

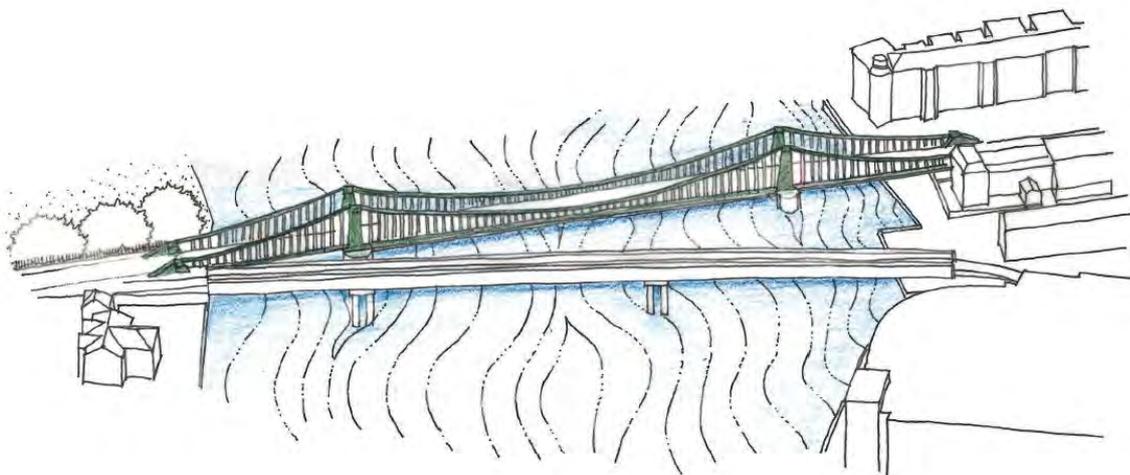


**Transport
for London**

Temporary Pedestrian and Cycle Bridge

Flood Risk Assessment

P e l l F r i s c h m a n n



Date: February 2020

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Abbreviations

TfL	Transport for London
NPPF	National Policy Planning Framework
FRA	Flood Risk Assessment
SFRA	Strategic Flood Risk Assessment
LBRuT	London Borough of Richmond upon Thames
LBHaF	London Borough of Hammersmith and Fulham
SWMP	Surface Water Management Plan
TTD	Thames Tidal Defences

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1 Introduction

1.1 Overview

Pell Frischmann has been appointed by Transport for London (TfL) to undertake a Flood Risk Assessment (FRA) to support the planning application for the proposed Temporary Pedestrian and Cycle Bridge in Hammersmith, London. The Temporary Pedestrian and Cycle Bridge is required to provide safe access for pedestrians and cyclists over the River Thames whilst Hammersmith Bridge is being repaired, which is estimated to take five years. The proposed site layout is included in Appendix B.

1.2 Scope of Works

The following scope of works has been undertaken to provide an FRA to meet the requirements of set out in Section 163 of the National Planning Policy Framework (NPPF) which states ‘when determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere and applications should be supported by a site-specific flood-risk assessment’. The FRA shall also meet the requirements presented within the associated Planning Practice Guidance (PPG) and local policy:

- Collate and undertake a desk-based review of publicly available flood risk information such as Environment Agency mapping, Strategic Flood Risk Assessments (SFRAs) and local policies and guidance;
- Undertake a desktop review of other data that has been made available such as topographic surveys, existing drainage plans and proposed layout plans;
- Provide outline advice on flood mitigation measures including Sustainable Drainage Systems (SuDS) opportunities for the proposed development; and
- Provide an FRA based on the above information.

1.3 Sources of Information

A review of relevant information from a range of sources has been undertaken and includes the following:

- National Planning Policy Framework (NPPF), February 2019;
- Technical Guidance to the National Planning Policy Framework, March 2012;
- Non-statutory technical standards for sustainable drainage systems, March 2015;
- London Borough of Hammersmith and Fulham Strategic Flood Risk Assessment Final, December 2016;

- London Borough of Hammersmith and Fulham Surface Water Management Plan Update, July 2015;
- Hammersmith & Fulham Local Plan, February 2018;
- Royal Borough of Kensington and Chelsea and London Borough of Hammersmith and Fulham Strategic Flood Risk Assessment Final Report, June 2010;
- London Borough of Richmond upon Thames Strategic Flood Risk Assessment Update, March 2016;
- London Borough of Richmond upon Thames Surface Water Management Plan, September 2011;
- London Borough of Richmond upon Thames Intermediate Assessment of Groundwater Flooding Susceptibility, March 2011; and
- Richmond upon Thames Local Plan, February 2018.

1.4 Environment Agency Data

The following information has been gathered from Department for Environment, Food and Rural Affairs (DEFRA) Spatial Data Catalogue of data.gov.uk [accessed December 2019]:

- Flood Map for Planning (Rivers and Sea) – Flood Zone 2;
- Flood Map for Planning (Rivers and Sea) – Flood Zone 3;
- Flood Map for Planning (Rivers and Sea) – Spatial Flood Defences;
- Flood Map for Planning (Rivers and Sea) – Areas benefitting from flood defences;
- Flood Map for Planning (Rivers and Sea) – Flood Storage Areas;
- Risk of Flooding from Surface Water Extent (3.3%, 1% and 0.1% AEP); and
- LiDAR (DTM 1M).

2 The Site

2.1 Site Location

The Temporary Pedestrian and Cycle Bridge, hereafter referred to as 'the Site', is situated to the east of Hammersmith Bridge which is in West London and overlies the River Thames. The Site, as illustrated in Figure 2.1 is centred at Grid Reference TQ 229780.

The south abutment is located on a green area on the south riverbank, just east of A306 Castelnau and north of Riverview Gardens. The southern end of the bridge is located within Richmond upon Thames Borough. The north abutment is also located on a green area on the north riverbank, to the south of Queen Caroline Street and north of Lower Mall. The northern extent of the bridge falls into Hammersmith and Fulham Borough. Both the northern and southern banks of the Thames, in which the Site is situated, are urban environments dominated by recreational, residential and commercial buildings.



Figure 2.1 – Site Location Map

2.2 Topography

The topographical survey, attached as Appendix A, indicates that land levels are similar on both sides of the River Thames, with land to the south of the site lying between 3.6mAOD and 5.9mAOD and land to the north lying between 3.9mOD and 5.7mAOD. Additionally, the LIDAR topographical map, as presented in Figure 2.2, shows that land on both sides of the River Thames is fairly flat and low lying between approximately 4mAOD and 7mAOD.

