Infrastructue NSW

Walsh Bay Arts Precinct

Wind Impact Study

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1 Executive Summary

This report outlines the results of a high level desktop study for local wind conditions at the Walsh Bay Arts Precinct, Sydney.

The report supports the Stage 2 State Significant Development Application by addressing the SEARS requirement (SSD 7689, Item 7) for environmental amenity of the project in terms of wind impacts. The study comprises a climate data analysis for the site, impacts of local geometry and potential design recommendations to facilitate improvements during specific wind conditions.

Given that the redevelopment proposes no significant changes to the existing massing of the buildings, there will be no expected change in local wind patterns post-redevelopment compared to current massing. This also means any suggested mitigation measures will be limited to small scale measures such as wind breaks via screening and planting. Any mitigations implemented will improve the conditions relative to the current massing.

2 Site and Project Description

2.1 The Site and surrounds

The Walsh Bay Arts Precinct (WBAP) (the "site") generally comprises Pier 2/3, Pier 4/5 and its shore sheds which make up Wharf 4/5, as well as the adjoining waterway. The site has a street frontage to Hickson Road. The site is shown in Figures 1 and 2. The site is part of the Walsh Bay area which is located adjacent to Sydney Harbour within the suburb of Dawes Point. The site is located within the City of Sydney Local Government Area.

Walsh Bay is strategically located to the north of Sydney's CBD in the vicinity of major tourist destinations including the Sydney Harbour Bridge, the historic areas of Millers Point and The Rocks, Circular Quay and the Sydney Opera House.

Figure 1Site location (Source: Google Maps)

Figure 2 Aerial view (Source: www.nearmap.com)

The immediate surrounds include the water to the north and north east, Sydney CBD and Barangaroo commercial development to the south and south west, with the Barangaroo Reserve to the west. This makes the site relatively exposed to the north and north east but generally well protected from the south. The site elevation is lower than Sydney Observatory Hill which offers further protection to the south. The walkway between all piers / wharfs creates a corridor towards Barangaroo Reserve which exposes the Waterfront Square to the west.

The approved Stage 1 development application comprised:

- A new waterfront public square between Pier 2/3 and Wharf 4/5;
- A series of new stairs and balconies on Pier 2/3 and Wharf 4/5 and modification to the roof of Pier 2/3;
- The inclusion of flexible and adaptive spaces in Pier 2/3 and Wharf 4/5 for arts and cultural activities; and,
- The use of the precinct for arts festivals, events and pop-ups and associated uses, including restaurants, cafes and bars.

The Walsh Bay Arts Precinct (WBAP) Stage 2 State Significant Development Application seeks consent for construction works for the above to realise the WBAP project, as well as the proposed external alterations and additions to all of Wharf 4/5. It also seeks consent for new commercial and event uses in the precinct.

