Royal HaskoningDHV / City of Newcastle

Surf Amenity Impact Assessment

Newcastle Southern Beaches CMP

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Executive Summary

City of Newcastle (CN) engaged Royal HaskoningDHV (RHDHV) to assist in the preparation of the Southern Beaches Coastal Management Program (CMP), to set the long-term strategy for coordinated management of the Newcastle coastline between Nobbys Head and Burwood Lagoon. The CMP is being prepared under the NSW Government's Coastal Management Framework. This stretch of coastline includes Merewether Beaches National Surfing Reserve (NSR) which was declared in March 2009, extending approximately 2km from Dixon Park in the north to Burwood Beach in the south. NSR is a voluntary collaboration dedicated to recognising and assisting iconic surfing sites in Australia.

In recognition of the iconic nature of the beaches between Merewether and Bar Beach, RHDHV engaged Intercoastal Consulting (Intercoastal) to undertake a Surf Amenity Impact Assessment (SAIA) of proposed CMP management options to:

- establish the physical and metocean characteristics that influence surf amenity;
- engage with local surfing stakeholders to understand and verify surf amenity characteristics; and
- to provide a platform for feedback relating to the proposed coastal management options as they relate to surf amenity.

Surf breaks are the product of complex interactions of nearshore bathymetry, wave characteristics (height, period and direction), water depth (tide), currents, local wind conditions, and if present, interactions with shoreline structures (ASBPA, 2011). When conditions are favourable, surf quality and surf amenity can generally be considered as being high or of good quality. The biggest influence on the shape of breaking waves is induced by changes in the underlying bathymetry of a surf break. Anthropogenic changes to the coastal zone can have both positive and negative effects to surf amenity.

Nine (9) preliminary coastal management options that have been developed for the coastline between Merewether and Bar Beach. These options fall broadly into four categories:

1. Retreat / landward movement of infrastructure and/or coastal protection structures.
2. Upgrade back beach coastal protection structures along existing alignment.
3. Beach nourishment (both subaerial and nearshore deposition)
4. Seaward movement of the alignment of back beach coastal protection structures

Stakeholder engagement through a one-on-one interview process was undertaken to:

- define each of the recognised surf spots and clarify location, extent and amenity;
- understand the ideal conditions for each spot (best geomorphic and metocean conditions);
- explain the CMP process one-on-one; and
- provide an opportunity for the surfing community to input into the CMP process and relay any concerns around perceived negative impacts to surfing amenity that may occur due to any management options.

Key stakeholders engaged in this process were selected on the basis of being long-standing and recognised members of the Newcastle surfing community. Th stakeholders included Mark Richards (OAM), Matt Hoy, Peter Boskovic, Dan Frodsham, Chris Tola, Tim Ryan, Steve Fleming and Evan Watterson.

The process identified at least twelve (12) recognised surf spots that were identified as being regularly surfed and having cultural and historical significance to the local surfing community. Stakeholders

provided further insight into the metocean and geomorphic conditions for optimum surf amenity at each break as well as an earnest discussion around possible coastal management options that may be incorporated to ensure the preservation of amenity at each spot.

The SAIA revealed that surf amenity was optimised on the hard rock/reef structure of Merewether and Bar Beaches when in an eroded state and that the other surf spots generally produced greatest amenity when there was a combination of sand and reef underlaying each break.

1. Introduction

1.1 Background

City of Newcastle (CN) are preparing the Southern Beaches Coastal Management Program (CMP), to set the long-term strategy for coordinated management of the Newcastle coastline between Nobbys Head and Burwood Lagoon. The CMP is being prepared under the NSW Government's Coastal Management Framework, which includes the Coastal Management Act 2016.

The current study is being undertaken by Royal HaskoningDHV (RHDHV) and will provide an update to previous coastal processes investigations to inform the development of long-term management actions to address the hazards identified. As part of the work, RHDHV have engaged Intercoastal Consulting (Intercoastal) to undertake a surf amenity impact assessment of proposed CMP management options for the beaches between Merewether and Bar Beach. Whilst this assessment exists as an independent piece of work, it will inform the Feasibility Assessment Report by allowing the impact on surf amenity to be considered in the Multi Criteria Analysis of the coastal management options.

1.2 Study objectives

This surf amenity impact assessment has the following key objectives:

- establish the physical and metocean characteristics that influence surf amenity at the study beaches;
- engage with local surfing stakeholders to understand and verify surf amenity characteristics at the study beaches; and
- to provide a platform for feedback relating to the proposed coastal management options as they relate to surf amenity.

1.3 Scope of this report

The scope of this report establishes surf amenity at the beaches between Merewether and Bar Beach and provides an assessment of possible impacts to this amenity due to coastal management options proposed as part of the CMP. The scope is broken down and reporting herein, as follows:

- Surf amenity and surfing science background (**Section 2**)
- Southern Beaches CMP management options (**Section 3**)
- Stakeholder engagement process and results (**Section 4**)
- Southern beaches surf amenity assessment s (**Section 5**)
- Summary and recommendations (**Section 6**)

2. Surf amenity/science background

Surf breaks are the product of complex interactions of nearshore bathymetry, wave characteristics (height, period and direction), water depth (tide), currents, local wind conditions, and if present, interactions with shoreline structures (ASBPA, 2011). When conditions are favourable at a given location, surf quality and surf amenity can generally be considered as being high or of good quality. However, surf quality and amenity can be subjective as it is often dependent on the individual surfer's skill level, preferences and mode of wave riding (standing, prone, kneeling, foiling, bodysurfing etc.). In addition, other external factors can affect a surfer's perception of amenity such as crowding, atmosphere in the line-up or ease of access to breaks.

The following section provides a primer on the key physical parameters and process used to describe surf amenity.

2.1 Physical factors affecting surf amenity

When waves propagate towards the shore or over a shallow bathymetric feature (e.g. reef, sandbar), shoaling occurs up to the point when the ratio of the wave height to the wavelength increases, steepening the wave until it becomes unstable and breaks. Depth-limited breaking will occur at the limit of the shoaling process when water particle orbital velocities (increasing in the landward direction during shoaling) exceed the wave phase speed (which decreases in the landward direction during shoaling). The breaking wave height, H_b is defined as the height between the wave trough and the wave crest prior to the point of the crest overtopping (breaking).

Meeting the wave celerity (or speed) by paddling, surfers can 'catch' the wave just prior to it breaking. Utilising the force of gravity as the wave steepens to break, the surf craft can then accelerate down the 'face' of the wave. The buoyancy and hydrodynamics of the surf craft hull allows the surfer to counteract the downward gravitational force to traverse across the wave face or unbroken wave crest. The duration and speed of the surfer's ride is dictated by the skill of the surfer and the following key physical wave parameters; peel angle, breaker intensity and section length. These key parameters are described in the following sub-sections.

2.1.1 Peel angle

The peel angle of a wave is defined as the angle between the trail of the broken wave ('white water') and the crest of the unbroken wave as it propagates shoreward. It is used to describe the minimum speed required for a surfer to traverse the unbroken face of the wave. **Figure 1** provides an example of the estimation of peel angles using aerial photography.

The peel angle governs the down-the-line velocity (speed) of the surfer as the wave breaks progressively along the wave crest. A small peel angle is associated with a fast down-the-line velocity and larger peel angles with slower down-the-line velocities. The down-the-line velocity experienced by the surfer is also a function of wave celerity (Henriquez, 2004) as shown in Figure 1 (right) . The speed an individual can reach under their own power also depends on the skill level of the surfer, the wave height and breaker intensity (available power), the mode of wave riding and the surfer's equipment.

The peel angle ranges between 0˚ and 90˚. Larger peel angles suit beginners (70° to 90°). Smaller peel angles (30° to 50°) are more challenging and are suited to more advanced surfers. Peel angles less than about 25˚ are described as 'close-outs' in surfing terms and mean a large section of the wave crest breaks simultaneously and thus cannot be surfed (Mead and Black, 2001). Even top professional surfers are unable to generate the speed required to stay clear of the breaking white water for these peel angles.

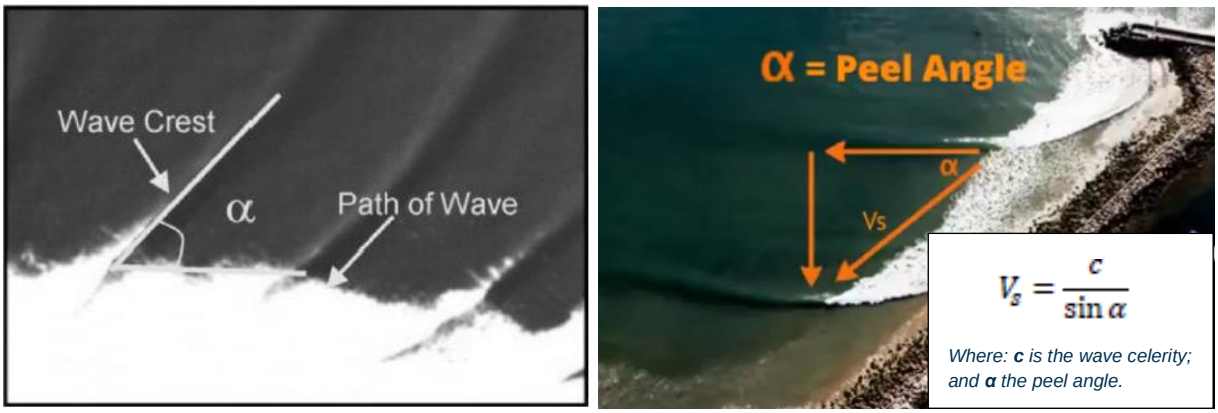


Figure 1: left: Estimation of wave peel angle using aerial photography (Mead, 2001). Right: Peel angle and surfer velocity representation, photo Tom Cozad, (source: https://www.youtube.com/watch?time_continue=284&v=A_ExZbTwFps:)

2.1.2 Breaking intensity (BI)

Wave breaking can be classified into three main types; spilling, plunging and surging (Table 1). Waves suitable for surfing generally break in the range between spilling and plunging types. When these waves are combined with an appropriate peel angle, surfing amenity is enhanced. Mead (2001) concluded that several factors including wave height, wave period, wind strength and direction can also affect the wave steepness and thus breaker intensity. However, the biggest influence on the shape of breaking waves is induced from changes in the bathymetry.

Galvin (1968) and Battjes (1974) implemented the so-called breaker type index and Iribarren Number (or surf similarity parameter), respectively, which allows the classification of the breaker type as a function of wave steepness and seabed slope (limits are presented in Table 1).

$$\xi_b = \frac{\beta}{\sqrt{H_b / L_\infty}}$$

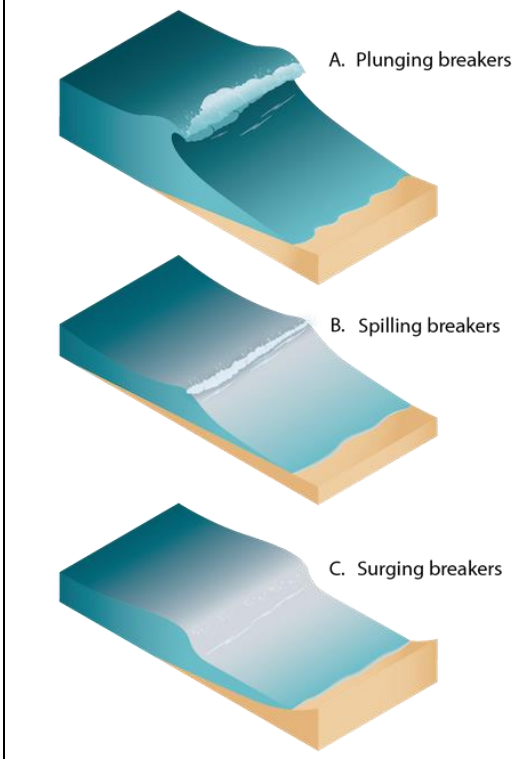
Where:

β *is the bottom slope;*

H_b *the wave height at breakpoint;*

L_∞ *the deep-water wavelength.*

Table 1: Description of three main breaker types after SPM (1977), Galvin (1968) and Battjes (1974).

Breaker Types	
 **Image source:** Byron Inouye	**Plunging Breaker: $0.4 < \xi_b < 2.0$** • Crest curls over a large air pocket (known colloquially as a 'barrel or 'tube') • Smooth splash-up usually follows crest impact. • Takes higher-skilled surfer to successfully 'take-off' due to steep (or inverted) wave face just prior to breaking. **Spilling Breaker: $\xi_b < 0.4$** • Bubbles and turbulent water spill down front of the wave face. • The upper 25% of the front face may become vertical before breaking. • Ideal breaker-type for learner to intermediate surfers due to 'softer' take-off (i.e. flatter wave face just prior to breaking). **Surging Breaker: $\xi_b > 2.0$** • Wave slides up beach with little or no bubble production. • Water surface remains almost plane except where ripples may be produced on the beach face during runback. • Surfers unable to paddle into wave due to low wave steepness.

2.1.3 Ride length (R_L)

The length of a surfer's ride is another factor in the perceived amenity of a surfing wave. The ride length is simply defined as the time elapsed during each ride. As a rule of thumb, the longer the ride length, the greater the amenity. However, this is a subjective correlation as amenity is generally dependant on the relationship of the ride length with breaker intensity and peel angle, as an example; a short ride length with a low peel angle and high breaker intensity may be to one surfer as amenable as a long ride length with high peel angle and low breaker intensity to another surfer.

The distance covered by the surfer over the ride length does not have a linear relationship with surfer velocity (V_s). This is due to a wave having a number of 'sections' of varying lengths. These sections are due to peaks in wave crest height along the incoming wave orthogonal[1]. The peaks can be caused by; interaction of swells with different periods and directions, wave super-position and from undulating bathymetry causing the orthogonal to have different wave height (and steepness) along its length. A new wave section begins when there is a change in breaking wave height (H_b), peel angle (α), or breaking intensity (BI), and is said to have a section length, S_L – see Figure 2.

[1] The wave orthogonal is defined as the unbroken line of the wave crest as it propagates forward

Each of these sections requires the surfer to make alterations in their speed (V_s) in order to traverse the unbroken wave face. Skilled surfers anticipate these changes and manage V_s by performing different manoeuvres on the wave face as well as atop the breaking portion of the wave. Some surfers see amenity in waves with several sections on which numerous manoeuvres may be performed and some view superior 'wave quality' as extended section lengths where there is uniformity of the (desired) peel angle along the ride length.



Figure 2: Examples of different section lengths (S_L). Left: longer section lengths at 'Ladies', Merewether Beach and right: 'Peaky' short section lengths at Dixon Park (Source: Air Hunter/YouTube & David Diehm).

2.2 Coastal processes as they relate to surf amenity

This subsection summaries the meteorological and oceanographic conditions (wind, waves, water levels and currents) at the study site as they relate to surfing and wave quality and describes the geomorphological parameters affecting wave quality (bathymetric conditions and variability) at each of the known surf locations within the study site. It is the interplay of these parameters (metocean and geomorphological) that govern the wave quality and subsequent surfing amenity.

2.2.1 Wind

Wind measurements were sourced from the European Centre for Medium-Range Weather Forecasts (ECMWF) fifth-generation atmospheric reanalysis of the global climate (ERA5) covering the period from January 1979 to the end of 2023. ERA5 is produced by the Copernicus Climate Change Service (C3S) at ECMWF, providing hourly estimates of oceanic climate variables on a 31 km global grid. U- and V- 10 m wind velocity components were extracted from the model as well as wave parameters for the closest model location offshore of Merewether Beach (152°E, -33°S).

A wind rose for the entire collection period can be seen in **Figure 3** the hourly wind data has been filtered to ascertain wind speed and directions that occur only in daylight hours (civil dawn to civil dusk) under the assumption that surfing will predominantly be practised between these times. The daytime winds show a slightly higher occurrence of directionality from the easterly sector (which is directed *onshore* between Merewether and Bar Beach). Winds from these directions (from the sea blowing to the land) are typical less favoured by surfers, especially if they exceed 5 to 10 kts (2.5 to 5 m/s) in magnitude.

