walker

TOONDAH HARBOUR

APPENDIX 1 - L

MARINE INFRASTRUCTURE
DESIGN REPORT

saunders havill group

REPORT

Toondah Harbour Development

Maritime Structures

Client: Walker Group Holdings

Reference: PA2060
Status: S1/P03
Date: 10 March 2022

Royal HaskoningDHV
Enhancing Society Together

Royal HaskoningDHV

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EXECUTIVE SUMMARY

The Toondah Harbour Development (the Project) will involve the construction of a number of permanent maritime structures associated with the waterways. These structures are primarily for the retention of reclaimed land (edge treatment) and for the safe berthing of commercial and private vessels.

The maritime structures include the following:

- Vessel berths (including a public pontoon);
- Ferry Terminal Ro-Ro berth;
- Fixed wharf;
- Harbour edge treatment; and
- Boat ramp (non-motorised).

Marina and Private Vessel Berths

There is proposed to be a commercial marina and private residential berths as part of the Toondah Harbour development. The layout of the proposed berths is shown in Figure ES-1 below.

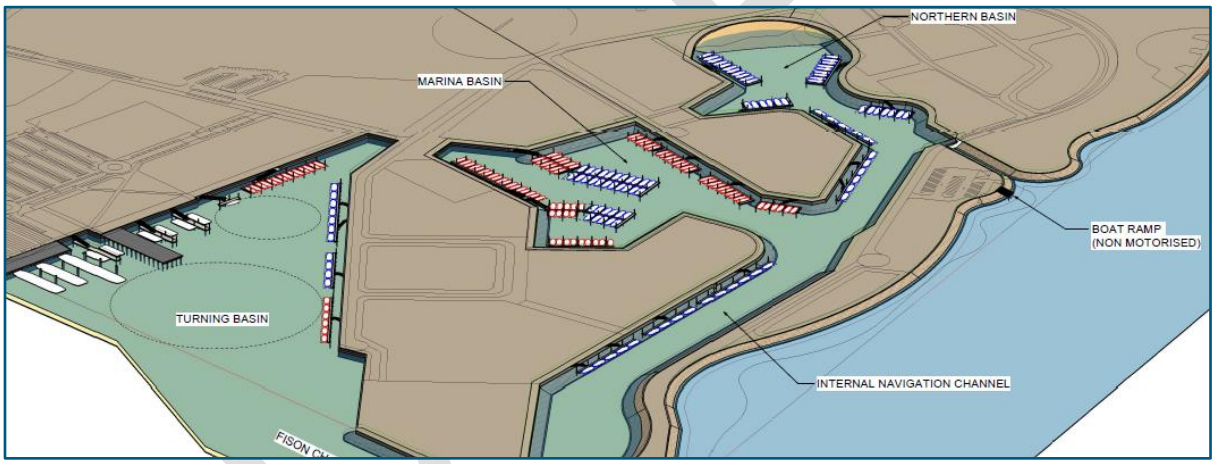


Figure ES-1 Marina and Private Vessel Berths

There is a total of 200 berths that can accommodate vessels up to 12m in length (~39 feet) shown in red and 14m in length (~46 feet) shown in blue. The vessel berths are proposed to comprise floating pontoons restrained by vertical piles driven into the seabed. Access from the land platform to the pontoons is via a hinged aluminium gangway. Similar berths are proposed for the smaller commercial vessels (fast passenger catamarans) and a public pontoon within the development. The berths will also have the potential for artificial habitat modules under the floating pontoons.

Ferry Terminal

The current commercial passenger operations to North Stradbroke Island (Minjerribah) consist of passenger and car ferries, which are Roll-on Roll-off (Ro-Ro) type vessels. The latter vessels incorporate a trafficable ramp, which is lowered to allow cars to embark and disembark. The design vessel for the largest Ro-Ro berth is proposed to be:

- Length : 80m
- Breadth : 15m
- Fully laden draft: 2.0m

The Ro-Ro berthing facility consists of berthing piles, landing structure for vessel ramp (refer Figure ES-2), fendering, and on-shore bollards for mooring.

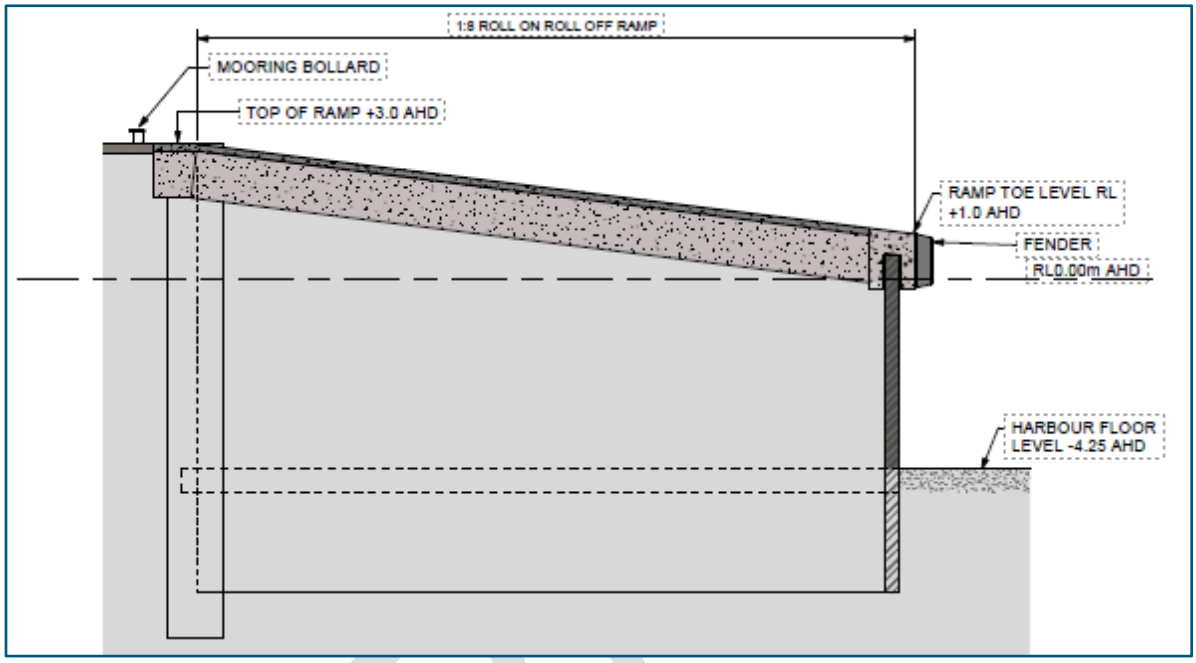


Figure ES-2 Section through Ro-Ro Ramp

Fixed Wharf

There is a proposed wharf structure located adjacent to the Ferry Terminal. This structure will be able to accommodate pedestrians and building structures to include marine services and commercial uses. The wharf will be constructed of a reinforced concrete deck and beams supported on tubular steel piles driven into the seabed.

Harbour Edge Treatment

The construction of harbour edge treatment is required to retain the reclaimed land.

A rock revetment will typically be used to protect the reclaimed land from erosion, as shown in Figure ES-3. This structure typically consists of a rock armour layer, rock under layer, rock core (if required) and geotextile to prevent migration of fine material from the reclaimed fill. The slope of the revetment is proposed to be 1 vertical to 2 horizontal. The revetment is also a suitable habitat for marine fauna. Further measures to enhance ecological outcomes for the rock revetment will be considered during detailed design.

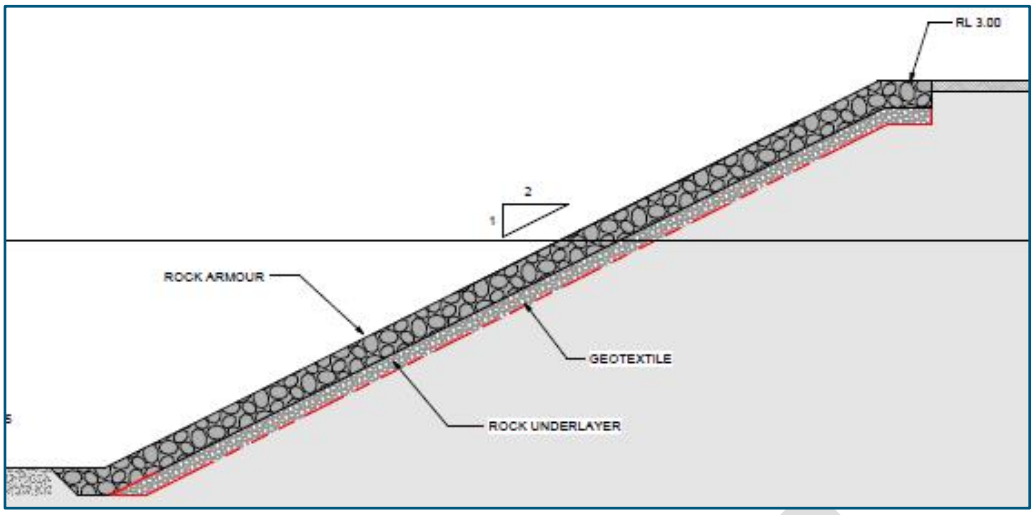


Figure ES-3 Rock Revetment

Some of the edge treatment will include a reinforced concrete wall on top of the revetment, which will reduce the plan footprint of the edge treatment.

In the Ferry Terminal area there will be a need for a relatively high vertical retaining wall. It is proposed that this will be an anchored steel sheet pile wall with a reinforced concrete capping beam. To restrain the wall, a series of tie-back anchors will be required. These are supported by a dead man anchor, as shown in Figure ES-4.

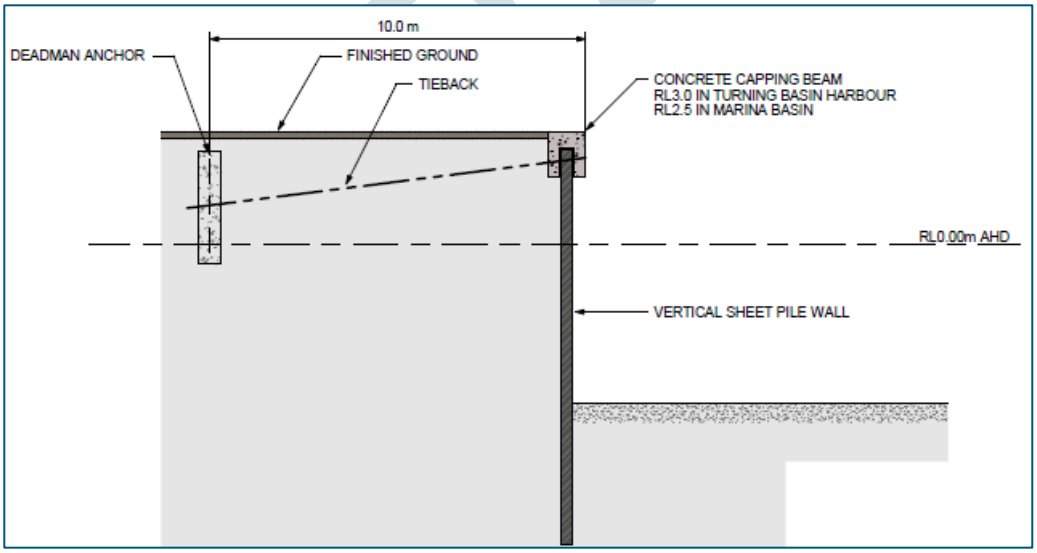


Figure ES-4 Anchored Steel Sheet Pile Wall

Boat ramp (non-motorised)

A small ramp (refer Figure ES-5), is proposed to be used for the launching and retrieval of non-motorised boats, such as kayaks and dinghies. This structure will primarily be constructed of timber members,

including piles, headstocks, girders and decking. Cleats on the surface of the ramp will be required to minimise the risk of slipping while launching and retrieving boats.

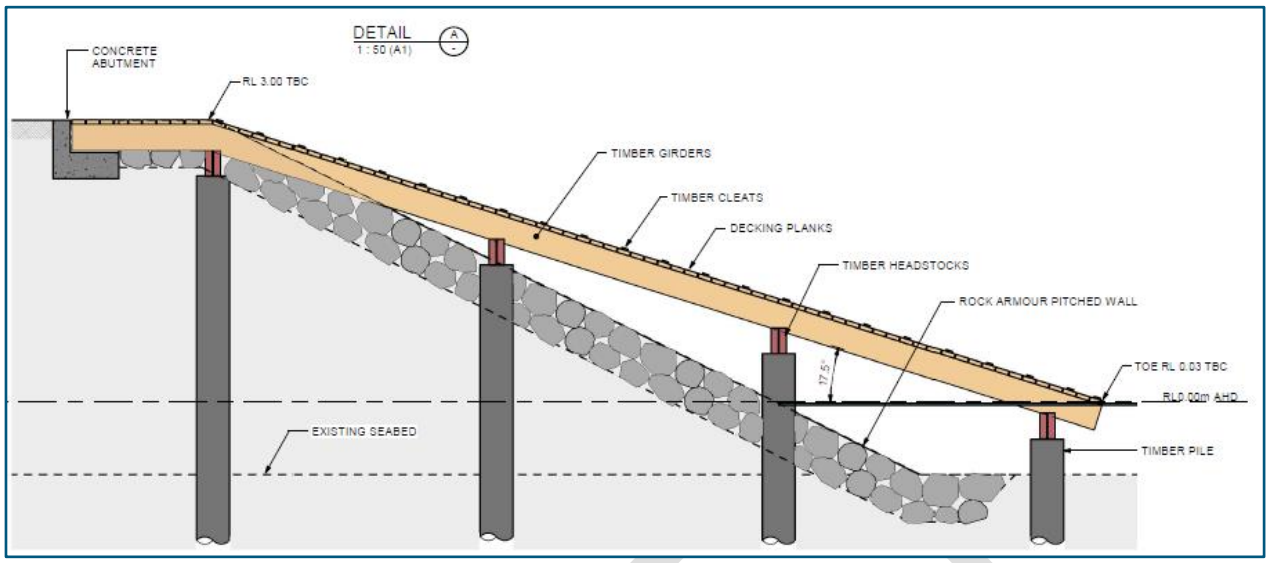


Figure ES-5 Boat Ramp

1 INTRODUCTION

Walker Group Holdings ('the Proponent') propose to undertake development of certain landholdings in the Toondah Harbour Priority Development Area (PDA) at Cleveland, including reclamation into Moreton Bay to create a new residential and commercial precinct, parks, recreational areas, a marina and internal waterways; widening and deepening of the existing navigation channel located to the south of the development area (Fison Channel); and general infrastructure to support the development.

This report has been prepared by Haskoning Australia Pty Ltd, a company of Royal HaskoningDHV (RHDHV), and provides an assessment and recommendation of the permanent maritime structures that are associated with the project. The areas that are relevant to the maritime structures include:

- Northern Basin;
- Marina Basin;
- Internal Navigation Channel
- Ferry Terminal; and
- Commercial Berths.

The types of maritime structures that have been considered in this report are:

- Vessel berths (including a public pontoon);
- Harbour edge treatment;
- Ro-Ro berth;
- Fixed wharf; and
- Boat ramp (non-motorised).

The report is structured in the following way:

- Section 2 provides an overview of the Toondah Harbour Master Plan, including proposed maritime structures and waterway edge treatments;
- Section 3 sets out a summary of the key site conditions;
- Section 4 sets out the proposed vessels for the marina, private berths, ferry terminal and commercial berths;
- Section 5 outlines the design standards that have informed the layout and preliminary design of the maritime structures;
- Section 6 sets out the assumed dead and live loads that have been considered in the preliminary design of the maritime structures;
- Section 7 provides a description of the preliminary design for each of the maritime structures and notes in relation to lighting requirements for navigation aids; and
- Section 8 provides recommendations going forward for the design development of the maritime structures.

RHDHV has also prepared a report setting out an assessment of the options and preliminary design for the dredging associated with widening and deepening the existing navigation channel located to the south of the development area and the use of this dredged material for reclamation. As such, that report considers in more detail the construction of the land platform and the temporary works to facilitate construction.

2 MASTER PLAN

The Master Plan for Toondah Harbour (1/10/2020) is shown below in Figure 2-1.

