Bank Street Park
Blackwattle Bay / Tjerruing

SSD-53386706

Appendix AK

Pedestrian Wind Environment Statement (Windtech)

December 2023

PEDESTRIAN WIND ENVIRONMENT STATEMENT

BANK STREET PARK, BLACKWATTLE BAY

WD758-25F02- WS REPORT (REV1)

NOVEMBER 28, 2023

Prepared for:

Infrastructure NSW (INSW)

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DOCUMENT CONTROL

Date	Revision History	Issued Revision	Prepared By (initials)	Instructed By (initials)	Reviewed & Authorised by (initials)
August 4, 2023	Initial.	0	PS/GC	MM	EV
October 20, 2023	Updated with new plans and INSW comments	1	GC	MM	GC/MM
November 28,2023	Updated with INSW Comments	2	GC	MM	GC/MM

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EXECUTIVE SUMMARY

This report presents an opinion on the likely impact of the Bank Street Park, located at 1A-19 Bank Street, Pyrmont, which includes the harbour development within Blackwattle Bay, on the local wind environment at the critical outdoor areas within and around the subject site. This report addresses the Secretary's Environmental Assessment Requirements (SEARs) Item 4 and Item 8 (App. No.: SSD-53386706).

The effect of wind activity has been examined for the three predominant wind directions for the region, namely the north-easterly, southerly, and westerly winds. The analysis of the wind effects relating to the proposed park have been carried out in the context of the local wind climate, building morphology and land topography.

Wind tunnel testing of the adjacent Blackwattle Bay masterplan was previously undertaken by Windtech Consultant (Ref: WD758-22F01(rev0)- WE Report, dated 9 June 2022). The results of the wind tunnel study are based on the layout of the existing 1A-19 Bank Street, Pyrmont site and thus are only used in this report to inform the wind conditions of the proposed design of the Bank Street Park. No wind tunnel testing has been undertaken for the current design of the park, and the conclusions of this report are predominantly drawn from our extensive experience in this field and are based on an examination of the latest plans (received 16 October 2023). However, considering the park's low-lying structures, the incorporation of dense vegetation and the absence of substantial projected structures in the design of the park that might affect wind conditions and make it incomparable to the conditions tested in previous wind tunnel tests, Windtech believes that further wind tunnel testing can be avoided. Any recommendations in this report are made only in-principle and are based on our experience in the study of wind environment effects.

The results of this assessment indicate that the proposed Bank Street Park is not expected to result in the development of adverse wind impacts within the Bank Street Park and the wider Blackwattle Bay Masterplan. The current park design has incorporated several design features and wind mitigating strategies and is expected to be suitable for the intended use for all the trafficable areas. It is recommended to retain the following features in the final design:

- Inclusion of all proposed dense tree planting and landscaping within and around the park, and including of an additional line of trees to the western aspect of the Marina area.

- Inclusion of the proposed batten fence around Dragon boat deck (30% maximum porosity).

With the inclusion of the abovementioned recommendations in the final design, it is expected that wind conditions for the various trafficable outdoor areas within and around the development will be suitable for their intended uses, and that the wind speeds will satisfy the applicable criteria for pedestrian comfort and safety. Hence, the current proposed design for the Bank Street Park ensures that SEAR conditions 4 and 8, as well as all wind-related Blackwattle Bay Design guidelines, will be achieved.

CONTENTS

1 INTRODUCTION

The purpose of this report is to provide an opinion on the likely wind impacts on the critical outdoor areas within and around the subject development, to support a State Significant Development Application (SSDA) for a new waterfront public park within Blackwattle Bay, to be known as Bank Street Park (SSD-53386706). Bank Street Park is located at 1A-19 Bank Street, Pyrmont on the shoreline of Tjerruing Blackwattle Bay and adjacent areas of Blackwattle Bay.

No wind tunnel testing has been undertaken for the current design of the Bank Street Park. This report addresses the general wind effects and any localised effects that are identifiable by visual inspection, and any recommendations in this report are made in-principle. However, Windtech believes that wind tunnel testing is not required. This is because the park incorporates:

- Low-lying structures,
- Dense vegetation,
- An absence of substantial projected structures in the design of the park that might affect wind conditions and make it incomparable to the conditions tested for Blackwattle Bay Masterplan (Ref: WD758-22F01(rev0)- WE Report, dated 9 June 2022).

