID	*Hazard Title*	*Hazard Description*	*Likely Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
12E - LTTAE	Mooring breakout	A vessel involved in Thames Tunnel activities breaks free temporary/layup moorings.	• Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • Collision avoidance	• 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	• Tug Operator Procedures • Emergency Plans & Procedures • Mooring Inspections • Inspection Routine • Qualified Crew	• Use of reputable marine contractors

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

Assessment Notes

13E - LTTAE - Collision Between London Duck and other non Thames Tunnel vessel

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
13E - LTTAE	Collision - London Duck aquatic vehicle collides with another vessel	A London Duck aquatic vehicle collides with another non Thames Tunnel vessel due to effects of the Thames Tunnel works	• 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 • Reduced Visibility	• Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary Moderate Pollution	• 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 • Arch No 5 closed to traffic	• Provision of a 'waterman's hut' during the construction phases of the project. • Provision of a safety boat for periods when London Duck Tours are in operation. • Fendering, ladders, safety grab chains and associated lifesaving equipment to be included in the design of the temporary and permanent works structure • Liaison and dialogue between Thames Tunnel and London Duck operator with early notification of any large scale plant movement that is likely to have an impact on Duck operations. • Emergency response exercises and training

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
4	3	12	**High**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	2	8	**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

- 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

14E - LTTAE - 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*
14E - LTTAE	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 Albert Embankment during the construction/ deconstruction of the temporary cofferdam.	• 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	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - High Speed Craft • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• 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 • Arch No 5 closed to traffic	• 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 • 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

- 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

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

15E - LTTAE- 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*
15E - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - Passenger Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• 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 • Arch No 5 closed to traffic •	• 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 • 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
•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
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16E - LTTAE - Collision with Private Leisure Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
16E - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• 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	• 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 • Arch No 5 closed to traffic	• 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 • 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

- 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

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

17E - LTTAE - Collision with Commercial Freight Operator (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
17E - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution	• 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 • Arch No 5 closed to traffic	• 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

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
4	4	16	**Extreme**

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

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

- 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

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	

18E - LTTAE - Collision with Tug and Tow (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
18E - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution	• 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 • Arch No 5 closed to traffic	• 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

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
4	4	16	**Extreme**

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

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

- 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

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

19E - LTTAE - Collision with London Duck (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
19E - LTTAE	Collision - London Duck aquatic vehicle (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a London Duck aquatic vehicle in the vicinity of Albert Embankment.	• 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 • Reduced Visibility	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - Passenger Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• 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 • Arch No 5 closed to traffic	• 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	4	16	**Extreme**

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

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

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

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

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

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

Post 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
- 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

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

20E - LTTAE - Contact with Vauxhall Bridge (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
20E - LTTAE	Contact with Vauxhall Bridge (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities makes contact with Vauxhall Bridge, including arches, abutments and any associated bridge superstructure during the construction/ deconstruction of the temporary cofferdam.	• 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	• 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	• 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	• 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

- 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

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

21E - LTTAE - 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*
21E - LTTAE	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 Albert Embankment during the delivery/ material removal of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

22E - LTTAE- 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*
22E - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• 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

Assessment Notes
Not relevant for this phase of the project

23E - LTTAE - 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*
23E - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• 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

Assessment Notes
Not relevant for this phase of the project

24E - LTTAE - 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*
24E - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

25E - LTTAE - 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*
25E - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

26E - LTTAE - Collision with London Duck (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
26E - LTTAE	Collision - London Duck aquatic vehicle (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a London Duck aquatic vehicle in the vicinity of Albert Embankment.	• 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 • Reduced Visibility	• 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

Assessment Notes
Not relevant for this phase of the project

27E - LTTAE - Contact with Vauxhall Bridge (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
27E - LTTAE	Contact with Vauxhall Bridge (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities makes contact with Vauxhall Bridge, including arches, abutments and any associated bridge superstructure during the delivery/ material removal of the temporary cofferdam.	• 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	• 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	• 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

