Estuarine Risk Management Report for 3 Panima Place, Newport

Authors:	Dr David Wainwright, Elizabeth Nevell
Prepared For	MHDP Architects
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1 Introduction

1.1 Northern Beaches Council's Requirements for an Estuarine Risk Management Report

Salients Pty Limited was approached by Liezl Dichoso of MDHP Architects to prepare an estuarine risk management report (this report) for a proposed boat shed at 3 Panima Place, Newport (Lot 6 of DP563641). The development is located on the foreshore of Newport, Pittwater. The site locality can be seen in Figure 1.

This report addresses the requirements of Northern Beaches Council (Council), through preparation of an Estuarine Risk Management Report (ERMR). Council have requested that an ERMR be prepared as the proposed development will be affected by wave action and tides.

Appendix 7 to the Pittwater 21 Development Control Plan (DCP)[1] contains the "*Estuarine Risk Management Policy for Development in Pittwater*". That policy requires that risks from wave action and tidal inundation are properly considered by the development. Consideration of those risks is the main aim of this report.

1.2 Proposed Development

The proposed development comprises a boat shed at the foreshore fronting the property. The boat shed will replace an existing boat shed that is to be demolished. The new boat shed and will be situated landward of the existing boat shed. The proposed works are shown in Figure 2 and Figure 3. With reference to those figures, the proposed boat shed comprises a 4m (shore parallel) by 6m (shore normal) building. The proposed floor level is 1.5m AHD. The new footprint is completely landward of the mean high water mark. A short length of adjacent seawall (~2m) will also be demolished with a replacement section reconstructed to sit entirely behind the mean high water mark.

[1]Version incorporating Amendments 1 through 25 has been used throughout this report. The DCP for Pittwater is still in effect as of July 2021.

Figure 1: Locality Plan

0 10 20 30 m

APPROX SCALE

Estuarine Risk Management Report for 3 Panima Place, Newport	REV A	DRAWN EN	CHECK DJW

GIS File: "Z:\BusinessShare\Them\Projects\P00146 3PanimaPlaceNewport\Outgoing\Figures\Locality.qgz"

Salients

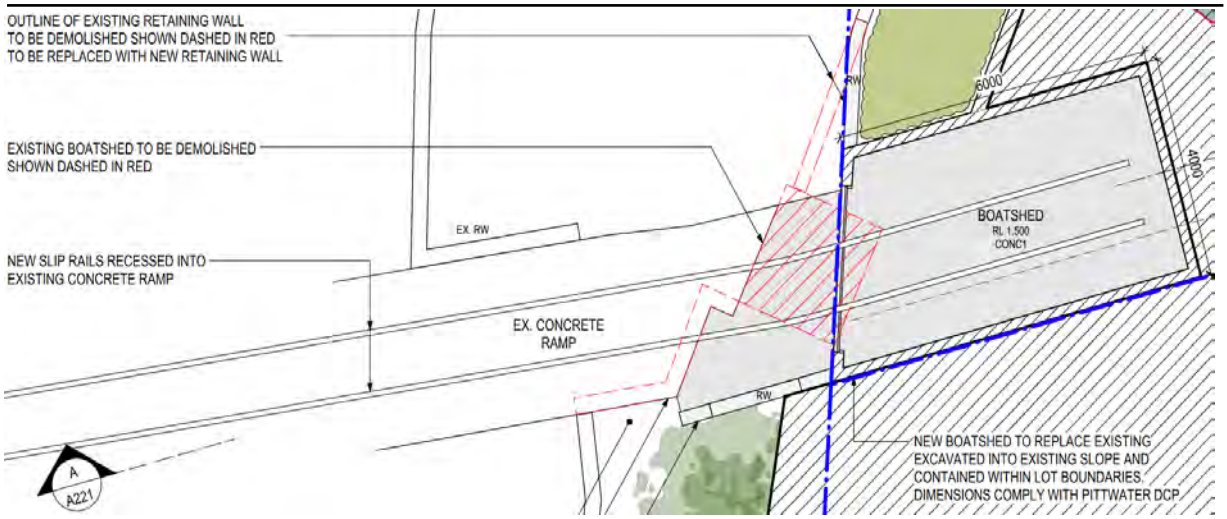

Figure 2 Plan View of Proposed Development (extract from drawings by MHDP Architects (2021, provided in Appendix B))

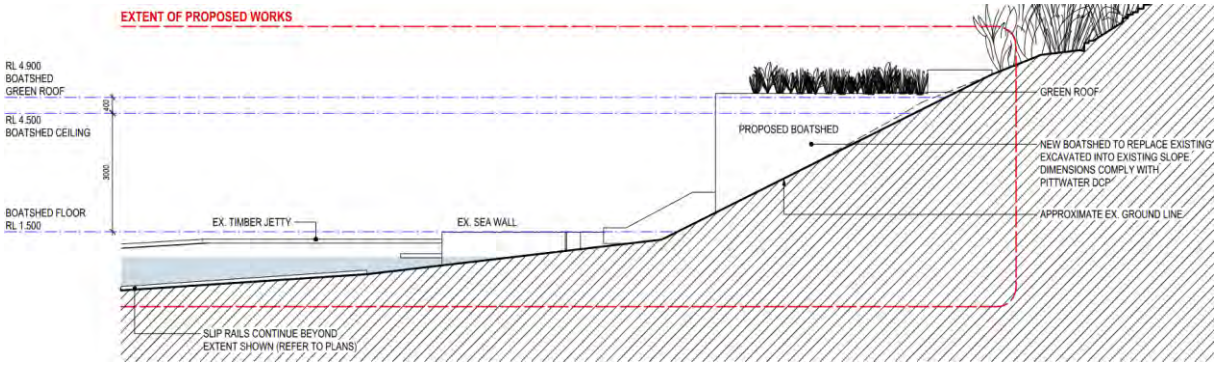

Figure 3 South-West Elevation of Proposed Development (extract from drawings by MHDP Architects (2021, provided in Appendix B))

1.3 Outline of Report

The requirements for this report have been determined through a review of Appendix 7 to the DCP and Section B3.7 *"Estuarine Hazard – Low Density Residential"* of the DCP. The identified requirements are presented in the remainder of this report as follows:

- Section 2 contains a description of the site locality and environment, insofar as it relates to waves and water levels that could interact with the new structure. The design life of the development is also discussed, as this affects the allowance for sea level rise that needs to be made and the magnitude of design waves.
- Section 3 considers the nature of the existing foreshore and the structural loadings that could be applied in design. Issues surrounding durability and functionality are also discussed.
- Section 4 includes a risk assessment. Risks are identified and assessed. Where appropriate, mitigation strategies are outlined.

1.4 Confirmation

Salients Pty Ltd maintains public liability insurance and professional indemnity insurances consistent with the requirements of Council. Furthermore, the author of this report, Dr David Wainwright is a chartered engineer with the Environmental and Civil Colleges of Engineers Australia and has been a practicing coastal engineer for close to 25 years. David's PhD is in Coastal Engineering. A signed copy of "Form 1" which pertains to this Estuarine Risk Management Report is provided as Appendix A.

2 Details of the Environment at the Site

2.1 Site Locality

Appropriate design wave and tide conditions are governed by the location of the Site within Pittwater, Pittwater's connection to the ocean, and the Site's exposure to fetches over which winds can blow to generate local waves. Due to its sheltered location, oceanic swell is not a significant issue at the Site. The location of the Site within Pittwater is shown in Figure 4

Of interest is the fetch for local wind waves, which could approach from directions spanning clockwise from west to north east, as shown in Figure 4, with north-westerly fetches being by far the longest.