Results from the aforementioned wind tunnel study indicate that the majority of the wind conditions within and around the masterplan satisfy the relevant comfort and safety criterions, due to how the design of the building forms respond to the prevailing winds to reduce the effect of the north-easterly, southerly, and westerly prevailing winds. Adverse wind conditions were primarily observed in the through-site link between the future massing towers, with no adverse wind conditions were recorded at the north-western end of the masterplan, where the proposed new park will be located.

1.1 Blackwattle Bay Precinct

Bank Street Park forms part of the Blackwattle Bay Precinct, which is an area of predominantly government owned land located on the western edge of the Pyrmont Peninsula and adjoining the waters of Blackwattle Bay (Figure 1).

Figure 1: Blackwattle Bay Precinct.
Source: INSW

The precinct was rezoned in December 2022 to facilitate a new mixed-use community, providing for around 2,000 new residents and 5,600 new jobs and creating a vibrant 24/7 economy. Updated planning and land use controls were incorporated into the Sydney Local Environmental Plan 2012, along with site specific design guidance in the Blackwattle Bay Design Guidelines.

A critical part of the Blackwattle Bay Precinct is the high quality public domain which includes a series of parks and open spaces connected by a foreshore promenade. Bank Street Park will bring new active and passive recreation uses into a unique park environment, catering for both existing and future communities in the vicinity.

1.2 Site Description

Bank Street Park is located at 1A-19 Bank Street, Pyrmont NSW within the City of Sydney local government area (LGA) and includes harbour development in Blackwattle Bay. The site area is approximately 1.9 hectare (including 0.7 hectare of harbour). The relevant lot and deposited plans and the respective ownership for the site are detailed in Table 1 and shown in Figure 2.

Table 1: Summary of land title details of the site

Street address	Lot and Deposited Plan details	Ownership
1A Bank Street, Pyrmont NSW 2009	Lot 1 DP 85206	Transport for NSW
1-3 Bank Street, Pyrmont NSW 2009	Lot 1 DP 188671	Infrastructure NSW
5 Bank Street, Pyrmont NSW 2009	Lots 1-2 DP 1089643	Transport for NSW
7 Bank Street, Pyrmont NSW 2009	Lot 1 DP 439245	Transport for NSW
9 Bank Street, Pyrmont NSW 2009	Lot 20 DP 803159	Transport for NSW
11 Bank Street, Pyrmont NSW 2009	Lot 19 DP 803159	Transport for NSW
17-19 Bank Street, Pyrmont NSW 2009	Lot 21 DP 803159	Transport for NSW
Sydney Harbour	Lot 22 DP 803159	Roads and Maritime Services (Transport for NSW)
Sydney Harbour	Lots 5-6 DP 803160	Transport for NSW
Part Bank Street Road reserve	Lot 5 DP 1209992	City of Sydney Council

Bank Street Park is located on Gadigal Land, one of the twenty-nine clans of the great Eora Nation. It adjoins the foreshores of Glebe to the west and Pyrmont Bridge Road and Wentworth Park to the south.

Figure 2: Site context map.
The indicative site location is outlined in red.
Source: SixMaps with Architectus edits (2023)