The London Borough of Richmond upon Thames (LBRuT) SFRA and Surface Water Management Plan (SWMP) states that a considerable proportion of the Borough, including that in which the southern abutment falls into, is on relatively low-lying ground. Land adjacent to the south of the River Thames lies between 1 and 6 mAOD. Additionally, The London Borough of Hammersmith & Fulham (LBHaF) SFRA and SWMP both highlight that the land on the north bank of the Thames, up to HM Prison Wormwood Scrubs, is flat lying and is situated at approximately 0 and 10 mAOD.



Figure 2.2 – LIDAR Topography Map

2.3 Watercourses & Flood Defences

The Hammersmith Temporary Footbridge is situated over the River Thames which is protected by the Thames Tidal Defences (TTD). The TTD provides protection through a combination of

raised defences, flood proofing, and the Thames Barrier. The Thames defences are designed to defend against events of a 1 in 1000-year standard (protection up to and including the 0.1 % AEP tide level) however there will always be a residual risk from the barriers being overtopped during a flooding event. The Thames Estuary Plan 2100 (TES2100) states that Hammersmith could witness flood depths of up to 2m if the Thames Barriers fails.

2.4 Geology & Hydrogeology

The Phase 1 Geotechnical and Geo-environmental Desktop study of Hammersmith Bridge Refurbishment (Pell Frischmann, October 2019) and The British Geological Survey's (BGS) Geology of Britain viewer have been reviewed to collate information on the local geology. The 1:50,000 scale BGS map indicates that north and south abutments are underlain by bedrock geology of London Clay formation and superficial deposits of Kempton Park Gravel Member. It is also likely that the southern abutment is underlain by made ground. The River Thames channel is underlain by bedrock geology of London Clay formation and superficial deposits of alluvium formed of Clay, Silt, Sand and Peat.

The bedrock geology of London Clay is classified as an Unproductive Aquifer. The superficial Kempton Park Gravel deposits are classified as a Secondary (A) Aquifer and the superficial River Channel Alluvium deposits are classified as a Secondary Undifferentiated Aquifer. The site is not located within a Source Protection Zone.

2.5 Proposed Development

In April 2019, Hammersmith and Fulham Borough declared that the movement of vehicles over the Hammersmith Suspension Bridge was restricted to emergency vehicles, vehicles with a gross vehicle weight below 7.5T and one 12T GVW public bus in each direction at any one time in response to concerns over the structural integrity of the bridge. Bus routes now terminate at either end of the bridge resulting in major flows of pedestrians and cyclists across the bridge. This closure has resulted in major disruption to the local and wider area due to the absence of a close alternative crossing.

The proposed temporary footbridge is a 3-span structure with 2 piers in the river, with a total length of approx. 216m. The north and centre spans are expected to be approximately 85.5m long and the south span is expected to be approximately 45m long (refer to GA Drawing 102963-PEF-BAS-ZZZ-DIA-C-00003, Appendix B).

The south abutment is located near the towpath on the south riverbank and the north abutment is in the green area on the north riverbank at the south west end of Queen Caroline Street. A ramp structure is to be installed at both ends of the bridge connecting the footbridge to the existing highway network.

The structure type is to be a temporary modular steel bridge. The bridge deck is to be demountable and of half through truss construction comprising structural elements put together to form the outer trusses, and transverse elements supporting a steel deck to carry the pedestrian and cycleway. The effective width of the segregated pedestrian and cycleway is to be a minimum of 5.50m, with an overall deck width of 7.1m, as shown on the GA Drawing (Appendix A). The total weight of the superstructure will not exceed 4.1 tonnes per metre span.

The bridge foundations, substructure and superstructure are designed to accommodate potential flooding of the river and breach of flood defence system. The soffit levels of the centre and south span are to match the soffit level of the Hammersmith Bridge, as a minimum, but the soffit level of the north span is to be lowered.

As the structure is to be temporary, all the substructure elements in the river (including foundations) are designed to be quickly installed and such that it can be decommissioned afterwards, once the bridge is no longer needed.

The substructure and foundation within the River Thames (piers 1 and 2) are to comprise an arrangement of 4 tubular socketed steel piles installed in augured shafts and braced with steel sections as shown on the GA Drawing (Appendix A).

The abutments on land will be of reinforced concrete construction supported on augured reinforced concrete piles.

It is noted that all the structure, including foundation elements and ramps, is to be fully removed once Hammersmith Bridge is refurbished and opened for cyclists and pedestrians.

3 Existing Flood Risk

3.1 Fluvial & Tidal Flood Risk

The Flood Map for Planning, as presented in Figure 3.1, shows that the Site is situated within Flood Zone 3a which is defined as 'land that has a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%)'. The River Thames is primarily tidally dominated meaning some of the greatest flood risks across London are a result of tidal surges.

Based on the information collated, the risk of flooding from fluvial and tidal sources for the whole of the Site is considered high based on its proximity to the River Thames. Flood zone designations do not take flood defences into consideration meaning the maps demonstrate the maximum extent of tidal flooding without accounting for the embankments on either side of the River Thames. Although the River Thames has flood defences that cover all of Hammersmith and Fulham Borough, the risk of flooding from breaching or overtopping is still present.

