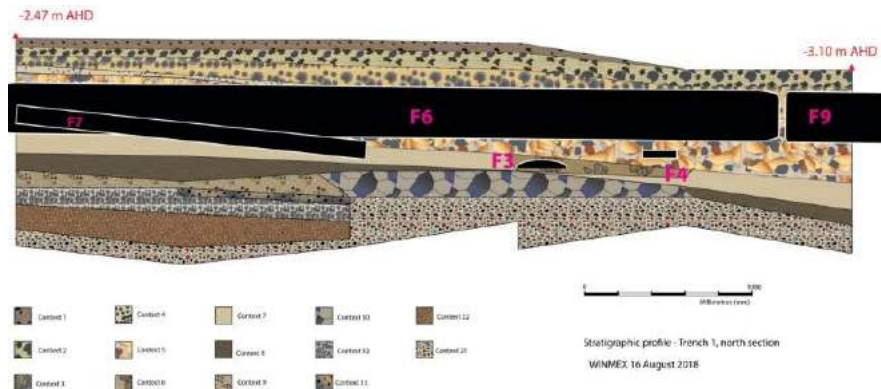
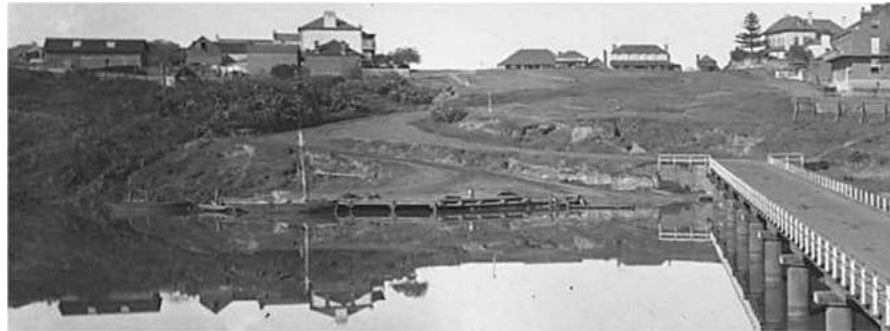


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Windsor Bridge Replacement Project



Report on Maritime Archaeological Excavation and Survey, June to September 2018

Windsor,
Hawkesbury River, NSW

September 2021

Windsor Bridge Replacement Project

Report on Maritime Archaeological Excavation and Survey June to September 2018

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A	31 December 2019	CC, CW, JM, KB, MB, CM	CC, JM	CC	Did not contain annexes.
B	3 November 2020	CC, CW, JM, KB, MB, CM	CC, JM	CC	Revised Section 8 with addition of most Annexes.
C	4 August 2021	CC, CW	CC	CC	Updated report with new information on the bricks associated with the 1874 bridge, included more information on the stone artefacts recovered and added an environmental section.
D	20 September 2021	CC, CW	CC, CW	CC	Revised report in accordance with comments received from Denis Gojak and Karina Rubenis, Transport for NSW

Cover Images: (top row) ca. 1879 photograph of Windsor Wharf (Moriarty / Musson Wharf) (Government Printing Office 1-06263, NSW State Library, Image BCP 044050); (second row) maritime archaeologist undergoing a helmet safety check before entering the water (Cosmos Archaeology); underwater photo of *in situ* copper alloy dress pin bent into fish hook shape, glass bottle fragment, and timber bedlog (UWF08) (Cosmos Archaeology); maritime archaeologist monitoring sieve for artefacts, showing sieve set up, silt curtain, and dredge for riverbed sediment (Cosmos Archaeology); (third row) north facing section of Deep Trench 1 (Cosmos Archaeology); (bottom row) wrought copper alloy boatbuilding nails with broad arrow stamps designating Government property on the underside of the heads (Cosmos Archaeology); clay tobacco pipe manufactured by Thomas White & Co., Edinburgh, Scotland, with sailing ship on bowl (Cosmos Archaeology); Aboriginal stone artefact - indurated mudstone / tuff complete flake (Cosmos Archaeology).

Executive Summary

This report outlines the conduct and findings of the maritime archaeological excavation and associated surveys undertaken as part of the approvals process for the proposed Windsor Bridge Replacement Project. These activities fulfil part of the Minister's Conditions of Approval SSI_4951B3.

The focus of the maritime archaeological excavation and associated surveys was the location of a successive series of former timber wharves on the Hawkesbury River at Windsor. The first Windsor Wharf was constructed at the initiative of NSW Governor Lachlan Macquarie by John Howe and James McGrath, Windsor settlers and entrepreneurs, in 1814-1815. In 1815-1816, further work was conducted by Howe and McGrath to expand the original wharf. However, in May 1816, a major flood of the Hawkesbury River destroyed Howe and McGrath's Windsor Wharf; prompting Macquarie to engage Government Civil Architect, Francis Howard Greenway, to draft an improved wharf design. The Greenway Windsor Wharf – also built by Howe and McGrath – was constructed in late 1816 / early 1817 to 1820 and was in operation for over four decades. In 1862, a replacement Windsor Wharf was designed by Edward Orpen Moriarty, Engineer-in-Chief for Harbours and River Navigation, NSW Department of Public Works, and built by contractor W. Musson. The Moriarty / Musson Windsor Wharf operated from the 1860s to 1930s, when it eventually deteriorated beyond use.

The site of the former Windsor wharves contains an unbroken archaeological record of activities performed on and around the wharf for over two hundred years. The ten week maritime archaeological excavation conducted in 2018 revealed complex stratigraphic layering of riverbed deposits. Eleven archaeological phases (Phases A-K) were identified, associated with five historical periods (Periods 1-5) extending from the late 18th century prior to the first Windsor Wharf up to the present day.

Almost 11,000 artefacts were recovered from the riverbed deposits during the maritime excavation, ranging from Aboriginal stone artefacts, early boat building materials, tools, and hardware, ceramic tableware, glass bottles, animal bones, oyster shells, horseshoes, plough blades, firearm ammunition, fishing tackle and dress pins formed into homemade fish hooks, curved bricks custom made for the construction of the 1874 Windsor Bridge, and a wide range of personal items including coins, jewellery, watches, pocket knives, clothing buckles and buttons, shoes, clay tobacco pipes, musical instruments, and toys.

The maritime excavation and accompanying above water survey also identified and recorded structural remains of the timber retaining wall that formed part of the first Howe and McGrath Windsor Wharf, remains of the Greenway / Howe and McGrath Windsor Wharf, and remains of the Moriarty / Musson Windsor Wharf.

The artefact assemblage – the most significant and representative of which are now stored and on display at the Hawkesbury Regional Museum – provides a vivid illustration of the deep and long-lasting connection between the inhabitants of Windsor and surrounding settlements and the Hawkesbury River. The artefacts reflect the vital role of the former Windsor wharves in regional trade and transport networks, but also illustrate additional use of the wharves as a marketplace, meeting point, and place of recreation.

This report contains detailed descriptions of the conduct of the maritime archaeological excavation, survey work, and monitoring. Comprehensive descriptions of the archaeological contexts identified and recovered finds are provided; along with a thorough discussion on the site formation process and the linking of the archaeological contexts with the known historical events and processes on the site.

The key findings of the maritime archaeological investigation are summarised as follows:

- Historical research conducted for this report revealed additional information regarding the Windsor Wharf that was built to replace the Greenway / Howe and McGrath. Most notably that the replacement wharf was constructed in 1862, not 1874 as identified in previous heritage reports, and that the wharf was designed by Edward Orpen Moriarty, Engineer-in-Chief for Harbours and River Navigation, who

was involved in the construction of numerous important public works in NSW during the latter 19th century;

- Survey and design plans of the 1862 Windsor Wharf were also found in NSW State Archives, which clearly show the construction details of the 1862 wharf as well as the remnant pile rows of the earlier Greenway / Howe and McGrath Wharf;
- Remains of the timber retaining wall constructed in 1814 across the front of Thompson Square as part of the first Howe and McGrath Windsor Wharf and the structural remains of the Greenway / Howe and McGrath Wharf were identified;
- The association of extant timber piles and walers with the 1862 Moriarty / Musson Windsor Wharf was also confirmed and recorded;
- A ballast layer was identified that appears to have been laid down as part of the 1815-1816 Howe and McGrath Windsor Wharf extensions. Another ballast layer was identified as being associated with the Greenway / Howe and McGrath Wharf. Also, from the mid 19th century onwards there had been a number of episodes of bank and riverbed stabilisation involving the dumping of rock;
- Samples of the ballast rock analysed were found to have derived from Hawkesbury Sandstone – the closest sources to Windsor being along the Hawkesbury River upstream from Richmond, downstream from Cattai. Adhered to some of the sandstone was oyster shell which suggests that the stone may have been picked up downstream of Wisemans Ferry or even Sydney Harbour – the water at Windsor is too fresh for oysters to grow. One of rocks sampled has similarities to a type of gneiss found in ballast in Sydney Harbour which originated in Brazil;
- The artefacts recovered from the excavation covered a wide range of dates from pre-colonisation, in the form of Aboriginal stone artefacts to decimal coins and a watch from the last quarter of the 20th century. It is also believed that this was the first underwater excavation in Australia where Aboriginal artefacts were recovered;
- The variety of artefacts found represented the commercial aspects of the former Windsor wharves, as well as a site of vessel repair and maintenance, a marketplace, and place of recreation;
- One of the more salient aspects of the recovered artefact assemblage is its personal nature ranging from coins, jewellery, buttons, buckles, shoes, watches, tobacco pipes, pocket knives, pens, musical instruments, and toys. These finds tell us much of the Windsor and upper Hawkesbury community's interaction with the Hawkesbury River via the Windsor Wharf for over 200 years, and also provide a vivid image of the people who used and visited the wharf during this time;
- A survey along of the toe of the scour protection on both banks of the River in August 2019, 8 months after it was laid, found little evidence of scouring.

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Annex list – Annexes are not attached to this report

Annex	Name
A	Artefact Retention Policy
B	Historical Artefact Catalogue
C	Historical Artefact Report
D	Aboriginal Stone Artefact Catalogue
E	Aboriginal Lithic Artefact Report
F	Mollusc Shell Catalogue
G	Animal Bone Catalogue
H	Plant Macro-Remains Catalogue
I	Animal Bone, Mollusc Shell & Plant Macro-Remains Report
J	Multibeam Survey Data
K	AWF & Fastenings Illustrated Table
L	Field Books and Dive Logs
M	Video (underwater footage)
N	Photos (artefact and features)
O	Timber Sample Analysis
P	Petrographic and XRD Analysis
Q	Scour Protection Monitoring Methodology

Abbreviations

AAJV	Austral Archaeology and Extent Heritage (formerly AHMS) Joint Venture
AHD	Australian Height Datum
ARD	Archaeology Research Design
Cxt	Context
DSS	Detailed salvage strategy
DT	Deep Trench
ICS	International Conservation Services
MATR-MARD-DSS	Maritime archaeological testing report and detailed salvage strategy for maritime archaeological excavation
MCoA	Minister's Conditions of Approval
OSL	Optically stimulated luminescence
RMS	Roads and Maritime Services – incorporated into Transport for NSW in 2019
SCMP	Strategic Conservation Management Plan
SSBA	Surface Supplied Breathing Apparatus
SSS	Side Scan Sonar
SQ	Square
ST	Shallow Trench
WBRP	Windsor Bridge Replacement Project

1 Introduction

1.1 Background

Transport for NSW - formerly NSW Roads and Maritime Service (RMS) - is currently finalising the Windsor Bridge Replacement Project (WBRP) which has involved the replacement of the former Windsor Bridge at Windsor, built in 1874, with a new bridge. The works has involved various modifications to the approaches and surrounds of the river crossing. The project had been assessed as State Significant Infrastructure under Part 5.1 of the *Environmental Planning and Assessment Act 1979*, and was approved in late 2013 (SSI_4951). Construction began on the project in mid-2018. Transport for NSW has engaged Cosmos Archaeology Pty Ltd to undertake maritime archaeological investigations and provide maritime heritage management services to Transport for NSW during the project.

The Minister's Conditions of Approval (MCoA) for the WBRP require a range of historical, maritime, and Aboriginal archaeological investigations to be carried out for the southern (Condition B3) and northern (Condition B4) banks of the Hawkesbury River. Initial investigations involving combined Aboriginal, historical archaeological test excavation were undertaken in 2016.¹

Following these investigations, a component of Condition B3 required the development of a Detailed Salvage Strategy (DSS) to outline further archaeological works required to avoid, minimise and/or mitigate impacts to the cultural resource.² This document was developed in August 2017 by AAJV (Austral Archaeology and Extent Heritage [formerly AHMS] Joint Venture). Cosmos Archaeology developed the *Maritime Archaeological Testing Report and Detailed Salvage Strategy for Maritime Archaeological Excavation* (MATR-MARD-DSS) for the maritime archaeological component of the project in 2018.³

In response to the 2018 MATR-MARD-DSS's recommendations, Cosmos Archaeology Pty Ltd was engaged to undertake the maritime archaeological (salvage) excavations and survey component of the project. The MATR_MARD_DSS recommended the following mitigation measures to meet the MCoA B3 condition which were:

Maritime Archaeological Excavation;

The excavation would address the relevant research questions posed in the archaeology research design (ARD), these being modified to specifically address the former Windsor Wharf ca. 1814 to 1950s:

- *How was the former Windsor Wharf ca. 1814 to 1950s constructed and how was it modified and altered throughout the 19th century?*
- *Is there any evidence of early ship construction?*
- *What can it tell us about the engineering skills available to the colony within the first five years of settlement?*
- *Was ballast used to stabilise the wharf, and which wharf phase was the ballast used for?*
- *How was the risk of flooding managed?*
- *What was the quality of the materials used in the wharf? (i.e. was copper sheathing used? Spacing of piles, size, and standard of fastenings). Does this say something about the availability of materials, or the level of importance placed on the wharf by the authorities, through comparison with other contemporary wharf sites?*

¹ AAJV, July 2016, *Windsor Bridge Replacement Project – Historical and Maritime Archaeological Research Design*, AAJV, May 2017a *Windsor Bridge Replacement Project; Test Excavation Report - Historical Archaeology*, AAJV, May 2017b *Windsor Bridge Replacement Project; Test Excavation Report - Aboriginal Heritage*, and Cosmos Archaeology Pty Ltd, March 2018, *Maritime Archaeological Testing Report and Detailed Salvage Strategy for Maritime Archaeological Excavation*

² AAJV, November 2017c *Windsor Bridge Replacement Project; Detailed Salvage Strategy*

³ Cosmos Archaeology Pty Ltd, March 2018, *Maritime Archaeological Testing Report and Detailed Salvage Strategy for Maritime Archaeological Excavation*

- *Was the wharf constructed on bed logs or piled directly into the riverbed?*
- *What do the river artefacts tell us about the use of the wharf and the commercial contacts over time?*

Post Construction management of *in situ* maritime archaeological remains;

To ensure that archaeological remains associated with the former Windsor Wharf are not compromised by scouring around the toe of the scour protection after the completion of the bridge construction a monitoring protocol is to be established.

Detailed and comprehensive management procedures for maritime archaeological remains will be included in final heritage report required under condition C5. Though these procedures can only be finalized after the installation of the scour protection a broad outline of the likely monitoring protocols is presented below:

The monitoring protocols will also outline steps to take with regards to inspections to be undertaken in the unforeseen event of erosion occurring up and downstream of the bridge site resulting from the changed conditions on the riverbed.

Interpretive signage;

The proposed scour protection will cover all remaining visible traces of the former Windsor Wharf. The bridge will pass directly over the site mimicking in part the function of the wharf, that of a transport conduit between water and land. The proposed pedestrian easement under the bridge on the southern bank will provide an excellent opportunity to display historical and archaeological information relating to the wharf and its uses. This could take the form of signage along the easement and possibly even installing timber planking as the walking surface in the easement spanning the length of the former Windsor Wharf. Artefacts recovered during the excavation such as bricks, glass, ceramic could be jammed between the planking to emulate, in part, the site formation process for archaeological deposits associated with maritime infrastructure such as wharves.

The above mitigation measures replace Recommendation 1 of the maritime archaeological statement of heritage impact in the 2012 EIS.³³ Recommendation 2 is still applicable, which is:

Archaeological monitoring works should be undertaken as part of the early site works on the northern side of the existing bridge in the general location of the northern punt landing. This archaeological monitoring should occur during early site preparation works to record any remaining archaeological remains, relics or landscape features that remain of the former crossing. This work should be done by a qualified archaeologist and an archaeological monitoring report should be prepared at the end of the monitoring works and submitted to the Office of Environment and Heritage for their records.

This report outlines the conduct and findings of the maritime archaeological (salvage) excavations and associated surveys to meet the mitigation measures in the MATR_MARD_DSS and the requirements MCoA Conditions B3 – see table below. This report also meets the MCoA of C5.

This report does not include the maritime archaeological conduct and findings during the installation of the scour protection on the northern bank where the remains of 19th century timber hulled vessels were discovered in January 2019. A report has been prepared by Cosmos Archaeology on these wrecks and other archaeological finds made during monitoring – *Windsor Bridge Replacement Project: Report on the early 19th century timber vessels and other finds on the north bank of the Hawkesbury River.*⁴

⁴ **Cosmos Archaeology Pty Ltd, April 2021**, Windsor Bridge Replacement Project: Report on the early 19th century timber vessels and other finds on the north bank of the Hawkesbury River. Prepared for Transport for NSW.

1.2 Response to Minister's Conditions of Approval SSI_4951B3

The following table provides a summary of the MCoA SSI_4951B3 and mitigation measures from MATR-MARD-DSS and how this report addresses them.

Condition	Location of Information
B3. <i>The results of the Archaeological Investigation Program are to be detailed in a Historic Archaeological Report and a Detailed Salvage Strategy comprising the non-Aboriginal and Aboriginal heritage findings. These are to be prepared in consultation with the OEH (Heritage Branch and Aboriginal heritage) and to the satisfaction of the Director-General, and shall include, but not necessarily be limited to:</i>	This report provides the findings of the work outlined in MATR-MARD-DSS (Cosmos Archaeology, 2018)
A) <i>detailed recommendations for further archaeological work;</i>	No further works required.
B) <i>consideration of measures to avoid or minimise disturbance to archaeology sites, where archaeology of historical and Aboriginal heritage archaeological significance are found to be present;</i>	Addressed in MATR-MARD-DSS (Cosmos Archaeology, 2018)
C) <i>where impacts cannot be avoided by construction of the SSI, recommend actions to salvage, and interpret salvaged sites, conduct further research and archival recording of the historic heritage and Aboriginal heritage value of each site, and to enhance and preserve the archaeology of historical non-Aboriginal and Aboriginal heritage significance</i>	MATR-MARD-DSS (Cosmos Archaeology, 2018) and results in this report
D) <i>consideration of providing visual evidence of heritage sites within the final landscape design of the SSI to preserve and acknowledge the heritage value of the Thompson Square Conservation Area and the site</i>	The Thompson Square Heritage Interpretation Plan Stage 2, Version Final, October 2020 and the Thompson Square Heritage Interpretation Plan Stage 1: Supplementary Document, October 2020 developed under condition B1 of SSI 4951, were approved by DPIE in Nov 2020.
E) <i>management and mitigation measures to minimise impacts due to preconstruction and construction activities;</i>	Addressed in MATR-MARD-DSS (Cosmos Archaeology, 2018) Section 12; Section 13
F) <i>preparation of a Hawkesbury Region Sand Bodies Study as detailed by Condition B3(f)</i>	Contained in the Hawkesbury Region Sand Bodies Study (AAJV, November 2017)
C5. <i>Within 12 months of completing the work required under conditions B3 and B4, the Applicant shall, in consultation with the NSW Heritage Council, the OEH (Aboriginal heritage) and to the satisfaction of the Director-General, prepare and submit a further report containing:</i>	This report addresses the maritime archaeological components of this condition
a) <i>an executive summary of the archaeological programme;</i>	Executive Summary
b) <i>the findings of the excavations, including detailed artefact analysis for non-Aboriginal and Aboriginal heritage;</i>	Sections 6 to 10 and Appendices
c) <i>the identification of a final repository for finds of non-Aboriginal heritage significance;</i>	The repository for the finds of the non-Aboriginal heritage significance is the Hawkesbury Regional Museum, Windsor.
d) <i>detailed information on the excavation including the aim, the context for the excavation, procedures, treatment of artefacts (cleaning, conserving, sorting, cataloguing, labelling, scale photographs and/or drawings, location of repository) and analysis of the information retrieved;</i>	Sections 4, 5 and 14

Condition	Location of Information
e) <i>nominated repository for the items, which has agreed to take the items;</i>	The nominated repository for the items is the Hawkesbury Regional Museum, Windsor.
MATR-MARD-DSS Mitigation measures <i>Maritime Archaeological Excavation.</i>	Sections 5 to 7
<i>Post Construction management of in situ maritime archaeological remains</i>	Section 13.2
<i>Interpretive signage</i>	Section 15

1.3 Study Area

The study area is located in the Hawkesbury River at Windsor, within the Hawkesbury City Council Local Government Area (LGA) which is approximately 57 kilometres north-west of Sydney, close to the foothills of the Blue Mountains (Figure 1). The study area incorporates the intertidal zone and the lower banks of the northern and southern side of the river.

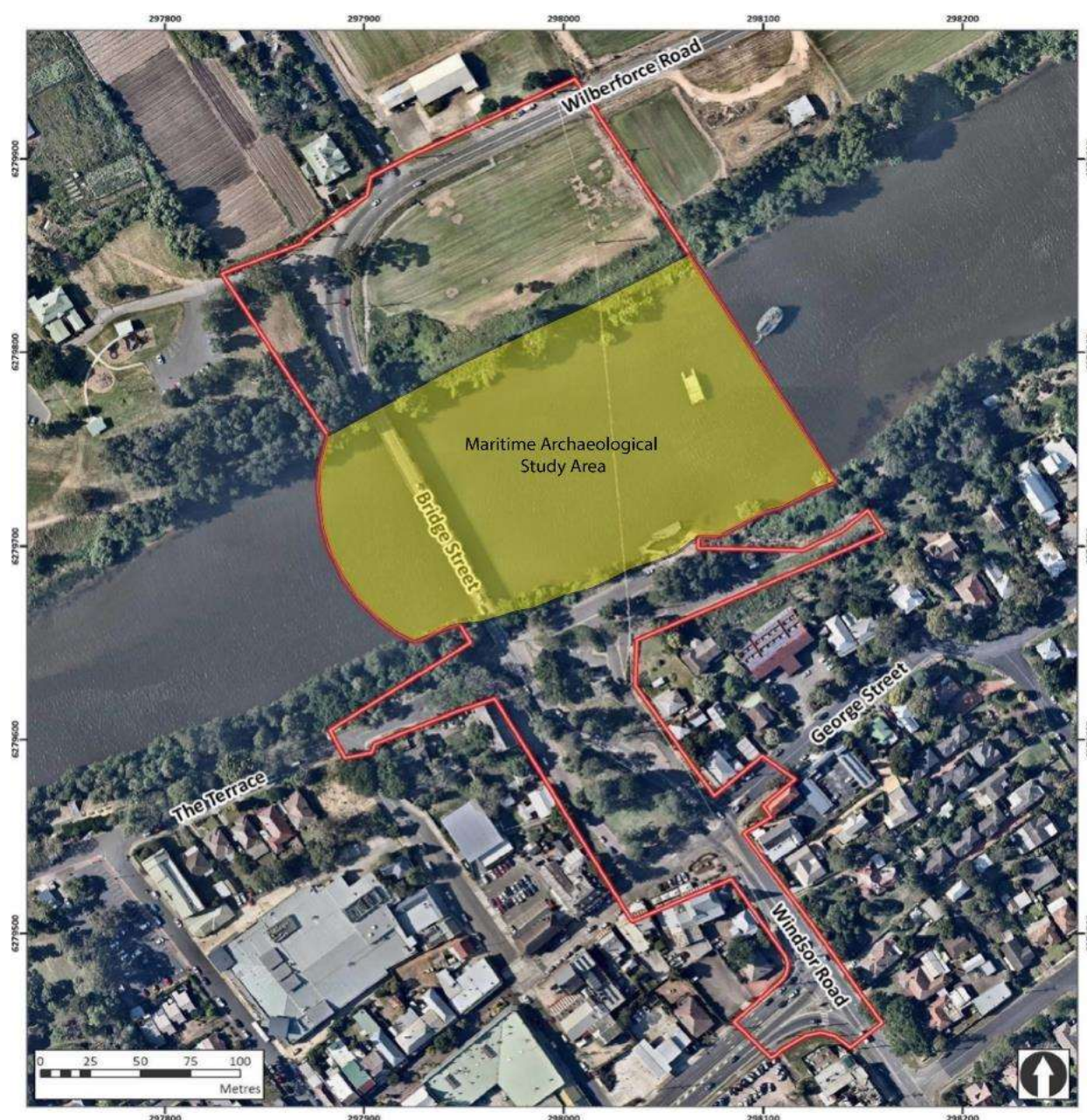


Figure 1: The maritime archaeological study area inside the WBRP Project Area in 2018. Image predates the construction of the current bridge.

1.4 Previous Maritime Archaeological Work

From 2008 to 2017, a number of maritime archaeological surveys and a test excavation had been undertaken for the WBRP. They are summarised below.

Maritime Archaeological Survey, December 2008

In December 2008, Cosmos Archaeology undertook a maritime archaeological survey with the primary objective of examining the location of the 19th century wharf on the southern side of the Hawkesbury River, downstream of the former road bridge. This underwater survey was conducted as part of the early stages of the planning for the proposed new bridge crossing over the Hawkesbury River at Windsor.

An archaeological survey recorded remains associated with the wharf, both above and below the waterline. Structural remains of the wharf, including a pile, deck beam and walings, were observed protruding from the riverbank above the waterline. Nine underwater transects were placed around the extant remains to assess the riverbed conditions and archaeological potential. Structural timbers associated with the former wharf were recorded, as well as cobble ballast, believed to have been used to help hold the structure in place, were surveyed on the riverbed in the location of the wharf.⁵

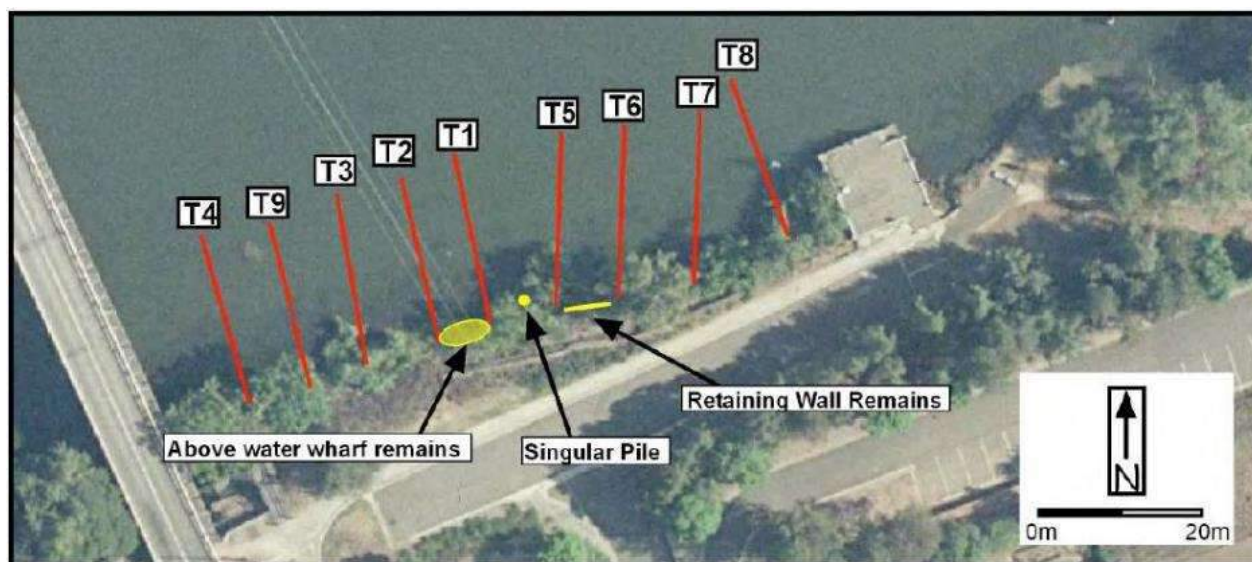


Figure 2: Location of above water wharf remains and nine transects run underwater during the 2008 maritime survey.

An underwater survey was also conducted adjacent to the former bridge on the northern side of the river in the probable location of the early punt crossing but did not locate any remains of the former landing. It was predicted that archaeological relics were present from the wharf built at Windsor within and under the sandstone cobble ballast. This included both structural remains relating to the early 19th century wharf, including piles and other timber structural remains; and artefacts associated with the use of the facility. It was thought there was also the potential for archaeological remains to exist from the earlier 1795 wharf which at the time, in 2008, was thought to be in the same location.

A brief examination was made on the northern bank adjacent and downstream of the bridge for any evidence of the punt site. Though there was evidence of a cutting, it angled towards the water ending at the base of the former bridge abutment. This suggests that the cutting may have been made during the building of the former bridge to assist in its construction. Thick vegetation precluded any detailed examination of the area.

⁵ Cosmos Archaeology, February 2009 Windsor Bridge: Punt and Wharf sites: Maritime Archaeology Inspection, p.11.

Maritime Archaeological Survey, October 2012

In June 2012, a side scan sonar (SSS) survey was carried out along the Hawkesbury River within and immediately adjacent to the former bridge and current bridge at Windsor. The survey was carried out by the RMS Hydrographical department.

Several known and potential cultural anomalies were identified from the SSS data. On the southern side of the river, the location of the 19th century wharf site there were no discernible anomalies. A number of potential cultural anomalies were identified on the downstream side of the former bridge and these were inspected in October 2012.⁶

The underwater diving survey examined seven anomalies of potential cultural heritage significance identified during the SSS. Close to north bank, 35 m to 60 m downstream of the former bridge, the survey located the fragmentary remains of a timber structure. It could not be determined whether the feature was *in situ* or had been transported into the area during previous flood events. There was no historical evidence of a maritime related structure being built in this area however it is possible that they have been associated with a line of what appear to be moorings running parallel to the north bank which are visible in aerial photographs from the 1950s.

The maritime archaeological survey also ran two transects in the area of the southern landing for the post 1832 punt operation. What was identified as a sandstone outcrop, which forms a shelf or bench, was observed. There was no evidence that the sandstone had been modified for use in the punt landing, though the punt operators may have used this feature as it was located 15 m from the current riverbank. The area has silted over closer to the bank, and the sandstone shelf could not be seen. No evidence was observed of any posts or other cultural remains that may have been associated with the former punt landing. This area is located close to the western side of the former bridge abutment. The remaining anomalies identified within the side scan sonar survey were natural localised souring, modern mooring foundations or modern material (shopping trolley).

Maritime Archaeology Survey and Test Excavation 2016

Cosmos Archaeology was engaged to undertake the maritime archaeological components of the field investigation for the Windsor Bridge Replacement Project. These components were:

- Test excavation incorporating three test trenches on the riverbed within the footprint of the former Windsor Wharf;
- Survey of the riverbank above the former Windsor Wharf and;
- Underwater survey of a potential second 19th century wharf downstream of the current Public Wharf.

The test excavation within the footprint of the former Windsor Wharf found that archaeological remains associated with the earliest, if not original, versions of the wharf, ca.1810s, were present (Figure 3). These remains were very likely to be reasonably well preserved under a cobble ballast mound which in places has been recently covered with larger quarried stones to serve as erosion protection. The artefacts recovered from the three test trenches reflected activities on and around the former Windsor Wharf and show that the area was used throughout the 19th and 20th centuries. The artefacts included discarded food and drink containers, discarded construction material and the possible presence of fastenings associated with small vessels. Those archaeological remains associated with the early 19th century remains of the wharf were assessed as being of State Heritage significance.

The survey of the riverbank adjacent to the wharf site documented evidence of the later 19th century version of the former Windsor Wharf as well as more recent bank erosion protection measures. Dense vegetation on the riverbank limited the amount of recording that could be undertaken. A diver survey downstream of the current public wharf in the area of a presumed second wharf did not find any structural remains.

⁶ Cosmos Archaeology Pty Ltd, October 2012 Proposed Windsor Bridge Replacement – Maritime Archaeological Statement of Heritage Impact: Final Working Paper Report.

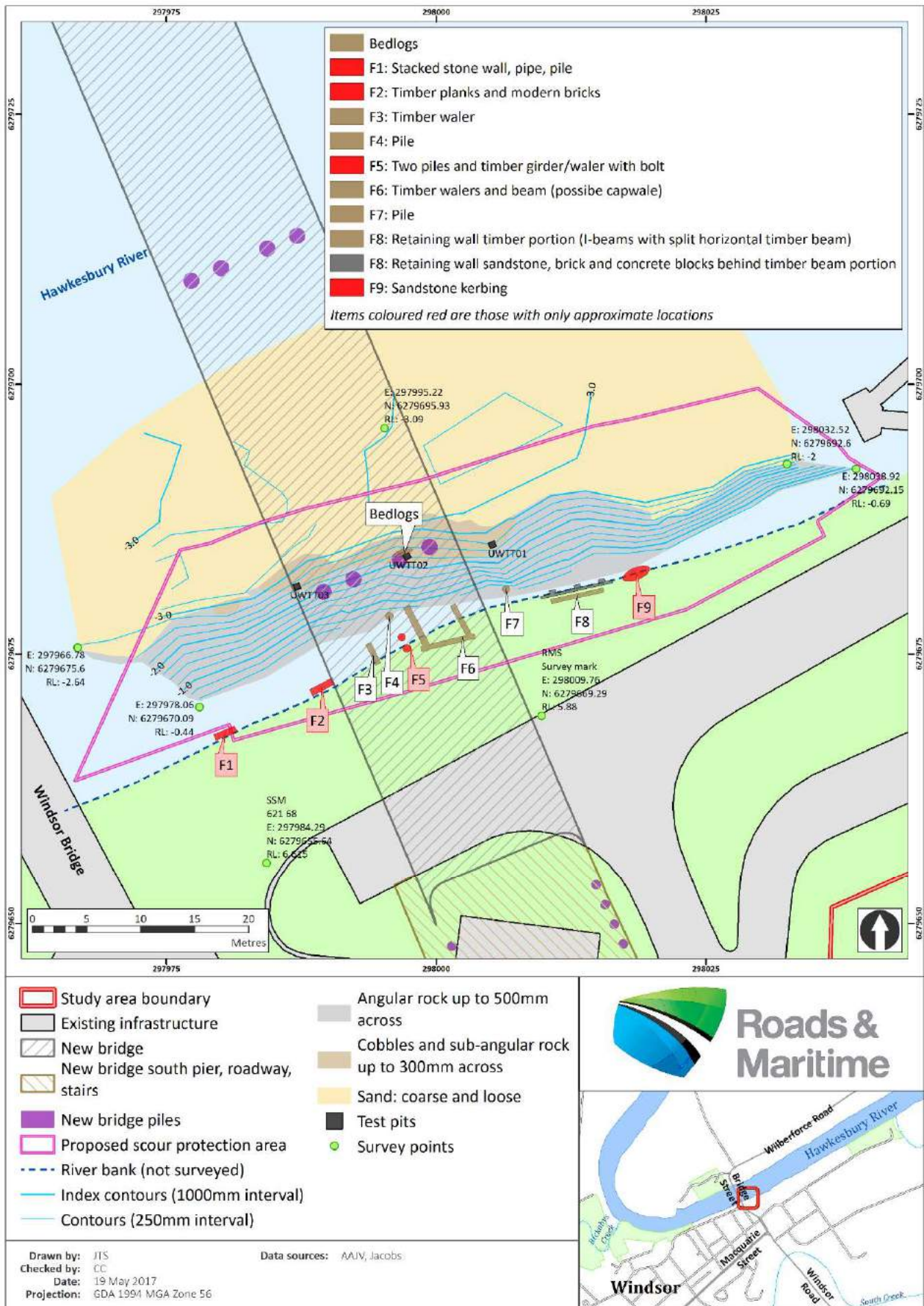


Figure 3: Site plan of features surveyed 2016, above waterline on south bank of Hawkesbury River at Windsor Bridge. Underwater test trenches are labelled UWTT01, UWTT02 and UWTT03

The revised impact assessment resulting from this survey, determined that there was potentially major impact to sections of the maritime infrastructure through piling and the bridge scour protection would make the site inaccessible for the lifetime of the bridge. To mitigate this negative impact, and the impact that piling was to have on the site, a number of measures were proposed which included a maritime archaeological research design and excavation strategy which detailed the manner and means with which to extract significant cultural information pertaining to the identified archaeological values of the former Windsor Wharf prior to the commencement of the bridge construction.

This report is the result of the implementation of the research design and excavation strategy developed from the work compiled in 2016.⁷

1.5 Authorship

This report was prepared by Cosmos Coroneos and Caroline Wilby, with contributions by Jane Mitchell, Kurt Bennett, Milly Bendell, Connor McBrian, and Jeanne Harris.

- Section 1: Introduction – written by Cosmos Coroneos
- Section 2: Physical Environment – written by Caroline Wilby
- Section 3: Historical Context – written by Caroline Wilby
- Section 4: Archaeological Research Design – written by Cosmos Coroneos
- Section 5: Conduct of Maritime Archaeological Excavation and Surveys – written by Cosmos Coroneos, with subsections on above water survey and artefact recording (Sections 5.6 and 5.9) written by Jane Mitchell
- Section 6: Findings, Underwater Excavation – written by Cosmos Coroneos with contributions by Kurt Bennett, Jeanne Harris, and Caroline Wilby
- Section 7: Findings, Above Water Survey – written by Jane Mitchell and Milly Bendell
- Section 8: Site Formation – written by Cosmos Coroneos with contributions by Kurt Bennett, Jeanne Harris, and Caroline Wilby
- Section 9: Addressing the Research Design – written by Cosmos Coroneos, with subsections on artefacts and cultural activities (Sections 9.4 and 9.5) written by Caroline Wilby
- Section 10: Aboriginal Stone Artefacts – written by Caroline Wilby
- Section 11: Revised Statement of Cultural Heritage Significance – written by Cosmos Coroneos
- Section 12: Scour Protection Works: Monitoring and Inspections – written by Jane Mitchell
- Section 13: Monitoring Methodology – written by Jane Mitchell
- Section 14: Artefact Repository – written by Cosmos Coroneos
- Section 15: Interpretative Signage – written by Cosmos Coroneos

Artefact cataloguing and analysis was undertaken by Jeanne Harris (historical artefacts) Cosmos Coroneos and Kurt Bennett (additional examination of wharf and boatbuilding artefacts) and Caroline Wilby (animal bone, mollusc shell, plant macro-remains, and Aboriginal stone artefacts).

Connor McBrian prepared and adapted the maps and plans throughout the report.

⁷ **Cosmos Archaeology Pty Ltd, March 2018**, Maritime Archaeological Testing Report and Detailed Salvage Strategy for Maritime Archaeological Excavation. Prepared for AAJV.

2 Physical Environment

2.1 Geology, geomorphology & soil landscapes

The Hawkesbury River valley landscape at Windsor is formed of Tertiary and Quaternary fluvial deposits overlying Triassic Ashfield Shale / Wianamatta Shale Group bedrock. As identified in NSW geological mapping data (see Figure 4), the southern and northern banks of the Hawkesbury at Windsor consist of late Pleistocene to Holocene Lowlands Formation floodplains of gravel, sand, silt, and clay alluvium. The alluvial floodplain on the southern bank is relatively narrow and abuts an elevated terrace of much older Miocene Londonderry Formation fluvial clay and gravel deposits. The subaqueous sediments in the Hawkesbury River channel along the Windsor reach consist of Quaternary deposits – primarily Holocene fluvial sand, gravel, silt, and clay.⁸

NSW soil mapping data shows two soil landscapes occur adjacent to the Hawkesbury River at Windsor – Freemans Reach across the active river floodplain and Berkshire Park across the elevated Tertiary terrace rising beyond the southern riverbank (Figure 5). The Freemans Reach soil landscape comprises moderately structured deep brown sand and loam alluvium derived from erosion of Hawkesbury Sandstone, Narrabeen Group and Wianamatta Shale Group materials. Freemans Reach is generally a dynamic soil landscape, with streambank and floodplain erosion and deposition regularly occurring. The Berkshire Park soil landscape consists of sandy loam overlying sandy clay and heavy clay alluvium, often mottled with ironstone nodule inclusions and silcrete boulders (up to 200 mm in size). The Berkshire Park soils derive from three depositional phases of sandstone and clay materials of Tertiary alluvial and colluvial origin, with the Londonderry Clay formation being the uppermost phase.⁹

Geotechnical and terrestrial archaeological investigations previously carried out adjacent to the Hawkesbury River at Windsor provide additional site-specific geological and geomorphological data.

Several geotechnical investigations involving core penetration testing, borehole sampling and sediment analysis have been conducted in the vicinity of Windsor Bridge over the Hawkesbury, including studies by RMS in 2008¹⁰, Jeffery & Katauskas in 2009¹¹ and Sinclair Knight Merz (SKM) in 2012-2013.¹² Based on a combination of data from all three investigations, Andrew (2013) developed an inferred subsurface profile across the length of the proposed replacement Windsor Bridge alignment, including the current study area (see Figure 6 below):

- Southern approach and bank of Hawkesbury River – The southern profile consists of a deep layer of Tertiary fluvial cemented gravelly sands and stiff clays (Londonderry Formation), measuring between at least 2.5 to 6.5 m thick on the ridgeline and elevated terrace towards Windsor, decreasing in thickness as it slopes down towards the riverbank; overlying siltstone and fine-grained sandstone laminate bedrock (Ashfield Shale sequence / Wianamatta Group). A localised area of fill comprising silty clay and loose sandy gravels, ranging from 0.15 to at least 1.75 m deep, also occurs on the lower slope of the southern riverbank, overlying the Tertiary fluvial deposits, and was identified as most likely associated with historical levelling, road, wharf, and riverbank restoration works;
- Hawkesbury River – The Hawkesbury riverbed sediments comprise an upper layer of fine to coarse-grained sand with trace silt, clay, and gravel alluvium, measuring between 1.5 m to 10 m thick, sloping down and increasing in thickness from the southern bank towards the middle of the river. This unit overlies a layer of coarse-grained sandy gravel alluvium with cobble (60-200 mm in size) inclusions – some of igneous origin. This layer also measures between 1.5 m to 10 m thick, increasing in thickness as it slopes down from the southern. An isolated basal layer up to 5 m thick of alluvial fine to coarse-grained sand

⁸ Clark, N. R. & D. C. Jones. 1991. *Penrith 1:100 000 Geological Sheet 9030*. Geological Survey of New South Wales, Sydney.; Troedson A.L. 2015. *Sydney Area 1:100 000 and 1:25 000, Coastal Quaternary Geology Map Series*. Geological Survey of New South Wales, Maitland. & Troedson, A.L. & L. Deyssing. 2015. "Coastal Quaternary mapping: southern Hunter to northern Illawarra, NSW." *Geological Survey of New South Wales*. No. 146.

⁹ Bannerman, S. M. & P. A. Hazelton. 1990. *Soil Landscapes of the Penrith 1:100 000 Sheet*. Soil Conservation Service of New South Wales, Sydney.

¹⁰ Roads & Maritime Services. 2008. *MR182 – Bridge over Hawkesbury River at Windsor, Geotechnical Investigations for Replacement Bridge*. Report No. G3892.

¹¹ Jeffery & Katauskas. 2009. *Geotechnical Investigation for Proposed Hawkesbury River Wharf at Old Bridge Street, Windsor, NSW*. Report prepared for Hawkesbury City Council, No. 22750LBrpt.

¹² Andrew, D. 2013. *Windsor Bridge Replacement – Detailed Design. Geotechnical Investigation Report*. Unpublished report prepared by Sinclair Knight Merz (SKM) for NSW Roads and Maritime Services (RMS).

also occurs towards the centre of the river. These alluvial deposits overlie siltstone and fine-grained sandstone laminate bedrock (Ashfield Shale sequence / Wianamatta Group). Towards the northern riverbank, an upper 1 to 2 m thick layer of fine to medium-grained clayey / silty sand with gravel traces occurs, sloping up towards the bank;

- Northern approach and bank of Hawkesbury River – The northern profile consists of a ca. 8 m thick upper layer of fine silty clay and gravel alluvium, overlying a ca. 10 m thick layer of fine to medium-grained clayey / silty sand alluvium, overlying a ca. 12 m thick layer of fine to coarse-grained sand alluvium with silt / clay and gravel traces, in turn overlying a ca. 12 m basal sediment layer of fine to coarse-grained sandy gravel with cobble inclusions. Again, these alluvial deposits overlie siltstone and fine-grained sandstone laminate bedrock (Ashfield Shale sequence / Wianamatta Group).¹³



Figure 4: Geological units across Hawkesbury River valley at Windsor.¹⁴



Figure 5: Soil landscapes across Hawkesbury River valley at Windsor.¹⁵

¹³ Op. Cit. Andrew, D. 2013

¹⁴ Based on geological mapping data from Clark, N. R. & D. C. Jones. 1991. & Troedson, A. L. 2015.

¹⁵ Based on soil landscape mapping data from Bannerman, S. M. & P. A. Hazelton. 1990.



In 2016-2018, AAJV conducted a series of terrestrial Aboriginal archaeological investigations adjacent to the Hawkesbury River at Windsor as part of cultural heritage management measures associated with the WBRP. These investigations included archaeological test excavation on both the northern and southern sides of the Hawkesbury in 2016,¹⁶ followed by targeted salvage excavation on the southern side of the river, in the lower section of Thompson Square park, in 2017-2018.¹⁷ In addition to stratigraphic documentation of sediment profiles during archaeological excavation, various post-excavation geomorphological, palaeoenvironmental and chronological analyses were carried out on soil samples obtained during both testing and salvage phases – including soil geochemistry and particle size analysis, pollen and phytolith analysis, and optically-stimulated luminescence (OSL) dating. The overall combination of excavation and post-excavation data enabled detailed examination of the nature and evolution of landforms within the subject areas.

Ultimately, four landscape units were identified by Williams *et al* in their 2017 and 2019 reports (Figure 7):

- *Rivers edge alluvium* – this landscape occurs on low elevations (<11 m AHD) of the Hawkesbury River floodplain and consists of a layer of compact silty loam alluvium ca. 1-2 m thick, overlying a fine sand and heavy clay alluvium at least 2-3 m thick. These deposits were most likely formed through low-energy fluvial deposition and accretion by the Hawkesbury River, reflecting low-energy submergence of the floodplain areas followed by sediment accumulation as the water receded. Based on OSL ages and stratigraphic position, this landscape was deposited in the last 6,500 to 7,000 years ago (mid to late Holocene), with some upper portions potentially being only a few hundred years old. The landscape has mixed integrity, showing some evidence of possible fluvial reworking of local soil profiles and historical disturbance;
- *Rivers edge reclaimed / introduced fill* – this landscape includes a mix of introduced fill materials and reworked natural deposits occurring in disparate pockets along the southern bank of the Hawkesbury River, extending from the Windsor Bridge to the eastern extent of the former Windsor wharf area. Historical information indicates that much of this area was reclaimed, filled, levelled, and stabilised throughout the 19th and 20th centuries;
- *Ridgeline* – this landscape extends across elevated areas on the southern side of the Hawkesbury, including the upper end of Thompsons Square park, George Street, Macquarie Street and parts of Old Bridge Street, Windsor, and consists of a shallow, residual duplex soil profile of compact silty clay overlying compacted / indurated heavy clays, with coarse sand and river cobble inclusions at depth. This landscape most likely formed from *in situ* pedogenesis of the underlying Tertiary Londonderry Formation clay. Evidence of heavy historical disturbance was observed across much of the ridgeline area;
- *Source-bordering dune* – this landscape occurs on the southern side of the Hawkesbury, across upper and lower portions of Thompsons Square, parts of Old Bridge Street, and the George / Bridge Street junction, and consists of a fluvial and aeolian-derived sand body, typically 1-1.5 m thick, overlying Tertiary Londonderry Formation clay. Three distinct sedimentary layers were identified within the sand body. At the base of the sequence, a coarse-medium grained sand and gravel alluvium occurs; most likely deposited periodically by the Hawkesbury River as a fluvial levee or terrace during periods of sustained flooding. OSL ages indicate this layer accumulated gradually during the Last Glacial Period, between ca. 82,000 to 40,000 years ago. Various overlying and abutting this basal sand deposit, a thin (< 300 mm) alluvial layer of fine sand, silt, and small sub-rounded to sub-angular gravels occurs. This second alluvial deposit most likely formed via intermittent and relatively low energy flooding of the Hawkesbury River – possibly as periodic increased river flow resulting from regular summer melting of glaciated uplands in the Blue Mountains during the Last Glacial Maximum. OSL ages indicate this deposit accumulated between ca. 30,000 to 21,000 years ago. Overlying this thin alluvium, particularly in the western portion of the

¹⁶ Williams, A., L. Berehowyj, T. Bryant & T. Sapienza 2017 *Windsor Bridge Replacement Project, Test Excavation Report – Aboriginal Heritage*. Report prepared by AAJV on behalf of NSW Roads and Maritime Services.

¹⁷ Williams, A., L. Barry, R. Hawkins, C. Neale & T. Sapienza 2019 *Windsor Bridge Replacement Project, Salvage Excavation Report – Aboriginal Heritage*. Report prepared by AAJV on behalf of NSW Roads and Maritime Services.

subject area, a ca. 0.8-1.2 m thick aeolian deposit of fine sand and silt occurs, most likely resulting from prevailing westerly winds carrying fine sediment from the Hawkesbury floodplain against the steep slopes beyond the southern riverbank. OSL ages indicate this deposit began forming ca. 19,000 years ago and accumulated intermittently through the Last Glacial – Interglacial Transition well into the Holocene. Finally, a loamy fine sand and silt occurs as a remnant pedogenic topsoil across most of the source-bordering dune landscape. OSL ages indicate this topsoil began forming ca. 500 years ago.

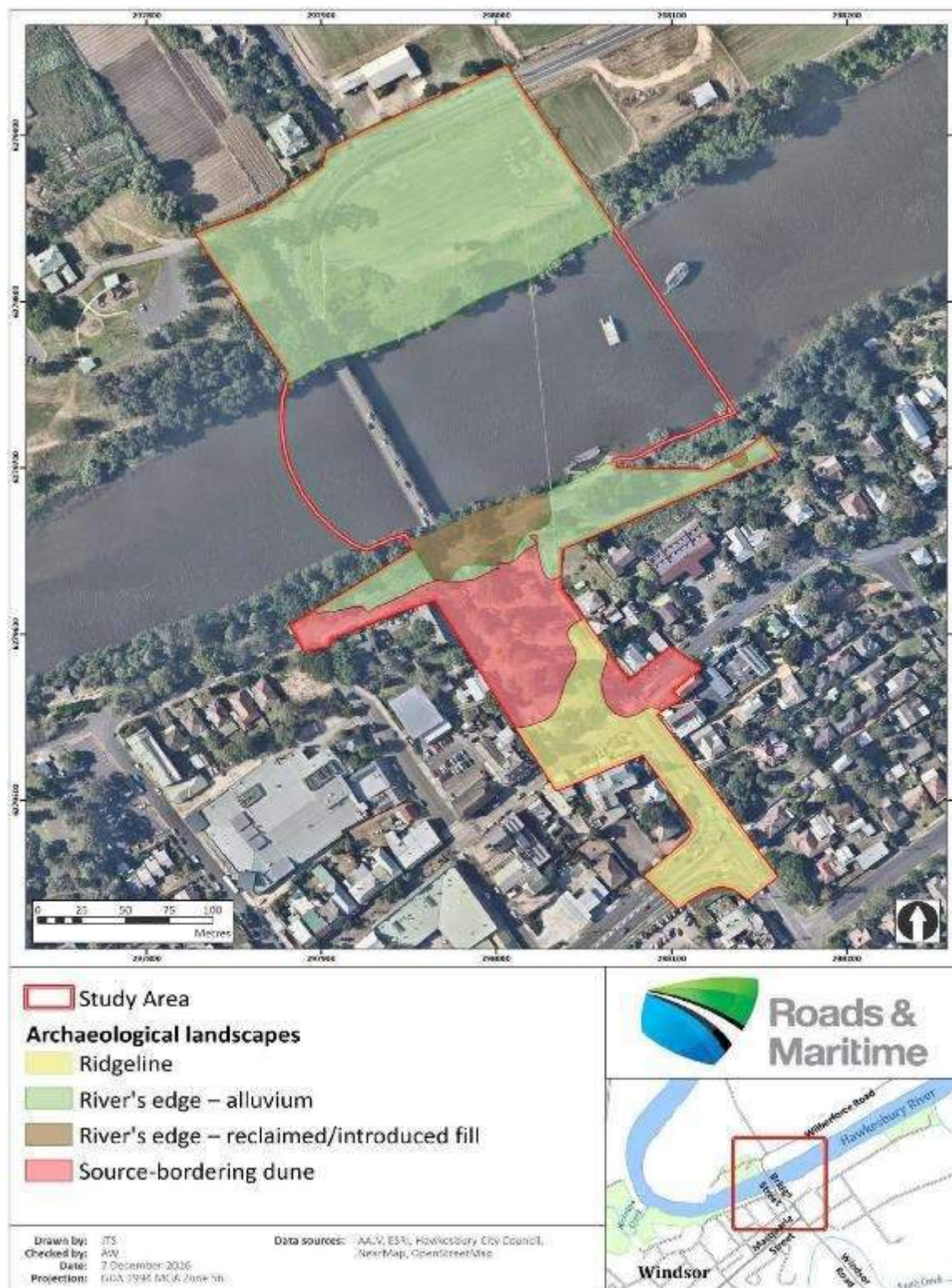


Figure 7 : Map of landscape units identified by Williams et al (2017 & 2019) on the northern and southern banks of the Hawkesbury River at Windsor.¹⁸

¹⁸ Williams, A., L. Barry, R. Hawkins, C. Neale & T. Sapienza 2019: Figure 9

2.2 The Hawkesbury River

The Hawkesbury River is a tide-dominated drowned river valley estuary that commences at the confluence of the Grose and Nepean Rivers, ca. 4 km west of Richmond, and flows generally north-east and south-east in a meandering course for ca. 145 km into Broken Bay. The Hawkesbury is part of the much larger Hawkesbury-Nepean River system that drains an area of the Sydney Basin ca. 23,000 km² in size. Technically, the Hawkesbury and the Nepean are in fact the same river – the different designation above and below the junction with the Grose River is solely a result of the order in which the river sections were discovered and named during early British exploration of NSW. The Hawkesbury has three major freshwater tributaries; the Grose and Colo Rivers that both originate in the Blue Mountains and the Macdonald River that rises in the Great Dividing Range, and a number of smaller tributaries including South, Redbank, Rickabys, Webbs and Cattai Creeks. The marine tidal reach in the Hawkesbury River extends all the way up from the river mouth to the junction with the Grose River. However, the tidal influence varies along the length of the Hawkesbury and the river can be divided into two broad sections including an estuarine reach, extending from the river mouth to ca. 75 km upstream, where the water is brackish to saline and the flow is always tidal; and a fluvio-tidal reach, between ca. 75 to 145 km from the mouth, including Windsor Reach, where the water is fresh and the flow is mostly tidal.¹⁹

The broad drainage pattern of the Hawkesbury River was formed ca. 85 to 95 million years ago, when tectonic events caused a massive uplift of land along eastern Australia. This uplift created the Great Dividing Range that beheaded the ancestral Hawkesbury, forcing it to reverse flow and cut a new path east towards the sea.²⁰ The current morphology and estuarine environment of the Hawkesbury River developed with the drowning of the ancestral river valley during the most recent post-glacial marine transgression that commenced ca. 18,000 years ago. Throughout the prior glacial period, particularly the later stages from ca. 40,000 years ago to the Last Glacial Maximum between ca. 24,000 to 18,000 years ago, global climatic downturn and cooler temperatures led to increasing amounts of water being trapped in continental ice sheets with global sea levels dropping as a result. At the height of the Last Glacial Maximum, sea levels throughout the Australasian region were ca. 100 to 130 m below current levels and the eastern coastline of Australia was ca. 25 to 30 km further to the east.²¹

During this period, the upper Hawkesbury River, including Windsor Reach, would have been a purely freshwater fluvial system, up to ca. 230 to 260 km from the coastal river mouth and well beyond marine tidal influence. Water levels in the upper Hawkesbury would in turn have been markedly lower, and the river channel would have been narrower and followed a pathway along lower elevations. The current study area, presently forming part of the southern edge of the Hawkesbury River bed, would likely have been variously situated above water as part of the former riverbank and / or adjacent alluvial terrace.

Around ca. 18,000 years ago, a climate reversal caused increasing temperatures and glacial retreat, resulting in rising sea levels. Along south-eastern Australia, the sea rose rapidly between ca. 18,000 to 8,000 years ago, progressively pushing the coastline to the west and drowning coastal river valleys, including the Hawkesbury. Seas along south-eastern Australia reached current levels between ca. 7,900 to 7,700 years ago and continued to rise to a highstand of +1-2 m between ca. 7,700 to 7,400 years ago, remaining stable until ca. 2,000 years ago when levels gradually fell to the present position.²²

The Hawkesbury River is prone to frequent and rapid flooding, predominantly across the wide and low-lying floodplains of the upper Hawkesbury around Richmond, Windsor, and Pitt Town. While most river valleys widen as they approach the sea, the Hawkesbury valley narrows as it cuts through deep sandstone gorges between Sackville (ca. 30 km downstream from Windsor) and the estuary mouth just beyond Brooklyn (ca. 130 km downstream from Windsor). Above Sackville,

¹⁹ Boon, P. I. 2017 *The Hawkesbury River: A Social and Natural History*. CSIRO Publishing, Victoria.; Geographical Names Board of NSW *Hawkesbury River*. https://www.gnb.nsw.gov.au/place_naming/placename_search/extract?id=MalOIMtLit; Hughes, M. G., P. T. Harris & T. C. T. Hubble 1998 "Dynamics of the turbidity maximum zone in a micro-tidal estuary: Hawkesbury River, Australia." *Sedimentology*. Vol. 45, pp. 397-410.; Manly Hydraulics Laboratory 2006 *Survey of Tidal Limits and Mangrove Limits in NSW Estuaries*. Prepared by for the NSW Department of Natural Resources.; Roy, P. 1984 "New South Wales estuaries: their origin and evolution." *Coastal geomorphology in Australia*. pp. 99-121.

²⁰ Op. Cit. Boon, P. I. 2017

²¹ Lewis, S. E., C. R. Sloss, C. V. Murray-Wallace, C. D. Woodroffe & S. G. Smithers 2013, 'Post-glacial sea-level changes around the Australian margin: a review.' *Quaternary Science Reviews*. Vol. 74.; Thom, B.G., and P.S. Roy 1985, 'Relative sea levels and coastal sedimentation in southeastern Australia in the Holocene.' *Journal of Sedimentary Petrology*. Volume 55 (2)

²² Lewis et al 2013; Sloss, C.R., C. V. Murray-Wallace & B. G. Jones 2007 'Holocene sea-level change on the southeast coast of Australia: a review.' *The Holocene*. Vol. 17, pp. 999-1014.

the river crosses floodplains that are situated virtually at sea level and widen out up to 6 km in some locations. When heavy rains occur and increased river flows reach Sackville, the constricted sandstone valley acts as a choke point, causing extensive overflow across the upper Hawkesbury floodplains. Floodwaters also flow back up the river's tributaries, particularly South Creek and Rickabys Creek, causing further inundation around Richmond and Windsor.²³

Historical records show that one hundred and thirty major floods that reached at least 6.4 m AHD – the height of the current Windsor Bridge – have occurred on the Hawkesbury River since 1790 (see Table 1). The largest Hawkesbury flood on record occurred in June 1867, when the river reached 19.3 m AHD at Windsor. It is estimated that a flood of such magnitude has an average chance of occurrence of 1:220 years at Windsor, however, it is by no means the largest that could occur on the Hawkesbury. The estimated Probable Maximum Flood (PMF) for the Hawkesbury River – i.e. a flood that may be expected from the most severe combination of critical meteorological and hydraulic conditions (in the current climate) – would reach a level of ca. 26.4 AHD at Windsor (see Figure 8).²⁴ There is evidence that at least one flood of even greater magnitude has occurred on the Hawkesbury River during the late Holocene. Sediment analysis within the Nepean River valley at Fairlight Gorge (3 km upstream of Penrith) has identified high-level flood slackwater deposits that indicate the occurrence of a palaeoflood throughout the Nepean-Hawkesbury River system ca. 3,756 years ago that would have had a peak height at least 8 m greater than the 1867 flood – i.e. at least 27.4 m AHD at Windsor.²⁵ Analysis of trace elements in sediment samples taken during recent archaeological excavation at Windsor – in particular traces of chlorine and calcium that are considered to reflect an index of flooding and / or site submergence – further indicate major Hawkesbury River flooding events during the Last Glacial-Interglacial Transition ca. 13,000-8,000 years ago, the early Holocene thermal maxima ca. 8,000-5,000 years ago, and the period of El Nino Southern Oscillation in the late Holocene ca. 4,000-2,000 years ago.²⁶

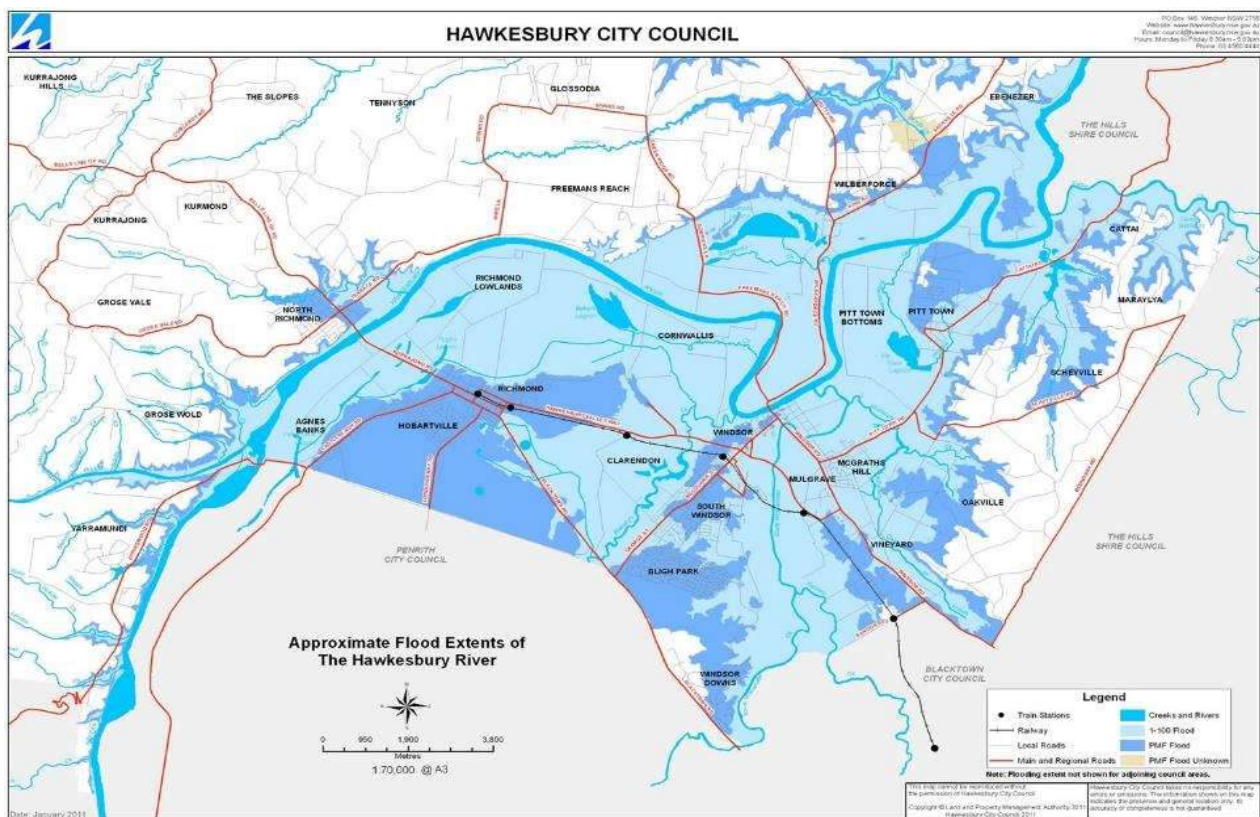


Figure 8: Map of approximate Hawkesbury River flood extents across Windsor, Pitt Town and Richmond (within Hawkesbury City Council area) – showing extent of a 1-100 year flood (ca. 17.2 m AHD at Windsor, 2.1 m less than the 1867 flood) and the PMF flood (ca. 26.4 m AHD at Windsor).²⁷

²³ Kidd, L. 2013 *Upper Hawkesbury River Bank Erosion, Foreshore Structure and Weed Mapping*. Prepared by BMT WBM Pty Ltd for Hawkesbury City Council.; Morrison, T. & S. Molino 2012 *Hawkesbury-Nepean Flood Damages Assessment*. Prepared by Molino Stewart Pty Ltd for Infrastructure NSW.

²⁴ Op. Cit. Boon, P. I. 2017, Morrison, T. & S. Molino 2012 and Warner, R.F. 2014 "Environmental flows in two highly regulated rivers: the Hawkesbury Nepean in Australia and the Durance in France." *Water and Environment Journal*. Vol. 28, pp. 365-381

²⁵ Saynor, M. J. & W. D. Erskine (1993) "Characteristics and implications of high-level slackwater deposits in the Fairlight Gorge, Nepean River, Australia." *Australian Journal of Marine and Freshwater Research*. Vol. 44, No. 5, pp. 736-747.

²⁶ Op. Cit. Williams, A., L. Barry, R. Hawkins, C. Neale & T. Sapienza. 2019

²⁷ Hawkesbury City Council. 2011. *Approximate Flood Extents of the Hawkesbury River*. https://www.hawkesbury.nsw.gov.au/_data/assets/image/0018/31815/flood-extent-map-south-websm.jpg

Table 1: List of Hawkesbury River floods ≥ 6.4 m AHD at Windsor that have occurred between 1790 to 2020.²⁸

DATE	AHD	DATE	AHD	DATE	AHD	DATE	AHD
1799 March	15.3 m	1879 September	10.5 m	1938 August	7.4 m	1963 August	9.6 m
1800 March	12.2 m	1879 September	13.9 m	1942 March	7.5 m	1964 June	14.6 m
1805 May	14.6 m	1889 May	11.7 m	1942 October	6.4 m	1967 August	9.0 m
1806 August	14.3 m	1890 March	12.1 m	1943 May	10.3 m	1968 February	9.5 m
1806 October	9.2 m	1890 March	10.8 m	1945 June	8.5 m	1969 April	6.4 m
1809 May	14.6 m	1890 June	6.8 m	1949 January	7.8 m	1969 November	10.2 m
1809 August	14.5 m	1891 June	10.8 m	1949 June	12.0 m	1972 January	6.3 m
1816 June	13.9 m	1892 September	8.0 m	1950 January	9.1 m	1972 January	7.1 m
1817 February	14.8 m	1893 March	8.6 m	1950 March	9.4 m	1974 January	6.8 m
1819 February	14.0 m	1894 March	9.6 m	1950 April	9.4 m	1974 March	7.3 m
1819 June	14.0 m	1895 January	9.3 m	1950 April	8.7 m	1974 April	8.7 m
1857 July	9.9 m	1897 July	6.9 m	1950 May	7.5 m	1974 May	10.4 m
1857 August	11.4 m	1898 February	9.6 m	1950 June	9.6 m	1974 June	8.0 m
1860 February	8.2 m	1899 August	6.7 m	1950 June	7.5 m	1974 August	9.6 m
1860 April	11.2 m	1899 August	8.1 m	1950 June	7.8 m	1975 June	11.2 m
1860 July	10.5 m	1900 July	14.1 m	1950 June	8.4 m	1975 July	6.6 m
1860 November	11.0 m	1904 July	12.2 m	1950 October	9.8 m	1976 January	9.4 m
1861 April	8.3 m	1910 July	6.4 m	1952 June	9.5 m	1976 March	8.0 m
1864 June	9.9 m	1911 January	7.9 m	1952 July	11.8 m	1977 March	8.9 m
1864 June	14.6 m	1912 July	6.7 m	1952 August	9.7 m	1978 March	14.5 m
1864 July	10.9 m	1912 August	7.3 m	1952 August	9.0 m	1979 June	9.7 m
1866 June	8.0 m	1913 May	8.0 m	1954 February	8.8 m	1984 July	8.3 m
1866 July	8.3 m	1915 January	7.6 m	1955 May	9.9 m	1986 August	11.4 m
1867 April	6.4 m	1916 October	10.8 m	1956 February	13.8 m	1988 May	12.8 m
1867 June	19.3 m	1922 July	9.5 m	1956 February	11.8 m	1988 July	10.0 m
1869 May	11.2 m	1925 May	7.6 m	1956 March	9.1 m	1989 April	9.2 m
1870 April	16.7 m	1925 June	11.4 m	1956 May	7.2 m	1990 February	7.7 m
1870 May	10.8 m	1927 April	7.2 m	1956 June	9.7 m	1990 April	8.7 m
1871 May	11.2 m	1928 February	6.7 m	1961 November	15.0 m	1990 August	13.5 m
1873 February	12.7 m	1929 February	8.1 m	1962 January	8.6 m	1992 February	10.8 m
1875 June	11.9 m	1929 October	8.6 m	1963 April	8.8 m	2020 February	9.2 m
1877 May	9.2 m	1931 April	7.0 m	1963 May	8.1 m		
1878 February	8.1 m	1934 February	9.3 m	1963 June	9.0 m		

Large floods can markedly alter the shape, depth, and direction of river channels, particularly across alluvial floodplain landscapes such as those along the upper Hawkesbury River between Richmond and Pitt Town. Increased water flow and current velocity during a flood can create high shear stresses along the bottom and sides of a river channel, resulting in bank erosion and riverbed scouring, with sediments carried downstream as suspended material. Flood current velocities in the upper Hawkesbury River can exceed 3 metres per second and can potentially erode and transport particles up to at least 10 mm and possibly 20 mm in diameter.²⁹ Bank erosion can also continue in the immediate aftermath of a flood, with undercut and / or waterlogged banks becoming unstable and slumping or collapsing as the water levels drop. These processes acting together in a flood event can further result in channel avulsion, whereby river flow is gradually or abruptly diverted out of an established channel into a new course at lower elevation on the adjacent floodplain.³⁰

Several portions of the upper Hawkesbury River are identified as geomorphologically unstable and particularly susceptible to erosion, including sections of Freemans Reach and Argyle Reach immediately upstream of Windsor. Since the late 19th century, the river channel at the lower end of Freemans Reach has shifted up to 200 m east and 400 to 500 m south; a large part of this movement appears to have occurred during major floods in the early 1960s. The channel at the upper and lower ends of Argyle Reach has also widened, narrowed, and moved up to 200 to

²⁸ Op. Cit. Boon, P. I. 2017

²⁹ Op. Cit., Boon, P. I. 2017

³⁰ Clarke, M. N. & M. G. Geary 1987 *Hawkesbury River Hydraulic and Sediment Transport Processes – Channel Geometry, Morphological Changes and Bank Erosion*. NSW Public Works Department, Report No. 10.; and Op.Cit., Hughes, M. G., P. T. Harris & T. C. T. Hubble 1998 and Boon, P. I. 2017

300 m, respectively eastwards and westwards, in the last 130 years (Figure 9). The channel alignment along Windsor Reach has remained largely unchanged since the 19th century, however localised bank erosion and collapse has occurred at various points on both sides of the river.³¹ Evidence of earlier Holocene flood erosion and removal of soil profiles across the adjacent Hawkesbury River terraces has also been identified during archaeological excavations at Windsor, where thick alluvium was found in several places to truncate the underlying sand body deposits.³² Overall, it is quite likely that the channel along Windsor Reach has shifted somewhat, north and / or south, throughout the development of the Hawkesbury River estuary during the past ca. 18,000 years. The current study area may thus have variously formed part of the southern edge of the riverbed – as it does now – and part of the exposed riverbank and / or adjacent terrace throughout this period of time.

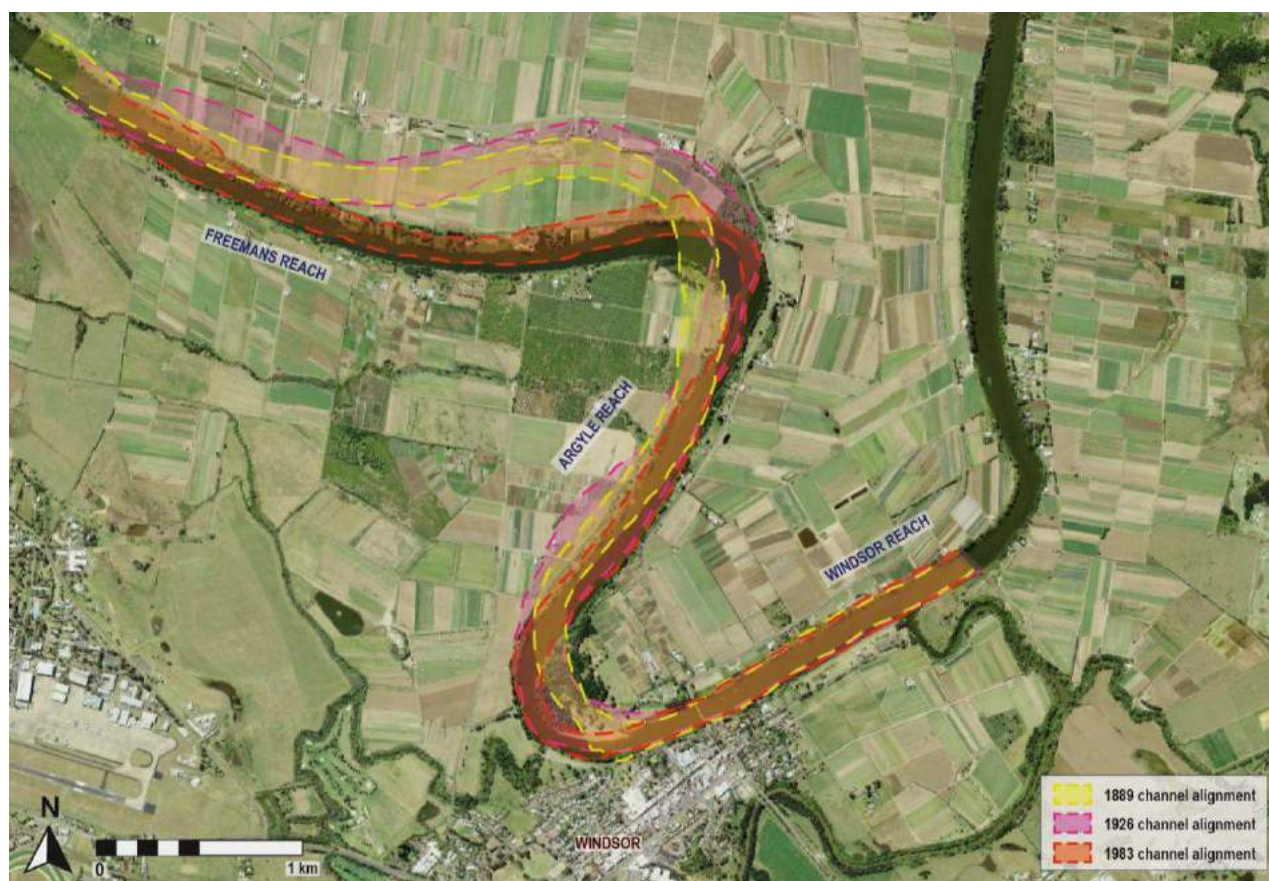


Figure 9: Map showing former alignments of Hawkesbury River channel along Freemans Reach, Argyle Reach and Windsor Reach in 1889, 1926 and 1983; overlain on 2019 aerial photograph.

Floods can also cause morphological changes to river landscapes via deposition of sediments, primarily as flood waters recede. During the height of a flood, erosion processes increase the sediment load conveyed to and within a river, and the heightened current velocity causes these eroded materials to be brought into suspension within the water column. As the flood recedes and current velocities decrease, these materials begin to fall out of suspension and are deposited across the floodplain, riverbanks, and riverbed. A substantial example of such a process occurred during the major Hawkesbury River flood in 1867, when up to 3-6 m of sand was deposited across large areas of farmland across the river floodplain as flood waters dropped.³³ Indeed, recent archaeological excavations have demonstrated that large portions of the sediment profile on the northern and southern Hawkesbury River terraces along Windsor Reach are alluvial flood deposits, periodically laid down during flood events and periods of high river discharge from the Late Glacial Period, between ca. 82,000 to 40,000 years ago, to the last few hundred years.³⁴

³¹ Op. Cit., Boon, P. I. 2017; Clarke, M. N. & M. G. Geary 1987; and & Scholer, H. A., A. M. H. Riddler & D. Benson 1974 *Geomorphology of New South Wales Coastal Rivers*. The University of New South Wales Water Research Laboratory, Report No. 139.

³² Op. Cit., Williams, A., L. Barry, R. Hawkins, C. Neale & T. Sapienza 2019

³³ Steele, Rev. J. 1916 *Early Days of Windsor, N. S. Wales*. Tyrrell's Limited, Sydney, NSW.

³⁴ Op. Cit., Williams, A., L. Barry, R. Hawkins, C. Neale & T. Sapienza 2019

The 1867 flood also deposited a large amount of sediment in the Windsor Reach channel, resulting in riverbed aggradation and reduced water depths, and creating problems for river navigation – a situation that gradually worsened throughout the late 19th century.³⁵ If a flood event is isolated, a river channel usually recovers to its former state, with scoured areas replenished via gradual deposition and sediment build-up gradually dispersed and transported downstream via normal river flows. However, if successive floods occur over several years, channel recovery is generally prevented. Studies have shown that the Hawkesbury River, along with most coastal rivers of NSW, exhibits alternating flood-dominated and drought-dominated regimes resulting from prevailing climatic conditions and secular rainfall. Each period generally lasts between 30 to 50 years and imposes great changes in water and sediment discharge in coastal river systems. In flood-dominated regimes, river capacities increase, and channels tend to become wider but shallower, with the bed infilled with coarse alluvial sediments. In drought-dominated regimes, the conveying capacity is reduced, and river channels become narrow and deeper, with finer bed sediments.³⁶ The period between 1857 to 1900 was a particularly strong flood-dominated regime in the Hawkesbury River, with thirty-eight floods of heights greater than 6.4 m AHD, sixteen massive floods with peaks over 9.8 m AHD and the major 1867 flood of 19.3 m AHD.³⁷ A comparison of hydrographic surveys of Windsor Reach from 1862 and 1890 shows a considerable reduction in recorded water depths over time (Figure 10)³⁸ – up to 15' / 4.5 m in some locations – illustrating a substantial bed aggradation during this flood-dominated period. Such patterns of channel alteration in response to drought and flood-dominated regimes would have occurred in the Hawkesbury River for thousands of years, resulting in a long-term dynamic environment of riverbed erosion, movement, and deposition within the current study area.



Figure 10: Riverbank outline and depth soundings taking during 1862 and 1890 hydrographic surveys of the Hawkesbury River at Windsor – soundings are shown in feet and reduced to low water Spring tides – overlain on 2019 aerial photograph.

³⁵ "Dredging the Hawkesbury." 30 November 1876. *The Sydney Morning Herald*. p. 6.; Op. Cit., Steele, Rev. J. 1916

³⁶ Op. Cit., Boon, P. I. 2017; Erskine, W. D. & R. F. Warner 1988 "Geomorphic Effects of Alternating Flood and Drought-Dominated Regimes on NSW Coastal Rivers." *Fluvial Geomorphology of Australia*. Academic Press Australia.; Warner, R. F. 1994 "A theory of channel and floodplain responses to alternating regimes and its application to actual adjustments in the Hawkesbury River, Australia." Kirkby, M. J. (ed.) *Process Models and Theoretical Geomorphology*. pp. 173-200. Wiley, Chichester, UK.

³⁷ Op. Cit., Warner, R. F. 1994

³⁸ Hydrographic data taken from Moriarty, E. O. 5 July 1862 *Survey for a Wharf for Windsor*. NSW State Records, "Hawkesbury River – Survey For Wharf - Windsor Wharf - Frame 1 - Plan Type: Engineering (Harbours & Rivers)." NRS-21554-1-3-PLAN14/10157_01. & NSW Public Works 1890 *Hawkesbury River at Windsor – Soundings Plan*. NSW State Records, PLAN X1080-74/12.

3 Historical Context

3.1 Green Hills Shipbuilding - Andrew Thompson

At the establishment of the Green Hills settlement in 1794 (later site of the town of Windsor), the Hawkesbury River was an important trade and transport route; providing local connections between farmers and villages along the river and linking the Hawkesbury region with the markets and supplies of Sydney. Early river shipping, however, was sporadic and heavily limited by the small number of vessels in the NSW colony. In 1787, in order to prevent convicts escaping and settlers embarking on unregulated travel, the British Government had instructed Governor Arthur Phillip to prohibit any private shipbuilding – “*It is our royal will and pleasure that you do not on any account allow craft of any sort to be built for the use of private individuals which may enable them to effect such intercourse.*”³⁹ Thus the only vessels initially available to supply Hawkesbury settlers and ship produce to Sydney were a handful of Government sloops and schooners.⁴⁰

The steadily increasing need to transport people, supplies and raw materials throughout the developing colony, however, soon led to an easing of shipbuilding restrictions under subsequent Governors John Hunter and Philip Gidley King. By the early 1800s, vessels up to a certain size could be constructed under a strict Government permit system.⁴¹ One of the earliest NSW colonists to take up such a permit, and the first on the Hawkesbury River, was Green Hills pioneer Andrew Thompson.⁴²

Andrew Thompson arrived in Sydney as a nineteen-year-old convict in 1792, sentenced to fourteen years transportation from Scotland for the theft of about £10 worth of cloth. Following a year spent working in the convict stores, Thompson joined the NSW colonial police force and in 1796 was appointed by Governor Hunter to serve as constable to Green Hills. In 1798, Thompson received a conditional pardon and in 1799 was granted a fourteen-year lease of one acre of land “*for the purposes of building on*” overlooking the Hawkesbury River at Green Hills – a site Thompson already occupied, with a small cottage as his residence (Figure 11). Thompson’s acre stretched from the southern bank of the Hawkesbury River to the top of the ridge adjacent to the Government granaries and the Commandant’s Barracks, bound on all sides by Crown Land.⁴³

Over the following years, Thompson engaged in various business enterprises and in ca. 1802, turned his hand to shipbuilding. Whilst a few Hawkesbury settlers had previously built small open boats to ply up and down the river, Thompson was the first on the river to construct large, ocean-going sailing vessels.⁴⁴ Historical sources indicate that Thompson established his shipyard on his one acre property and a section of Crown Land to the immediate west – land that would later form part of the site selected by Governor Lachlan Macquarie for the site of Windsor town square, which he named “Thompson Square” in honour of Andrew Thompson.

A ca. 1807 watercolour painting of Green Hills by Government surveyor George William Evans, who lived on the Hawkesbury from 1805 to 1809, depicts Thompson’s shipyard with a vessel in construction at the top of a long, boarded slipway (Figure 12). The slipway is positioned in front of the large timber building that is likely to be the former Government granary built ca. 1796-1799 under Governor Hunter’s instructions, and which may have been converted by Thompson into use as a working shed for his shipbuilding operations.⁴⁵

³⁹ **Draught Instructions for Governor Phillip, 25 April 1787.** *Historical Records of New South Wales*. Volume 1, Series II. Phillip 1783-1792, Government Printer, Sydney, 1892.

⁴⁰ **Watson, Capt. J. H. 1920** “Early shipbuilding in Australia.” *Journal of the Royal Australian Historical Society*. Vol.VI, Part II.

⁴¹ Op. Cit. Watson, Capt. J. H. 1920

⁴² **Boon, P. I. 2017** *The Hawkesbury River: A Social and Natural History*. CSIRO Publishing, Victoria; Purtell, J. 1995. *The Mosquito Fleet: Hawkesbury River Trade and Traders 1794-1994*. Deerubbin Press, Berowra Heights, NSW.

⁴³ **Byrnes, J. V. 1967.** “Thompson, Andrew (1773–1810).” *Australian Dictionary of Biography*. Volume 2. National Centre of Biography, Australian National University, ACT.; Colonial Secretary’s Correspondence (1 October 1799) NSW State Records [Fiche 3267; 9/2731]; Surveyor General’s Registers of Land Grants and Leases; Book 2, NSW State Records.

⁴⁴ **Byrnes, J. V. 1967; Jack, J. B. 1997** “Early Boat building on the Upper Hawkesbury River.” *Cross Currents. Historical Studies of the Hawkesbury*. Deerubbin Press, NSW. pp. 38-39.

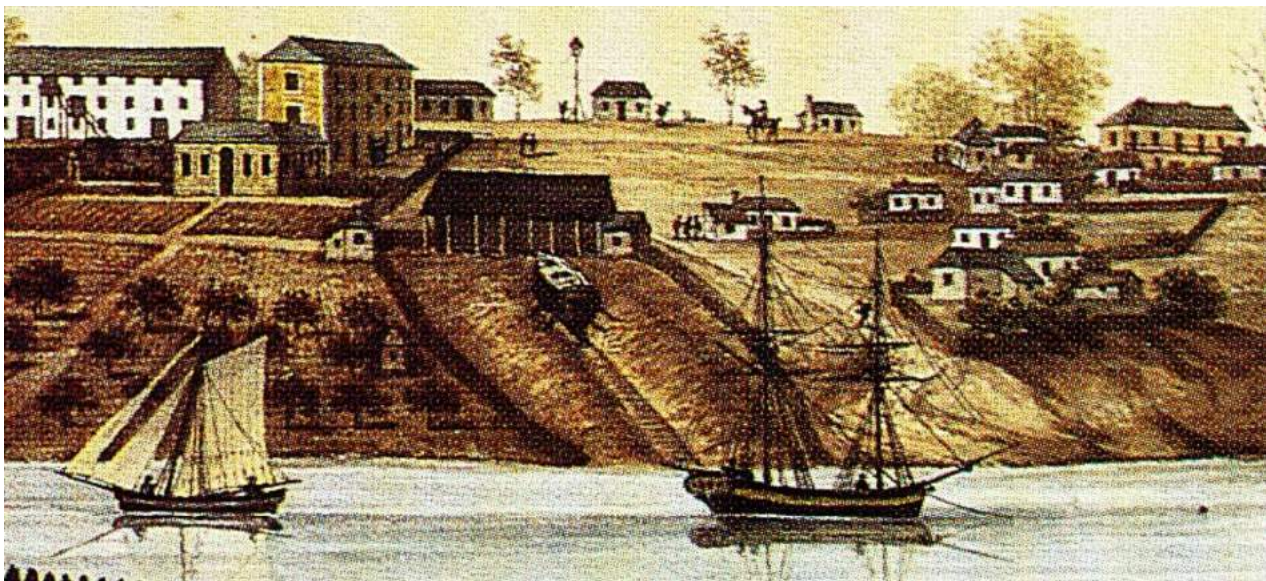
⁴⁵ **Austral AHMS Joint Venture (AAJV) 2018** *Thompson Square, Windsor NSW – Strategic Conservation Management Plan. & Biosis Research & Cultural Resources Management 2012 Windsor Bridge Replacement Project Historic Heritage Assessment & Statement of Heritage Impact*. Prepared for NSW Roads and Maritime Services.



Figure 11 : Surveyor James Meehan's 1812 plan of Windsor town – showing “Mr. Thompson's Premises” (highlighted red).



Figure 12:
G. W. Evans
ca. 1807
watercolour of
Green Hills
Enlargement of
Thompson's
shipyard
slipway below.⁴⁶



⁴⁶ Evans, G. W. 1807. “A View of the Green Hills.” Hordern House 1994 *Colonial Paintings: Twelve Early Works*. Potts Point, NSW.