Traditionally surfers favour *offshore* winds, where the winds blow from the land to the sea. Depending on the peel angle of the wave around the underlaying bathymetric structure, or protection afforded by headlands or cliffs, the direction of the offshore wind (in comparison to the orthogonal coastline) may vary by 10° to 15° and still be considered as *offshore* conditions and be favoured by surfers, this has been represented by the red-yellow-green arrows on the monthly wind statistic plot provided in **Figure 3**. Surfers also prefer *glassy* conditions or very light winds less than 5 kts (2.5 m/s). A schematic of wind speeds and directions as they relate to surf amenity at the project site is provided in **Figure 4.**

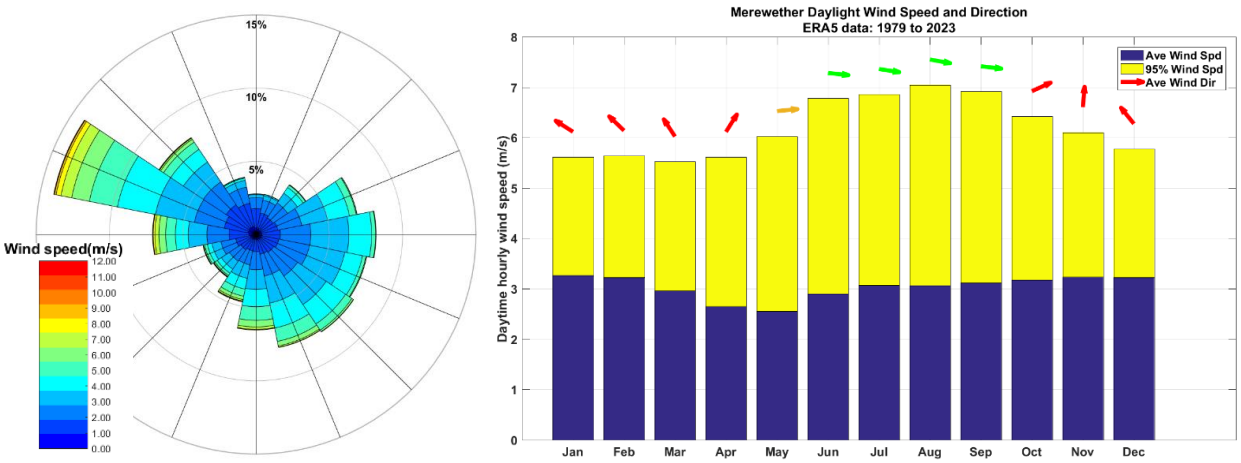


Figure 3: Wind rose of ECMWF ERA5 hindcast daytime wind data offshore of Merewether Beach for the period 1979-2023 (left). Monthly mean and 95th percentile wind speed and corresponding weighted mean wind direction (right), arrow colours represent surf amenity.



Figure 4: Topographical map of the study area illustrating wind speed and directions (blowing to) conducive to maintaining surf amenity.

A statistical analysis of the full 44-year ECMWF ERA5 daytime wind and wave dataset extracted offshore of Merewether Beach is provided in **Appendix A** for reference.

2.2.2 Waves

Wave parameters were also extracted from the ECMWF ERA5 hindcast dataset between 1979 and 2023. The data was again filtered to only analyse waves that occurred during daylight hours. Long term average (LTA) statistics for seasonal significant wave height (H_s, m), mean wave direction (D_z, °N) and mean wave period (T_z, sec) are presented in Table 2 and the accompanying wave rose (H_s/D_z) and scatter plot (T_z/D_z) in **Figure 5.**

In general, at the offshore model extraction point (approximately 1 km offshore of Merewether) the majority of waves come from the southeast quadrant. Short period (T_z < 8 sec) waves or *seas* occur approximately 75% of the time and tend to follow the predominant wind direction. There is a higher proportion of swell waves (T_z > 8 sec) occurring between April and July (Autumn/Winter) and arrive from just south of east.

In general, greater surf amenity is provided by longer period waves when the underlying bathymetric feature is large (such as a headland, large reef break, offshore focussing structure or point break). Here, the longer period waves interact or 'feel' the bathymetry, causing the wave orthogonal to refract (or diffract) and peel (refer to **Section 2.1**) increasing ride and section length.

Shorter period waves are favoured when the bathymetric feature is relatively small (in relation to the wavelength), such as nearshore sandbanks and rip features. In these instances, ride and section lengths are usually shorter. Longer period waves will tend to 'close-out[2]' when interacting with these smaller bathymetric features.

In short period swells and when swells are from a number of directions simultaneously, waves do not always break or 'peel' along a deep-to-shallow bathymetric feature. Wave-wave interactions and wave superposition increase wave heights and steepness along the wave orthogonal. The increased 'peakiness' of these swells provides more opportunities for a larger number of surfers.

The point and reef breaks of Merewether, Bar Beach and the offshore rock shelves/bombies will tend to favour longer period swells, whereas the beach breaks of Dixon Park, Bar Beach and nearshore spots like *Pogos* will favour shorter period waves.

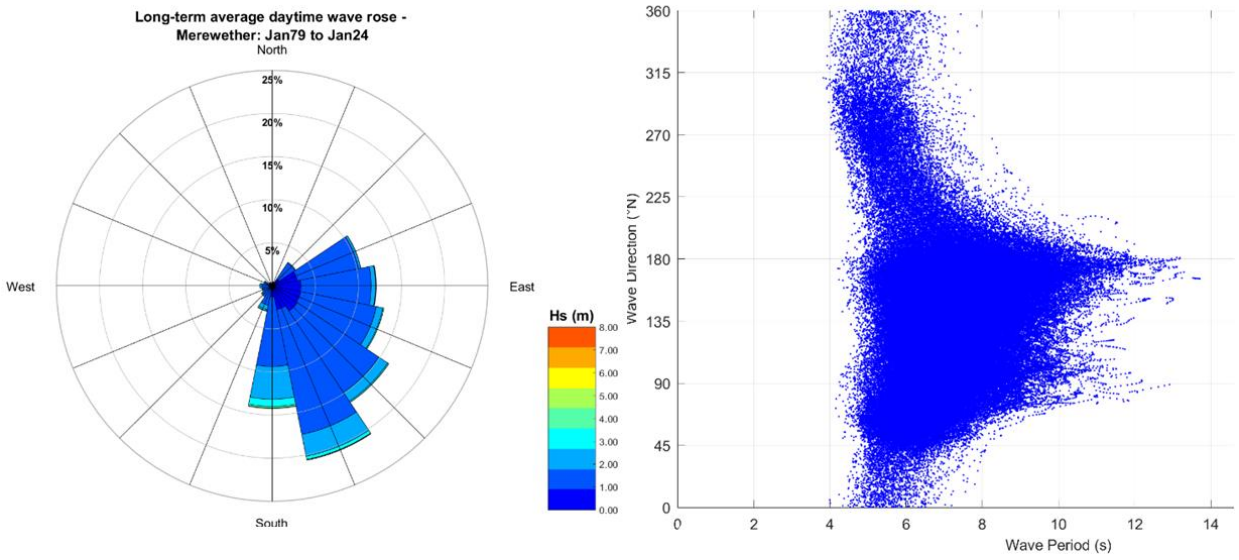


Figure 5: Long term (44 years) wave rose for the ECMWF ERA5 daytime wave data extracted offshore of Merewether Beach (left) and associated wave period/direction scatter plot.

Table 2: Long term (44 years) and monthly statistics for the for the ECMWF ERA5 daytime wave data extracted offshore of Merewether Beach

Parameter	Statistic	LTA 44yrs	Winter	Autumn	Summer	Spring
Significant wave height	**Average**	1.42	1.50	1.47	1.37	1.37
	20%ile	1.00	0.96	1.02	1.02	0.97

[2] A close-out is where the wave crest breaks simultaneously (or at a low peel angle) along its orthogonal, providing little or no surf amenity.

Parameter	Statistic	LTA 44yrs	Winter	Autumn	Summer	Spring
Hs (m)	**90%ile**	2.13	2.38	2.21	1.94	2.03
	Max	7.69	6.27	7.69	5.57	5.40
Mean wave period Tz (sec)	**Average**	7.1	7.3	7.5	6.9	7.0
	% of Time Sea (Tp<8s)	77%	69%	69%	86%	81%
	% of Time Swell (Tp>8s)	23%	31%	31%	14%	19%
Mean wave direction Dz (°N)	**Weighted Average**	155	169	152	134	158
	Standard Deviation	46	53	39	37	47

2.2.3 Bathymetric features

Like the majority of the NSW coastline, the study site can be defined as a wave-dominated beach, see Short (2006) for more information. The Merewether and Bar Beaches have rocky headlands with underlaying rocky reef bathymetry protruding through the surf zone which dictate the breaking characteristics of the waves in their vicinity.

Beachsafe.org.au describes the project site as follows:

> *"The entire beach receives waves averaging 1.6m and is bounded by 50m high cliffs fronted by wide rock platforms. Rocks and reefs also occur in the surf at either end and at places along the beach and are exposed following beach erosion. Higher waves break on an outer bar and the northern and southern reefs, the latter called 'The Ladies."*

Seabed landform features in the nearshore areas of the study site have been classified from the NSW marine Light Detection and Ranging (LiDAR) dataset, acquired in 2018 by Fugro Pty Ltd on behalf of the Department of Planning and Environment. Seabed features include reefs, plains, peaks, scarps, depressions and channels. These landforms capture variation in the shape and structure of reef outcrops in at the project site and are provided below in Figure 6.

Subaerial rocky outcrops have been identified in the recent update to the CN Southern Beaches CMP (RHDHV, 2022) from aerial imagery and historical photos. Large erosion events exposing the upper beach face, most notably the Sygna storm of 1974 and more recent events in May 2015 and July 2020 reveal an underlaying rock bed founding the ephemeral sand land layer, see **Figure 7** and **Figure 8**.

When exposed, these rocky platforms and outcrops interact with the incoming wave field, especially when there is a more pronounced gradient to the adjacent bathymetric features. The interaction with these bathymetric structures induces wave shoaling and refraction and has the potential to enhance surf amenity.

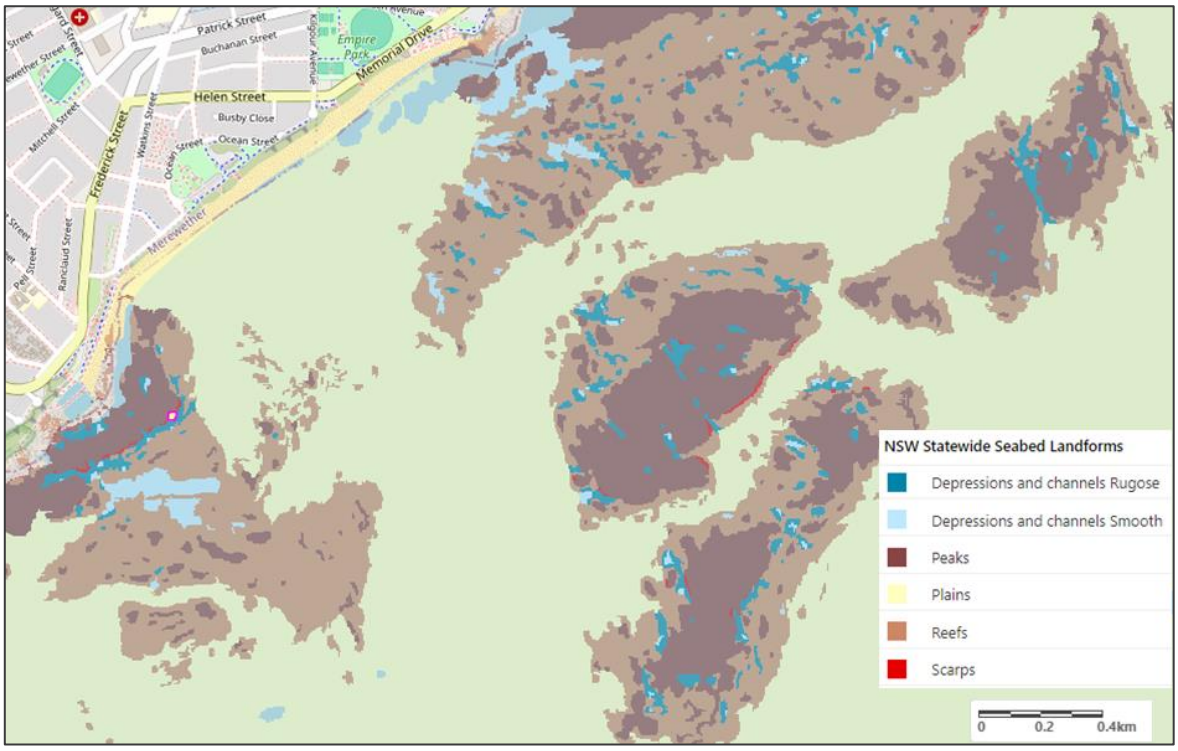


Figure 6: Seabed landforms identified through the NSW statewide marine LiDAR survey (https://geo.seed.nsw.gov.au/)



Figure 7: Beach erosion following the 1974 *Sygna* storm event exposing the underlying rock in the southern corner of Merewether Beach, (source: Kim Bent / Warren Kirby)



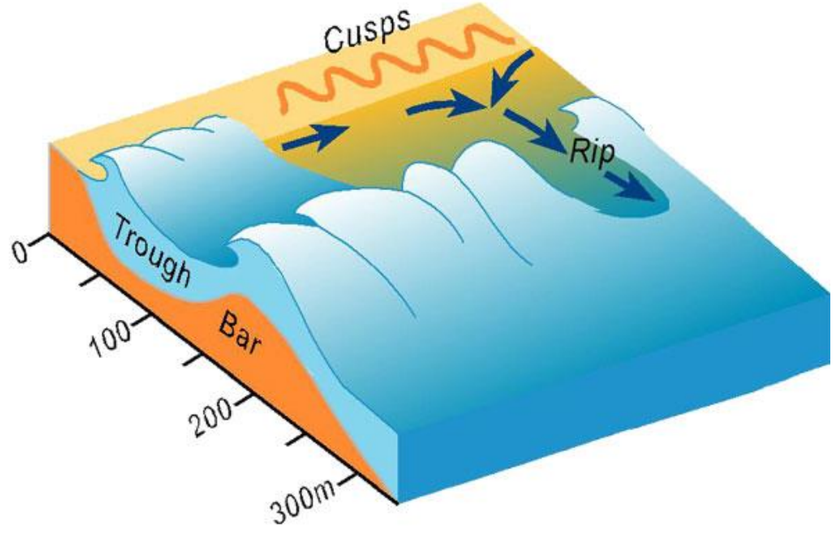
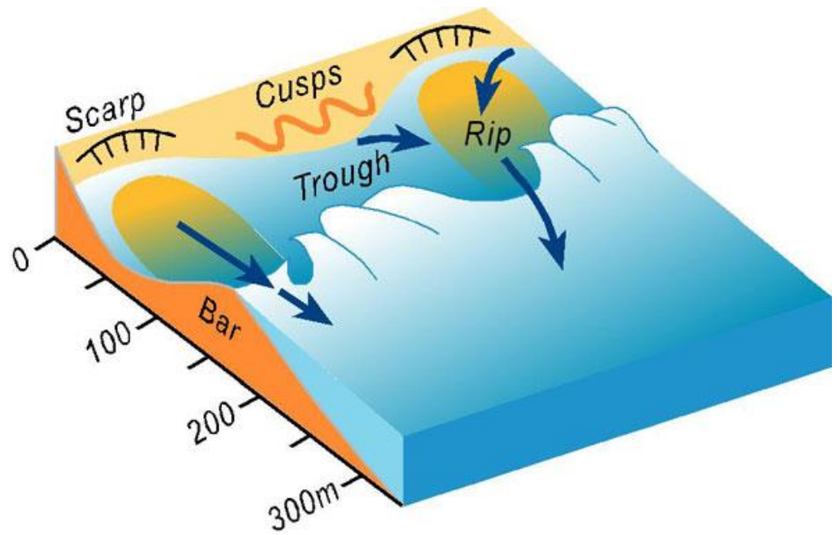
Figure 8: exposed rock platform following July 2020 storm event, *Pogos* looking south (source: Merewether Surfboard Club)

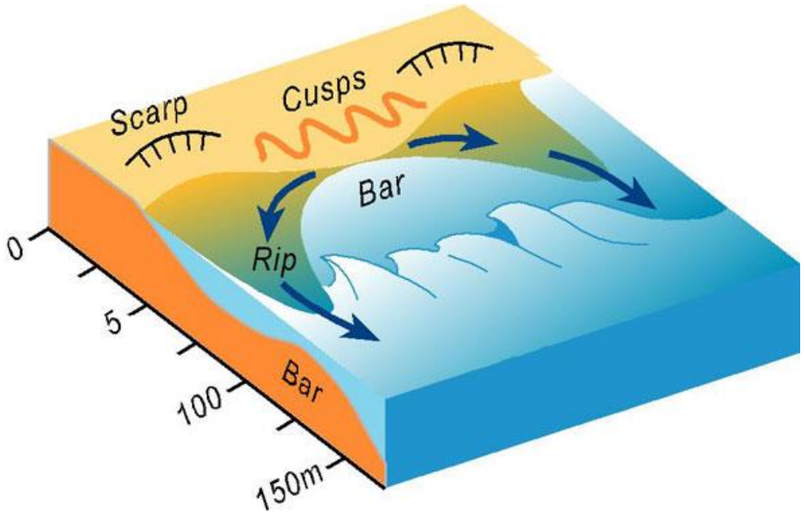
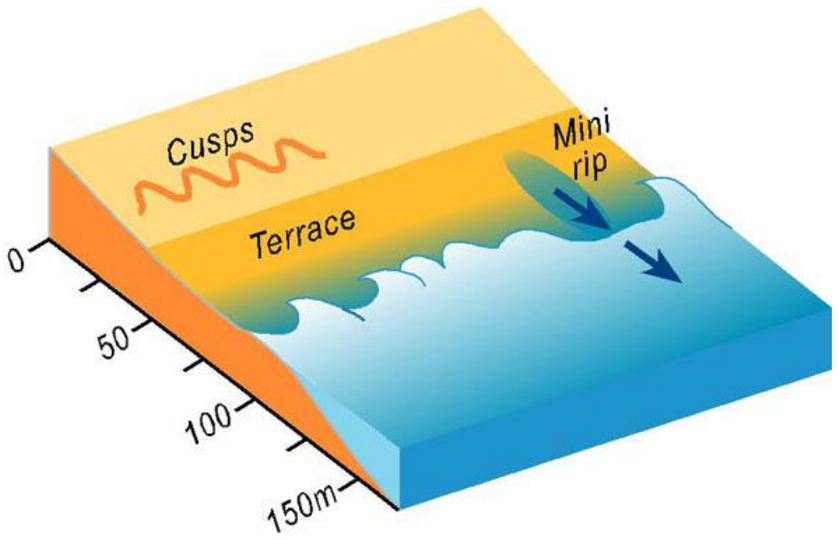
Beachsafe.org.au describes the central (open) section of beach in the study area between Merewether and Bar beaches as:

> *"The waves and sand produce a beach characterised by a bar usually cut by 4-5 beach rips with permanent rips at either end, the northern at Cooks Hill being the more prominent."*

The morphology of this section of coast is typical of rip-dominated intermediate beaches along the NSW coasts. Andrew Short (ozcoasts.org.au) provides detailed conceptual models of the four main beach states that are prevalent along the open beach section of the study site, these have been summarised in **Table 3**, below. The beach will transition between each of these states depending on antecedent wave conditions and sediment supply to the embayment. The layout and extent of sand bars and rip features as they transition between the states shown in **Table 3** is also dictated heavily by the amount of underlying bedrock or rocky formations that are exposed.