2.2 Proposed Design Life for Facility

Council's policy specifies a design project life of 100 years unless it can be *otherwise justified by the applicant* (and accepted by Council). The design life proposed has an impact on design conditions in terms of the sea level rise allowance applied.

The Australian Standard for the design of maritime structures (Standards Australia, 2005) recommends that a design life of 25 years be adopted for a small craft facility[2]. The boat sheds fit squarely into this category. A 25-year design life is appropriate and has been assumed and adopted henceforth in this report.

Overall, the scale and relatively infrequent use of the structure (compared to use of residential buildings) lead to our assessment that the structure represents a "*low degree of hazard to life or property*". A related table from the maritime structures Standard indicates that the 2% Annual Exceedance Probability (AEP) wave[3] would be an appropriate wave height for the 25-year design life. Such wave heights would have an approximate 40% chance of occurring at least once over a 25-year design life.

2.3 Consideration of Wave Environment

Previous work by Lawson and Treloar (2004, 2003) and Cardno (2015) examined the wind wave climate around Pittwater. Those studies applied extreme wind speed analysis to a wind record from Sydney Airport, which can be reasonably applied to Pittwater, resulting in estimated extreme wind speeds from directions between west and north east shown in Table 1.

[2] Refer to Table 6.1 of AS4997, 2005
[3] Refer to Table 5.4 of AS4997, 2005

Figure 4: Site Locality and Fetch

0 0.5 1 1.5 km

APPROX SCALE

Estuarine Risk Management Report for 3 Panima Place, Newport	REV A	DRAWN EN	CHECK DJW	Salients

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Table 1 Estimated Extreme Wind Speeds for Pittwater (m/s) (from Lawson & Treloar (2003), Table 3.5)

	West	North West	North	North East
1% AEP Gust Speed	38.3	33.9	28.4	23.8
5% AEP Gust Speed	35.0	31.3	26.1	22.9
1% AEP 10 min Average	26.6	21.3	19.3	18.3
5% AEP 10 min Average	24.3	21.3	17.8	17.6
1% AEP 3 hr Average	25.5	22.1	18.5	17.6
5% AEP 3 hr Average	23.3	20.4	17.0	16.9

To estimate extreme nearshore wave conditions in the vicinity of the site the response of a computational wave model to a range of wind speeds from 16 compass directions was assessed. Those responses were used, by Lawson and Treloar, to transfer the time series of wind speeds from Sydney Airport to a corresponding time series of waves within Pittwater. Statistical analysis then determined the occurrence of extreme wave conditions at a variety of foreshores within Pittwater. The resulting local wind generated waves that are indicated as being applicable to Crescent Reserve (the sector of the foreshore within which the site is located) are replicated in Table 2.

Table 2 Estimated Extreme Wind Wave Heights for Crescent Reserve (from Lawson & Treloar (2003), Table 3.7)

Recurrence	Wind Wave Height (Hs,w, m)
5% AEP	0.44
2% AEP	0.46
1% AEP	0.49

A check of design wave heights, considering the length and narrowness of wave generation fetch from directions ranging from north east to south west, was made using the simplified methods presented in the US Army Corps of Engineers Coastal

Engineering Manual[4]. The values for significant wind wave height presented in Table 2 were found to be reasonable and have been adopted for design.

For this report, the 2% AEP significant wave height (Hs of 0.46) was adopted. AS4997 recommends a factor of 1.5 be applied to the Hs wave height to obtain the H_1 wave height, which represents the highest 1% of waves occurring during a design storm and should be used in determining structural loads. Accordingly, a wave with height 0.69m (1.50 × 0.46) can be used in deriving forces for structural design.

It is possible that a wave of this height may not make it to the site without breaking. This is governed by the following relationship:

$$H_b = \gamma \times h_b$$

Where H_b is the size of the wave that would break in water depth h_b and γ is the breaker index, which is commonly given a value of 0.78. A nearshore depth of around 0.88m is required for a 0.69m wave to pass without breaking before it reaches the foreshore. Bed elevations of close to 0.0m AHD are present in front of the property, meaning that the design wave (0.69m) would tend to break when the water level gets below 0.88m AHD immediately offshore of the site. Normally, this breaking wave condition would govern the design of foreshore structures. The water level environment is discussed in the next section.

2.4 Consideration of Water Level Environment

Council's designated Estuarine Planning Level (EPL) for the site is 2.50m AHD. Under this condition, the design wave of 0.69m AHD could easily propagate all the way to the foreshore and the full wave height would govern design. It is important to understand how the EPL has been derived. It contains the following components:

- Storm Tide.
- Wind Setup.
- Wave Related Increment.
- Freeboard.
- Sea Level Rise.

Each of these are discussed in turn. Storm tide includes the astronomical tide and other large-scale processes that act to raise the ocean water level over large distances (i.e., 100s of km). For the most recent analyses (Cardno, 2015), a storm tide of 1.44m AHD was applied across Pittwater, which differed from that originally determined by the Pittwater Estuary Processes Study (Lawson & Treloar, 2003).

[4] http://www.publications.usace.army.mil/USACE-Publications/Engineer-Manuals/u43544q/436F617374616C/

By applying the 1% AEP 3 hourly average wind speeds from Table 1 to a hydrodynamic model, the following wind setup values were determined for Crescent Reserve (Lawson & Treloar, 2003):

- Westerly Wind: +0.03m
- North Westerly Wind: +0.13m
- Northerly Wind: +0.13m
- North Easterly Wind: +0.10m
- Easterly Wind: +0.02m

For all other directions, winds across Pittwater indicated a set down of water levels. The value adopted for Crescent Bay ("Winji Jimmi Bay" in Cardno, 2015) in the most recent analysis of water levels was +0.13m (Cardno, 2015). This is likely to occur concurrently with wind waves approaching from the north west.

A "Wave Related Increment" EPL component was also determined for this part of Pittwater. This component corresponds to the height of the run-up and overtopping of the foreshore and is therefore related to the type of foreshore (e.g., sloping natural, vertical seawall etc.). The foreshore at 3 Panima Place is best described as a sea wall, with crest elevation around 1.5m AHD. The 1% AEP still water level, including wind set up allowance, is 1.57m AHD (Cardno, 2015). For this condition, Cardno (2015) calculated the wave related increment as half of the design wave height when the still water is above the crest. A wave height of 0.46m[5] results in a level of 1.80m AHD.

Cardno (2015) describe the freeboard as a "factor of safety" which provides a level of mitigation against risk exposure arising from uncertainties, particularly with relation to wave run-up. A freeboard of 0.3m was included.

For climate change related sea level rise, Council has adopted a rise of 0.4m by 2050 and 0.9m by 2100. Within Cardno (2015), these were considered to be relative to a "present day level" of 0.0m. With sea level rise of 0.4m (by 2050), a total estuarine planning level of 2.50m AHD was determined.

In considering the degree of periodic foreshore infrastructure inundation that could be expected from tides of different frequencies within Pittwater, Cardno (2015) also presented more statistics as shown in Table 3. These do not include the wave related increment or freeboard and indicate that, with sea level rise of 0.4m, a boatshed floor of 1.5m could be inundated relatively frequently (several times a year)

[5] Note that, unlike other foreshores in Pittwater, Cardno 2015 adopted the 2% AEP (aka 1 in 50 yr) wind wave height in this calculation, instead of a 1% AEP (aka 1 in 100 yr) condition which were originally presented in Lawson and Treloar, 2003. The reasons for this are unclear and probably immaterial. The difference in the resulting estuarine planning level would be less than 2cm (i.e., 2.52 m AHD c.f. 2.50m AHD)

Table 3 Comparison of Still Water Levels from Astronomical Tides (m AHD, to nearest 0.1m)

	"Present Day"	2050 (including 0.4m Sea-level rise)
Fortnightly High Tide	0.6	1.0
Monthly High Tide	1.0	1.3
Biannual (King) Tide	1.2	1.6
100yr Storm Tide	1.4[6]	1.8

2.5 Potential Justification for Modifying the Estuarine Planning Level

Considering the components of the EPL, the storm tide adopted is reasonably typical for estimates based on the record available from Fort Denison. Varying the storm tide level to represent a 2% AEP event (applicable for a 50yr design life), instead of a 1% event, would typically result in lowering the level by a few centimetres.