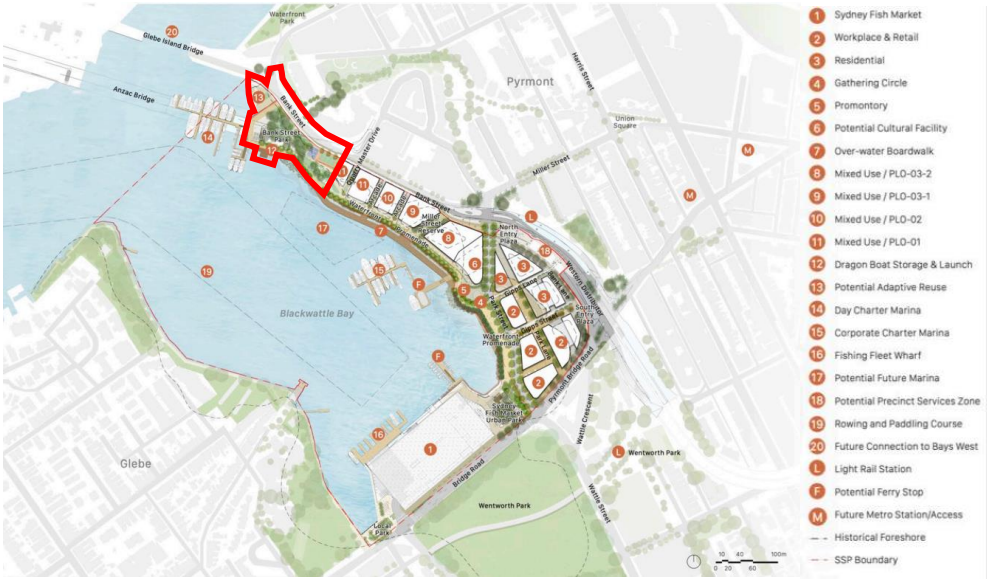

Figure 3: Bank Street Park site location within Blackwattle Bay State Significant Precinct
The indicative site outline is outlined in red.
Source: Blackwattle Bay Design Guidelines with Architectus edits (2023)

1.3 Proposed development

Development consent is being sought for a recreation area for the primary purpose of a public park, comprising:

- Site preparation works, including tree removal, earthworks and remediation to facilitate the proposed use;
- Demolition of three existing buildings at 1-3 Bank Street;
- New and adapted facilities for community use, including:
    - New single storey building to accommodate flexible community space, café, and marina office/store facilities, with green roof and photovoltaics;
    - Adaptive reuse of Building D for public amenities, bin and other storage;
    - Boat launching ramp and pontoon for passive watercraft, including dragon boats and kayaks;
    - Boat storage building with change facilities for dragon boat users with publicly accessible rooftop deck;
- Public domain works, including:
    - 'Interpretation Garden' in existing building 'ruins' at 1-3 Bank Street;
    - Split level foreshore promenade;
    - Multi-purpose court with edge seating and partial fence;
    - Nature-based inclusive playspace for ages 2-12;
    - Fitness equipment;
    - Public plaza and grassed open space areas;
    - New tree plantings and planter beds;
    - Public art, wayfinding and interpretative signage, lighting, bike parking and seating;
- Harbour works including:
    - Overwater boardwalk;
    - Land/water interface works, including sandstone terracing into water and support structure, to improve marine habitat;
    - Demolition and construction of a new timber launching ramp for dragon boats;
    - Kayak/passive craft pontoon; and

- Restoration, repair and alterations to the existing seawall for new stormwater outlets.

- Works to Bank Street road reserve, including:
  - Road space reallocation to provide separated cycleway;
  - Cycleway transition to Bank Street to continue south as part of future works;
  - Reinstatement of existing on-street parallel parking;
  - Tree planting;
  - Accessible parking space; and
  - Loading zone adjacent 1-3 Bank Street.

1.4 Planning Secretary's Environment Assessment Requirements

This report has been prepared in response to the relevant requirements outlined within the Planning Secretary's Environmental Assessments Requirements (SEARs) issued on 11 May 2023 for application SSD-53386706. Table 2 addresses the relevant SEARs requirements and provides a project response.

Table 2: Secretary's Environmental Assessments Requirements

Item	SEARs	Relevant report section(s)
4	• Landscape Design and Public Domain o Consider how the proposed design responds to the context, site constraints (land contamination, hydrology, flooding, wind etc) site opportunities, access and circulation, heritage, character and visual amenity, character and spatial qualities for play and recreation, streetscape and existing and future character of the locality, including the interface with the water and future development of the Blackwattle Bay Precinct.	Section 5.
8	• Environmental Amenity o Assess amenity impacts on the surrounding locality including lighting impacts, wind, noise and vibration	Section 5.

2 DESCRIPTION OF DEVELOPMENT AND SURROUNDINGS

The site is bounded by Bank Street to the north-east, Glebe Island Bridge to the north and Blackwattle Bay from the south to north-west. The buildings surrounding the subject development are predominately high-rise residential and commercial buildings to the east of the proposed development.

A survey of the land topography indicates a significant slope to the east of the proposed site. There are no major elevation changes within the proposed site.

An aerial image of the subject site and the local surroundings is shown in Figure 4, with the frequency and magnitude of the prevailing winds is superimposed for each wind direction.