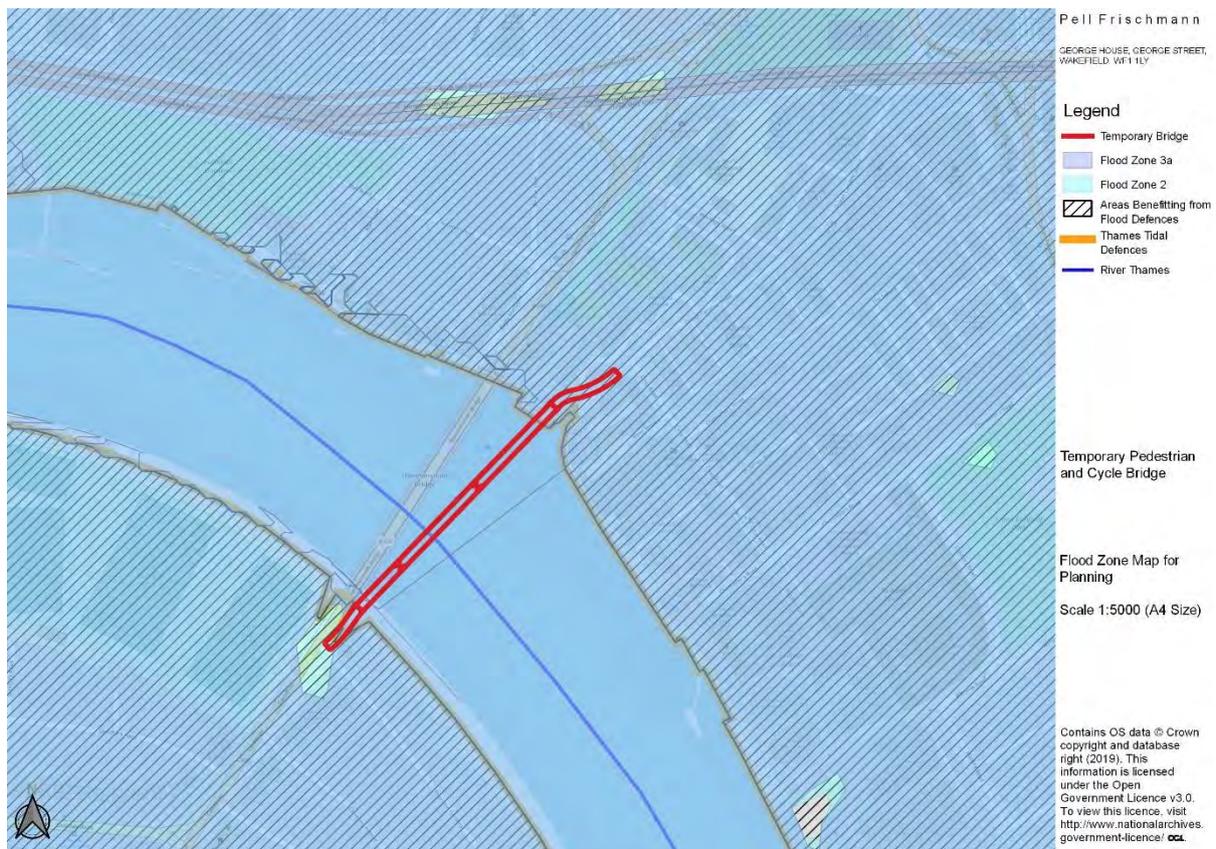


Figure 3.1 – Flood Risk Map for Planning

3.2 Risk of a Breach of Tidal Defences

The Thames Estuary 2100 (TE2100) plan includes an assessment of the potential breach of defences during extreme tidal conditions and breach modelling which demonstrates the risks that are presented if the defences along the Thames fail.

The TE2100 plan presents the Extreme Water Levels (0.5% AEP event) for 2012, 2065 and 2100 that account for changes encouraged by climate change. Table 3.1 shows the Extreme Water Levels for the Tidal Thames for node 2.20 which is situated close to the Site.

Table 3.1 – TE2100 Extreme Water Levels (mAOD) for the Tidal Thames

Scenario (year)	0.5 AEP for node 2.19 (mAOD)
2012	5.01
2065	5.63
2100	5.92

The LBRuT SFRA demonstrates that the breach hazard rating to the north of Barnes Ward, in which the south abutment is situated in, is low which is described as a ‘flood zone with shallow flowing or deep standing water’. The LBHaF SFRA demonstrates that the breach hazard rating to the south of Hammersmith Broadway ward, in which the north abutment is situated in, is also low.

3.3 Surface Water Flood Risk

The Environment Agency’s Risk of Flooding from Surface Water Map, as illustrated in Figure 3.2, shows that the area in which the south abutment is situated in demonstrates no risk of flooding from surface water sources. The area in which the north abutment is located in presents a medium to high risk of flooding from surface waters, which is likely to be due to the topography of the Hammersmith and Fulham Borough.

Surface water modelling completed within the Hammersmith and Fulham Borough indicates that King Street and the London Underground Railway Line (which lie approximately 380 and 500m to the north of the north abutment respectively) have a tendency for surface water flooding. Hammersmith Broadway ward, in which the Site is situated, is predicted to have the second greatest risk of surface water flooding amongst all of the wards within the borough.

The LBHaF SFRA and the LBRuT SWMP states that intense periods of rainfall led to a surface water flooding event in 2007 on both sides of the River Thames.



Figure 3.2 Environment Agency's Risk of Flooding from Surface Water (RoFSW)

3.4 Groundwater Flood Risk

The LBRuT Intermediate Assessment of Groundwater Flooding Susceptibility report suggests that superficial deposits along the River Thames may encourage groundwater levels to rise leading to flooding of properties with basements/cellars and/or other underground structure. Kempton Gravel Member superficial deposits, which are formed primarily of Sand and gravel, underlay both bridge abutments. Because superficial deposits, specifically river terrace deposits, increase the potential for elevated groundwater, it could be assumed that there is a risk of groundwater flooding at the Site.

The LBHaF SFRA demonstrates that the area to the north of the River Thames, in which the north abutment is situated, has a very high ($\geq 75\%$) risk susceptibility to groundwater flooding. Additionally, the LBHaF SWMP states that the area around Hammersmith underground and bus station, which is situated approximately 370m to the north east of the Site, has an increased Potential for Elevated Groundwater (iPEG).

The BGS Susceptibility to Groundwater Flooding Map for London Borough of Richmond upon Thames demonstrates that the area south of the River Thames, in which the south abutment is situated, has the potential for groundwater flooding to occur at the surface.

The Environment Agency have 22 records of groundwater flooding incidents in Richmond upon Thames between 2000 and 2010 however no records have been presented for Hammersmith and Fulham.

3.5 Sewer Flood Risk

Sewer and surface water flooding are particularly problematic in Hammersmith & Fulham and the borough's SWMP identified that much of the Borough is at risk from sewer and/or surface water flooding. Between 400 and 800 sewer flooding events have been recorded for the land adjacent to the north of the River Thames where the Site is located. Additionally, between 21-50 sewer flooding events have been recorded for the land adjacent to the south of the River Thames where the Site is located. However, sewerage capacity checks with Thames Water at the reserved matters stage will ensure the scheme will not increase flood risk.

The floods in 2007, as previously mentioned, were also believed to be influenced by surface water sources. To conclude, sewer flooding presents a risk to the Site which is greater on the north bank of the River Thames.

3.6 Artificial Sources Flood Risk

The Environment Agency's Risk of flooding from Reservoirs map highlights that the Site is at risk of flooding from artificial sources such as lakes, ponds, canals and reservoirs.

The Richmond area is potentially at risk of flooding from more than ten reservoirs in the immediate area however the LBRuT Local Flood Risk Management Strategy (LFRMS) states that there have been no reports of flooding from artificial sources within the Richmond upon Thames borough. The Hammersmith and Fulham documents also do not mention the occurrence of flooding from artificial sources.

Reservoirs in the UK have an extremely good safety record, with all reservoirs falling under the Reservoirs Act 1975, having regular inspections and supervised by reservoir panel engineers. As stated within the SFRA, these reservoirs present a minimal risk due to the regular inspections and maintenance work on these structures.

