Keepmoat

NORTHFLEET, ROSHERVILLE PIER

Asset Management Plan



70015663
AUGUST 2021

CONFIDENTIAL

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Asset Management Plan

REPORT CONFIDENTIAL

PROJECT NO. 70015663

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1 EXECUTIVE SUMMARY

1.1 OVERVIEW

1.1.1. This Asset Management Plan (AMP) relates to Rosherville Pier as illustrated in Figure 1. The pier is located directly in front (riverward) of the flood defences/ riverwall fronting The Shore, Northfleet. In plan the structure is approximately 27m long by 10m wide up to the face of the adjacent flood defence.

1.1.2. The AMP has been prepared to outline a recommended framework to be used for the long term inspection and maintenance of Rosherville Pier throughout the design life of the proposed landward development of Northfleet Embankment (design life of 100 years).

1.1.3. Based on the 2018 inspection, Rosherville Pier was observed in a typically 'good' condition (condition grade 2), with no significant defects noted, see Section 3.4. The primary structure is relatively low maintenance mass concrete which typically has a slow rate of deterioration, however it should be noted that due to:

i) the uncertainty around timing of interventions into the future to maintain the structure;
ii) likely changes in environmental conditions in the future; and
iii) continued aging/ deterioration of the structure.

It is possible that some form of significant intervention or change in management of the structure will be required over this time period.

1.1.4. The key purpose of undertaking this AMP is to maintain the condition of the asset to:

i) maximise longevity of the existing structure as far as reasonably practicable;
ii) ensure ongoing safety to adjacent users / assets landward and river-side;
iii) provide safe access for inspection, routine maintenance; and
iv) prevent potential trespassing.

1.1.5. As the 2018 inspection did not observe any significant defects requiring immediate repair it recommended that in the short to medium term to continue with a regular schedule of monitoring and inspections.

1.1.6. It will be the responsibility of the asset owner to ensure inspections are routinely completed by competent personnel. The definition of inspection types are detailed in Section 5.2, and in summary; General Inspections should be undertaken at 3 year intervals with Safety Inspections annually and other Special and Post-Event Inspections undertaken as required to collectively inform potential changes to the inspection regime and potential maintenance and capital works interventions.

1.1.7. Whilst Keepmoat Homes will not legally be the asset owner until the completion of development, Keepmoat Homes are committed to taking on the responsibility of the inspection regime noted until such time that the asset is transferred to a third party. Responsibility for any maintenance or capital works interventions resulting from these inspections will still be the responsibility of the legal owner, as is the existing arrangement.

1.1.8. To enable a consistent approach for recording the inspections a structure specific pro-forma has been developed, see Appendix B, which should be used to record the condition of the structure during all inspections.

1.1.9. Health, safety and welfare considerations should be considered by the inspection team and other duty holders, details of likely site-specific considerations are in Section 4.3 based on the conditions observed in the 2018 inspection.

2 INTRODUCTION

2.1 AMP PURPOSE

2.1.1. This AMP has been prepared by WSP on behalf of Keepmoat Homes, who act-for the landowner Homes England. Following the completion of the Northfleet Embankment development the Rosherville Pier and AMP obligations will be transferred from Homes England to Keepmoat Homes, or an alternative third party to be agreed. Invitations for Expressions of interest have been extended to various third parties including Ebbsfleet Development Corporation, Kent County Council, Gravesham Borough Council, Port of London Authority, Environment Agency and Homes England with conversations still to be progressed.

2.1.2. This AMP solely relates to Rosherville Pier as illustrated below, which is located directly in front (riverward) of the flood defences/ riverwall fronting The Shore, Northfleet, as illustrated in Figure 1. In plan the structure is approximately 27m long by 10m wide up to the face of the adjacent flood defence.

Figure 1 - Site Location Plan (Local Scale)



2.1.3. The AMP has been prepared to outline a recommended framework to be used for the long term maintenance of Rosherville Pier throughout the design life of the Northfleet Embankment development (100 years). The primary structure is relatively low maintenance mass concrete; however due to:

i) the uncertainty around timing of interventions into the future to maintain the structure,

ii) likely changes in environmental conditions in the future and

iii) continued aging/ deterioration of the structure

It is possible that some form of more significant intervention or change in management of the structure may be required over this long term time period which should be identified and addressed early through this AMP's structured inspection and maintenance regime.

2.1.4. This AMP has been prepared based on no current public access, and updates will be required following the completion of the remedial works and the controlled opening of the pier to the public which is to be agreed with the future third party owner. If the assets use or condition significantly changes (e.g. restored for public access/ severe damage from a storm) where capital works are

considered necessary a full review of the AMP will be required by a competent person, to determine if the recommended procedures within this AMP need to be adjusted.

3 BASELINE INFORMATION

3.1 LAND REGISTRY BOUNDARY

3.1.1. This AMP solely relates to the Rosherville Pier land boundary defined on the Land Registry Title Plan K772536, see Appendix A.

3.1.2. Based on the land registry ownership extent any elements upstream/ downstream, landward or riverward are not included within this AMP, however a duty of care should be taken to notify relevant parties, if any significant issues (e.g. Health and Safety concerns) are identified to these adjacent structures.

3.1.3. The responsibility for the management of these adjacent assets remains the responsibility of the respective land owners.

3.1.4. The current understanding of land ownership is as summarised below:

- Keepmoat: Rosherville Pier
  - Extent as per Land Registry Title Plan K772536, see Appendix A, and includes:
    - Pier, Steps and WWII Mine Watching Post
- Unregistered Title:
  - Drawdock (Unknown ownership) with Kent County Council owned and maintained highway above the drawdock.

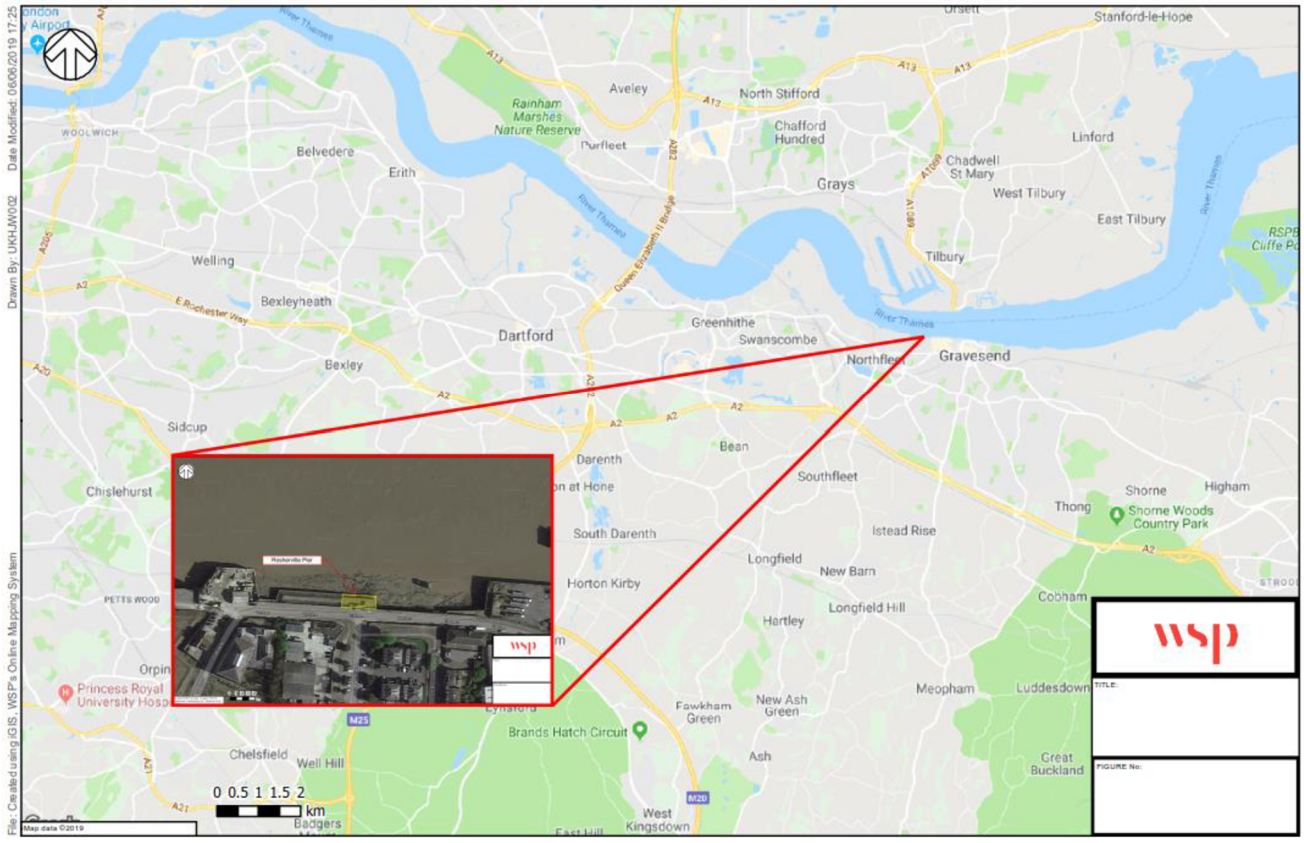
3.2 ENVIRONMENTAL SETTING

STRUCTURE LOCATION

3.2.1. Rosherville Pier, as illustrated in Figure 2, is located

- Nearest Postcode: DA11 9NL
- Grid Reference: TQ 63712 74484
- Easting, Northing: 563712, 174484

Figure 2 - Site Location (Regional Scale)



RIVER ENVIRONMENT

Tide Details

3.2.2. The site fronts the River Thames (downstream of the Thames Barrier) which is tidal. Based on Port of London (PLA) bathymetry data (Ref. No: 113-335-609 Dated: 02-2012) the tidal range is as shown in Table 1.