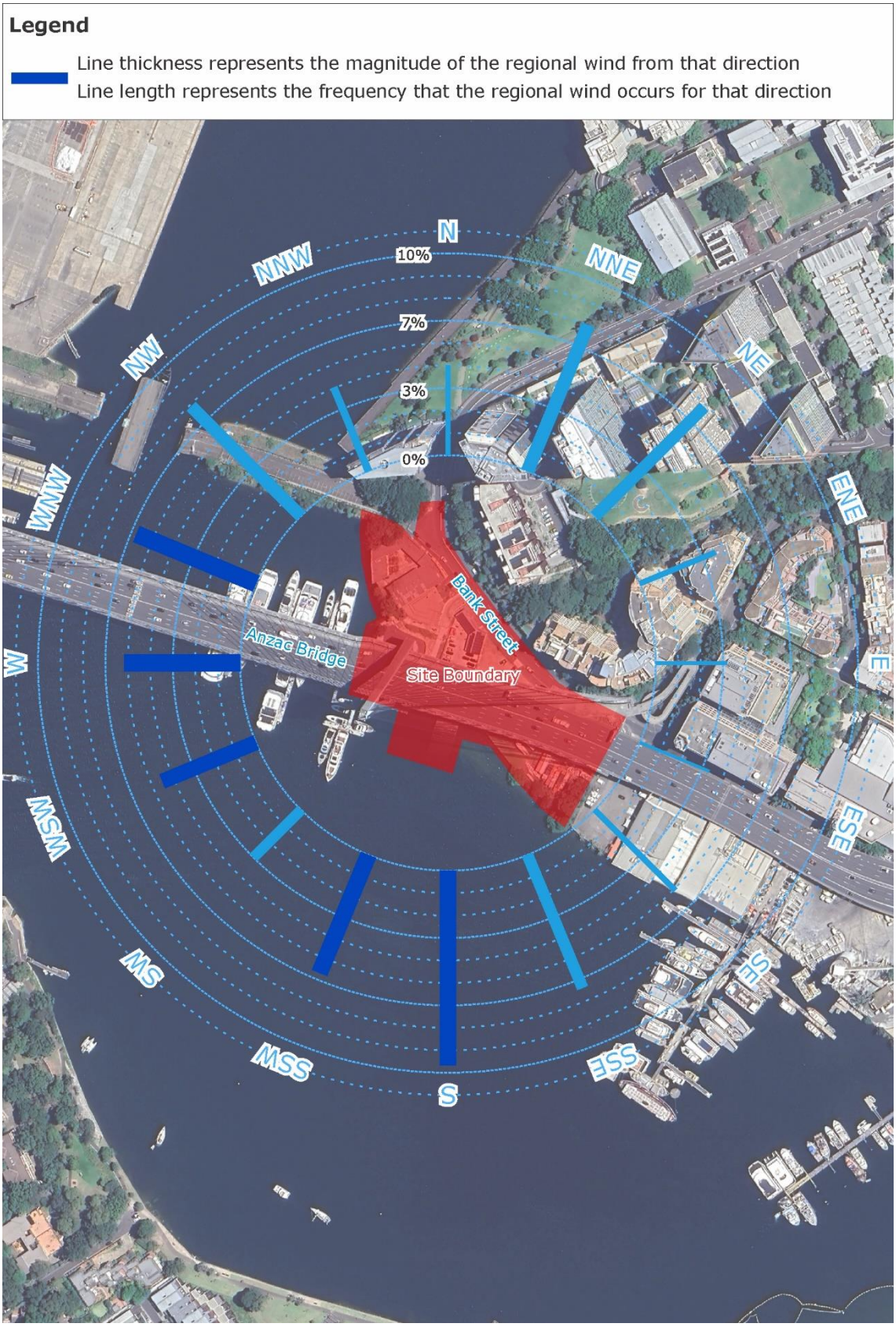

Figure 4: Aerial Image of the Site Location and Prevailing Wind Directions

3 REGIONAL WIND

The Sydney region is governed by three principal wind directions that can potentially affect the subject development. These winds prevail from the north-east, south, and west. These wind directions were determined from an analysis undertaken by Windtech Consultants of recorded directional wind speeds obtained from the meteorological station located at Kingsford Smith Airport by the Bureau of Meteorology (recorded from 1995 to 2016). The data has been corrected to represent winds over standard open terrain at a height of 10m above ground level. The results of this analysis are presented in Figure 5 in the form of a directional plot of the annual and 5% exceedance mean winds for the region. The frequency of occurrence of these winds is also shown in Figure 5.

