ABM
ASSOCIATION OF BAYSIDE MUNICIPALITIES

Final Report | 2017

Port Phillip Bay
Managing Better Now program

REPORT 04

PORT PHILLIP BAY WAVE CLIMATE

This report has been prepared by Cardno Victoria Pty Ltd for the Association of Bayside Municipalities as part of the Managing Better Now program.

ASSOCIATION OF BAYSIDE MUNICIPALITIES

The Association of Bayside Municipalities represents the ten councils with frontage to Port Phillip Bay. As coastal councils we are acutely aware of the need to protect and manage Port Phillip Bay for our local communities, and for the benefit of all Victorians, tourists and the unique ecosystems it supports.

As the appointed Committee of Management for much of the Port Phillip Bay coast, councils play a vital role in the environmental management of Port Phillip Bay, as the foreshore manager, strategic land use planning authority; asset manager; and service provider to Parks Victoria or other Committees of Management, and more.

The ABM vision is a healthy Port Phillip Bay that is valued and cared for by all Victorians.

ABM MEMBER COUNCILS:

ACKNOWLEDGEMENTS

The Association of Bayside Municipalities acknowledges funding from Member councils and state government to enable the Managing Better Now program. Thank you to the staff from ABM Member Councils and Melbourne Water for providing technical input and feedback on the reports.

The Association of Bayside Municipalities recognising the substantial support from Cardno in preparing the reports, and presenting the outputs and recommendations over many years.

EXECUTIVE SUMMARY

The *Managing Better Now* program is an initiative of the Association of Bayside Municipalities.

Launched in 2013, the program aimed to better understand the dynamics and coastal processes of Port Phillip Bay using data modelling and analysis to:

- Improve knowledge of coastal processes in Port Phillip Bay, and their effects on vulnerable sections of the coast.
- Understand present and future risks and hazards.
- Inform the management of coastal processes impacting Port Phillip Bay 'now' and into the future.
- Contribute to a future coastal hazard assessment for Port Phillip Bay.

Outputs from the Managing Better Now program are designed to support better decision making, clearer investment, management and planning by ABM Member Councils and other bay stakeholders in:

- beach protection,
- local coastal hazard and risk assessment,
- foreshore and infrastructure management,
- maintenance planning and response to weather extremes, and
- coastal climate adaptation.

Using a 'step by step' approach, the program was undertaken in phases with work proceeding as funding and resources were secured.

Phases 1 and 2 examined the programs, strategies and approaches used to manage the coastline, beaches and immediate foreshore areas, identifying gaps in knowledge. Phases 3, 4 and 5 gathered existing information and invested in data modelling and analysis of new essential data, mapping and modelling – compiling a series of reports aimed at better understand the dynamics of Port Phillip Bay.

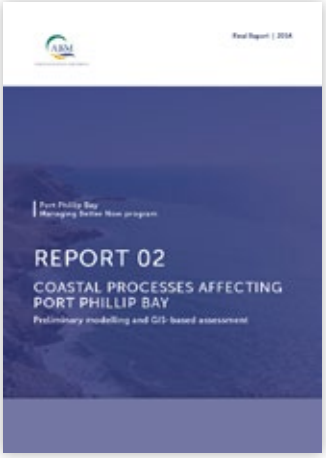
As coastal mangers, the ABM recognises the importance of using the best available information, and values working in partnership to improve understanding of the processes and systems affecting Port Phillip Bay

The following reports comprise the Managing Better Now series, and are available on the ABM website at www.abm.org.au.

REPORT **Snapshots**

Report #1: Coastal Processes Affecting Port Phillip Bay - preliminary data collection and gap analysis

Identification of existing spatial and non-spatial information to inform a coastal hazard assessment. This included spatial data layers, over 200 technical reports, images and 60 strategies and plans relevant to Port Phillip Bay. More than 200 GIS data layers were identified and stored on an online GIS portal, made available to ABM councils.



Report #2: Coastal Processes Affecting Port Phillip Bay – preliminary modelling and mapping of coastal asset location and proximity to the Port Phillip Bay shoreline; and GIS-based assessment of width and volume of erodible land along Port Phillip Bay.

- **Part 1:** Preliminary modelling and mapping of coastal asset location and proximity to the Port Phillip shoreline. Purpose of this study was to use readily available spatial information layers identified in Report 1 to locate and map coastal assets at a bay-wide scale, and improve understanding of the proximity of assets to the Port Phillip Bay shoreline. This work was not intended to be a comprehensive study or replace a local hazard study. It provided a demonstration of the type of analysis that can be undertaken using readily available spatial data layers, informing local studies by individual coastal land managers such as the effects of coastal storms on sections of shoreline, the effects of coastal inundation on parts of the coast, the quality of drainage networks and associated infrastructure to model water flow, availability of information for assets of significance, their values, etc.
- **Part 2:** Spatial Analysis of area (width) and volume of erodible land along Port Phillip Bay. Three methodologies were used to demonstrate the calculation of area and volume of sand between the mean sea level (taken as the shoreline) and three different landward extents. The landward extents are based on existing infrastructure such as roads or houses; horizontal distances (eg, within 5 metres, 10 metres, etc.); or vertical elevation (eg, 0.5 metres, 1.0 metres, etc.) from the shoreline. Information about physical processes or hazards, including sediment transport rates, wave impacts, shoreline erosion rates or other such information was not available. The approach used is of generic and demonstrative nature and can be applied around Port Phillip Bay; and substantially enhanced if coupled with information about coastal processes and coastal hazard information.

Report #3: Port Phillip Bay Sea Level

Analysis of existing historical sea level data for Port Phillip Bay measuring sea levels over an extended period at multiple locations. Data was collected from Port of Melbourne Corporation, National Tidal Centre, Victorian Regional Channel Authority and Melbourne Water. Data was subjected to extreme value analysis to develop values for sea level with Annual Exceedance Probabilities at 1%, 2%, 5% and 10% (corresponding to Annual Recurrence Intervals of 100, 50, 20 and 10 years).

The results are intended to support the setting of values for planning and design, not replace decisions made by the appropriate responsible authorities. Results may be useful in establishing regional variations; undertaking assessments of the appropriate values in setting planning benchmarks and design criteria; investigating potential risks; supporting planning, design and assessment of future coastal vulnerability considering climate change.

Report #4: Port Phillip Bay Wave Climate

Wave modelling for the whole of Port Phillip Bay using a tested and consistent approach. The modelling incorporated annual and seasonal occurrence of wave conditions, highlighting the marked seasonal variability in wave conditions over Port Phillip Bay resulting from seasonal wind changes. The longshore component of wave power was also computed for the entire shoreline providing insights into the annual and seasonal variability of potential sediment transport around Port Phillip Bay.

Modelling results can be used to understand phenomena observed on a specific beach, or to review broad bay-wide scale processes.

In addition to the data presented in the report, detailed frequency of occurrence matrices for each of the 248 data extraction points have been provided as tables which can be accessed via a Geographic Information System. Contact the ABM for further information.

Report #5: Port Phillip Bay Storm Bite Analysis

Building on the previous studies of waves and sea levels in Port Phillip Bay, this project modelled likely volumes and extent of storm bite erosion on 20 beach profiles in Port Phillip Bay between Little River and Sorrento, under varying storm conditions. Results inform changes in beach profile following an individual storm event, and the magnitude of the storm event.

This report provides a first-pass risk assessment of coastal erosion that can be used to identify and prioritise areas of concern; focus more detailed studies on areas of intolerable risk level; and to understand what level of coastal erosion might be expected in a 'typical' or an 'extreme' storm event.

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Glossary

Symbol	Name/ Definition
ABM	Association of Bayside Municipalities
AEP	Annual Exceedance Probability The likelihood or probability that the given level will be exceeded in any one year.
AHD	Australian Height Datum The Australian Height Datum is a geodetic datum for altitude measurement in Australia, "In 1971 the mean sea level for 1966-1968 was assigned the value of zero on the Australian Height Datum at thirty tide gauges around the coast of the Australian continent"
BoM	Bureau of Meteorology
CD	Chart Datum The datum to which soundings on a chart are referenced. It is usually taken to correspond to a low-water elevation, typically the lowest astronomical tide.
Dir	Mean wave direction The average wave direction. Directions are given as the direction the waves are coming from.
Hs	Significant wave height The significant wave height is originally defined as the average height of the largest one third of the waves in a given record. With the advent of digital processing techniques and spectral analysis of wave records, the significant wave height is now commonly defined as Hs=4 √m0, where m0 is the variance of the wave spectrum or the "zero order moment". For the purposes of this study the definition based on variance is used. Wave heights referred to in this report are the significant wave height. For practical purposes, the significant wave height is close to the value reported by an experienced observer making visual observations of the wave height.
Tp	Spectral peak wave period The period associated with the peak of the wave energy spectrum

01. Introduction

1.1. General

This report presents wave modelling within Port Phillip Bay, focused on wave heights and average wave energy direction. Using a tested and consistent approach the modelling incorporated annual and seasonal occurrence of wave conditions, highlighting the marked seasonal variability in wave conditions in Port Phillip Bay.

The energy from the incoming waves directed along the beach (the longshore component of wave power) was also calculated, for the entire Port Phillip Bay shoreline. This energy drives longshore currents and sediment transport and can cause significant beach erosion. Results provide insights into the annual and seasonal variability of potential sediment transport around the bay, informing phenomena observed on a specific beach, or review of broad bay-wide scale processes.

Extreme or "design" conditions are provided for the whole bay, using a consistent methodology. It should be noted however, that design values for a specific project might require specific investigations, of detail greater than what has been provided in this report.

In addition to the data presented in this report, detailed frequency of occurrence matrices for each of the 248 data extraction points is available as tables, accessible via a Geographic Information System. Contact the Association of Bayside Municipalities for details.

1.2. Scope of Work

The scope of work for this report is:

- Determine 1%, 2%, 10% Annual Exceedance Probability (AEP) wave heights for Port Phillip Bay;
- Determine the annual and seasonal average wave conditions for Port Phillip Bay; and
- Determine the longshore wave power around the shoreline of Port Phillip Bay on an annual and seasonal basis.

1.3. Qualifications

The data used for this report has been provided by others. No independent checks on the accuracy or validity of the data has been undertaken. The sources are reputable and presumed to have carried out quality control checks prior to providing the data to this study.

Extreme wave heights are determined from simulations with extreme wind speeds. No external analysis was carried out to confirm the wave heights.

Note that the values provided in this report may not be suitable for specific engineering design purposes but are indicative of the conditions likely to be experienced. Determining the suitability of the data for any given project is the responsibility of the designer. Detailed design may require additional statistical analysis, calculation of potential extreme values and consideration of the design life of the facility.

02. Available Data

2.1. Bathymetry

Bathymetric data is available from Laser Airborne Depth Sounder (LADS) surveys undertaken by Department of Sustainability and Environment (now DELWP) in 2007 and 2008/9. This data was part of the State Government's *Future Coasts Project*.

The maximum depth range of the LADS system depends on water clarity and the maximum depths obtained in Port Phillip Bay are just over 20 metres, although this varies slightly in different areas. Multi-beam echo-sounding surveying techniques have been used to capture the bathymetry of the shipping channels. This data provided information in areas where the water depth is beyond the range of the LADS system. For the areas outside the coverage of the LADS and the multi-beam surveys, the water depths used for the Channel Deepening Project were applied. These areas are not critical to the wind-driven waves at the coast and the lack of detailed high-accuracy bathymetry in the deeper portions of the bay does not impact on the results of the modelling.

The LADS data is provided relative to 0.0 m AHD (Australian Height Datum), which is close to mean sea-level in 1990. The multi-beam channel-survey data was provided relative to the local chart datum and therefore was corrected to be consistent with the LADS dataset.

2.2. Wave

Wave data is required to calibrate and validate the wave model. There is very limited suitable data available in Port Phillip Bay. In order to provide full calibration, it is necessary to have both wave measurements and full wind-fields for the wave generation area. Suitable wave data is available from two Waverider® buoys deployments in the south of Port Phillip. These were deployed to monitor the waves generated by ships traversing South Channel (Cardno Lawson Treloar, unpublished). One, a non-directional buoy, was moored about 150 m south of Beacon number 15, west of Hovell Pile. The other, a direction-measuring buoy, was moored in about 8 m of water, 1.5 km west of Rosebud Pier. These locations are shown in Figure 1. The buoys measured wave conditions for the period 22 August to 30 September 2003.

2.3. Wind

Wind data is available from a number of locations around the Bay including several "over-water" sites. These can be used to provide inputs for model preparation. The wind measurements used in this study are from Bureau of Meteorology (BoM) stations. Details are provided in Table 1 and the locations shown in Figure 1.

Table 1: Wind Data

Station Name (BoM station #)	Location	Data Period
Fawkner Beacon (086376)	Lat: -37.9500 Long: 144.9258	1992 to 2011
Point Wilson (087166)	Lat: -38.0956 Long: 144.5353	1991 to 2011
South Channel Pile (086344)	Lat: -38.3078 Long: 144.8003	1998 to 2011

Figure 1: Wind and wave measurement locations in Port Phillip Bay used in the analysis

The percentage of occurrence of wind speed and direction at each location was determined in order to derive the wave climate in Port Phillip Bay. Both annual and seasonal climate has been included in Appendix A in the form of percentage of occurrence wind direction and speed matrices.

Extreme wind speeds were taken from the Structural Wind Codes, AS/NZS 1170.2.2011 for the appropriate direction.

03. Determination of Wave Climate

3.1. General

Waves within Port Phillip are what are termed "fetch limited". This means that waves are derived from winds blowing locally, and in this case propagating across the bay. The size of the waves is limited by the distance over which the wind can blow, that is, the fetch. The ocean waves from Bass Strait are generated by winds blowing over the ocean in both Bass Strait and the adjacent Southern and Indian Oceans. They do not penetrate into the body of Port Phillip Bay, north of the Sands. These waves are only significant for the areas immediately adjacent to the heads. For the remainder of the Bay, the wave energy is all generated locally, by winds blowing over the waters within the bay. The shallow nature of the bay means that the effects of refraction and the loss of wave energy caused by bottom friction are important. The modelling does not include wave energy entering the bay from Bass Strait and thus results are only presented in the south east of the bay for locations east of Point King as this is the approximate limit of the penetration of wave energy from outside the bay.

The wave climate was modelled using the Simulating Waves Nearshore (SWAN) III model (Booij *et al*, 2004). SWAN is a numerical wave model based on the wave-action balance equation. The model is capable of taking into account wave generation by wind, refraction, white-capping, depth-induced breaking, bottom friction and wave-wave interaction.

In order to assess the wave climate, wave modelling was aimed at determining the distribution of wave energy in terms of wave height, period and direction, for locations at nominally 500 m intervals along the coast of Port Phillip Bay. The climate was determined by running a wave propagation model for thirteen representative wind speeds and 36 directions (10° intervals) and then combining the results from these 468 runs using the frequency of occurrence of wind speed and direction in the bay.

3.2. Wave Modelling

The model uses a flexible mesh grid allowing finer detail along the coast and area of steep gradients, while reducing the computations in areas where topography is constant in slope and shape. The bathymetry used to develop the model is shown in Figure 2. The model does not extend outside of Port Phillip Bay as wave energy from Bass Strait does not penetrate into the main body of the Bay.

