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Marine Facilities - Design Considerations

CCC Naval Point Redevelopment

Christchurch City Council
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Contents

1 Introduction

Enviser Ltd have undertaken a desktop review to ascertain the following for the proposed Naval Point Development:

- Determine a suitable design vessel or vessels.
- Determine the likely required water space for vessel approach, manoeuvring and waiting areas to serve the public ramp, proposed dinghy hand launch area and the Naval Point Club Lyttelton (NPCL) ramps.
- Determine the appropriate number of on-water 'parking spaces' to serve users launching and retrieving vessels.
- Determine the appropriate number of parking spaces to serve landside users.
- Determine design wave conditions for these areas.

The purpose of this work is to inform decision making for the Naval Point Development.

2 Design vessel

As the geometry of the facility is conditional upon the size of vessels which will use the ramp, a design vessel should be identified to serve as a basis for ramp design. The design vessel should not be the maximum possible vessel, rather of a size that represents the largest vessel commonly launched at the ramp. To date, no specific survey has been undertaken to establish the size range of existing vessels using the ramp. Limited published information is available on the breakdown of trailerable vessel sizes in New Zealand, and even less so for Canterbury.

In lieu of site-specific data, we have used the following information to inform the selection of a design vessel(s):

- Legal towing limits
- Maritime New Zealand recreational boating surveys
- Size range of trailer boats currently for sale

2.1 Legal towing limits

Most trailer boats are designed to fit within New Zealand Transport Agency's (NZTA) 'light simple trailer' limits, which are:

- Maximum legal width for trailers (including load) 2.55m
- Maximum legal length for trailers (including load) 12m
- Maximum overall length (car and trailer) 22m
- Maximum mass (car and trailer) 6,000 kg

Over-dimension trailer boats are available, ranging up to 10-12m in length and 3m in width. Although these are relatively rare, they can travel on the roads at limited times and require special permits to travel through Lyttelton Tunnel.

2.2 Maritime New Zealand Survey

Maritime New Zealand undertakes a regular recreational boating survey, with one of the questions relating to vessels used in recreational boating.

The 2019 survey (**Figure 1**) showed that:

- Canterbury/West Coast has the second highest participation rates in boating (14%)
- 85% of Canterbury/West Coast boating is undertaken within the region
- Kayaks and small unpowered craft account for over 50% of vessels
- Power boats up to 6m account for 22% of the owned or used vessels, powerboats over 6m account for 8%

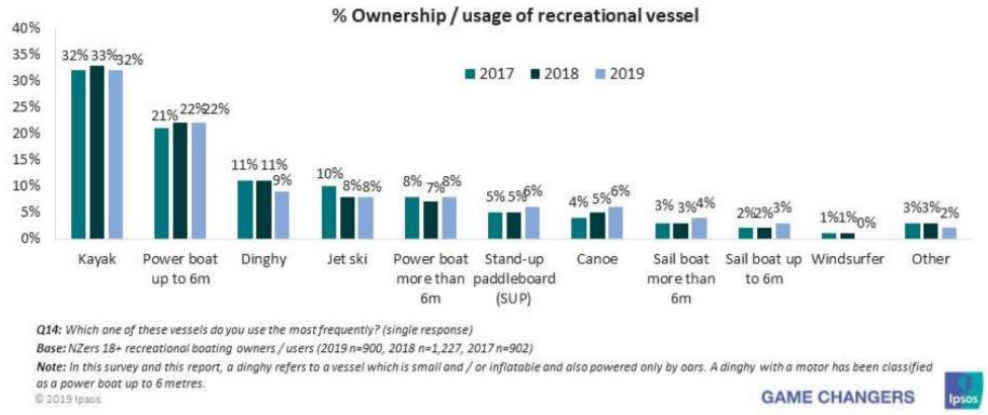

Figure 1 – Maritime New Zealand recreational vessel survey 2019

Assuming the public ramp caters primarily for powerboats (and similar sized sailboats), 26% of users will have boats greater than 6m, the remainder under 6m. The survey also shows there is a large percentage of unpowered craft, reinforcing the need for facilities for these craft. Whilst the majority of trailerable sail boats will be launched at Naval Point Club's ramp, some will be launched at the public ramp. It can be assumed these vessels will fall within the length and breadth characteristics of powerboats, but with a greater draught (the vertical distance between the waterline and the bottom of the hull or any appendages such as a propeller) requirement and less manoeuvrability.