Records indicate that the first vessel constructed for Thompson was the 16-ton sloop *Hope* built ca. 1802, which by early 1803 was regularly running maize, wheat, barley and oats from the Hawkesbury to Sydney.⁴⁷ In September 1803, Thompson's second vessel, the sloop *Nancy*, was launched at his Green Hills yard.⁴⁸ *Nancy* was built under the management and direction of former whaling chief mate and navigator Mr. Kelly. Contemporary sources variously list *Nancy* as 20 to 40 tons burthen;⁴⁹ further described as a "strong well-built sloop" that "carries 5 men and has 4 swivels mounted on her quarter railing."⁵⁰

In October 1803, *Nancy* sailed to Sydney for the first time, carrying 1160 bushels (equivalent to approximately 42.19 m³ in volume) of wheat cultivated by the NSW Government at Cornwallis Farm. A short article in the *Sydney Gazette and New South Wales Advertiser* describing the arrival of *Nancy* stated that in addition to the 1160 bushels, the vessel "could have taken in with safety 250 more." The article further speaks favourably of *Nancy*, stating "Connoisseurs find no other fault with her than on account of her being rather 'Shallow in the Bow.' A Turkey once presumed to censure the legs of the Peacock!"⁵¹

Figure 13: *Sydney Gazette and New South Wales Advertiser* Article on the arrival of *Nancy* in Sydney in October 1803.

The New Hawk-bury Sloop, built at the Green Hills, Mr. A. Thompson, owner, came round for the first time on Monday last, with 1160 Bushels of Wheat, on from Cornwallis Farm, cultivated by Government, and could have taken in with safety 250 more. This vessel called the *Nancy*, was built under the sole management and direction of Mr. Kelly, formerly chief mate of the *Eliza* whaler, who also navigates her. Her computed burthen is 40 tons, carries 5 men, and has 4 swivels mounted on her quarter railing. Connoisseurs find no other fault with her than on account of her being rather "shallow in the Bow." A Turkey once presumed to censure the legs of the Peacock!

By early 1804, *Nancy* operated not only on the Hawkesbury but also shipped timber from the Hunter River, stores and supplies to Port Phillip, Victoria, and skins and oil to Sydney from the fur sealing industries in the Derwent River and Bass Strait, Tasmania.

When *Nancy* was launched in September 1803, Thompson was reported to have "another vessel of nearly the same size now on the stock, which will be shortly ready to launch."⁵² This third vessel was "another handsome sloop" of 30 to 37 tons burden, laid down by Mr. Kelly and which, "in compliment to the spot of her nativity" was named *Hawkesbury*.⁵³ Fittingly, *Hawkesbury* was soon engaged in the Hawkesbury River trade, shipping grain to Sydney.⁵⁴

In February 1804, only twenty-one non-Government schooners and sloops were recorded in the NSW colony – three of which, *Hope*, *Nancy* and *Hawkesbury* – belonged to Andrew Thompson.⁵⁵

⁴⁷ "Ship News." *The Sydney Gazette and New South Wales Advertiser* - 26 March 1803, 29 May 1803, 5 June 1803, 21 August 1803, 11 September 1803 & 9 October 1803.

⁴⁸ "Sydney." 25 September 1803. *The Sydney Gazette and New South Wales Advertiser*. p. 3.

⁴⁹ "Return of Schooners and Sloops belonging to Individuals in His Majesty's Territory of New South Wales, 28th February 1804" quoted in Watson, Capt. J. H. 1920.

⁵⁰ "Sydney." 23 October 1803. *The Sydney Gazette and New South Wales Advertiser*. p. 3.

⁵¹ "The New Hawk-bury Sloop." 23 October 1803. *Sydney Gazette and New South Wales Advertiser*. p. 2.

⁵² "Sydney." 25 September 1803. *The Sydney Gazette and New South Wales Advertiser*. p. 3.

⁵³ "Sydney." 19 February 1804. *The Sydney Gazette and New South Wales Advertiser*. p. 4.

⁵⁴ "Port News." 3 June 1804. *The Sydney Gazette and New South Wales Advertiser*. p. 4.; "Ship News." 11 November 1804. *The Sydney Gazette and New South Wales Advertiser*. p. 4.

⁵⁵ "Return of Schooners and Sloops belonging to Individuals in His Majesty's Territory of New South Wales, 28th February 1804" quoted in Watson, Capt. J. H. 1920.

The fourth and last vessel known to have been built at Thompson's Green Hills shipyard was a schooner estimated at 100 tons burden – the second largest ship built in NSW at the time.⁵⁶ The vessel was commenced in November 1805 and launched in April 1807 to great celebration:

*Last Tuesday se'nnight Mr. Thompson's fine vessel was launched from the Green Hills: numerous spectators attended on the occasion, which afforded to that part of the country a spectacle as pleasing as it was nouvelle. She went off in a very good style, and as she darted across the stream was honoured with the appellation of "The Governor Bligh."*⁵⁷

Thompson used *Governor Bligh* to further his interests in "The Sealing Islands", shipping fur seal skins from Bass Strait, Tasmania and Foveaux Strait, New Zealand; as well as in an experimental attempt to establish a trade in New Zealand flax.⁵⁸

After the completion of *Governor Bligh*, Thompson moved his shipyard to new premises on his 1809 grant of Scotland Island in Pittwater, where his last two ships, *Whale* (1810) and – completed after his death in October 1810 – *Geordy* (1811) were built.⁵⁹

3.2 Windsor Wharves

3.2.1 Green Hills Wharf 1795-1814

In early 1795, a wharf was established on the Hawkesbury River at the Green Hills settlement – initially provided for the landing and loading of supplies at the Government storehouse. In his account of the NSW colony in the 1790s, David Collins, then Lieutenant-Governor of NSW, wrote:

February 1795] Early in February, the storehouse at the Hawkesbury being completed, the provisions which had been sent round in the schooner were landed and put under the care of Baker....

*May 1795] On the 21st the colonial schooner returned from the Hawkesbury, bringing upwards of eleven hundred bushels of remarkably fine Indian corn from the store there. The master....reported.... He found five feet less water at the store-wharf than when he was there in February last, owing to the dry weather which had for some time past prevailed.*⁶⁰

Very little is known about the design and construction of the wharf, and no descriptions of it have been found in the historical record. Indeed, it is possible that the initial wharf was largely formed via cutting and sloping of the natural riverbank. A series of watercolour paintings and engravings of Green Hills dating from 1807 to 1813 depict what appears to be the settlement wharf / landing place with a track leading up the hill into the village (see Figure 14⁶¹,

Figure 15 and Figure 12) – however, there is no clear evidence of any built structure. An 1812 plan of the township of Windsor also shows what appears to be a break in the bank of the Hawkesbury in a similar location (Figure 16) – quite possibly representing the wharf as a short projection or a cutting. Together, these images indicate that the Green Hills wharf was situated in the location of the current Windsor Bridge southern abutment (outside the current study area).

⁵⁶ "Sydney." 17 November 1805 and 16 February 1806 *The Sydney Gazette and New South Wales Advertiser*.

⁵⁷ "Sydney." 12 April 1807. *The Sydney Gazette and New South Wales Advertiser*. p. 2.

⁵⁸ "Ship News." 12 March 1809 and 16 April 1809. *The Sydney Gazette and New South Wales Advertiser*. "Sydney." 11 August 1810. *The Sydney Gazette and New South Wales Advertiser*. p. 2.; Marr, A. P. 1 March 1940 "Early Hawkesbury Ships." *Windsor & Richmond Gazette*. p. 10.

⁵⁹ *Op. Cit.* Boon, P. I. 2017

⁶⁰ Collins, D. Esq. 1798. *An Account of the English Colony in New South Wales, Vol. 1. With Remarks On The Dispositions, Customs, Manners, Etc. Of The Native Inhabitants Of That Country. To Which Are Added, Some Particulars Of New Zealand; Compiled, By Permission, From The Mss. Of Lieutenant-Governor King.* T. Cadell Jun. and W. Davies, The Strand, London, UK.

⁶¹ Evans, G. W. 1809. "The Settlement on the Green Hills." Mitchell Library, State Library of NSW, PXD 388, Vol. 3, Fol. 7.

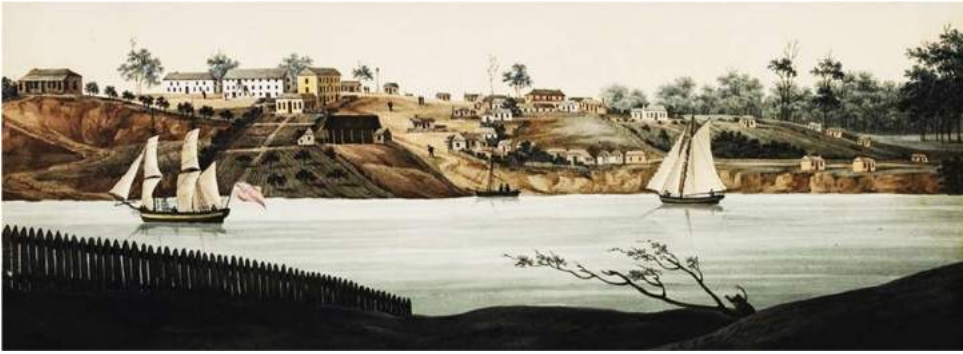


Figure 14:
Watercolour of
Green Hills, dated
1809.

*(enlargement of
wharf / landing
place below*



Figure 15:
Engraving of Gre
Hills, dated 1813.⁶²

*(enlargement of
wharf / landing
place below).*



⁶² Slager, P. 1813. 'A view of part of the town of Windsor in New South Wales, taken from the banks of the River Hawkesbury'. A. West, Sydney. National Library of Australia, PIC Drawer 2230 #U2028 NK2044/B.



Figure 16: Surveyor James Meehan's 1812 plan of the Town of Windsor.⁶³ (Enlargement of possible wharf / landing place on the right).

3.2.2 Howe & McGrath Windsor Wharf 1814-1816

In December 1810, Governor Lachlan Macquarie declared his intention to establish five townships in the Hawkesbury-Nepean River districts to provide accommodation and security against flooding to the settlers of the area, whose agricultural pursuits were of great importance to the subsistence of the NSW colony. Macquarie selected the settlement of Green Hills as the site of one of these five new towns; to thenceforth be known as "Windsor."⁶⁴

Macquarie further gave detailed instructions for the laying out of the towns to James Meehan, Assistant Surveyor, specifying that each town must consist of an organised grid with streets and allotments of regular size, and that land must be set aside for a church, school, gaol, guard house, burial ground and public square.⁶⁵ In early 1811, Macquarie recorded in his journal that he had laid out the streets of Windsor and formed a town square, which he named "Thompson Square":

.... I laid out the Town of Windsor in regular Streets, and formed the open area immediately to the Westward of the Government Domain and the late Mr. Thompson's Premises into a Square. The main, or principal Street extending from this Square to the new Township, I have called George Street in honor of His Majesty; and the New Square I have named Thompson Square, to commemorate the memory of the late Andrew Thompson Esqr., the great Promoter of this Town - and who may justly be called its Founder.⁶⁶

In July 1812, Macquarie visited Windsor to check progress and instruct on further works required – including the construction of a bridge over South Creek and a public wharf on the bank of the Hawkesbury River at Thompson Square:

Thursday 9th. July 1812 – At 11. a.m. Set out for Windsor and arrived there at 3. P.M.

Friday 10th. July 1812 – Went to survey and line out the spot for erecting the new Bridge across the South Creek to Windsor – the Scite [sic] of the Toll-House – and the approach to the Town. Went afterwards to survey and mark out the proper Place in Thompson Square for

⁶³ Meehan, J. 1812. "Plan of Windsor." NSW State Records, Map SZ 529.

⁶⁴ Steele, J. Rev. 27 November 1914. "Early Days of Windsor. Hawkesbury and Green Hills. Early Data." *The Windsor and Richmond Gazette*. p. 7.

⁶⁵ Macquarie, L. Gov. 26 December 1810. "Instructions given to James Meehan for the laying out of the Five Townships." NSW State Records, NRS 935 Colonial Secretary: Copies of letters sent - Local and overseas, 28 Dec 1809-28 Dec 1813 [4/3490D, pages 55-60; Reel 6002].

⁶⁶ Macquarie, L. Gov. 11 May 1811. *Memoranda & Related Papers*. NSW State Library, Mitchell Library, A772 30-31 ff. [Microfilm Reel CY301 Frames #37-38]. Transcript also available at *The Lachlan & Elizabeth Macquarie Archive*. <https://www.mq.edu.au/macquarie-archive/lema/1811/1811may.html>

*erecting a Public Wharf at on the Bank of the Hawkesbury, being accompanied by James Harrax, who has promised to undertake the Job, after he has finished the New Bridge and the Turnpike Road to Windsor. He has also undertaken to fill up the Hollows & chasms in Thompson Square.*⁶⁷

There appears to have been no particular sense of urgency regarding the construction of a public wharf on the Hawkesbury River at Windsor, as the work was scheduled to be undertaken only after the toll road connecting Windsor to Sydney and the bridge over South Creek were completed. It might thus be assumed that the original Green Hills wharf / landing place was considered by Macquarie to be sufficient in the immediate short term.

James Harrex (Harrex) was an emancipist builder who in 1810 had successfully tendered for the Government contract to construct a road from Sydney to the Hawkesbury. In mid-1813, before the work was finished, Harrex was convicted of stealing livestock and a contract for the completion of the road was subsequently awarded to Windsor settlers and entrepreneurs John Howe and James McGrath.⁶⁸ The road was completed in late 1813; as was the bridge over South Creek built by John Howe. In early 1814, Howe and McGrath were further engaged to construct a road between the South Creek Bridge into the town of Windsor.⁶⁹

Upon completion of the road into Windsor in early to mid-1814, Howe and McGrath were invited to submit a proposal to carry out the works that Macquarie had planned for Thompson Square. The proposal was approved and in August 1814 a signed agreement was drawn up between Howe ("dealer") and McGrath ("labourer"), and D'Arcy Wentworth and Simeon Lord as Commissioners of Roads and on behalf of the Government, for works that entailed "*filling up and levelling a certain Portion of Ground Called "Thompson's Square" at the Hawkesbury and Erecting a Wharf at the Hawkesbury at Windsor.*"⁷⁰

Based on the agreement, the work appears to have involved the construction of a timber pile and planking retaining wall along the bank of the Hawkesbury extending the width of Thompsons Square, deposition of fill behind the retaining wall to reduce the slope of the Square from the northern ridge to the riverbank, and to erect a timber wharf 50' (15.2 m) long by 18' (5.5 m) wide extending out from the downstream end of the retaining wall. Specifically, the contract outlines the work was to be completed in the following manner:

The front of the Square (Thompson Square) to be piled with Sound Piles from 16 to 18 inches thick to be from three to four feet apart in the (?) to be three feet above the Water Mark of Spring Tides (but in a Line with it) Well Capped and Secured by Land Ties to extend from Side line to Side line of the Square to be planked on the Inside of the Piles and then filled up to the top.

*The Wharf to Commence from the Upper Side Line of the Square to Extend Eighteen feet from the above Row of Piles which will be in deep water to Extend fifty feet in Length to be planked on the Inside and filled up unless it should be thought best to plank the top and in that Case the same is to be planked and not filled up, the whole to be Capped and well secured by Land Ties as also to the Row of Piles in the Front of the Square.*⁷¹

The contract also involved construction of a drain / sewer through Thompson Square, emptying out into the Hawkesbury River, with the stated requirement to "Sink and Erect One Sewer in the Middle of the Square with Channels leading thereto or to Sink and Erect two Sewers one on each side of the Square."⁷² Howe and McGrath chose to build a single central brick barrel drain with a network of feeder drains – which appears to have been completed by March 1816.⁷³

The August 1814 agreement further specified that work shall commence as soon as possible, and shall be completed within twelve calendar months of the date the contract was signed. Howe and McGrath certainly appear to have started work shortly thereafter and were paid £100 from the

⁶⁷ Macquarie, L. Gov. 9-10 July 1812. *Memoranda & Related Papers*. NSW State Library, Mitchell Library, A772 47-49 ff. [Microfilm Reel CY301 Frames #54-56]. Transcript also available at *The Lachlan & Elizabeth Macquarie Archive*. <https://www.mq.edu.au/macquarie-archive/lema/1812/1812july.html>

⁶⁸ *Colonial Secretary's Papers 1813* (Reel 6042; 4/1723 pp. 298-301); (Reel 6043; 4/1728 pp.147-50), NSW State Records.

⁶⁹ "Sydney." 20 November 1813. *The Sydney Gazette and New South Wales Advertiser*. p. 2.; Campbell, J. T. 30 April 1814.

"Government and General Orders." *The Sydney Gazette and New South Wales Advertiser*. p. 2.

⁷⁰ Howe, J. 1810-1849. "John Howe Papers, 1810-1849." NSW State Library, Mitchell Library, MLMSS 106; Item 37.

⁷¹ Op. Cit., Howe, J. 1810-1849

⁷² Ibid.

⁷³ *Colonial Secretary's Papers. March 1816*. "Report of Committee of Survey Re New Government Wharf at Windsor." CS 4/1736; Reel 6046. pp. 61-63. NSW State Records.

Colonial Police Fund in part for “erecting a wharf at Windsor” in the financial quarter ending 30th September 1814.⁷⁴

However, in April 1815, likely as the wharf was nearing completion, it appears that an assessment was made that the structure was insufficient in size – length, width, and height. Howe and McGrath were further engaged by the Government to substantially enlarge the wharf so that it extended the full width of Thompson Square, was increased 3’ (0.9 m) in height and extended out an additional two rows of piles along the riverward side. The details of the additional work, according to the signed agreement, were as follows:

*To erect a Wharf or Platform in the front of Thompson’s Square in the Town of Windsor in this Territory which shall extend the width of the Square on a line with the present Jetty or Wharf but three feet higher, the said wharf to be constructed to have two Rows of Piles without the present platform and one Row behind the whole to be secured with Land Ties and Caps and planked with sound two inch Planks, and not more than six inches wide to be spiked with five inch Spikes.*⁷⁵

An article published in the *Sydney Gazette and New South Wales Advertiser* in June 1815 promoted the benefits of the proposed wharf extension and reported that the completed structure would measure 270’ (82.3 m) long and project a width of 30’ (9.1 m) into the river:

The improvement designed at Windsor in continuing the wharf or jetty the whole extent of the square will be most serviceable, not only in extending the experience of a good landing place, but in preventing any future incroachment [sic] from floods, which have already undermined several houses about the same area. The present jetty projects 20 feet into the river, is six (?) feet high, and 65 in length.

*The new one, projecting 30 feet, will be (?) three feet higher, and measure an extent of 2(?)0 [either 210 or 270] feet in front, the whole erected on upwards of 560(?) massy piles.*⁷⁶

* The print of this newspaper article is faded and indistinct in certain places.

Works on the extended wharf were carried out by Howe and McGrath throughout 1815 and early 1816, with the pair being paid from the Colonial Police Fund £100 in part for “*constructing a Wharf*” at Windsor in the financial quarter ending 30th June 1815,⁷⁷ and then £200 as “the first instalment for their contract of enlarging and improving the wharf at Windsor” in the financial quarter ending 30th September 1815.⁷⁸

In early 1816, however, Macquarie received a report that the construction of the Windsor wharf was being carried out with both poor quality materials and poor technique:

*.... a very inferior and bad description of timber and other materials having been latterly used in the construction of the Government wharf at Windsor, by Messrs Howe and McGrath the contractors for that works and the square leading thereto, in the town of Windsor and it being further stated that the workmanship is very slight and insufficient, contrary to the true intent of the contracts.*⁷⁹

Macquarie subsequently ordered the formation of a Committee of Survey in March 1816, consisting of Hawkesbury officials William Cox, James Mileham and Richard Fitzgerald, to inspect the wharf works. The Committee was instructed to engage a qualified carpenter to identify any deficiencies in the materials or construction of the wharf, and to order Howe and McGrath to replace or rebuild any insufficient components at their own cost. The Committee was further empowered to “*put a stop to the work altogether until His Excellency’s pleasure shall be made known*” if Howe and McGrath refused to “alter bad materials or bad workmanship and to render them conformable to the true spirit and meaning of the original contract.”⁸⁰

The Survey Committee shortly thereafter reported back to Macquarie that the wharf was indeed “*being finished in an insubstantial way*” and “*some of the planks and timbers are very insufficient, not by any means what they ought to be according to the contract.*” The Committee determined that much of the work had been subcontracted to labourers who were not being properly

⁷⁴ Campbell, J. T. 12 November 1814. “Government & General Orders.” *The Sydney Gazette and New South Wales Advertiser*. p. 1.

⁷⁵ Howe, J. 1810-1849. “John Howe Papers, 1810-1849.” NSW State Library, Mitchell Library, MLMSS 106; Item 37.

⁷⁶ “Sydney.” 3 June 1815. *The Sydney Gazette and New South Wales Advertiser*. p. 2.

⁷⁷ Campbell, J. T. 5 August 1815. “Government & General Orders.” *The Sydney Gazette and New South Wales Advertiser*. p. 2.

⁷⁸ Campbell, J. T. 4 November 1815. “Government & General Orders.” *The Sydney Gazette and New South Wales Advertiser*. p. 2.

⁷⁹ Campbell, J. T. 6 March 1816. NSW State Records, Colonial Secretary’s Papers, March 1816 (Reel 6004; 4/3494 p.392)

⁸⁰ Op. Cit., Campbell, J. T. 6 March 1816.

overseen, and recommended the replacement of the inferior timber elements and closer supervision of the works by the contractors.⁸¹

Howe and McGrath agreed to make the required improvements and continued with the wharf works, receiving another pay instalment from the Colonial Police Fund covering the financial quarter ending 31st of March 1816 of £238 10s for “erecting a wharf at Windsor.”⁸²

On 31st May 1816, a major flood hit the Hawkesbury River valley with waters rising at least 46’ (14 m) above normal river levels over the following two days. Several settlements along the river suffered extensive damage and large areas of wheat and maize crops were destroyed.⁸³ The following month, Macquarie sent a request to the Survey Committee, asking them to inspect the condition of the Windsor wharf after the flood. On 4th July 1816, the Committee reported back that the wharf had been almost completely destroyed – in their assessment, likely due largely to the fact that the work had not been carried out in a substantial manner. The report concluded that “all the planking is carried away and there is no part of the wharf that can be built on again.”⁸⁴

A ca. 1817-1819 etching and engraving of the Hawkesbury River showing a sailing vessel alongside the ruins of a timber wharf structure (Figure 17) is believed to depict the Windsor wharf as it was after the destruction of the May 1816 flood.

This engraving also shows the ferry service that had been established in 1814 to transport passengers, cargo, and livestock between the south and north banks of the Hawkesbury River at Windsor. As announced in a Government Public Notice in October 1814:

*It having been deemed expedient for the general Accommodation of the Public, that a commodious Ferry should be established across the River Hawkesbury from the Town of Windsor.....His Excellency has been pleased to sanction the Establishment of such Ferry: and Mr. John Howe, of Windsor, having provided a Punt for that express Purpose.*⁸⁵

As owner of the punt, Howe oversaw the operation of the ferry service and was permitted to charge a set rate of tolls for passage. The ferry initially ran from a location on the southern riverbank slightly upstream from the Windsor wharf site.⁸⁶



Figure 17: ca. 1817-1819 engraving of Hawkesbury River showing Windsor wharf destroyed by 1816 flood.⁸⁷

⁸¹ Fitzgerald, R. & J. Mileham 14 March 1816. NSW State Records, Colonial Secretary's Papers March 1816 (Reel 6046; 4/1736 pp.61-3)

⁸² Campbell, J. T. 11 May 1816. "Government and General Orders." *The Sydney Gazette and New South Wales Advertiser*. p. 2.

⁸³ Macquarie, L. Gov. 2-3 June 1816. *Diary 10 April 1816 - 1 July 1818*. NSW State Library, Mitchell Library, A773 pp.19-28. [Microfilm Reel CY301 Frames #256-265]. Transcript also available at *The Lachlan & Elizabeth Macquarie Archive*. <https://www.mq.edu.au/macquarie-archive/lema/1816/1816june.html>

⁸⁴ Cox, W., J. Mileham & R. Fitzgerald 4 July 1816. NSW State Records, Colonial Secretary's Papers, (Reel 4045, 4/1735, p. 83).

⁸⁵ Campbell, J. T. 29 October 1814. "Government Public Notice. Secretary's Office, Sydney." *The Sydney Gazette and New South Wales Advertiser*. p. 1.

⁸⁶ *Ibid.*

⁸⁷ Wallis, Capt. J. & W. Preston ca. 1817-1819. "A View of the Hawkesbury, and the Blue Mountains, New South Wales."

3.2.3 Greenway / Howe & McGrath Windsor Wharf 1816-1861

In light of the unsatisfactory construction of the Windsor wharf and the fact that it did not survive the June 1816 flood, Macquarie turned to Government Civil Architect, Francis Howard Greenway, to draft an improved wharf design. In November 1816, Macquarie approved plans and estimates submitted by Greenway for “repairing and completing” the wharf in a “solid and durable manner” and agreed to again engage Howe and McGrath to carry out the work – but this time with Government approved carpenters and sawyers, and all under Greenway’s direction:

In consideration of the greater part of the Govt. Quay or Wharf already erected by the contractors having been carried away or destroyed by the late Floods of the Hawkesbury, I have this day agreed on an Estimate made out and Submitted to me by Mr. Greenway the Govt. Civil Architect, of the additional Expense of repairing and Completing the same in a solid and durable manner (agreeably to a Plan thereof made out by Mr. Greenway) to allow and pay unto Messrs. Howe & Mc.Grath the additional sum of Two Hundred & Twenty – including Twenty Pounds for Mr. Greenway's trouble in planning and directing them also for payment such Iron & Spike Nails from the Store as can be spared – with a Carpenter and Pair of Sawyers off the Store; the Contractors now engaging to complete the said Quay or Wharf in Eight months from this date.⁸⁸

Macquarie also drew £150 from the Colonial Police Fund to pay Howe and McGrath the third and final instalment of their previous contract for “erecting a Wharf for Government at Windsor.”⁸⁹ Under Macquarie’s instructions Howe and McGrath were required to complete the new Windsor wharf designed by Greenway in eight months from mid-November 1816 – i.e. by mid-July 1817. On 29th July 1817, Macquarie noted in his journal that he visited Windsor and “inspected the new Wharf.” However, he made no comment on whether the work was completed or whether he found the structure satisfactory.⁹⁰ It would seem that there were delays and unfinished components – quite possibly due to two further floods in the Hawkesbury River valley in March 1817 (14.3 m [47']) and February 1819 (13.4 m [44']) – as Howe and McGrath were not paid for any of the work on the new wharf until February 1820. This payment was recorded as being £316 10 s as the “Balance for erecting Wharf and filling up Thompson Square, at Windsor.”⁹¹ The completed Windsor wharf was included in an 1822 list of public works undertaken in NSW during Macquarie’s administration (1810-1821) – described by Macquarie as follows:

A large substantial wooden wharf or quay Constructed in the Centre of the Town on the right Bank of the river Hawkesbury for the convenience of Vessels and Boats, trading to Windsor, and at which Quay Vessels of 100 Tons Burthen can load their Cargoes.”⁹²

It would appear that Greenway’s wharf certainly was of solid and durable construction, as no further mention of wharf repair or construction works at Windsor over the following four decades have been found in the historical record.

Macquarie further states in his 1822 report that “A very convenient Ferry has been established from the same wharf to the north bank of the river by a large punt”⁹³ – suggesting that once the Windsor Wharf was completed, it served as the southern landing point for the ferry service across the Hawkesbury River that had been established in 1814. In 1832, however, the ferry service was taken over by the Government and Howe’s punt was replaced by a larger cable-operated punt that ran from a southern landing upstream of Windsor Wharf to a northern landing cut into the northern bank of the river⁹⁴ – see Figure 18 and Figure 51.

⁸⁸ Macquarie, L. Gov. 14 November 1816 *Diary 10 April 1816 - 1 July 1818*. State Library of NSW, Mitchell Library, A773 pp.59-72. [Microfilm Reel CY301 Frames #295-307]. Transcript also available at *The Lachlan & Elizabeth Macquarie Archive*. <https://www.mq.edu.au/macquarie-archive/lema/1816/1816november.html>

⁸⁹ Campbell, J. T. 8 February 1817. “Government and General Orders.” *The Sydney Gazette and New South Wales Advertiser*. p. 2.;

Macquarie, L. Gov. 14 November 1816

⁹⁰ Macquarie, L. Gov. 29 July 1817. *Memoranda & Related Papers. 22 December 1808-14 July 1823*. State Library of NSW, Mitchell Library, A772 87-90 ff. [Microfilm Reel CY301 Frames #99-102]. Transcript also available at *The Lachlan & Elizabeth Macquarie Archive*. <https://www.mq.edu.au/macquarie-archive/lema/1817/1817july.html>

⁹¹ Campbell, J. T. 29 July 1820. “Government and General Orders.” *The Sydney Gazette and New South Wales Advertiser*. p. 2.; Colonial Secretary’s Letters 16 February 1820. (Reel 6050; 4/1746 pp.209-11), NSW State Records.

⁹² Macquarie, L. Gov. 1822. “Appendix to the Report of Major General Lachlan Macquarie, late Governor of the Colony of New South Wales, being A List and Schedule of Public Buildings and Works erected and other useful Improvements, made in the Territory of New South Wales and its Dependencies, at the expence of the Crown from the 1st of January 1810, to the 30th of November 1821, both inclusive.” *Historical Records of Australia*. Series 1. Governor’s Despatches to and from England. Volume X. January 1819 – December 1822. The Library Committee of the Commonwealth Parliament, Sydney, NSW. William Applegate Gullick, Government Printer, Sydney. Edited by Frederick Watson. p. 715.

⁹³ *Ibid.*

⁹⁴ Fitzgerald, J. C. L. 1923. *Those were the days: more Hawkesbury history*. Bookstall Co, Sydney, NSW

The details of Greenway's Windsor wharf design are not known, and no construction plans appear to have survived. However, the outline of the wharf is shown in a series of 1830s to 1840s survey plans of the township of Windsor (see Figure 18, Figure 19, Figure 20). The 1840s plans appear to use the 1830s plan as a template, however, all three consistently depict the wharf as a rectangular structure extending westward along the riverbank from the eastern boundary of Thompson Square and measuring approximately 85' (25.9 m) in length and 26' (7.9 m) in width. It would thus appear that the idea of constructing a wharf along the whole width of the Thompson Square frontage was abandoned by Greenway, although the wharf was still built in larger dimensions than those in the original 1814 contract. An 1835 survey by Government Assistant Surveyor George Boyle White (Figure 18) further shows a line of six points along the riverward side of the wharf – possibly indicating a row of mooring posts and / or fender piles. Finally, an examination of the wharf in the early 1860s indicates that at least some, if not all, of the timber piles were formed of Australian ironbark (*Eucalyptus* sp.).⁹⁵



Figure 18: 1835 plan of Windsor township, showing Greenway / Howe & McGrath wharf and cable punt.⁹⁶



Figure 19: 1841 plan of Windsor township, showing Greenway / Howe & McGrath wharf.⁹⁷

⁹⁵ "Country News. Windsor." 16 September 1862. *The Empire*. p. 5.

⁹⁶ White, G. B. 1835. *Plan of Windsor*. NSW State Records, Map 5968.

⁹⁷ Galloway, J. J. 1841. *Town Design of Windsor*. NSW Land & Property Information, Crown Plan W.443.a



Figure 20: 1848 plan of Windsor township, showing Greenway / Howe & McGrath wharf.⁹⁸

3.2.4 Moriarty / Musson Windsor Wharf 1862-1950s

By the early 1860s, the Greenway / Howe & McGrath wharf had become quite badly deteriorated. Accounts of accidents and near misses during unloading of goods and passenger transfer at the wharf were reported in Sydney newspapers, and the “very bad state” of the structure was put forward in local debates as an argument for the need to establish a Windsor municipality. The steadily increasing volume of river traffic and trade at Windsor and the pivotal role the wharf played in the economy and development of the district led a sense of urgency to the need for a major refurbishment or replacement of the wharf.⁹⁹

[March 1861] *The want of a wharf at Windsor is much felt by those who trade to and from Windsor, with the various settlements on the Hawkesbury. Often they have to wade through the water in conveying their produce to shore, which, in the winter season especially, is the cause of much inconvenience and trouble. There was a strong plain structure in use situated on the right hand side of the ferry, the piles of which are now standing. It was allowed to decay, and ultimately fall to pieces, and since that time the present uncomfortable state of things above alluded to has been allowed to continue. The absence of any landing place must be sensibly felt by the numerous excursionists that visited Windsor last Sunday by the Rainbow and Victoria steamers. As the Victoria was on the point of starting for Sydney on Sunday afternoon, one of the passengers in endeavouring to get on board fell into the water, but escaped with only a good wetting.*¹⁰⁰

In late March 1861, a public meeting was held in the Fitzroy Hotel, Windsor, to organise a petition to the NSW Parliament requesting that a sum of money be set aside for the purpose of constructing a new public wharf at Windsor.¹⁰¹ Two hundred and five Windsor residents signed the petition and it was presented to the Legislative Assembly by William Walker, member for Windsor, in early April. After considering the issue, the House resolved in early May to place £500 on the Government Supplementary Estimates to fund the proposed new wharf.¹⁰²

⁹⁸ Shone, W. 1848. *Plan of Part of the Town of Windsor*. NSW Land & Property Information, Crown Plan W.22.873.

⁹⁹ “Windsor. Public Meeting for a Municipality.” 10 September 1860. *The Sydney Morning Herald*. p. 2.; “Windsor. Wharf at Windsor.” 23 March 1861. *The Sydney Morning Herald*. p. 5.

¹⁰⁰ “Windsor.” 2 March 1861. *The Empire*. p. 8.

¹⁰¹ “Windsor. Wharf at Windsor.” 23 March 1861. *The Sydney Morning Herald*. p. 5.

¹⁰² “Legislative Assembly.” *The Empire*. 4 April 1861; 9 April 1861; 4 May 1861; “Printed Public Documents – Petitions.” 22 July 1861 *The*

Topographic and hydrographic surveys of the Windsor wharf site were subsequently undertaken by the NSW Department of Public Works and plans for a replacement wharf were prepared by Edward Orpen Moriarty, Engineer-in-Chief for Harbours and River Navigation.

A public call for tenders for the construction of a timber wharf at Windsor was placed on 31st May 1862; and on 4th July 1862, it was announced that the tender of Mr. W. Musson had been accepted.¹⁰³

The final site and design plans for the replacement Windsor wharf formed part of the contract and were signed by both Moriarty and Musson in late July 1862 (Figure 22 and Figure 24 below).

Figure 21: Department of Public Works call for tenders for “the construction of a Timber Wharf at Windsor” 31st May 1862.¹⁰⁴

Department of Public Works,
Sydney, 31st May, 1862.

TO CONTRACTORS AND OTHERS.
TIMBER WHARF, WINDSOR.

TENDERS will be received at this Office, until 12 o'clock, on Tuesday, the 24th June, from persons willing to Contract for the construction of a Timber Wharf at Windsor.

Tenders to be endorsed “*Tender for Wharf, Windsor.*”

Plan, Specification, and form of Tender may be seen, and further particulars obtained at the Office of the Engineer-in-Chief for Harbours and Rivers, 33, Hunter-street, Sydney.

Tenders must state the time within which it is proposed to complete the work, and at the foot of every Tender there must be a memorandum signed by the party tendering, and two responsible persons as sureties, agreeing to be answerable for the due performance of the Contract, in the event of the Tender being accepted, and undertaking in that event, that they will severally execute and deliver at the Office of the Crown Solicitor in Sydney, within fourteen days from the usual notification of acceptance, a Bond to Her Majesty in the penal sum of £100 for securing such performance, otherwise the Tender will not be taken into consideration.

W M. ARNOLD.

The survey plan of the Windsor wharf site prepared by the Department of Public Works in 1862 (Figure 22) shows the proposed location of the replacement wharf and details of associated excavation required to tie the wharf in to the bank of the Hawkesbury River.

The replacement wharf was to be constructed approximately 35-40' (10.7 – 12.2 m) west / upstream of the eastern boundary of Thompson Square and thus slightly offset from the location of the former Greenway / Howe and McGrath wharf – which according to the 1835 plan was aligned with the eastern boundary of the Square. Indeed, an overlay of the 1835 and 1862 plans using the Windsor town grid and property boundaries as anchors (Figure 23), suggests that the replacement wharf designed by Moriarty was not only situated slightly further upstream but was also positioned further south than the Greenway / Howe and McGrath Windsor wharf – due, it appears, to erosion of the riverbank since the 1810s.

The 1862 plan further identifies several remnant piles from former phases of construction of the Windsor wharf; including a line of “front row of piles of broken down wharf” shown running broadly parallel with the Hawkesbury riverbank between low and high water marks, and a line of “*back row of piles*” shown approximately 16' (4.9 m) landward of the “front row,” beyond the high water mark. Both lines commence at a solid point broadly aligned with the eastern edge of Thompson Square and extend approximately 160' (48.8 m) westwards. As neither line has a solid end point at the western extent, it may be assumed that these rows of piles actually continued further but their full length was not mapped. Based on their substantial length, it is likely that both lines depict remnant piles of the timber retaining wall constructed along the river frontage of Thompson Square by Howe and McGrath in 1814-1815 – with the “front row” representing the exterior face of the wall, and the “back row” representing the land tie piles used to anchor the wall to the bank. A third line of remnant piles is shown on the 1862 plan – measuring approximately 75-80' (22.9 – 23.4 m) long and situated on the riverward side of the “front row of piles.” Based on the length and position of this line, it most likely relates to remnants of the enlarged Windsor wharf partially constructed by Howe & McGrath in April 1815 to May 1816 that was destroyed in the 31; May 1816 flood.

Empire, p. 6.

¹⁰³ “New South Wales Parliament. Legislative Assembly.” 30 May 1862. *The Sydney Morning Herald*. p. 5.; Arnold, W. M. 24 June 1862. “Tenders for Public Works and Supplies.” *The Sydney Morning Herald*. p. 6.; Arnold, W. M. 4 July 1862 “Government Gazette Tenders and Contracts – Department of Public Works” *New South Wales Government Gazette*. [Issue No. 112]. p. 1192.

¹⁰⁴ Arnold, W. M. 31 May 1862. *New South Wales Government Gazette* (No.100), p. 1127

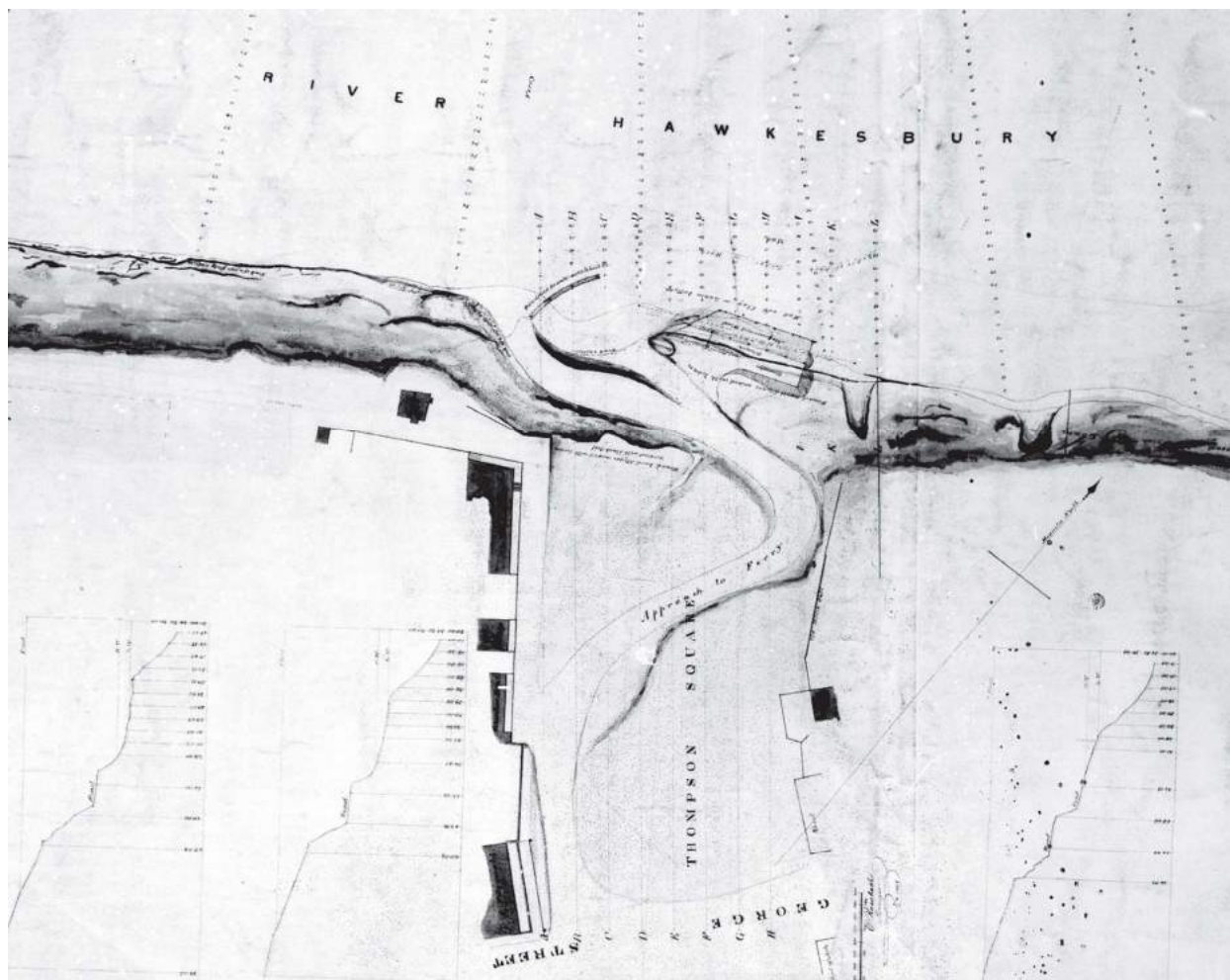
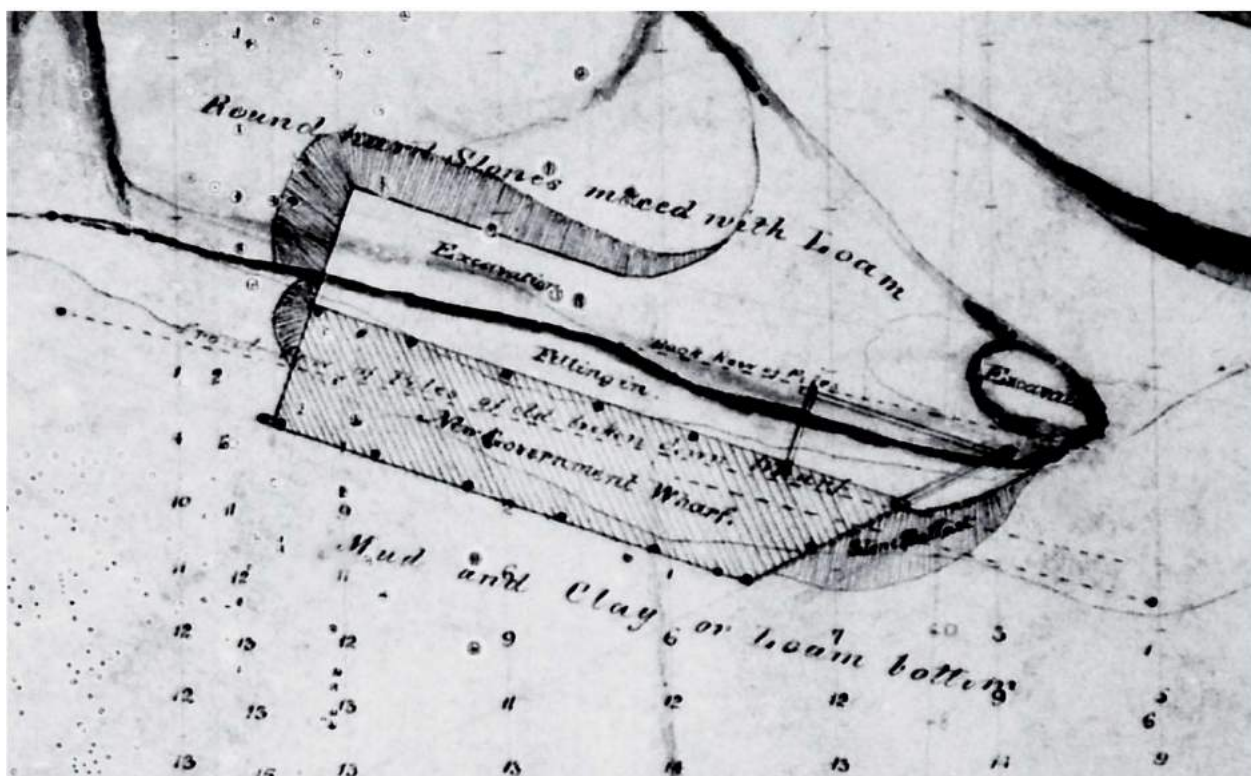


Figure 22: Survey plan for the replacement Windsor wharf, 1862.¹⁰⁵

Rotated enlargement of wharf features shown below (rotated with SE at top).



¹⁰⁵ Moriarty, E. O. 5 July 1862. Survey for a Wharf for Windsor. NSW State Records, "Hawkesbury River - Survey For Wharf - Windsor Wharf - Frame 1 - Plan Type: Engineering (Harbours & Rivers)." NRS-21554-1-3-PLAN14/10157_01.

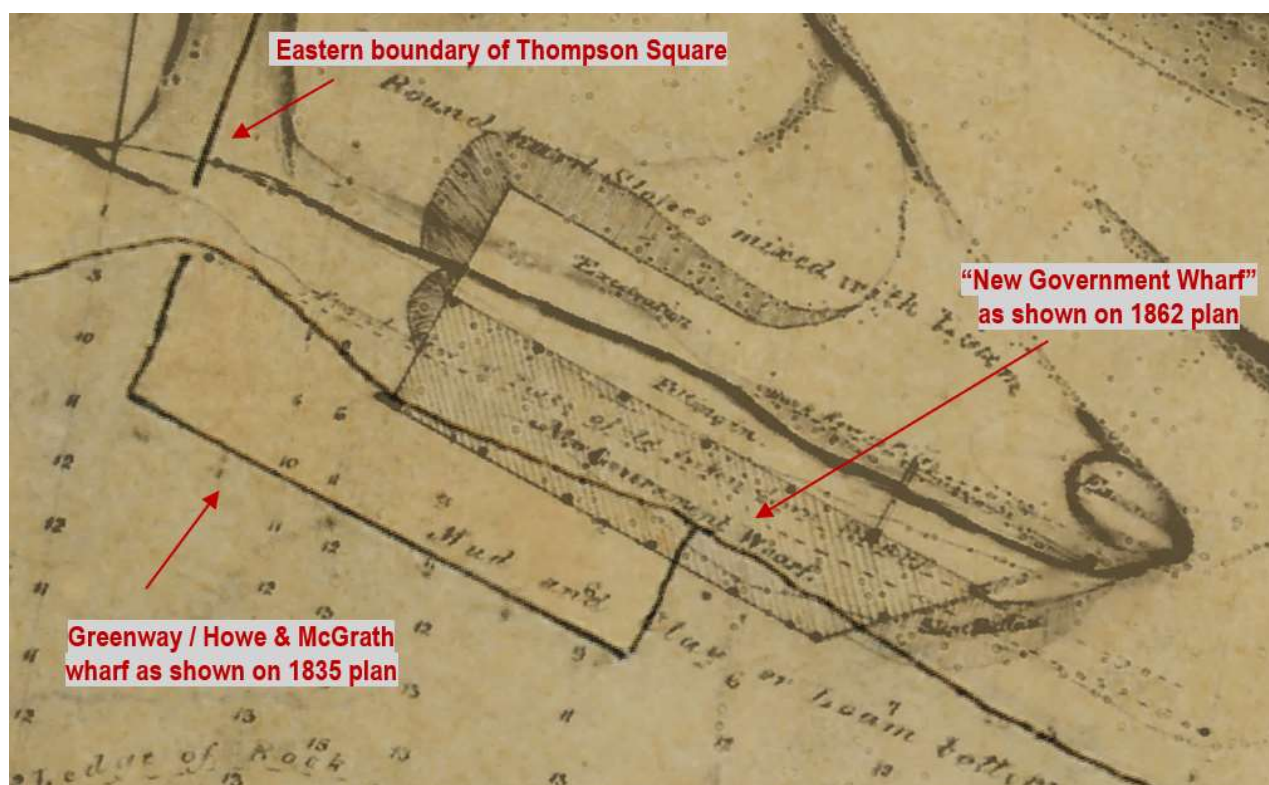


Figure 23: Overlay of 1835 Windsor plan and 1862 survey plan of Windsor wharf site (aligned with SE at top).

The design plans for the proposed replacement Windsor wharf (Figure 24) show that the wharf was to be cut into the riverbank, with transverse superstructure members, comprising 16" (406 mm) diameter round timbers, tied into deadman anchors, with the slope backfilled and covered with stone ballast. The wharf structure, according to the design plans, consisted of two rows of timber piles parallel to the riverbank; a back row extending 96'9" (29.5 m) in length and consisting of seven piles spaced 15' (4.6 m) apart (from centre of pile to centre of pile); and a front row extending 77' (23.5 m) in length and consisting of six piles 15' (4.6 m) apart. The front and back rows were positioned 18' (5.5 m) apart, with the full width of the wharf – from deadman anchors to front row of piles – measuring 32'9" (10 m).

The upstream side of the wharf formed a diagonal between the front and back rows – making the wharf trapezoid rather than rectangular in overall plan. The diagonal section measured 18'6" (5.6 m) long and contained an additional mooring pile towards the centre. A second mooring pile doubling as a bracing pile was also situated at the downstream front corner of the wharf. The piles were braced along the length of the wharf with longitudinal 16" x 8" (406 x 203 mm) half-round timber members, affixed with 7/8" copper fasteners; with front and back rows of piles supported with diagonal 16" x 8" (406 x 203 mm) timber cross-bracing.

The wharf superstructure consisted of a row of 16" (406 mm) diameter round transverse timber bearers positioned atop each pile, and longitudinal timber plank girders – with exterior and central girders comprising 12 x 12" (305 x 305 mm) timbers and interior girders of 12 x 6" (305 x 152 mm) timbers – all secured with metal brackets and 1¼" bolts. The wharf deck consisted of transverse timber planking attached to the girders with 8" (203 mm) long driving spikes, with deck kerbing consisting of 12 x 12" (305 x 305 mm) timbers (rear kerb) and 12 x 8" (305 x 203 mm) timbers (front kerb). The deck measured 17'6" (5.3 m) wide between kerbs and the top of the deck was to be situated 3' 6" (1.1 m) above the high water mark.

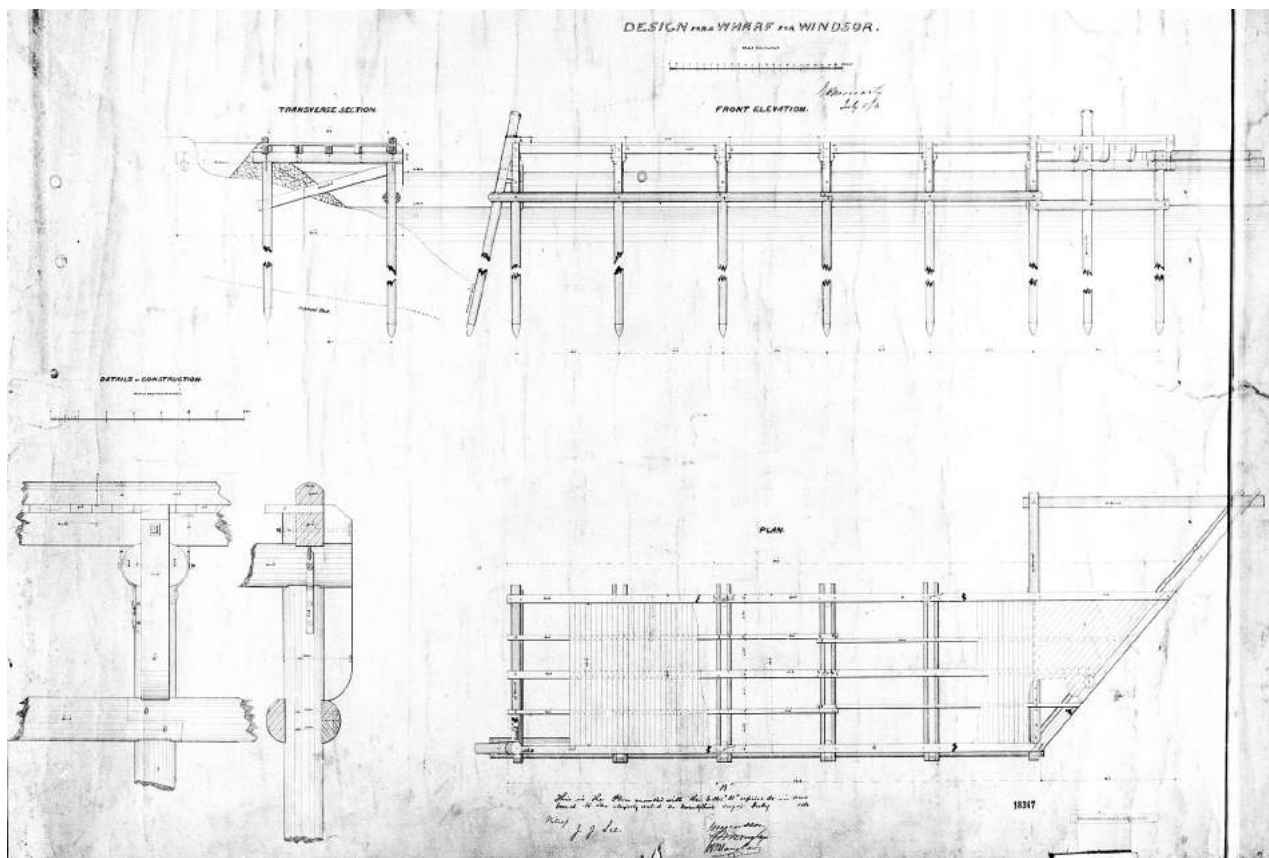


Figure 24: Design plan for the replacement Windsor wharf, 1862.¹⁰⁶

Work on the construction of the replacement Windsor wharf commenced shortly after the contract was signed in July 1862; and was completed by late November the same year.¹⁰⁷

WINDSOR. THE NEW WHARF – This useful and much required public work is now completed, and judging by appearance, is strong and substantially built. Vessels trading to and from Windsor with produce, have for some time past availed themselves of the wharf, much satisfaction being expressed by the owners at its erection.¹⁰⁸



Figure 25: 1863 watercolour painting of the Hawkesbury River at Windsor, showing the Moriarty / Musson wharf.¹⁰⁹

¹⁰⁶ Moriarty, E. O. 5 July 1862. *Design for a Wharf for Windsor*. NSW State Records, "Hawkesbury River - Survey For Wharf - Windsor Wharf - Frame 2 - Plan Type: Engineering Harbours & Rivers." NRS-21554-1-3-PLAN14/10148_02

¹⁰⁷ "Country News. Windsor." 16 September 1862. *The Empire*. p. 5.; "Windsor." 1 December 1862. *The Empire*. p. 2.

¹⁰⁸ "Windsor." 1 December 1862. *The Empire*. p. 2.

¹⁰⁹ Lloyd, H. G. 1863. "On the Hawkesbury, Windsor." in *Sketches of N. S. Wales, 1857-1888*. Volume 2. State Library of NSW, Dixson Library, DL PX 43.



Figure 26: Windsor Bridge and wharf, ca. 1879 –

enlargement of wharf below, clearly showing front edge and angled upstream side.¹¹⁰



Figure 27: Windsor wharf and bridge ca. 1888 – enlargement of wharf below.¹¹¹



¹¹⁰ Anon ca. 1879. *Windsor Bridge, Windsor*. NSW State Library, Government Printing Office 1-06263, Image BCP 04405

¹¹¹ Mills, J. ca. 1888. "Windsor, NSW." NSW State Library, At Work and Play – 04405.

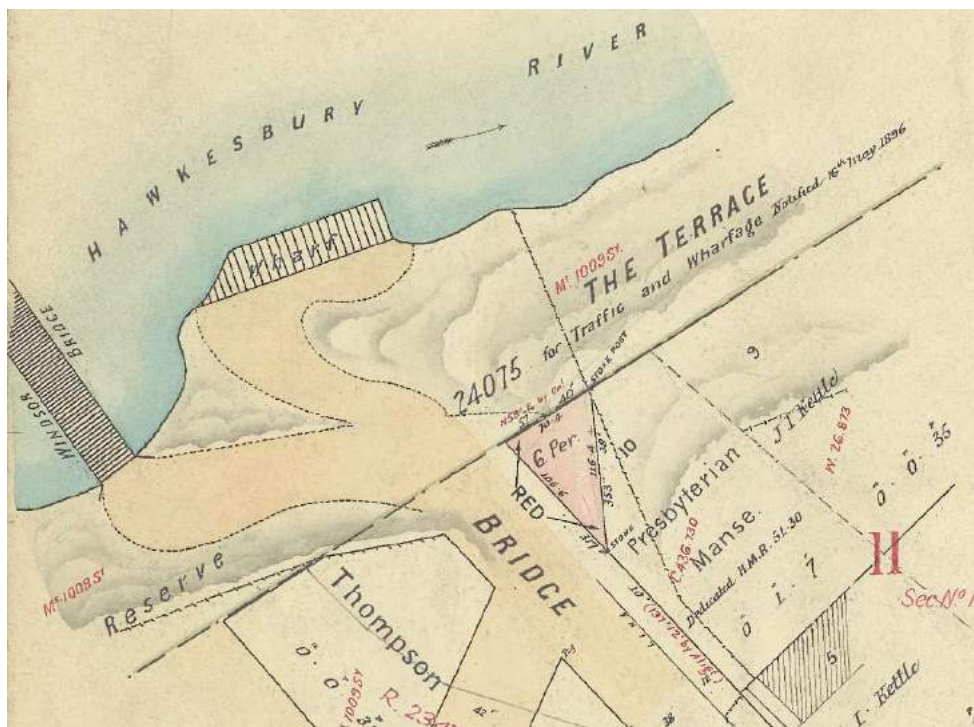


Figure 28: 1894 survey plan of Thompson Square showing Windsor wharf.¹¹²

By the early 1890s, the Moriarty / Musson Windsor wharf was beginning to deteriorate and was only infrequently used – largely due to increasing siltation in the Hawkesbury River channel that had rendered navigation to the wharf near impossible for anything but small river craft (see Section 3.3) As a result of public petitioning throughout the 1880s, the NSW Government investigated the possibility of dredging the upper Hawkesbury to facilitate navigation to Windsor – with an additional £300 nominated to reconstruct the Windsor wharf. The overall cost of the proposed dredging, however, was ultimately deemed to be too high by the Government, and neither the channel deepening nor the wharf reconstruction was carried out.¹¹³



Figure 29: Windsor wharf, ca. late 1890s – showing what appears to be some deterioration of superstructure elements at the upstream end.¹¹⁴

¹¹² Scrivener, C. R. 1894 "Plan of Thompson Square situated at Windsor. Parish of St. Matthew. County of Cumberland." NSW Land & Property Information, Plan Ms 1009 Sy / 1009-3000. As base map to "Plan of land to be resumed under the Public Roads Act of 1897, for widening approach to the Bridge over the Hawkesbury River at Windsor. Parish of St. Matthew, County of Cumberland." 1898 NSW Land & Property Information, Plan R6026-1003.

¹¹³ "Hawkesbury Navigation Scheme." 5 December 1891. *The Windsor and Richmond Gazette*. p. 5.; Steele, J. Rev. 4 September 1914.

¹¹⁴ Anon ca. late 1890s "Bridge over Windsor, Hawkesbury River." NSW State Library, Mitchell Library, PXA 311/Item 43.

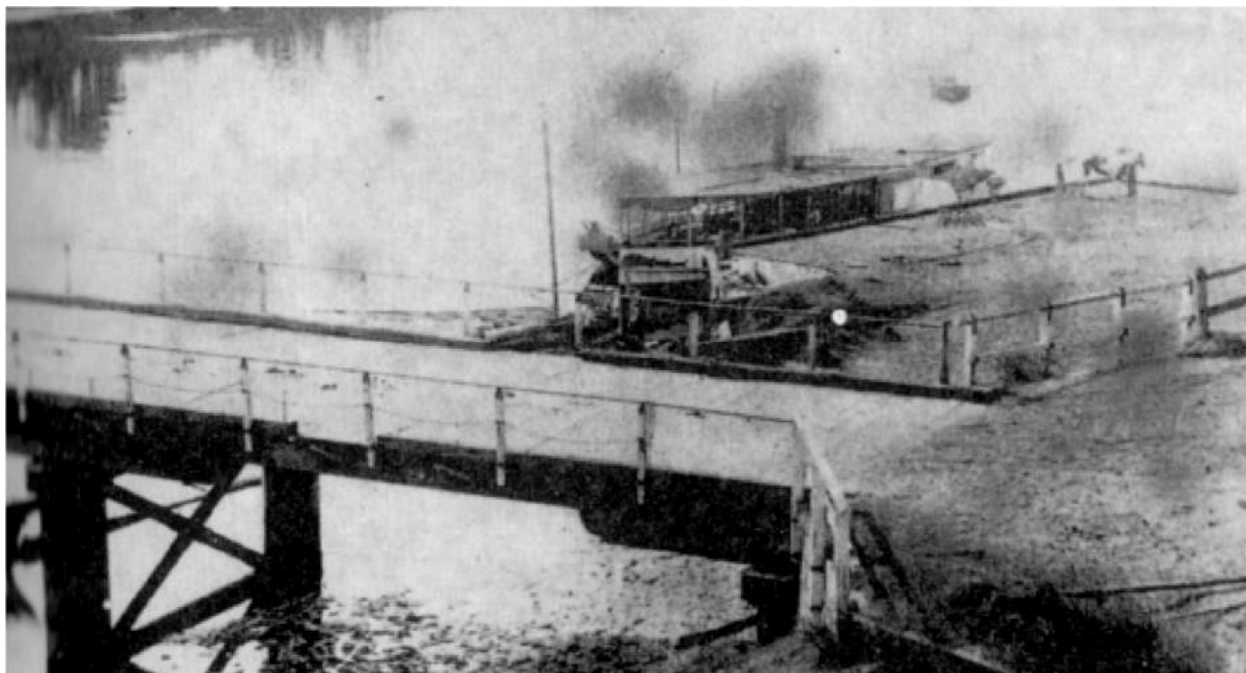


Figure 30: St. Albans at Windsor Wharf, 1889. Showing what appears to be some deterioration of timber decking at the upstream end.¹¹⁵



Figure 31: Steamer Daisy at Windsor wharf 1902.¹¹⁶



Figure 32: River craft at Windsor wharf, early 1900s.¹¹⁷

¹¹⁵ **Anon 1889.** "The Steamer St. Albans at Windsor Wharf." Reproduced in Bowd, D. G. 1986. *Up the Windsor Road for Baulkham Hills*. Library of Australian History, Sydney, NSW. p. 100.

¹¹⁶ **Anon 1902.** "River boat Daisy at Windsor Wharf, Hawkesbury River NSW." Hawkesbury Library, Image 000652.

¹¹⁷ **Anon ca. early 1900s.** "Windsor Bridge from the wharf." Hawkesbury Historical Society Collection.

In 1920, the NSW Government vested the Windsor wharf and the adjacent riverside reserve (Public Reserve No. 24075, declared in 1896) in the Windsor Municipal Council under the *Public Trusts Act 1897*.¹¹⁸ By this time the wharf was in a severely dilapidated condition, with substantial sections of superstructure and decking missing – particularly at the western / upstream end. Windsor Council identified the wharf as a safety hazard and a potential public liability issue given they now held responsibility for the structure. A request for a special grant to repair the wharf was subsequently sent to the NSW Public Works Department, along with a complaint that the wharf had been handed over to the Council in a “*most dangerous state.*” The Public Works Department refused the request, however, citing lack of available funds, and with limited local funding Windsor Council held the matter in abeyance. In the interim, the Council Works Committee organised for a section of the Windsor wharf to be made safe, with superstructure and decking repaired using surplus timber obtained for local works at Cornwallis Bridge.¹¹⁹



Figure 33: Windsor wharf, ca. 1920s, missing superstructure at upstream end and remnant pile stump.¹²⁰



Figure 34: View of Hawkesbury River with Windsor wharf in foreground, 1925.¹²¹

By the early 1930s, Windsor Council still had not moved forward on the issue of wharf repairs – much to the agitation of river users. In 1933, the Upper Hawkesbury Motor Boat Club approached the Council with a proposal to have Reserve No 24075 vested in a local trusteeship with the aim to beautify the reserve and improve boating facilities. Council accepted the proposal and over the following months the trust – comprised of Ronald B. Walker MLA and members of the Upper Hawkesbury Motor Boat Club – secured funding from the NSW Government to carry out a series of

¹¹⁸ Ashford, W. G. 5 March 1920. “Lands Department Notices.” *Government Gazette of the State of New South Wales*. Issue No. 50, p. 1485.

¹¹⁹ “Windsor Municipal Council.” 17 September 1920. *Windsor and Richmond Gazette*. p. 3.; “Windsor Municipal Council.” 8 October 1920. *Windsor and Richmond Gazette*. p. 1.; “Windsor Municipal Council.” 29 October 1920. *Windsor and Richmond Gazette*. p. 1.; “Windsor Municipal Council.” 19 November 1920. *Windsor and Richmond Gazette*. p. 1.; “Windsor Wharf and Adjoining Reserve. Proposed Reconstruction Scheme. New Trustees Required.” 24 February 1933. *The Windsor and Richmond Gazette*. p. 6.; “Windsor Municipal Council.” 17 September 1920. *Windsor and Richmond Gazette*. p. 3.; “Windsor Municipal Council.” 8 October 1920. *Windsor and Richmond Gazette*. p. 1.; “Windsor Municipal Council.” 29 October 1920. *Windsor and Richmond Gazette*. p. 1.; “Windsor Municipal Council.” 19 November 1920. *Windsor and Richmond Gazette*. p. 1.; “Windsor Wharf and Adjoining Reserve. Proposed Reconstruction Scheme. New Trustees Required.” 24 February 1933. *The Windsor and Richmond Gazette*. p. 6.;

¹²¹ Anon 1925. “From the Old Wharf at Windsor – A reach of the Hawkesbury River just after the moon had capped the hills.” Reproduced in 3 December 1925. “The Beauties of Night – Camera Studies by the Light of the Moon.” *The Sun*. p. 24.

improvements to the reserve. The first works undertaken, using a Government grant of £150, involved repairs and partial reconstruction of the Windsor wharf. Members of the Motor Club held a working bee in early 1933 to prepare the wharf site, during which a quantity of deteriorated deck planking was removed from the upstream end of the wharf and the structure was “made safe and sound for landing purposes.”¹²² A contract for more extensive repairs to the wharf was let to Mr. George Curl, of Pitt Town, and the work was carried out in early 1934. Details of the major repair works are not known – other than the fact that the Government specified that the timber used was to be of the same size as those to be replaced.¹²³ However, photographs of the wharf in ca. 1935 and 1936 (Figure 35) show what appear to be replacement piles and / or fenders, mooring posts installed along the front of the wharf, and repaired decking. This photo also shows that the entire upstream angled section of the wharf had been removed by this time.



Figure 35: Windsor Bridge and wharf, ca. 1935.¹²⁴

(Enlargement of the wharf shown below).



The Upper Hawkesbury Motor Club remained as Trustees of the Windsor wharf reserve throughout the 1940s to mid-1950s, carrying out various improvements over the years including erection of boat sheds, clubhouse, riverside viewing stage, boat crane and slipway downstream of the wharf. Although no detail has been found in the historic record, it is possible that further repairs and timber replacements were also made to the Windsor wharf. By the late 1940s, however, photographs show that the wharf had almost entirely disintegrated (Figure 36), and by the late 1950s, almost all visible trace of it had gone (Figure 37).

¹²² “Week to Week.” 10 February 1933. *Windsor and Richmond Gazette*. p. 4.

¹²³ “Windsor Wharf and Adjoining Reserve. Proposed Reconstruction Scheme. New Trustees Required.” 24 February 1933. *The Windsor and Richmond Gazette*. p. 6.; “Week to Week.” 3 November 1933. *Windsor and Richmond Gazette*. p. 4.; “Windsor Wharf Reserve.” 26 January 1934. *Windsor and Richmond Gazette*. p. 1.; “Week to Week.” 23 February 1934. *The Windsor and Richmond Gazette*. p. 4.; NSW Lands Department 29 September 1933. “Notice Appointing Trustees Under the Public Trusts Act, 1987.” *Government Gazette of the State of New South Wales*. [Issue No. 155]. p. 3511.

¹²⁴ Anon ca. 1935. “Bridge across the Hawkesbury River, Windsor, New South Wales, ca. 1935.” National Library of Australia, PIC P838_1419.



Figure 36: 1949 photograph of Windsor wharf reserve after a flood – showing pile stumps as the only visible surviving remnants of the wharf. ¹²⁵

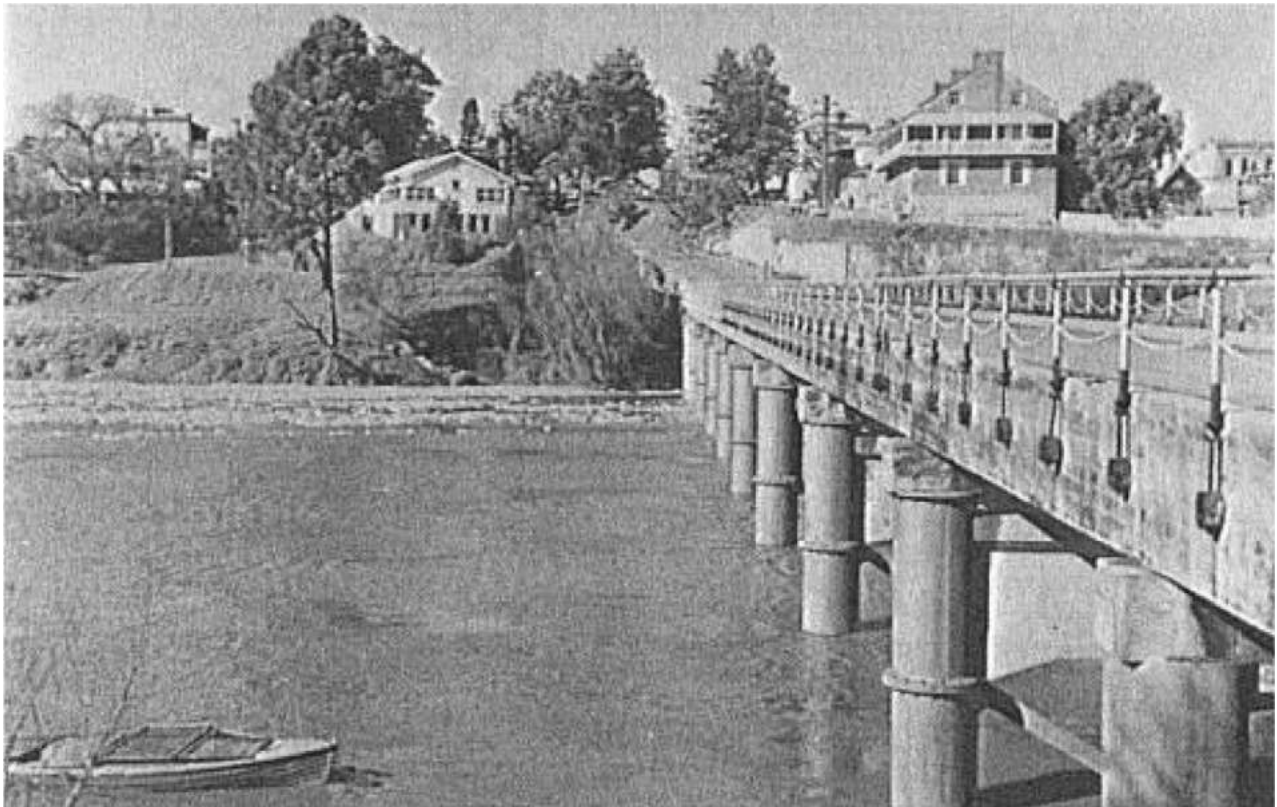


Figure 37: 1959 photograph of Windsor Bridge and reserve showing former location of wharf with no structural remains visible. ¹²⁶

¹²⁵ Searle, E. W. 1949. "Flood damage after motor boat regatta, Windsor, Hawkesbury River, New South Wales, 1949." National Library of Australia, PIC P838/482a.

¹²⁶ Anon 1959. "Windsor Bridge." Hawkesbury City Council Library, Image No. 014998.

3.2.5 Post Windsor Wharf – 1950s onwards

In 1955, under direction from the NSW Department of Lands, trusteeship of the Windsor wharf reserve was reverted back to the Windsor Municipal Council.¹²⁷ The reserve continued to be dedicated for public recreation and wharfage, and in the mid-late 1960s, a small reinforced concrete boat landing stage was constructed in the location of the former Windsor wharf – at the downstream end of the former wharf footprint (Figure 38). In the mid to late 1980s, a new wharf was erected further downstream to cater for increased tourist and passenger ferry services – in the location of the current wharf – and the small boat landing was deconstructed and removed (Figure 39).



Figure 38: 1970 aerial photograph showing small boat landing stage constructed within footprint of former Windsor wharf.¹²⁸

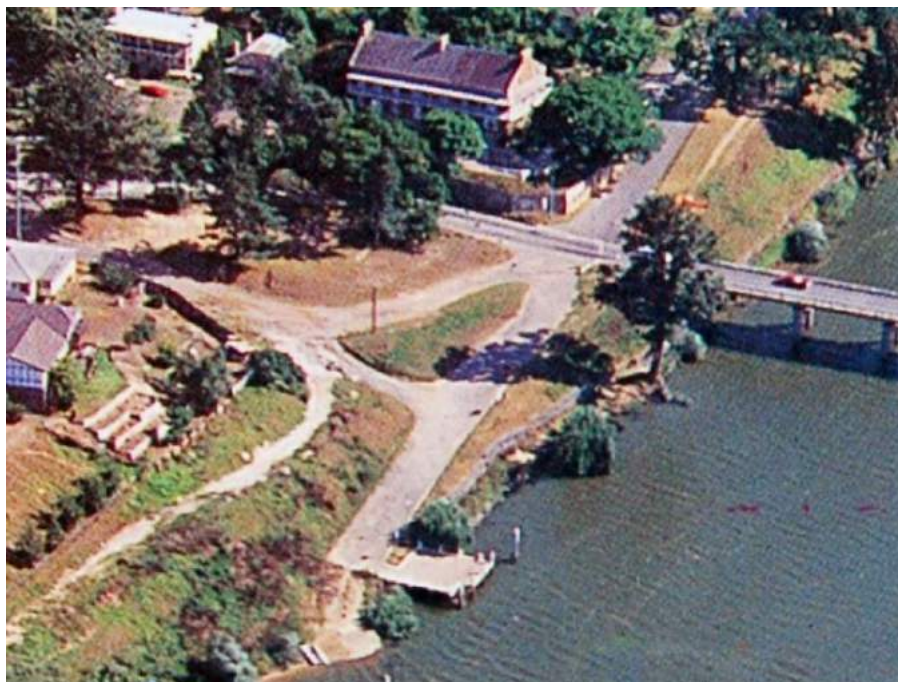


Figure 39: mid to late 1990s oblique aerial photograph showing new wharf constructed downstream of former Windsor wharf location.¹²⁹

¹²⁷ "Trusteeship of Wharf Reserve." 29 September 1954. *Windsor and Richmond Gazette*. p. 14.; "New Dedication of Wharf Area." 10 August 1955. *Windsor and Richmond Gazette*. p. 10.

¹²⁸ NSW Land & Property Information 1970. Aerial Photography – Run 17; Windsor.

¹²⁹ Postcard photograph, reproduced in Austral AHMS Joint Venture (AAJV) 2018 *Thompson Square, Windsor NSW – Strategic Conservation Management Plan*. Prepared for NSW Roads and Maritime Services.

3.3 Windsor Shipping

When Windsor wharf was constructed in the late 1810s, traffic on the upper Hawkesbury River consisted of a range of timber rowing and sailing vessels – from small open boats up to 1-2 tons burden built by settlers to ply the river and tributaries, to Government and private sailing vessels ranging between 10 to 40 tons burden, used to ship Hawkesbury wheat and maize to Sydney and transport stores, supplies and building materials for the developing Windsor township.¹³⁰ One of the largest vessels recorded at the Windsor wharf during this early period was the schooner *Sinbad* of 45 tons burden in 1820.¹³¹ River transport between Sydney and the upper Hawkesbury, however, remained somewhat costly and intermittent due to the limited number of vessels in the colony able and available to serve the river trade. In 1826, only six sloops and schooners were recorded as regularly trading between Sydney and the Hawkesbury, carrying out a combined total of twenty-six return trips over the course of the year.¹³² In some instances, Hawkesbury settlers attempted to make the produce run down the river and along the ocean coast to Sydney using their own small sailing vessels, but such voyages were generally met with little success.¹³³

An 1813 engraving of the Hawkesbury at Windsor (Figure 40) provides a good illustration of the range of vessels that would have initially used the Windsor wharf. Whilst this engraving actually predates the construction of the wharf, the Upper Hawkesbury river trade of the late 1810s to 1820s involved the same types of vessels depicted – including rowing boats loading and unloading produce and supplies, small cutters, single-masted sloops, and a double-masted schooner – although a busier river scene is depicted than what would have likely been the norm at the time.



Figure 40: 1813 engraving of Windsor showing a range of vessels on the Hawkesbury River.¹³⁴

In 1832, the first steamship to travel the Hawkesbury River, *William the Fourth*, reached Windsor wharf – an arrival that excited much interest among Windsor residents.¹³⁵ *William the Fourth*

¹³⁰ Boon, P. I. 2017. *The Hawkesbury River: A Social and Natural History*. CSIRO Publishing, Victoria.; Purtell, J. 1995. *The Mosquito Fleet: Hawkesbury River Trade and Traders 1794-1994*. Deerpublish Press, Berowra Heights, NSW.

¹³¹ "Sydney." 2 December 1820. *The Sydney Gazette and NSW Advertiser*. p.2.; Lord, M. 2 September 1820. "Auction." *The Sydney Gazette and New South Wales Advertiser*. p. 2.

¹³² Purtell, J. 1995.

¹³³ Boon, P. I. 2017.

¹³⁴ Slager, P. 1813. *A view of part of the town of Windsor in New South Wales, taken from the banks of the River Hawkesbury*. A. West, Sydney. National Library of Australia, PIC Drawer 2230 #U2028 NK2044/B.

¹³⁵ "Agricultural Report for July 1832 (No. XIV). Hawkesbury." 4 August 1832. *The Sydney Gazette and New South Wales Advertiser*. p. 3.; Mercer, H. E. 1962. "Tales of the Hawkesbury." *Walkabout*.

(Figure 41) was a 57-ton wooden paddle steamer, 74' (22.6 m) long, 15' 6" (4.7 m) beam and 7' (2.13 m) draught, and was the first oceangoing steam vessel built in Australia when launched in 1831.¹³⁶ *William the Fourth* returned to Windsor wharf occasionally throughout the mid-1830s, transporting various supplies and sundries from Sydney and returning with large cargoes of Hawkesbury beef and maize.¹³⁷ However, a regular shipping trade between Sydney and Windsor was still yet to develop. The number of vessels in the NSW colony continued to fall short of the increasing demands for both coastal and river shipping, and Hawkesbury settlers continued to rely largely on overland coach transport; which in turn resulted in vessel owners struggling to acquire enough sizeable business to make regular river trips worthwhile. In the late 1830s, several shallow draught vessels designed specifically for the river trade were under construction and appeals were made to Hawkesbury settlers to support the undertaking of regular steam services by establishing consolidated stores and depots along the river where vessels could receive large shipments of produce.¹³⁸

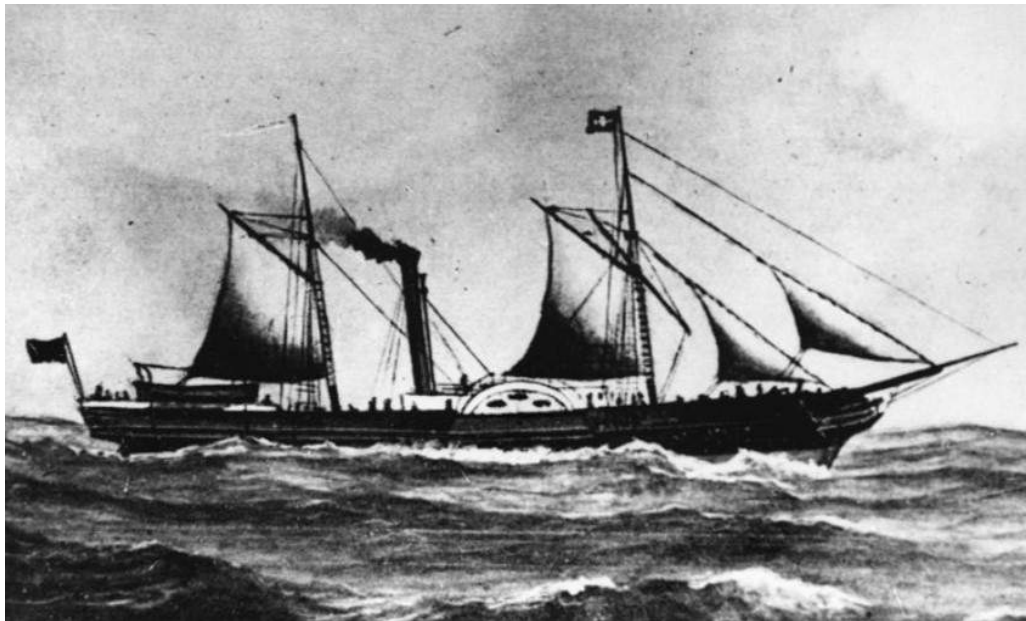


Figure 41: 1813 engraving of Windsor showing a range of vessels on the Hawkesbury River.¹³⁹

The number of local river traders, on the other hand, increased steadily throughout the 1830s, driven by a combination of the expanding agricultural harvests along the Hawkesbury, the growing population of Windsor township and the size of local markets. Numerous “down-the-river” settlers made regular trips to Windsor carrying shells, lime, maize, vegetables and sometimes poultry, with the wharf often clustered by a “little fleet” of sailing vessels offering goods for sale directly from their holds.¹⁴⁰

By the early 1840s, around twenty-five schooner and cutter sailing vessels ranging in size from eight to twenty-two tons were regularly trading between Sydney and the Hawkesbury; with several making trips as far as Windsor, including *Brothers*, *Gleaner*, *Highland Lass*, *Mary Anne*, *Matilda*, *Nancy* and *Susan*. A small number of steamers also traded upriver to Windsor, including the paddle steamer *Sovereign*. These vessels generally transported building materials, manufactured goods and sundries to Windsor or travelled up river “trim, in ballast”; and returned to Sydney with cargoes of maize, oats, barley, wheat, pumpkins, potatoes, and occasionally iron and sawn timber.¹⁴¹ Again, it appears that some of the larger vessels also moored alongside

¹³⁶ “The Colonial Built Steamer.” 24 September 1831. *The Sydney Gazette and New South Wales Advertiser*. p. 3.

¹³⁷ “Progress of Steam.” 19 August 1834. *The Sydney Gazette and New South Wales Advertiser*. p. 2.; “Shipping Intelligence.” 14 April 1836. *The Sydney Herald*. p. 2.

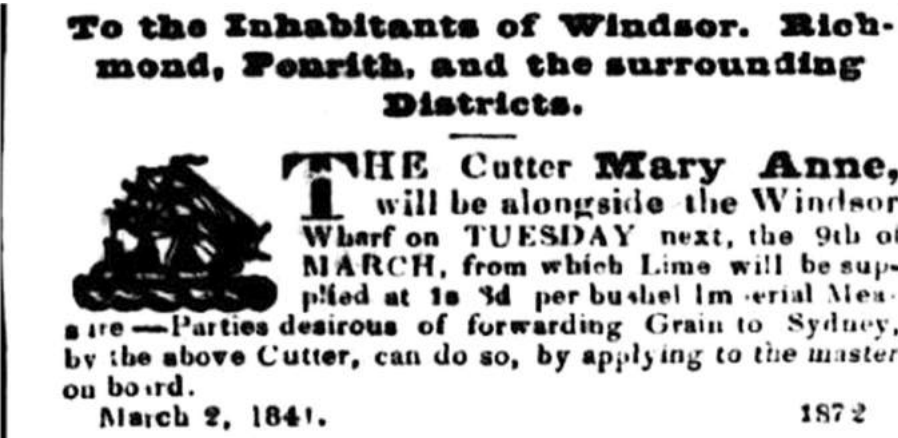
¹³⁸ “Steam Navigation.” 9 July 1839. *The Sydney Gazette and New South Wales Advertiser*. p. 2.; “Steam Boat.” 13 July 1839. *Bent’s News and New South Wales Advertiser*. p. 2.; “Steam Boats Wanted.” 27 July 1839. *Bent’s News and New South Wales Advertiser*. p. 3.

¹³⁹ Anon. nd. *William the Fourth ship*. John Oxley Library, State Library of Queensland, image 196747.

¹⁴⁰ Harris, A. 1847. *Settlers and Convicts. Recollections of Sixteen Years’ Labour in the Australian Backwoods*. C. Cox, London, UK.; Mayne, D. 1 August 1911. “Dan Mayne. His Reminiscences.” *The National Advocate*. p. 1.

¹⁴¹ “To the Inhabitants of Windsor, Richmond, Penrith and the surrounding Districts.” 6 March 1841. *Sydney Gazette and New South Wales Advertiser*. p. 1.; “Coasters Outwards.” *The Sydney Herald*. – 19 July 1842. p. 2.; 26 November 1842 p. 2.; 5 January 1843 p. 2.; 19 July 1843 p. 2.; 15 July 1847 p. 2.; “Coasters Inwards.” *The Sydney Morning Herald*. 21 August 1843 p. 2.; “Coasters Inwards.” 24 August 1852 *The Empire*. p. 2. “Coasters Outwards.” 2 July 1852 *The Empire*. p. 2. ; Boon, P. I. 2017; Christie, J. 26 January 1934 “Looking Backward. The Old Trading Days on the Hawkesbury.” *The Windsor and Richmond Gazette*. p. 10.; Purtell, J. 1995

Windsor wharf, trading directly with customers rather than offloading and transporting their cargo into town stores (Figure 42).¹⁴²



To the Inhabitants of Windsor. Richmond, Penrith, and the surrounding Districts.

THE Cutter Mary Anne,
I will be alongside the Windsor Wharf on TUESDAY next, the 9th of MARCH, from which Lime will be supplied at 1s 3d per bushel Imperial Measure. Parties desirous of forwarding Grain to Sydney, by the above Cutter, can do so, by applying to the master on board.

March 2, 1841. 1872

Figure 42: 1841 advertisement from the owner of the cutter Mary Anne offering lime for sale at Windsor wharf.¹⁴³

The 1850s saw further growth of the upper Hawkesbury River trade and use of Windsor wharf. The number of local river traders continued to increase, several semi-regular Sydney to Windsor shipping services were established, more steamers started plying the river, and recreational passenger excursions began to be offered.