Assessment Notes
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 3 or 4	There may be an emergency requirement to close No 3 or 4 arch.	5	3	4	4
2F	Planned arch closure - Arch No 3 or 4	There may be a requirement to close No 3 or 4 arch for maintenance.	5	3	4	4
3F	Planned Arch closure - Arch No 5	During construction/use/Deconstruction of the temporary cofferdam it is proposed that Arch No 5 is closed to all navigation.	N/A	N/A	N/A	N/A
4F	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Vauxhall 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 Albert 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 Albert 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 Albert 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 Albert 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 Albert Embankment.	8	6	8	6
10F	Contact - London Duck aquatic vehicle with Work Site	A London Duck aquatic vehicle comes into contact with Thames Tunnel temporary or permanent work site at Albert Embankment.	12	9	12	12
11F	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
12F	Mooring Breakout	A vessel involved in Thames Tunnel activities breaks free from moorings	8	6	8	6
13F	Collision - London Duck aquatic vehicle collides with another vessel	A London Duck aquatic vehicle collides with another non Thames Tunnel vessel due to effects of the Thames Tunnel works	10	8	8	10
14F	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 Albert Embankment	N/A	N/A	N/A	N/A
15F	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 Albert Embankment.	N/A	N/A	N/A	N/A
16F	Collision - private leisure vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a private leisure vessel in the vicinity of Albert Embankment.	N/A	N/A	N/A	N/A
17F	Collision - commercial freight operator (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a commercial freight operator in the vicinity of Albert Embankment.	N/A	N/A	N/A	N/A
18F	Collision - tug and tow (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a tug and tow in the vicinity of Albert Embankment.	N/A	N/A	N/A	N/A

19F	Collision - London Duck aquatic vehicle (construction/decon struction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a London Duck aquatic vehicle in the vicinity of Albert Embankment.	N/A	N/A	N/A	N/A
20F	Contact with Vauxhall Bridge (construction/decon struction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Vauxhall Bridge, including arches, abutments and any associated bridge superstructure.	N/A	N/A	N/A	N/A
21F	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 Albert Embankment	6	4	6	8
22F	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 Albert Embankment.	6	4	6	8
23F	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 Albert Embankment.	8	6	8	8
24F	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 Albert Embankment.	9	12	9	9
25F	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 Albert Embankment.	9	12	9	9
26F	Collision - London Duck aquatic vehicle (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a London Duck aquatic vehicle in the vicinity of Albert Embankment.	12	9	12	12
27F	Contact with Vauxhall Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities makes contact with Vauxhall 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 - LTTAE - 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 - LTTAE	Emergency Arch Closure - Arch No 3 or 4	During Thames tunnel works there may be an emergency requirement to close No 3 or 4 arch of Vauxhall Bridge.	• Emergency Bridge Arch Closure • River Incident	• 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	• VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Thames AIS • COLREGs • Other arch (3 or 4) would likely remain open	• In the event of an incident, any Thames Tunnel works that may interfere with the remaining Arch are suspended.

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

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

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

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	1	3	**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	1	4	**Minor**

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	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 Albert Embankment - Maritime Issues and Navigational Risk Assessment Report.

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

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
2F - LTTAE	Planned Arch Closure - Arch No 3 or 4	During construction of the temporary cofferdam there may be a scheduled requirement to close No 3 or 4 arch.	• Planned Bridge arch closure • Maintenance and Inspection routines	• 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	• Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Bridge Special Signal Lights • VTS Qualification • Other arch (3 or 4) would likely remain open	• 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**

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

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

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	1	3	**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	1	4	**Minor**

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	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 Albert Embankment - Maritime Issues and Navigational Risk Assessment Report.

3F - LTTAE - Planned Arch Closure - Arch No 5

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
3F - LTTAE	Planned Arch Closure - Arch No 5	During construction of the temporary cofferdam it is proposed that Arch No 5 is closed to all navigation.	• Planned Bridge arch closure	• 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

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
• It is proposed that Arch No 5 is closed to all navigation during all Phases, however this is not a change to the current situation as Arch 5 is not currently lit for navigation due to being entirely on the foreshore. • This hazard is not considered relevant due to arch not being navigable.

4F - LTTAE - Increased Flow

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
4F - LTTAE	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Vauxhall Bridge.	• Shape and position of Works structures	• 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	• Arch No 5 closed to traffic	• 3D and computational modelling • A Notice to Mariners to advise of any increases in river flow

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
• 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
• Fluvial modelling (numerical and physical) have been used to develop the design of the structure. • Analysis of HR Wallingford fluvial modelling report indicates minimum change in flow in this area.