The sea level rise allowance applied in Cardno (2015) appears to be 0.4m between 2015 and 2050 and a further 0.5m between 2050 and 2100. Most widely accepted projections now indicate that the rate of sea level rise will accelerate over time. A comparatively conservative approach is to consider a linear increase between 2015 and 2050. This approach projects around 0.35m of sea level rise by 2046, at the end of the 25-year design life for the boat shed. Allowing for this adjustment represents a potential reduction in the EPL by 0.05m.

In total, considering a design life extending to 2046, an appropriate planning level for the foreshore of around 2.45m AHD could be applied. The design still water level, without freeboard nor wave related increment, for this modified condition (~1.92m AHD) would still significantly exceed the proposed floor elevation of the boat shed. The potential for inundation should be considered as part of structural design for the boat shed, with the frequency of inundation increasing with time as sea levels rise.

We conclude that the EPL could be reasonably reduced by 0.05m at this site. However, this would need to be approved by Council. It is not essential that the final design consider this path. Designing to a higher EPL would result in a more robust design that is likely to last longer and, depending on cost, this may be a more attractive option.

[6] Note that a level of 1.44 (1.84 at 2050) was used in derivation of the Estuarine Planning Level

For the reasons outlined above and considering the nature of wave impact forces acting on the structure, we recommend that Council's EPL of 2.50m AHD be retained for design purposes. Similarly, it would be advantageous, if feasible, to increase the boat shed floor to a higher elevation more in keeping with present day storm tide elevations (e.g., 1.80m AHD).

3 Interaction of Water Levels and Waves with the Proposal

3.1 Existing Foreshore and Structural Conditions

Our assessment of the existing site is based on photographs provided to us by Liezl Dichoso (captured 30 September 2015 at 5:30pm and 23 March 2016 at 3:50pm) and design plans prepared by MHDP Architects (Appendix B).

A photograph of the site looking towards the south east at the foreshore is shown in Figure 5. A 30m long sea wall exists along the foreshore with crest elevation around 1.5m AHD. There is a concrete boat ramp at the western end of the sea wall in front of the existing boat shed. A 5-8m wide grassed area is situated between the sea wall and the property boundary. There is, currently, a retaining wall which follows the seaward property boundary for most of its length but sits outside that boundary at its westernmost end, closest to the existing boat shed.

A photograph showing the foreshore and sea wall in more detail, taken from a timber jetty that extends from the sea wall, is shown in Figure 6.

Figure 5 Foreshore at 3 Panima Place, captured 23 March 2016

Figure 6 Sea Wall at foreshore of 3 Panima Place, (retaining wall to rear of grassed area). captured 30 September 2015

3.2 Determination of Structural Design Conditions

As described in Section 2.5, Council's estuarine planning level for the site is 2.50m AHD, although it could be argued that an alternative, lower level of 2.45m AHD is justified. Clearly, the proposed floor level of the boat shed (1.50m AHD) is significantly lower than either the original or alternative estuarine planning levels.

To provide a safe, habitable floor level for a 25-year design life, the floor of the boat shed would need to be raised to at least 2.45m AHD. However, a boat shed used primarily for boat storage does not need a habitable floor and a lower floor is acceptable.

Clause B3.7 of Council's DCP notes that:

> *"Consideration may be given on a merit basis to a floor level of a boat shed at a level lower than the Estuarine Planning Level where it can be demonstrated through an Estuarine Risk Management Report that the boat shed is structurally designed to withstand periodic wave action and tidal inundation up the Estuarine Planning Level"*

Even with a floor level set at 1.50m, the flooring and lower wall timbers can (and should) be designed to handle temporary inundation to meet the requirements of Council at the end of the structure's design life. Structural design should consider inundation to at least 2.50m AHD, including allowances for the shrink and swell of any timber or weatherboard and the ability for these to dry out once water levels subside.

The effect of wave forces on the proposed boat shed and adjacent section of retaining wall need to be considered. The primary way waves will load the foreshore structures are by slamming against the vertical sides of the structures. A design wave height of 0.69m at the foreshore has been assumed. Waves that reach the foreshore will break and potentially slam against vertical surfaces of the structures during an extreme wave condition at the end of the structure's design life.

3.2.1 Waves Acting against Vertical Planar Surfaces

The wave forces discussed below should be applied to all vertical planar surfaces such as boat shed walls and the sides of structural members.

The method presented by Goda (2010) for calculating the wave forces on a vertical breakwater can be conservatively adopted. Goda's model produces a (roughly) triangular pressure distribution which varies with height. It is necessary to consider those components of the EPL that should be included in this force calculation. It is appropriate to include the storm tide, wind setup and sea level rise components in determining a still water level across which the wave will propagate. The wave related increment can be ignored in this instance as Goda's method calculates the amount which the wave will run up a vertical planar surface. An argument could be mounted for ignoring the freeboard as well, but in this instance, it is considered appropriately conservative to retain that component. Considering the information in Sections 2.3 through 2.5, and adopting Council's original EPL, (with a 2% AEP design wave), the design condition comprises a 0.69m high wave propagating across a still water level of 2.22m AHD.

Using Goda's method, a peak wave pressure of around 3.1 kPa is calculated at the adopted "still water level" of 2.22m AHD. We recommend that this horizontal pressure be considered to act evenly on all parts of vertical surfaces below 2.22m AHD. Goda's method calculates that the waves could run up the face of a vertical surface to a height of 3.26m AHD, although this behaviour would be intermittent and only occur at the peak of the storm surge. The wave pressure distribution should be considered to reduce linearly between 2.22m and 3.26m AHD, from 3.1 kPa to zero.

This vertical pressure distribution represents the conditions at the peak of a temporally varying distribution that changes with a period equal to the incident wave period (around 2.2 seconds, derived from linear wave theory). There is also potential for a

very high impulsive breaking wave force to impact on the structure. Goda notes that this can occur when there is:

1 A broad rubble berm at a high elevation; or

2 The sea bottom is steep, and the incident wave is not.

Neither of these conditions are met, so impulsive breaking wave forces are not a concern in this instance.

3.2.2 Summary of Structural Design Actions

In summary, the following load conditions should be considered during a review of the structural adequacy of the structures:

- Acting on vertical surfaces: An even pressure of 3.1 kPa up to 2.22m AHD, with a linearly decreasing pressure above 2.22m, reducing from 3.1 kPa to 0kPa at 3.26m AHD. This pressure varies with time and the values presented above represent peak conditions as a wave slams into the structure.

All forces should have factors applied in accordance with standard structural engineering practice. Some guidance on appropriate factors is also provided in AS4997 *Design of Maritime Structures.*

3.3 Other Design Considerations

Other structural loads, in accordance with normal structural design practice (winds, dead loads and pedestrian loads etc.) also need to be considered. Buoyancy forces should also be assessed with the structure considered empty and inundated to 2.57 m AHD. The height of 2.57m is calculated from the design still water level of 2.22m AHD plus half the design wave height of 0.69m in accordance with AS4997.