In the early to mid-1850s, several newly constructed sailing vessels commenced regular trade and transport between Sydney and Windsor, including the 34-ton cutter *Defiance*, the composite-built schooner *Maid of Australia*, the 39-ton, the clinker built ketch *William and Betsy* – measuring 42.39' (12.92 m) in length, 19.9' (6.07 m) in width, with 5.8' (1.77 m) draught, and the 45-ton carvel-planked ketch *William and Mary* – measuring 47.7' (14.5 m) in length, 12.9' (3.9 m) in width, with 5.6' (1.7 m) draught.¹⁴⁴ These vessels carried to Windsor supplies of wheat for local flour mills, building materials including timber, bricks, lime, tiles, plate and lead, and various other manufactured goods and sundries; and returned to Sydney from Windsor with shipments of maize, grain, oats, oranges, melons, pumpkins, poultry, eggs, tanned hides, cut timber, shingles and bark.¹⁴⁵

Maid of Australia and *William and Mary*, in particular, became regular and well-known visitors to Windsor wharf, trading in the upper Hawkesbury well into the 1870s. *Maid of Australia* shipped supplies to Windsor every two to three weeks for many years, and became a favoured passenger vessel commonly transporting Windsor residents to Sydney for business and pleasure trips.¹⁴⁶ *William and Mary* was regarded as one of the fastest and most impressive river vessels travelling to Sydney at the time, and was fondly described by owner and captain W. J. Woodbury in his later reminiscences:

*What old river trader was there who did not see the William and Mary under canvas ploughing the Hawkesbury's placid bosom?... There was a sand-bar at the mouth of South Creek, and the W. and M., loaded and drawing 6ft 2in, often came to this bar at dead low water, and after waiting there for an hour for the high tide, sailed into Windsor with a "black nor-easter" behind her. We used to sail up Wilberforce side, and there was ample room to round her up to the wind when coming alongside the wharf.*¹⁴⁷

¹⁴² "News from the Interior. Windsor." 3 April 1844. *The Sydney Morning Herald*. p. 2.

¹⁴³ "To the Inhabitants of Windsor, Richmond, Penrith and the surrounding Districts." 6 March 1841. *Sydney Gazette and New South Wales Advertiser*. p. 1.

¹⁴⁴ "Windsor." 1 July 1867. *The Sydney Morning Herald*. p. 3.; "Certificates of Competency." 24 November 1859. *New South Wales Government Gazette*. Issue No. 235 Supplement.; Australasian Underwater Cultural Heritage Database "William and Betsy" Shipwreck ID 2058. <https://dmzapp17p.ris.environment.gov.au/shipwreck/public/wreck/wreck.do?key=2058&action=expandAll>; Australasian Underwater Cultural Heritage Database "William and Mary" Shipwreck ID 2060 <https://dmzapp17p.ris.environment.gov.au/shipwreck/public/wreck/wreck.do?key=2060&action=expandAll>; "Chris" 16 December 1905. "On the River. Promiscuous Pars." *Windsor and Richmond Gazette*. p. 8.; Christie, J. 26 January 1934.; Grono, W. 2 November 1907. "The Maid of Australia." *The Windsor and Richmond Gazette*. p. 7.

¹⁴⁵ "Coasters Inwards." *The Empire*. 16 April 1852 p. 2.; 19 June 1852 p. 2.; 10 September 1856 p. 4.; 25 June 1859. p. 4.; 27 August 1859. p. 4.; "Coasters Inwards." *The Sydney Morning Herald*. 24 August 1853 p. 4.; 12 May 1855 p. 4.; 3 September 1858. p. 4.; "The Late Captain Manning." 24 July 1907. *The Evening News*. p. 2.; "Wiseman's Ferry." 3 August 1907. *The Windsor and Richmond Gazette*.; Grono, W. 2 November 1907. "The Maid of Australia." *The Windsor and Richmond Gazette*. p. 7.

¹⁴⁶ "Wiseman's Ferry." 3 August 1907. *The Windsor and Richmond Gazette*.; Grono, W. 2 November 1907.

¹⁴⁷ Christie, J. 26 January 1934. "Looking Backward. The Old Trading Days on the Hawkesbury." *The Windsor and Richmond Gazette*. p. 10.

In 1855, two paddle steamers, *Planet* and *Huntress*, began running a series of pleasure trips and fishing excursions between Windsor and Sydney. Both vessels were chartered by groups of Windsor residents, with additional tickets then offered for public sale. At a time when steam vessels were still a rare and novel sight on the Hawkesbury, the arrival of both steamers at Windsor was both happily anticipated and celebrated.¹⁴⁸ *Huntress* was a 54-ton carvel-planked, side-wheel paddle steamer, rigged as a three-masted schooner and measuring 86' (26.2 m) in keel length, 16'6" (5.0 m) beam, 7'6" (2.3 m) depth of hold, and a draught of 5'10" (1.8 m) when loaded (Figure 43 and Figure 44).¹⁴⁹ As the first to be chartered, *Huntress* arrived in Windsor to much fanfare, including a salute fired from Thompson Square:

*On Friday afternoon last, shortly before two o'clock, several gun-shots were suddenly heard fired in quick succession from the neighbourhood of Thompson square, and numbers of men, women, and children might be seen hurrying towards the river. What could be the cause of this consternation, thought we? Nothing more nor less than the anxiously looked for arriving of the Huntress steamer, "walking the waters" of our noble Hawkesbury "like a thing of life!"*¹⁵⁰

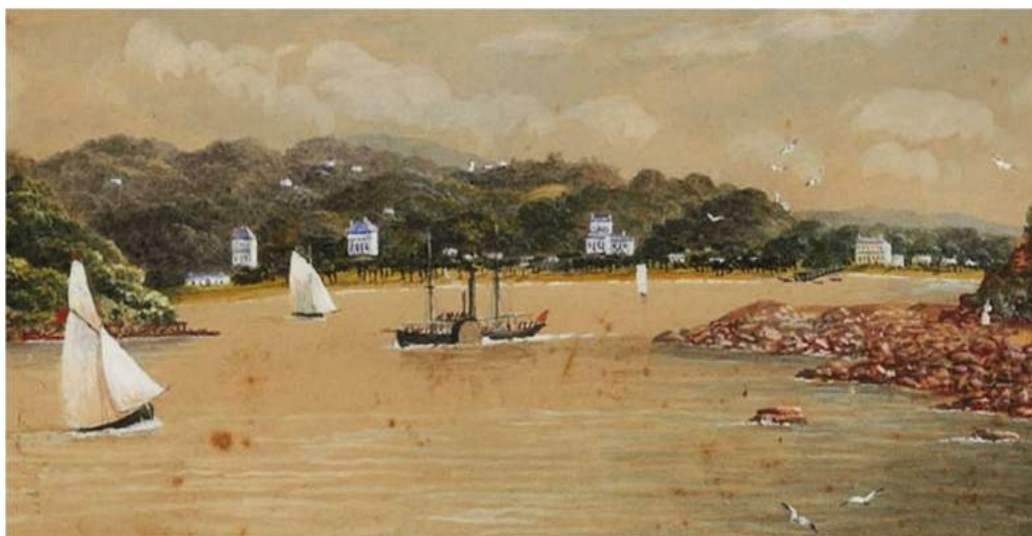


Figure 43: 1855 painting of the paddle steamer *Huntress* in Manly Cove

STEAM FROM WINDSOR TO SYDNEY AND BACK.—The steamer *HUNTRESS* will leave the wharf at Windsor at 7 o'clock on **MONDAY MORNING**, reaching Sydney in the evening. She will start from the wharf at Sydney, on her return to Windsor, at 4 p.m. on **TUESDAY**, and leave Windsor again for Sydney on **SUNDAY**, 18th instant, at 7 a.m. Persons desirous of visiting Broken Bay on a fishing excursion, or to view the noble Hawkesbury, should avail themselves of this opportunity.

Figure 44: 1855 advertisement for Hawkesbury River excursions between Sydney and Windsor on *Huntress*.¹⁵²

Planet was a 45-ton side-wheel paddle steamer, measuring 72' (21.9 m) in keel length, 13' (3.9 m) beam and 6' (1.8 m) depth of hold¹⁵³; that drew "very little water and is just of such a draught to suit the shoals of the Hawkesbury between Pitt Town and Windsor."¹⁵⁴ The "*most pleasing anticipations*" were also entertained by Windsor residents at the prospect of *Planet*'s arrival, a few weeks after *Huntress*.¹⁵⁵ Both *Planet* and *Huntress* returned to Windsor over the following years; commissioned for further river excursions and pleasure trips, as well as occasional cargo runs

¹⁴⁸ "Steam from Windsor to Sydney." 9 February 1855. *The Sydney Morning Herald*. p. 1.; "Windsor." 10 February 1855. *The Sydney Morning Herald*. p. 3.; "The River Hawkesbury." 23 February 1855. *The Sydney Morning Herald*.; "Chris" 16 December 1905. "On the River. Promiscuous Pars." *Windsor and Richmond Gazette*. p. 8.; "Excursion Trip to Windsor." 2 May 1856. *The Sydney Morning Herald*. p. 1.; . Puzey, G. 25 January 1855. "Excursions on the Hawkesbury River." *The Sydney Morning Herald*. p. 3.
¹⁴⁹ "Shipping Intelligence – The "Huntress" Steamer." 1 October 1853. *The Maitland Mercury and Hunter River General Advertiser*. p. 2.

¹⁵⁰ "Windsor." 6 February 1855. *The Sydney Morning Herald*. p. 5.

¹⁵¹ Anon. ca. 1855. "Manly Cove from North Harbour." NSW State Library, Image PXA 980/5.; Great Lakes Historical Society, Tuncurry-Forster, NSW. "Collections – Coastal Shipping – Great Lakes Manning Valley, NSW." <https://www.flickr.com/photos/glmrsnsw/albums/72157662856016962/with/23531030933/> accessed October 2019.

¹⁵² "Steam from Windsor to Sydney and Back." 9 February 1855. *Sydney Morning Herald*. p. 1.

¹⁵³ "The New Steamer Planet." 4 December 1854. *The Shipping Gazette and Sydney General Trade List*. p. 237.

¹⁵⁴ "The Hawkesbury – Steam Navigation." 6 May 1856. *The Maitland Mercury and Hunter River General Advertiser*. p. 3.

¹⁵⁵ "Windsor. Getting the Steam Up." 27 January 1855. *The Sydney Morning Herald*.

carrying wheat, maize, bran, hay, hides, sheepskins and tallow from Windsor to Sydney markets (Figure 45).¹⁵⁶



PLEASURE TRIP TO THE HAWKESBURY.—The Steamer **PLANET**, a regular trader, will leave the Phoenix Wharf for Windsor direct, on **FRIDAY, 23rd** instant, at half-past 2 o'clock, p.m. Saturday being a holiday this excursion will afford gentlemen an opportunity of viewing the magnificent scenery of the Hawkesbury without any interruption to business. For further particulars, apply to **Mr. E. W. LAYTON**, Exchange-corner. Sydney, 21st May. 9370a

Figure 45: 1856 advertisement for Hawkesbury River pleasure trips between Sydney and Windsor on Planet.¹⁵⁷

In 1857, the first weekly steamer service between Windsor and Sydney was established with the introduction of *Star* – a 45-ton, carvel-planked, side wheel paddle steamer, measuring 73.4' (22.4 m) in length, 10' (3.1 m) in width, with a draught of 6.8' (2.1 m).¹⁵⁸ *Star* provided both passenger and freight services, carrying cargoes of iron and sundries to Windsor and returning to Sydney with maize, wheat and oranges (Figure 46).¹⁵⁹ *Star* was wrecked in Broken Bay in July 1857, but the weekly Windsor to Sydney services were re-established in 1858 with the newly constructed replacement vessel *New Moon*; a 49-ton, side wheel paddle steamer measuring 91.1' (27.7 m) in length, 12' (3.7 m) in width, with a draught of 6' (1.8 m).¹⁶⁰ *New Moon* transported cargo to and from Windsor for several years, chiefly bringing wheat (for the Windsor mills), potatoes and various sundries from Sydney, and returning with maize, oranges, fowls, eggs, pigs from Windsor (Figure 47).¹⁶¹



STEAMER STAR TO HAWKESBURY AND WINDSOR.—On **MONDAY, 3 p.m.** For particulars, apply at the Flour Company's Wharf. 3147a

Figure 46: 1857 advertisement for transport from Sydney to Windsor via Star.¹⁶²

STEAMER NEW MOON, for the HAWKESBURY AND WINDSOR, on **WEDNESDAY**, she will be ready to receive cargo, on **TUESDAY MORNING**. For particulars, apply on Board.

Figure 47: 1859 advertisement for cargo transport from Sydney to Windsor via New Moon.¹⁶³

In 1861, *Victoria*, the largest steamer known to have travelled the upper Hawkesbury in the 19th century, reached Windsor wharf carrying passengers on a river excursion from Sydney.¹⁶⁴ *Victoria* was 164' (50 m) in length, 108 tons burden, with 3'9" (1.1 m) draught and licensed to carry up to 328 passengers.¹⁶⁵ Advertisements offering tickets on *Victoria* at the time stated that despite the vessel's size "excursionists may rest quite assured of the *Victoria* proceeding as far as Windsor, as from her extremely light draught of water, she will readily pass over the numerous shoals in the river."¹⁶⁶ *Victoria* ran several pleasure trips to Windsor throughout the year and was the vessel chartered to transport Governor Sir John Young and his party on an official visit along the Hawkesbury to Windsor in October 1861.¹⁶⁷

¹⁵⁶ "The Hawkesbury – Steam Navigation." 6 May 1856.; Pritchard, W. 8 July 1857. "Regular Produce Sale." *The Empire*. p. 8.

¹⁵⁷ "Pleasure Trip to the Hawkesbury." 23 May 1856. *Empire*. p. 1.

¹⁵⁸ Australasian Underwater Cultural Heritage Database "Star" Shipwreck ID 1712

<https://dmzapp17p.ris.environment.gov.au/shipwreck/public/wreck/wreck.do?key=1712&action=expandAll>

¹⁵⁹ "Windsor." 4 June 1857. *The Empire*. p. 3; "Windsor." 6 June 1857. *The Freeman's Journal*. p. 3; "Coasters Inwards." 11 June 1857. *The Sydney Morning Herald*. p. 4.

¹⁶⁰ Australasian Underwater Cultural Heritage Database "New Moon" Shipwreck ID 1333.

<https://dmzapp17p.ris.environment.gov.au/shipwreck/public/wreck/wreck.do?key=1333&action=expandAll>

¹⁶¹ "Windsor." 20 October 1858. *The Sydney Morning Herald*. p. 3.; "Windsor." 9 November 1858. *The Sydney Morning Herald*. p. 3.; "Coasters Inwards." 6 June 1859. *The Empire*. p. 4.

¹⁶² "Steamer Star to Hawkesbury and Windsor." 20 June 1857. *Empire*. p. 1.

¹⁶³ "Steamer New Moon for the Hawkesbury and Windsor." 27 June 1859. *Empire*. p. 1.

¹⁶⁴ Steele, J. Rev. 4 September 1914. "Early Days of Windsor. Hawkesbury River." *The Windsor and Richmond Gazette*. p. 6.

¹⁶⁵ "China. British Consular Court." 8 February 1864. *The Sydney Morning Herald*. p. 3. Wilshire, W. J. 31 December 1860.

"The Steam Navigation Board." *The Empire*. p. 1.; Manning, J. E. 7 January 1861. "To the Secretary of the Steam Navigation Board." *The Sydney Morning Herald*. p. 2.

¹⁶⁶ Manning, E. 15 February 1861. "Excursion on the Hawkesbury River." *The Empire*. p. 1.

¹⁶⁷ "Visit of Sir John Young to the Hawkesbury." 7 October 1861. *The Sydney Morning Herald*. p. 5.; Steele, J. Rev. 4 September 1914.

The local river trade continued to thrive at Windsor throughout the 1860s, with numerous vessels bringing all kinds of farm, dairy and orchard produce to Windsor wharf from settlements along the Hawkesbury River and tributaries including Wisemans Ferry, Sackville Reach, Cattai, Portland Head, Lower Portland, Webbs Creek, Macdonald River and Colo River. Regular markets soon developed at the wharf, and vessels left Windsor carrying return stores and supplies from shopkeepers in town to customers along the river.¹⁶⁸

The increasing upper Hawkesbury river trade and the establishment of regular steam services between Sydney and Windsor largely contributed to the decision to reconstruct the Windsor wharf in 1862 – which was, by that time, beginning to fall into disrepair (see Section 3.2).

In 1864, a light rail branch line from Blacktown to Richmond, including a station built at Windsor, was constructed off the main western railway line from Sydney. The establishment of a rail connection further stimulated business at the Windsor wharf, with vessels shipping a wide range of produce from across the upper Hawkesbury region to Windsor to be offloaded and sent by rail to Sydney and inland towns.¹⁶⁹ Hawkesbury River traders began developing relationships directly with Sydney and Parramatta produce dealers travelling by train to Windsor, and coincided their sales and auctions of cargo with the train timetable (Figure 48).

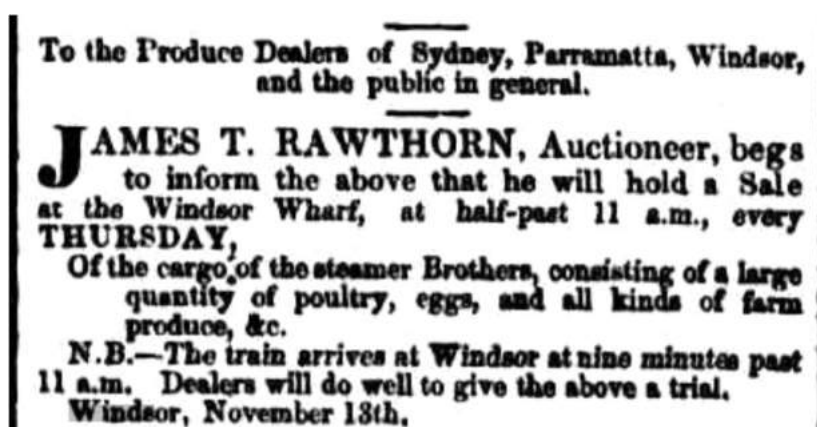


Figure 48: 1865 advertisement for auction of the cargo of Brothers steamer to be held at Windsor wharf – coinciding with the timing of train arrival from Sydney.¹⁷⁰

Documented recollections of Hawkesbury River residents provide vivid imagery of the busy and lively scenes at Windsor wharf during the mid to late 1860s:

....one could see, any Tuesday morning (market day), quite a fleet – twenty or more in number – of craft of all sizes lying alongside Windsor wharf, laden with maize, poultry, watermelons, etc. in galore. the loading and unloading; the perspiring horses and the cracking of whips, as the heavily-laden drays were hauled up the Punt Hill; the chaffing and chiacking of the boatmen ... These were gay old times, and one cannot easily forget the picturesque scenes at the wharf on the arrival of the river fleet.¹⁷¹

In 1867, the Hawkesbury River valley experienced a major flood event – the highest on record with waters rising up to 63' (19.2 m) above normal river levels. Windsor was rapidly, and almost entirely, inundated. The flood waters deposited vast amounts of sand and silt across low lying areas – up to 20' (6 m) deep in some places, resulting in a substantial decrease in both the width and depth of the existing river channel. Many of the larger coasters that had previously traded from Sydney to Windsor were thereafter unable to navigate beyond Pitt Town, and several passenger and freight services were discontinued. Even moderately sized steam vessels drawing only 3' to 4' (0.9 – 1.2 m) were occasionally grounded on sand shoals whilst attempting to approach Windsor.¹⁷²

The fleet of smaller and shallower river vessels, however, remained largely unimpeded and local trade at the Windsor wharf continued to prosper. By the early to mid-1870s, at least thirty different Hawkesbury vessels regularly shipped to Windsor wharf, including *Elisabeth*, *Emma Matilda*,

¹⁶⁸ "The Australian." 3 March 1899. *The Australian, Windsor, Richmond, and Hawkesbury Advertiser*. p. 2.; Steele, J. Rev. 4 September 1914.

¹⁶⁹ Steele, J. Rev. 4 September 1914.

¹⁷⁰ Rawthorn, J. T. 15 November 1865. "Notice." *The Sydney Morning Herald*. p. 7.

¹⁷¹ Quoted in Purtell, J. 1995. p. 48.

¹⁷² "Dredging the Hawkesbury." 30 November 1876. *The Sydney Morning Herald*. p. 6.; "Windsor. The Late Jonathon Leet." 29 April 1921. *The Windsor and Richmond Gazette*. p. 3.; Steele, Rev. J. 1916. *Early Days of Windsor, N. S. Wales*. Tyrrell's Limited, Sydney, NSW.

Fanny, Industry, Maid of Erin, Nil Desperandum, Perseverance, Spray and paddle steamer *Telegraph* from Macdonald River with cargoes of maize, poultry, eggs, butter, oranges, wattle bark and sundries;¹⁷³ *Cecilia, Emma Jane, Eve, Fly-By-Night, Substitute* and *Wave* from the Colo River carrying of maize, poultry, eggs, oranges and wattle bark;¹⁷⁴ *Better Times, Forget-Me-Not, Hard Times, Spitfire* and *Stone Parson* from Lower Portland with cargoes of maize, straw, poultry, geese, ducks, eggs, potatoes, melons and other fruit, straw, wattle bark, shingles and sundries;¹⁷⁵ *Adventure, Tormenting Rose* and *Wild Irish Girl* from Webbs Creek carrying maize, poultry, eggs, sheet bark and sundries;¹⁷⁶ *Eva, John and Herbert, Sir Andrew Agnew* and *Suffolk* from Sackville Reach and Wisemans ferry with cargoes of poultry, geese, eggs, melons, wattle bark and sundries;¹⁷⁷ *George* from Ebenezer with maize¹⁷⁸ and *Fly* from Broken Bay transporting lime.¹⁷⁹

After a visit to Windsor wharf markets in mid-1878, a local resident described "...there were also ten river crafts at the Windsor wharf on Tuesday morning, with a large assortment of produce. I have visited the wharf for many years and it was the greatest market day I ever saw there."¹⁸⁰



Figure 49: Windsor wharf ca. 1879 – showing several river craft clustered alongside the wharf and horses and carts and horses used carry goods up and down from Windsor township standing nearby.¹⁸¹

Estimates of Hawkesbury River traffic indicate that throughout the 1870s to early 1880s, between 260 to 370 vessel trips were made each year to Windsor wharf.¹⁸² Contemporary records for the year 1875 to 1876 show 260 arrivals of river craft and the trade of £17,200 worth of goods:

From the 11th September, 1875, to the 2nd September, 1876, there were 260 arrivals of river craft at the Windsor Wharf. The average weekly amount of maize brought to the wharf was

¹⁷³ "Arrivals of River Craft." *The Australian, Windsor, Richmond and Hawkesbury Advertiser*. – 18 October 1873. p. 2.; 21 March 1874. p. 2.; 4 April 1874, p. 2.; 30 September 1876; 16 December 1876. p. 2.; "The Markets." 22 June 1878. *The Cumberland Mercury*. p. 4.

¹⁷⁴ "Review of the Markets." 25 October 1873. *The Australian, Windsor, Richmond and Hawkesbury Advertiser*. p. 2.;

"Arrivals of River Craft." *The Australian, Windsor, Richmond and Hawkesbury Advertiser*. – 23 May 1874. p. 2.; 30 September 1876; 21 October 1876, p. 2.; 16 December 1876. p. 2.

¹⁷⁵ "Review of the Markets." 25 October 1873. *The Australian, Windsor, Richmond and Hawkesbury Advertiser*. p. 2.;

"Arrivals of River Craft." *The Australian, Windsor, Richmond and Hawkesbury Advertiser*. – 21 March 1874. p. 2.; 23 May 1874. p. 2.; 7 October 1876, p. 2.

¹⁷⁶ "Arrivals of River Craft." *The Australian, Windsor, Richmond and Hawkesbury Advertiser*. – 21 March 1874. p. 2.; 27 June 1874; 16 December 1876. p. 2.

¹⁷⁷ "Arrivals of River Craft." *The Australian, Windsor, Richmond and Hawkesbury Advertiser*. – 14 October 1873. p. 2.; 18 October 1873. p. 2.; 21 March 1874. p. 2.; 31 March 1877, p. 4.

¹⁷⁸ "Arrivals of River Craft." 28 October 1876. *The Australian, Windsor, Richmond and Hawkesbury Advertiser*. p. 2.

¹⁷⁹ "Arrivals of River Craft." 21 March 1874. *The Australian, Windsor, Richmond and Hawkesbury Advertiser*. p. 2.

¹⁸⁰ "The Markets." 22 June 1878. *The Cumberland Mercury*. p. 4.

¹⁸¹ Anon 1879. "Windsor Bridge as in 1879." Reproduced in Steele, Rev. J. 1916. *Early Days of Windsor, N. S. Wales*. Tyrrell's Limited, Sydney, NSW. p. 183.

¹⁸² Steele, J. Rev. 4 September 1914.

1500 bushels, making a total for the year of 78,000 bushels, which, valued at 3s. per bushel, represents a sum of £10,200. The quantity of timber during the same period was about 80,000 feet, valued at £560; poultry and eggs, £1500; melons and pumpkins, £500; hides, £250; wattle bark, £250; oranges, £3000. These, together with other miscellaneous items, make a total of £17,200.¹⁸³



Figure 50: Windsor Bridge, ca. 1888, showing an example of a small river sailing vessel in the foreground at Windsor Wharf.¹⁸⁴



Figure 51: The Windsor punt approaching Windsor terminus (slightly upstream of Windsor wharf), showing an example of several small river sailing vessels moored along the southern riverbank.¹⁸⁵

Passenger excursions and pleasure trips continued to be offered from Sydney along the Hawkesbury River to Windsor throughout the 1870s; however, such trips no longer involved direct travel as the coastal steamers could not clear Windsor reach. Advertised packages included transport via steamers such as *Illalong* and *Pelican* from Sydney to Barrenjoey, Pittwater, with passengers then transhipped to small craft, such as steam yacht *Ripple* (licensed to carry 35), for the journey up the Hawkesbury River to Windsor wharf.¹⁸⁶

Local river traffic and trade at Windsor continued steadily into the early 1880s, with contemporary estimates regarding use of the wharf for 1880-1882 remaining at an average of up to 370 vessel trips a year.¹⁸⁷ In 1881, it was reported that 468 vessel trips to the Windsor wharf had occurred in the preceding year, delivering 70,000 pounds (31.2 tons) of produce.¹⁸⁸

Newspaper accounts of vessel arrivals in 1881-1882 show that there were still at least thirty river craft from different parts of the Hawkesbury and tributaries were trading at Windsor wharf, including *Emma Matilda*, *Eva* (steamer) *Janet*, *Industry*, *Nonsuch*, *Settlers Friend* (steamer), *Telegraph* (steamer), *Victory* carrying maize, poultry, eggs, oranges, lemons, melons, fruit and sundries from the Macdonald River¹⁸⁹; *Eliza Jane*, *Emily Edith*, *Empress*, *Gem*, *Jessie Lee*, *Maid of Erin*, *Progress*, *Sarah*, *Sarah Jane*, *Victoria*, *Wave* carrying maize, poultry, eggs, oranges, melons, fruit, wattle bark and sundries from the Colo River¹⁹⁰; *Ada*, *Florrie*, *Same Old Game* and *Welcome Home* carrying maize, pumpkins, melons, poultry and sundries from Webbs Creek and Wisemans Ferry¹⁹¹; *Barcoo* (steamer) carrying maize from Cattai Creek¹⁹², *Agenora* and *Alma* (28-ton steamer) carrying maize, poultry, eggs, oranges, melons, fruit and sundries from Sackville Reach¹⁹³; *John and Herbert* (cutter-rigged steamer) and *William and Herbert* carrying maize,

¹⁸³ "Dredging the Hawkesbury." 3 February 1877. *The Sydney Mail and NSW Advertiser*. p. 136; estimates by Mr. G. Davies.

¹⁸⁴ Mills, J. ca. 1888. "Windsor Bridge - Windsor, NSW." NSW State Library, item no. BCP 04404

¹⁸⁵ Paine, J. ca. 1870. *Ferry across the Hawkesbury River, Windsor to Wilberforce*. Hawkesbury City Council Library, 007297.

¹⁸⁶ "Excursion by rail to Windsor and by Steamer down the Hawkesbury." 23 December 1873. *The Sydney Morning Herald*. p. 4; "Steam Excursion to Broken Bay and up the Hawkesbury River." 30 December 1873. *The Sydney Morning Herald*. p. 4.

¹⁸⁷ Steele, J. Rev. 4 September 1914.

¹⁸⁸ Purtell, J. 1995.; Rosen, S. 1995. *Losing Ground: An Environmental History of the Hawkesbury-Nepean Catchment*. Hale & Iremonger with the Hawkesbury-Nepean Management Trust, Sydney, NSW.

¹⁸⁹ "Arrival of river craft at Windsor Wharf." *The Hawkesbury Chronicle and Farmers Advocate*. 28 May 1881. p. 2.; 4 June 1881. p. 2.; 16 July 1881. p. 2.; 15 October 1881. p. 2.; 25 February 1882. p. 2.; 11 March 1882. p. 2.; 1 July 1882. p. 2.

¹⁹⁰ "Arrival of river craft at Windsor Wharf." *The Hawkesbury Chronicle and Farmers Advocate*. – 28 May 1881. p. 2.; 16 July 1881. p. 2.; 20 August 1881. p. 2.; 10 September 1881. p. 2.; 15 October 1881. p. 2.; 25 February 1882. p. 2.; 11 March 1882. p. 2.; Saturday 19 August 1882, p. 2.; 11 November 1882. p. 2.; 26 November 1881. p. 2.

¹⁹¹ "Arrival of river craft at Windsor Wharf." *The Hawkesbury Chronicle and Farmers Advocate*. – 9 July 1881. p. 2.; 30 July 1881. p. 2.; 1 April 1881. p. 2.; 10 September 1881. p. 2.; 19 November 1881. p. 2.

¹⁹² "Arrival of river craft at Windsor Wharf." *The Hawkesbury Chronicle and Farmers Advocate*. – 23 July 1881. p. 2.

¹⁹³ "Arrival of river craft at Windsor Wharf." *The Hawkesbury Chronicle and Farmers Advocate*. – 4 June 1881. p. 2.; 20 August 1881. p. 2.; 25 February 1882. p. 2.; 11 November 1882. p. 2.

butter, eggs, poultry, potatoes, melons, oranges, peaches, wattle bark, palings, hides and sundries from the Lower Hawkesbury¹⁹⁴, and *Bull Pup* and *Queen* from Portland Head with cargoes of maize, poultry, eggs, butter, oranges, melons, fruit, and sundries.¹⁹⁵

Arrival of river Craft at Windsor Wharf.

SATURDAY, JULY 23.
Maid of Erin, from the Macdonald. Maize and sundries. (Morris.)

MONDAY, JULY 25.
Gem, from the Colo. Maize, oranges, &c.
S.S. Eva, from the Macdonald. Maize, &c.
Settlers' Friend, from Webb's Creek. Maize and sundries. (Geo. Butler.)
Same Old Game, from Webb's Creek. Maize and sundries. (Jos. Butler.)

TUESDAY, JULY 26.
Alma, steamer, from St. Albans. Maize, oranges, and sundries. (Jurl.)
Victoria, from Lower Portland. Maize and sundries. (Wall.)
Queen, from Portland Head. Maize, oranges, and sundries. (Everingham.)
Victory, from Colo. Maize, oranges, and sundries. (Jones.)

WEDNESDAY, JULY 27.
Florrie, from Wiseman's Ferry. Maize and sundries. (Scadden.)
Emily Edith, from Colo. Maize and sundries.
Sarah Jane, from Colo. Maize, poultry, and sundries.
Agnes, from Colo. Maize and sundries.

THURSDAY JULY 28.
S.S. Telegraph, from the Macdonald. Maize and sundries. (Jones.)
John and Herbert, from Lower Hawkesbury. Maize, &c. (Woodbury.)
Ada, from Lower Hawkesbury. Maize, &c.

Figure 52: Published weekly list of river vessels landing produce at Windsor wharf, late July 1881¹⁹⁶ – showing up to four different vessels arriving at the wharf on a daily basis.

Despite the solid local river trade, Windsor residents became increasingly concerned throughout the 1870s about the inability of larger vessels to navigate the upper Hawkesbury and the resultant injury to commercial and agricultural interests of the district. In 1876, a petition was sent to the Minister of Public Works asking for Government funding and resources to dredge the Hawkesbury below Windsor, “*setting forth the state of the river's channel and praying for steps to be taken to remedy the evil.*”¹⁹⁷ In 1882, the Government resolved to make attempts to clear the channel and steam bucket dredge *Archimedes* was sent to the upper Hawkesbury River. *Archimedes* spent over ten months working on the section of the river between Pitt Town and Windsor – however, only minimal success was achieved as river freshes continually re-filled the newly-cut channel. In early 1883, the Government eventually abandoned the dredging plan and *Archimedes* was removed.¹⁹⁸

By mid-1883, the shoals in the upper Hawkesbury were reported as becoming “*worse than ever*”, with many of even the shallow draught river vessels struggling to reach Windsor wharf.¹⁹⁹ Contemporary estimates show that river traffic and trade at Windsor wharf started sharply declining from this point onwards. The recorded average number of vessel trips to the wharf in 1883 to 1885 was 260 per year – 110 less than the 1870s to early 1880s averages; and the yearly average amount of produce traded was less than 20,000 pounds (8.9 tons). Between 1886 to 1887, the average number of trips declined further to 135 per year, and by 1888, records show that only 40 trips were made to Windsor wharf.²⁰⁰

¹⁹⁴ “Arrival of river craft at Windsor Wharf.” *The Hawkesbury Chronicle and Farmers Advocate*. – 20 August 1881. p. 2; 10 September 1881, p. 2; 29 October 1881. p. 2; 19 November 1881, p. 2; 26 November 1881. p. 2; 11 March 1882. p. 2; 1 July 1882. p. 2

¹⁹⁵ “Arrival of river craft at Windsor Wharf.” *The Hawkesbury Chronicle and Farmers Advocate*. – 20 August 1881. p. 2; 26 November 1881, page 2; 1 April 1882. p. 2; 25 February 1882. p. 2.

¹⁹⁶ “Arrival of River Craft at Windsor Wharf.” 30 July 1881. *Hawkesbury Chronicle and Farmers Advocate*. p. 2.

¹⁹⁷ “Hawkesbury.” 2 December 1876. *The Sydney Mail and New South Wales Advertiser*. p. 715.

¹⁹⁸ “The Australian.” 20 May 1882. *The Australian, Windsor, Richmond, and Hawkesbury Advertiser*. p. 2.; “Town Talk.” 28 October 1882. *The Australian, Windsor, Richmond and Hawkesbury Advertiser*. p. 2.; “Wiseman's Ferry.” 3 March 1883. *The Cumberland Mercury*. p. 8.; “Sackville Reach.” 10 March 1883. *The Cumberland Mercury*. p. 3.; “Windsor.” 10 March 1883. *The Cumberland Mercury*. p. 3.; Steele, J. Rev. 4 September 1914.

¹⁹⁹ “Stray Leaves.” 7 April 1883. *The Australian, Windsor, Richmond, and Hawkesbury Advertiser*. p. 2.

²⁰⁰ Op. Cit., Purtell, J. 1995; Steele, J. Rev. 4 September 1914.

Various improvements to overland transport in the Windsor district had been made by that time. The Windsor Bridge over the Hawkesbury River had been built in 1874, replacing the cable-punt service and providing a direct road link between communities on the northern side of the Hawkesbury with Windsor township and the railway connection to Sydney. The railway itself had been further improved, with the original light rail branch line from Blacktown to Richmond progressively upgraded in 1876 - 1883 to take heavier rolling stock, thus providing increased capacity to transport goods from Windsor to Sydney markets. As the siltation in the Hawkesbury River made navigation to Windsor wharf increasingly difficult, local traders began relying more and more on road and rail transport networks.²⁰¹

Trade was further drawn away from Windsor wharf in 1885 with the creation of the Hawkesbury Steam Navigation Company, a public share company established by three steam vessel proprietors and supported by numerous Hawkesbury farmers and fruit growers. With a fleet of three steamers, *Amy*, *Albatross* and *Maramara*, the Hawkesbury Steam Navigation Company commenced operating biweekly passenger and freight services between Sydney and the Hawkesbury River. As large steamers could no longer navigate the upper Hawkesbury, the Company's river terminus was established at Sackville Reach. Before long, much of the produce from Macdonald River, Colo River, Webbs Creek and Wisemans Ferry that had previously been shipped to Windsor wharf for trade was instead delivered to Sackville for transportation to Sydney by the Company steamers.²⁰²

In 1886, an attempt to re-establish steam passenger and freight services between Windsor and the Macdonald and Colo Rivers was made with the introduction of newly constructed *St. Albans* (Figure 53 and Figure 54); a 52 ton steamer specifically designed to draw less than 2' (0.6 m) of water when loaded. In March 1886, *St. Albans* left Windsor wharf laden with passengers and cargo, including three racehorses, bound for St. Albans – the first successful navigation of Windsor reach by a sizeable steamer since the late 1860s.²⁰³ The celebration was somewhat short-lived, however, as in May 1886, *St. Albans* became grounded on a sand bar just below Windsor wharf on the return leg of a passenger excursion.²⁰⁴ *St. Albans* continued to run occasional pleasure excursions and cargo trips from Windsor wharf throughout the late 1880s to mid-1890s, with trips timed carefully to coincide with high tide at Windsor. However, the risk of grounding was ever present, and on several occasions passengers had to disembark on the riverbank part way along Windsor reach and return to town on foot.²⁰⁵

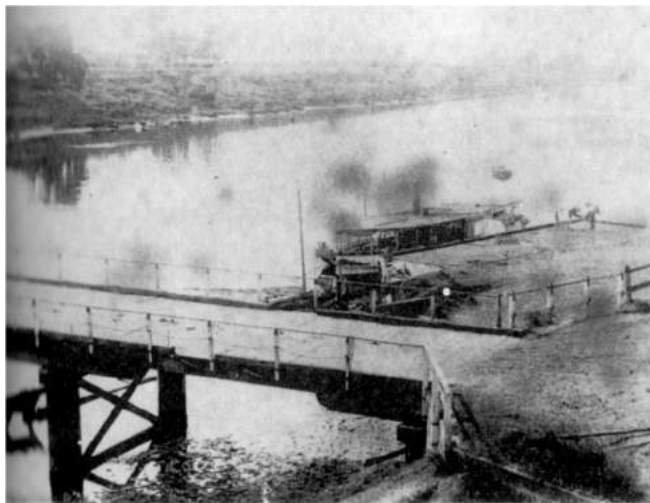


Figure 53: *St. Albans* at Windsor Wharf, 1889. Note the very low water level. ²⁰⁶



Figure 54: *St. Albans* beached at low tide below Windsor Wharf, ca. 1889. ²⁰⁷

²⁰¹ Op. Cit., Boon, P. I. 2017.

²⁰² "Steam Communication with the Hawkesbury." 25 July 1885. *The Sydney Mail and New South Wales Advertiser*. p. 191; "Wiseman's Ferry" 27 March 1886. *The Sydney Mail and New South Wales Advertiser*. p. 669.; "Wiseman's Ferry" 19 March 1887. *The Sydney Mail and New South Wales Advertiser*. p. 669.

²⁰³ "Navigating the Hawkesbury." 18 March 1886. *The Evening News*. p. 6.; "Wiseman's Ferry" 27 March 1886. *The Sydney Mail and New South Wales Advertiser*. p. 669.

²⁰⁴ "Down the River in the *St. Albans*." 29 May 1886. *The Hawkesbury Chronicle and Farmers Advocate*. p. 3.

²⁰⁵ "Windsor." 12 October 1889. *The Sydney Mail and New South Wales Advertiser*. p. 840.; "Trip to Mouth of Colo." 4 January 1890. *The Windsor and Richmond Gazette*. p. 4.; "Lower Portland Concert." 14 December 1895. *The Windsor and Richmond Gazette*. p. 22.; Steele, J. Rev. 4 September 1914.

²⁰⁶ Anon 1889. "The Steamer *St. Albans* at Windsor Wharf." Reproduced in Bowd, D. G. 1986. *Up the Windsor Road for Baulkham Hills*. Library of Australian History, Sydney, NSW. p. 100.

²⁰⁷ Anon ca. 1889. "St Albans on beach below Windsor wharf, ca. 1889." Hawkesbury City Council Library Image 000886.

In 1887, a series of freshes temporarily scoured the channel between Pitt Town and Windsor, allowing the newly built passenger steamer *General Gordon* to navigate the Hawkesbury River all the way to Windsor wharf.²⁰⁸ *General Gordon* (Figure 55 and Figure 56) was a flat-bottomed 104 ton stern-wheel paddle steamer, measuring 117' (35.7 m) in length, 25.6' (7.8 m) in width, with a 5.4' (1.6 m) draught.²⁰⁹ The arrival of *General Gordon* at Windsor was described at the time as “an event to make all those who have interested themselves in river and creek navigation shake hands with each other.”²¹⁰ Once again, however, celebrations were short-lived. Siltation shortly thereafter reclosed the river channel and it was another three and a half years before *General Gordon* could reach Windsor wharf again.²¹¹



Figure 55: *General Gordon* at Flat Rock Wharf, Long Island, ca. 1886-1889.²¹²



Figure 56: *General Gordon* on the Hawkesbury River, ca. 1890.²¹³

Public agitation and petitioning of the NSW Government to dredge the upper Hawkesbury continued throughout the 1880s. In 1889, the Government resolved to set aside £5,000 for works to facilitate river navigation to Windsor. Over the following two years, investigations were carried out by the Public Works Department and three options were proposed. The first two schemes involved dredging a 10' (3.1 m) deep channel from the mouth of South Creek to Windsor Bridge, and either removing the silt entirely or building a ballast dyke along the southern bank and depositing the dredged silt behind it; the third scheme involved dredging South Creek and diverting river traffic to the southern side of Windsor. All three proposals further involved cutting 8' (2.4 m) deep channels through several shoals in the Hawkesbury between Pitt Town and South Creek. However, hydrographic surveys had revealed that the problem was much bigger than previously thought. The depth of the Hawkesbury leading up to Windsor wharf was recorded as only 1' to 5 ½' (0.3 to 1.7 m) deep (below mean low tide); compared to 11' to 16' (3.6 to 4.9 m) deep as recorded in the early 1860s. The estimated costs were subsequently much higher than anticipated – £26,000, £33,400 or £19,200 respectively for the three proposed options. The Public Works Department engineer further predicted that costly ongoing maintenance would be required and that the first flood would likely fill the dredged channels back up again. The Government ultimately concluded that the costs far outweighed any advantages, maintaining that Hawkesbury residents were already well served by the railway and shipping connections on the lower river, and that excursion passenger craft seemed to be the only class of river traffic to Windsor to be provided for, which would not justify the outlay.²¹⁴

The Government's decision was not received well by Windsor residents, and local agitation for dredging the upper Hawkesbury continued. In 1895, Captain A. Manning, owner of the steamer

²⁰⁸ “Arrival of the ‘General Gordon’.” 16 April 1887. *The Hawkesbury Chronicle and Farmers Advocate*. p. 3.

²⁰⁹ Australasian Underwater Cultural Heritage Database “General Gordon” Shipwreck ID 748

<https://dmzapp17p.ris.environment.gov.au/shipwreck/public/wreck/wreck.do?key=748>

²¹⁰ “Arrival of the ‘General Gordon’.” 16 April 1887. *The Hawkesbury Chronicle and Farmers Advocate*. p. 3.;

²¹¹ “Topics of the Day.” 8 November 1890. *The Windsor and Richmond Gazette*. p. 1.; Mercer, H. E. 1962. “Tales of the Hawkesbury.” *Walkabout*.; Steele, J. Rev. 4 September 1914.

²¹² Anon ca. 1886-1889. “The General Gordon paddle steamer at Flat Rock Wharf, Long Island.” Hornsby Shire Library, Image 1108.

²¹³ Anon ca. 1890. “The General Gordon paddle steamer on the Hawkesbury River.” Hornsby Shire Library, Image 4881.

²¹⁴ “Hawkesbury Navigation Scheme.” 5 December 1891. *The Windsor and Richmond Gazette*. p. 5.; Steele, J. Rev. 4 September 1914.

St. Albans made a proposal to Windsor Borough Council whereby he would lease the Windsor wharf for a period of three years, during which time he would make his own attempt to “deepen and clear the channel of the river Hawkesbury to such an extent as to enable the steamer *General Gordon* and sea-going vessels to come up to the wharf.”²¹⁵ After much deliberation, Council agreed and Capt. Manning proceeded to construct two basic breakwaters along the bank of the Hawkesbury, near the junction of South Creek – the intention being that the breakwaters would act to direct river flow and act as a scour to the channel. Capt. Manning’s work was inspected by Department of Public Works Harbours and Rivers Branch engineer Thomas Edward Burrows in late 1895, who informally approved the work after providing a few suggested alterations.²¹⁶ In 1896, there was much optimism that Capt. Manning’s scheme appeared to be working, and he was able to drive *St Albans* to and from Windsor wharf at low tide.²¹⁷ However, the success was short lived and the breakwaters ultimately had no significant or lasting effect. By 1897, public agitation for the Government to fund a dredging program recommenced – but to no avail.²¹⁸

Several upper Hawkesbury farmers, traders and entrepreneurs continued to intermittently ship goods and offer river excursions to and from Windsor wharf throughout the 1890s to early 1900s, using small craft with shallow draughts designed specifically for the river trade and timing navigation to coordinate with high tides. *St Albans*, river boat *Violet*, and newly constructed screw steamers *Acme* and *Surprise*, and 40-ton steam launch *Daisy* (Figure 57 and Figure 58) occasionally ran trips to Windsor from Wisemans Ferry, Sackville Reach and the Colo River, carrying maize, fruit, eggs, butter, fowls and wattle bark, and *Surprise* and *Daisy* in particular ran several day trips and pleasure cruises along the Hawkesbury.²¹⁹



Figure 57: *Daisy* alongside Windsor wharf, 1902. ²²⁰

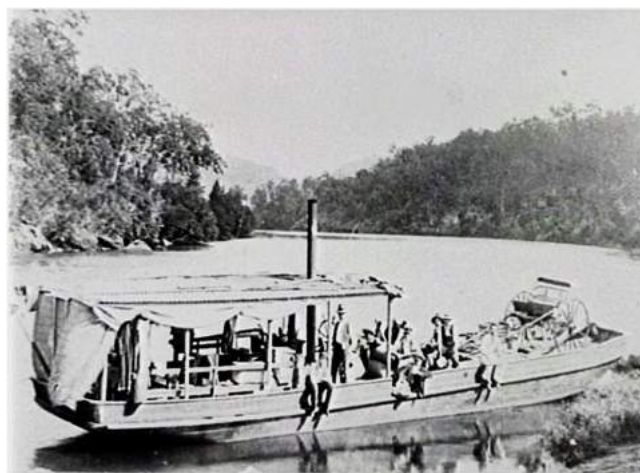


Figure 58: *Daisy* on Hawkesbury River, early 1900s. ²²¹

In many instances, produce runs were made to Windsor wharf during the 1890s in an active attempt to revive the former river trade. New difficulties were encountered, however, as traders found that the river-based market at Windsor had largely disappeared and they could no longer rely on being able to sell their cargo. With commerce having been progressively drawn away from Windsor wharf during the 1880s to early 1890s due to the silting up of the Hawkesbury channel and increasing reliance on the railway and downriver steam ship companies, speculative produce buyers from Parramatta and surrounding regions no longer travelled to Windsor and local transactions offered only limited trade.²²²

²¹⁵ Manning, A. 24 August 1895. “Tenders. Windsor Borough Council.” *The Windsor and Richmond Gazette*. p. 12.

²¹⁶ “Social.” 21 September 1895. *The Windsor and Richmond Gazette*. p. 12.; “Notes on News.” 16 November 1895. *The Windsor and Richmond Gazette*. p. 9.

²¹⁷ “Windsor.” 18 January 1896. *The Sydney Mail and New South Wales Advertiser*. p. 149.

²¹⁸ “Topics of the Day.” 19 June 1897. *Windsor and Richmond Gazette*. p. 1.

²¹⁹ “The Acme.” 12 November 1892. *Windsor and Richmond Gazette*. p. 10.; “News in Brief.” 11 February 1893. *The Windsor and Richmond Gazette*. p. 3.; “Week to Week.” 29 April 1899. *The Windsor and Richmond Gazette*. p. 3.; “Current News.” 14 November 1902. *Newcastle Morning Herald and Miners’ Advocate*. p. 4. “Colo.” 28 November 1902. *The Hawkesbury Herald*. p. 12.; “A Week’s Cruise on the Daisy.” 17 April 1903. *The Hawkesbury Herald*. p. 6. Steele, J. Rev. 4 September 1914.

²²⁰ Anon 1902. “River boat Daisy at Windsor Wharf, Hawkesbury River NSW.” Hawkesbury City Council Library, Image 000652.

²²¹ Anon ca. 1900s. “S. S. Daisy at Ben Herps wharf near Leets Vale, Hawkesbury River NSW.” Hawkesbury City Council Library, Image 000703.

²²² “The River Trade. What a River Boatman Says.” 2 September 1893. *The Windsor and Richmond Gazette*. p. 6.

Navigation conditions in the upper Hawkesbury River worsened further still throughout the late 1890s to early 1900s, due to years of severe drought across NSW – the “Federation Drought” of 1895 to 1902 – that resulted in lower river levels, reduced flows and increased riverbed siltation. Not long after the turn of the 20th century, Windsor wharf became almost entirely deserted.²²³

[1903] *The shoals in Windsor Reach are worse now than ever known before, and navigation to Windsor wharf is quite out of the question. Vessels even of the lightest draught cannot get nearer than a quarter of a mile away.*²²⁴

A temporary resurgence of local river traffic at Windsor wharf occurred throughout the late 1910s to 1920s, owing to the Hawkesbury channel being somewhat passable again and increasing freight costs being charged by downriver steamer companies. Several fruit growers from the Colo River, Ebenezer, Wilberforce and Freeman’s Reach began transporting crates of produce – primarily citrus and stone fruits – to Windsor wharf by small river craft, which were then carted to the railway for transport to Sydney markets.²²⁵ A handful of river traders also started using Windsor wharf again, with small oil engine motor launches such as *Almedia* and *Killara* (Figure 59 and Figure 60) carrying domestic goods and supplies from Windsor stores to riverside communities along Cattai, Sackville, Leets Vale and the Colo River and Macdonald Rivers.²²⁶



Figure 59: Motor launch *Almedia* ca. 1920s.²²⁷

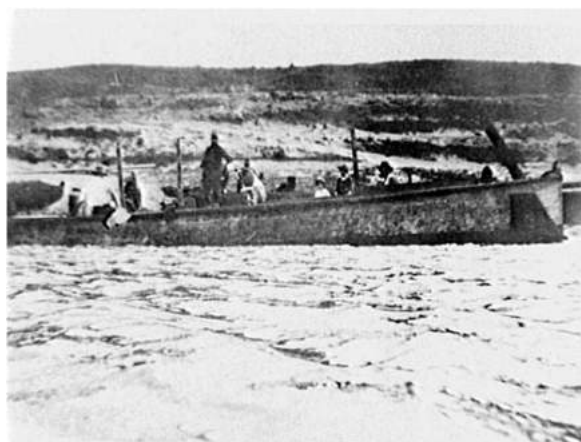


Figure 60: Motor launch *Killara* ca. 1920s.²²⁸

As in previous decades, however, navigation to Windsor wharf continued to be difficult and most vessels could only reach the wharf during very high tides. To make matters worse, both the wharf and the road leading to it had fallen into disrepair by the 1920s, adding further challenges to loading and unloading of goods. Public appeals were again made to Windsor Municipal Council and the NSW Government by river traders and the Wilberforce Fruit Growers Association – this time for both dredging of the Hawkesbury River channel and reconstruction of the Windsor wharf. Yet again, neither Council nor State Government were willing to allocate funding to improve navigation and river facilities at Windsor and within a few years the commercial use of the wharf had ceased.²²⁹

In the late 1920s, the increasing development and popularity of motorboats saw the emergence of a new class of recreational river users. In 1932, an Upper Hawkesbury Motor Boat Club was established²³⁰ and in 1933, under agreement with the Windsor Municipal Council, the Club became Public Trustees of the Windsor wharf and the adjacent reserve (see Section 3.2).

²²³ “Drought on the Hawkesbury.” 16 April 1902. *The Shoalhaven Telegraph*. p. 7.; Purtell, J. (1995)

²²⁴ “From Week to Week.” 3 January 1903. *Windsor and Richmond Gazette*. p. 3.

²²⁵ “Week to Week.” 2 January 1920. *Windsor and Richmond Gazette*. p. 4.; “Windsor Municipal Council.” 20 August 1920. *Windsor and Richmond Gazette*. p. 9.; “Windsor Wharf. Suggested Improvements.” 15th October 1920. *The Windsor and Richmond Gazette*. p. 2.

²²⁶ Anon 18 November 1921 “Week to Week.” *Windsor and Richmond Gazette*. p. 4.; Anon 10 April 1924 “News from Down the River.” *The Hawkesbury Herald*. p. 1. Boon, P. I. 2017.

²²⁷ Anon ca. 1920s. “The ‘Almedia’ river boat owned by Mr. W. J. Singleton.” Hawkesbury Library, Image 000732.

²²⁸ Anon ca. 1920s. “‘Killara’ after salvage at Windsor wharf.” Hawkesbury Library, Image 000743.

²²⁹ Boon, P. I. (2017); “Windsor Municipal Council.” 17 September 1920. *Windsor and Richmond Gazette*. p. 3.; “Windsor Wharf. Suggested Improvements.” 15th October 1920. *The Windsor and Richmond Gazette*. p. 2.; “Windsor Municipal Council.” 23 December 1921. *Windsor and Richmond Gazette*. p. 2.; “‘Hard-Face’ Returns.” 27 October 1922. *Windsor and Richmond Gazette*. p. 16.; “Weir is Doomed.” 22 February 1924. *The Burrowa News*. p.7.; “Week to Week.” 24 July 1925. *Windsor and Richmond Gazette*. p. 4.

²³⁰ “Motor Boat Club.” 28 October 1932. *Windsor and Richmond Gazette*. p. 3

Throughout the 1930s to 1950s, the Windsor wharf reserve served as club premises for the Upper Hawkesbury Motor Boat Club and the wharf was used in numerous motor boat race meetings, regattas, carnivals, festivals and river excursions (see Figure 61 to Figure 63).²³¹ By the late 1940s, the wharf itself had almost entirely disintegrated (see Section 3.2), however, the river bank along the reserve in the location of the former wharf continued to be used to launch motor boats and transfer passengers, as well as providing a riverside vantage point for event participants and spectators.



Figure 61: Windsor wharf during Hawkesbury River motorboat regatta, 1936. ²³²



Figure 62: Motorboat carnival at Windsor wharf reserve in the 1950s. ²³³



Figure 63: Motorboat regatta at Windsor wharf reserve, 1949. ²³⁴

In 1955, the Hawkesbury riverside reserve was re-gazetted as a public recreation and wharfage reserve under the trusteeship of the Windsor Municipal Council, and area was opened up for wider use by the general public.²³⁵ In the mid to late 1960s, a small boat landing stage was constructed in the location of the former wharf (See Section 3.2), which for the following two decades served river cruise and passenger ferries operators and private recreational boat users. In the mid to late 1980s, however, a new wharf was constructed further downstream and the landing stage was removed – and with that, after approximately one hundred and eighty years, the site of the former Windsor wharf finally ceased to be a focus point of river activities.

²³¹ "Week to Week." 15 March 1935. *The Windsor and Richmond Gazette*. p. 4.; "Motor Boat Racing." 12 February 1937. *Windsor and Richmond Gazette*. p. 3.; "Week to Week." 17 November 1939. *The Windsor and Richmond Gazette*. p. 4.; "Motor Boat Races on the Hawkesbury." 13 February 1949. *The Truth*. p. 30.; "U.H.M.B.C. Re-Formed." 28 March 1945. *Windsor and Richmond Gazette*. p. 3.; "Boat Club News." 22 September 1948. *Windsor and Richmond Gazette*. p. 10.

²³² Morley, L. M. 1936 "The 'MV Surprise' on the Hawkesbury River at Windsor Wharf 1936." Hawkesbury City Council Library, Image 000738.

²³³ Anon ca. early 1950s. "Windsor Wharf in the 1950s." Hawkesbury Council Library, Image 000665.

²³⁴ Searle, E. W. 1949. "Motor boat regatta, Windsor, Hawkesbury River, New South Wales, 1949." National Library of Australia, PIC P838/479a.

²³⁵ "New Dedication of Wharf Area." 10 August 1955. *Windsor and Richmond Gazette*. p. 10.; "Cautious as Trustee of Wharf Area." 28 September 1955. *Windsor and Richmond Gazette*. p. 8.

4 Archaeological Research Design

The research design and methodology for the underwater excavation and riverbank survey has been prepared in the following manner:

- An appraisal of previous maritime archaeological excavation work that has been undertaken in Australia on wharf or jetty sites;
- Appraisal of the research questions and methodologies that were asked on these projects and if the methodology was sufficiently robust to answer the research questions;
- Research questions that should be asked for the former Windsor Wharf site.

4.1 Previous Maritime Archaeological Excavations of Wharf Sites in Australia

4.1.1 Long Jetty, Western Australia

The Western Australian Maritime Museum (now the Department of Maritime Archaeology, Western Australian Museum) undertook a maritime archaeological excavation at the location of the former Long Jetty, Bathurst Bay (Fremantle), Western Australia in the 1984.²³⁶ The jetty was Fremantle's first sea jetty built in 1831 and was the focal point for trade and communications for the Western Australian Colony. A maritime archaeological excavation was conducted as the site was to be redeveloped for a new Marina. The archaeological excavation had the opportunity to examine Fremantle's early economic and social development.

The excavation had three objectives:

- Map the remaining jetty structure, ascertain the spread of material and gauge the extent to which it would be covered or disturbed by the development;
- Raise, catalogue, conserve and display a representative sample of material from the threatened area for research and educational purposes; and,
- Verify the heritage value of the Long Jetty with a view to gaining protection for the site, possibly under the Western Australian *Maritime Archaeology Act 1973*.

The excavation was initially conducted with a water dredge, but this was considered too slow considering the area and depth to be excavated. Propeller wash was used instead to expose large areas in a short time. Holes were created at 5 m intervals, with divers monitoring the holes and relaying instructions on strength and direction to the boat skipper. An airlift was used in areas too shallow for propeller wash and in areas inaccessible for the boat. Seventy holes were created in total. The locations of the trenches were recorded by triangulating their location from the remaining extant piles from the original jetty that were already mapped. Only a sample of the site was excavated, approximately 7,500 m² out of 50,000m², (ca. 14%) however over 1,140 artefacts were recovered, recorded, catalogued, and conserved for display.

The Western Australian Maritime Museum was limited by time constraints, previous looting of the site and low visibility conditions, all of which did not allow for stratigraphic analysis of the sediment and archaeological deposits or slower controlled method of excavation. However, the excavation work and artefacts recovered were sufficient to assess the various economic, social, and cultural activities associated with the site. The vast majority of material relates to ships and shipping activities, with a prevalence of alcoholic bottles. There were also artefacts relating to bay whaling, personal belongings, coins, and spent ammunition.

As a site, it consisted of a collection of randomly located material over a vast area, lost over a 90 year time span. Stratigraphy was less evident and had been dramatically altered by environmental and human activities. Despite this, a pattern emerged showing greater concentrations of artefacts under and in the area 0-10 m either side of the jetty and again in the area 15-25 m either side of the jetty. This indicates that the material was either dropped from the

²³⁶ Garratt, Dena, 1994, *The Long Jetty Excavation, 14 July to 20 Aug, 1984 – A Report on the Long Jetty Excavation*.

side of moored vessels or from the jetty itself, with those in the outer corridor having a greater association with shipping and less with the jetty.

4.1.2 Albany Jetty, Western Australia

The Western Australian Maritime Museum (now the Department of Maritime Archaeology, Western Australian Museum) also undertook an underwater excavation on the site of the former Albany Town Jetty.²³⁷ The jetty formed Western Australia's international port and was used extensively from the mid-19th century until the 1880s. The site was under threat from a proposed marine upgrade, and the Western Australian Maritime Museum were engaged to undertake a salvage maritime archaeological excavation and recording of the former jetty site.

The project was to assess the impact that the proposed new marina would have on the archaeological remains of the former jetty. The aims of the investigations were to determine if artefacts were present in and around the location of the previous jetty, if there was horizontal patterning of the artefacts in and around the different locations of the jetty, and whether there was evidence for stratigraphic deposits at the site. The information collected could then be used to suggest strategies for minimising the impact of the proposed marina development.

The excavation was conducted with the use of an underwater dredge with divers working using surface supplied breathing equipment. A series of 2 m by 2 m test trenches were excavated using a premade metal square grid frame to mark the boundaries of the excavation area. The resulting excavation area was a conical pit roughly 1.5 to 2 m deep.

In total, 125 artefacts were recovered from the excavation work, with a horizontal distribution of the artefacts present underneath and immediately adjacent to the jetty and another deposit present 10 m away from the edge of the jetty. The lack of personal and alcoholic drinking containers that were recovered from the site suggested the jetty was not used for recreational purposes like other jetties were. The excavation methodology also allowed for the recording of stratigraphic sediment deposits, though the presence of a shell deposit layer across the site below the seabed suggested surge and wave turbulence constantly resorted the accumulated deposits according to density, shape, and surface area rather than by chronological deposition.

4.1.3 Holdfast Bay Jetty, South Australia

The Society for Underwater Historical Research (now the South Australian Archaeological Society) in South Australia undertook a maritime archaeological excavation in several locations directly under and immediately around the location of the former jetty built at Holdfast Bay.²³⁸ The project was funded by a research grant for the excavation and a permanent interpretation display at the Glenelg Museum.

The project targeted excavation to beneath former activity areas associated with the former jetty, including underneath the café and aquarium built on the jetty itself. Ten 1 x 2 m trenches were gridded out on the site with smaller 2 m units marked out with star pickets within each trench. The location of these trenches was surveyed with the use of a Total Station. The excavation aimed to answer several research questions, including:

- Where artefacts were distributed on the seabed;
- Whether the artefact distribution was similar to that recorded at Long Jetty and Albany Bay Jetty;
- Whether there was evidence of artefact stratification within the archaeological deposits; and,
- Whether there was evidence for the vertical movement and patterning of artefacts within the archaeological deposits.

²³⁷ Garratt, D. et al., 1995, An Assessment of the Submerged Archaeological Remains at the Albany Town Jetty.

²³⁸ Lewczak, C. and Richards, N. 2007, Artefact patterning at the Holdfast Bay jetty: Part 1, a consideration of non-cultural site formation factors, in *AIMA 2001 Vol.31*; Lewczak, C. and Richards, N., 2007, Artefact patterning at the Holdfast Bay jetty: Part 2, an interpretation of the archaeological deposit, in *AIMA 2001 Vol.31*. Lewczak, C. 2000, *Where Things May Lie: An Investigation into Artefact Patterning from Within a Coastal Marine Deposit*. Honours thesis, Flinders University, South Australia.

The excavation was conducted with the use of a water dredge with divers working systematically through each 2 x 2 m trench. Visibility ranged from one to five metres and allowed for the divers to stop excavating when artefacts were uncovered. It also allowed for recording the location of the artefacts through triangulation, using four measuring tapes to record the location of the artefact in three dimensions.

All artefacts collected were catalogued, recorded, and photographed, along with their location information. This allowed for the artefacts to be mapped to their three dimensional locations within each trench, enabling analysis of their distribution including factors such as material type, weight and density. The archaeological excavation was able to answer the research questions asked of the site due to accurate, three dimensional recording. It found that the distribution of artefacts underneath and immediately below the jetty matched the predictive modelling that was seen on the Long Jetty and Albany Bay Jetty projects for the location of artefacts located immediately below the jetty structure, and that there is potential for the movement of artefacts within marine sediment deposits based on the density, surface area and/or shape of the artefact.

4.1.4 Heart of the River excavations, Bremer River, Ipswich, Queensland

A cultural heritage study along the Bremer River in Ipswich, Queensland, identified a number of mid-19th century wharves and associated storehouses on the banks of the river within the boundary of the project area. The site continued to be used for commercial shipping and ferry activities well into the 20th century. Three wharves were located within the study area including the J and G Harris wharf, the Australian Steam Navigation Company's wharf, and the Railway wharf.

A maritime archaeological survey was carried out in January 2006 by Oceania Maritime Consultants in the vicinity of the three former wharves. The results of the preliminary survey found that there were archaeological remains present on the site of the former wharves that were considered to yield information relating to the understanding of Queensland's history, particularly the early development of Ipswich, the Darling Downs and Brisbane Valley.²³⁹

Cosmos Archaeology was commissioned to undertake a maritime archaeological investigation in April 2006 to inform a proposed riverbank redevelopment along the Bremer River in Ipswich, Queensland,²⁴⁰ including an underwater survey in the location of the proposed pile locations. This survey identified rubble sandstone across the riverbed, as well as artefact remains. The rubble sandstone was located below a shallow deposit of silt across the site, extending out from the base of the bank. The original function of the rock rubble on the site was unknown however, it was speculated that the source could have been from a formal retaining wall or fill material that had collapsed and deflated across the site, or it could have been deliberately cast into the river and used as ballast between the piles. The size of the rocks is such that they can be lifted by one or two individuals. The assessment argues the rock is likely to be associated with ballasting for former wharves as similar material was not observed along the riverbank in the vicinity of the more recent wharf sites.

Hand fanning was employed on the site to remove silt that had accumulated on top and within the sandstone rubble layer. Artefacts were recorded as being present on the site, including items ranging from copper alloy buttons to iron tie rods, as well as personal and structural remains. There was a large number of smaller artefacts present in concretions present on the rock ballast; including personal items such as a copper alloy zipper tag and a copper alloy broach pin. These items were found at one pile location; however, the results of the underwater survey stipulated that further personal material may be located in the study area if more accurate excavation techniques are employed.

Heavier structural material recorded on the site included handmade and machine pressed bricks, lead flashing, roofing slate and square shanked nails. This material was attributed to either dropped cargo, remains of demolished nearby buildings or mixed fill. Two wrought iron rods, one large with an eyelet and the other smaller, were also recovered and believed to have been structural remains of the former wharf.

²³⁹ **Oceania Maritime Consultants, January 2006** *A Preliminary Survey of Three Historic Wharf Sites at Town Reach, Bremer River, Ipswich*: p16

²⁴⁰ **Cosmos Archaeology June 2006**, River Heart Phase 1: Maritime Archaeological Investigation.

The artefacts recovered from the site were not associated with a specific date range – analysis identified a range from prior to 1850 through to the present. No stratification was found within the deposits on the site, and the investigation could not identify if material was directly deposited onto the site, was redeposited by wave action from further upstream or originated from land.²⁴¹

Analysis of the site formation processes for the study area attributed the collection of artefacts to the presence of the rock rubble field. The Bremer River has flooded in its history and is known to become a fast flowing river. Artefacts were able to fall between the rocks and be held in place, even during times of floods or during other strong currents. The archaeological investigation also assumed that, with the presence of artefacts on the surface between the rock rubble, there is the potential for artefacts to be present within the rock rubble matrix.

The archaeological investigation also considered the date that the rock rubble was deposited on site as this had bearing on the archaeological potential for the site. If the rubble was deposited during the time of the earliest wharf on site, artefacts from that early period were considered likely to be present and include artefacts from vessels docked at the wharf as well as items dropped from the wharf. If the rubble was deposited at a later date, such as from the collapse of a retaining wall, then only artefacts relating from that time, or later, would be captured by the rubble.²⁴²

4.1.5 Summary of the conduct and findings of maritime excavations of wharf sites in Australia

The excavations undertaken by the Western Australian Maritime Museum (now the Department of Maritime Archaeology, Western Australian Museum) at Long Jetty and Albany Bay Jetty revealed the artefact patterning that is present in and around sites such as wharves and jetties. The excavations show that concentrations of artefacts are present immediately underneath and adjacent to the structure, as well as 10 m out and away from the structure. The distance that artefacts are present further out from the structure is representative of the width of the vessels docking at the jetties, as this represents deposition from the side of the vessels.

Methodologies employed on both excavations was quite different. The Long Jetty excavation used propeller wash from a boat. The propeller wash excavation method would not be suited to the excavation at Windsor as sediments and any artefacts within them would be scattered. Low to zero visibility diving conditions at Windsor would not enable the collection of scattered artefacts, as was conducted at Long Jetty, and the artefacts would be lost. The excavation methodology used at Albany Bay Jetty employed a 2 x 2 m gridded system and excavation through the use of a water dredge. This excavation was able to record artefacts when they were uncovered, as well as accurately recording the change in sediment profiles. This was successful, in part, to more favourable visibility conditions that were present on the site, as well as to controlled excavation method used.

The excavation undertaken at Holdfast Bay set out a grid system over the activity areas underneath and immediately adjacent to the jetty. The excavation took advantage of better underwater visibility that was present to record artefacts and sediment deposits as they were excavated. This allowed for three dimensional recording techniques to be used on the site. Gridding of the site allowed for more accurate understanding of where artefacts were uncovered and the context of activities they were likely associated with. Use of the water dredge as a means for excavation allowed for a more controlled excavation. This technique would be well suited for use on the site at Windsor as gridding of the trenches and controlled excavation would allow for very specific spatial information to be recorded, including depth and location, despite the zero visibility diving conditions. However, it would not be possible to use the same three dimensional recording techniques for each artefact on this site due to the limited visibility expected in the Hawkesbury River.

The survey and limited excavation at Bremer River in Ipswich were conducted on an archaeological site similar to that at Windsor. The excavation used hand fanning to assess the potential for maritime archaeological remains, including artefacts, on top and within the sandstone rubble remains. The techniques were successful in determining the presence of smaller personal

²⁴¹ Op. Cit., Cosmos Archaeology, 2006: p31.

²⁴² Op. Cit., **Cosmos Archaeology, 2006: p31.**

artefacts as well as larger structural remains; however, this technique would be too slow to be used on a large site such as at Windsor. Hand fanning with use of an induction dredge would allow for the faster excavation of the deposits. However, at Windsor, artefacts themselves will only be able to be recorded if they were brought up to the surface, due to the anticipated very poor visibility conditions.

4.2 Maritime archaeological research questions

The following are the MATR-MARD-DSS research design questions. The questions have been broken down into three categories;

- The former Windsor Wharf as part of a local and greater regional trade network;
- The former Windsor Wharf as the nexus between river transportation and the settlement at Windsor, and;
- The construction of the various forms of the former Windsor Wharf.

A detailed response to each of the categories and their site specific questions is included in Section 9 of this report.

4.2.1 Maritime infrastructure sites as part of a local and greater regional trade network

The construction of maritime infrastructure, initially a jetty and later a wharf, at Windsor was important for the transport of goods and people between the town and Port Jackson, as well as the settlements up and down the river. This is evidenced by how quickly the first jetty was constructed – within one year of the establishment of the formal settlement in 1795. Vessels coming into Windsor were carrying cargo for the satellite settlement as well as for exporting goods.

Research Questions

- *Is there any ballast present which is not of local origin?* (See 9.1)
- *Can non-local ballast be provenanced?* (See Section 9.2)
- *What can the provenance of the ballast tell us about the trade networks of the port of Windsor?* (See Section 9.3)

4.2.2 The former Windsor Wharf as a nexus between the river transport route and the settlement at Windsor

Many activities occur through the use life of a wharf. The wharves at Windsor were used both to import goods to the farming settlement as well as to export goods back to the settlement at Port Jackson and later around the mouth of the Hawkesbury River. The presence and importance of this maritime infrastructure is directly linked to the settlement, growth, and development at Windsor. Other activities also take advantage of the presence of a wharf in the local area, such as recreational uses including fishing on a more local level. Activities around a wharf also change as the primary role of the wharf changes or ceases.

Research Questions

- *What types of activities were occurring at the site of the former Windsor Wharf?* (See Section 9.4)
- *Was there a change in the types of activities that were being undertaken on the former Windsor Wharf over time?* (See Section 9.5)

4.2.3 The construction of the former Windsor Wharf ca. 1814 to 1950s

There is limited information available relating to the construction methods of maritime infrastructure in the early settlement of Australia. Information that can be found is incomplete and relies on descriptions or, in the case of Windsor, tender documents, which mention the presence of a wharf or jetty. Information relating to how the structure was built, including technique, material, fastenings, and piling works, is not known. The archaeological record has the potential

to provide answers to these questions. Evidence of repairs and possible additions may also be found from investigating remains associated with the wharves built at Windsor.

The presence of structural remains of the early 19th century wharf demonstrates a considerable archaeological potential to show how the earliest versions of the second wharf were constructed. Contemporary archaeological evidence of similar maritime structures from NSW and Tasmania, such as Squires Jetty at Putney,²⁴³ Brick Point at Port Arthur,²⁴⁴ and the steamer jetty at Saltwater River on the Tasman Peninsula,²⁴⁵ are of jetties. Such linear structures projected out from the bank/shore and their width was dictated by the uniform length of the bed logs.

In the case of a wharf, the structure runs along the bank, and it could be assumed that the bed logs would be laid perpendicular to the bank and the width of the wharf essentially influenced by the length of the available bed logs. The discovery during the 2016 investigations of bed logs laid parallel to the bank suggests a more complicated structure as it is very unlikely that a single log could span the length of the early wharf, which was reportedly from 20 m to 23 m long.

Research Questions

- *How was the former Windsor Wharf ca. 1814 to 1950s constructed and how was it modified and altered throughout the 19th century? (See Section 9.6)*
- *What is the extent of the remains of the earlier phases of the former Windsor Wharf? (See Section 9.7)*
- *What was the quality of the materials used in the wharf? Was copper sheathing used? What were the spacing of piles and the size and standard of fastenings? Does this say something about the availability of materials or the level of importance placed on the wharf by the authorities, through comparison with other contemporary wharf sites? (See Section 9.8)*
- *What can it tell us about the engineering skills available to the colony within the first few decades of European settlement? (See Section 9.9)*
- *Is there any evidence of early ship construction? (See Section 9.10)*
- *What do the artefacts associated with the site tell us about the use of the wharf and commercial contacts over time? (See Section 9.11)*

²⁴³ **Cosmos Archaeology, March 2015**, Halvorsen's Boat Building Complex. Maritime Archaeological Assessment.

²⁴⁴ **Coroneos, C. 2004**, 'The Maritime History and Archaeology of Port Arthur'. In *A Harbour Large To Admit a Whole Fleet*: 92 and **Cosmos Archaeology June 2000** *Port Arthur Maritime Archaeological Survey: Report on the 2000 field season*: 109 and Figure 33

²⁴⁵ **Jackman, Greg, 2004** 'Foetal Shore: The sea as critical medium in the past and future of the Tasman Peninsula convict system'. In *A Harbour Large To Admit a Whole Fleet*. 29

5 Conduct of Maritime Archaeological Excavation and Surveys

5.1 Summary

The maritime archaeological excavation was carried out between 2nd July to 6th September 2018. The investigation took place over six days a week for the duration of the excavation. Cataloguing and photographing artefacts from the excavation continued on until the 8th November 2018.

For the excavation nine divers undertook 112 separate dives amounting to 287 hours underwater, for an average of around 2.5 hours for each dive. Three 'deep' and six shallow trenches were excavated amounting to an excavation area of 74 square metres with 64 m³ of material – mostly rock rubble – moved. Also recorded were 44 extant timber and non-timber features in the intertidal zone within the study area that were associated with the former Windsor Wharf.

In addition, the monitoring of the covering of the extant timber wharf features was undertaken on the 3rd October 2018. The inspection of the scour protection, post-installation, took place between the 18th and 22nd August 2019. See Section 12 for description of the conduct and findings of the monitoring.

The monitoring on the north bank during the installation of the scour protection and the recording of the finds made, including the wrecks UHRW02 to 04 will be described in another report.²⁴⁶

5.2 Factors affecting excavation methodology

The underwater excavation and above water survey approach for this investigation has taken the following critical factors into account:

Underwater Excavations

- 1) Water visibility on the site of the former Windsor Wharf varied from 200 mm to zero mm. Water clarity depends on rainfall in the previous days, tide, and possible seasonal factors. The turbidity of the water at this location on the Hawkesbury River can provide the diver with the sensation of light (indicating which way is up) and nothing else if visibility is zero. Though the test excavation had 200 mm of visibility, this level of visibility was not relied on for a comprehensive excavation. At times, the excavation was conducted solely by touch. This of course limited what can be achieved when compared to a terrestrial excavation. It also means only one diver at a time could effectively work in a trench to avoid confusion and disturbance. Crucial to the success of the excavation programme was the use of trained, experienced, and well-briefed divers as well as constant communication between the diver and the surface using hard wire communications.
- 2) The water depth of less than 6 m, was shallow enough to avoid concerns of nitrogen build-up and the need for excessive decompression stops, meaning that a diver could, theoretically, stay underwater for a whole day with only short breaks. Such a regimen over a period of weeks would have been fatiguing and, in any case, the threat of hyperthermia would limit a diver to working underwater for between 2 to 4 hours a day. This means that a trench had more than one diver working in separate shifts on it each day. Further to what was stated above, divers were well briefed as to the objectives and methods of the excavation, as well as being briefed by the preceding diver before commencing their shift.
- 3) From the test excavation it appeared that there may be chronological cultural contexts present that are associated with the late 18th century. This is not commonly encountered in a submerged environment within an Australian context with respect to

²⁴⁶ Cosmos Archaeology Pty Ltd, April 2021, *Windsor Bridge Replacement Project – Windsor boat wrecks*. Prepared for Transport for NSW.

archaeological excavations. The excavation methodology was developed to attempt to isolate these contexts in what is a relatively rare opportunity.

- 4) As the excavation took place in zero visibility, the diver had limited ability to recover artefacts on the riverbed. As such, all material, including archaeological material, was brought up to the working platform via the induction dredge and sieved. This is not a common maritime archaeological method, and as excavations in zero visibility are uncommon within Australia, it was thought this was the best method for the conditions.
- 5) The rock armour placed over the site in recent years presented a challenge for the underwater archaeological investigation of the site. Potentially up to 2 m thick close to the riverbank and comprising of boulders up to 750 mm across, exposing the remains of the former Windsor Wharf would be a laborious task, possibly involving a mechanical excavator or a small crane (Figure 64). There was also concern that bulk excavation would potentially severely impact the archaeological remains. However, the majority of the rock armour was able to be removed from the area by the divers, through either rolling it away or stacking the rocks in crates and moving them from the area. The trenches were not excavated deep enough that extra shoring of the walls was required. In two cases, excavation ceased due to safety concerns, but no wharf remains had been found up to that point so shoring to continue the excavation was not considered necessary.



Figure 64: Gabion baskets shoring up the riverbank and rock armour in the shallow water laid down for stabilisation.

Above Water Survey

- 1) Since the previous inspection in 2016, the overgrown vegetation within the survey area between the old bridge and the public wharf had been cut back. The remaining vegetation consisted of low grass and bushes providing greater access to the wharf remains. Some overhanging vegetation where the water meets the riverbank did remain (Figure 65).



Figure 65: Overhanging vegetation and the river water level covering the riverbank wharf features. Water and deck beam visible centre of image, further wharf remains obscured by vegetation at bottom centre of image. (Image taken 16th July 2018, Cosmos Archaeology).

- 2) The Gabion basket wall installed prior to 2008 means the slope near the old bridge is very steep and the gradient lessens downstream towards the public wharf. This steep slope limited the amount of equipment that could be carried to the site (Figure 66). Basic recording equipment including drawing slates, handheld cameras and scale poles were used for the survey.



Figure 66: The steep slope and gradient of the riverbank. Top of gabion baskets are indicated with red arrows. Image taken 16th July 2018, Cosmos Archaeology).

- 3) At high tide the majority of the riverbank wharf features were largely underwater. All inspections had to be conducted at low tide so as to ensure access to as many of the cultural features as possible. This particularly applied to the cut-off piles that protruded from the riverbed for only a short distance.
- 4) The riverbed at the base of the bank consisted of silt with occasional rock rubble. There was also modern litter such as shopping trolleys at varying locations within the survey area

(Figure 67). These larger items made accessing details of wharf features difficult. The river mud decreased any water visibility as soon as it was touched and made detailed observations of cultural features underwater difficult. As a result, underwater features of the riverbank wharf could not be recorded.



Figure 67: Modern litter, such as shopping trolleys, present at various locations within the survey area. (Image taken 16th July 2018, Cosmos Archaeology).

5.3 Excavation approach

The excavation approach followed what was described in Section 12.3 of the MATR-MARD-DSS with minor variations. The excavation was carried out by divers on Surface Supplied Breathing Apparatus (SSBA). Survey work was undertaken on occasion by divers in SCUBA depending on the nature of the task. The divers were tethered to the dive boat and able to communicate via communication lines with the crew on the working platform at all times (Figure 68).

The primary means of excavation was by the use of a diver-operated water induction dredge (**Error! Reference source not found.**). The sediments were hand-fanned into the dredge, and the material collected pumped onto the working platform (see Section 5.5 for more detail on vessels).

The working platform was a dumb barge of 8,500 mm x 3,750 mm with a collection well on board, whereby the sediments and other material can be sent onto and passed through a 3.5 mm mesh sieve set in place over the well (Figure 70). Artefacts were collected from the sieve and sorted. A silt curtain lined the inside of the well to prevent turbidity around the work area.



Figure 68: Divers kitting into SSBA equipment, one diver in water and the second diver above water standby



Figure 69: Set up of the sieve, silt curtain and dredge for sediment on the riverbed.



Figure 70: The collection well, whereby the sediments and other material can be sent onto and passed through a 3.5 mm mesh sieve set in place over the well. Artefacts were collected from the sieve and sorted. A silt curtain lined the inside of the well.

Larger materials, such as ballast samples, larger artefacts and loose structural remains associated with a wharf, were excavated first and then removed by hand (if possible) into crates that are then brought to the surface by the diver. Most of the ballast was manually placed in a crate and deposited in deeper water a few metres away from the excavation area.

The excavation approach was undertaken incorporating the following tasks:

- Task 1 – Site setup.
- Task 2 – Excavation around location of the proposed bridge piers.
- Task 3 – Excavation to locate further wharf bedlogs.
- Task 4 – Mapping of excavated area and exposed structural features.
- Task 5 – Backfilling and site clean-up.

Task 1 – 2nd to 7th July 2018

The maritime archaeological excavation commenced with an initial site setup that included:

- Setting up the marker buoys delineating the boundary of the work area;
- Setting up moorings for the work platform;
- Marking the location of each of the bridge piles using a total station;
- Undertaking a pre-disturbance inspection of the locations of Deep Trench 1, 2 and 3 (Figure 71). Involved removing vegetation, branches, and large bluestone rock armour across locations of Deep Trench 1, 2 and 3.

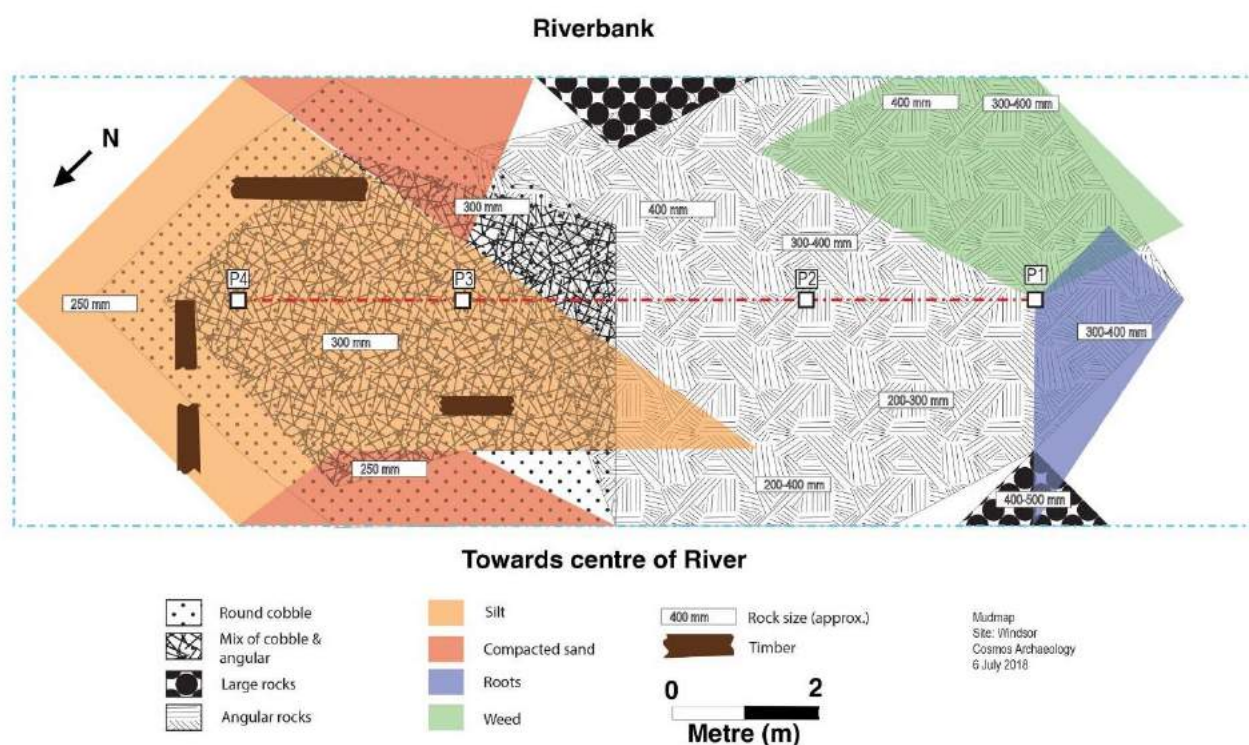


Figure 71: Pre-disturbance site plan. P1 to P4 indicates proposed location of bridge piles.

Task 2 – 9th July to 29th August 2018

This task involved excavation where the four bridge piles were to be placed. As the piles would destroy any archaeological information within the footprint of each pile, the aim of the excavation was to focus on recovering artefacts within stratigraphic contexts. In addition, exposed sections of bedlogs and other wharf features were to be recorded (see Figure 3).

The two downstream bridge pile locations were covered by Deep Trench 1 (DT1). The horizontal dimension of the trench was 12 square metres. The trench was orientated parallel to the riverbank and on a similar axis to timber logs exposed amongst the sediment and ballast (Figure 72). The long axis of the trench measured 5 m x 2 m. The trench was separated into 1 x 1 m squares, each square being made up of pvc tubing and each square was cable tied to each other to form a flexible structure. The corners of each square were secured by a star picket driven into the riverbed. During the course of the excavation of DT1 two squares, 7 and 12, were appended to the northern side of the trench so as to investigate further timbers that had been exposed along the edge of the trench (Figure 72). This trench was excavated down to bedrock, reaching in places around 1.6 m below the riverbed.

The two upstream bridge pile locations were covered by a 2 m x 2m sized trench - DT2 and DT3 (Figure 72). DT2 was the furthest trench upstream and DT3 was between DT1 and DT2. Both these trenches were formed by a 2 m x 2 m pvc grid anchored at each corner by star pickets. These trenches were excavated to depths of 2.3 m and 1.8 m below the riverbed respectively. For DT2, bedrock was not reached but the excavation was stopped over concerns of the stability of the trench and that no evidence of a former wharf had been encountered.

