AKAROA WHARF RENEWAL: PRELIMINARY REBUILD OPTIONS

PREPARED FOR CHRISTCHURCH CITY COUNCIL

710552.005 | 31 May 2019

Calibre Consulting Ltd

QUALITY ASSURANCE STATEMENT

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1 EXECUTIVE SUMMARY

The Akaroa wharf is a 155m long timber wharf originally constructed in 1888. It is majority owned and maintained by Christchurch City Council (CCC). The wharf is in a condition that requires significant investment to remain safe for public use, and CCC have made provision for this in their medium and long term plans.

This report sets out structural approaches for the wharf with the brief to create a wharf that will last a minimum of 100 years. The factors we considered that will influence the physical design options were construction materials and location and of the structure. The options that have been developed have been prepared as starting points for discussion with Christchurch City Council, the project team and the community.

The visual condition of the wharf is moderate to poor, with further hidden deterioration very likely. Even exchanging old materials for new, like for like would essentially require a rebuild, as the vast majority of the structural timber requires replacement now or in the near future.

The wharf timber is generally Australian hardwoods which were typically used for the construction 19th Century wharves in New Zealand. This timber is significantly stronger than the treated softwood which is commonly available today. Large hardwood sections are not readily available in volume, selective harvesting of large hardwood timber can contribute to deforestation. A careful balance must be found between minimising the environmental impact of sourcing hardwood timber and minimising the heritage impact of using modern construction materials.

A brief summary of the preliminary structural options presented for wharf upgrade are;

Option 1 - Full Restoration of the existing wharf with like for like hardwood timber

Option 2 - Full Replacement with mixture of concrete and hardwood timber (Visible members would be hardwood)

Option 3 - Full Replacement with modern reinforced concrete

A brief summary of the preliminary options for location of the wharf are

Option A - Same position as existing

Option B - Along the north side of the existing position

Option C - New location, possibly at original wharf site of Church St

Changing the location of the wharf would likely be contentious, though not without precedent as the wharf was built as a replacement to an earlier jetty located at the end of Church Street around 50m north west. Building the wharf in a new location would simplify construction as the existing structure could continue to operate. This would minimise the economic impact of the wharf upgrade and keep the construction work and traffic away from crowds. It is recognised however that moving the wharf may have a significant impact on the heritage character of the historic waterfront.

The current wharf has evolved as it's use has changed, currently two jetties are used to accommodate tenders from cruise ship visits during the summer season. The wharf is known to become highly congested, so the upgraded wharf could be wider in areas where crowds gather. Fishing vessels also use the wharf, however berthing is restricted to commercial vessels less than 10m. A new structure could be designed for larger ships including other vessels that are known to visit during storms.

Options 3 and C would be easier to construct, be less disruptive to current operations and provide a more durable structure, however these options have the greatest impact on the heritage character to the historic waterfront area.

2 INTRODUCTION

2.1 Background

Christchurch City Council (CCC) owns the 155m long wharf at Akaroa. The wharf was built in 1888 and served as the main economic gateway for both passengers and goods until the mid-twentieth century.

Recently the wharf has again become of significant economic importance to Akaroa due to the diversion of cruise ships and tourists from Lyttelton, and serving as a hub for the sight-seeing tours within the harbour. The wharf is also regularly used by commercial fishing vessels.

CCC have regularly engaged engineering consultants to complete structural inspections with ongoing specified repairs. The most recent inspection was completed in August 2018 and Calibre assessed the condition of the wharf to be moderate to poor. The wharf is over 130 years old and a large amount of the original material has been replaced which is also deteriorating.

Following previous inspections, CCC had made allowance for temporary upgrade of the wharf to survive the next 5 years.

2.2 Important Notes about this Report

The purpose of this report is to discuss options for the wharf upgrade to help CCC engage with stakeholders to find the best outcome for the community of Akaroa.

Different construction materials and structural forms will be discussed, along with high level concepts. The wharf is a key component of the Akaroa historic waterfront area, and commentary about the potential impact of the wharf upgrade can be found in the Akaroa Main Wharf Conservation Plan dated May 2019 by Origin Consultants.

No cost estimates are provided in this report, although the relative cost of the differing options will be discussed. The cost of the wharf upgrade will be heavily influenced on the level of service required during construction.

This report refers to various structural members that form wharf structures, so an annotated diagram is provided in Appendix B for guidance.

This report is intended for the use of the Christchurch City Council and Calibre do not accept any liability for any use of or reliance on the report by third parties, however Calibre recognise the obligations for CCC to distribute this report to other interested parties such as Heritage NZ and/or architects.

3 DESCRIPTION OF EXISTING WHARF

Akaroa Wharf is a linear wharf, 155m long. Alongside the council owned wharf are some privately owned buildings, supported by a combination of privately owned and council owned piles. The area of the wharf deck is approximately 1125m², excluding the privately owned buildings. The wharf in its current configuration is shown in Appendix A.

The deck of the wharf is was originally formed by 4" (100mm) thick hardwood planks. These have been replaced by 50x100mm softwood timbers planks on edge between bents 0-12 and bents 23-40. Running boards above the deck between bents 0 -12 have been installed to allow vehicle access. The deck between bents 12 and 23 is 100-200mm thick reinforced concrete.

A concrete approach, 20m long provides access to the wharf. During the Canterbury earthquake sequence the approach reportedly suffered liquefaction with severe cracking still visible.

The pile caps and stringers were originally Ironbark timber beams, typically 350x300 (capping beams) and 350x200 (stringers). Stringers that were identified as in need of repair in previous assessments have been made redundant by the addition of steel stringers alongside. The piles comprise of a mixture of original hardwood piles and newer softwood piles. In some locations concrete or steel jackets have been installed to reinstate the capacity of deteriorating piles.

The lateral load resisting system in the wharf is a combination of raking piles and bracing. Raking piles are located approximately every fourth bent. The majority of the original hardwood bracing has been replaced by steel tension only bracing.

Two pontoon structures, one on either side of the main wharf were constructed approximately 10 years ago. The pontoons are floating steel structures anchored in place by steel piles driven into the seabed. The pontoon on the south side of the wharf is approximately 68m^2 and the pontoon on the north side of the wharf is approximately 81m^2.

There are several privately owned buildings built alongside the wharf. The buildings rely on council owned piles along grid line C for structural support. The buildings have limited bracing and so may also rely on the council owned wharf for lateral load resistance. This will need to be considered during the replacement of the wharf.

3.1 Current Use of the Wharf

The wharf was originally constructed for coastal shipping and was the primary means of access for both goods and people. However its use declined and access to Akaroa has been mainly via road since the middle of the twentieth century.

The main users of Akaroa Wharf are tourists, fishermen, cruise ship transfers and recreational walkers. There are several privately owned buildings built over the harbour directly adjacent to the wharf offering souvenirs and harbour tours. There is also a caravan on the wharf which sells fresh fish. The wharf is known to get very busy during the summer season, over 4,000 passengers can arrive at wharf via tenders from cruise ships on a single day.

Fishing vessels regularly moor at the wharf to restock and allow the crew off. Larger fishing vessels are known to berth at the wharf during storms to take shelter.

3.2 Condition of Wharf

The structure has been assessed in Calibre report dated August 2018 to be in a moderate to poor condition, with numerous elements nearing the end of their life. Many of the original hardwood elements have been replaced. Repairs completed in the last 10-15 years mainly comprise replacement of the original hardwood structure with galvanised steel beams and stainless steel bracing. Some of these repairs are now in poor condition with a large proportion of the stainless steel tension bracing needing replacement this year.