The potential for fatigue to occur due to repeated but less severe loading, or deterioration of structural members needs to be considered. As part of structural design, an appropriate program for structural inspection and expected maintenance requirements is to be provided. This is discussed further under Section 4.7. Consideration of the durability of materials used for the floor and lower walls of the boat shed is required. These members should be designed to handle regular inundation at the end of the boat shed's design life.

If electrical fixtures are to be provided to the boat shed, these should be kept above Council's Estuarine Planning Level of 2.50m AHD. If situated below the EPL fixtures should be of submersible grade. Any power outlets located below the maximum wave runup height (3.26m AHD) should also be of submersible grade.

The floor of the shed should enable draining, drying and ventilation after an inundation event. Structural member and connection design below the design

inundation elevation should also consider the need for drying and ventilation. The grade of all surfaces should encourage water to drain back into Pittwater.

4 Risk Assessment and Management Strategy

4.1 Background

A risk assessment and management strategy for the works has been prepared using the guidance provided by the international risk management standard, ISO 31000. That standard suggests the following steps for risk assessment:

- Establish the risk management context.
- Identify the risks.
- Assess the likelihood and consequences of those risks.
- Evaluate the risks.

Management strategies can then be suggested for those risks which are unacceptable.

4.2 Establish the Context

The risks assessed by this strategy relate to elevated water levels and waves, insofar as they may impact on the following foreshore elements:

- Proposed boat shed.

The different risks that are of relevance in the context of Council deciding about a development application fall into the following three categories:

1 Structural.

2 Safety.

3 Environmental.

4.3 Identification of Risks

The three risk categories listed above were considered in turn. Risks that could possibly be of some concern (even minor) have been listed and numbered for further consideration.

4.3.1 Structural Risks

Risk 1: *There is a risk that the foreshore structure will fail under elevated water level and/or wave conditions.*

Risk 2: *There is a risk that the foreshore structure will deteriorate over time, making them more susceptible to failure under even moderate loads.*

4.3.2 Safety Risks

There are two types of safety risks broadly considered, those that arise during construction, and those that arise during use of the facilities. The proposed works are typical for foreshore structures of this type and abnormal construction risks are not expected. It is expected that the contractor completing the work will comply with standard safe building practice and Work Health and Safety legislation, giving due consideration to the hazards present in a marine environment. Construction safety risks are not considered further here.

Regarding safety risks during use of the facilities, the assessment requires consideration of the existing situation, and how modification of the facilities might impact on the exposure of individuals to dangerous wave and water level conditions.

Individuals may approach the facility from the water side or the land side. In terms of approaches from the water side, it is not expected that the modified facilities will change the current safety environment.

With approaches from the land side, however, the following risk has been identified:

Risk 3: *There is a risk that construction of the facilities will create a perception that the foreshore is safer during periods of elevated water levels and waves, increasing the exposure of people to being knocked down by waves and potentially drowned.*

4.3.3 Environmental Risks

Facilities such as this can potentially interact with waves to have undesirable impacts on environmental processes. The proposed foreshore structures will not impact on water levels in Pittwater. The major component of this proposal is the boat shed, which will replace an existing shed of similar size and location, and thus will not have significant impact on the wave reflection patterns or the movement of sediment along the shoreline.

The proposed works will not alter any environmental risks associated with coastal processes to a significant degree.

4.4 Method for Likelihood Assessment

The likelihoods of the identified risks have been assessed qualitatively using the descriptors provided in Table 4 (adapted from AS5334 (Australian Standards, 2013)).

The assessment of likelihood for each of the identified risks is presented in Section 4.7.

4.5 Method for Consequences Assessment

The consequences of the identified risks have been assessed qualitatively using the descriptors provided in Table 5 (adapted from AS5334 (Australian Standards, 2013)).

The assessment of consequences for the identified risks is presented in Section 4.7.

Table 4 Likelihood Assessment Table.

Likelihood Rating	Descriptor
Almost Certain	Could occur several times per year
Likely	May arise about once per year
Possible	Maybe a couple of times in a generation
Unlikely	Maybe once in a generation
Very Unlikely	Maybe once in a lifetime

Table 5 Consequences Assessment Table.

Consequence Rating	Structural Factors	Safety/Health Factors	Environmental Factors
Insignificant	No damage	No adverse effects	No adverse effects on natural environment
Minor	No permanent damage, minor restoration required	Slight adverse human health effects	Minimal effects on the natural environment
Moderate	Limited damage, recoverable by maintenance and minor repair	Adverse human health impacts	Some damage to the environment including local ecosystems
Major	Extensive damage requiring major repair	Permanent physical injuries and fatalities to a single individual	Significant effect on the environment and local ecosystems. Remedial action required.

Consequence Rating	Structural Factors	Safety/Health Factors	Environmental Factors
Catastrophic	Significant permanent damage or loss of structure	Injuries and/or fatalities involving multiple individuals	Very significant environmental loss with extensive remedial action required.

4.6 Method for Risk Evaluation

Using the likelihoods and consequences described above, evaluation of the risks has been completed using Table 6 (adapted from AS5334 (Australian Standards, 2013)).

AS5334 regards that the following treatments are applicable:

- *Low* risks would typically be addressed through routine maintenance and day to day operations.
- *Moderate* risks would require a change to the design or maintenance regime of assets.
- *High* risks require detailed research and appropriate planning (or design).
- *Extreme* risks would require immediate action to mitigate.

The evaluation of each of the identified risks is presented in Section 4.7

Table 6 Risk Rating Matrix

Likelihood	Consequences				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost Certain	Low	Moderate	High	Extreme	Extreme
Likely	Low	Moderate	Moderate	High	Extreme
Possible	Low	Low	Moderate	High	Extreme
Unlikely	Low	Low	Moderate	Moderate	High

Likelihood	Consequences				
	Insignificant	Minor	Moderate	Major	Catastrophic
Very Unlikely	Low	Low	Low	Moderate	Moderate

4.7 Risk Management Discussion and Treatment

The following discusses risk assessment, evaluation and proposed management strategies for each of the four risks in turn.

Risk 1: *There is a risk that the foreshore structures will fail under elevated water level and/or wave conditions.*

Overall, the force of waves during the design event and less severe events is destructive. These design events could be expected to occur once or twice in a generation (Possible) and, if the structure is under designed, extensive damage could be expected (Major). A "high" risk would be indicated for an under designed structure.

Risk Management Action 1

> The recommended action here is to ensure that the structure is assessed by a qualified structural engineer, considering the loadings outlined in Section 3 of this report, and that other loads and suitable factors are applied in accordance with standard structural engineering practice. Allowance must be made for suitable drainage of water back towards Pittwater.

This action would reduce the consequences to "Minor" in nature, resulting in a "Low" risk rating.

Risk 2: *There is a risk that the foreshore structures will deteriorate over time, making them more susceptible to failure under even moderate loads.*

It is likely that the structures will deteriorate with time. However, the nature of the failure that could be expected is only partial failure of a structure, which could be remediated through minor repairs and maintenance (replacement of failing members etc.). This results in a moderate risk rating. However, if the following two actions are adopted, the risk rating would be reduced to "Low".

Risk Management Action 2

> Again, ongoing degradation of the structure can be addressed by design. Construction materials and connections should be suitable for exposure to

harsh conditions, including occasional inundation and regular wave action. A storm generating wind waves of 0.35m could be expected around once a year. If appropriate, the design should allow for a loss of structural integrity (serviceability and strength) over time.

Risk Management Action 3

A maintenance and inspection regime appropriate for the construction materials adopted should be defined by the structural designer, so that any abnormal deterioration of the structure is identified before it becomes problematic. Furthermore, the structural design should consider the accessibility of structural members if it is expected that they would need to be replaced.