Table 1 - Tide Details based on PLA Chart 335 (2012)

Tidal State	Ordnance Datum Level (m)	Chart Datum (m)
Highest Recorded High Water	4.92 (1953)	8.04 (1953)
Highest Astronomical Tide	5.93	7.05
Mean High Water Springs	3.44	6.56

Tidal State	Ordnance Datum Level (m)	Chart Datum (m)
Mean High Water	2.87	5.99
Mean High Water neaps	2.29	5.41
Ordinance Datum (Newlyn)	0.00	3.12
Mean Low Water Neaps	-1.61	1.51
Mean Low Water Springs	-2.56	0.56
Chart Datum	-3.12	-
Lowest Recorded Low Water	-3.87 (1987)	-0.75 (1987)

3.2.3. Ordnance Datum Newlyn (ODN) is 3.12m below Chart Datum (CD). Therefore, at mean low water springs the water level is at 0.56m relative to chart datum and -2.56m relative to ordnance datum.

3.2.4. Product 4 data from the Environment Agency (October 2018) provides predicted river levels for a 0.1% annual exceedance probability tidal event (1 in 1000 year return period), as summarised in Table 2 for node 3.24 and 3.25. These nodes are located upriver and downriver of the Rosherville Pier respectively within the River Thames.

Table 2 - Tide Level for Set Return Periods

Return Period	Level at Node 3.24 (m AODN)	Level at Node 3.25 (m AODN)
0.1% AEP event (2000)	5.83	5.81
0.1% AEP event (2040)	6.04	6.02
0.1% AEP event (2070)	6.19	6.17
0.1% AEP event (2100)	6.49	6.47
0.1% AEP event (2120)	6.69	6.67
0.1% AEP event (2170)	7.18	7.19

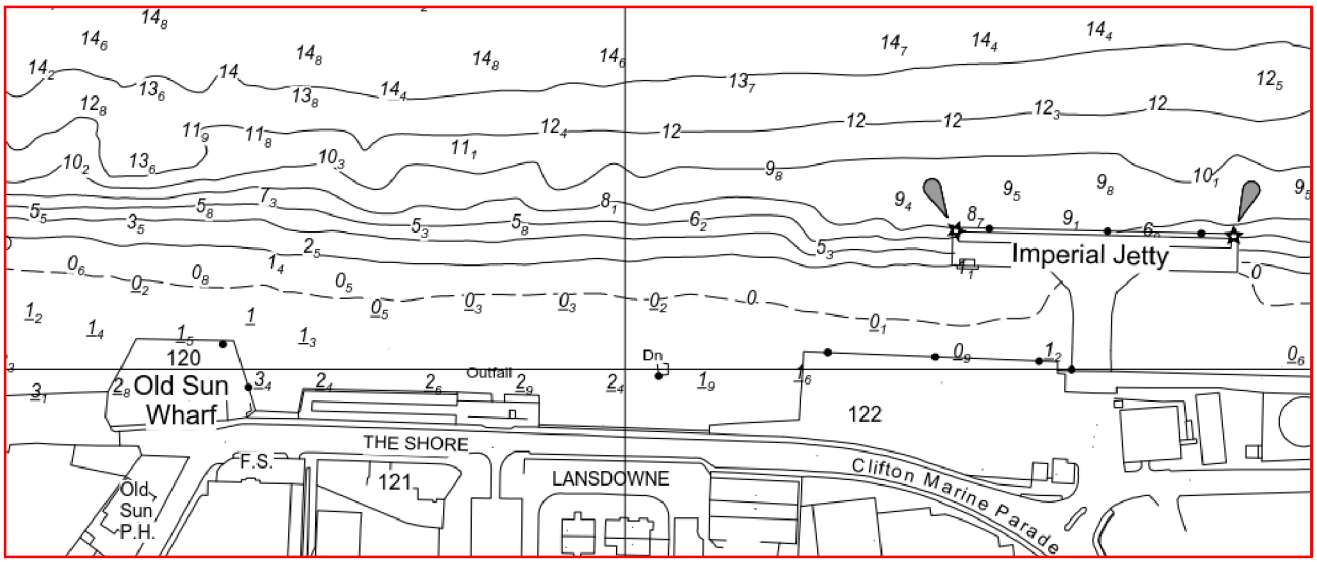
River Bathymetry and Geomorphology

3.2.5. Bathymetry data (river bed levels) is presented in Figure 3, where underlined values represent levels above chart datum (+CD) and numbers not underlined represent levels below chart datum (-CD).

3.2.6. Based on mean low water neaps (+1.51m CD) and mean low water springs (+0.56m CD) it can be seen that the foreshore fronting the Rosherville Pier will often remain land-locked due to bathymetric levels being circa 0 to 1m CD adjacent to Imperial Jetty (to the east) and the Old Sun Wharf (to the west) where the riverwall alignment steps out. Thus isolating the foreshore below Rosherville Pier from access upstream and downstream along the foreshore.

3.2.7. The River Thames is a dynamic watercourse and due to the typical bed material of silt and sand is highly mobile with bed formations susceptible to frequent change.

Figure 3 - Extract of PLA Chart showing Bathymetry Levels



Currents

3.2.8. A survey of the currents at the site has not been undertaken for this report. It is understood that the River Thames typically has relatively high velocities and these will be locally higher / focussed around structures resulting in an increased local risk of scour.

3.2.9. The PLA hold a numerical hydrodynamic model of the river, which can be used to derive local flows under a variety of conditions. This model could provide boundary conditions if there were a need to understand flows around Rosherville Pier.

Wave Climate

3.2.10. A survey of the wave climate at the site has not been undertaken for this report.

3.2.11. The site is located far enough upstream not to be subject to swell waves. However, the River Thames is approximately 600m wide at Northfleet with a potential for an approximate 7.5km fetch which is significant enough to produce short period wind generated waves which could be accentuated from reflection and refraction from the vertical river walls.

3.2.12. Vessels such as tug boats, cruise barges, working barges, naval vessels and container vessels amongst others all pass along this section of the river and will produce vessel induced waves / wash.

3.2.13. No site specific wave information was found during the desk study. Maritime and Coastguard Agency (MCA) Categorisation of Water Regulations 1992 (SI 1992 No. 2356) identified the site to be located within the River Thames above a line drawn north / south through the eastern extremity of Denton Wharf Gravesend named as River Thames and its tributaries, England. This section of waterways has a category C classification where the significant wave height could not be expected to exceed 1.2 metres at any time.

GEOLOGY

3.2.14. Based on British Geological Survey (BGS) online mapping it is understood that the geology in the area is:

- Superficial Geology: Tidal River or Creek Deposits - Clay and Silt bordered with an area of no recorded superficial geology; and
- Bedrock Geology: Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated) - Chalk. Sedimentary Bedrock

3.2.15. Boreholes taken within The Shore, as recorded on as-built drawings from Kent County Council, detail made ground directly below the carriageway down to 7.5m below ground level (b.g.l.) and 5.6m b.g.l. thereafter material is recorded as chalk.

HISTORIC USAGE

Historic Use/ Knowledge of Structure

3.2.16. It is understood that the pier was constructed in the 1830's (circa 1837) and provided land access for tourists visiting Northfleet and Rosherville Gardens/ Pleasure Park by steamboat. The park was closed prior to the First World War.

3.2.17. Following the First World War, Henley Telegraph and Cable Works started to utilise the site from 1924.

3.2.18. It is understood that the original construction of the pier had steps down to the foreshore, however they were encased in concrete in the 1960's. The reason for the encasement works associated to the steps is unknown, however it is considered likely that the encasement would have been associated to prevent any further deterioration of the original stone construction.

3.2.19. From correspondence with Kent County Council it is understood that there was a collapse of the river wall north of Rosherville Pier in 1988. Following this a sheet pile stabilisation wall, to the west side of Rosherville Pier, was constructed.

3.2.20. The only recent maintenance recorded by Kent County Council are stone repairs which were undertaken in 2016 which were extended to include refurbishment of the steps down to Rosherville Pier.

Present Day

3.2.21. At the present day the Rosherville Pier is no longer operational and has been closed off with fencing to prevent public access.

STATUTORY AND NON-STATUTORY DESIGNATIONS

3.2.22. Based on a review of the gov.uk 'MAGIC Maps', which provides geographic information about the natural environment from across government, the following statutory and non-statutory designations are present at or adjacent to the asset.

- Land Based Statutory
  - SSSI Impact Risk Zones
  - Listed Buildings (England) Grade II
- Non-statutory:
  - None listed

Historic England Listed Building Details

3.2.23. The Rosherville Pier which is covered as part of this assessment forms part of a Grade II Listing as summarised below.

- **Grade Listing:** II
- **List Entry Number**: 1396396
- **Date First Listed**: 06-Jan-2011
- **Statutory Address**: Rosherville Quay Walls, Steps, Drawdock and WWII Mine Watching Post, The Shore
- **National Grid Reference**: TQ 63704 74490
- **Listing Detail**: 742/0/10020 THE SHORE 06-JAN-11 Rosherville quay walls, steps, drawdock and WWII mine watching post
- **Summary**: II Quay walls, steps, drawdock and attached WWII mine watching post. 1837, designed by the architect H.E.Kendall (1776-1875) and his son Henry Edward Kendall, Junior for Jeremiah Rosher. The attached mine watching post is of circa 1940. The 1960s concrete reinforcement to the sides of the platform is of lesser interest.

3.2.24. **Reasons for Designation**: The Rosherville quay walls, steps, drawdock and WWII mine watching post are designated at Grade II for the following principal reasons: * Architectural interest: impressive c.1837 stone quay walls, drawdock and steps to a Thames pier at Rosherville, designed by the eminent architect H. E. Kendall. It is the only marine structure designed by this architect. * Degree of intactness or alteration: The quay walls, steps and drawdock survive substantially intact. The wooden pier no longer survives. * Historic interest: This is the only surviving structure of the 1830s new town, Rosherville, and it provided travel to the very popular pleasure gardens, Rosherville Gardens, between 1837 and 1913. The attached WWII mine watching post is evidence of a further use at a later historical period.

3.2.25. For further details refer to the listing on Historic England's website: (https://historicengland.org.uk/listing/the-list/list-entry/1396396).