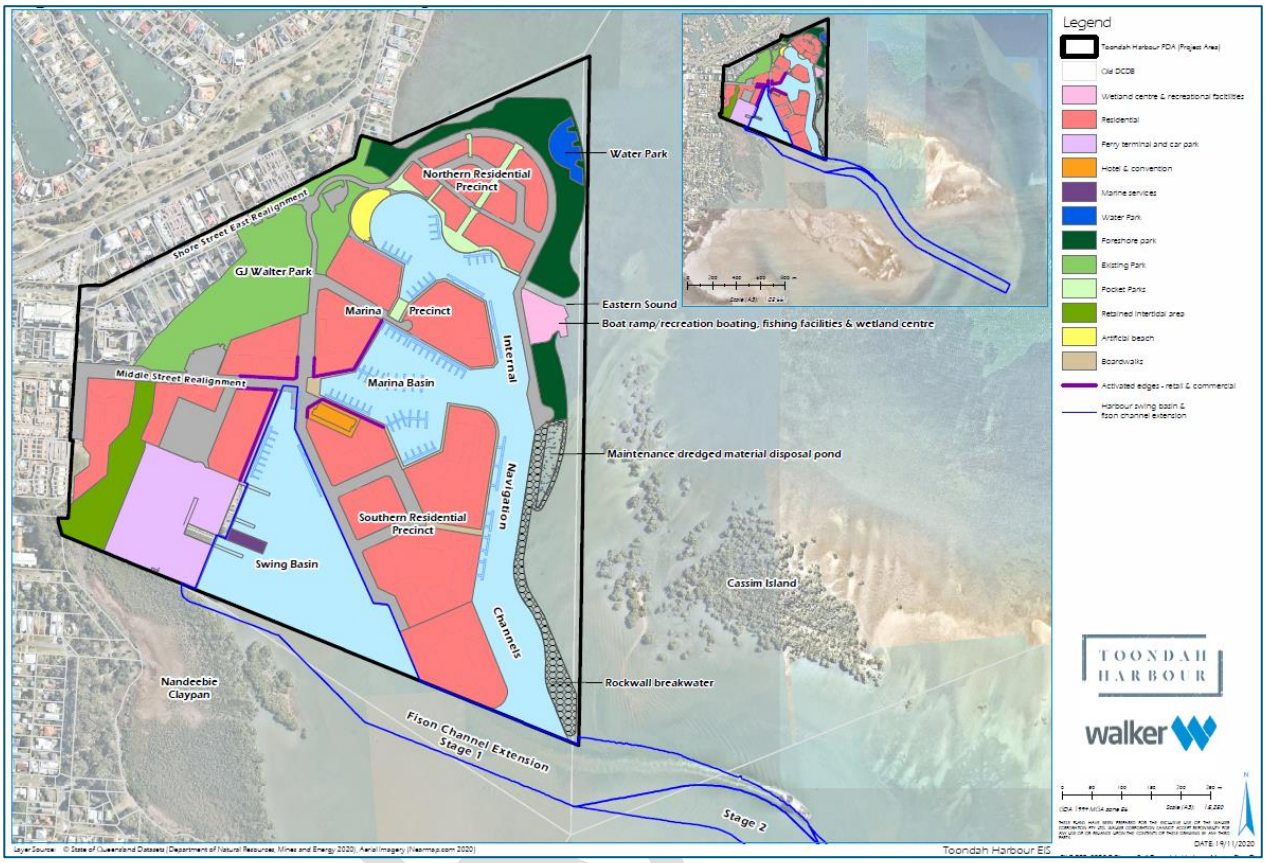


Figure 2-1 Master Plan (1/10/2020)

The maritime structures have been developed generally in accordance with the concept layout as provided in the Master Plan.

The waterway profile (Figure 2-2) and types of edge treatments (Figure 2-3) have been prepared in accordance with the Master Plan.

The Master Plan drawing is provided in Appendix A, and *Waterway Profile and Edge Treatment* drawings are provided in Appendix B.

The width of waterways in residential waterway developments is important for amenity considerations and aesthetics, in addition to satisfying minimum requirements for safe navigation. The overall width of waterways in residential developments is recommended to be a minimum of 50m (NSW Public Works Department, 1992). The minimum proposed waterway width in the Toondah Harbour development is 60m (the main channel running north-south) and hence exceeds the minimum recommended width. In addition, the outlook from residential properties adjacent to this waterway is to the open space and natural areas to the east.

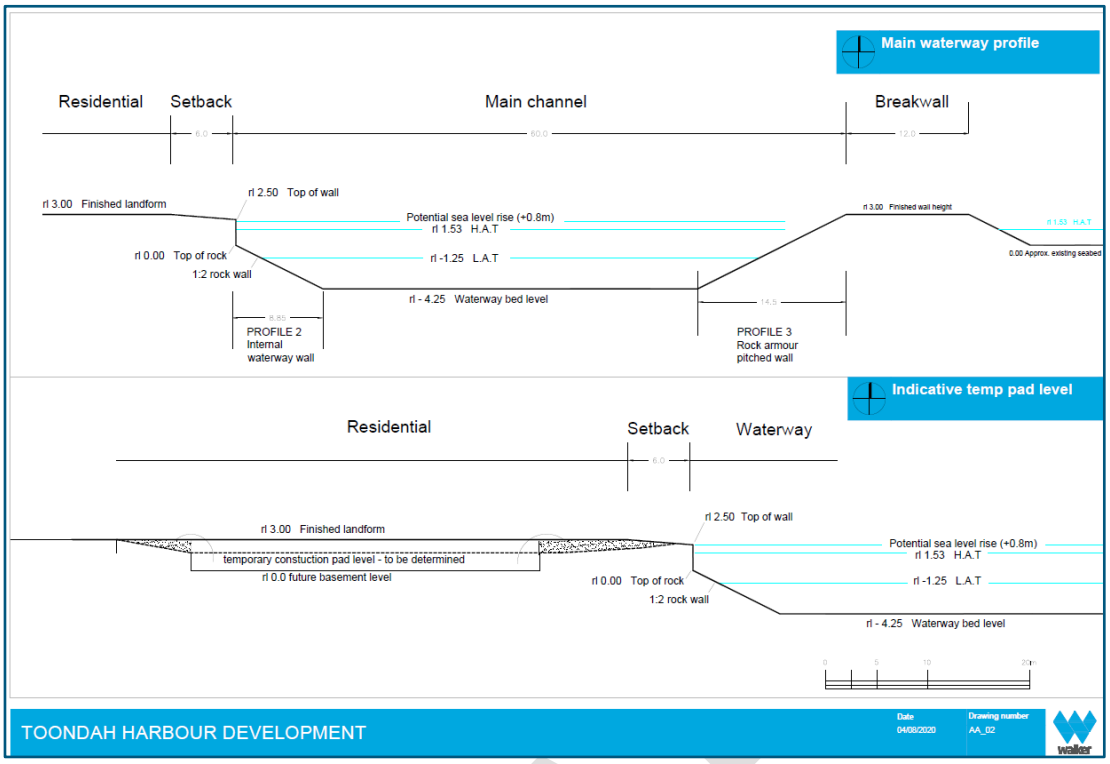


Figure 2-2 Waterway Profiles

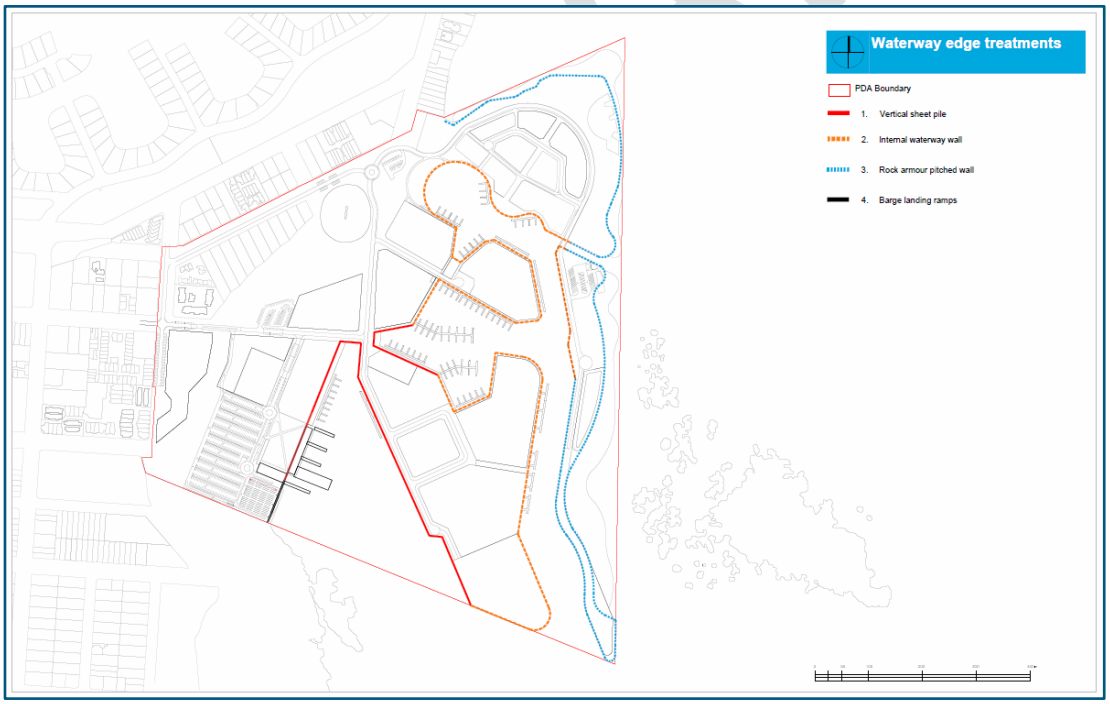


Figure 2-3 Waterway Edge Treatments

3 SITE CONDITIONS

3.1 General

Site conditions which affect the maritime structures are summarised in this section and comprise:

- geotechnical information;
- bathymetry;
- tidal conditions; and
- wind, wave and current climate.

3.2 Geotechnical

Geotechnical information for the proposed development site and for the widening and deepening of the existing navigation channel is available from three previous investigations carried out in 2013, 2014 and 2015 and a recent (2019) investigation. These investigations are listed below:

- Department of Transport and Main Roads (TMR) – July 2013;
- Structerre – May 2014;
- Soil Surveys Engineering – January 2015; and
- Pacific Geotech – November 2019.

Based on the Cone Penetrometer Test (CPT) results in 2014 and 2019, the following general subsurface profile was established:

- upper very weak layer of interbedded sand, silt and clay, overlying; and
- clay profile of soft to firm consistency, increasing in strength with depth becoming very stiff to hard.

The combined thickness of the upper very weak layer and underlying soft clay layer generally increases with distance offshore and is highest in the south with a maximum combined thickness of 3.0 to 3.5m. Below the soft layer, the clay profile generally transitions relatively quickly to firm, stiff, very stiff and hard consistency.

3.3 Bathymetry

The seabed levels within the proposed development site are generally uniform at approximately -0.5m AHD, or approximately MLWN. The site therefore dries at low tide on a regular basis. Water depths over the site at MHWN are approximately 1m and at MHWS are approximately 1.5m.

Seabed levels within the existing navigation channel to the south of the development site are typically in the range -3.8 to -4.2m AHD (-2.55 to -2.95m LAT).

A view towards the proposed development site during low tide with extensive mud flats exposed is shown in Figure 3-1.

Figure 3-1 View looking westward towards the proposed development site during low tide

3.4 Tidal Conditions

Tidal planes for Toondah Harbour relative to both Chart Datum (LAT) and AHD are shown in Table 3-1. Tides are semi-diurnal, i.e. two high tides and two low tides daily. Mean spring tide range is 1.83m and mean neap tide range is 1.04m.

Tidal flows at the proposed site are principally directed to the south during the flood tide and to the north during the ebb tide.

Table 3-1 Tidal planes for Toondah Harbour

Tidal Plane	Level	
	m CD	m AHD
Highest Astronomical Tide (HAT)	2.78	1.53
Mean High Water Springs (MHWS)	2.21	0.96
Mean High Water Neaps (MHWN)	1.82	0.57
Mean Sea Level (MSL)	1.29	0.04
Mean Low Water Neaps (MLWN)	0.78	-0.47
Mean Low Water Springs (MLWS)	0.38	-0.87
Lowest Astronomical Tide (LAT)	0.00	-1.25

3.5 Wind, Waves & Currents

The following summary of metocean conditions at the site is based on the study undertaken by BMT.

The Bureau of Meteorology (BOM) weather station approximately 6km east of Toondah Harbour shows that northerly winds occur more frequently in spring and summer, whereas southerly winds are more frequent in winter and autumn. Winds also tend to be stronger over the spring and summer period. Observation of wind rose data between 2002-2017 shows that winds rarely exceed 12 m/s.

The site is located in a semi-enclosed bay, which is protected from large waves and oceanic currents by the islands to the east. The tide within the bay generally flows in a southerly direction during a flood tide and a northerly direction during the ebb tide. Hydrodynamic modelling of the area has shown higher current velocities offshore. Nearer the Toondah Harbour site the tidal currents do not exceed 0.5m/s.

Toondah Harbour is sheltered from swell waves by North Stradbroke and Moreton Islands. The wave climate at Toondah Harbour is dominated by waves generated by winds from within the bay itself. Modelled SWAN results for significant wave heights in the vicinity of the site are shown to be less than 0.25m. It is probable that vessel wash generated by large vessels will exceed this wave height, albeit this area will likely be a ‘no wash’ zone with vessel speeds limited to no greater than 6 knots.

The overall metocean conditions at the Toondah harbour site can be described as relatively benign and will not have a significant impact on the design of the maritime structures.

4 DESIGN VESSELS

4.1 Private Vessels

The Master Plan for Toondah Harbour consists of a commercial marina and a number of berths that are allocated for private use.

The size of berths is intended to reflect the vessel distribution, which is expected to be similar to vessels found in the adjacent Raby Bay waterways. These vessels are up to 12-14m in length.

The Toondah Harbour marina and private berths have therefore been designed for motorised yachts with overall dimensions as shown in Table 4-1. Note that the vessel drafts correspond to approximately 95 percentile values, i.e. only 5% of vessels of the nominated length would be expected to have a draft in excess of the values stated.

Table 4-1 Private Vessel Dimensions

Vessel	Length	Beam	Draft
Motor Yacht - 12m	12m / 39 feet	4.3m	1.3m
Motor Yacht - 14m	14m / 46 feet	4.7m	1.5m

Note: Beam and Draft are based on AS3962:2020.

4.2 Commercial Ferry Vessels

The current commercial vessel operations that service North Stradbroke Island (Minjerribah) include:

- Stradbroke Flyer Gold Cats.

Stradbroke Flyer Gold Cats Calypso and Alley Cat are typical catamarans shown in Figure 4-1.

Figure 4-1 Commercial catamaran vessels: Calypso and Alley Cat

It is expected that the Calypso catamaran has approximate dimensions of Length = 22m and Breadth = 8m.

SeaLink's current commercial operations to North Stradbroke Island consist of passenger and car ferries, which are Roll-on Roll-off (Ro-Ro) type vessels. These vessels incorporate a trafficable ramp, which is lowered to allow cars to embark and disembark. Typical ferry dimensions are shown in Table 4-2.

Only the Sea Breeze and Minjerribah vehicle ferries operate out of Toondah Harbour

Table 4-2 Stradbroke Ferries

Vessel Name	Passengers	Cars	Length	Beam
Minjerribah	400	52	67.68m	13m
Sea Breeze	300	60	49m	15.78m
Escape to Stradbroke	130	-	23.95m	6.7m

The MV Minjerribah ferry is shown in Figure 4-2.

Figure 4-2 MV Minjerribah: Roll-On Roll-Off Car & Passenger Ferry

The adopted design vessel for the Ro-Ro berths has been prepared using the largest vessel likely to utilise the channel in the foreseeable future based on discussions with the existing vehicle ferry operator. Design vessel dimensions are outlined in Table 4-3. The design vessel would be further reviewed over time, in consultation with the ferry operator, as the project proceeds past the concept and preliminary design phase.

Table 4-3 Ro-Ro Design Vessel

Vessel	Length	Beam	Draft
Ferry Ro-Ro Design Vessels	80m	15m	2.0m

5 DESIGN STANDARDS and GUIDELINES

The following design guidelines and standards have been used in developing the layouts and the preliminary design of the maritime facilities for Toondah Harbour:

- AS3962:2020 Marina Design
- AS4997: Guidelines for the Design of Maritime Structures
- BS6349: Code of Practice for Maritime Structures
- AS1170: Structural Design Actions
- The Rock Manual: The Use of Rock in Hydraulic Engineering
- Fisheries Guidelines for Fish-Friendly Structures, Fish Habitat Guideline FHG 006 (July 2006)

6 DEAD and LIVE LOADS

6.1 Dead Loads

Dead loads generally relate to the self-weight of structures. Different material weights have been based on the recommendations in AS1170.

6.2 Live Loads

Live loads are related to the imposed loads on structures for pedestrians, vehicles, etc.

The following live loads have been assumed for the preliminary design of the maritime structures at Toondah Harbour as shown in Table 6-1:

Table 6-1 Live Loads on Maritime Structures

Maritime Structures	Live Load	Reference
Floating Pontoons	3.0kPa UDL 4.5kN Point Load	Cl. 4.7.2, AS3962
Access Gangway	4.0kPa UDL 4.5kN Point Load	Cl. 4.5.1, AS3962
Surcharge on harbour edge - Typical (pedestrian) - Road reserve (vehicular) - Ferry terminal (Ro-Ro)	 5kPa 10kPa 15kPa	 Table 5.1, AS4997 Table 5.1, AS4997 Class 15, Table 5.1, AS4997
Fixed Wharf	25 kPa	Class 25, Table 5.1, AS4997 (to allow for building structure)

7 MARITIME STRUCTURES

7.1 General

The maritime structures include the following:

- Vessel berths (including public pontoon);
- Ferry Terminal Ro-Ro berth;
- Fixed wharf;
- Harbour edge treatment; and
- Boat ramp (non-motorised).