In August, immediately following the inspection of the wharf, urgent repairs were recommended which have since been completed. Further repairs are currently underway, intended to keep the structure in use for another 5 years. It is expected that the structure will be upgraded within this time frame.

Many of the original piles have already been replaced or repaired and there is evidence of widespread Teredo worm damage, the loss of section is highly variable though is typically confined to the intertidal zone. Once marine borer are in the piles there is little that can be done to mitigate except replace the piles and install a barrier (FRP jacket or similar) covering the intertidal zone to prevent future infestation.

It should be noted that the wharf has already been significantly altered through the addition of modern jetties, a concrete deck, handrails and buildings alongside and on the wharf.

4 PRELIMINARY OPTIONS FOR WHARF UPGRADE

The wharf requires significant investment to remain safe for public use in the medium and long term, and CCC have provision for this in their long term plan. Demolition of the wharf without replacement has been discounted due to the economic, heritage and social value of the wharf. The wharf is very important to the tourism industry and is a key component of the historic waterfront at Akaroa.

The main considerations in upgrading the wharf are

- Type of materials , hardwood or softwood timber or concrete
- Site location , existing or new site

4.1 Choice of construction materials / form

Australian hardwoods were used for the construction of most 19th Century New Zealand wharves. Treated softwood timber is significantly weaker and cannot be substituted like for like.

Currently equivalent hardwood sections are not readily available in volume, the selective harvesting of timber contributes to deforestation. A careful balance must be found between minimising the environmental impact of sourcing hardwood timber and minimising the heritage impact of using modern materials.

The wharf upgrade options have been considered on the basis that the wharf should last 50 years with only 'routine' repairs and maintenance. We have summarised the three options for the materials to be used for the wharf upgrade.

4.1.1 Preliminary Option One, Refurbishment of existing wharf, like for like materials.

Refurbishment of the wharf would comprise a like for like replacement of each structural element retaining the form of the existing wharf. A full refurbishment would also restore some of the structural elements that have been replaced such as the hardwood cross bracing and timber decking.

There is very little of the 1888 structure that could be retained and expected to last 50 years, which means that effectively even the refurbishment option would essentially be a rebuild. This option would have the least impact on the heritage character of the waterfront area, however it would also have the largest environmental impact due to the volume of hardwood that would be needed. With much of the timber structure (i.e. central stringer beams) being hidden from view, it is considered wasteful to put hardwood in these locations.

The level of the existing wharf's deck is approximately one metre above from the mean high water line, anecdotally, we understand that during king tides, sea water was seen coming through the floor of the buildings and wharf deck. With the anticipated rise in sea level due to climate change, keeping the wharf deck at the same height is not recommended.

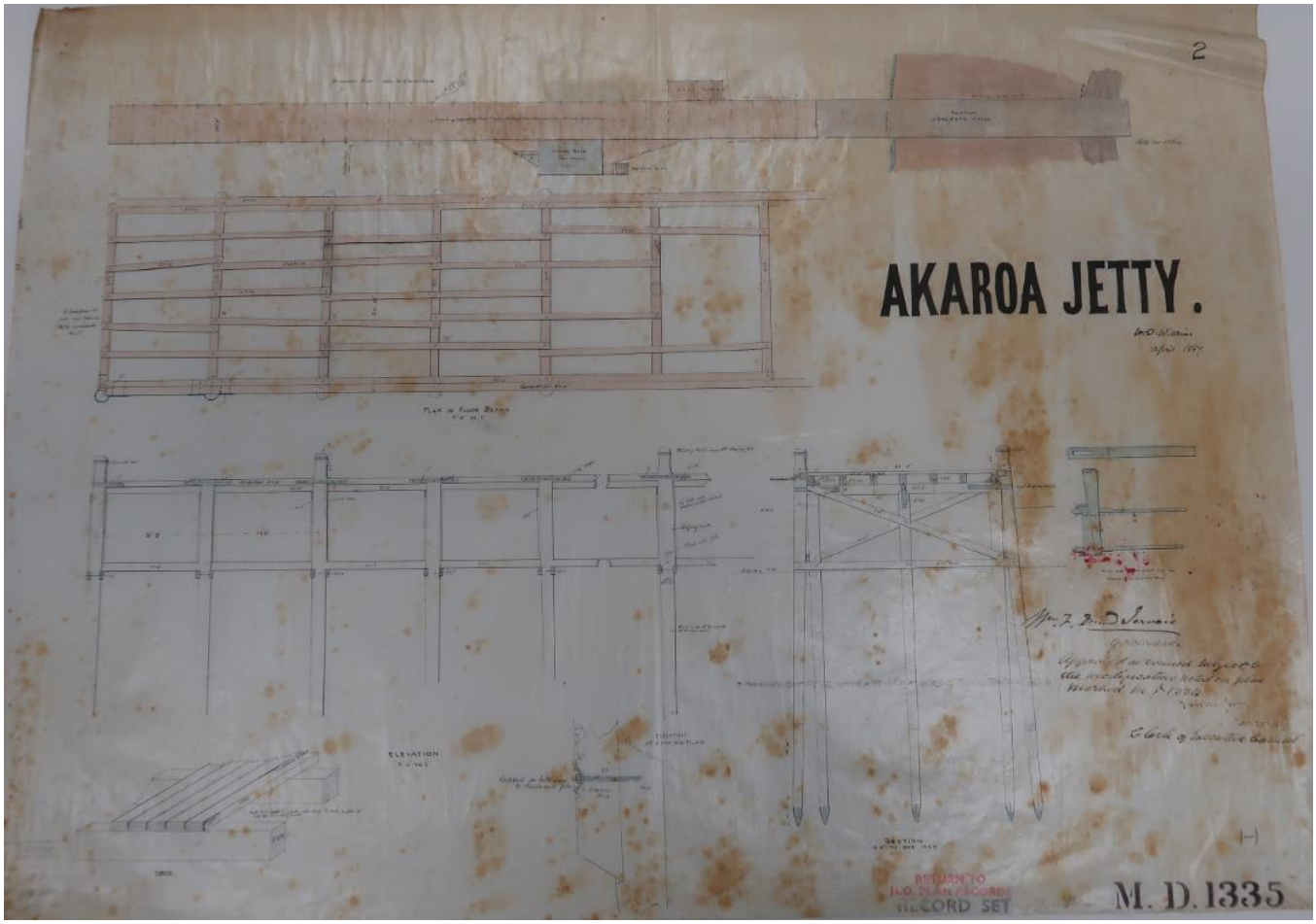


Figure 4.1 Original 1887 construction drawings for the main wharf at Akaroa

4.1.2 Preliminary Option Two, Replacement wharf, mixture of concrete and timber structural elements.

This option would use hardwood for prominent members and reinforced concrete for elements which are hidden.

The piles, bracing, cap beams and walers would be hardwood timber. These members are below the deck and give the wharf structure much of it's character.

It is proposed that the stringer beams would be concrete, although the outer stringer beams are exposed, these could be hidden behind non-structural facing timbers recycled from the existing wharf structure. This would help maintain the character and fabric of the existing wharf.