Table 3: The four rip-dominated intermediate beach states prevalent along the open beaches of the study site (source: Andre Short / ozcoasts.org,au)

Beach state	Description	Examples
Longshore Bar and Trough (LBT) 	• Waves averaging 1.5 to 2 m. • Near continuous longshore bar located between 100 to150 m seaward of the beach. • 50 to100 m wide, 2 to 3 m deep longshore trough. • Beach face is straight alongshore and depending on sand size may have a low tide terrace (fine sand) and/or a reflective beach with beach cusps (medium sand). • Bar crossed by rips every 250 to 500 m, commonly occurring as an outer second bar. • Usually occur after a large wave event when significant seaward cross-shore sediment transport has occurred. • Less frequent and short-lived on this embayment due to the interspersed beach rock and bombies intersecting the formation of an outer bar. • Surf amenity is usually only provided on the rips at either end of the longshore bar or from wave-wave interactions creating more peaks.	
Rhythmic Bar and Beach (RBB) 	• Waves averaging more than 1.5 m. • Rhythmic outer bar separated from the beach by a deep trough, varying in width and elevation alongshore. • Waves break more heavily on the shoreward-protruding rhythmic bar sections with the broken wave and white water flowing shoreward as a wave bore. • The bore flows into the deeper tough becoming a rip feeder current. • Waves reform and break again on the shore. • The waves and swash move water along the beach toward the adjacent rip embayment. The rip moves through the trough and across the deeper sections of the rhythmic bar. • The rhythmic bar acts as a ‘temporary’ reef structure providing surf amenity along the steep face between the bar and adjacent rip. • This is generally the most favoured beach state by surfers as ride lengths are longer where the sandbar starts further seaward (as opposed to TBB) and rides can continue across the nearshore trough (as opposed to LBT).	

Beach state	Description	Examples
Transverse bar and rip (TBR) 	• Waves averaging 1.5 m. • Bars are transverse or perpendicular to and attached to the beach, separated by deeper, regularly spaced rip channels (150 m to –350 m depending on wave energy) • The shoreline is also rhythmic building a few metres seaward behind the attached bars as deposition occurs forming the mega cusp horns and being scoured out and often scarped in the lee of the rips forming the embayment. • The surf zone has a cellular circulation pattern. As waves break on the bars, the water flows both directly into the adjacent rip channel and, closer to the beach, into the rip feeder channels located at the base of the beach. The water in the rip feeders converge and return seaward as a strong rip current • Surf amenity is produced as the waves break along the bars. Although ride lengths are generally short, breaker intensity can be high as the breaking wave opposes the outward flowing rip, steepening the wave face.	 **TBR Beach State: March 2010** Nearmaps™
Low tide terrace 	• Waves average approximately 1 m. • A moderately steep beach face, which is joined at the low tide level to an attached bar or terrace. • The bar usually extends between 20 to –50 m seaward and continues alongshore, attached to the beach. • At high tide, waves may pass right over the bar and break on the beach face and become reflective. • Water is returned seaward, both by reflection off the beach face and via mini rips, which are usually shallow, ephemeral or transient. • There is usually very little-to-no surf amenity under this beach state besides maybe bodysurfing.	 **LTT Beach State: October 2012** Nearmaps™

2.3 Effects of coastal management on surf amenity

The inherent subjectivity of surf amenity should be noted when investigating the wave quality parameters described above. However, undoubtably the biggest influence on the shape of breaking waves is induced by changes in the underlying bathymetry of a surf break.

Anthropogenic changes to the coastal zone can have both positive and negative effects to surf amenity, see examples provided in Figure 9. Covering of permanent bathymetric features like reefs through nearshore and subaerial beach nourishment can affect surf amenity through changes to peel angles, section lengths and breaker intensity. Strategic placement of sand offshore of the breaking zone can also affect surf amenity through the pre-conditioning of wave fronts prior to breaking.

Wave reflections caused by wave interactions with coastal structures or excessively steep beach faces can have a detrimental effect on ride length and perceived wave quality due to shortening the section length as well as creating discontinuities (or bumps) in the wave face. These reflections (referred to as backwash) inhibit the surfer's ability to successfully maintain speed and traverse the entire open section of the wave.



Figure 9: Left: wave reflection/'backwash' negatively impacting surf amenity (Source: Bruce Frye Photography). Right: constructive interference/pre-conditioning of wave fronts due to an offshore sand delta resulting in positive surf amenity. (Source: Bluecoast, 2019).

3. Southern Beaches CMP management options

As part of RHDHV's CMP Stage 2 technical investigation, the coastal process understanding was updated based on extended metocean records, further geotechnical investigations and sea level rise scenarios. A revised probabilistic hazard assessment was undertaken of coastal erosion and inundation to inform the development of long-term management approaches on Newcastle's southern beaches.

Although still at a draft stage, **Table 4** presents the nine (9) preliminary coastal management planning options that have been developed for the coastline between Merewether and Bar Beach.

Table 4: Draft Southern Beaches Coastal Management Planning options

Study Area	Option	Description	Triggers/Thresholds
Merewether/ Dixon Park Beach	**MDP1**	Maintain/upgrade existing revetments with beach nourishment for amenity from offshore dredging	Maintenance/upgrade of existing revetments in Year 1. Beach nourishment from offshore dredging in year 20
	MDP2	Maintain/upgrade existing revetments with beach nourishment for amenity sourced from back passing from Nobbys Beach	Maintenance/upgrade of existing revetments in Year 1. Beach nourishment from offshore dredging in year 20
	MDP3	Maintain John Pde revetment. Remove carpark revetment. Relocation of Assets	Maintenance/upgrade of existing John Pde revetment in Year 1. Removal of Dixon Park revetment and relocation of carpark in year 20.
	MDP4	In combination with BB1. Beach nourishment of full embayment for coastal protection sourced from offshore dredging.	In combination with BB1. Beach nourishment and temporary protection in year 1.
Bar Beach	**BB1**	In combination with MDP4. Beach nourishment of full embayment for coastal protection sourced from offshore dredging. Nourishment is required immediately to protect Memorial Drive and the Skate Park. Temporary protection structures may be required in the interim period prior to nourishment being placed.	In combination with MDP4. Beach nourishment and temporary protection in year 1.
	BB2a	Terminal protection (along seaward alignment of Bathers Way) with beach nourishment for	Terminal protection (along seaward alignment of Bathers Way) with beach

Study Area	Option	Description	Triggers/Thresholds
		amenity sourced from offshore dredging	nourishment for amenity sourced from offshore dredging in year 5.
	BB2b	Terminal protection (along seaward alignment of Bathers Way) with beach nourishment for amenity sourced from back passing from Nobbys Beach	Terminal protection (along seaward alignment of Bathers Way) with beach nourishment for amenity sourced from back passing from Nobbys Beach in year 5.
	BB3	Planned retreat with one way traffic on Memorial Dr, SLSC relocation and seawall setback (approx. 12m landward of Option BB2) and nourishment for amenity	One way traffic on Memorial Dr, and seawall setback (approx. 12m landward of Option BB2) in year 1. SLSC relocation in year 10 and nourishment for amenity in year 20.
	BB4	Planned retreat with Memorial Dr closure and traffic redirection onto Bar Beach Ave and Kilgour Rd (no nourishment)	

3.1 Implications on surf amenity

The nine management options presented in **Table 4** can be broadly separated into four categories, based on their expected impact on coastal processes and subsequent implication this may have on surf amenity. These intervention categories are listed in **Table 5** in order of those having the least to those having the most impact on coastal processes and surf amenity. The applicable CMP options are listed against each category as well as supporting narrative around possible surf amenity implications.

Table 5: Coastal management interventions as they relate to surf amenity on the CN southern beaches.

Intervention category	CMP options	Possible surf amenity implications
Retreat / landward movement of infrastructure and/or coastal protection structures.	MDP3, BB3, BB4	These management options will have no impact on the current surf amenity. Surf amenity in the future may be affected by landward movement of structures. However, at that time, existing surf amenity at recognised spots will have also been modified by the higher water levels and altered beach state associated with SLR.
Upgrade back beach coastal protection structures along	MDP1, MDP2, MDP3	This management option will have little to no impact on surf amenity depending on the extent of the upgrade. Any increase to the surface area of hard vertical faces of structures along the back beach may temporarily increase wave reflections when the beach is in a fully eroded state. This could only occur during and immediately after a significant erosion storm event when the seawall is interacting with the

Intervention category	CMP options	Possible surf amenity implications
existing alignment.		surf zone (as it is designed to do in such an event), prior to subsequent beach recovery (or nourishment for beach amenity) post storm event. Wave reflections impact surf amenity by reducing ride and section length and a surfer's ability to traverse the wave face.
Beach nourishment (both subaerial and nearshore deposition)	MDP1, MDP2, MDP4, BB1, BB2a, BB2b,	The reef and point breaks around Merewether and Bar Beach will be adversely affected by an increase in sediment (nourishment for either **beach amenity** or **asset protection**) in the coastal system. These waves provide maximum surf amenity when the nearshore is in an eroded state and the natural contours of the underlying rock shelves are fully exposed providing a large depth gradient to the adjacent seabed. Surf amenity along the open beach breaks of Middles, Dixon Park and Bar Beach may be adversely affected if sand nourishment was only applied to the subaerial beach. Under this scenario immediate steepening of the beach face may occur as the beach re-establishes its equilibrium. The steep beach face will increase wave reflections. Strategic placement of nearshore sediment nourishment has been used elsewhere (see Gold Coast Northern Beaches Strategy, 2016) to temporarily improve surf amenity along open beaches. This technique may also be appropriate at Merewether/Dixon Park/Bar Beach for beach nourishment campaigns when the volumes of sand are intended to provide **beach amenity** only, depending on the pre exiting beach state. However, in the embayed beach scenario of Merewether/Dixon Park/ Bar Beach, nearshore sediment nourishment to provide **asset protection** will require a volume of sand that is more likely to cover existing permanent bathymetric features. This will adversely affect surf amenity of the beach breaks in the area by effectively straightening the beach and nearshore bathymetry causing approaching wave to 'close-out' with no opportunity for length of ride.
Seaward movement of the alignment of back beach coastal protection structures	BB1, BB2a, BB2b	Seaward movement of hard vertical faces of coastal protection structures may increase wave reflections off the structure under a wider range of water level and beach state conditions. Wave reflections impact surf amenity by reducing ride and section length and a surfer's ability to traverse the wave face.

4. Stakeholder engagement

4.1 Introduction

Stakeholder engagement was undertaken with long-standing and recognised members of the Newcastle surfing community. The purpose of the engagement process was to:

- Define each of the recognised surf spots and clarify location, extent and amenity.
- Understand the ideal conditions for each spot (best geomorphic and metocean conditions).
- Explain the CMP process one-on-one and to;
- provide an opportunity for the surfing community to input into the CMP process and relay any concerns around perceived negative impacts to surfing amenity that may occur due to any management options.

4.2 Methodology

Recognised Newcastle surfing stakeholders were interviewed one-on-one over the period from Wednesday 15th to Friday 17th May 2024 at various locations around Newcastle. The interviewers worked through the Stakeholder Engagement Form (provide in **Appendix B**) with each stakeholder, physically marking out the extent of each surf break on the locality map and then asking subsequent questions as to the ideal metocean and geomorphic conditions required to provide surf amenity at each break.

The interviewers proceeded to discuss the City of Newcastle's CMP process, and that although management options may be planned into the future, they may not occur until certain maintenance triggers are met or forecast sea level rise are realised. It was conveyed, that certain management options may not be instigated within their lifetimes, however the CMP process is in place to provide effective and transparent planning to appropriately maintain the City's assets, including its beaches.

The results of the stakeholder consultation are provided in the detailed breakdown of each surf break (**Section 5.2)** , an explanation of each amenity metric and a background of key stakeholders is provided below.

4.2.1 Metocean conditions

Stakeholders were asked under what conditions each spot would start breaking (providing amenity) and the ideal conditions. Wave height, period and direction as well as ideal wind direction were ascertained during the interview.

Surfers generally measure wave heights in feet and generally provide a range in 2 feet increments when describing conditions (e.g. 4 to 6 ft). Significant wave height (H_s) used in the metocean analysis previously is analogous to the wave height measurements used by surfers as H_s is the average highest one-third of wave heights measured over a given period (usually an hour) and surfers will generally favour catching the large waves (or sets) during a session. Surfers particularly in Australia (and Hawaii) tend to traditionally under-estimate wave heights, so a 3 to 4 ft day would equate to a 1.5 to –2 m measured H_s.

Due to the relatively small range in wave periods experienced in the area, wave period has been omitted from the results. The stakeholders generally did not have a favoured band of wave period or if an answer was provided, for all spots *"Between 8-12 seconds"* was the response.

There was also some conjecture around wave direction. As the embayment faces south-east, waves arriving from the east or east-northeast (ENE) were generally perceived as being "North-Swells". After discussion with the stakeholders and revision of past (memorable) swells, there was agreeance that these

perceived north swell events were in fact either from the E or ENE and it was confirmed that true north swells were extremely rare. These events have been saved in the preferred wave direction as north-east.

Each response was plotted for each surf spot based on the range and as a percentage of responses. The higher values mean the greatest consensus amongst stakeholders, as presented in the *Ladies* example provided in Figure 10.

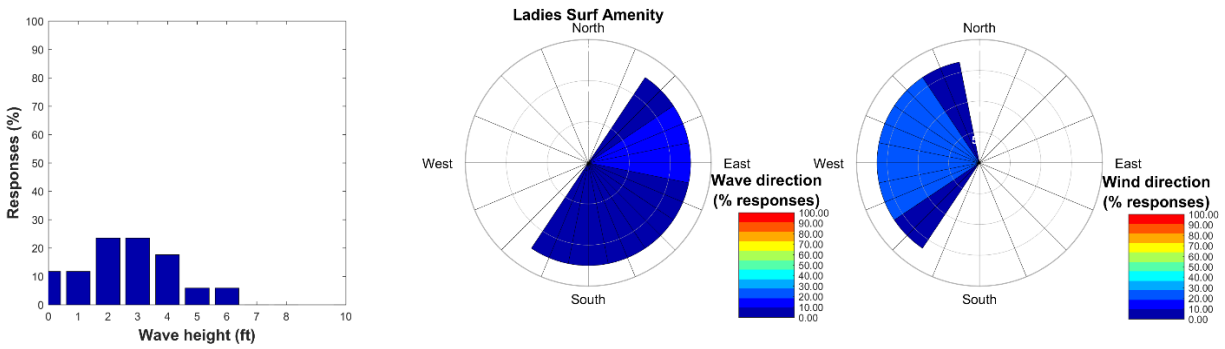


Figure 10: Stakeholder responses for preferred metocean conditions at the *Ladies* surf spot.