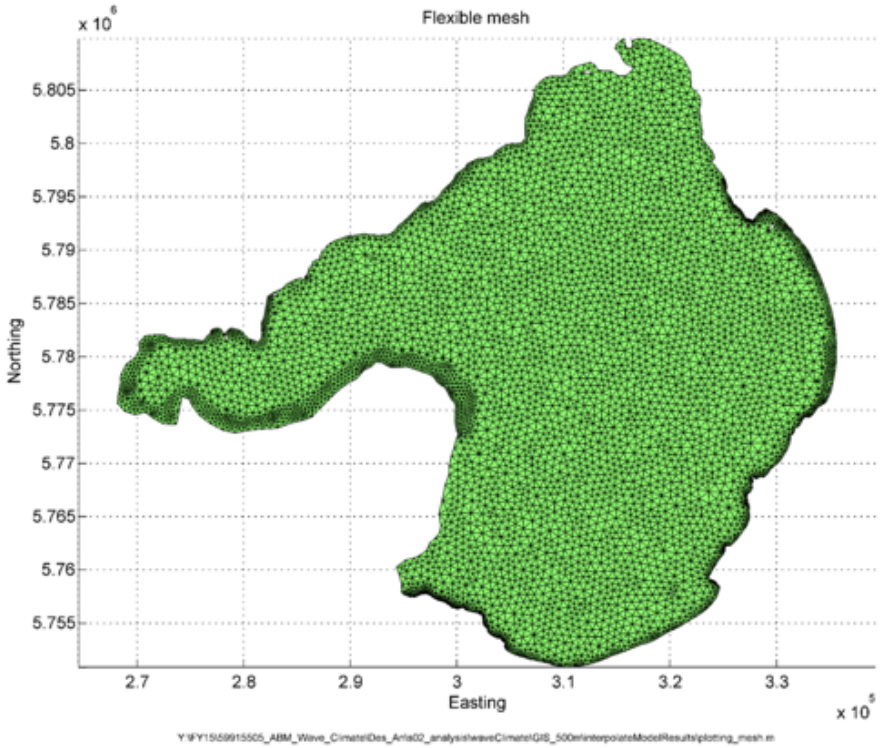


Figure 2: Flexible mesh for the SWAN model of Port Phillip Bay

The wind climate at each of the three measurement locations was compared, and found to be similar. Due to its location relatively close to the centre of the bay, the data from Point Wilson was selected as the basis for determining the wave climate.

For each of the 468 model cases, each representing a given wind speed and direction, results in terms of significant wave height (Hs), peak wave period (Tp) and mean wave direction were extracted at 507 locations along the coast of Port Phillip Bay. In order to generate a time series of wave conditions, the time series of wind speed and direction was used to select the relevant model runs and the appropriate wave conditions applied for that time.

Due to the lack of sufficient measured wave data, the model was not calibrated separately, but rather its performance assessed against the measured data using a time series of wind data from South Channel Fort. The result of the comparison of modelled and measured significant wave height and spectral-peak period for both buoys and the wave direction for the buoy off Rosebud are shown in Figure 3 and Figure 4.

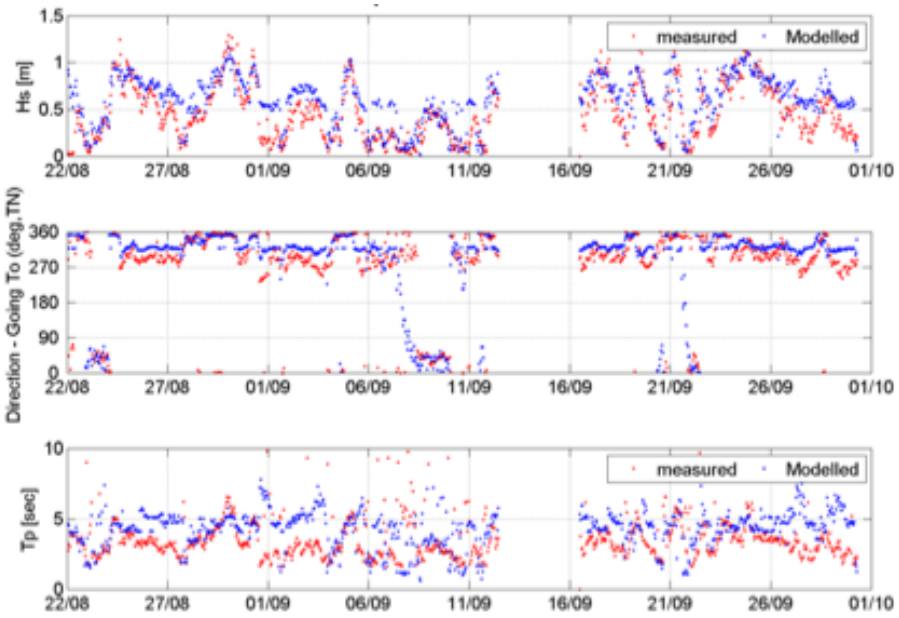


Figure 3: Comparison of measured and modelled wave parameters at the Rosebud site

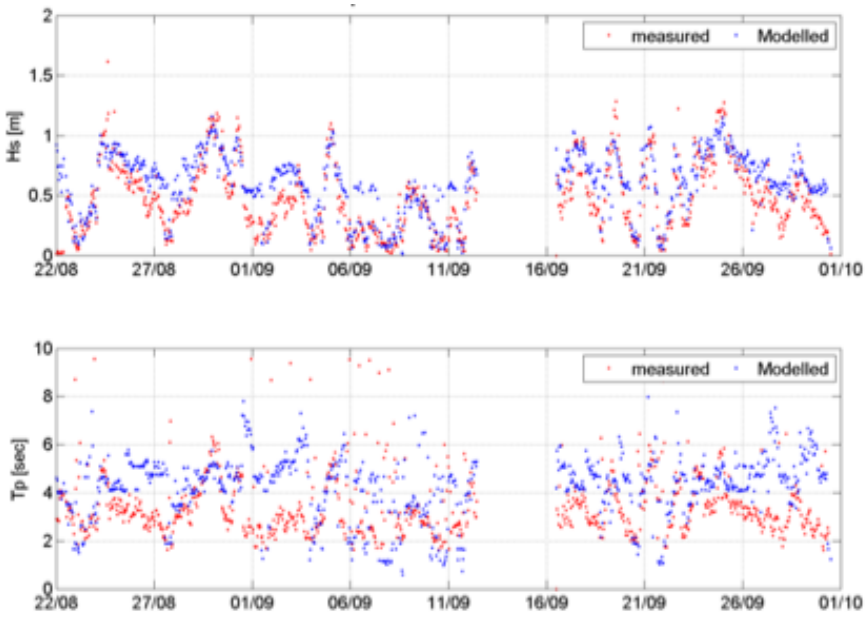


Figure 4: Comparison of measured and modelled wave parameters at the Beacon #15 site

The results for significant wave height indicate satisfactory performance with the model at both inshore at offshore location. Wave periods are reasonably reproduced and the wave directions are in agreement within the accuracy of such measurements.

3.3. Wave Extraction Location

In order to present the wave climate along the Port Phillip Bay coast, data was extracted from the wave modelling results at 248 locations at an interval of nominally 1 km along the 4 m depth contour except in the Geelong Arm, where extraction of wave parameters was at the 2 m depth contour. These depths were selected as representing the breaker line under severe conditions. The coordinates for all these points are presented in Appendix B. A subset of 24 extraction points was selected as representative of the different sections of the coast. These 24 points coordinates and location names are given in Table 2.

Note that the models are set up in Map Grid of Australia (MGA) coordinates as easting and northing and these are used in the scale on the figures.

Table 2: Selected wave climate locations

No	Name	Easting [m, MGA 55]	Northing [m, MGA 55]
1	BLAIRGOWRIE	306355	5751750
2	RYE	310703	5750876
3	ROSEBUD	316605	5752733
4	SAFETY BEACH	324141	5757131
5	MOUNT MARTHA	326640	5763370
6	FISHERMANS	327537	5767319
7	MOONDAH	331091	5771601
8	FRANKSTON	335181	5776881
9	CARRUM	335415	5783514
10	MORDIALLOC	331622	5791685
11	BEAUMARIS YACHT CLUB	326977	5793286
12	SANDRINGHAM	324665	5797411
13	BRIGHTON	323359	5800092
14	ST KILDA MARINA	321824	5806387
15	WILLIAMSTOWN	314732	5806729
16	ALTONA (BURNS RESERVE)	310965	5807098
17	POINT COOK HOMESTEAD	306258	5800304
18	WERRIBEE SOUTH	297343	5794481
19	BEACON POINT BOAT RAMP	286190	5788366
20	POINT WILSON EAST	281433	5781343
21	MOORPANYAL PARK	269577	5779706
22	CLIFTON SPRINGS	286571	5774550
23	STEELES	295232	5779159
24	ST LEONARDS	299918	5774124

Figure 5: Selected wave climate locations

04. Wave Climate in Port Phillip Bay

4.1. Wave height, period, direction

For each of the 248 extraction points around the bay, a climate of wave conditions was created. The wave climate for each point in terms of:

- significant wave height (Hs) - spectral peak wave period (Tp);
- significant wave height (Hs) - mean wave direction (Dir); and
- spectral peak wave period (Tp) - mean wave direction (Dir).

Joint frequency of occurrence matrices are generated and accessed through a GIS interface using the location of the data-extraction point. For the 24 selected locations plotted in Figure 5, the annual, summer and winter wave roses are presented in Figure 7 and Figure 8.

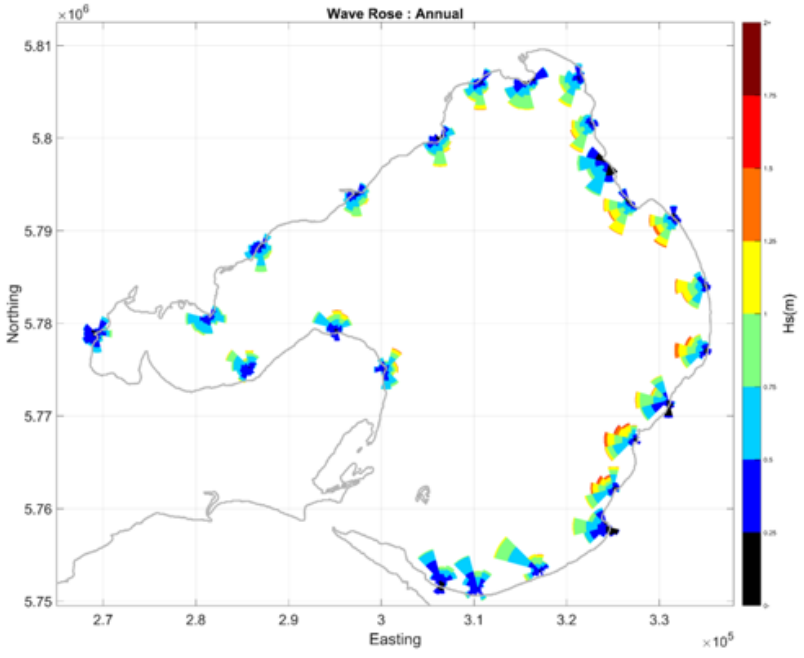


Figure 6: Annual wave roses around Port Phillip Bay at 24 locations

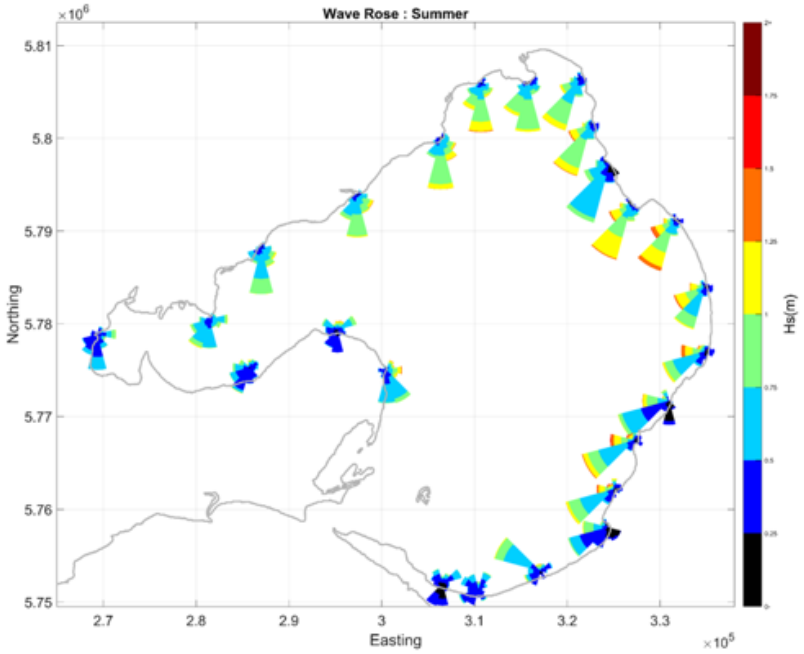


Figure 7: Summer wave roses around Port Phillip Bay at 24 locations

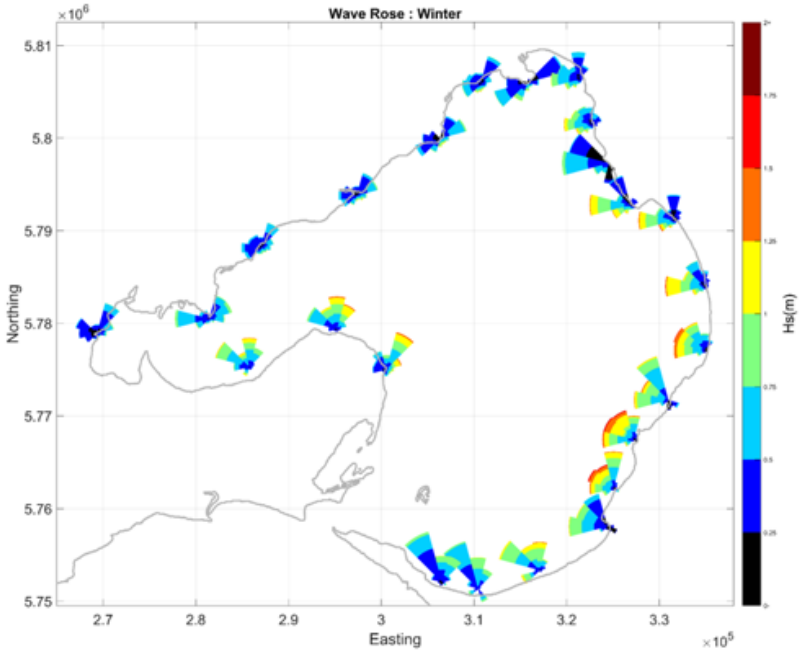


Figure 8: Winter wave roses around Port Phillip Bay at 24 locations

The wave roses show the marked change in the wave climate between seasons. In summer, the wave climate is dominated by waves from the south, which are refracted to become south-westerly along the eastern shoreline. In winter the dominant waves are from the northwest. This means that in summer, the general wave climate along the southern shoreline of the bay shows low wave conditions, while in winter, the north western shoreline has low wave conditions. This reversal in the dominant direction of the wave energy is an important factor when considering the movement of sediment by waves.

4.2. Extreme wave conditions

The design wave climate was modelled using the calibrated wave model. The design wave climate was determined for the extreme wind events of 1% AEP, 2% AEP and 10% AEP. The extreme wind speeds were derived using the Structural Wind Codes, AS/NZS 1170.2.2011. Although strictly speaking, these codes are for land-based structures and not for offshore structures they do enable the wind conditions within Port Phillip to be defined. Wind speed for the 16 compass directions for 1% AEP, 2% AEP and 10% AEP were computed for input into the model, Table 3. Note these winds have been converted to the 10-minute mean values, not the 3-second gust as presented in the Structural Wind Code.

Table 3: Wind Speed (10-minute mean) for defined AEP, based on the Wind Code (AS/NZS 1170.2.2011)

Direction	Wind Speed (m/s)		
	1% AEP	2% AEP	10% AEP
N	28.5	27.3	23.7
NNE	26.4	25.3	21.9
NE	24.2	23.2	20.1
ENE	23.5	22.5	19.5
E	22.8	21.9	18.9
ESE	22.8	21.9	18.9
SE	22.8	21.9	18.9
SSE	23.5	22.5	19.5
S	24.2	23.2	20.1
SSW	25.0	23.9	20.7
SW	25.7	24.6	21.3
WSW	27.1	26.0	22.5
W	28.5	27.3	23.7
WNW	27.8	26.6	23.1
NW	27.1	26.0	22.5
NNW	27.8	26.6	23.1

The wind speeds and their corresponding directions were used to force the model by applying the wind uniformly over the model domain. The model was run for steady-state, that is, it is assumed that the wind blows at the prescribed strength for long enough for wave growth to be fully-developed. A total of 48 different scenarios were run.

The significant wave height Hs (m), the peak wave period Tp (s), and the mean wave direction, in degree were the output from the model extracted at 248 points along the coast of Port Phillip Bay.

The maximum significant wave height and corresponding mean wave direction, peak wave period and the wind direction at 24 selected locations for the three AEP's are presented in Table 2.

The significant wave height for 1%, 2% and 10% AEP is also plotted at those 24 locations in Figure 9.