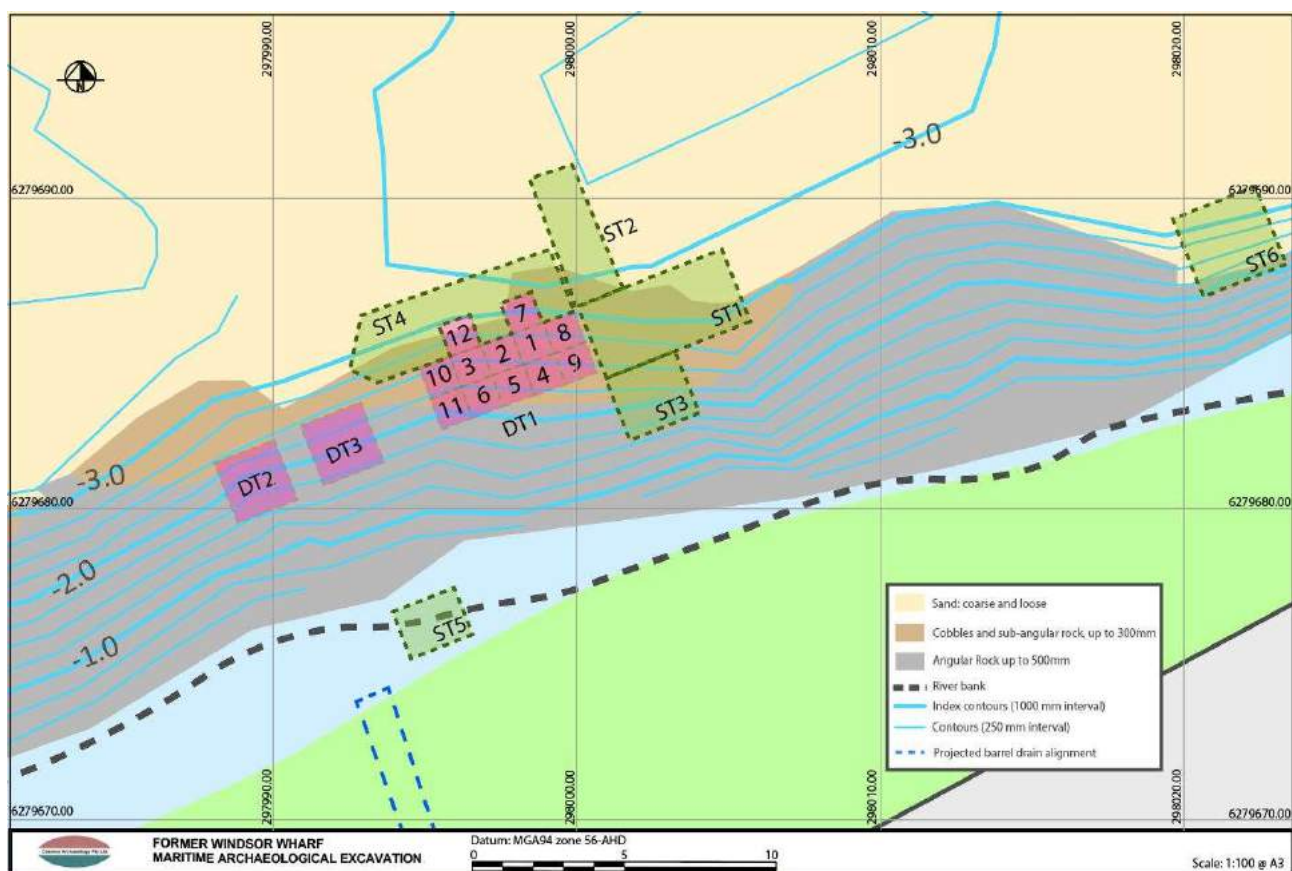


Figure 72: Maritime archaeological trench locations 2018.

Stage 3 – 16th August to 4th September 2018

The aim of the archaeological works in this task was to learn more about the wharf structure which would address the research questions dealing with the construction of the wharf such as the different phases of construction, the spacing of the bedlogs and how solidly the structures were built. For this purpose, the riverbed around DT1 was investigated and two trenches were excavated adjacent to the riverbank (ST5) and further downstream (ST6).

The investigation around DT1 primarily involved exposing timbers found during the excavation that extended beyond the confines of the trench. This entailed manually removing loose rubble above and adjacent to the timbers. These excavations were designated as Shallow Trenches (ST).

ST1 followed a number of timbers exposed in DT1 which extended downstream (Figure 72). The length of ST1 was dictated by the requirement to find the end of the timbers so as to see if they abutted, or were joined to, another timber which continued the alignment. Such a find would indicate that they were bedlogs associated with the earliest phases of the wharf. ST 1 was approximately 3 m wide and 5 m in length ceasing when the ends of two large timbers UWF05 and 09 were reached.

ST 2 and ST 3 were excavated for the purpose of uncovering parallel rows of bedlogs towards the riverbank and possibly towards the centre of the river (Figure 72). ST 2 also had the objective of locating the edge of the ballast formation, which was found up to 3.7 m from the southern edge of DT 1 (see Section 6.6). ST 3 was excavated towards the riverbank for up to 2 m before excavation ceased due to the large > 500 mm in size bluestone rock armour on the steepening bank making it unsafe to continue. No parallel alignments of bedlogs were uncovered.

ST 4 was excavated along the northern and western end of DT 1 for a distance of 3 m to the north exposing timbers (Figure 72). Excavation ceased when no further timbers were being found.

All the trenches noted above were also excavated using the water dredge. Artefacts from these shallow trenches were also recovered in the sieve with larger objects being placed in a milk crate for later recovery when each shallow trench was completed.

ST 5 was placed between the extant timber piles and waler AWF2 and AWF6 (Figure 72). The purpose of this trench was to determine the presence or absence of the early 19th century phases of the former Windsor Wharf. This is also the area where the 1815/16 brick barrel drain may have emptied into the river.²⁴⁷ Archaeological excavations carried out on land in January 2018 discovered the drain and were able to determine its alignment and where it would exit the riverbank. Two metres x 2 m in size the trench was initially recorded at low tide which allowed an archaeologist on land to excavate without visual limitation due to poor water quality. As the trench depth continued excavation was conducted by a diver using a water dredge and this was done at high tide. It was expected that the trench would bottom out relatively quickly onto large bluestone rock armour but this did not arise. The trench was excavated to a depth of around 2m below the riverbed surface before encountering bedrock.

To investigate whether there are remains of the former Windsor Wharf further downstream – a 3 m x 3 m shallow trench – ST 6 - was excavated to a depth of around 500 mm below the riverbed at a point midway between the proposed bridge piles and the current public wharf (Figure 72). This location was chosen as 19th century plans of the study area show the wharf was present in this approximate location.²⁴⁸ In this area the rock armour did not appear to extend far from the riverbank and it was thought that it might be possible with the excavation of the sandy riverbed and limited removal of rock armour to find the remains – ballast and/or bedlogs – of the former Windsor Wharf.

Task 4 – 16th and 23rd July, 18th, 26th and 31st August 2018

This task focused on the recording of structures exposed in Tasks 2 and 3. The expected zero to poor visibility provided challenges for mapping the excavation area. The mapping of the site revolved around the use of a total station with divers. The survey system established by Guy Hazell involved setting up a total station on shore tied into the nearest permanent survey mark and in line of sight with the site. Guy was aboard the work platform with a handheld unit with which he could operate the total station remotely. The ranging staff had a prism fixed to the top and was adjustable to accommodate the water depth at the time of the survey. Due to water depth and the requirement that the prism stay dry the survey was timed to coincide at low tide. As the staff was extended at times up to 4 m in length, an inflatable tube was affixed near to the top of the staff to keep it stable (Figure 73).

Each point was obtained with a diver positioning the base of the staff on the feature to be surveyed. Once in position, the diver notified the work boat who informed the surface swimmer who steadied the staff to vertical with the use of a spirit level. Once steady and vertical the surface swimmer signalled to Guy who then took the position and plotted it on a map (Figure 74).

²⁴⁷ Op. Cit., **AAJV, January 2018** : pg 89

²⁴⁸ Op. Cit., Cosmos Archaeology, November 2017: Figure 27

Underwater 3D photogrammetry was attempted by team members with experience in this technique however the water quality too poor for any effective surveying to be done using this technique.

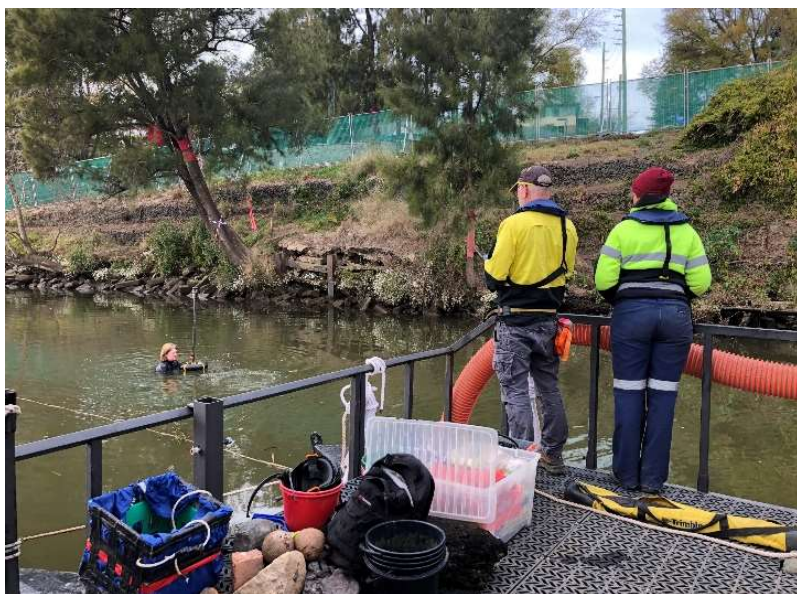


Figure 73 : Surveyor Guy Hazel, maritime archaeologist, Jane Mitchell and archaeologist, Caroline Wilby using a total station to position cultural features. (Image taken 16th July 2018 by Cosmos Archaeology)

The relative stability of the excavated walls of the trenches and the occasional water visibility of 200 m provided the opportunity for conventional section drawings to be drawn. The relative thickness of, and the alternating ballast layers of DT 1 allowed for drawings to be made of the two long sections (north and south) as well as the short east section. For the other two trenches DT2 and DT3 the walls were less stable and as such only the best preserved wall could be drawn. This was the west section for DT 2 and east section for DT3. The drawings are presented in Section 6 of the report. The sections of the shallow trenches – ST1 to 6 – were not drawn.

A multi-beam survey was undertaken of the excavation area towards the end of the field work on 26th August 2018. The conduct and findings of the survey are discussed in Section 5.7.

Task 5 – 4th to 6th September 2018

This last task involved backfilling the trenches with the ballast recovered during the excavation. The base of the trenches, including the shallow trenches were lined with shade cloth before they were backfilled with rock. Exposed timbers were also covered with shade cloth and rock. Samples were taken from select timbers prior to re-burial.

It had been originally proposed that the artefacts not selected for conservation or further analysis were to be re-buried on site. This was because it was anticipated that no more than 500 artefacts were to be recovered and so they could be photographed in detail and catalogued, from the photos, with the artefacts recovered from the terrestrial excavation.²⁴⁹ Prior to the commencement of the excavation it was decided to have the artefacts from the maritime archaeological excavation catalogued by Cosmos Archaeology (see Section 5.9). Artefact photography and cataloguing took place concurrently with the excavation however the recovery of nearly 4,000 artefacts meant that the cataloguing could not finished before the completion of the excavation. Given the number, variety, and interpretative quality of the artefacts it was also decided that they be temporarily stored after the excavation so that select artefacts could be incorporated into the interpretation display for the overall project.

²⁴⁹ Op. Cit., Cosmos Archaeology, November 2017: Section 12.7



Figure 74: Survey plan of the underwater excavation as of 19th August 2018.

5.4 Excavation techniques

The project blended conventional maritime archaeological excavation techniques with conventional terrestrial archaeological recording to best document the complex archaeological evidence of the former Windsor Wharf site. The approach taken for this excavation was based on the understanding that site formation was not too dissimilar to a land site where there are successive building phases (rock layers, bedlogs and piles) with intervening periods of abandonment (silt/sand layers). This is a distinct contrast from single event wreck sites where intra-site contexts were confined to internal spaces within a vessel such as holds or cabins. The relative stability afforded by the rock layers allowed trench walls to remain intact for a sufficient period of time to allow contexts to be identified, excavated, and recorded with relatively little mixing of the contexts compared to when digging in sand. See Section 7.3 for the discussion on the challenges in dating the identified contexts.

As this diachronic site was underwater, conventional terrestrial excavation techniques with trowel and pan was not possible. Instead, the conventional underwater excavation tool at relatively shallow depths – the water dredge – was used (Figure 75 and Figure 76). The intake of the dredge head was six inches in diameter and driven by a 3" submersible pump capable of delivering up to 2,200 litres per minute to the dredge head which was configured to create suction (known as the venturi effect).



Figure 75 : A typical example of a water dredge used for this Windsor Bridge Replacement Project. 1 – is the inlet hose which delivers water under pressure to the dredge head. 2 – the curved pipes which directs the water under pressure away from the intake – 3 – through which sediments and artefacts are drawn into. The excavated material is conveyed through the outlet hose – 4 – and carried in this case to the surface to be emptied onto a sieve (Figure 69 and Figure 77).

The approach taken for the excavation was for the nominated diver to describe, via helmet to surface hard wire communications, the riverbed surface prior to the commencement of excavation. DT1 was portioned in to twelve 1 mx 1 m squares and one square was excavated at any one time. The composition of the matrix was noted by the supervising archaeologist aboard the dive vessel and a context number was assigned to the matrix. The artefact registrar on the sieve was notified of the context number with sufficient time so as to prepare bags and write labels.



Figure 76: Diver in ST5 using the dredge. The trench is marked by a 1m x 1m square grid. The dredge removed sediments and smaller artefacts that were then recovered and recorded on the sieve. (Image source Cosmos Archaeology)



Figure 77: Detail of the outlet pipe emptying water, sediment and smaller artefacts onto the sieve that were then recovered and recorded. (Image source Cosmos Archaeology)

The diver commenced excavating with the water dredge. The dredge removed sediments and smaller artefacts. The variable visibility during excavation from zero to 200 mm meant that most artefacts excavated were recovered on the sieve. On the occasion when small artefacts could be seen they were sent up the dredge pipe as it was seen as a safer way to handle them than trying to place them in bags or small containers where they could be easily lost in the poor visibility (Figure 78). Larger artefacts were placed in a milk crate adjacent to the working area. It was bought up at the change of context.



Figure 78 : Rare occasion where water visibility allowed small objects to be photographed. Copper alloy pin bent into hook shape resting within a glass fragment next to bedlog UWF06

Excavation in rock rubble contexts required the rock to be removed from the trench by hand. This is because the rocks were either too large to fit up the dredge head or that smaller rocks would cause blockages along the length of the dredge hose. Even though the water depth ranged between 3 m and 5 m the power of a 33KVA electrical generator on the dive boat was only sufficient to draw sediments and rocks up to 150 mm in size onto the sieve. Furthermore Context 5 was composed of conglomeration of rock rubble that had to be broken by a hammer before removal.

The rocks were placed in a milk crate which was emptied down slope for a few metres away from the excavation area. A spoil heap was created over the course of the excavation between the trenches and the work platform. Larger rocks were carried by the diver down the slope. Select examples of rock which were considered to be part of a ballast layer were collected for analysis.

The diver was alert to changes in the matrix being excavated, for example from fine sand to gravel or when a rock layer became exposed. For most of the time this was only achievable by touch. The diver was also alert to assessing and measuring when possible, the thickness of the matrix. The diver was in constant communication with the supervising archaeologist on the surface describing what was seen or felt. All relevant communications were entered into an A4 hard bound minute book. Referred to as the 'log book', this book also contained such information as daily weather predictions and observations, personnel working on the day, daily objectives, start and finish times as well as any other incidents relating to the project (Figure 79 and Figure 80).

When the diver noted a change of matrix, it was described to the supervising archaeologist who had the role of deciding on whether the change warranted the assigning of a new context number. The diver then excavated the remainder of the existing context down to the matrix across the square (DT 1) or trench (DT2 and DT3). When the existing context had been fully excavated the diver then manipulated the dredge hose to the new square and or context, whilst holding the dredge head upright before commencing. This was done so as ensure as best as possible that the hose was clear of artefacts before the new square or context was started.

For the most part the excavation proceeded excavating one context at a time. In DT 1 where there were twelve 1 m x 1 m squares, a series of contexts may have been excavated in one square before moving to the adjacent square. This is because 1m x 1m squares after a depth of around 0.75 m was reached could not be effectively excavated by a diver using a water dredge because it was too small to manoeuvre.

The relative thickness of the layers and the difficulties relating to visibility and controlled excavation into rock rubble meant that spits were not often used during this excavation. The occasions where spits were used was mostly in the relatively thick sandy contexts in DT2 and DT3 where there appeared to be no change the composition of the matrices.

For this excavation there were no context sheets created. All context information was entered into the log books including sketches and other observations. When a log book was completed an index of all the contexts across the squares and trenches with page references was compiled for easy reference.

During the course of the excavation timber elements were exposed. These elements were a labelled as 'Features' and for the purposes of this report have been labelled as Under Water Features – UWF – to differentiate the features identified in the above water survey.

Figure 79: An example of log book notes from 26th July 2018.

Figure 80: An example of log book notes from 7th August 2018.

5.5 Work site configuration

The work site for the underwater excavation revolved around four vessels each having their own distinct interconnecting role (Figure 81).

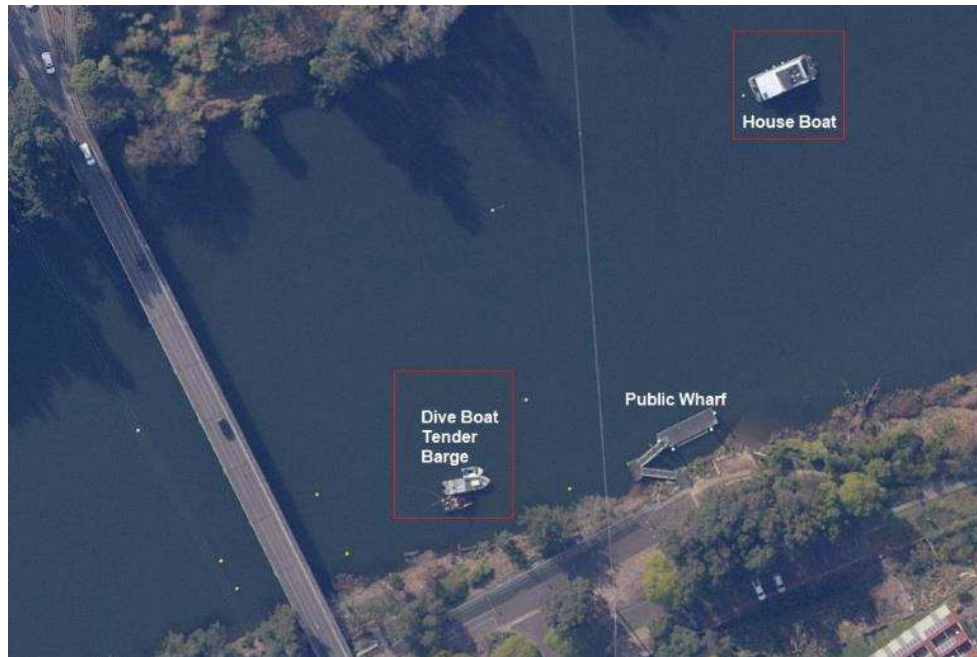


Figure 81: Arrangement of the boat set up during the working day. Houseboat and barge in fixed locations (red square). Dive boat attached to the barge and the tender used as a passenger between houseboat, dive boat and public wharf (Image source: SixMaps).

5.5.1 Work dumb barge

This 8,500m x 3,750 m vessel was stationed over the worksite for the duration of the excavation (Figure 82). The barge was moored on all four points with the lines set so that it could be manoeuvred short distances by hand.



Figure 82: Permanent location of the barge during the project. Located inside the exclusion zone, moored on all four corners. (Source image: Cosmos Archaeology)

The primary function of the barge was the initial collection and sorting point for artefacts recovered during the excavation. The main feature of the barge was a 1 m x 1m well in the centre over which the sieve was positioned. The outlet of the water dredge emptied onto the

sieve where artefacts were collected, bagged, and tagged according to context. The inside of the well was lined with silt curtain that extended to the riverbed. This set-up contained all the turbid water generated by the water dredge. The intake and pump for the water dredge was operated off the north west corner of the barge.

5.5.2 Dive boat

All diving operations were conducted from this 11 m long vessel. Located on the vessel was the dive panel, low pressure air compressor, air cylinders, umbilicals, tools and the 33 KVA electrical generator for the pump (Figure 83 and Figure 84). The diver entered the water from the dive vessel and the standby diver was seated next to the dive supervisor who oversaw the dive panel. The supervising archaeologist was stationed next to the surface communication unit.



Figure 83: View to the stern of the Dive boat; (showing from left to right), barge, dive boat with SSBA dive panel, diver umbilicals, tools and generator in bottom right corner.



Figure 84: View to the bow of the Dive Boat; (showing from left to right), diver umbilical and 33 KVA electrical generator for the pump.

At the start of the day the dive vessel rafted up to the work dumb barge and connected the power cord to the pump. At the cessation of work for the day the dive vessel untied from the barge and proceeded to its night station at the houseboat.

5.5.3 Houseboat

A 12 berth houseboat was moored on a public mooring offsite but within visual contact with the work site and barge. The primary purpose of the houseboat was to serve as storage for the dive and survey gear as well as other stores and tools for the excavation. The dive boat and tender were moored alongside the houseboat each night (Figure 85).



Figure 85: Arrangement of the boat set up outside work hours. Dive boat attached to the house boat overnight (Source image: Cosmos Archaeology).

The houseboat also served as accommodation for project personnel. The crew, who were mostly rotated during the course of the excavation, had the role of monitoring the work barge overnight and to take remedial action with the tender should the barge come loose from its moorings.

The houseboat also served as the 'dig house' where tool box meetings were held in the morning and debriefs at the end of each work day (Figure 86). Lunches were also eaten on the houseboat, with catering supplied by The Hawkesbury Paddle Wheeler.



Figure 86: Project planning in the main room of the Houseboat with Caroline Wilby (left), Cosmos Coroneos (centre) and Kurt Bennett (right).
(Source image: Cosmos Archaeology)

5.5.4 Tender

A 5 m tender was used to ferry personnel between the dive boat, houseboat and public wharf (Figure 87 and Figure 88).



Figure 87: Tender Boat taking team members to houseboat for toolbox meeting

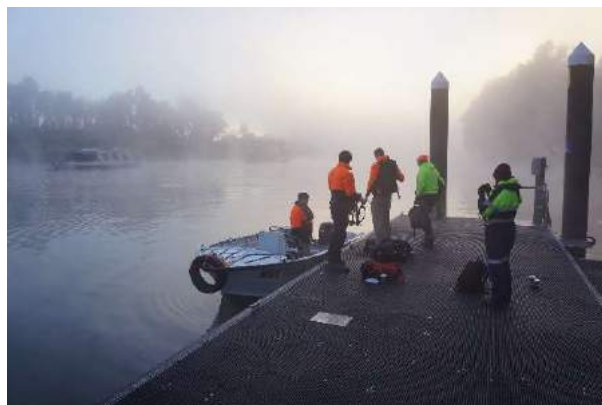


Figure 88: Tender boat at the public wharf picking up team members in the morning.

5.6 Survey – Exposed wharf remains

A site inspection of the southern riverbank was conducted on the 16th and 17th July 2018 by Jane Mitchell (Maritime Archaeologist, Cosmos Archaeology) and Milly Bendell (Assistant Archaeologist, Cosmos Archaeology). Each inspection was undertaken from 8 am to 12:30 pm when the tide was at its lowest. The inspection concentrated on the maritime infrastructure remains on both the riverbank and in the shallows of the river (Figure 89). As a baseline to begin the survey, the archaeologists used the site plan drawn during the 2016 Maritime Archaeological survey of the southern riverbank (Figure 90). The 2016 feature nomenclature was used with additional information added as required.



Figure 89: The wharf survey study area (red rectangle) on the southern side of the Hawkesbury River. The yellow buoys around the dive marked out the designated work area for the excavation. (Image source: SixMaps).

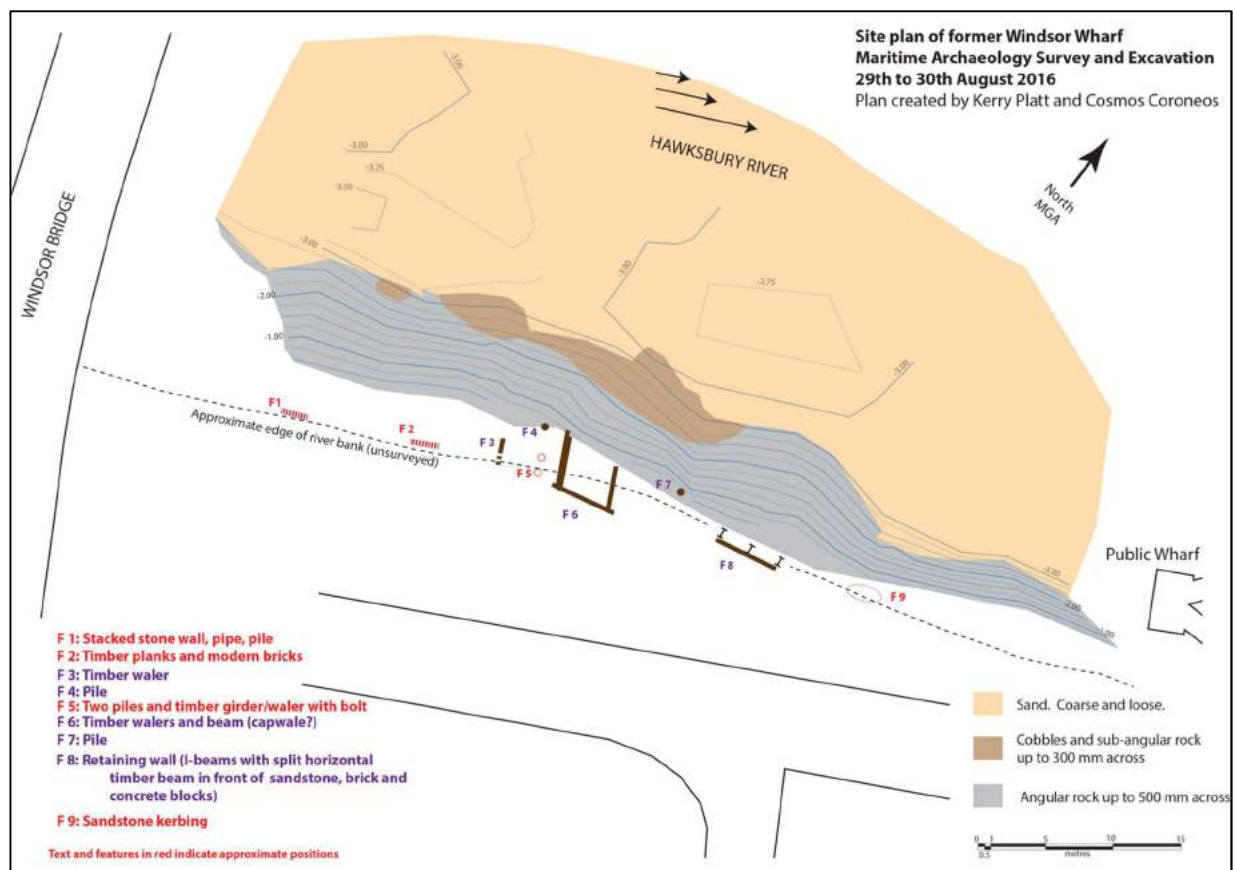


Figure 90: The site plan drawn during the 2016 Maritime Archaeological survey of the southern riverbank.

The archaeologists made observations of the site, taking measurements and detailed photographs of each cultural feature identified (Figure 91). Cultural features that were visible and accessible were also positioned using a Total Station. The aim of these inspections was to determine what remained of the wharf structure and to what phase(s) they belonged to.

Timber samples were taken of select features to determine the type and origin of timber species used in the wharf construction.

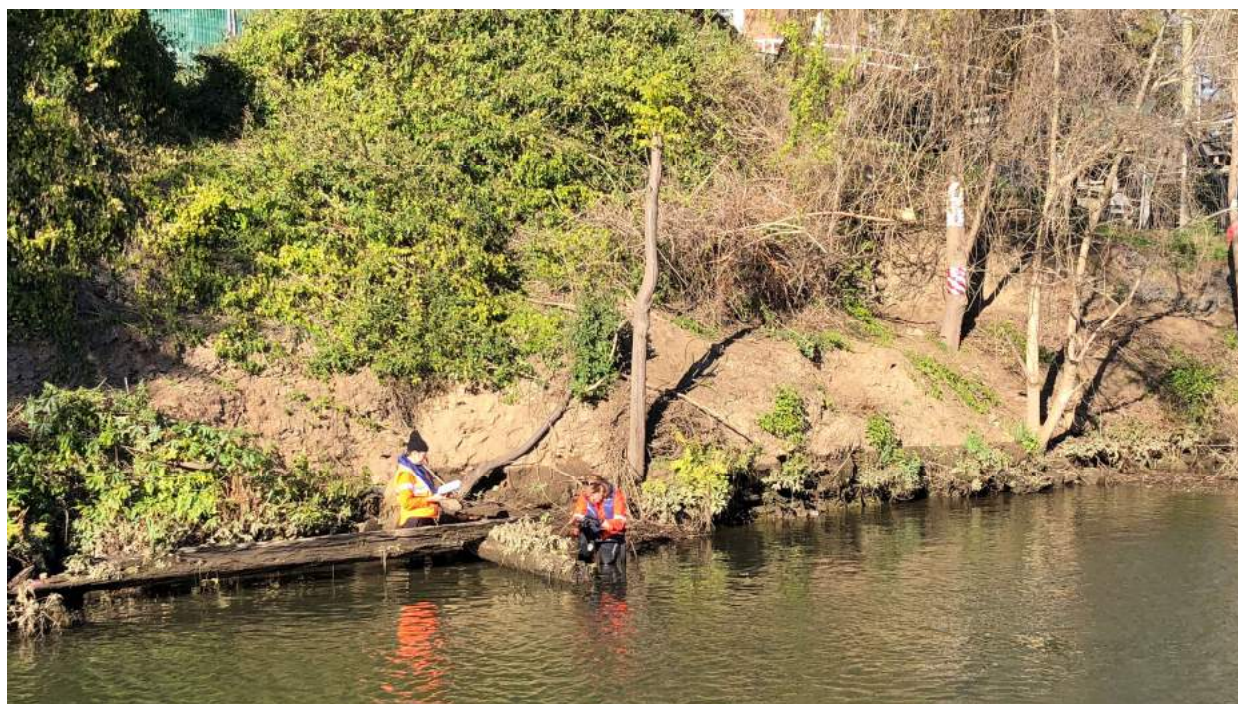


Figure 91: Maritime archaeologists, Jane Mitchell (right) and Milly Bendell recording the cultural features on the southern riverbank. (Image taken 16th July 2018. Source : Cosmos Archaeology)

Further examination of the riverbank took place on the 28th August 2018 when the tides were lower than those experienced in July.

5.6.1 Tides and visibility

Conditions for the survey were chosen due to the low tides of July and August (Table 2). Even with low tide parts of the banks were still covered by around 600 mm – 1,000 mm of silty water as well as branches and other detritus. The archaeologists made use of a scale rod to pass through the water column and identify any riverbed features that may be cultural material.

Table 2: Tide ranges at Windsor during field investigations around the riverbank.

Date	Time of low tide and height (mAHD)	Time of high tide and height (mAHD)	Time of low tide and height (mAHD)
16 July 2018	1041 – 0.8	1612 – 1.35	2249 – 0.24
17 July 2018	1132 – 0.8	1706 – 1.37	2327 – 0.31
28 August 2018	0931 – 0.19	1506 – 1.36	2129 – 0.25

5.6.2 Riverbed and bank

The dense vegetation that hampered the 2016 survey had been cleared in 2018 to allow easier access to the cultural features along the riverbank downstream of the public wharf. The remaining vegetation was low grass and small bushes growing on a steep slope (Figure 92). Prior to 2008, the riverbank between the old Windsor Bridge and the public wharf had been modified and stabilised with the installation of a Gabion wall²⁵⁰. This created a near vertical retaining wall close to the bridge, with the gradient lessening with distance downstream close to the public wharf, where the wall ended.



Figure 92: The remaining vegetation of grass and low bushes growing on a steep slope to the waterline.

The riverbed for the majority of the site consisted of silt with occasional rocks. Water visibility through the water column was poor to zero.

5.7 Survey – Multibeam survey

Poor water visibility was identified as a key concern on the efficiency and accuracy of the underwater excavation. It was thought that a multibeam survey of the site could pick up key features thereby providing divers a coarse features map of the riverbed through which they could orientate themselves. The multibeam survey data could be interlinked with the Total Station survey thereby filling in gaps such as the extent of the trenches.

The survey was undertaken on the 26th August 2018. See Annex J for the report and associated survey files. The survey was useful in showing the extent – horizontal and vertical – of the archaeological excavation was carried out (Figure 93 and Figure 94) It also demonstrates the relative steepness of the riverbed in the vicinity of the excavation (Figure 95). At the time the survey was undertaken DT2 was starting to fill back in.

²⁵⁰ **Cosmos Archaeology Pty Ltd 2009, Windsor Bridge, Punt and Wharf sites: Maritime Archaeological Inspection – Final.** Prepared for The Roads and Traffic Authority of NSW.

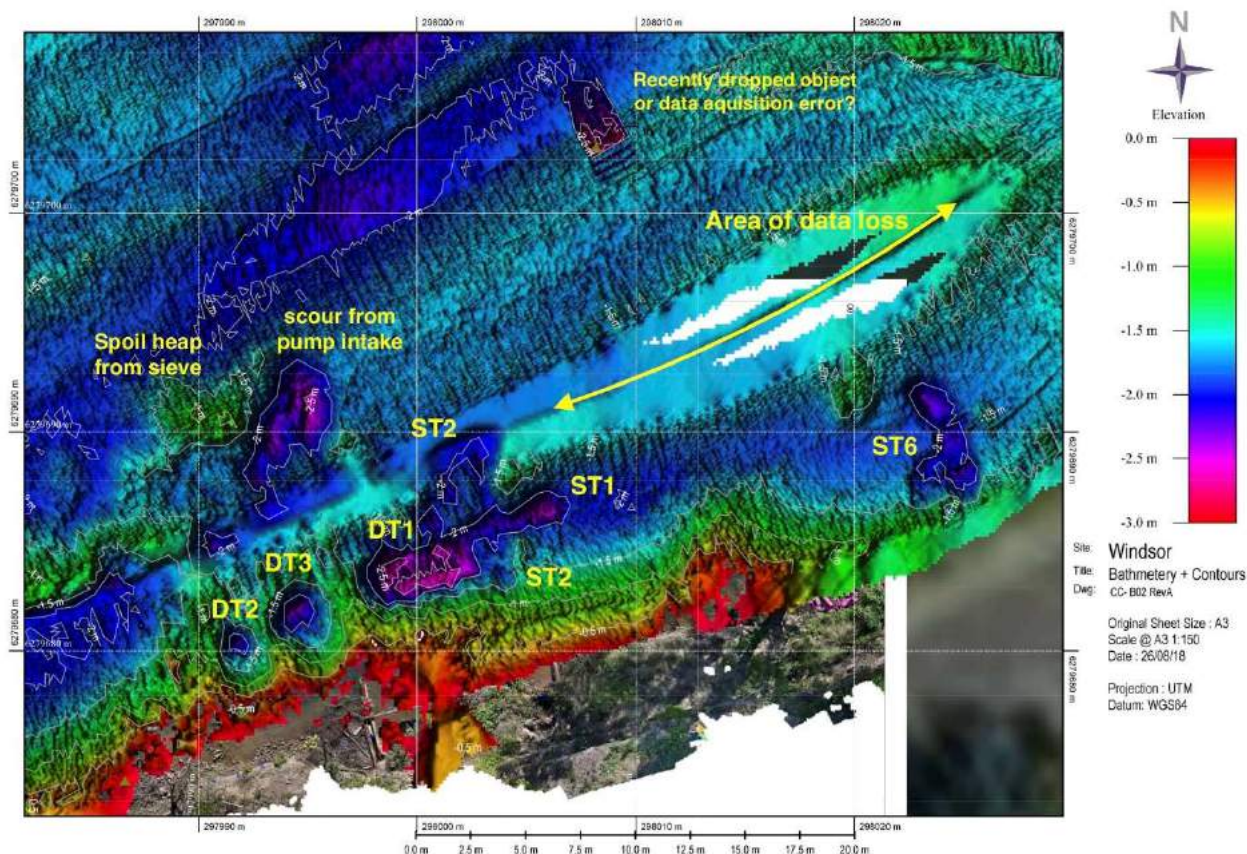


Figure 93: Topographic view of multibeam survey. Trenches marked in yellow. Timbers of extant remains of 1862 wharf visible at base of image.

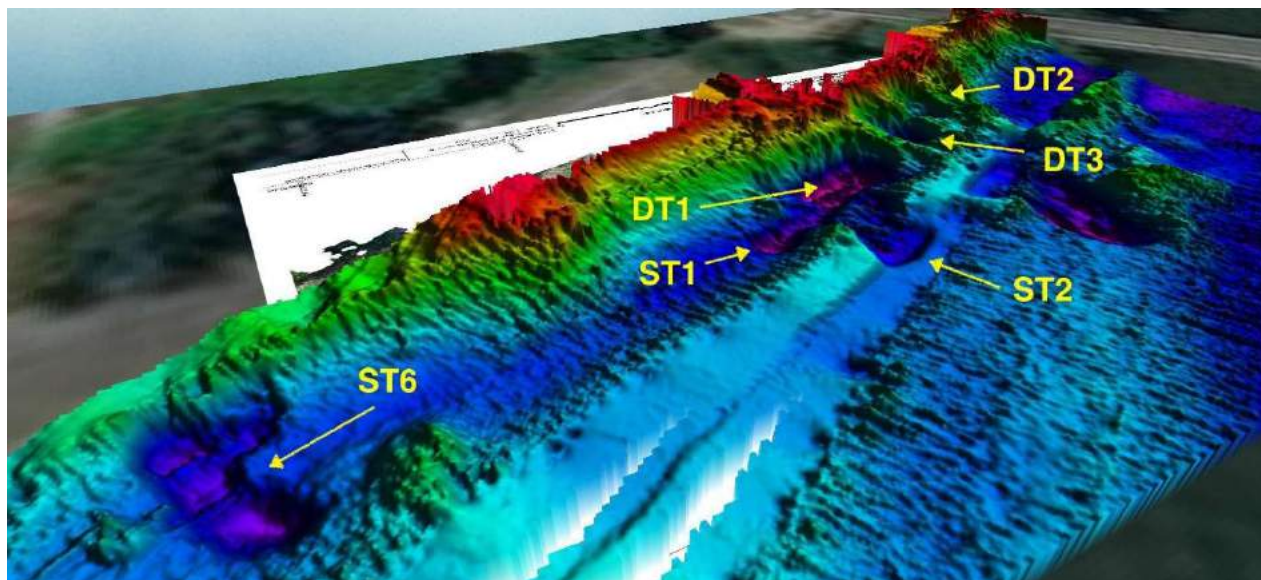


Figure 94: Oblique view of multibeam survey looking south west. Trenches marked in yellow.

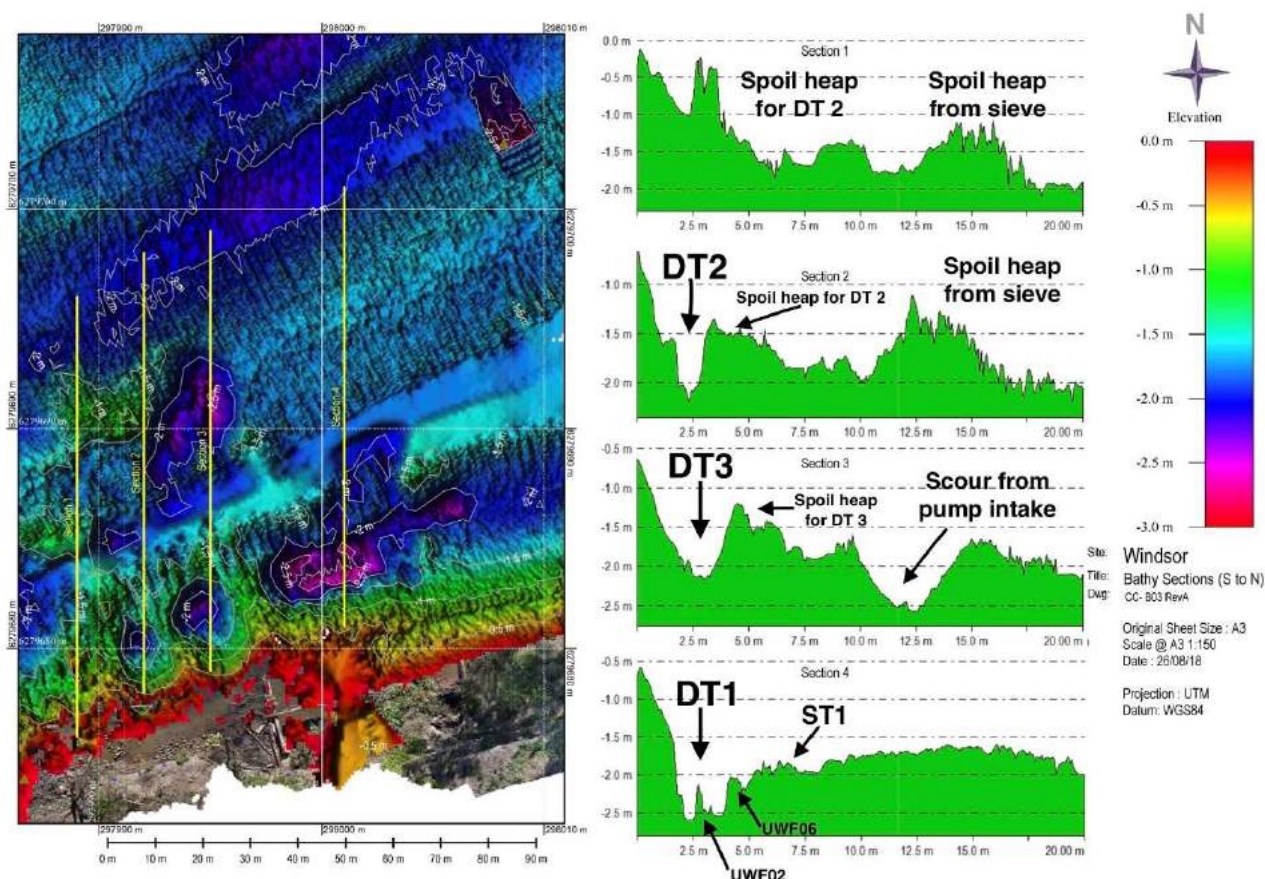


Figure 95: Sections across the excavation area.

5.8 Personnel

The personnel who participated in the project fieldwork are listed in Table 3 below.

Table 3: Personnel that participated in the Windsor Bridge Replacement Project fieldwork 2019.

Name	Title	Company
Cosmos Coroneos	Excavation Director	Cosmos Archaeology
Kurt Bennett	Maritime Archaeological Team Leader (MATL)	Cosmos Archaeology
Caroline Wilby	Archaeologist and Artefact Registrar	Cosmos Archaeology
Matt Carter	Maritime Archaeologist	Cosmos Archaeology
Jane Mitchell	Maritime Archaeologist	Cosmos Archaeology
David Steinberg	Maritime Archaeologist	Cosmos Archaeology
Milly Bendell	Assistant Maritime Archaeologist	Cosmos Archaeology
Guy Hazel	Surveyor	Archaeological Surveying and Illustration
Scott Whilam	Multibeam Surveyor	Trivium Research
Gina Scheer	Archaeologist and Artefact Assistant	Cosmos Archaeology
Jeanne Harris	Artefact Analyst	Urban Analysts
Sue Hern	Assistant Artefact Analyst	Urban Analysts
James Parkinson	Coxswain, Supervisor, Diver	Professional Diving Services
Felix Venturoni	Coxswain, Supervisor, Diver	Professional Diving Services
Malcolm Venturoni	Coxswain, Supervisor	Professional Diving Services
Kevin Graham	Coxswain, Supervisor	Professional Diving Services
Kent Clifton-Bligh	Coxswain, Supervisor	Professional Diving Services
Callum Harvey	Diver	Professional Diving Services
Colin Silvey	Supervisor, Diver	Professional Diving Services

5.9 Artefact recording

5.9.1 On site

Throughout the maritime archaeological excavation, the outlet of the diver-operated water dredge was positioned over a 1 x 1 metre sieve with a 3.5 mm mesh situated onboard the project dumb barge. This setup ensured that all excavated deposits passed through the sieve and the fine mesh size enabled even the smallest of artefacts to be recovered. The sieve was attached to a timber framework fitted inside a gantry bolted to the deck of the barge and was positioned over a 1 m x 1 m open deck well, lined with a silt curtain (Figure 96 and Figure 97). The dredge hose was affixed to the barge railing and the deck gantry with ropes and adjustable ratchet straps, allowing the dredge outlet to be securely positioned over the sieve.

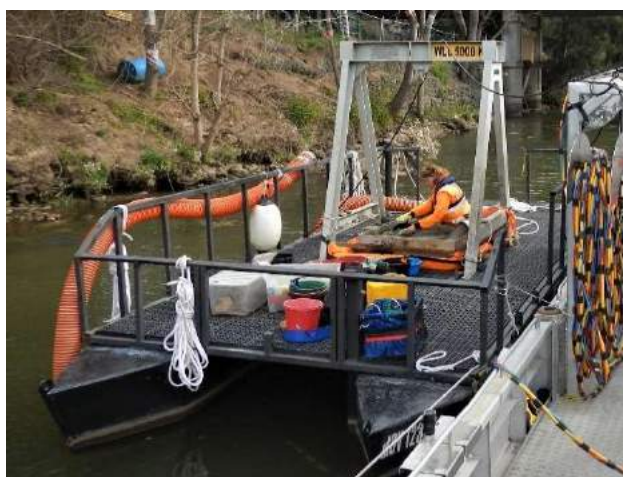


Figure 96: Barge setup with sieve fitted inside gantry in the centre of the deck.



Figure 97: Sieve setup showing dredge outlet secured to gantry with water passing through sieve and into the open well lined with a silt curtain.

The sieve was monitored by at least one to two archaeologists at all times the dredge was in operation (Figure 98). Excavation of each archaeological unit – context, spit and / or feature – commenced with a cleared dredge hose and a clean sieve. As excavation of each unit progressed, artefacts were collected from the sieve and placed directly into pre-labelled plastic bags filled with river water – thus keeping the artefacts in a similar environment in order to maintain artefact stability throughout the recovery and recording process. In an effort to reduce the risk of galvanic corrosion and streamline the recording process, artefacts from each context were also sorted directly at the sieve into material groups (such as ferrous, copper alloy, lead, glass, ceramic, faunal etc.), with each different material type placed in separate bags. Each bag was labelled with waterproof tags containing provenance information – including site name, trench number, context number and in some cases spit or feature number – and the date of excavation (Figure 99 and see Figure 102).

In some instances, sediment samples and examples of rocks that appeared to be non-local in origin were also collected from the sieve for geological testing and identification. These samples were also bagged and labelled with site name, trench number, context number and date.

At the completion of excavation of each archaeological unit, the diver lifted the dredge head upright and allowed water to be drawn up the dredge for several minutes, thus ensuring the dredge hose was clear and all artefacts had been transferred up to the sieve. The sieve was cleared with brushes and pans, and all non-cultural objects that had captured in the sieve, such as natural river gravels and cobbles, were dropped down the well and returned to the riverbed.



Figure 98: Sieve in operation with two archaeologists monitoring and clearing river gravels.



Figure 99: Collection of artefacts recovered and stored on deck in labelled bags filled with river water.

5.9.2 Cataloguing

At the end of each day, the artefacts were transported to the site of accommodation where they were packed while still in their bags into plastic tubs filled with fresh water. These tubs were labelled with their material type (Figure 100 and Figure 101).



Figure 100: Artefacts at accommodation ready to be sorted after each day's excavation.



Figure 101: Collection of artefacts recovered and stored at accommodation in labelled bags filled with fresh water and sorted by material type, ready for cataloguing.

Every artefact was photographed during the course of the excavation to assist with the registration and for future reference after artefacts had been relocated or discarded. The photography of the artefacts at this stage was not meant to be to publication standard. Due to the number of artefacts found during the works, this process continued for another month after the excavation had ceased. The process for photography was to remove the artefact(s) and context tag from its plastic bag and place it on plain coloured cardboard background. The context tag was photographed first on its own signifying all artefacts photographed after the tag were from that trench, square (if applicable), context and spit (if applicable) on the date inscribed. Select artefacts such as rings and coins were photographed from different angles while all artefacts were photographed with a scale. (Figure 102 and Figure 103). For small pieces of ceramic, glass or copper alloy removed from the same context, images were taken in groups. Once photographed, the artefacts were returned to their water filled bags.



Figure 102: Photography of each item included an image of the artefacts context/ID tag in orange and, if catalogued, its catalogue number in pink.



Figure 103: Images were taken of each artefact using plain card for background and included a scale.

Concurrently with photography, artefact cataloguing took place between August and November 2018. The artefact catalogue provides data on shape, function, material, completeness, count, minimum item count, description, dimensions, conjoins, product, manufacturer, and temporal placement. Artefacts were catalogued according to a system developed by La Trobe University and adapted to be consistent with other nationally recognised cataloguing systems. Each artefact's catalogue number was written on pink flagging tape and placed in the bag with the artefact and its context tag.

During cataloguing, artefacts were separated into three major categories – conservation, relocation, and de-accession in accordance with the approved artefact retention policy – see Annex A. Artefacts in the *Conservation* category were set aside to be reviewed by a conservator in order to assess appropriate procedures for the preservation of these materials. Artefacts in the *Relocation* category were deemed to have research potential and subsequent to cataloguing were stored in sealed containers. Artefacts in the *De-accession* category were deemed to have no further research potential, based on a number of factors such as deterioration, corrosion, fragmentation and/or the inability to identify the form or function of the artefact. Until the disposition of de-accessioned materials is determined, they also were secured in sealed containers.

5.9.3 Curation

The artefacts for conservation and relocation were packed into plastic bags containing their catalogue and excavation tags and each bag was filled with fresh water. They were then packed into larger plastic containers for ease of transport and storage. Items too big for the plastic bags were placed directly into plastic tubs with catalogue and excavation tags tied to them and the tubs filled with fresh water.

The ferrous items were placed into plastic tubs with a 10% soda ash solution to slow down deterioration. This was changed to 5% soda ash solution on 23rd February 2019 under the advice from conservators at Western Australian Museum. Advice has been sought from the conservators, Vicki Richards and Jon Carpenter, since the commencement of the excavation.

The artefacts were transferred to a self-storage facility on 7th November 2018 and have been monitored at least monthly (Figure 104 and Figure 105). The monitoring included:

- Checking water levels;
- Visual checking of water quality;
- Checking for increase of bronze disease on the copper alloy coins;
- Monitoring ferrous tubs containing soda ash and changing as necessary, and;
- Monitoring the condition of the organic artefacts.



Figure 104: First of two sheds where artefacts selected for de-accession kept. The space also was used to store artefacts from the terrestrial excavations.



Figure 105: Second of two sheds where artefacts selected for conservation kept. Photo taken when majority of artefacts selected for retention has been removed for conservation. The space also was used to store artefacts from the terrestrial excavations.

In April 2020 artefacts that had been assigned to the *Conservation* category were taken to the premises of a conservation firm – International Conservation Services (ICS) – for treatment. It was decided by Transport for NSW that those artefacts designated as *Relocation* were also to be conserved rather than be re-buried in an underwater repository in the vicinity former Windsor Wharf site. These artefacts were delivered to ICS in August 2020.

The conserved artefacts, amounting to 1904 objects (assigned to 1,179 catalogue numbers), were delivered to the Hawkesbury Regional Museum, 8 Baker St, Windsor in early 2021. A number of these artefacts are currently on display at the Museum (Figure 106 and Figure 107).



Figure 106: Part of the 'Uncovered: archaeology of Thompson Square' exhibition at Hawkesbury Regional Museum, as of 23rd June 2021.



Figure 107: Example of a display drawer for the 'Uncovered : archaeology of Thompson Square' exhibition at Hawkesbury Regional Museum, as of 23rd June 2021

6 Findings – Underwater Excavation

6.1 Summary

The maritime archaeological excavation exposed a stratigraphical sequence of alternating layers of sediments, likely flood borne, and culturally deposited rock rubble over a 200 year period. Twenty three contexts were identified and from within these contexts were recovered over 3,500 artefacts ranging in date from the late 18th century, such as 1799 coins, up towards the end of the 20th century such as a 1979 *Seiko Twin Quartz* man's wristwatch. There was a wide variety of artefacts recovered such as Aboriginal stone artefacts, copper alloy fastenings used for timber vessels, toys, ammunition and fishing implements including copper alloy pins bent into what has been interpreted as fish hooks. Also found were 17 worked timbers in the form of piles, planks or walers, and bedlogs (Figure 108).

The following section describes the characteristics – matrix and artefacts found - of each context within each trench.

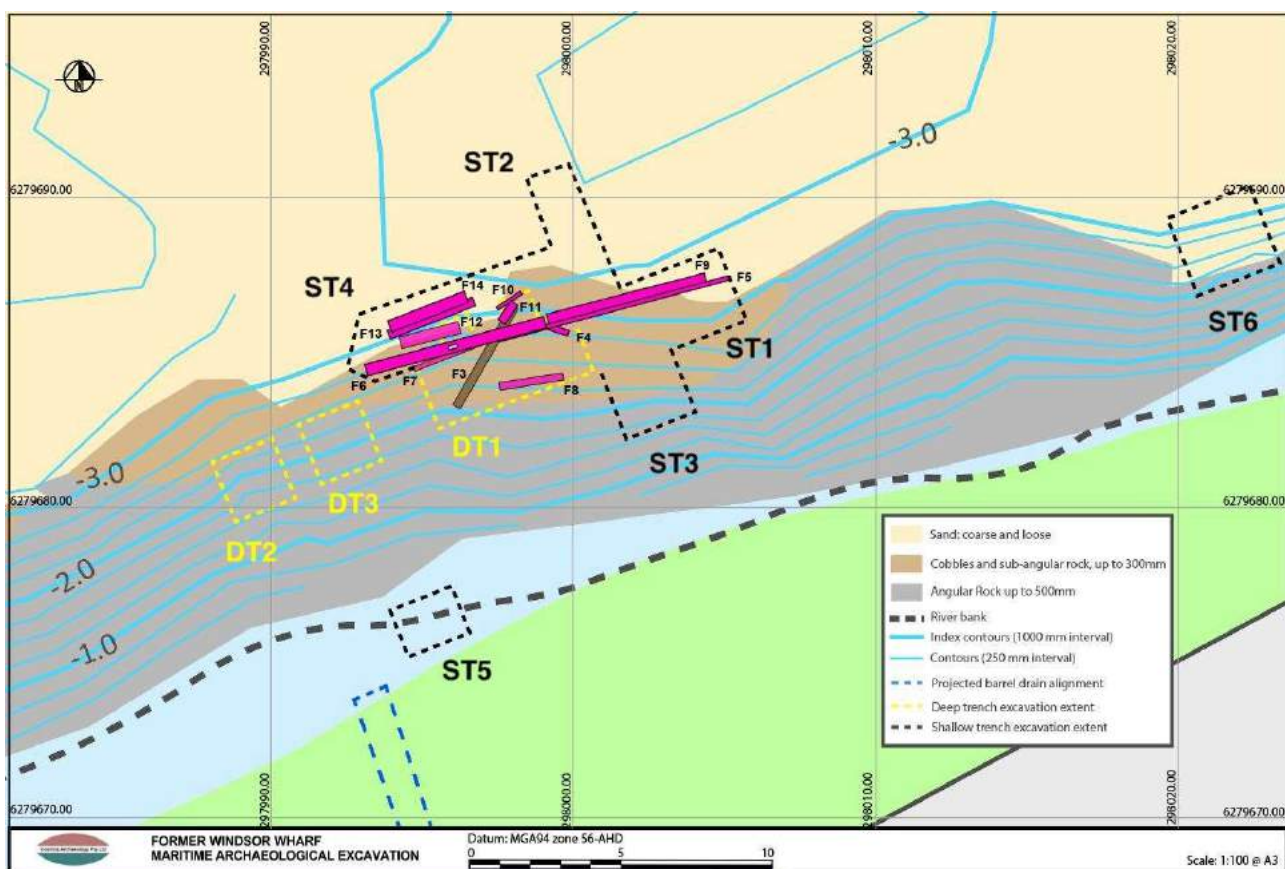


Figure 108 : Site plan showing trench locations and timbers uncovered relative to the riverbank. For distribution of squares within DT1 see Figure 72.

6.2 Deep Trench One

Context 01

The surface of DT 1 was composed of a relatively thin layer of fine silt up to 50 mm thick with occasional angular rocks and organic material such as branches (Figure 109). The artefacts found within this context were mostly modern, such as beer bottles, with ferrous nails forming the largest type of artefacts recovered.

Exposed at the south eastern end of the trench (Sq 4, 5 and 6) was the 3.5 m long remains of a 450 mm diameter timber pile (UWF01) laying parallel to the riverbank. The pile tapers at one end and is heavily impacted by marine borer activity. It appears to have been 'necked' at this point, meaning that this part of the pile was either situated close to the riverbed or in the intertidal zone

of the water column. Sand abrasion and/or constant wetting and drying with tidal changes resulted in the deterioration of the timber, the ensuing weaknesses in the fabric at this point giving marine borers better purchase so as to colonise the wood thereby accelerating the deterioration process. Eventually the pile began taking on an 'hourglass' or 'apple core' appearance until it broke off and collapsed. The other end of the pile has been cut and has a 600 mm long and 200 mm deep rebate cut longitudinally at the top of the pile. The rebate would have received either a corbel or headstock which indicates that the pile was very likely once part of a jetty or wharf. There was no evidence of copper sheathing on the pile. The species of the timber is River Sheoak - *Casuarina? cunninghamiana* - (see Section 9.6).

Context 02

Under the silt was a mixture of loose cobbles measuring up to 250 mm in diameter and angular rocks measuring up to 500 mm diameter (Cxt 02). A loose sand/silt mix filled the voids between the rocks (Figure 109). The thickness of this context varied with the sizes of the rocks and ranges between 150 mm and 250 mm.

The artefacts recovered from this matrix was mostly bottle and brick fragments of various types ranging in date of manufacture from the early 19th to the 20th century, ferrous and copper nails and pins, remains of copper alloy sheathing, ceramic jars, bicycle chain, decimal (> 1966) coins as well as a 19th century half-penny. There were also remains of fishing tackle and large fragments of ferrous objects such as rods up to 750 mm in length in Sq 1.

Two sheep bone fragments were found in this context and a small number of oyster and flood plain mussel shells. Peach pits were found along with one watermelon seed.

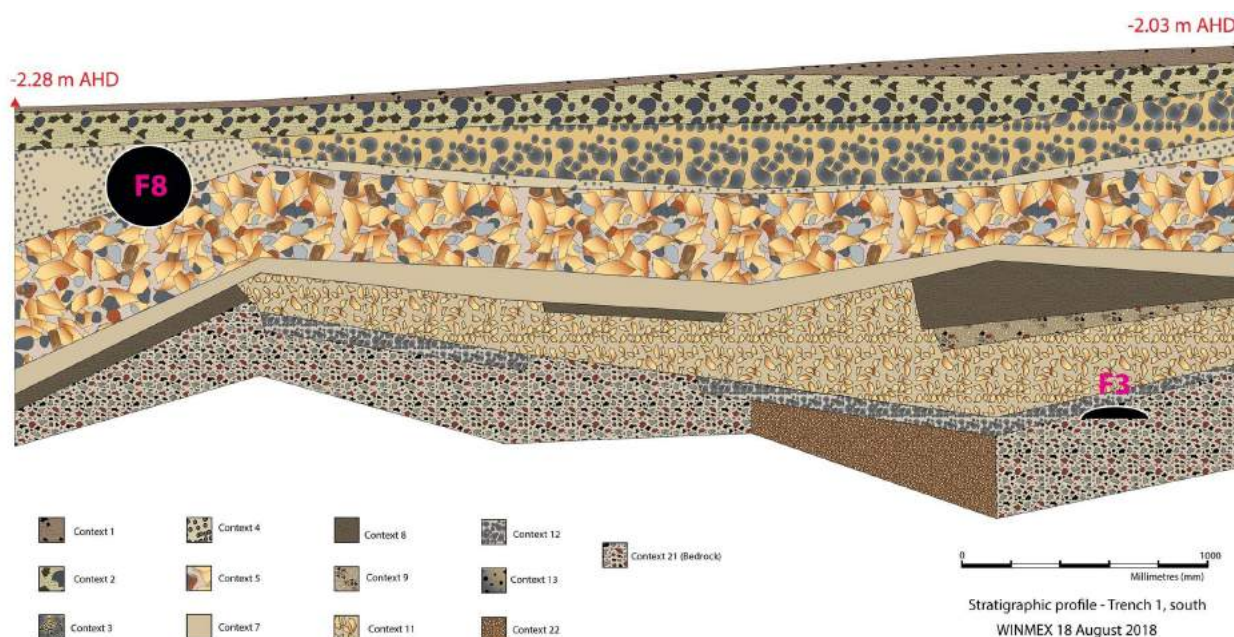


Figure 109: South section of DT1.

Context 03

The relatively loose cobble matrix of Cxt 02 lay on a distinct compact layer of cobbles with sand and gravel filling the voids (Cxt 03). The cobbles measured up to 250 mm in diameter. Some occasional larger rock up to 300 mm across was noted in Sq 1 and 11. Within Sq 5 the excavators observed thin layers of loose sand mixed with fragmented angular rock, brick and pockets of gravel under the cobbles. This context measured between 100 mm and 250 mm thick.

Also within this context were clumps of compacted gravel and rock, of which more substantial deposits were to be found in Cxt 04 and in Cxt 05 where the whole of the matrix was concreted (see discussion on relevant contexts below). This material, a coarse-grained polymictic orthoconglomerate, is derived from numerous components within the local alluvial gravels as well as material introduced by cultural activity (Figure 110). The matrix itself would have developed *in situ*

within the river system, as shown by its weakly cemented nature and the lack of any sorting or orientation within the clasts (See Annex P – S036).



Figure 110: Example of conglomerate from Cxt 3.

The artefacts recovered within Cxt 03 were mostly ferrous nails and other forms of construction related objects as well as bricks. Also present were copper alloy sheet fragments and fasteners, and glass fragments. Among the more uncommon artefacts were gun cartridges and shot gun shells, clothing fasteners, fish hooks and tackle, toys and tobacco pipes. Three Aboriginal stone artefacts was found within this context.

Mollusc shells were recovered in this context, mostly oyster shells but also freshwater mussel fragments and one Sydney cockle fragment. There were also fragments of sheep and cattle bone and more peach pits.

At the downstream end of the trench the upper portions of a wharf bedlog was exposed (UWF06). This structural element will be discussed when discussing Cxt 5. The lower part of UWF01 lay within the upper portion of this context.

Context 04

Across most of the trench sandwiched between the compact layer of cobbles of Cxt 03 and the concreted rock matrix of Cxt 05 was a fine loose sand lens with occasional patches of gravel and rock that measured up to 100 mm across (Cxt 04). In the south east corner of the trench, in Sq 9 (Figure 111), this sand layer abutted the compact cobble layer of Cxt 03 and was between the looser rock matrix of Cxt 02 and the concreted rock matrix of Cxt 05. A patch of clay measuring 450 mm x 300 mm x 250 mm in size was recorded in Sq 2. The thickness of this context for the most part was 100 mm with its thickness increasing to around 250 mm in Sqs 4 and 9.

The largest individual classes of artefacts within this matrix were bricks and brick fragments, ferrous fasteners and other hardware, bottle glass, copper fasteners and copper sheathing fragments. Also found were a belt buckle, clothing fasteners, pins, gold watch winder finial, necklace chain, toys, a spark plug and tobacco pipes. Eight Aboriginal stone artefacts were also recovered from this context across three squares - 1, 4 and 6.

Ten peach pits were found in this context. Three cattle bone fragments and 8 fragments of oyster shell were also found.

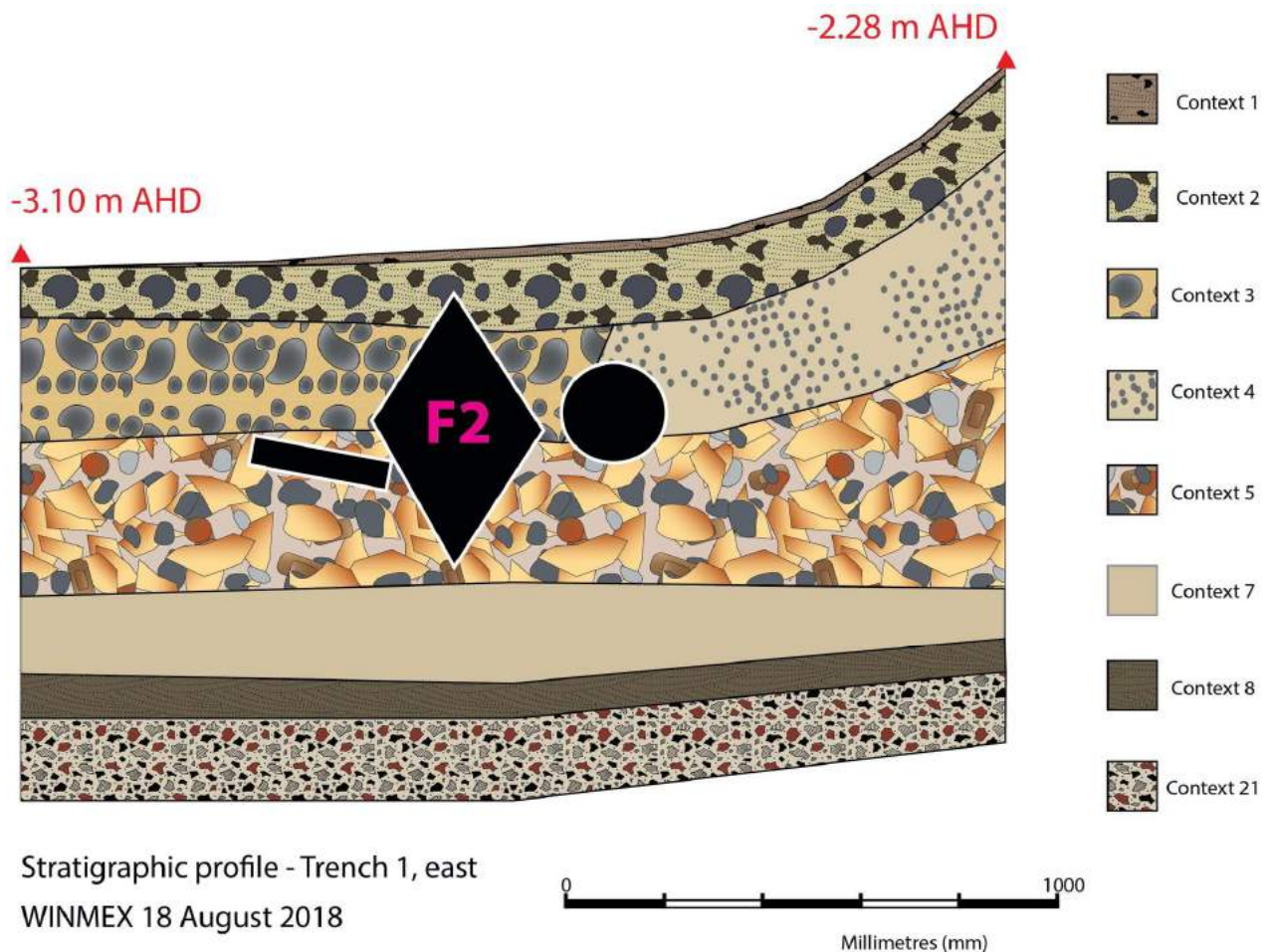


Figure 111: East section of DT1. Black features are timber/wood elements.

The upper part of the remnant timber logs UWF02 and 08 were exposed in Cxt 04. The former timber had an irregular diameter of 180 mm to 200 mm and relatively little teredo damage. It was 4.2 m long with sawn ends suggesting this was a branch that had been cut. The species was identified as Grey Ironbark or Coast Grey Box - *Eucalyptus ?paniculata*.²⁵¹ UWF08 measured 220 mm x 240 mm across with one flat side. The other sides were badly damaged by marine borers, but it does appear it had been squared. The full length of the feature was not determined as it entered the south eastern baulk of the trench, however the exposed length was 710 mm. The exposed end was broken and there was no evidence of sheathing on it. The timber species was Red Ironbark – *Eucalyptus ?siderophloia* (not *Eucalyptus sideroxylon*).

Context 05

Encountered across most of the trench below Contexts 03 and 04 was a concreted conglomerate (Cxt 05) of rocks including, pebbles <100 mm across, small stones up to 35 mm in diameter, angular sandstone up to 400 mm across, with occasional larger sandstone up to 550 mm in length, cobbles up to 250 mm across and pieces of brick cemented/concreted together as well as other artefacts mixed with sand and marine oyster shell. A sample of the sandstone from this context was found to be of a quartzose sandstone, being derived from the Hawkesbury Sandstone formation (See Annex P – S029).

This matrix was so hard it had to be broken up with hammers and crowbars by the excavators. The thickness of this context measured between 300 mm and 400 mm. This concreted mass did not extend across the northern part of Sq 12.

²⁵¹ The “?” in the species identification indicates there is a possibility the wood is of another species from the same commercial group, as it is generally not possible to specifically determine degraded wood. (Dr. Jugo Ilic, pers. comm). See Annex O.

As with the above contexts the largest single class of artefacts recovered from within this context were ferrous nails and fasteners. Food related artefacts were also common in the form of glass bottle fragments and tableware. A large number of bricks and brick fragments were found throughout the matrix ranging from sandstock early 19th century bricks to curved buff coloured bricks which date to the early 1870s. Copper alloy artefacts were well represented, especially copper fasteners and sheeting. Other artefacts included a bullet, cartridges and a percussion cap, a pen, a pencil, clothing fasteners, a pocket watch, jewellery, a marble, 19th century commemorative tokens and tobacco pipes.

By far the highest amount of Aboriginal stone artefacts recovered from DT1 came from this context. They were found in three squares – 1, 5 and 6.

The highest amount of mollusc shell recovered from DT1 also came this context. The vast majority were oyster shell fragments, with the remainder consisting of freshwater mussel shell fragments and a single Sydney cockle shell fragment. Of particular interest in this context, four of the oyster shells identified were attached to a piece of natural sandstone. This indicates that the stone was bought in, presumably as ballast, from a location either downstream of Wisemans Ferry or even Sydney Harbour.

There was a high number of peach pits, with one pecan endocarp and a pumpkin seed.

Just over a quarter of the animal bone recovered from DT1 came from Cxt 05 – representing the highest proportion of bone recovered from this trench. The majority were cattle bone fragments, with the remainder being sheep bone fragments.

Within this conglomerate were also a number of timber logs associated with maritime infrastructure. The base of UWF02 and UWF08 were imbedded into the upper part of this matrix (Figure 112). The previously mentioned bedlog, UWF06, lay along the northern edge of the trench (Sqs 1, 2, 3, 8 and 10) and parallel to the bank. It is 380 mm in diameter and was at least 6.080 m long. At either end are poorly preserved quarter lap scarfs 220 and 330 mm in length (down the log) approximately 120 mm thick and 120 to 100 mm deep (Figure 113). Approximately midway along the timber, facing upwards, was a mortise 160 mm deep, 170 mm wide and 330 mm long. The timber around the mortice was abraded leaving a circular impression approximately 480 mm in diameter. The mortice had once received a tenoned timber pile, 480 mm in diameter. The quarter lap scarfs at either end of the bedlog keyed into other bedlogs forming a continuous line of timber footings for wharf piles. The timber species of this log is Red Ironbark - *Eucalyptus ?siderophloia*, (not *Eucalyptus sideroxylon*).

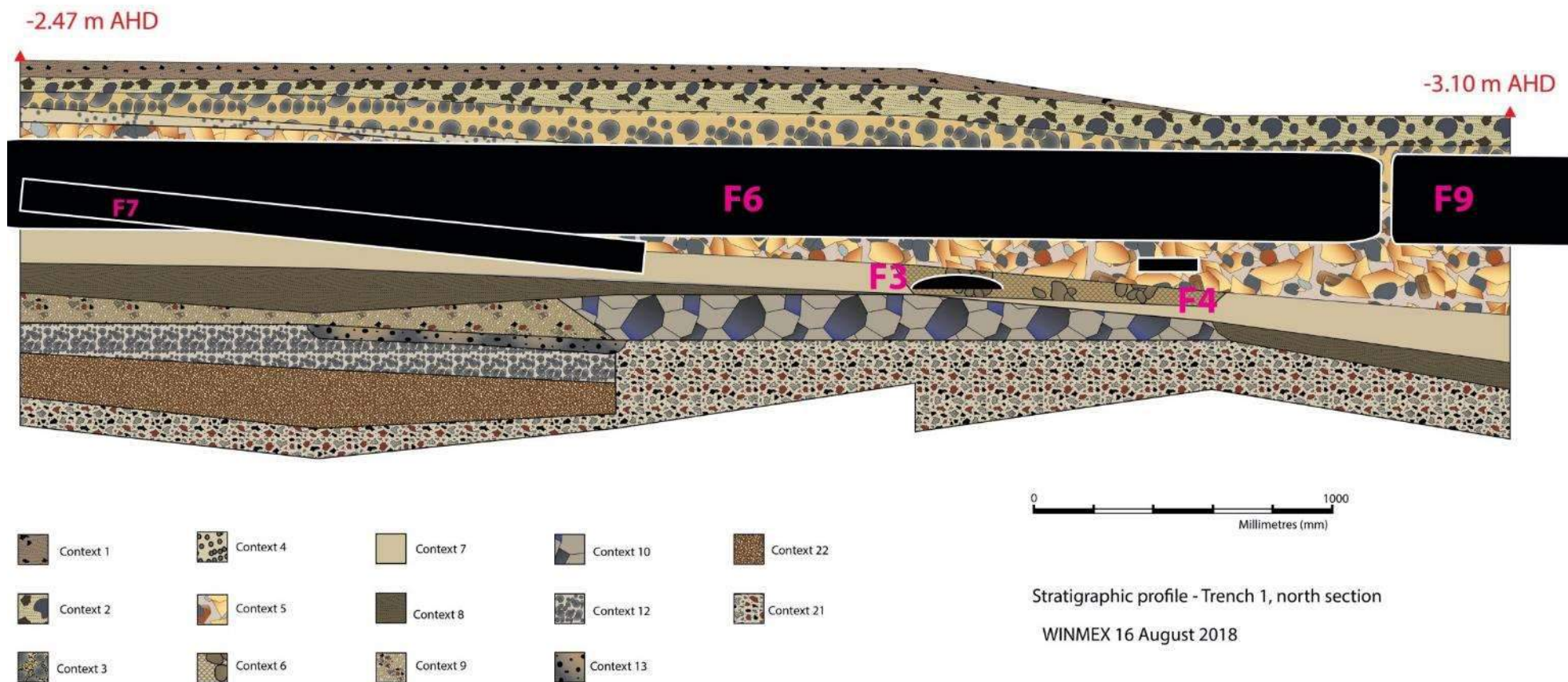


Figure 112: North section of DT1. Black features are timber/wood elements.

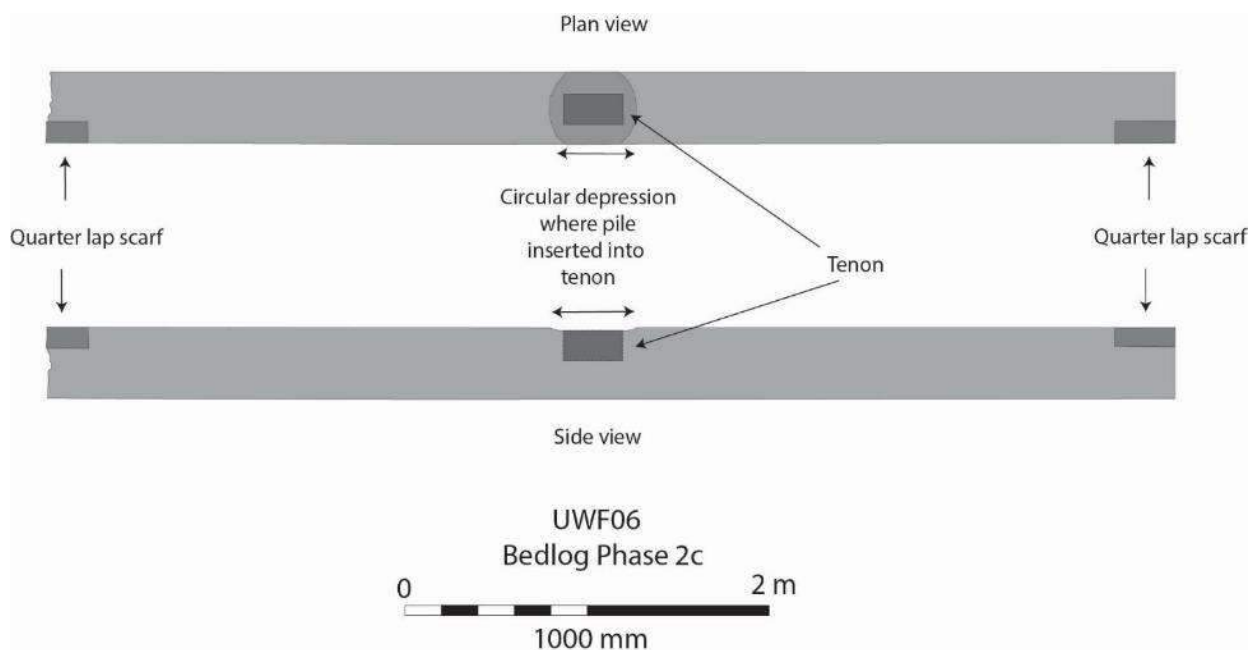


Figure 113: Drawing of UWF06.

Abutting UWF06 at its downstream (eastern end) was another log UWF09 which was laid on the exact same alignment. Very badly degraded log approximately 300 mm diameter and approximately 5 m long. The end of timber which abuts UWF06 appears to have had a half or quarter lap scarf approximately 120 mm long and up to 200 mm deep. At 1,800 mm from the end of the scarf is a cut out or half cross lap on the northern or riverward edge of the log, 410 mm long, 180 mm wide and 150 mm deep. The upper surface of the log was too damaged by marine borer activity to determine whether there was circular impression around the scarf joint. A further 1,800 mm along the log was a very badly preserved of what appeared to be either the remnants of a half lap joint or a mortice facing north or riverward. If a mortice it would have been up to 590 mm in length, 70 mm wide and 180 mm deep. The downstream end of the timber was badly deteriorated and no joinery had survived. This log abuts UWF06 and maintains the same alignment. The two scarfs are on the riverward edge of the log indicating that if it was a bedlog *in situ* it had rolled 90° onto its side. The species of the wood is Grey Ironbark - *Eucalyptus ?paniculata*.

Within the conglomerate matrix (Cxt 05) and north, riverward, of UWF06 two timbers were uncovered. Overlaying each other in a random manner, the uppermost timber was a half round plank (UWF10) 120 mm wide and 60 mm high at the apex. Orientated on an approximate NE-SW axis only 950 mm of the timber was exposed. Beneath UWF10 was a 40 mm thick plank, 280 mm wide. Only 750 mm of this timber was exposed. The species was Forest Red Gum - *Eucalyptus ?tereticornis*.

Laying alongside UWF06, on the riverbank side was a timber plank (UWF07) 60 mm thick, 150 mm wide and at least 2.4 m long. Its western end continued into the baulk of the western or upstream side of the trench. The species was Forest Red Gum or possibly Grey Gum - *Eucalyptus ?tereticornis*.

Also laying alongside UWF06 and UWF09 on their southern or riverbank sides was a half round timber plank - UWF04 - 150 wide, 120 mm thick at the apex, 8.1 m in length and laying on its edge. The timber species was Forest Red Gum - *Eucalyptus ?tereticornis*.

Passing underneath UWF05 and UWF06, imbedded in the conglomerate of Cxt 05 was another timber plank (UWF04) 180 mm wide and 50 mm thick laying on its edge. It measured approximately 800 mm in length and was of the species Grey Gum or possibly Forest Red Gum - *Eucalyptus ?propinqua*.

Context 06

Also passing underneath UWF05 and UWF06 was another half round plank 280 mm wide and 60 mm high at the apex (UWF03). The plank was lying flat, curved side up, and was orientated on a NE - SW axis, its southern end entered the baulk of the trench at Sq 11. The NE end that passed under UWF06 was poorly preserved due to marine borer activity. No fastenings, or holes for fastenings, were observed in the timber.

The northern end of the timber was found within Cxt 06 which was a 50 mm to 100 mm thick lens composed of a mixture of loose sand and gravel with isolated clumps of cobbles that measure up to 250 mm in diameter which were partially concreted together. This context was found only in Sqs 1 and 6 and was considered to be part of the same matrix as Cxt 05 that had yet to form into a conglomerate.

Of the artefacts found in Cxt 06 the most common were a variety of bricks and brick fragments ranging from the early to late 19th century and food related objects such as fragments of alcohol bottles and tableware. Ferrous hardware, including fasteners, was present, but less common than in other contexts. As with the above contexts, fragments of copper alloy sheathing, nails and roves were also present. Other artefacts recovered from this context were a bullet, a cartridge, pins, and hook & eye fasteners. One Aboriginal stone artefact was found within this context, as were two sheep bone fragments and one cattle bone fragment.

Context 07

The conglomerate of Cxt 05 and Cxt 06 lay atop of a loose sand gravel mixture (Cxt 07) around 100 mm thick across most of the trench, thickening towards 300 mm in Sq 6. Gravel stones within the matrix measured up to 50 mm in size with occasional larger rocks up to 150 mm across. Two rocks of an unusual nature were analysed and were found to be ironstone and surficial hematized laterite both of which were originally derived from the Hawkesbury Sandstone formation but likely sourced locally (See Annex P – S097, 099).

There was a wide variety of artefacts with those related to food and hardware being the most prevalent. The food-related artefacts are mostly fragments of alcohol bottles and tableware while hardware artefacts are mostly ferrous nails and fasteners. Brick fragments were also present including two sandstock types. Maritime related artefacts were also found, consisting mainly of copper sheathing fragments and nails. Other artefacts included coins, clothing fasteners, tobacco pipes and pins. Also recovered were five Aboriginal stone artefacts from across three squares – 1, 5 and 6.

Eight peach pits were recovered from this context, with a large amount of fragmentary oyster shell. Fragments of Sydney cockle shell and freshwater mussel were also present.

Cattle bone fragments were present along with a small number of sheep, pig, and fish bone. There was also a fragment of dog bone - the only dog element found during the excavation.

Context 08

Context 08 was a 50mm to 200 mm thick silty layer, compacted in places, made up of fine sediments, gravel patches with the occasional rock up to 300 mm diameter. One of the rocks from this context was analysed and was found to be hematized fine-grained quartzose sandstone derived from the Hawkesbury Sandstone formation (See Annex P – S100). This context was found across most of the trench with it thinning out towards the southern side of the trench.

Within this matrix food related, architectural elements and hardware were the most common artefact groups. Food-related artefacts include fragments of tableware and alcohol bottles. There are also three lead sinkers used in food-procurement fishing. Architectural elements include brick fragments, nails, roofing slates and window glass. Half of the brick fragments are a sandstock type and were recovered from Sqs 1 and 9. Copper sheathing and nails were also recovered. Other artefacts included coins, buttons, hook and eye fastener, tobacco pipes and pins. Also recovered were fourteen aboriginal stone artefacts - found across Sqs 4, 6 and 8.

Peach pits and oyster fragments were recovered along with three sheep bone fragments, three pig bones and two cattle bone fragments.

Context 09

At the eastern and western ends of the trench there was a relatively thin loose sand lens with isolated pockets of a sand/gravel mix with occasional larger rock (Cxt 09). One of the rocks from this context was analysed and was found to be medium-grained quartzose sandstone derived from the Hawkesbury Sandstone formation (See Annex P – S092). The thickness of this context ranged between 100 mm and 200 mm.

Artefacts within this context were mostly associated with food such as fragments of alcohol bottles and tableware. The ubiquitous fragments of copper sheathing and nails were also present as was a gun cartridge, a fishing lure, tobacco pipes and pins. Four Aboriginal stone artefacts were also found within this context.

A single peach pit was recovered from this context while 23 pieces of oyster shell were found. Animal bone recovered included two cattle bone fragments, one sheep bone fragment and one fish bone.

Context 10

Limited in extent across Trench 1 – Sqs 1, 2 and 8, was a patchy layer of up to 200 mm thick of sand and gravel with rocks up to 500 mm in size (Cxt 10). Contained within this context were mostly hardware fasteners as well as fragments of copper sheathing, nails, and pins possibly bent into the shape of fish hook. Two small sheep bones were recovered as was one Aboriginal stone artefact.

Context 11

Beneath the Cxts 07, 08, 09 and 10 predominantly in the middle of the trench, Sqs 2, 4, 5, 6, and 11, was a sandstone rock layer (Cxt 11) with the rocks measuring up to 300 mm diameter. A compacted sand/gravel mix filled the voids between the rocks. The context thickness was up to 300 mm. The majority of the artefacts recovered from within this context were ferrous nails, fragments of tableware as well as fragments of copper sheathing and nails. Fragments of bricks and tobacco pipes were also present in this context. Four Aboriginal stone artefacts were also found within this context in Sqs 6 and 11.

One pig bone and four oysters shell fragments were recovered.

Context 12

Context 12 was a 150 mm thick gravelly sand mixture with pebbles present up to 80 mm in size, localised to around Sqs 3, 4, 6, 10 and 13. An unusual sub rounded cobble recovered from this context was identified as olivine phyric basalt which would have been locally derived from nearby outcrops which are relatively abundant in the western Sydney region (See Annex P – S096).

Remains of alcohol bottles, tableware and nails were the most numerous of the artefacts recovered while fragments of copper sheathing, tacks and nails were also present. Also found were a percussion cap, button, buckle, hook & eye fastener, pins and tobacco pipes. Ten Aboriginal stone artefacts were recovered from this context over five squares – 3, 4, 6, 10 and 11.

Peach pits, oyster shell and freshwater mussel shell were present. Four sheep bone fragments, two pig bone fragments and one fish (bream) bone were also found.

Context 13

A very localised lens (Cxt 13), up to 50 mm thick, of clay mixed with patches of sand and gravel stones measuring up to 60 mm in size was present within Sqs 2, 3, 5 and 6. One recovered rock from this context was a quartzose sandstone derived from the Hawkesbury Sandstone formation (See Annex P – S098).

Of the few artefacts recovered from this context of interest was a copper alloy pin with an applied wound head as well as one Aboriginal stone artefact. Also recovered was a single peach pit and two oyster shells.

Context 21

Bedrock, Cxt 21, was reached across the whole of the trench. The upper part of bedrock was composed of a mixture of broken pieces of shale, coarse grained sand and gravel. This matrix was excavated up to a depth of 450 mm before solid rock was reached.

The most common artefacts found within this matrix were ferrous nails followed by fragments of alcohol bottles, tableware and fishing tackle. Fragments of copper sheathing, and nails were also present. Other artefacts included a coin, a pocket knife, a railway seal, buttons, pins, a homemade fishing lure, a buckle, and a tobacco pipe. The SW end of UWF023 was resting on this matrix. Five Aboriginal stone artefacts were found across two squares.

Animal bone recovered included three cattle bone fragments, two fish bones and one duck bone. Also found were two peach pits, 6 oyster shell fragments, one Sydney cockle fragment and one Hairy mussel fragment – one of the few saltwater mussel remains found during the excavation.

Context 22

Found within depressions and fractures of the bedrock was a compact silt layer that measured between 75 and 200mm thick (Cxt 22). As with Cxt 21, the most common artefacts found within this matrix were ferrous nails followed by fragments of copper sheathing and nails were also present. Other artefacts included a coin, a button, a tobacco pipe, a horseshoe and rope. A single peach pit was recovered from this context while animal bone was represented by two pig bones, one sheep bone and one duck bone.