Based on a new wharf of a similar size to the existing structure, using concrete stringers would reduce the amount of hardwood timber required by 1,100 linear meters. Using a concrete deck instead of the 100mm thick decking would save a further 115m³ of hardwood timber.

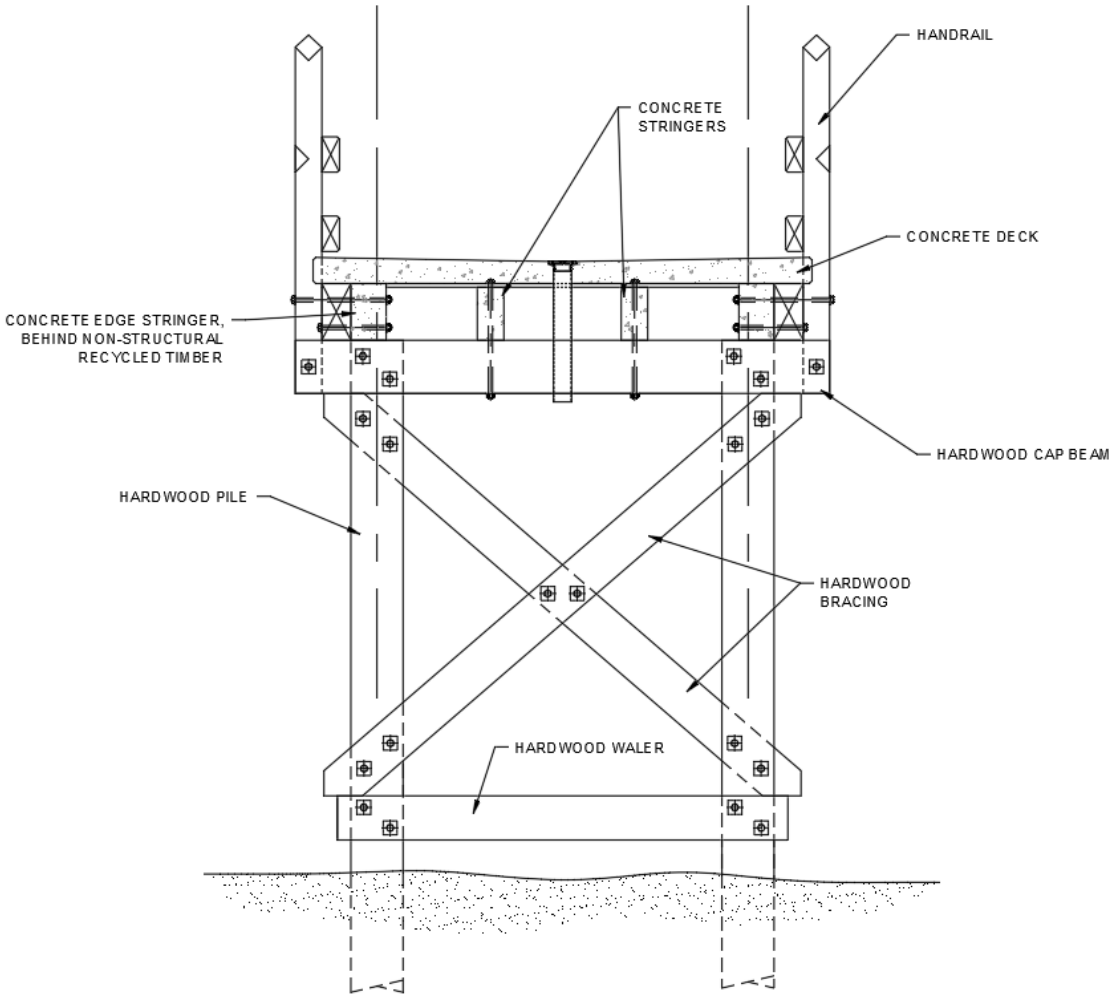


Figure 4.2 Indicative cross section through wharf with proposed materials for option two

Figure 4.3 Photograph showing refurbished wharf with timber bracing, piles and walers, concrete edge beam and deck.

4.1.3 Preliminary Option Three, Replacement wharf, modern reinforced concrete structure

A new modern reinforced concrete structure, built with a higher deck than the current wharf. A modern structure can easily be designed to accommodate berthing loads from larger fishing vessels that are known to berth at the wharf, taking shelter during storms.

Using modern materials for the piles would mitigate the risk of damage from marine borers. Fewer piles would need to be driven and standard pre-cast bridge beams could be used to form the deck.

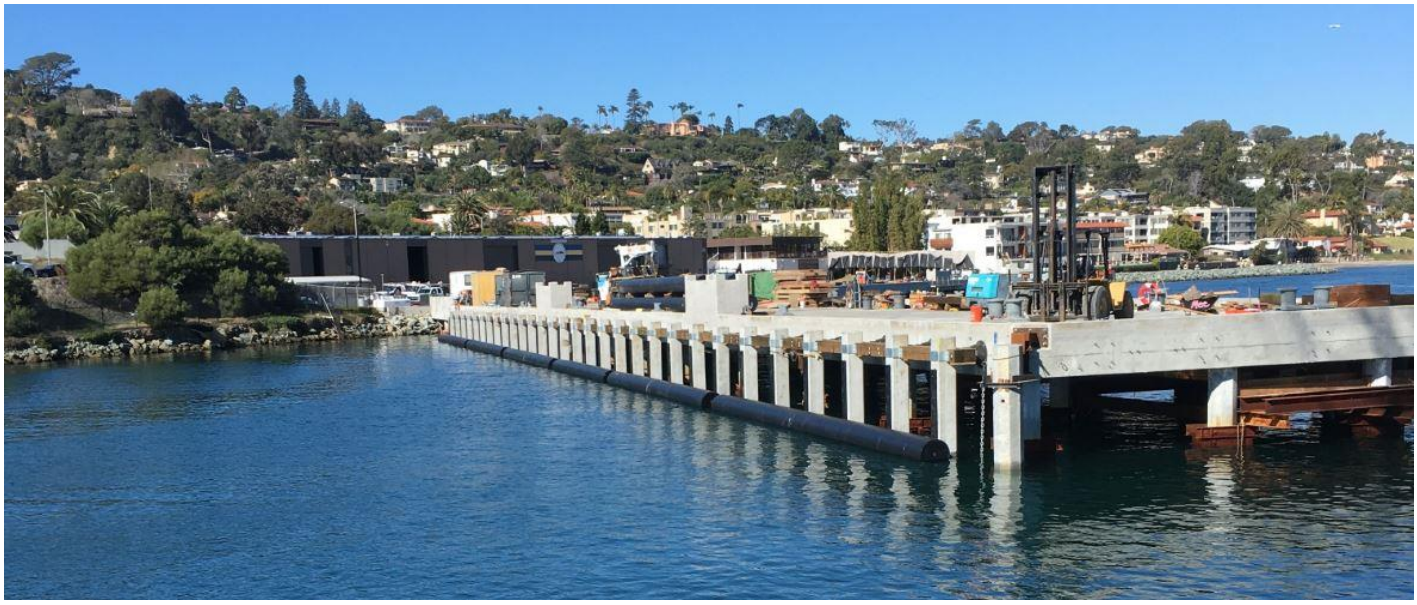


Figure 4.4 UCSD Nimitz Wharf. Example of reinforced concrete wharf

Figure 4.5 Rangitoto Island Wharf, Auckland. Example of reinforced concrete wharf

A wharf using modern construction materials could have a significant impact on the heritage character of the Akaroa Waterfront Historic Area, but would not rely on sourcing a large volume of hardwood timber.