Risk 3: *There is a risk that construction of the facilities will create a perception that it provides a safe platform during periods of elevated water levels and waves, increasing the exposure of people to being knocked over by waves and potentially drowned.*

The design event is a rare occurrence. Furthermore, it would take the occurrence of abnormal circumstances, or a lapse of judgement, for individuals to approach the foreshore during the height of a storm. This may happen, but the number of individuals that could approach the foreshore from the landward side during a storm would be limited to the residents of 3 Panima Place, and their visitors. Even if these people did approach the foreshore, the elevated and/or clear nature of landward approaches to the boat shed would normally mean that visibility is reasonable, except at night. Furthermore, we understand that access to the boat shed will still be via stairs from more elevated (landward) parts of the property, in the same location as exists prior to this development.

Overall, it is considered that there is an extremely remote chance that problems would occur, but that the consequences could be "Major". A "Moderate" risk rating is implied, but this does not represent a change from the existing situation.

Risk Management Action 4

The probability of occurrence is remote, but the consequences could be major, however this does not represent a change from the existing situation. A motion sensing light should be considered to illuminate the foreshore at night, so that dangerous water level and wave conditions can be more easily identified and avoided by persons approaching the foreshore from the land side. This light could also have the practical function of making the facility more usable at night. While this will not eliminate the potentially major consequences, it is considered that these actions are reasonably practicable and cost effective.

5 Summary and Endorsement

The proposed foreshore facilities at 3 Panima Place, Newport can be structurally designed to withstand appropriate water and wave loadings without failure. Appropriate environmental loadings are presented in Section 3 of this report and summarised in Section 3.2.2. Other considerations which a structural designer should regard are presented in Section 3.3.

A risk assessment was undertaken and the outcomes of that assessment, including the actions that should be taken to mitigate against those risks, are summarised in Section 4.7. The residual risks arising from the development are minor and/or otherwise acceptable and can be easily addressed during design and construction.

The proposed boat shed can be constructed and used without undue impacts or negative consequences to public safety or the environment. A formal endorsement of the findings of this report is provided in Appendix A.

6 References

Australian Standards, 2013. AS 5334 Climate Change Adaptation for Settlements and Infrastructure.

Cardno, 2015. Pittwater Estuary Mapping of Sea Level Rise Impacts (Revised Draft Report No. LJ2882/R2658v7).

Goda, Y., 2010. Random Seas and Design of Maritime Structures, 3rd ed, Advanced Series on Ocean Engineering. World Scientific, Singapore.

Lawson & Treloar, 2004. Estuarine Planning Level Mapping Pittwater Estuary (No. J2230/R2075).

Lawson & Treloar, 2003. Pittwater Estuary Processes Study (No. J1942/R1945).

Standards Australia, 2005. AS4997-2005 Australian Standard Guidelines for the design of maritime structures.

Appendix A “Form 1” for Estuarine Risk Management Report Certification

FORM NO. 1

To be submitted with Estuarine Risk Management Report

Development Application for PharmaCare Pty Ltd c/o MHDP Architects

Address of site 3 Panima Place, Newport

Declaration made by a Coastal Engineer as part of an Estuarine Risk Management Report

I, David Wainwright, on behalf of Salients Pty Ltd

on this the 26 October 2021

certify that I am a Coastal Engineer as defined by the Estuarine Risk Management Policy for Development in Pittwater and I am authorised by the above organisation/company to issue this document and to certify that the organisation/company has a current professional indemnity policy of at least $2 million.

Please mark appropriate box

X I have prepared the detailed Estuarine Risk Management Report referenced below in accordance with the Estuarine Risk Management Policy for Development in Pittwater

☐ I am willing to technically verify that the detailed Estuarine Risk Management Report referenced below has been prepared in accordance with the Estuarine Risk Management Policy for Development in Pittwater

☐ I have examined the site and the proposed development/alteration in detail and, as detailed in my report, am of the opinion that the Development Application only involves Minor Development/Alterations or is sited such that a detailed Estuarine Risk Management Report is not required.

Estuarine Risk Management Report Details:

Report Title: Estuarine Risk Management Report for 3 Panima Place, Newport

Report Date:26 October 2021

Author: Dr David Wainwright

Documentation which relate to or are relied upon in report preparation:

Australian Standards, 2013. AS 5334 Climate Change Adaptation for Settlements and Infrastructure.
Cardno, 2015. Pittwater Estuary Mapping of Sea Level Rise Impacts (Revised Draft Report No. LJ2882/R2658v7).
Goda, Y., 2010. Random Seas and Design of Maritime Structures, 3rd ed, Advanced Series on Ocean Engineering. World Scientific, Singapore.
Lawson & Treloar, 2004. Estuarine Planning Level Mapping Pittwater Estuary (No. J2230/R2075).
Lawson & Treloar, 2003. Pittwater Estuary Processes Study (No. J1942/R1945).
MHDP Architects, 2021. Plans "Alterations and Additions, 3 Panima Place Newport". (As provided in parallel Appendix A)
Standards Australia, 2005. AS4997-2005 Australian Standard Guidelines for the design of maritime structures.

I am aware that the above Estuarine Risk Management Report, prepared for the above mentioned site is to be submitted in support of a Development Application for this site and will be relied on by Northern Beaches Council as the basis for ensuring that the estuarine risk management aspects of the proposed development have been adequately addressed to achieve an acceptable risk management level for the life of the structure, taken as at least 100 years unless otherwise stated and justified in the Report and that all reasonable and practical measures have been identified to remove foreseeable risk.

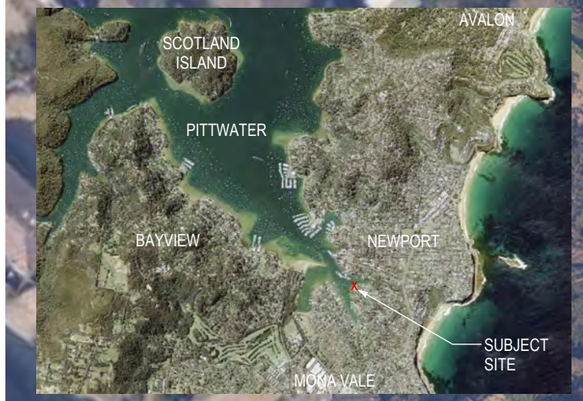
Signature: 

Name: Dr David Wainwright

Chartered Professional Status: MIEAust, CPEng, NER (Civil and Environmental Colleges), APEC Engineer, IntPE(Aus), RPEQ

Membership No. 884280

Appendix B Design Plans, MHDP Architects, 2021



EXISTING TIMBER JETTY AND PONTOON

PROPOSED BOATSHED LOCATED WITHIN SITE BOUNDARIES

EXISTING TIMBER JETTY AND PONTOON

EXISTING CONCRETE BOAT RAMP

EXTENT OF PROPOSED WORKS

EXISTING BOATSHED TO BE DEMOLISHED SHOWN DASHED IN RED

SUBJECT SITE
3 PANIMA PLACE NEWPORT

P I T T W A T E R

LOCATION PLAN

ALTERATIONS AND ADDITIONS

3 PANIMA PLACE NEWPORT

A001 B

1:1000 @ A3

MAY 2021

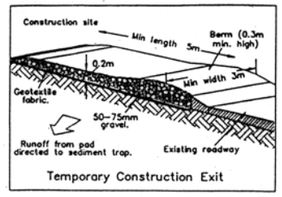
ISSUED FOR DEVELOPMENT APPLICATION	26/5/21	B
AMENDMENT	DATE	ISSUE

MARK HURCUM DESIGN PRACTICE
A R C H I T E C T S
LEVEL 2 271 ALFRED STREET NORTH
NORTH SYDNEY NSW 2060
FACSIMILE 02) 9955 5063
TELEPHONE 02) 9955 5608