As the waves in the bay are fetch-limited; the highest wave is expected to be generated from the direction of the longest fetch. However, large waves may also approach from other directions and this must be included in considerations for design purposes. The significant wave heights for the 1%AEP wind from the 16 compass points is shown for the 24 selected locations in Table 3. The highest value for each point is presented in Table 2.

An example of the spatial variation of the significant wave height is presented in Figure 10. The upper plot displays the west south-westerly wind for 1% AEP case, and the lower plot presents the northerly wind for the same case.

Table 4: Maximum significant wave height, associated peak wave period, wave directions, and wind direction for 1%, 2% & 10% AEP at 24 locations around Port Phillip Bay

	1% AEP				2% AEP				10% AEP			
Location Name	Wind Dir.	Hs [m]	Tp [s]	Dir. [0]	Wind Dir.	Hs [m]	Tp [s]	Dir. [0]	Wind Dir.	Hs [m]	Tp [s]	Dir. [0]
ST LEONARDS	NNE	1.5	5.6	39	NNE	1.5	5.7	40	NNE	1.4	5.3	42
STEELES	N	1.6	5.5	4	N	1.6	5.4	4	N	1.5	4.9	4
CLIFTON SPRINGS	N	1.7	5.2	317	N	1.7	5.1	317	N	1.5	4.7	317
MOORPANYAL PARK	E	1.2	4.4	88	E	1.2	4.4	88	E	1.0	4.1	88
POINT WILSON EAST	WSW	1.4	4.6	237	WSW	1.3	4.5	238	WSW	1.2	4.1	238
BEACON POINT BOAT RAMP	ESE	1.3	5.2	125	SE	1.3	5.1	139	SE	1.2	4.8	140
WERRIBEE SOUTH	SSE	1.4	5.2	154	SSE	1.4	5.2	153	SE	1.3	5.1	136
POINT COOK HOMESTEAD	SSE	1.6	5.8	152	SSE	1.5	5.8	152	SSE	1.4	5.3	152
ALTONA (BURNS RESERVE)	S	1.5	5.5	177	S	1.5	5.6	177	S	1.4	5.2	178
WILLIAMSTOWN	SSW	1.4	5.6	194	S	1.4	5.6	180	SSW	1.3	5.2	194
ST KILDA MARINA	W	1.4	4.9	260	WSW	1.4	5.1	241	SW	1.3	5.2	225
BRIGHTON	W	1.8	5.7	262	WSW	1.8	5.7	245	WSW	1.6	5.2	245
SANDRINGHAM	W	1.2	5.9	254	WSW	1.2	5.8	242	W	1.1	5.4	255
BEAUMARIS YACHT CLUB	W	1.6	6.1	255	WSW	1.6	5.9	241	W	1.5	5.6	255
MORDIALLOC	W	1.8	6.2	257	WSW	1.8	5.9	243	WSW	1.7	5.5	243
CARRUM	W	1.8	6.4	265	W	1.8	6.0	266	W	1.6	5.8	265
FRANKSTON	W	1.8	6.4	277	WNW	1.8	6.1	289	W	1.7	5.9	278
MOONDAH	W	1.8	6.1	278	WNW	1.7	5.9	291	WNW	1.6	5.7	291
FISHERMANS	WNW	2.2	6.5	297	WNW	2.1	6.2	297	WNW	1.9	5.9	298
MOUNT MARTHA	NNW	2.0	6.1	327	NNW	1.9	6.1	327	WNW	1.8	5.4	297
SAFETY BEACH	W	1.5	5.7	274	WNW	1.5	5.6	284	W	1.4	5.2	274
ROSEBUD	N	1.7	6.2	356	N	1.6	6.1	356	N	1.4	5.5	356
RYE	N	1.2	5.8	6	N	1.2	5.8	6	N	1.1	5.2	6
BLAIRGOWRIE	N	1.2	4.5	356	N	1.2	4.4	356	N	1.1	4.2	1

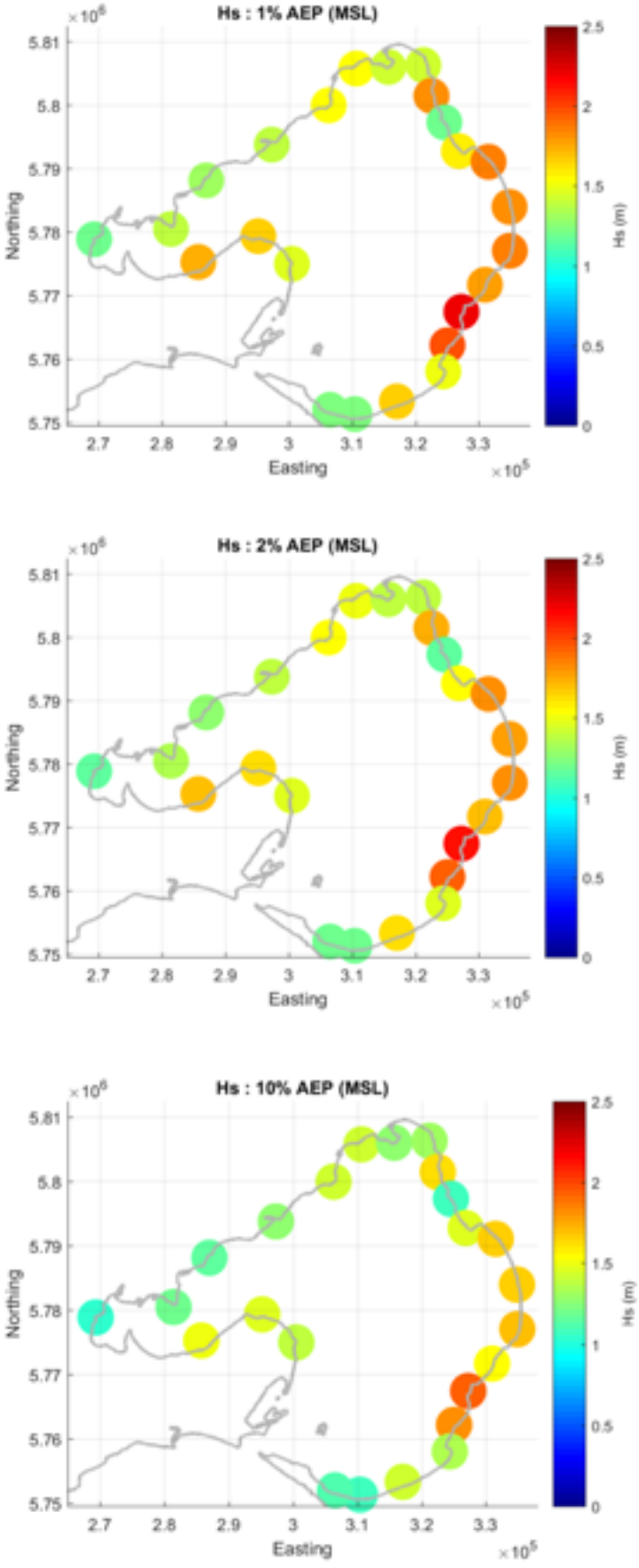


Figure 9: Extreme events (1%, 2% & 10% AEP) significant wave height around the coast of Port Phillip Bay

Table 5: Significant Wave Height (Hs m) around the coast of Port Phillip Bay for 1% AEP winds from different directions.

	Wind Directions															
Location Name	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
ST LEONARDS	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.2	1.1	1.0	0.9	1.0	1.1	1.2	1.4
STEELES	1.6	1.6	1.5	1.4	1.3	1.1	0.9	0.8	0.7	0.7	0.8	1.0	1.3	1.4	1.5	1.6
CLIFTON SPRINGS	1.7	1.6	1.4	1.2	1.0	0.8	0.8	0.8	0.8	0.9	1.1	1.3	1.5	1.6	1.6	1.7
MOORPANYAL PARK	1.0	1.0	1.1	1.2	1.2	1.2	1.1	1.1	1.1	1.0	0.9	0.9	0.9	0.9	0.8	0.9
POINT WILSON EAST	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.2	1.1	1.1
BEACON POINT BOAT RAMP	1.0	1.1	1.1	1.2	1.3	1.3	1.3	1.3	1.3	1.2	1.2	1.1	1.1	1.0	0.9	0.9
WERRIBEE SOUTH	1.0	1.1	1.2	1.3	1.4	1.4	1.4	1.4	1.4	1.4	1.3	1.2	1.1	0.9	0.8	0.9
POINT COOK HOMESTEAD	1.0	1.1	1.2	1.3	1.4	1.5	1.5	1.6	1.6	1.5	1.4	1.3	1.1	0.9	0.8	0.8
ALTONA (BURNS RESERVE)	1.0	1.0	1.0	1.2	1.3	1.4	1.5	1.5	1.5	1.5	1.5	1.4	1.3	1.2	1.0	1.0
WILLIAMSTOWN	0.8	0.8	0.9	1.0	1.0	1.1	1.2	1.4	1.4	1.4	1.4	1.3	1.3	1.1	0.8	0.7
ST KILDA MARINA	1.1	0.9	0.8	0.8	0.8	0.9	1.0	1.2	1.3	1.4	1.4	1.4	1.4	1.3	1.2	1.1
BRIGHTON	1.3	1.0	0.8	0.8	0.7	0.8	1.0	1.3	1.6	1.7	1.8	1.8	1.8	1.7	1.6	1.4
SANDRINGHAM	0.8	0.5	0.3	0.3	0.4	0.6	0.7	0.9	1.0	1.1	1.2	1.2	1.2	1.1	1.0	0.9
BEAUMARIS YACHT CLUB	1.1	0.8	0.7	0.8	0.9	1.0	1.2	1.3	1.4	1.5	1.6	1.6	1.6	1.5	1.4	1.3
MORDIALLOC	1.0	0.8	0.7	0.7	0.7	0.9	1.1	1.4	1.6	1.7	1.8	1.8	1.8	1.7	1.4	1.2
CARRUM	1.2	0.9	0.7	0.6	0.6	0.6	0.8	1.0	1.3	1.5	1.7	1.8	1.8	1.8	1.6	1.5
FRANKSTON	1.6	1.2	0.8	0.7	0.6	0.6	0.6	0.7	1.0	1.3	1.6	1.7	1.8	1.8	1.8	1.7
MOONDAH	1.6	1.3	0.9	0.7	0.5	0.4	0.4	0.6	0.8	1.1	1.4	1.6	1.8	1.8	1.7	1.7
FISHERMANS	2.0	1.7	1.2	0.9	0.6	0.6	0.6	0.8	1.2	1.5	1.7	2.0	2.2	2.2	2.2	2.2
MOUNT MARTHA	1.9	1.7	1.3	0.9	0.6	0.5	0.5	0.7	1.0	1.3	1.6	1.8	1.9	2.0	2.0	2.0
SAFETY BEACH	1.2	0.9	0.6	0.5	0.4	0.4	0.5	0.6	0.7	0.9	1.2	1.4	1.5	1.5	1.4	1.3
ROSEBUD	1.7	1.5	1.3	1.1	0.9	0.7	0.7	0.7	0.7	0.8	0.9	1.1	1.3	1.4	1.5	1.6
RYE	1.2	1.2	1.1	1.0	0.8	0.7	0.6	0.6	0.6	0.6	0.7	0.8	0.9	1.0	1.0	1.1
BLAIRGOWRIE	1.2	1.2	1.1	1.0	0.9	0.8	0.6	0.5	0.5	0.5	0.5	0.7	0.9	1.0	1.1	1.2

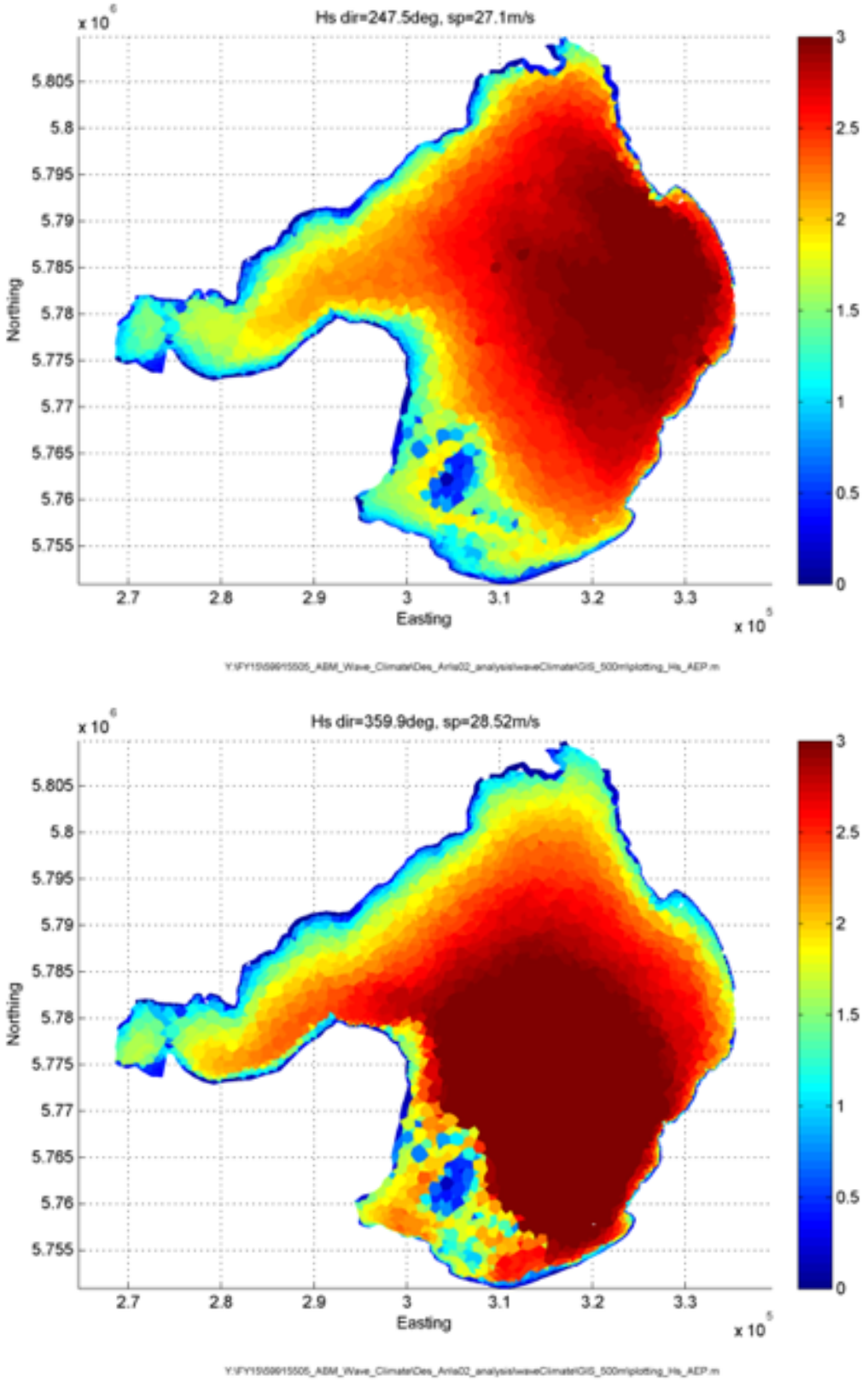


Figure 10: Example of the spatial variation of significant wave height (a) wind from the WSW for 1% AEP (b) wind from north for 1% AEP

05. Net Wave Power

An important parameter of the wave climate for coastal processes is the longshore component of wave power or flux (USACE, 2002, page III-2-10). In simple terms, this is the amount of energy from the incoming waves, directed along the shoreline. This energy drives longshore currents and sediment transport. This parameter is the input to a number of sediment-transport calculation methods, providing a guide to the direction and relative magnitude of the wave-driven longshore sediment-transport.

Using the wind measurements from Point Wilson, a time-series of hourly values of wind speed and direction was generated. Following the methods described in the previous section, these values were transferred to a time series of wave conditions at the 4 metre depth contour around the bay (or 2 metre depth in Corio Arm). At each data extraction point, the detailed bathymetry data was used to define the 'normal' to the shoreline. Using the direction and wave parameters, the longshore wave power was computed at each point hour by hour. These values were summed to yield, annual and seasonal values. This energy flux (N s^{-1}) is directed along the shoreline and, in the direction convention adopted for this calculation, a flux directed in a clockwise direction around the bay has a negative sign and that directed anticlockwise is positive. For example, on the east coast of the bay, a positive flux is towards the north and a negative flux to the south.