6.3 Deep Trench Two

Context 01 and 02

The surface of DT 2 was composed of a thin layer of fine silt (Cxt 01). This silt overlay 100 to 200 mm thick silt and sand mixture with occasional relatively small rocks (Cxt 02). The artefacts found in this context included nine small Diya clay oil lamps – a lamp type used in the Indian subcontinent, a group of keys, fishing lures, tobacco pipes and fragments of copper sheathing.

One pecan endocarp was recovered, and freshwater mussel fragments were the only shell present in this context.

Context 03

Underneath Cxt 02 was a compacted rock layer consisting of sandstone (mostly rounded), basalt, brick and pebbles ranging in size between 50 mm and 400 mm in diameter (Cxt 03). The thickness of this context measures between 150 mm at the northern edge of the trench to 250 mm at the western edge. From within this matrix were found mostly nails but also spikes (both ferrous and copper alloy), bolts, a cotter pin, chain, screws, tacks, wire, copper sheathing, roves and washers. Other artefacts included a number plate, spark plug, multiple bullets and cartridges and glass fragments. Thirteen Aboriginal stone artefacts came from this context.

Fragments of oyster and freshwater mussel shell were present. One cattle bone fragment, one sheep bone fragment, one bird bone fragment and one fish (mullet) bone were recovered. Two peach pits were also found from this context.

Context 04

As the thickness of Cxt 03 increased towards the west, the frequency of rock decreased. This led to gradual transition to Cxt 04 which was a sandy gravel layer around 220 mm thick (Figure 114). The gravel in the matrix was up to 25 mm in size.

The artefacts recovered ranged from nails (which formed the majority) to copper alloy fasteners and fragments of sheathing. Also found were coins, a watch part, a pocket knife, a brooch, a fishing sinker, pins and a tobacco pipe. No plant remains, animal bone or shell were recovered from this context. Three Aboriginal stone artefacts were also recovered from this context.

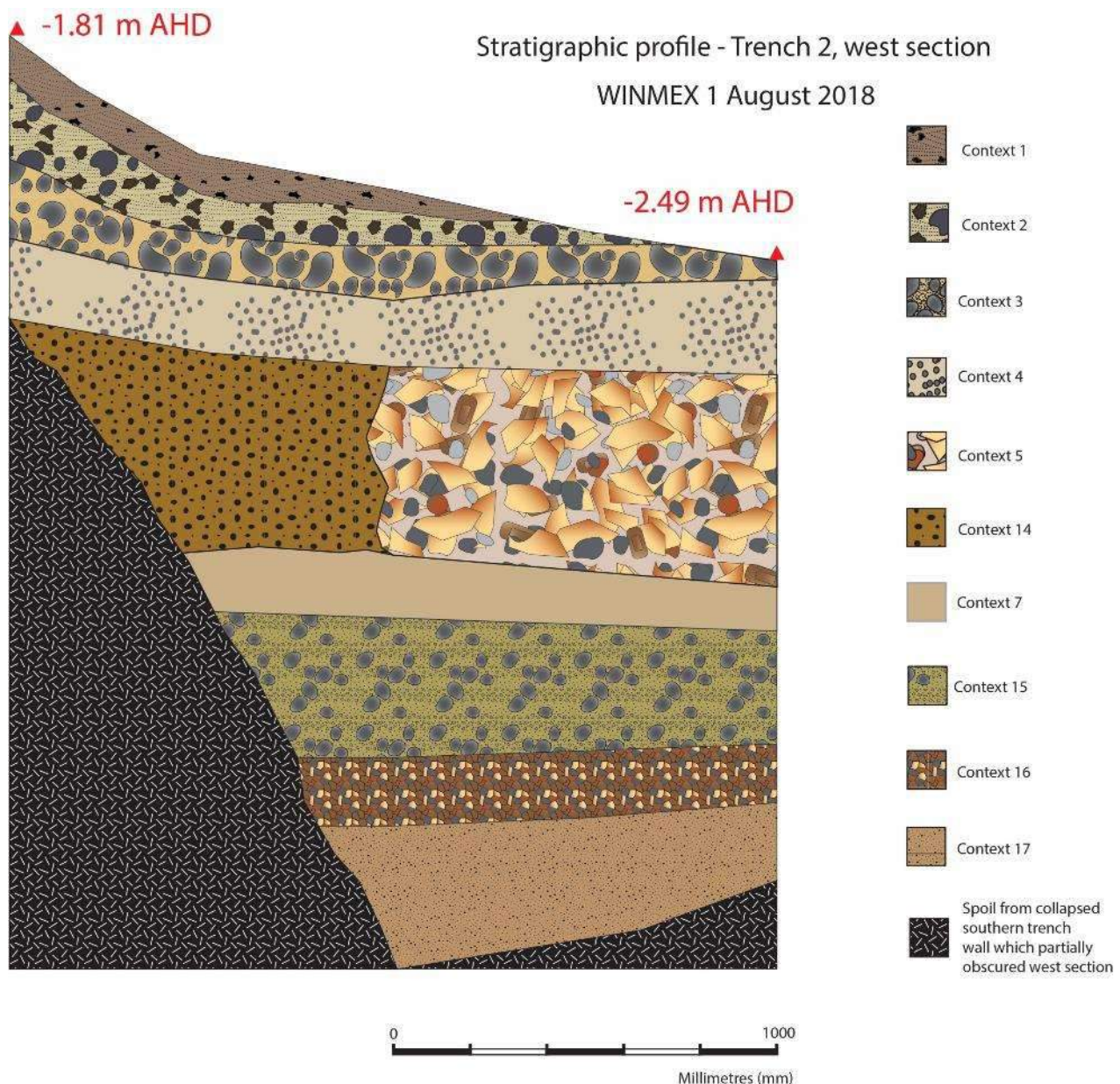


Figure 114: West section of DT 2.

Context 05

Underneath Context 04 in the northern half of the trench was a matrix of mixed types of rock cemented together to form a conglomerate (Cxt 05) as was found in Trench 1. One of the rocks sampled from this matrix was a quartzose sandstone derived from the Hawkesbury Sandstone formation (See Annex P – S28). The matrix was up to 500 mm thick. The southern edge of the conglomerate was very irregular which indicate that it was not deposited within timber formwork. Hardware and maritime artefacts, including ferrous fasteners, fragments of copper alloy sheathing, tacks and nails formed the largest proportion of artefacts recovered from this context. In addition, a large number of glass fragments were also recovered, along with coins, a pocket knife, a jewellery component, a fishing lure, lead sinkers, pins, a harmonica and a tobacco pipe. Three Aboriginal stone artefacts were also recovered from this context.

Of mollusc shell recovered there were five oyster shell fragments, two freshwater mussel fragments and two Hairy mussel fragments. One pig bone was found along with a small number of peach pits.

Context 14

Adjacent and on the southern side of the conglomerate was loose coarse sand containing gravel up to 20 mm in size (Cxt 14). This context was very similar to Cxt 04 but was excavated separately so as to differentiate the artefacts recovered from the sediments above the conglomerate and those from beside it. The majority of artefacts recovered from this context were nails and fasteners along with the ubiquitous fragments of copper sheathing. Other artefacts included glass bottle fragments, pieces of ceramic serving ware, a coin, pins, clothing fasteners and a tobacco pipe. Also found were three Aboriginal stone artefacts.

Three oyster shell fragments were recovered as were one cattle bone fragment, one pig element and one fish (mullet) bone. Also present were two peach pits and a walnut endocarp – one of only two walnut remains found during the excavation.

Context 07

Both Cxt 05 and 14 lay on top of an approximate 100 mm layer of gravelly coarse sand (Cxt 07). The rock inclusions were up to 50 mm in size. Ferrous nails, tacks and screws formed the largest grouping of artefact type found followed by copper sheathing and copper fasteners. Also found were pins, clothing fasteners and a fishing sinker. Two Aboriginal stone artefacts were recovered as well.

Context 15

The stratum below Cxt 07 was composed of cobbles measuring up to 200 mm diameter with the occasional angular sandstone fragment. There was fine sand filling the voids between stones (Cxt 15). One of the rocks sampled from this matrix was a medium-grained quartzose sandstone which very likely derived from the Hawkesbury Sandstone formation (See Annex P – S90).

This context measured between 250 mm and 300 mm in thickness. As with the above contexts the majority of the artefacts recovered were nails and other forms of fasteners. Copper alloy sheathing and fasteners were also present as were buttons, pins, a lead security seal and a tobacco pipe.

Animal bone recovered included two cattle bone fragments, one bird (cormorant) bone, and two fish bones – one of which was flathead. Four peach pits and a watermelon seed were also found in this context.

Context 16

The cobble layer of Cxt 16 lay above an approximately 100 mm thick compacted rock layer consisting of sandstone and what appeared to be basalt. One of the 'basalt' rocks was identified as a moderately weathered olivine basalt which was likely locally derived from nearby outcrops which are relatively abundant in the western Sydney region (See Annex P – S91). The artefacts from this context included a coin, cut nails and a pin with wire-wound head.

A single peach pit, a cattle bone fragment and a freshwater mussel fragment was recovered from this context.

Context 17

At the limit of excavation was a matrix composed of loose sand mixed with pebbles inclusion measuring between 20 mm and 30 mm in diameter (Cxt 17). This matrix was excavated up to a depth of 400 mm without encountering a change in composition. The artefacts found within this matrix are nails, fragments of ceramic as well as a button and a tobacco pipe fragment.

Three peach pits were recovered from this context, as were one cattle bone fragment, one sheep bone fragment and one fish (mullet) bone.

6.4 Deep Trench Three

Context 02

The surface of DT 3 was composed of cobbles, sandstone and smaller stones (Cxt 02). The cobbles measured less than 150 mm across while the sandstone was generally larger, up to <200 mm across and the smaller stones between 20 and 50 mm in size (Figure 115). The voids between the rocks were filled with a sand gravel mix. The thickness of this context measured between 100 mm and 200 mm. The artefacts from this context were mostly glass fragments from bottles, ferrous nails and other fasteners, as well as fragments of copper sheathing. Besides coins, also found were pins, clothing fasteners, and a few ceramic fragments. A single Aboriginal stone artefact was also recovered.

Eight oyster shell fragments and one freshwater mussel shell fragment were found. Only two plant macro-remains were recovered from this context, a peach pit and a pumpkin seed.

Context 03

Underlying Cxt 02 was a sandy gravel matrix with cobbles up to 200 mm thick (Cxt 03). Within this context were found pins, clothing fasteners, a brass ring, a fish lure and a tobacco pipe while glass fragments, ferrous nails and copper alloy sheathing fragments formed the majority of the finds. Three oyster shell fragments were also recovered.

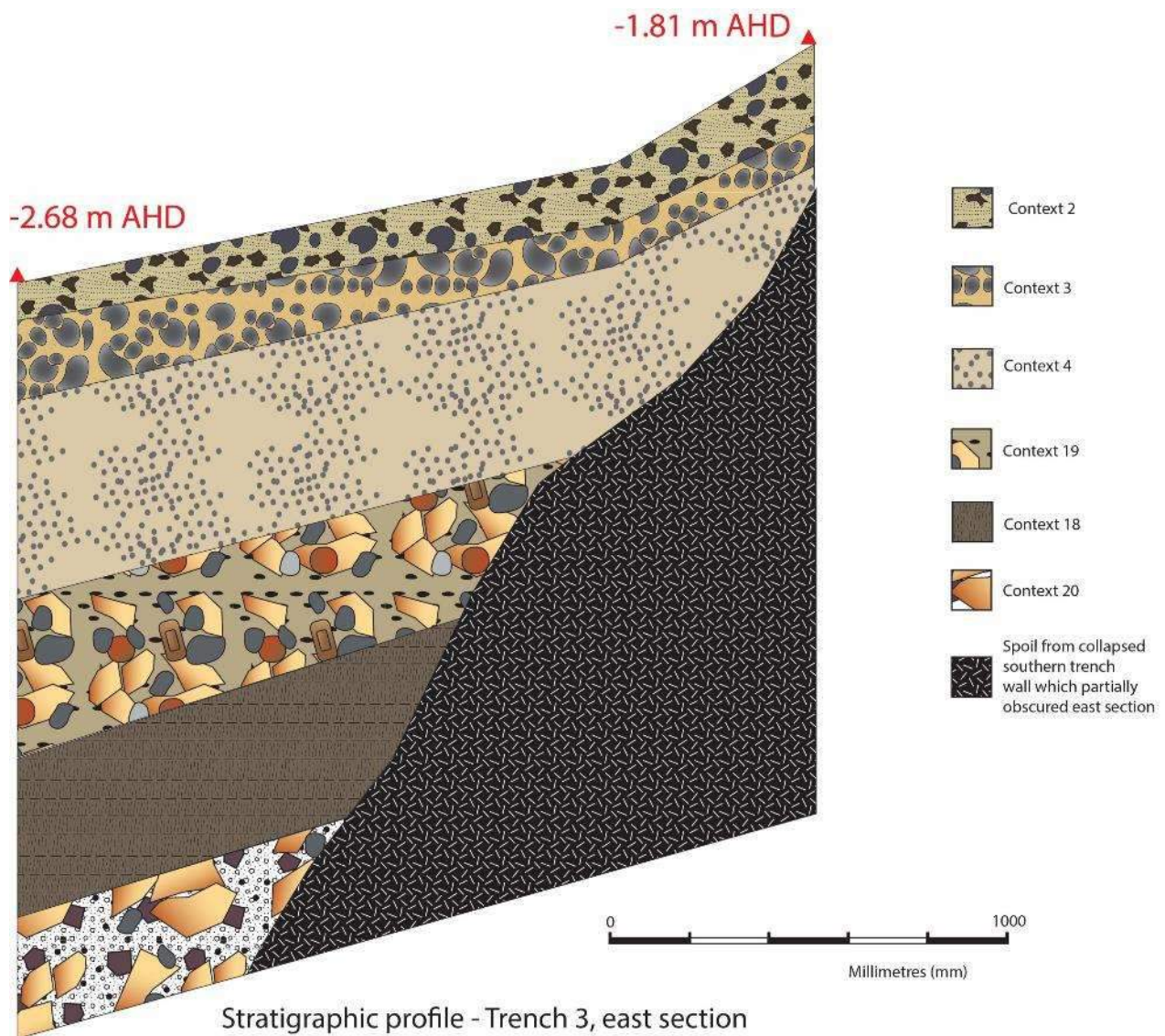
Context 04

Cxt 04 was a coarse sand layer up to 500 mm thick which had a high frequency of pebbles 20 mm to 30 mm in size. There were patches of gravel within the matrix within which were stones measuring up to 100 mm across. There were also the infrequent larger stones measuring between 300 mm and 400 mm across.

Ferrous nails were the most common artefact types with a higher representation of ferrous spikes than found elsewhere in the excavated areas. There was also a considerably high frequency of copper sheathing, nails and tacks. A large number of fragments from glass bottles was also recovered. Also found were coins, pins, clothing fasteners, fishing tackle and sinkers, fibrous rope, a toothpaste cap, four pocket knives and tobacco pipes. The vast majority of Aboriginal stone artefacts (9) recovered from DT3 came from this context.

A large amount of oyster shell fragments was found, along with some freshwater mussel and Sydney cockle shell fragments. Twenty-eight peach pits and some coconut shell and one watermelon seed were also recovered.

Animal bone recovered consisted of ten cattle bone fragments, seven sheep bone fragments, five pig fragments, four fish bones and two bird bones – duck and egret / heron.



Context 19

Cxt 19 was a rocky matrix around 400 mm thick consisting of basalt and sandstone measuring between 150 and 450 mm across and included brick fragments and conglomerate. A number of rock samples were obtained from this context and analysed. Two of the samples were quartzose sandstone very likely derived from the Hawkesbury Sandstone formation (See Annex P – S103 and 104). One of the samples initially thought to be a type of basalt was an iron silicate (fayalite-quartz-magnetite) also known as slag (Figure 116). Crystalline iron silicate slag is produced by smelting for iron from a non-blast furnace (as blast furnace iron slags produce a glassy slag) which would date the material to at least the mid 1800's (See Annex P – S102). Another basalt type rock was identified as a moderately altered and weathered micro-dolerite which was more than likely locally sourced (See Annex P – S102).



Figure 116: Sample of slag from Cxt 19, DT 3 (See Annex P – S102).

A fragment of 'conglomerate' was also sampled from this context (Figure 117). Defined as poorly-sorted clast-supported polymictic conglomerate, the wide range in lithic clast compositions and degree of roundness, lack of any sorting and the occurrence of quartzose sandstone clasts (most likely derived from the Hawkesbury Sandstone formation) clearly suggested that this conglomerate is of local derivation (See Annex P – S101).



Figure 117: Sample of conglomerate from Cxt 19, DT 3 (See Annex P – S101).

Ferrous fasteners were the largest single class of artefacts recovered from this context with copper alloy spikes, nails, tacks and copper sheathing also represented. Also found were rope, bricks, glass fragments, a fishing sinker, a toy gun, pins and a tobacco pipe.

Three peach pits and one coconut shell fragment were recovered from this context as were six oyster shell fragments. Three cattle bone fragments and two sheep bone fragments were also found.

Context 18

Underlying the rocky matrix of Cxt 19 was a 100 to 400 mm thick layer of compacted fine silt with a plastic consistency (Cxt 18). There were no rock or gravel inclusions. As with the context above the largest artefact classes were ferrous fasteners while copper alloy sheathing and a spike were recovered as were fragments of tobacco pipes and two pieces of coal. Additionally, there were relatively large numbers of brick fragments and shards of glass from bottles and drinking vessels.

Mollusc shell recovered included 16 oyster shell fragments and two Sydney cockle shell fragments. A single cattle bone fragment was found.

Context 20

The base of the trench was bedrock, which was a compacted rock layer consisting of worn sandstone, cobbles and what appeared to be angular basalt (Cxt 20). The rocks were too large to move and excavation ceased. A number of the rocks were sampled from this matrix and were identified as friable medium-grained quartzose sandstone, derived from the Hawkesbury Sandstone formation and partially altered micro-dolerite which has a relatively widespread occurrence throughout the Sydney Basin and the Sydney region (See Annex P – S026, 027 and 032).

6.5 Shallow Trench One

Shallow trench 1 extended eastwards of the eastern end of Deep Trench 1 along the tops and sides of timbers UWF05 and UWF09 (described in Section 6.2) which resulted in the depth of the trench not exceeding 500 mm. The contexts which would have been excavated would have been 01 to 04 and the upper portions of the conglomerate of Cxt 05. As such no context number was assigned to the artefacts recovered. Artefacts recovered included pins, glass, coins, part of a plough, fishing related equipment as well as fragments of copper sheathing. One Aboriginal stone artefact was also found.

Animal bones were represented by three cattle bone fragments and one sheep bone fragment. Five oyster shell fragments and two peach pits were identified.

6.6 Shallow Trench Two

Shallow Trench 2 extended northwards of the north eastern end of Deep Trench 1. It was approximately 500 mm wide and 3 m in length. The only matrix removed was the sediment laying above the bluestone rock armour and wharf ballast. The artefacts recovered from the sandy matrix which could be considered to be Cxt 01 included wrought, cut, and wire drawn nails, ceramic sherds, a pin, coins and several ferrous spikes. Two Aboriginal stone artefacts were also found.

Bluestone rock armour, up to 500 mm across, was uncovered between 500 mm and 1 m from the northern edge of Trench 1. Under the bluestone was sandstone rock up to 200 mm across, and other rock which may have been granite. This rubble extended northwards for around 2 m before ending at a matrix of gravel and coarse sand. What appears to have been decomposing bedrock – sandstone and shale up to 100 mm across was identified around 3.7 m from the northern edge of Trench 1. The top of this exposed bedrock was -3.57m AHD which was lower than the bedrock exposed in Deep Trench 1, -3.44 m to -3.50 m.

6.7 Shallow Trench Three

Shallow Trench 3 extended southwards of the south eastern end of Deep Trench 1 for up to two metres. Silt and loose rock rubble was removed for a distance of around 3 m before encountering immovable large, > 500 mm, bluestone rubble. At this point the trench was abandoned. No timbers were uncovered within the trench. The artefacts included a pin, copper tacks, copper sheathing, a horseshoe, a screw and decimal coins.

6.8 Shallow Trench Four

Shallow Trench 4 extended northwards of the northern edge of Deep Trench 1 for around 2 m and along the tops and sides of timbers UWF12, UWF13 and UWF 14 which resulted in the depth of the trench not exceeding 500 mm. The contexts which would have been excavated would have been Cxts 01 to 04 and the upper portions of the conglomerate of Cxt 05. As such no context number was assigned to the artefacts recovered. The artefacts recovered included pins, glass, coins, part of a plough, fishing related equipment, numerous ferrous nails and other ferrous hardware, cartridges and percussion caps, copper nails, tacks, and roves, as well as fragments of copper sheathing.

Five peach pits, a single walnut endocarp and a single chestnut endocarp – the only chestnut fragment found during the excavation – were recovered from this trench.

Of the timbers exposed they had been partially exposed in Sq 12 of Trench 1. UWF12 was laying almost parallel to UWF06 and up to 150 apart. It measured 300 mm x 400 mm across, was rounded at the corners but was not circular. It was around 1.8 m long and badly damaged by marine borers. This appears to have been its original length as there were remnant mortices at either end. The mortice at the better preserved eastern end is 250 mm long, 250 mm wide and 180 mm deep. The mortice at the western end is 500 mm long, at least 130 mm wide and 130 mm deep. This timber was likely part of the upper part of a wharf structure, possibly a corbel. The timber species was Red Ironbark – *Eucalyptus ?siderophloia* (not *Eucalyptus sideroxylon*).

Around 100 mm to 150 mm further north of UWF12 is a heavily degraded 300 mm diameter timber pile – UWF13 - of which 2.85 m was exposed, the eastern end remained unexcavated. It was squared in places but was mostly round. The timber species was Red Ironbark – *Eucalyptus ?siderophloia* (not *Eucalyptus sideroxylon*).

Laying adjacent and eventually passing under UWF13 at its eastern end is what appears to be a very degraded timber pile (UWF14) between 390 mm diameter. It was exposed for a distance of 2.7 m and the timber species was Red Ironbark – *Eucalyptus ?siderophloia* (not *Eucalyptus sideroxylon*). There were the remains of a 115 mm wide and 380 mm deep cut in the western end of the timber. There was no evidence on this timber or the others of copper sheathing.

6.9 Shallow Trench Five

The surface of ST 5 was comprised of large angular rocks as well as smaller stone overlain by 19th and 20th century brick rubble in the SW corner and silty sand elsewhere.

As the silt and sand was removed more brick rubble was exposed across the trench. This layer was around 200 mm thick and rested on an approximate 300 mm thick silt layer which itself overlay a gravelly matrix of angular stone up to 50 mm across and river pebbles which had formed into conglomerate in places. This gravel matrix was around 200 mm to 300 mm thick. These three matrices were named 'ST5 overburden'. Even though there was discernible stratigraphy these matrices were very disturbed as plastic was found throughout them. The artefacts recovered in the rocks, bricks and conglomerate were mostly modern plastics and glass with fragments of copper sheathing and tacks also being found.

In the NE corner of the trench, timbers were also uncovered. Most were loose and too damaged by marine borer activity to record in detail. The most substantial timber was a 200 mm diameter log (UWF16) which tapered to 190 mm diameter at its northern end where it entered the trench baulk. A sawn off small branch on the log suggests it may not have been a structural element but rather an offcut from a tree lopping exercise. At the southern end the log has also been sawcut and it abuts the end of another saw cut log (UWF15), 220 mm in diameter, which was exposed in the face of the southern baulk.

Protruding from under the log (UWF16) were three thin timber overlapping planks (UWF17). Laying on or up against the planks were ferrous spikes up to 100 mm long and two 2 cent pieces. These timbers were wreckage from a clinker built boat. No other evidence of the wreckage was found in ST5 or anywhere else in on the site.

Context 23

Below gravelly matrix described above, with depth increasingly became siltier and sandier with small stone inclusions, occasional river cobbles up to 300 mm across and sandstone chunks up to 150 mm across. This silty sand matrix was labelled Cxt 23 and was around 250 mm to 500 mm thick. A considerable number of coins was found in this context most of which were decimal (post 1966) as well as clothing fasteners and pins. Twelve Aboriginal stone artefacts were found in this context.

Four peach pits and a pecan endocarp were found in this context. Four oyster shell fragments and three Sydney cockle shell fragments were recovered as were one cattle bone fragment and one pig element.

Context 24

Under Cxt 23 was a thick grey silty clay (Cxt 24). Within this silt were the occasional large sandstone or bluestone rock up to 250 mm across as well as the occasional unworked wood fragment. With depth the density of the clay increased as did the frequency and size, up to 400 mm across, of sandstone fragments. The rocks were relatively flat and plate-like which was consistent with the eroding sandstone of the Wianamatta Shale bedrock. The rocks however were not lying flat but were resting at random angles. This suggests a level of disturbance of the upper layers of the bedrock. Not all sandstone appeared to be local, as one was recovered that had an oyster shell on it which indicates was brought to the site downstream from Wisemans Ferry.

Approximately 400 to 500 mm of this context was excavated with probing indicating there was another 300 to 550 mm of clay before solid bedrock was reached. Artefacts found in this context include ceramic sherds, decimal coins, clothing fasteners and pins. Also found were 10 Aboriginal stone artefacts.

Six peach pits, a pumpkin seed and a watermelon seed were recovered. Oyster shell and Sydney cockle shell fragments were present as were 10 pig bones and one sheep bone.

6.10 Shallow Trench Six

The surface of ST 6 was silty sand and this deposit continued for 500 mm with patches of sandy gravel with depth. Within this deposit were found five Australian coins with mint dates from 1976 to 2009 and a 1979 *Seiko Twin Quartz* man's wristwatch.

The sand matrix came down across the 3 m x 3 m trench onto exposed angular rock less than 1 m in length, possibly sandstone kerbing with other rocks up to 600 mm across. No evidence of timber structure was encountered.

A 0.5 m wide trench extended northwards from ST 6 to the centre of the river. At 2.5 m from the northern boundary of the trench and 400 mm below the riverbed the larger stone gave way to smaller angular rock, possibly sandstone up to 300 mm across. This matrix which lay under the layer composed of the larger rock continued for approximately 500 mm before its edge was reached. Along the edge of the smaller rock layer was sandy gravel which lay directly atop of flat expanses of rock which was interpreted as bedrock.

No contexts were assigned to these matrices.

7 Findings – Above Water Survey

The survey of the riverbank identified 44 structural elements that have been broken down into 13 groupings maritime infrastructure features and their associated sub elements. An additional feature composed of sandstone kerbing has also been deposited on the riverbed in recent years to prevent erosion of the bank.

AWF6 is the most substantial feature remaining. Consisting of four walers running out into the river and two deck beams running perpendicular to the river attached to the top of the walers (

Figure 118). There are two degraded piles at the NW (AWF4) and NE (AWF11) corners (Figure 119). These piles have copper sheathing present attached with copper alloy tacks. There is another pile located at the SW corner embedded in the riverbank. This pile did not have any obvious sheathing or other protective shield present and is approximately 400 mm in diameter. In the centre of the bay, there are seven cut off rounded piles. There is also a remnant sandstone block that may have been used for fill under the wharf at the riverbank. At the western end, there are another three cut-off rounded piles. These cut-off piles were all similar in diameter, ranging from 280mm-330mm. The condition of the piles was generally good, apart from one; AWF6/11, that is heavily degraded (Figure 120).

The clearing of vegetation from the riverbank resulted in new features being uncovered. AWF10 appears to be constructed similarly to AWF6 (

Figure 118). What remains are two walers and two deck beams with one degraded pile in the river, AWF7 appears to be located at the NW corner. This pile is protected with copper sheathing, although the much of the sheathing has worn away, particularly on the western side (Figure 121 and Figure 122). There are also three cut off piles in the centre of this feature ranging from 300-330mm in diameter.

Figure 118: From left to right AWF10 (green arrow), AWF6 (yellow arrow) and AWF 2 at right edge of image (orange arrow).



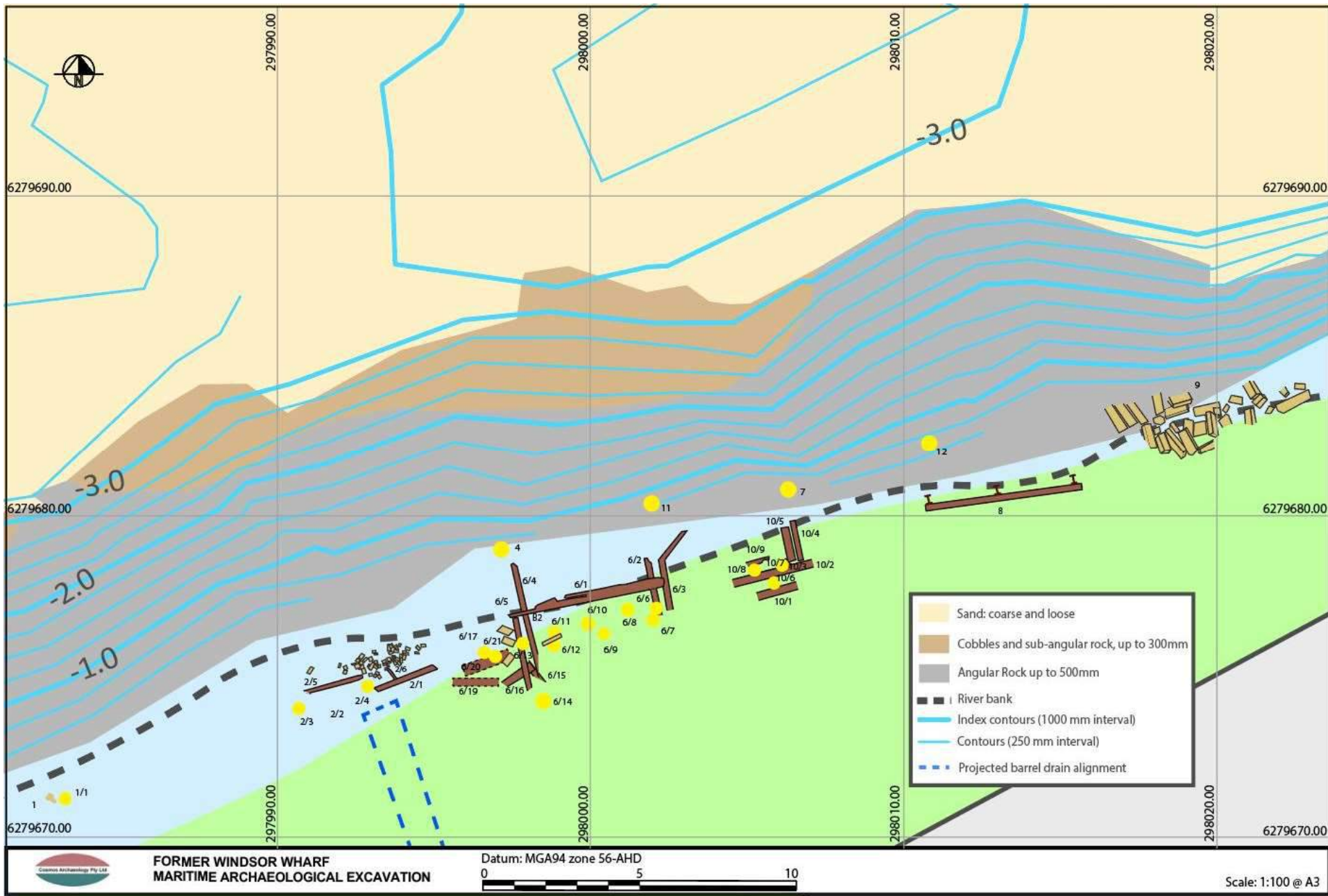


Figure 119: Site plan of exposed wharf remains.



Figure 120: Cut off piles AWF6/10 and AWF6/11. Note heavily degraded pile to the right and bolts near the base of these piles.



Figure 121: Remains of copper sheathing on the western side of AWF7. Red arrow indicated potential sheathing repair and brown arrow indicates sheathing lined notch. Scale in 100 mm increments.



Figure 122: Only small sections of sheathing survive on the western side of AWF7, indicated by orange arrow. Scale in 100 mm increments.

Timber samples were taken from AWF7 (degraded pile) and AWF6/9 (cut-off pile) and the timber for both was determined to be *Eucalyptus ?paniculata*, commonly known as Grey Ironbark or Coast Grey Box.

AWF2 is at the western end of the remaining wharf structure. This section is quite heavily degraded with only a short section of one waler next to a warped section of remaining deck beam and three cut off round piles running parallel to the deck beam, approximately 1,000 mm apart. These piles were approximately 300 mm in diameter (Figure 123).



Figure 123: Section of AWF2, showing timber beam with bolt B11 (red circle) and brick rubble pile (AWF13). A cut off pile (AWF2/4) associated with this feature is lower right of frame (red arrow).

The brick rubble pile, AWF13, located adjacent to AWF2 appeared to consist of three different types of bricks.

1. Dry, pressed shale with frog, 240 mm long, 120 mm wide and 90 mm thick. The frog measured 140 mm long and 70 mm wide. (Figure 124)
2. Mid brown to red clay likely pressed, 240 mm long, 110 mm wide and 88 mm thick. (Figure 125)
3. Friable red clay sandstock with large frog, no fully extent bricks located, remnant length 150 mm, 110 mm wide and 80 mm thick. (Figure 126).



Figure 124: Dry, pressed shale brick. Scale in 100 mm increments.



Figure 125: Mid brown to red clay pressed brick. Scale in 100 mm increments.



Figure 126: Fragile, waterworn red clay brick. Scale in 100 mm increments.

In January 2018 the archaeologists working on the terrestrial excavation were able to determine the alignment of the 1815/16 brick barrel drain and where it would exit the riverbank after its discovery.²⁵² It appeared that AWF2 was where the drain emptied into the river, however, there was no obvious visible evidence of any remnants of the feature.

The third type of brick (Figure 126) was contemporary with the construction of the brick barrel drain, but the examined bricks utilised in the construction of the drainage system or found within the fills had no frogs, government Broad Arrows nor other identifying marks.²⁵³

There were no obvious fitted bricks and all the bricks were jumbled together. There was brick rubble above and between the exposed timber, meaning it is likely the brick rubble deposit was brought in as fill and dumped over the wharf remains, most likely towards the end of the 20th

²⁵² AAJV, September 2019. Windsor Bridge Replacement Project, Salvage Excavation Report – Historical Archaeology; **Cosmos Archaeology Pty Ltd, March 2018**, Maritime Archaeological Testing Report and Detailed Salvage Strategy for Maritime Archaeological Excavation: p:69

²⁵³ Op. Cit. AAJV, September 2019:134

century. The broken state of the fragile red clay bricks also suggested these bricks were transferred to this location from elsewhere.

The more modern features recorded in 2008-2016 were still present on the site. The condition and placement of AWF9, the sandstone kerbing and AWF13, the brick rubble pile was as per 2016. The condition of AWF8, the retaining wall comprised of “I” beams and brick rubble fill, has deteriorated since 2008.

The individual elements of each feature are described in detail in Table 4 and shown in Figure 119. For interpretation of the features refer to Section 8.

Table 4 Description of features located on the southern riverbank.

Feature ID	Type	Description
AWF1	Rough stone wall and pipe	This is the closest recorded feature to the former (1874) bridge and comprised of a hand- stacked irregular-coursed retaining wall composed of squared sandstone blocks up to 300mm across. This wall was in poor condition in 2016 and had since deteriorated. Set into the remains of this wall is a broken stone ware pipe up to 300mm in diameter which served as a storm water or sewer outlet.
AWF1/1	Pile	Timber pile, 300mm diameter, 450mm length, degraded but not cut, partially exposed within the riverbank. This feature was located adjacent to the end of the line of gabion baskets that run along the river edge at the low water level. There is no evidence of protective copper sheathing or pitch.
AWF2/1	Timber plank	Timber plank, 350mm visible length, and 20mm thick, running parallel to the river undercut into the bank. There is approximately 2m of sloping ground up to the base of the gabion baskets. One large ferrous bolt, length 220mm with washer, 45mm x 45mm and square head 35mm x 35mm. Possible deck plank, washed into position.
AWF2/2	Cut off pile	Cut off timber pile, 300mm diameter underneath timber plank. No evidence of copper sheathing or pitch. Pile cut off 10mm above riverbed. Three piles AWF2/1, AWF2/2 and AWF2/3 1,000mm apart, running parallel to the riverbank.
AWF2/3	Cut off pile	Cut off timber pile, 300mm diameter underneath timber plank. No evidence of copper sheathing or pitch. Pile cut off 10mm above riverbed Three piles AWF2/1, AWF2/2 and AWF2/3 1000mm apart, running parallel to the riverbank.
AWF2/4	Cut off pile	Cut off timber pile, 300mm diameter underneath timber plank. No evidence of copper sheathing or pitch. Pile cut off 10mm above riverbed Three piles AWF2/1, AWF2/2 and AWF2/3 1000mm apart, running parallel to the riverbank.
AWF2/5	Timber beam	Runs parallel to riverbank and rests in front of AWF2/3 and AWF2/4 (probably a section of AWF2 that has broken away)
AWF2/6	Waler	Highly degraded, with only 500mm length extending out from the riverbank. Rough half round shape, this beam is only 200mm wide and 180mm thick. This is likely the wale beam exposed during 2016 and labelled as F3.
AWF 4	Timber Pile Stump	Approximately 350mm diameter, highly degraded and is not visible above waterline. Height was unable to be taken. Protective copper sheathing attached by copper alloy tacks. Sheathing is degraded and missing in parts. There is no evidence of any marks or stamps in the sheathing, but much of the sheathing is underwater so there may be marks underwater.
AWF6/1	Timber deck beam	Running parallel to the riverbank and measuring 5500mm in length, 250mm wide and 200mm thick. This beam appears to have rolled forward approximately 45 degrees. Timber is Narrow Leaved Red Ironbark (<i>Eucalyptus crebra</i>).
AWF6/2	Waler	Inner waler eastern end of F6 which appears to be resting on a pile (F6/6). The visible length is 1860mm and 300mm wide. At its thickest point, the timber is 250mm. The wale beam is half round shaped and appears to run back into the riverbank possibly attached to a buried section of wharf. The flat edge of the wale beam is spaced 400mm apart from the flat edge of wale beam AWF6/3.

Feature ID	Type	Description
AWF6/3	Waler	Outer waler eastern end of F6. The wale beam is crescent shaped and appears to run back into the riverbank possibly attached to a buried section of wharf. The visible length is 1850mm. The beam is 300mm wide and 250mm thick. The wale beam is half round shaped and appears to run back into the riverbank possibly attached to a buried section of wharf. The flat edge of the wale beam is spaced 400mm apart from the flat edge of wale beam AWF6/2.
AWF6/4	Waler	Inner waler at western end of F6. The wale beam is crescent shaped and appears to run back into the riverbank possibly attached to a buried section of wharf. The wale beam is half round shaped and appears to run back into the riverbank possibly attached to a buried section of wharf. The visible length is 3700mm. The beam is 300mm wide and 200mm thick edge of wale beam AWF6/5.
AWF6/5	Waler	Outer western end of F6 broken off before F6/1. Measurable length 2480mm until the timber disappears into the riverbank. Bolt observed in 2016 at northern end joining the two whalers is missing. Both whalers (6/4 and F6/5) are shorter than 2016 survey. This waler is heavily degraded, with remnant width 250mm wide and thickness 200mm. Timber is Red Ironbark (<i>Eucalyptus ?siderophloia</i> not <i>Eucalyptus sideroxylon</i>)
AWF6/6	Cut off timber pile	300mm diameter, appears square but is also very worn. Whaler F6/2 is resting on this pile. No sheathing or fastenings present.
AWF6/7	Cut off timber pile	310mm diameter. No sheathing, pitch or fastenings present.
AWF6/8	Cut off timber pile	320mm diameter, very degraded on northern face. No sheathing, pitch or fastenings present.
AWF6/9	Cut off timber pile	280mm diameter. No sheathing or fastenings present. Timber is Grey Ironbark or Coast Grey Box (<i>Eucalyptus ?paniculata</i>).
AWF6/10	Cut off timber pile	340mm diameter. On the western side of pile, there is a heavily corroded bolt present. No sheathing present.
AWF6/11	Cut off timber pile	300mm diameter. Very damaged/degraded. On the eastern side there appears to be a ferrous bolt approximately 100mm off the riverbed.
AWF6/12	Cut off timber pile	300mm diameter. Sandstone block resting between F6/11 and F6/12.
AWF6/13	Cut off timber pile	Cut off round pile 300mm diameter. Very damaged/degraded.
AWF6/14	Timber pile	Possible uncut pile buried in riverbed, visible through whalers but inaccessible for measurements. No obvious fastenings noted.
AWF6/15	Timber	Diagonal to F6/14 NW direction
AWF6/16	Timber	Diagonal to F6/15 SW direction and resting underneath F6/5 with a split down the middle
AWF6/17	Cut off timber pile	300mm diameter. This pile is likely the same pile labelled as part of F5 in 2016. No sheathing present.
AWF6/19	Timber piece	Embedded in riverbank, running parallel to it.
AWF6/20	Timber piece	To the north of 6/19, possibly a fallen beam from that feature running east to west disappears into riverbed at western end, very degraded visible section 1600mm long.
AWF6/21	cut off timber pile	300mm diameter. Located partially underneath F6/20. This is likely to be the second pile identified in 2016 and labelled F5.
AWF7	Timber pile stump	Approximately 1200 mm high and 400mm diameter. In line with the walers on the western end of AWF10. Protective copper sheathing attached by copper alloy tacks. Sheathing is degraded and missing in parts but largely present up to approximately 1200mm height. There is no evidence of any marks or stamps in the sheathing, but much of the sheathing is underwater so there may be marks underwater. Evidence of repairs with squares of sheathing in patches visible over older sheathing. There is a round hole through the pile running north-south approximately 1200mm from the riverbed. On the western side there is a rectangular inset in the sheathing, measuring 50mm by 30mm and inset approximately 25mm. This inset was also lined with sheathing. Timber is Grey Ironbark or Coast Grey Box (<i>Eucalyptus ?paniculata</i>).

Feature ID	Type	Description
AWF8/1	Retaining wall	Formed of three vertical steel "I" beams, 300 mm by 200 mm, backed by two squared timber beams, 200 mm across and approximately 5 m long, with a fill of sandstone, brick and concrete fragments. This structure has collapsed significantly since 2016.
AWF9	Sandstone kerbing	Downstream and adjacent to the retaining wall was a collection of sandstone kerbing up to 750 mm in length. During the 2016 field investigation a worker from the Council explained that the kerbing originated from the main road through the Windsor Township and was deposited in the late 20th century to retard bank erosion.
AWF10/1	Timber	Timber runs parallel to riverbed disappears underneath the mud (closest to riverbed). Visible section of the beam is 1300mm long.
AWF10/2	Timber beam	Parallel to AWF10/1 on the northern or riverside. One loose ferrous bolt running parallel to timber and two ferrous bolts running through timber perpendicular. Visible sections of beam are 2600mm in length.
AWF10/3	Timber pieces (deck planking?)	Two short pieces of timber running perpendicular to 10/2. Appears to be checked into the timber of F10/2 rather than fastened but very heavily degraded.
AWF10/4	Waler	Outer western end of F10. Two ferrous fastenings present. Length of timber is 1850mm and continues underneath the riverbank. Timber is <i>Eucalyptus ?bosistoana</i> Coast Grey Box or Broad Leaved Red Ironbark.
AWF10/5	Waler	Inner western end of F10. One ferrous fastening is present. Length is 2800m and continues underneath the riverbank. Distance between the two whalers is 295mm.
AWF10/6	Cut off timber pile	300mm diameter, no sheathing or fastenings present.
AWF10/7	Cut off timber pile	330mm diameter, no sheathing or fastenings present.
AWF10/8	Cut off timber pile	300mm diameter, no sheathing or fastenings present.
AWF10/9	Timber	Timber piece running in a SW direction 1300mm in length and continues underneath riverbank. One ferrous fastening present.
AWF11	Timber pile stump	Approximately 400mm high and 400mm diameter. Runs in line with the whalers on the eastern end of AWF6. Protective copper sheathing attached by copper alloy tacks. Sheathing is largely present surrounding the pile to its current height. There is no evidence of any marks or stamps in the sheathing.
AWF12	Timber pile stump	Approximately 300mm high and 400mm diameter. Runs in line with the western end of the retaining wall AWF8/1. Protective copper sheathing attached by copper alloy tacks. Sheathing is present mostly remaining on the southern side with the northern side heavily degraded.
AWF13	Brick rubble pile	Three different types of bricks present all jumbled together adjacent to AWF2

There are three main types of fastenings present on the riverbank wharf. Fastenings joining the whaler beams, fastenings attaching the large deck beams to the whalers and smaller fastenings that most likely attached deck planking to beams. See Figure 127 for fastening locations on the site plan. Many of the bolts are heavily corroded and worn and as such difficult to identify individual features.

There is only one bolt joining two whalers remaining across the site. This bolt is a through bolt, approximately 15mm in diameter and most likely round, although it is heavily degraded. This bolt has likely survived due to protection from the overhanging riverbank. Due to its location it was difficult to access and neither end of the fastening could be seen. The other whaler fastenings that were present and surveyed in 2016 are no longer on site. A good image of what these fastenings looked like was taken in 2008 (

Figure 128).²⁵⁴

²⁵⁴ Cosmos Archaeology Pty Ltd, 2008, *Punt and Wharf Sites, Maritime Archaeological Inspection*, prepared for Roads and Traffic Authority, p. 13.

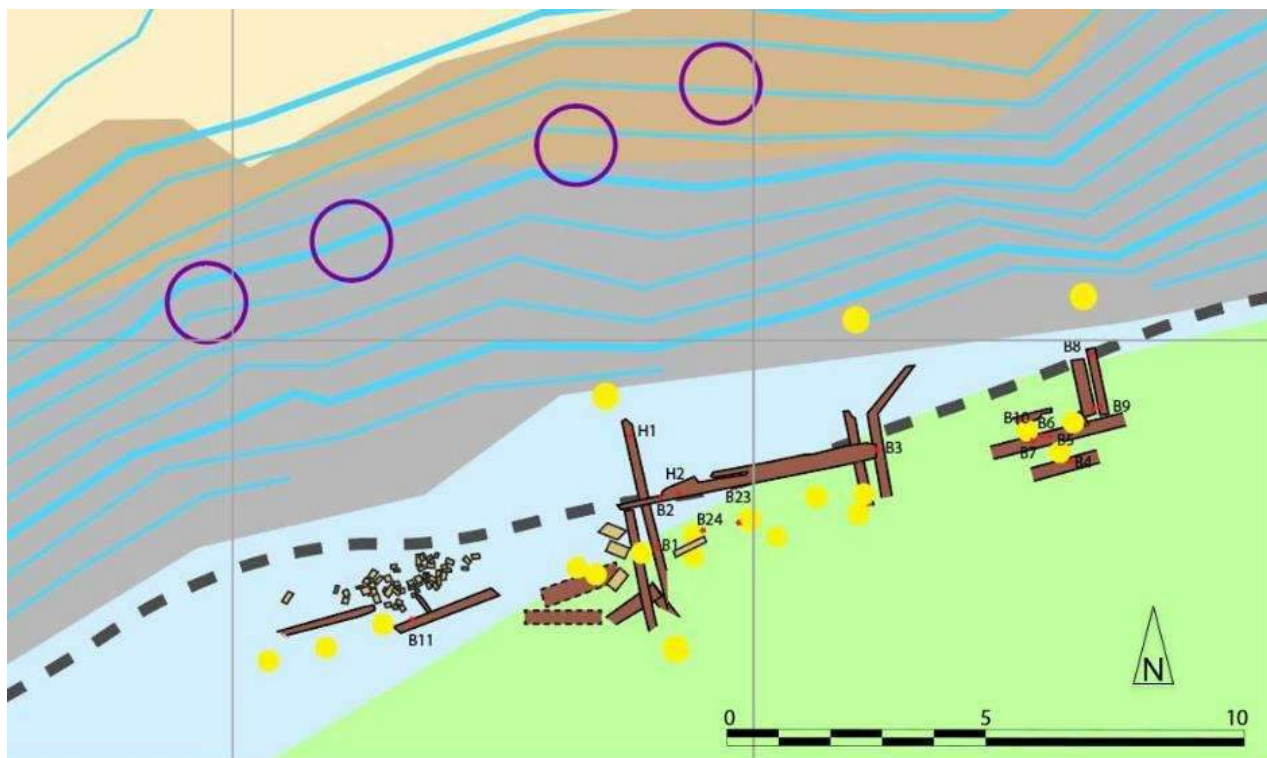


Figure 127: Site plan highlighting fastenings (B#) on exposed wharf remains. Purple circles are new Windsor bridge pile locations. For fastening description see to Table 5



Figure 128: Bolt connecting two walers, AWF5 and AWF6, in 2008. Note the bolt appears to be copper alloy rather than ferrous.

There were observed five through bolts joining deck beams to walers. These are 800 mm long, approximately 25 mm in diameter with square 35 mm heads (Figure 129). There is a square washer underneath one of these heads of 45 mm diameter (Figure 130). At the other end, these bolts are threaded and fastened with a large rectangular washer (120 mm x 40 mm) and 30 mm square nut (Figure 131).



Figure 129: Through bolt joining deck beams to walers. This bolt is through waler AWF6/4 with the deck beam no longer present. Scale in 100mm increments.



Figure 130: Bolt head with square washer (AWF2).



Figure 131: Bolt end with washer and nut through AWF6/1.

The remaining bolts are predominantly square, although heavily corroded. They do not present as through bolts rather all that remains is the end of a bolt protruding from the timber. There does not appear to be any washers or nuts used for these fastenings with the exception of a round shanked bolt with a round washer note in the deck beam of AWF6.

All the fastenings observed the site appear to be ferrous and more specifically cast iron, and there is no evidence of hand forged spikes or nails. There is no concrete or steel present in or around the remaining wharf structure. A detailed inventory was taken as part of the wharf survey (Table 5).

Table 5: Fastening descriptions for Windsor Wharf. Note this table only includes features where fastenings were present.

Feature	Feature Description	Fastening ID	Description
AWF4	Degraded pile	T1	Copper sheathing tacks, round flat heads, approximately 4 mm in diameter, square shanked 15mm long.
AWF2/1	Plank	B11	Appears to be a round through bolt with a 30 mm diameter square head. Heavily corroded square 40 mm washer fused to bolt head. Bolt possibly fastening a deck beam but the nut end disappears into the riverbank. Visible length 500 mm.
AWF 6/4	Wale beam	B1	Through bolt connecting whaler to deck beam 35 mm square head, round shaft 25 mm diameter. A large, degraded mass is all the remains of the nut end under the whaler. Approximate length 800 mm.
AWF 6/1	Deck beam/stringer	B2	Rear end of bolt only. 80mm long with 20 mm diameter shaft, heavily concreted. Bolt is likely round as there is a round 45 mm diameter washer. This is the only round washer currently visible on site.
		B3	Through round bolt with thread. Bolt head under timber and inaccessible for survey. 30 mm square nut with thread. Rectangular washer/flange 120 mm x 40 mm x 20 mm thick. Accessible length 700 mm. Appears to join whaler to deck beam.
AWF6/3	Wale beam	B22	Through bolt connecting whaler to deck beam 35 mm square head, round shaft 20 mm diameter. A large degraded mass is all the remains of the nut end under the whaler. Approximate length 800 mm.
AWF6/10	Cut off pile	B23	Remains of bolt extending from the western side of the cut off pile. Shaft is 20 mm diameter and possibly square although heavily corroded. 80 mm in length. No other cut off pile has this type of bolt except AWF 6/11 (see below).
AWF6/11	Cut off pile	B24	Remains of bolt extending from the eastern side of the cut off pile. Shaft is 20 mm diameter and possibly square although heavily corroded. 80 mm in length.
AWF7	Degraded pile	T2	Copper sheathing tacks, round flat heads, approximately 4 mm in diameter, square shanked 15mm long.
AWF10/1	Beam	B4	Heavily corroded bolt fastened into timber beam. Appears round but could have been originally square. Extending 80 mm out of timber. Approximately 20mm diameter.
AWF10/2	Beam	B5	Heavily corroded broken bolt resting along length of timber not attached. Approximately 30 mm in length. Could possibly be the bolt head but shape difficult to determine. Remnant diameter 20mm at one end, 10mm at the other end.
	Beam	B6	Heavily corroded bolt fastened into timber beam. Appears rounded. Extending 80 mm out of timber.
	Beam	B7	Heavily corroded bolt fastened into timber beam. Appears rounded. Extending 80 mm out of timber. This bolt had fallen

Feature	Feature Description	Fastening ID	Description
			out of the beam between the survey in July and the survey in September.
	Beam	B20	30 mm square bolt head with rectangular washer appears to join AWF 10/5 to AWF 10/2.
AWF10/4	waler	B8	Through bolt into whaler and disappearing into the riverbed. Visible length 350 mm and 30 mm in diameter. Corrosion makes it difficult to determine bolt head shape and size but appears square.
	waler	B9	Heavily corroded bolt connecting whalers with 30 mm square head extending through AWF 10/5. Diameter 20 mm. Nut end inaccessible behind AWF 10/4.
AWF10/9		B10	Bolt shaft only. Heavily corroded, approximately 15mm diameter and 60 mm long, welded to timber planking, likely piece of wharf deck.

8 Site Formation

8.1 Known cultural activity on the site

The known cultural activity on the site is discussed primarily within the context of the construction and subsequent functioning, or not, of the various wharves that were built. These events are organised into periods and are based on the findings of Section 3 of this report as summarised in the table below:

Period	Date range	Structure(s)	Description
Period 1	1795 - 1813	Riverbank and Thompson's shipyard	The riverbank during this phase seems to have had no structures on it. It was bordered upstream by the punt crossing established at the end of this period with the western portion of Thompson's shipyard (ca. 1802-1807) encroaching on the eastern boundary of the site. Was most likely used as an informal beaching location for small boats to access the town or for repairs.
Period 2	Period 2a 1814-1815	1 st Howe and McGrath retaining wall and wharf	In August 1814 two contracts were issued, one for the construction of a retaining wall along the entire length of Thompson Square made up of piles 16" (41 cm) to 18" (46 cm) thick. The second contract was for the construction of a wharf 50' (15 m) long which projected 18' (6 m) into the River. In June 1815 wharf was described as projecting 20' (6 m) into River, 6' (2 m) high and 65' long (20 m).
	Period 2b 1815-1816	2 nd Howe and McGrath Wharf	The wharf was in the process of being extended by an additional 226' (69 m) and widened by another 12' to a full width of 30' (9.14 m) wide when it was destroyed by flood. The contract had asked for at least 3 rows of piles, two of which were forward of the edge of the apron of the first wharf. Planking was to be 2" (5 cm) thick and 6" (15 cm) wide fastened with 5" (13 cm) spikes with capwales and land ties.
	Period 2c 1817-1861	Greenway wharf	Francis Greenway took over the supervision of the construction of the wharf after the damaging flood of 1816. The wharf was finally built in 1820. No contemporary records of the dimensions and manner of construction of the wharf. 1835 plan of Windsor showing the wharf depicts it being ca. 85' (26 m) long and ca. 26' (8 m) wide. Timbers used were reportedly Australian Ironbark. This was larger than Howe and McGrath's first wharf but substantially shorter but possibly a similar, if not the same, width than their second wharf. Was non-functional by 1862 but piles visible at that time.
Period 3	1862-1933	Moriarty and Musson Wharf, early	The wharf was rebuilt in 1862. Detailed plans of the wharf exist and its basic dimensions were 35 m long and 5.5 m wide. The timber piles were driven into the rock substrate.
Period 4	1934 -1950s	Moriarty and Musson Wharf, late	The wharf was renovated in 1934 which involved repairs and replacement of some of the timber elements. It was renovated under the instigation of the Motor Boat Club, who were using it as their premises.
Period 5	1950s – present	Bank stabilisation and boat landing stage	Attempts at bank stabilisation involved rock armour composed of basalt boulders and occasional sandstone street kerbing. Latest attempts at bank stabilisation included the installation of gabion baskets. A steel girder and concrete retaining wall is all that is left of a short lived landing that was constructed sometime in the 1970s/80s.

Historical Period 1: 1795 to 1813 - Initial settlement and Thompson's Shipyard

The slipway of Thompson's Shipyard was located on the riverbank adjacent to the site. While most of the shipbuilding activity took place on land, launched vessels may have been moored along the riverbank for final fitting out. Vessels may also have been moored for repairs. Such activities would have resulted in shipbuilding material being discarded into the river both used and unused as well as tools and other stores. The use of the area for the repairs and maintenance of vessels would have taken place up until the present day.

Land clearance at the time of European settlement especially on the relatively steep slopes of the adjacent riverbank would have resulted in soil and artefacts washing down into the river. In flooding events the number and size of artefacts washing into the site would have increased. Relatively fewer artefacts would have entered the site from upstream and these artefacts, such as timber, would have been relatively buoyant to be carried by flood waters.

This influx of artefacts being washed onto the site by storm and flood events would have been an ongoing phenomenon from Period 1 to Period 5. The flood events during this period, before the laying of ballast in subsequent periods, would also have had a scouring effect whereby archaeological deposits would have been disrupted, eroded and dispersed downstream.

Historical Period 2a: 1813 to 1815- Retaining wall and 1st Howe and McGrath wharf

While the land ties (also referred to as deadman anchors) and the piles associated with the retaining wall were likely to have been driven, or dug, into the ground, the front row of piles forming the apron of the wharf would have been fitted into the bedlogs laid on the riverbed. This is because the silt and sand overlaying the bedrock substrate is too shallow for piles to hold without being driven into the bedrock. The technology to drive piles into hard rock was very unlikely to be available to the contractors in the colony at the time. The bedlogs and pile structure would have been secured and weighed down by the deposition of rock ballast. The rock would have been sourced locally but also from vessels stopping at Windsor under ballast. Such vessels may have come from as far as Sydney.

The laying of the ballast would have generally carpeted the riverbed under the wharf, mounding around the piles and bedlogs. Ballast may have also been laid down first to provide a relatively level and hard surface for the placement of the bedlogs. It is not known at present whether breath hold diving was involved in this phase of the construction of the wharf.

It is assumed that this wharf did have vessels tie up alongside and load/offload cargoes and people. As such, artefacts associated with accidental and deliberate discard would have been deposited around the wharf apron with smaller artefacts falling through the gaps in the wharf deck. An account from 1878 talks about the wharf deck being 'well swept' as well as being kept in order.²⁵⁵

At around this time Howe and McGrath constructed the brick barrel drain as part of the integrated public works programme at Thompson Square which included the retaining wall and wharf.²⁵⁶

This sewer carried effluent and storm water from the town and discharged it into the river. The outlet for the drain was somewhere in the vicinity of ST 5 (see Figure 72), which would have been slightly upstream of the Greenway Wharf – Phase 2c (see [Section 8.5](#)). Over the period of its use, presumed to be around 75 to 100 years, the 1.3 m high x 0.7 m wide drain would have carried through it a considerable amount of cultural material from food waste to fragments of ceramic and glass.²⁵⁷

Historical Period 2b: 1815-16 - 2nd Howe and McGrath wharf

It is unclear how much of the large extension of the wharf had been completed by the time the flood of 1816 demolished the original (2a) wharf and the new works (see [Section 3.2](#)). The extension would have required more ballast laid along with more bedlogs. It is unknown whether all the ballast and required bedlogs would have been laid first before piles were inserted or whether the extension was done in sections.

²⁵⁵ "The Markets." 25 May 1878. *The Cumberland Mercury*. p. 5.

²⁵⁶ AAJV May 2018, Brick Drain, Windsor, NSW – Heritage Mitigation and Options Report:13

²⁵⁷ Op. Cit. AAJV May 2018 :28 and 50

Vessels would have continued to use the original wharf during this extension phase which would have left artefacts discarded accidentally or deliberately.

Historical Period 2c: 1817 to 1861 – Greenway wharf

The Greenway wharf was of a lesser size in terms of length than the 2nd Howe and McGrath wharf but larger than the 1st Howe and McGrath wharf. It would be expected that the original bedlogs and ballast of the earlier wharves may have been utilised and added to as well as being replaced where lost. During the life of this wharf ballast would have been added at irregular intervals either through vessels unloading ballast to take on cargo or by planned laying so as to strengthen the integrity and stability of the wharf. The ballast would have been laid under the wharf and while rock, and possibly even brick, would have also been deposited forward of the apron so as to limit the effect of scouring on the structure, it would have been limited so as to not increase the height of the riverbed thereby limiting the access to the wharf to smaller vessels.

The operation of the wharf as the nexus between the river and land for the movement of people, goods and produce would have resulted in the dropping of objects into the water. This not only took place between the transfer of objects between the vessel and the wharf but also for smaller objects, such as personal possessions, between the gaps in the wharf planking. Objects would also have deposited from either side of moored vessels either as deliberate or accidental discard. This would have included tools and materials replaced as part of repair work to the structure.

The Windsor wharf in this period and in subsequent periods served also as a market place where cargoes were sold directly to the public. This would have resulted in more opportunity for deliberate and accidental discard of goods, equipment, coins and personal items from both wharf and vessel by both buyers and sellers.

The wharf would also have been used for recreational purposes such as fishing and as such artefacts associated with such activities would dropped into the water. Wharf elements over time would have degraded and/or become damaged and would also have dropped into the water.

Objects dropped into water would have alighted onto the ballast. Over time these objects, depending on their size and density would have descended through the voids in the ballast until their downward passage was impeded by compacted sands and gravels which would have gradually filled the voids (see [Section 8.2](#)).

Historical Period 3: 1862-1933 – Moriarty and Musson Wharf, early

Over the decades, the piles of the Greenway wharf would have deteriorated from the effects of marine borers, in particular teredo worm as well as constant water flow. The rate of deterioration would have been retarded by the possible wrapping of the piles by copper sheathing. The replacing of the piles would have been a relatively costly exercise requiring a certain level of skill and possibly diving was involved to remove the ballast from around the affected pile and setting the new pile into the bedlog.

By the commencement of the 1860s, the Greenway wharf was in a dilapidated state. With improvements in pile driving technology due to advancements in steam driven machinery, it would have been a more economical option to construct a new wharf on the site of the old one. This structure was also stronger and that it was not destroyed in the massive flood of 1867 is good evidence as to its durability. The remains of the earlier wharf phases would have been pulled out or sawn down close to the riverbed.

The new wharf would not have required the laying of ballast to stabilise the piles of the structure. However, ballast may have been laid under and around the wharf to reduce bank erosion. It would appear that around the time the construction of the new wharf the riverbank may have eroded by a few metres in some places as is evidenced by the exposure of what appears to be the land ties or deadman anchors behind the Phase 2 retaining walls. (Figure 132). The rear or back row of piles are likely to have been land ties or deadman anchors for the Phase 2a retaining wall.

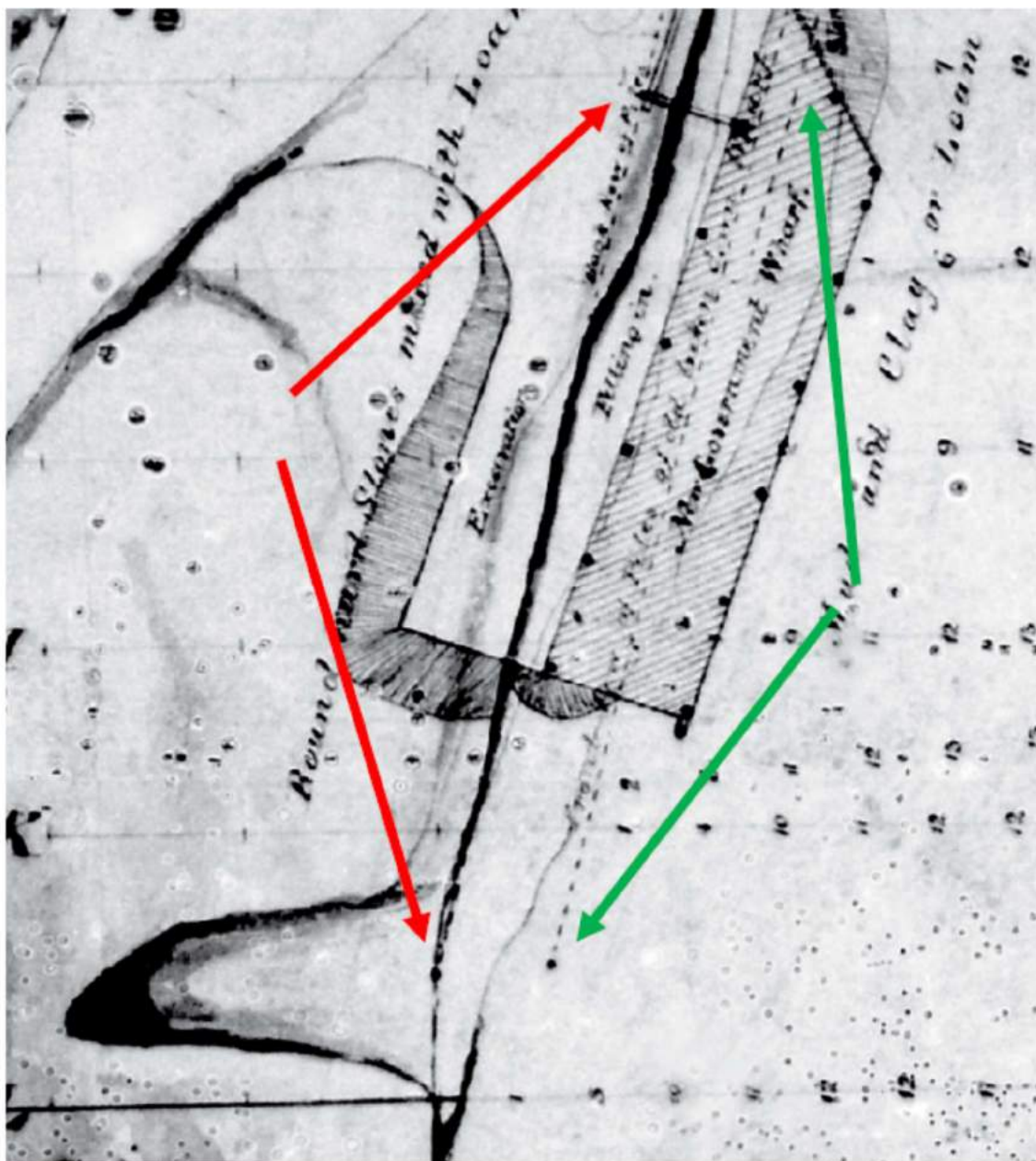


Figure 132: Portion of 1862 plan of proposed wharf showing line of piles located in an embayment downstream. The rear or back row of piles (red arrows) are likely to have been land ties or deadman anchors for the Phase 2a retaining wall while the green arrows point to the line of pile remains that formed the retaining wall. See Figure 22 in **Section 3.2** for the full image.²⁵⁸

Historical Period 4: 1934-1950s – Moriarty and Musson Wharf, late

All timber wharves need to have their timber elements replaced over time. With regards to pile driven wharves, failing piles are often cut off close to the riverbed and the replacement piles are driven in beside them. For major repairs of a wharf, such as re-decking as well as re-piling, the footprint of the structure remains essentially the same with pile stumps indicating the original or earlier configuration. Replaced wharf timbers such as piles, girders, planking and metal fastenings are usually discarded on site. The extent of repairs to the wharf in 1935 is not well understood from the historical records.

It would also appear by this time the wharf would have operated less as a commercial facility and more for recreational purposes which would have included minor boat repairs and maintenance.

²⁵⁸ Moriarty, E. O. 5 July 1862. *Survey for a Wharf for Windsor*. NSW State Records, "Hawkesbury River - Survey For Wharf - Windsor Wharf - Frame 1 - Plan Type: Engineering (Harbours & Rivers)." NRS-21554-1-3-PLAN14/10157_01.

Historical Period 5: 1950s to present – Bank stabilisation

It would appear the timber wharf gradually deteriorated in the second half of the 20th century. This would have resulted in uncontrolled collapses of piles and upper works (headstocks, girders, planking, kerbing). These materials would have collapsed onto the site and rolled down the riverbed slope. Some may have been carried away in flood events. The copper sheathing on the piles gradually became less effective, the sheets of copper also breaking down into small pieces and sinking onto the site.

As the wharf became unsafe vessels may have still tied up to it but passage over the wharf deck would have become less practical and frequent as time went on with inversely greater chance of dropping objects into the water due to unsteady nature of the structure. Activities such as fishing would have continued either from a tethered vessel or by precariously perching on the ruins.

There was, for a short time in the 1970s and 1980s, a small landing constructed downstream of the wharf. There would have been limited berthing on the structure but nevertheless it would have served as an adequate platform for recreational activities such as fishing.

Bank stabilisation continued throughout however with little regard to the functionality of the remains of the wharf. This resulted in the placing of Gabion baskets on the bank above the wharf as well as along the low water mark. By leaving the section of riverbank where the extant remains of the wharf un-stabilised, this very likely accelerated the rate of erosion of the bank behind the structure. Bank stabilisation also took place in the form of the placement of larger rocks, by machine and not by hand as occurred with earlier ballasting events, which mostly covered the earlier periods of riverbed stabilisation and ballasting.

8.2 Natural factors affecting site formation

The dating of the contexts on this site is qualified based on a number of factors relating to the physical characteristics of the matrices as they were formed in an underwater riverine environment and the realities of underwater archaeological excavation in near zero visibility conditions.

The formation of deposits underwater is greatly affected by water movement. In bodies of water where wave action results in surge, sediments are constantly raised into suspension and re-settled. This forms layers sorted by grain size and weight, with heavier objects settling out first and forming the lowest layer at the limits of the wave base. Cultural material is also constantly re-sorted based on density and surface area. Therefore, rounder heavier objects tend to be found lower in a sediment profile rather than flatter and lighter objects. In summary cultural material deposited in a relatively high energy underwater environments are not found in stratigraphical units based on chronological order of deposition but by their physical characteristics.

There is insufficient fetch across the Hawkesbury River at Windsor to generate waves that would affect riverbed sediments to the degree which would result in the re-sorting of archaeological deposits. The wharf at Windsor by the mid-19th century had vessels with propellers operating alongside and such craft would have generated localised propeller jet turbulence which has a similar effect in mobilising sediments as does wave action. Also, as the 20th century developed, motor vessels cruising past with no restrictions on speed could have generated sufficiently large wake so as create short-lived wave surge.

Horizontal water movement in the form of current either tidal or river flows, the latter of which could be amplified during flood events, has the effect of moving objects in the direction of the flow. Objects with low density will be mobilised at lower current velocities than heavier objects. Flatter objects are less likely to move than rounder objects. Furthermore, objects will move in response to current in a way that presents the least resistance to the flow which would reduce and even halt their movement. For example, long round objects such as logs will orientate to present their narrow end to the flow, with their longest side laying on the same direction of the flow. All these movements are affected by large obstacles on the riverbed where logs are inhibited from orientating themselves to the direction of the flow and other objects are prevented from moving downstream, thereby collecting on the upstream side of an obstacle such as a series of piles or rock mound.

The development of the underwater site of the former Windsor Wharf has, over time, modified or negated the general natural factors affecting site formation described above. This is because of the laying down of ballast and later rock armour protection within the wharf footprint. The weight of the rock was too great to be raised into suspension by wave action or be moved by current. As a result, artefacts deposited on the riverbed prior to the laying of the rock was effectively protected by the effects of wave and current which would have re-sorted them. In addition, artefacts deposited onto the rock rubble would have become trapped within the matrix and over time gradually descended through the voids in the rubble. The rock itself would have been laid initially to weigh down the bedlogs for the early 19th century wharves. Over the time of use of the Period 2 wharf (and after it was removed) there would have been episodes of rock deposition under the wharf either from vessels discharging ballast or when it was thought further ballasting and bank stabilisation was needed.

As can be seen from the excavation there are three main rock laying episodes, excluding the laying of the bluestone rock armour in the late 20th century. The earliest episode of ballast incorporates Cxts 10, 11, 15 (DT2), 16 and 19 (DT3). This layer was overlain by sand and silt (Cxts 07, 08 and 09) which could represent flood layers. Above these flood layers was a relatively thick layer of ballast (Cxt 05 and 06) within which two bedlogs (UWF 06 and 09) end on end were encased. Another rubble layer (Cxts 02 and 03) was immediately above, separately by a relatively sandy deposit which also could have been a flood layer.

These three rock layers would have been permeable when first deposited. Artefacts would have descended through the voids in the rubble restricted by their size and by the gradual filling up of the voids by sand/silt/gravel. It can be expected that over time the voids would eventually be filled thereby preventing the downward procession of artefacts. This would thereby creating a *terminus ante quem* for the deposits below the rubble, not for when they were initially formed but from when they ceased to be affected by activities occurring above. It should be pointed out too that the closing or filling up of the voids would not have been uniform across the rubble layers (Figure 133).

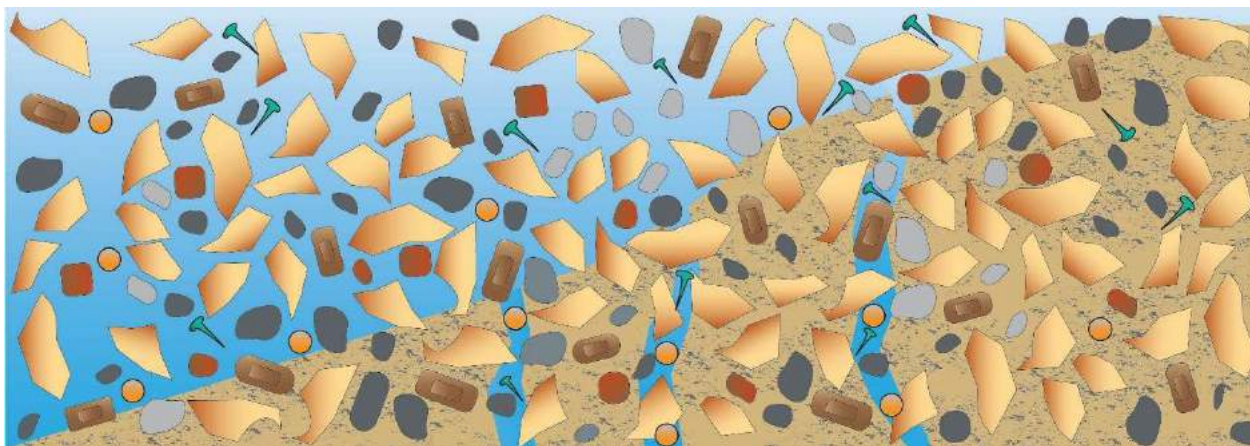


Figure 133: Schematic drawing of how the voids in rubble layers become progressively filled with sand/silt/gravel and artefacts. This would not be uniform and as such some holes and cracks would still be present though diminishing in size and frequency over time.

Of these rubble layers, Cxt 05 is of some interest. The matrix of this context is composed of rock, sandstone and cobbles as well as brick. It is bonded together with sand and gravel to form a conglomerate. Such conglomerates were found elsewhere on the site such as in Cxt 04 and Cxt 19 (Figure 134). During excavation it was observed that oyster shell was within the matrix. Oyster does not grow this far up the Hawkesbury River. This led to an initial speculation that the conglomerate was a form of marine cement, that is, that it was deliberately formed on the site. Marine or underwater cement was not common in the early 19th century and if it was used at Windsor it would have been noted in accounts at the time. The excavation of Trench 2 exposed the southern edge of this conglomerate and there was no evidence of form work indicating that this was a structure poured and set *in situ*. There was also no evidence of this conglomerate was formed in blocks on land and deposited in sections. As noted above there were bedlogs set into the matrix making the notion that it was created by laying down pre-formed blocks less likely.



Figure 134: Example of ‘conglomerate’ with coin concreted within. This sample is from DT3 Context 3. Note the corroding ferrous nail which would have contributed to the process of concreting / conglomeration.

The conglomerate, referred to as coarse-grained polymictic orthoconglomerate (a clast made up of different rock types) that is weakly weathered/oxidised (hematite/goethite staining) in places.²⁵⁹ The latter, which provides a red hue to the samples, indicates a ferrous content, apart from the visible artefacts, which contributed as a bonding agent. Corroding iron forms the basis for concretions that encase artefacts found in maritime sites.

It is very likely that the conglomerate of Cxt 05 gradually formed *in situ* naturally due to the cultural material within the matrix either concreting in the case of the ferrous objects or cementing in the case of the introduced oyster shell. For this to happen, it would require no, or minimal, water movement. The process may have started towards the base of Cxt 05 but would have been completed after the later layer of rubble (Cxts 02 and 03) were deposited. That the artefacts found within Cxt 05 range from the early to late 19th century including the presence of curved bricks used in the construction of the bridge in 1874 (see Section 9.4), support the proposition that the conglomerate matrix formed over time.

It should be noted that the geological, geomorphological and environmental conditions along this stretch of the Hawkesbury River appear conducive to such conglomerates forming without human agency. In the 1970s sand miners encountered on the Windsor side of the river patches, ranging in thickness from 75 mm to 300 mm of ‘*conglomerated material consisting of sand, gravel and some shells*’.²⁶⁰ That a similar formation was observed near the ‘*old Pitt Town Wharf*’ does raise

²⁵⁹ See Annex O Sample S36

²⁶⁰ Op Cit., Scholer, H. A., A. M. H. Riddler & D. Benson 1974: Appendix IV

the question of whether the ‘conglomerated material’ was in some way associated with early wharf sites.

The permeability of the rock rubble layers as well as the transformable and ephemeral nature of the flood layers in between is problematic for the secure dating of the contexts from the underwater excavation. Small and dateable artefacts such as coins are the very type of object that could percolate through a ballast layer over time. Therefore, using coins and other normally reliable markers to date the contexts is of very limited value for this underwater site.

Overall dating of the contexts relies on the nature of the contexts whether it be ballast or flood deposit, the presence of structures such as bedlogs or on larger diagnostic artefacts that would be less likely to have filtered through deposited rock layers, such as bricks. Such artefacts however have broad date ranges, such as 1788 to 1840s for sandstock brick, which does not allow for more precise dating of contexts. Nevertheless, the presence or absence of sandstock or pressed bricks can say something about the chronological integrity of the context.

The curved pressed bricks found during the excavation provide a very useful dating marker (see Section 9.4 and Figure 157 to Figure 161). These bricks were used in the construction of the original Windsor Bridge in 1874. They are a very specific type of brick and were likely to have been made specially for the 1874 Windsor Bridge. It would then follow that these bricks would have been deposited onto the riverbed during or just after the construction of the bridge. The distribution of these bricks within the site stratigraphy is instructive (Table 6).

Table 6: Curved pressed bricks used in 1874 Windsor bridge construction by context.

Context	Sum of Quantity
DT 1 - 02	2
DT 1 - 03	3
DT 1 - 04	5
DT 1 - 05	33
DT 1 - 06	3
DT 1 - 12	1
DT 1 – surface spoil	3
DT 3 - 04	4
Total	54

The majority of the bricks were found embedded within Cxt 5. This context was composed of rock rubble that had eventually become concreted (see above). It would then follow that the bricks had found their way into Cxt 5 before the concreting phenomenon was completed. This does not mean that Context 5 was created around 1874 but was ‘open’ to receive objects that had fallen onto the rubbly uneven surface at that time. The surface of Context 5 may have been exposed to open water or covered by silt when the bricks were deposited. This could be reflected in the bricks found in the context above – Cxt 4 – and/or could be the result of later disturbance which included bricks moving down the riverbed slope into the excavation area. The few bricks found below Cxt 5 can be attributed to the conditions of the archaeological excavation which made it possible for larger objects to migrate into earlier and lower contexts. This is discussed further in the following section.

8.3 Excavation related activities affecting interpretation of site formation

The constraints placed on the underwater excavation are broadly discussed in Section 5.2. How it has affected the interpretation of the site formation, with regards to the dating of contexts, is presented in the following points:

Zero to near zero visibility

The inability of the diver to see anything most of the time meant that artefacts could fall into the trench unobserved, due to the activities described below, from upper contexts. Where divers noticed this happening, it was noted in the excavation log book.

Nature of excavation underwater

Most archaeological excavation underwater takes place in sandy or silt contexts. It is not possible without considerable shoring and or caisson style installations to prevent the sides of the trenches collapsing resulting in the mixing of contexts. On this site this was the case with DT 2 (south side) and DT 3 and ST 6. The ballast layering within DT 1 and northern half of DT 2 had the effect of keeping the sides of the trenches relatively stable, particularly around the conglomerate of Cxt 05. This allowed for the undertaking of an archaeological excavation as is common on terrestrial sites where contexts are identified, mostly by feel (see below) and excavated separately. Nevertheless, trench wall stability was not possible all the time.

Water dredge head and hoses

The operation of the water dredge at times contributed to the destabilisation of trench sides. This is because as the trenches became deeper the heavy metal dredge head and/or hose had to rest on the edge of the trench. With all the care given, there were times when parts of the trench wall were disturbed thereby allowing artefacts from the upper contexts to mix with those below.

Artefacts caught in dredge hoses

At the start of the excavation it was observed that artefacts noted by the diver entering the dredge head when excavating one context, fell onto the sieve when subsequent contexts were being excavated. Some artefacts became temporarily stuck within the dredge hose between the dredge head and the sieve usually behind blockages of rock and gravel. So as to ensure a greater integrity of the contexts, when a diver noted a change of context, the dredge head was raised by the diver and the hose shaken so as to dislodge any rock obstacles as well as artefacts. The dredge was then let to run for around 5 minutes, with the dredge intake raised, before the diver recommenced excavation in the new context.

8.4 Assigning archaeological phases to historical periods

This section ties the contexts identified during the excavation with the known historical periods of activity that took place on the site. The contexts will be grouped into phases based on their contemporaneousness and assigned to the historical periods based on the matrix from which the contexts were composed, its stratigraphical relationships to other contexts and to a certain extent from the date range of artefacts found within. Select images of artefacts noted in this section are presented in Section 9. A summary table is presented at the end of this section. All height measurements are in AHD.

Phase K	Historical Period 1
	1795 - 1813 Initial settlement and Thompson's Shipyard
	Decaying bedrock

The earliest phase recorded during the excavation was that of decaying bedrock which comprises alternating layers of shale and sandstone. This phase, Phase K (Cxt 20 and 21), was encountered at – 3.44 m to -3.50 m in DT 1, -3.58 m in DT 3 and at -3.57 m in ST 2. It was also exposed in ST6. In DT 2, the limit of excavation was around -3.2 m and so bedrock would have probably been another 200 mm to 300 mm deeper.

Some of the rock sampled from this phase was analysed – See Annex P. Two samples (S26 and S27) of cobble type stone were partially altered micro-dolerite which has a relatively widespread occurrence throughout the Sydney Basin and the Sydney region and were more than likely locally sourced. Another sample (S32) was a friable medium-grained quartzose sandstone derived from the Hawkesbury Sandstone formation. The closest source of this rock is the Blue Mountains however the closest source by water is downstream from Wisemans Ferry or Sydney Harbour itself.

The most common artefacts found within this phase were ferrous nails followed by fragments of alcohol bottles, tableware and fishing tackle. Fragments of copper sheathing, and nails were also present. Other artefacts included a coin, a pocket knife, a railway seal, buttons, pins, a homemade fishing lure, a buckle, and a tobacco pipe. Five Aboriginal stone artefacts were also found.

Cattle bone fragments, fish bones a duck bone were recovered as were peach pits, oyster shell fragments, a Sydney cockle fragment and one Hairy mussel fragment – one of the few saltwater mussel remains found during the excavation.

The wide ranging variety of dates of the artefacts found exemplifies the difficulties in attempting to assign a temporal point for the contexts/layers. Though there were fragments of ceramic that dated from the late 18th and early 19th century there was also a 1951 coin and a railway seal (see Annex C). By screening out the smaller artefacts which could have filtered their way through to this lowest layer, a refined date range for these deposits is late 18th into the first quarter of the 19th century and pre-date the construction of the wharves.

Phase J	Historical Period 1
	1795 - 1813 Initial settlement and Thompson's Shipyard
	Sandy riverbed around early 1810s or earlier

Above the decaying bedrock were a number of contexts (Cxts 12, 13, 17, 18 and 22) composed of silt, sand and gravel in varying proportions and consistency across all three deep trenches as well as ST 2 and 6. The thickness of this phase ranged from around 75 mm in DT 1 (Cxt 22) to around 400 mm thick DT 2 (Cxt 17). This phase seems consistent with riverbed sediments, their grading from silt to gravel influenced directly by the velocity of the water flow.

An unusual sub-rounded cobble recovered from this context was identified as olivine phyric basalt which would have been locally derived from nearby outcrops which are relatively abundant in the western Sydney region, while another rock was identified as a quartzose sandstone derived from the Hawkesbury Sandstone formation (See Annex P – S96, S98).

Remains of alcohol bottles, ceramic tableware and nails were the most numerous of the artefacts recovered while fragments of copper sheathing, a spike, tacks and nails were also present. Also found were a percussion cap, a horseshoe, buttons, a coin, buckle, hook & eye fastener, pins, tobacco pipe fragments and rope. Also found was a fragment of coal and sandstock brick fragments.

Eleven Aboriginal stone artefacts were also recovered from contexts within this phase.

Oyster shell was well represented in this phase while Sydney cockle shell and freshwater mussel fragments were also found. Sheep bone fragments, cattle, pig and duck bone, as well as bones from various species of fish were recovered. Seeds were present in the form of peach pits.

The artefacts found within the contexts of this phase included those with a manufacture date from the second half of the 19th century such as wire drawn nails and a decimal 1970 coin. Applying the filtering methodology (see Annex C) the temporal date range for this layer is from the late 18th century to first quarter of the 19th century. This can be confirmed by the absence of pressed brick fragments of an appreciable size and the presence of a sandstock brick fragment (<30% of original size). The presence of a fragment of curved pressed brick (in Cxt 12) associated with the 1874 construction of the bridge was very likely collected as part of Cxt 12 during the excavation.

Phase I	Historical Period 2a
	1813 to 1815- Retaining wall and 1 st Howe and McGrath wharf
	Pile remains associated with 1814 retaining wall across Thompson Square.

The only structural remains identified as being associated with this phase are the nine cut off piles in the intertidal zone on the riverbank that appear to align with what has been interpreted as the retaining wall constructed by Howe and McGrath in 1814 (Figure 135 and see [Section 3.2](#)). Of the nine piles, seven (AWF1/1, 2/2, 2/3, 2/4, 6/12, 6/21 and 10/6) have a diameter of 300 mm (11.8"). The other two, AWF6/7 and 6/9, have diameters of 280 mm (11") and 310 mm (12.2") respectively.

Where there is a row of piles, 3 or more close together, they are spaced around 1 m or 3' apart. The piles showed no evidence of having been copper sheathed or coated in pitch.