4 Consultation

4.1 Environment Agency

The London Borough of Richmond upon Thames and the London Borough of Hammersmith and Fulham are both being engaged and consulted as part of the wider Environmental Assessments for this scheme. In addition, as the development is within Flood Zone 3a and related to works taking place on the river Thames, the Environment Agency has been consulted for this FRA. The Environment Agency's response, as attached in Appendix C, was received on the 23rd of December (ref NE/2019/131178/01-L01) and addresses the following points:

- Soffits

The Environment Agency's design criteria specifies that bridges across the Thames normally requires that the soffit level is set 600mm or more above the 2100 flood level and no lower than 300mm above either of the upstream bank tops, in order to allow floating debris to pass freely under the structure. To satisfy both criteria, the soffit level of temporary footbridge must lie above 6.52m.

The impact of future development and climate change, which may increase flows within the catchment must also be considered.

Soffit levels on rivers will need to take account of the clearance level required for boats that legally use the river for navigation purposes. The clearance level required for the temporary footbridge will be consulted with the Port of London Authority (PLA). The underside level of the footbridge is no lower than the existing Hammersmith Bridge which means that clearance should not be any issue.

- Design Flows

A hydro-morphology assessment was required to demonstrate that there will be no scour or loss of protected habitat as a result of the new piers. A study of bridge failures has indicated that between 60 and 70% are caused by hydraulic action. The assessment was completed by HR Wallingford Ltd and the report number is DDR6237-RT001-R01-00. The main conclusions from this report are; scour is expected to occur around the proposed piles, potentially up to a depth of 3.1m for the most conservative scenario considered. The limited geotechnical data defining the overlying mobile material layer above the underlying clay indicates that its thickness is less than 1m in the vicinity of the works, which would limit scour depths to a similar level. It is recommended that scour predictions are updated when site specific geotechnical data becomes available. Overall riverbed levels are not expected to be affected and changes predicted in the main navigation channel and at river walls are negligible.

- Bridge Span

Developers must provide design calculations in order to confirm that the capacity of the river will be maintained. Navigation rights can present issues to any proposals that set out to introduce piers into the channel and therefore the developer must consult the PLA. Consultation with the PLA has been undertaken at the reserved matters.

- Flood Defences

Any works within 16m of flood defences, including any underground elements of these flood defences, will require a condition survey and loading calculations to be completed and submitted. The results must adequately demonstrate that the bridge and any supporting piers will not impact the stability of the flood defences or prevent access for inspection and maintenance.

Two options for the northern landing point of the Temporary Bridge were provided to the Environment Agency. One of these options placed the landing point on a slipway. The Environment Agency highlighted that the walls of that slipway are part of the statutory flood defences and include a movable flood gate, and therefore recommended that the bridge cleared the flood gate and landed directly into Queen Caroline Street. The Environment Agency also noted that the floodgate at the slipway is currently in poor conditions and therefore a fixed replacement that would reduce the necessity for inspections or emergency maintenance works would be required. The second option placed the northern landing point into a green space, avoiding the slipway, flood defences and flood gate, and as a result, this option was preferred by the Environment Agency. This is the option that is being taken forward (as shown in drawings of Appendix B).

5 Permits

A Flood Risk Activity Permit is required from the Environment Agency for any proposed works or structures in, under, over or within 16 metres of the River Thames or any flood defence structures. This permit has been applied for and a response from the Environment Agency is pending.

6 Planning Policy and Guidance

6.1 National Planning Policies & Guidance

6.1.1 National Planning Policy Framework

The NPPF provides the planning framework on which this FRA has been based. The NPPF states that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk. Where development is necessary, the development should be made safe and not increase flood risk elsewhere by including mitigation methods into the design stages of the development.

The NPPF also states that local planning authorities should only consider development in flood risk areas once a site-specific FRA has been completed to identify and assess the risks of flooding from fluvial, surface water, groundwater, sewer and artificial sources. The FRA should then suggest ways in which the flood risks will be managed so that the development remains safe throughout its lifetime, taking climate change into account.

6.2 Flood Risk Assessment: Climate Change Allowances Guidance

6.2.1 Climate Change

In February 2016, updated climate change allowances were published by the Environment Agency for each of the different river basin districts across England. Every district was given its own allowances based upon predicted local changes in fluvial flows and rainfall intensities as a result of climate change. The climate change allowances are predictions of anticipated change for:

- Peak river flow by river basin district;
- Peak rainfall intensity;
- Sea level rise; and
- Offshore wind speed at extreme wave height.

6.2.2 Peak Fluvial Flows

The climate change guidance states the peak river flow allowances for different river basins across the United Kingdom. The Site falls into the Thames River Basin District and the peak flow allowances for this specific catchment area are summarised in Table 6.1.

Table 6.1 - Peak River Flow Allowances for The Thames River Basin District

Allowance category	Total potential change anticipated for '2020s' (2015 to 2039)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2115)
Upper end	25%	35%	70%
Higher central	15%	25%	35%
Central	10%	15%	25%

The proposed development is considered essential infrastructure in Flood Zone 3a, the proposal and associated FRA shall consider the upper end allowance values meaning the total potential change anticipated for the '2080s' epoch as a result of climate change is 70%.

6.2.3 Peak Rainfall Intensity

The climate change guidance states the peak rainfall intensity allowances for the whole of England. Peak rainfall allowances for the country are summarised in Table 6.2. Both the upper end and central allowances of 20 to 40% total potential change anticipated for the '2080s' should be applied when designing attenuation for surface water.

Table 6.2 - Peak Rainfall Intensity Allowance

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

7 Managing Flood Risk

7.1 Flood Vulnerability Classification

Any proposed development on the site will be subject to the planning requirements of London Borough of Hammersmith and Fulham, London Borough of Richmond upon Thames and the NPPF.

Flood Risk and Coastal Change guidance, published by the Ministry of Housing, Communities & Local Government, states whether an Exception Test is required. As highlighted in Table 7.1, which has been extracted from Table 2 of the Flood Risk and Coastal Change guidance document, the proposed development requires an Exception test because the Site is located within Flood Zone 3a and has been given a “essential infrastructure” flood risk vulnerability

classification. An exception test is required to demonstrate that the benefits provided from the development outweigh the risk of flooding. In Flood Zone 3a, any essential infrastructure must be designed and constructed in a way that allows it to remain operational and safe in times of flooding. Table 7.1 Flood Risk Vulnerability Classification

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a	Exception Test required	X	Exception Test required	✓	✓
Zone 3b	Exception Test required	X	X	X	✓

7.2 Flood Mitigation

The Site has been identified as generally being at medium to high risk of flooding from all identified sources of flood risk, due to its location on the River Thames.