Appendix C provides preliminary drawings for the layout and details of all maritime structures proposed for the Toondah Harbour development.

7.2 Vessel Berths

There is proposed to be a commercial marina, a public pontoon and private residential berths as part of the Toondah Harbour development. The layout of the proposed berths is shown in Figure 7-1 below. Further details are shown in the Drawings provided in Appendix C.

Figure 7-1 Marina, Private Vessel Berths and Public Access Pontoon

There is a total of 200 berths that can accommodate vessels up to 12m in length (~39 feet) shown in red and 14m in length (~46 feet) shown in blue. The vessel berths would comprise floating pontoons restrained by vertical piles driven into the seabed. Access from the land platform to the pontoons would be via a hinged aluminium gangway. Similar berths are proposed for the smaller commercial vessels (fast passenger catamarans).

A cross-section of the floating pontoons and access gangway connecting to the shore for the commercial marina berths is shown in Figure 7-2. The arrangement shown would be generally similar for the public pontoon and private residential berths, although the size and orientation of the pontoons would differ.

The vertical restraining piles would be driven into the seabed to sufficient depth to allow for lateral loading from vessels moored to the pontoons The piles would typically consist of tubular steel approximately

400mm to 450mm diameter and 12mm wall thickness, with appropriate corrosion protection such as painting and/or HDPE sleeves.

Piles would be fabricated offsite, transported to site by truck, and offloaded by crane. Piles located within the internal waterways would be driven by land-based plant 'in the dry' before flooding of the waterways. Piles located within the port area would be driven by floating plant. Depending on rock levels, pre-boring using a drill rig may be required before the piles can be pitched and driven into the hole.

The total number of tubular steel piles to be installed for the commercial marina, public pontoon and private residential berths would be approximately 200. The majority of the piles, approximately 160, would be installed in the dry. The estimated rate of installation of the piling in the dry would be 4 piles per day, hence based on a five and a half day working week, the duration of piling in the dry would be 7 to 8 weeks. The estimated rate of installation of the piling from floating plant would be 1 pile per day, hence the duration of this over-water piling would also be 7 to 8 weeks[1].

The floating pontoons would be constructed of a concrete or polyethylene shell with interior styrofoam floatation. The individual pontoons would typically be interconnected by timber walers and through bolts, or an aluminium framing system. The pontoons would be fabricated offsite, transported to site by truck and unloaded into the water by crane. The pontoons would be manoeuvred into position in small groups by a workboat and interconnected manually.

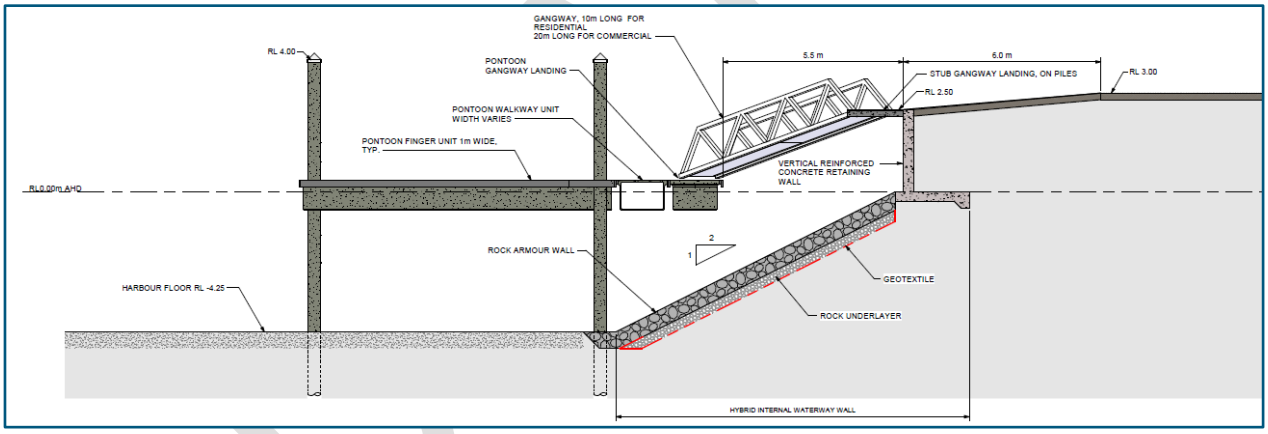


Figure 7-2 Floating Pontoon & Access Gangway

Access gangways are typically constructed of durable aluminium sections. They are hinged at the top and have rollers on the pontoon landing. This enables the gangway to rotate and move up and down with the tide. The length of the gangways would be sufficient to allow for a slope that is acceptable for disabled access (e.g. 1:8) for at least 80% of the tidal range. The slope may be increased (1:3.5) for private berths. Gangway widths would typically be in the range of 0.9m -1.5m.

The gangways would be fabricated offsite, transported to site by truck, and installed by crane, following installation of the pontoons and completion of the footing on land.

Access gangways would be 'angled' to the shoreline to allow the pontoons to be close to the revetment and maximise available waterway area. This would enable the appropriate gangway slope to be achieved for disabled access. An example is shown in Figure 7-3.

[1] *The hours of operation for piling have been assumed to be between 9am and 3pm daily, with 15 minute respite every hour. This applies to all estimates of piling duration in this report.*

Figure 7-3 Angled Access Gangway over Rock Revetment to Floating Pontoon (Bermagui Boat Harbour, NSW)

The pontoons will typically have the following plan dimensions to comply with AS3962:2020:

- Walkways : 1.5m -1.8m width
- Fingers : 0.9m width
- Berths:
  - 12m double berth clear width : 9.6m
  - 14m double berth clear width : 10.4m
- Public Access pontoon : 20m x 3m

Piling and floating pontoons will be suitable for the incorporation of fish habitat modules wherever appropriate, as described in *Fisheries Guidelines for Fish-Friendly Structures*.

Installation of the piling, pontoons and gangways would be staged. The facilities located in the port area would be constructed in the initial phases of the development. The facilities within the internal waterways would be constructed later in time when these waterways are completed and prior to their connection to the Fison Channel.

7.3 Ferry Terminal Ro-Ro Berths

SeaLink's current commercial operations to North Stradbroke Island (Minjerribah) consist of passenger and car ferries, which are Roll-on Roll-off (Ro-Ro) type vessels. These vessels incorporate a trafficable ramp, which is lowered to allow cars to embark and disembark.

The layout of the proposed ferry terminal is similar to what is currently provided, but incorporated into a new overall Harbour layout. It is proposed that there would be three Ro-Ro berths as shown in Figure 7-4.

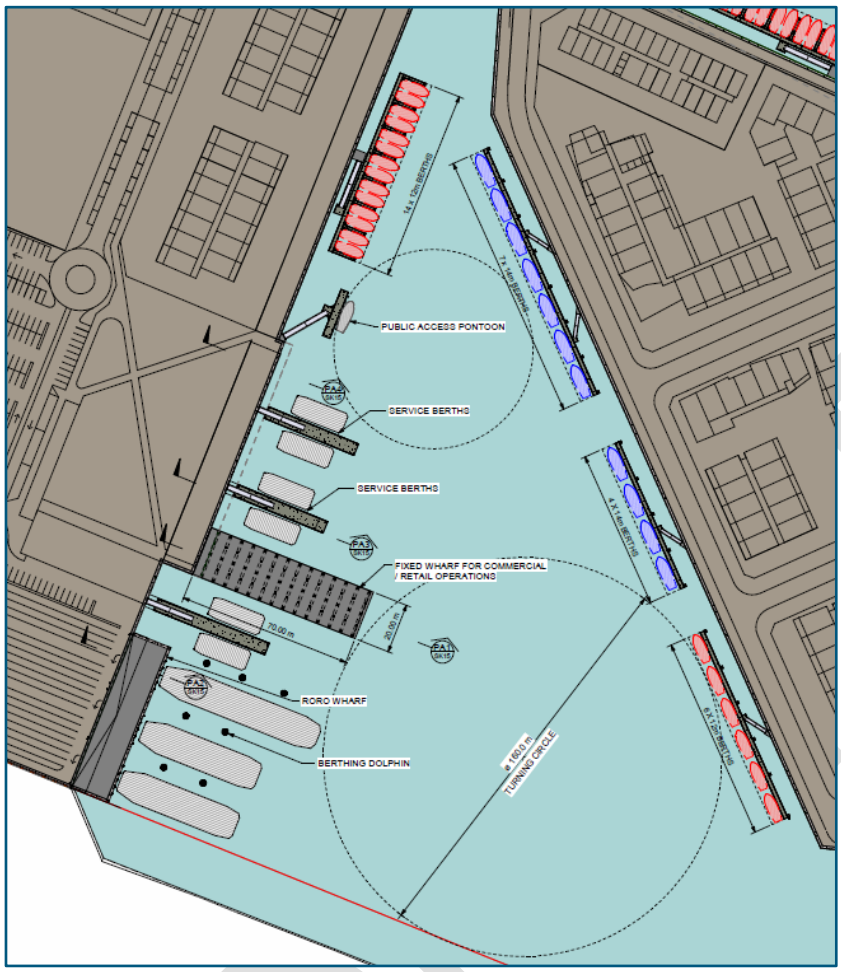


Figure 7-4 Ferry Terminal

The Ro-Ro berthing facility consists of berthing piles, landing structure for vessel ramp, fendering, and on-shore bollards for mooring. The waterway area immediately adjacent the Ro-Ro berths has sufficient turning circle area for the largest vessel (i.e. 2.0 x L = 160m diameter). A section through the Ro-Ro berth is shown in Figure 7-5.

The berthing piles would typically consist of tubular steel approximately 450mm diameter and 12mm wall thickness, arranged in groups of three (referred to as a 'dolphin'). The total number of individual piles would be 21. The piles would be fabricated offsite, transported to site by truck, and offloaded by crane.

Piles would be driven by floating plant, with possible pre-boring using a drilling rig where required. The estimated rate of installation of the piling would be 1 pile per day, hence the duration of this over-water piling would be approximately 4 weeks.

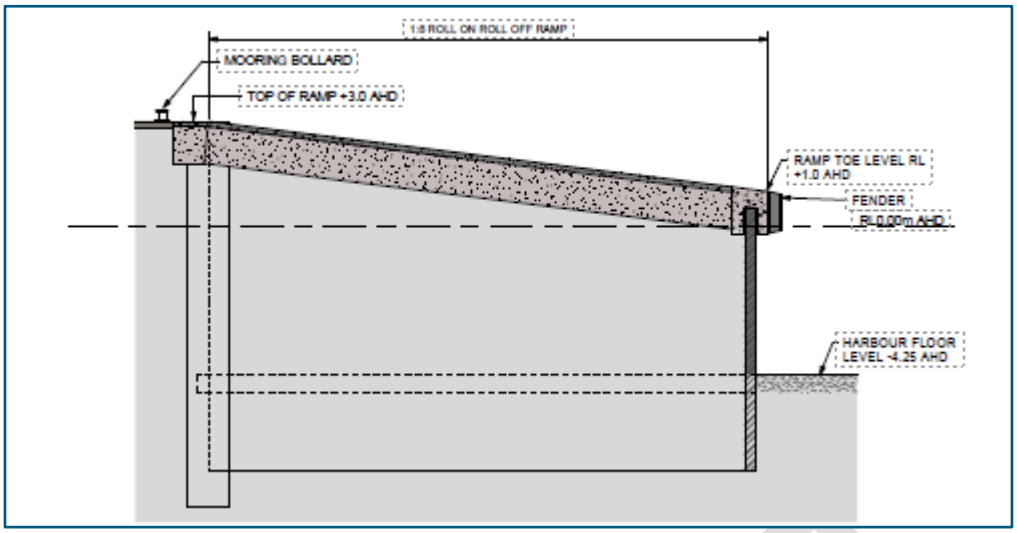


Figure 7-5 Section through Ro-Ro Ramp

In the Ferry Terminal area there would be a need for a relatively high vertical retaining wall. It is proposed that this would be an anchored steel sheet pile wall with a reinforced concrete capping beam. To restrain the wall, a series of tie-back anchors will be required. These are supported by a dead man anchor, as shown in Figure 7-6.

The sheet piles would be type AU 20 or similar having an individual width of 750mm and thickness of 12mm. The total length of sheet pile wall at the ferry terminal Ro-Ro berths would be approximately 100m.

The sheet piles would be fabricated offsite, transported to site by truck, and offloaded by crane. The sheets would be driven by floating plant.

The estimated rate of installation of installation of the sheet piling would be approximately 4.5m linear metres per day, hence the duration of the sheet piling for the ferry terminal Ro-Ro berths would be around 4 weeks.

There is significant additional linear metres of sheet piling to be installed in the port area aside from the Ro-Ro berths and also within a portion of the internal waterways, as shown on the Waterway Profile and Edge Treatment drawings in Appendix B. The total additional linear metres of sheet piling would be approximately 1,100m and would take an estimated 40-50 weeks to install.

The steel sheet pile wall would constitute a relatively impermeable barrier to water flow in both directions. Based on information contained in the publication 'Impervious Steel Sheet Pile Walls – Design & Practical Approach' prepared by ArcelorMittal, the so-called 'inverse interlock resistance' of the sheet piling would be around 2 x 10^{-7}m/s based on 'empty interlocks' (interlocks between individual sheets not purposely sealed).

The maritime facilities within the port area, including the edge treatments, would be constructed in the initial phases of the development.

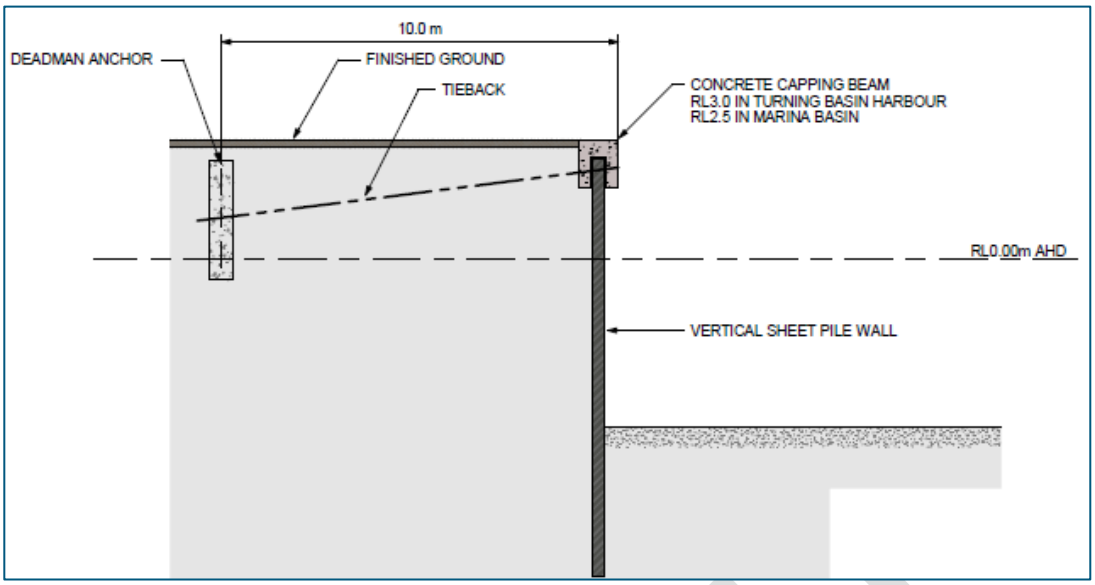


Figure 7-6 Anchored Steel Sheet Pile Vertical Wall

7.4 Fixed Wharf

There is a proposed fixed wharf structure located adjacent to the Ferry Terminal. This structure would be able to accommodate pedestrians and low-level building structures. The wharf would be constructed of a reinforced concrete deck and beams supported on tubular steel piles driven into the seabed, as shown in Figure 7-7. The tubular steel piles would be approximately 500mm in diameter and 14mm wall thickness. The total number of piles would be approximately 70.

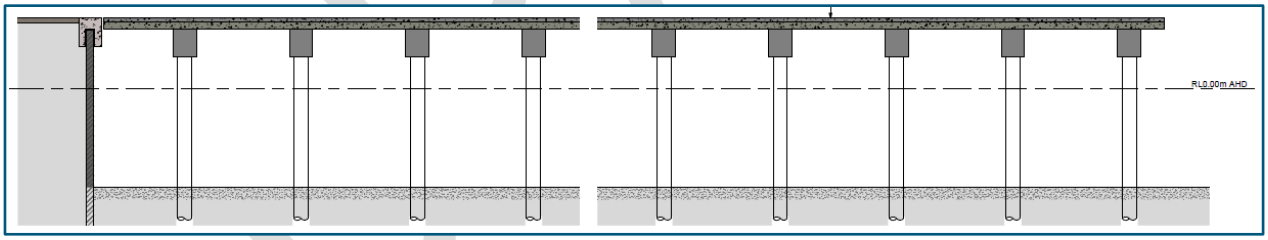


Figure 7-7 Section through Fixed Wharf

The piles would be fabricated offsite, transported to site by truck, and offloaded by crane. The piles would be installed by floating plant.