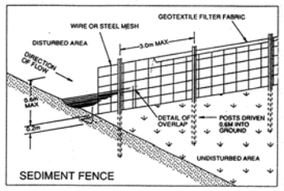
DESIGN PRACTICE

1531 A101 Current Plans - Boatshed DA v2018.vwx

Fri, 20 Aug 2021



Temporary Construction Exit



SEDIMENT FENCE

NOTES:

1. ALL EROSION AND SEDIMENT CONTROL DEVICES TO BE INSPECTED AND MAINTAINED DAILY BY THE SITE MANAGER.
2. MINIMISE DISTURBED AREAS.
3. ALL LOOSE MATERIAL STOCKPILES TO BE COVERED AND CLEAR OF ALL DRAINS, NATURAL WATER COURSES, GUTTERS AND FOOTPATHS.
4. ROAD AND FOOTPATH TO BE SWEPT DAILY
5. STABILIZE AND REVEGETATE SITE BEFORE REMOVING EROSION AND SEDIMENT DEVICES.
6. DRAINAGE TO BE CONNECTED TO STORMWATER SYSTEM AS SOON AS POSSIBLE.
7. EXCESS MATERIALS (CEMENT, CONCRETE SLURRY, WATER AND SOLVENT FOR CLEANING PAINT BRUSHES AND TOOLS) MUST **NOT** BE WASHED INTO THE STORMWATER SYSTEM.

DA APPROVED WORKS CURRENTLY UNDER CONSTRUCTION (N0057/16 & N0057/16/S96/1)

NO. 4 PANIMA PLACE TWO STOREY DWELLING

BOUNDARY 48.210

SITE ENTRY & SITE EXIT

EXISTING TIMBER JETTY AND PONTOON

PITTWATER

OVERLAND FLOW PATH

SEDIMENT FENCE

RECLAIMED AREA 181.7m²

FSBL

NO. 3 PANIMA PLACE DA APPROVED TWO STOREY DWELLING (N0468/17, Mod2018/0448 & Mod2019/0152)

NO. 3 PANIMA PLACE GARAGE

EXISTING TIMBER JETTY AND PONTOON

TIMBER JETTY 22.1m²

TIMBER RAMP 8.6m²

TIMBER JETTY 10.7m²

TP

BERTHING AREA & TIMBER PILES 44.8m²

SITE WASTE

SITE STORAGE

OUTLINE OF EXISTING BOATSHED TO BE DEMOLISHED AND REPLACED WITH NEW BOATSHED WITHIN LOT BOUNDARIES

NEW SLIP RAILS RECESSED INTO EXISTING CONCRETE RAMP

CONCRETE RAMP 29.1m²

GREEN ROOF RL 4.900

BOUNDARY 47.845

EXTENT OF PROPOSED WORKS

OUTLINE OF EXISTING RETAINING WALL TO BE DEMOLISHED

LIMITED PUBLIC ACCESS TO FORESHORE BEYOND EXISTING BOAT RAMP DUE TO EXISTING LANDSCAPING AND STEEP EMBANKMENT WHICH ABUTS SEA WALL

NO. 140A CRESCENT ROAD TWO STOREY DWELLING

NO. 140 CRESCENT ROAD TWO STOREY DWELLING

SITE PLAN & SITE ANALYSIS

ALTERATIONS AND ADDITIONS

3 PANIMA PLACE NEWPORT

A002 B

1:200 @ A3

MAY 2021

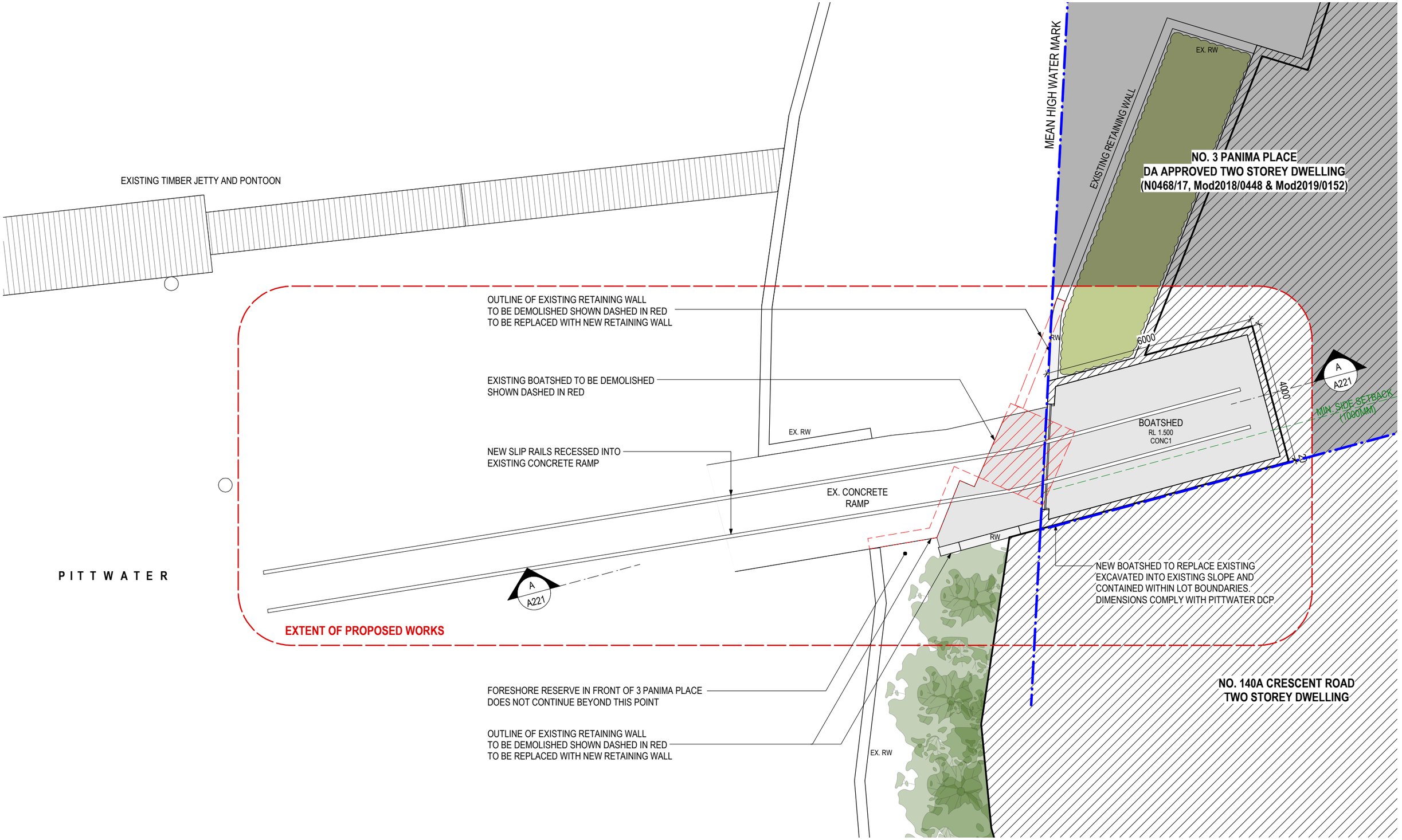
ISSUED FOR DEVELOPMENT APPLICATION	26/5/21	B
AMENDMENT	DATE	ISSUE

MARK HURCUM DESIGN PRACTICE
ARCHITECTS
LEVEL 2 271 ALFRED STREET NORTH
NORTH SYDNEY NSW 2060
FACSIMILE 02) 9955 5063
TELEPHONE 02) 9955 5608