It is recommended that due consideration is given to the external levels design of the Site both at the northern and southern embankments, ensuring that any external areas generally fall away from property entrances and towards positively drained areas. The surface water management strategy will ensure that there is no increased flood risk relating to surface water to the surrounding areas. Recommendations as set out in section 4 of this report will be incorporated where appropriate.

7.3 Surface Water Management

A surface water drainage strategy is currently being developed for the bridge, based on sustainable drainage principles. This will ensure surface water runoff generated by the proposed

development does not have an adverse impact on flood risk elsewhere by adopting a design flood level with a 100-year return period.

In accordance with the Sustainable Drainage Systems Non-Statutory Technical Standards, clause S1 “Where the drainage system discharges to a surface water body that can accommodate uncontrolled surface water discharges without any impact on flood risk from that surface water body (e.g. the sea or a large estuary) the peak flow control standards (S2 and S3 below) and volume control technical standards (S4 and S6 below) need not apply.”

As the above is true for the Site, no attenuation requirement is envisaged at this stage and a traditional gravity piped system is being proposed.

8 Conclusion

This FRA has been written in support the planning application for the construction of a Temporary Pedestrian and Cycle Bridge.

In summary:

- The Site is situated within Flood Zone 3a, meaning it is an area characterised by a high probability of flooding from fluvial and/or tidal sources however this designation does not consider the flood defences present and, as this FRA has shown, the site is within an area that benefits from flood defences;
- The Thames Tidal Defences, which are situated on both banks of the River Thames by the Site, are designed to defend against events of a 1 in 1000-year standard (protection up to and including the 0.1 % AEP tide level). Although there is a risk of the defences being overtopped, the breach hazard rating for the Site is considered low;
- The north of the Site demonstrates a medium to high risk of flooding from surface waters however a Surface Water Drainage Strategy is being produced to mitigate the risk of flooding;
- It was found that previous sewer flooding incidents have occurred in the land surrounding the north of and south of the river. Should the scheme required disposal to an existing sewer, then sewerage capacity checks with Thames Water at the reserved matters stage will ensure the scheme will not increase flood risk; and
- The Site is at risk of flooding from artificial sources however no there have been no reports of flooding events and local reservoirs are regularly inspected and maintained to reduce the risk of flooding;
- The design criteria set by the Environment Agency has been adhered to as:
 - The soffit levels of the bridge will be above 6.52mAOD and the underside of the bridge will be no lower than the existing hammersmith bridge; The soffit levels of the centre and south span match this requirement, although the soffit level of the north span is to be lowered to softly connect with the existent highway in land. Nevertheless, the FRA that was carried out has not identified an increase of flood risk to the area;
 - Design flows were assessed via the hydro-morphology assessment by HR Wallingford and scour levels around the piles can reach 3.1m at worst-case but

are more likely to reach 1m. It is recommended to update the scour predictions when site specific geotechnical data is available;

- Design calculations of the bridge span will be provided and consultation with the PLA has been undertaken at the reserved matters to ensure navigation rights do not present issues to any proposals; and
- Load calculations will be submitted to demonstrate that the bridge and its supporting piers will not impact the stability of the flood defences or prevent access for inspection where works are carried out within 16m of flood defences. A flood gate on the northern landing point is in poor condition and a fixed replacement could be required, if the construction of the temporary bridge requires its use or removal.

In accordance with the requirements of the NPPF, this FRA has demonstrated the proposed temporary footbridge could proceed without being subject to significant flood risk. Furthermore, the temporary footbridge will not result in increased flood risk to third parties as a result of suitable management of surface water runoff. The development accords with the flood risk policies of the relevant local plan policies.

9 Uncertainties & Limitations

This report has been prepared by Pell Frischmann with reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the Client in accordance to the agreed scope of services.

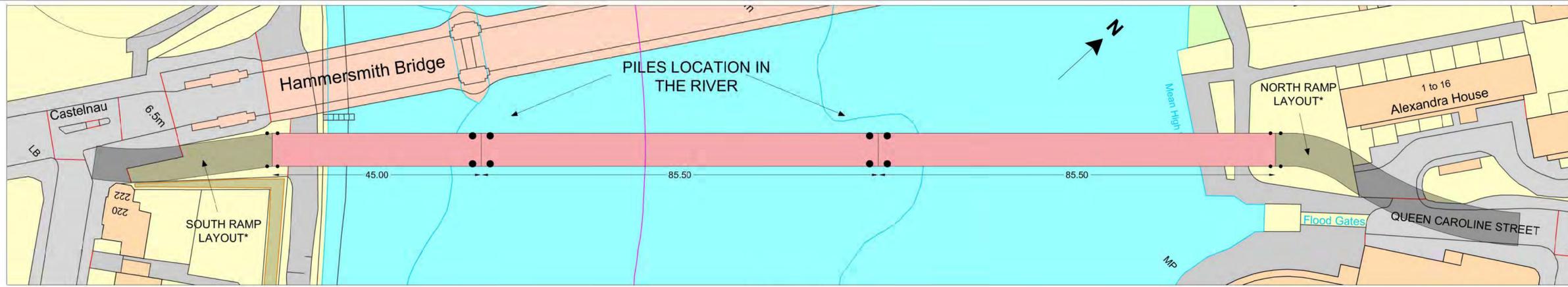
This report has been prepared solely for the use of the Client. The report may not be relied upon by other parties without written consent from Pell Frischmann. Pell Frischmann disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

The report details the findings of work carried out by Pell Frischmann during a study period during January 2020. The report has been prepared based on available information obtained during that study period. Information provided by the referenced third parties has been used in good faith and is taken at face value; however, Pell Frischmann cannot guarantee its accuracy or completeness.

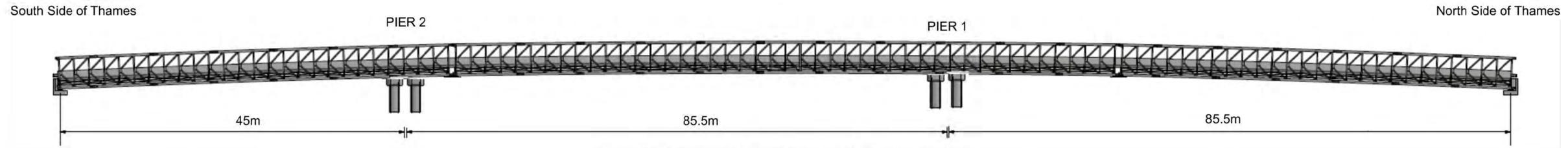
Although every reasonable effort has been made to gather all relevant information within the context of the agreed scope of work, all potential flood risk constraints or liabilities associated with the Site may not have been revealed. Should additional Information become available (including new legislation and changed practices), after the date of the report submission, Pell Frischmann reserves the right to reconsider the recommendations and alter the report accordingly.