5F - LTTAE - 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 - LTTAE	Contact - High Speed passenger vessel with work site	A High Speed passenger vessel comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• 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	• 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 • Arch No 5 closed to traffic	• 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	2	10	**High**

Post 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**

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

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	82	**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
5	2	10	**High**

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

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

6F - LTTAE - 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 - LTTAE	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• 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	• 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 • Arch No 5 closed to traffic	• 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	2	10	**High**

Post 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**

Post 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**

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	2	10	**High**

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

7F - LTTAE - 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 - LTTAE	Contact - Private leisure vessel with work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Single Fatality • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• Aids to Navigation • VHF Communications • COLREGs • General Directions • Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast • Arch No 5 closed to traffic	• 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**

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
4	3	12	**High**

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

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

8F - LTTAE - Contact - Commercial freight with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
8F - LTTAE	Contact - commercial freight with work site	Commercial freight comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• 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 • Arch No 5 closed to traffic	• 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	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
3	2	6	**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	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
3	2	6	**Moderate**

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

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

9F - LTTAE - 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 - LTTAE	Contact - Tug and Tow with work site	A Tug and Tow comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• 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 • Arch No 5 closed to traffic	• 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	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
3	2	6	**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	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
3	2	6	**Moderate**

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

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

10F - LTTAE - Contact - London Duck with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
10F - LTTAE	Contact - London Duck aquatic vehicle with Work Site	A London Duck aquatic vehicle comes into contact with Thames Tunnel temporary or permanent work site at Albert Embankment.	• 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 • Reduced Visibility	• Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• 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 • Arch No 5 closed to traffic	• Provision of a 'waterman's hut' during the construction phases of the project. • Provision of a safety boat for periods when London Duck Tours are in operation. • Fendering, ladders, safety grab chains and associated lifesaving equipment to be included in the design of the temporary and permanent works structure • Liaison and dialogue between Thames Tunnel and London Duck operator with early notification of any large scale plant movement that is likely to have an impact on Duck operations. • Emergency response exercises and training

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

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

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

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

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

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

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

Post 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
- 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

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

11F - LTTAE - 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*
11F - LTTAE	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.	• 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	• 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	• 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

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

12F - LTTAE - Mooring breakout

Hazard ID	*Hazard Title*	*Hazard Description*	*Likely Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
12F - LTTAE	Mooring breakout	A vessel involved in Thames Tunnel activities breaks free temporary/layup moorings.	• Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • Collision avoidance	• 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	• Tug Operator Procedures • Emergency Plans & Procedures • Mooring Inspections • Inspection Routine • Qualified Crew	• Use of reputable marine contractors

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

Assessment Notes

13F - LTTAE - Collision Between London Duck and other non Thames Tunnel vessel

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
13F - LTTAE	Collision - London Duck aquatic vehicle collides with another vessel	A London Duck aquatic vehicle collides with another non Thames Tunnel vessel due to effects of the Thames Tunnel works	• 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 • Reduced Visibility	• Multiple Major Injuries • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• Provision of a 'waterman's hut' during the construction phases of the project. • Provision of a safety boat for periods when London Duck Tours are in operation. • Fendering, ladders, safety grab chains and associated lifesaving equipment to be included in the design of the temporary and permanent works structure • Liaison and dialogue between Thames Tunnel and London Duck operator with early notification of any large scale plant movement that is likely to have an impact on Duck operations. • Emergency response exercises and training

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
4	3	12	**High**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	2	8	**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

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

14F - LTTAE - 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*
14F - LTTAE	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 Albert Embankment during the construction/ deconstruction of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
•
• Not relevant for this phase of the project
•

15F - LTTAE- 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*
15F - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• 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

Assessment Notes
Not relevant for this phase of the project

16F - LTTAE - Collision with Private Leisure Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
16F - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• 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

Assessment Notes
Not relevant for this phase of the project

17F - LTTAE - Collision with Commercial Freight Operator (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
17F - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

18F - LTTAE - Collision with Tug and Tow (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
18F - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

19F - LTTAE - Collision with London Duck (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
19F - LTTAE	Collision - London Duck aquatic vehicle (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a London Duck aquatic vehicle in the vicinity of Albert Embankment.	• 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 • Reduced Visibility	• 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

Assessment Notes
Not relevant for this phase of the project

20F - LTTAE - Contact with Vauxhall Bridge (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
20F - LTTAE	Contact with Vauxhall Bridge (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities makes contact with Vauxhall Bridge, including arches, abutments and any associated bridge superstructure during the construction/ deconstruction of the temporary cofferdam.	• 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	• 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	• 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