4.2.2 Beach state and management option

The favoured geomorphic state for the surf spot was also determined from each stakeholder. The respondents were provided three preferred beach states; eroded, neutral and nourished. An eroded beach state meant that there was no sand present over the bed rock structure. Neutral generally meant there was a mix of some sand and rock, and nourished meant that there was only sand underlaying the surf spot.

Stakeholders were also asked their favoured management option at the landward extent of each surf spot, if required to provide management at the site, noting that the overwhelming response from all stakeholders was generally to not do any management at any of the sites and to “leave the beach alone”.

The four management options for the stakeholders were to choose from were:

1. Retreat / landward movement of infrastructure.
2. Upgrade hard structures in current location.
3. Beach nourishment (both subaerial and nearshore deposition)
4. Seaward movement or introduction of new hard infrastructure

These options are defined above in Table 5.

4.2.3 Key stakeholders

Stakeholders were generally selected on the basis of being long-standing and recognised members of the Newcastle surfing community. Representatives of Bar Beach Boardriders were also interviewed as a diverse user group of surfers. As noted on the Bar Beach Boardriders website, they are a family friendly club providing competition and social events for both male and female early learners, recreational and advanced surfers. Due to demand the club commenced a Parent-Assist and Junior Girl's division in the competition format. In recent years the membership has reached 100+ ranging from five-year to over sixty-year old’s. Evan Watterson was also interviewed based on his local surfing experience and professional coastal engineering background. This approach allowed for the full spectrum of backgrounds surfing abilities from professional to recreational, to be considered.

Key stakeholders engaged in this process are detailed below.

Mark Richards (OAM)

Mark Richards (known colloquially as 'MR") is a four-time world surfing champion. He was born and raised in Newcastle and has surfed the breaks of Merewether for over 50 years. He is one of Australia's most respected and best-known surfers. His father Ray owned one of the region's first surf shops which is still run today. Mark is a life member of Merewether Boardriders Club.


Photo: Peter Boskovic

Matt Hoy


oto: Craig Tonls

Matthew Hoy is a professional surfer who spent several years on the World Championship Tour (the highest level of competitive surfing). Hoy won three World Championship Tour events and was ranked in the top ten three times. He was born in Newcastle and has surfed the breaks of Merewether for over 40years. He is still to this day, one of Australian surfing's most loved characters. He is a life member of Merewether boardriders club.

Peter Boskovic

Peter 'Bosko' Boskovic is a professional surfing photographer with more than 25 years' experience. He has worked for all major surf brands and has had images run in all major surfing magazine including several cover shots, with his work also branching into many other mainstream sports publications and newspapers. He has focussed most of his career on shooting surfers in his hometown of Newcastle and has spent more time than most on the beaches in this study.



Dan Frodsham



Daniel Frodsham is an ex-professional surfer from the Newcastle area. He now owns and operates the Newcastle Surf School. Dan Frodsham's Newcastle Surf School is the longest-running surf school in the Newcastle and Lake Macquarie area, catering for all ages and levels of surfing, from beginners to intermediates and advanced. Dan's school regularly runs both surf lessons and coaching on the stretch from Merewether to Bar Beach.

Tim Ryan



Tim Ryan is a patron, life member and longtime administrator of the Merewether Boardriders Club. He has been surfing the breaks of Merewether for over 50 years. Tim was also on the National Surfing Reserve committee who organised the inauguration of the Merewether National Surfing Reserve. He is one of the most-respected elders of the Merewether surfing community.

Chris Tola



Chris Tola is a director and co-chair of National Surfing Reserves. He is a life-long surfer who has surfed the stretch from Bar Beach to Dixon Park for over 30 years. Chris was also the National Chair, Regional President and Board Member of the Surfrider Foundation Australia. Chris is well-versed with the CMP process having worked with City of Newcastle in previous capacities through its current development.

Steve Fleming



Steve Fleming is currently the president of the Bar Reef Board Riders Inc. surfboard riding club. Steve is a Life Member of the club serving on the committee for 25 years and has been surfing the breaks of Bar Reef/Beach for over 50 years.

Commonly known as the "Reef Rats" the club was formed in1971. Over time the club has evolved into a family friendly club providing competition and social events for both male and female early learners, recreational and advanced surfers. In recent years the membership has reached 160 ranging from five-year to over sixty-year old's.

Evan Watterson



Evan Watterson is a respected coastal engineer with a consultancy firm located in Newcastle. He is a born and bred Novocastrian who has surfed Bar Beach for over 25 years. Evan has acted as the lead engineer on a range of national and international projects spanning in size from small residential developments to large multidisciplinary investigations, including several coastal management projects for City of Newcastle as well as the port. He brings a wealth of experience and knowledge about coastal management as well as a love for Newcastle's beaches.

5. Southern beaches surf amenity

5.1 Site overview

The study site consists of the surf breaks between Merewether and Bar Beach along the southern coast of Newcastle, New South Wales, depicted in Figure 11. Each section of beach is delineated by the three surf lifesaving clubs; Merewether, Dixon Park and Cooks Hill, rather than geologic features. Newcastle is one of Australia's most recognised surfing coastlines due to its long history of local and visiting surfers, long-running international surfing competitions and high-quality surfing spots close to a metropolitan centre. This stretch of coast has at least twelve (12) recognised surf spots spread between Merewether and Bar Beach headlands (Figure 11), with many more surfing opportunities offered between these established spots, depending on geomorphic and metocean conditions.

The embayment encapsulating the study site can be described as a south-east facing pocket beach with a quasi-dynamic shoreline in long-term equilibrium. The subaerial beach is comprised of medium-grained quartz sands overlaying a basement of hard rock. Longshore sediment transport occurs in both directions, however there is a net northerly littoral drift due to the orientation of the embayment to the dominant south-easterly wave direction encountered along this coast. The two rock headlands at either end of the beach have exposed rocky reefs at their bases, which can be seen alongside other nearshore bathymetric landforms identified in a 2022 marine LiDAR survey (Figure 11). The Dixon Park surf lifesaving club in the centre of the embayment sits atop a rocky cliff lowering on either side to areas of sandy dune interspersed among deposits of remnant coal mining spoil which stretch further inland.

A comprehensive coastal process study, geotechnical and geomorphic analysis has been undertaken as part of the CN Southern Beaches CMP (RHDHV, 2022).

5.1.1 National Surfing Reserve

Merewether Beaches National Surfing Reserve (NSR) was declared in March 2009, stretching approximately 2km from Dixon Park in the north to Burwood Beach in the south, this is delineated by the red polygon in Figure 11. NSR is a voluntary collaboration dedicated to recognising and assisting iconic surfing sites in Australia. Crown Land, the property management authority along the NSW coast, endorses the NSR initiative as a way to work with local communities to promote the history and culture of Australian surfing (surfingreserves.org).

A NSR is defined as "an 'iconic' place of intrinsic environmental, heritage, sporting and cultural value to a nation", surfingreservs.org lists the following criteria for becoming an NSR:

- quality of the waves (i.e. a national class surfing break);
- a place considered sacred by the local and national surfing community; and
- long-term usage of the beach and wave environment by local and national surfing community, e.g. long-term surf lifesaving club and/or boardriders club with significant history.

Currently, the NSR declaration offers no regulatory framework for protection of the site. However, the stretch of coast which includes the Merewether Beaches NSR site is currently managed by CN, the NSW Government / NSW Crown Lands and is protected under several regulatory and non-regulatory frameworks.

5.2 CN Southern beaches surf spots

The series of surf spots along the beach stretching from Bar Beach (Cooks Hill) in the north to Merewether in the south is revered as some of the best in the Newcastle area. The diversity of the

bathymetric landforms is what produces surf amenity in this zone, “At its focal point is nature’s gift of a series of rock shelves delivering consistently challenging waves in a variety of conditions” (MNSR, 2009). The following subsections describe surf amenity at the most well-known beaches in the study area. This information has been gathered from online resources including historic video and imagery analysis, satellite and aerial imagery, articles in surfing publications and from the results of the stakeholder engagement consultations.

This list is by no means exhaustive. However, captures information from those who are recognised to have the longest history and strongest connection with these surf locations, they have lived their life and/or made careers surfing or being associated with these breaks.

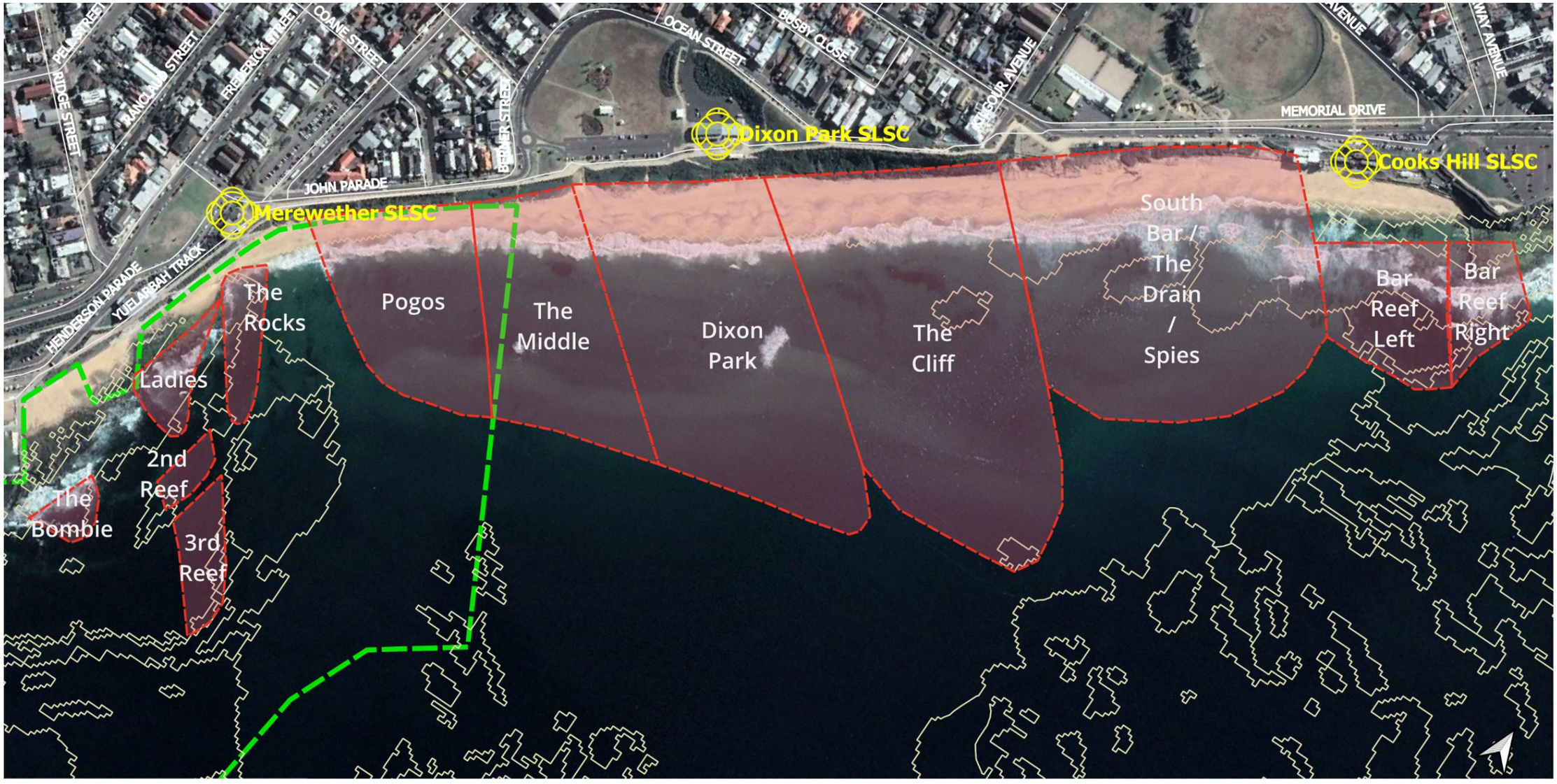
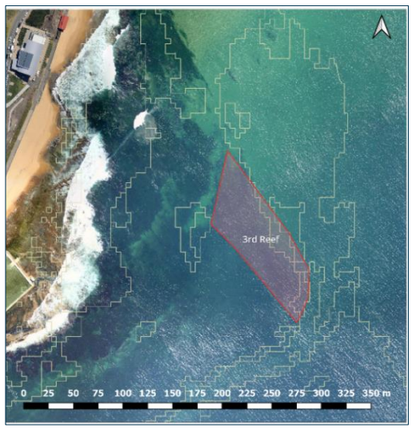


Figure 11: Merewether to Bar Beach recognised surfing spots, surf lifesaving clubs and the National Surfing Reserve.

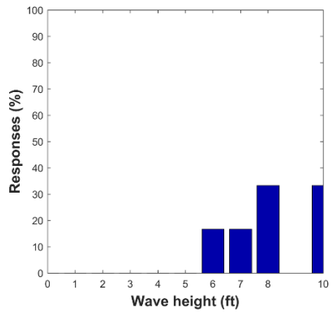
Surf spot	Description	Preferred metocean and geomorphic conditions for surf amenity

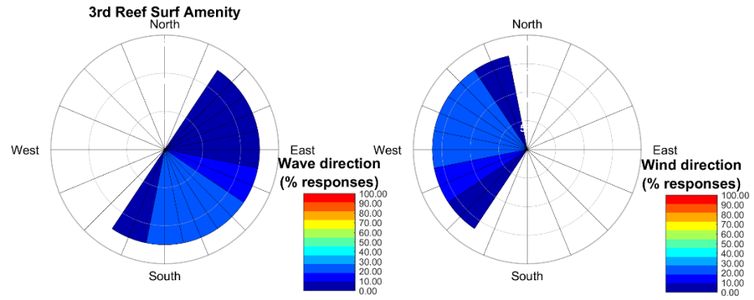
Third Reef



The most seaward of the consistently breaking rock shelves of Merewether is Third Reef. It is a right-hander that generally only breaks on waves larger than six foot and can hold swells large than ten feet. Generally, it is a short, intense (steep) take-off that loses power as the wave travels into the deeper water shoreward of the shelf. However, on larger days, the wave can continue through to *Ladies*, across to *The Rocks* and sometimes even across to *Pogos* depending on the power of the swell and sand bank configuration.





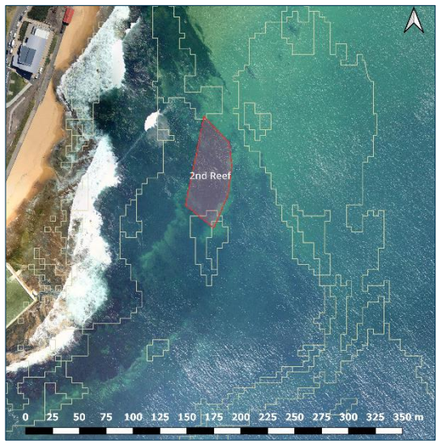


Preferred morphologic state: Eroded (100%)

Preferred management option: Status Quo / Maintain existing structures (100%)

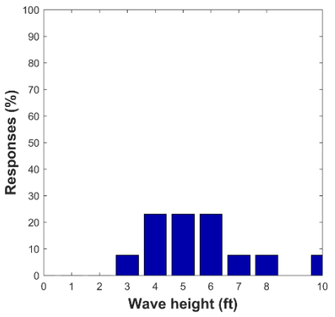
General notes: The distance offshore of the reef means that it is generally free from any reflections/interference caused by land-based structures. An over-nourishment of the embayment with sand may affect surf amenity.