3 Site Analysis

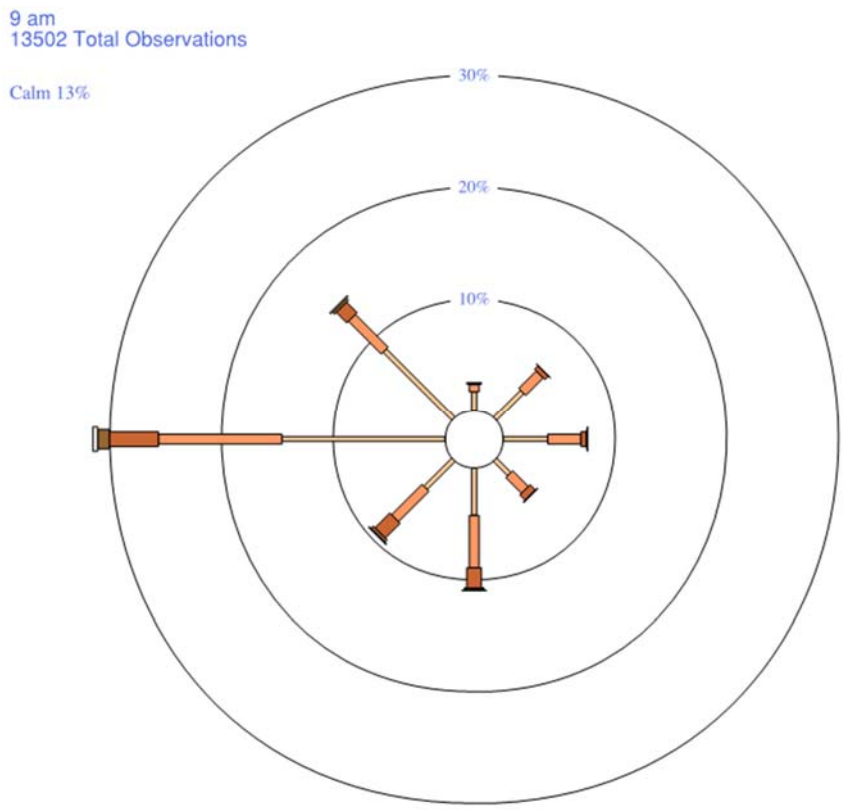
3.1 Weather Data

Weather data collected by the Bureau of Meteorology at Sydney Observatory Hill has been analysed for wind speed and direction.

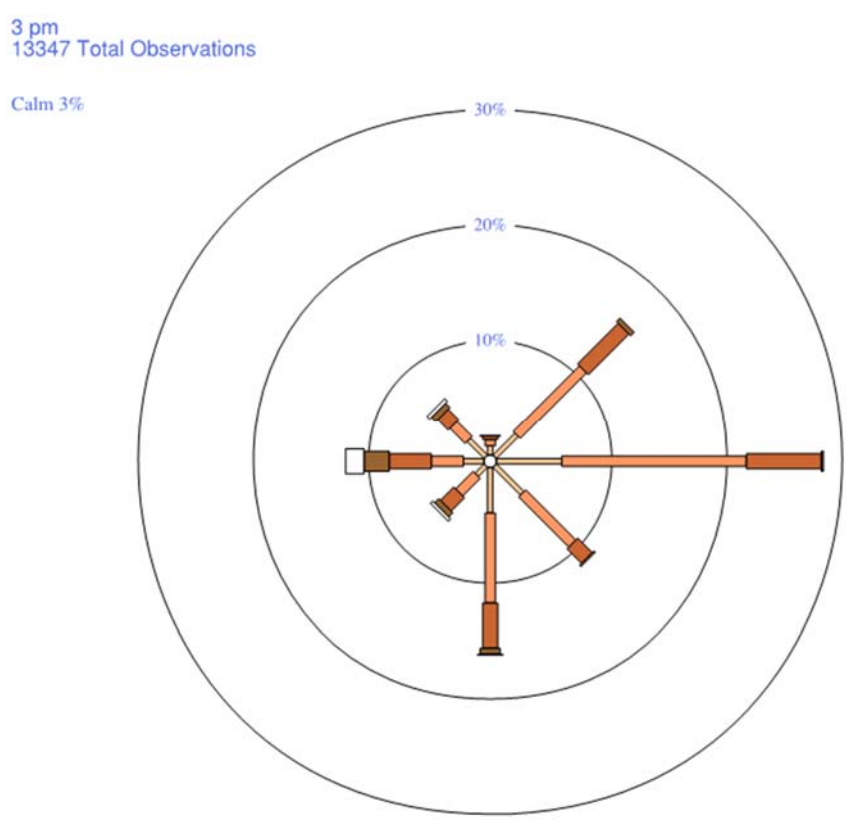
Annual records allow identification of prevailing wind directions for the site, including daily changes from morning to afternoon.

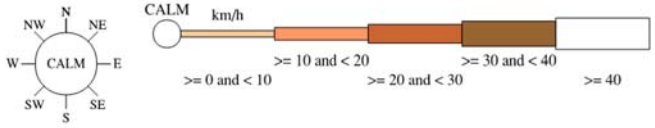
Annual wind rose plots are presented on the following page identifying these key wind directions.

Morning



Afternoon





3.2 Environmental wind speed criteria

The Beaufort Scale correlates wind speed to observed conditions at sea and on land. The latter helps to put the climate data into context so that expected wind speeds on site can be better understood.

Beaufort Number	Descriptive Term	Speed (km/h)	Speed (m/s)	Description on Land
0 -3	Calm to Light winds	0-20	0 – 6	Calm to light wind felt on face.
4	Moderate winds	20-30	6 – 8	Raises dust, loose paper. Small branches moved.
5	Fresh winds	30-40	8 – 11	Small trees being to sway.
6	Strong winds	>40	11+	Large branches sway, difficulty using umbrellas.