Assessment Notes
Not relevant for this phase of the project

21F - LTTAE - 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*
21F - LTTAE	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 Albert Embankment during the delivery/ material removal of the temporary cofferdam.	• 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	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - High Speed Craft • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• 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 • Arch No 5 closed to traffic	• 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 • 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
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

- 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

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	

22F - LTTAE- 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*
22F - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - Passenger Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• 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 • Arch No 5 closed to traffic	• 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 • 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
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

- 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

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

23F - LTTAE - 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*
23F - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• 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	• 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 • Arch No 5 closed to traffic	• 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 • 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
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

- 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

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

24F - LTTAE - 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*
24F - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution	• 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 • Arch No 5 closed to traffic	• 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

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
4	4	16	**Extreme**

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

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

- 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

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	

25F - LTTAE - 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*
25F - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution	• 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 • Arch No 5 closed to traffic	• 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

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
4	4	16	**Extreme**

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

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

- 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

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

26F - LTTAE - Collision with London Duck (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
26F - LTTAE	Collision - London Duck aquatic vehicle (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a London Duck aquatic vehicle in the vicinity of Albert Embankment.	• 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 • Reduced Visibility	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - Passenger Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• 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 • Arch No 5 closed to traffic	• 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

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

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

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

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

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

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

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

Post 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
•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
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

27F - LTTAE - Contact with Vauxhall Bridge (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
27F - LTTAE	Contact with Vauxhall Bridge (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities makes contact with Vauxhall Bridge, including arches, abutments and any associated bridge superstructure during the delivery/ material removal of the temporary cofferdam.	• 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	• 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	• 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	• 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
•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
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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 3 or 4	There may be an emergency requirement to close No 3 or 4 arch.	5	3	4	4
2G	Planned arch closure - Arch No 3 or 4	There may be a requirement to close No 3 or 4 arch for maintenance.	5	3	4	4
3G	Planned Arch closure - Arch No 5	During construction/use/Deconstruction of the temporary cofferdam it is proposed that Arch No 5 is closed to all navigation.	N/A	N/A	N/A	N/A
4G	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Vauxhall 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 Albert 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 Albert 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 Albert 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 Albert 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 Albert Embankment.	8	6	8	6
10G	Contact - London Duck aquatic vehicle with Work Site	A London Duck aquatic vehicle comes into contact with Thames Tunnel temporary or permanent work site at Albert Embankment.	12	9	12	12
11G	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
12G	Mooring Breakout	A vessel involved in Thames Tunnel activities breaks free from moorings	8	6	8	6
13G	Collision - London Duck aquatic vehicle collides with another vessel	A London Duck aquatic vehicle collides with another non Thames Tunnel vessel due to effects of the Thames Tunnel works	10	8	8	10
14G	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 Albert Embankment	6	4	6	8
15G	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 Albert Embankment.	8	4	6	8

16G	Collision - private leisure vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a private leisure vessel in the vicinity of Albert Embankment.	8	6	8	8
17G	Collision - commercial freight operator (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a commercial freight operator in the vicinity of Albert Embankment.	9	12	6	6
18G	Collision - tug and tow (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a tug and tow in the vicinity of Albert Embankment.	9	12	9	9
19G	Collision - London Duck aquatic vehicle (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a London Duck aquatic vehicle in the vicinity of Albert Embankment.	12	9	12	12
20G	Contact with Vauxhall Bridge (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Vauxhall Bridge, including arches, abutments and any associated bridge superstructure.	9	6	9	9
21G	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 Albert Embankment	N/A	N/A	N/A	N/A
22G	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 Albert Embankment.	N/A	N/A	N/A	N/A
23G	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 Albert Embankment.	N/A	N/A	N/A	N/A
24G	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 Albert Embankment.	N/A	N/A	N/A	N/A
25G	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 Albert Embankment.	N/A	N/A	N/A	N/A
26G	Collision - London Duck aquatic vehicle (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a London Duck aquatic vehicle in the vicinity of Albert Embankment.	N/A	N/A	N/A	N/A
27G	Contact with Vauxhall Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities makes contact with Vauxhall 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 - LTTAE - 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 - LTTAE	Emergency Arch Closure - Arch No 3 or 4	During Thames tunnel works there may be an emergency requirement to close No 3 or 4 arch of Vauxhall Bridge.	• Emergency Bridge Arch Closure • River Incident	• 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	• VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Thames AIS • COLREGs • Other arch (3 or 4) would likely remain open	• In the event of an incident, any Thames Tunnel works that may interfere with the remaining Arch are suspended.