Appendix A: Topographic Survey

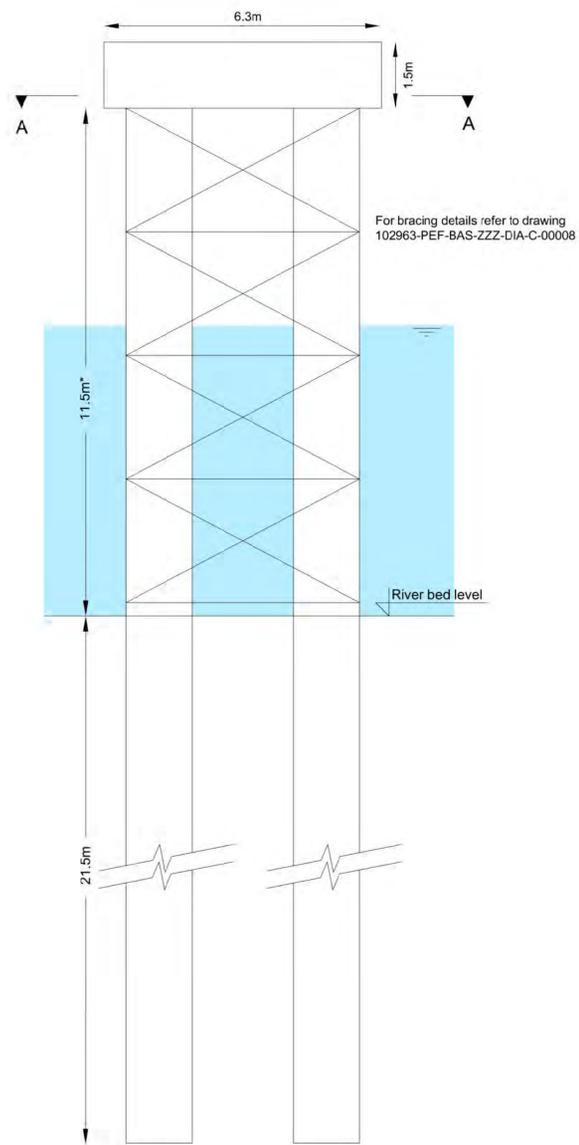
Appendix B: Proposed Site Layout Plan



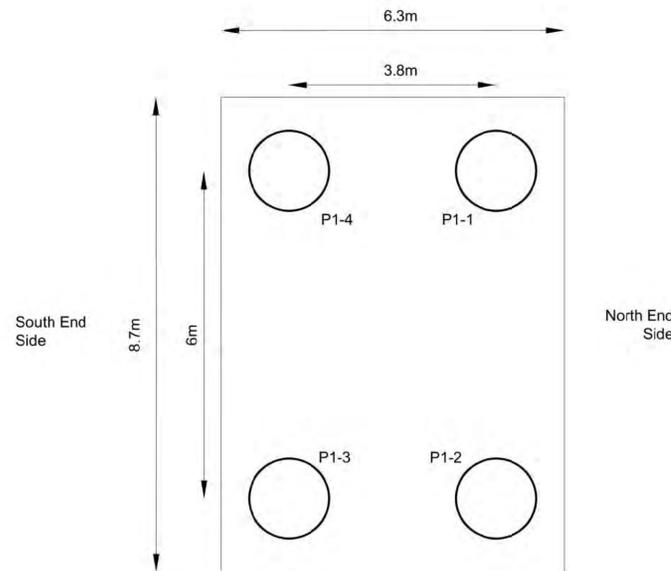
PLAN VIEW



INDICATIVE ELEVATION LOOKING NORTHWEST



PIER 1 / PIER 2
CROSS SECTION LOOKING NORTHWEST



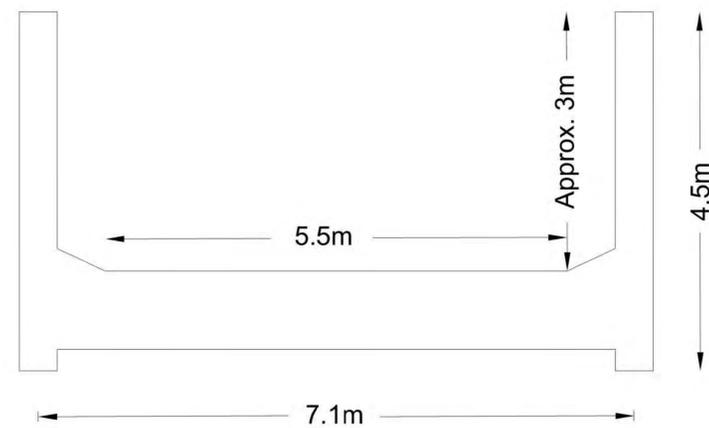
SECTION AA
PIER 1 / PIER 2 - PILES ARRANGEMENT

PILE NO.	Easting	Northing
1-1	523011.5559	178090.2721
1-2	523015.9842	178086.2237
1-3	523013.4202	178083.4191
1-4	523008.9919	178087.4675

PIER 1 - APPROXIMATE PILE COORDINATES



LOCATION PLAN



DECK CROSS-SECTION
GEOMETRICAL REQUIREMENTS

- GENERAL NOTES
- DO NOT SCALE THIS DRAWING.
 - PILES DIMENSIONS:
 - SOCKETED STEEL PILES IN THE RIVER TO BE CIRCA 1.5m DIAMETER.
 - AUGURED RC PILES AT THE ABUTMENTS LOCATION TO BE CIRCA 0.75m DIAMETER.
 - ALL DIMENSIONS ARE APPROXIMATE AND MAY CHANGE DEPENDING ON THE DETAILED TOPOGRAPHICAL SURVEY AND GEOTECHNICAL INVESTIGATIONS.
 - PIERS LOCATION SUBJECT TO CONCLUSION OF NAVIGATION RISK ASSESSMENT.
 - THE EXACT LOCATION OF PILES AND ABUTMENTS TO BE CONFIRMED FOLLOWING DETAILED TOPOGRAPHICAL SURVEY AND GEOTECHNICAL INVESTIGATIONS.
 - *METALLIC RAMP LAYOUT AND EXACT LOCATION ARE INDICATIVE AND MAY CHANGE DEPENDING ON THE DETAILED TOPOGRAPHICAL SURVEY.
 - RAMPS TO BE OF METALLIC STRUCTURE. DETAILS TO BE DEVELOPED.
 - THERE ARE UTILITIES LOCATED ON EACH RIVER BANK WHERE THE ABUTMENTS AND RAMPS ARE TO BE CONSTRUCTED. THE LOCATIONS OF THESE UTILITIES WILL BE CONFIRMED AFTER THE INVESTIGATIONS ARE COMPLETE.