Table 1 Beaufort scale (Source: Bureau of Meteorology)

Based on the scale above, local wind speeds above 40 km/h (11 m/s, Beaufort Number 6) are undesirable as they begin to cause difficulty for people in public domains.

3.3 Prevailing winds

Based on the wind rose plots the following observations have been made:

- In the morning, west and north west winds are prevailing. There are occasionally fresh and moderate winds from the west, but for the majority of time winds are light, between 0 and 20 km/h (0 to 6 m/s) for both directions. Seaononal analysis shows that mid season and winter winds cause this prevailing morning trend.
- In the afternoon, north east, east and south winds are prevailing. The winds more frequently reach 20 to 30 km/h (6 to 8 m/s), but still for the majority of the time are considered light, falling between 10 and 20 km/h (3 to 6 m/s). Seasonoal analysis shows that mid season and summer winds cause the north east and east trends, whilst afternoon winter winds are predominantly from the south.

3.4 Impact of building geometry

Aside from minor changes to external access (stairs, lifts, balconies) the redevelopment proposes no significant changes to the general existing massing of the buildings. This means there will be no expected change in local wind patterns post-redevelopment compared to current conditions.

The image below indicates expected impacts of the existing geometry on local wind patterns, with a written summary following.

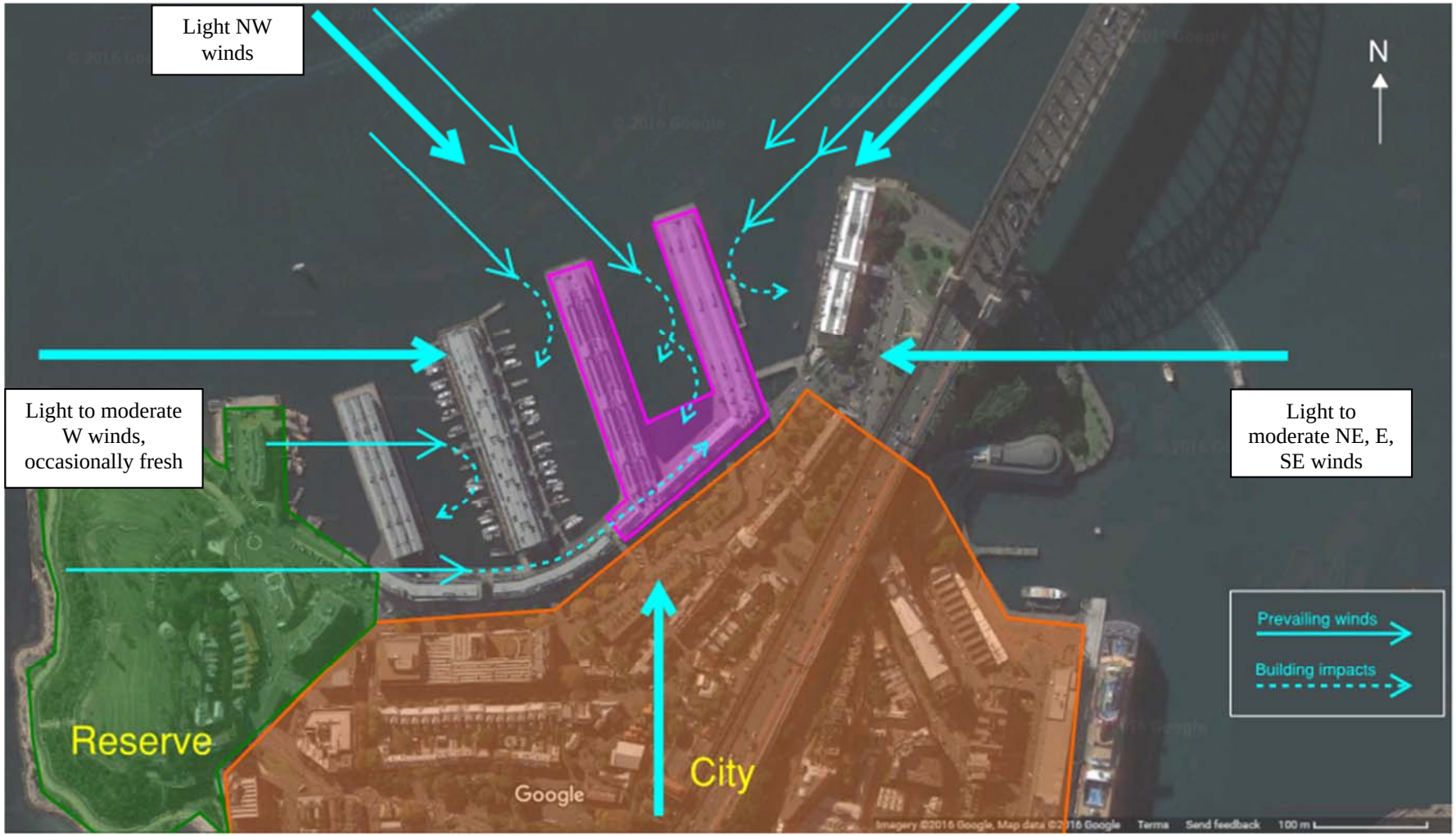


Figure 3 Prevailing wind conditions for site with expected impact building massing will have on local wind patterns

The following observations are made based on the current building massing which will not be significantly changed post-development:

- The site offers no protection to north winds, as buildings are orientated north-south, with the waterfront square fully exposed to oncoming north winds. Climate analysis shows prevailing winds for the site are not from the north direction.