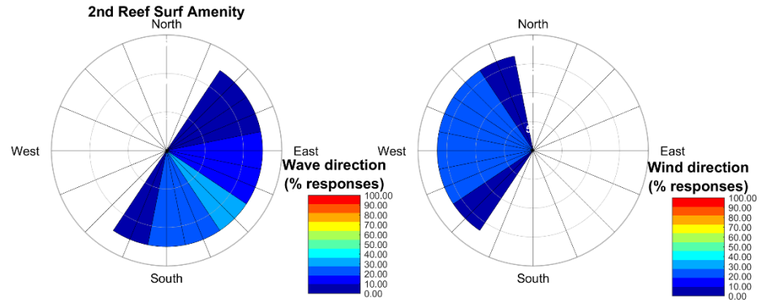
Second Reef



Located shoreward and further south (towards Merewether Headland) than *Third Reef.* Second Reef is also a bigger wave spot, requiring more than three to –four ft of wave height to start to break. Generally, waves larger than eight to ten ft tend to close-out at Second Reef and waves (and surfing) at this size are focussed out on *Third Reef*. “In an east or southeast swell, Second Reef often links to The Rocks offering a combination of clean wave face, critical sections and the prospect of a backdoor tube ride.” (MNSR, 2009)







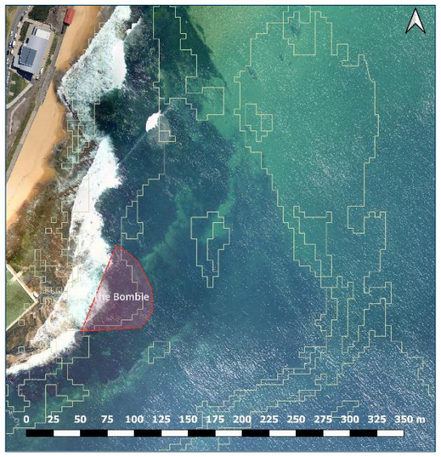
Preferred morphologic state: Eroded (100%)

Preferred management option: Status Quo / Maintain existing structures (100%)

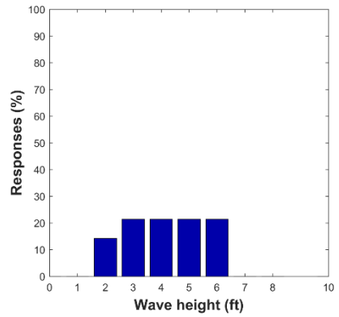
General notes: General notes: The distance offshore of the reef means that it is generally free from any reflections/interference caused by land-based structures. An over-nourishment of the embayment with sand may affect surf amenity.

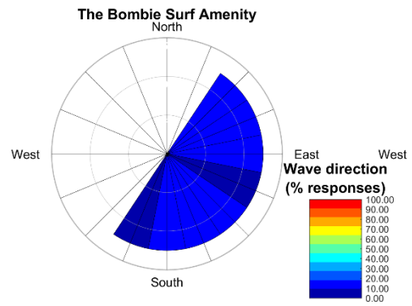
Surf spot	Description	Preferred metocean and geomorphic conditions for surf amenity

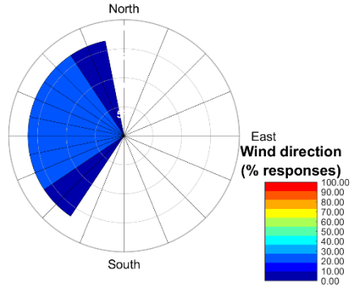
The Bombie



The Bombie (short for *Bombora*) is located just off the Merewether Ocean Pool. It is predominantly a right-hander and is best when waves are between two to six feet. It is generally quite crowded due to its consistency.





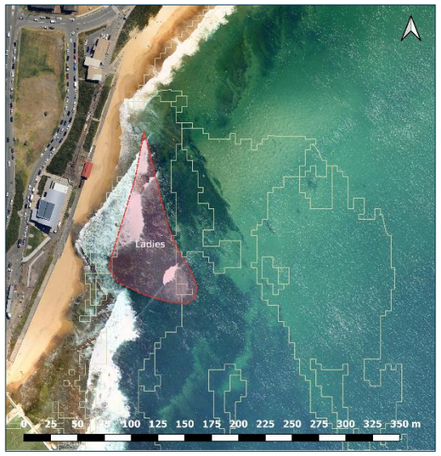


Preferred morphologic state: Eroded (100%)

Preferred management option: Status Quo / Maintain existing structures (100%)

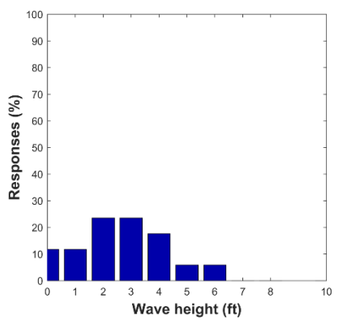
General notes: Any increase to vertical-faced structures on the existing shoreline is strongly opposed as with any increase to sedimentation (nourishment) of the reef shelf.

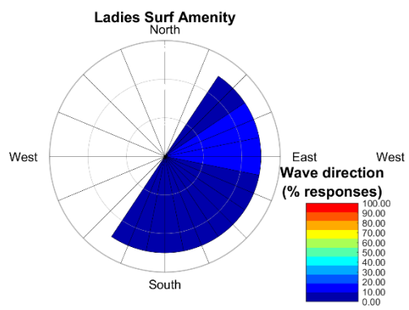
Ladies

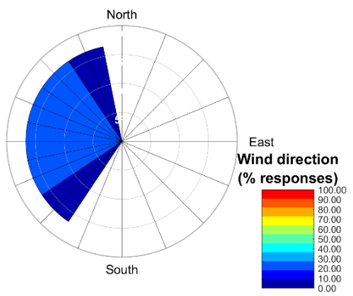


‘Ladies’ is a series of exposed rock shelves adjacent to the old Ladies Baths to the north of the Merewether SLSC. The right-hand wave is the most famous of the area. The rock shelf starts breaking at around one to two ft but is at is best between three to five ft. The consistency of ride and section length (and amenity) is maximised when in an erosive beach state (shelf is devoid of sand).







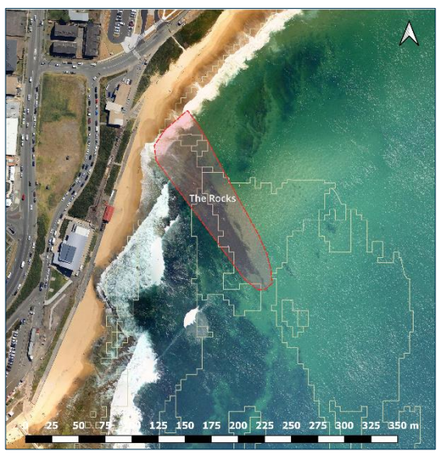


Preferred morphologic state: Eroded (100%)

Preferred management option: Status Quo / Maintain existing structures (100%)

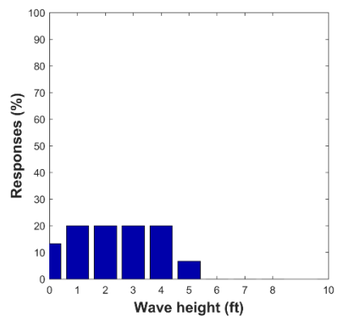
General notes: Any increase to vertical-faced structures on the existing shoreline is strongly opposed as with any increase to sedimentation (nourishment) of the reef shelf.

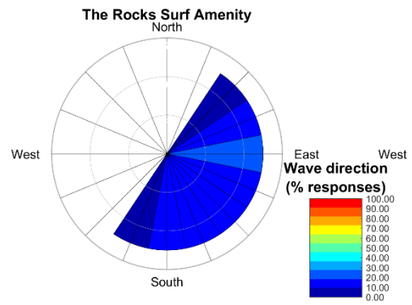
The Rocks

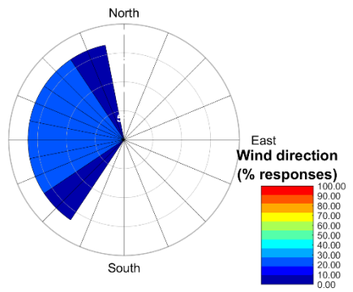


The Rocks is best known for its consistency, starting to break in the smallest of swells and holding up to about four to five ft before the wave closes out and surfers move out to the more seaward rock ledges. Predominantly a right-hander that will only break when Merewether is totally devoid of sand. An exposed nearshore rock shelf ends the 50 to100 m rides on the beach. The rock is an important spot to the local surfing community as it is where many first learned to surf.









Preferred morphologic state: Eroded (100%)

Preferred management option: Status Quo / Maintain existing structures (100%).

General notes: Any increase to vertical-faced structures on th eexisting shoreline is strongly opposed as with any increase to sedimentation (nourishment) of the reef shelf.

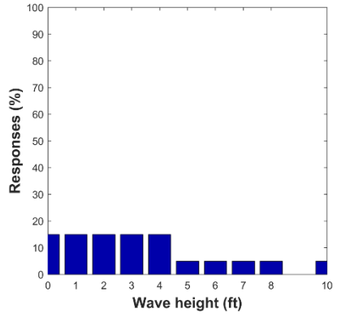
Surf spot	Description	Preferred metocean and geomorphic conditions for surf amenity

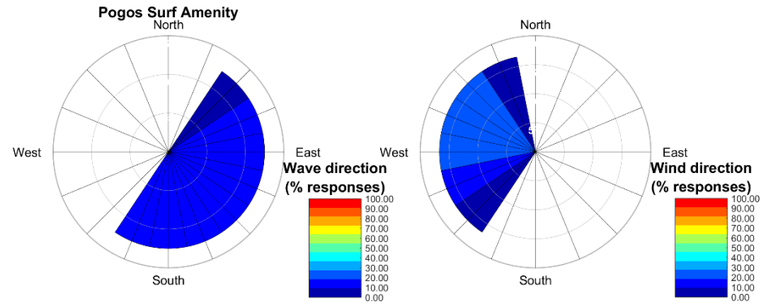
‘Pogos’



Pogos is named after the Pogonoski family who lived in front of break in the 1950s. Typically, Pogos is a small left-hand break near the shore when the surf is small (zero to three ft). It generally shifts to the outside bank when the waves are larger than four ft. The mix of sand banks, rips and rocky outcrops create surf amenity here. The persistence of the rip adjacent to *The Rocks,* the nearby stormwater outflow and the underlying bedrock layout provide consistency in the wave’s amenity.







Preferred morphologic state: Neutral (100%)

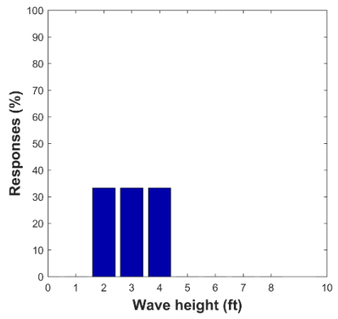
Preferred management option: Status Quo / Maintain existing structures (100%)

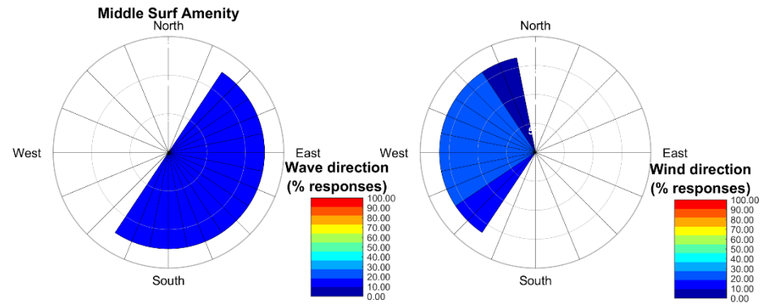
General notes: The combination of a neutral (some sand - not totally eroded or over-nourished) beach state and underlying bathymetry is essential to maintain surf amenity.

The Middle



Generally having fairly fluid borders, The Middle is essentially the stretch of beach between Pogos and Dixon Park. It is a less-defined wave than Pogos with random peaks breaking in the nearshore when waves are in the two to four ft range. Transient rips as well as the distribution of sand over the underlying bed rock create surf amenity here.



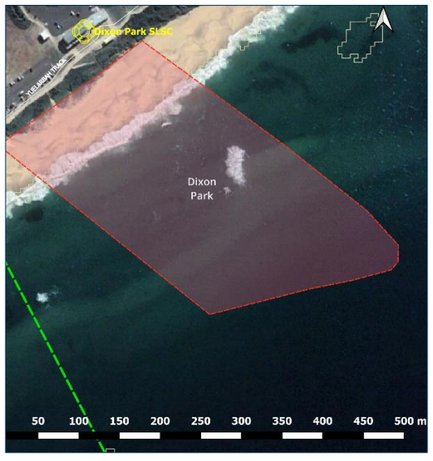


Preferred morphologic state: Neutral (50%), Eroded (50%)

Preferred management option: Status Quo / Maintain existing structures (100%)

General notes: There was conjecture among stakeholders as to whether a totally eroded or neutral beach state is what provides amenity here.

Dixon Park

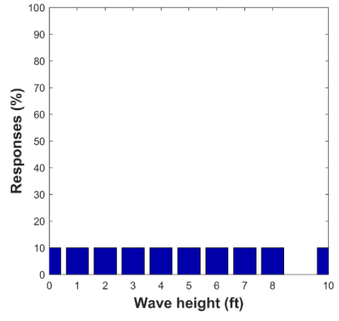


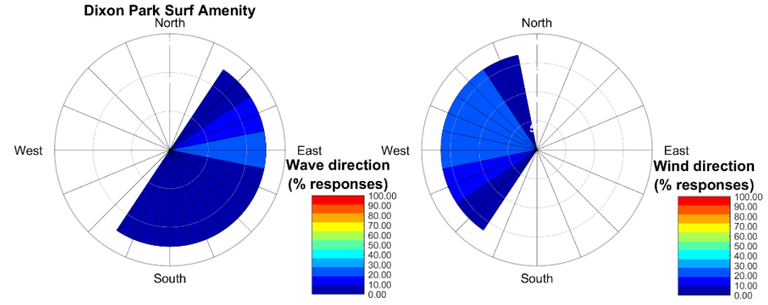
Dixon Park is the stretch of beach offshore of the Dixon Park SLSC and adjacent car park. Similarly to *The Middle*, random peaks provide amenity in the nearshore when waves are in the two to four ft range. Transient rips as well as the distribution of sand over the underlying bed rock create surf amenity during these conditions.

When large E-NE swell events occur with offshore winds, a large left-hand wave breaks between 300 to 500 m offshore.









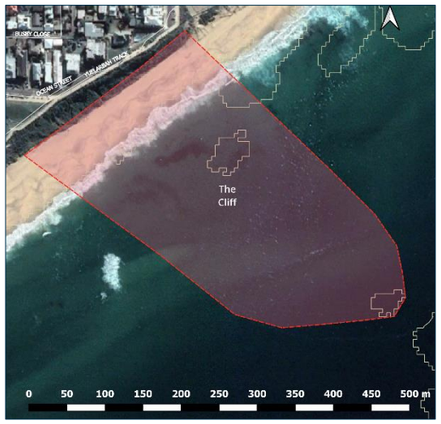
Preferred morphologic state: Neutral (75%), Nourished (25%)

Preferred management option: Status Quo / Maintain existing structures (100%)

General notes: Some believe the large offshore left breaks in large swell due to a rock shelf, others sand accumulation and others from wave focussing due to the influence of the offshore rock shelves.

Surf spot	Description	Preferred metocean and geomorphic conditions for surf amenity

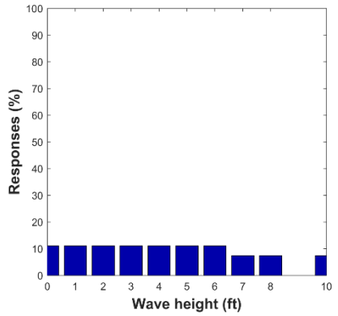
The Cliff

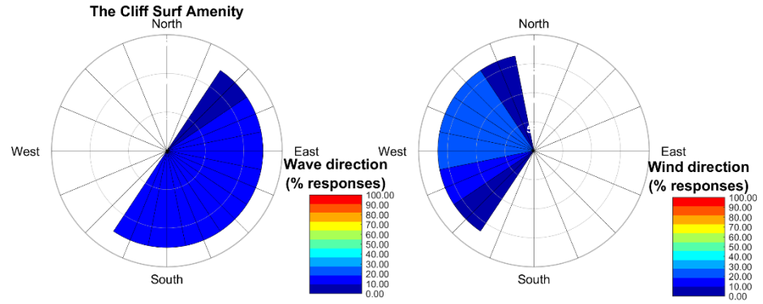


The Cliff section of beach begins where Ocean St and Kilgour Avenue terminate and a steep 50 m cliff fronts the foreshore. The southern boundary with *Dixon Park* is fairly fluid depending on beach state., However, the northern boundary is generally dictated by a persistent rip that is located between the beach entry stairs and stormwater outlet. This fairly constant feature as well as transient rips and interspersed sand over the underlying bed rock create surf amenity when waves are less than six feet. Similarly to *Dixon Park,* an offshore peak begins to break approximately 300 – 500 m offshore when waves are more than eight ft .







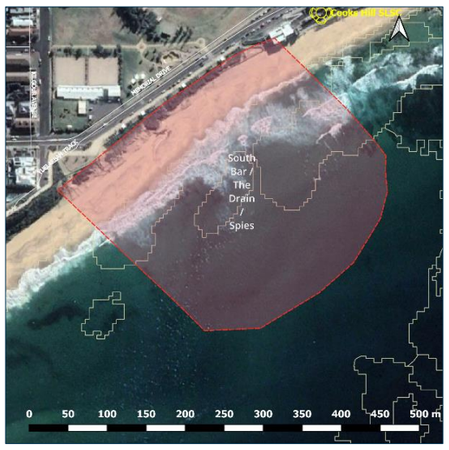


Preferred morphologic state: Eroded (33%), Neutral (66%)

Preferred management option: Status Quo / Maintain existing structures (75%), upgrade structures landward (25%)

General notes: Some stakeholders not opposed to stabilisation of the cliff and introduction of a rubble mound seawall if buried and no further seaward than the toe of the cliff.