DRAFT

REV	DESCRIPTION	DRN	CHK	DSN	APP	DATE
P03	Minor changes	IR	AW	IR	SM	21/02/20
P02	Changes to span arrangement	IR	AW	IR	SM	28/11/19
P01	Draft	DK/ER/IR	SM	IR	AW	15/11/19

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Architect/Client/Contractor

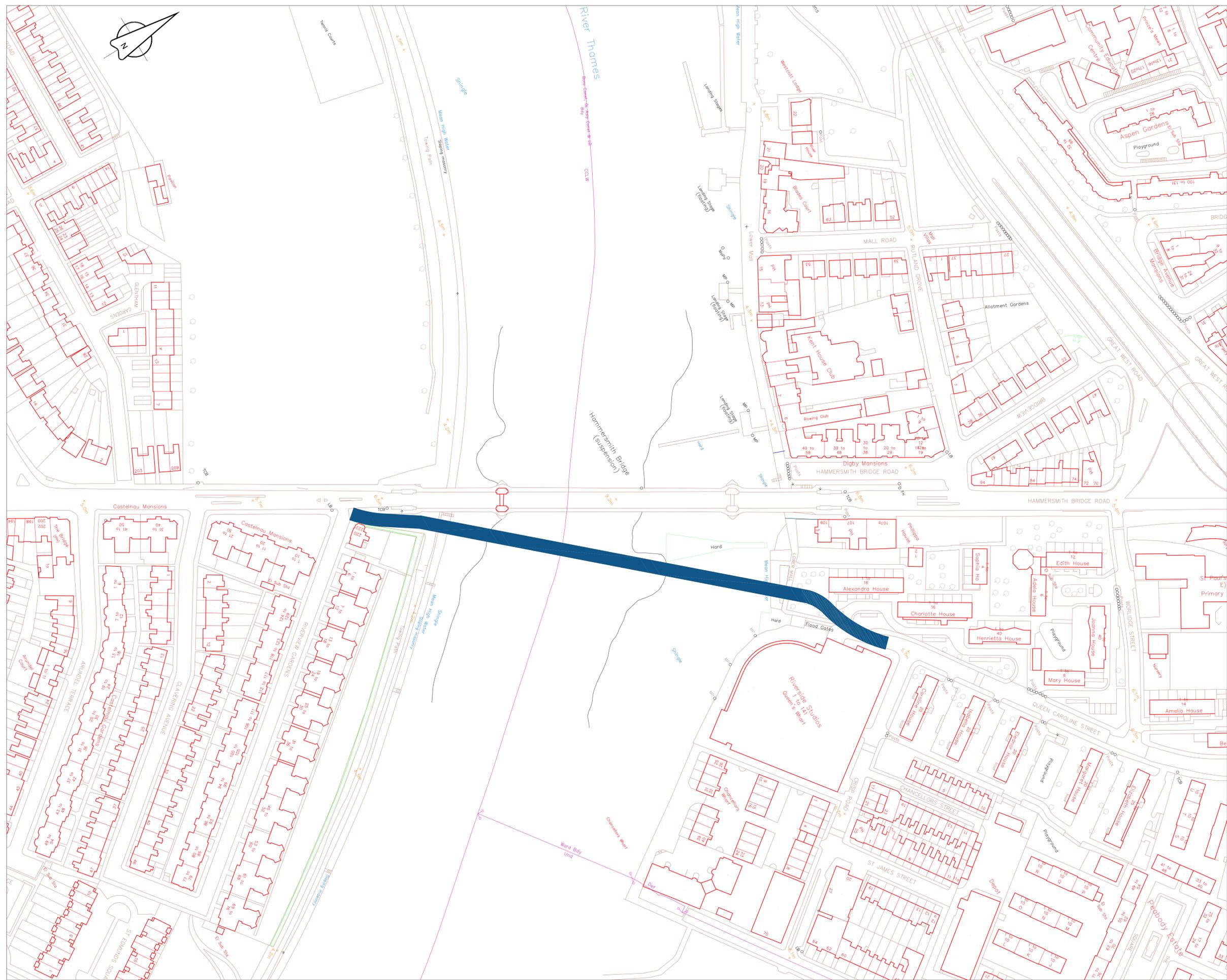
TRANSPORT FOR LONDON

Project
TEMPORARY PEDESTRIAN AND CYCLE BRIDGE

Drawing Title
TEMPORARY BRIDGE GENERAL ARRANGEMENT

Name	Date	Scale	NTS
Drawn	IR	28/11/2019	Drawing Status
Designed	DK / ER / IR	28/11/2019	FOR PRICING
Checked	AW	28/11/2019	Revision
Approved	SM	28/11/2019	P03

Drawing No. 102963-PEF-BAS-ZZZ-DIA-C-00003



NOTES

1. FINAL FOOTBRIDGE ALIGNMENT AND RAMP LAYOUT ARE INDICATIVE AND MAY CHANGE SUBJECT TO DETAILED TOPOGRAPHICAL SURVEY AND GEOTECHNICAL INVESTIGATIONS.

DRAFT

Rev	Description	Dm	Chk	App	Date
CDM Regulations					
Hazards	Date added	Date Mitigated	Risk Assessment Date		

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TEMPORARY PEDESTRIAN AND CYCLE BRIDGE

TEMPORARY BRIDGE
Site Boundary

Name	Date	Scale	1:1000 @ A1
Drawn	DJ	28/11/19	File No.
Design	DK/ER/IR	28/11/19	
Checked	AW	28/11/19	Drawing Status
Approved	SM	28/11/19	For information
Drawing No.	102963-PEF-BAS-ZZZ-DIA-G-00009		Revision
			P01

Appendix C: Response from the Environment Agency

Sophia Borgese
Transport for London

Our ref: NE/2019/131178/01-L01
Your ref: -

SophiaBorgese@tfl.gov.uk

Date: 23 December 2019

Dear Sophia

Proposal scope for environmental services. Proposed temporary Hammersmith Footbridge

Hammersmith Bridge, Hammersmith, London.

Thank you for consulting us on the document *Temporary Footbridge, Proposal for Environmental Services* produced by Pell Frischmann, dated 19 November 2019. We have reviewed the document in respect to our remit in planning and regulation and have the following comments.

2 Scope of Services

While we do not comment on Arboricultural Reports, or Site Waste Management Plans we will have an interest in the Environmental Impact Assessment (EIA), Flood Risk Assessment (FRA) and Water Framework Directive (WFD) Assessment.