4.2 Location of replacement structure

Changing the location of the main wharf at Akaroa could have an impact on the character of the waterfront area, however this could simplify construction process as the old wharf could remain in use whilst the new structure is built. Moving the wharf would have implications for the privately owned buildings that are adjacent to and partially on the current wharf. These buildings rely on the CCC owned wharf for structural support.

4.2.1 Preliminary Option A, Wharf built in existing location.

The wharf could be upgraded, with the structure staying in its existing location. Some of the existing structure could be used, though this is likely to be limited to the piles which would be repaired with the deteriorated top sections replaced with new piles and spliced to the original timber.

It is assumed the wharf will continue to operate during the upgrade, this will complicate the construction and there is risk having crowds in the vicinity of a large construction project. Building could cease during the summer season, however, this would require multiple mobilisations and extend the duration and cost of the project.

Building in the current location would also be complicated by the presence of privately owned buildings on the edge of the wharf. These buildings rely on the piles of the wharf for structural support. CCC would need to agree a holistic approach to the wharf upgrade with the building owners as the new wharf will be higher making modifications to the existing buildings necessary.

4.2.2 Preliminary Option B, Wharf immediately to the north of existing location.

A new wharf could be built alongside the existing structure, with the Northern side being most suited due to the existing buildings on the Southern side. The current wharf could continue to operate from one side / jetty during construction of the replacement structure, this would reduce the impact on the tourism that depends on the wharf though there would still be construction traffic in the busiest part of Akaroa.

Moving the wharf would require modification of the approach and abutment, however significant work is expected to the existing abutment to accommodate a higher deck and to mitigate the risk of liquefaction.

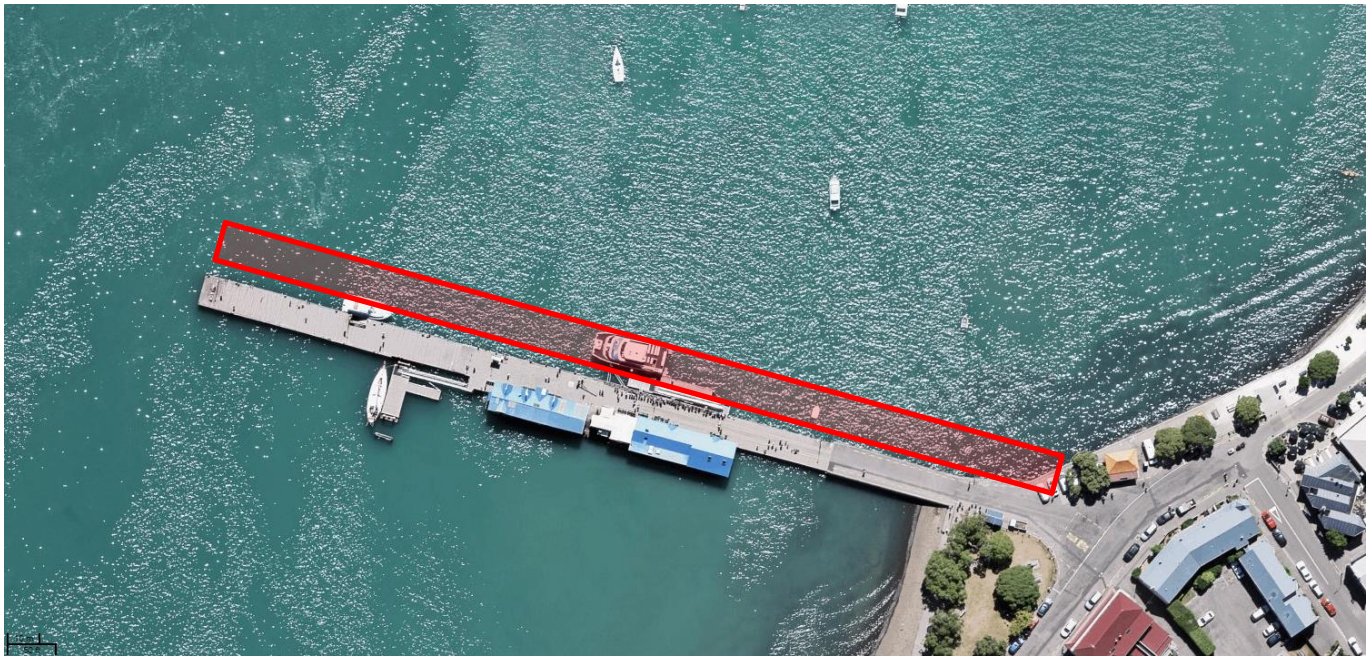


Figure 4.6 Location of wharf adjacent to current structure, option B

4.2.3 Preliminary Option C, Wharf built at approximate location of 1850's jetty

The original jetty was located at the end of Church Street, as shown in the locality plan for the 1887 wharf, Appendix C. A new wharf could be built in this location, this would mean the existing wharf could continue to operate with little impact from the construction works. Compared to the other location options, the construction traffic would be relatively isolated from tourist crowds using the wharf.