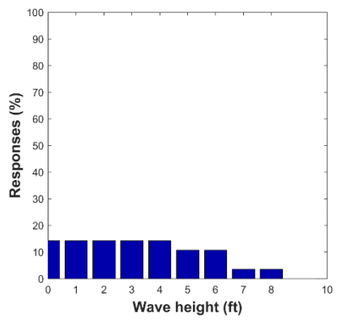
South Bar

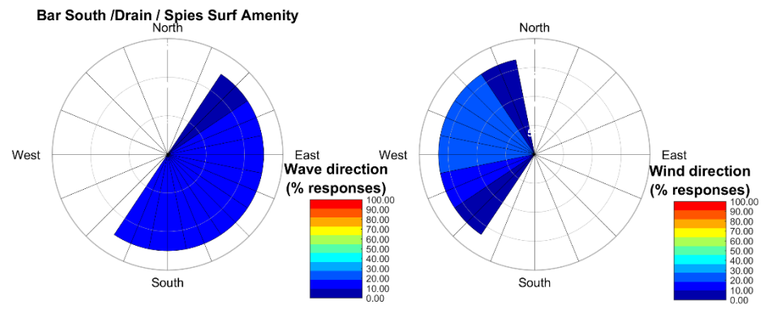


This section is bounded on both sides by (semi) persistent rips. These features, in combination with transient sandy bedforms over the underlying bed rock create surf amenity when waves are less than six ft - waves larger than this tends to close out this stretch of beach.

The stormwater outlet in the centre of this stretch is also believed to shape nearshore sand banks providing amenity on smaller days.







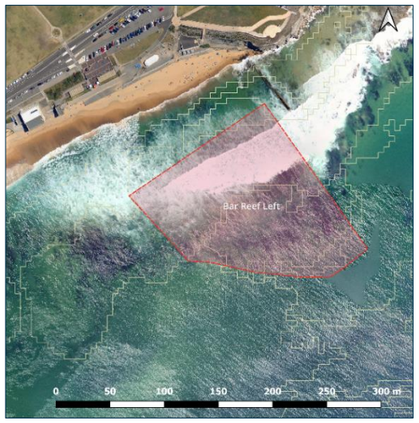
Preferred morphologic state: Eroded (90%), Neutral (10%)

Preferred management option: Status Quo / Maintain existing structures (100%)

General notes: Stakeholders happy to maintain existing structures or introduction of a rubble mound (or one respondent suggested vertical) seawall buried into the back beach/dune (which may require amenity nourishment). Status Quo in this instance may mean Retreat/Relocation of assets in the future due to currently unprotected pocket of shoreline.

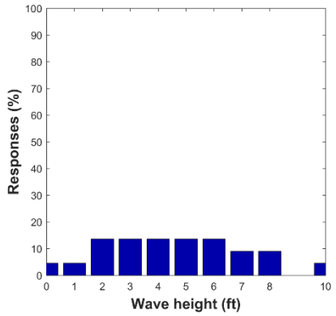
Surf spot	Description	Preferred metocean and geomorphic conditions for surf amenity

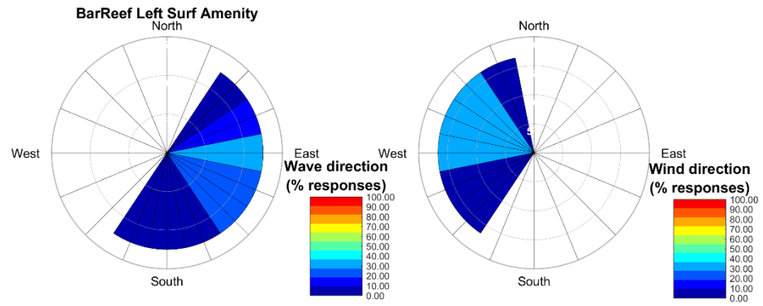
Bar Reef - Left



Bar Reef is an exposed triangular-shaped rock shelf that predominantly breaks as a left-hander. The varying shape of the surrounding rock shelves means that ride lengths and section lengths are inconsistent. Waves start breaking at one to two ft and are best when between three to six ft. This spot is very consistent and as such is crowded at times. Unintuitively, surf amenity is claim by most to be best when waves arrive from the south-east (rather than the east to north-east which would tend to run down the reef).





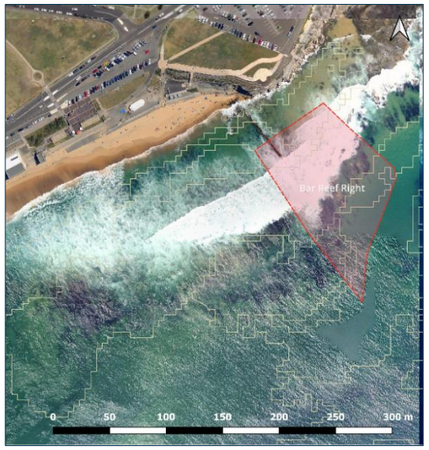


Preferred morphologic state: Eroded (100%)

Preferred management option: Status Quo / Maintain existing structures (100%)

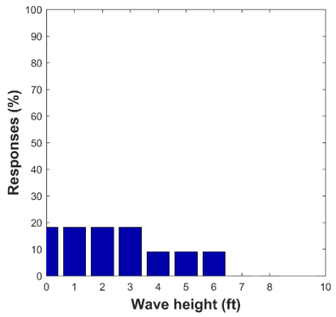
General notes: Any increase (or seaward movement) to vertical-faced structures on the existing shoreline is strongly opposed. Relocation of surf club also raised on several occasions as well as artifical enhancement of the reef structure for amenity.

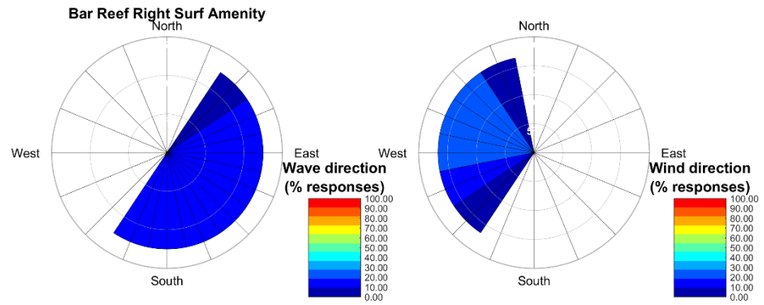
Bar Reef - Right



A short right-hander is offered by the triangular Bar Reef when swell is less than three to four and from the E-SE. This wave relieves some of the pressure from the more crowded *Bar Reef Lefts* and is frequented by beginners on smaller swells.







Preferred morphologic state: Eroded (90%), Neutral (10%)

Preferred management option: Status Quo / Maintain existing structures (100%).

General notes: Any increase (or seaward movement) to vertical-faced structures on the existing shoreline is strongly opposed.

6. Summary and recommendations

A surf amenity impact assessment was undertaken for the beaches between Merewether Headland and Bar Beach as part of the update to the CN Southern Beaches CMP. A general background on surfing amenity was initially provided and factors affecting surf amenity were then applied to the surf spots along the study site based on a metocean and geomorphic analysis.

Long-term hindcast wind and wave data were used to characterise the (daylight hours) metocean characteristics of the site. Based on this analysis it showed that metocean conditions were most amenable for surfing during the late Autumn through to the Winter months. Satellite imagery, as well as historical photographs and a literature review were used to review the geologic and geomorphic variability of the beaches and their effects on surf amenity. This bathymetric analysis revealed that surf amenity was generally increased on the hard rock/reef structure of Merewether and Bar Beaches when in an eroded state and that the other surf spots along the study stie generally produced greatest amenity when there was a combination of sand and reef underlaying each break.

A stakeholder engagement exercise was undertaken with recognised personalities of the Newcastle surfing community, most notably those with the strongest and longest connections to the surf spots between Merewether and Bar Beach. In addition, representatives from both Bar Beach and Merewether Beach Boardriders were interviewed to cover a diverse range of surfer abilities and backgrounds.

The engagement exercise was used to verify and add to the initial surf amenity assessment and to provide a platform for the surfing community to provide input into the CMP process. Twelve (12) recognised surf spots were identified as being regularly surfed and having cultural and historical significance to the local surfing community. Stakeholders provided further insight into the ideal metocean and geomorphic conditions required to provide surf amenity at each of the breaks as well as an earnest discussion around possible coastal management options that may be incorporated to ensure the preservation of amenity at each spot. Figure 12 shows ideal bathymetric conditions/beach state for the twelve known surf spots of the study area and the preferred surfing stakeholder coastal management options adjacent to their landward extent.

Typically, the preferred morphologic state was eroded. Any management options involving mass beach nourishment would therefore potentially impact surfing amenity detrimentally. The preferred management option was typically the status quo and maintenance of existing structures though it is noted that in some areas such as Bar Beach south, status quo may mean Retreat/Relocation of assets in the future due to currently unprotected pocket of shoreline. Any increase (or seaward movement) of vertical-faced structures on the existing shoreline was typically strongly opposed.



LEGEND

- Eroded bed form amenity
- Neutral bedform amenity
- Maintain existing structures
- Landward buried rubble seawall
- Image taken August 2018 Soiurce: Google Earth

City of Newcastle Southern Beaches CMP
Surf Amenity Impact Assessment

Merewether to Bar Beach

SCALE: 1:6,000

Royal HaskoningDHV

INTER COASTAL

Figure 12: Ideal bathymetric conditions/beach state to produce surf amenity at the known surf spots of the study area and the preferred coastal management options adjacent to their landward extent, based on stakeholder engagement.

7. References

ASBPA, 2011: Science and Technology Committee, Surfers as Coastal Protection Stakeholders. American Shore & Beach Preservation Association White Paper, January 2011.

Battjes, J.A. 1974. Surf Similarity. Proc 14th International Conference on Coastal Engineering, 466–479.

Bluecoast, 2019. Duranbah Beach Surf Quality Investigation/ Report for the NSW Department of Industry – Crown Lands. PA1881M&ARP25012019. 25 January 2019

Galvin, C.J. 1968. Breaker Type Classification on Three Laboratory Beaches. Journal of Geophysical Research,73(12), 3651–3659.Henriquez, 2004

Mead, S. T., K. P. Black and P. McComb, 2001. Lyall Bay Surfing Reef Feasibility Study. For the Lyall Bay Surfing Reef Charitable Trust, Wellington, January 2001.

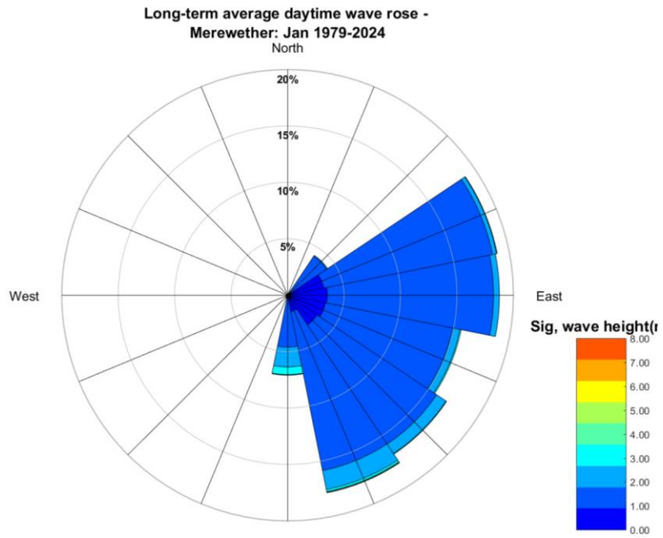
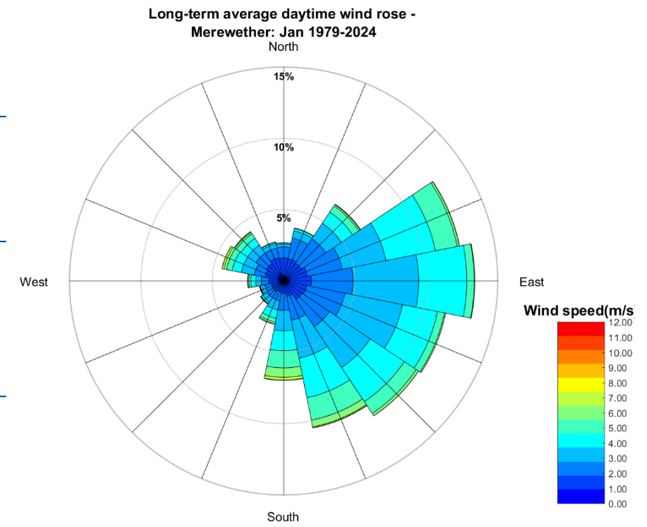
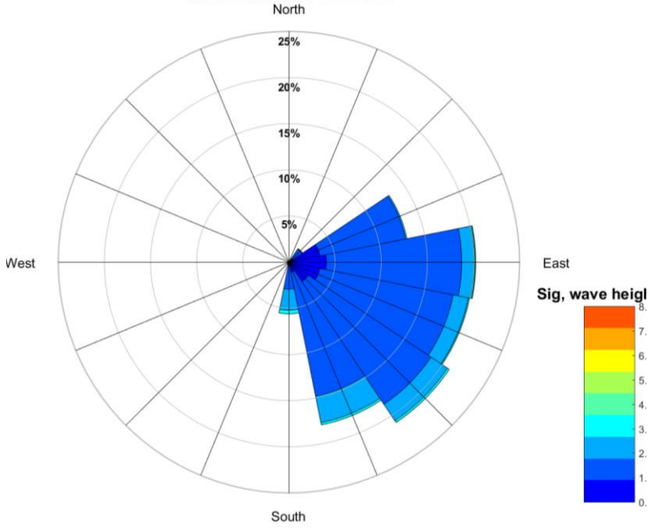
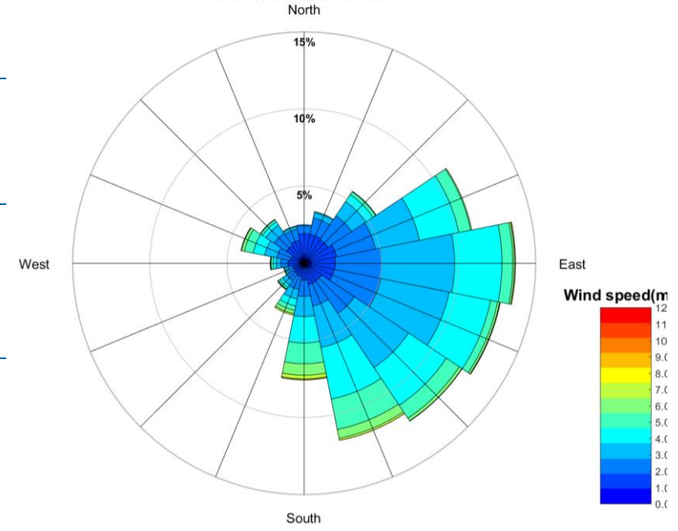
MNSR, 2009. Merewether National Surfing Reserve Booklet. Produced by the Merewether National Surfing Reserve Committee to commemorate the inauguration of the Merewether NSR, 2009.