2.3 Vessels for sale

A review of current vessels for sale in New Zealand[1] shows approximately 64% of vessels are less than 6m, 86% less than 7m, and 95% are less than 8m in length (**Table 1**). This aligns with the New South Wales Boat Ramp Facility Guidelines[2], which note 93% of boats registered in NSW were less than 8m and suggest a design vessel of 7-8m.

It is useful to note that vessels in the larger classes, whilst able to be put on a trailer, may be kept in marinas for convenience. As a result, the average size of vessels using the ramp would be smaller than these numbers suggest.

[1] On Trademe, the largest online market for boats in NZ

[2] New South Wales Boat Ramp Facility Guidelines, NSW Government, Transport: Roads and Maritime Services. 2015.

Table 1. Current powerboat listings by size (December 2019)

Size	Number of listings (trailer)	Percentage
6m or less	1800	64
6m-7m	607	22
7-8m	261	9
8m-9m	103	4
9m+	44	2

Aside from length and width, the draught also needs to be set for the design vessel. The draught of trailer boats is variable, with the deepest draught required by yachts (trailer-sailers). Generally power boats need a draught of 1m-1.2m and trailer-sailers a draught of up to 1.5m (with the board down). Trailer-sailers do not need this draught to launch, but do in the manoeuvring area and entrance/approach channel.

2.4 Design vessel dimensions

The dimensions of the recommended design vessels are set out in **Table 2** with **Photographs 1 and 2** showing an example of the powerboat and trailer-sailer design vessel.

Table 2. Recommended design vessel dimensions

Vessel	Length	Beam	Draught	Manoeuvrability
Powerboat	8m	2.55m	1.2m (outboard down)	Good
Trailer-sailer	8m	2.5	1.5m (board down), 0.5m board up.	Moderate

Photograph 1 – An example of a vessel similar to the design power boat (8.2m LOA, 2.5m beam)

Photograph 2 – An example of a vessel similar to the design trailer-sailer (7.8m LOA, 2.5m beam)

Consideration should also be given to the infrequent launching of vessels larger than the design vessel. Noting that some of these types of vessels may not routinely use the main public ramp, but others at Naval Point. The characteristics of these vessels are set out in **Table 3**.

Table 3. Other vessel dimensions

Vessel	Length	Beam	Draught	Manoeuvrability
Waka Ama	14m	2.5m	0.5m	Limited
Yacht Haul Out	12m	5m (catamaran)	2.2m	Limited
Large power boat	10m	3m	1.2m	

3 Wave criteria

For safe launching and retrieval of vessels, the ramp(s) need to be sufficiently protected from waves and swell. Two cases should be considered:

- anticipated normal conditions, and
- extreme events.

For anticipated normal conditions, the wave climate should be well controlled, provide a high level of amenity and be very safe in launch and retrieve conditions (i.e. a low wave height and limited surge conditions). For extreme events, it should be anticipated that very few vessels would use the ramp, mainly those caught out in adverse weather (i.e. an unexpected southerly front). In these conditions, the amenity expectation would be lower, with the focus being on the ability to safely launch/retrieve a vessel, possibly on a limited section of the ramp. This extreme case would be used for design loads on structures. Noting that the extreme event and associated loads on the marine structures will likely be a controlling case for the engineering design.

In order to establish the design wave criteria (wave height and period) for both cases, a return period event and acceptable wave height must be selected.

For the typical case, there is no specific guidance on the appropriate return period. Ultimately what is appropriate will be reliant on user's expectation on how often wave conditions are above a level which detracts from their enjoyment of using the ramp. We suggest that the risk of this event occurring a single time in one year should be no more than 20%[3]. This equates to a 5-year return period event.

In terms of wave height, the Australian Standard (AS3962-2001) for marina design recommends boat ramps are "aligned to the dominant waves from swell. Sea and boat wash" and sheltered from waves greater than 0.2m. Although Permanent International Association of Navigational Congresses (PIANC) recommends launching and retrieving areas are subject to no more than 0.15m high waves.