The annual flux is illustrated in Figure 11 and the flux for summer in Figure 12 and for winter in Figure 12.

Values for the longshore energy flux for each of the 248 data extraction points is included in Appendix D.

The annual flux is very small over much of the bay coastline indicating small annual-average sediment-transport. However, the summer and winter values are much greater in magnitude, showing there is a marked variation in the sediment transport, but that overall there is a balance. For example, in the area around Carrum, the annual longshore wave power is around zero (between -50 and +50). In summer, the same area has a flux around +200 (to the north) and in winter around the same value, but negative (to the south).

The figures and the data can be used to assess the relative potential for sediment transport between two locations as well as the likely differences between summer and winter.

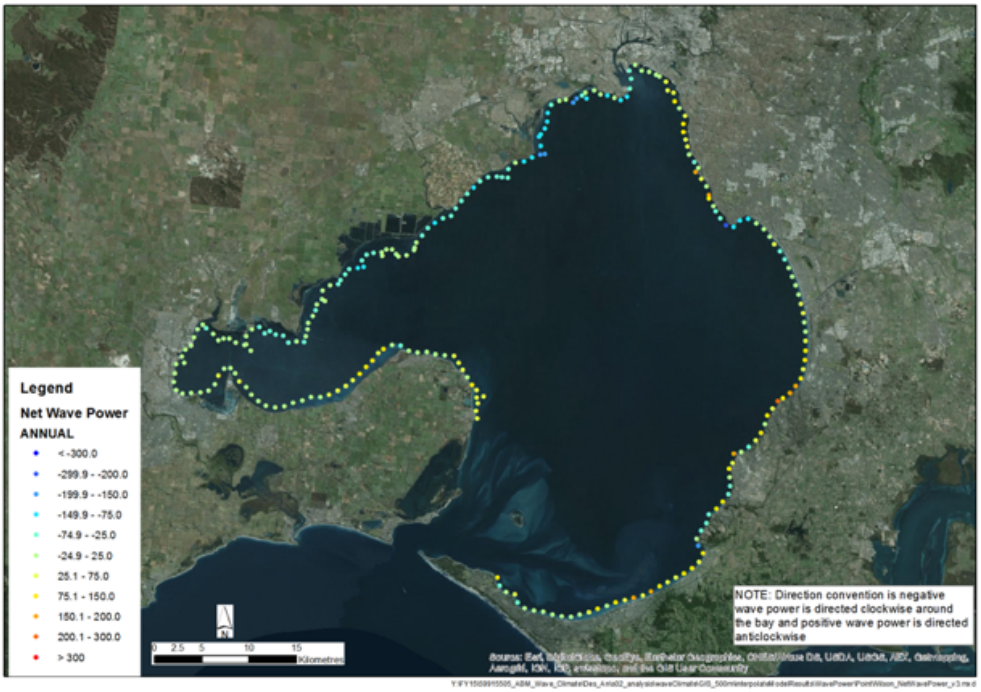


Figure 11: Annual net wave power (N s-1); note: direction convention is negative wave power is directed clockwise around the bay and positive wave power is directed anticlockwise

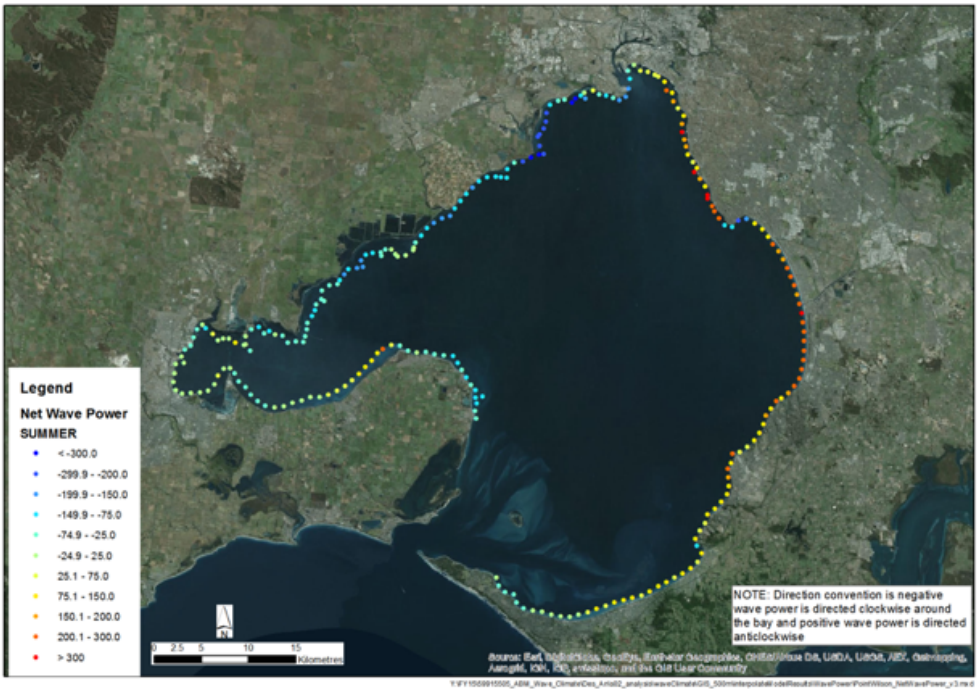


Figure 12: Net wave power (N s-1) during summer; note: direction convention is negative wave power is directed clockwise around the bay and positive wave power is directed anticlockwise

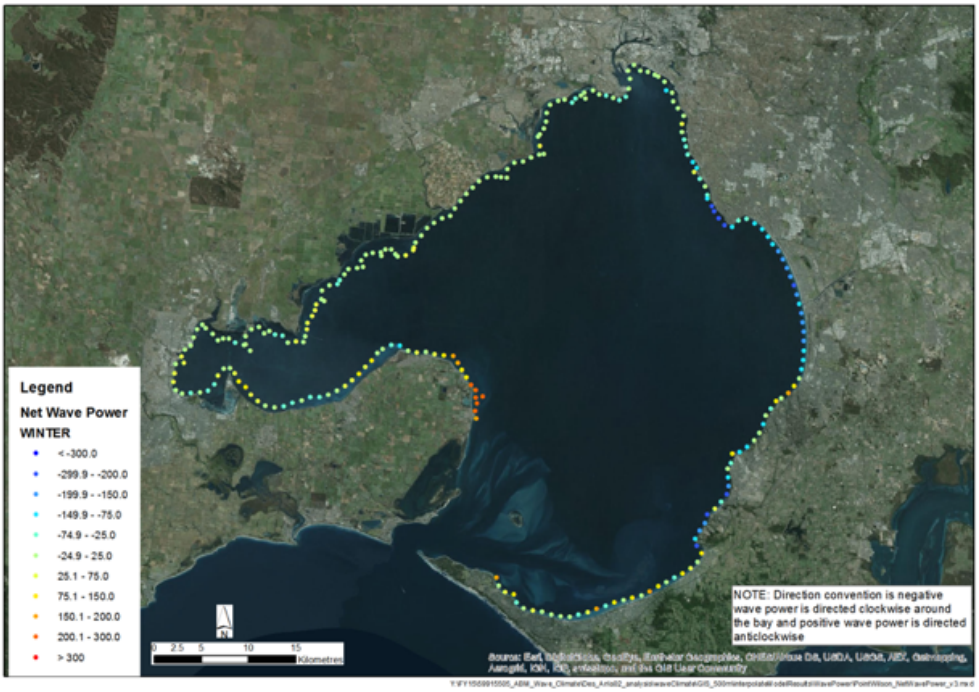


Figure 13: Net wave power (N s-1) during winter; note: direction convention is negative wave power is directed clockwise around the bay and positive wave power is directed anticlockwise

06. References

Booji N., Haagsma Ij.G., Holthuijsen L.H., Kieftenburg A.T., Ris R.C., and Zijllema M. (2004): *Simulating Waves Nearshore (SWAN) Cycle III version 40.41* – User Manual. Delft University of Technology. December 24, 2004.

Cardno (2015). *Port Phillip Bay Sea Level*, prepared for the Association of Bayside Municipalities as part of the "Port Phillip Bay Managing Better Now" project by Cardno Victoria Pty Ltd, Report 59914543, Final, Rev D.

USACE, (2002). *Coastal Engineering Manual*, prepared by U.S. Army Corps of Engineers (USACE), reference EM 1110-2-1100

07. Appendices

Appendix A - Wind matrices

Wind Speed and Direction - Percentage occurence
Fawkner Beacon
Wind data from 1992 to 2011
Annual

Direction (°)	Wind Speed [m/s]										Total (%)
	0.00+	2.50+	5.00+	7.50+	10.00+	12.50+	15.00+	17.50+	20.00+	22.50+	
'355 - 5'	2.35	2.37	1.78	2.74	1.85	0.80	0.21	0.02	0.00	0.0	12.12
'5 - 15'	0.57	1.42	0.99	1.30	0.89	0.38	0.11	0.01	0.00	0.0	5.68
'15 - 25'	0.44	0.99	0.64	0.55	0.26	0.11	0.02	0.01	0.00	0.0	3.03
'25 - 35'	0.40	0.72	0.46	0.23	0.07	0.02	0.00	0.00	0.00	0.0	1.89
'35 - 45'	0.36	0.48	0.23	0.10	0.02	0.00	0.00	0.00	0.00	0.0	1.19
'45 - 55'	0.33	0.37	0.12	0.04	0.01	0.00	0.00	0.00	0.00	0.0	0.86
'55 - 65'	0.30	0.30	0.08	0.03	0.00	0.00	0.00	0.00	0.00	0.0	0.72
'65 - 75'	0.30	0.31	0.10	0.04	0.00	0.00	0.00	0.00	0.00	0.0	0.75
'75 - 85'	0.31	0.39	0.14	0.08	0.02	0.00	0.00	0.00	0.00	0.0	0.94
'85 - 95'	0.28	0.52	0.24	0.15	0.06	0.01	0.01	0.00	0.00	0.0	1.27
'95 - 105'	0.30	0.61	0.34	0.26	0.11	0.04	0.01	0.00	0.00	0.0	1.67
'105 - 115'	0.30	0.70	0.48	0.36	0.14	0.04	0.00	0.00	0.00	0.0	2.02
'115 - 125'	0.32	0.76	0.59	0.47	0.19	0.10	0.02	0.00	0.00	0.0	2.45
'125 - 135'	0.38	0.81	0.71	0.51	0.24	0.09	0.02	0.00	0.00	0.0	2.76
'135 - 145'	0.37	0.83	0.72	0.59	0.14	0.03	0.00	0.00	0.00	0.0	2.70
'145 - 155'	0.41	0.99	0.82	0.66	0.14	0.03	0.01	0.00	0.00	0.0	3.07
'155 - 165'	0.46	1.03	0.94	0.74	0.18	0.04	0.01	0.00	0.00	0.0	3.40
'165 - 175'	0.47	1.14	1.12	0.97	0.26	0.04	0.01	0.00	0.00	0.0	4.00
'175 - 185'	0.46	1.19	1.18	1.12	0.33	0.06	0.01	0.00	0.00	0.0	4.34
'185 - 195'	0.41	1.07	1.17	1.10	0.35	0.10	0.02	0.00	0.00	0.0	4.21
'195 - 205'	0.33	0.86	0.98	1.00	0.40	0.09	0.01	0.00	0.00	0.0	3.68
'205 - 215'	0.30	0.66	0.78	0.92	0.39	0.09	0.02	0.01	0.00	0.0	3.16
'215 - 225'	0.28	0.55	0.61	0.68	0.35	0.10	0.02	0.00	0.00	0.0	2.59
'225 - 235'	0.24	0.54	0.52	0.51	0.24	0.09	0.02	0.00	0.00	0.0	2.16
'235 - 245'	0.24	0.52	0.57	0.62	0.27	0.09	0.01	0.00	0.00	0.0	2.31
'245 - 255'	0.25	0.55	0.67	0.80	0.34	0.10	0.02	0.00	0.00	0.0	2.74
'255 - 265'	0.25	0.55	0.74	0.87	0.38	0.14	0.02	0.00	0.00	0.0	2.96
'265 - 275'	0.25	0.52	0.74	0.82	0.38	0.13	0.02	0.00	0.00	0.0	2.86
'275 - 285'	0.23	0.49	0.62	0.78	0.39	0.12	0.03	0.00	0.00	0.0	2.67
'285 - 295'	0.26	0.50	0.60	0.65	0.31	0.11	0.02	0.00	0.00	0.0	2.44
'295 - 305'	0.26	0.53	0.53	0.51	0.22	0.07	0.01	0.00	0.00	0.0	2.13
'305 - 315'	0.25	0.51	0.50	0.48	0.19	0.06	0.01	0.00	0.00	0.0	1.99
'315 - 325'	0.28	0.48	0.44	0.38	0.17	0.05	0.01	0.00	0.00	0.0	1.80
'325 - 335'	0.30	0.49	0.37	0.39	0.17	0.06	0.01	0.00	0.00	0.0	1.79
'335 - 345'	0.34	0.54	0.39	0.51	0.24	0.10	0.02	0.00	0.00	0.0	2.14
'345 - 355'	0.45	0.76	0.58	0.84	0.54	0.25	0.07	0.00	0.00	0.0	3.49
Bin Totals (%)	14.01	26.07	22.51	22.79	10.20	3.55	0.77	0.08	0.01		100.00
Exceedence (%)	100.00	85.99	59.91	37.40	14.61	4.41	0.86	0.09	0.01		

Number of records in time series: 289632

Summary of Statistics
Mean Wind Speed = 6.5 m/s
Maximum Wind speed = 22.5 m/s

Wind Speed and Direction - Percentage occurence
Fawkner Beacon
Wind data from 1992 to 2011
Summer

Direction (°)	Wind Speed [m/s]										Total (%)
	0.00+	2.50+	5.00+	7.50+	10.00+	12.50+	15.00+	17.50+	20.00+	22.50+	
'355 - 5'	1.46	1.19	0.80	1.26	0.75	0.27	0.06	0.00	0.00	0.00	5.79
'5 - 15'	0.39	0.77	0.54	0.76	0.43	0.12	0.02	0.00	0.00	0.00	3.03
'15 - 25'	0.34	0.55	0.42	0.34	0.13	0.05	0.00	0.00	0.00	0.00	1.84
'25 - 35'	0.27	0.57	0.36	0.20	0.05	0.02	0.00	0.00	0.00	0.00	1.46
'35 - 45'	0.34	0.43	0.18	0.08	0.01	0.00	0.00	0.00	0.00	0.00	1.04
'45 - 55'	0.32	0.35	0.11	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.82
'55 - 65'	0.29	0.34	0.07	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.74
'65 - 75'	0.34	0.38	0.11	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.88
'75 - 85'	0.31	0.50	0.17	0.10	0.02	0.00	0.00	0.00	0.00	0.00	1.10
'85 - 95'	0.31	0.62	0.32	0.23	0.08	0.03	0.00	0.01	0.00	0.00	1.61
'95 - 105'	0.27	0.71	0.41	0.41	0.22	0.08	0.05	0.01	0.00	0.00	2.16
'105 - 115'	0.31	0.81	0.69	0.50	0.24	0.11	0.01	0.00	0.00	0.00	2.67
'115 - 125'	0.28	1.01	0.84	0.66	0.35	0.20	0.05	0.00	0.00	0.00	3.39
'125 - 135'	0.32	1.08	1.18	0.80	0.40	0.15	0.04	0.00	0.00	0.00	3.97
'135 - 145'	0.31	1.10	1.27	0.96	0.18	0.03	0.00	0.00	0.00	0.00	3.86
'145 - 155'	0.35	1.34	1.41	1.21	0.16	0.05	0.00	0.00	0.00	0.00	4.51
'155 - 165'	0.42	1.46	1.75	1.49	0.26	0.05	0.00	0.00	0.00	0.00	5.43
'165 - 175'	0.41	1.65	2.03	2.06	0.45	0.06	0.01	0.00	0.00	0.00	6.68
'175 - 185'	0.38	1.65	2.11	2.42	0.77	0.08	0.01	0.00	0.00	0.00	7.42
'185 - 195'	0.40	1.47	2.09	2.40	0.82	0.15	0.02	0.00	0.00	0.00	7.36
'195 - 205'	0.32	1.16	1.67	2.13	0.89	0.17	0.02	0.00	0.01	0.00	6.35
'205 - 215'	0.25	0.92	1.30	1.82	0.80	0.13	0.02	0.01	0.00	0.00	5.24
'215 - 225'	0.22	0.65	0.85	1.12	0.56	0.21	0.04	0.00	0.00	0.00	3.66
'225 - 235'	0.22	0.57	0.54	0.60	0.32	0.12	0.03	0.00	0.00	0.00	2.41
'235 - 245'	0.22	0.40	0.43	0.59	0.26	0.11	0.02	0.00	0.00	0.00	2.04
'245 - 255'	0.20	0.37	0.48	0.59	0.33	0.11	0.04	0.00	0.00	0.00	2.12
'255 - 265'	0.16	0.30	0.44	0.64	0.31	0.12	0.03	0.00	0.00	0.00	2.00
'265 - 275'	0.12	0.28	0.44	0.48	0.24	0.09	0.02	0.00	0.00	0.00	1.68
'275 - 285'	0.15	0.30	0.33	0.44	0.23	0.09	0.03	0.00	0.00	0.00	1.58
'285 - 295'	0.18	0.32	0.24	0.32	0.20	0.07	0.01	0.00	0.00	0.00	1.34
'295 - 305'	0.16	0.29	0.17	0.20	0.11	0.03	0.01	0.00	0.00	0.00	0.97
'305 - 315'	0.15	0.28	0.15	0.19	0.08	0.03	0.00	0.00	0.00	0.00	0.89
'315 - 325'	0.14	0.25	0.13	0.15	0.07	0.03	0.00	0.00	0.00	0.00	0.78
'325 - 335'	0.20	0.23	0.10	0.15	0.06	0.04	0.00	0.00	0.00	0.00	0.78
'335 - 345'	0.21	0.31	0.11	0.15	0.09	0.06	0.00	0.00	0.00	0.00	0.93
'345 - 355'	0.30	0.42	0.19	0.26	0.20	0.09	0.01	0.00	0.00	0.00	1.48
Bin Totals (%)	11.03	25.01	24.44	25.83	10.08	2.96	0.57	0.07	0.01		100.00
Exceedence (%)	100.00	88.97	63.96	39.52	13.69	3.61	0.65	0.08	0.01		