3.3 STRUCTURE FORMATION

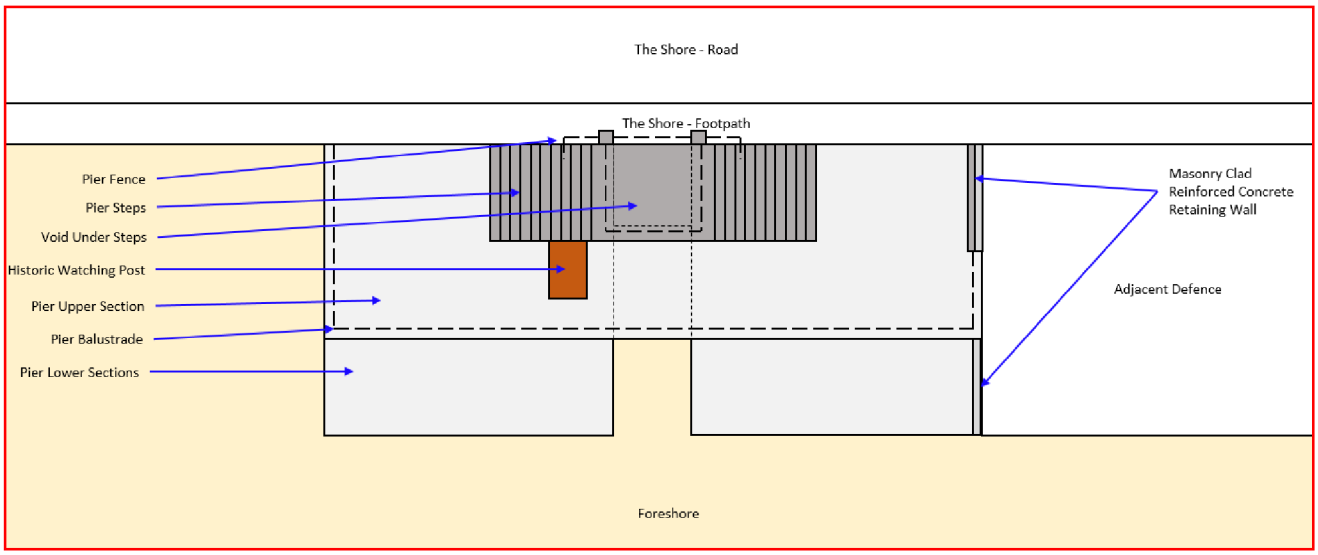
STRUCTURE DESCRIPTION

3.3.1. Based on site observations it is understood that Rosherville Pier is primarily a mass concrete structure with a stone masonry arch forming a landing in front of / river side of stone masonry steps which provides access down onto the upper section of the pier.

3.3.2. It is understood that historic masonry elements of the pier have been encased in concrete, the extent of this and the reasons for this encasement are unknown, no drawings were identified during the preparation of this study.

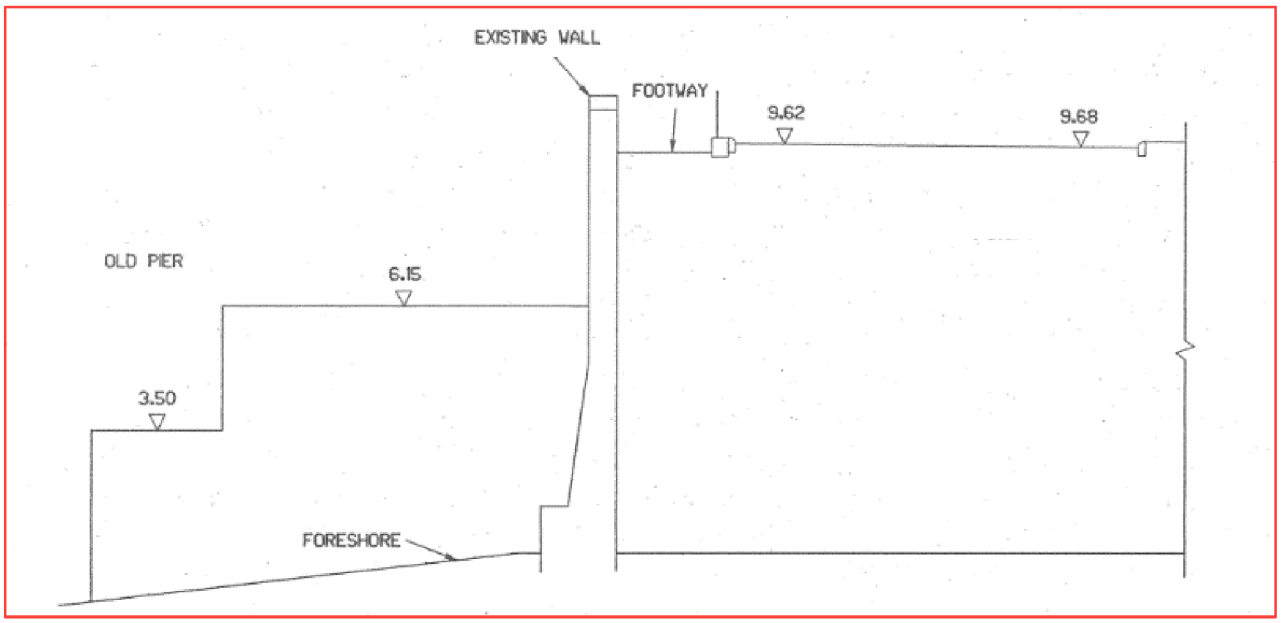
A sketch plan of Rosherville Pier can be seen below in Figure 4.

Figure 4 - Sketch Plan of Rosherville Pier



3.3.3. An indicative section of Rosherville Pier relevant to the riverwall and carriageway thereafter is provided in Figure 5 as extracted from a Kent County Council drawing which was prepared for the repair of a failed section of river wall north of Rosherville Pier in the 1988.

Figure 5 - Extract from Kent County Council Record Drawing of Wall Collapse Repair



3.3.4. Key features on Rosherville Pier are summarised below.

Pier Fence

3.3.5. The Shore footway is segregated from the pier by a boundary fence. This fence has 'fans' over the riverwall to further deter members of the public attempting to access the structure. A padlocked gate proves access onto the pier between the two columns which provide support to the fence.



Pier Steps

3.3.6. A masonry arch forms a landing at carriageway level over the underlying opening within the upper section of the pier. Masonry steps provide access down onto the upper section of the pier, with a mid-level landing on both sides. The level difference from the top of the steps to bottom is approximately 3.5m.



Void Under Steps/ Pier Step Arch

3.3.7. Within the upper section of the pier a void is present ahead of the draw dock that extends under The Shore road. A balustrade is present around the exposed edge of the opening at the upper pier level.



Historic Watching Post

3.3.8. A watching post is located on the upper section of the pier. The structure is formed of brick with a concrete roof slab.




Pier Upper Section

3.3.9. Pier Upper Section is mass concrete with regular construction joints throughout. A balustrade railing is located around the perimeter of the pier. A wall and fence provides a barrier between the pier and adjacent flood defence structure.





Pier Lower Sections

3.3.10. The lower section of the pier is formed of mass concrete.




Pier Arch

3.3.11. Between the lower pier level there is an approximate 4m opening which provides access through to the draw lock. A masonry arch spans between the upper pier section to provide a continuous floor across the upper pier level.

3.3.12. The arch is formed on stone masonry abutments with a brick arch and stone masonry voussoirs.





Pier Balustrade

3.3.13. As discussed above a balustrade located around the perimeter of the exposed edges on the upper pier level, the balustrade is embedded into the mass concrete structure. It is understood that the balustrades are routinely painted with painting last been undertaken during November 2018.



Masonry Wall/ Retailing Wall – Upper and Lower

3.3.14. A wall is located at the west end of the pier and acts as a boundary to the adjoining structure.

3.3.15. The wall is a reinforced concrete wall with a reinforcement link into the river wall (see record drawing appended) and is clad with stone masonry.



Foreshore

3.3.16. The foreshore gently slopes down towards the main channel of the River Thames. The foreshore appeared to be exposed chalk in places with overlying river silts and loose rock above.




ADJACENT STRUCTURE BACKGROUND

East of Structure (towards estuary)

3.3.17. East of Rocherville Pier the alignment steps back to the original masonry river wall.




West of Structure (towards central London)

3.3.18. West of Rocherville Pier a sheet piled wall continues west along the same alignment as the toe of the pier.




3.4 UNDERSTANDING OF STRUCTURES CONDITION

LATEST (2018) INSPECTION SUMMARY

3.4.1. Full details of the structures observed condition, from the 2018 inspection, can be seen in the Rosherville Pier Visual Condition Inspection Report (Report Ref.: 70015663-WSP-C-RP-001_R0), with a high-level summary hereafter.

3.4.2. Observations from the site visit have also been translated into the inspection pro-forma, see Appendix B.

Pier

3.4.3. At the time of the 2018 inspection the Rosherville Pier was typically in a 'good' condition (condition grade 2), with no significant defects noted. A summary of the condition of the main elements and isolated defects observed at this time can be seen in Table 3.

Table 3 - Summary of Rosherville Pier Elements Condition

Rosherville Pier Element	Overall Condition Grade	Isolated Defects Summary
Pier Fence	2	Render crazing
Pier Masonry Steps	2	Minor section loss
Upper Pier Masonry Arch	2	Joint loss
Lower Pier Masonry Arch	2	Joint loss Render spalling
Masonry Watch Post	2	Hairline Fracture
Concrete Upper Pier Section	2	Terrestrial Vegetation Growth Marine Vegetation Growth Hairline Fracture Construction Joints
Concrete Lower Pier Section	2	Terrestrial Vegetation Growth Spalling Hairline Fracture Honeycombing Marine Vegetation Growth
Pier Balustrade	2	No comment
Retaining Wall Upper	2	No comment
Retaining Wall Lower	2	No comment
Pier Toe/ Foreshore	2	Minor Undermining

Foreshore

3.4.4. The foreshore was found to be in a stable condition with no significant signs of scouring or erosion. It is assumed that the majority of the foreshore in the area is found on chalk bedrock with some slit deposits above, chalk outcrops were observed on the foreshore.