For the extreme case, PIANC suggests that a design event of 1 in 50 years is appropriate for marina type structures with a design life of 30 years. This results in a 45% chance of the design storm occurring in the projects life. There is no guidance for an acceptable wave height in these types of conditions, although PIANC notes for marinas that 'moderate conditions' can be up to 1.67 times 'excellent conditions'. This would equate to a design wave height of 0.25m in the 1 in 50-year event. Noting that this recommendation is for boats moored in a marina, not for vessels launching at a ramp so should be used with care.

There is no readily available guidance for wave period and surge conditions, however the wave model should be interrogated to evaluate how longer period waves may impact on the ramp use and amenity.

A summary of the potential design criteria is included in **Table 4**.

Table 4. Summary of potential design wave criteria

Design case	Return period event	Max wave height (m) within protected area.	Considerations
Normal conditions	5 year	0.15	Period and swell angle.
Extreme event	50 year	0.25	

Note: The extreme wave criteria for any breakwater design would be the incident wave outside the breakwater.

4 On-water approach and manoeuvring space

There is little guidance from local or international guidelines or standards for on-water approach and manoeuvring space for boat ramps. There is however general guidance on approach channels to harbours and fairways within marinas.

4.1 Entrance and approach channel

PIANC provides useful guidance on the approach channel (i.e. the entrance through the breakwater), recommending that:

- Two-way entrance channels have a standard width of 6 times the beam of the largest boat or a width equal to the length of the longest vessel.
- For practical reasons, a minimum width of 30m is also recommended. This width pertains to the navigable width, i.e. between the points of water with sufficient depth for vessels to

[3] Referred to as the encounter probability (PIANC Report No. 149 Part 2)

navigate in. These minimum widths may need to be adjusted for special vessel or environmental characteristics (i.e. waves, currents etc).

Generally, the wider a channel is, the more wave energy will be transmitted through the entrance. Consequently, the effect on wave energy transmission must be considered when designing the width of the entrance, and its orientation to the critical wave direction. PIANC recommends entrance channels be orientated so that vessels experience a quartering sea (waves arriving at a 45-degree angle to the vessel), rather than a following sea (which can impair slow speed manoeuvring for powerboats).

4.2 On-water manoeuvring space

Space is needed between the ramp and the breakwater to allow for vessels to line up the ramp, wait for ramp space and wait whilst the driver parks the vehicle. The space should also allow for the circulation of departing and arriving vessels. If pontoons can be provided for vessels to wait at and drop/pick up passengers, it would limit the number of vessels milling in the manoeuvring space. This would make for more efficient circulation, especially if the waiting pontoon was distant from the ramp.

In the absence of guidance for on-water manoeuvring, we have collated the key information for a range of similar existing boat ramps across New Zealand. Noting that many New Zealand boat ramps are either located within protected harbours, or marina, with only a few having dedicated breakwaters.

The data is presented in **Table 5** and images of those facilities are included in **Appendix A**. For ease of comparison we have also overlain the outline of some of these facilities on an aerial photograph of Naval Point (**Appendix B**). Note that every effort has been made to make the image scales the same, however some slight differences may exist. The orientation of some of the overlain images has been altered to best suit the Naval Point orientation and layout.

Table 5. Summary of ramp and protected area dimensions for similar New Zealand boat ramps.

Ramp	Number of lanes	Entrance channel width	Distance from ramp/pontoon to breakwater	Width of protected area	Protected area (sq.m)	Comments
Kaikoura South Bay	3	30m	70m	45m		South facing, exposed in southerly, breakwater protects moored whale watch boats, not ramp
Kawakawa Bay	4	25m	30m	50m	2,300	Similar wave fetch to Lyttelton. Club ramp. Purpose built breakwater.
Waikawa (in marina)	2 or 3	34m	N/A	28m		Within a marina, access via marina fairway.
Waikawa (outside marina)	2 or 3	26m	18m	25m		Breakwater protects northerly waves only.
Maraetai	2 (within breakwater)	17m	73m	53m	3,700	Purpose built breakwater
Gulf Harbour	2	NA	22m	50m	2,000	Rock breakwater, open on one side
Napier (Nelson Quay ramp)	2	13m	17m	46m	1,400	Small protected area, near entrance to main harbour.
Napier (W.Quay ramp)	Multiple	n/a	50m	100m	NA	Within harbour, no breakwater.
Naval Point (existing)	2	n/a	n/a	n/a	n/a	No all-weather protection, open to southerly. NB width from breakwater to marina structure is approximately 220m.