The estimated rate of installation of the piling would be 1 pile per dry, hence the duration of the piling for the fixed wharf would be approximately 14 weeks.

The steel piles would need to be sufficiently embedded into the stiff/hard clays to obtain the geotechnical capacity to carry the wharf loads. As well as accommodating loads from potential emergency vehicles, the wharf structure would be designed to accommodate loads from small structures / buildings.

The form of construction for the superstructure would likely consist of precast concrete beams and precast soffit units with an insitu topping. The reinforced concrete elements will need to consider a durability strategy, similar to that as described in Section 7.6 below. Precast elements would be fabricated offsite,

transported to site by truck and offloaded by crane. Insitu concrete would be supplied to site by transit mixer.

The fixed wharf would be constructed in the initial phases of the development.

7.5 Rock Revetment

A rock revetment would typically be used to protect the reclaimed land from erosion, as shown in Figure 7-8. This structure typically consists of a rock armour layer, rock under layer, rock core (if required) and geotextile to prevent migration of fine material from the reclaimed fill. The slope of the revetment is proposed to be 1 vertical to 2 horizontal. The rock revetment would be constructed progressively during the development of the land platform.

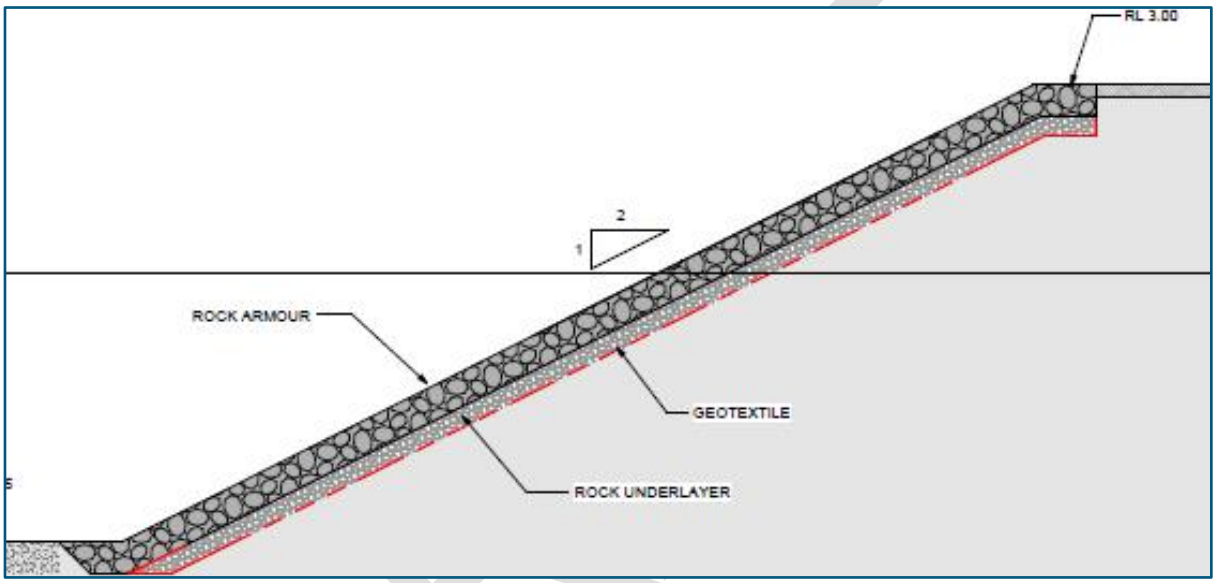


Figure 7-8 Rock Revetment

The rock used in the construction of the revetment should be hard and durable for use in a marine environment (e.g. igneous rock). The rock would be supplied to site from a quarry(s) and installed using an excavator. The geotextile would be fabricated offsite, transported to site in rolls by truck, and unloaded by crane.

The rock revetment is also a suitable habitat for marine fauna such as small fish, as shown in Figure 7-9.

Further measures to enhance ecological outcomes for the rock revetment would be considered during detailed design.

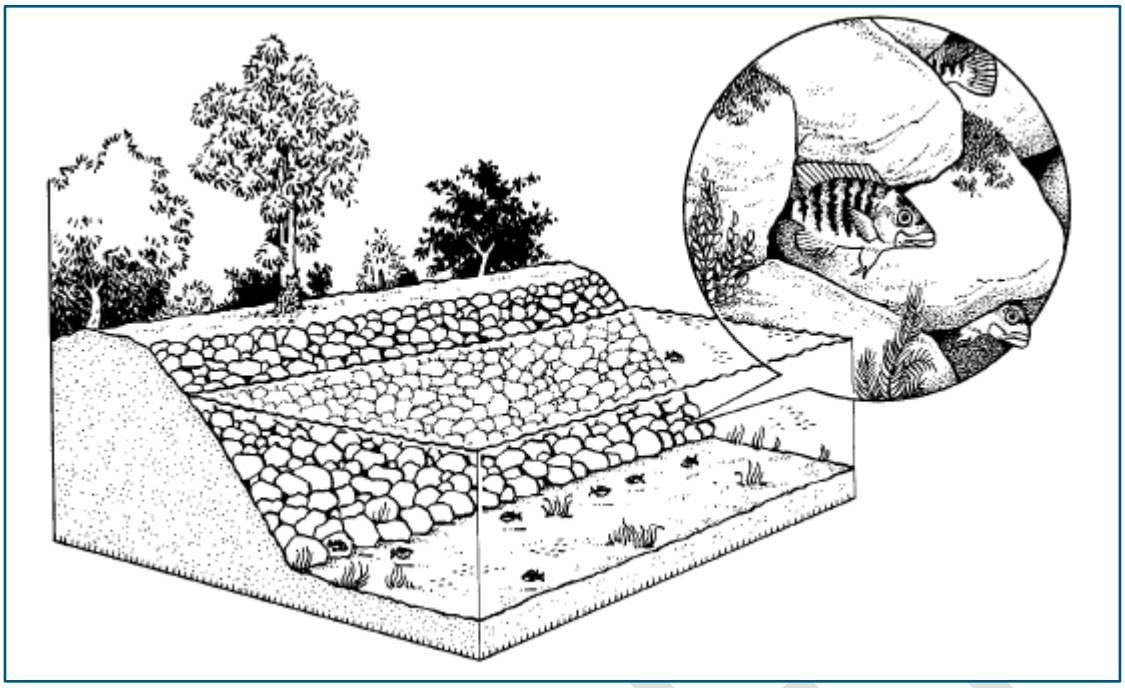


Figure 7-9 Rock Revetment as Fish Habitat
***Source**: Figure 4, Fish Habitat Guideline FHG 006: Fisheries Guidelines for Fish-Friendly Structures*

7.6 Vertical Wall on Rock Revetment

A significant length of the edge treatment would include a reinforced concrete wall on top of the rock revetment, which would reduce the plan footprint of the edge treatment (refer Figure 7-2).

It is proposed that this wall would be an 'L-shape' with a vertical facing and horizontal base. This allows the wall to act as a gravity structure with the fill on the base assisting the wall to resist sliding and overturning. An example of this type of wall for a similar application but at a larger scale is shown in Figure 7-10.

The reinforced concrete L-shape wall would most likely be a precast element, fabricated offsite in controlled conditions, transported to site by truck and offloaded by crane. It is also possible the precasting could take place on site.

Figure 7-10 Reinforced Concrete L-shaped Wall (Shell Cove Boat Harbour, NSW)

The concrete wall would be exposed to continuous wetting and drying from salt water. This harsh marine environment would have significant potential durability issues for the wall including corrosion of reinforcement and spalling of concrete. Appropriate measures for concrete structures in this environment would need to be considered, including:

- High strength, dense, durable concrete;
- Large concrete cover to reinforcement;
- Consideration for the use of galvanised (or stainless steel) reinforcement;
- Passive anodes embedded in the concrete to protect reinforcement; and
- Use of protective coatings (e.g. silane).

7.7 Non-Motorised Boat Launching Facility

A small ramp is proposed to be used for the launching and retrieval of non-motorised boats, such as kayaks and dinghies, as shown in Figure 7-11. This structure would primarily be constructed of timber members, including piles, headstocks, girders and decking. Cleats on the surface of the ramp would be required to minimise the risk of slipping while launching and retrieving boats.

The timber elements of the structure would need to consist of naturally durable timbers, such as Turpentine, Ironbark and Blackbutt. Timber piles would need to have resistance to marine borers. Steel fixings would need to be either galvanised or stainless steel due to the aggressive marine environment.

Piles would be installed by land-based plant over a period of less than 1 week. Heavy timber elements would be installed by a small crane or excavator. Decking and fixings would be a manual operation.

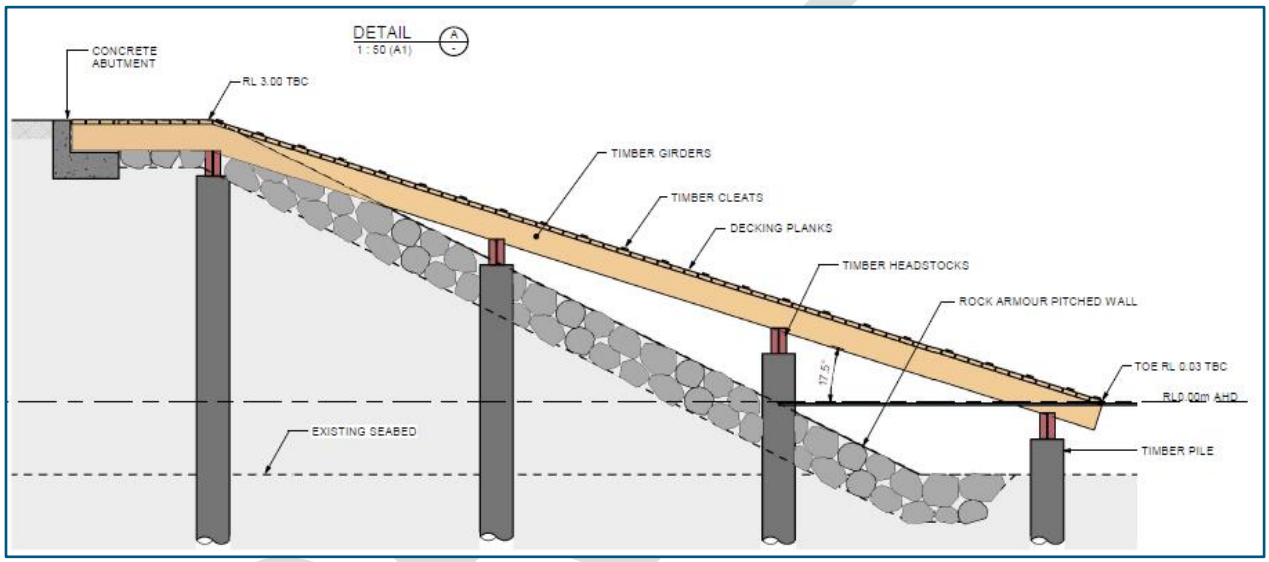


Figure 7-11 Non-Motorised Boat Launching Ramp

7.8 Lighting for Navigation Aids

Discussions have been held with the Regional Harbour Master within Maritime Safety Queensland (MSQ) Department of Transport and Main Roads, who controls the Toondah Harbour area, regarding the general lighting requirements for the proposed development.

The following general advice has been received, divided into the Fison Channel, the swing basin and ferry terminal, and the internal waterways within the development. Further detail would be developed as the design of proposed development progresses beyond the concept/preliminary stage.

7.8.1 Fison Channel

There are currently 12 lateral markers along the existing channel and three sets of lead markers. A similar number of lateral markers would be required for the new channel, marking the channel entrance and gating the bends.

Timing of flashing of the lateral markers would need to be considered as the design develops and it may be necessary for the lateral lights synchronised. The lighting would require a range of 2 nautical miles.

7.8.2 Swing basin and ferry terminal

MSQ would look to decommission the existing three sets of lead lights and replace them with a Port Entry Light system, in consultation with the ferry operators. If ambient lighting within the swing basin/port area from surrounding areas is sufficient, internal navigation lighting would not be required.

The individual pontoons and jetties would require lighting.

7.8.3 Internal waterways

Low level lighting would be required along the breakwater (eastern boundary of the site) along with special markers at the southern end of the breakwater. If ambient lighting from surrounding areas is sufficient internal navigation lighting would not be required. The individual pontoons and jetties would require lighting.

Speed signs would be required within the waterways (eg. 6 knots), but no specific lighting would be required for these signs.

There may be line of sight issues for vessels exiting the internal waterways and entering Fison Channel. An assessment would be needed as the design develops and it is likely a “Port in Use” warning light system will be required to warn recreational vessels of ferry movements.

8 RECOMMENDATIONS

The following recommendations are proposed for consideration during design development of the maritime structures for Toondah Harbour:

Geotechnical: Further geotechnical investigations would be required to define sub-surface conditions, especially for the location of proposed maritime structures. Boreholes would need to penetrate well into the stiff/hard clays to determine the vertical and horizontal load capacity of piles. Laboratory testing for the clays would also be important in determining the soil properties for use in slope stability assessment of the rock revetment.

Durability: The durability of maritime structures is an important consideration in design and ongoing maintenance considerations. The level of durability measures in the capital investment of maritime structures would need to be considered in conjunction with expected ongoing maintenance repairs/replacement of structural elements.

Vessel Berths: The layout of the vessel berths would need to be considered in greater detail as the land platform layouts are developed. For example, the private berths and access points may need to be repositioned in relation to private residential blocks and location of road reserves.

Ferry Terminal: The ferry terminal layout should be further discussed with the ferry operators to ensure the adequacy of the Ro-Ro berths in relation to berth size, berthing/mooring dolphins, ramp slope and location of onshore bollards.

Lighting for Navigation Aids: Ongoing consultation would need to take place with the Regional Harbour Master to confirm details for navigation aids within the widened and deepened Fison Channel, the port area, and the internal waterways.

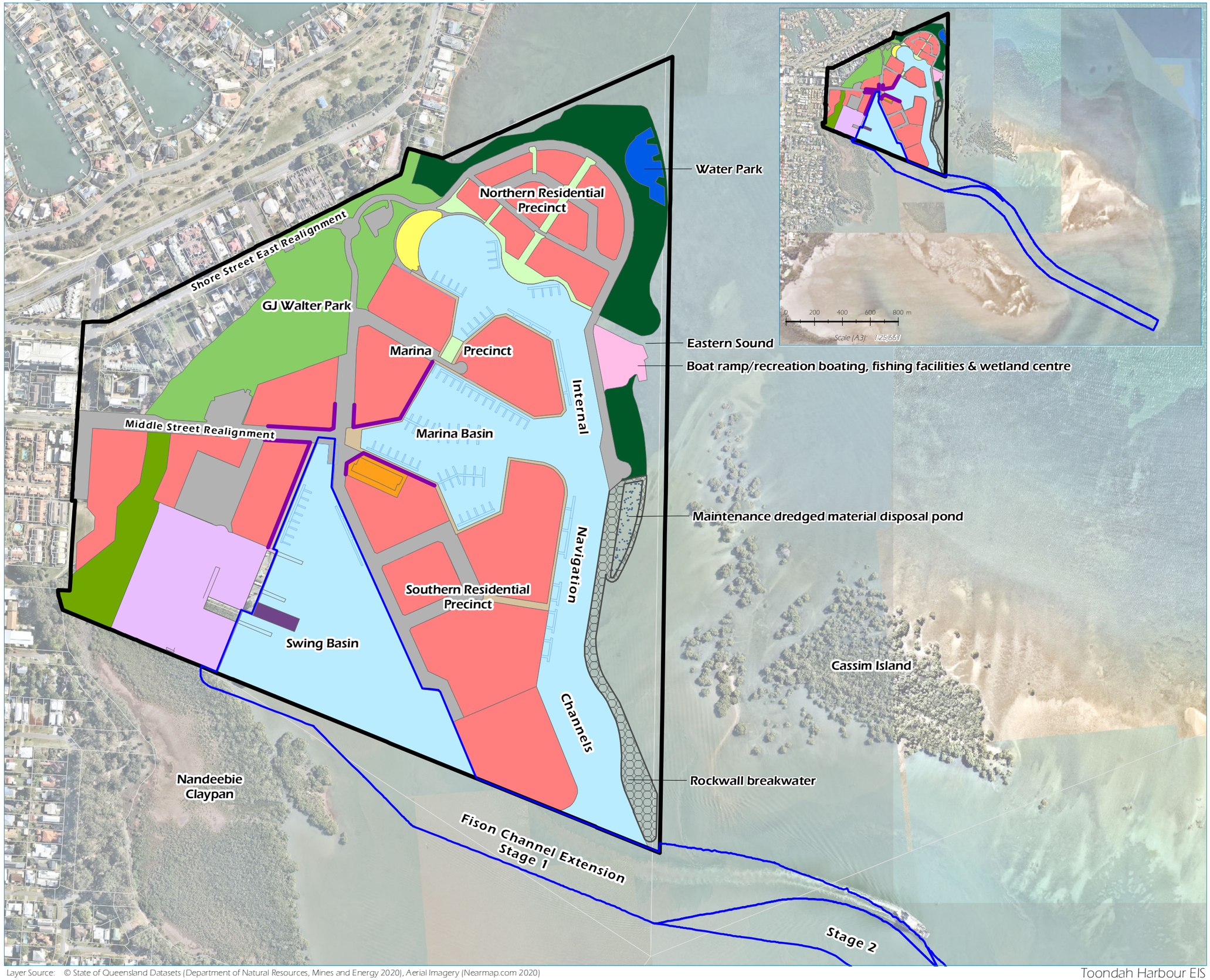
9 REFERENCES

ArcelorMittal (2017), Impervious Steel Sheet Pile Walls – Design & Practical Approach, Edition January 2017