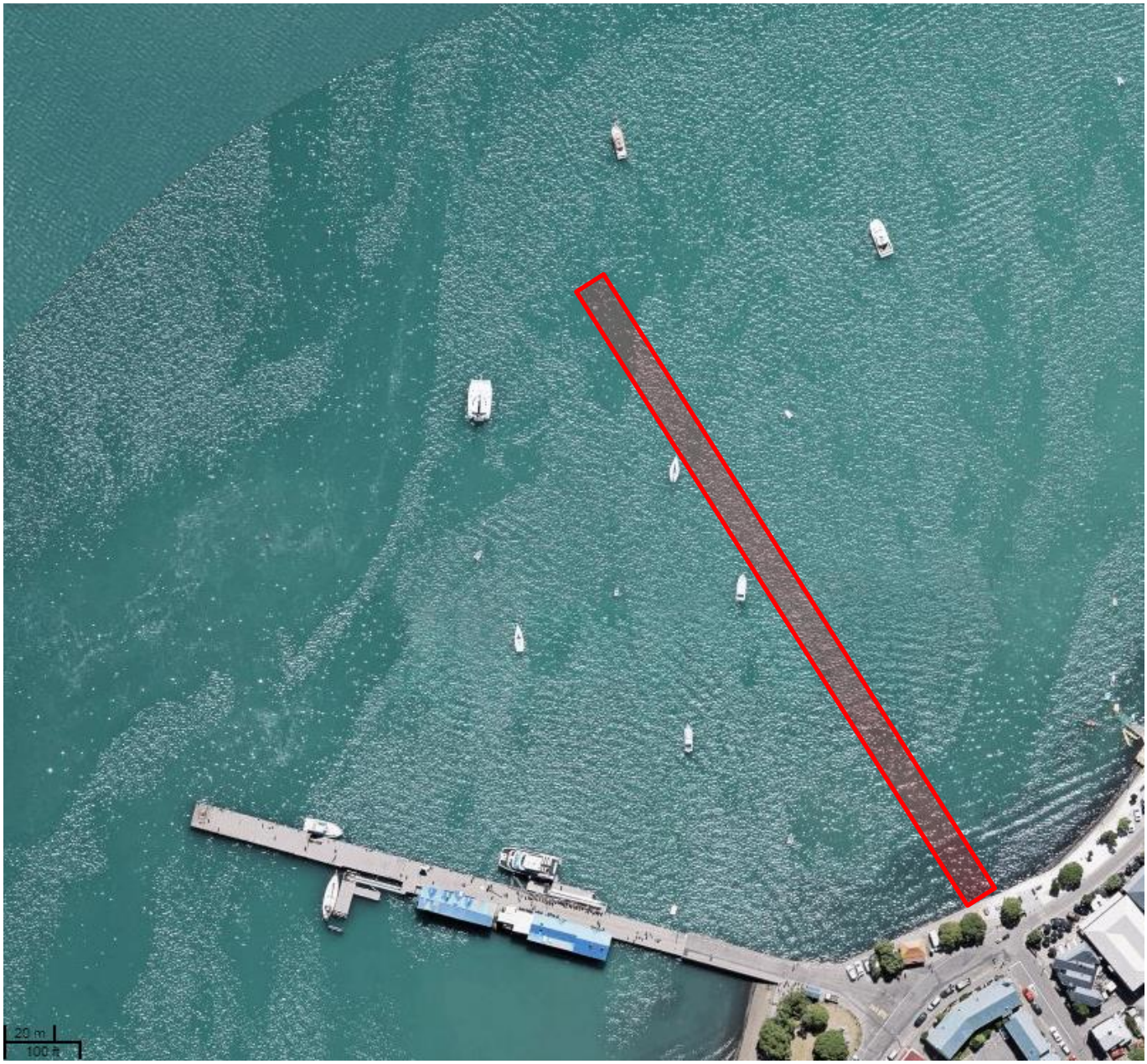


Figure 4.7 Location of new structure, approximately where 1850's jetty was located, preliminary option C

5 Recommendations

It is recommended that the options in this report are debated as part of a public consultation process. This should include the owners of the buildings adjacent to the wharf.

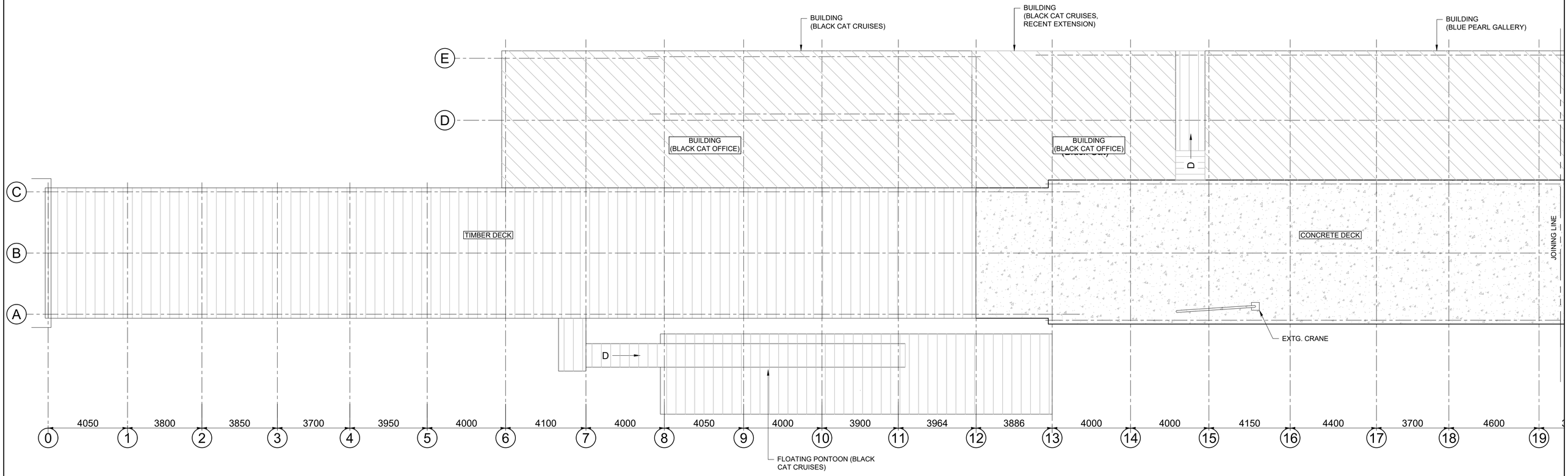
The preliminary options in this report should also be assessed by heritage consultants who can comment on the impact of each proposed solution. Minimising the heritage impact of the wharf upgrade will simplify the process of obtaining a resource consent. We understand that Council will also be engaging with Ōnuku Rūnanga on the cultural context of the wharf as a part of the renewal planning and design.

CCC investigate the procurement of hardwood timber from sustainable resources.

AKAROA WHARF RENEWAL: PRELIMINARY REBUILD OPTIONS

Appendix A Plans of current wharf configuration

CHRISTCHURCH CITY COUNCIL



DECK LAYOUT PLAN

1:100 (A1)
1:200 (A3)

Revision	App	Date
Surveyed		
Designed	WS	02/19
Drawn	MB	02/19
Reviewed	TA	02/19
Approved	BW	02/19

Client: Christchurch City Council

Project Title: Akaroa Wharf
Wharf Repairs & Maintenance

Sheet Title: Deck Layout Plan
Sheet 1

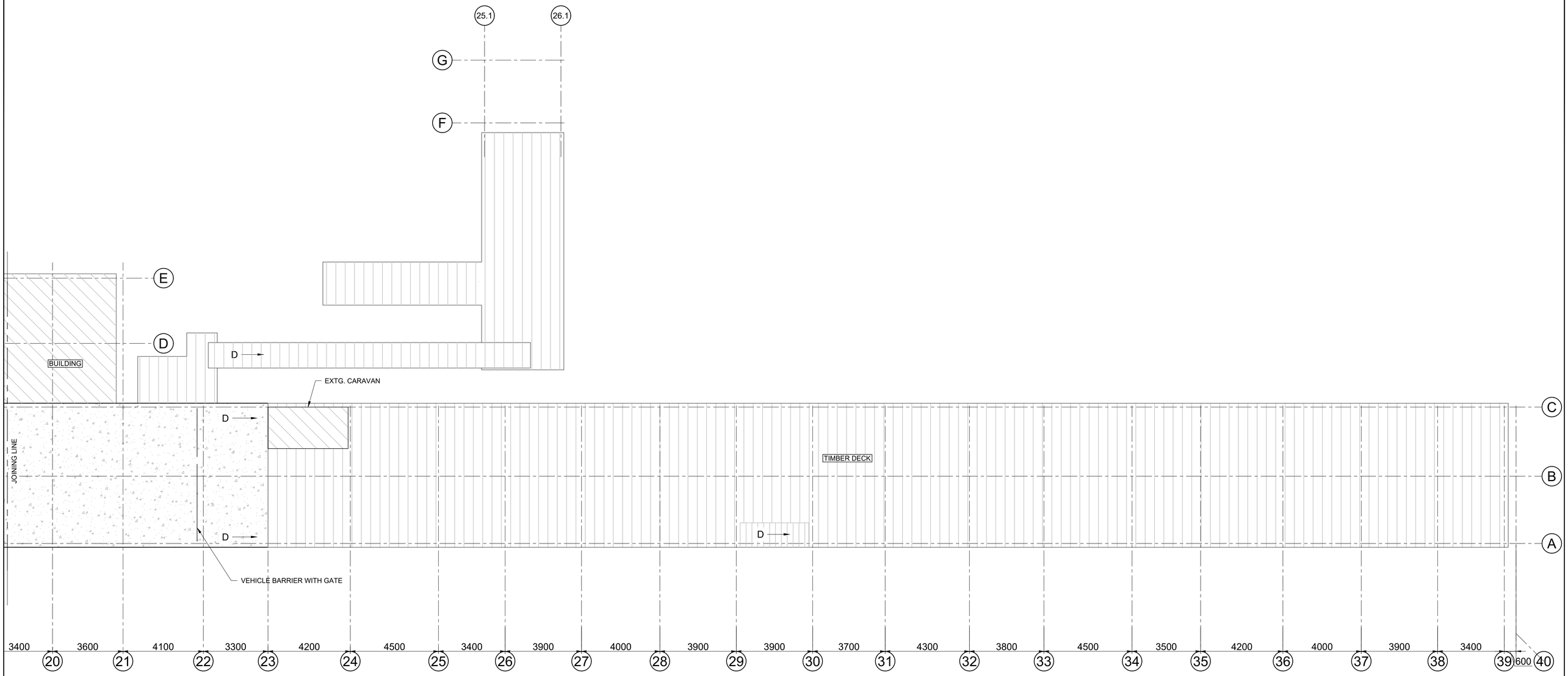
Level 1
323 Madras Street
Christchurch 8042
+64 3 374 6515
calibreconsulting.co