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

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

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

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	1	3	**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	1	4	**Minor**

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	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 Albert Embankment - Maritime Issues and Navigational Risk Assessment Report.

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

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
2G - LTTAE	Planned Arch Closure - Arch No 3 or 4	During construction of the temporary cofferdam there may be a scheduled requirement to close No 3 or 4 arch.	• Planned Bridge arch closure • Maintenance and Inspection routines	• 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	• Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Bridge Special Signal Lights • VTS Qualification • Other arch (3 or 4) would likely remain open	• 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**

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

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

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	1	3	**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	1	4	**Minor**

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	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 Albert Embankment - Maritime Issues and Navigational Risk Assessment Report.

3G - LTTAE - Planned Arch Closure - Arch No 5

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
3G - LTTAE	Planned Arch Closure - Arch No 5	During construction of the temporary cofferdam it is proposed that Arch No 5 is closed to all navigation.	• Planned Bridge arch closure	• 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

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
•It is proposed that Arch No 5 is closed to all navigation during all Phases, however this is not a change to the current situation as Arch 5 is not currently lit for navigation due to being entirely on the foreshore. •This hazard is not considered relevant due to arch not being navigable.

4G - LTTAE - Increased Flow

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
4G - LTTAE	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Vauxhall Bridge.	• Shape and position of Works structures	• 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	• Arch No 5 closed to traffic	• 3D and computational modelling • A Notice to Mariners to advise of any increases in river flow

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
• 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
Fluvial modelling (numerical and physical) have been used to develop the design of the structure. Analysis of HR Wallingford fluvial modelling report indicates minimum change in flow in this area.

5G - LTTAE - 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 - LTTAE	Contact - High Speed passenger vessel with work site	A High Speed passenger vessel comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• 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	• 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 • Arch No 5 closed to traffic	• 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	2	10	**High**

Post 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**

Post 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**

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	2	10	**High**

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

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

6G - LTTAE - 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 - LTTAE	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• 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	• 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 • Arch No 5 closed to traffic	• 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	2	10	**High**

Post 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**

Post 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**

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	2	10	**High**

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

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

7G - LTTAE - 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 - LTTAE	Contact - Private leisure vessel with work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Single Fatality • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• Aids to Navigation • VHF Communications • COLREGs • General Directions • Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast • Arch No 5 closed to traffic	• 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**

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
4	3	12	**High**

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

Sub Contractors Risk Assessment

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

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

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
8G - LTTAE	Contact - commercial freight with work site	Commercial freight comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• 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 • Arch No 5 closed to traffic	• 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	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
3	2	6	**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	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
3	2	6	**Moderate**

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

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 - LTTAE - 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 - LTTAE	Contact - Tug and Tow with work site	A Tug and Tow comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• 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 • Arch No 5 closed to traffic	• 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	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
3	2	6	**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	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
3	2	6	**Moderate**

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

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

10G - LTTAE - Contact - London Duck with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
10G - LTTAE	Contact - London Duck aquatic vehicle with Work Site	A London Duck aquatic vehicle comes into contact with Thames Tunnel temporary or permanent work site at Albert Embankment.	• 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 • Reduced Visibility	• Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• 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 • Arch No 5 closed to traffic	• Provision of a 'waterman's hut' during the construction phases of the project. • Provision of a safety boat for periods when London Duck Tours are in operation. • Fendering, ladders, safety grab chains and associated lifesaving equipment to be included in the design of the temporary and permanent works structure • Liaison and dialogue between Thames Tunnel and London Duck operator with early notification of any large scale plant movement that is likely to have an impact on Duck operations. • Emergency response exercises and training

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

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

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

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

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

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

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

Post 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
- 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

11G - LTTAE - 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*
11G - LTTAE	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.	• 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	• 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	• 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
•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
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

12G - LTTAE - Mooring breakout

Hazard ID	*Hazard Title*	*Hazard Description*	*Likely Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
12G - LTTAE	Mooring breakout	A vessel involved in Thames Tunnel activities breaks free temporary/layup moorings.	• Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • Collision avoidance	• 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	• Tug Operator Procedures • Emergency Plans & Procedures • Mooring Inspections • Inspection Routine • Qualified Crew	• Use of reputable marine contractors