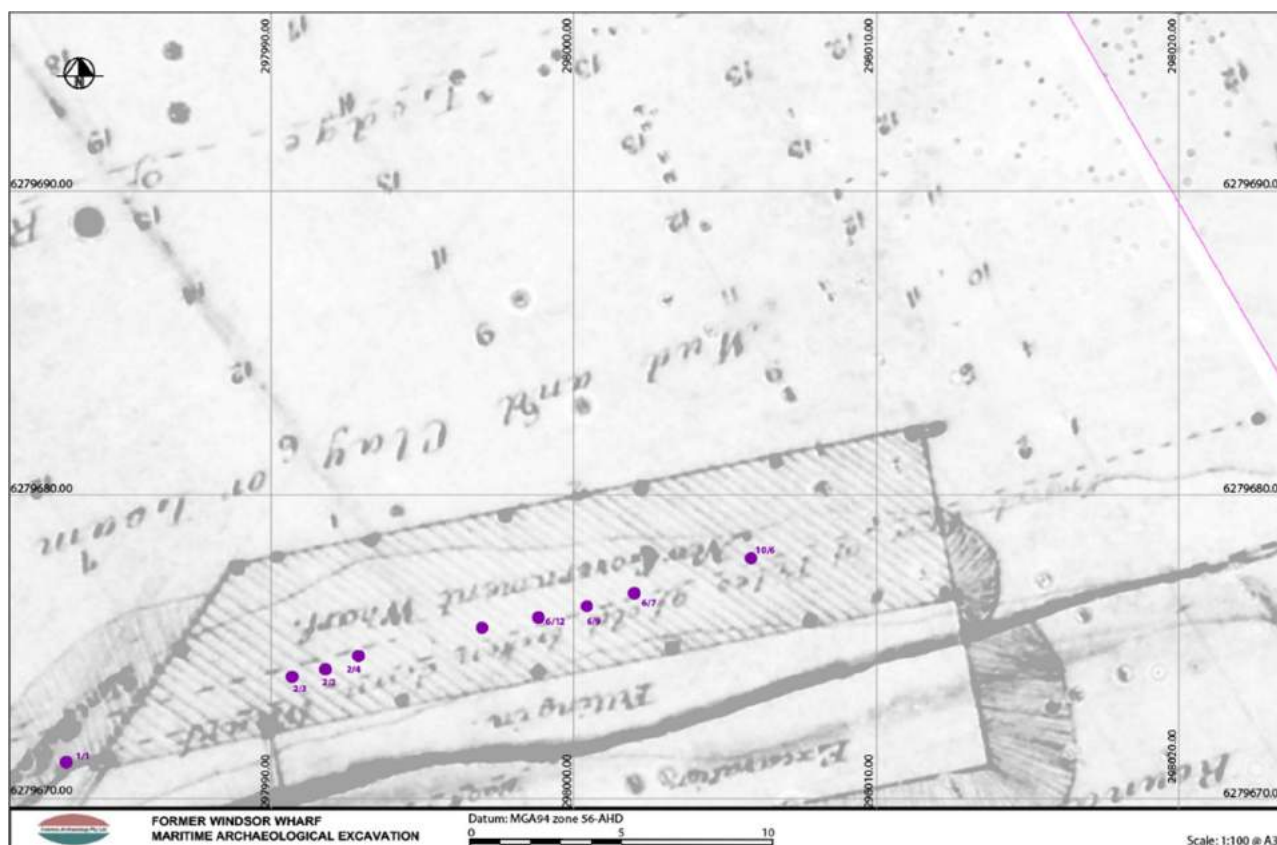


Figure 135: Cut off piles (in purple) associated with 1814 retaining wall overlaid onto 1862 wharf plan. They align approximately with the line of piles on the 1862 plan which has been interpreted as being the former timber retaining wall constructed in 1814 (Phase 2a). Piles AWF 2/2, 2/3 and 2/4 could be associated with a line of pile interpreted as being part of the failed extension of the wharf in 1815/16 (Phase 2b).

Possibly associated with this phase is Cxt 24 from ST 5. It is a thick grey silty clay ranging in thickness from between 700 mm to 1,050 mm with the occasional sandstone rock up to 250 mm across. This matrix lays atop of bedrock. The sandstone could be the remnants of ballast laid over the bedlogs for the 1814 retaining wall (Period 2a). This context is heavily disturbed and the silty clay sediments could represent the remains of a flood event or gradual scouring which took place along the riverbank since the first half of the 19th century.

Artefacts found in this context include ceramic sherds, coins, clothing fasteners and pins. That this context does not have a compact sealing matrix above it which allowed modern artefacts to filter down, such as the six decimal coins dating from 1966 to 1981.

The majority of plant macro-remains recovered from ST5 were found in this context, including peach pits, a pumpkin seed and a watermelon seed. Most of the shell recovered was oyster with a relatively high concentration of Sydney cockle shell fragments. The majority of animal bone found consisted of pig elements with a single sheep bone fragment making up the remainder.

Phase H	Historical Period 2b 1815 to 1816. 2nd Howe and McGrath Wharf
	Ballast deposit

This is a rock rubble layer (Cxts 10, 11, 15 and 16 [DT 2], as well as Cxt 19 [DT 3]) composed of angular sandstone, cobbles and what appeared to be basalt with fine to coarse sand and gravel filling the voids. The rocks ranged in size up to 500 mm across (Cxt 10).

Rocks sampled from this phase were from Cxt 16 and 19. Apart from locally sourced, moderately altered and weathered micro-dolerite (S95) and moderately weathered olivine basalt (S91) there was also sandstone (S90, S103 and 104) derived from the Hawkesbury Sandstone formation. The closest source of this rock is the Blue Mountains however the closest source by water is downstream from Wisemans Ferry or Sydney Harbour itself.

Also of interest is a fragment of a crystalline iron silicate slag produced by smelting for iron from a non-blast furnace (as blast furnace iron slags produce a glassy slag) which would date the material to up to the mid 1800's. It is unclear whether this slag was produced on site or introduced as ballast.

Contained within this context were mostly hardware fasteners as well as fragments of copper sheathing, spikes, nails, tacks and pins some of which may have been bent into fishhooks. Also found were a coin, fragments of ceramic tableware and glass, buttons, a lead security seal, a fishing sinker, a toy gun and tobacco pipe fragments. Six Aboriginal stone artefacts were also found.

Cattle, sheep and pig bone were recovered as were bird (cormorant) and fish bone - one of which was flathead. Oysters shell fragments were prevalent with a freshwater mussel fragment also being recovered.

Peach pits were the most common seed found. A watermelon seed and coconut shell fragment were also recovered.

The dateable artefacts from this phase range in date from the late 18th century in the form of ceramics to the early 21st century including coins which date up to 1955. Applying the filtering methodology (see Annex C) the temporal date range for this phase is from the late 18th century to first quarter of the 19th century. This can be confirmed by the absence of pressed brick fragments of an appreciable size and the presence of sandstock brick fragments greater than 30% of original size.

This phase seems consistent with the depositing of rock rubble for either stabilising the riverbed and bank and/or weighing down bedlogs for the piles of a wharf. As a more substantial ballast layer is located above (Phase E) separated by what appears to be a siltation and/or flood layers (Phase G and F) it is possible this Phase, H, represents Howe and McGrath's attempts to expand the wharf in 1815/1816.

Phase G	Historical Period 2b 1815 to 1816. 2nd Howe and McGrath Wharf
	Silt and sand strata associated with a flood event.

The sequence of predominantly loose sands (Cxt 09) overlain by silt (Cxt 08) seems consistent with riverbed sediments, their grading from silt to sand influenced directly by the velocity of the water flow. This phase, Phase G, which was up to 400 mm thick was only identified in Trench 1. It may immediately post-date one of the recorded flood events that took place in the second half of the 1810s.

Rocks sampled from this phase were quartzose sandstone derived from the Hawkesbury Sandstone formation (See Annex P – S100).

Within this phase food related, architectural elements and hardware were the most common artefact groups. Of note in hardware is one metal wedge that may have been used to split

timbers. Food-related artefacts include fragments of tableware and alcohol bottles. There are also three used in food-procurement fishing. Architectural elements include brick fragments – mostly sandstock, nails, roofing slates and window glass.

The ubiquitous fragments of copper sheathing and nails were also present as was a gun cartridge, lead sinkers and a fishing lure. Other artefacts included coins, buttons, hook and eye fastener, tobacco pipe fragments and pins. Also recovered were eighteen Aboriginal stone artefacts.

Peach pits dominated the seed assemblage from this phase while oyster shell were the only shell species recovered. Cattle, pig, sheep and a single fish bone were found.

The artefacts found included pressed brick, > 30% of original size and machine made bottle remains but also late 18th century artefacts such as fragments white glazed stoneware and 1799 coins. Applying the filtering methodology (see Annex C) the temporal date range for this phase is from the late 18th century to first quarter of the 19th century. The frequency of sandstock brick fragments of appreciable size – 10 – was greater than those pressed brick fragments and for the purposes of dating this phase it is assumed that the pressed brick fragments had fallen into the excavation area from contexts above.

Phase F	<i>Historical Period 2b</i>
	<i>1815 to 1816. 2nd Howe and McGrath Wharf</i>
	<i>Riverbed at time of laying of ballast for 1815 wharf extension</i>

A sandy gravel layer up to 100 mm thick (Cxt 07) which lays above the silt/sand flood layer (Phase G) and immediately below the conglomerated rock rubble layer (Phase E) which appears to have been the surface of the riverbed at the time of the laying of the rock rubble layer. Two rocks of an unusual nature from this context were analysed and were found to be ironstone and surficial hematized laterite both of which were originally derived from the Hawkesbury Sandstone formation (See Annex P – S097, 099).

The matrix may have been similar to Phase E with its high gravel content having been gradually introduced when the rubble layer was deposited. This could also explain the relatively high number proportion of late 19th and 20th century artefacts in this phase as well as fragments of conglomerate of the kind found in Cxt 06.

Of the artefacts found in this phase the most common were a variety of bricks and brick fragments ranging from the early to late 19th century and food related objects such as fragments of alcohol bottles and tableware. Ferrous hardware, including fasteners, were present, but less common than in other phases. As with the above contexts, fragments of copper alloy sheathing, nails and roves were also present. Other artefacts recovered from this context were a bullet, a cartridge, pins, coins, clothing fasteners, tobacco pipes and hook & eye fasteners.

Six Aboriginal stone artefacts were also found within this phase including a ground edged hand axe (see Section 10).

The only seeds recovered from this phase were peach pits. A large amount of oyster shell was recovered from this phase along with relatively tiny amounts of Sydney cockle shell and one freshwater mussel fragment. Also present were cattle, sheep, fish and pig bone as well as a dog bone – the only dog element found during the excavation.

The dateable artefacts from this phase ranged from early sandstock bricks to cut and wire nails. Applying the filtering methodology (see Annex C), the temporal date range for this phase is from the second quarter of the 19th century to first quarter of the 20th century. This date range does not indicate when the riverbed was formed but the period in which artefacts worked their way down through the rubble matrix of Phase D and before it solidified into a conglomerate.

Embedded into the layer was the half round plank (Phase F). There was no evidence of fastenings on the plank which suggests that it had not yet been used when it found its way onto the site. It may have been dropped during the construction of one of the wharves built on the site in the 1810s or may have been carried downstream during a flood event. Its orientation,

perpendicular to the axis of the current flow, suggests it was dropped off a boat or wharf. However, its shape – flat with a low curved profile – would indicate it would have been resistant to being re-orientated to the axis of the water flow. Its similarity with some of the timbers located in the layer above suggests it may have been associated with the wharf construction on site.

Parts of timbers UWF 04, 05, 06 and 07 extended into this layer however the bulk of their lengths are in Phase E and are therefore considered to be contemporary with the depositing of the rock rubble associated with that phase.

Phase E	Historical Period 2c 1817 to 1862. Greenway Wharf
	Ballast for Greenway Wharf

This phase dominates the stratigraphy on the site. It is composed of sandstone pieces up to 550 mm across and cobbles up to 250 mm across (Cxt 5). Two sample of rocks from this phase were identified as quartzose sandstone derived from the Hawkesbury Sandstone formation (See Annex P – S028, 029).

Between the rocks is brick, both pressed and sandstock, gravel and small stones up to 35 mm across. Some of the brick is of the curved type which was used in the construction of the 1874 bridge. The whole matrix has been bonded to form a solid conglomerate. The presence of oyster (introduced to the site) and ferrous material have acted as a bonding agent to facilitate the conglomeration.

Imbedded at the base of this conglomerate and protruding into the lower phase (Phase G) are cut timbers, two (UWF06 and 09) of which are positioned end on end and are aligned parallel to the riverbank (Figure 136). These timbers are logs with scarphing at either end for the purposes of keying into other similar timbers and appear to be *in situ*. The diameters and lengths of the two logs vary from approximately 300 mm and 5 m (UWF09) to 380 mm and 6.08 m for UWF06. UWF06 has a mortise cut into it. The other log seems to have rolled over from its original position and the level of degradation due to marine borer damage precluded any definitive interpretation but there also appeared to be the remains of a mortise. At one time a pile had been fitted into the mortise of UWF06 and it left an approximately 480 mm diameter circular depression into the log's upper side. One of the specifications for the 1st Howe and McGrath wharf was for piles 16" (41 cm) to 18" (46 cm) in diameter. The specifications for the 2nd Howe and McGrath and Greenway wharves are not known but it is likely that the pile diameters would have been similar. It is very likely that these two bedlogs were associated with the latest Period of wharf construction in the 1810s, that of Greenway's wharf. This also means that the surrounding rock rubble was deposited to weigh down or ballast the logs and associated piles. This activity is likely to have commenced with the extension (Period 2b) of the 1st Howe and McGrath wharf (Period 2a) in 1815 and took over 5 years to complete.

Of note is that timber species of most of these timbers including UWF06 is Australian Ironbark, the species identified in the 1862 description of the former wharf (see Section 3.2).

Also present within the basal portion of this layer were planks of varying sizes. UWF04 which passed under UWF06 was 180 mm and 50 mm thick. This plank was laying across the flow of the River but for similar reasons described for UWF03 this object likely has an association with the construction of the wharf on site.

Laying alongside the bedlogs UWF06 and UWF09, on the riverbank side, were timber planks UWF05 and UWF07. The former was half round, 8.1 m long, 150 mm wide and 120 mm thick at the apex. The latter was at least 2.4 m long, 150 mm wide and 60 mm thick which equated with the required dimensions of the 2nd Howe and McGrath wharf.

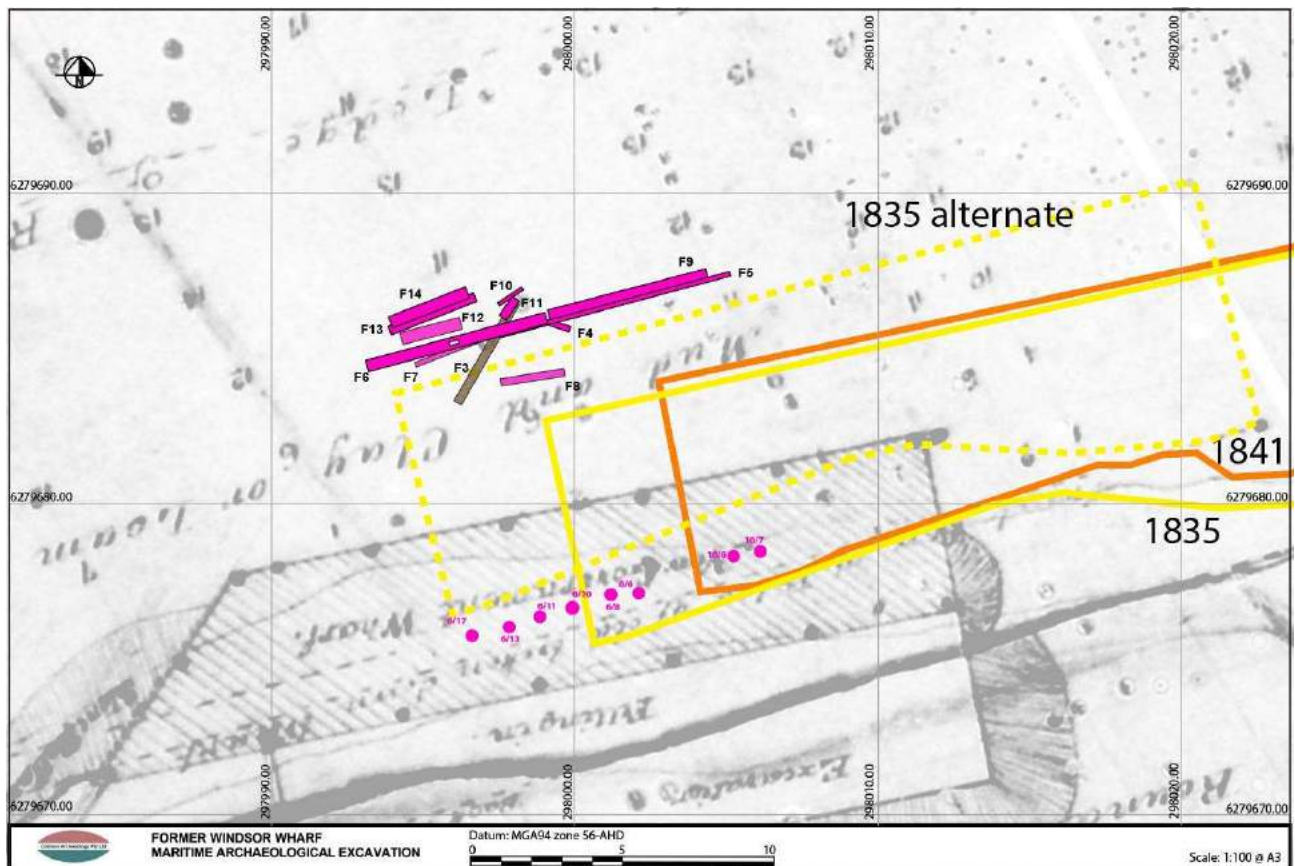


Figure 136: Overlay of outline of Greenway Wharf (Period 2c) from 1835 (yellow) and 1841 (orange) maps onto 1862 base map. The remains of maritime infrastructure interpreted as being associated with the Greenway Wharf is shown in purple. The dotted yellow outline is the alternative position of the Greenway Wharf which is based on aligning the 1835 outline of the wharf with the downstream end of piling on the 1862 plan of the Moriarty and Musson Wharf (Period 3).

Timbers were also partially embedded in the upper portions of the conglomerate, which extended into the layers above. All of these timbers, UWF02, 08, 10, 11, 12, 13, and 14, share(d) similar attributes in that they were either rounded timber logs and beams or planks which were laying approximately parallel to the riverbank. It would be most likely that most if not all had fallen into the water and either rolled down the slope of the riverbed or were pushed downstream by water flow. In both scenarios the movement of the timbers would have been retarded by the rock rubble of Phase E.

Timbers UWF02 and 08 lay on the riverbank side of bedlogs UWF06 and UWF09. The former seems to have been a cut tree branch while the latter may have been part of a wharf structure such as a partially squared beam rather than a pile.

Riverward of the bedlogs UWF06 and UWF09 were further timbers that varied in size and shape. UWF10 was a half round plank 150 mm wide and 60 mm thick at the apex. It was adjacent to a 40 mm thick and 280 mm wide plank (UWF11). Laying almost side by side were a succession of three worked timbers; what appeared to be a corbel (UWF12) 300 mm x 400 mm across and approximately 1.8 m long and two heavily degraded piles 300 mm (UWF13) and 390 mm diameter (UWF14).

The line of eight cut-off piles along the riverbank could also be associated with the Greenway Wharf (Figure 136). These piles are less than one metre northwards from the line of cut off piles associated with Phase I. They also seem to stop approximately where the upstream edge of the Greenway Wharf apron. The arrangement of piles is what would be expected if a timber retaining wall is rebuilt or substantially repaired. In these situations, with the timber retaining wall in disrepair - in this case the 1814 (Phase 2a) retaining wall which is likely to have been damaged during the major floods from 1816 onwards - is left in place while a new line of piles is placed directly in front. The old line of piles are then buried under fill placed up against the new retaining walls. This new

retaining wall could have been built in the 1815 wharf extension (Period 2b) but would have been finished with the completion of the 1820 Greenway Wharf (Period 2c).

The majority of the piles (AWF 6/6, 6/12, 6/13, 6/17 and 10/8) have a diameter of 300 mm where the remainder are larger with AWF 6/10 having the greatest diameter of 340 mm. Most piles are very worn though there were no obvious evidence of marine borers. None of the piles showed any evidence of copper sheathing or pitch. One of the piles AWF6/6 seemed squared as did the loose collapsed pile UWF13 which had the same diameter. Two of the piles had remnant ferrous fastenings on the eastern (AWF6/11) and western (AWF6/10) sides which could have connected walers or ties back to the earlier retaining wall.

The largest single class of artefacts recovered from within this context were ferrous nails and fasteners. Food related artefacts were also common in the form of glass bottle fragments and tableware. A large number of bricks and brick fragments were found throughout the matrix ranging from early 19th century sandstock bricks to curved buff bricks directly associated with the 1874 bridge. The presence these curved bricks clearly indicates that cultural material was permeating through this matrix well after the Greenway Wharf had collapsed and that the 'conglomeration' of the ballast (Cxt 05) had not been completed by at least 1874.

Copper alloy artefacts were well represented, especially copper alloy nails, tacks, pins and sheeting. Other artefacts included coins, 19th century commemorative tokens, jewellery, a pocket watch, a pen, pencil, a harmonica, clothing fasteners, a marble, and tobacco pipes fragments. Also found were a bullet, cartridges and a percussion cap as well as a pocket knife, a fishing lure, lead sinkers.

The majority of Aboriginal stone artefacts (45) found during the excavation came from this phase.

Oyster shell fragments formed the greatest portion of the shell recovered with minor quantities of freshwater mussel shell and Hairy mussel fragments and a Sydney cockle shell fragment. Of particular interest in this phase, four of the oyster shells identified were attached to a piece of natural sandstone. This indicates that the stone was bought in, presumably as ballast, from a location either downstream of Wisemans Ferry or even Sydney Harbour. The vast majority of plant macro-remains were peach pits, with the remainder consisting of a pecan endocarp and a pumpkin seed. Cattle and sheep and a single pig bone were also recovered.

The date range of the artefacts recovered from this matrix reflects the decades of cultural activity that had taken place over the site, from the construction of the Greenway Wharf in 1820 to its abandonment and construction of a replacement in 1862. The 1862 (Period 3) wharf functioned into the mid-20th century and artefacts from that period are well represented in this matrix as would be expected as they would be discards from moored vessels and/or from the edge of the wharf.

The earliest dateable artefacts present are late 18th century ceramics tableware including one white salt-glazed stoneware as well as early sandstock bricks. The latest artefacts are modern and include bottle glass and coins dating up to 1978. Applying the filtering methodology (see Annex C) the temporal date range for this layer is from the second quarter of the 19th century to first quarter of the 20th century. This date range does not indicate when the ballast layer was formed but the period in which it had a functional purpose in stabilising the Greenway Wharf. As is it is clearly evidenced by the curved bricks from the 1874 Windsor Bridge, artefacts post-dating 1862 worked their way down through this rubble matrix before it solidified into a conglomerate.

Phase D	Historical Period 3 Moriarty and Musson Wharf, early
	Wharf structure

This phase consists solely of structural elements associated with the 1862 wharf. These features are located close to the riverbank and in the intertidal zone. Four of the eight timber piles that made up the apron of the wharf were extant – AWF4, 7, 11 and 12. They were around 400 mm in diameter and were sheathed in copper (Figure 137). They are poorly preserved and ravaged by marine borers. It is uncertain whether these are the original 1862 piles or later replacements. A fifth pile, AWF6/14, located on the riverbank was one of the retaining wall piles.

Seven remnant walers were recorded - AWF2/6, 6/2, 6/3, 6/4, 6/5, 10/4, 10/5. They were in an extremely poor condition. They vary in size but the best preserved timbers were 300 mm wide and 250 mm thick (AWF 6/2 and 6/3). One waler is half round, AWF 2/6, being 200 mm wide and 180 mm thick.

Other timbers included beams (AWF2/5, 6/1, 10/2), possible decking (AWF10/3), a plank (AWF2/1), and a collection of unidentified timbers (AWF6/15, 6/16, 6/19, 6/20, 10/1 and 10/9).

At the upstream end of the site there is a hand - stacked irregular-coursed retaining wall composed of squared sandstone blocks up to 300 mm across. This wall was in poor condition. Set into the remains of this wall is a broken stone ware pipe up to 300 mm in diameter which served as a storm water or sewer outlet. It is likely that the pipe was installed sometime after 1862.

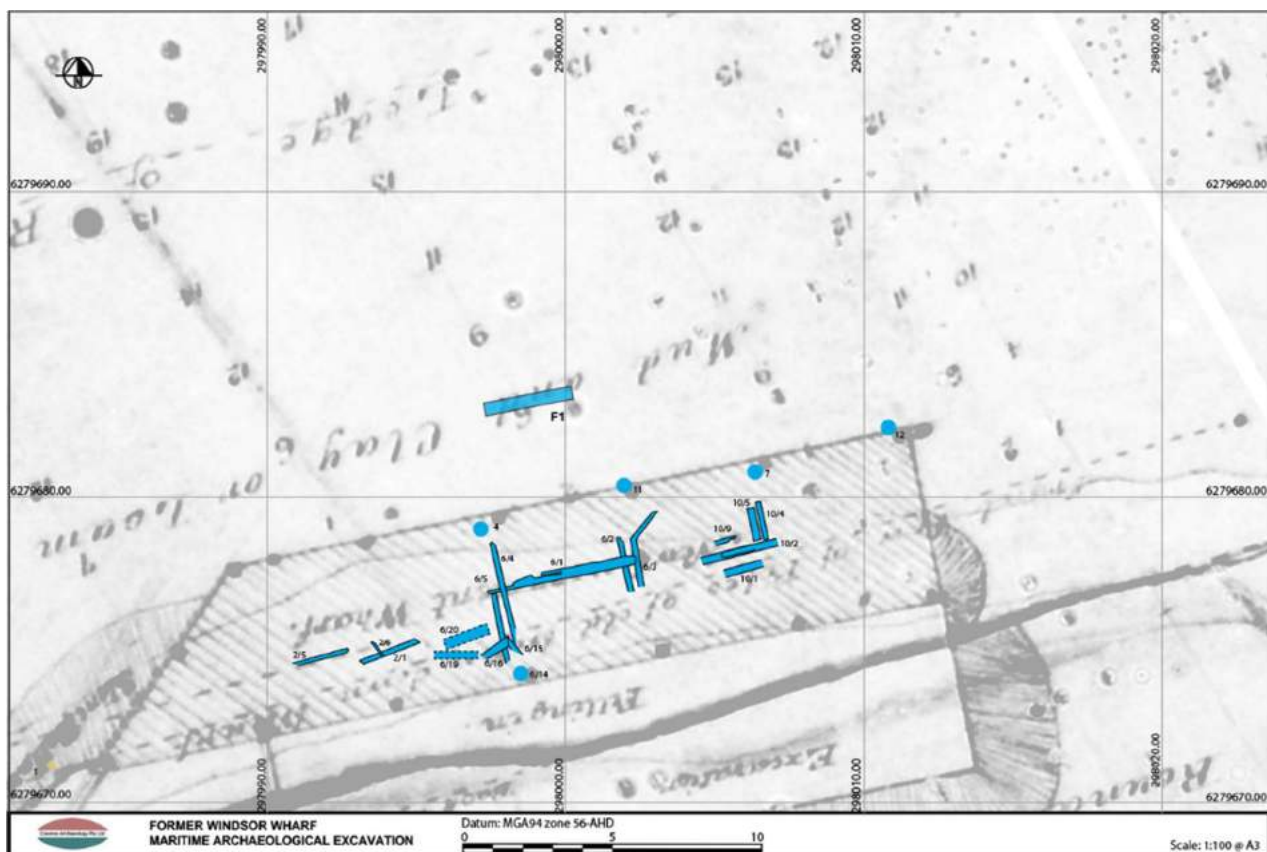


Figure 137: Structural elements associated with 1862 Wharf (Period 3).

Phase C	Historical Period 3 Moriarty and Musson Wharf, early
	Siltation

This phase is a layer of loose sand with occasional patches of gravel, small rock and clay, overlaying (Cxt 04) or adjacent (DT 2, Cxt 14) to Phase E. It is up to 100 mm thick in DT 1 and up to 500 mm thick in DT 2. It is likely that this phase, located between two rubble layers (Phases E and B), reflects the gradual silting up or sediment accretion of the river at Windsor in the latter decades of the 19th century. It is possible that some of the timbers discussed in Phase D, principally UWF02, 08, 10, 11, 12, 13, and 14, may have been deposited during this time through collapses of the Period 3 wharf or from material coming down stream in one or more of the regular flood events.

Within this matrix the largest individual classes of artefacts were bricks and brick fragments, ferrous fasteners and other hardware, bottle glass, copper alloy fasteners and sheathing fragments. Also found were coins, a belt buckle, pieces of ceramic serving ware, clothing fasteners, pins, watch parts, jewellery, toys, a spark plug, fibrous rope, a toothpaste cap, pocket knives, fishing tackle and sinkers as well as tobacco pipe fragments.

Twenty-three Aboriginal stone artefacts were also recovered from these contexts that made up this phase.

Oyster shell heavily dominated the count for mollusc remains with the remainder consisting of freshwater mussel shell and Sydney cockle shell fragments. Peach pits were the most plentiful of the seeds with walnut, coconut shell fragments and a watermelon seed also represented.

The majority of animal bone found in this phase was cattle bone followed by sheep and pig bone. Fish and bird bone was also recovered.

The dateable artefacts from this layer ranged from the early 1800s to the start of the 21st century and include buttons dating from 1801 and a 1960 decimal coin. The majority of the dateable artefacts are from the mid-19th century. Applying the filtering methodology (see Annex B) the temporal date range for this layer is from the last quarter of the 19th century to first quarter of the 20th century. This date range does not indicate when the silt layer was formed but the period in which artefacts worked their way down through the rubble matrix of Phase B.

Phase B	Historical Period 3 Moriarty and Musson Wharf, early
	Riverbed stabilisation

This layer is composed of both compacted (Cxt 03) and loose (Cxt 02) rock rubble which is mostly composed cobbles up to 250 mm across. This layer was up to 450 mm thick and extended across ST 1, 2, 3 and 4 as well.

This rock rubble layer most likely represents a bank stabilisation event using a higher proportion of local cobbles. This may have happened soon after a flood event in Phase C and it appears to have been a wider riverbed stabilisation programme towards the end of the 19th century as this layer stretches across DT 3 where the lower conglomerate layer of Phase E is absent.

Context 23 of ST 5 seems also have been part of this stabilisation Period where there was mixed in with the sandy gravel matrix occasional river cobbles up to 300 mm across and sandstone fragments up to 150 mm across. It was also around 250 mm to 500 mm thick.

The artefacts recovered from this matrix was mostly bottle and brick fragments of various types from the early 19th and 20th centuries, ferrous and copper fasteners such as bolts, screws, tacks, nails and pins as well as the remains of copper alloy sheathing, ceramic jars, coins (mostly decimal), gun cartridges and bullets, fishing tackle as well as clothing fasteners. Among the more uncommon artefacts were, clothing fasteners, fish hooks and tackle, toys, bicycle chain, a number plate, a spark plug, keys, a brass ring, Diya clay oil lamps and tobacco pipe fragments.

Seventeen Aboriginal stone artefacts were found within this context.

Bones belonging to sheep were the most prevalent in this phase followed by cattle with bird and fish bones also represented. Peach pits were the most common seed recovered with pumpkin, pecan and one watermelon seed also found. The majority of shell found was oyster though freshwater or floodplain mussel fragments were well represented.

The artefacts from this layer have manufacturing and popularity date ranges that have broad spans across the nineteenth century and twentieth century including pearlware tableware (1780–1830). The coins found within this layer range in date from 1810 to 1999 with the majority dating to the 1960s and 1970s. This reflects activity taking place on the site well after the Period 3 and 4 Windsor wharf had collapsed.

Phase A	Historical Period 5 1950s to present. Bank Stabilisation
	Rock armour protection layer and small landing

Adjacent to the riverbank in the intertidal zone the riverbed surface was composed of bluestone rock, sandstone road kerbing (AWF09) and brick rubble (AWF13) overlaying a gravel matrix

which had been deposited as part of the bank stabilisation works in recent decades. Within this gravel and rubble were cut branches (UWF15 and 16) and remnant timber planking of a timber clinker hulled boat (UWF17 in ST5). This section of hull had become jammed under the logs as it had come down the river. No other wreck remains were found.

The remains of a small landing from the 1970s and 80s (AWF8/1) are three vertical steel I-beams, 300 mm by 200 mm, backed by two squared timber beams, 200 mm across and approximately 5 m long, with a fill of sandstone, brick and concrete fragments.

Within this phase was the remains of the timber pile, UWF01, 3.5 m long and around 450 mm in diameter. The species, *Casuarina ?cunninghamiana* - River Sheoak, is uncommon for marine or river piles and could have been brought down from a terrestrial structure during a flood event.

Throughout the rest of the site the layer is composed of silt or silty sand ranging from 50 mm thickness in and around DT 1, 2 and 3 to 500 mm thick in ST 6. This uncompacted matrix is in essence ephemeral, easily mobilised with higher than normal current. Lighter artefacts deposited in this silt would also be mobilised and moved downstream leaving heavier artefacts to rest on or filter through Phase B.

The artefacts from this layer were mostly modern such as a 1979 *Seiko Twin Quartz* man's wristwatch, but also included wire drawn nails post-dating 1860 and earlier ceramic fragments.

Below is the summary table of the archaeological phasing on the site (Table 7).

Table 7: Summary table of archaeological phases.

Phase	Contexts	Descriptions	Date range and interpretation	Construction related Period
A	1	Silt layer of riverbed at time of excavation. Shallow layer of fine silt up to 50 mm thick with occasional angular rocks. The average thickness of this context is 50 mm	Modern	Period 5 – 1950s to present. Bank Stabilisation and boat landing stage.
		Remains of landing (AWF8/1)	Short-lived 1970s/80s	
		Brick rubble (AWF13)	Part of stabilisation	
		Sandstone kerbing (AWF09)	Part of stabilisation	
B	2	Rock, loose. Mixture of loose cobbles measuring up to 250 mm in diameter and angular rocks measuring up to 300 mm diameter. A loose sand/silt mix fills the voids between the rocks. The thickness of this context varied with the sizes of the rocks and ranges between 150 mm and 250 mm.	Deposited after the construction of Period 3 Windsor wharf, later in the 19 th century as scour protection or bank stabilisation possibly in response to a flood event.	Period 3 – 1862 to 1933. Moriarty and Musson Wharf, early.
	3	Rock, compacted. Compacted cobbles with sand filling the voids. The cobbles measure up to 250 mm in diameter. Some occasional larger rock up to 300 mm across. This context measured between 100 mm and 200 mm in thickness.		
	23	Gravelly sand. With depth, became increasingly siltier and sandier with small stone inclusions, occasional river cobbles up to 300 mm across and sandstone chunks up to 150 mm across. Between 250 mm to 500 mm thick.	Deposited after the construction of Period 3 Windsor wharf, later in the 19 th century possibly in response to a flood event. Highly disturbed by scouring and later activity.	
C	4	Sand, loose. loose sand with occasional patches of gravel and rock that measure up to 100 mm across. A patch of clay measuring	Evidence of silting up or sediment accretion from	Period 3 –

Phase	Contexts	Descriptions	Date range and interpretation	Construction related Period
		450 mm x 300 mm x 250 mm in size was recorded in square two. The thickness of this context measured up to 100 mm in DT1 and 450 mm in DT3	the 3 rd quarter of the 19 th century	1862 to 1933. Moriarty and Musson Wharf, early to mid.
	14 (DT2 only)	Coarse sand, loose. Loose coarse-grained sand with gravel stones measuring <20 mm in size.		
D	UWF	Beams (AWF2/5, 6/1, 10/2), Decking? (AWF10/3), Piles (AWF4, 6/14, 7, 11, 12), Stone wall (AWF1), Plank (AWF2/1), Waler (AWF2/6, 6/2, 6/3, 6/4, 6/5, 10/4, 10/5) and Unidentified timbers (AWF6/15, 6/16, 6/19, 6/20, 10/1 and 10/9)	Wharf structure from 1862. It is very likely that some of the timber elements recorded were not original 1862 fabric but later replacements.	Period 3 – 1862 to 1933. Moriarty and Musson Wharf, early to mid
E	5	Rock, naturally cemented <i>in situ</i>. mixture of rocks including, pebbles <100 mm across, small stones up to 35 mm in diameter, angular sandstone up to 400 mm across, occasional larger sandstone up to 550 mm in length, cobbles up to 250 mm across and pieces of brick cemented/concreted together with sand and marine oyster shell. The thickness of this context measured between 300 mm and 400 mm.	Deposited as ballast possibly as part of the Phase 2b enlargement in 1815 and added to up to the 1850s and still 'exposed' into the 1870s. Associated with Greenway Wharf (Period 2c).	Period 2b – 1815 to 1816. 2 nd Howe and McGrath Wharf
	UWF	Bedlogs (UWF06,09), Planks (UWF05, 07, 10, 11), Beams (UWF 08, 12), Piles (UWF 13, 14)	Built between 1815 and 1820 when Greenway wharf was completed. Loose timbers could be associated with the construction or the destruction of the earlier wharf.	And Period 2c – 1817 to 1862. Greenway wharf.
	AWF	Piles (AWF6/6, 6/8, 6/10,16/11, 6/13, 6/17, 10/07 and 10/8).		
F	UWF	Half round plank (UWF03)	Riverbed at the time of the laying of the ballast for the Greenway wharf (Phase E). However, the ballast may have been laid earlier as part of Phase 2b wharf construction.	Period 2b – 1815 to 1816. 2 nd Howe and McGrath Wharf.
	6	Sand and gravel, loose. a 50 mm to 100 mm thick mixture of loose sand and gravel with isolated clumps of cobbles that measure up to 250 mm in diameter and rocks are concreted together. These concretions required prying apart		
	7	Sandy gravel, loose. a 100 mm thick loose sand gravel mixture. Gravel stones measure up to 50 mm in size with occasional larger rocks up to 150 mm across.		
G	8	Silt. a 50mm to 200 mm thick silty layer made up of fine sediments and compacted in places. Also, occasional rock up to 300 mm diameter.	Likely flood layer, possibly from around 1815 to 1820. Slower water flow than Phase D due to the fine nature of the sediments.	Period 2b – 1815 to 1816. 2 nd Howe and McGrath Wharf.
	9	Sand, loose. A loose sand layer with isolated pockets of a sand/gravel mix. This context is between 100 mm and 200 mm thick.	Flood layer, possibly from around 1815 to 1820. Faster water flow than Cxt 08 due to the coarser nature of the sediments.	

Phase	Contexts	Descriptions	Date range and interpretation	Construction related Period
H	10	Sandy gravel with rock. A mixture of sand and gravel with rocks up to 500 mm in size.	Possibly earlier (1815/16) ballast deposit.	Period 2b – 1815 to 1816. 2 nd Howe and McGrath Wharf.
	11	Rock, sandstone. Sandstone rock layer with the rocks measuring up to 300 mm diameter. A compacted sand/gravel mix fills the voids between the rocks. This context measures up to 300 mm thick.		
	15 (T2 only)	Rock, cobble. A layer of river worn stone cobbles measuring up to 200 mm diameter with a fine sand filling the voids between stones. This context measures between 250 mm and 300 mm.		
	16	Rock, loose. A compacted rock layer consisting of sandstone and basalt and measures 100 mm thick		
	19 (T3 only)	Rock, loose. A rock matrix consisting of basalt and sandstone measuring between 150 and 450 mm and includes brick fragments.		
I	AWF	Piles (AWF1/1, 2/2, 2/3, 2/4, 6/7, 6/9, 6/12, 6/21 and 10/6).	Pile remains associated with 1814 retaining wall across Thompson Square.	Period 2a – 1814 to 1815. Retaining wall and 1st Howe and McGrath Wharf.
	24	Silty clay and rock. Compact and grey with occasional large sandstone or bluestone rock up to 250 mm across as well as the occasional unworked wood fragment. Between 700 mm to 1,050 mm thick.	Possible ballast layer associated with 1814 retaining wall. Highly disturbed by scouring and later activity.	
J	12	Sandy gravel. A 150 mm thick sand gravel mixture which majority is sand (60%). Pebbles up to 80 mm in size are included in this mix.	Riverbed, natural around early 1810s or earlier.	Period 1 – 1795 to 1813. Riverbank and Thompson's shipyard.
	13	Clay with sand and gravel patches. A layer of clay mixed with patches of sand and gravel stones measuring up to 60 mm in size.		
	22	Silt, compacted. Compacted silt that measures between 75 mm and 200 mm thick.		
	17 (T2 only)	Sand, loose. A layer of loose sand particles mixed with pebbles measuring between 20 and 30 mm in diameter. This context measures up to 400 mm thick.		
	18 (T3 only)	Fine silt, compacted. A 100 mm thick layer of compacted fine silt with a consistency of clay. No rock or gravel inclusions.		
K	20	Rock layer. A compacted rock layer consisting of worn sandstone, cobbles and angular basalt. The rocks are too large to move and appeared to be a natural deposit.	Decaying bedrock	Period 1 – 1795 to 1813. Riverbank and Thompson's shipyard
	21	Broken up shale. Mixture of broken pieces of shale, coarse grained sand and gravel. This context measures up to 450 mm thick.		

9 Addressing the Research Design

9.1 Is there any ballast present which is not of local origin?

The composition of the ballast used to stabilise the Period 2 Windsor Wharf (Cxts 05, 10, 11, 15, 16 and 19) differed from that of the rubble/ armour layer associated with the Period 3 wharf (Cxts 02 and 03) in that the contexts associated with Period 2 were mostly composed of angular sandstone fragments up to 500 mm across. The bedrock substrate on the site is Ashfield Shale of the Wiannamatta Group which comprised alternating layers of shale and sandstone.²⁶¹ The local sandstone broke up into flat plate like fragments no more than 50 mm thick while the majority of the sandstone from these contexts were thicker and more irregular in shape.

Twenty six rock samples were analysed by Dr Ian Graham from the School of Biological, Earth and Environmental Sciences, UNSW (see Annex P). Nineteen of the samples tested were taken from contexts composed of rock rubble which has been interpreted as being either deposited as ballast or scour protection (see Section 8.4). The remaining seven samples analysed had been recovered from the sieve and had been set aside as they appeared atypical to the type of rock that was being found.

The rounded cobbles (dolerites) which were common throughout the site which made up a higher proportion of the rock rubble in Cxts 02 and 03 which are associated with the post construction period of the 1862 Moriarty and Musson Wharf (Phase C, Period 3) are very likely to be local (Figure 138). This is supported by the geotechnical studies and historic plans (see Figure 23) which refer to deposits of cobbles or 'round hard stones' on the southern side of the river.²⁶²



Figure 138: Partially altered micro-dolerite cobble. See Annex P - S27.

Other samples were identified as basalts and dacitic crystal tuff appear to have originated west of the Blue Mountains but were sourced locally from alluvial gravels (see Annex P – S53 and S70).

Also found within the ballast layers were lumps of black clay up to 250 mm across. This clay was also noted to be present on the south bank of the river in association with the cobbles (see Figure 22).

²⁶¹ Op.Cit. Sinclair Knight Mertz, June 2013: 5

²⁶² Op.Cit. Sinclair Knight Mertz, June 2013: 31

The analysis of the rock samples recovered showed that the angular fragments of sandstone, as opposed to the plate-like local sandstone, was derived from the Hawkesbury Sandstone formation, the nearest direct source being downstream past Pitt Town at Cattai or upstream of Richmond (Table 8 and Figure 139).



Figure 139: Example of quartzose sandstone derived from the Hawkesbury Sandstone formation. See Annex P - S32.

The most unusual rock sample analysed was a foliated biotite granite which showed no signs of having been in an alluvial system, strongly suggesting it is not of local provenance. The closest granites to the Windsor area are in Bathurst; far to the west of the Blue Mountains. Interestingly, the granite bears a similarity with gneissic granite that has been found in Sydney Harbour and identified as ballast that originated from Rio de Janeiro, Brazil²⁶³ (See Annex P - S64 and Figure 140). Unfortunately, the context from which this rock was recovered was not recorded.



Figure 140: Foliated biotite granite. See Annex P - S64.

²⁶³ Dr. Graham, I. T. 2019. *Determination of likely provenance of rock samples from underwater pylons of Windsor Bridge, NSW, using petrographic and XRD analysis.* Report ITG028.

Table 8: Rock samples not from the immediate Windsor area.

ID No.	Trench	Cxt	Name	Provenance
S028	2	5	Quartzose sandstone	Strongly suggestion that it is derived from the Hawkesbury Sandstone formation.
S029	1	5	Quartzose sandstone	Strongly suggestion that it is derived from the Hawkesbury Sandstone formation.
S032	3	20	Friable medium-grained quartzose sandstone	Strongly suggestion that it is derived from the Hawkesbury Sandstone formation.
S047	No context		Quartzose sandstone	Strongly suggestion that it is derived from the Hawkesbury Sandstone formation.
S050	No context		Dacitic crystal ash flow tuff	A former cobble in the alluvial system. The nature of the rock itself (dacitic ash flow tuff) would suggest that it must have been originally formed within the Lachlan Fold Belt to the west of the Blue Mountains.
S064	No context		Foliated biotite granite	This granite is somewhat similar to gneissic granites that have seen from Sydney Harbour which were ballast derived from Rio de Janeiro in Brazil.
S071	No context		Fine-grained quartzose sandstone	Strongly suggests that it is derived from the Hawkesbury Sandstone formation.
S073	No context		Very fine-grained partially weathered aplite	This is most likely locally derived from the river alluvial deposits though originally from the west of the Blue Mountains.
S090	2	15	Medium-grained quartzose sandstone	Strongly suggests that it is derived from the Hawkesbury Sandstone formation.
S092	1	9	Medium-grained quartzose sandstone	Strongly suggests that it is derived from the Hawkesbury Sandstone formation.
S097	1	7	Ironstone	It is most likely of local provenance, and the high quartz content is suggestive of the Hawkesbury Sandstone formation.
S098	1	13	Highly friable quartzose sandstone	Strongly suggests that it is derived from the Hawkesbury Sandstone formation.
S099	1	7	Surficial hematized laterite	The abundance of quartz and muscovite suggests that it may have been originally derived from the Hawkesbury Sandstone formation and that it was sourced locally.
S100	1	8	Hematized fine-grained quartzose sandstone	Strongly suggests that it is derived from the Hawkesbury Sandstone formation.
S101	3	19	Poorly-sorted clast-supported polymictic conglomerate	The wide range in lithic clast compositions and degree of roundness, lack of any sorting and the occurrence of quartzose sandstone clasts (most likely derived from the Hawkesbury Sandstone formation) clearly suggests that this conglomerate is of local derivation.

ID No.	Trench	Cxt	Name	Provenance
S102	3	19	Iron silicate (fayalite-quartz-magnetite) slag	A crystalline iron silicate slag produced by smelting for iron from a non-blast furnace (as blast furnace iron slags produce a glassy slag) which would date the material to at least the mid 1800's.
S103	3	19	Highly ferruginised quartzose sandstone	Strongly suggests that it is derived from the Hawkesbury Sandstone formation.
S104	3	19	Quartzose sandstone	Strongly suggests that it is derived from the Hawkesbury Sandstone formation.

9.2 Can non-local ballast be provenanced?

The sandstone identified as being derived from the Hawkesbury sandstone formation could have been transported to the site by vessel from locations where such rock is present close to water. This sandstone outcrops onto the river approximately 4 km upstream from Richmond and approximately 10 km downstream from Windsor at Cattai.

Some of the sandstone recovered had oyster shell growing on the rock when it was taken and deposited on site. It can be assumed that most such oyster covered rock was recovered from the intertidal zone and used as ballast aboard a vessel. Due to the fresh water conditions oysters do not naturally grow in the Hawkesbury River at Windsor. These molluscs are found downstream of Wisemans Ferry and as such these rocks could have been recovered from the lower Hawkesbury as well as of course Sydney Harbour (see Annex I for discussion on the natural occurrence of oysters on the Hawkesbury River).

It is therefore possible that the Hawkesbury Sandstone found on this site could have come from as close as 4 km upstream or as far as Sydney Harbour. It could be argued however that vessels operating on the River and collecting produce from farms upstream and downstream from Windsor would rarely have required to take on ballast for two reasons; firstly, that such vessels would have been laden with produce to take to the Windsor wharf and secondly that the relatively sheltered waters of the River would have not have often dictated a need to stabilise an unladen vessel with ballast. Such reasoning leads to the inference that vessels under ballast would have been operating in more open waters such as the approximate 30 km stretch of sea between Sydney Heads and Broken Bay. This would suggest that empty vessels coming from Sydney to load produce from the Windsor area would have taken on ballast in the Harbour. The presence of gneiss granite similar to ballast in Sydney Harbour known to have originated from South America provides support for the provenance of the sandstone ballast on site as being from around Sydney Harbour.

9.3 What can the provenance of the ballast tell us about the trade networks of the port of Windsor?

The sandstone rock used as ballast came from a combination of sources up and downstream from Windsor with a strong suggestion that the overwhelming majority came from Sydney Harbour. This reflects our understanding of the historically documented trade networks of Windsor, where the port served as an outport for the colony of Sydney (hence the rock ballast from Sydney area) while concentrating produce at this location from the surrounding area. The gneiss granite of potential Brazilian origin does not indicate direct trade between Windsor and South America but reflects the practice of establishing areas for ballasting vessels – such as Ballast Point in Sydney Harbour - and the re-use of ballast.

9.4 What types of activities were occurring at the site of the former Windsor Wharf?

In order to identify the types of historical activities that occurred at the site of the former successive Windsor wharves, the artefact assemblage was analysed according to broad categories of object function and form. This analysis included only those artefacts where the object type could be confidently identified. By far the most prevalent artefact types represented are those relating to food and beverage procurement, storage, preparation, and consumption (ca. 32% raw count), building materials including bricks, fasteners, window glass, flooring, and roofing components, (ca. 30% raw count) and maritime artefacts relating to wharf infrastructure, boat building and repair work, and water transport (ca. 21% raw count).

It is not a straight line, however, between the identification of artefact form and function categories and the interpretation of cultural activities that may have taken place at a given site. The archaeological, historical, and environmental context must always be taken into account. Objects may be used for various purposes other than their original function – i.e. the specific purpose they were created for. Objects may also be transported into a site by natural processes, or cultural activities that are entirely unrelated to their original function.

An examination of the maritime artefact assemblage taking these things into account revealed indications of a wide range of cultural activities at the site of the former Windsor wharves. Many of these activities reflect use of the Windsor Wharf for its primary purpose – i.e. mooring of vessels, and loading and unloading of people and cargo. Several artefacts were also found to represent physical remains of the wharves themselves. These components of the artefact assemblage demonstrate the status of Windsor Wharf as the nexus between river and land transport and trade, and a vital connection between the Hawkesbury River, the Windsor townships, and the numerous agricultural settlements along the upper Hawkesbury and tributary rivers. The artefact assemblage also provides evidence of use of the Windsor Wharf to facilitate the construction of the 1874 Windsor Bridge.

However, a large number of artefacts indicate additional use of the Windsor Wharf for other activities – including as a commercial marketplace, a meeting point, the site of boat maintenance and repair, and the location of recreational activities such as fishing, plinking, and drinking. These artefacts illustrate the wider role the Windsor Wharf played in the cultural activities and day to day lives of Windsor and upper Hawkesbury settlers. The wide array of personal items – including footwear, clothing, jewellery, adornments, coins, pens, pencils, musical instruments, keys, and toys – also provides a view of the range of people who used or visited Windsor Wharf. Whilst dominated by articles traditionally associated with men, the artefact assemblage also demonstrates the presence of women and children at the wharf. The occurrence of these artefacts also highlights the incidence of personal item loss associated with the use of maritime infrastructure, with objects accidentally dropped or broken and irretrievably lost into the river during activities on the wharf, on vessels moored alongside, transfer between the two, or indeed resulting from accidents where people themselves may have fallen into the river.

Table 9 below provides a summary of the artefact categories identified in the Windsor Wharf maritime assemblage and the likely associated activities in the context of the wharf. The following section provides a more detailed discussion of each artefact functional category.

Table 9: Artefact functional categories and likely associated activities at Windsor Wharf

Artefact functional category	Artefact types	Likely associated activities in the context of Windsor Wharves site
Maritime – including subcategories of maritime infrastructure, boat building, operation, maintenance and repair work, and maritime timber protection	Ferrous shanks, spikes, and bolts, copper alloy nails, screws, rivets, roves, and tacks, boat fittings, fragments of wreckage, and copper sheathing.	Timber wharf construction, deterioration, maintenance, and repair Boat maintenance and repair conducted whilst vessels were moored at the wharf or adjacent riverbank Use and operation of small timber rivercraft along Hawkesbury River
Building and construction materials (terrestrial) – including subcategories of masonry components, structural fasteners, roofing and flooring components, and windows	Masonry bricks, ferrous nails, bolts, nuts, and screws, roofing slate, floor tiles, window glass.	Deposition of heavy materials to provide ballast, scour protection and/or riverbank stabilisation around the Windsor Wharf Loading of building materials from wharf to rivercraft associated with the 1874 construction of Windsor Bridge Natural processes of downslope erosion and run-off resulting in reworking of adjacent terrestrial cultural deposits and redeposition of artefacts on the Hawkesbury riverbed
Food and beverage – including subcategories of food procurement, food storage, food preparation, food service and consumption, food refuse, and alcoholic and non-alcoholic beverage consumption	Fishing tackle, ferrous food tins and cans, ceramic service ware and tableware, glass and ceramic bottles, drinking glasses, aluminium drink cans, butchered animal bones, mollusc shells, fruit and vegetable remains.	Riverine fishing from Windsor Wharf Consumption of alcoholic and non-alcoholic beverages by people using the wharf, possibly largely for recreational purposes Use of Windsor Wharf as a marketplace, with river traders selling produce directly to vendors and public from their vessels moored alongside Transport and transfer of fresh and preserved food produce and lime burning / mortar production materials between vessels and Windsor Wharf Natural processes of downslope erosion and run-off resulting in reworking of adjacent terrestrial cultural deposits and redeposition of artefacts on the Hawkesbury riverbed
Transport (terrestrial)	Horseshoes, cart / carriage parts, bicycle parts, motor vehicle parts, railway parts.	Terrestrial transport on Windsor Wharf, adjacent riverbank, and approach road, including horse and cart, bicycle, and motor vehicles, Link between river and land transport and trade – including use of horse and cart to transport cargo and produce up and down Punt Hill between Windsor Wharf and the township of Windsor Land transport of rivercraft to / from Windsor Wharf Transfer of cargo between Windsor Wharf and rivercraft
Manual tools and implements	Hammers, spades, spanners, pliers, rasps, files, drill bits, plough blades.	Cargo handling, manual labour, and maintenance / repair work conducted on Windsor Wharf and vessels moored alongside Transfer of cargo between Windsor Wharf and rivercraft

Artefact functional category	Artefact types	Likely associated activities in the context of Windsor Wharves site
Armament	Firearm accessories, and fired and unfired musket, rifle, pistol, revolver, and shotgun ammunition	Recreational shooting of firearms from Windsor Wharf – as informal target practice / plinking
Sewing and darning	Sewing needles, scissors, darning egg, and dress pins.	Utilisation and possible repair of fabric – possibly fabric used to cover fresh produce on rivercraft during transport Modification and reuse of dress pins as homemade fishing hooks Riverine fishing from Windsor Wharf
Personal – including subcategories of currency, jewellery and adornments, smoking equipment, pocket tools, recreational objects, clothing buckles and fasteners, footwear, clerical, and security	Coins, tokens, clay tobacco pipes, cigarette lighter, pocket knives, belt buckles, clothing buttons, fasteners, studs, and zipper tags, leather shoes, watches, brooches, earrings, rings, toys, marbles, musical instruments, pens, pencils, and keys.	Transfer of people and cargo between the Windsor Wharf and vessels moored alongside Use of Windsor Wharf as a marketplace, with river traders selling produce directly to vendors and public from their vessels moored alongside Tobacco smoking by people on wharf and / or vessels moored alongside – either as a recreational activity or during general working activities by river traders and merchants Riverine fishing from Windsor Wharf Use of and visitation to Windsor Wharf by men, women, and children Potential incidents of both adults and children falling into the Hawkesbury River from Windsor Wharf, moored vessels, and / or transfer in between
Celebration / ceremony	Diya clay oil lamps	Festive, religious, and / or funerary ceremonies conducted on Windsor Wharf or adjacent riverbank

Maritime

The maritime artefact category is one of the key categories that contains artefacts directly associated with activities conducted on the site of the former Windsor wharves.

Maritime infrastructure

The maritime infrastructure sub-category includes various artefacts associated with timber wharf construction, including large ferrous shanks, spikes, and bolts – some of which have been specifically identified as forming part of the Period 2a and 2b Howe & McGrath Wharves (constructed 1814-1816), the Period 2c Greenway Wharf (constructed 1820), and the Period 3 Moriarty & Musson Wharf (constructed 1862) – see Figure 141 to Figure 144. These artefacts are discussed in detail in Section 9.6. Timber wharf fasteners such as these would have been deposited on the riverbed as each of the successive Windsor wharves deteriorated, and / or during episodes of wharf maintenance and repair.



Figure 141: Large ferrous spike, likely wharf structural fastener associated with Howe & McGrath / Period 2 wharves (DT3 / C04)



Figure 142: Large ferrous spike, likely wharf deck fastener associated with Howe & McGrath / Period 2 wharves (DT3 / C04 / Spit 2).



Figure 143: Large ferrous spike, likely wharf deck fastener associated with Greenway Wharf (DT1 / SQ5 / C05).



Figure 144: Large ferrous spike, likely wharf deck fastener associated with Greenway Wharf (DT1 / SQ2 / C03).

Boat building, operation, maintenance, and repair work

This sub-category consists primarily of a range of timber boat fasteners and hardware, such as copper alloy cast and wrought nails, screws, rivets, roves, and tacks; many of which show evidence of having been used – see Figure 145 to Figure 148. Of particular interest are a small number of square, wrought copper alloy nails with applied heads that bear a broad arrow stamp on the underside of the heads – a mark used by the British Government to identify government property (Figure 147). This sub-category also includes possible boat building tools such as a copper alloy ruler that appears to have been cut to produce squared roves – see Figure 149, and boat fittings, including two ferrous oarlocks – see Figure 150.

Boat building activities are known to have occurred on the bank of Hawkesbury River to the east of the wharves site – notably, Thompson's Shipyard, which was in operation between 1802-1809. Whilst it is possible that some of the boat building artefacts are associated with the operation of Thompson's Shipyard, it is considered unlikely that many, if any, artefacts from the shipyard would be transported upstream by natural processes to end up deposited at the wharves site – see Section 9.10 for a detailed discussion of early shipbuilding artefacts. It is more likely that the presence of boat fasteners, hardware, tools, and fittings at the site of the Windsor wharves indicates that boat maintenance and repair works were being carried out as vessels were moored alongside the wharf, and also along the riverbank within the study area prior to the mid 1810s construction of the first Windsor wharf. The boat building artefacts likely represent objects that were accidentally lost or intentionally discarded during such activities.



Figure 145: Copper alloy fasteners including (from top to bottom), one tack, two nails, and one rove (DT1 / SQ1 / C06).



Figure 146: Copper alloy fasteners including five nails (left), one screw (bottom right) and four tacks (upper right) (DT2 / C07).



Figure 147: Square wrought copper alloy nails with applied heads that bear the British Government property broad arrow stamp on the underside of the heads (DT2 / C15).



Figure 148: Dump or bolt hammered at both ends. 242 mm long and 15 mm diameter was possibly a keel bolt for a boat or a frame bolt for a larger vessel (T3 / C04 / Spit 2).



Figure 149: Copper alloy ruler, possibly fashioned to cut squared roves (DT1/SQ3/C21).



Figure 150: Ferrous oarlock (DT1 / SQ10 / C05).

Finally, small fragments of hull wreckage of a clinker built timber boat (UWF17) were also recovered (ST5) – see Figure 151. These fragments consisted of three thin, overlapping timber planks fastened together by round and square shanked ferrous blunt tipped nails (ca. 40-50 mm diameter), some of which were clenched. Hessian also appears to have been placed between the planks as caulking. The most intact plank measures 110 mm wide with a remnant length of 871 mm.

No other evidence of timber boat wreckage was found within ST5 or anywhere else at the former Windsor wharves site, and it is unlikely that these timbers are associated with the boat remains found on the northern (opposite) bank of the Hawkesbury River.²⁶⁴ It is most likely that these timber hull fragments derive from a river vessel that was wrecked or abandoned upstream of the Windsor wharves, with sections subsequently breaking up, being transported downstream by natural water movement, and ending up deposited on the riverbed at the Windsor wharves site.



Figure 151: Exterior view of fragmentary remains of three planks (UWF 17) from a clinker built boat (ST5).

Maritime timber protection

This sub-category consists of a large number copper alloy sheeting or sheathing fragments of various thicknesses from 0.3 mm to 1.6 mm (Figure 152 and Figure 153). From the mid 18th to the mid 19th century, copper sheathing was used to protect the hulls of timber vessels and below-water sections of maritime structures from marine borers and the corrosive effects of salt water. The copper sheathing fragments in the artefact assemblage are likely to be associated both with timber boat building, repair, and / or maintenance activities, and wharf construction and maintenance. It is quite likely that most of the thicker copper sheathing fragments – particularly one large flat fragment of Muntz Metal, a copper and zinc alloy patented by George Frederick Muntz in 1832 and used widely in vessel sheathing – are associated with boat building, repair, and / or maintenance work, and likely represent sheathing sections or offcuts that were either intentionally discarded or accidentally dropped into the river (Figure 154). Some of the thinner fragments are likely to be associated with the Windsor wharf structures – particularly as records show that the piles of the Moriarty & Musson Wharf constructed in 1862 were copper sheathed, and were most likely deposited on the riverbed as the sheathing, and perhaps the wharf structure, deteriorated – see

²⁶⁴ See **Cosmos Archaeology Pty Ltd, April 2021**, *Windsor Bridge Replacement Project Report on the early 19th century timber vessels and other find on the north banks of the Hawkesbury River*. Prepared for Transport for NSW.

Section 9.8 for further discussion. However, without undertaking metallurgical testing, which is beyond the scope of this report, it is difficult to determine with any accuracy which copper sheathing fragments were associated with which activity.



Figure 152: Copper alloy sheathing fragment, showing holes where fasteners had been punched through (ST2).



Figure 153: Copper alloy sheathing fragments (DT1 / SQ2 / C07).



Figure 154: Muntz Metal sheathing; stamp (detail on right) reads “MUNTZ PATENT 11 20 11” (DT1/SQ6/C05).

Building materials (terrestrial)

The building materials category consists of a range of materials most commonly associated with terrestrial constructions, including masonry bricks, ferrous fasteners (nails, bolts, and screws), and a small number of roofing materials, flooring materials, and window glass. It is possible that some of the ferrous fasteners are associated with timber wharf construction, however, the majority are considered too small in size to have been used to affix wharf structural elements.

Masonry bricks

This sub-category is made up of several hundred complete bricks, partial bricks, and brick fragments of various manufactured types, shapes, styles, and sizes.

Ca. 30% of the bricks are handmade sandstock bricks manufactured between 1780s-1840s, and ca. 40% are dry-pressed or re-pressed bricks manufactured between 1840s-1880s onwards. Whilst some complete bricks were recovered (Figure 155 and Figure 156), the majority are partial or fragmented.

These bricks and brick fragments appear to have been deposited on the riverbed by both cultural and natural processes. Ca. 48% of bricks were found within wharf ballast layers, and it is likely that many of these were intentionally deposited along with rock rubble as part of scour protection and bank stabilisation works. Ca. 51% were recovered from natural riverbed sediments and / or flood deposits, and it is likely that many of these brick fragments

represent redeposited demolition debris from adjacent terrestrial sites that washed into the Hawkesbury River during flood events and / or downslope erosion and run-off.

However, an unusual subset of bricks was recovered that appear to represent losses or discards during cargo loading activities, and are almost certainly directly associated with the 1874 construction of Windsor Bridge.

These bricks include various curved and tapered buff-coloured, pressed bricks – see Figure 157 to Figure 160 – and account for over 30% of the overall brick collection. Almost all of these bricks are complete and exhibit no remnants of bonding mortar; suggesting that they are unused bricks. Two slightly different sizes of the curved bricks occurred; a longer type measuring 220-280 mm (8.7-11") long x 110 mm (4.3") wide x 75 mm thick (3"), and a shorter type measuring 210-270 mm (8.3-10.6") long x 110 mm (4.3") wide x 75 mm (3"), thick. The arc measurements of the curved sides indicate an overall external circular diameter of approximately 106 to 110 cm (3'5.7" to 3'7.3"). A single tapered brick with the same curve was also recovered; measuring 140 mm (5.5") maximum width x 75 mm (3"), thick.



Figure 155: Complete sandstock brick (DT1 / SQ4 / C04)



Figure 156: Complete sandstock brick (DT1 / SQ2 / C03)



Figure 157: Complete curved brick – smaller size (DT1 / SQ1 / C06).



Figure 158: Complete curved brick – larger size (DT1 / SQ3 / C12)



Figure 159: Complete curved brick – larger size (DT1 / SQ4 / C4)



Figure 160: Tapered curved brick – larger size (DT1 / SQ10 / C5)

Curved bricks such as these are generally identified as fire or refractory bricks. Fire bricks were specifically manufactured to be used in lining furnaces, flues, kilns, ovens, and fireplaces, or any other places where a brick structure was required to resist very high temperatures. Fire bricks were commonly made in a curved or wedge form to facilitate building arches over fireplaces and ovens, or for use in segments of circles for building round furnaces or flues. However, in the context of the former Windsor Wharf and the former Windsor Bridge, it is most likely that the curved bricks in the maritime assemblage are associated with another type of cylindrical construction.

Historical records show that the iron cylindrical piers of the 1874 Windsor Bridge were filled with “a ring of 9-inch radiating bricks, enclosing a cone of concrete to the top of the pier.”²⁶⁵ The original plans for the Windsor Bridge illustrate that these bricks were designed to be laid in two concentric layers – with an outer row of slightly longer curved bricks and an inner row of slightly shorter curved bricks – and alternating tapered bricks set lengthwise across both layers – see Figure 161. Photographs taken during the demolition of the iron piers of the 1874 Windsor Bridge in April 2020 further show that the brick layers were bonded together with what appears to be cement mortar – see Figure 162 to and Figure 164.

The construction of this type of internal brickwork would have been difficult and labour intensive, however, it substantially enhanced the strength and load-carrying capacity of the bridge piers. The use of brick-lined cylindrical iron piers in bridge construction appears to have been a relatively rare and short-lived mid to late 19th century technique, with only one other comparative historical structure known in NSW; the Denison Bridge over the Macquarie River in Bathurst.

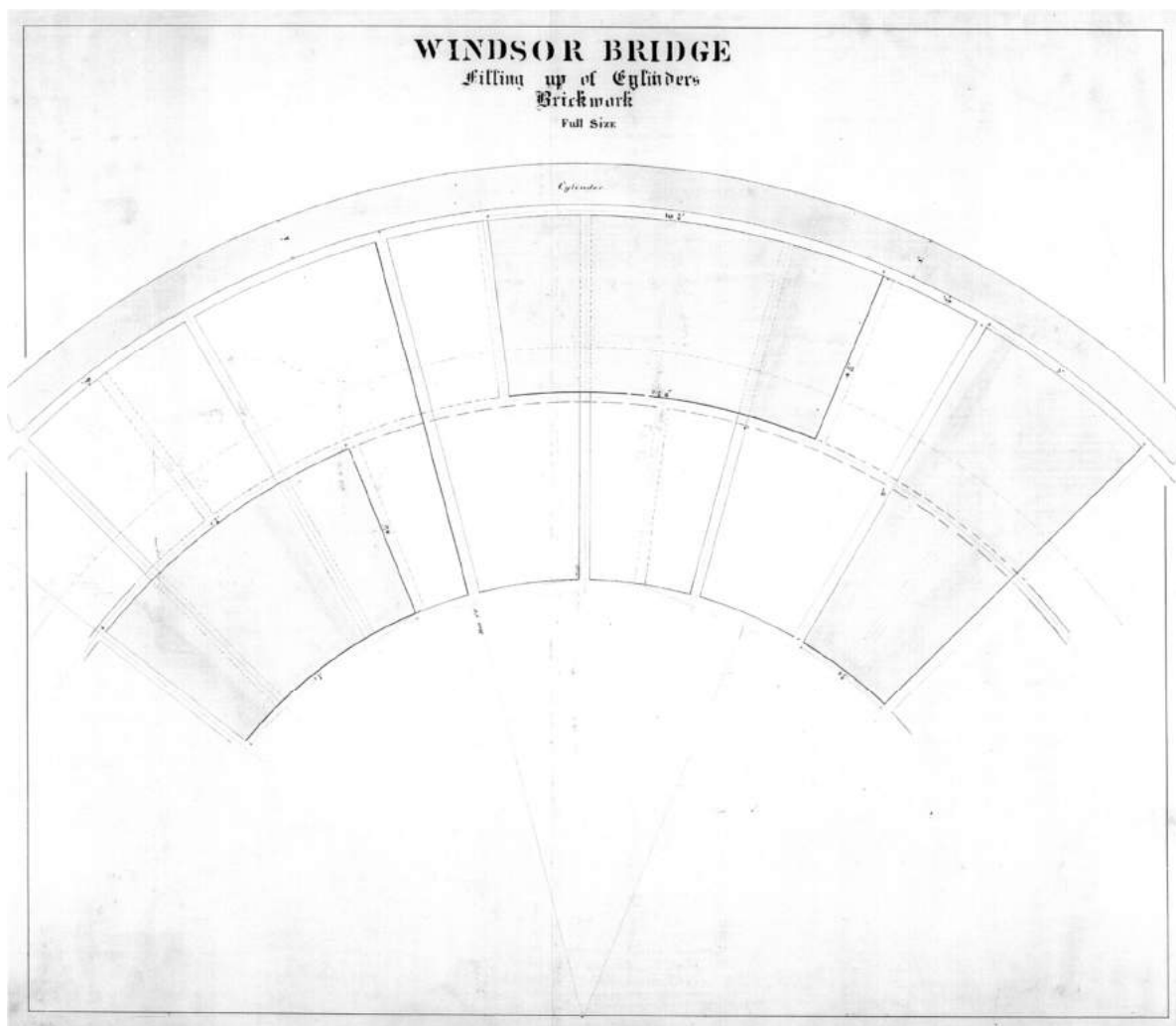


Figure 161: 1874 Windsor Bridge design plan showing details of “filling up of cylinder brickwork.” ²⁶⁶

²⁶⁵ “The New Bridge over the Hawkesbury at Windsor.” 22 August 1874. *Australian Town and Country Journal*. p. 20.

²⁶⁶ Windsor Bridge. Filling up of Cylinders Brickwork. RMS Plans 0182091BC0104: 10.



Figure 162: Iron pier removed from 1874 Windsor Bridge during demolition, showing internal brickwork (photograph by Neil Dand, April 2020).²⁶⁷



Figure 163: Detail of 1874 Windsor Bridge pier internal brickwork (photograph by Neil Dand, April 2020).²⁶⁸



Figure 164: Demolished iron pier from 1874 Windsor Bridge showing longitudinal view of layered internal brickwork (photograph by Paul Caleo, April 2020).²⁶⁹

The curved and tapered bricks in the maritime assemblage closely correspond to the three types and sizes depicted in the 1874 Windsor Bridge plan, and the calculated diameter of the curved edges matches the Windsor Bridge pier dimensions of 3'6" diameter. It is thus highly likely that these bricks represent construction materials associated with the 1874 bridge. The absence of mortar remnants on any of the recovered bricks further indicates that they were unused bricks that were either accidentally dropped into the river, or surplus materials that were intentionally discarded.

The occurrence of these bricks on the riverbed at the former Windsor Wharf site further suggests that the wharf was used to load river vessels with materials for transport to the mid-river bridge construction site. These bricks were concentrated along the shoreward edge of DT 1 and DT 3 (Table 10 and Figure 72 for further context regarding trench locations). This is to be expected as the apron of the 1862 Windsor Wharf was closer to

²⁶⁷ Dand, N. April 2020 – reproduced on CAWB (Community Action For Windsor Bridge) Facebook page, <https://www.facebook.com/cawbwindsor/photos/a.224213424335369/3883705208386154>

²⁶⁸ Dand, N. April 2020 – reproduced on CAWB (Community Action For Windsor Bridge) Facebook page, <https://www.facebook.com/cawbwindsor/photos/a.224213424335369/3869963563093652>

²⁶⁹ Caleo, P. April 2020 – reproduced on CAWB (Community Action For Windsor Bridge) Facebook page, <https://www.facebook.com/cawbwindsor/photos/a.224213424335369/3866856626737679>

the riverbank, and the brick distribution pattern could be consistent with a dropped pallet of bricks between boat and wharf dispersing down the riverbed slope.

Table 10: Distribution of curved bricks associated with the 1874 Windsor Bridge across the Deep Trenches and squares within Deep Trench 1.

DT 2 = 0	DT 3 = 4	DT 1				
			S 12 = 0		S 7 = 0	
		S 10 = 6	S 3 = 2	S 2 = 5	S 1 = 4	S 8 = 3
		S 11 = 4	S 6 = 10	S 5 = 8	S 4 = 7	S 9 = 1

Ferrous fasteners

This sub-category comprises over one thousand ferrous fasteners that were identified as terrestrial / architectural fasteners based on size and design. The vast majority of these ferrous fasteners consist of cut nails (pre-1880), wire-drawn nails (post 1860) and wrought nails. The remainder includes a variety of cast screws, wire-drawn and wrought tacks, and cast, wrought and machine-made bolts (see Figure 165 to Figure 168).

It is possible that some of these fasteners represent items of cargo accidentally lost during vessel onloading / offloading or trade at Windsor Wharf. However, most of the fasteners are bent or otherwise damaged in a fashion that indicate they are used items. It is thus more likely that these fasteners represent demolition debris from adjacent terrestrial buildings and structures, which have been redeposited into the river via natural processes of erosion and downhill slope wash.

It is also possible that some of the wrought nails could have some association with boat building, as ferrous fastenings of the type that could have been used in terrestrial functions have been found in a timber wreck from the early 19th century on the northern bank during this project.²⁷⁰



Figure 165: Various ferrous terrestrial structural fasteners and hardware (DT2 / C14).



Figure 166: Various ferrous terrestrial structural fasteners and hardware (DT2 / C03).

²⁷⁰ See **Cosmos Archaeology Pty Ltd, April 2021, Windsor Bridge Replacement Project Report on the early 19th century timber vessels and other find on the north banks of the Hawkesbury River.** Prepared for Transport for NSW.



Figure 167: Various ferrous terrestrial structural fasteners and hardware (DT3 / C02).



Figure 168: Various ferrous terrestrial structural fasteners and hardware (DT2 / C03).

Food and beverage

The food and beverage category consists of a wide range of artefacts that fall into several sub-categories including food procurement, food service and consumption, food refuse, non-alcoholic beverage consumption, and alcoholic beverage consumption.

Food procurement

The food procurement sub-category consists entirely of fishing tackle and includes ferrous and stainless steel fish hooks, copper alloy, lead, and plastic fishing lures and spinners, various types of lead sinkers including manufactured ball, barrel, bean, conical, spoon, split shot, quick drop types, and several handmade sinkers consisting of lead weights and folded or rolled lead offcuts, and fragments of synthetic fishing line (see Figure 169 to Figure 173). This collection of fishing tackle includes items manufactured from the late 19th century to the late 20th century, and undoubtedly represents gear accidentally lost or dropped during fishing activities carried out either from the former Windsor wharves and / or the adjacent riverbank. Possible evidence of early 19th century fishing activities from the former Windsor wharves can also be found in another artefact category – see the *sewing and darning* category below.



Figure 169: Quick-drop snapper style sinker, with remnants of synthetic line attached (DT2 / C05).



Figure 170: Four ball sinkers tied together as one weight, a reused lead weight, and stainless steel fish hook (DT3 / C03).



Figure 171: Spoon style lead sinker (ST5).



Figure 172: Barrel style sinker (DT1 / SQ9 / C08).



Figure 173: A Shakespeare Company (established 1897) “GET EM” fishing lure (DT1 / SQ1 / C06)



Figure 174: Ferrous fish hook (DT1 / SQ1 / C07)

Food service and consumption

The food service and consumption category is dominated by fragments of ceramic service ware and tableware, including platters, dishes, jugs, bowls, plates, saucers, egg cups and tea cups. The majority (over 70%) are formed of refined earthenware, including creamware, graniteware, pearlware, whiteware, and red paste, with lower numbers of porcelain, consisting of Chinese export, hard paste and soft paste porcelains, and white paste, salt-glazed and lead-glazed stoneware. A range of decorative types occur, including painted annular banded, gilt / gilt painted, sponge decoration, and flow blue / black and decalcomania transfer printing. See Figure 175 to Figure 182.

A large number of the ceramic tableware fragments consist of ceramic types dating from the late 18th to mid 19th centuries and are of a very similar range of material and manufacture types, vessel styles, and decorative types to the ceramic fragments found in adjacent terrestrial archaeological excavations undertaken at Thompson Square.²⁷¹

It is rather unlikely that it was a common 18th-19th century cultural behaviour to consume meals on refined earthenware and porcelain tableware at the Windsor wharf. It is possible that some of the large steamships offering passenger excursions up the Hawkesbury River to Windsor wharf may have served meals on fine ceramic ware, some of which may have been lost or discarded overboard whilst moored; however, large passenger vessels were only infrequent visitors to Windsor. It is most likely that the range of ceramic service ware and tableware fragments recovered from the Hawkesbury riverbed represent domestic debris from nearby terrestrial sites. Some domestic debris may have been discarded directly into the river, as a convenient method of disposal, however, natural processes of erosion and slope wash are also likely to have reworked terrestrial deposits and transported debris downhill into the river.

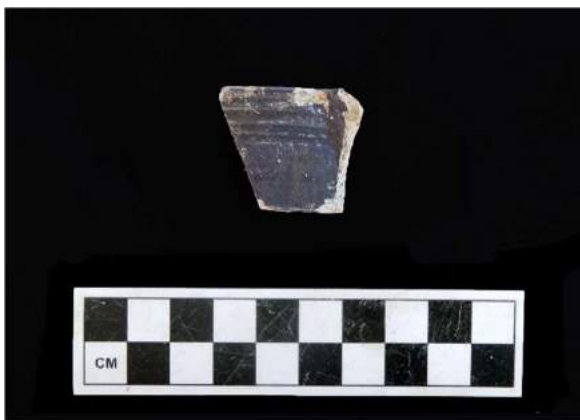


Figure 175: White paste stoneware vessel fragment, salt-glazed & moulded, 1720-1785 (DT1 / SQ10 / C05).



Figure 176: Red paste, lead-glazed colonial ware bowl fragments, 1800-1830 (DT1 / SQ4 / C08).

²⁷¹ See McGuinness, J., D. Marcus & A. Yousif / AAJV. 2019. Windsor Bridge Replacement Project. Salvage Excavation Report – Area 1 – Historical Archaeology. Report to NSW Roads and Maritime Services.

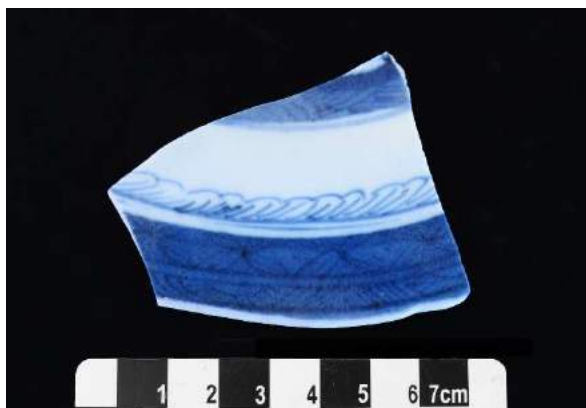


Figure 177: Chinese export porcelain plate fragment showing Canton style trellis pattern “cloud and rain” hand painted decoration, 1785-1853 (ST2).



Figure 178: Chinese export porcelain cup fragment showing Nanking influenced hand painted decoration, 1780-1830 (T1 / SQ2 / C10).



Figure 179: Whiteware bowl with transfer printed blue willow pattern decoration on both interior and exterior surfaces, 1820s onwards (DT1 / SQ6 / C04).



Figure 180: Whiteware plate fragment with red willow pattern decoration, 1820s onwards (DT2 / C02).



Figure 181: Whiteware plate fragments with transfer printed Asiatic pheasant decoration, 1820s onwards (DT1 / SQ9 / C02).



Figure 182: Whiteware platter fragment with transfer printed cable patten, 1860s onwards (DT1 / SQ4 / C05).

Food refuse

The food refuse sub-category includes livestock bones and bone fragments, saltwater mollusc shells, fruit and vegetable seeds, stones, and nut shells. A small number fish bones, bird bones, and freshwater mollusc shells were also recovered, however, these are most likely to represent a background scatter of natural death deposits of local native fauna.

The livestock bones and bone fragments include skeletal elements from cattle, sheep, and pig – see Figure 183 to Figure 188. It is possible that some of these bones derive from animals that fell into the river and subsequently drowned, as livestock have been grazed along the banks of the Hawkesbury since the early 19th century. However, cultural modification and butchery marks are evident on a substantial proportion of these livestock bones, and it is probable that most, if not all, represent cultural food debris. Some of these livestock bones may represent accidentally lost or dropped cargo – either from salted meat or fresh meat cuts, both of which were occasionally shipped along the Hawkesbury River to and from Windsor. However, it is likely that most were deposited through intentional discard of domestic food refuse into the river, possibly from adjacent residences, or via erosion and slope wash from adjacent bone bearing terrestrial deposits. Indeed, rodent gnawing marks were observed on some of the larger livestock bone fragments, indicating that at least some of these skeletal remains had been exposed on the ground surface for a period of time before being redeposited onto the riverbed (Figure 189). See also Annex I for a detailed examination of the animal bone assemblage.



Figure 183: Cattle skull fragment (ST5).



Figure 184: Butchered cattle tibia fragment (DT1 / SQ4 / C04).



Figure 185: Butchered cattle rib segments (DT3 / C4).



Figure 186: Pig maxilla fragment (ST5 / C24)



Figure 187: Butchered sheep pelvis fragment (DT1 / SQ5 / C03).



Figure 188: Sheep metacarpal (DT3 / C19).



Figure 189: Cattle ventral rib fragment showing rodent gnaw marks (DT1 / SQ5 / C5)

The saltwater mollusc shells recovered consist predominantly of oyster shells, particularly Sydney rock oyster, and a small number of Sydney cockle and Hairy mussel shells – see Figure 190 and Figure 191. These mollusc species occur naturally in the brackish estuarine environments at the mouth and lower reaches of the Hawkesbury River, however, are not native the fresh water upper reaches at Windsor. These species, particularly Sydney rock oyster, were a common and popular food resource since the earliest days of the NSW colony, and it is quite likely that much of these shell deposits represent food refuse from nearby inhabitants – again either discarded directly into the river or transported downslope via natural processes.

However, oyster shells also served as a valuable source of calcium to produce lime for colonial building purposes from the late 18th to mid 19th centuries and shell lime was utilised in the construction of many buildings in the early Windsor township. Terrestrial archaeological excavations at Thompson Square have revealed evidence of a possible early 19th century local area of shell lime burning and mortar preparation associated with the 1814-1816 construction of the Howe and McGrath brick drainage system through Thompson Square,²⁷² and historical records show that supplies of oyster shells for lime production were shipped up the Hawkesbury and offloaded at the Windsor wharf during the 19th century (see Section 3.3). As such, it is also possible that a significant proportion of the shell deposits from the riverbed represent lost cargo, accidentally dropped during transfer from vessels to the wharf. This assumption has been based in part on the observation that none of the shell show charring or calcination due to burning. See also Annex I for a detailed examination of the mollusc shell assemblage.

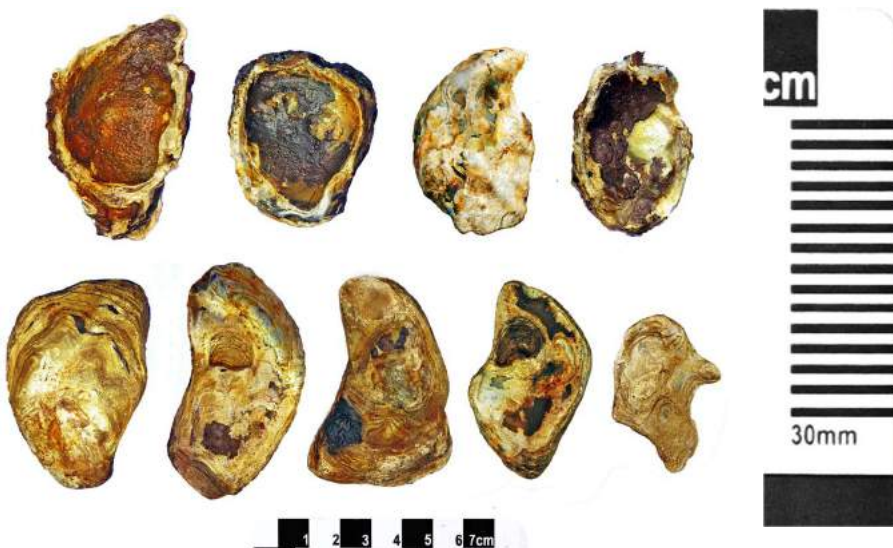


Figure 190: Complete oyster shells – left valves (top) and right valves (bottom).



Figure 191: Ark clam / cockle shell fragments.

²⁷² See McGuinness, J., D. Marcus & A. Yousif / AAJV. 2019. Windsor Bridge Replacement Project. Salvage Excavation Report – Area 1 – Historical Archaeology. Report to NSW Roads and Maritime Services.

The fruit and vegetable remains in the assemblage consist of stones, seeds, and nut shells from seven plant genera including peaches, watermelons, coconuts, pumpkins, pecans, walnuts and chestnuts (see Figure 192 and Figure 193). All are edible species not native to the Windsor area and as such, these stones, seeds, and nut remains found on the Hawkesbury riverbed almost certainly represent cultural food debris. It is possible that some of these plant remains were directly discarded into the river by nearby inhabitants, or were transported in via downslope erosion, water runoff and/or floated down the River. However, historical records show that orchard fruits, pumpkins, and melons were commonly shipped to Windsor wharf to supply the township from rivercraft travelling from farms and orchards along the upper Hawkesbury, Colo and MacDonald Rivers, and were often sold on market days directly to customers at the wharf from vessels moored alongside (see Section 3.3 and Annex I). It is very likely that some, if not most, of the stones, seeds, and nut shells, in the assemblage were dropped into the river during such trade transactions.



Figure 192: Peach stones and endocarp segments.



Figure 193: Pumpkin and watermelon seeds.

Alcoholic and non-alcoholic beverage consumption

This artefact sub-category consists of a wide range of glass and ceramic beverage vessels and drinking glasses, including alcohol bottles such as beer, beer / wine, champagne, gin / schnapps bottles and a spirit flask, non-alcoholic drink bottles including aerated water, soda, ginger beer and other soft drinks, drinking glasses including tumblers, shot glasses and wine glass fragments, and aluminium alcoholic and non-alcoholic drink cans – see Figure 194 to Figure 199. The date of manufacture of both alcoholic and non-alcoholic beverage vessels ranges from the early 19th century to the late 20th century.

The majority of the beverage bottles and drinking glasses in the assemblage occur as partial vessels and broken fragments, however, a noticeable number survive as complete or near complete items. It is likely that a proportion of this sub-category of artefacts represents debris from adjacent terrestrial settlement – either directly discarded into the river as a convenient means of rubbish disposal, or transported downslope from terrestrial deposits via erosion and water runoff. However, the presence of numerous complete beverage vessels and drinking glasses also suggests that a certain amount of alcoholic and non-alcoholic beverage consumption occurred directly on the successive Windsor wharves and adjacent riverbank, or vessels moored alongside, with empty bottles and glasses either accidentally lost or intentionally dropped directly into the river when finished with.



Figure 194: Stoneware ginger beer or stout bottle (DT1 / SQ7 / C05).



Figure 195: Glass spirit flask, 1930s onwards (DT1 / SQ6 / C04).



Figure 196: Codd patent aerated water bottle – H.E. Stevenson, 1890-1907 (DT1 / SQ5 / C03).



Figure 197: Coca Cola patented bottle, 1920s onwards (DT1 / SQ5 / C02).



Figure 198: Two complete / near complete shot glasses, 1835 onwards (DT1 / SQ6 / C05).



Figure 199: Resch's "Dinner Ale" can, 1950s-1960s (DT1 / SQ9 / C02).

Transport (terrestrial)

The transport (terrestrial) category consists of a range of objects associated with horses and carts including horseshoes, horseshoe nails, a horse tie down or tether weight, and a broken cart / carriage step; bicycle parts including bicycle chain fragments and a tyre valve stem; motor vehicle parts including car window glass, spark plugs and a mid 19th century car trailer number plate; and railway components including a dog spike and a railway circuit breaker seal stamped as NSW Government Railways property. These objects date to a wide range of periods, from mid to late 18th century horseshoes and railway components to late 20th century motor vehicle components – see Figure 200 to Figure 203.