3.5 POTENTIAL STRUCTURE DAMAGE MODES AND MECHANISMS

3.5.1. As discussed in Section 5 the inspections should be undertaken by a competent engineer.

3.5.2. Based upon the definitions of source, pathway and receptors considered in Environment Agency Guidance: 'Asset performance tools – asset inspection guidance' the section below provides an indication of the likely forms of potential damage modes and mechanisms on Rosherville Pier to be considered by the inspection team.

Source (Hazard) & Pathway (Damage Mechanism)

3.5.3. Typical damage mechanisms for each of the hazards are summarised below.

Table 4 - Typical Damage Mechanisms

Source (Hazard)	Pathway (Damage Mechanism)
Vegetation Growth	Vegetation growth can allow root penetration into the structure core, creating voids (internal erosion) and also destabilising the mass concrete and masonry blocks.
Temperature Variation	Weathering due to freeze/ thaw cycle or wetting/ drying (chloride ingress) can lead to degradation, e.g. cracking/ spalling, of mass concrete and masonry blocks.
Wave/ Tidal Action	Wave action can damage/ destabilise toe protection, leading to undermining of the structure and/ or allowing increased wave attack and exposure to further undermining. Wave action can destabilise structures due to uplift pressures, leading to internal erosion/ void formation (or directly erode unprotected cores).
Geotechnical Failures	Geotechnical failure of the underlying soils and embankment itself leading to superficial damage or major collapse (localised). Settlement due to compaction (or liquefaction) of the underlying soils could occur.
Rainfall/ Surface Water	Rainfall/ surface water can lead to erosion of structure and can also lead to internal erosion (void formation) through ingress to the core.
Loading	A change in loading (accidental, temporary or permanent), to or adjacent to the structure, could result in failure / damage.

Receptor (Consequence)

3.5.4. Based on the various sources and pathways the following receptor consequences have been identified.

Table 5 - Summary of Potential Failure Modes and Receptor (Consequence)

Element	Local damage	Global failure	Receptor (Consequence)
Mass Concrete	▪ Seepage ▪ Spalling ▪ Settlement/ Displacement ▪ Fracturing ▪ Undermining/ scour	▪ Overturning ▪ Ground Bearing ▪ Sliding ▪ Slip ▪ Collapse ▪ Accidental Vessel/ Debris Impact	▪ Harm/ injury to people accessing the Pier (Maintenance Staff/ Inspectors/ Trespassers) ▪ Failure of Pier causing increased environmental exposure to the adjacent riverwall ▪ Failed elements within River Thames may cause damage to other structures or river users
Masonry Arch	▪ Joint Loss ▪ Section Loss ▪ Settlement/ Displacement	▪ Overturning ▪ Ground Bearing ▪ Sliding ▪ Slip ▪ Collapse ▪ Accidental Vessel/ Debris Impact	
Metal Balustrade	▪ Corrosion ▪ Delamination ▪ Bolt Failure	▪ Collapse ▪ Accidental Vessel/ Debris Impact	

3.6 FUTURE IMPACT OF CLIMATE CHANGE

3.6.1. The predicted increase in sea levels and more frequent and severe weather could result increased exposure of the structure to environmental factors that could increase the rate of deterioration to the structure.

3.6.2. It is not appropriate to take a full assessment on how this would affect the structure at this stage and a pragmatic approach is recommended to monitor the structure, assess how changing environmental factors are affecting the structure, and appropriately intervene through maintenance or capital works if required.

4 ASSET MANAGEMENT RESPONSIBILITIES

4.1 OWNERSHIP AND MANAGEMENT

4.1.1. The asset is owned by Homes England.

4.1.2. Whilst Keepmoat Homes will not legally be the asset owner until the completion of development, Keepmoat Homes are committed to taking on the responsibility of the inspection regime, as detailed below, until such time as the asset is transferred to a third party. The ongoing inspections will help inform the requirement and planning of future maintenance activities.

4.1.3. The asset is owned by Homes England and Keepmoat Homes have been appointed as their development partner for the delivery the Northfleet Embankment Development scheme. Upon completion of the scheme, the ownership of Rosherville Pier will be transferred from Homes England to Keepmoat Homes, or an alternative third party to be agreed along with the maintenance responsibility of this AMP.

4.1.4. The funding arrangements for the long term maintenance and management of Rosherville is to be agreed via an updated asset management plan to be submitted to and approved in writing by the local planning authority once expressions of interest from potential third party owners have been firmed up.

DUTY HOLDERS

Implementation of Inspections

4.1.5. Inspections should be undertaken at frequencies as detailed within this report.

Implementation of Maintenance/ Capital Works

4.1.6. Any maintenance or requirement for capital works identified or recommended through inspections should be designed by and implemented by competent designers/ contractor under appointment in accordance with relevant permitting and consenting requirements.

AMP Updates

4.1.7. In the event that a third party is identified to take on ownership of the asset, the AMP will require updating and written approval of the local planning authority prior to transfer of ownership taking place. The update should include funding arrangements for maintenance and management of the asset and include provisions for allowing public access. ~~The AMP will require updating and submission to LPA for approval once a third party is identified to take on ownership of the asset and funding arrangements for maintenance and management are agreed.~~

4.1.8. Due to the likely changing environmental conditions and the existing condition and age of the structure it is recommended that the AMP is reviewed on a 15 to 20 year basis (or after significant change) by a competent Civil & Structural/ Coastal Engineer to determine if the AMP principles remain appropriate.

Safety Critical Action and Interaction with Associated Stakeholders

4.1.9. Any person that observes a ‘safety critical issue’ with the structure or adjacent structures that may cause danger or have the potential to cause a safety issue should immediately inform the owner who should take immediate action as deemed appropriate to manage the issue and to contact other relevant stakeholders where appropriate. Key stakeholders may include, but are not limited to:

- River Thames Navigation – Port of London Authority (e.g. notify of potential danger);
- River Thames Flood Risk – Environment Agency (e.g. notify of potential risk flood defence breach/ pollution incident); and
- The Shore Carriageway – Kent County Council (e.g. notify of potential risk to road users safety).

4.2 PERFORMANCE REQUIREMENTS

4.2.1. Rosherville Pier is currently a disused structure which with no direct access to the public. The key purpose of undertaking this AMP is to maintain the condition of the asset to:

i) maximise longevity of the existing structure as far as reasonably practicable;

ii) ensure ongoing safety to adjacent users / assets landward and rive-side;

iii) provide safe access for inspection, routine maintenance; and

iv) prevent potential trespassing.

4.2.2. Following the completion of remedial works (including new handrails and lifesaving equipment) it is proposed to allow controlled access to the heritage asset, for which an appropriate assessment should be conducted to ensure the structure is in a safe condition to accept access from the public and number of people expected (e.g. potential crowd loading on archway).

4.2.3. The number of days the Pier can be opened to the public is subject to further discussion with the LPA and the third party taking the ownership of the asset.

4.3 HEALTH AND SAFETY MANAGEMENT

4.3.1. Health, safety and welfare considerations should be considered by the inspection team and other duty holders, details of likely site-specific considerations based on the conditions observed in the 2018 inspection are summarised below.

Working near Water

4.3.2. The Pier is located in a tidal environment where the deck become inundated during extreme high tide scenarios, and increasing so in the future due to sea level rise. Furthermore, the foreshore is land locked and access can only be safety obtained through ladder access from the structure (by trained personal) or by boat access from the River Thames.

- Main Access:
  - Foreshore only accessible via ladder or via boat access.
  - Foreshore is landlocked and becomes completely inundated by the flood tide.
- Hidden Obstructions:
  - Foreshore has various debris protruding from the ground which may pose a risk to operation of any vessel intending to access structure
- Slips, trips and Falls:
  - Tidal inundation, wash from vessels and extreme weather may cause debris to collect on the structure which may present hazards for foot access,
  - During high to mid tides, overtopping from vessel wash or extreme weather could cause people to loose their footing and be dragged into the river.
  - Numerous trip hazards and large areas of soft mud, slopes/ and marine growth present on the foreshore.
  - Marine growth and wash of silt can cause flat even surfaces to become very slippery.

Working from Height

4.3.3. Balustrades are noted around the upper pier level due to the drop greater than 2m.

4.3.4. During the 2018 inspection no balustrade was noted to the steps providing access to the main deck, which have an unprotected edge with a drop of 3.5m at its highest. As these steps provide access to the main deck of the asset it is recommended that a balustrade is fitted as all personnel accessing the Pier may not be familiar with working from heights, the presence of the risk, or what safety measures should be taken.

4.3.5. In the interim prior to installing a balustrade a safety warning notice should be fitted to the access gate notifying personal of the risk.

4.3.6. This requirement should however be balanced against the fact that the area is currently fenced off and not accessible to the public and only people working in the area should have access, therefore a management process may be deemed acceptable to manage this identified risk.

4.3.7. The installation of a balustrade would need to be suitably designed to ensure that the loading can be accommodated within the existing structure and may require some local remediation to the existing masonry blocks on the steps.

Proposed Installation of Safety Measures

4.3.8. Keepmoat, as Principal Designer, confirm that lifesaving equipment such as grab chains, escape ladders and life buoys, along with the handrails to steps will be installed on the pier prior to handover to a third party. However, these will be subject to planning approval/ listed building consent from Gravesham Borough Council in consultation with the Port of London Authority. The application for listed building consent/planning approval will be made within 12 months of approval of the Rosherville Pier asset management plan to allow pre-application engagement with Gravesham Borough Council and the Port of London Authority to agree the works and extent of life saving equipment required. The works outlined within the application for listed building consent/planning approval are to be completed within 3 months of receipt of the listed building consent/planning approval and permits to work.

4.3.9. Furthermore, a health and safety audit should be undertaken in advance of confirming the safety measures to ensure these measures are appropriate, designed by a competent designer and agreed with the Principal Designer.