NSW Public Works Department (1992),
Canal Subdivisions – Conditions and Guidelines,
Report No. 91021, ISBN No. 0-7305-7534-9, July 1992

Appendix A – Toondah Harbour Master Plan

Figure 2-4: Toondah Harbour Project Master Plan



Legend

- Toondah Harbour PDA (Project Area)
- Qld DCDB
- Wetland centre & recreational facitilities
- Residential
- Ferry terminal and car park
- Hotel & convention
- Marine services
- Water Park
- Foreshore park
- Existing Park
- Pocket Parks
- Retained intertidal area
- Artificial beach
- Boardwalks
- Activated edges - retail & commercial
- Harbour swing basin & fison channel extension

TOONDAH HARBOUR

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0 50 100 150 200 250 m

GDA 1994 MGA zone 56 Scale (A3): 1:5,250

N

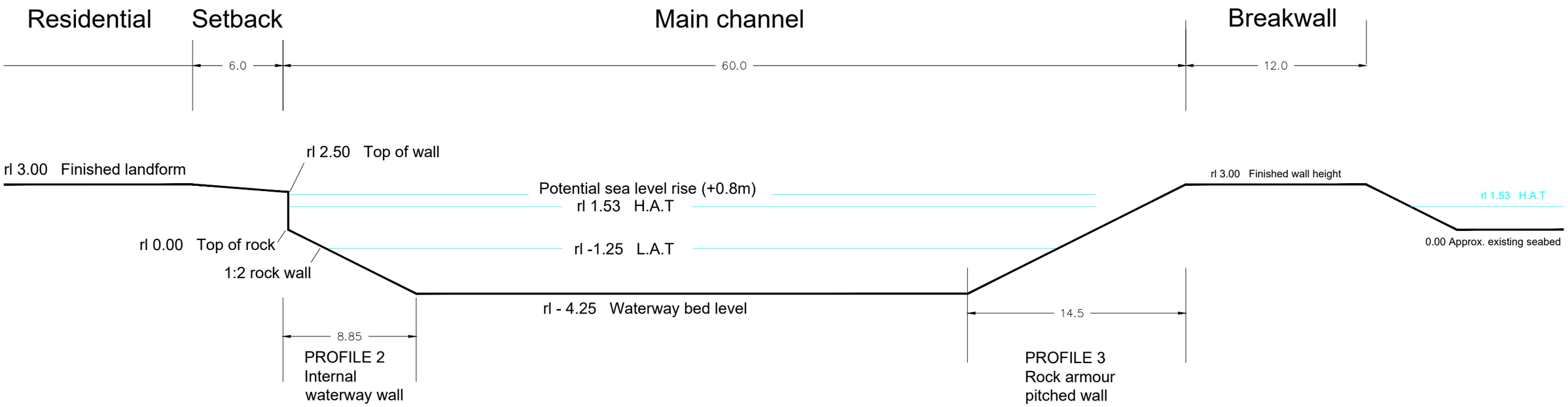
DATE: 19/11/2020

FILE REF: 9858 E Figure 2_4 Toondah Harbour Master Plan D

Layer Source: © State of Queensland Datasets (Department of Natural Resources, Mines and Energy 2020), Aerial Imagery (Nearmap.com 2020)

Appendix B – Waterway Profile & Edge Treatments

Main waterway profile



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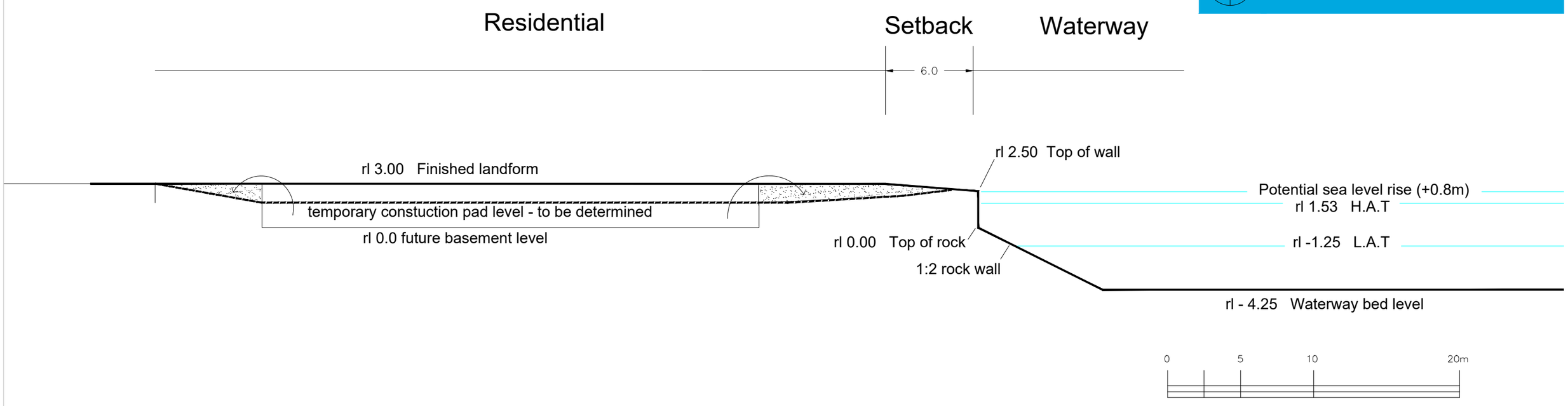

TOONDAH HARBOUR DEVELOPMENT

Date 04/08/2020

Drawing number AA_02

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Waterway edge treatments

PDA Boundary

1. Vertical sheet pile
2. Internal waterway wall
3. Rock armour pitched wall
4. Barge landing ramps

0 50 100 200 300 400m

TOONDAH HARBOUR DEVELOPMENT

Date
15/05/2020

Drawing number
AA_03

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Appendix C – Drawings

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PA2060-RHD-00-DR-W-SK01

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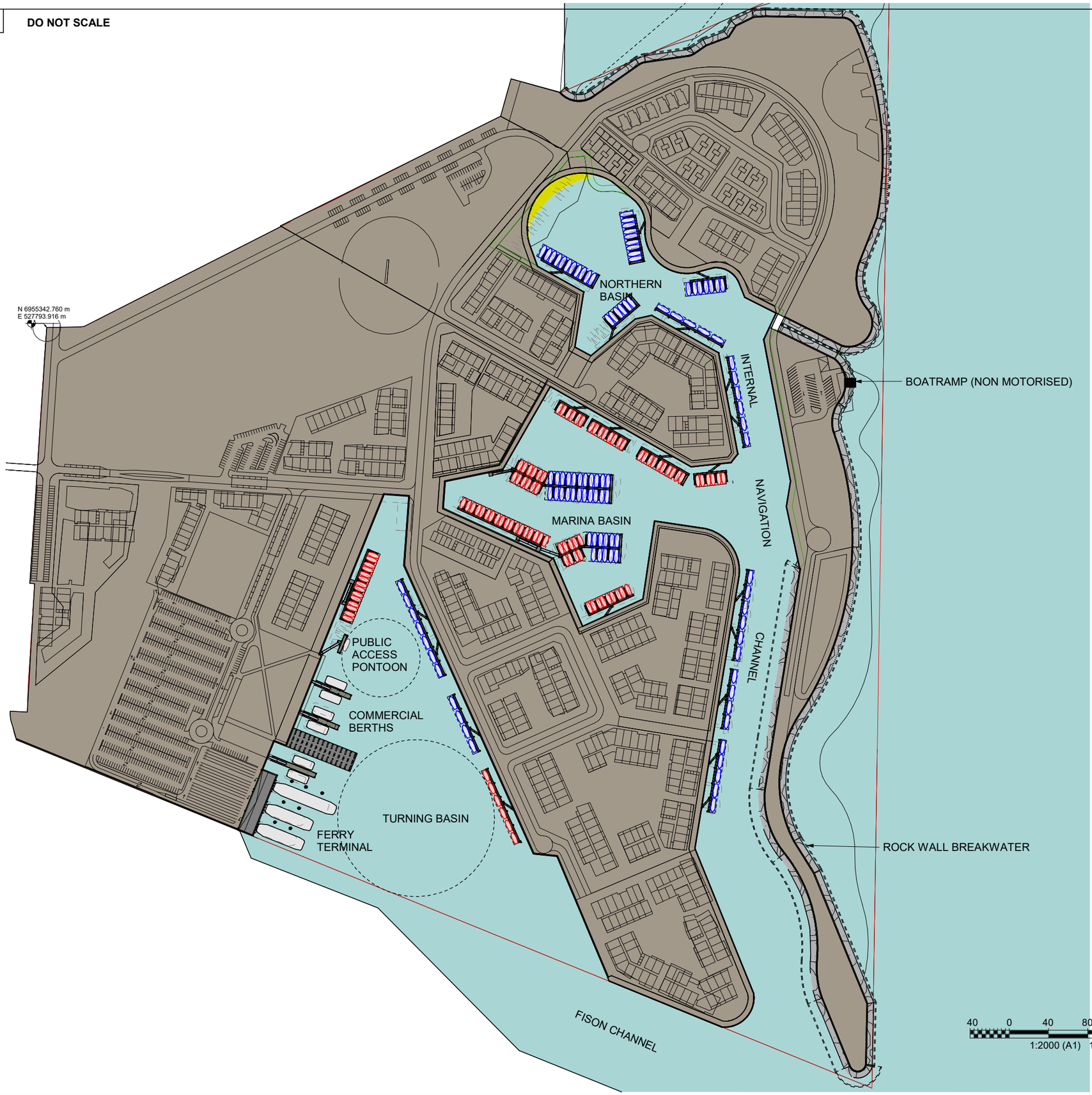

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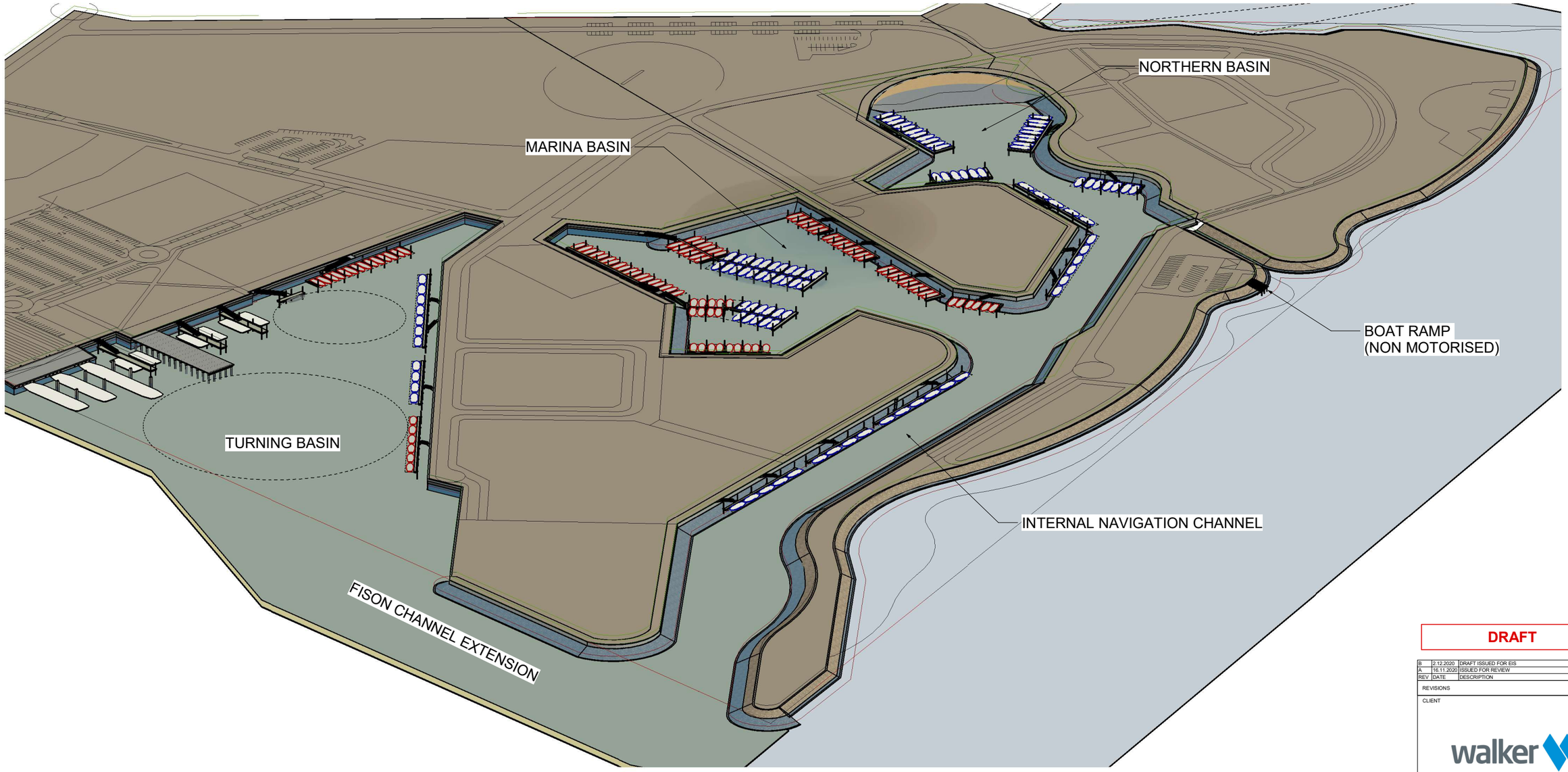

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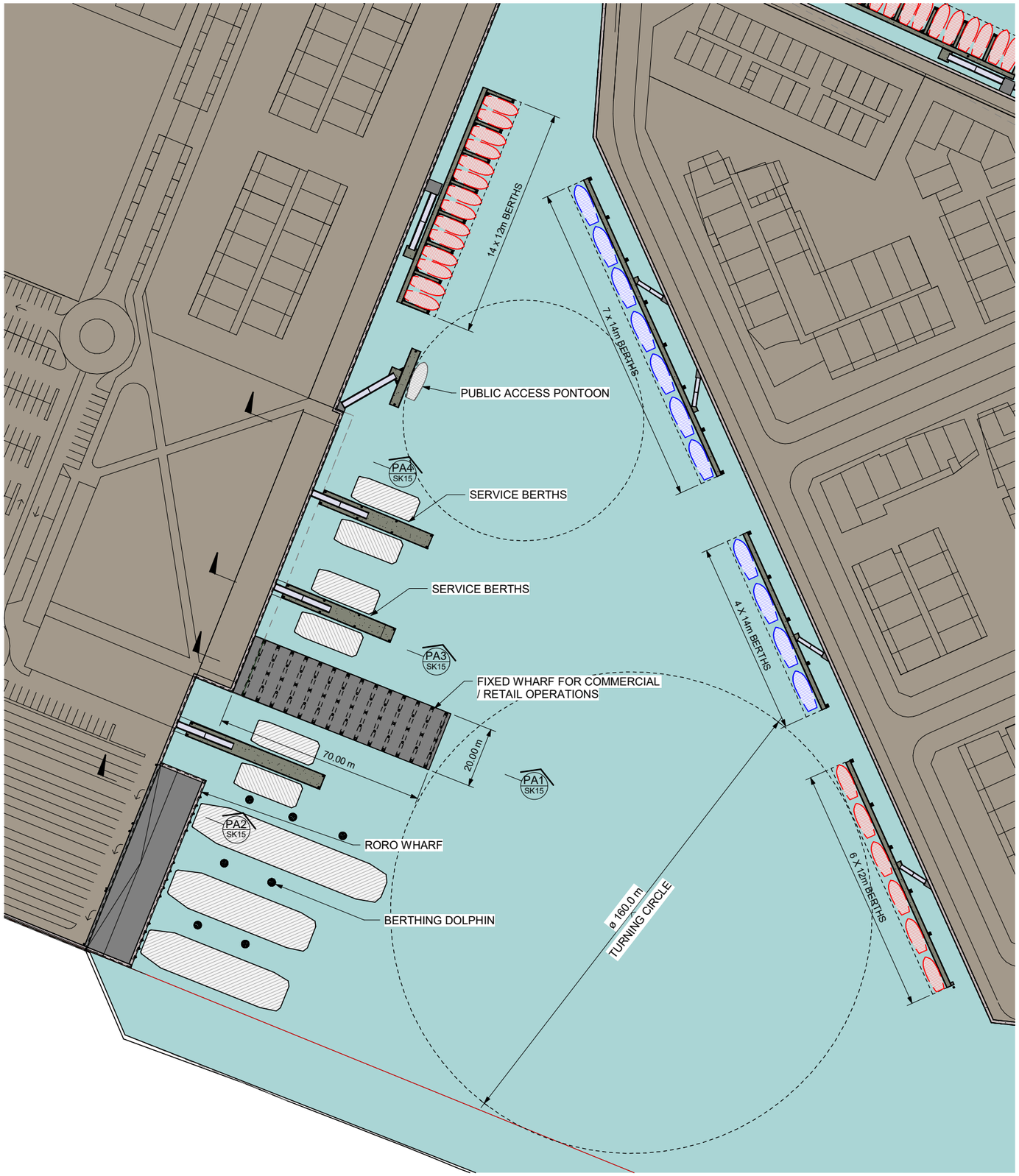