These artefacts were almost certainly associated with terrestrial transport activities on the successive Windsor wharves, adjacent riverbank, and approach road, and represent objects that were accidentally lost, or broken and subsequently deposited into the river. These artefacts clearly illustrate the role of former Windsor Wharf as a link between river transport and various forms of land transport, connecting the Hawkesbury River trade and transport network to the Windsor township and the surrounding region.

The horseshoes, horseshoe nails, horse tie down and cart / carriage components are most likely associated with the horses and carts that were used through the 19th century to early 20th century to carry goods offloaded from vessels at the former Windsor wharf up the Punt Hill into Windsor township (see Section 3.3 and Figure 49). The motor vehicle components show the continued connection between land transport and the wharf through the 19th century, and the car trailer number plate – quite possibly from a boat trailer – also hints at recreational boating uses of the Hawkesbury River from the riverbank and latter 20th century boat ramp adjacent to the wharf site.

The mid to late 19th century railway components, including the seal stamped as NSW Government Railways property, are also of particular interest. In 1864, a railway branch line off the main western railway line from Sydney was constructed from Blacktown to Richmond, with a station built at Windsor. The rail connection provided a stimulus for river transport and commerce at the former Windsor wharf, as river traders could now sell produce to Sydney merchants and have it quickly transported to inland markets by rail (see Section 3.3). Various materials and equipment for the construction of the Blacktown to Richmond railway line were undoubtedly shipped to the former Windsor wharf and it is quite likely that the railway components in the assemblage represent incidental losses during unloading and transfer from vessel to wharf.



Figure 200: Forged ferrous horseshoe, 1750-1800 (DT1 / SQ9 / C05).



Figure 201: Ferrous horse tie down / tether weight (DT2 / C04 / Spit 2).



Figure 202: Lead railway circuit breaker seal, showing NSW Government Rail stamp, 1855-1900 (DT1 / SQ2 / C21).



Figure 203: NSW trailer number plate, 1948-1981, (DT2 / C03).

Manual tools and implements

This category includes a range of manual tools and implements including wire cutters, needle nose pliers, drill bits, punches, rasps, files, a claw hammer, a spade, several small spanners and a large spanner of a size generally used for locomotive and railcarriage works, and several horse-drawn plough components including two plough blades – see Figure 206 to Figure 207.

Several of the small hand tools are potentially associated with cargo handling, manual labour, and possibly maintenance or repair work carried out onboard vessels moored alongside the wharf, and most likely represent objects that were accidentally dropped overboard. The large spanner could possibly be a lost item of a cargo of railway operation and maintenance tools and equipment being shipped up the Hawkesbury River to railway yards on the Blacktown to Richmond line. Similarly, the horse-drawn plough components are perhaps most likely to represent items of cargo lost during transfer between vessel and wharf – either farm implements being shipped from Sydney for sale in Windsor or being transported from stores in Windsor via riverboat to customers on farms along the upper Hawkesbury, Macdonald, and Colo Rivers.



Figure 204: Hammer head (DT3 / C04 / Spit 2).



Figure 205: Needle-nose pliers (DT1 / SQ9 / C02).



Figure 206: Horse-drawn plough blade (F12).



Figure 207: Railway spanner (F14).

Armament

The armament category consists of a wide range of firearm ammunition – both fired and unfired, and a firearm accessory. The latter is a pan primer flask for a flintlock muzzle-loaded firearm, used to dispense priming powder into the flash pan (see Figure 215). The ammunition includes musket and pistol / small rifle percussion caps, various different types of rifle, pistol, and revolver cartridges, including .22, .270 and .38 calibres, and 10 gauge brass shotgun shells (Figure 208 to Figure 214). The overall collection of armament artefacts ranges in date of manufacture from the early 19th century to the latter 20th century.

The presence of both fired and unfired ammunition clustered together in an area generally indicates the location of a shooter – with the fired caps, cartridges, and shells representing intentional discards and the unfired caps and rounds being unintentionally dropped and lost during loading. It is unlikely that these armament artefacts are associated with hunting activities, given the riverine location, rather it would appear that the successive Windsor wharves were a popular location for informal target practice or plinking using a wide variety of firearm types.

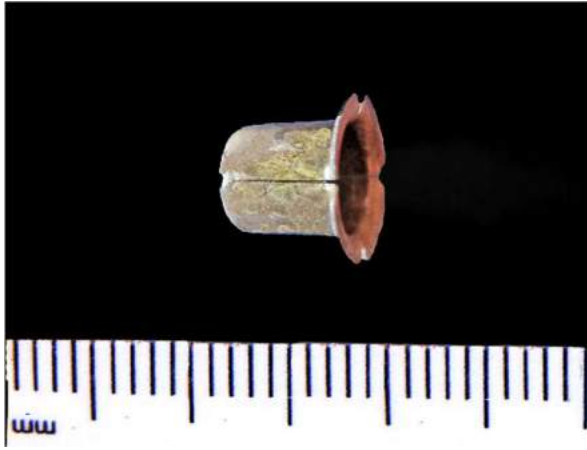


Figure 208: Unfired "military" or "top hat" musket percussion cap.

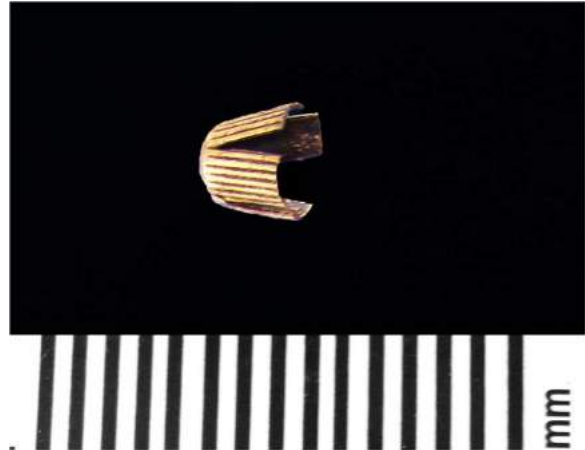


Figure 209: Fired "common" pistol / small rifle percussion cap.



Figure 210: Unfired Remington – UMC .38 Special cartridges – detail of headstamp on right.



Figure 211: Unfired .22 short and long cartridges



Figure 212: Fired .22 cartridge headstamp (ICI = Imperial Chemical Industries)



Figure 213: Unfired Winchester .270 Super-X cartridge.



Figure 214: Unfired Super-X .22 cartridge headstamp.



Figure 215: Muzzleloader pan primer flask.



Figure 216: Fired 10 gauge brass shotgun shell.

Sewing and darning

This artefact category consists of several types of objects that have an original function of sewing and darning, including ferrous needles, sewing scissors, and a lathed timber darning egg. However, the sewing and darning category is vastly dominated by a substantial number of copper alloy straight pins or dress pins, designed to be used to fasten pieces or segments of cloth together. Three different sizes of straight pins occur, including long white pins (30-70 mm long), short white pins (24-30 mm long) and lillikin pins (12 mm long). The collection of pins also comprise two different manufacturing techniques and periods, including pre-1830s wire-wound pins and post 1830s drawn and machine-made pins.

Such pins often occur in 18th and 19th century domestic archaeological sites, and it is possible that some of the pins found on the riverbed represent secondary deposits transported from terrestrial contexts via erosion and water runoff. However, no similar pins were identified during adjacent terrestrial archaeological excavations at Thompson Square.²⁷³ The substantial number of pins within the maritime assemblage also tends to suggest that they were associated with particular activities carried out directly at the site of the former Windsor wharves. These pins were manufactured with the intended function of fastening pieces of cloth together, and it is possible that some served that function onboard vessels utilising the wharf; for instance, possibly securing pieces of fabric used to cover and protect fresh produce cargo during transport and offloading.

However, it also appears that some of the pins may have been used for purposes completely unrelated to sewing or securing fabric. Almost 30% of the straight pins in the assemblage are bent. This is not an altogether uncommon occurrence and bent straight pins – damaged through general wear and tear – are often found in terrestrial domestic archaeological sites. However, a sizeable number of the pins in the maritime assemblage – including both pre and post 1830s types – are bent and curved in a fashion that distinctly resembles the shape of a

²⁷³ See McGuinness, J., D. Marcus & A. Yousif / AAJ.V. 2019. Windsor Bridge Replacement Project. Salvage Excavation Report – Area 1 – Historical Archaeology. Report to NSW Roads and Maritime Services.

fish hook – Figure 217 and Figure 218. Such patterning of damage appears unlikely to have occurred through general use of the pins to secure sections of fabric, and it is quite possible that these pins were intentionally shaped to be used as homemade fish hooks, and were subsequently lost during fishing activities undertaken from the wharf or adjacent riverbank.

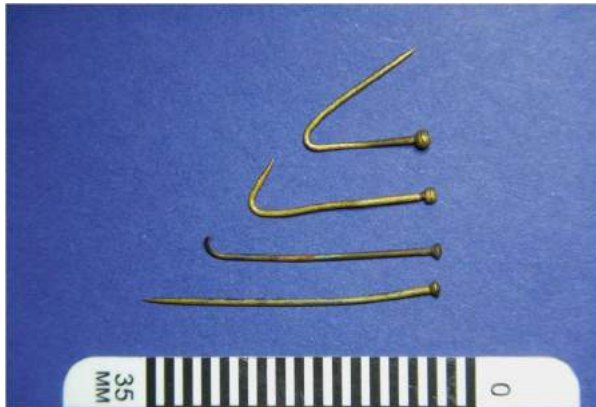


Figure 217: Copper alloy straight pins (DT1 / SQ9 / C08), showing wire-wound head pins (pre-1830) at top, and machine made pins (post 1830s) at bottom.



Figure 218: Copper alloy straight pins (DT1 / SQ6 / C05), showing several curved into the shape of fish hooks.

Personal

The personal artefact category includes a wide range of objects that are considered to represent personal effects as they are generally worn or carried on the person and are for personal use. This category consists of numerous sub-categories, including currency, jewellery and adornments, smoking equipment, pocket tools, recreational objects, clothing buckles and fasteners, footwear, clerical, and security. It is likely that most of the artefacts in this personal category were accidentally lost by people on the wharf, in vessels moored alongside, or during transfer between the two.

Currency

The currency sub-category comprises almost two hundred British, Australian, and New Zealand coins and currency tokens of various denominations, dating from the late 18th century to the early 21st century (Figure 219 to Figure 227). Specifically, the coins include British farthings (1790s), pennies (1790s to 1870s), half pennies (1860s-1890s), shillings (1810s-1880s), sixpence (1810s-1950s) and four pence (1810s), Australian pennies and half pennies (1910s-1950s), florins (1930s-1940s), sixpence (1920s-1950s), threepence (1920s-1960s), and shillings (1910s-1940s), Australian one dollar (1980s), fifty cent (1960s-1970s), twenty cent (1960s-2000s), ten cent (1970s-1990s), five cent (1960s-1970s), two cent and one cent (1960s-1980s), and a New Zealand twenty cent (1970s) coin. The currency tokens include three 1850s one penny store tokens minted by Heaton & Sons, UK, with two specifically manufactured for Sydney based iron merchants and ironmongers Iredale & Co. These tokens were legal currency in NSW during the 1850s and 1860s and were used by merchants *in lieu* of small change.

Coins are commonly dropped or lost during everyday activities, either falling out of pockets or bags, or simply slipping through fingers. The incidence of permanent coin loss undoubtedly increases around maritime infrastructure, as coins dropped into the water or falling through gaps in wharf decking generally cannot be easily retrieved. Nonetheless, the high number of coins and tokens in the assemblage also tends to illustrate and highlight the status of the successive Windsor wharves as locations of commerce and trade. For many years throughout the 19th and early 20th centuries, river traders would moor alongside the former Windsor Wharf, particularly on market days, and sell their produce and wares directly from the holds of their vessels to customers standing on the wharf (see Section 3.3), and it is likely that a sizeable number of the coins in the assemblage were dropped and lost into the river through such commercial transactions.



Figure 219: 1799 farthing (DT1 / SQ3 / C9)



Figure 220: 1799 penny (DT1 / SQ4 / C12)



Figure 221: 1866 penny (DT1 / SQ6 / C5)



Figure 222: ca. 1857 Iredale & Co. one penny token (DT1 / SQ1 / C8)



Figure 223: 1859 "Peace & Plenty" one penny token (DT1 / SQ4 / C5)



Figure 224: 1864 half penny (F17)



Figure 225: 1936 sixpence (DT3 / C3)



Figure 226: 1943 half penny (F13)



Figure 227: 1952 penny (ST5 / C23)

Tobacco smoking equipment

This artefact sub-category consists almost entirely of fragments of clay tobacco pipes – amounting to over 100 pipes in total; and one copper alloy reusable pocket lighter – see Figure 228 to Figure 231. Tobacco smoking was an acceptable and popular activity for all classes of male society in the NSW colony throughout the 18th to 20th centuries. However, historical records show that attitudes towards smoking varied between social classes – amongst the mid to upper classes smoking was seen as an activity of leisure and contemplation, whilst in the lower classes smoking was associated with work and boisterous entertainment. Smoking apparatus also differed and the clay pipe – relatively cheap, easily breakable and with an average lifespan of a few days to a fortnight – was largely used by those of lower socio-economic status.

Several clay tobacco pipe stems in the assemblage are embossed with makers' marks, showing nine different pipe manufacturers from England, Scotland, Belgium and Australia, with pipes dating in manufacture from the early 19th to early 20th century. Two decorated pipe bowls were also recovered – one with an unidentified figure head (manufactured by David Miller, Liverpool, England) and another with a sailing ship on one side and a flag with

“AUSTRALIA” written across it on the other side (manufactured by Thomas White and Co., Edinburgh, Scotland).

The wide range of manufacturers within the small sample size of marked pipes, and the fact that many show evidence of use, indicates that these pipes represent lost or discarded personal items rather than an example of lost or dropped cargo. Whilst some of the clay pipe fragments may represent terrestrial deposits that were transported into the river via erosion and slope wash, it is likely that a large number – particularly those surviving largely intact – were lost directly from the successive Windsor wharves, and / or vessels moored alongside, by river traders, merchants, labourers, and customers, and perhaps others using the wharf for recreational activities. The copper alloy reusable pocket lighter also likely represents an unintentionally lost object directly from the wharf or a vessel moored alongside.



Figure 228: Clay tobacco pipe manufactured by David Miller showing figure head in profile on bowl (DT1 / SQ8 / C05).



Figure 229: Clay tobacco pipe manufactured by Thomas White & Co, showing sailing ship on bowl (DT1 / SQ2 / C10).



Figure 230: Largely intact long stem of clay tobacco pipe (F5)



Figure 231: Clay pipe fragments including Thomas Saywell (Sydney) pipe (1865-1905), Thomas White and Co (Edinburgh) 1823-1882, and William Murray (Glasgow) pipe (1830-1861) (DT1 / SQ6 / C05).



Figure 232: Copper alloy reusable pocket lighter (DT1 / SQ6 / C04).

Pocket tools

The pocket tool sub-category includes of a sizeable range of pocket folding knives, all formed of ferrous alloy blades fitted inside a timber cover. These are not unusual personal objects; however, the high number of folding knives in the maritime assemblage suggests that these personal tools were commonly carried by people using the Windsor wharves and were directly associated with activities carried out on the wharf and or vessels moored alongside. Folding knives would undoubtedly have been useful objects for river traders, deckhands, and wharf labourers to carry on their person, and are also likely to have been an important part of fishing gear for people using the wharf and adjacent riverbank to fish the river. It is most likely that all the folding knives identified represent objects that were unintentionally lost or dropped directly into the river during use.



Figure 233: Folding pocket knife (ST5 / C23).



Figure 234: Folding pocket knife (T1 / SQ5 / C05).



Figure 235: Folding pocket knife (DT2 / C04).



Figure 236: Folding pocket knife (DT3 / C04 / Spit 2).

Clothing – buckles and fasteners

The clothing buckles and fasteners sub-category consists of a wide range of belt buckles, strap buckles, waistcoat buckles, hook and eye clothes fasteners, cotter pins, studs, zipper tags, and a large and diverse array of sew-through and shanked ferrous alloy, copper alloy, and gold buttons – see Figure 237 to Figure 244. These artefacts have identified dates of manufacture ranging from the early 19th century to the mid 20th century. Of particular interest are a small number of early 19th century and early 20th century military buttons (Figure 245).

Some of these buckles and clothes fasteners may represent objects from adjacent terrestrial archaeological deposits that have been transported downslope into the river via erosion and water runoff. However, it is likely that most, if not all, represent items that were unintentionally lost, broken, or pulled off clothing, as people were carrying out activities directly on the successive Windsor wharves; on vessels moored alongside, or whilst transferring between the two – possibly on some occasions of people themselves accidentally falling into the water from the wharf or whilst transferring to or from vessels. It is interesting to note that the majority of clothing buckles and fasteners derive from clothing items and styles traditionally associated with men.



Figure 237: Copper alloy belt buckle with two moulded depictions of cricket bats leaning on a cricket pitch (DT1 / SQ12 / C04).



Figure 238: Copper alloy waistcoat buckle (F13).



Figure 239: Copper alloy shanked and two-hole sew-through buttons (DT2 / C03).



Figure 240: Copper alloy four-hole sew-through buttons (DT3 / C04 / Spit 2).



Figure 241: Copper alloy button with crossed anchor motif (DT1 / SQ8 / C08).



Figure 242: Copper alloy button with crossed anchor motif (DT3 / C02).



Figure 243: Belt buckle (DT3 / C02)



Figure 244: Copper alloy eyelet hook (ST5/C02)



Figure 245: Military button, from 1801 onwards (DT3 / C04 / Spit 2)

Clothing - footwear

The footwear sub-category includes a range of leather and ferrous alloy shoe fragments including soles, head plates, and shoe body sections, and copper alloy shoe hook and eyelet fasteners – see Figure 246 and Figure 247. As with the various clothing fasteners, these items of footwear were mostly likely lost from people using the Windsor wharf and / or vessels moored alongside, and perhaps particularly from incidents of people accidentally falling into the water from the wharf or vessels as shoes tend to be a common item lost or kicked off in such cases. Of particular interest is an almost complete handmade child's shoe, indicating the presence of children at the wharf and possibly resulting from a child falling into the river from the wharf or adjacent riverbank.



Figure 246: Mens' leather shoe insole (DT1 / SQ2 / C21).



Figure 247: Handmade leather childrens' shoe (DT1 / SQ10 / C05).

Jewellery and adornment

The artefact sub-category consists of a range of complete and broken items of gold, silver, and copper alloy jewellery and personal adornments, including brooches, earrings, rings – including one gold wedding band, necklace chains, wrist watches, fob or pocket watches, and a military medal ribbon holder attachment (Figure 248 to Figure 251). These items most likely all represent objects that were broken and lost or accidentally dropped into the river by people using the successive Windsor wharves and / or vessels moored alongside. It is interesting to note that jewellery and adornments traditionally associated with both men and women are present.



Figure 248: Silver hoop earring (ST5)

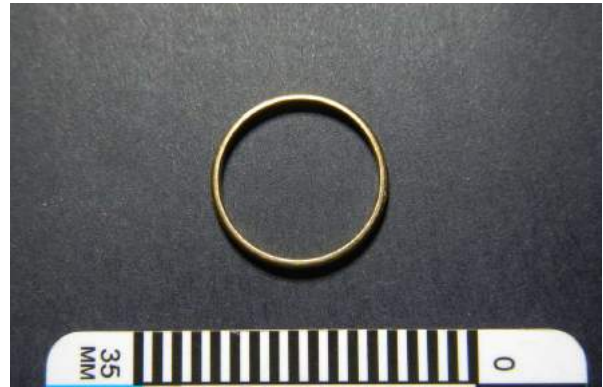


Figure 249: Gold wedding band (DT1 / SQ2 / C07)



Figure 250: Base plate from a pocket watch (DT2 / C04)



Figure 251: Copper alloy military medal ribbon holder (DT2 / C03)

Recreation

The recreation artefact sub-category consists of objects created purely for recreational purposes, including childrens' toys, games, and musical items, that would commonly be carried on the person. Many other objects and associated activities can serve a recreational purpose – such as fishing or plinking, however, this category was limited to those created solely for recreation. The childrens' toys and game objects consist of several earthenware, stoneware, and glass marbles, a painted soft paste porcelain doll's leg, and a "Mity Mite" metal toy cap gun – it appears that it was not only adults who enjoyed shooting firearms from the Windsor wharf (see Figure 252 to Figure 255). It is interesting to note this group includes different toys traditionally associated with boys and girls. The musical items include the top cover and one reedplate from an iconic Australian "Miniature Boomerang" harmonica, and a music compact cassette tape. The dates of these recreational objects range from mid 19th century to mid 20th century toys, and early to late 20th century musical objects.

As with several other categories, it is possible that some of these objects derive from terrestrial deposits that have been reworked and washed downslope into the river via natural processes. However, it is likely that many of these small recreational items were accidentally lost or dropped by people using the wharf, perhaps for the specific purposes of recreation, and / or vessels moored alongside.

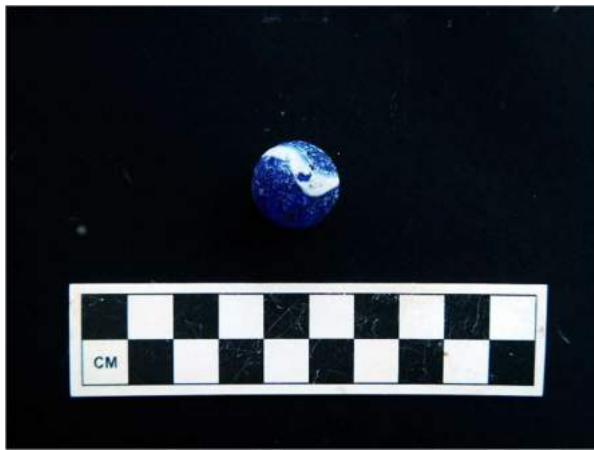


Figure 252: Handblown marble, 1850-1920 (DT1 / SQ5 / C03).



Figure 253: Painted porcelain doll's leg (DT1 / SQ4 / C05).



Figure 254: Albert's Patent "Miniature Boomerang" harmonica (top cover and one reedplate) (DT1 / SQ2 / C07).



Figure 255: "Mity Mite" cap gun (T3 / C19).

Clerical

The clerical sub-category consists of a small collection of artefacts associated with written communication that are often carried on the person, and includes fragments of writing slate, graphite / carbon pencils, ferrous and copper alloy paper clips and paper fasteners, and a copper alloy Hinkswell & Co. pen nib holder (Figure 256 and Figure 257). Most, if not all, of these likely represent items that were accidentally lost or dropped by people utilising the wharf and / or vessels moored alongside. One unusual clerical item was also identified – a letterpress printing typesetting sort reading "NOTICE – ANY PERSON FOUND TRESPASS." This artefact could possibly represent a lost item of trade cargo (Figure 258).



Figure 256: Hinkswell & Co pen nib holder (DT1 / SQ5 / C05).



Figure 257: Graphite pencil (F8).

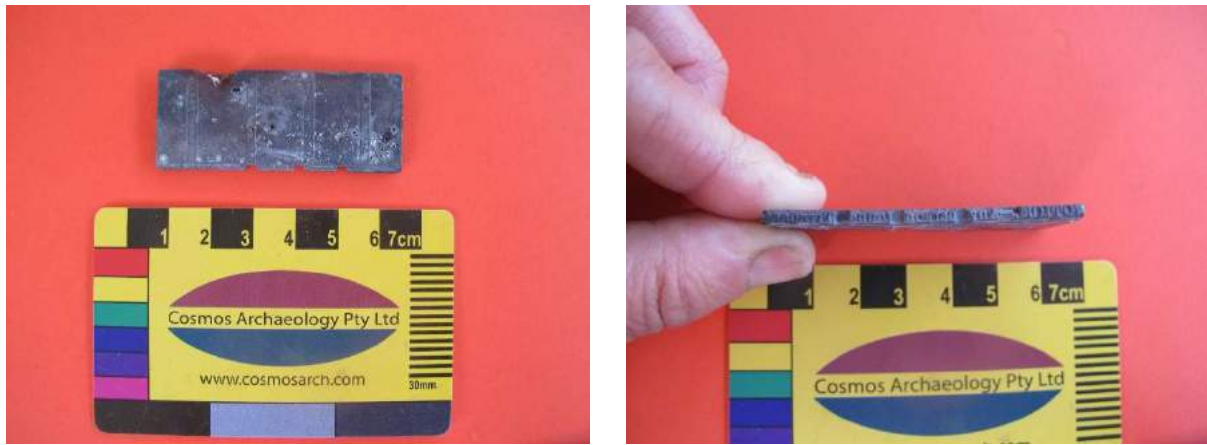


Figure 258: Letterpress printing typeset (DT3 / C04 / Spit 2)

Security

The security category includes a collection of machine-made keys and a padlock shackle, and almost certainly represent items lost or dropped by people using the Windsor wharf, vessels alongside, or transferring between the two. Interestingly, the keys were found in several broad clusters within archaeological contexts, and it is likely that several were lost or dropped into the river as a complete set or ring of keys. See Figure 259 and Figure 260.



Figure 259: Keys (DT2 / C02)



Figure 260: Keys (DT2 / C03)

Celebration / ceremony

A final category of artefacts in the maritime assemblage is the celebration or ceremony category, which consists of nine small Diya clay oil lamps of two different designs – see Figure 261 and Figure 262. Diya lamps are Indian subcontinental cultural objects that are designed as floating oils lamps and are often used in Hindu, Sikh, Jain, and Zoroastrian religious ceremonies, festivals, and funerals. The presence of these lamps on the riverbed suggests they were used in a celebratory or ceremonial context, possibly either festive occasions or sad occasions, carried out from the wharf or on the banks of the Hawkesbury River in the vicinity of the former Windsor wharves site.



Figure 261: Clay Diya oil lamps (T2 / C02).



Figure 262: Clay Diya oil lamps (T2 / C02).

9.5 Was there a change in the types of activities that were being undertaken on the former Windsor Wharf over time?

In order to address this research question, artefacts were sorted according to their identified or estimated date of manufacture – where that could be ascertained, and then grouped according to the artefact type and function categories discussed in Section 9.4.

This analysis was limited by the availability of dateable artefacts, and various artefact categories are thus overrepresented or underrepresented due to their ability to be dated effectively. For instance, some artefacts such as fragments of copper sheathing, which make up a large proportion of the maritime artefact category, are near impossible to date and were thus excluded. Other predominant artefact types, such as wrought and cut ferrous fasteners, have a wide possible date range of manufacture, and thus cannot be fitted closely within specific time periods.

In an attempt to capture as much information as possible, all dateable objects were included in this examination. However, given the inherent biases in this approach, no calculation or comparison of the relative frequency of different artefact types, or the extent to which associated activities may have been carried out at the former Windsor wharf site, was undertaken.

Four date ranges were selected for this analysis, based roughly on the phases of wharf construction at Windsor, are outlined in Section 8, are defined below and the artefacts represented in these broad date ranges are presented in Table 11:

Pre-1820: This section corresponds to Periods 1, 2a, and 2b, beginning with the initial European settlement in Windsor in 1795, the construction and operation of Thompson's shipyard from 1802 – 1807, and the first and second Howe and McGrath wharves, built from 1814 to 1816.

1820 – 1860: This corresponds to Period 2c, the time period contemporaneous with the construction and operation of the Greenway wharf from its completion in 1820 to 1862 by which point the wharf had become inoperable.

1860 – 1950: Corresponding to Periods 3 and 4, when the Moriarty and Musson wharf was constructed as a replacement for the Greenway wharf. The early phase (Period 3) lasted from 1862 when the new wharf was constructed, to 1934 when it was renovated by the Upper Hawkesbury Motor Boat Club. The later phase, Period 4, runs from 1934 to the 1950s.

Post-1950: Corresponding to Period 5, as the wharf continued to deteriorate and fall into disuse and as bank stabilization became the main construction on the waterfront.

Table 11: Artefact categories represented over time

PERIOD	ARTEFACT CATEGORIES REPRESENTED
Pre-1820	• Food service and consumption – including earthenware and stoneware ceramic vessel fragments and drinking cup fragments; • Alcoholic beverage consumption – including glass beer / wine bottle fragments; • Transport (terrestrial) – including a ferrous alloy horseshoe, and; • Personal items – consisting entirely of currency.
1820 – 1860	• Building materials – including bricks and brick fragments, and window glass fragments; • Food service and consumption – including various earthenware, stoneware and porcelain ceramic tableware fragments such as bowls, plates, saucers, and jugs; • Alcoholic beverage consumption – including glass beer / wine and schnapps bottle fragments, and a stemware wine glass fragment; • Sewing / fishing – consisting entirely of copper alloy straight pins, many of which are bent and possibly served as homemade fish hooks; • Armament – including muzzleloader ammunition and accessories; • Personal items – including clothing fasteners, clay tobacco pipes, and currency.
1860 – 1950	• Building materials – including bricks and brick fragments, and window glass fragments; • Transport (terrestrial) – including a NSW Government Railways lead circuit breaker seal; • Food service and consumption – including a small number of whiteware ceramic tableware fragments such as plates and saucers; • Alcoholic and non-alcoholic beverage consumption – including glass beer / wine, champagne, gin and schnapps bottle fragments, and glass soda and aerated water bottle fragments; • Sewing / fishing – consisting entirely of copper alloy straight pins, many of which are bent and possibly served as homemade fish hooks; • Armament – including rifle and handgun cartridges of various calibres, and shotgun shells; • Personal items – including clothing fasteners, a reusable pocket lighter, clerical items, jewellery and adornments, recreational items, musical items, and currency.
Post-1950	• Transport (terrestrial) – including motor vehicle parts and accessories; • Food service and consumption – including a small number of whiteware ceramic tableware fragments; • Alcoholic and non-alcoholic beverage consumption – including glass beer bottle fragments, drinking glasses, beer cans, and soft drink bottles; • Fishing – including sinkers, lures, and synthetic fishing line; • Armament – including rifle and handgun cartridges of various calibres, • Personal items – including clothing fasteners, clerical items, jewellery and adornments, security, musical items, and currency.

Interestingly, whilst limited in scope and excluding numerous artefact categories and sub-categories, such an examination of the maritime artefact assemblage illustrates both shifting patterns of use and activity at the successive Windsor wharves, and well as an enduring continuity of certain activities.

Artefacts dating to the earliest period of pre-1820 illustrate the status of the Windsor landing place and developing Howe and McGrath wharves as the connection between Hawkesbury River transport and shipping, and land transport – horse and cart – servicing the early Windsor township and surrounding farms. Also the relatively low densities of material relating to shipbuilding suggests that the excavated areas were upstream of the slipway and construction area (see Section 9.10). Other artefacts dating to this period include personal items and objects associated with food consumption and alcoholic beverage consumption. This certainly indicates the presence of people visiting the wharf and adjacent riverbank, and possibly using it as a location for relaxation and recreation. However, there is little evidence of items relating to trade or commerce during this period.

Interestingly over half the bone recovered from the excavation was assigned to this early period, with pig bone being particularly prevalent – more so than cattle, illustrating the importance of pig meat products in the early Hawkesbury colonial diet. Indeed, livestock statistics of the early Sydney colony show that the Hawkesbury region had two to three times as many pigs as cattle during the 1800s to 1820.²⁷⁴ The relatively high frequency of bone found in the earlier contexts, which correlates with what was found in the Thompson Square salvage excavation, is however most likely a function of the rubbish disposal practices at Windsor at this time than the accidental discards of commercial activity on the wharf (see Annex I for more discussion).

Artefacts dating to the periods of the Greenway Wharf and Moriarty and Musson Wharf derive from a wider range of categories, with the addition of building materials – possibly items of trade / lost cargo, sewing items / likely fishing gear, and firearm ammunition and accessories. The wider range of artefact categories and subcategories tends to indicate an expansion of the types of activities undertaken at the wharf, which corresponds with historical records that indicate the mid 19th to early 20th century were the busiest years of river trade and transport at Windsor. The link between the Windsor wharves and land transport networks is again demonstrated via the occurrence of railway components – likely shipped to Windsor for the 1860s construction or subsequent maintenance of the Blacktown to Richmond branch line, which boosted upper Hawkesbury River trade at Windsor wharf by providing a direct rail link to the Sydney markets.

Artefacts dating to the latest period, pre-1950, when the Moriarty and Musson wharf was falling into disuse, derive from a similar range of categories as those during the earliest pre-1820 period – including food and beverage consumption, and personal items indicating the presence of people visiting the wharf / wharf site and adjacent riverbank, but without any clear demonstration of commercial trade or transport. Several activities, including drinking alcohol, fishing, and plinking, are also represented by artefacts post-dating 1950, demonstrating the enduring nature of relaxation and recreational activities at the site of the former Windsor wharf throughout the mid 19th to late 20th centuries.

²⁷⁴ **Fletcher, B. H. 1976.** Landed enterprise and penal society: a history of farming and grazing in New South Wales before 1821.

9.6 How was the former Windsor Wharf ca. 1814 to 1950s constructed and how was it modified and altered throughout the 19th century?

The construction sequence, through the archaeological remains, of the former Windsor wharf from 1814 to 1862, is shown in Figure 263. Each phase of construction will be discussed separately below.

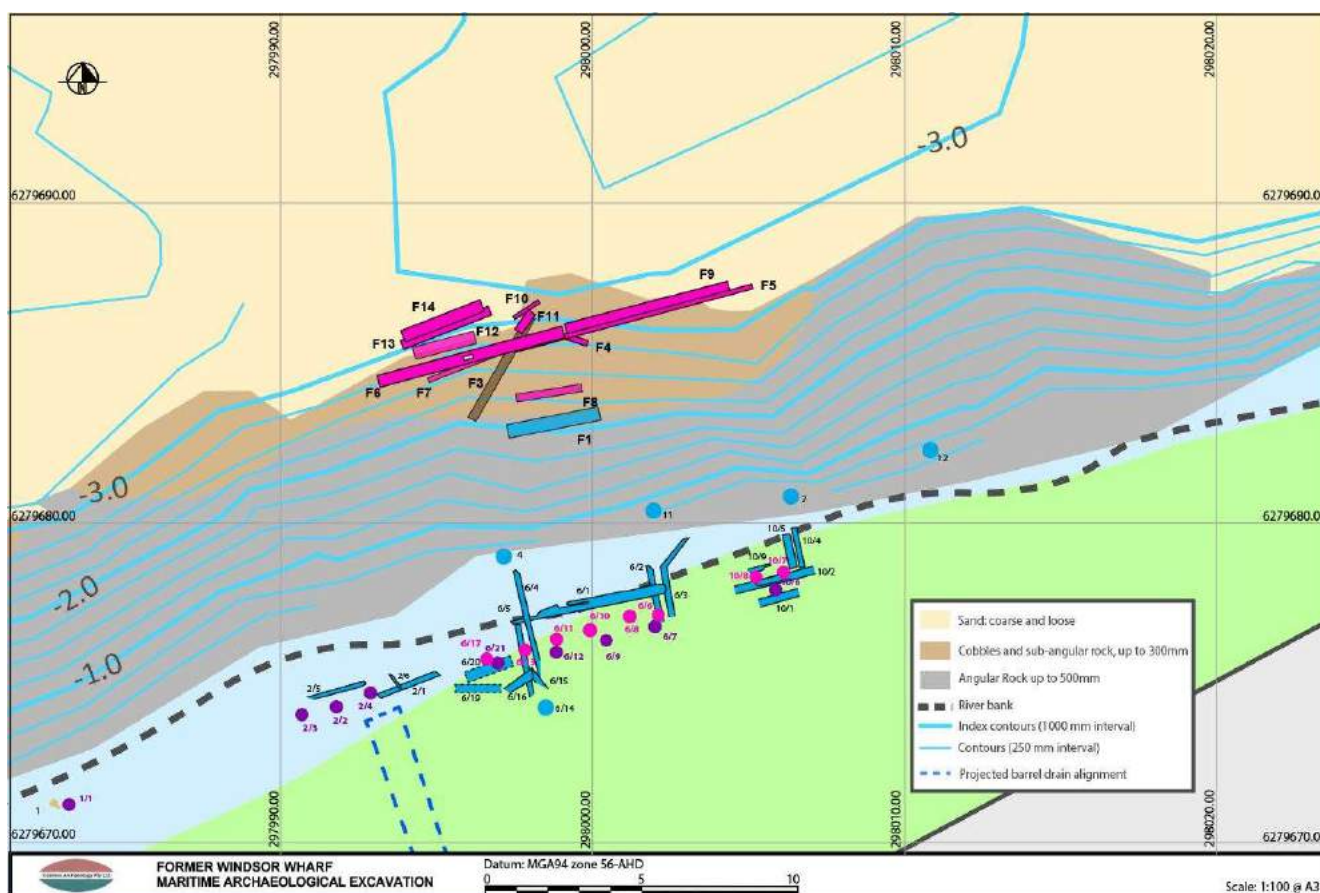


Figure 263: Structural remains associated with the former Windsor Wharf. Period 2a features in purple, Period 2b in brown, Period 2c in pink and Period 3 in blue.

Period 2a – Retaining wall and 1st Howe and McGrath Wharf

Structural elements identified as being associated with the 1814 Retaining wall and 1st Howe and McGrath Wharf are presented in Table 12.

What is most apparent when comparing the contract specifications given to Howe and McGrath to the archaeological remains identified as being associated with the first wharf and retaining wall is the smaller diameter of the piles. Though the spacings appear correct, the piles are around 25% smaller than specified. Though the complaints of the quality of the wharf expansion carried out by the same contractors in 1815 is well documented it may be that the inferior and slight quality of the work and timber could also be attributed to these earlier works.

Table 12: Archaeological remains associated with Period 2a – The retaining wall and 1st Howe and McGrath Wharf.

Period	Construction element	Historical information	Features according to Period	Details
Period 2a <i>“Row of Piles which will be in deep water to Extend fifty feet in Length to be well secured by Land Ties as also to the Row of Piles in the Front of the Square”</i>	Retaining wall - piles	406 mm (16”) to 457 mm (18”) diameter	AWF1/1 AWF2/2 AWF2/3 AWF2/4 AWF6/7 AWF6/9 AWF6/12 AWF6/21 AWF10/6	300 mm 300 mm 300 mm 300 mm 310 mm 280 mm 300 mm 300 mm 300 mm
		914 mm (3') apart		ca. 1,000 mm
	Width, wharf	5.5 m (18 ') - contract		
		6.1 m (20') - reported 1815		
	Length, wharf	15.24 m (50') - contract		
		19.8 m (65') -reported 1815		
	Species		AWF6/9	<i>Eucalyptus ?paniculata</i> ; Grey Ironbark or Coast Grey Box

Period 2b – 2nd Howe and McGrath Wharf

There is little identifiable that could be comfortably attributed to the Howe and McGrath wharf expansion which commenced in 1815. UWF03 is a plank which is 55% wider than that specified in the contract for the expansion. Its context places it within the period of the expansion and it seems to have ended up on site as an accidental loss or from a flood event in which case it may have no association with the wharf. That it has no evidence of fastenings on it suggests that it may have been unused at the time of loss. Structural elements identified as being associated with the second Howe and McGrath Wharf are presented in Table 13.

Two ferrous spikes of similar dimensions to what was specified in government documentation had been recovered. One (Art. ID #0922) was found in a context that was near contemporary with the expansion while the other (Art. ID #2226) was found in a later 19th century context could have gradually migrated down the riverbed slope having eroded out of the riverbank.

A threaded bolt of a similar length – 120 mm – however with a thread of 38 mm in length was found in one of the earliest contexts, Cxt 21, and may have some association with this phase of wharf construction (Figure 264). Threaded bolts were used in maritime applications in the early 19th century and in this time were becoming increasingly common.²⁷⁵

²⁷⁵ McCarthy, M. 2005 Ships' Fastenings from sewn boat to steamship: 95



Figure 264: Threaded bolt with mushroom head, 120 mm long, 38 mm of which is threaded and 15 mm diameter. Artefact ID 708, DT 1, Sq 5, Cxt 21

Additional wrought ferrous fastenings were recovered from contexts considered contemporary of the Period 2a and 2b or in Deep Trench 2 and 3 over which the Greenway Wharf did not extend (see Figure 275). These fastenings were longer – between 165 mm and 205 mm in length than the 127 mm specified in the government documentation (see Figure 265 for example). It is very likely that the specifications indicated a minimum for the size of spikes be used and a variety of shapes and sizes would have been used for differing structural elements such as attaching deck planks to the deck beams (or girders), or walers/cross beams to the piles. These spikes listed in Table appear too large for boat building/repair but it is possible that they, in particular Art. ID #959, could have a connection with Thompson's Shipyard (see Section 9.10).



Figure 265: Wrought (hand forged) ferrous spikes. Note how only two sides taper a point. Artefact ID 794, DT 3, Cxt 4, Sp2



Figure 266: Wrought (hand forged) ferrous spike. Artefact ID 959, DT 1, Sq2, Cxt 21

It is possible that the ballast identified in Cxt 5 – Phase E may have commenced being laid during this period and the piles of a retaining wall attributed to the Greenway Wharf (see discussion on Period 2c below) could have been installed as part of the expansion.

Table 13: Archaeological remains associated with Period 2b - 2nd Howe and McGrath Wharf.

Period	Construction element	Historical information	Features and artefacts according to Period	Details
Period 2b “..a very inferior and bad description of timber and other materials... workmanship is very slight and insufficient..”	Piles	3 rows	None identified	N/A
	Planks	50.8 mm (2") thick and 152 mm (6") wide	UWF03 (half round)	280 mm wide x 60 mm thick
	Spikes	127 mm (5")	#0922 DT1 Sq7 Cxt5 #2226 DT2 Cxt4	129 mm long () 131 mm long
	Other potential fastenings	None available	#708 DT1 Sq5 Cxt21 #2178 DT3 Cxt 4 #2105 DT2 Cxt 15 #2441 DT1 Sq7 Cxt 7 #794 DT3 Cxt 4 #795 DT3 Cxt 4 #959 DT1 Cxt 21	120mm long, 15mm dia. 165mm long, 14 x 11mm 175 mm long, 11 x 10mm 180 mm long, 13mm dia. max 199 mm long x 2, 12 mm ² max. 165+ mm long, 13 mm ² max. 205 mm long, 12 mm ² max.

**Figure 267: Wrought (hand forged) ferrous spike.** Artefact ID 2226, DT 2, Cxt 04**Period 2c – Greenway Wharf**

The above water (AWF) piles attributed to the Greenway wharf are of a similar diameter to those attributed to the 1814 retaining wall, which suggests that they may have been installed by Howe and McGrath as part of the expansion of the wharf in 1815. If this is correct, then Greenway in his overseeing of the construction of the wharf would appear to have considered the re-piling of the retaining wall as being of sufficient durability and quality so as to append the deck and apron piles of the wharf. Structural elements identified as being associated with the Greenway Wharf are presented in Table 14.

Table 14: Archaeological remains associated with Period 2c - Greenway Wharf.

Period	Construction element	Historical information	Features according to Period	Details
Period 2c “Vessels of 100 Tons Burthen can load their Cargoes” Such vessels ranged in length from 60' to 80'	Bed log	None available	UWF06 UWF09	380 mm dia, 300 mm dia.
	Piles	None available	UWF06 UWF13 UWF14 AWF6/6 AWF6/8 AWF6/10 AWF6/11 AWF6/13 AWF6/17 AWF10/7 AWF10/8	480mm dia impression 300 mm 390 mm 300 mm 320 mm 340 mm 300 mm 300 mm 300 mm 330 mm 300 mm
	Length (1835 map)	25.9 m (85')	None identified	N/A
	Width (1835 map)	7.9 m (26')	None identified	N/A
	Plank, half round	None available	UWF05 UWF10	150 mm x 120 mm thick 120 mm x 60 mm thick
	Plank	None available	UWF07 UWF11 UWF04	150 x 60 mm thick 280 x 40 mm thick 180 x 50 mm thick
	Beam	None available	UWF08	220 x 240 mm
	Corbel?	None available	UWF12	300 x 400 mm
	Fastenings	None available	AWF6/10 – B22 AWF6/11 – B24 #5280 ST1, Cxt4 #644 DT1, Sq2, Cxt3 #2379 DT1, Sq3, Cxt 3 #716 DT1, Sq5, Cxt3 #659 DT2, Cxt3 #5274 DT1, Sq5, Cxt5 #719 DT1, Sq8, Cxt5 #720 DT1, Sq8, Cxt5	App. 20 mm diameter or square? App. 20 mm diameter or square? 210 mm long, 14 mm ² max. 210 mm long, 11 mm ² max. 202 mm long, 12 mm ² max. 200 mm long, 12 mm ² max. 200 mm long, 12 mm ² max. 192 mm long, 13 mm ² max. 180 mm long, 12 mm ² max. 99 mm long, 9 mm ² max.
	Species, timber	Ironbark	UWF05	<i>Eucalyptus ?tereticornis</i> . FOREST RED GUM
			UWF06	<i>Eucalyptus ?siderophloia</i> . RED IRONBARK (not <i>Eucalyptus sideroxylon</i>)
			UWF07	<i>Eucalyptus ?tereticornis</i> . FOREST RED GUM or GREY GUM
			UWF08	<i>Eucalyptus ?siderophloia</i> . RED IRONBARK (not <i>Eucalyptus sideroxylon</i>)
			UWF09	<i>Eucalyptus ?paniculata</i> . GREY IRONBARK
			UWF11	<i>Eucalyptus ?tereticornis</i> . FOREST RED GUM

Period	Construction element	Historical information	Features according to Period	Details
			UWF12	<i>Eucalyptus ?siderophloia</i> . RED IRONBARK (not <i>Eucalyptus sideroxylon</i>)
			UWF13	<i>Eucalyptus ?siderophloia</i> . RED IRONBARK (not <i>Eucalyptus sideroxylon</i>), <i>Eucalyptus ?tereticornis</i> . FOREST RED GUM or GREY GUM
			UWF14	<i>Eucalyptus ?siderophloia</i> . RED IRONBARK (not <i>Eucalyptus sideroxylon</i>)
			UWF04	<i>Eucalyptus ?propinqua</i> . GREY GUM or FOREST RED GUM

The piling on the Greenway Wharf as well as the 1st and 2nd Howe and McGrath wharf would have been set into bedlogs as bedrock was not far from the surface and the technology to drive piles into rock is unlikely to have been available. It is unclear whether this would have been the case for the retaining wall piling as there may have been deep enough sediment overlaying the bedrock to secure the piles. Figure 268 is a plan of a jetty built at Coal Point on the Tasman Peninsula showing timber piles checked into timber logs laid perpendicular to the axis of the jetty.

The timbers identified as bedlogs, UWF06 and 09, are laying parallel to the shoreline abutting each other. They have differing diameters both less than 400 mm. Though heavily worn they appear to have had half lap scarfs at each end, but it is unclear whether they were fitted together with or without the aid of fastenings.

The diameter of the piles along the apron were at least 480 mm as evidenced by the circular depression atop of the upstream bedlog (UWF06), while the which fitted into UW09 may have been up to an improbable 590 mm in diameter.

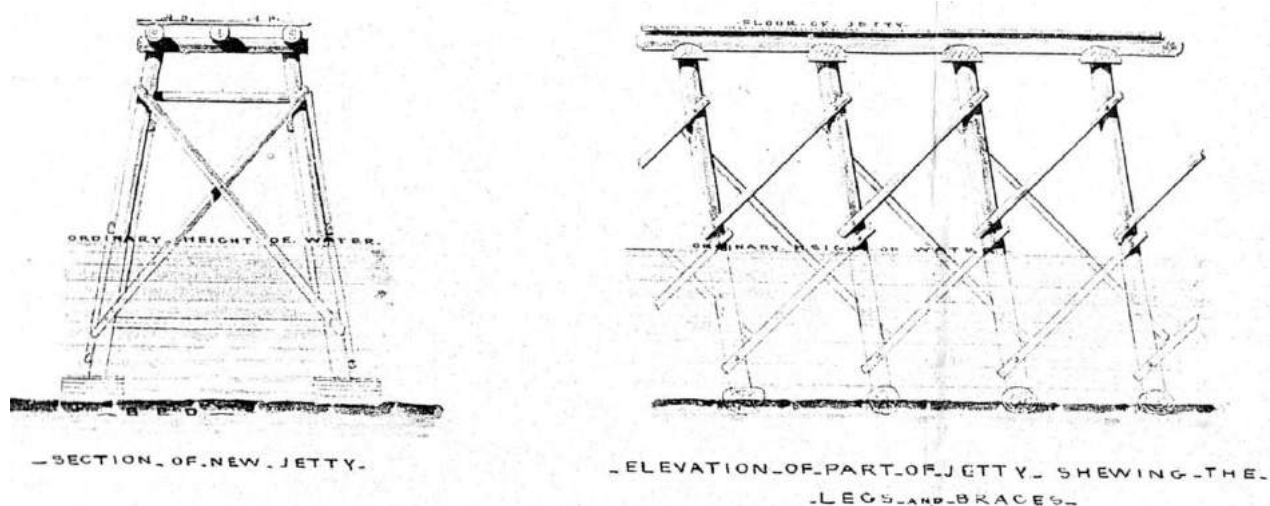


Figure 268: Diagram of 1830s jetty at Coal Point, Tasman Peninsula, Tasmania, showing how timber piles were checked into bedlogs.²⁷⁶

The determination of the spacing of the piles along the apron is problematic. The mortice to receive the pile for UWF06 was approximately in the centre of the 6 m log. This means that the pile spacings were at least 1.5 or 5'. On the abutting log, UWF09, a possible mortice (410 mm long) or half lap scarf is 1.8 m from the upstream end of the timber. This would make the

²⁷⁶ Laing, Henry, 'Survey of Jetties at Coal Point' Archives Office of Tasmania. Con87/74

distance between the two mortices around 4.8 m or 15', which incidentally is the distance between the apron piles of the 1862 Moriarty and Musson Wharf. There is another potential mortice/half lap strake 1.8 m or 6' further along UWF09. It would be very unlikely that the next apron pile would have been so close and so it could have been left vacant (unpiled) or may have housed the apron pile on this log, thereby making the spacing between the piles at 6.6 m or 22'.

The timber planks and beams (UWF 04, 05, 07, 08, 10 and 12), one of which is possibly a corbel (UWF12), were found in the same context as the bedlogs. They could represent structural elements lost during construction or collapsed into the water after the completion of the wharf.

Eight ferrous spikes, most of which are wrought (hand forged), were recovered from contexts formed during the construction and operating life of the Greenway wharf. They appear too large to be associated with timber boats and are very likely to have been used in a larger structure and that some are clenched would suggest that they were not accidentally lost. Compared to the fastenings *in situ* on the cut off piles of AWF6/10 and 11 they appear undersized.

The fastenings are square shanked, tapering to a point on two opposite sides. Most – six – range in length from 192 mm to 210 mm. Fastening Art. ID #720 appears to be 'cut' rather than hand forged suggesting a date of manufacture post-dating the 1820s and could represent a later repair. A fastening of 100 mm in length (Art. ID #720) has been attributed to the construction of the wharf though it is at the high end of the range for use in a timber boat hull (Figure 269).



Figure 269: Wrought (hand forged) ferrous spike, or long nail, 99 mm in length with maximum thickness near the head of 9mm². Artefact ID 720, DT 1, Sq8, Cxt 05.

Fastening Art. ID #5280 is clenched over at the end by 20 mm (Figure 270). This indicates that the two timbers it fastened had a combined thickness of 190 mm. This sort of thickness could have some association with deck planking on a deck beam. Given that the planks (UWF04, 07 and 11) attributed to the Greenway Wharf ranged in thickness from 40 mm to 60 mm it would mean that a deck beam would have been around 130 mm (5.1") to 150 mm (5.9") thick. The other spikes of similar length are not clenched indicating that their ends did not protrude from the timbers they fastened.



Figure 270: Wrought (hand forged) ferrous spike, 210 mm unclenched length, clenched over with maximum thickness near the head of 14mm². Artefact ID 5280, ST 1, Cxt 04

A shorter spike of 180 mm in length (Art. ID #719) has been clenched over by 80 mm indicating that it could have fastened to pieces of timber with a combined thickness of 100 mm – unlikely to have fastened a deck plank to a beam (Figure 271). This seemingly unwieldy use of a such a long fastening for the task may say something about the lack of availability of appropriately sized fastenings during the construction of the wharf.



Figure 271: Wrought (hand forged) ferrous spike, 180 mm unclenched length, clenched over with maximum thickness near the head of 12mm². Artefact ID 719, ST 1, Cxt 08

Period 3 – Moriarty and Musson Wharf

The comparison of the archaeological remains attributed to 1862 Moriarty and Musson Wharf show some variance with what described on the plans. For example, the extant piles are 400 mm in diameter in comparison with the plans which show diameters of around 450 mm. The pile UWF01 has the same diameter but an uncommon wood for wharf piling. It also has no remnant copper sheathing on it. It is possible the UWF01 may not be associated with the wharf, but it is also possible that it was one of the original piles and that the extent sheathed piles are later replacements. Investigations around the piles did not identify any adjacent piles stumps but such features may have been cut close to the riverbed and covered in recent times with rock armour.

The walers connecting the apron piles with the retaining wall piles are around half the width described in the plans. Even with water erosion this is a substantial reduction in size. As with the suggestion above if the extant piles were replacements for the original piles, then the walers too may have been replaced. The fasteners appear to be undersized based on the designs with the exception of the fastening (B8) through the waler (AWF10/4) and that (B11) through the plank AWF2/1. The latter elements may not be part of the original wharf decking due to its thickness being around 25% of what was specified in the historical documentation.

Structural elements identified as being associated with the Moriarty and Musson Wharf are presented in Table 15.

Table 15: Archaeological remains associated with Period 3 - Moriarty and Musson Wharf.

Period	Construction element	Historical information	Features according to Period	Details
Period 3	Max length	29.5 m (96.9')		
	Apron width	23.5 m (77')		
	Pile spacing (centre to centre)	4.6 m (15')	AWF4, 7, 11, 12	4.2 to 5.1 m
	Width, deck	5.5 m (18')		
	Piles (diameter at low water)	457 mm (18") diameter	AWF4, 7, 11, 12 UWF1	400 mm diameter 450 mm
	Walers (half round)	406 x 203 mm (16" x 8")	AWF2/6 (v. worn) AWF6/2 (v. worn) AWF6/3 (v. worn) AWF6/4 (v. worn) AWF6/5 (v. worn)	200 x 180 mm 300 x 250 mm 300 x 250 mm 300 x 200 mm 250 x 200 mm
	Walers (squared)	406 x 203 mm (16" x 8")	AWF10/4, 10/5	Not measured
	Bearers or corbels, (round)	406 mm (16")		
	Girders	305 x 305 mm (12"x12"), 305 x 152 mm (12"x6") and 203 mm (8")		
	Kerbing	305 x 305 mm (12"x12") and 305 x 203 mm (12"x8")		
	Fasteners - copper	22.5 mm (7/8") diameter		
	Fasteners - ferrous	31.75 mm (1.25") diameter	AWF2/1 – square AWF6/4 – B1 AWF6/1 – B2 AWF6/3 – B22 AWF10/1 – B4 AWF10/2 – B5 AWF10/4 – B8 AWF10/4 – B9 AWF10/9 – B10 #5279 ST1, Cxt4?? #2181 DT3, Cxt4??	35 mm x 35 mm App. 25 mm diameter App. 20 mm diameter App. 20 mm diameter App. 20 mm diameter. App. 20 mm diameter App. 30 mm diameter App. 20 mm diameter App. 15 mm diameter 11 mm dia., 180 mm long 12 mm dia, 227 mm long
	Sheathing, copper	No information	#2998 AWF7 # 3093 DT1, Sq1, Cxt3	
	Plank	228 x 76.2 mm (9" x 3")	AWF2/1	20 mm thick
	Species		AWF6/1	<i>Eucalyptus crebra</i> . NARROW-LEAVED RED IRONBARK
			AWF7	<i>Eucalyptus ?paniculata</i> . GREY IRONBARK or COAST GREY BOX
			AWF6/5	<i>Eucalyptus ?siderophloia</i> . RED IRONBARK (not <i>Eucalyptus sideroxylon</i>)
			AWF10/4	<i>Eucalyptus ?bosistoana</i> . COAST GREY BOX or BROAD-LEAVED RED IRONBARK
			UWF1	<i>Casuarina ?cunninghamiana</i> . River Sheoak

The piles were sheathed in copper to protect them from marine borers and to a lesser extent abrasion (Figure 272 and Figure 273). The sheathing tacks used to attach the sheathing to the piles have round flat heads 4mm across with a square 15 mm long shank tapering to a point. This was not uncommon in NSW for piles that were not of Turpentine and before the introduction of concrete sleeves and chemical treatments (see Section 9.8).



Figure 272: Copper sheathing tack and remnant sheathing tack. Associated with the 1862 wharf. Artefact ID 3093, DT 1, Sq 01 Cxt 03.



Figure 273: Copper sheathing tack and remnant sheathing tack from AWF7. Artefact ID 2998.

In addition, two bolts (Art. ID #5279 and 2181) were recovered during the excavation which had a more likely affiliation with maritime infrastructure than boat construction. They are through bolts with threaded ends. Fastening Art. ID # 5279 (Figure 274) would therefore have fastened two pieces of timber with a combined thickness of 154 mm while Art. ID #2181 would have fastened a combined thickness of 192 mm. Neither bolt would have been of sufficient length to fasten deck planks to the girders as specified in the historical documentation. In addition, the diameter of both bolts is about 33% of what was specified in the documentation. They may be associated with the 1862 wharf but were unlikely used to for the main elements of the structure.



Figure 274: Threaded through bolt, 11 mm diameter and 180 mm long. Artefact ID 5279, ST 1, Cxt 04.

9.7 What is the extent of the remains of the earlier periods of the former Windsor Wharf?

The remains on the earlier phases of the former Windsor Wharf are fragmentary and the underwater excavation focused where irreversible impacts were to take place not where most likely remains of the wharf were to be found. However, it would appear that the bedlog UWF06 formed the north west or upstream corner of the Greenway Wharf, the end of which lines up with the last cut off pile attributed to the retaining wall of the wharf (Figure 275). The half lap scarf on the upstream end of the log suggests that the line of bedlogs may have continued further upstream. This anomaly could possibly be explained that either all bedlogs were pre-cut in such a way or that the bedlog was part of the 1815 extension and it was intended to continue the apron upstream, but this never eventuated.

The overlay of the 1835 outline of the Greenway Wharf the apron falls short by around 1 to 2 m but this would be an acceptable margin of error when interpreting early 19th century plans. It is suspected however that the width of the Greenway Wharf may have been the same as

that specified for the 1815 extension. If this was the case, then there could have been another two rows of bedlogs between UWF06 and 09 and the cut off piles of the retaining wall.

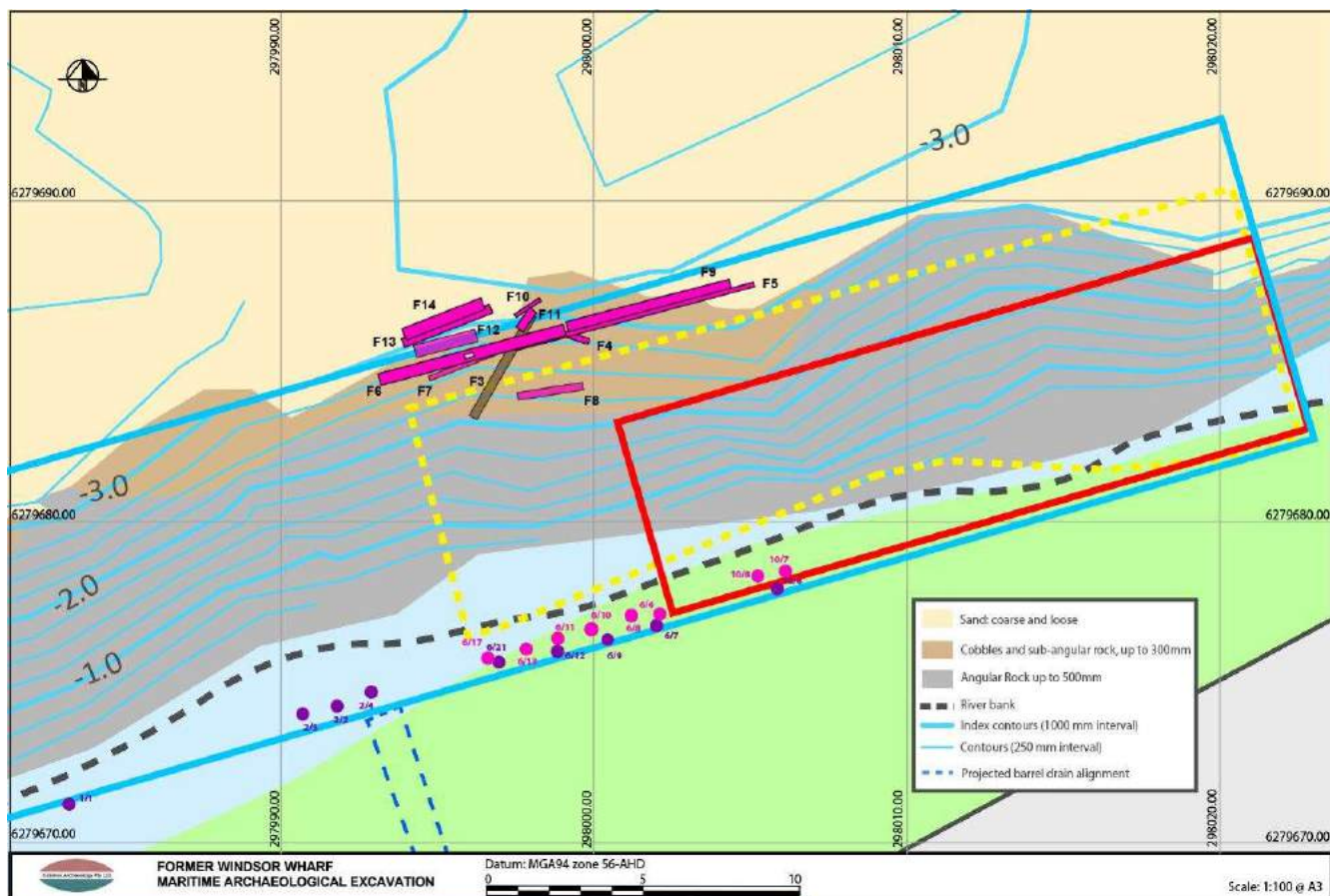


Figure 275: Potential extent of Period 2 wharves. Period 2a features in purple, Period 2b in brown, Period 2c in pink and Period 3 in blue. The solid red line is the 1814 wharf as per contract conditions, the blue line is the 1815/16 wharf extension and dotted yellow line is the 1835 outline of the Greenway wharf anchored on the downstream end of the pile row shown of the former Period 2 wharves in the 1862 plan of the site. Dotted black line is approximate 2018 shoreline.

The ballast for the Greenway Wharf, Cxt 5 extended the full length of DT1 and ST1 with the discovered bedlogs encased in it. Its northern extent was irregular as it was not present in the northern half of Sq 12 but extended for 2 m north of UWF09 (see ST1). It was also present in the northern half of DT 2 which suggests that the laying of this ballast layer may have commenced during Period 2b as the apron of the 1815 wharf extension would have passed over DT2.

9.8 What was the quality of the materials used in the wharf?

“...a very inferior and bad description of timber and other materials the workmanship is very slight and insufficient, contrary to the true intent of the contracts...”

The historical sources are clear about the lack of quality in the materials used for the 1815 extension (Period 2b) of the wharf. A number of wrought iron spikes were recovered in contexts that are associated with Period 2b (Art. ID #708 and Art. ID #959). Such items would have been used for a number of functions on a wharf such as securing deck planking or walers. They would have been standard components of a timber wharf at the time. The finding of a threaded bolt from a contemporary context, if associated with the Period 2b wharf, would represent the use of what would have been at the time possibly uncommon quality fastenings in colonial NSW.

The contemporary observations of the lack of quality may also be the case for the 1814 wharf and the retaining wall as the piles used were around 25% smaller than specified in the contract. It would also appear that the Greenway Wharf, at least for the rear row or retaining wall, used seemingly undersized piles.

The timbers used in the Period 2a and 2c wharf were either Red Gum or Iron Bark which were standard timbers used for wharf piles until the widespread use of Turpentine in NSW.²⁷⁷ The particular reference to the inferior timbers is for the Period 2b wharf of which one timber, UWF03, has been tentatively associated with this period. A timber sample was unfortunately not taken of the timber, but it did appear to be similar in colour and texture to the planks found in contexts associated with Period 2c, such as UWF05, 07 and 11 which were either red or grey gum.

Wrought iron spikes found in contexts associated with the Period 2c wharf are generally longer than those found in Period 2a/b contexts but seem to be of a similar quality and inconsistency with their thickness. This may suggest that the Greenway Wharf used larger timbers than those used in the Howe and McGrath wharves. The presence of a spike almost half clenched over (Art. ID #719) indicates that at some stage during construction there may not have been sufficient variety of spike sizes available for the task at hand.

Wharves and jetties constructed on bedlogs would not have been uncommon in early colonial NSW. They would have been sited in areas where there was limited wave activity such as rivers and sheltered bays. The only known recorded site of comparable age and construction in the NSW is Squires Jetty on the Parramatta River at Ryde.²⁷⁸ Constructed in 1795 the jetty serviced James Squire's estate and brewery for around 30 years. All that remains of the site today is a linear ballast mound with remnant bedlogs visible. No excavation has been undertaken on the site to date.

Tasmania provides a number of examples of jetties constructed using bedlogs to support the timber piles.²⁷⁹ As with Squires Jetty they do not appear not have been recorded in sufficient detail to provide comparable data for the Period 2 Windsor Wharf with the exception of the jetty at Brick Point.²⁸⁰ Constructed in the 1830s the bedlogs measure around 750 mm across, over twice the diameter of those found at Windsor (Figure 276). As this was a jetty the logs were laid about 4.4 m apart and ranged in length from 3.6 m to 39 m long, indicating the width of the jetty.

Another near contemporary site in Tasmania is the former penal colony at Sarah Island, Macquarie Harbour which operated from 1822 to 1833.²⁸¹ The maritime infrastructure recorded at this site were timber slipways with breakwaters and wharves being constructed by filling rectangular timber log caissons or pounds with rock rubble. These were in effect reclamations that provided wharfage and sheltered harbours for the settlement.

²⁷⁷ Mann, J. 1905 'Australian Timbers – Present Day Practice in Australia and some original experiments (paper Discussion)', *Proceedings of the Victorian Institute of Engineers* vol. V (1905), 106-37, 149-151.

²⁷⁸ Cosmos Archaeology, March 2015, Halvorsen's Boat Building Complex. Maritime Archaeological Assessment.

²⁷⁹ Jackman, G. 2004 'Foetal Shore: The sea as critical medium in the past and future of the Tasman Peninsula convict system'. In *A Harbour Large To Admit a Whole Fleet*: 29 and Bullers, R. *Convict Probation and the Evolution of Jetties in Tasmania*. Flinders University Maritime Archaeology Monographs Series No. 7

²⁸⁰ Coroneos, C. 2004 'The Maritime History and Archaeology of Port Arthur'. In *A Harbour Large To Admit a Whole Fleet*: 92.

²⁸¹ Nash, M. 2007 'A survey of maritime infrastructure at the Sarah Island penal settlement'. *Bulletin of the Australasian Institute for Maritime Archaeology*, Vol 31

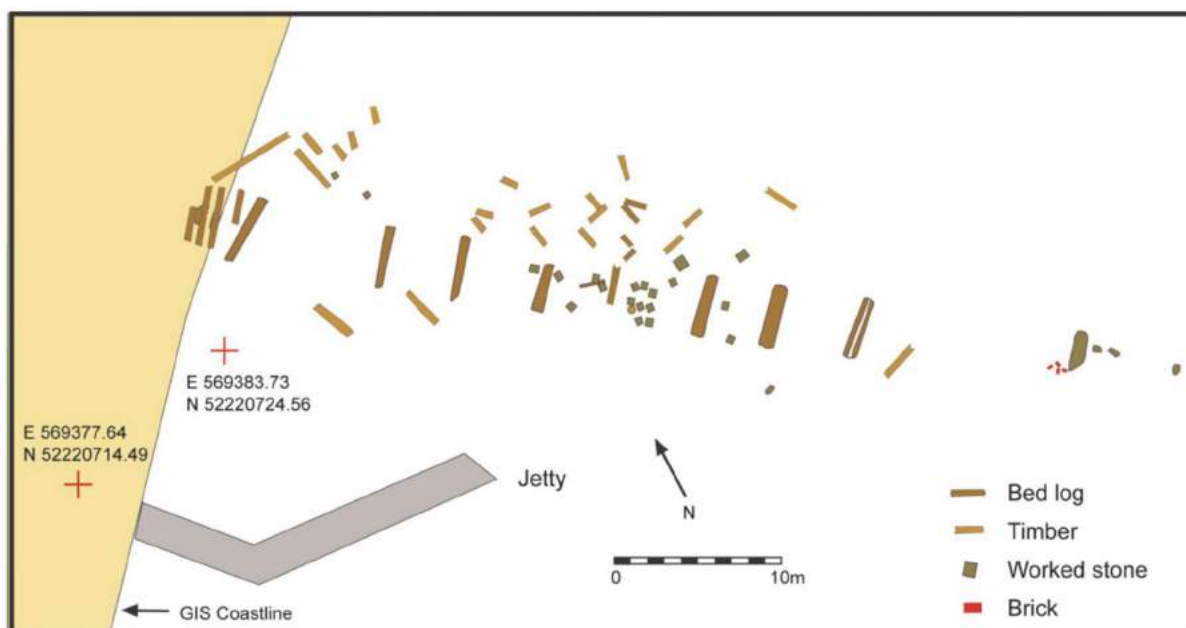


Figure 276 : Remains of jetty built on bedlogs, Brick Point, Port Arthur, Tasmania. ²⁸²

The Period 3 wharf in the 1862 plans was of a heavier/sturdier design than what was recorded on site in 2018. The timbers were undersized as were the fastenings. It is possible that what was recorded were later, and smaller, replacement piles and superstructure. If this is the case it brings into question whether the Period 3 wharf was originally copper sheathed. UWF01 has the approximate diameter to those piles shown on the 1862 plan and it has no evidence of copper sheathing. The timber species, Sheoak, however is a poor choice for a wharf pile due to its susceptibility to marine borer attack. By 1862 it would have known that the waters at Windsor were conducive to the infestation of teredo-like marine borers. The specification to use copper bolts on the piles nearer to the water line in the 1862 plan (see Section 3.2) does however indicate that there may have been an intention to copper sheath the piles as the use of ferrous fastenings would have set off a galvanic reaction when in contact where the different metals were in contact resulting in the weakening of the fastenings.

In NSW the copper sheathing of timber piles for protection against marine borers was not uncommon. Examples of copper sheathed piles are found at the former Burrill Lake Bridge constructed in 1889 (Figure 277 and Figure 278), the Government Wharf at Coraki built in 1882 which also had copper alloy bolts (Figure 279), Sugar Wharf at Broadwater built in 1881 (Figure 280), and Walsh Bay Pier 2/3 constructed in 1920/21 (Figure 281 and Figure 282).



Figure 277: Timber pile stumps of the former Burrill Lake Bridge. The stump on right of image is copper sheathed. ²⁸³



Figure 278: Copper sheathed pile stump of the former Burrill Lake Bridge.

²⁸² Cosmos Archaeology February 2003 *Port Arthur Maritime Archaeological Survey: Overview: 62 and Figure 22*

²⁸³ Cosmos Archaeology December 2017 *Burrill Lake Bridge- Archival Recording*. Prepared for Roads and Maritime Services.



Figure 279: Copper sheathed pile at Government Wharf, Coraki, Richmond River.²⁸⁴ Scale in 200 mm increments.



Figure 280: Piles with sheathing, Sugar Wharf, Broadwater on Richmond River.²⁸⁵



Figure 281: Sheathing tacks and copper staining on a pile from Walsh Bay 2/3.²⁸⁶ Scale in 100 mm increments.



Figure 282: Remnant sheathing tacks on a pile from Walsh Bay 2/3. Scale in 100 mm increments.

9.9 What can it tell us about the engineering skills available to the colony within the first few decades of European settlement?

The government documents which noted the sub-standard quality of the materials used in the construction of the Period 2b wharf also disparaged the workmanship. The destruction of the Period 2b, and presumably earlier 2a wharf structures in flood events within a year or two of construction and the subsequent survival of the Phase 2c wharf for at least 30 years says something of the relative merits of construction.

It is unclear from the archaeological remains whether a difference in engineering skills between the Period 2 wharves is discernible. The use of bedlogs for piles was common

²⁸⁴ **Curby, P. June 1997** Richmond River Maritime History Survey 1840 – 1960.: pg17 and **Coroneos, C. June 1997**, Richmond River Maritime History Survey 1840 – 1960 – Part 2 Results of the Maritime Archaeological Investigation. : Figure 19

²⁸⁵ *Ibid*: Figure 44

²⁸⁶ **Cosmos Archaeology February 2002** Re-Development of Pier 2/3, Walsh Bay: Maritime Archaeological Inspection of Copper Sheathed Piles.

engineering practice for the time. The half lap scarfs seem small for the task of joining bed logs together, but it is uncertain if that was their purpose or whether this done on this site.

The diameter of the apron piles and their spacing seem have been either close to specifications stipulated at the time of construction or are similar to the wharf constructed around 40 years later. The rear or retaining wall piles of Period 2a and 2c are relatively small but they were apparently sufficiently robust to contribute to the longevity of the Greenway Wharf. The smaller diameter of these piles probably says less about skills of those who built it and more about business practices (i.e. cost cutting) by early colonial building contractors.

It is believed that there are no other wharf/jetty sites in Australia from this period that have been studied to a sufficient degree to invite a comparable analysis with respects to this question (see Section 9.9).

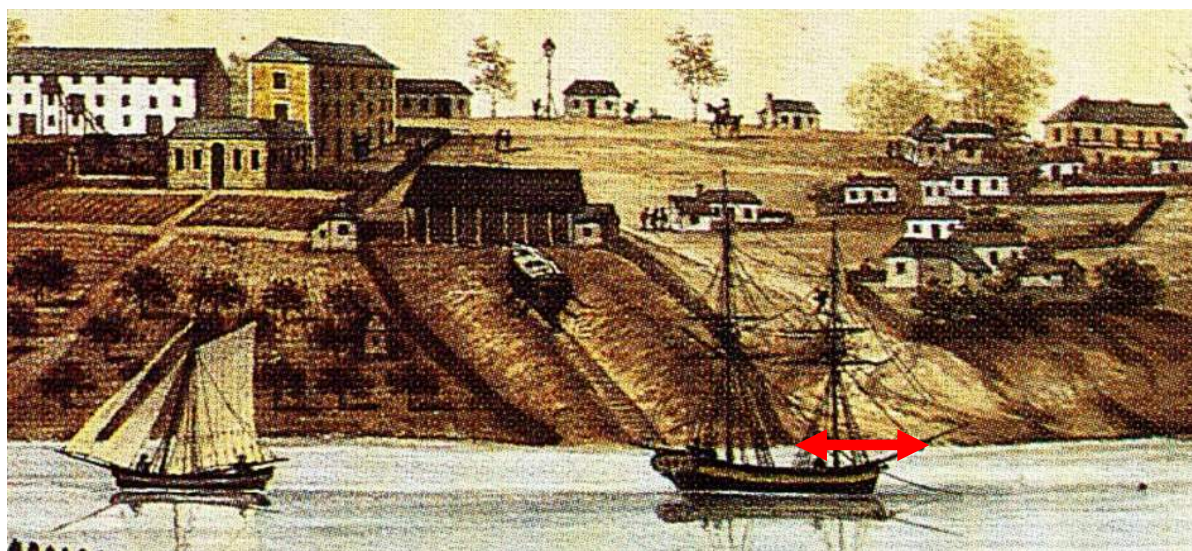
9.10 Is there any evidence of early ship construction?

The maritime archaeological excavation recovered a substantial quantity of artefacts that could be associated with watercraft, the most attributable of which were copper alloy fastenings and copper sheathing. The attribution of artefacts associated with Thompson's Shipyard (Period 1) is very problematic on account that the shipyard was located on the downstream boundary of the study area (Figure 283). It would have been unlikely that artefacts from the shipyard would have worked their way upstream with the tidal flows though recently launched vessels may have been tied up along the banks within the study area for fitting out. However, the riverbank within the study area at the time when the shipyard was operating was also being used by other vessels, the potential boat/ship related artefacts recovered by the maritime archaeological excavation from the phases associated with Period 1 most likely come from activities or vessels unrelated to the shipyard. Nevertheless, an examination of these artefacts may contribute some insights into early Australian shipbuilding on account of vessels trading to and from Windsor even in the first few decades of the colony would likely have been locally made.



Figure 283: G. W. Evans ca. 1807 watercolour of Green Hills

Enlargement of Thompson's shipyard slipway below. Approx. location of excavation red shown by red arrow.²⁸⁷



²⁸⁷ Evans, G. W. 1807. "A View of the Green Hills." Hordern House 1994 *Colonial Paintings: Twelve Early Works*. Potts Point, NSW.

The examination of artefacts associated early ship construction will focus therefore on those contexts that have been identified as being associated with Period 1 – 1795 to 1813. These contexts being 12, 13, 17, 18 and 22 which form Phase J, a stratum interpreted as being the rived bed prior to construction of the wharves, and Cxts 20 and 21 which form Period K, decaying bedrock.

The analysis of the finds needs to take into consideration and is qualified by issues relating to site formation processes as described in Section 8. Artefacts, particularly small, flat and narrow objects such as nails and roves filtered down through the cultural strata over time thereby creating uncertainty as to how many vessel / boat related artefacts discarded/dropped in later years had infiltrated into these lowest layers. However, artefacts such as cut or wire drawn nails could be filtered out as they were manufactured after this period.

Not included in the examination also were the fragments of copper sheathing that are ubiquitous across most contexts on the site, analogous to the pervasiveness of crushed small brick fragments on some sites. The wharf piles from Period 3 were copper sheathed and over time the copper sheets had broken down into tiny fragments and presently being able to confidently distinguish what is early 19th and what is late 19th century copper sheathing is beyond the scope of this report (Figure 286).



Figure 284 Copper alloy sheathing fragment with copper alloy nail embedded. This artefact given its context could be associated with a vessel as opposed to the 1862 Wharf however an analysis of the chemical composition of the copper alloy may be required. Artefact ID 3385, DT 1, Sq 1, Cxt 06.

The following table shows the variety and frequency of artefacts considered to be potentially associated with boat/ship construction recovered from Phases J and K which are associated with Period 1 (Table 16). Fastenings of ferrous composition make up the majority of artefacts though some caution should be exercised in assigning these artefacts to a maritime based activity. The wreck UHRW02 which was most likely built in the early 19th century was fastened with hand forged wrought iron nails however such fastenings would have obviously been used for terrestrial timber structures.²⁸⁸ Their presence however in riverbed contexts that pre-date the construction of the wharf suggests that they were either dropped being transferred between boat and shore or were being used to repair boats. Keeping in mind the limitations of attributing ferrous fastenings to boat/ship repairs or building the range in sizes from nails, typically around 60 to 80 mm in length to longer spikes and bolts up to 215 mm in length suggest that larger or carvel built iron fastened vessels may have been worked on at this location. Carvel type hulls required thicker planks and frames.

²⁸⁸ Op. Cit., Cosmos Archaeology Pty Ltd, April 2021

Table 16: Artefacts possibly relating to ship/boat repairs/building from Phases J and K.

Nail (Fe), 13	Nail (Cu alloy), 6		Tack (Cu alloy), 6		Wire (Fe), 6	
	Spike (Fe), 5	Bar (Fe), 4		Rope, 3	Screw (Fe), 3	
		Offcut (Pb), 4		Tack (Fe), 3	Washer (Fe), 3	
				Bolt (Fe), 2	Bracket (Cu alloy), 1	Chain link (Fe), 1
Strapping (Fe), 9	Wire (Cu alloy), 5	Offcut (Cu alloy), 3		Rod (Fe), 2	Rove (Cu alloy), 1	Screw down fitting (Cu...)
					Screw (Cu alloy), 1	Washer (Pb), 1

The relatively fewer copper alloy fastenings could point to fewer copper fastened vessels being worked on in the study area during this period which is to be expected. The presence of copper fastenings such as tacks could also indicate that vessels were copper sheathed. The smaller sized copper alloy fastenings suggest smaller sized and/or clinker built vessels (Figure 285). Clinker vessels required a lot of smaller fastenings to join the overlapping planks. Larger fastenings were confined to frames and keel/keelson assemblies and made up a very small percentage of the fastenings used overall.



Figure 285: Copper alloy nail and rove. A fastening that would have been used in a clinker built vessel. Artefact ID 3809, DT1, Sq 5, Cxt 11. Scale in 10 mm increments.

The presence of a single copper alloy rove does indicate the practice of clenching and clinker boat building tradition. A very good example of utilising whatever is on hand to create fastenings is the discarded copper alloy ruler (Figure 286) which seems to have been cut to possibly create square roves such those shown in Figure 287 and Figure 288.

The presence of lead offcuts is not unusual on boat repairs sites as it was used as flashing and for localised patching. Wire was sometimes used to strengthen rope and lashed timbers.



Figure 286: Copper alloy ruler which has been cut to possibly provide squared roves. # 3677 DT1, Sq 3, Cxt 21. Scale in 10 mm increments.



Figure 287: Square or diamond shaped rove (red circle). DT3, Cxt19.



Figure 288: Square or diamond shaped rove (red circle). DT1, Sq1,Cxt 06. . Scale in 10 mm increments.

The above discussion excludes the findings of the Windsor boats along the northern side of River.²⁸⁹ This is because there is no apparent connection between the wrecks and the boat building that took place in the vicinity of the study area prior to 1814. Though one of the wrecks, UDHRW02, may be contemporary with Thomson's shipyard the vessel may have been built by any of the other yards along the Hawkesbury River, including Brisbane Waters, as well as Sydney.

²⁸⁹ See **Cosmos Archaeology Pty Ltd, April 2021, Windsor Bridge Replacement Project Report on the early 19th century timber vessels and other find on the north banks of the Hawkesbury River.** Prepared for Transport for NSW.

9.11 What do the artefacts associated with the site tell us about the use of the wharf and commercial contacts over time?

Overall, the maritime artefact assemblage recovered from the site of the former Windsor wharf includes a wide array of objects that demonstrate the use and operation of the successive wharves throughout the 19th and 20th centuries as a river commerce and transport hub, and the nexus between Hawkesbury River passenger and cargo shipping, the Windsor township, and the wider regional land transport network.

Maritime infrastructure artefacts provide information on the physical construction of the successive Windsor wharves, and the sizeable number of timber boat fasteners and hardware indicates boat building, operation, maintenance, and repair work was carried out on site. Possible elements of lost cargo indicate shipping and trade of items such as building materials, fresh produce, farming equipment and implements, and railway components and tools, and the substantial number of coins and currency tokens attests to the status of the wharves as locations of direct commercial transaction. The occurrence of distinctive curved bricks almost certainly associated with the 1874 Windsor Bridge indicates that the former Moriarty & Musson Windsor wharf was used to load materials onto river vessels for transfer to the mid-river bridge construction site.

Various artefact categories also suggest that some level of intentional discard of domestic refuse directly into the Hawkesbury River around the location of the wharf and likely from the wharf itself, occurred from time to time, and also that fragments of domestic refuse from adjacent terrestrial sites have been transported downslope into the river via natural processes of erosion and slope wash.

A number of objects further demonstrate additional activities conducted at the successive wharves, and indicate that fishing, plinking, and drinking alcohol were popular past-times on and from the former Windsor wharf, and that the Hawkesbury River was used for various recreational and celebratory activities.

Finally, the wide array of personal objects, such as harmonicas and toys, in the maritime assemblage provides a direct view of the people using the wharf and river vessels throughout the 19th and 20th centuries, and illustrate the presence of men, women, and children. Such artefacts bring to the front one of the understated facets of this the former Windsor Wharf in that this place has been an important gathering point for the townspeople of Windsor and surrounding communities for well over 200 years.

10 Aboriginal Stone Artefacts

During the course of the maritime archaeological excavation, a number of Aboriginal stone artefacts were unexpectedly encountered within the Hawkesbury riverbed sediments. These artefacts were identified in the sieve onboard the work barge whilst divers were dredging.

Upon identification of the first Aboriginal stone artefact, Cosmos Archaeology immediately informed AAJV, who were undertaking the terrestrial Aboriginal archaeological excavations associated with the Windsor Bridge Replacement Project. AAJV were also conducting consultation with Aboriginal stakeholder groups, including Deerubbin Local Aboriginal Land Council, Darug Custodian Aboriginal Corporation, Darug Tribal Aboriginal Corporation, Darug Aboriginal Cultural Heritage Assessments, Darug Land Observations, Darug Aboriginal Landcare Incorporated, Gunjeewong Cultural Heritage Aboriginal Corporation, and Tocomwall Cultural Heritage Consultants (formerly Yarrowalk). During an on-site meeting between Cosmos Archaeology and AAJV, it was decided that Cosmos Archaeology would recover, analyse, and report on all maritime Aboriginal stone artefact finds, and AAJV would inform and liaise with all Aboriginal stakeholders regarding the maritime fieldwork and findings.

A cautious approach was taken to the identification and recovery of potential stone artefacts from the sieve during the maritime excavation, as the riverbed contained high amounts of natural pebbles and cobbles and the nature of the excavation methodology required objects to be removed from the sieve and bagged quite quickly. A total of 193 stone pieces were initially recovered during fieldwork, however, closer examination revealed that 34 of these were geofacts or naturally fractured stone fragments. In the end, a total of 159 Aboriginal stone artefacts were recovered from the Hawkesbury riverbed sediments.

The following section provides a summary overview of the Aboriginal stone artefact assemblage. See Annex D for the stone artefact catalogue, and Annex E for the stone artefact analysis report.

The maritime Aboriginal stone artefact assemblage consists largely of complete and broken flakes (61.6%), followed by angular fragments / core fragments (22.6%), cores (8.8%), including cobble, microflake, and conical microblade cores, and complete and broken retouched flakes (4.4%). Several of the flakes and one of the cores show evidence of edge damage associated with use wear. All the flakes, retouched flakes, and angular fragments measure between 5-51 mm in maximum dimension, whilst the cores measure between 25-90 mm in maximum size. See Figure 289 to Figure 293. Two cobble tools (1.3%) were also identified, including a bifacial chopper and a unifacial chopper / ground-edge axe (see Figure 303 and Figure 304). The remainder of the stone artefact assemblage (1.3%) comprises heat-damaged angular fragments (see Figure 291), most commonly associated with cultural heating of stone materials. The range of artefact types indicates this assemblage derives from various activities, including manufacture, utilisation, and discard (once exhausted or broken) of worked lithic raw materials and stone implements.

Stone artefact raw material types in the maritime assemblage were dominated by indurated mudstone / tuff (42.1%), followed by silcrete (33.9%) and fine-grained siliceous (15.1%). A small amount of quartzite (6.3%), quartz (1.3%), and basalt (1.3%) also occurred. The predominance of indurated mudstone / tuff indicates particular exploitation of local lithic resources such as Hawkesbury River gravels and cobbles.



Figure 289: Silcrete, quartzite, and fine-grained siliceous flakes (DT1 / SQ6 / C05).



Figure 290: Silcrete microblade core (DT1 / SQ6 / C05).



Figure 291: Heat-damaged (pot-lidded) indurated mudstone / tuff angular fragment (DT1 / SQ1 / C04).



Figure 292: Indurated mudstone / tuff flake (DT1 / SQ10 / C22).