DESIGN PRACTICE

1531 A101 Current Plans - Illustrated DA v2018.vwx

Fri, 20 Aug 2021



BOATSHED GROUND FLOOR PLAN

ALTERATIONS AND ADDITIONS
3 PANIMA PLACE NEWPORT

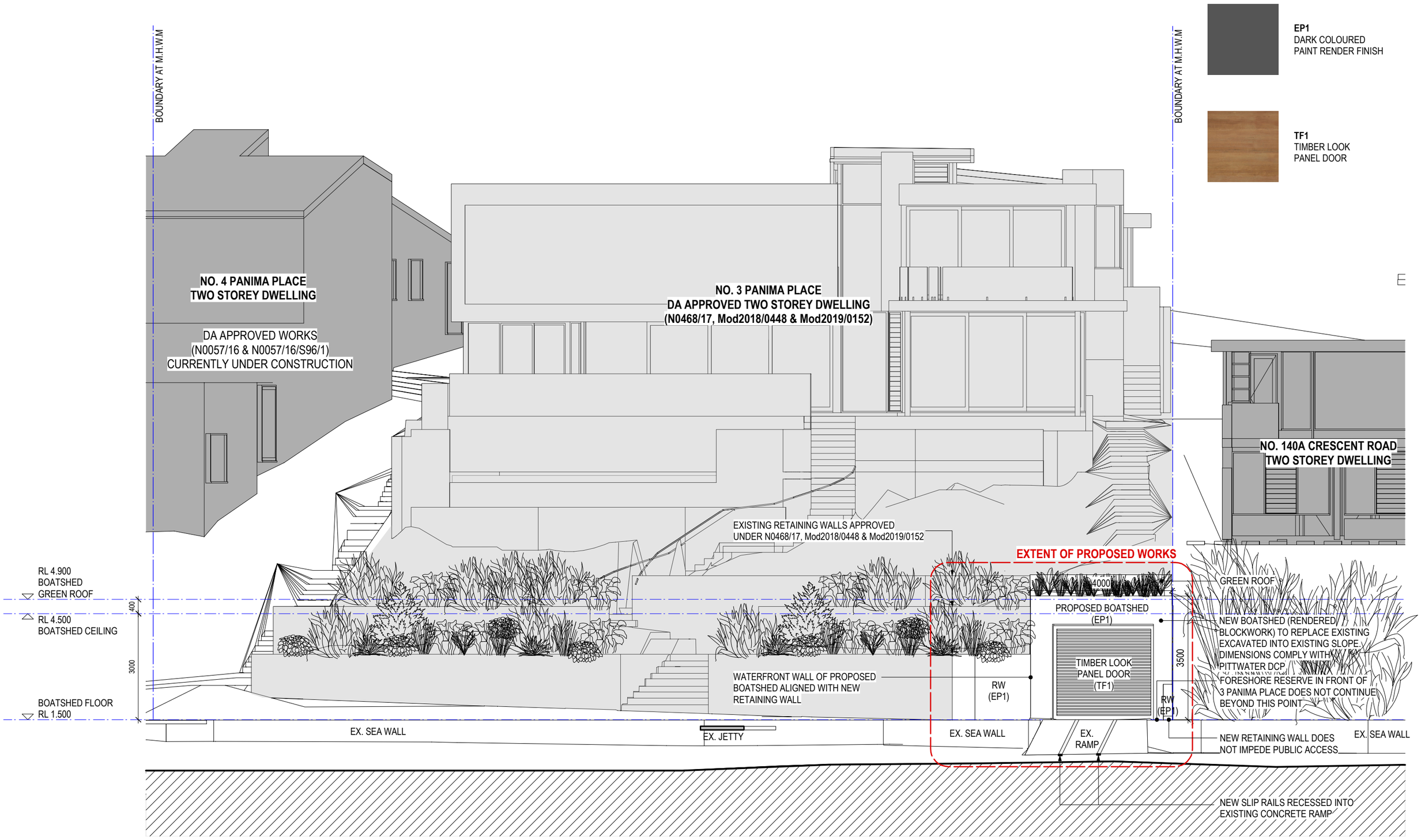
A101 B

1:100 @ A3

MAY 2021

AMENDMENT	DATE	ISSUE
ISSUED FOR DEVELOPMENT APPLICATION	26/5/21	B

MARK HURCUM DESIGN PRACTICE
A R C H I T E C T S
LEVEL 2 271 ALFRED STREET NORTH
NORTH SYDNEY NSW 2060
FACSIMILE 02) 9955 5063
TELEPHONE 02) 9955 5608
DESIGN PRACTICE