4.3 Pontoons and boat holding structures

To improve the efficiency of the boat ramp and the circulation within the protected area, facilities for boats to temporarily tether to, should be provided. These facilities may involve a pontoon with cleats to tie off on, or similar. On ramp pontoons or jetties should be designed to hold three of the design vessels per lane. Noting a single pontoon between lanes could serve two ramp lanes with three vessels spaces on each side. Additional, or some of the required three spaces could be provided away from the ramp if the layout allowed.

Table 6 sets out a range of potential design criteria based on the PIANC guidelines, Australian Standards and review of similar New Zealand boat ramps.

Table 6. Potential design minimums for entrance and protected area

Design item	Width	Length	Depth (at datum)	Considerations
Entrance	6 x max beam but ideally 30m (two way)	N/A but limits on turn radius	2.4m+wave factor (10%-30% max draught)	Wave height, period and angle, current and wind.
Entrance Channel	6 x max beam but ideally 30m (two way)	N/A but limits on turn radius	2.4m	Circulation, multiple entrances
Protected area	70m (minimum)	30m (from end of pontoon at ramp)	2.4m (but could be less in some circumstances)	Circulation and provision of waiting pontoons
Pontoons	1.5m	Able to hold three design vessels at any tide	Design vessel draught (board up)+0.5m	Circulation (water and land)

For the NPCL ramp, the same entrance and channel dimensions should apply. Due to the nature of the vessels at this ramp, some unpowered and with less manoeuvrability, a large protected area may be warranted. Prior to the piles being removed in 2019, the ramp had a clear area of approximately 75m by 85m in front of the ramp. A similar sized protected area is likely to be appropriate, particularly if a separate hand launching ramp is provided. Naval Point has existing boat holding facilities next to the ramp, although they are undersized for the current ramp use during peak periods.

5 Other design considerations

Cultural values and mahinga kai – consideration of the values associated with the foreshore and coastal marine area are an important component of the final water space design. Specific consideration to Te Hapū o Ngāti Wheke's long-term vision of protecting and restoring mahinga kai values in Lyttelton Harbour/Te Whakaraupō should be considered as part of the design.

Sediment movement –sediment transportation and deposition patterns may be altered by the installation of infrastructure to support the public boat ramp and hand launching ramp. Changes to sediment transportation and deposition patterns may affect marine ecosystems and cause shoaling of the area. This should be considered in the design process.

Hand launching ramp – the provision of a designated ramp for the hand launching of non-motorised craft e.g. sailing dinghy's, waka and kayaks, is proposed. This hand launching ramp should aim to provide a safe entry/exit point for smaller craft and protect unpowered vessels from interacting with powered vessels. Having a separate hand launching ramp may further ease traffic congestion on the

main ramp and will inherently reduce conflict between powered and unpowered craft. The on-water facilities should be laid out to naturally direct motorised vessels away from the hand launching ramp. Whilst total avoidance may not be possible, good design should encourage separation of these vessel types.

Due to the specialised nature of some sailing craft (i.e. foiling dinghy's), a separate hand launching ramp designed specifically for these craft may be desired by the NPCL. The overall design of the facility should allow for NPCL to install such a ramp.

Sailing approach angles – to ensure sailing craft can approach and depart the hand launch and NPCL ramps under sail, the predominant wind direction and likely sailing angles will need to be considered. Ideally, the current approaches would be kept clear of obstructions (i.e. breakwaters), or where that is not possible, allow for sufficient room for tacking manoeuvres.

Wave reflection and diffraction – the introduction of a breakwater will alter the way wave energy is distributed in the Naval Point area. The installation of a breakwater will provide shelter to the area behind, but can create different wave environments in front of, or beside the breakwater. The effects of this should be considered in the design process.

Applicability

Enviser Ltd has prepared this report for the Christchurch City Council in accordance with the agreed scope. No other party, aside from the Christchurch City Council, may rely on this report, or any conclusions or opinions within it, for any purpose without the express written permission of Enviser Ltd.

The opinions and conclusions within this report are based on the information that was viewed during preparation of the report.