Structural and Geotechnical Capacity

4.3.10. There are no known structural or geotechnical assessments available to confirm the current design / working loading. However; based on the current understanding of the structures condition, it is suitable for pedestrian access (e.g. two-person inspection team). However, if the structures condition significantly changes or additional loading to the structure is required (e.g. plant/ materials required for maintenance works) a structural/ geotechnical assessment should be undertaken, to ensure the structure has sufficient capacity.

Asbestos

4.3.11. No asbestos register is currently available for the structure which is primarily of concrete and masonry construction, Rosherville Pier is located in open space with a low risk of disturbance to the structure during visual inspections alone. It is recommended that an asbestos risk assessment is undertaken prior to any intrusive investigations, maintenance/ capital works or demolition to determine if further action, or control measures are required.

4.4 HERITAGE

4.4.1. Keepmoat confirm that ~~prior to handover to a third party~~ a photographic survey shall be undertaken to document the heritage assets as per the Historic England listing as stated in the 'Historic England Listed Building Details' Section above in this report. This will be undertaken within 6 months of the AMP being approved.

4.4.2. Rosherville Pier is currently within the ownership of Homes England and is due to transfer to Keepmoat Homes upon the completion of development. In the interim, Keepmoat Homes confirm to complete the survey work covering the asset in accordance with the AMP. This will include the drawdock, although any required maintenance of the drawdock still falls outside of this asset management plan. These surveys will be to Historic England Level 3 and results will be shared with the local planning authority, ~~and~~ Kent County Council and the Environment Agency once available.

4.4.3. Keepmoat Homes confirms that ~~prior to a transfer to a third party,~~ a 3D survey will be carried out within 12 months of the AMP approval and prepared with detailed sections to document the heritage assets as per the Historic England listing as stated in the 'Historic England Listed Building Details' section above in this report.

4.4.4. Following the 3D survey, a photo survey will then be carried every other year by the future owner and copies issued to Kent County Council and the Environment Agency for information ~~for review and consideration~~.

5 ASSET INSPECTION AND MONITORING REGIME

5.1 PURPOSE OF INSPECTION

5.1.1. The purpose of inspections are to capture information relating to the structure; namely:

- identify current condition, checking for observations of:
  - excessive weathering or abrasive deterioration
  - gaps or displacement
  - undermining or scouring
  - any other damaged or failed elements
  - debris that may lead to damage or failure
  - stability of foreshore and height of foreshore relevant to structure;
- observation of significant changes / deterioration since the last inspection;
- observe change in rate of deterioration compared to previous inspections;
- identify where intervention (maintenance or capital works) may be required;
- identify any safety critical issues that may require immediate action.

5.1.2. This section of the AMP aims to provide a consistent approach to inspecting the asset. Inspections should be thoroughly planned and follow a logical sequence.

LIMITATIONS

5.1.3. Visual inspection is the simplest form of non-destructive testing, as it does not require any specialist equipment. It is a widely used technique for monitoring assets and their surroundings. However, this method can only assess the surface details and condition of an asset; changes to interior structure and changes to condition are not easily identifiable until they lead to changes to the surface of the asset.

5.2 INSPECTION REGIME

5.2.1. Based on industry guidance including; CIRA 746, Inspection Manual for Highway Structures and PIANC 119, the following programme of inspections is recommended for Rosherville Pier, which balances the current observed condition of the structure and age.

Table 6 - Inspection Regime Type and Frequency

Inspection Type	Frequency	Form of Inspection
General/ Principle (Detailed) Inspection	One every 3 years	Close visual inspection within touching distance to report on physical condition of all inspectable structural parts and assign recommendations for future maintenance activities or further investigations and monitoring/ special inspections. Including elements at foreshore level.
Safety Inspection	Annually	Annual inspection by competent and qualified person to notify of any obvious major damages in terms of usability of the structure or safety critical elements. Any identified issues should be followed as soon as reasonably practicable by a Special Inspection and notification of other third parties that may be affected. (Unless specific concern of undermining this inspection is likely to be undertaken from the main deck only, access to foreshore not included which would prevent observations of toe of structure, however any major safety issues should be visible from the deck)

Inspection Type	Frequency	Form of Inspection
Special Inspection	Not scheduled performed as required following advice from general or safety inspection or public notification of safety critical issue (e.g. known vessel impact or extreme severe storm)	Rapid evaluation by qualified engineer to determine if further attention to the structure is required as a result of the event or if the condition has significantly changed since the previously observed inspection and required further immediate intervention and notification of other third parties that may be affected. (Unless specific concern of undermining this inspection is likely to be undertaken from the main deck only, access to foreshore not included which would prevent observations of toe of structure, however any major safety issues should be visible from the deck) Special inspection may include intrusive inspection to be undertake by relevant qualified person.
Post-event Inspection	Not scheduled performed as required following a significant potentially damage causing event (e.g. known vessel impact or extreme severe storm)	Rapid evaluation by qualified engineer following damage caused by a storm, flood, vessel impact etc. in order to determine if further attention to the structure is required as a result of the event or if the condition has significantly changed since the previously observed inspection and required further immediate intervention and notification of other third parties that may be affected. (Unless specific concern of undermining this inspection is likely to be undertaken from the main deck only, access to foreshore not included which would prevent observations of toe of structure, however any major safety issues should be visible from the deck)

5.3 INSPECTION PERSONNEL

5.3.1. The asset should be inspected by suitably experienced engineers (minimum two per inspection) who are familiar with the type of structure and are competent in assessing the deterioration rate and likely future performance/ reliability of the structure.

5.4 INSPECTION SITE ACCESS

5.4.1. Only the upper section of the pier can be safely accessed by the gate located on The Shore by foot, access to the lower pier section and foreshore can only be obtained through ladder access or via boat access due to the foreshore fronting the structure being land locked.

5.4.2. Ladders should only be used by competent ladder trained operatives utilising a mobile ladder or by installing a permanent ladder to facilitate safe access.

5.4.3. To enable safe access to the foreshore installation of a permanent ladder could be considered, however this may introduce further maintenance requirements that would not outweigh the benefit for relatively infrequent inspections.

5.4.4. As the foreshore is land locked and within a tidal environment which becomes inundated, inspection from the foreshore should only be undertaken around low water by a minimum two-person team.

5.4.5. Access onto the upper section should only be undertaken when the tide has suitably dropped such that no overtopping onto the structure would occur.

5.4.6. A dynamic risk assessment should always be undertaken by site operatives and common sense used to observe typical safety issues and if required personnel should stop and remove themselves from the situation if required.

5.5 INSPECTION CONDITION RATING

5.5.1. The condition ratings are based on the Environment Agency (EA) Condition Assessment Manual (CAM) suited to flood and coast protection structures. This rating criteria is recommended for use to assess the condition of the asset in the future to provide a consistent rating based on clear, standardised and appropriate guidance criteria.

Table 7 - Environment Agency CAM Condition Ratings

Condition Grade	Condition Rating	Description
1	Very Good	Cosmetic defects that will have no effect on performance.
2	Good	Minor defects that will not reduce the overall performance of the asset.
3	Fair	Defects that could reduce the performance of the asset.
4	Poor	Defects that would significantly reduce the performance of the asset. Further investigation required.
5	Very Poor	Severe defects resulting in complete performance failure.

5.6 SITE SPECIFIC INSPECTION PRO-FORMA

5.6.1. To enable a consistent approach for recording the inspections a structure specific pro-forma has been developed, see Appendix B, which should be used to record the condition of the structure during all inspections.

KEY ELEMENTS TO MONITOR

5.6.2. Based on the current observed condition and form of the structure the following key aspects should be monitored as part of general inspections:

- Extent of undermining to toe of structure;
- Spalling to the concrete;
- Significant section loss to masonry blocks;
- Any obvious distortion to the masonry arch;
- Any safety issues (e.g. failed balustrade, collapse of section); and
- Foreshore levels

5.6.3. If an element of an asset cannot be seen at the time of inspection (e.g. because it is hidden by vegetation growth, or because access to the asset is not possible or has been denied), this should be noted and an appropriate recommendation made by the inspecting engineer (e.g. recommendation for clearance of the obstruction and re-inspection or defer to the next inspection if deemed appropriate).

5.6.4. Subject to the restrictions to the structure due it is listed building status mortar tabs should be fitted to the fractures to enable any potential continued movement to be monitored and recorded qualitatively.

5.6.5. Furthermore, it is recommended to continue to monitor the foreshore level to understand if the foreshore level is changing. Attention should be given to the northern end of the riverwall where the clay foreshore has become exposed. Any further reduction in foreshore level may require the implementation of scour protection measures to prevent undermining.

6 POTENTIAL FUTURE MAINTENANCE

6.1 LIKELY ROUTINE MAINTENANCE ACTIVITIES

6.1.1. Based on the current condition no urgent repairs are recommended, however a number of repairs are considered likely to be required in the future to prevent any continued and/ or accelerated deterioration to occur. These recommended repairs are likely to include:

- Cleaning of open joints (including fractures) and re-pointing;
- Removal of spalling blocks and replacement;
- Patch repair to spalled concrete;
- Removal of vegetation;
- Routine painting of railings/ balustrade; and
- Patch repair of missing stone blocks.

6.1.2. It is recommended to continue with a programme of inspections to monitor the current isolated defects and to consider implementing repair works in the future if the defects severity increases to maintain the current condition of the structure.

6.1.3. The decision to implement repair or maintenance works should be balanced with their benefit to the structure, reduced deterioration of the structure and the works impact to the structure.

6.2 WORKS CONSENT REQUIREMENTS

6.2.1. There are a number of consultees with professional interest in the site, including:

- The Marine Management Organisation (MMO)
- Port of London Authority (PLA)
- Environment Agency (EA)
- Historic England
- Gravesham Borough Council
- Kent County Council

6.2.2. Any proposed temporary, permanent and intrusive testing works within proximity of the riverwall including any works which could influence the structural support zone of the adjacent flood defence will require approval through permitting with the Environment Agency.

6.2.3. Furthermore, approval through permitting with the Port of London Authority and Marine Management Organisation may be required for any works below the mean high-water springs level (exemptions may be applicable for investigations).