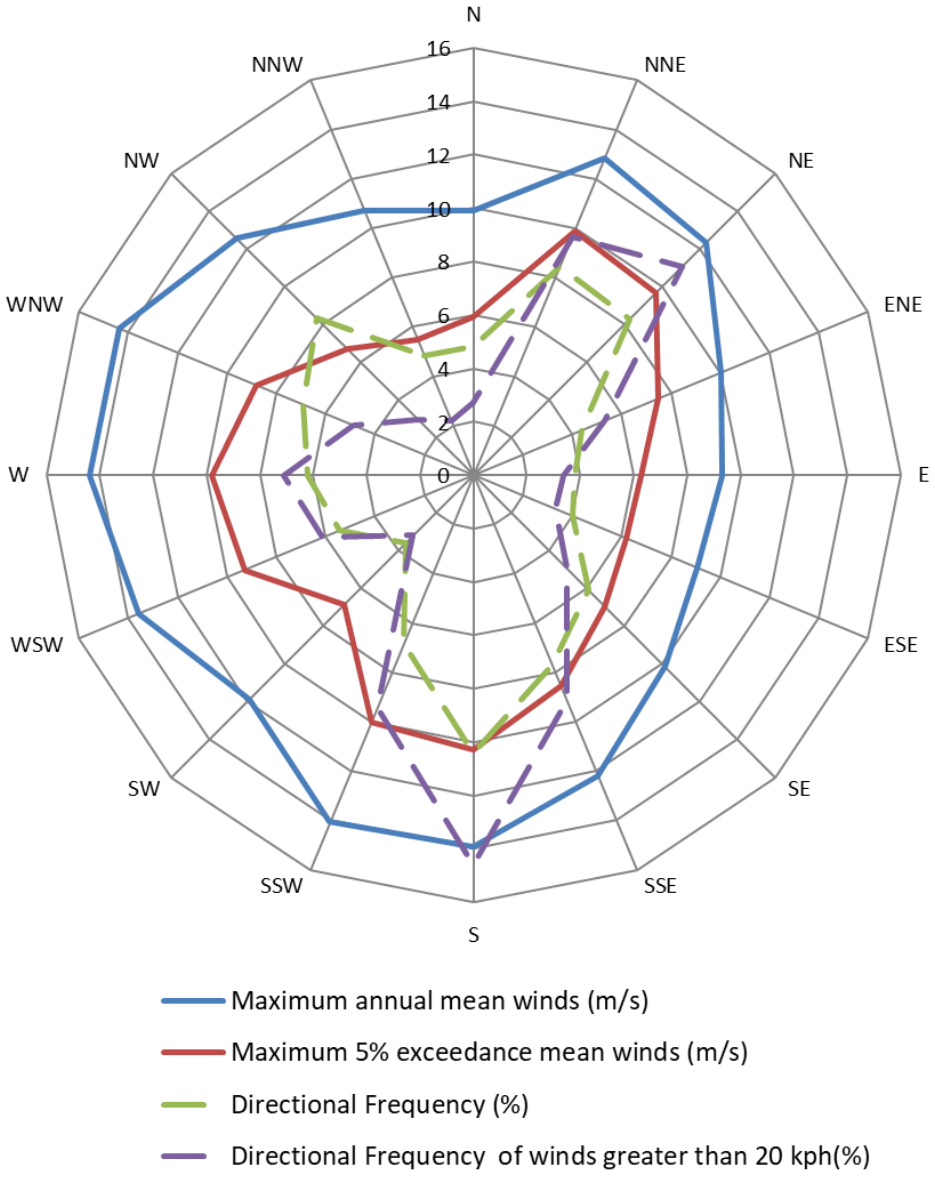

Figure 5: Directional Annual and 5% Exceedance Hourly Mean Wind Speeds (referenced to 10m height in standard open terrain), and Frequencies of Occurrence, for the Sydney Region (winds occurring between 6am and 10pm AEST)

4 WIND EFFECTS ON PEOPLE

The acceptability of wind in any area is dependent upon its use. For example, people walking, or window-shopping will tolerate higher wind speeds than those seated at an outdoor restaurant. Various other researchers, such as A.G. Davenport, T.V. Lawson, W.H. Melbourne, and A.D. Penwarden, have published criteria for pedestrian comfort for pedestrians in outdoor spaces for various types of activities. Some Councils and Local Government Authorities have adopted elements of some of these into their planning control requirements.

For example, A.D. Penwarden (1973) developed a modified version of the Beaufort scale which describes the effects of various wind intensities on people. Table 3 presents the modified Beaufort scale. Note that the effects listed in this table refers to wind conditions occurring frequently over the averaging time (a probability of occurrence exceeding 5%). Higher ranges of wind speeds can be tolerated for rarer events.