Number of records in time series: 71107

Summary of Statistics
Mean Wind Speed = 6.66 m/s
Maximum Wind speed = 22.5 m/s

Wind Speed and Direction - Percentage occurence
Fawkner Beacon
Wind data from 1992 to 2011
Winter

Direction (°)	Wind Speed [m/s]										Total (%)
	0.00+	2.50+	5.00+	7.50+	10.00+	12.50+	15.00+	17.50+	20.00+	22.50+	
'355 - 5'	3.78	3.08	2.99	5.29	3.69	1.63	0.49	0.05	0.00	0.0	21.01
'5 - 15'	0.69	1.82	1.73	2.17	1.76	0.82	0.28	0.03	0.00	0.0	9.31
'15 - 25'	0.53	1.32	0.96	0.89	0.49	0.24	0.06	0.02	0.00	0.0	4.51
'25 - 35'	0.51	0.76	0.54	0.27	0.07	0.02	0.00	0.00	0.00	0.0	2.18
'35 - 45'	0.43	0.50	0.23	0.07	0.01	0.00	0.00	0.00	0.00	0.0	1.24
'45 - 55'	0.35	0.36	0.08	0.04	0.00	0.00	0.00	0.00	0.00	0.0	0.82
'55 - 65'	0.31	0.19	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.0	0.54
'65 - 75'	0.25	0.17	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.44
'75 - 85'	0.27	0.21	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.0	0.56
'85 - 95'	0.26	0.26	0.11	0.06	0.02	0.00	0.00	0.00	0.00	0.0	0.71
'95 - 105'	0.23	0.37	0.15	0.08	0.02	0.02	0.00	0.00	0.00	0.0	0.88
'105 - 115'	0.23	0.38	0.18	0.19	0.04	0.01	0.00	0.00	0.00	0.0	1.03
'115 - 125'	0.27	0.35	0.23	0.20	0.07	0.01	0.00	0.00	0.00	0.0	1.13
'125 - 135'	0.33	0.43	0.24	0.19	0.04	0.01	0.00	0.00	0.00	0.0	1.25
'135 - 145'	0.26	0.41	0.21	0.18	0.08	0.01	0.00	0.00	0.00	0.0	1.15
'145 - 155'	0.32	0.45	0.26	0.16	0.05	0.02	0.00	0.00	0.00	0.0	1.27
'155 - 165'	0.29	0.37	0.24	0.15	0.05	0.05	0.02	0.00	0.00	0.0	1.16
'165 - 175'	0.30	0.38	0.22	0.22	0.07	0.02	0.01	0.00	0.00	0.0	1.21
'175 - 185'	0.35	0.44	0.23	0.21	0.05	0.02	0.02	0.00	0.00	0.0	1.33
'185 - 195'	0.30	0.44	0.20	0.20	0.05	0.04	0.01	0.00	0.00	0.0	1.24
'195 - 205'	0.32	0.43	0.23	0.15	0.07	0.02	0.01	0.00	0.00	0.0	1.23
'205 - 215'	0.28	0.39	0.25	0.20	0.12	0.03	0.00	0.00	0.00	0.0	1.27
'215 - 225'	0.33	0.42	0.27	0.30	0.09	0.02	0.01	0.00	0.00	0.0	1.44
'225 - 235'	0.27	0.47	0.38	0.28	0.10	0.03	0.00	0.00	0.00	0.0	1.53
'235 - 245'	0.30	0.60	0.55	0.52	0.15	0.04	0.01	0.00	0.00	0.0	2.18
'245 - 255'	0.31	0.67	0.73	0.92	0.29	0.04	0.01	0.00	0.00	0.0	2.98
'255 - 265'	0.32	0.78	0.83	1.03	0.36	0.10	0.02	0.00	0.00	0.0	3.42
'265 - 275'	0.38	0.76	0.89	1.07	0.40	0.13	0.02	0.00	0.00	0.0	3.65
'275 - 285'	0.28	0.69	0.91	0.97	0.44	0.10	0.02	0.00	0.00	0.0	3.41
'285 - 295'	0.36	0.72	0.83	0.91	0.37	0.13	0.01	0.00	0.00	0.0	3.34
'295 - 305'	0.42	0.74	0.86	0.75	0.32	0.09	0.02	0.00	0.00	0.0	3.18
'305 - 315'	0.35	0.78	0.86	0.82	0.29	0.09	0.01	0.00	0.00	0.0	3.22
'315 - 325'	0.45	0.75	0.82	0.70	0.28	0.08	0.00	0.00	0.00	0.0	3.09
'325 - 335'	0.46	0.76	0.75	0.77	0.33	0.09	0.01	0.00	0.00	0.0	3.16
'335 - 345'	0.40	0.76	0.74	1.04	0.49	0.21	0.03	0.00	0.00	0.0	3.68
'345 - 355'	0.59	1.03	1.10	1.69	1.18	0.54	0.14	0.02	0.00	0.0	6.29
Bin Totals (%)	16.07	23.45	19.87	22.74	11.84	4.67	1.23	0.13	0.01		100.00
Exceedence (%)	100.00	83.93	60.49	40.62	17.88	6.04	1.37	0.14	0.01		

Number of records in time series:69198

Summary of Statistics
Mean Wind Speed = 6.66 m/s
Maximum Wind speed = 21.55 m/s

Wind Speed and Direction - Percentage occurence
Point Wilson
Wind data from 1991 to 2011
Annual

Direction (°)	Wind Speed [m/s]										Total (%)
	0.00+	2.50+	5.00+	7.50+	10.00+	12.50+	15.00+	17.50+	20.00+	22.50+	
'355 - 5'	1.97	1.82	1.17	1.08	0.50	0.20	0.05	0.01	0.00	0.0	6.81
'5 - 15'	0.37	0.74	0.77	0.80	0.42	0.17	0.04	0.01	0.00	0.0	3.33
'15 - 25'	0.31	0.65	0.63	0.63	0.27	0.10	0.02	0.00	0.00	0.0	2.62
'25 - 35'	0.32	0.61	0.49	0.41	0.15	0.03	0.00	0.00	0.00	0.0	2.01
'35 - 45'	0.35	0.62	0.39	0.26	0.06	0.01	0.00	0.00	0.00	0.0	1.69
'45 - 55'	0.40	0.65	0.33	0.14	0.03	0.00	0.00	0.00	0.00	0.0	1.56
'55 - 65'	0.40	0.72	0.34	0.12	0.02	0.00	0.00	0.00	0.00	0.0	1.60
'65 - 75'	0.49	0.87	0.42	0.19	0.03	0.00	0.00	0.00	0.00	0.0	2.00
'75 - 85'	0.48	0.95	0.55	0.28	0.07	0.01	0.00	0.00	0.00	0.0	2.34
'85 - 95'	0.36	0.87	0.53	0.35	0.14	0.03	0.00	0.00	0.00	0.0	2.29
'95 - 105'	0.25	0.73	0.43	0.30	0.16	0.05	0.01	0.00	0.00	0.0	1.93
'105 - 115'	0.19	0.71	0.41	0.28	0.13	0.03	0.00	0.00	0.00	0.0	1.75
'115 - 125'	0.17	0.63	0.37	0.26	0.10	0.01	0.00	0.00	0.00	0.0	1.54
'125 - 135'	0.18	0.58	0.37	0.22	0.09	0.02	0.00	0.00	0.00	0.0	1.46
'135 - 145'	0.18	0.69	0.46	0.25	0.07	0.01	0.00	0.00	0.00	0.0	1.66
'145 - 155'	0.21	0.87	0.61	0.28	0.06	0.01	0.00	0.00	0.00	0.0	2.04
'155 - 165'	0.23	0.93	0.84	0.40	0.05	0.00	0.00	0.00	0.00	0.0	2.46
'165 - 175'	0.30	1.14	1.24	0.69	0.10	0.01	0.00	0.00	0.00	0.0	3.47
'175 - 185'	0.40	1.30	1.52	1.01	0.17	0.02	0.00	0.00	0.00	0.0	4.43
'185 - 195'	0.37	1.17	1.39	1.24	0.34	0.05	0.01	0.00	0.00	0.0	4.58
'195 - 205'	0.29	0.99	1.16	1.16	0.53	0.11	0.01	0.00	0.00	0.0	4.24
'205 - 215'	0.24	0.76	0.71	0.71	0.42	0.13	0.02	0.00	0.00	0.0	3.00
'215 - 225'	0.26	0.69	0.52	0.44	0.24	0.08	0.02	0.00	0.00	0.0	2.23
'225 - 235'	0.26	0.78	0.68	0.60	0.21	0.05	0.01	0.00	0.00	0.0	2.59
'235 - 245'	0.32	0.94	0.95	1.06	0.47	0.11	0.01	0.00	0.00	0.0	3.86
'245 - 255'	0.35	1.00	0.97	1.01	0.44	0.11	0.02	0.00	0.00	0.0	3.92
'255 - 265'	0.29	1.08	1.18	1.21	0.45	0.13	0.02	0.00	0.00	0.0	4.36
'265 - 275'	0.32	1.01	1.18	1.35	0.59	0.17	0.03	0.00	0.00	0.0	4.64
'275 - 285'	0.35	0.97	0.73	0.82	0.46	0.14	0.03	0.00	0.00	0.0	3.50
'285 - 295'	0.38	1.05	0.84	0.85	0.40	0.13	0.03	0.00	0.00	0.0	3.69
'295 - 305'	0.32	0.86	0.64	0.53	0.24	0.07	0.01	0.00	0.00	0.0	2.68
'305 - 315'	0.30	0.72	0.45	0.33	0.16	0.05	0.01	0.00	0.00	0.0	2.01
'315 - 325'	0.28	0.55	0.34	0.28	0.14	0.04	0.01	0.00	0.00	0.0	1.64
'325 - 335'	0.28	0.53	0.34	0.34	0.18	0.06	0.01	0.00	0.00	0.0	1.74
'335 - 345'	0.27	0.54	0.38	0.38	0.20	0.08	0.02	0.00	0.00	0.0	1.87
'345 - 355'	0.33	0.70	0.59	0.50	0.25	0.08	0.01	0.00	0.00	0.0	2.47
Bin Totals (%)	12.77	30.42	24.92	20.73	8.36	2.32	0.42	0.06	0.00	0.00	
Exceedence (%)	100.00	87.23	56.82	31.90	11.16	2.81	0.49	0.07	0.01	0.00	

Number of records in time series: 322615

Summary of Statistics
Mean Wind Speed = 6.19 m/s
Maximum Wind speed = 23.05 m/s

Wind Speed and Direction - Percentage occurence
Point Wilson
Wind data from 1991 to 2011
Winter

Direction (°)	Wind Speed [m/s]										Total (%)
	0.00+	2.50+	5.00+	7.50+	10.00+	12.50+	15.00+	17.50+	20.00+	22.50+	
'355 - 5'	3.35	2.21	2.31	2.12	0.92	0.39	0.13	0.02	0.00	0.0	11.45
'5 - 15'	0.49	1.10	1.46	1.71	0.84	0.36	0.07	0.02	0.00	0.0	6.05
'15 - 25'	0.41	0.93	1.10	1.22	0.61	0.21	0.06	0.00	0.00	0.0	4.53
'25 - 35'	0.37	0.82	0.91	0.83	0.26	0.06	0.01	0.00	0.00	0.0	3.26
'35 - 45'	0.44	0.71	0.59	0.48	0.10	0.01	0.00	0.00	0.00	0.0	2.32
'45 - 55'	0.43	0.66	0.34	0.21	0.02	0.00	0.00	0.00	0.00	0.0	1.66
'55 - 65'	0.45	0.62	0.23	0.07	0.01	0.00	0.00	0.00	0.00	0.0	1.37
'65 - 75'	0.39	0.61	0.27	0.04	0.00	0.00	0.00	0.00	0.00	0.0	1.32
'75 - 85'	0.37	0.67	0.31	0.06	0.01	0.00	0.00	0.00	0.00	0.0	1.42
'85 - 95'	0.34	0.57	0.23	0.08	0.02	0.00	0.00	0.00	0.00	0.0	1.24
'95 - 105'	0.25	0.43	0.19	0.13	0.05	0.01	0.00	0.00	0.00	0.0	1.07
'105 - 115'	0.20	0.49	0.16	0.14	0.08	0.01	0.00	0.00	0.00	0.0	1.08
'115 - 125'	0.19	0.39	0.19	0.19	0.07	0.00	0.00	0.00	0.00	0.0	1.03
'125 - 135'	0.16	0.26	0.18	0.12	0.02	0.00	0.00	0.00	0.00	0.0	0.75
'135 - 145'	0.15	0.30	0.17	0.08	0.01	0.00	0.00	0.00	0.00	0.0	0.70
'145 - 155'	0.14	0.35	0.15	0.06	0.01	0.00	0.00	0.00	0.00	0.0	0.72
'155 - 165'	0.15	0.37	0.20	0.08	0.02	0.00	0.00	0.00	0.00	0.0	0.81
'165 - 175'	0.16	0.35	0.20	0.11	0.03	0.01	0.00	0.00	0.00	0.0	0.86
'175 - 185'	0.20	0.39	0.22	0.16	0.06	0.03	0.00	0.00	0.00	0.0	1.04
'185 - 195'	0.19	0.35	0.24	0.19	0.06	0.04	0.01	0.00	0.00	0.0	1.08
'195 - 205'	0.18	0.40	0.32	0.33	0.09	0.04	0.00	0.00	0.00	0.0	1.35
'205 - 215'	0.23	0.35	0.36	0.29	0.10	0.05	0.01	0.00	0.00	0.0	1.39
'215 - 225'	0.28	0.46	0.24	0.17	0.10	0.02	0.01	0.00	0.00	0.0	1.28
'225 - 235'	0.27	0.61	0.42	0.24	0.08	0.01	0.00	0.00	0.00	0.0	1.64
'235 - 245'	0.43	1.09	0.69	0.50	0.16	0.03	0.00	0.00	0.00	0.0	2.91
'245 - 255'	0.57	1.38	0.87	0.69	0.22	0.04	0.01	0.00	0.00	0.0	3.78
'255 - 265'	0.49	1.55	1.47	1.36	0.39	0.07	0.01	0.00	0.00	0.0	5.33
'265 - 275'	0.52	1.56	1.72	2.07	0.74	0.16	0.03	0.00	0.00	0.0	6.79
'275 - 285'	0.61	1.47	1.16	1.26	0.67	0.20	0.05	0.01	0.00	0.0	5.42
'285 - 295'	0.61	1.58	1.16	1.38	0.58	0.24	0.03	0.00	0.00	0.0	5.59
'295 - 305'	0.58	1.30	0.81	0.76	0.33	0.13	0.02	0.00	0.00	0.0	3.93
'305 - 315'	0.52	1.15	0.67	0.53	0.27	0.09	0.02	0.00	0.00	0.0	3.25
'315 - 325'	0.53	0.89	0.51	0.46	0.28	0.11	0.02	0.00	0.00	0.0	2.80
'325 - 335'	0.49	0.93	0.58	0.60	0.32	0.12	0.02	0.01	0.00	0.0	3.07
'335 - 345'	0.45	0.91	0.68	0.69	0.40	0.15	0.03	0.00	0.00	0.0	3.32
'345 - 355'	0.48	1.16	1.11	1.03	0.41	0.16	0.04	0.00	0.00	0.0	4.39
Bin Totals (%)	16.07	29.37	22.42	20.43	8.32	2.72	0.58	0.08	0.01		100.00
Exceedence (%)	100.00	83.93	54.56	32.14	11.70	3.38	0.66	0.08	0.01		