In addition to the above, unless covered within the scope of the EIA and FRA's, the proposed development will also need to consider;

- The impact on flood defences – including the requirement for ongoing inspections and maintenance of the river walls.
- Contaminated land – including dispersal of contaminants into controlled waters through the installation and removal of piles.
- The impact on fisheries, biodiversity and habitat.

2.1 EIA Screening

Please note that through the planning system we do not comment on the EIA at the screening stage. We advise you discuss this further with the Local Planning Authorities at Richmond and Hammersmith and Fulham.

Further information on the requirements of an EIA or Environmental Statement can be found at: <https://www.gov.uk/guidance/environmental-impact-assessment#Preparing-an-Environmental-Statement1>

Where a riverside development has the potential to impact the environment, including water quality, an applicant should be able to explain how the proposal would affect a relevant water body detailed in a river basin management plan and how they propose to mitigate the impacts. Applicants should provide sufficient information for the local planning authority to be able to identify the likely environmental impacts. The information supplied should be proportionate to the nature and scale of development

Cont/d..

proposed and the level of concern.

Please see Gov.uk for further guidance on the requirements of an [environmental statement](#), if one is required.

2.3 Flood Risk Assessment (FRA)

We agree that a FRA will be required for this proposal.

In accordance with Paragraph 163 of the National Planning Policy Framework (NPPF), a site specific FRA will need to be produced in support of this application. The FRA must show that there will be no increase to the risk of flooding as a result of the bridge and associated infrastructure, and will ideally be an overall benefit. We recommend the following design criteria for the bridge as best practice:

Soffits

For bridges across the Thames we normally require that the soffit level is set 600mm or more above the 2100 flood level and no lower than 300mm above either of the upstream bank tops, in order to allow floating debris to pass freely under the structure. The impact of future development and climate change, which may increase flows within the catchment must also be considered.

Soffit levels on navigable rivers will need to take account of the clearance level required for boats legally using the river.

We recommend that, due to the temporary nature of the bridge, the underside level of the footbridge be no lower than the existing Hammersmith Bridge.

Design Flows

A hydro-morphology assessment will be required demonstrating that there will be no scour or loss of protected habitat as a result of the new piers. A study of bridge failures has indicated that between 60 and 70% are caused by hydraulic action.

Bridge Span

Developers must provide design calculations to confirm the capacity of the river is maintained. Where navigation rights exist, there may be issues with any proposals for piers in the channel. The developer must consult us Port of London Authority (PLA).

Flood Defences

For any works within 16m of the flood defences, including any underground elements of a flood defence, we will require a condition survey and loading calculations to be submitted that adequately demonstrates that the bridge and any supporting piles will not impact on the stability of the flood defences or prevent access for inspection and maintenance.

We have so far seen two proposed designs for the bridge with different landing points on the northern bank. The first design proposes to land the bridge on a slipway. It should be noted that the walls of this slipway are part of the statutory flood defences and include a movable flood gate. We recommend that, if pursuing this landing point, you consider clearing the flood gate and landing directly into Queen Charlotte Street.

The flood gate at this slipway is currently in a poor condition. As access to this flood gate will be limited during the operational period of the bridge, we would require a fixed replacement that will reduce the requirement for inspections or emergency maintenance works.

In addition to planning permission, under the terms of the Environmental Permitting Regulations a *Flood Risk Activity Permit* is required from the Environment Agency for any proposed works or structures, in, under, over or within 16 metres of the landward side of a flood defence structure or the top of the bank of the River Thames, designated a 'main river'.

Details of lower risk activities that may be Excluded or Exempt from the Permitting Regulations can be found on the [gov.uk](https://www.gov.uk) website. For further information please contact us at PSO-Thames@environment-agency.gov.uk.

2.4 Water Framework Directive (WFD) Assessment

Due to the nature of the proposed works it is likely that a WFD Assessment will be required. This should assess any potential impacts on the watercourses and demonstrate that the required enhancements will be delivered. Any development that has the potential to cause deterioration in classification under WFD or that precludes the recommended actions from being delivered in the future is likely to be considered unacceptable to us.

We have produced guidance on the production of a WFD Assessment which can be found on our website: <https://www.gov.uk/government/publications/water-framework-directive-how-to-assess-the-risk-of-your-activity>

Information on WFD and the current status of water bodies can be found in our [River Basin Management Plans](#).

If you require any data from the Environment Agency relating to water quality, please contact our Customers and Engagement Team at HNLInquiries@environment-agency.gov.uk.

We are happy to discuss elements of a WFD assessment or review a draft copy prior to submission if required.

Ecological Assessment

A detailed Ecological Survey will need to be submitted alongside any planning application.

Developers must take account of fish, including their migration and breeding seasons and phase the works to have minimal impact. An assessment of noise and vibrations should be included with this and appropriate mitigation proposed.

The assessment should also consider the intertidal foreshore, protected under the London Biodiversity Action Plan (BAP). There should be no net loss of habitat as a result of this development. An assessment of scour should be submitted demonstrating that the change of flow around the piers will not result in erosion.

The design of the bridge should aim to ensure that shading and disturbance of the watercourse is minimised. Light spill from the bridge into the watercourse or intertidal foreshore should also be kept to a minimum (less than 2lux).

Piling

An assessments will be required of ground conditions and contamination prior to us agreeing a method for piling. Developers should ensure that any proposed piling methods do not pose a pollution risk to controlled waters.

It is expected that the piles, as proposed, will not be a major concern for water quality if the sediment disturbance raised (via piling and any associated river works) is less than approx. 300 cu m into suspension.

A Piling method Statement will need to consider the impact on water quality and marine life during the installation and removal phases.

Permits

As stated above, in addition to planning permission, a *Flood Risk Activity Permit* is required from the Environment Agency for any proposed works or structures, in, under, over or within 16 metres of the river Thames or any flood defence structure.

We recommend that you open discussions relating to this permit as soon as possible as they can take up to three months to be issued. Please contact the relevant team at PSO-Thames@environment-agency.gov.uk

Please note that this proposal will also require permits from the Marine Management Organisation (MMO) and the Port of London Authority (PLA).

If you have any questions please contact me on 0203 025 5486 or email me at HNL SustainablePlaces@environment-agency.gov.uk, quoting the reference at the beginning of this letter.

Yours sincerely

Mr Andy Goymer
Planning Specialist

Telephone: 0203 025 5486 / 07831 600237
E-mail: HNL SustainablePlaces@environment-agency.gov.uk
Address: Environment Agency, 2 Marsham Street, London, SW1P 4DF