6.2.4. Further details of the potential permitting for the Environment Agency, Port of London Authority and Marine Management Organisation is detailed below. It is recommended to consult with each regulator as early as possible in the design process to ensure they support the proposals.

6.2.5. Furthermore, it should be noted that Rosherville Pier is listed under the Planning (Listed Buildings and Conservation Areas) Act 1990 as amended for its special architectural or historic interest and therefore any works (temporary and permanent) may require consent with Historic England and further consultation should be undertaken to understand and listing restrictions.

6.2.6. It should be noted that the time taken to obtain licences / permits can be significant, for example the target time for a response from the Environment Agency is 8 weeks and for the Marine Management

Organisation is 13 weeks, these durations should be factored into any programme to undertake investigations / works and extended lead times to account for potential details should be considered in programming when such permits are likely to be obtained.

6.2.7. A non-exhaustive summary of anticipated consents from a marine perspective are summarised below.

Table 8 - Marine Consents

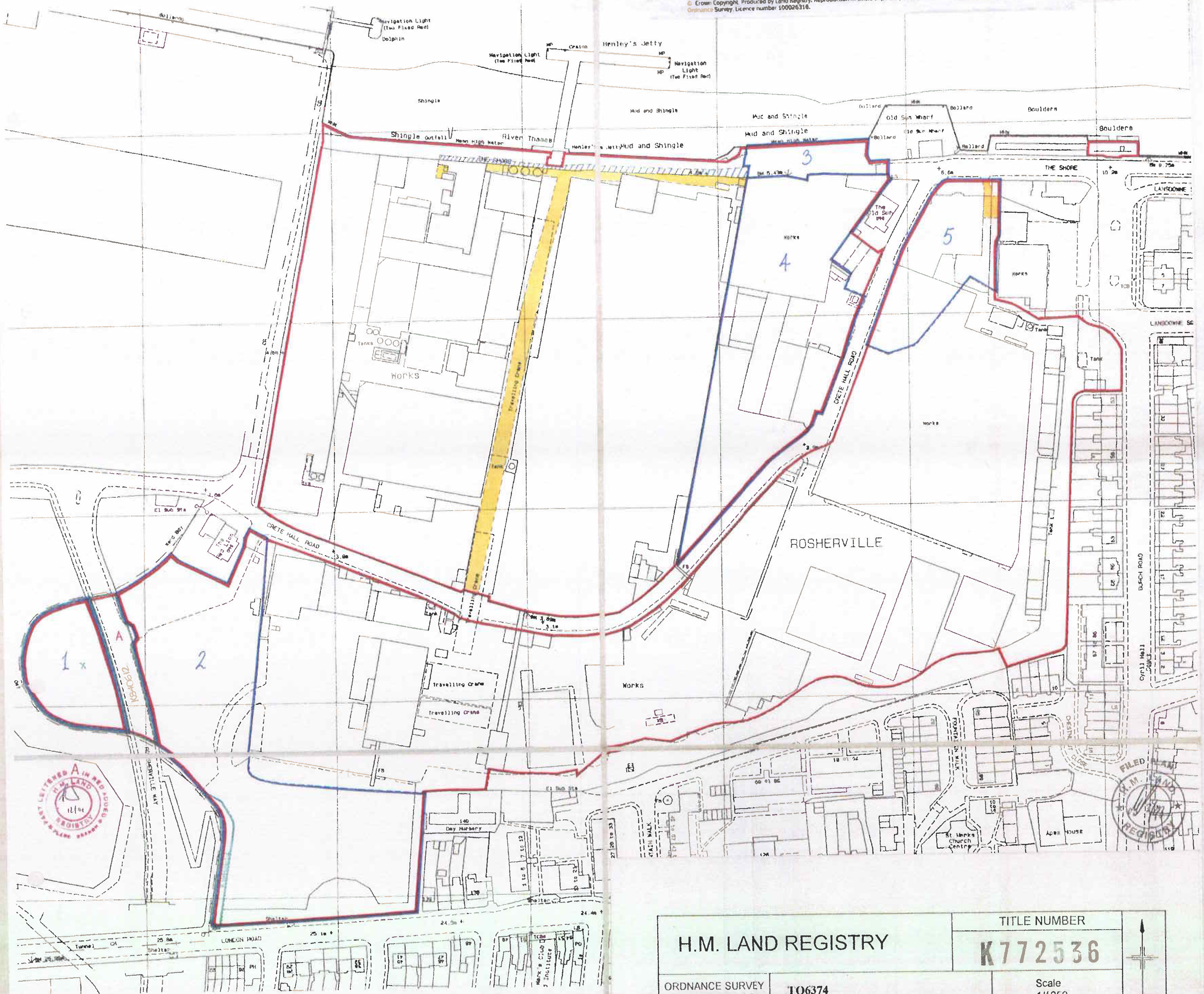
Regulatory Authority	Type of Consent	Relevant Legislation	Additional Information
Local Planning Authority	Planning Permission Environmental Impact Assessment	Town and Country Planning Act 1990 Town and Country Planning (EIA) Regulations	Requirement for obtaining consent should be determined by a competent planning consultant
Marine Management Organisation	Marine Licence Environmental Impact Assessment	Marine and Coastal Access Act 2009 Marine Works (EIA) Regulations 2007	Required for works seaward of Mean High-Water Springs (MHWS)
Environment Agency	Water Framework Directive Assessment	EU Water Framework Directive Water Environment (WFD) (England and Wales) Regulations 2003	Required for works that have the potential to impact on water quality
Environment Agency	Flood Risk Activities Permit	Environmental Permitting (England and Wales) Regulations 2016	Required due to the proximity of works to flood defence and Main River (River Thames), activity may be except – consult with Environment Agency to identify if activity is exempt.
Natural England	Habitat Regulations Assessment	EU Birds and Habitats Directive Conservation of Habitats and Species Regulations	Required for works that have the potential to impact on designated European Sites
Historic England	Listing Building/ Planning Permission	Planning (Listed Buildings and Conservation Areas) Act 1990	May be required for any works due to structure being Grade II listed.
Port of London Authority	River Works Licence	Harbours Act 1964	Required to construct, alter, renew or extend works within the tidal River Thames, up to MHWS

Appendix A

BACKGROUND INFORMATION

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This official copy issued on 21/10/13 shows the state of this title plan on 21/10/13 at 00:00:01. This title plan shows the general position, not the exact line, of the boundaries. It may be subject to distortions in scale. Measurements scaled from this plan may not match measurements between the same points on the ground. See Land Registry Public Guide 19 - *Title Plans and Boundaries*. It is admissible in evidence to the same extent as the original (s.67 Land Registration Act 2002).
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H.M. LAND REGISTRY		TITLE NUMBER K772536
ORDNANCE SURVEY PLAN REFERENCE	TQ6374	Scale 1/1250
COUNTY KENT	DISTRICT GRAVESHAM	© Crown Copyright