Number of records in time series:78993

Summary of Statistics
Mean Wind Speed = 6.08 m/s
Maximum Wind speed = 21.66 m/s

Wind Speed and Direction - Percentage occurence
Point Wilson
Wind data from 1991 to 2011
Summer

Direction (°)	Wind Speed [m/s]										Total (%)
	0.00+	2.50+	5.00+	7.50+	10.00+	12.50+	15.00+	17.50+	20.00+	22.50+	
'355 - 5'	1.51	0.55	0.36	0.45	0.30	0.08	0.02	0.00	0.00	0.0	3.27
'5 - 15'	0.17	0.42	0.28	0.29	0.16	0.08	0.01	0.00	0.00	0.0	1.42
'15 - 25'	0.17	0.36	0.28	0.22	0.12	0.05	0.02	0.00	0.00	0.0	1.22
'25 - 35'	0.19	0.42	0.22	0.17	0.05	0.00	0.00	0.00	0.00	0.0	1.05
'35 - 45'	0.20	0.54	0.21	0.11	0.02	0.01	0.00	0.00	0.00	0.0	1.09
'45 - 55'	0.25	0.69	0.34	0.09	0.01	0.00	0.00	0.00	0.00	0.0	1.38
'55 - 65'	0.21	0.88	0.42	0.08	0.01	0.00	0.00	0.00	0.00	0.0	1.61
'65 - 75'	0.26	1.08	0.78	0.20	0.03	0.00	0.00	0.00	0.00	0.0	2.35
'75 - 85'	0.23	1.07	1.06	0.54	0.07	0.00	0.00	0.00	0.00	0.0	2.97
'85 - 95'	0.28	0.87	0.83	0.85	0.29	0.06	0.00	0.00	0.00	0.0	3.19
'95 - 105'	0.25	0.75	0.51	0.54	0.32	0.16	0.03	0.00	0.00	0.0	2.55
'105 - 115'	0.24	0.73	0.45	0.45	0.27	0.08	0.01	0.00	0.00	0.0	2.24
'115 - 125'	0.24	0.73	0.36	0.30	0.16	0.03	0.00	0.00	0.00	0.0	1.84
'125 - 135'	0.24	0.87	0.46	0.33	0.16	0.03	0.00	0.00	0.00	0.0	2.09
'135 - 145'	0.26	1.05	0.73	0.32	0.15	0.02	0.00	0.00	0.00	0.0	2.54
'145 - 155'	0.26	1.57	1.10	0.32	0.09	0.01	0.00	0.00	0.00	0.0	3.35
'155 - 165'	0.27	1.62	1.67	0.61	0.07	0.00	0.00	0.00	0.00	0.0	4.24
'165 - 175'	0.28	1.96	2.84	1.47	0.13	0.00	0.00	0.00	0.00	0.0	6.69
'175 - 185'	0.24	1.79	3.53	2.75	0.30	0.01	0.00	0.00	0.00	0.0	8.63
'185 - 195'	0.26	1.55	2.76	3.06	0.90	0.10	0.01	0.00	0.00	0.0	8.64
'195 - 205'	0.32	1.23	1.79	2.32	1.30	0.30	0.02	0.01	0.00	0.0	7.29
'205 - 215'	0.26	1.05	0.86	1.05	0.79	0.28	0.04	0.01	0.00	0.0	4.34
'215 - 225'	0.28	0.95	0.75	0.61	0.23	0.11	0.02	0.01	0.00	0.0	2.96
'225 - 235'	0.24	0.85	1.00	0.74	0.20	0.06	0.02	0.00	0.00	0.0	3.10
'235 - 245'	0.22	0.66	0.99	1.45	0.61	0.17	0.03	0.00	0.00	0.0	4.13
'245 - 255'	0.22	0.54	0.92	1.06	0.46	0.12	0.01	0.00	0.00	0.0	3.33
'255 - 265'	0.15	0.39	0.65	0.79	0.35	0.10	0.02	0.00	0.00	0.0	2.44
'265 - 275'	0.13	0.28	0.43	0.59	0.40	0.11	0.01	0.00	0.00	0.0	1.95
'275 - 285'	0.14	0.30	0.26	0.35	0.24	0.06	0.02	0.00	0.00	0.0	1.37
'285 - 295'	0.13	0.43	0.33	0.31	0.17	0.04	0.01	0.00	0.00	0.0	1.42
'295 - 305'	0.14	0.44	0.38	0.21	0.06	0.02	0.00	0.00	0.00	0.0	1.25
'305 - 315'	0.14	0.35	0.18	0.10	0.05	0.02	0.00	0.00	0.00	0.0	0.84
'315 - 325'	0.13	0.27	0.16	0.09	0.05	0.02	0.01	0.00	0.00	0.0	0.73
'325 - 335'	0.13	0.23	0.13	0.10	0.11	0.04	0.01	0.00	0.00	0.0	0.75
'335 - 345'	0.13	0.23	0.09	0.16	0.11	0.03	0.00	0.00	0.00	0.0	0.75
'345 - 355'	0.15	0.30	0.12	0.23	0.16	0.04	0.01	0.00	0.00	0.0	1.01
Bin Totals (%)	8.90	28.02	28.23	23.29	8.90	2.28	0.32	0.04	0.00		100.00
Exceedence (%)	100.00	91.10	63.07	34.84	11.54	2.64	0.36	0.04	0.00		

Number of records in time series: 78373

Summary of Statistics
Mean Wind Speed = 6.51 m/s
Maximum Wind speed = 21.66 m/s

Wind Speed and Direction - Percentage occurence
South Channel
Wind data from 1998 to 2011
Annual

Direction (°)	Wind Speed [m/s]										Total (%)
	0.00+	2.50+	5.00+	7.50+	10.00+	12.50+	15.00+	17.50+	20.00+	22.50+	
'355 - 5'	1.05	1.66	1.41	1.85	1.29	0.59	0.15	0.02	0.00	0.0	8.03
'5 - 15'	0.31	0.90	0.90	1.10	0.60	0.24	0.04	0.01	0.00	0.0	4.10
'15 - 25'	0.24	0.79	0.64	0.56	0.20	0.06	0.01	0.00	0.00	0.0	2.50
'25 - 35'	0.25	0.71	0.55	0.37	0.09	0.02	0.00	0.00	0.00	0.0	1.98
'35 - 45'	0.27	0.67	0.48	0.27	0.07	0.01	0.00	0.00	0.00	0.0	1.77
'45 - 55'	0.30	0.76	0.54	0.33	0.07	0.02	0.00	0.00	0.00	0.0	2.01
'55 - 65'	0.32	0.78	0.50	0.41	0.14	0.04	0.00	0.00	0.00	0.0	2.19
'65 - 75'	0.31	0.81	0.57	0.45	0.19	0.07	0.01	0.00	0.00	0.0	2.41
'75 - 85'	0.38	0.89	0.64	0.54	0.24	0.14	0.02	0.00	0.00	0.0	2.87
'85 - 95'	0.26	0.61	0.46	0.41	0.18	0.07	0.01	0.00	0.00	0.0	1.99
'95 - 105'	0.20	0.44	0.35	0.34	0.17	0.05	0.00	0.00	0.00	0.0	1.54
'105 - 115'	0.19	0.44	0.27	0.28	0.14	0.04	0.01	0.00	0.00	0.0	1.37
'115 - 125'	0.20	0.49	0.35	0.31	0.17	0.03	0.00	0.00	0.00	0.0	1.54
'125 - 135'	0.28	0.64	0.52	0.42	0.14	0.03	0.00	0.00	0.00	0.0	2.04
'135 - 145'	0.31	0.74	0.66	0.50	0.09	0.03	0.00	0.00	0.00	0.0	2.33
'145 - 155'	0.31	0.76	0.76	0.55	0.09	0.01	0.00	0.00	0.00	0.0	2.46
'155 - 165'	0.26	0.65	0.77	0.71	0.13	0.01	0.00	0.00	0.00	0.0	2.54
'165 - 175'	0.29	0.74	0.93	0.88	0.26	0.04	0.01	0.00	0.00	0.0	3.15
'175 - 185'	0.48	0.96	1.15	1.26	0.48	0.11	0.02	0.00	0.00	0.0	4.46
'185 - 195'	0.52	1.13	1.30	1.37	0.60	0.16	0.04	0.00	0.00	0.0	5.12
'195 - 205'	0.49	1.05	1.26	1.42	0.71	0.25	0.05	0.01	0.00	0.0	5.25
'205 - 215'	0.36	0.87	1.04	1.31	0.72	0.32	0.09	0.01	0.00	0.0	4.72
'215 - 225'	0.20	0.56	0.74	1.04	0.71	0.31	0.09	0.01	0.00	0.0	3.67
'225 - 235'	0.14	0.36	0.44	0.70	0.51	0.28	0.07	0.01	0.00	0.0	2.51
'235 - 245'	0.11	0.25	0.29	0.45	0.31	0.21	0.04	0.01	0.00	0.0	1.68
'245 - 255'	0.12	0.25	0.28	0.41	0.31	0.17	0.04	0.00	0.00	0.0	1.58
'255 - 265'	0.12	0.36	0.40	0.51	0.38	0.18	0.04	0.01	0.00	0.0	2.00
'265 - 275'	0.15	0.46	0.64	0.90	0.58	0.23	0.06	0.01	0.00	0.0	3.01
'275 - 285'	0.22	0.58	0.80	1.26	0.83	0.37	0.08	0.01	0.00	0.0	4.15
'285 - 295'	0.19	0.50	0.66	1.12	0.88	0.37	0.08	0.01	0.00	0.0	3.82
'295 - 305'	0.17	0.39	0.51	0.77	0.51	0.23	0.06	0.01	0.00	0.0	2.63
'305 - 315'	0.14	0.29	0.36	0.48	0.33	0.13	0.03	0.01	0.00	0.0	1.76
'315 - 325'	0.12	0.30	0.28	0.41	0.24	0.09	0.03	0.01	0.00	0.0	1.48
'325 - 335'	0.13	0.30	0.31	0.40	0.26	0.10	0.03	0.00	0.00	0.0	1.54
'335 - 345'	0.14	0.30	0.33	0.45	0.29	0.12	0.03	0.00	0.00	0.0	1.67
'345 - 355'	0.18	0.43	0.41	0.54	0.34	0.14	0.05	0.01	0.00	0.0	2.10
Bin Totals (%)	9.70	22.84	22.51	25.07	13.23	5.26	1.21	0.18	0.02	0.00	
Exceedence (%)	100.00	90.30	67.46	44.96	19.89	6.66	1.41	0.20	0.02	0.00	

Number of records in time series: 209122

Summary of Statistics
Mean Wind Speed = 7.17 m/s
Maximum Wind speed = 23.05 m/s

Wind Speed and Direction - Percentage occurence
South Channel
Wind data from 1998 to 2011
Summer

Direction (°)	Wind Speed [m/s]										Total (%)
	0.00+	2.50+	5.00+	7.50+	10.00+	12.50+	15.00+	17.50+	20.00+	22.50+	
'355 - 5'	0.81	0.41	0.29	0.50	0.36	0.14	0.02	0.00	0.00	0.0	2.53
'5 - 15'	0.17	0.41	0.35	0.56	0.26	0.09	0.01	0.00	0.00	0.0	1.83
'15 - 25'	0.17	0.50	0.49	0.49	0.10	0.02	0.00	0.00	0.00	0.0	1.76
'25 - 35'	0.22	0.56	0.46	0.38	0.02	0.00	0.00	0.00	0.00	0.0	1.65
'35 - 45'	0.21	0.57	0.50	0.21	0.03	0.01	0.00	0.00	0.00	0.0	1.54
'45 - 55'	0.19	0.71	0.69	0.23	0.03	0.00	0.00	0.00	0.00	0.0	1.86
'55 - 65'	0.20	0.74	0.73	0.35	0.08	0.01	0.00	0.00	0.00	0.0	2.12
'65 - 75'	0.15	0.70	0.66	0.67	0.22	0.05	0.02	0.00	0.00	0.0	2.46
'75 - 85'	0.26	0.69	0.61	0.93	0.55	0.28	0.08	0.01	0.00	0.0	3.42
'85 - 95'	0.19	0.51	0.44	0.64	0.42	0.17	0.02	0.01	0.00	0.0	2.39
'95 - 105'	0.19	0.41	0.34	0.37	0.24	0.11	0.00	0.00	0.00	0.0	1.67
'105 - 115'	0.26	0.38	0.28	0.26	0.20	0.06	0.02	0.00	0.00	0.0	1.46
'115 - 125'	0.26	0.53	0.32	0.35	0.23	0.06	0.00	0.00	0.00	0.0	1.74
'125 - 135'	0.35	0.96	0.70	0.54	0.22	0.08	0.00	0.00	0.00	0.0	2.86
'135 - 145'	0.37	1.31	1.00	0.56	0.14	0.03	0.01	0.00	0.00	0.0	3.42
'145 - 155'	0.28	1.44	1.32	0.68	0.09	0.01	0.00	0.00	0.00	0.0	3.82
'155 - 165'	0.27	1.30	1.56	0.96	0.11	0.00	0.00	0.00	0.00	0.0	4.21
'165 - 175'	0.28	1.21	1.72	1.62	0.23	0.02	0.00	0.00	0.00	0.0	5.08
'175 - 185'	0.29	1.34	2.28	3.07	0.63	0.07	0.01	0.00	0.00	0.0	7.69
'185 - 195'	0.23	1.15	2.71	3.44	0.94	0.20	0.02	0.00	0.00	0.0	8.69
'195 - 205'	0.29	1.27	2.39	3.00	1.31	0.38	0.04	0.02	0.00	0.0	8.69
'205 - 215'	0.28	1.14	1.66	2.08	1.46	0.57	0.08	0.01	0.00	0.0	7.29
'215 - 225'	0.26	0.72	0.89	1.24	1.11	0.68	0.17	0.03	0.01	0.0	5.11
'225 - 235'	0.25	0.44	0.50	0.70	0.60	0.42	0.11	0.02	0.00	0.0	3.04
'235 - 245'	0.21	0.34	0.30	0.35	0.26	0.16	0.04	0.02	0.00	0.0	1.69
'245 - 255'	0.17	0.27	0.26	0.30	0.20	0.08	0.02	0.00	0.00	0.0	1.30
'255 - 265'	0.17	0.27	0.28	0.44	0.32	0.13	0.02	0.00	0.00	0.0	1.62
'265 - 275'	0.13	0.31	0.39	0.56	0.44	0.16	0.02	0.00	0.00	0.0	2.01
'275 - 285'	0.15	0.26	0.33	0.60	0.49	0.16	0.02	0.00	0.00	0.0	2.00
'285 - 295'	0.12	0.16	0.24	0.54	0.29	0.10	0.02	0.01	0.00	0.0	1.48
'295 - 305'	0.11	0.14	0.20	0.21	0.21	0.10	0.02	0.00	0.00	0.0	0.98
'305 - 315'	0.10	0.14	0.11	0.14	0.12	0.05	0.01	0.00	0.00	0.0	0.68
'315 - 325'	0.09	0.11	0.07	0.10	0.06	0.03	0.00	0.00	0.00	0.0	0.47
'325 - 335'	0.11	0.12	0.07	0.07	0.05	0.02	0.00	0.00	0.00	0.0	0.44
'335 - 345'	0.12	0.12	0.07	0.06	0.05	0.02	0.00	0.00	0.00	0.0	0.44
'345 - 355'	0.14	0.15	0.08	0.09	0.05	0.03	0.00	0.00	0.00	0.0	0.56
Bin Totals (%)	8.07	21.78	25.29	27.28	12.13	4.53	0.77	0.14	0.01		
Exceedence (%)	100.00	91.93	70.15	44.86	17.59	5.46	0.92	0.16	0.01		