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

Assessment Notes

13G - LTTAE - Collision Between London Duck and other non Thames Tunnel vessel

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
13G - LTTAE	Collision - London Duck aquatic vehicle collides with another vessel	A London Duck aquatic vehicle collides with another non Thames Tunnel vessel due to effects of the Thames Tunnel works	• 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 • Reduced Visibility	• Multiple Major Injuries • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• Provision of a 'waterman's hut' during the construction phases of the project. • Provision of a safety boat for periods when London Duck Tours are in operation. • Fendering, ladders, safety grab chains and associated lifesaving equipment to be included in the design of the temporary and permanent works structure • Liaison and dialogue between Thames Tunnel and London Duck operator with early notification of any large scale plant movement that is likely to have an impact on Duck operations. • Emergency response exercises and training

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
4	3	12	**High**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	2	8	**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

- 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

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

14G - LTTAE - 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*
14G - LTTAE	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 Albert Embankment during the construction/ deconstruction of the temporary cofferdam.	• 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	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - High Speed Craft • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• 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 • Arch No 5 closed to traffic	• 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 • 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

- 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

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	

15G - LTTAE- 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*
15G - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - Passenger Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• 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 • Arch No 5 closed to traffic •	• 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 • 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

- 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

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	

16G - LTTAE - Collision with Private Leisure Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
16G - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• 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	• 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 • Arch No 5 closed to traffic	• 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 • 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

- 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

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

17G - LTTAE - Collision with Commercial Freight Operator (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
17G - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution	• 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 • Arch No 5 closed to traffic	• 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

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
4	4	16	**Extreme**

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

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	6	**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	6	**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

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	

18G - LTTAE - Collision with Tug and Tow (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
18G - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution	• 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 • Arch No 5 closed to traffic	• 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

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
4	4	16	**Extreme**

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

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

- 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

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

19G - LTTAE - Collision with London Duck (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
19G - LTTAE	Collision - London Duck aquatic vehicle (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a London Duck aquatic vehicle in the vicinity of Albert Embankment.	• 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 • Reduced Visibility	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - Passenger Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• 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 • Arch No 5 closed to traffic	• 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	4	16	**Extreme**

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

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

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

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

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

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

Post 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
- 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

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

20G - LTTAE - Contact with Vauxhall Bridge (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
20G - LTTAE	Contact with Vauxhall Bridge (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities makes contact with Vauxhall Bridge, including arches, abutments and any associated bridge superstructure during the construction/ deconstruction of the temporary cofferdam.	• 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	• 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	• 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	• 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

- 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

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

21G - LTTAE - 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*
21G - LTTAE	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 Albert Embankment during the delivery/ material removal of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

22G - LTTAE- 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*
22G - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• 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

Assessment Notes
Not relevant for this phase of the project

23G - LTTAE - 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*
23G - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• 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

Assessment Notes
Not relevant for this phase of the project

24G - LTTAE - 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*
24G - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

25G - LTTAE - 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*
25G - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

26G - LTTAE - Collision with London Duck (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
26G - LTTAE	Collision - London Duck aquatic vehicle (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a London Duck aquatic vehicle in the vicinity of Albert Embankment.	• 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 • Reduced Visibility	• 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

Assessment Notes
Not relevant for this phase of the project

27G - LTTAE - Contact with VauxhallBridge (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
27G - LTTAE	Contact with Vauxhall Bridge (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities makes contact with Vauxhall Bridge, including arches, abutments and any associated bridge superstructure during the delivery/ material removal of the temporary cofferdam.	• 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	• 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	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

Assessment Notes
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 3 or 4	There may be an emergency requirement to close No 3 or 4 arch.				
2H	Planned arch closure - Arch No 3 or 4	There may be a requirement to close No 3 or 4 arch for maintenance.	N/A	N/A	N/A	N/A
3H	Planned Arch closure - Arch No 5	During construction/use/Deconstruction of the temporary cofferdam it is proposed that Arch No 5 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 Vauxhall 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 Albert 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 Albert 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 Albert 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 Albert 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 Albert Embankment.	8	6	8	6
10H	Contact - London Duck aquatic vehicle with Work Site	A London Duck aquatic vehicle comes into contact with Thames Tunnel temporary or permanent work site at Albert Embankment.	12	9	9	9
11H	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
12H	Mooring Breakout	A vessel involved in Thames Tunnel activities breaks free from moorings	N/A	N/A	N/A	N/A
13H	Collision - London Duck aquatic vehicle collides with another vessel	A London Duck aquatic vehicle collides with another non Thames Tunnel vessel due to effects of the Thames Tunnel works	10	8	8	10
14H	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 Albert Embankment	N/A	N/A	N/A	N/A
15H	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 Albert Embankment.	N/A	N/A	N/A	N/A
16H	Collision - private leisure vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a private leisure vessel in the vicinity of Albert Embankment.	N/A	N/A	N/A	N/A
17H	Collision - commercial freight operator (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a commercial freight operator in the vicinity of Albert Embankment.	N/A	N/A	N/A	N/A