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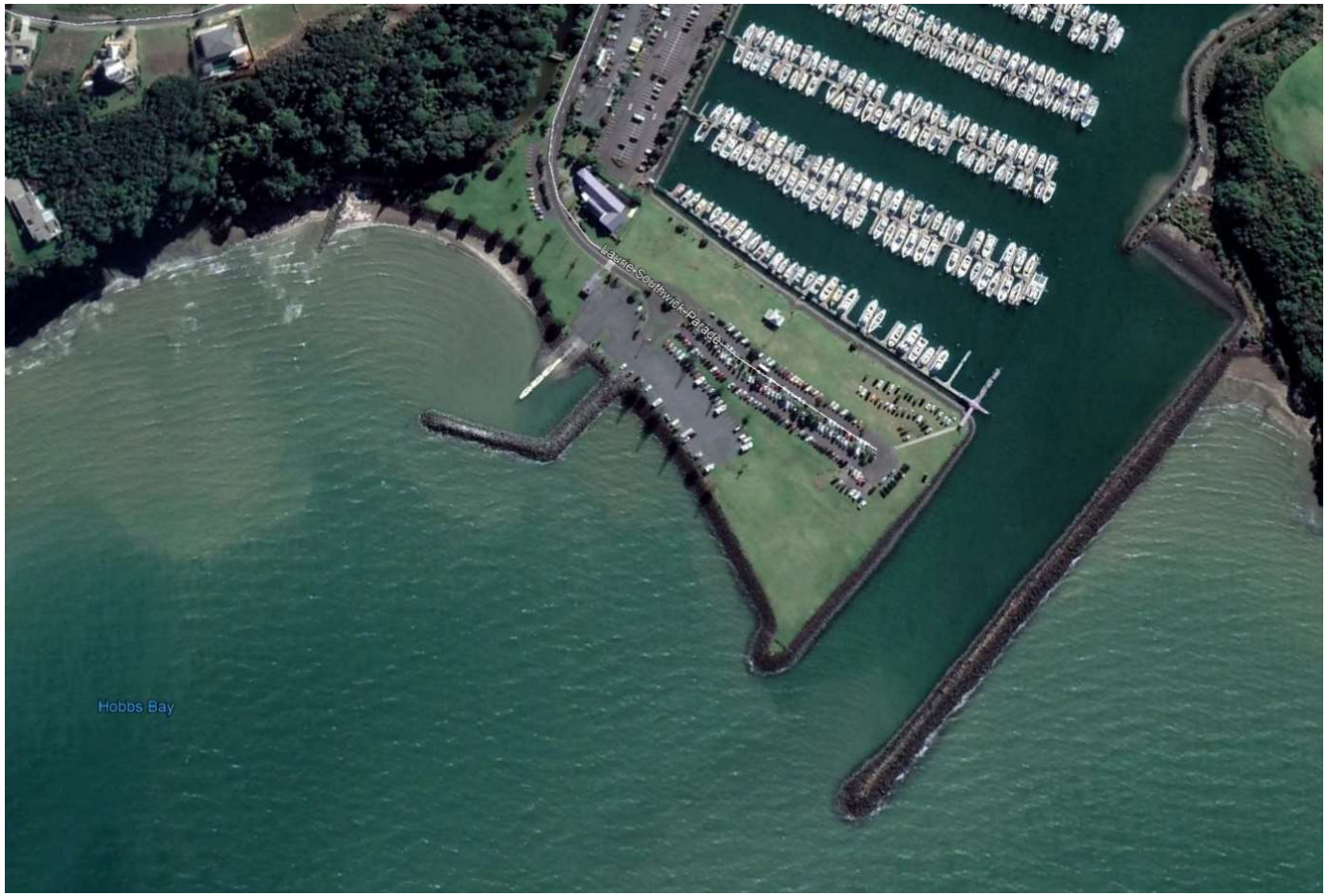
Appendix A: Images of similar New Zealand boat ramps



Gulf Harbour ramp, open to wave action from the south. The breakwater was built after ramp installation due to unacceptable wave action.

Kawakawa Bay club ramp, area open to wave action from north west through to north east.

Maraitai ramp, one within breakwater and one facing into open sea.

Napier (Nelson Quay) ramp, within relatively sheltered harbour.

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Waikawa North Ramp. Within relatively sheltered bay, not subject to large seas.

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South Bay ramp and marina (very exposed to southerly conditions, ramp unprotected. High use by large commercial vessels.

Appendix B: Naval Point with other ramps facilities overlain

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