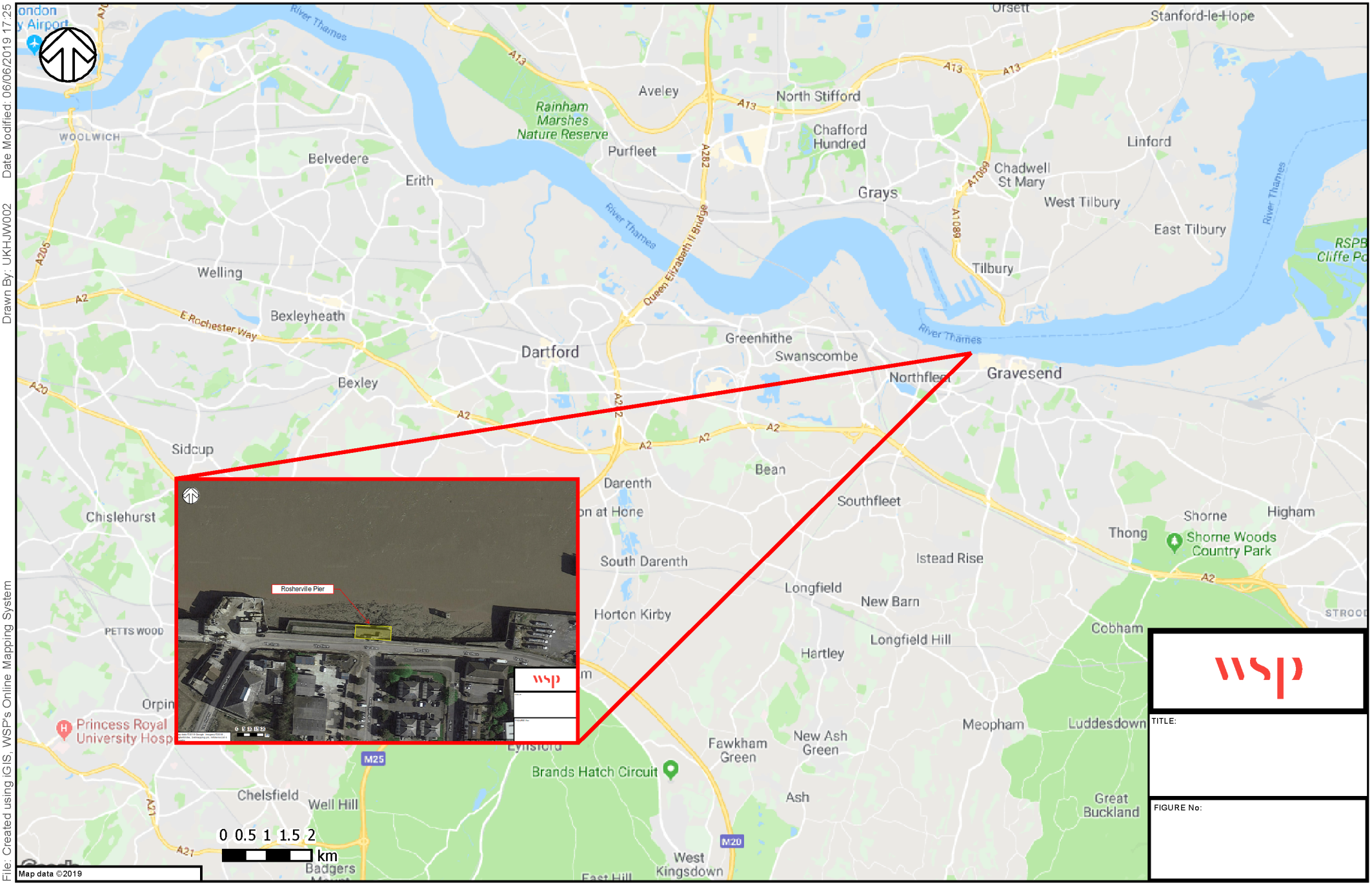


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Appendix B

INSPECTION PRO-FORMA

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Appendix B.1

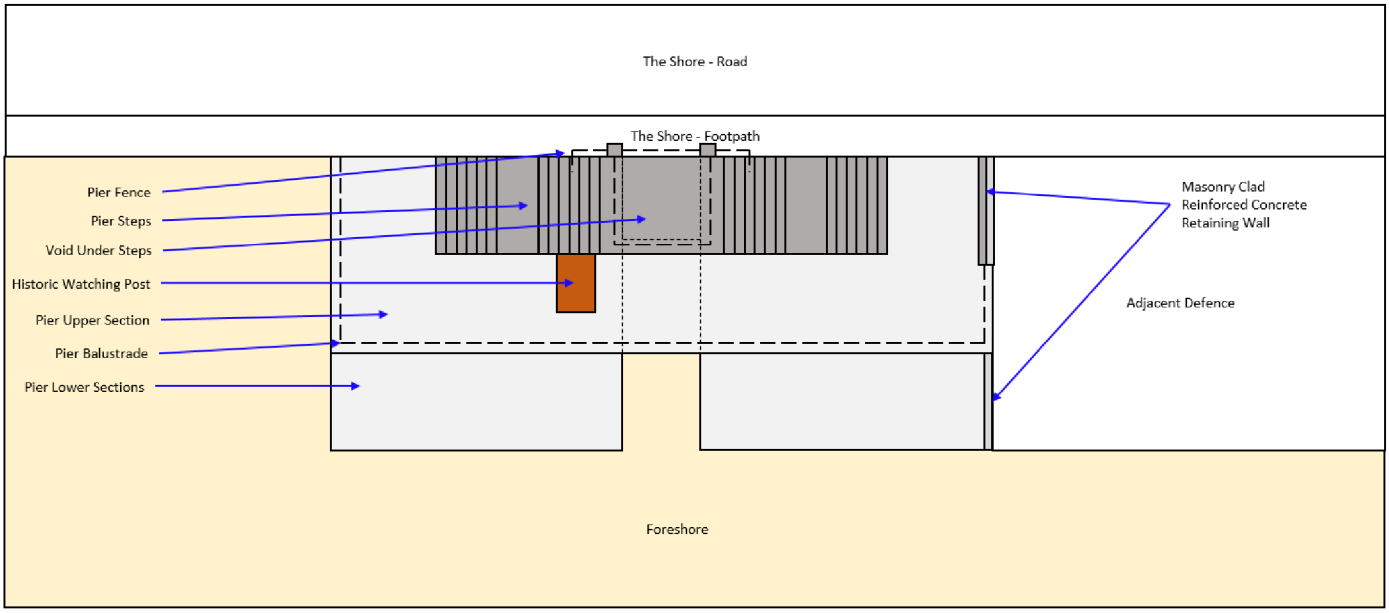
EXAMPLE (BASED ON 2018 INSPECTION)

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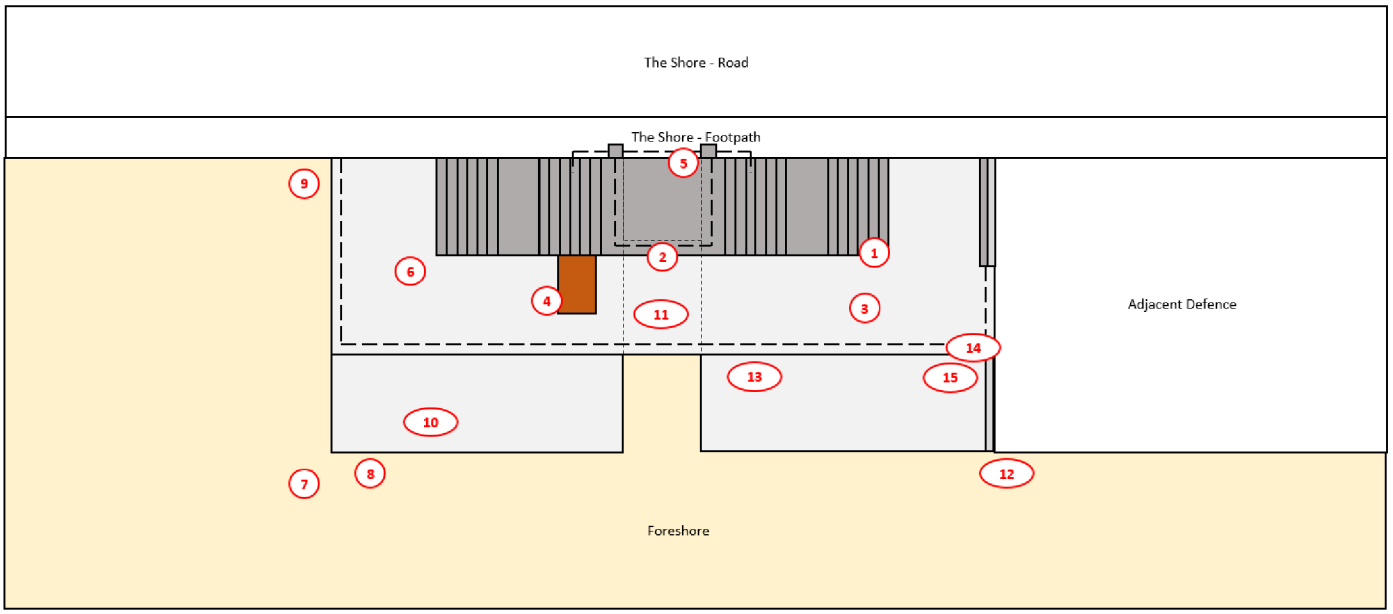
ROSHERVILLE PIER: INSPECTION PRO-FORMA

Date of Inspection	16 November 2018						**Date of Last Inspection**	n/a			
Type of Inspection	**General**	**X**	**Safety**		**Special**		**Post-event**		**Other**		
Inspection Team Personnel	Howard Rushton (WSP) Jo Welbourn (WSP)										
Access Details	Access on foot, access provided through gate via. Keepmoat Homes representative. Access to foreshore via mobile ladder operated by trained operatives under WSP's H&S policies.										
Time of Survey / Weather Conditions	The visual condition assessment was conducted on foot at low tide on 16 November 2018 between 1000hrs and 1400hrs, no intrusive works were conducted during the condition assessment. At the time of the inspection the weather was fair / sunny. The inspection was conducted around low tide to ensure safe access could be obtained to the foreshore. The tide times (Greenwich Mean Time) and levels (m above CD) on the date of inspection were: • High Water: 0556hrs @ 5.2m CD • Low Water: 1214hrs @ 1.6m CD; and • High Water: 1858hrs @ 5.2m CD.										
Summary of Inspection Observations	Main Pier: Rosherville Pier was typically in a 'good' condition (condition grade 2), with no significant defects noted. A summary of the condition of the main elements and isolated defects can be found hereafter. Foreshore: The foreshore was found to be in a stable condition with no significant signs of scouring or erosion. It is assumed that the majority of the foreshore in the area is found on chalk bedrock with some slit deposits above, chalk outcrops were observed on the foreshore										
Summary of Recommendations	Overview Based on the observed condition of the structure at the time of the inspection there are no significant defects recommended to be remediated immediately. However, a number of repairs are considered likely to be required in the future to prevent any continued and/ or accelerated deterioration to occur. It is recommended for a balustrade to be installed to the exposed edge of the steps, as there is currently an unprotected edge with a drop of up to 3.5m and in the interim a safety warning sign installed on the entrance gate. Installation of a balustrade would need to be suitably designed to ensure that the loading can be accommodated within the existing structure and may require some local remediation to the existing masonry blocks on the steps. Monitoring Subject to the listing restriction, mortar tabs should be fitted to the fractures to monitor if any continued movement is occurring. Monitor the foreshore level to understand if the foreshore level is changing. Attention should be given to the northern end of the riverwall where the clay foreshore has become exposed. Any further reduction in foreshore level may require the implementation of scour protection measures to prevent undermining. Key aspects to be monitored as part of routine inspections include: • Extent of undermining to toe of structure; • Spalling to the concrete; • Significant section loss to masonry blocks; • Any obvious distortion to the masonry arch; and • Any safety issues (e.g. failed balustrade, collapse of section).										

SITE LOCATION PLAN (INC. ELEMENT REFS.)



OBSERVED DEFECT LOCATION PLAN (INC. PHOTO REFS.)