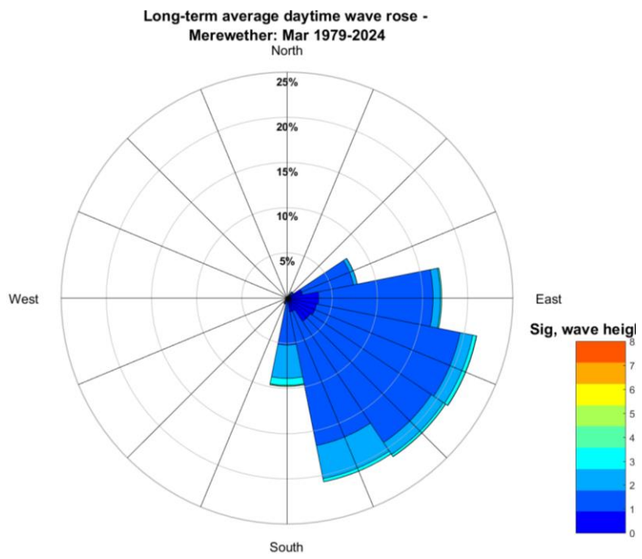
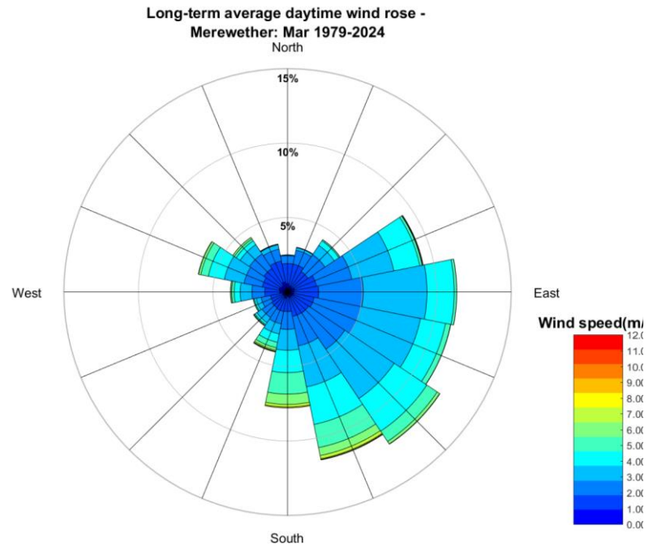
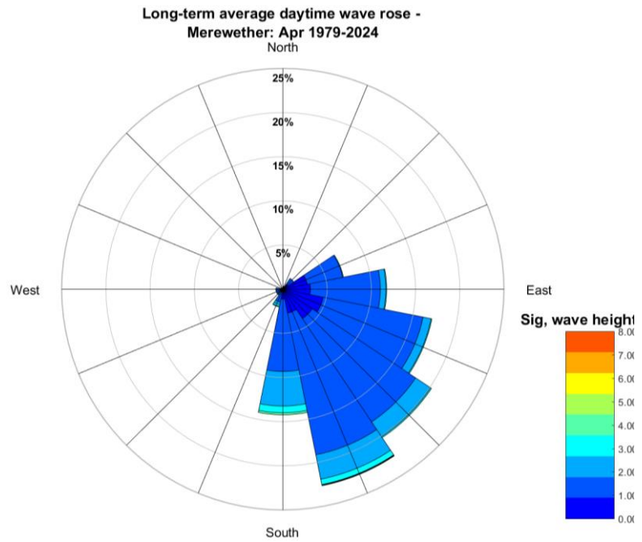
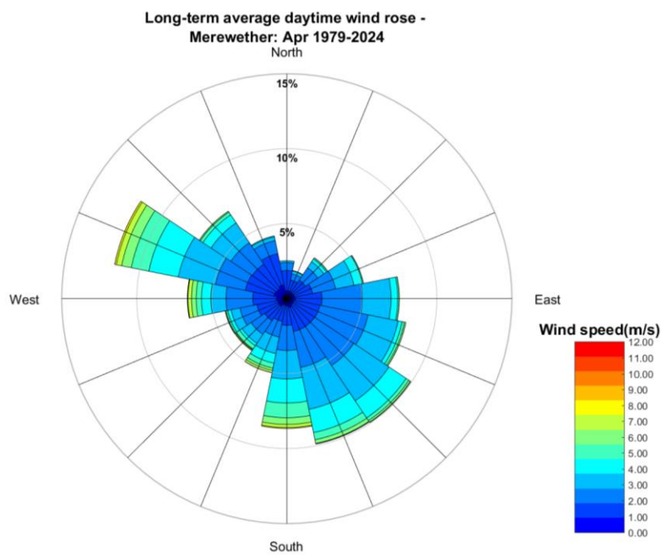
RHDHV, 2022. Newcastle Southern Beaches CMP Coastal Processes Review. Report by Royal HaskoningDHV for the City of Newcastle. PA2744-ZZ-XX-CS-Z-0013. 24th August 2022.

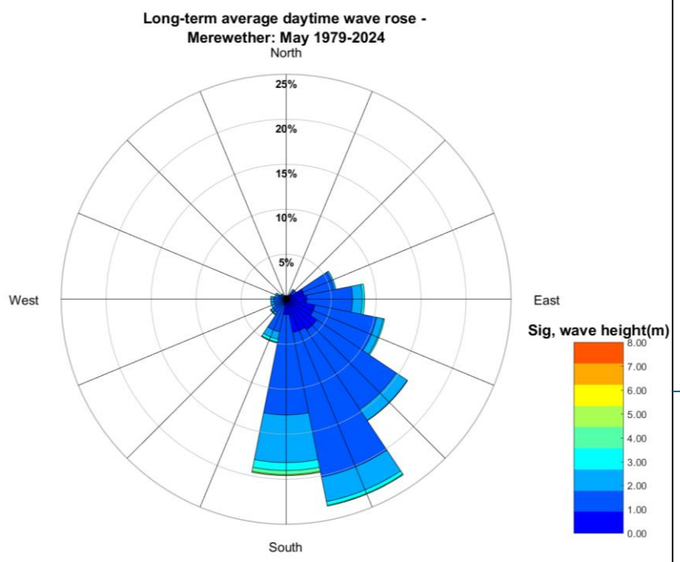
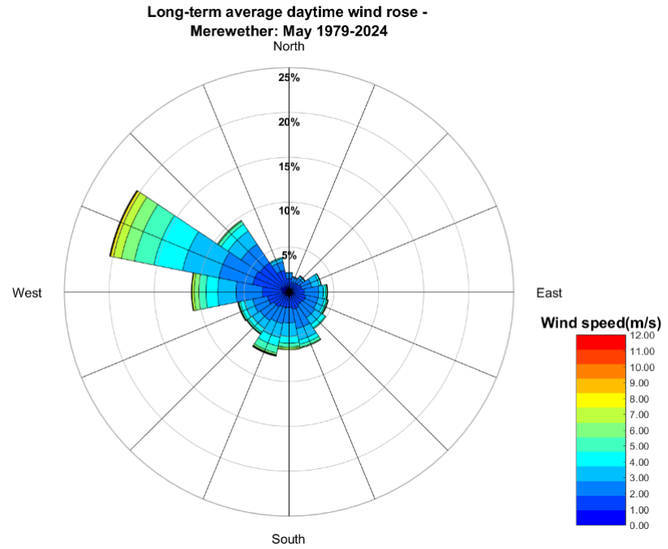
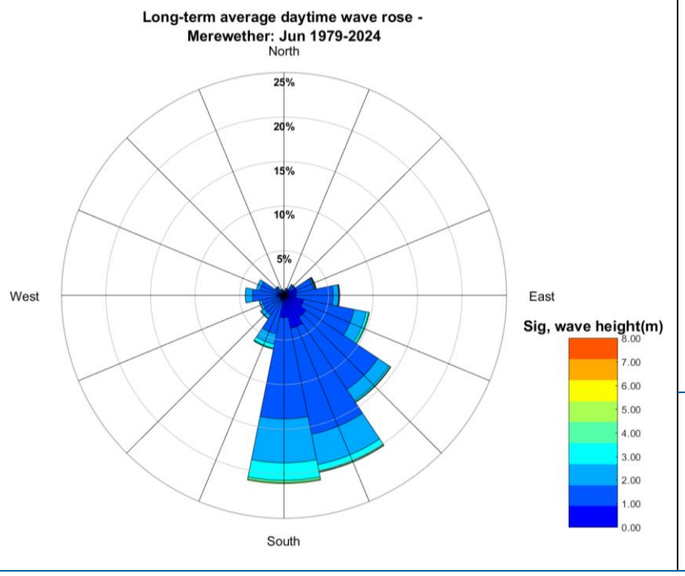
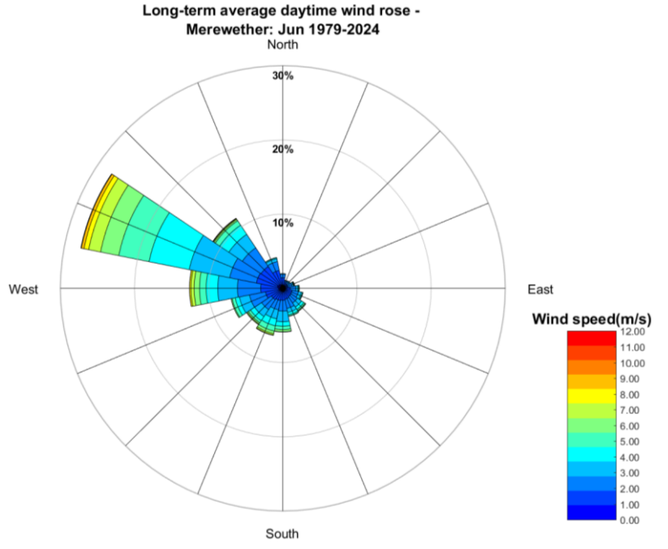
SHORT, A.D., 2006. Australian beach systems—nature and distribution. Journal of Coastal Research, 22(1), 11–27. West Palm Beach (Florida), ISSN 0749-020

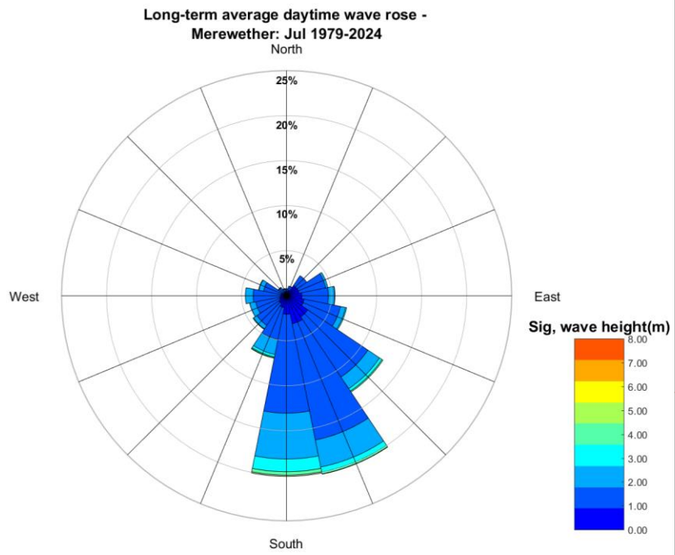
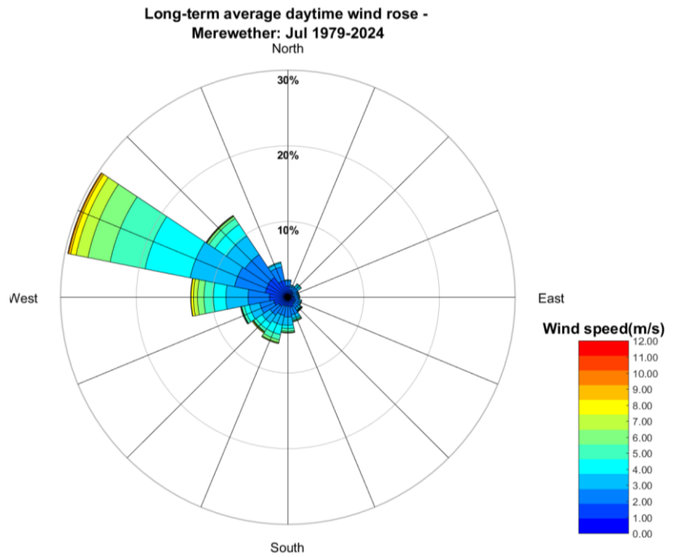
SPM, 1977. Shore Protection Manual. United States. Army. Corps of Engineers; Coastal Engineering Research Centre (U.S.). Washington, DC.

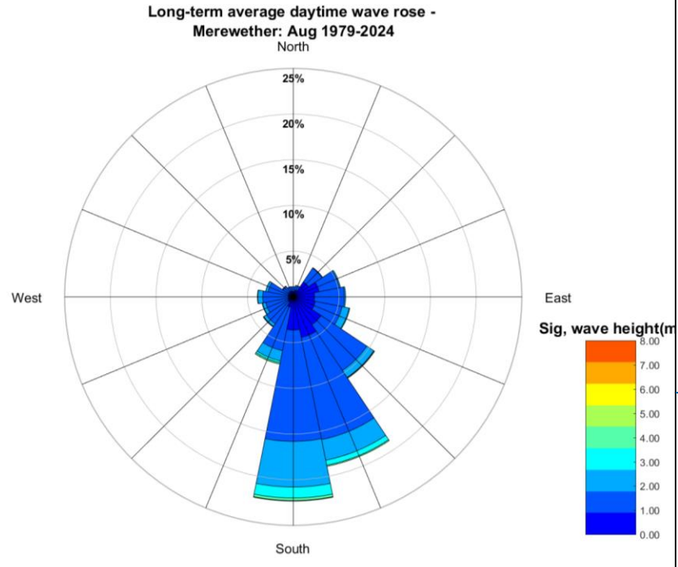
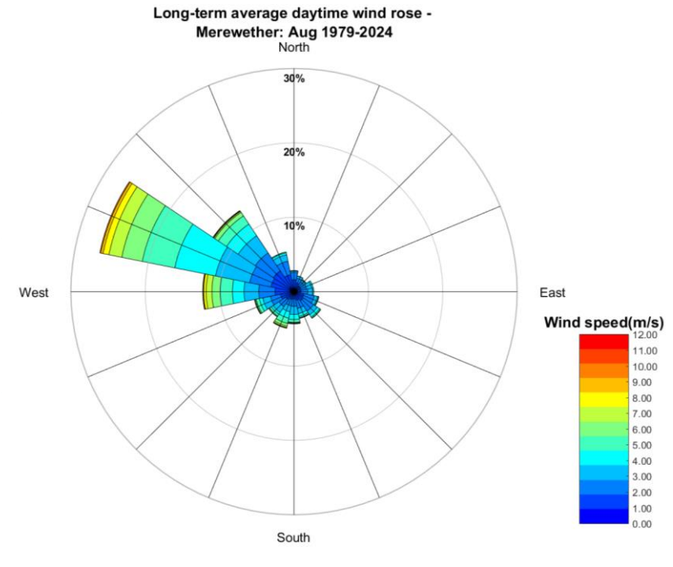
8. Appendix A: Monthly daytime wind and wave analysis of ERA5 data at 152°E, -33°S (offshore Merewether)