calibre

Scale (A1 Original) 1:100 (A3) 1:200

SCALE AS NOTED

Project No	Sheet	Revision
710552.004	S104	



DECK LAYOUT PLAN

1:100 (A1)
1:200 (A3)

Revision	App	Date

Surveyed		
Designed	WS	02/19
Drawn	MB	02/19
Reviewed	TA	02/19
Approved	BW	02/19

Client
Christchurch City Council

Project Title
Akaroa Wharf
Wharf Repairs & Maintenance

Sheet Title
Deck Layout Plan
Sheet 2

Level 1
323 Madras Street
Christchurch 8042
+64 3 374 6515
calibreconsulting.co

calibre

Scale (A1 Original) 1:100 **(A3)** 1:200

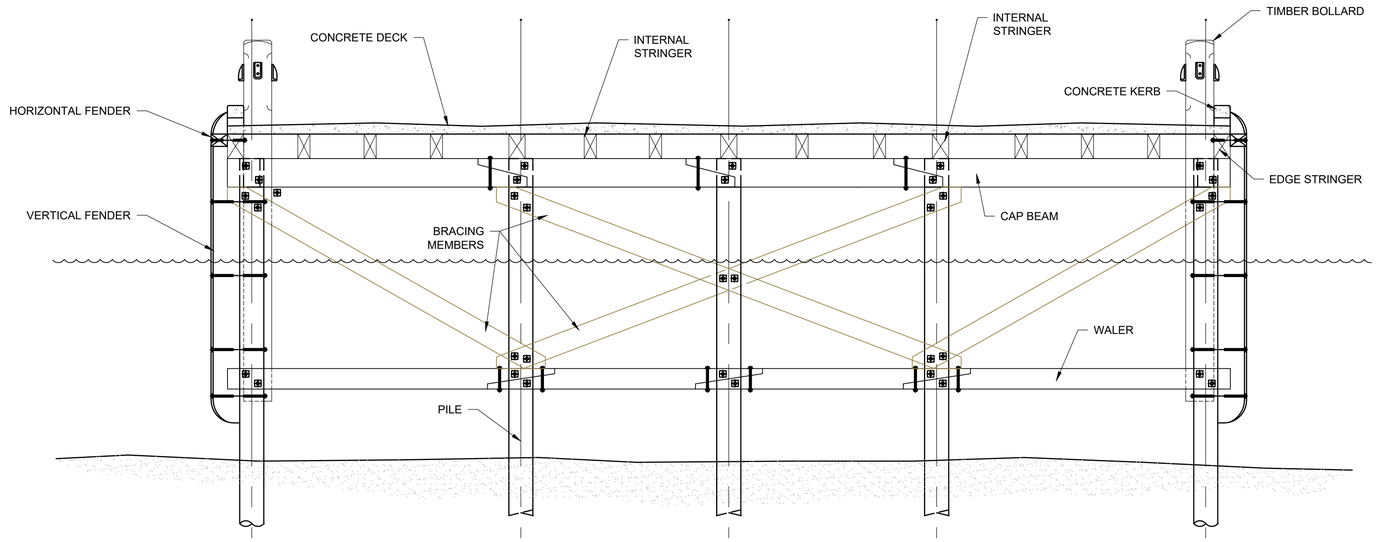
SCALE AS NOTED

Project No	Sheet	Revision
710552.004	S105	

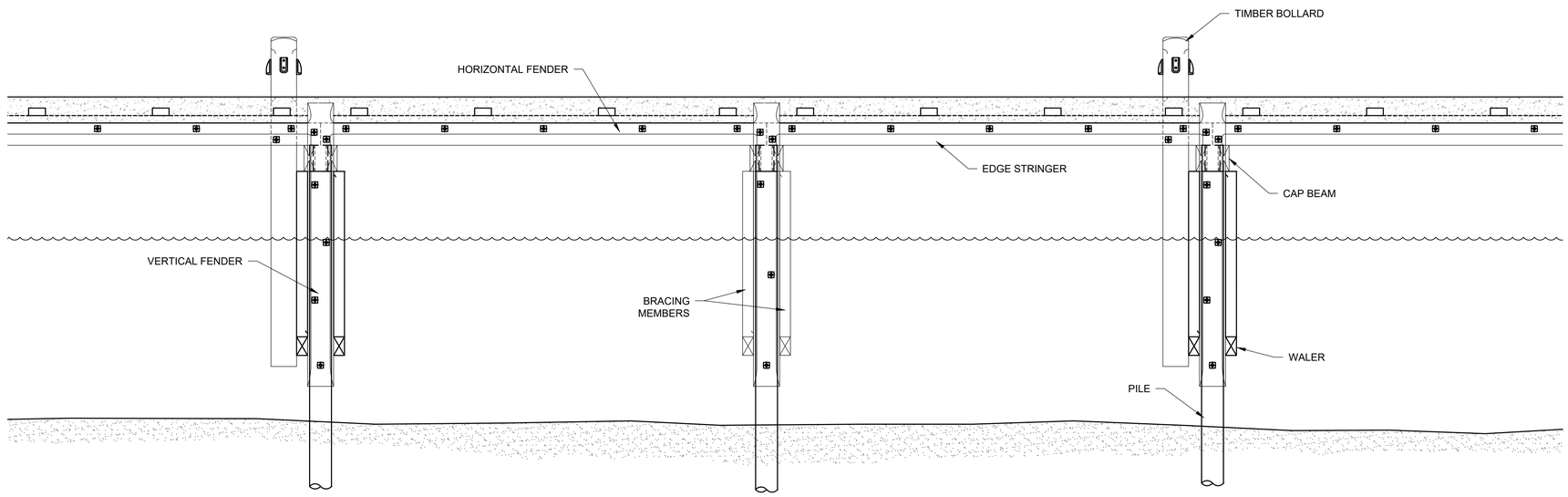
AKAROA WHARF RENEWAL: PRELIMINARY REBUILD OPTIONS

Appendix B Typical Wharf Components

CHRISTCHURCH CITY COUNCIL



TYPICAL WHARF SECTION



TYPICAL WHARF ELEVATION

Revision	App	Date
Surveyed		
Designed	-	-
Drawn	-	-
Reviewed	-	-
Approved	-	-

Client: Christchurch City Council

Project Title: Akaroa Wharf Upgrade Options Report

Sheet Title: Typical Wharf Component diagram

Level 13
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109-125 Willis Street
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Scale (A1 Original): SCALE AS NOTED

Project No	Sheet	Revision
710552	-	-

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AKAROA WHARF RENEWAL: PRELIMINARY REBUILD OPTIONS

Appendix C 1887 Construction Drawings

CHRISTCHURCH CITY COUNCIL

AKAROA JETTY.