18H	Collision - tug and tow (construction/decon struction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a tug and tow in the vicinity of Albert Embankment.	N/A	N/A	N/A	N/A
19H	Collision - London Duck aquatic vehicle (construction/decon struction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a London Duck aquatic vehicle in the vicinity of Albert Embankment.	N/A	N/A	N/A	N/A
20H	Contact with Vauxhall Bridge (construction/decon struction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Vauxhall Bridge, including arches, abutments and any associated bridge superstructure.	N/A	N/A	N/A	N/A
21H	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 Albert Embankment	N/A	N/A	N/A	N/A
22H	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 Albert Embankment.	N/A	N/A	N/A	N/A
23H	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 Albert Embankment.	N/A	N/A	N/A	N/A
24H	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 Albert Embankment.	N/A	N/A	N/A	N/A
25H	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 Albert Embankment.	N/A	N/A	N/A	N/A
26H	Collision - London Duck aquatic vehicle (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a London Duck aquatic vehicle in the vicinity of Albert Embankment.	N/A	N/A	N/A	N/A
27H	Contact with Vauxhall Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities makes contact with Vauxhall 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 - LTTAE - 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 - LTTAE	Emergency Arch Closure - Arch No 3 or 4	During Thames tunnel works there may be an emergency requirement to close No 3 or 4 arch of Vauxhall Bridge.	• Emergency Bridge Arch Closure • River Incident	• 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	• VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Thames AIS • COLREGs • Other arch (3 or 4) would likely remain open	In the event of an incident, any Thames Tunnel works that may interfere with the remaining Arch are suspended.

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

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

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

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	1	3	**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	1	4	**Minor**

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	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 Albert Embankment - Maritime Issues and Navigational Risk Assessment Report.

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

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
2H - LTTAE	Planned Arch Closure - Arch No 3 or 4	During construction of the temporary cofferdam there may be a scheduled requirement to close No 3 or 4 arch.	• Planned Bridge arch closure • Maintenance and Inspection routines	• 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

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 Albert Embankment - Maritime Issues and Navigational Risk Assessment Report.

3H - LTTAE - Planned Arch Closure - Arch No 5

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
3H - LTTAE	Planned Arch Closure - Arch No 5	During construction of the temporary cofferdam it is proposed that Arch No 5 is closed to all navigation.	• Planned Bridge arch closure	• 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

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
•It is proposed that Arch No 5 is closed to all navigation during all Phases, however this is not a change to the current situation as Arch 5 is not currently lit for navigation due to being entirely on the foreshore. •This hazard is not considered relevant due to arch not being navigable.

4H - LTTAE - Increased Flow

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
4H - LTTAE	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Vauxhall Bridge.	• Shape and position of Works structures	• 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	• Arch No 5 closed to traffic	• 3D and computational modelling • A Notice to Mariners to advise of any increases in river flow

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
• 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
Fluvial modelling (numerical and physical) have been used to develop the design of the structure. Analysis of HR Wallingford fluvial modelling report indicates minimum change in flow in this area.

5H - LTTAE - 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 - LTTAE	Contact - High Speed passenger vessel with work site	A High Speed passenger vessel comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• 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	• 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 • Arch No 5 closed to traffic	• 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	2	10	**High**

Post 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**

Post 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**

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	2	10	**High**

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

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

6H - LTTAE - 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 - LTTAE	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• 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	• 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 • Arch No 5 closed to traffic	• 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	2	10	**High**

Post 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**

Post 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**

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	2	10	**High**

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

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

7H - LTTAE - 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 - LTTAE	Contact - Private leisure vessel with work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Single Fatality • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• Aids to Navigation • VHF Communications • COLREGs • General Directions • Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast • Arch No 5 closed to traffic	• 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**

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
4	3	12	**Extreme**

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

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

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

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
8H - LTTAE	Contact - commercial freight with work site	Commercial freight comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• 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 • Arch No 5 closed to traffic	• 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	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
3	2	6	**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	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
3	2	6	**Moderate**