SUMMARY OF INSPECTION OBSERVATIONS

Pier Element	Previous Inspection Condition *(1,2,3,4,5)*	Current Observed Condition *(1,2,3,4,5)*	Deterioration Since Last Inspection *(Y/N)*	General Comments *(Type of defect)* *(Commentary)*	Recommendation *(Commentary)*	Photo Ref. *(No.)*
Overall Condition	n/a	2	n/a	Observed in typically in a 'good' condition (condition grade 2), with no significant defects noted. Element condition and isolated defects summarised hereafter.	**Continue to monitor structure through inspection regime.**	
Pier Fence	n/a	2	n/a	**Render crazing** Crazing (sporadic hairline fracturing) located to both columns at the pier entrance. Superficial damage only	**Monitor**	5
Pier Masonry Steps	n/a	2	n/a	**Minor section loss** Located on steps typically on the outside edge around where it is expected that a balustrade may have previously been anchored	**Monitor**	1
Upper Pier Masonry Arch	n/a	2	n/a	**Joint loss** Isolated joint loss to stone masonry to voussoirs and vertical walls	**Monitor**	2
Lower Pier Masonry Arch	n/a	2	n/a	**Joint loss** Isolated joint loss to stone masonry to voussoirs and vertical walls	**Monitor**	2
				Render spalling Spalling noted to the render covering the brick arch under the upper pier, render may be covering defects to the underlying brickwork. However, visible areas of underlying brickwork in a good condition with no visible signs of distortion to the arch		10
Masonry Watch Post	n/a	2	n/a	**Hairline Fracture** Minor fracturing through masonry blocks, it is recommended to monitor this to identify if movement is ongoing	**Monitor (install mortar tabs)**	4
(Assumed) Mass Concrete Upper Pier Section	n/a	2	n/a	**Terrestrial Vegetation Growth** Sporadically located throughout structure, typically located in isolated to construction joints	**Monitor**	3
				Marine Vegetation Growth Marine vegetation growth and staining noted to the concrete face. Appears to be superficial only and not affecting the structures integrity	**Monitor**	7

				Hairline Fracture hairline fracture through concrete upper pier slab, not considered to affect the performance of the concrete however the fracture introduces a pathway for water seepage that increases the structures susceptibility to weathering	**Monitor (install mortar tabs)**	**6**
				Construction Joints Hairline fractures noted at construction joints, anticipated to be caused from formwork	**Monitor (install mortar tabs)**	**8**
(Assumed) Mass Concrete Lower Pier Section	**n/a**	**2**	**n/a**	**Terrestrial Vegetation Growth** Sporadically located throughout structure, typically located in isolated to construction joints	**Monitor**	**3**
				Spalling Minor isolated area of spalling top face of the lower pier	**Monitor**	**9**
				Hairline Fracture Vertical hairline fracture through concrete face, not considered to affect the performance of the concrete however the fracture introduces a pathway for water seepage that increases the structures susceptibility to weathering	**Monitor (install mortar tabs)**	**12**
				Honeycombing Isolated area of honeycombing noted to concrete due to poor mix of aggregate and cement during construction. No spalling noted to isolated area of honeycombing	**Monitor**	**13**
				Marine Vegetation Growth Marine vegetation growth and staining noted to the concrete face. Appears to be superficial only and not affecting the structures integrity	**Monitor**	**7**
Pier Balustrade	**n/a**	**2**	**n/a**	No comment		
Retaining Wall Upper	**n/a**	**2**	**n/a**	No comment		
Retaining Wall Lower	**n/a**	**2**	**n/a**	No comment		
Pier Toe/ Foreshore	**n/a**	**2**	**n/a**	**Minor Undermining** Isolated area of spalling with a maximum depth of 200mm at base of structure at interface with foreshore level, no scour noted around area	**Monitor**	**11**
Other						

PHOTOS



Photo 1



Photo 2



Photo 3



Photo 4



Photo 5



Photo 6



Photo 7



Photo 8



Photo 9



Photo 10



Photo 11



Photo 12



Photo 13



Photo 14



Photo 15

ADDITIONAL SITE NOTES AND SKETCHES

None recorded

Appendix B.2

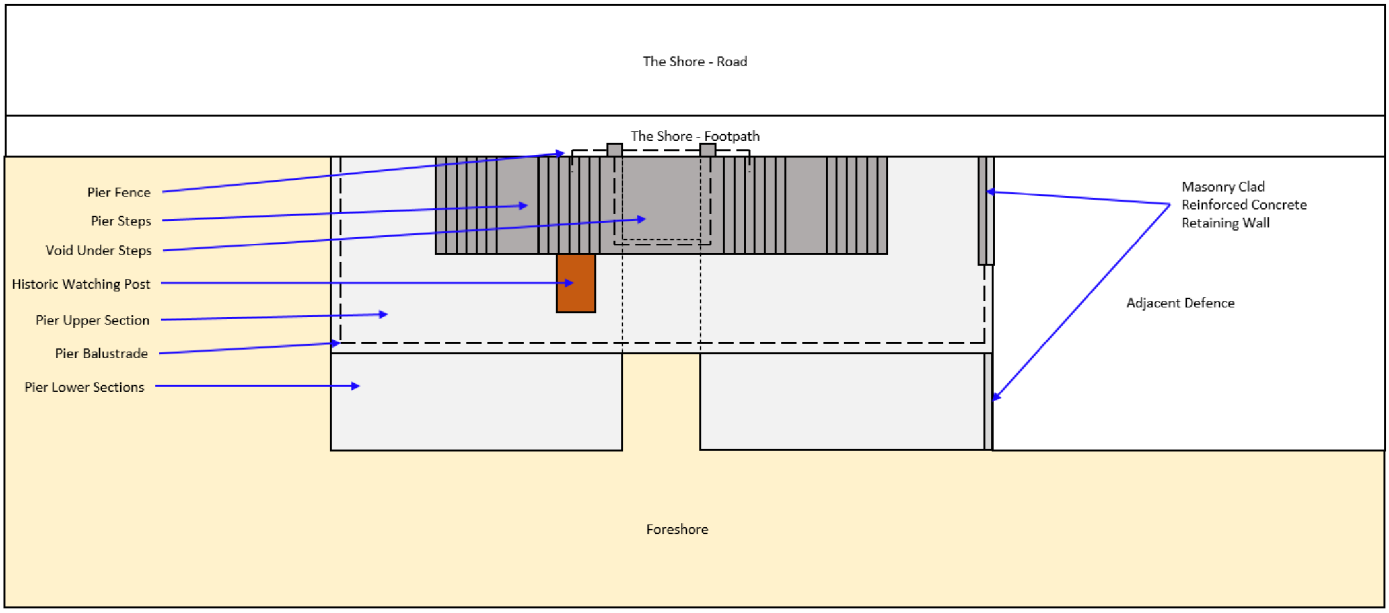
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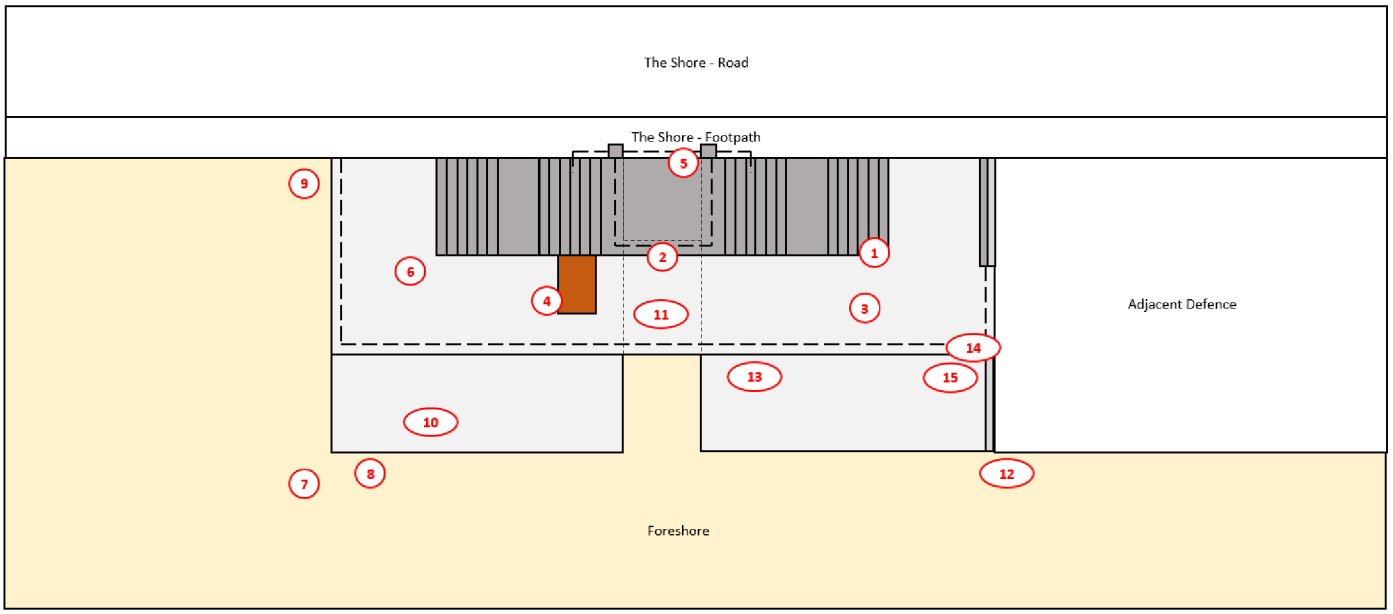
ROSHERVILLE PIER: INSPECTION PRO-FORMA

Date of Inspection	[Input date]						**Date of Last Inspection**	[Input date]			
Type of Inspection	**General**		**Safety**		**Special**		**Post-event**		**Other**		
Inspection Team Personnel											
Access Details											
Time of Survey / Weather Conditions											
Summary of Inspection Observations											
Summary of Recommendations											

SITE LOCATION PLAN (INC. ELEMENT REFS.)



OBSERVED DEFECT LOCATION PLAN (INC. PHOTO REFS.)



SUMMARY OF INSPECTION OBSERVATIONS

Pier Element	Previous Inspection Condition *(1,2,3,4,5)*	Current Observed Condition *(1,2,3,4,5)*	Deterioration Since Last Inspection *(Y/N)*	General Comments *(Type of defect)* *(Commentary)*	Recommendation *(Commentary)*	Photo Ref. *(No.)*
Overall Condition						
Pier Fence						
Pier Masonry Steps						
Upper Pier Masonry Arch						
Lower Pier Masonry Arch						
Masonry Watch Post						
(Assumed) Mass Concrete Upper Pier Section						
(Assumed) Mass Concrete Lower Pier Section						

Pier Balustrade						
Retaining Wall Upper						
Retaining Wall Lower						
Pier Toe/ Foreshore						
Other						

PHOTOS

ADDITIONAL SITE NOTES AND SKETCHES



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