(SITE)

(Scale 3 chains to 1 inch)

Wm. F. Drd Jervois

Governor

Approved subject to the modifications noted on plan marked M D 1334

Forster Goring.

Clerk of Executive Council

June 28th 1887

W. D. Wilkins
Authorised Surveyor
Akaroa Mar: 1887.

MD 1333

Roll

Akaroa Borough Council.

AKAROA JETTY.

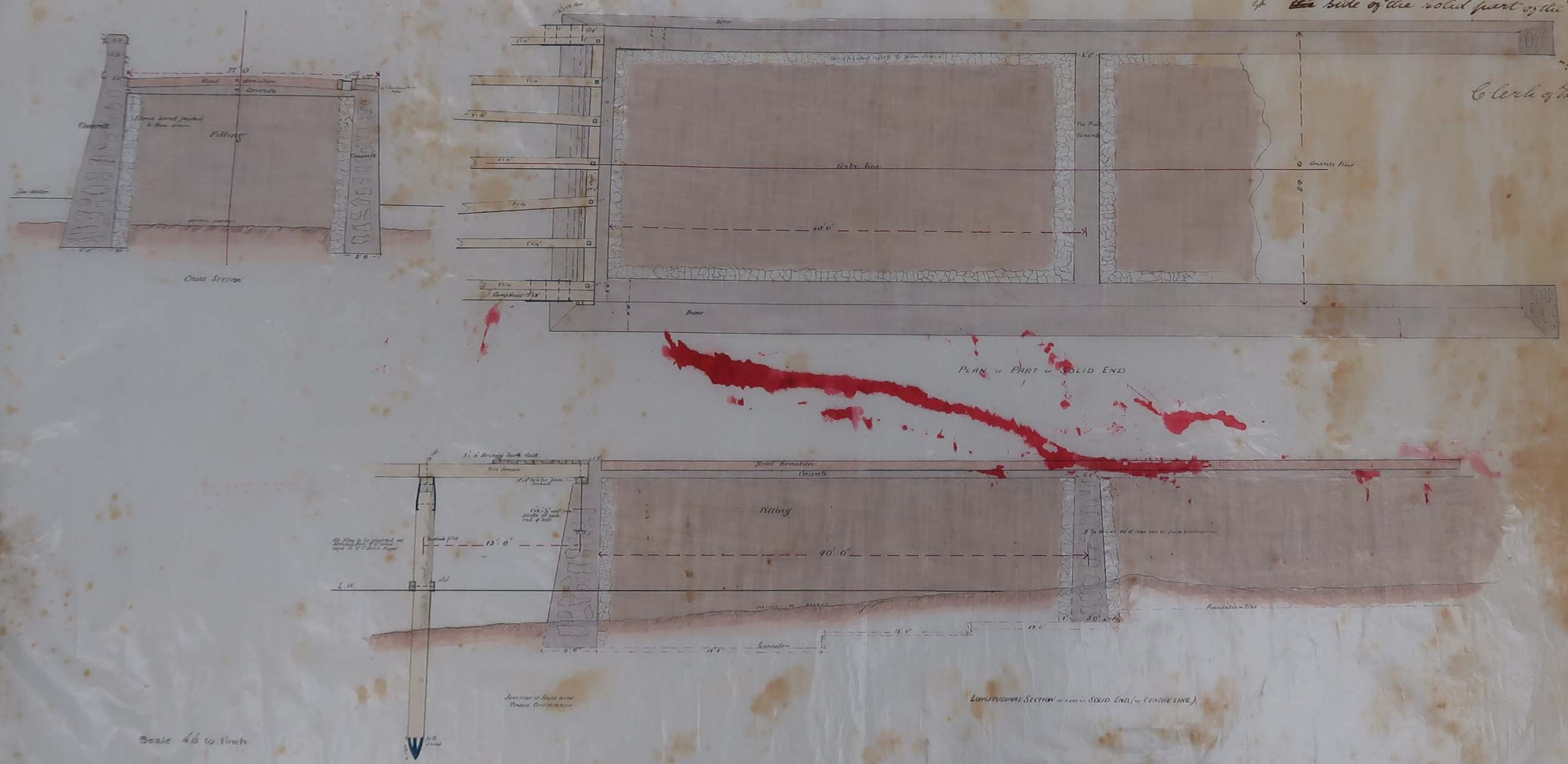
1.