Number of records in time series: 52058

Summary of Statistics
Mean Wind Speed = 7.17 m/s
Maximum Wind speed = 21.66 m/s

Wind Speed and Direction - Percentage occurence
South Channel
Wind data from 1998 to 2011
Winter

Direction (°)	Wind Speed [m/s]										Total (%)
	0.00+	2.50+	5.00+	7.50+	10.00+	12.50+	15.00+	17.50+	20.00+	22.50+	
'355 - 5'	2.12	2.22	2.18	3.92	3.72	1.97	0.58	0.09	0.00	0.0	16.79
'5 - 15'	0.46	1.19	1.21	2.03	1.56	0.58	0.16	0.02	0.00	0.0	7.21
'15 - 25'	0.35	1.08	0.68	0.68	0.30	0.11	0.02	0.01	0.00	0.0	3.23
'25 - 35'	0.33	0.95	0.51	0.33	0.09	0.02	0.01	0.00	0.00	0.0	2.24
'35 - 45'	0.39	0.91	0.44	0.15	0.03	0.01	0.00	0.00	0.00	0.0	1.92
'45 - 55'	0.39	1.03	0.48	0.18	0.02	0.00	0.00	0.00	0.00	0.0	2.08
'55 - 65'	0.38	0.85	0.43	0.23	0.03	0.00	0.00	0.00	0.00	0.0	1.92
'65 - 75'	0.32	0.72	0.35	0.31	0.03	0.00	0.00	0.00	0.00	0.0	1.73
'75 - 85'	0.31	0.64	0.35	0.31	0.08	0.00	0.00	0.00	0.00	0.0	1.70
'85 - 95'	0.27	0.44	0.19	0.22	0.04	0.01	0.00	0.00	0.00	0.0	1.18
'95 - 105'	0.26	0.38	0.13	0.20	0.06	0.02	0.00	0.00	0.00	0.0	1.04
'105 - 115'	0.16	0.33	0.20	0.13	0.12	0.02	0.00	0.00	0.00	0.0	0.95
'115 - 125'	0.21	0.33	0.20	0.17	0.10	0.03	0.00	0.00	0.00	0.0	1.04
'125 - 135'	0.21	0.30	0.19	0.17	0.06	0.01	0.00	0.00	0.00	0.0	0.95
'135 - 145'	0.16	0.42	0.22	0.13	0.03	0.00	0.00	0.00	0.00	0.0	0.96
'145 - 155'	0.21	0.32	0.19	0.12	0.03	0.00	0.00	0.00	0.00	0.0	0.87
'155 - 165'	0.15	0.30	0.19	0.18	0.05	0.01	0.01	0.00	0.00	0.0	0.89
'165 - 175'	0.17	0.29	0.29	0.27	0.07	0.08	0.05	0.01	0.00	0.0	1.24
'175 - 185'	0.20	0.35	0.28	0.45	0.23	0.12	0.04	0.01	0.00	0.0	1.68
'185 - 195'	0.23	0.36	0.41	0.63	0.32	0.09	0.01	0.00	0.00	0.0	2.06
'195 - 205'	0.18	0.41	0.43	0.74	0.40	0.11	0.03	0.01	0.00	0.0	2.31
'205 - 215'	0.16	0.42	0.43	0.53	0.33	0.17	0.06	0.02	0.00	0.0	2.12
'215 - 225'	0.12	0.32	0.39	0.45	0.32	0.15	0.06	0.01	0.00	0.0	1.82
'225 - 235'	0.09	0.29	0.26	0.38	0.20	0.16	0.05	0.00	0.00	0.0	1.43
'235 - 245'	0.07	0.19	0.24	0.29	0.21	0.14	0.02	0.01	0.00	0.0	1.17
'245 - 255'	0.12	0.22	0.23	0.27	0.21	0.13	0.04	0.00	0.00	0.0	1.23
'255 - 265'	0.12	0.28	0.29	0.40	0.23	0.13	0.06	0.01	0.00	0.0	1.53
'265 - 275'	0.16	0.52	0.65	1.02	0.61	0.22	0.08	0.02	0.00	0.0	3.28
'275 - 285'	0.25	0.83	1.18	1.86	1.30	0.52	0.14	0.02	0.00	0.0	6.10
'285 - 295'	0.26	0.74	1.02	1.81	1.55	0.63	0.17	0.04	0.00	0.0	6.23
'295 - 305'	0.26	0.63	0.80	1.23	0.98	0.41	0.10	0.01	0.00	0.0	4.42
'305 - 315'	0.21	0.51	0.65	0.83	0.64	0.26	0.05	0.00	0.00	0.0	3.15
'315 - 325'	0.18	0.58	0.58	0.76	0.43	0.21	0.02	0.00	0.00	0.0	2.76
'325 - 335'	0.22	0.55	0.63	0.81	0.43	0.21	0.03	0.01	0.00	0.0	2.89
'335 - 345'	0.24	0.62	0.70	0.93	0.57	0.26	0.04	0.01	0.00	0.0	3.37
'345 - 355'	0.28	0.84	0.84	1.17	0.85	0.41	0.11	0.01	0.00	0.0	4.51
Bin Totals (%)	10.22	21.36	18.43	24.30	16.23	7.18	1.94	0.31	0.02	0.00	
Exceedence (%)	100.00	89.78	68.42	49.99	25.69	9.46	2.28	0.34	0.03	0.00	

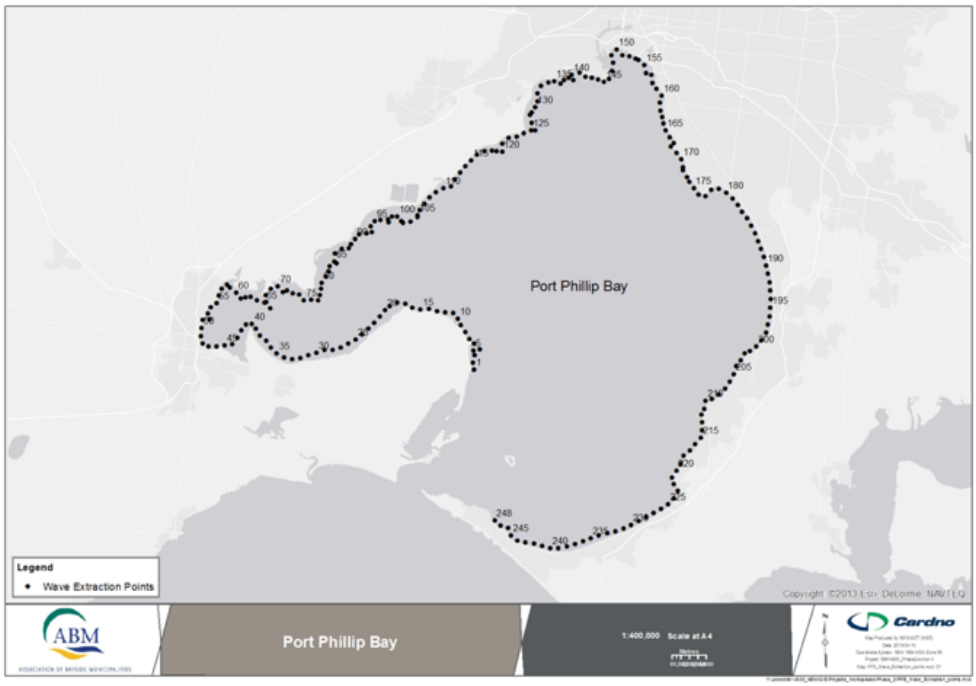
Number of records in time series: 52095

Summary of Statistics
Mean Wind Speed = 7.52 m/s
Maximum Wind speed = 23.04 m/s

Appendix B - Wave data extraction locations

Point ID	Easting [m, MGA 55]	Northing [m, MGA 55]	Point ID	Easting [m, MGA 55]	Northing [m, MGA 55]	Point ID	Easting [m, MGA 55]	Northing [m, MGA 55]	Point ID	Easting [m, MGA 55]	Northing [m, MGA 55]
1	300543	5772302	31	281081	5773958	61	273176	5780590	91	287020	5788140
2	300401	5773098	32	280150	5773612	62	273722	5780756	92	287941	5788240
3	300573	5773942	33	279168	5773468	63	274337	5780780	93	288531	5788365
4	301201	5774649	34	278209	5773702	64	275035	5780368	94	288366	5789047
5	300468	5774522	35	277386	5774192	65	275930	5780100	95	288866	5789641
6	300479	5775326	36	276650	5774838	66	276606	5779478	96	289556	5789814
7	299962	5775869	37	276121	5775624	67	276114	5780158	97	290490	5789504
8	299488	5776677	38	275393	5776252	68	276098	5781024	98	290434	5789876
9	298979	5777472	39	274922	5777093	69	276691	5781757	99	290932	5790196
10	298593	5778216	40	274481	5777652	70	277515	5782023	100	291535	5790180
11	298100	5778938	41	273787	5777576	71	278084	5781311	101	291949	5789690
12	297122	5778992	42	273198	5776865	72	278607	5781574	102	292212	5789483
13	296151	5779124	43	272779	5775968	73	279251	5781184	103	293093	5789624
14	295225	5779354	44	272135	5775279	74	280025	5781059	104	293861	5790134
15	294238	5779302	45	271244	5775085	75	280572	5780363	105	293907	5790379
16	293283	5779506	46	270293	5775006	76	281445	5780486	106	294133	5790947
17	292428	5780018	47	269365	5774964	77	282203	5780415	107	294696	5791705
18	291523	5780113	48	268672	5775300	78	282413	5781016	108	295315	5792462
19	290642	5779692	49	268463	5776205	79	282577	5781762	109	296056	5793041
20	290080	5779246	50	268552	5777125	80	282632	5782446	110	296934	5793517
21	289455	5778483	51	268693	5778090	81	283118	5783192	111	297799	5793760
22	288789	5777766	52	269535	5778180	82	283439	5783799	112	298295	5794573
23	288102	5777051	53	269333	5778870	83	283589	5784399	113	298880	5795366
24	287390	5776367	54	269666	5779588	84	284406	5784743	114	299486	5796078
25	286611	5775763	55	270312	5780039	85	284103	5784936	115	300166	5796769
26	285774	5775289	56	270568	5780906	86	284176	5785867	116	300866	5797431
27	284890	5774858	57	270958	5781740	87	284990	5786396	117	301704	5797841
28	283935	5774585	58	271540	5782219	88	285840	5786512	118	302641	5797910
29	282948	5774579	59	271864	5781907	89	286115	5786990	119	303166	5797860
30	282034	5774207	60	272601	5781296	90	286555	5787602	120	303800	5797815

Point ID	Easting [m, MGA 55]	Northing [m, MGA 55]	Point ID	Easting [m, MGA 55]	Northing [m, MGA 55]	Point ID	Easting [m, MGA 55]	Northing [m, MGA 55]	Point ID	Easting [m, MGA 55]	Northing [m, MGA 55]
121	303839	5798729	153	319454	5808699	185	333025	5789148	217	325804	5762794
122	304580	5799383	154	319812	5808532	186	333450	5788244	218	325053	5762188
123	305520	5799530	155	320500	5807939	187	333838	5787323	219	324760	5761265
124	306338	5799964	156	320695	5807031	188	334188	5786387	220	324239	5760448
125	307190	5800263	157	321292	5806791	189	334501	5785438	221	323726	5759602
126	307715	5800313	158	321427	5805851	190	334732	5784467	222	323941	5758861
127	307286	5801147	159	321932	5805149	191	334979	5783499	223	324389	5758064
128	307080	5802119	160	322502	5804377	192	335140	5782513	224	323962	5757174
129	307269	5802363	161	322301	5803514	193	335236	5781520	225	323253	5756485
130	307703	5803031	162	322353	5802605	194	335274	5780521	226	322418	5755946
131	307964	5803713	163	322601	5801865	195	335245	5779522	227	321548	5755470
132	307990	5804628	164	322743	5801106	196	335170	5778527	228	320667	5755017
133	308370	5805526	165	322955	5800265	197	334996	5777543	229	319790	5754547
134	309240	5805939	166	323487	5799477	198	334738	5776580	230	318930	5754049
135	309925	5806040	167	323920	5798831	199	334231	5775731	231	318038	5753623
136	310676	5805757	168	323592	5798388	200	333606	5775005	232	317089	5753345
137	311040	5806165	169	324255	5797678	201	332881	5774446	233	316127	5753102
138	311610	5806471	170	324808	5796887	202	332294	5774145	234	315166	5752834
139	312127	5806214	171	325030	5795968	203	331782	5773367	235	314219	5752513
140	311982	5806789	172	325044	5795613	204	331235	5772664	236	313292	5752160
141	312907	5807036	173	325502	5794803	205	330975	5771710	237	312347	5751842
142	313557	5806600	174	325728	5794260	206	330534	5770824	238	311401	5751549
143	314321	5806490	175	326274	5793520	207	329965	5770016	239	310426	5751353
144	315047	5806255	176	326864	5792759	208	329243	5769335	240	309446	5751384
145	315743	5806011	177	327650	5792568	209	328435	5768803	241	308472	5751593
146	316376	5806347	178	328316	5793295	210	327683	5768607	242	307520	5751861
147	316714	5807249	179	329198	5793458	211	327551	5767644	243	306542	5752022
148	316825	5808242	180	330061	5792963	212	327164	5767011	244	305579	5752244
149	316606	5809116	181	330823	5792323	213	327257	5766090	245	304831	5752850
150	317229	5809756	182	331454	5791557	214	327284	5765156	246	304535	5753713
151	317913	5809110	183	331912	5790784	215	327093	5764311	247	303621	5753959
152	318710	5808985	184	332552	5790028	216	326462	5763543	248	302915	5754634



Appendix C - Extreme wave conditions

1% AEP maximum Hs and corresponding wind direction, Tp, mean wave direction				
Point ID	Wind Dir. [0, coming from]	Hs [m]	Tp [s]	Wave Dir. [0]
1	ENE	1.6	5.9	77
2	E	1.6	5.9	91
3	E	1.6	5.8	94
4	E	1.7	5.8	93
5	NE	1.5	5.4	60
6	NNE	1.5	5.5	37
7	NNE	1.4	5.5	34
8	NNE	1.4	5.3	34
9	NNE	1.4	5.3	24
10	NNE	1.6	5.5	24
11	N	1.8	5.7	3
12	N	1.8	5.7	6
13	N	1.8	5.7	6
14	N	1.6	5.5	4
15	N	1.8	5.4	4
16	N	1.7	5.4	12
17	N	1.7	5.4	14
18	N	1.8	5.2	346
19	N	1.7	5.2	143
20	N	1.8	5.2	356
21	W	1.7	5.3	278
22	WNW	1.6	5.1	297