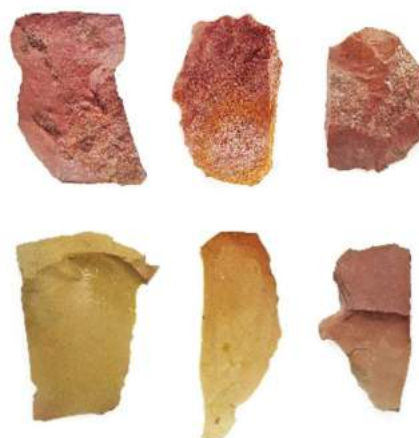


Figure 293: Small silcrete and indurated mudstone / tuff flakes (DT2 / SQ6 / C07).



Figure 294: Basalt ground-edge axe / unifacial chopper – the ground-edge is visible on the left (DT1 / SQ1 / C07).



Figure 295: Oblique view of basalt ground-edge axe / unifacial chopper (DT1 / SQ1 / C07).



Stone artefact densities were low across the maritime excavation areas, ranging from ca. 1.1 per m² to ca. 10 per m². However, artefacts were encountered in almost all of the excavation trenches in different areas of the Hawkesbury riverbed; from ST 5 located adjacent to the southern bank of the Hawkesbury between the extant timber piles of the former Windsor Wharf to DT1, DT2, DT3 ST1 and ST2, situated between ca. 6-10 m riverwards of the southern bank.

Stone artefacts were also recovered from almost all identified maritime stratigraphic units, including (see also Table 17):

- Upper layers of late 19th to early 20th century cobble ballast associated with the former wharf structure extending to a depth of ca. 400-500 mm below the riverbed surface (Periods 3 to 5 and Phases A to D);
- A compact semi-concreted layer of early to mid 19th century cobble, sandstone and brick ballast variously occurring between 400 to 850 mm below the riverbed surface (Periods 2b to 2c and Phase E);
- Several thin silt, sand and sandy lenses variously occurring between 600-1200 mm below the riverbed surface and likely representing layers resulting from flood events and vertical sorting and settling of the riverbed sediments (Period 2b and Phases F to G);
- Lower layers of sandstone rock and gravels occurring between 900-1000 mm below the riverbed surface and likely representing early 19th century ballast deposits (Period 1 to 2b and Phases H to J), and;
- A layer of decomposing bedrock encountered between 900-1200 mm below the riverbed surface (Period 1 and Phase K).

Table 17: Distribution of stone artefacts according to archaeological phases & historical periods

Phase	Historic Period	Cxts	Artefacts	Total
A	Period 5 – 1950s to present. Bank Stabilisation and boat landing stage.	1	0	0
B	Period 3 – 1862 to 1933. Moriarty and Musson Wharf, early	2	1	30
		3	17	
		23	12	
C	Period 3 – 1862 to 1933. Moriarty and Musson Wharf, early to mid.	4	24	27
		14	3	
D	Period 3 – 1862 to 1933. Moriarty and Musson Wharf, early to mid		0	0
E	Period 2b – 1815 to 1816. 2nd Howe and McGrath Wharf and Period 2c – 1817 to 1862. Greenway wharf.	5	44	44
F	Period 2b – 1815 to 1816. 2 nd Howe and McGrath Wharf	6	1	7
		7	6	
G	Period 2b – 1815 to 1816. 2 nd Howe and McGrath Wharf.	8	14	18
		9	4	
H	Period 2b – 1815 to 1816. 2 nd Howe and McGrath Wharf.	10	1	3
		11	2	
		15	0	
		16	0	
		19	0	
I	Period 2a – 1814 to 1815. Retaining wall and 1st Howe and McGrath Wharf.	24	10	10
J	Period 1 – 1795 to 1813. Riverbank and Thompson’s shipyard	12	13	14
		13	1	
		22	0	
		17	0	
		18	0	
K	Period 1 – 1795 to 1813. Riverbank and Thompson’s shipyard	20	0	6
		21	6	
				159

A distinct concentration of stone artefacts (ca. 27.7%) occurred within the semi-concreted ca. 150-300 mm thick ballast layer (Phase E), located approximately midway through the riverbed profile and associated with 1815-1862 historical occupation. However, this is possibly a result of post-depositional sorting, whereby small artefacts have trickled down through the profile and come to rest on top of, and within, the compact ballast layer (see Section 8.2).

It should also be noted that the riverbed sediments were excavated down to bedrock in most trenches, and historical artefacts were found throughout the entire profile and within all contexts that yielded Aboriginal stone artefacts.

Terrestrial Aboriginal archaeological excavations conducted on both the northern and southern banks of the Hawkesbury River as part of the Windsor Bridge Replacement Project recovered several thousand Pleistocene and Holocene stone artefacts from a mixture of fluvial, alluvial, and aeolian deposits, dating from ca. 30,000 years ago to the early colonial period ca. 250 years ago. The terrestrial stone artefact assemblage indicated three main phases of visitation and occupation at ca. 27,000 to 19,000 years ago, ca. 13,000 to 8,500 years ago, and ca. 5,000 years ago onwards, corresponding with major climatic changes in the past.²⁹⁰

As discussed in Section 2, geomorphological, palaeoenvironmental, and chronological analysis of sediment profiles encountered during the terrestrial archaeological excavations revealed the occurrence of four landscape units along and above the Hawkesbury River at Windsor. The areas closest to the site of the former Windsor wharves were identified as 19th-20th century reclaimed / introduced fill along the rivers edge, and rivers edge alluvium dating to within the last ca. 6,500-7,000 years – See Figure 7. These alluvial deposits likely formed through low-energy fluvial deposition and accretion by the Hawkesbury River, reflecting low-energy submergence of the river floodplain followed by sediment accumulation as the water receded.

The presence of small silcrete artefacts, including some heat-treated materials, quartz artefacts, and a basalt ground-edge axe in the maritime stone artefact assemblage indicates that at least part of the assemblage is of mid-late Holocene age. However, relatively high proportions of indurated mudstone / tuff and fine-grained siliceous artefacts also tentatively suggests that some of the stone artefacts may be of Pleistocene age. No clear patterning of relative frequencies of raw material types in different contexts and / or depths were observed, however, with each material occurring consistently in each stratigraphic unit. Whilst this may be a factor of small sample size, it may also be an indication that the assemblage represents a post-depositionally mixed collection of Pleistocene and Holocene artefacts.

Ultimately, characteristics of the stone artefact assemblage, the riverbed stratigraphic profile, and the environmental context indicate that the maritime stone artefacts do not derive from *in situ* submerged cultural landscape. Rather, it appears the artefacts have been deposited on the Hawkesbury riverbed via natural processes of erosion, slope wash, run-off, and flooding of terrestrial cultural deposits in the riverbank and slopes adjacent to, and upstream of, the maritime excavation area, and likely also historical cultural disturbance of the southern Hawkesbury riverbank. The stone artefacts within the maritime assemblage are perhaps most likely to represent reworked terrestrial cultural deposits from within the historical riverbank reclaimed / introduced fill and natural riverbank alluvium.

²⁹⁰ See **Williams, A., L. Berehowyj, T. Bryant & T. Sapienza 2017 Windsor Bridge Replacement Project, Test Excavation Report – Aboriginal Heritage**. Report prepared by AAJV on behalf of NSW Roads and Maritime Services.; and **Williams, A., L. Barry, R. Hawkins, C. Neale & T. Sapienza 2019 Windsor Bridge Replacement Project, Salvage Excavation Report – Aboriginal Heritage**. Report prepared by AAJV on behalf of NSW Roads and Maritime Services.

11 Revised Statement of Cultural Heritage Significance

11.1 Introduction

An assessment of cultural significance or heritage significance seeks to understand and establish the importance or value that a place, site or item may have to select communities and the general community at large. The Australian ICOMOS Charter for the Conservation of Places of Cultural Significance (the Burra Charter 1979, most recently revised in 2013), is the standard adopted by most heritage practitioners in Australia when assessing significance. It defines cultural significance as:

“Aesthetic, historic, scientific or social value for past, present or future generations.”²⁹¹

This value may be contained in the fabric of the item, its setting and relationship to other items, the response that the item stimulates in those who value it now, or the meaning of that item to contemporary society.

Accurate assessment of the cultural significance of sites, places and items is an essential component of the NSW heritage assessment and planning process. A clear determination of a site's significance allows informed planning decisions to be made for place, in addition to ensuring that their heritage values are maintained, enhanced, or at least minimally affected by development. Assessments of significance are made by applying standard evaluation criteria:

European Cultural Heritage Significance Criteria (NSW Heritage Office Guidelines)

- a. An item is important in the course or pattern of NSW's cultural or natural history (or the cultural or natural history of the local area);
- b. An item has strong or special associations with the life or works of a person, or group of persons, of importance in NSW' cultural or natural history (or the cultural or natural history of the local area);
- c. An item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area);
- d. An item has strong or special associations with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons;
- e. An item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area);
- f. An item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area);
- g. An item is important in demonstrating the principal characteristics of a class of NSW's cultural or natural places; or cultural and natural environments.²⁹²

²⁹¹ Australia ICOMOS Inc. 1999 *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance*. Article 1.2.

²⁹² NSW Heritage Office & Department of Urban Affairs & Planning 2001 *NSW Heritage Manual – Assessing Heritage Significance*

11.2 Evaluation of the former Windsor Wharf

Based on the findings of the maritime archaeological excavation and survey of the former Windsor Wharf site and utilising the historical research obtained for the Strategic Conservation Management Plan (SCMP) and this report, the statement of cultural heritage significance, assessed against NSW Heritage Council criteria, is presented below. This assessment differs from that presented in the March 2018 *Maritime Archaeological Testing Report and Detailed Salvage Strategy for Maritime Archaeological Excavation* in that it does not assess the 1795 Wharf and Store which was constructed further upstream and was not within the bridge construction footprint.²⁹³

Criterion a) An item is important in the course or pattern of NSW's cultural or natural history (or the cultural or natural history of the local area)

The construction of the former Windsor Wharf is associated with the survival of the early colony of Sydney, providing a means of facilitating the efficient transport of agricultural crops out of the greater Windsor area to the main settlement at Port Jackson.

The construction of a wharf and store in 1795, at what was then called Green Hills, upstream of the former Windsor Wharf site underscored the rationale for the siting for the settlement at this location – that of a river port for the exporting of crops out to the settlement in Sydney. Sydney Town at this time was suffering acute shortages of food largely due to the poor local soils in the immediate area of the settlement being unsuitable for farming. Satellite settlements such as Parramatta, Pitt Town, Richmond, and Green Hills (Windsor) formed a network of farming nodes from which Sydney was sustained.

Transport in the late 18th and 19th centuries by water was faster with a capacity to carry greater volumes than the overland route, which in the case of Windsor was not formally established until 1816. This piece of maritime infrastructure was an integral part of the establishment and development of dispersed frontier farming and later the township.

The former Windsor Wharf replaced this earlier wharf which had been destroyed by floods. Located immediately downstream of Thompson's, one of Australia's earliest shipyards which operated until 1807, its position was personally surveyed by Governor Macquarie. This was a more substantial structure, first constructed in 1814 and was appended onto a timber retaining wall that seems to have been constructed along the whole of Thompson's Square.

The importance given to this piece of maritime infrastructure is highlighted by an ambitious plan to expand the wharfage offered by new Windsor Wharf by over five fold as soon as the structure was built. The tenacity displayed in rebuilding the wharf over a five year period eventually headed by Francis Greenway underscores its importance to the colony, even if the final relatively modest result was perhaps a tacit concession to the limits of technology at the time when pitted against the uncooperative nature of a frequently flooding Hawkesbury River.

The former Windsor Wharf served as the nexus between land and water for the transfer of goods, produce and people to and from the 'mosquito fleet' that plied the Hawkesbury River and beyond.²⁹⁴ Such was the importance and volume of the water borne trade, and burgeoning tourism, that an additional temporary wharf was constructed in 1855.

By the late 1850s the wharf had fallen into disrepair which resulted in a completely new wharf being constructed on the site in 1862 under the supervision of Edward Moriarty. This signifies the continued importance of Windsor as an *entrepot* of river borne trade especially with the introduction of regular steam services between Sydney and Windsor.

The construction of the rail line to Windsor in 1864 actually increased the wharf's importance for a short while as vessels brought produce from properties along the river to the rail head. However a decade later the river trade had begun to decline as siltation, possibly exacerbated

²⁹³ **Cosmos Archaeology Pty Ltd, March 2018**, Maritime Archaeological Testing Report and Detailed Salvage Strategy for Maritime Archaeological Excavation.: Section 7.2

²⁹⁴ 'mosquito fleet' is a term used for the collection of small shallow draft vessels used to service those busy ports which could not accommodate large tonnage vessels.

by the construction of the Windsor Bridge in 1874, reduced the size of vessels that could access the wharf. This decline was accelerated by the construction of the rail line at Brooklyn in 1887 at the entrance to the Hawkesbury River which diverted away the cargo trade. The introduction of the motor vehicle had a substantial impact on river transport and the utility of the wharf for trade. The structure was repaired and partially reconstructed from 1933 to 1934 with the function of the wharf being more focused on recreational activities. By the middle of the 20th century this wharf had fallen into disrepair.

Since the 1950s there were a number of attempts at stabilising the riverbank including the construction of a short section of concrete and steel girder retaining wall, deposition on the riverbed of basalt rubble as well as sandstone kerbing discarded from the refurbishment of Windsor's streets. The last form of bank stabilisation prior to the construction of the new bridge in 2019 had been the installation of gabion baskets around 20 years earlier.

The historical significance of the various phases and manifestations of the wharfage at Windsor is assessed as follows:

Table 18: Historical significance of the different periods of the former Windsor Wharf.

Period	Date range	Name	Assessment	Significance
1	1795 to 1813	Riverbank, adjacent to Thompson's shipyard	Immediately upstream of Thompson's shipyard. Was most likely used as an informal beaching location for small boats to access the town or for repairs.	Local
2	1814 to 1860s	Windsor Wharf, early	An important (one of only a few in the early 19 th century) port within the intra-colony trade network.	State
	a) 1814 to 1815	1 st Howe and McGrath wharf		
	b) 1815 to 1816	2 nd Howe and McGrath wharf		
	c) 1820 to 1861	Greenway wharf		
3	1862 to 1933	Moriarty and Musson Wharf, early to mid	One of many riverine ports within the colony of NSW which were revitalised or expanded due to changes piling technology and good economic times. The port initially stimulated by the rail line passing by Windsor but declined in importance as a trade centre as rail networks and later motor vehicle transport expanded across the Sydney basin.	Local
4	1934 to 1950s	Moriarty and Musson Wharf, late	River borne trade had all but ceased by the time the last version of the wharf was constructed. Its role was primarily one for recreation uses which reflected the main use of the Hawkesbury River as the 20 th century wore on.	Local
5	1950s to present	Bank Stabilisation	The attempts at bank stabilisation do not merit any significant historical associations.	Does not meet criterion threshold.

The earliest phases of the former Windsor Wharf (ca.1814 - ca.1861) are considered to be State significant under this criterion on the basis they formed part of critical transport and trade infrastructure for one of the earliest European settlements in Australia - Windsor - a settlement which was important for the survival of Sydney as a viable colony.

Criterion b) An item has strong or special associations with the life or works of a person, or group of persons, of importance in NSW' cultural or natural history (or the cultural or natural history of the local area);

The earliest version of the former Windsor Wharf - Period 2 - was associated with two important personages in the early colony – Governor Macquarie who commissioned its construction in 1814, and Francis Greenway who oversaw its final construction in 1820. Three years earlier Macquarie had developed a plan for the formation of a township at Windsor, as well as four other townships on the Hawkesbury River. While it was not in the original plan for the establishment of a formal town, the need for adequate loading facilities on the river was later identified and endorsed by Governor Macquarie.

The wharf was built by John Howe and James McGrath, both early land grantees at Mulgrave (Windsor), who also improved the road from Parramatta to Windsor and searched for an overland route to the Hunter River. After the wharf was damaged in a flood in 1816, Macquarie ensured the survival of the wharf by granting further funding to complete the wharf. Oversight of the construction was entrusted to Francis Greenway who completed the structure in 1820. Well-known for his flamboyant and sound design principles, it is not currently known whether his flair was translated into the construction of this structure. The enlarged 276' wharf (Period 2b), proposed and commenced in 1815, was ambitious but may have been designed prior to Greenway's involvement in the project. The smaller scale wharf (Period 2c) finally constructed under his supervision appears to have lasted for fifty years before being rebuilt is possibly testament to his skills as both an architect and a builder.

The plans for the replacement wharf constructed in 1862 were prepared by Edward Orpen Moriarty, Engineer-in-Chief for Harbours and River Navigation for NSW and the structure was built by W. Musson. Moriarty was either responsible or involved in engineering improvements on the Hunter River as well as the building of water supply schemes for Wollongong, Bathurst, Wagga Wagga, Albury and Hunter Valley towns.²⁹⁵ He also supervised the building of the Penrith Nepean Bridge Co. in the 1850s and Pyrmont Bridge in 1865-66. In 1877 he oversaw the commencement of the construction of a 1.6 km breakwater at Trial Bay, a project that was finally abandoned 36 years later. Moriarty is also associated with the Tathra Wharf.²⁹⁶

The association of the various phases and manifestations of the former Windsor Wharf with a person or persons of importance in NSW is assessed as follows:

Table 19: Association of the different periods of former Windsor Wharf with important persons.

Period	Date range	Name	Assessment	Significance
1	1795 to 1813	Riverbank, adjacent to Thompson's shipyard	No known association with a person or persons of importance in NSW	Local
2	1814 to 1860s	Windsor Wharf, early	Associated with John Howe and James McGrath who contributed to the early development of the area.	State
	a) 1814 to 1815	1 st Howe and McGrath wharf		

²⁹⁵ **Australian Dictionary of Biography** Moriarty, Edward Orpen (1825-1896) <http://adb.anu.edu.au/biography/moriarty-edward-orpen-4437>

²⁹⁶ **Engineers Australia**, Tathra Wharf 1862 - portal.engineersaustralia.org.au/heritage/tathra-wharf-1862

Period	Date range	Name	Assessment	Significance
	b) 1815 to 1816	2 nd Howe and McGrath wharf	The third rebuild of the wharf, sub-period c), is associated with Lachlan Macquarie and Francis Greenway. It is the only known wharf to have been constructed, and possibly designed, under Greenway's supervision.	
	c) 1820 to 1861	Greenway wharf		
3	1862 to 1933	Moriarty and Musson Wharf, early to mid	Associated with H.E. Moriarty and engineer credentialed with supervising a number of civil works in NSW including the Pyrmont Bridge.	Local
4	1934 to 1950s	Moriarty and Musson Wharf, late	No known association with person or persons of importance in NSW	Does not meet criterion threshold.
5	1950s to present	Bank Stabilisation	No known association with person or persons of importance in NSW	Does not meet criterion threshold.

The earliest phase of the former Windsor Wharf ca.1814-ca.1950s, has a strong association with both Governor Macquarie and Francis Greenway, who are both important figures in the history of NSW, and as such the former Windsor Wharf is considered to be **State** significant under this criterion.

Criterion c) An item is important in demonstrating aesthetic characteristics and / or a high degree of creative or technical achievement in NSW (or the local area);

Limited archaeological remains associated with the ca.1814-ca.1950s wharf were visible from the current road bridge or via boat at the time of the construction of the new bridge. These remains were limited to the mid 19th to 20th century phase of construction and consisted of the lower support components of the wharf, such as bracing and deck beams, and as such are not considered to be aesthetic characteristics or show a creative or technical achievement. The former wharf site, particularly the early 19th century manifestations, exist within the archaeological record, including on and below the riverbed, and are now buried under scour protection laid for the new bridge. As the remains are not visible the former Windsor Wharf is not considered to meet the requirements of this criterion.

Criterion d) An item has strong or special associations with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons;

For almost 130 years the former Windsor Wharf had functioned as a major transportation hub for cargo and passengers between the upper Hawkesbury region and the Sydney area eventually becoming a focus for local recreational activities. The 2018 maritime archaeological excavation of the former Windsor Wharf showed that the site had been intensively used for both commerce and recreational purposes up to the end of the 20th century. This demonstrates the importance of the former Windsor Wharf, and by extension the Hawkesbury River, to the local Windsor community over a long period of time. This enduring connection with the River was seen during the 2018 excavation by the local activity – day and night – that took place on the current pontoon wharf.

As such, the former Windsor Wharf is considered to be of Local cultural heritage significance.

Criterion e) *An item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area);*

Maritime archaeological investigations in 2018 recovered a significant amount of information related to the differing phases of construction of the former Windsor Wharf from the earliest evidence of retaining timber piling and wharf structure constructed in 1814 to the 1862 complete rebuild of the structure. Such surviving early maritime infrastructure sites are rare in a State context and those sites have not had the same level of examination as has the former Windsor Wharf. The findings made on this site will serve as a baseline for future studies of early colonial Australian maritime infrastructure.

The 2018 maritime archaeological excavation also recovered artefacts from stratified deposits that dated from the decades prior to the construction of the former Windsor Wharf in 1814 up to recent times. The 2016 and 2018 excavations did not exhaust the archaeological potential of the site. The excavations took place where irreversible impacts were to occur, with the remainder of the site securely preserved under rock armour. Though remains of bedlogs were identified they offered a glimpse into how the earliest phases of the wharf were constructed. More intact remains are expected to be present. The artefacts recovered were varied and exceptional however the excavation was limited to the edge of the earliest phases of the wharf apron. As with underfloor deposits in buildings the distribution of artefacts can indicate how the space was utilised. This principal could hold true with wharf sites and so different locations within the shadow of the wharf, and beyond its apron could provide a starkly different mix of artefacts which would give further insight into use over time.

This archaeological asset is possibly unique within a State Colonial and Commonwealth context for its unbroken continuity of use for over 200 years. It serves as a valuable resource for documenting the development of Windsor from the late 1700s into the 21st century which was an important and at times vital regional centre for the Sydney region particularly in the early 19th century.

The continued potential of the archaeological remains of the various phases and manifestations of the former Windsor Wharf to yield information of importance to NSW is assessed as follows:

Table 20: Potential of the different periods of the former Windsor Wharf to yield important information.

Period	Date range	Name	Assessment	Significance
1	1795 to 1813	Riverbank, adjacent to Thompson's shipyard	A number of the artefacts recovered from this period have some maritime link with ship or boat building and could be associated with the activities in Thompson's shipyard. Though this would possibly represent some of the earliest evidence of shipbuilding in colonial NSW, a limited understanding of this most critical of early colonial industries can be obtained.	Local
2	1814 to 1860s	Windsor Wharf, early	Archaeological investigations have identified structural remains associated with all three wharf sub-periods. This included the retaining wall piling which extended the whole length of Thompson Square built in 1814, the bedlogs, piling and fastenings associated with Howe and McGrath's 2 nd Wharf and Greenways Wharf. Such maritime infrastructure remains have not been recorded to such detail anywhere else in NSW.	State
	a) 1814 to 1815	1 st Howe and McGrath wharf		
	b) 1815 to 1816	2 nd Howe and McGrath wharf		

Period	Date range	Name	Assessment	Significance
	c) 1820 to 1861	Greenway wharf	Thousands of artefacts within stratified deposits associated with activities on and around the wharf were recovered – a rare, if not unique, underwater archaeological resource in NSW.	
3	1862 to 1933	Moriarty and Musson Wharf, early to mid	The wharf was rebuilt at a time of changing technology in maritime infrastructure construction. The piles would have been screwed or pounded into the riverbed by a steam driven hammer. This form of construction became ubiquitous from the 1860s to the present day. The archaeological investigations in 2018 documented the extant remains of these piles which showed they have been sheathed in copper. As the importance of the port as a trade centre declined there would have been a change of the activities that took place on and around the wharf. The 2018 excavation found artefacts in stratified deposits associated with this period showing evidence of commercial and recreational activities taking place around the wharf.	Local
4	1934 to 1950s	Moriarty and Musson Wharf, late	The materials and techniques used in the construction of the wharf in this phase would have been commonplace throughout NSW at this time. The artefacts recovered in the 2018 maritime archaeological excavation showed continued use of the site primarily for recreational purposes.	Local
5	1950s to present	Bank Stabilisation	Investigations in 2016 and 2018 of the forms of bank stabilisation used on the site in this phase did not yield any new information on this type of civil engineering.	Does not meet criterion threshold.

The *in situ* archaeological remains associated with former Windsor Wharf, above and below the low water line, still have the potential to contribute to a greater understanding of European settlement before and during the Macquarie era.

As such, the earliest phases of archaeological site associated with the remains of the former Windsor Wharf and associated archaeological deposits are considered to be State significant under this criterion.

Criterion f) *An item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area);*

The archaeological remains associated with the former Windsor Wharf are considered to be a rare and endangered archaeological resource. There are few if any such wharf sites in the wider Sydney area, NSW and by extension the remainder of Australia which can provide an archaeological record of use from the early 1800s into the 21st century. This is because in major centres, such as Sydney (and Newcastle, Wollongong, Hobart and Launceston), early shorelines with their associated maritime infrastructure were often buried under reclamation throughout the 19th century onwards thereby truncating their time span of use as well as making the archaeological remains relatively inaccessible.

Wharf sites along major rivers and secondary ports are likely to exist, both intact and as an archaeological resource, as redevelopment of these sites is less likely to occur over the development of other transportation advances, such as rail or road infrastructure. However, these sites would very unlikely match the longevity of the former Windsor Wharf.

Aspects of Thompson's shipyard and the former wharf that are at present buried at Windsor are likely to be intact and relate to design and construction techniques that are directly associated with the early settlement of NSW that has since evolved.

The 1820 reconstruction of the wharf was supervised by renowned architect Francis Greenway. As far as is known, this is the only in-water construction of maritime infrastructure within his repertoire of public works.

Table 21: Rarity of the different periods of the former Windsor Wharf.

Period	Date range	Name	Assessment	Significance
1	1795 to 1813	Riverbank, adjacent to Thompson's shipyard	Shipyards were a rare feature in the first few decades of European settlement.	State
2	1814 to 1860s	Windsor Wharf, early	Wharves of the type constructed at Windsor in the early 19 th century would have become more commonplace around NSW towards the middle of the century. However, remains of such structures, and associated archaeological deposits, are relatively rare and/or are inaccessible under reclamation. The wharf constructed in sub-period c) was done so under the direction of Francis Greenway and is possibly the only structure of this type that he is associated with.	State
	a) 1814 to 1815	1 st Howe and McGrath wharf		
	b) 1815 to 1816	2 nd Howe and McGrath wharf		
	c) 1820 to 1861	Greenway wharf		
3	1862 to 1933	Moriarty and Musson Wharf, early to mid	Wharves constructed in the second half of the 19 th century were commonplace forms of maritime infrastructure. The archaeological remains of such structures are largely accessible in areas where ports have declined and inaccessible in places which saw a lot of foreshore development in the late 19 th and 20 th centuries, such as Sydney Harbour.	Local
4	1934 to 1950s	Moriarty and Musson Wharf, late	Wharves constructed in the first half of the 20 th century were commonplace forms of maritime infrastructure. The archaeological remains of such structures are largely accessible across the State.	Local
5	1950s to present	Bank Stabilisation	The use of retaining walls, rock armour and more recently Gabion baskets is ubiquitous across the State. The use of former 19 th century sandstone kerbing as rock armour, however, is unusual.	Local

The archaeological remains of the former Windsor Wharf are considered to be State significant under this criterion.

Criterion g) An item is important in demonstrating the principal characteristics of a class of NSW's cultural or natural places; or cultural and natural environments.

The site of the former Windsor Wharf is now buried under rock scour protection and now exists solely in the archaeological record. As such, the site is not considered to retain the principal characteristics of its type or design. The former Windsor Wharf is not considered to meet the standards of this criterion.

Statement of cultural significance

The earliest phases of former Windsor Wharf played a critical role in the survival of the colony of New South Wales as it facilitated the bulk movement of much needed agricultural produce to Sydney by means of small locally built sailing vessels. The initial construction of the wharf in 1814 was part of the formalisation and development of the Macquarie town and reinforced the importance of the settlement and the need for maritime infrastructure as part of that plan. Such was its significance to the colony that its location was personally sited and surveyed by Governor Macquarie and its re-construction, completed in 1820 despite repeated demolition by flooding events, was overseen by Francis Greenway. The wharf was an integral part of the Windsor Township until the expansion of rail to Brooklyn at the entrance to the Hawkesbury River diverted away the cargo trade and the motor vehicle decreased the importance of water borne transport.

The archaeological resource present on the site is considered to be a rare and endangered resource that can provide new information into the design and construction types of wharves in the early settlement of NSW and Australia. The artefacts recovered, many of which are stored and displayed in the Hawkesbury Regional Museum, provide a fascinating record of an unbroken continuity of use of the wharf and riverbank by the inhabitants of, and visitors to Windsor from the early 1800s into the 21st century. Only a fraction of this rich resource has been recovered with the remainder laying *in situ* and protected from on-going erosion by rock armour.

The early to mid 19th century version of the former Windsor Wharf is assessed to be of **State** significance.

12 Scour Protection Works: Monitoring and Inspections

12.1 Introduction

The scour protection system chosen for the project on the south bank of the river involved covering the riverbank and riverbed up to 20m into the river with rock armour. Rock armour was chosen over a concrete retaining wall to minimise the impacts to the archaeological remains of the former Windsor Wharf.²⁹⁷ This scour protection was planned to have a positive impact on the long term preservation of fabric and context, aligning with best practice in underwater cultural heritage management (see Figure 296).

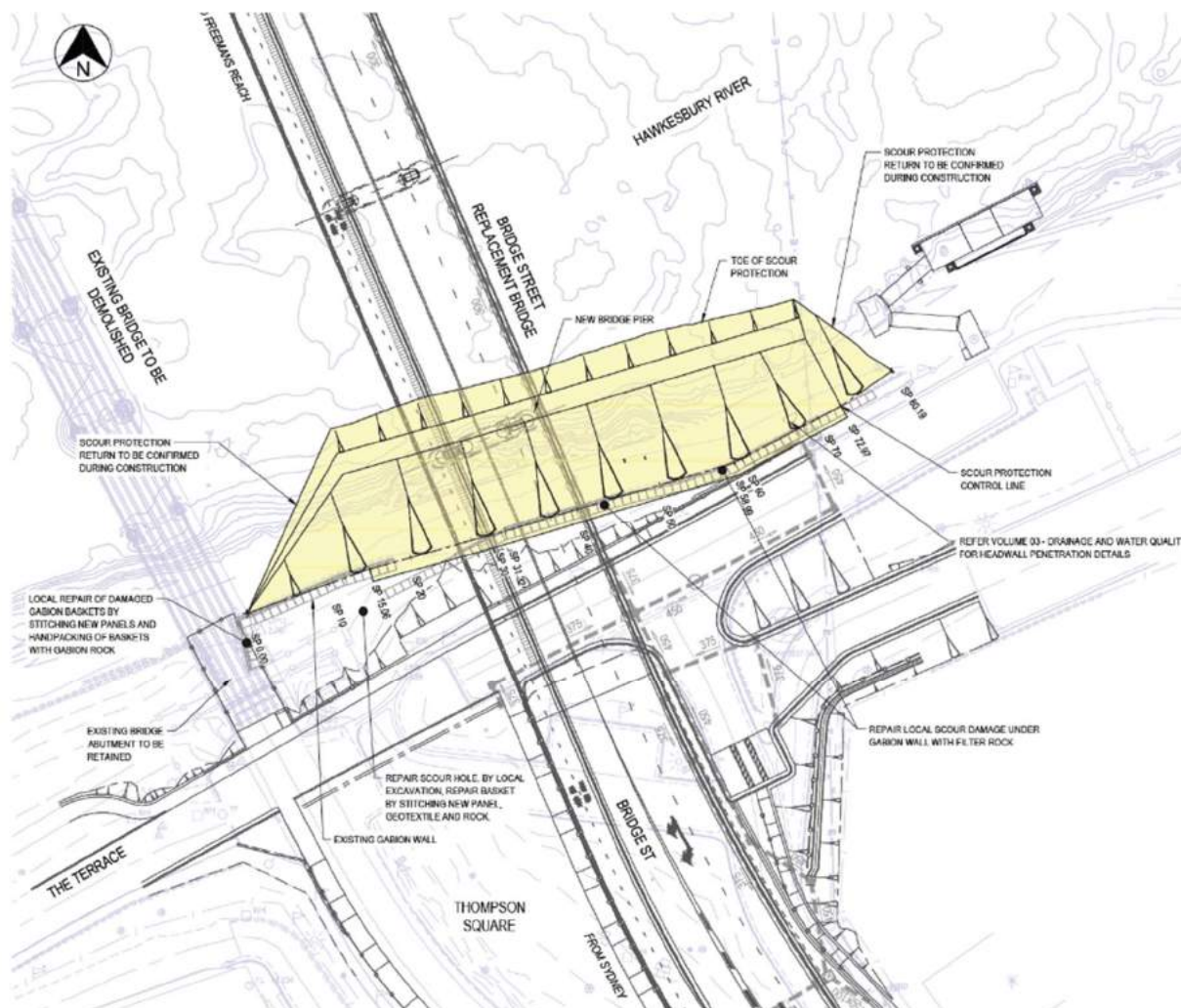


Figure 296: Proposed extent of scour protection on the southern bank and location of southern most bridge piles.

In preparation for the placement of the rock armour vegetation on the southern riverbank was cleared with no grubbing carried out. No excavation of the riverbank or riverbed for the purposes of installing the proposed scour protection was also undertaken. Extant structures associated with the former Windsor Wharf site were covered with a granular fill to form a smooth surface prior to placing geotextile and rock rip rap.²⁹⁸ One feature, a timber waler (AWF6/4) associated with the 1882 wharf (Phase 3), was severely damaged by marine borers and assessed that the best option was to cut the timber prior to installation of the granular fill. This was to be done so as not to put too much strain on the remaining structure (Figure 288)). The cutting of the timber was monitored by a maritime archaeologist (see Section 12.2).

²⁹⁷ **Cosmos Archaeology Pty Ltd March 2018** Maritime Archaeological Testing Report and detailed salvage strategy for maritime archaeological excavation, pg. 48.

²⁹⁸ **Jacobs & Royal Haskoning DHV 13 April 2017:** General notes Sheet 1



Figure 297: The timber waler (AWF6/4) associated with the 1882 wharf (Phase 3) that was to be cut as to not further strain the remaining structure (red circle).

The granular fill was a graded cohesiveness material (gravel) ranging in size from between 5 and 150 mm. The rip rap was composed of igneous metamorphic rock less than 2.5 m across which was edged and locked together so that they did not shift and move (Figure 298).

One of the potential impacts of the placement of the rock armour was scouring around the perimeter which could potentially expose further cultural material. The MATR-MARD-DSS addressed the impact the proposed scour protection would have on the archaeological remains:

“.....Another potential impact may be scouring around the toe of the riverward edge of the scour protection. Such scouring could result in the exposure of archaeological remains associated with the former Windsor Wharf and result in accelerated degradation.”²⁹⁹

The strategy proposed mitigation measures to ensure early action could mitigate any potential loss of cultural material:

Post Construction management of in situ maritime archaeological remains.

To ensure that archaeological remains associated with the former Windsor Wharf are not compromised by scouring around the toe of the scour protection after the completion of the bridge construction a monitoring protocol is to be established. Detailed and comprehensive management procedures for maritime archaeological

²⁹⁹ Op. cit. Cosmos Archaeology Pty Ltd March 2018 pg. 55.

remains will be included in final heritage report required under condition C5. Though these procedures can only be finalised after the installation of the scour protection a broad outline of the likely monitoring protocols is presented below:

1. *Baseline survey. Dive inspection of the perimeter of the scour protection, within one month of installation. The inspection would include video survey (if visibility allows) and annotated descriptions of the scour protection and riverbed interface on a surveyed plan which shows the extent of the scour protection.*
2. *First dive inspection. To be carried out six months after the baseline survey.*
3. *Second dive inspection. To be carried out six months after first dive inspection.*³⁰⁰

This section outlines the monitoring of the timber cutting prior to the rock armour installation and the conduct of the first monitoring baseline survey (see Section 12.3). These results of the baseline survey will be compared with future inspections.

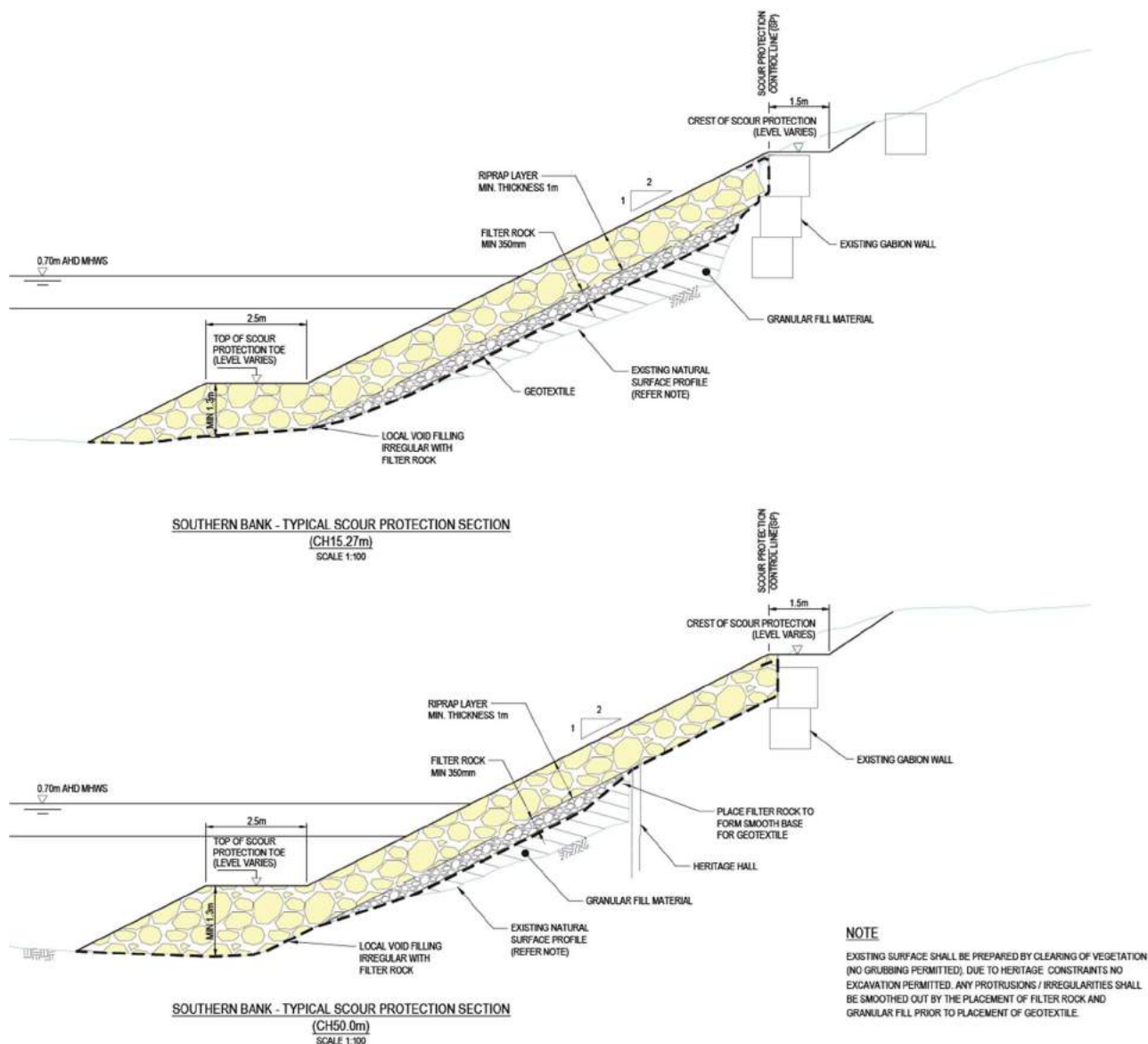


Figure 298: Typical scour protection sections on the southern bank.

³⁰⁰ Op. Cit. Cosmos Archaeology Pty Ltd March 2018 pg. 57.

12.2 Monitoring of covering of former Windsor Wharf remains.

Prior to the installation of granular fill, a section of feature AWF6/4 (AWF6/4) was deemed at risk and to prevent further damage to the remaining structure of the wharf, the timber was to be cut. Monitoring was undertaken by a maritime archaeologist, Milly Bendell. The section of timber from AWF 6/4 was cut on Wednesday 3rd October 2018 at 2:15pm with a low tide of 0.5m. AWF 6/4 was cut with a chainsaw back to the junction of AWF 6/1. The timber was then securely wrapped in geo textile material, tapped and placed back underneath the remaining wharf to be buried under the scour protection works. (Figure 299 to 301). After the timber was secured, the laying of the rock armour commenced (Figure 302).



Figure 299: Piece of timber AWF 6/4 after it had been cut.



Figure 300: Timber AWF 6/4 wrapped in geofabric materials and placed underneath remaining structure of feature 6. Visible is the junction of 6/4 and 6/1 where the timber was cut back to (red circle).



Figure 301: A section view of the remaining piece of AWF6/4. Timber piece severely damaged from marine borer activity.



Figure 302: An in progress shot of the rock armour scour protection being laid. Taken 14th December 2018. Looking east. The site of the former Windsor Wharf is protected under the scour protection.

12.3 Scour Protection baseline inspection

12.3.1 Dates and personnel

The inspection and survey were conducted over the course of four days of diving, from Monday 19th August to Thursday 22nd August 2019. The personnel involved were:

Jane Mitchell:	Lead Maritime Archaeologist; Cosmos Archaeology Pty. Ltd.
Cosmos Coroneos:	Maritime Archaeologist; Cosmos Archaeology Pty. Ltd.
Kevin Graham:	Coxswain, Supervisor, Diver; Professional Diving Services
Felix Venturoni:	Supervisor, Diver; Professional Diving Services
Callum Harvey:	Diver; Professional Diving Services
Guy Hazell:	Surveyor; Archaeological Surveying and Illustration

12.3.2 Recording process

The inspection and survey were conducted using a commercial dive team under the direct supervision of a maritime archaeologist who also dived. The diving was done using Surface Supplied Breathing Apparatus (SSBA) from a dive boat, with hardwired communications between the diver and the surface. The diver wore a Kirby Morgan 17 diving helmet with helmet mounted video camera, providing a live video feed to the surface. The inspection and survey complied with OH&S requirements.

- There were two main components of this survey:

- Inspect the perimeter of the rock armour on both the north and south side of the Hawkesbury River at the location of the new Windsor Bridge for any scouring and exposed cultural material, and;
- Survey the positions of the extent of the rock armour where it meets the riverbed using a Total Station.

Star pickets were placed approximately every 10 m around the extent of the rock armour. A weighted transect line with length markers was cable tied to these star pickets to provide a reference point for the survey. The diver then swam slowly downstream to upstream using video and narrating observations to the surface.

To survey in the rock armour extent, the diver swam along the transect line around the perimeter of the rock armour carrying a staff with a prism while another diver on the surface helped maintain the staff upright. The diver placed the staff at 5 m intervals and the surveyor shot these positions in using a Total Station placed on the riverbank. The Total Station was placed downstream, however as the diver moved upstream the position of the temporary jetty blocked line of sight, so the Total Station was moved to the upstream extent to complete the survey.

This process was repeated for the south side rock armour.

12.4 Findings

12.4.1 North side riverbank rock armour

The video survey took place on 20th August 2019, following the extent of the rock armour from its downstream extent to its upstream extent. The area surveyed on the north side of the river measured approximately 120 m in length.

Due to a silt curtain installed underneath the temporary jetty, the inspection was undertaken in two parts. The first ran from the downstream extent to the 85 m marker which was located at the upstream end of the new bridge pier and took 28 minutes to run. The second run commenced at the 80 m marker and continued to the upstream extent and took 6.43 minutes to complete.

In the first run it was noted that the sand was beginning to move over the edge of the rock armour on this side of the river, making the toe less defined. This sand dusting extended the length of the run until the bridge pier was reached. Timbers associated with a small boat were observed at the 36-37 m marker, with three timbers and smaller fragments lying loose in the sand or caught between rocks. These timbers are associated with the wrecks recorded and recovered in early 2019.³⁰¹ One timber was attached to another timber that was buried too deep to be removed. This timber did not appear to have been exposed through scouring action and there was no other evidence of scouring except around the four bridge piles underneath the bridge pier.

Once the bridge pier was reached the rock armour was abutting the riverbank side of the piles but does not extend around the piles to the river side. Scouring was noted between the piles on the downstream side, approximately 500 mm deep and 1,500 mm in length, running perpendicular to the riverbank. No cultural material was exposed in the scour.

The second video run was predominantly underneath the silt curtain where the visibility was almost zero, there was a fine layer of silt and loose natural vegetation over the toe of the rock armour. The vegetation in this area will help prevent any potential scouring.

³⁰¹ Op Cit. Cosmos Archaeology, April 2021

Detailed observations

Table 22 below outlines the observations taken from diver video when visibility allowed during the northside downstream video run and from the running documentary provided by the diver during the inspection.

Table 22: Detailed observations of north side rock armour inspection #1

Distance from downstream, end (m)	Observations	Video timings: WBRP Rock Armour Run 002
0	Sandy riverbed, tree material	00:25
5	Large rocks from rock armour meeting sand (Figure 303)	01:21
10	Sand is starting to spread over the top of the rock edge, with the edge is becoming less defined	02:30
20	Rock armour with sandy edge	04:20
25	Rock armour with sandy edge (Figure 304)	05:08
35	Rock armour with sandy edge	06:44
36	Timbers associated with a small boat	11:00
40	Rock armour with sandy edge	15:57
45	Rock armour with sandy edge (Figure 305)	16:58
50	Rock armour with sandy edge	18:00
55	Rock armour with sandy edge	18:56
60	Rock armour with sandy edge	19:56
65	Rock armour with sandy edge, meeting the downstream bridge pier pile (Figure 306).	20:47
70	Riverbank side of bridge piles: rock armour hard against piles	21:48
75	Riverbank side of bridge piles: rock armour hard against piles	22:36
80	Upstream riverbank side of bridge piles	23:22
	Diver swims to river side of bridge piles for outside run	
65	River side of bridge pier: no rock armour and scouring between the individual piles on the downstream side approximately 500 mm deep	25:10
70	River side of bridge pier: no rock armour and scouring between the individual piles on the downstream side approximately 500 mm deep	
75	River side of bridge pier: no rock armour and scouring between the individual piles on the downstream side approximately 500 mm deep	
80	End of river side bridge pier.	28:37



Figure 303: 5 m marker, large rocks and sand under the transect line (Video: WBRP Rock Armour run 002, still image taken at 01:21)



Figure 304: 25 m marker, large rocks and sand under the transect line. (Video: WBRP Rock Armour run 002, still image taken at 05:08)



Figure 305: 45 m marker, large rocks to the right of the transect line under a light dusting of sand. (Video: WBRP Rock Armour run 002, still image taken at 16:58)



Figure 306: 65 m marker, bridge pier 4, pile 1, rocks to the right of the pile. (Video: WBRP Rock Armour run 002, still image taken at 20:47)

Table 23 below outlines the observations taken from diver video when visibility allowed during the northside upstream video runs and from the running documentary provided by the diver during the inspection.

Table 23: Detailed observations of north side rock armour survey #2

Distance from downstream end (m)	Observations	Video timings: WBRP Rock Armour run 004
0	Sandy riverbed, tree material	00:25
80	Upstream bridge pile	00:26
85	Rock armour with sandy edge (Figure 298)	01:00
90	Rock armour with sandy edge	01:44
95	Silt beginning to build, visibility reducing, rock armour can only be felt, not seen.	02:25
100	End of 100m transect line at downstream pile of temporary jetty. Markers changed from 5 m to 2 m. Very silty, rock armour can be felt underneath the silt (Figure 299).	03:09

Distance from downstream end (m)	Observations	Video timings: WBRP Rock Armour run 004
104	Riverbed vegetation increasing, rock armour under silt	04:03
108	Riverbed vegetation increasing, rock armour under silt	04:35
112	Underneath silt curtain, very silty with natural vegetation. Toe of rock armour can be felt underneath silt (Figure 300).	04:59
116	Underneath silt curtain, very silty with natural vegetation. Toe of rock armour can be felt underneath silt	05:55
120	Underneath silt curtain, very silty with natural vegetation. Toe of rock armour can be felt underneath silt	06:18
122	Upstream extent of north side rock armour near shore, changing from rock armour to smaller river stones (Figure 301).	06:30

Key features for future inspections

A key feature for this transect is the wreck timbers located at the 36-37 m mark that could not be removed. These timbers are located at the toe of the armour and if scouring occurs in this area, then more timber or timbers may become exposed. If, during the next inspection, these timbers are still exposed, they should be wrapped in geotextile and labelled and covered by rock armour to prevent further deterioration in their condition.

The level of scouring between the four bridge piles underneath the bridge pier should also be monitored during future surveys.

Upstream of the bridge pier, the area was very silty, reducing visibility to almost zero. While the rock armour could be felt, this silt build up may potentially reduce when the silt curtains and the temporary jetty are removed and should be monitored for future inspections.



Figure 307: 85 m marker, large rocks to the left and sand to the right of the transect line. (Video: WBRP Rock Armour run 004, still image taken at 00:56)



Figure 308: 100 m marker, temporary jetty pile and large rocks to the right. (Video: WBRP Rock Armour run 004, still image taken at 03:09)



Figure 309: Inside silt curtain, vegetation and silty sand over rock armour. (Video: WBRP Rock Armour run 004, still image taken at 04:59)



Figure 310: Upstream extent of north side rock armour. (Video: WBRP Rock Armour run 004, still image taken at 06:30)

Details of the scouring observed during the northside rock armour inspection can be found below (Figure 3.11 and Figure 3.12).

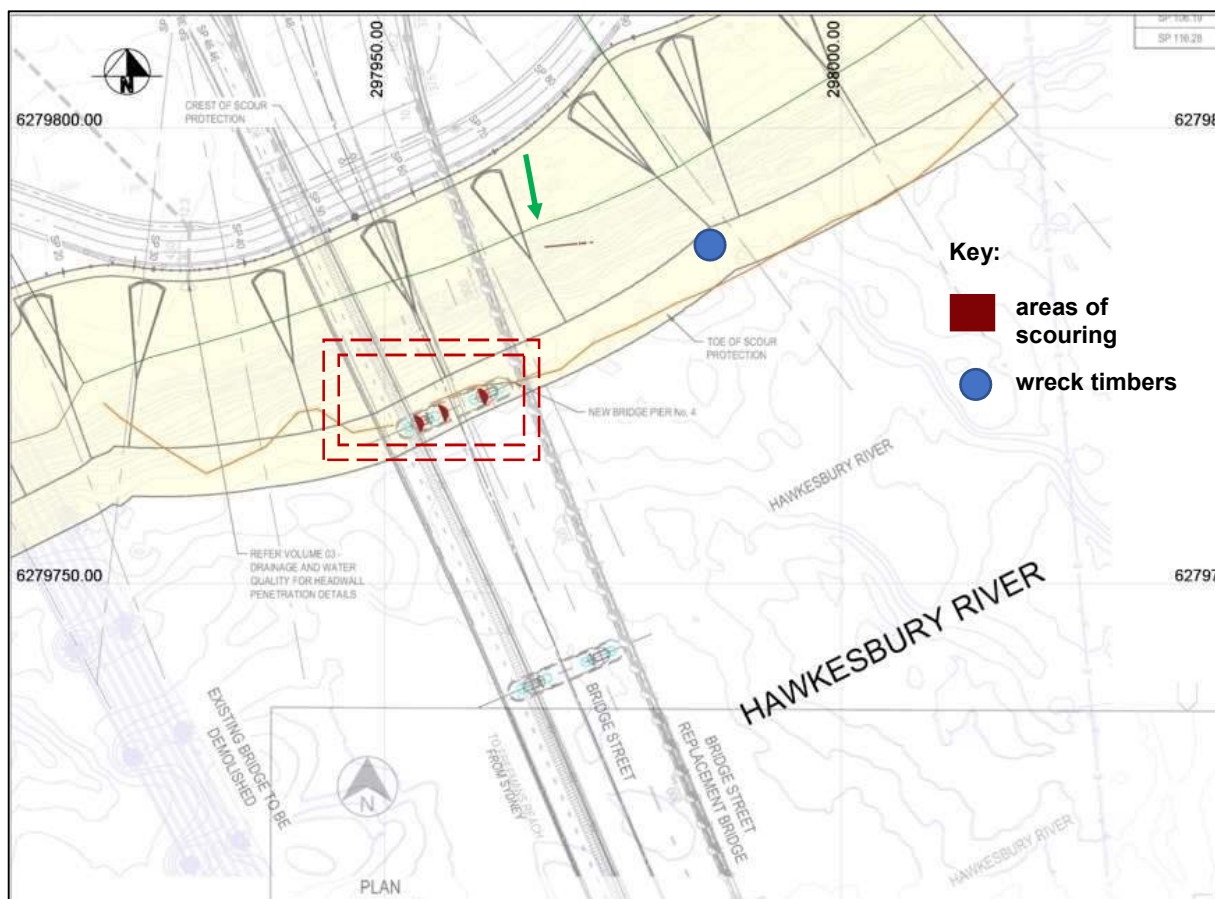


Figure 311: North side rock armour extent with scour marks indicated near bridge pier 4. The orange line is the edge of the toe of the rock armour, the green arrow is WBRP UHWR-02 keel.³⁰²

³⁰² Op. Cit. Cosmos Archaeology April 2021

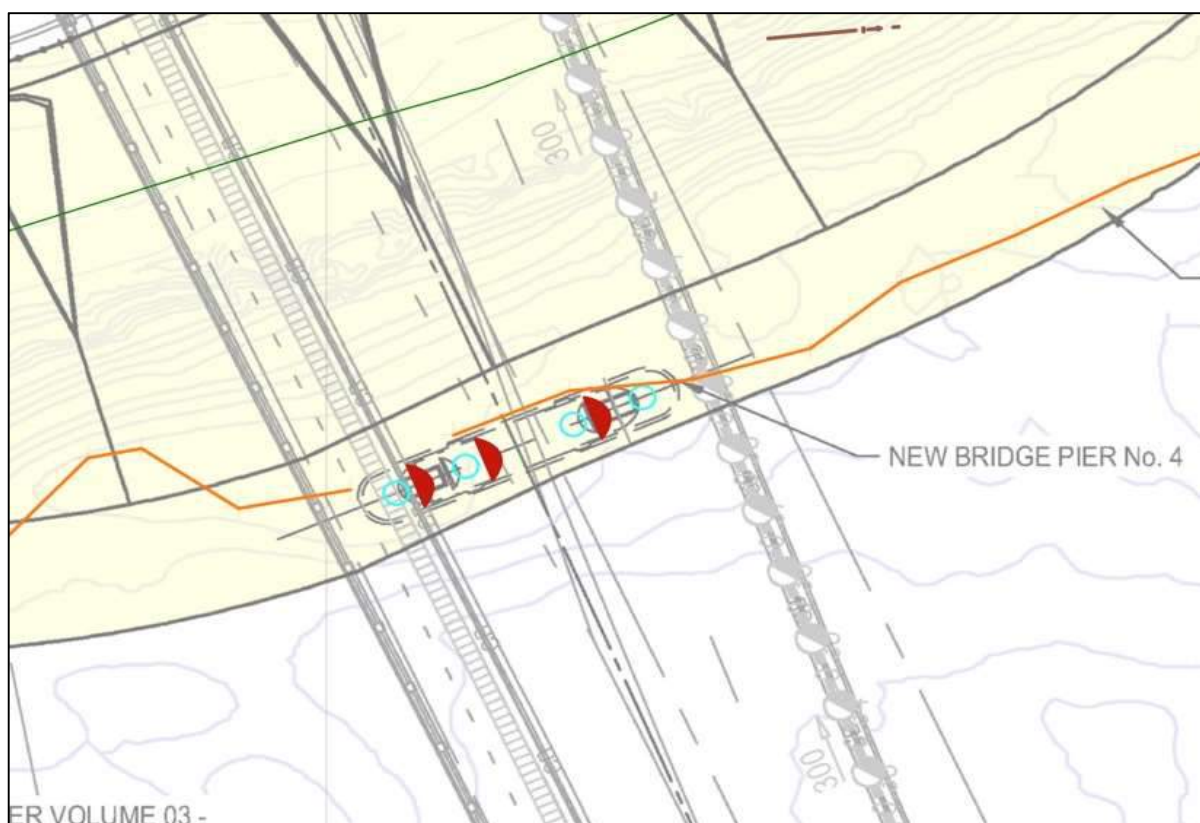


Figure 312: Detail of scouring around Bridge Pier 4.

12.4.2 South side riverbank rock armour

The video run took place on 21st August 2019, following the extent of the rock armour from its downstream extent to its upstream extent. The area surveyed on the south side of the river measured approximately 80 m in length and took approximately 13 minutes to run.

A silt curtain was wrapped around bridge pier 1 for engineering works during the survey. This stretched from approximately the 35 m marker to the 45 m marker. The 40 m marker was inside the silt curtain. While this did not interfere with the inspection, it may have some influence on the effects on the riverbed, such as scouring or accumulation as the base of the silt curtain rested along the edge of the rock armour.

At the downstream and upstream extent of the rock armour, there was exposed geofabric with no rocks over the top (see Figure 313 and Figure 316). This geofabric floated up into the water column, up to approximately 300-400 mm off the riverbed and extends outwards from the edge of the rock armour to approximately 1000 mm.

The toe of the rock armour was very clearly defined on this side of the river. There was no evidence of scouring and no exposed cultural material.

Detailed observations

Table 24 outlines the observations taken from diver video when visibility allowed during the south side video run and from the running documentary provided by the diver during the inspection.

Table 24: Detailed observations of south side rock armour inspection

Distance from DS end (m)	Observations	Video timings: WBRP Rock Armour run 005
0	Silty sand/mud and small river rocks, natural riverbed	00:20
3	Large rocks as rock armour	00:46
5	Exposed geofabric stretching past rock armour, larger rocks (Figure 313).	01:06
10	Exposed geofabric stretching past rock armour, larger rocks	01:44
20	Large rocks reaching to the extent of the geofabric. No scouring in sand.	02:46
25	Large rocks reaching to the extent of the geofabric. No scouring in sand.	03:21
30	Large rocks reaching to the extent of the geofabric. No scouring in sand (Figure 314).	04:00
35	Large rocks reaching to the extent of the geofabric. No scouring in sand.	04:43
40	Large rocks (inside silt curtain) and sand. No scouring	05:12
45	Large rocks (outside silt curtain) reaching to the extent of the geofabric. No scouring in sand.	06:12
50	Large rocks reaching to the extent of the geofabric. No scouring in sand (Figure 315).	07:03
55	Large rocks reaching to the extent of the geofabric. No scouring in sand.	07:32
60	Large rocks reaching to the extent of the geofabric. No scouring in sand.	08:04
65	Large rocks reaching to the extent of the geofabric. No scouring in sand.	10:57
67	Exposed geofabric heading into the river	11:02
70	Exposed geofabric stretching past rock armour, larger rocks (Figure 316).	11:34
75	Exposed geofabric stretching past rock armour, larger rocks	12:10
80	End of rock armour, silty sand/mud and small river rocks, natural riverbed	12:45

Key features for future inspections

A key feature for future monitoring on the south side transect is the exposed geofabric at both the upstream and downstream extents of the scour protection to ensure there is no scouring as a result of the loose material.

The excavated area of the former Windsor wharf should also be carefully monitored. This area is located near the bridge pier (and southside silt curtain), approximately 40 m – 60 m along the transect line. Any scouring in this area has the potential to expose further cultural remains.



Figure 313: uncovered geofabric to the right of the transect line at the 5 m marker. (Video: WBRP Rock Armour run 005, still image taken at 01:06)



Figure 314: large rocks to the left of the transect line at the 30 m marker. (Video: WBRP Rock Armour run 005, still image taken at 04:00)



Figure 315: Large rocks to the left of the transect line at the 50 m marker. Video: WBRP Rock Armour run 005, still image taken at 07:03)



Figure 316: uncovered geofabric to the right of the transect line at the 70 m marker, large rocks to the left. (Video: WBRP Rock Armour run 005, still image taken at 11:34)

Details of the exposed geofabric observed during the south side rock armour inspection can be found below (Figure 317).

The spot depths for the toe of the rock armour can be found in Figure 3.18. An overview of the rock armour extent for both the north and south side of the river can be found at Figure 319. This figure highlights the current rock armour positioning relative to the planned scour protection layer.

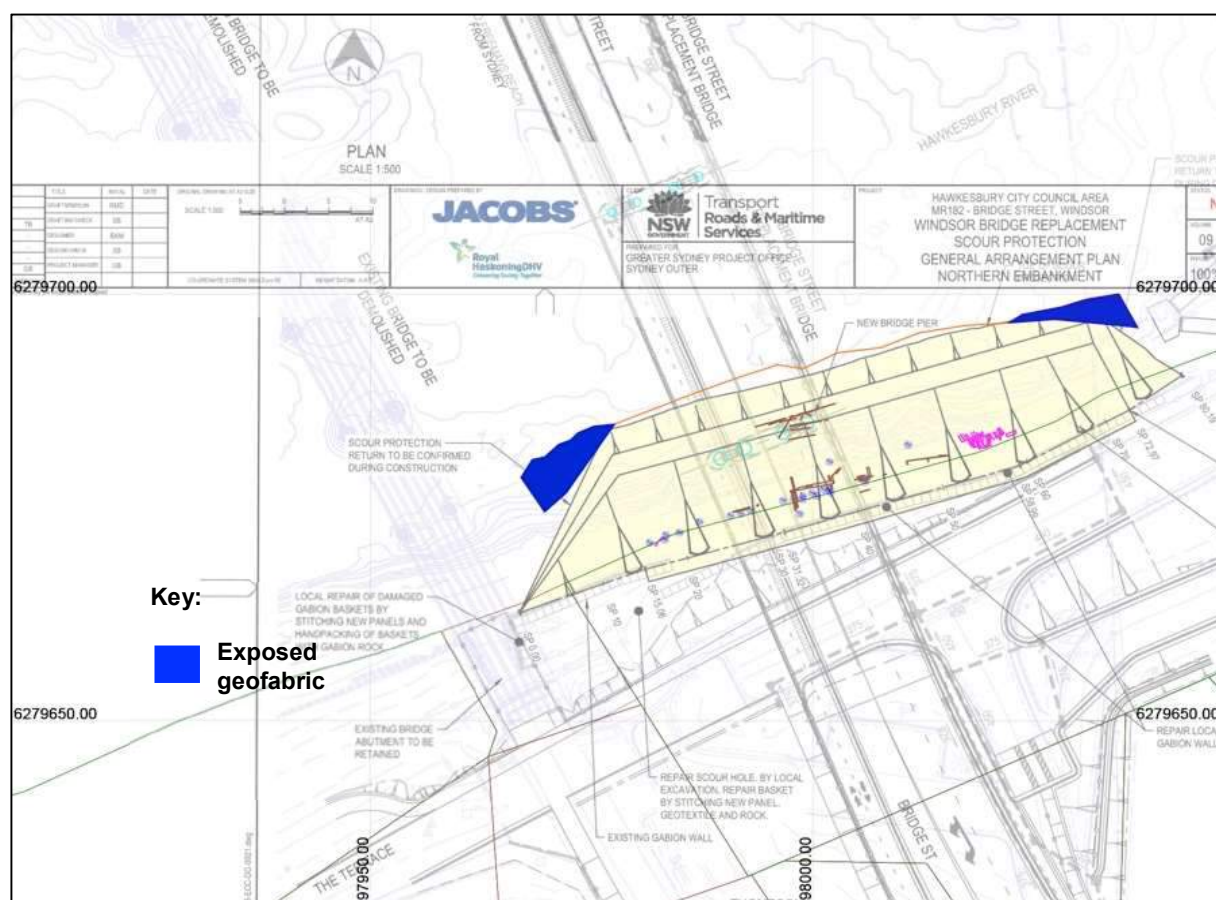


Figure 317: South side survey results showing approximate extent of exposed geofabric with no covering rock armour. Note the timbers of the former Windsor Wharf shown on the plan are buried under the rock armour and are visible near the downstream end of the bridge pier. The orange line is the edge of the toe of the rock armour.

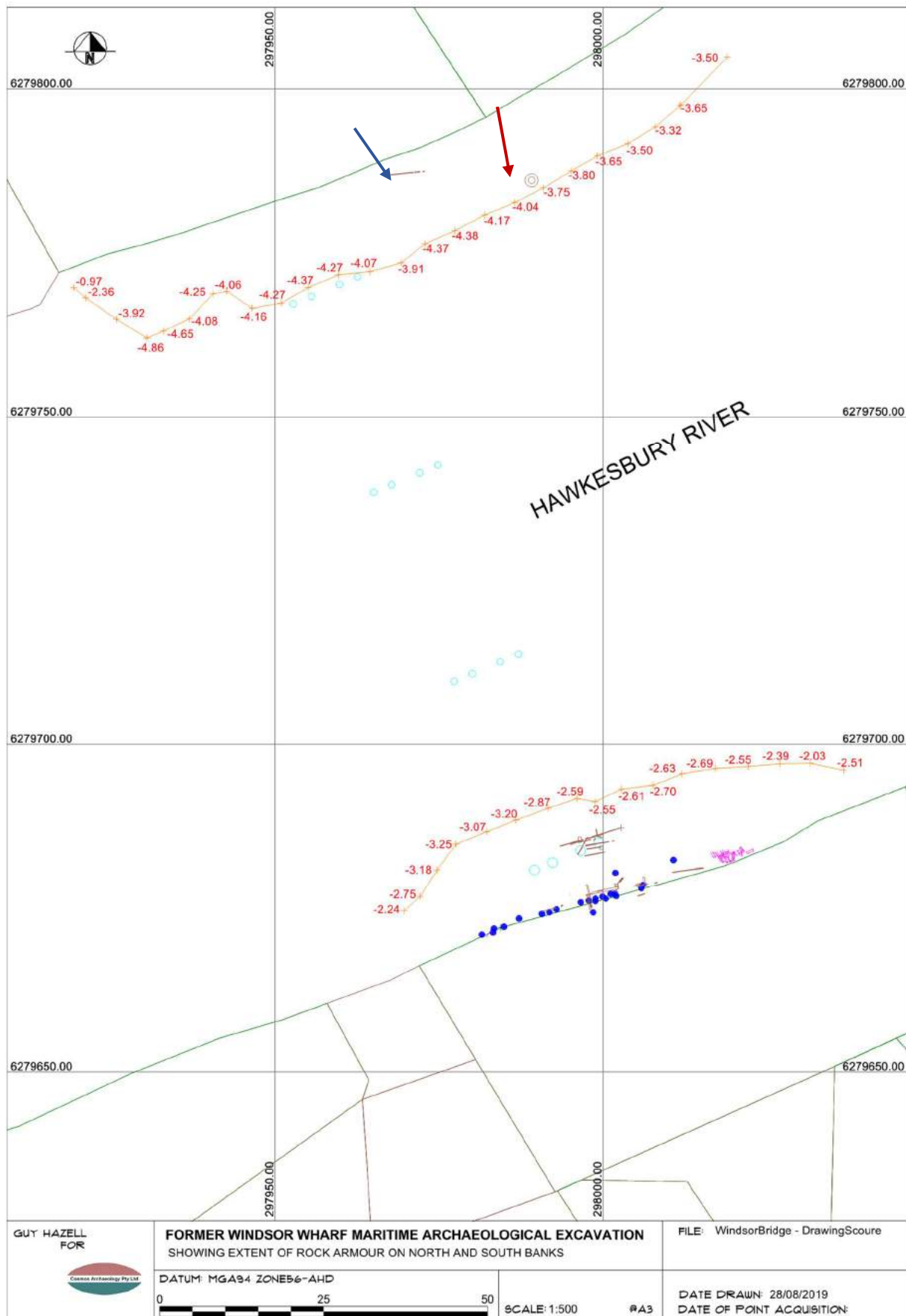


Figure 318: Spot depths at toe of rock armour (AHD). Blue arrow indicates position of WBRP UHWR-02 keel and red arrow indicates position of wreck timbers observed in August 2019.

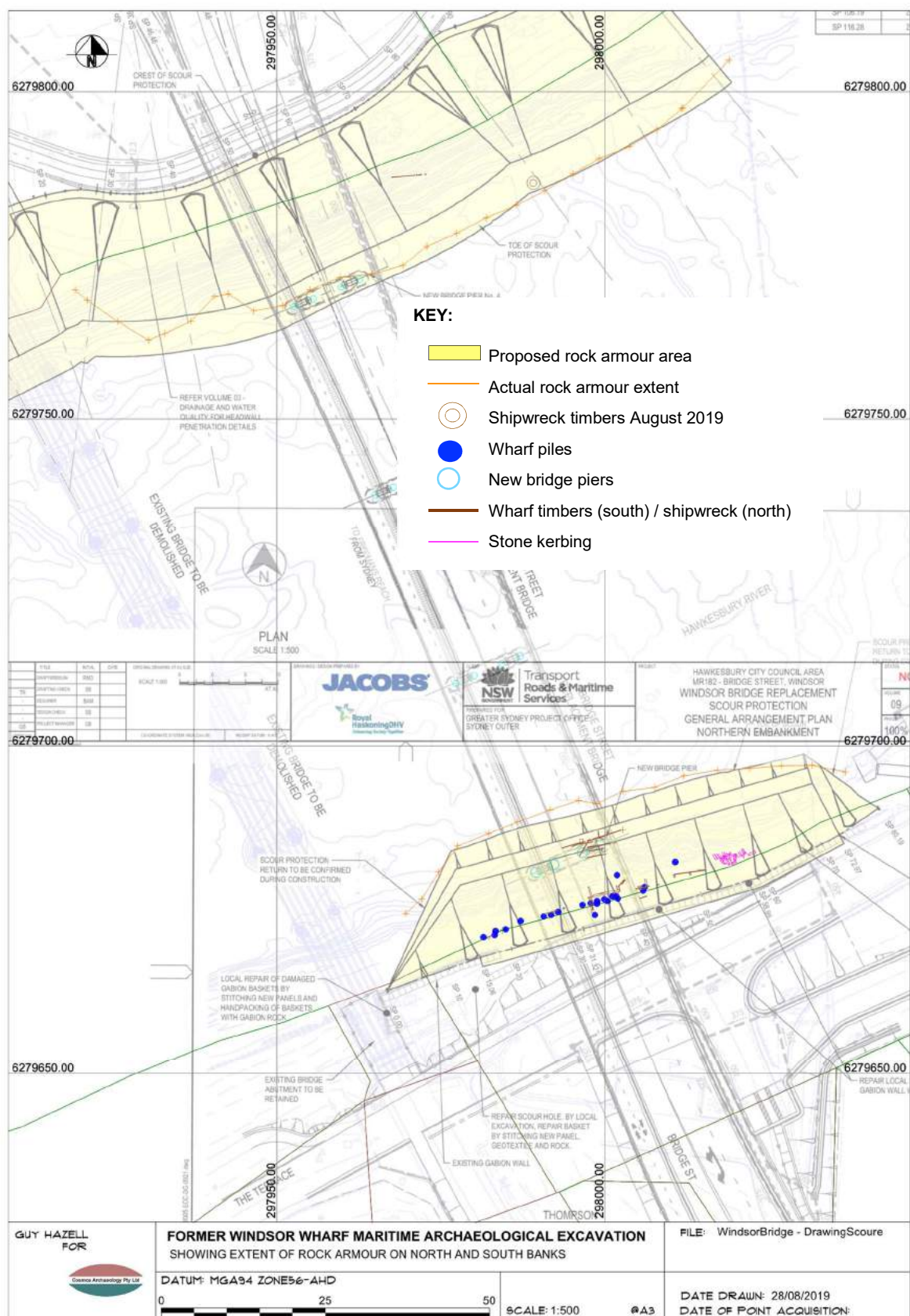


Figure 319: Windsor Bridge Rock Armour overlay, showing extent of rock armour on both the north and south sides, compared to proposed plan.³⁰³

³⁰³ **Jacobs & Royal Haskoning DHV 13 April 2017** Hawkesbury City Council Area, MR82 – Bridge Street, Windsor. Windsor Bridge Replacement from Macquarie Street to Wilberforce Road – Detailed Design Volume 09 Scour Protection.

12.4.3 Wreck timbers

During the first observation dive for the north side survey on 19th August 2019, timber fragments were observed. One timber had what appeared to be a scarph joint and was abutting the rock armour (Figure 320). The diver retrieved this timber and another as well as several smaller fragments. These timbers all had evidence of modern breakage at the ends. The long timbers were labelled Plank 01-190819 (Figure 321 and Figure 322) and Plank 02-190819 (Figure 323) and placed in the holding skip which contained wreck timbers associated with UHRW02 to 04.³⁰⁴ The smaller fragments were discarded as there was not enough timber left for diagnostic purposes.



Figure 320: Timber plank 01-190819 abutting rock armour north side Hawkesbury River, scarph joint visible at top of timber. Diver facing north. (Video: WBRP Rock Armour run 001, still image taken at 00:08).



Figure 321: Plank 01-190819, note modern breakage at one end and scarph joint at the other. Image taken 23rd August at works compound.

³⁰⁴ Op. Cit. Cosmos Archaeology April 2021



Figure 322: Detail of scarph joint on Plank 01-190819. Image taken 23rd August at works compound.



Figure 323: Plank 02-190819. Image taken 23rd August at works compound.

On 20th August, the area where the shipwreck timbers were found was again inspected for loose timbers. Diver removed Plank 01-190820 (Figure 324) **Error! Reference source not found.** from this area. The timber had canvas sheathing held to the plank by tacks, ferrous fastenings and a scarph joint at one end. Another plank, 02-190820 (Figure 325), was also removed. This timber had round fastening holes and saw marks, but no evidence of pitch. Both timbers were placed in the skip for future recording.



Figure 324: Plank 01-190820. Image taken 23rd August at works compound.



Figure 325: Plank 02-190820. Image taken 23rd August at works compound.

During recording on 23rd August, it was determined that all four timbers were likely from the same vessel, as they all displayed similar characteristics. These included dimensions of the planks, canvas sheathing attached by tacks with pitch/tar underneath, ferrous fastenings, saw marks and scarph joints.

One plank was unable to be removed from the riverbed. This timber extended out of the riverbed approximately 350 mm and was loose but attached to another timber running horizontally underneath the sand (Figure 326). This timber ran in an upstream-downstream direction and was too deep to be exposed by hand. These timbers were left in position as a reference point for future surveys.



Figure 326: Timber plank with attached timber underneath the riverbed. Diver facing downstream. (Video: WBRP Rock Armour run 003, still image taken at 00:35)

It did not appear that any of the timbers had been exposed due to scouring from the rock armour, as the riverbed was flat and sandy with some timbers lying loose on the sand.

Proposed mitigation measures

The timbers have been deemed to be of Local Significance. They currently have been left exposed on the edge of the rock armour.

During the next inspection, these timbers should be re-visited and their condition assessed. If they are still exposed, they should be covered with geofabric, labelled and surrounded by rock armour (see Section 13.2).

13 Monitoring Methodology

The MATR-MARD-DSS outlined potential monitoring protocols to be followed after installation of the rock armour to alleviate assessed potential impacts of the rock scour protection on the former Windsor Wharf on the south side of the River. The MATR-MARD-DSS considered that the most likely broad protocols would consist of a series of inspections beginning with a baseline survey one month after installation of the rock armour, a second dive inspection six months after the baseline survey and a third six months after the second dive inspection.³⁰⁵ These monitoring protocols were extended to include the north side of the river after the location of the shipwreck timbers in January and February 2019.³⁰⁶

The baseline survey however did not observe any cultural material exposed through scouring or major changes to the condition of the riverbed around the toe of the rock armour. Therefore, it was recommended that the next inspection be scheduled 12 months from the date of the baseline survey – this being August 2020.

This inspection was to be carried out under the supervision of a maritime archaeologist. The objective would be to collect data to compare to the results of the baseline survey. If any cultural material has been exposed, this will need to be assessed and the significance of the finds and level of threat would dictate mitigation options.

Depending on the condition of the finds and the level of threat to the find a number of mitigation options could be implemented such as recording the exposed remains *in situ* and covering with rock armour, recovering of artefacts, to limited archaeological excavation. For example, if early 19th century phases of the former Windsor Wharf are exposed the appropriate mitigation would be to cover the remains with scour protection or rock armour. See Section 13.2 for further mitigation responses.

13.1 Peak flood events

The follow up inspections mentioned above are for when the river is running as ‘normal’. However, the Hawkesbury River and the Windsor area is subject to peak flood events. The 2012 Environment Impact Statement produced for the Windsor Bridge Replacement Project modelled estimates of peak water levels along the Hawkesbury River and floodplain in the vicinity of Windsor. Based on the results of previous flood studies, this data showed that peak flood levels at the new Windsor Bridge are 11.1 metres Australian Height Datum (AHD) and 17.2 metres AHD for the five year and 100 year ARI events respectively.³⁰⁷

If such a peak flood event occurs prior to the next scheduled inspection, an extra inspection should be scheduled once the water recedes. This will enable early intervention in the event of scouring caused by the increased water movement and debris washed into, and out of, the area. The possibility of more than one flood inspection should be considered.

A flood event occurred in February 2020 where levels peaked at 9.2m. A dive inspection was undertaken when it was considered safe to do so in April 2020.³⁰⁸ The key findings of the inspection were:

- *There has been significant sediment changes to the riverbed, with the north side building up sediment and the south side washing away.*
- *There is no evidence of cultural material being exposed through scouring at the toe of the rock armour on either the north side or the south side of the river bank.*
- *Wreck timbers located during the 2019 survey were not relocated. It is likely, due to the sediment changes on the north side, they are now covered.*

³⁰⁵ Op. Cit., Cosmos Archaeology Pty Ltd March 2018

³⁰⁶ Op. Cit. Cosmos Archaeology Pty Ltd, April 2021

³⁰⁷ Sinclair Knight Merz, November 2012, Windsor Bridge Replacement Project – Environment Impact Statement. Prepared for NSW Roads and Maritime Services, pg. 352.

³⁰⁸ Cosmos Archaeology Pty Ltd, May 2020. Windsor Bridge Replacement Project; Flood inspection – Scour protection

- In 2019, the only evidence of scouring noted was on downstream side of each of the bridge piles at Bridge Pier 4 in 2019. In 2020, it appears that the sediment changes have filled in some of this scouring.
- There is no exposed geofabric at the upstream and downstream extent of the south side rock armour. The rock armour has settled into position and is holding the geofabric to the riverbed.

The inspection report also recommended:

Recommendation 1: August 2020 dive survey not required

The 2019 Scour Protection Survey Report recommended a second dive survey was to be carried out one year after the August 2019 baseline survey.³⁰⁹ The survey conducted in April 2020 has made the requirement for an August 2020 survey redundant.

Recommendation 2: Post peak flood dive surveys to continue after old bridge removed.

The April 2020 dive survey found that flood events lead to accretion on the north bank and scouring on the south bank. Though this appears to be an historical occurrence it is possible that the removal of the old bridge piles may alter the pattern that has been observed to date.

13.2 Proposed threshold limits and management responses

Based on the findings of the baseline survey the following threshold limits are proposed which would trigger the appropriate recommended management responses (Table 25).

Table 25: Threshold limits and management responses during scour protection surveys.

Activity	Threshold	Proposed Action	Proposed site mitigation
August wreck timbers exposed as per baseline survey	Nil	If timbers cannot be removed: wrap with geotextile and label with cattle tag. If timbers can be removed: remove timbers from water, record and place with wreck timbers previously located.	Cover and surround with rock armour
August wreck timbers scoured out exposing further cultural material	Nil	Record all exposed cultural material <i>in-situ</i> . If timbers cannot be removed: wrap with geotextile and label with cattle tag If timbers can be removed: remove timbers from water, record and place with wreck timbers previously located.	Cover and surround with rock armour
August wreck timbers expose articulated wreck remains	Nil	Possible archaeological excavation to assess extent of timbers and record <i>in-situ</i> . Assess significance.	Possibly remove timbers or cover with geofabric and rock armour depending on result of significance assessment.

³⁰⁹ See Section 12.

Activity	Threshold	Proposed Action	Proposed site mitigation
Scouring around toe of rock armour	Noticeable scouring (1m long and 0.5m deep)		Further inspection in 12 months.
Exposure of 19 th century wharf in scoured area	Visible bed logs or wharf timbers at or near 2018 excavation site	Record <i>in-situ</i> .	Cover with sediment and rock armour. Further inspection 12 months after changes addressed.
Exposure of loose cultural material artefacts in scoured area	Artefacts visible on surface of riverbed	Record <i>in-situ</i> . Remove and assess significance. Action according to artefact retention policy.	If not discarded, return to where found and cover with sediment and rock armour. If scouring has reached threshold above, then a further inspection 12 months (August 2020) after changes addressed.

14 Artefact Repository

A total of 10,639 artefacts were recovered during the maritime archaeological excavation. In accordance with the artefact retention policy (Annex A), artefacts (excluding Aboriginal artefacts) were divided during cataloguing into three management categories – conservation, relocation (underwater reburial), and de-accession (discard) – see Section 5.9 for further information. Table 26 below shows the number of artefacts designated to each of these three categories.

Table 26: Artefact management designations

Status	Artefact raw count	Artefact %
Conserve	179	1.7%
Relocate	1,983	18.6%
De-accession	8,477	79.7%
Total	10,639	100%

A comparison of the costs associated with reburying the 1,983 artefacts assigned for relocation in a secure site, against the costs of conserving them found the costs were comparable. It was therefore decided that the artefacts assigned for relocation would instead be retained and conserved where necessary according to material type and condition. In the end, a total of 1904 artefacts were conserved. The remainder of those originally selected for relocation – such as bricks, ceramics, and glass – did not require conservation treatment because the Hawkesbury River at Windsor is essentially fresh and contains very little salts that can damage such materials.

The artefacts selected for conservation were treated by International Conservation Services (ICS), and then all artefacts selected for conservation and retention were delivered to the Hawkesbury Regional Museum at Windsor by Transport for NSW and WolfPeak Environment and Heritage in early 2021.

The artefacts assigned for de-accession, that is to be discarded, included common and / or low significance artefacts, modern (post-1950s) artefacts, and undiagnostic artefacts. 1,527 of these artefacts were donated to interested research institutions including Silentworld Foundation and the Department of Archaeology, Flinders University, for use as reference collections and teaching aids. The remainder of artefacts assigned for de-accessioning were left at the storage facility where they had been housed since November 2018 for Transport for NSW to dispose of as seen fit (see Section 5.9.3).

15 Interpretative Signage

Public information relating to the maritime salvage archaeological program was managed in accordance with the RMS Community and Stakeholder Engagement Plan for the WBRP.

An A2 sized interpretation sign (Figure 327 and Figure 328) was placed at the public wharf adjacent to the site and nearby public boat ramps that contained the following information:

- History of the former Windsor Wharf;
- The rationale and objectives of the excavation, and;
- Safety information such where diving works are taking place and to be aware of dive flags.



Figure 327: Location of the A2 Sized interpretation signage during excavations.

An earlier version of this report was referenced and was used in the preparation of the Heritage Interpretation Plan - Stage 2, Windsor Bridge Replacement Project (October 2020), and interpretative signage content.



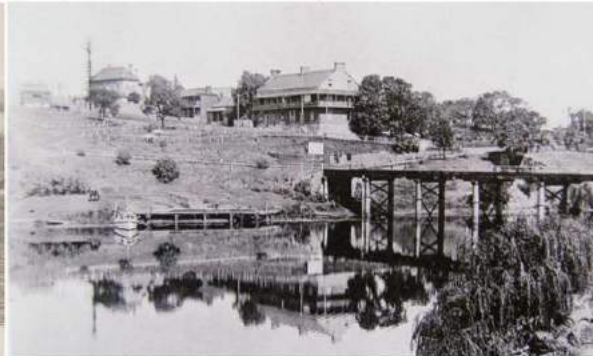
Transport
Roads & Maritime
Services



The Windsor Bridge Replacement Project



The Windsor wharf in a state of disrepair after a flood. C. 1818. A watercolour drawing titled 'Hawkesbury and Blue Mountains, / from Windsor', which is inscribed 'James Wallis 1815 with Camera Lucida', is in a private Sydney collection. (State Library of NSW Call no. PXD 373/1)



Thompson Square, the wharf and Windsor Bridge around 1900. Note the slope above the wharf is more gradual than it is today. It shows how much the riverbank has been raised with fill and Gabio baskets as a means to reduce the effects of erosion and flooding. (Source: State Library of NSW, Mitchell Library, Small Picture File.)

History of wharfage at Windsor

Phase 1 : 1795- ca. 1806	Phase 2 : 1814-1860's	Phase 3 : 1874-1934	Phase 4 : 1934-1950's	Phase 5 : 1950's onwards
A wharf and store were built in 1795 and destroyed in 1799. The wharf was rebuilt but was washed away in 1800-01 or in 1806. Based on historical analysis it is thought to have been constructed on the south-western side of Thompson Square, adjacent and up stream of the current bridge. The presumed site of the wharf store is outside the impact area	In August 1814, the first Howe and McGrath Wharf contract was issued for a wharf, 50 ft (15 m) in length, projecting 18ft (6 m) into the river. Piles were to be spaced 3ft to 4ft (about 1 m) apart and were to be 16" (41 cm) to 18" (46 cm) thick. In June 1815 the wharf was described as projecting 20ft (6 m) into the river, 6ft (2 m) high and 65ft long (20 m). The second Howe and McGrath Wharf was, or was in the process of being extended by an additional 226ft (69m) and 33ft (10 m) wide. There were at least 3 rows of piles, two of which were forward of the edge of the apron of the first wharf. Planking was to be 2" (5 cm) thick and 6" (15 cm) wide fastened with 5" (13 cm) spikes with capwales and land ties. These wharves were damaged and/or destroyed by a series of major floods throughout the 1810s. The Greenway wharf was constructed in the 1820's and is of State Significance. There are no contemporary records of the dimensions and manner of construction of the wharf. An 1835 plan of Windsor showing the wharf depicts it being ca. 26 m (85ft) long and ca. 8 m (26ft) wide. This was larger than Howe and McGrath's first wharf but substantially smaller than their second wharf, which may never had been completed.	The wharf was rebuilt in 1874. There are no contemporary records of the dimensions and manner of construction of the wharf. Given the date of construction, it very likely involved new screw piling technology or piles driven into the riverbed by steam powered hammers. A plan from 1894 shows the wharf as being ca. 30 m long at the riverward edge and ca. 6 m wide. It was presumably built from timber.	The wharf was rebuilt in 1935. There are no contemporary records available of the dimensions and manner of construction of the wharf. It was presumably built from timber with possible steel and concrete elements. The remains of this wharf are those that which are most visible along the riverbank and the riverbed at low tide.	Attempts at bank stabilisation involved a steel girder and concrete retaining wall, rock armour composed of basalt boulders and occasional sandstone.

Maritime Archaeological Excavation

Four of the piles of the new bridge will be constructed within the area where the remains of the Phase 2 wharf are located. The remainder of the wharf site is to be covered - and protected - with scour protection.

To mitigate the impact of the construction of the new bridge on the archaeological remains a maritime archaeological excavation is underway. The objectives of the excavation are to:

- * Understand how the Phase 2 wharf was constructed.
- * What activities took place there.

To achieve these objectives a maritime archaeology team is excavating to recover artefacts and to expose the timber remains of the wharf. Select artefacts will be retained for conservation and display while the remainder that are to be retained will be reburied near the site.



For the safety of the divers a marine Exclusion Zone has been set up around the work site. The Zone is marked by the yellow corner buoys you can see. There are penalties for unauthorised entry into the Exclusion Zone. For more information on see Marine Notice SY1819.

Timbers of old wharfage close to Windsor Bridge visible in 1989. The fastenings visible in the image suggests these are either the remains of the 1935 or perhaps the 1874 wharf (Source: E. Higginbotham, 'Historical and Archaeological Investigation of Thompson Square, Windsor, NSW', report to Hawkesbury Shire Council, 1986, inventory no. 10.)

Figure 328: The A2 sized interpretation sign placed at the public wharf.

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