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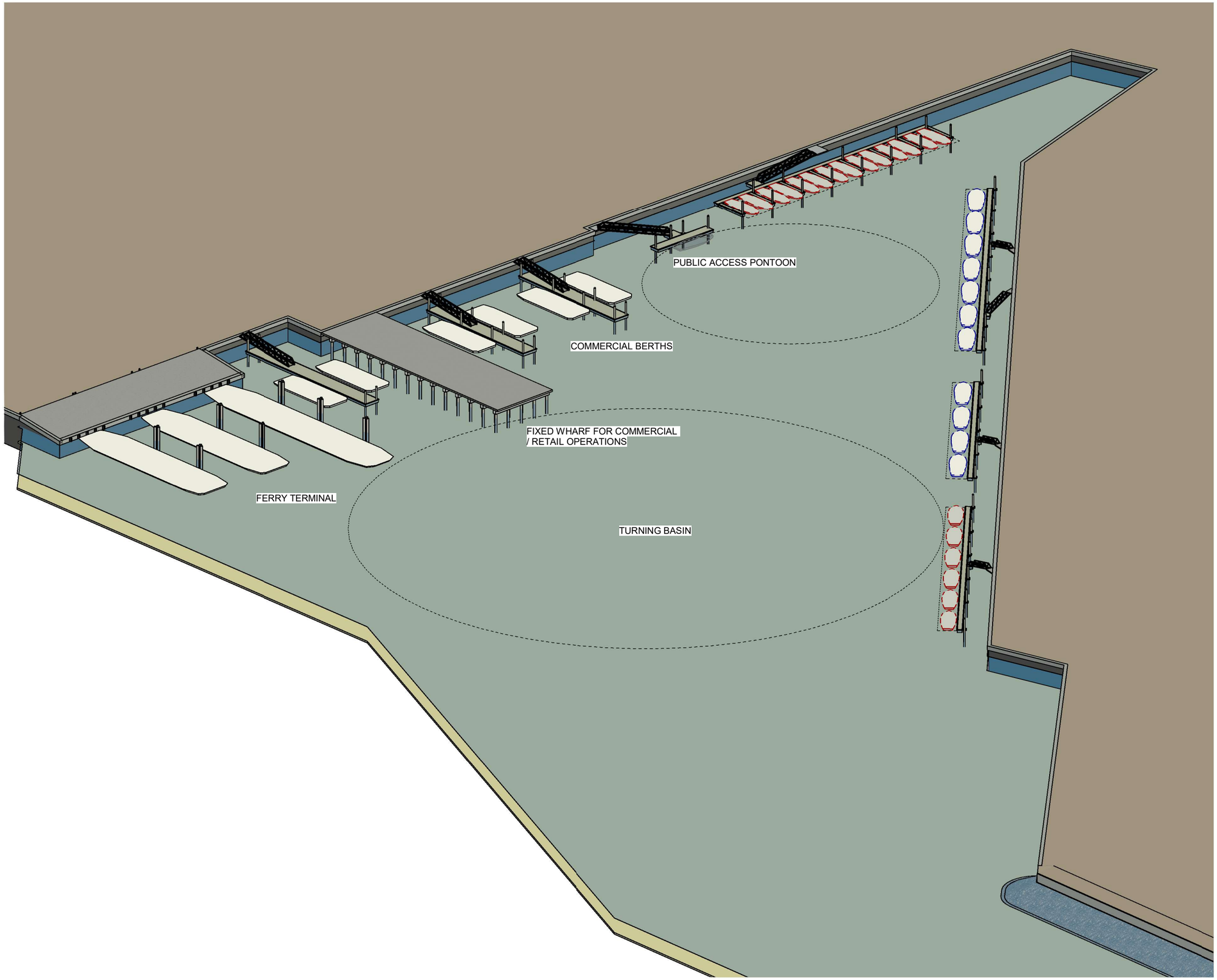

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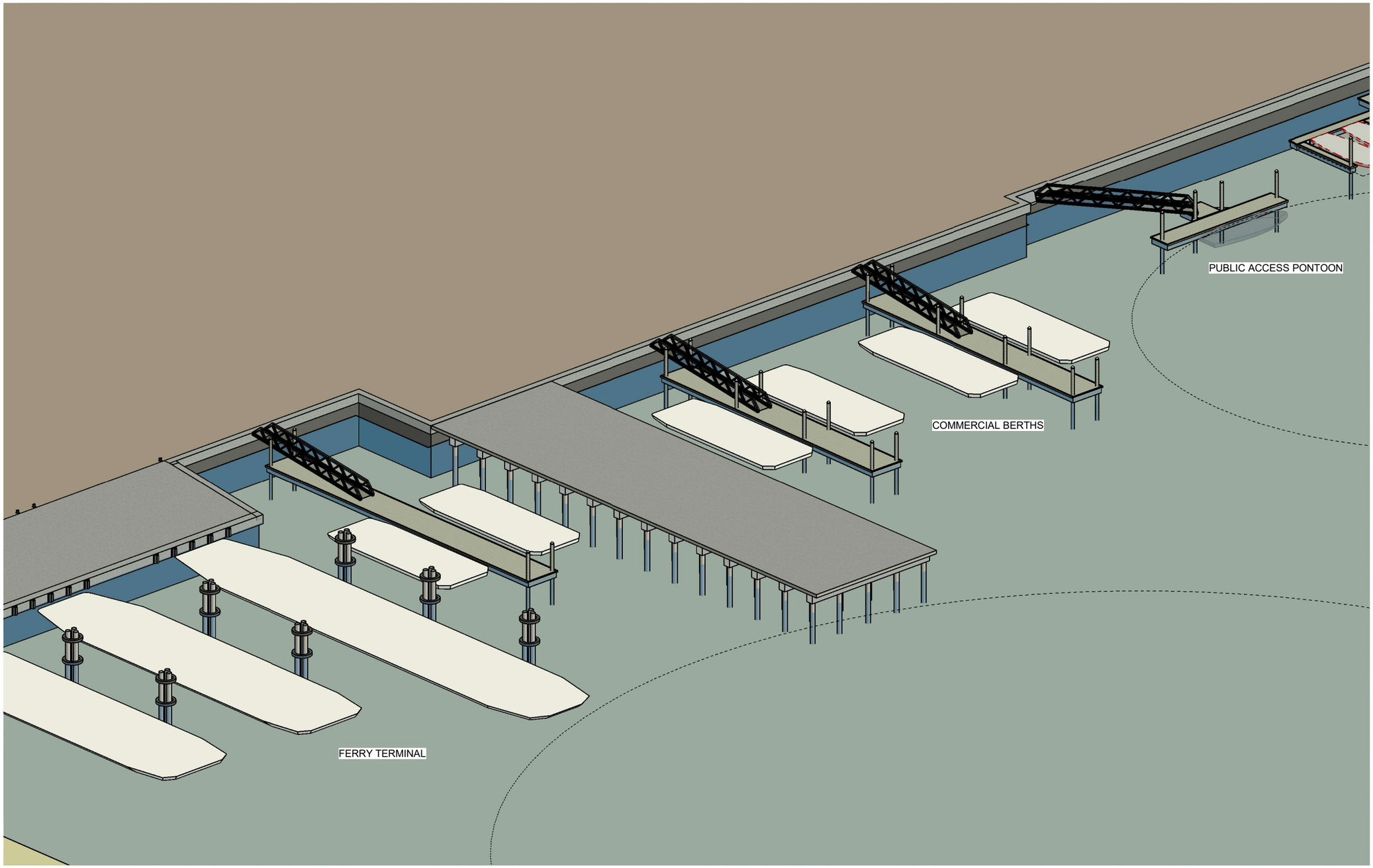

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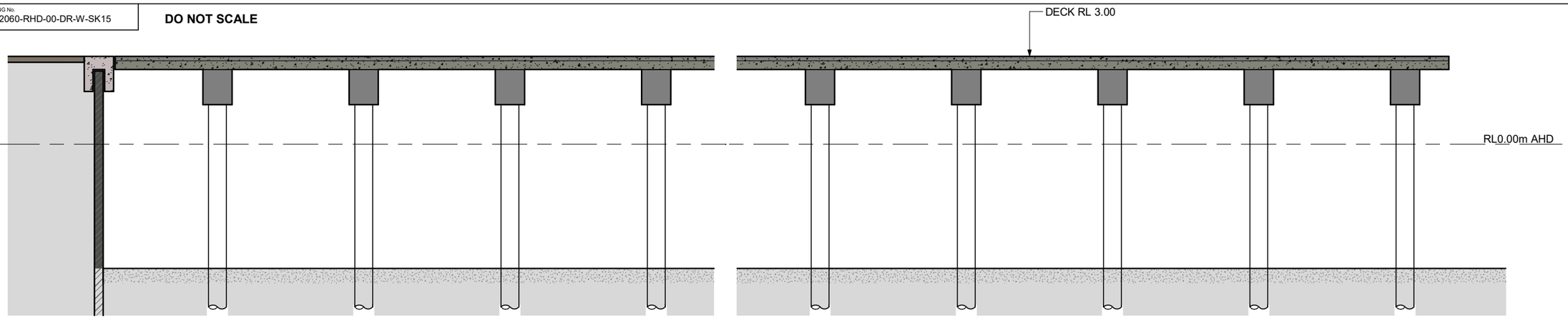

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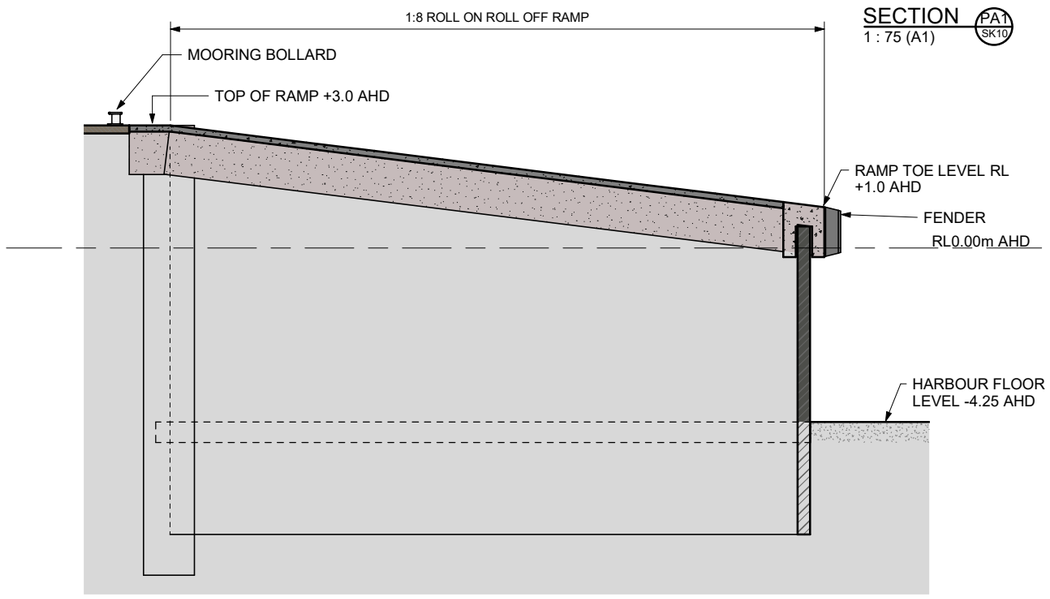

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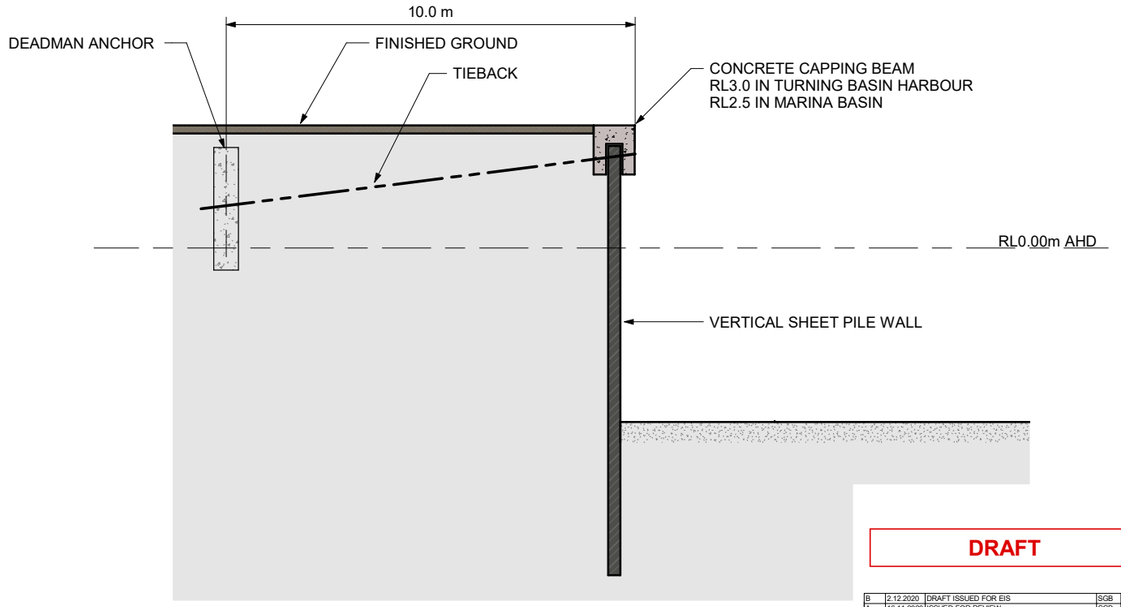

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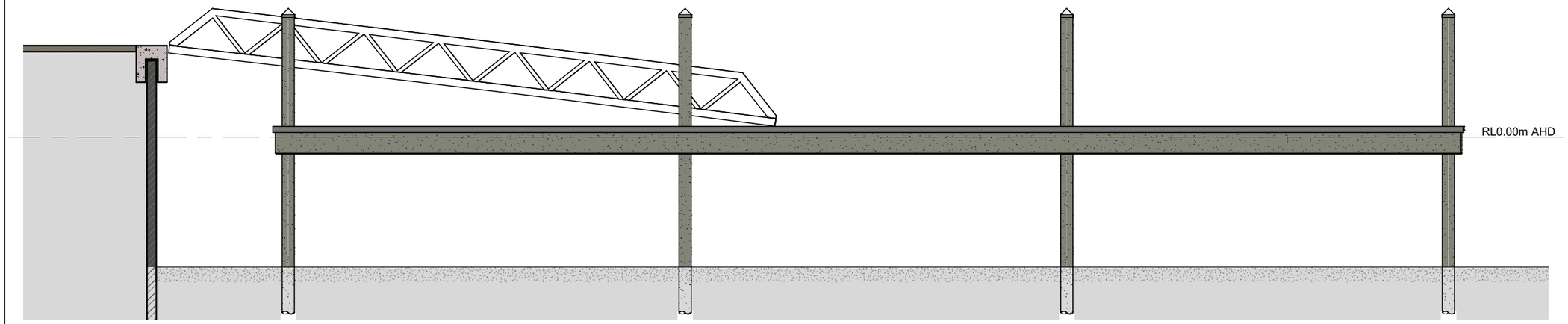