NORTH-WEST ELEVATION

ALTERATIONS AND ADDITIONS

3 PANIMA PLACE NEWPORT

A201 D

1:100 @ A3

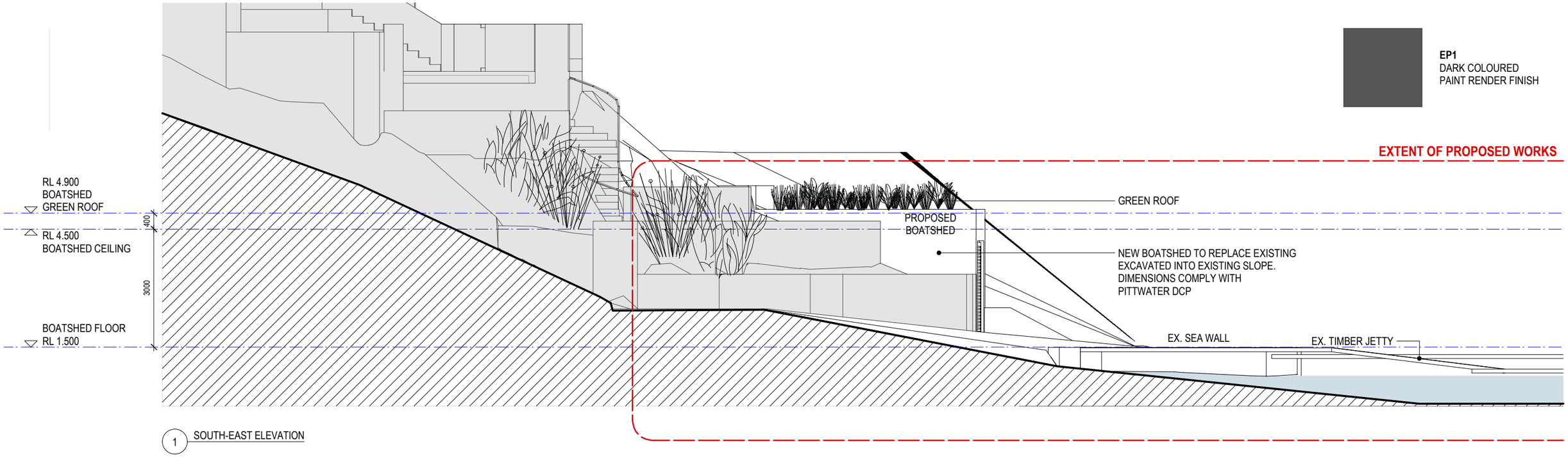
MAY 2021

ISSUED FOR DEVELOPMENT APPLICATION	26/5/21	D
AMENDMENT	DATE	ISSUE

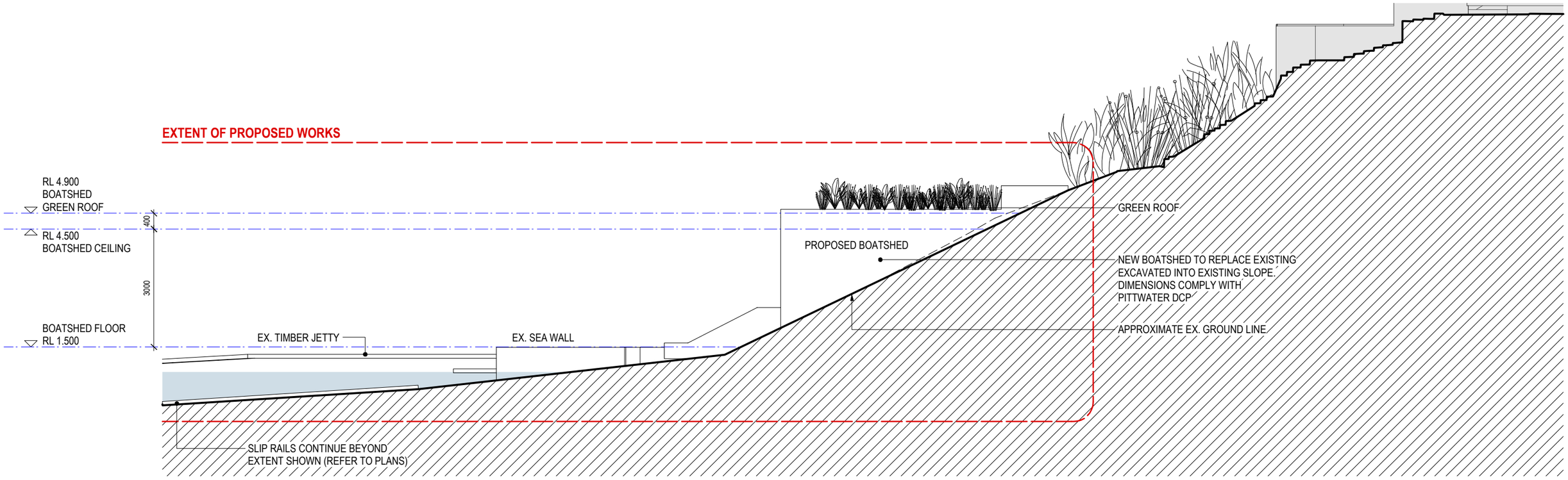
MARK HURCUM DESIGN PRACTICE
ARCHITECTS
LEVEL 2 271 ALFRED STREET NORTH
NORTH SYDNEY NSW 2060
FACSIMILE 02) 9955 5063
TELEPHONE 02) 9955 5608
DESIGN PRACTICE

1531 A101 Current Plans - Boatshed DA v2018.vwx

Fri, 20 Aug 2021



1 SOUTH-EAST ELEVATION



2 SOUTH-WEST ELEVATION

NORTH-EAST AND SOUTH-WEST ELEVATIONS

ALTERATIONS AND ADDITIONS

3 PANIMA PLACE NEWPORT

A202 A

1:100 @ A3

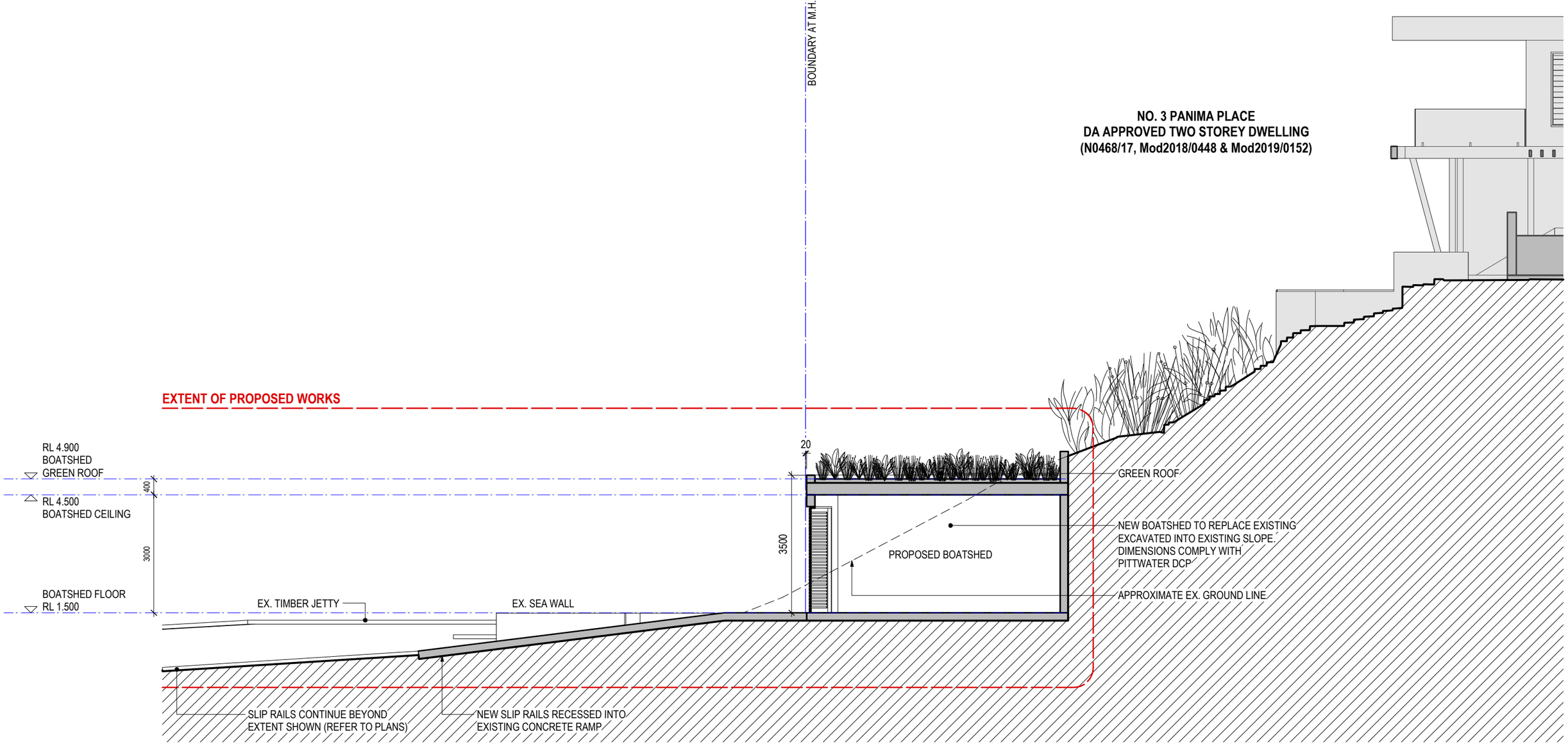
MAY 2021

AMENDMENT	DATE	ISSUE
ISSUED FOR DEVELOPMENT APPLICATION	25/3/21	A

MARK HURCUM DESIGN PRACTICE
ARCHITECTS
LEVEL 2 271 ALFRED STREET NORTH
NORTH SYDNEY NSW 2060
FACSIMILE 02) 9955 5063
TELEPHONE 02) 9955 5608
DESIGN PRACTICE

1531 A101 Current Plans - Boatshed DA v2018.vwx

Fri, 20 Aug 2021



BOATSHED SECTION A-A

ALTERATIONS AND ADDITIONS

3 PANIMA PLACE NEWPORT

A221 B

1:100 @ A3

MAY 2021

ISSUED FOR DEVELOPMENT APPLICATION	26/5/21	B
AMENDMENT	DATE	ISSUE

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A R C H I T E C T S
LEVEL 2 271 ALFRED STREET NORTH
NORTH SYDNEY NSW 2060
FACSIMILE 02) 9955 5063
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Fri, 20 Aug 2021