Table 3: Summary of Wind Effects on People (A.D. Penwarden, 1973)

Type of Winds	Beaufort Number	Mean Wind Speed (m/s)	Effects
Calm	0	Less than 0.3	Negligible.
Calm, light air	1	0.3 – 1.6	No noticeable wind.
Light breeze	2	1.6 – 3.4	Wind felt on face.
Gentle breeze	3	3.4 – 5.5	Hair is disturbed, clothing flaps, newspapers difficult to read.
Moderate breeze	4	5.5 – 8.0	Raises dust, dry soil and loose paper, hair disarranged.
Fresh breeze	5	8.0 – 10.8	Force of wind felt on body, danger of stumbling
Strong breeze	6	10.8 – 13.9	Umbrellas used with difficulty, hair blown straight, difficult to walk steadily, wind noise on ears unpleasant.
Near gale	7	13.9 – 17.2	Inconvenience felt when walking.
Gale	8	17.2 – 20.8	Generally impedes progress, difficulty balancing in gusts.
Strong gale	9	Greater than 20.8	People blown over.

This assessment addresses the general wind effects and any localised effects that are identifiable by visual inspection and the acceptability of the conditions for outdoor areas are determined based on their intended use. It should be noted that the recommendations made in this report are not only based on our extensive experience in the study of wind environment effects but, where applicable, uses Wind Tunnel Data from the aforementioned report (Ref: WD758-22F01(rev0)- WE Report, dated 9 June 2022) to inform on the localised wind conditions of certain locations within the proposed Bank Street Park.

5 RESULTS AND DISCUSSION

The expected wind conditions affecting the development are discussed in the following sub-sections of this report for the various outdoor areas within and around the subject development. The interaction between the wind and the building morphology in the area is considered and important features taken into account including the distances between the surrounding buildings and the proposed building form, as well as the surrounding landform. Note that only the potentially critical wind effects are discussed in this report. A glossary of the different wind effects described in this report included in Appendix A.

For this assessment, the wind speed criteria for pedestrian comfort that are considered are listed as follows:

- Walking Criterion (8.0m/s with a 5% probability of exceedance)
  for general circulation and pedestrian thoroughfares, e.g. footpaths, private balconies/terraces, through-site links etc.

- Standing (Short Exposure) Criterion (6.0m/s with a 5% probability of exceedance)
  for stationary activities generally less than an hour, e.g. waiting areas, communal terraces, main entries, café seating etc.

- Sitting (Long Exposure) (4.0m/s with a 5% probability of exceedance)
  for stationary activities longer than an hour, e.g. outdoor cinemas, outdoor fine dining etc.

Note that the above wind comfort levels are derived from the Sydney DCP 2012. Although this assessment is qualitative in nature, the abovementioned criteria for pedestrian comfort was adapted in the previously issued pedestrian wind tunnel study report (Ref: WD758-22F01(rev0)- WE Report, dated 9 June 2022). However, all areas are also assessed with consideration to a pedestrian safety criterion of 24m/s for the annual maximum gust.

5.1 Courtyard area

The proposed courtyard located to the north-west of the park is shielded from the prevailing north-easterly winds by the raised topography and the mid-rise residential buildings to the east of the site. However, some north-easterly winds channelling down Bowan Street are expected to impact the north-western end of the courtyard. This area is also likely susceptible to strong wind conditions approaching from the prevailing west to south sector winds.

The new community building is expected to provide sufficient shielding to the proposed seating area to the east of Building D and the public plaza from the prevailing west to south sector winds. However, the outdoor seating area associated with the kiosk/café to the east of the new community building is susceptible to wind sidestreaming along the façade of the new community building. The proposed line of the tree planting along the western aspect of the park is expected to be crucial in breaking up the approaching winds and ensuring comfort levels are met within the proposed courtyard zone hence they are recommended to be retained in the final design. Operator-controlled portable screens are also recommended for the outdoor café seating to improve comfort levels during longer stationary activities.

Similarly, the existing trees at the north-western end of the courtyard (1A Bank Street Site) and the proposed trees to the north are expected to be beneficial in mitigating the impact of the approaching north-westerly

winds and funnelling north-westerly wind. In general, the proposed dense landscaping within the courtyard is recommended to be retained to ensure the courtyard is suitable for short duration stationary activities.