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DO NOT SCALE

HYBRID VERTICAL / ROCK ARMOUR WALL

24 x 12m BERTHS

2 x 10 x 14m BERTHS

VERTICAL SHEET PILE WALL,
REFER SECTION PA4 ON SK15

2 x 6 x 12m BERTHS

6 x 14m BERTHS

18 x 12m BERTHS

14m VESSELS SHOWN BLUE

12m VESSELS SHOWN RED

6 x 14m BERTHS

5 x 12m BERTHS

4 x 12m BERTHS

9 x 12m BERTHS

10 0 10 20 30 40 50m

1:500 (A1) 1:1000 (A3)

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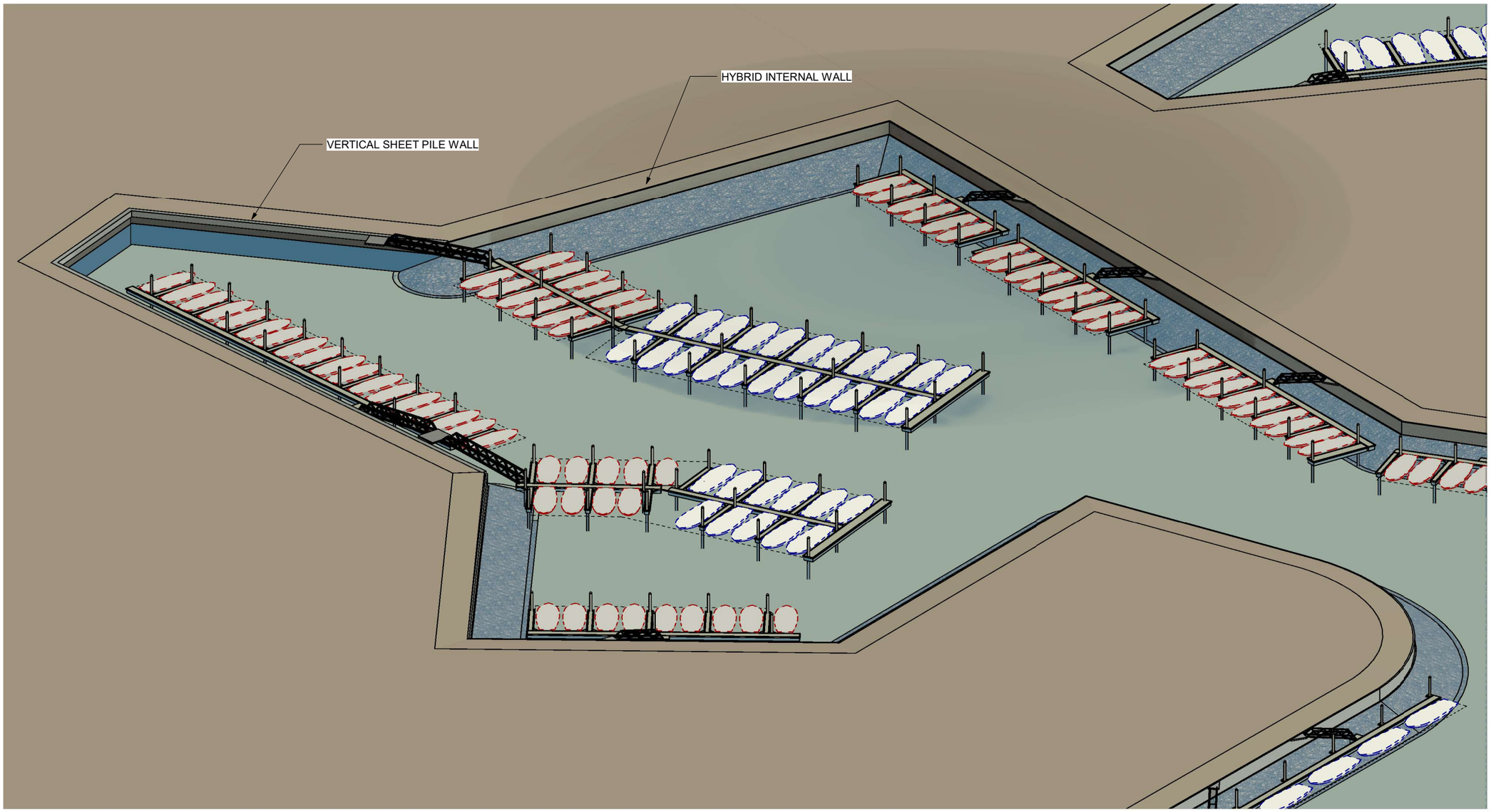

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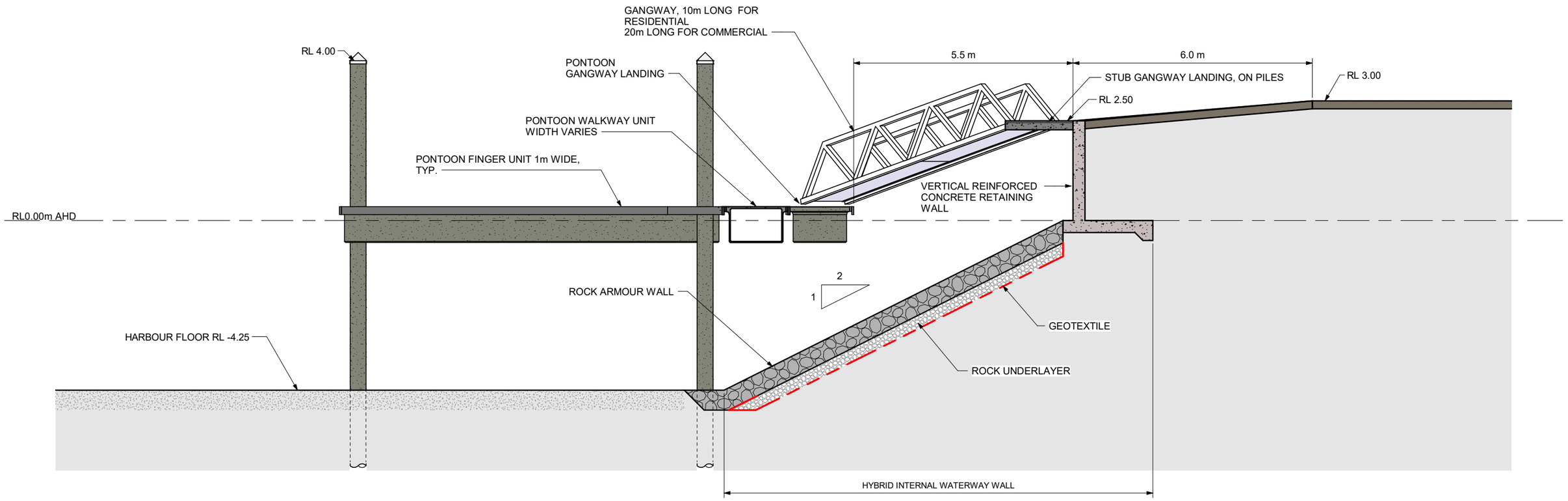

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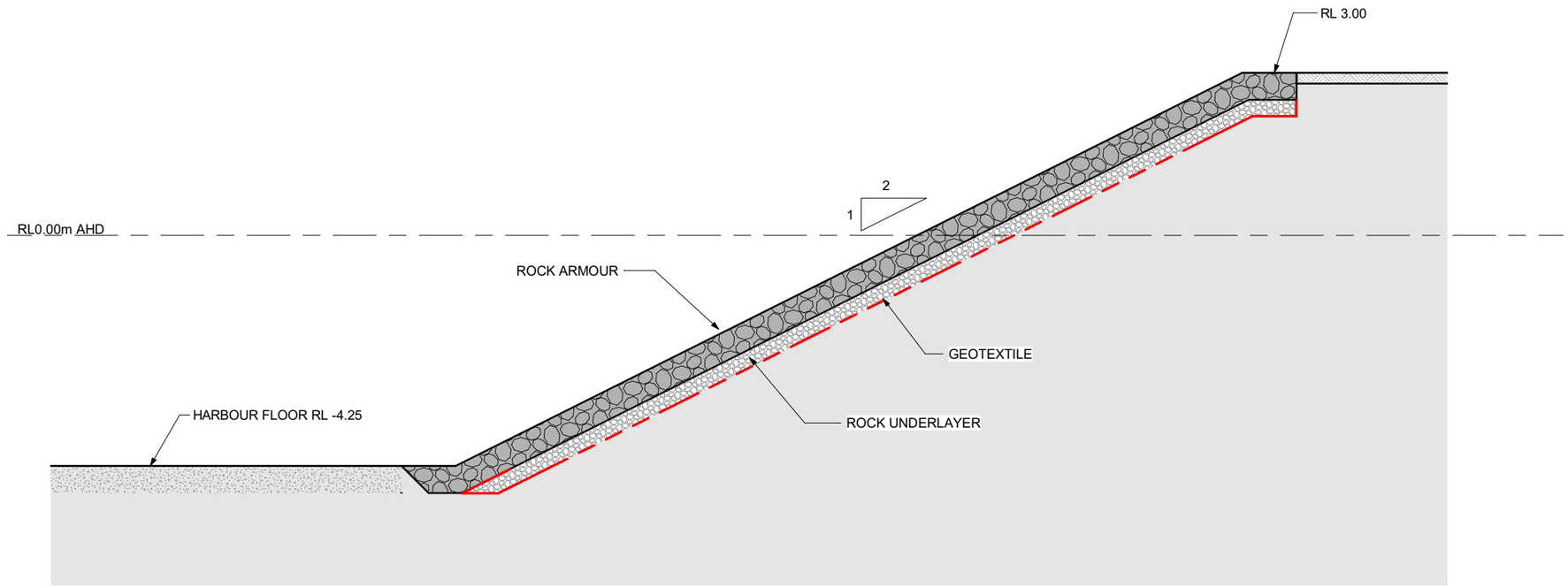

TYPICAL ROCK ARMOUR PITCHED WALL
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PA2060-RHD-00-DR-W-SK30

DO NOT SCALE

10 0 10 20 30 40 50m

1:500 (A1) 1:1000 (A3)

DRAFT

REV.	DATE	DESCRIPTION	BY	CHK	APR
B	2.12.2020	DRAFT ISSUED FOR EIS	SGB	CSS	
A	16.11.2020	ISSUED FOR REVIEW	SGB	CSS	GWB

REVISIONS

CLIENT

walker

PROJECT

TOONDAH HARBOUR

TITLE

NORTH BASIN

Level 14, 56 Berry Street
North Sydney NSW 2060, Australia
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Website: www.royalhaskoningdhv.com

Royal HaskoningDHV
Enhancing Society Together

DRAWN	COORD. SYSTEM	DATUM
SGB	MGA	AHD
DATE 27.10.2020	SCALE AT A1 1 : 500	REF.

DRAWING No. PA2060-RHD-00-DR-W-SK30

REVISION B

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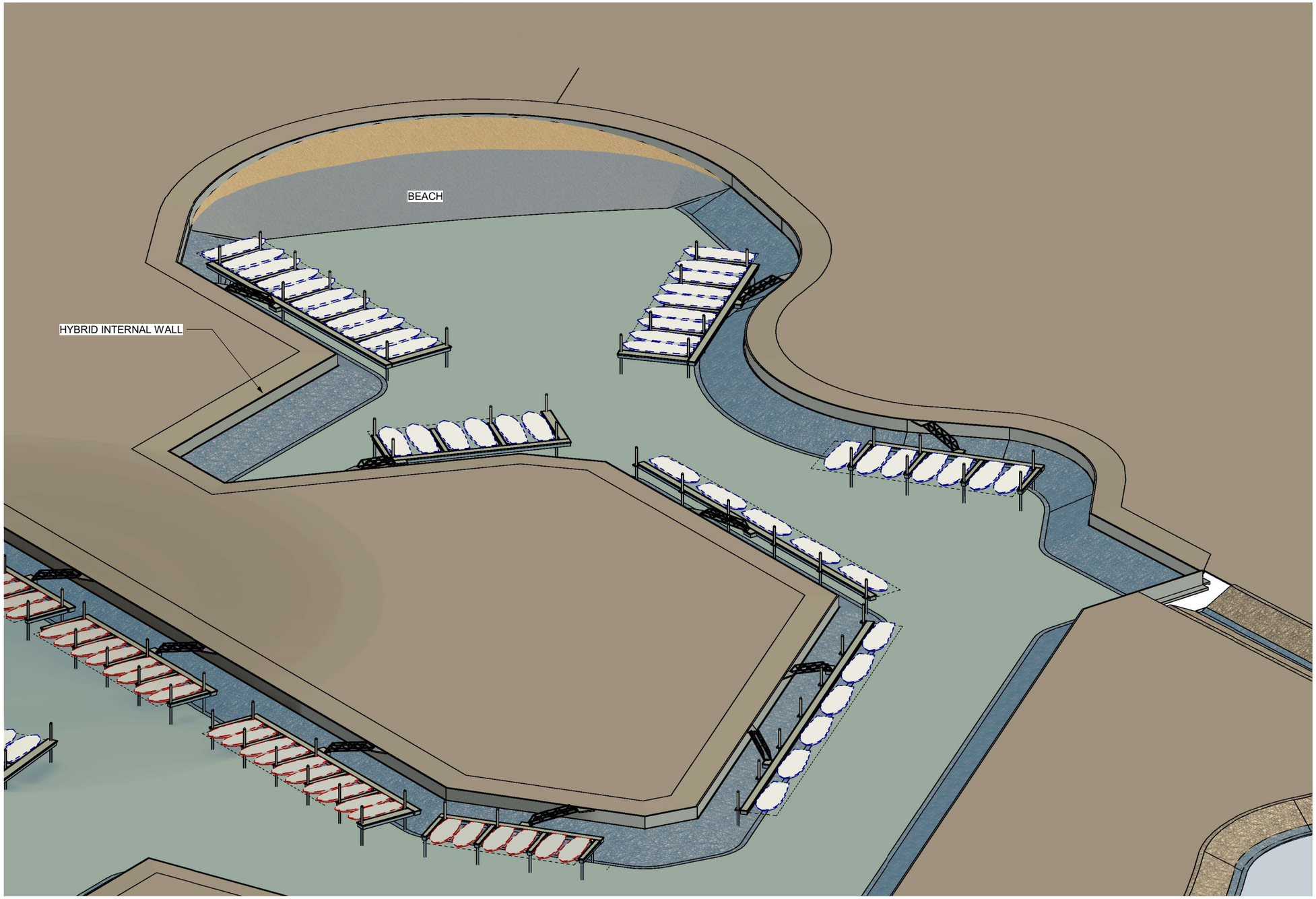
DRAWING No.
PA2060-RHD-00-DR-W-SK31

DO NOT SCALE



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REV	DATE	DESCRIPTION	BY	CHK	APR
B	2.12.2020	DRAFT ISSUED FOR EIS	SGB	CSS	
A	16.11.2020	ISSUED FOR REVIEW	SGB	CSS	GWB

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PROJECT

TOONDAH HARBOUR

TITLE

NORTH BASIN PERSPECTIVE

Royal HaskoningDHV
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DRAWN	COORD. SYSTEM	DATUM
	MGA	AHD
DATE 10/27/20	SCALE AT A1	REF.