- The east aprons of Pier 2/3 and Wharf 4/5 are exposed to north west winds. Pier 2/3 building offers some minor protection to Wharf 4/5 building from north-east and east winds. Climate analysis shows afternoon prevailing winds from this direction with speeds frequently reaching 6 to 8 m/s. Winds reaching the east façade of Wharf 4/5 will be slightly slowed by the obstructing Pier 2/3.
- The west aprons of Wharf 4/5 and Pier 2/3 are exposed to north west winds. Wharf 4/5 building offers limited protection to Pier 2/3 from north-west winds, with the orientation of buildings likely to capture wind from this direction and drive it towards the Waterfront Square. Climate analysis shows morning prevailing winds from this direction with lower wind speeds predominantly between 0 and 6 m/s. When moderate speeds (6 to 8 m/s) occur, local speed up may make the wind at the Waterfront Square feel fresh (Beaufort Number 5).
- The public access route connecting the site to adjacent piers, leading to Barangaroo Reserve leaves the Waterfront Square exposed to some minor wind tunnelling from this direction. West winds are a prevailing morning condition and the winds can be occasionally moderate to fresh, but for the most part are between 0 and 6 m/s. The geometry might cause some local speed up of air as wind moves between the piers and the elevated south topography adjacent to Hickson Road. As a result, light winds may be tunnelled to become moderate and fresh winds in the context of the Beaufort scale. At times when fresh winds occur, this tunnelling may result in strong winds occasionally occurring at the entrance to and on the Waterfront Square.
- The elevated south topography adjacent to Hickson Road / Observatory Hill means the buildings are already well protected from afternoon south winds.

3.5 Impact of wind on wave action

Refer to the Metocean Conditions Report prepared by Arup which discusses the wave climate for the site and in the vicinity of the Waterfront Square, including wind-generated waves.

4 Potential issues and mitigation measures

From reviewing the climate data and local geometry, the following key scenarios have been identified where mitigation measures for the site may be of use:

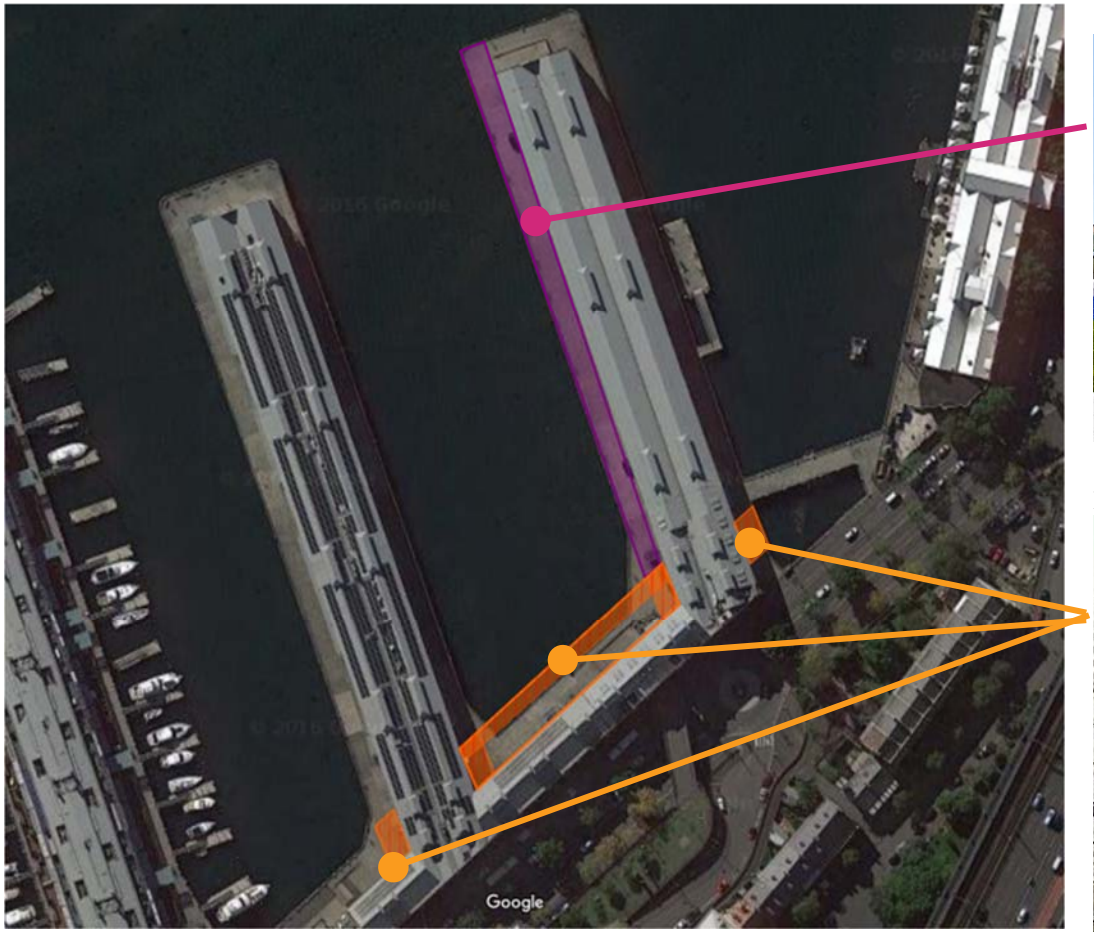
The Waterfront Square

- The Waterfront Square is expected to function as a space where the public would be present for more prolonged periods. Mitigating measures in this area may help reduce local speed up from tunnelling effects of west winds. As building massing is to remain unchanged during development due to heritage nature of the project, small-scale, local mitigation measures could be explored at the east and west immediately adjacent to the Waterfront Square.
- Trees or planting with dense foliage or wind blocks (screens or the like) could be positioned to lift winds above pedestrian level and slow higher moderate and fresh winds speeds. The image below shows an example of proposed wind blocks and/or vegetation placement to shield from the west and east winds.
- Light morning winds from the north west that are captured by Pier 2/3 and driven towards the Waterfront Square could be mitigated with planting or blocks at the north of the Square to act as a screen to oncoming winds.

East and West aprons of Wharf 4/5 and Pier 2/3

- It is expected the aprons will be used predominantly as a transient space rather than for prolonged stays. As such, mitigation measures here are less critical. However, screening with wind blocks could help to slow oncoming north west winds towards pedestrians in this area with the added effect of slowing winds towards the Waterfront Square.

Any mitigation measures would need to be developed in context of the heritage nature of the development.



Example of wind screens

Source: **http://www.pierrepoussin.com/** and **http://www.urbandesignsystems.com.au/**

Example of planting screens

Source: Google

5 Conclusion and Recommendations

Climate analysis shows prevailing morning winds from north west and west directions, with afternoon winds predominantly from south east, east and south directions. Data shows that more often than not, wind speeds are moderate or light, falling below 30 km/h.

The existing geometry is likely to cause some local speed up of winds from the west and north west moving towards the Waterfront Square, where patrons are expected to be using the space for more prolonged periods.

Local planting or screens to the east / west entrances to the Waterfront Square and towards the north will help to slow winds in this area.

Screens along the west apron of Pier 2/3 would facilitate a slowing of north-west winds, further improving wind conditions at the Waterfront Square.

The aprons themselves are expected to be used predominantly for walking / transient activities and so mitigation to these areas is less critical.

The redevelopment proposes no significant changes to the general existing massing of the buildings. This means there will be no expected change in local wind patterns post-redevelopment compared to current massing. Any ameliorations implemented as part of the new development will be an improvement on the current conditions and would need to be selected within the heritage context of the development.