5.2 Dragon boat deck and Marina area

The deck over the dragon boat storage will benefit from the shielding provided by the Anzac Bridge pylon to the west and the proposed tree planting to the north-west against the prevailing westerly and north-westerly sectors winds respectively. The deck is still exposed to the prevailing southerly winds. The proposed standard height batten fence is expected to assist in protecting seating areas within the deck against the approaching southerly winds. However, for the batten fence to be an effective wind mitigation measure, it is recommended to decrease its porosity to 30-35%. Alternatively, an impermeable balustrade can be used.

Short-duration stationary activities are expected in the area around the kayak rental kiosk next to the marina. This area is primarily exposed to the prevailing westerly and southerly winds. It is recommended to include the proposed line of trees on the southern aspect of the area, and include an additional line of tree planting to the western aspect to providing shielding against the prevailing westerly and enhance comfort levels near the kiosk.

5.3 Sport/activity areas

Proposed plans show that the eastern section of the park will be designated as a sport/activity area. It will include a multi-purpose court, playground, outdoor gym/fitness area, and multiple open lawn areas. Short-duration stationary activities are expected within all the aforementioned areas.

Similar to the western section of the park, the eastern section is exposed to the south to west sector winds as well as the north-westerly winds. The impact of the north-westerly winds is expected to be magnified due to the sidestreaming effect down Banks Street driven by the terrain to the north-east. Furthermore, the open lawn and court areas are likely susceptible to southerly wind sidestreaming and corner accelerated flow due to the future building envelope to the east of the park.

Landscaping plans show dense tree planting around the perimeter of the eastern section of the park as well as some additional tree planting centrally. This dense landscaping, in particular the mature existing tree planting along the south-eastern corner, is expected to be beneficial in reducing the impact of the abovementioned strong winds and ensuring comfort levels are met. Therefore, both the existing and proposed landscaping are recommended to retained in the final design.

5.4 Pedestrian footpaths

The Bank Street footpath, the southern promenade and primary pathway across the park are expected to be suitable for comfortable walking with the incorporation of the proposed landscaping.

6 CONCLUSION

In conclusion, no significant adverse wind conditions are expected to impact or to be caused by the proposed Bank Street Park. The proposed park layout and landscaping elements are expected to be beneficial in ensuring that comfort and safety levels are met for the various pedestrian activities expected within and around the park. Hence, in the final design. It is recommended to retain the following features into the final design:

- Inclusion of all proposed dense tree planting and landscaping within and around the park, and including of an additional line of trees to the western aspect of the Marina area.
- Inclusion of the proposed batten fence around Dragon boat deck (30% maximum porosity).

The conclusions presented in this report are drawn from extensive experience in this field and previous wind tunnel data obtained for the wider Blackwattle Bay Masterplan. Considering the park's low-lying structures and the absence of substantial projected structures in the design that might affect wind conditions and make it incomparable to the conditions tested in previous wind tunnel tests, Windtech believes that further wind tunnel testing can be avoided.

In summary, the proposed Bank Street Park incorporates design features aimed at providing a comfortable and safe wind environment for park users. Furthermore, the design ensures that SEAR conditions 4 and 8, as well as all wind-related Blackwattle Bay Design guidelines, will be achieved.

7 REFERENCES

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APPENDIX A WIND EFFECTS GLOSSARY

A.1 Downwash and Upwash Effects

The downwash wind effect occurs when wind is deflected down the windward face of a building, causing accelerated winds at pedestrian level. This can lead to other adverse effects as corner acceleration as the wind attempts to flow around the building, as seen in Figure A.1.

This can also lead to recirculating flow in the presence of a shorter upstream building, causing local ground level winds to move back into the prevailing wind.

The upwash effect occurs near upper level edge of a building form as the wind flows over the top of the building. This has the potential to cause acceleration of winds near the leading edge, as well as potentially reattaching onto the roof area. This effect causes wind issues particularly near the leading edges of tall building and on the rooftop areas if there is sufficient depth along the wind direction. Upwash is more apparent in taller towers and podia.