DRAWING No. PA2060-RHD-00-DR-W-SK31

REVISION B

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DRAWING No.
PA2060-RHD-00-DR-MA-SK40

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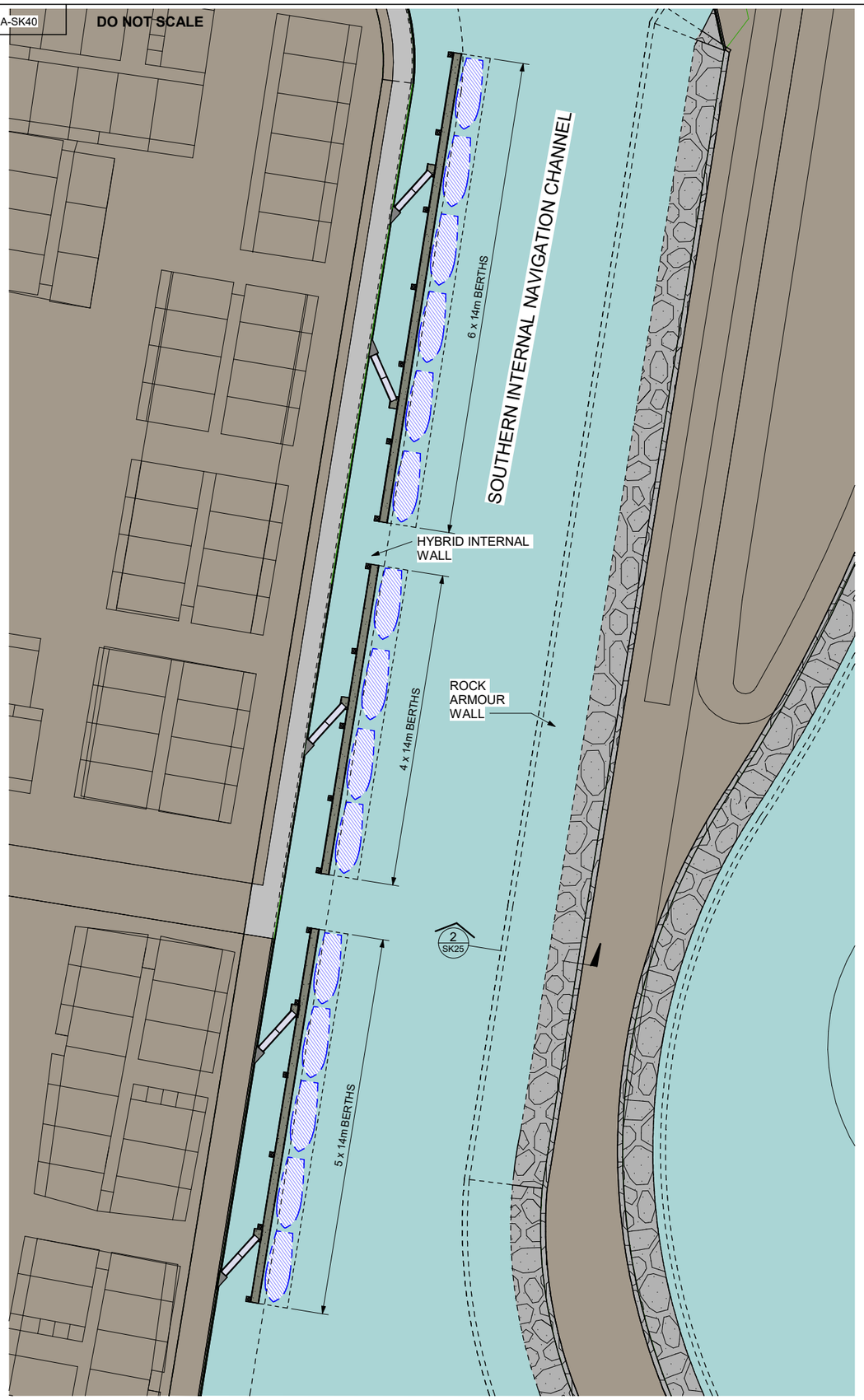

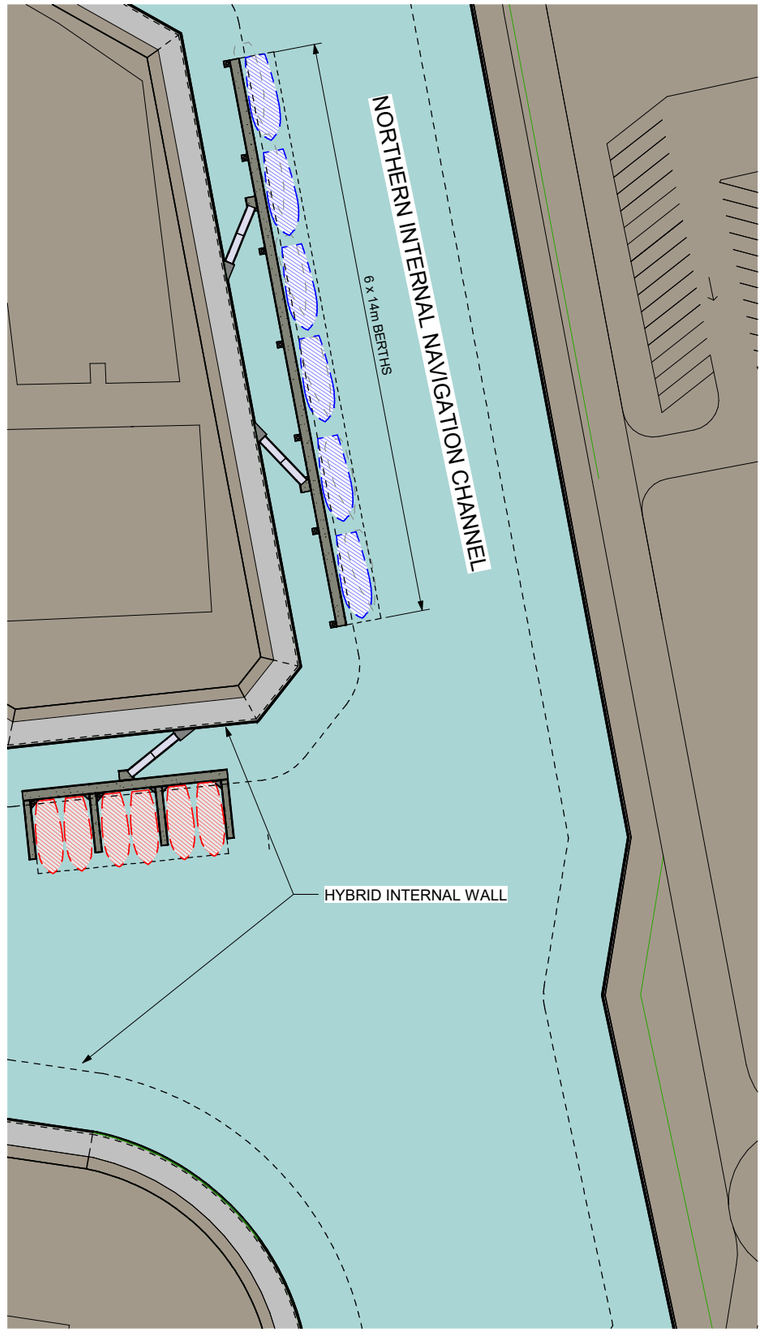

10 0 10 20 30 40 50m
1:500 (A1) 1:1000 (A3)

DRAFT

REV	DATE	DESCRIPTION	BY	CHK	APR
B	2.12.2020	DRAFT ISSUED FOR EIS	SGB	CSS	
A	16.11.2020	ISSUED FOR REVIEW	SGB	CSS	GWB

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PROJECT

TOONDAH HARBOUR

TITLE

INTERNAL NAVIGATION CHANNELS

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Royal HaskoningDHV
Enhancing Society Together

DRAWN	COORD. SYSTEM	DATUM
SGB	MGA	AHD
DATE 27.10.2020	SCALE AT A1 1 : 500	REF.

DRAWING No. PA2060-RHD-00-DR-MA-SK40 | REVISION B

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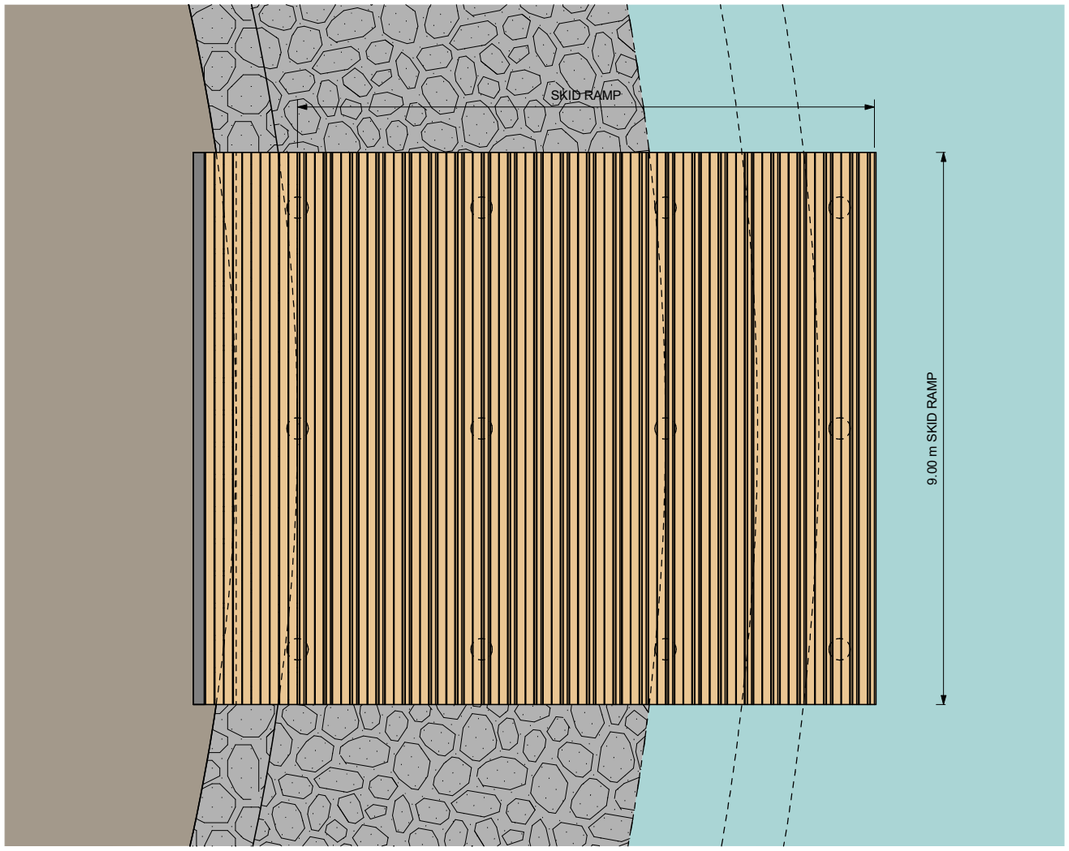
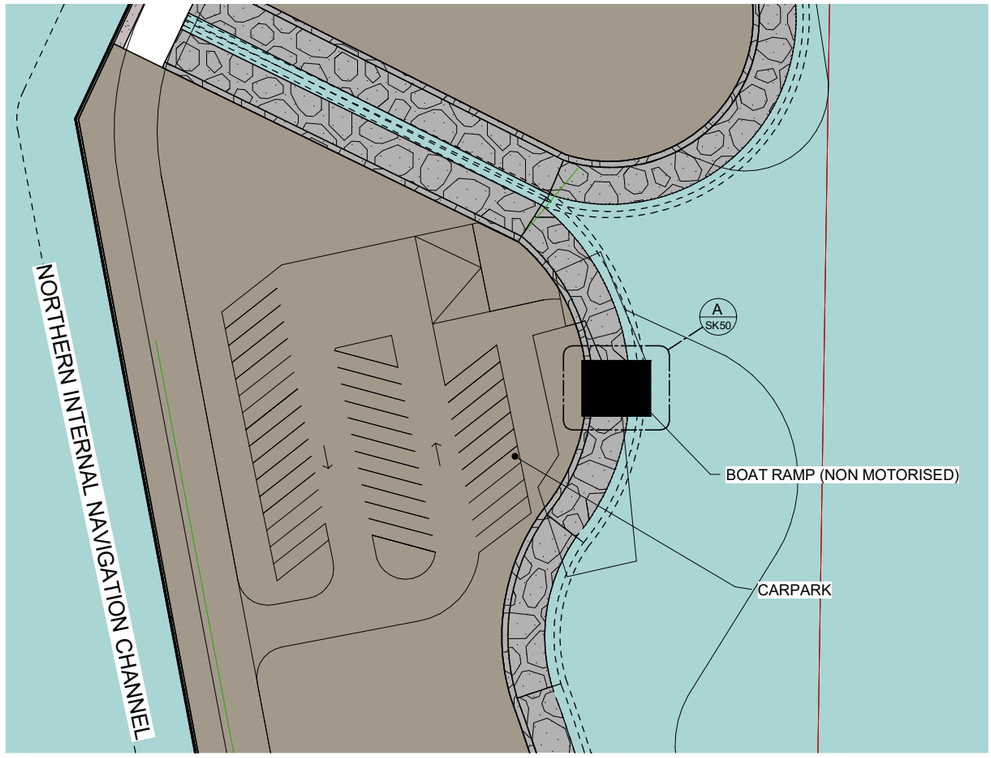
DRAWING No.
PA2060-RHD-00-DR-W-SK50

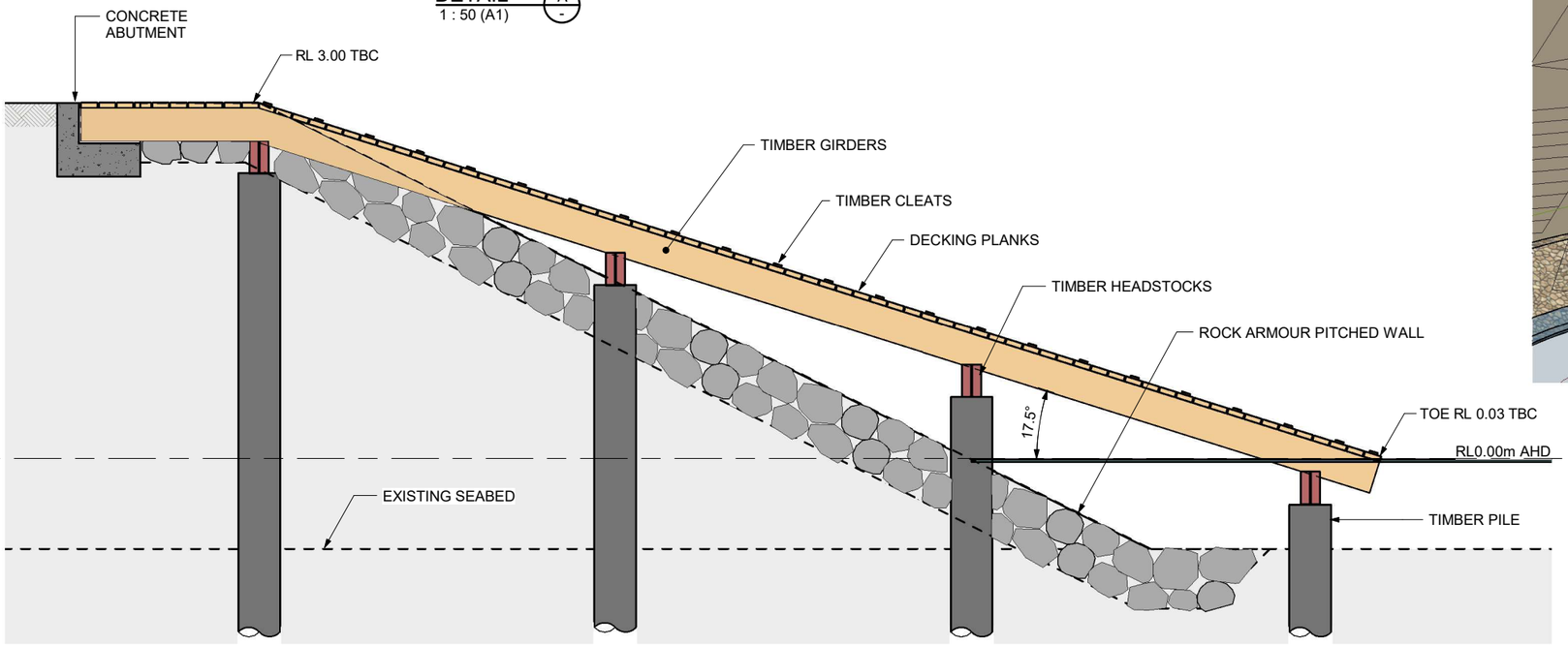
DO NOT SCALE



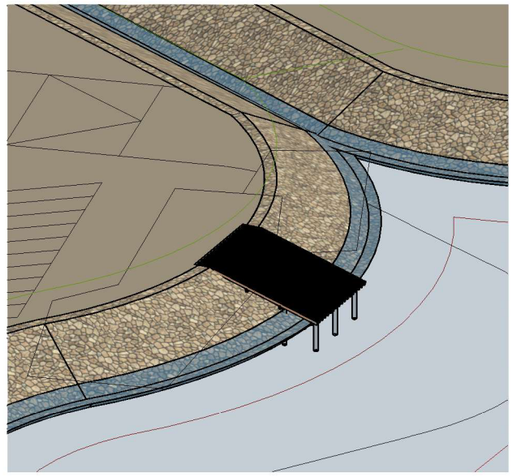


BOATRAMP / RECREATION BOATING, FISHING FACILITIES AND WETLAND CENTRE
1 : 500(A1)

DETAIL A
1 : 50 (A1)



TYPICAL BOAT LAUNCH RAMP SECTION
1 : 25(A1)



BOAT RAMP PERSPECTIVE
(A1)

500 0 500 1000 1500 2000 2500mm
1:25 (A1) 1:50 (A3)

1000 0 1000 2000 3000 4000 5000mm
1:50 (A1) 1:100 (A3)

10 0 10 20 30 40 50m
1:500 (A1) 1:1000 (A3)

DRAFT

REV	DATE	DESCRIPTION	BY	CHK	APR
B	2.12.2020	DRAFT ISSUED FOR EIS	SGB	CSS	
A	16.11.2020	ISSUED FOR REVIEW	SGB	CSS	GWB

REVISIONS

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PROJECT

TOONDAH HARBOUR

TITLE

RECREATION BOATING, FISHING FACILITIES AND WETLAND CENTRE BOAT RAMP DETAILS

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Royal HaskoningDHV
Enhancing Society Together

DRAWN	COORD. SYSTEM	DATUM
	MGA	AHD
DATE 11/15/20	SCALE AT A1 As indicated	REF.

DRAWING No.	REVISION
PA2060-RHD-00-DR-W-SK50	B

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