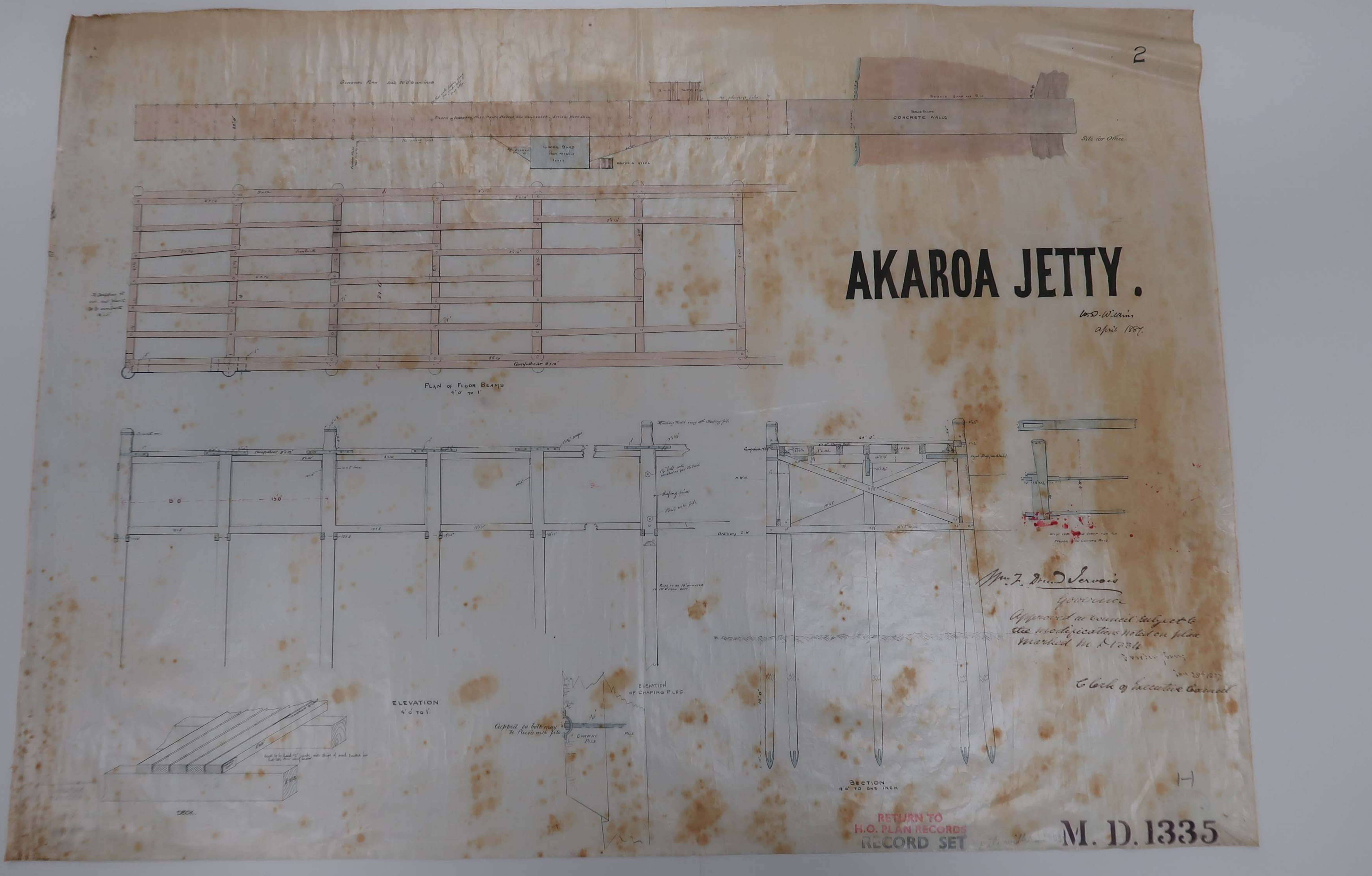
Wm. F. Drummond Jervois
Governor

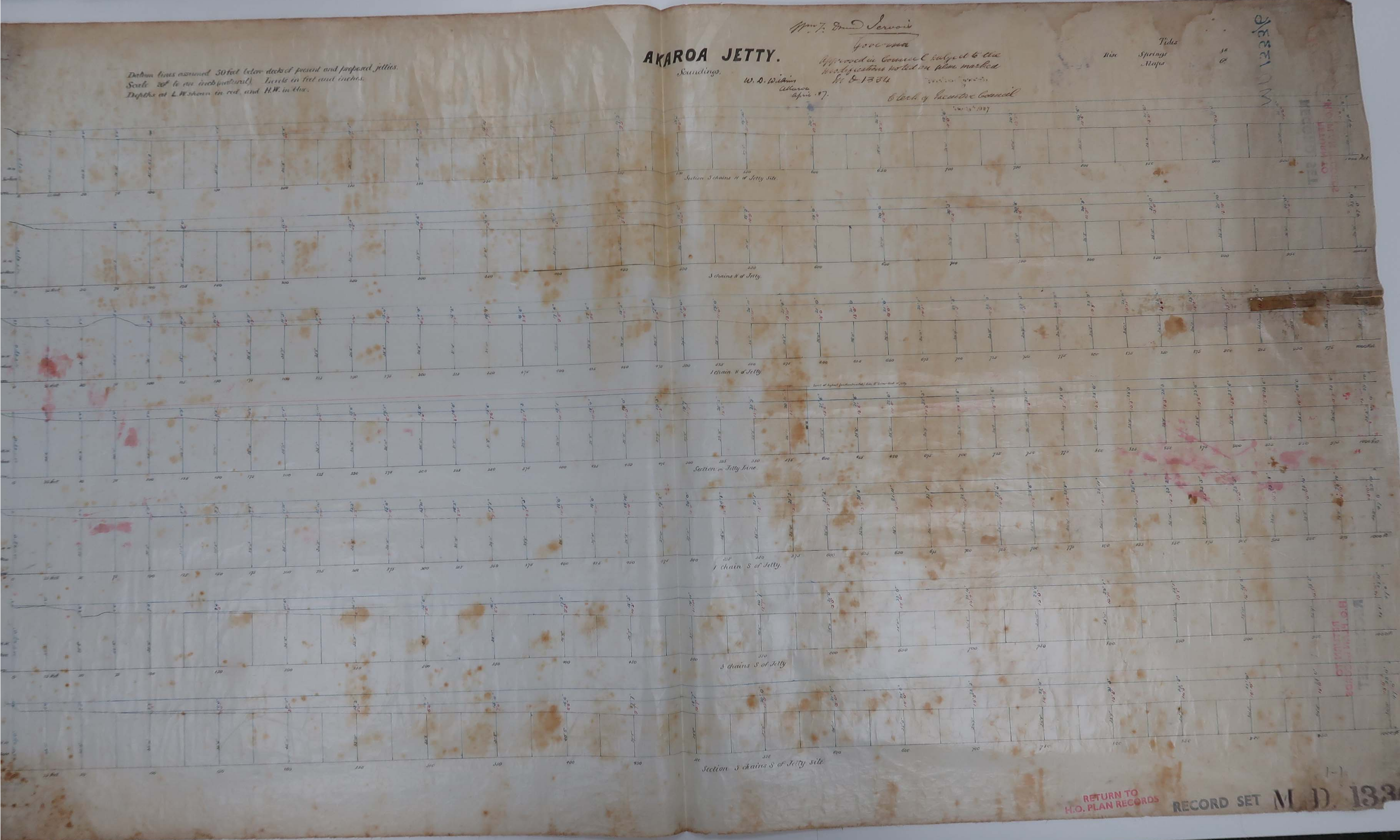
Approved in Council subject to the following modifications
1st Not more than the first 100 feet of the wharf shall be built solid & both side walls for the outer forty feet of the solid part shall be made not less than 4 ft 6 inches thick and each of such walls together with the end wall of the solid part shall have a footing of 5 ft 6 inches wide and 18 inches thick
2nd The concrete tie wall shown about 40 feet from the end of the wharf between the walls & also the concrete floor below the metalling shall be omitted
3rd Weep holes shall be provided in the walls and the hand packed stones shown inside the walls from top to bottom to act as drains shall be omitted, so also shall the system of drains and pipes shown on one side of the solid part of the wharf

W. D. Wilkins
Akaroa.
April 1887

Clerk of Executive Council




2
CONCRETE WALLS
Site for Office
AKAROA JETTY.
April 1887.
PLAN OF FLOOR BEAMS
4'0" TO 1'
ELEVATION
4'0" TO 1'
ELEVATION
OF CHAFING PILES
SECTION
4'0" TO ONE INCH
Wm. F. Drummond Jervois
Governor
Approved in council subject to
the modifications noted on plan
marked M D 1334
Clerk of Executive Council
RETURN TO
H.O. PLAN RECORDS
RECORD SET
M. D. 1335


AKAROA JETTY.
Soundings.
Datum lines assumed 50 feet below decks of present and proposed jetties.
Scale 20ft to an inch (natural). Levels in feet and inches.
Depths at L.W. shown in red, and H.W. in blue.
W. D. Wilkins
Akaroa
April '87.
Wm. F. Drummond Jervois
Governor
Approved in Council subject to the modifications noted on plan marked M.D. 1334
Clerk of Executive Council
Tides
Rise Springs
Neaps
Section 5 chains N. of Jetty Site.
3 chains N. of Jetty.
1 chain N. of Jetty.
Section on Jetty Line.
1 chain S. of Jetty.
3 chains S. of Jetty.
Section 5 chains S. of Jetty site.
RETURN TO
H.O. PLAN RECORDS
RECORD SET M.D. 133

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