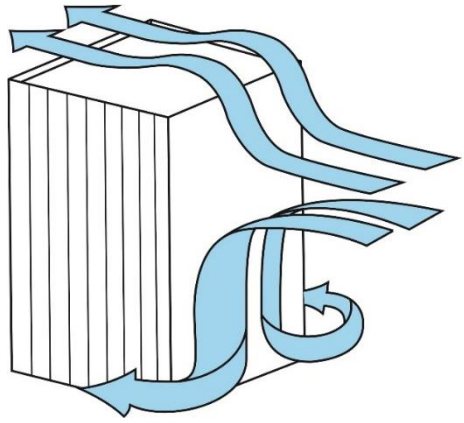

Figure A.1: Downwash Leading to Corner Wind Effect, and Upwash Effects

A.2 Funnelling/Venturi Effect

Funnelling occurs when the wind interacts with two or more buildings which are located adjacent to each other, which results in a bottleneck, as shown in Figure A.2. This causes the wind to be accelerated through the gap between the buildings, resulting in adverse wind conditions and pedestrian discomfort within the constricted space. Funnelling effects are common along pedestrian links and thoroughfares generally located between neighbouring buildings that have moderate gaps between them.

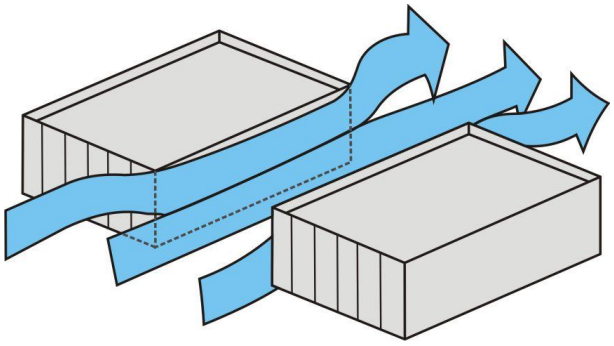

Figure A.2: Funnelling/Venturi Wind Effect

A.3 Gap Effect

The gap effect occurs in small openings in the façade that are open to wind on opposite faces, as seen in Figure A.3. This can involve a combination of funnelling and downwash effects. Presenting a small gap in the façade on the windward aspect as the easiest means through which the wind can flow through can result in wind acceleration through this gap. The pressure difference between the windward façade and the leeward façade also tends to exacerbate the wind flow through this gap.

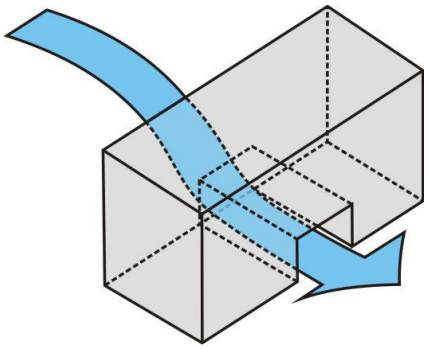

Figure A.3: Gap Wind Effect

A.4 Sidestream and Corner Effects

The sidestream effect is due to a gradual accumulation of wind shearing along the building façade that eventuates in an acceleration corner effect. The flow is parallel to the façade and can be exacerbated by downwash effects as well, or due to corner effect winds reattaching on the façade.

This is shown in Figure A.4. The corner refers to the acceleration of wind at the exterior vertical edge of a building, caused by the interaction of a large building massing with the incident wind, with the flow at the corner being accelerated due to high pressure differentials sets up between the windward façade and the orthogonal aspects. It can be further exacerbated by downwash effects that build up as the flow shears down the façade.

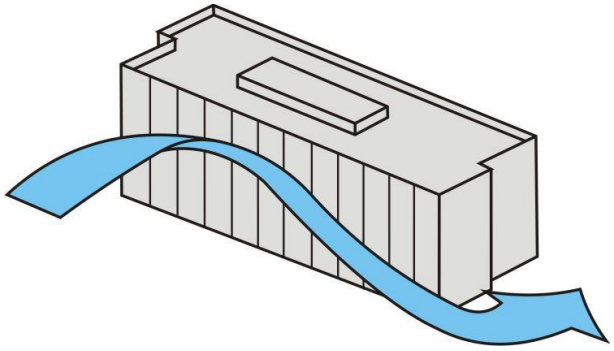

Figure A.4: Sidestream and Corner Wind Effect

A.5 Stagnation

Stagnation in a region refers to an area where the wind velocity is significantly reduced due to the effect of the flow being impeded by the bluff body. For a particular prevailing wind direction, this is typically located near the middle of the windward face of the building form or over a short distance in front of the windward face of a screen or fence. Concave building shapes tend to create an area of stagnation within the cavity, and wind speeds are generally low in these areas.