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

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

9H - LTTAE - 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 - LTTAE	Contact - Tug and Tow with work site	A Tug and Tow comes into contact with Thames Tunnel work site at Albert Embankment.	• 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	• Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• 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 • Arch No 5 closed to traffic	• 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	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
3	2	6	**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	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
3	2	6	**Moderate**

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

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

10H - LTTAE - Contact - London Duck with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
10H - LTTAE	Contact - London Duck aquatic vehicle with Work Site	A London Duck aquatic vehicle comes into contact with Thames Tunnel temporary or permanent work site at Albert Embankment.	• 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 • Reduced Visibility	• Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• 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 • Arch No 5 closed to traffic	• Update of PLA Charts • Provision of life saving equipment such as grab chains to be located on permanent works structure

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

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

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

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

- 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

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

11H - LTTAE - Vessels subject to increased interaction during periods of low water

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Safeguards*
11H - LTTAE	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.	• 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	• 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	• 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
•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
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

12H - LTTAE - Mooring breakout

Hazard ID	*Hazard Title*	*Hazard Description*	*Likely Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
12H - LTTAE	Mooring breakout	A vessel involved in Thames Tunnel activities breaks free temporary/layup moorings.	• Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • Collision avoidance	• 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	• 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

Assessment Notes
Not relevant for this phase

13H - LTTAE - Collision Between London Duck and other non Thames Tunnel vessel

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
13H - LTTAE	Collision - London Duck aquatic vehicle collides with another vessel	A London Duck aquatic vehicle collides with another non Thames Tunnel vessel due to effects of the Thames Tunnel works	• 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 • Reduced Visibility	• Multiple Major Injuries • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• 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 • Arch No 5 closed to traffic	• Update of PLA Charts • Provision of life saving equipment such as grab chains to be located on permanent works structure

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
4	3	12	**High**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	2	8	**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
•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

Assessment Notes

14H - LTTAE - 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*
14H - LTTAE	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 Albert Embankment during the construction/ deconstruction of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

15H - LTTAE- 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*
15H - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• 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

Assessment Notes
Not relevant for this phase of the project

16H - LTTAE - Collision with Private Leisure Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
16H - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• 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

Assessment Notes
Not relevant for this phase of the project

17H - LTTAE - Collision with Commercial Freight Operator (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
17H - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

18H - LTTAE - Collision with Tug and Tow (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
18H - LTTAE	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 Albert Embankment, during the construction/ deconstruction of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

19H - LTTAE - Collision with London Duck (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
19H - LTTAE	Collision - London Duck aquatic vehicle (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a London Duck aquatic vehicle in the vicinity of Albert Embankment.	• 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 • Reduced Visibility	• 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

Assessment Notes
Not relevant for this phase of the project

20H - LTTAE - Contact with Vauxhall Bridge (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
20H - LTTAE	Contact with Vauxhall Bridge (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities makes contact with Vauxhall Bridge, including arches, abutments and any associated bridge superstructure during the construction/ deconstruction of the temporary cofferdam.	• 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	• 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	• 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

Assessment Notes
Not relevant for this phase of the project

21H - LTTAE - 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*
21H - LTTAE	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 Albert Embankment during the delivery/ material removal of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

22H - LTTAE- 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*
22H - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• 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

Assessment Notes
Not relevant for this phase of the project

23H - LTTAE - 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*
23H - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• 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

Assessment Notes
Not relevant for this phase of the project

24H - LTTAE - 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*
24H - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

25H - LTTAE - 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*
25H - LTTAE	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 Albert Embankment, during the delivery/ material removal of the temporary cofferdam.	• 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	• 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

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

Assessment Notes
Not relevant for this phase of the project

26H - LTTAE - Collision with London Duck (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
26H - LTTAE	Collision - London Duck aquatic vehicle (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a London Duck aquatic vehicle in the vicinity of Albert Embankment.	• 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 • Reduced Visibility	• 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

Assessment Notes
Not relevant for this phase of the project

27H - LTTAE - Contact with VauxhallBridge (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
27H - LTTAE	Contact with Vauxhall Bridge (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities makes contact with Vauxhall Bridge, including arches, abutments and any associated bridge superstructure during the delivery/ material removal of the temporary cofferdam.	• 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	• 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	• 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

Assessment Notes
Not relevant for this phase of the project

Thames Water Utilities Limited
Clearwater Court, Vastern Road, Reading RG1 8DB

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