1% AEP maximum Hs and corresponding wind direction, Tp, mean wave direction				
Point ID	Wind Dir. [0, coming from]	Hs [m]	Tp [s]	Wave Dir. [0]
23	WNW	1.7	5.1	299
24	N	1.7	5.2	350
25	N	1.6	5.2	351
26	N	1.7	5.2	317
27	N	1.7	5.1	356
28	N	1.7	5.1	4
29	N	1.7	5.0	22
30	N	1.7	4.9	331
31	N	1.7	4.9	2
32	N	1.6	5.1	118
33	N	1.6	5.1	7
34	N	1.6	5.1	11
35	N	1.6	5.1	12
36	NNE	1.5	4.8	37
37	NNE	1.5	4.6	36
38	NNE	1.5	4.3	38
39	ENE	1.4	5.1	71
40	ENE	1.0	4.9	73
41	W	1.0	4.1	273
42	W	1.3	4.1	276
43	N	1.4	4.2	350
44	N	1.3	4.3	353
45	N	1.4	4.4	357
46	N	1.4	4.4	29
47	N	1.1	4.3	11
48	NNE	0.7	4.6	39
49	ENE	1.0	4.4	70
50	ENE	1.2	4.4	75
51	E	1.1	4.5	97
52	E	1.4	4.6	93
53	E	1.2	4.4	88
54	ESE	1.0	4.2	115
55	ESE	1.4	4.2	112
56	ESE	1.3	4.2	118
57	SSE	1.1	4.1	153
58	SSE	0.7	4.1	156
59	S	1.1	4.1	182
60	SSW	1.2	4.0	203
61	WSW	1.2	4.0	242
62	S	1.1	3.9	180
63	SSE	1.2	4.0	155
64	WSW	1.3	3.9	241
65	E	1.4	5.0	101
66	W	1.6	4.3	263
67	E	1.4	5.0	100
68	ESE	0.9	4.8	113

1% AEP maximum Hs and corresponding wind direction, Tp, mean wave direction				
Point ID	Wind Dir. [0, coming from]	Hs [m]	Tp [s]	Wave Dir. [0]
69	SSE	0.9	4.4	155
70	SSW	1.2	4.2	198
71	SSW	1.3	4.2	201
72	S	1.1	4.3	178
73	SW	1.5	4.5	220
74	WSW	1.3	4.5	238
75	WSW	1.5	4.5	242
76	WSW	1.4	4.6	237
77	ENE	1.5	5.4	80
78	ENE	1.4	5.3	79
79	ENE	1.4	5.3	81
80	E	1.4	5.3	96
81	E	1.4	5.2	97
82	ESE	1.4	4.9	113
83	ESE	1.4	5.0	112
84	E	1.5	5.2	93
85	E	1.4	5.2	95
86	ESE	1.3	5.1	115
87	ESE	1.4	5.1	120
88	ESE	1.6	5.1	118
89	ESE	1.5	5.2	119
90	ESE	1.3	5.2	120
91	ESE	1.3	5.2	125
92	SSE	1.5	4.9	156
93	ESE	1.5	5.3	120
94	ESE	1.4	5.3	120
95	SSE	1.4	4.9	155
96	SSE	1.4	4.9	157
97	SSE	1.5	5.0	157
98	S	1.4	4.9	176
99	S	1.4	4.9	177
100	S	1.3	4.8	178

1% AEP maximum Hs and corresponding wind direction, Tp, mean wave direction				
Point ID	Wind Dir. [0, coming from]	Hs [m]	Tp [s]	Wave Dir. [0]
101	SSE	1.5	5.0	158
102	SSE	1.5	5.0	157
103	ESE	1.5	5.7	117
104	ESE	1.5	5.8	114
105	ESE	1.5	5.8	114
106	ESE	1.4	5.8	117
107	ESE	1.0	5.7	120
108	ESE	1.1	5.7	120
109	SSE	1.5	5.3	151
110	SSE	1.5	5.2	154

1% AEP maximum Hs and corresponding wind direction, Tp, mean wave direction				
Point ID	Wind Dir. [0, coming from]	Hs [m]	Tp [s]	Wave Dir. [0]
111	ESE	1.6	5.6	119
112	ESE	1.5	5.4	116
113	ESE	1.5	5.4	117
114	ESE	1.4	5.3	117
115	SSE	1.4	5.3	150
116	SSE	1.5	5.3	150
117	S	1.6	5.4	169
118	S	1.6	5.4	172
119	S	1.5	5.4	172
120	SSE	1.5	5.5	151
121	SSE	1.5	5.6	147
122	SSE	1.5	5.7	153
123	S	1.3	5.6	175
124	SSE	1.6	5.8	152
125	S	1.8	5.8	169
126	S	2.1	5.9	169
127	SE	1.5	5.7	132
128	ESE	1.5	5.5	114
129	ESE	1.6	5.5	117
130	SSE	1.6	5.8	144
131	SSE	1.5	5.7	147
132	SE	1.5	5.4	130
133	SSE	1.3	5.5	146
134	SSE	1.3	5.6	154
135	S	1.0	5.7	166
136	S	1.5	5.5	177
137	S	1.5	5.4	170
138	S	1.3	5.3	175
139	S	1.6	5.4	175
140	SE	1.1	5.0	142
141	S	0.9	5.3	183
142	S	1.1	5.5	177
143	SSW	1.2	5.6	193
144	S	0.7	5.6	181
145	SSW	1.4	5.6	194
146	SSW	1.3	5.6	191
147	S	1.1	5.2	158
148	S	1.2	4.2	167
149	SSE	1.2	4.2	150
150	S	0.9	4.4	177
151	SSW	1.3	5.0	197
152	SSW	1.3	5.1	203
153	SSW	0.8	5.1	207
154	SW	0.8	5.1	220
155	SW	1.1	5.2	222
156	WSW	1.6	5.2	239

1% AEP maximum Hs and corresponding wind direction, Tp, mean wave direction				
Point ID	Wind Dir. [0, coming from]	Hs [m]	Tp [s]	Wave Dir. [0]
157	WSW	1.1	5.0	242
158	W	1.3	5.2	257
159	W	0.6	5.4	254
160	W	0.9	5.4	257
161	W	1.2	5.2	266
162	W	1.5	5.5	264
163	W	1.4	5.6	265
164	W	1.3	5.8	261
165	W	1.2	5.8	255
166	W	1.4	5.9	256
167	W	1.2	5.9	263
168	W	1.7	5.9	261
169	W	1.0	5.9	254
170	WSW	0.9	5.9	241
171	W	1.6	6.0	266
172	W	1.5	6.1	258
173	W	1.7	6.1	259
174	W	1.9	6.2	256
175	W	1.9	6.2	252
176	W	1.6	6.1	255
177	SSW	1.9	5.9	191
178	S	1.2	5.6	174
179	SSW	1.5	5.7	203
180	SW	1.7	5.8	221
181	SW	1.7	5.7	224
182	W	1.4	6.1	251
183	WSW	1.6	5.9	238
184	W	1.7	6.1	256
185	W	1.7	6.2	259
186	W	1.9	6.2	259
187	W	1.8	6.3	260
188	W	1.9	6.4	262
189	W	1.6	6.4	264
190	W	1.7	6.3	263
191	W	1.7	6.4	265
192	W	1.9	6.5	264
193	W	2.0	6.6	269
194	W	1.8	6.6	270
195	W	1.9	6.6	272
196	W	1.9	6.5	272
197	W	1.9	6.5	276
198	W	1.8	6.4	278
199	WNW	1.8	6.1	297
200	NNW	1.8	5.8	308

1% AEP maximum Hs and corresponding wind direction, Tp, mean wave direction									
Point ID	Wind Dir. [0, coming from]	Hs [m]	Tp [s]	Wave Dir. [0]	Point ID	Wind Dir. [0, coming from]	Hs [m]	Tp [s]	Wave Dir. [0]
201	NNW	1.8	5.8	308	226	NNW	1.6	6.4	337
202	W	1.9	6.0	277	227	N	1.8	6.6	348
203	WNW	1.5	6.0	300	228	N	1.8	6.6	346
204	W	1.7	6.1	279	229	NNW	1.7	6.4	335
205	W	1.8	6.1	278	230	N	1.6	6.5	348
206	WNW	1.7	6.1	294	231	N	1.8	6.4	353
207	WNW	1.7	6.4	301	232	N	1.7	6.2	356
208	NNW	1.7	6.4	326	233	N	1.7	6.3	123
209	NNW	1.8	6.5	332	234	N	1.7	6.0	324
210	W	1.8	6.2	277	235	N	1.7	5.8	139
211	WNW	1.9	6.5	298	236	N	1.2	5.9	211
212	W	2.2	6.3	272	237	N	2.0	5.9	356
213	W	1.7	6.1	271	238	N	2.1	5.8	58
214	WNW	1.8	6.2	287	239	N	1.2	5.8	6
215	WNW	1.8	6.1	296	240	N	1.6	5.8	13
216	NW	1.9	6.2	313	241	N	1.1	4.7	16
217	NNW	1.6	6.5	324	242	N	1.4	5.2	9
218	NNW	2.0	6.1	327	243	N	1.2	4.5	356
219	NNW	1.2	6.1	320	244	N	1.4	4.4	8
220	NNW	1.7	6.2	320	245	NE	1.3	4.2	60
221	NNW	1.5	6.3	322	246	N	1.5	4.2	5
222	W	1.6	5.5	262	247	NNE	1.4	4.0	27
223	W	1.5	5.7	274	248	NNE	1.2	4.3	24
224	WNW	1.4	5.8	298					
225	NNW	1.8	6.4	331					

Appendix D - Net longshore wave power

Net Longshore Wave Power [N/s] Note: Direction convention is negative wave power is directed clockwise around the bay and positive wave power is directed anticlockwise			
Point ID	Annual	Summer	Winter
1	55	-57	195
2	69	-52	221
3	56	-86	233
4	58	-122	279
5	48	-94	227
6	56	-97	248
7	78	-34	224
8	19	-85	146
9	28	-64	141
10	33	-90	177
11	44	-78	184
12	19	-59	103
13	4	-42	46
14	-13	-38	-11
15	13	-17	36
16	-5	-38	25
17	-64	-40	-119
18	13	30	-40
19	107	206	-15
20	75	101	8
21	109	106	88
22	84	80	64
23	92	82	76
24	67	66	38
25	69	68	43
26	32	47	-17
27	27	34	-9
28	-4	18	-54
29	2	21	-47
30	21	25	-3
31	-7	12	-51
32	-7	7	-42
33	-6	-5	-20
34	-5	-25	12
35	17	-28	67
36	-5	-50	43
37	10	-51	75
38	45	-25	120
39	-3	-64	54
40	2	3	-5
41	17	24	3
42	44	40	43
43	-1	16	-38
44	-4	15	-40

Net Longshore Wave Power [N/s] Note: Direction convention is negative wave power is directed clockwise around the bay and positive wave power is directed anticlockwise			
Point ID	Annual	Summer	Winter
45	7	-1	13
46	-23	-5	-51
47	0	-15	16
48	-1	-8	8
49	11	-5	32
50	21	-1	52
51	4	-14	23
52	18	-5	49
53	9	-8	28
54	-7	-31	17
55	-14	-43	14
56	-10	-38	14
57	-14	-30	-2
58	10	16	5
59	-41	-79	-11
60	-1	32	-23
61	-17	-8	-18
62	-15	-17	-9
63	-12	-19	-4
64	18	90	-36
65	-3	-20	16
66	-19	-41	6
67	-2	-20	16
68	-12	-24	-3
69	-22	-42	-5
70	-54	-94	-19
71	-34	-53	-13
72	-59	-101	-25
73	-37	-17	-43
74	-42	-28	-44
75	-35	-48	-8
76	-21	-62	27
77	-31	-53	-6
78	-8	-35	23
79	6	-34	52
80	2	-52	70
81	-13	-76	63
82	-31	-95	42
83	-23	-73	30
84	-25	-70	16
85	-21	-64	18
86	-21	-63	11
87	-23	-69	11
88	-43	-57	-44
89	-53	-77	-44

Net Longshore Wave Power [N/s] Note: Direction convention is negative wave power is directed clockwise around the bay and positive wave power is directed anticlockwise			
Point ID	Annual	Summer	Winter
90	-69	-154	5
91	-59	-128	-2
92	-78	-167	-5
93	-88	-181	-5
94	-73	-157	-2
95	-45	-104	2
96	-29	-77	10
97	-6	-28	20
98	-7	-28	15
99	-19	-47	8
100	1	5	5
101	9	25	6
102	-6	-24	17
103	1	-25	31
104	13	-9	41
105	10	-17	37
106	0	-29	21
107	-32	-76	5
108	-41	-108	17
109	-75	-168	1
110	-65	-151	1
111	-64	-153	5
112	-51	-133	11
113	-56	-144	14
114	-46	-120	13
115	-89	-199	-1
116	-57	-136	1
117	-60	-137	-1
118	-31	-78	8
119	-26	-76	17
120	-56	-146	13
121	-65	-145	-1
122	-17	-47	7
123	-100	-202	-16
124	-148	-304	-23
125	-157	-307	-7
126	-158	-295	0
127	-105	-227	29
128	-91	-209	19
129	-103	-228	16
130	-121	-251	4
131	-132	-273	-7
132	-106	-217	-12
133	-63	-138	-3
134	-11	-28	1

Net Longshore Wave Power [N/s] Note: Direction convention is negative wave power is directed clockwise around the bay and positive wave power is directed anticlockwise			
Point ID	Annual	Summer	Winter
135	-16	-34	-3
136	-186	-363	-43
137	-172	-334	-42
138	-66	-121	-17
139	-92	-181	-16
140	4	5	3
141	18	52	-6
142	-24	-32	-15
143	-79	-138	-27
144	-25	-32	-16
145	-117	-192	-48
146	-100	-189	-27
147	-68	-160	11
148	-41	-92	14
149	-27	-67	6
150	5	13	-2
151	16	65	-20
152	9	48	-14
153	4	32	-14
154	14	50	-12
155	30	97	-16
156	62	239	-80
157	54	128	-3
158	77	170	3
159	-1	28	-23
160	27	75	-13
161	101	179	28
162	144	318	-13
163	66	191	-34
164	64	183	-32
165	8	98	-59
166	-39	36	-89
167	-3	89	-76
168	196	305	67
169	48	159	-41
170	20	75	-24
171	180	448	-52
172	150	439	-91
173	-15	264	-221
174	-48	265	-275
175	-28	224	-211
176	-253	-149	-299
177	-140	-119	-124
178	-110	-203	-34
179	-127	-176	-73

Net Longshore Wave Power [N/s] Note: Direction convention is negative wave power is directed clockwise around the bay and positive wave power is directed anticlockwise			
Point ID	Annual	Summer	Winter
180	-9	107	-85
181	3	148	-95
182	-19	96	-99
183	26	254	-145
184	-31	162	-170
185	-36	162	-184
186	-10	219	-187
187	14	245	-171
188	-17	217	-202
189	-7	185	-166
190	39	255	-146
191	67	312	-150
192	12	218	-171
193	17	244	-192
194	27	220	-160
195	83	278	-123
196	89	242	-80
197	68	223	-116
198	145	230	10
199	188	220	94
200	189	167	168
201	79	102	12
202	216	224	148
203	56	119	-32
204	103	167	14
205	24	130	-108
206	75	129	-10
207	57	78	14
208	-35	44	-139
209	-13	29	-76
210	200	266	108
211	57	130	-43
212	135	233	1
213	9	160	-148
214	-32	86	-159
215	-49	82	-215
216	86	147	-38
217	122	140	52
218	-40	136	-281
219	-41	44	-153
220	-29	66	-158
221	21	94	-78
222	-182	-95	-232
223	116	120	87
224	42	69	-7

Net Longshore Wave Power [N/s] Note: Direction convention is negative wave power is directed clockwise around the bay and positive wave power is directed anticlockwise			
Point ID	Annual	Summer	Winter
225	90	94	31
226	109	93	93
227	50	69	-25
228	68	84	-8
229	147	122	128
230	153	124	151
231	68	75	12
232	152	136	136
233	57	82	-4
234	124	113	107
235	18	52	-60
236	117	79	150
237	68	56	61
238	4	16	-47
239	20	10	21
240	-9	-16	-25
241	-1	-16	2
242	4	-20	21
243	16	-8	36
244	-15	-36	-2
245	-42	-61	-26
246	35	-43	127
247	2	-42	51
248	-26	-55	4

ASSOCIATION OF BAYSIDE MUNICIPALITIES

Level 12, 60 Collins Street
Melbourne 3000
GPO BOX 4326PP
MELBOURNE VIC 3001

Phone (03) 96675536
Email abm@mav.asn.au
Website abm.org.au