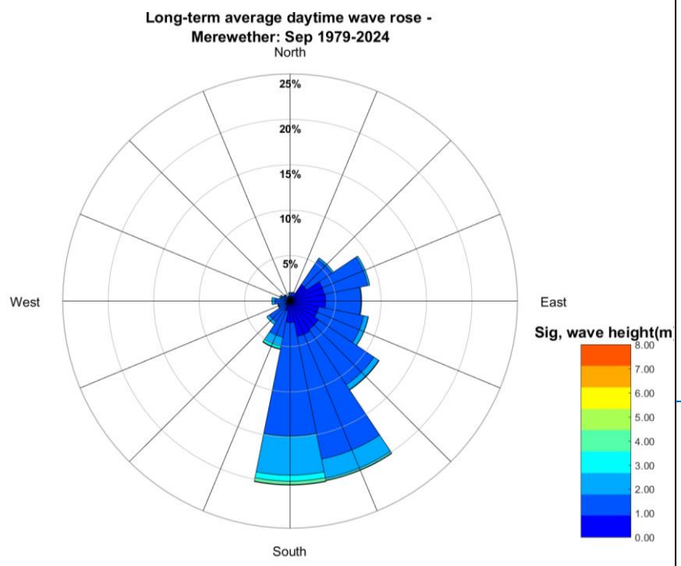
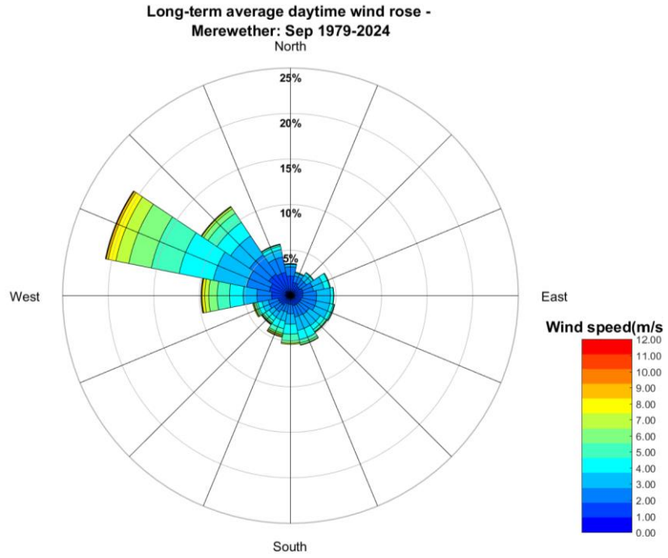
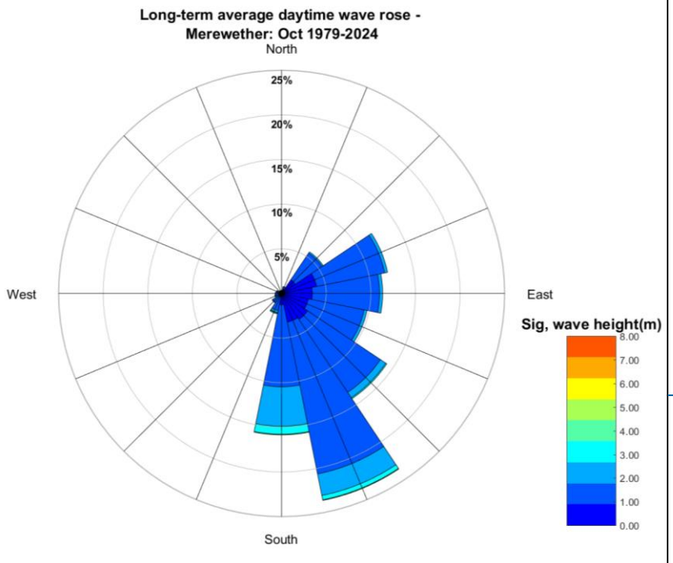
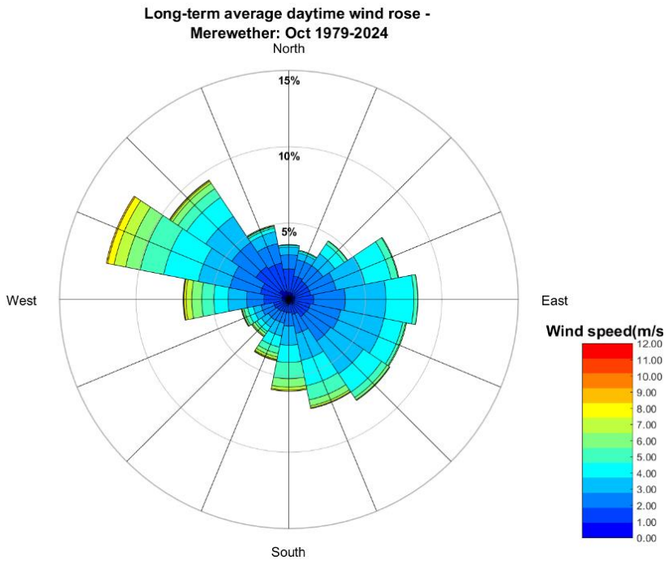
Waves					Wind			
Month	Parameter	Statistic	Value	Wave rose	Parameter	Statistic	Value	Wind Rose
January	Hs	Average	1.38		Wind speed, hourly (m/s)	Max	9.5	
		20%ile	1.04			95%ile	5.6	
		90%ile	1.89					
		Max	5.16			50%ile	3.3	
	Tp	Average	6.79		Wind direction (°N)	Weighted Average	123	
		% of Time Sea (Tp<8s)	88%					
		% of Time Swell (Tp>8s)	12%					
	Dp	Average	134					
February	Hs	Average	1.43		Wind speed, hourly (m/s)	Max	9.2	
		20%ile	1.05			95%ile	5.6	
		90%ile	2.09					
		Max	5.57			50%ile	3.2	
	Tp	Average	7.10		Wind direction (°N)	Weighted Average	134	
		% of Time Sea (Tp<8s)	80%					
		% of Time Swell (Tp>8s)	20%					
	Dp	Average	131					

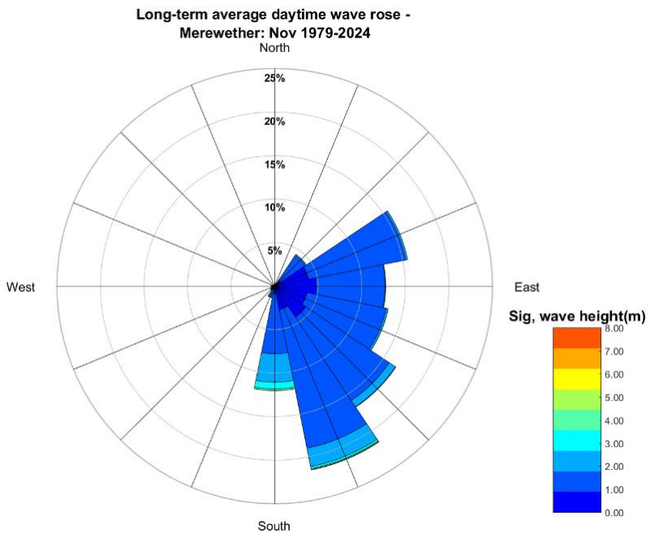
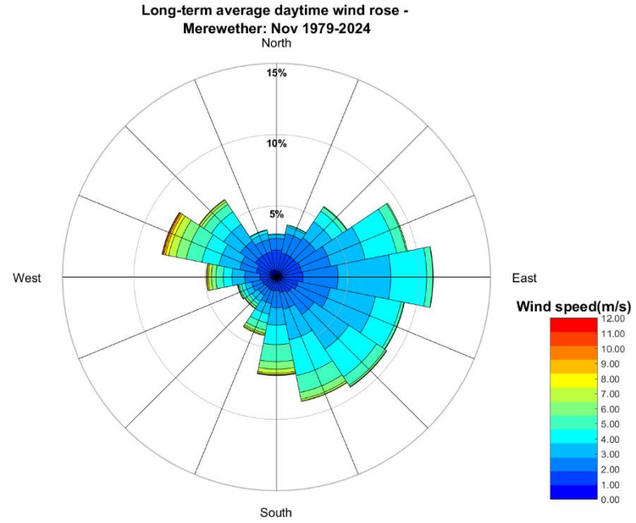
Waves					Wind			
Month	Parameter	Statistic	Value	Wave rose	Parameter	Statistic	Value	Wind Rose
March	Hs	Average	1.47		Wind speed, hourly (m/s)	Max	10.3	
		20%ile	1.06			95%ile	5.5	
		90%ile	2.18			50%ile	3.0	
		Max	5.23					
	Tp	Average	7.40		Wind direction (°N)	Weighted Average	147	
		% of Time Sea (Tp<8s)	73%					
		% of Time Swell (Tp>8s)	27%					
	Dp	Average	141					
April	Hs	Average	1.45		Wind speed, hourly (m/s)	Max	9.3	
		20%ile	1.00			95%ile	5.6	
		90%ile	2.14			50%ile	2.6	
		Max	7.69					
	Tp	Average	7.56		Wind direction (°N)	Weighted Average	212	
		% of Time Sea (Tp<8s)	68%					
		% of Time Swell (Tp>8s)	32%					
	Dp	Average	153					

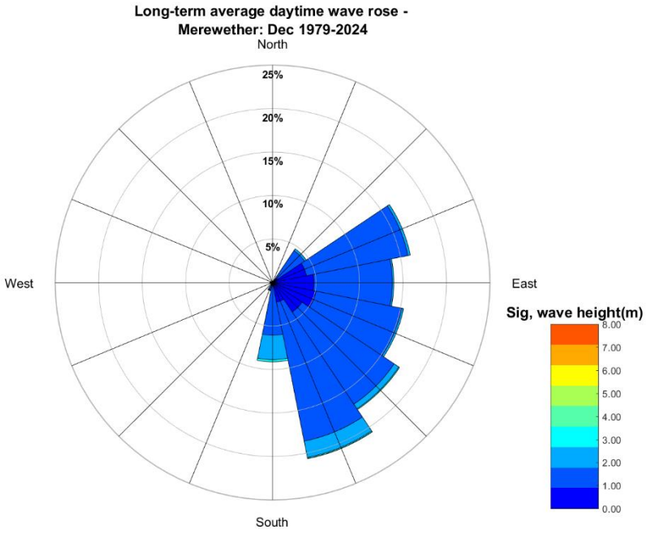
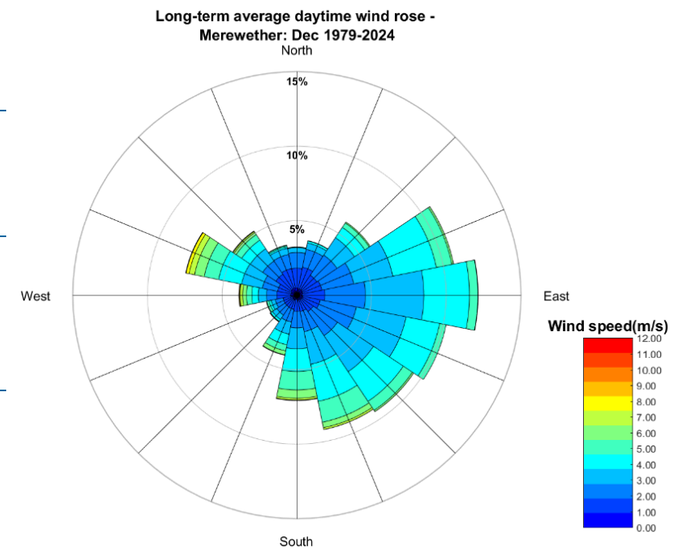
Waves					Wind			
Month	Parameter	Statistic	Value	Wave rose	Parameter	Statistic	Value	Wind Rose
May	Hs	Average	1.49		Wind speed, hourly (m/s)	Max	11.7	
		20%ile	1.00			95%ile	6.0	
		90%ile	2.30					
		Max	5.78			50%ile	2.6	
	Tp	Average	7.60		Wind direction (°N)	Weighted Average	265	
		% of Time Sea (Tp<8s)	65%					
		% of Time Swell (Tp>8s)	35%					
	Dp	Average	162					
June	Hs	Average	1.58		Wind speed, hourly (m/s)	Max	13.5	
		20%ile	1.01			95%ile	6.8	
		90%ile	2.49					
		Max	5.80			50%ile	2.9	
	Tp	Average	7.45		Wind direction (°N)	Weighted Average	276	
		% of Time Sea (Tp<8s)	66%					
		% of Time Swell (Tp>8s)	34%					
	Dp	Average	164					

Waves					Wind			
Month	Parameter	Statistic	Value	Wave rose	Parameter	Statistic	Value	Wind Rose
July	Hs	Average	1.53		Wind speed, hourly (m/s)	Max	11.6	
		20%ile	0.99			95%ile	6.9	
		90%ile	2.41					
		Max	5.60			50%ile	3.1	
	Tp	Average	7.30		Wind direction (°N)	Weighted Average	279	
		% of Time Sea (Tp<8s)	69%					
		% of Time Swell (Tp>8s)	31%					
	Dp	Average	170					

Month	Parameter	Statistic	Value	Wave rose	Parameter	Statistic	Value	Wind Rose
August	Hs	Average	1.42		Wind speed, hourly (m/s)	Max	11.4	
		20%ile	0.91			95%ile	7.1	
		90%ile	2.22					
		Max	6.27			50%ile	3.1	
	Tp	Average	7.19		Wind direction (°N)	Weighted Average	280	
		% of Time Sea (Tp<8s)	71%					
		% of Time Swell (Tp>8s)	29%					
	Dp	Average	173					

Waves					Wind			
Month	Parameter	Statistic	Value	Wave rose	Parameter	Statistic	Value	Wind Rose
September	Hs	Average	1.37		Wind speed, hourly (m/s)	Max	12.3	
		20%ile	0.92			95%ile	6.9	
		90%ile	2.10					
		Max	5.37			50%ile	3.1	
	Tp	Average	7.12		Wind direction (°N)	Weighted Average	277	
		% of Time Sea (Tp<8s)	76%					
		% of Time Swell (Tp>8s)	24%					
	Dp	Average	166					
October	Hs	Average	1.38		Wind speed, hourly (m/s)	Max	10.7	
		20%ile	0.97			95%ile	6.4	
		90%ile	2.06					
		Max	4.92			50%ile	3.2	
	Tp	Average	7.02		Wind direction (°N)	Weighted Average	245	
		% of Time Sea (Tp<8s)	79%					
		% of Time Swell (Tp>8s)	21%					
	Dp	Average	155					

Waves					Wind			
Month	Parameter	Statistic	Value	Wave rose	Parameter	Statistic	Value	Wind Rose
November	Hs	Average	1.35		Wind speed, hourly (m/s)	Max	12.2	
		20%ile	0.99			95%ile	6.1	
		90%ile	1.96			50%ile	3.2	
		Max	5.40		Wind direction (°N)	Weighted Average	185	
	Tp	Average	6.76					
		% of Time Sea (Tp<8s)	86%					
		% of Time Swell (Tp>8s)	14%					
	Dp	Average	152					

Month	Parameter	Statistic	Value	Wave rose	Parameter	Statistic	Value	Wind Rose
December	Hs	Average	1.32		Wind speed, hourly (m/s)	Max	9.5	
		20%ile	0.98			95%ile	5.8	
		90%ile	1.87			50%ile	3.2	
		Max	4.18		Wind direction (°N)	Weighted Average	142	
	Tp	Average	6.70					
		% of Time Sea (Tp<8s)	88%					
		% of Time Swell (Tp>8s)	12%					
	Dp	Average	140					

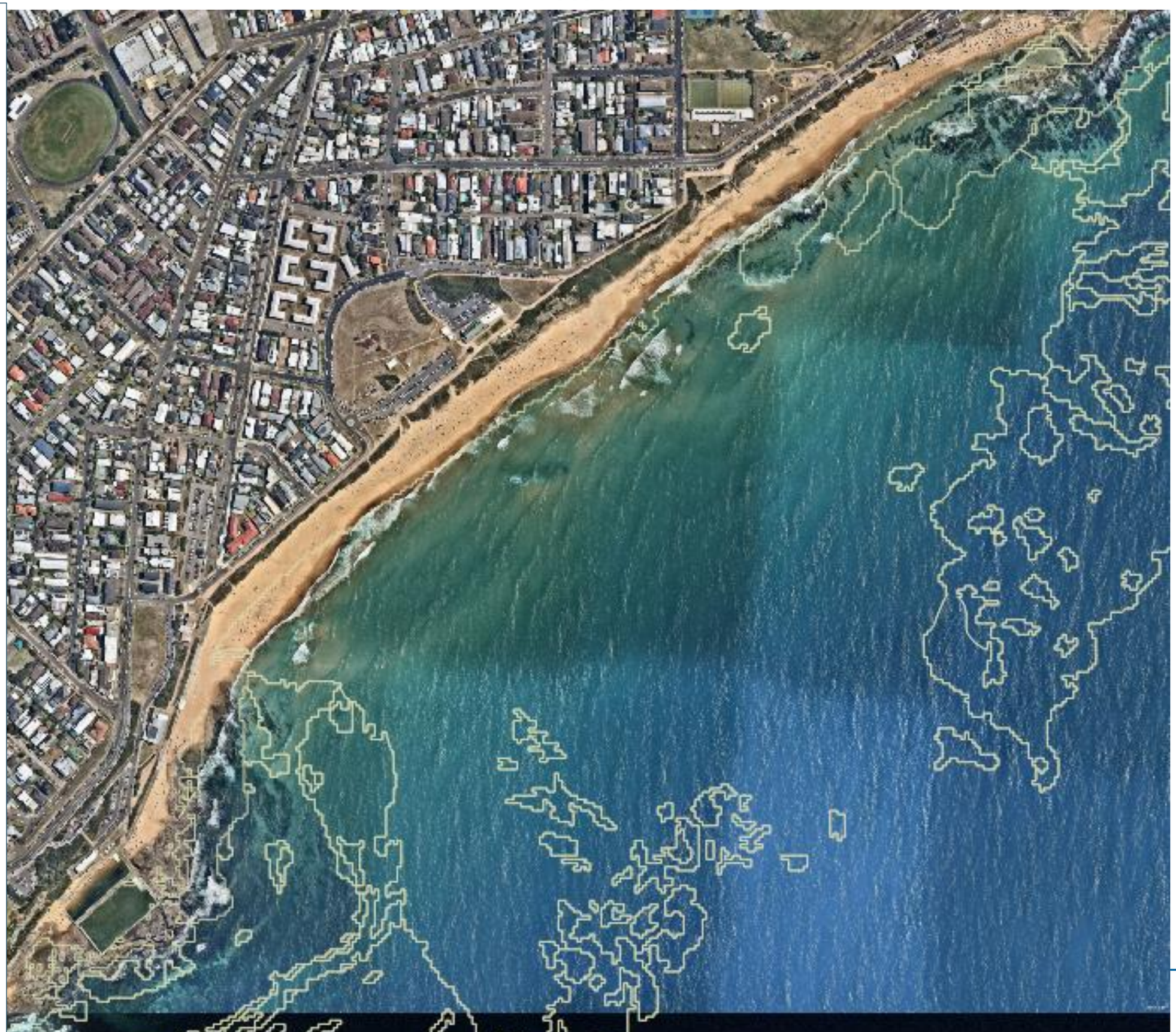
9. Appendix B: Stakeholder Engagement Form

Location map

Stakeholder/s:

Interview date/time:

General notes:



Surf spot	Best metocean conditions				Best morphologic conditions eroded / nourished / neutral	Preferred management option to maintain / enhance surf amenity
	Wave height	Wave period	Wave direction	Wind Spd/Dir		