

Project: Crows Nest OSD – Site B

Project Number: 301351270

To: Thirdi Group

Date: 11.03.2025

From: Rebecca Dracup

Subject: Wintergarden Ventilation Assessment

Abstract: This memorandum provides a predicted airflow assessment for the wintergardens.

1. Introduction

This memo has been prepared by Stantec for the proposed Crows Nest OSD – Site B at 477-495 Pacific Highway, Crows Nest NSW 2065. It has been developed in response to the query from the government Architect's office on the draft SDRP pack #5 "Has the team undertaken any testing of the effectiveness of the proposed high-level natural ventilation system in the wintergardens".

Computational Fluid Dynamics (CFD) modelling has been conducted in an environmental modelling software (IES Virtual Environment). The wintergardens were assessed for their local air change effectiveness and local mean air age in their naturally ventilated space, and based on this dynamic assessment, the results demonstrate that the spaces achieve:

- Significantly less than five minutes of local mean air age (LMAA), implying air in the space is extremely fresh.
- Much greater than one local air change effectiveness (LACE), implying the space fresh air replaces indoor air better than ideal mixing. Essentially, fresh outdoor air is arriving directly into the occupied zone and pushing older (stale) air out without significant mixing.
- Air speeds are maintained within the comfortable range of 0.0 - 3.5 m/s.

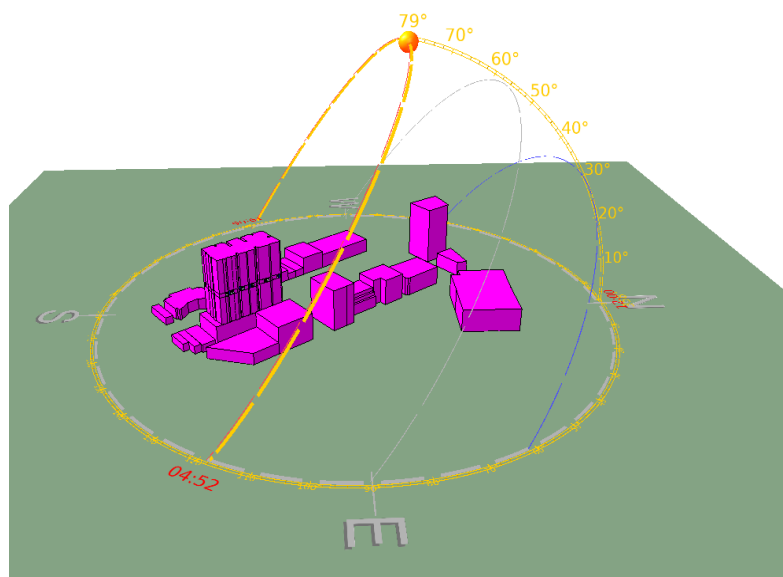
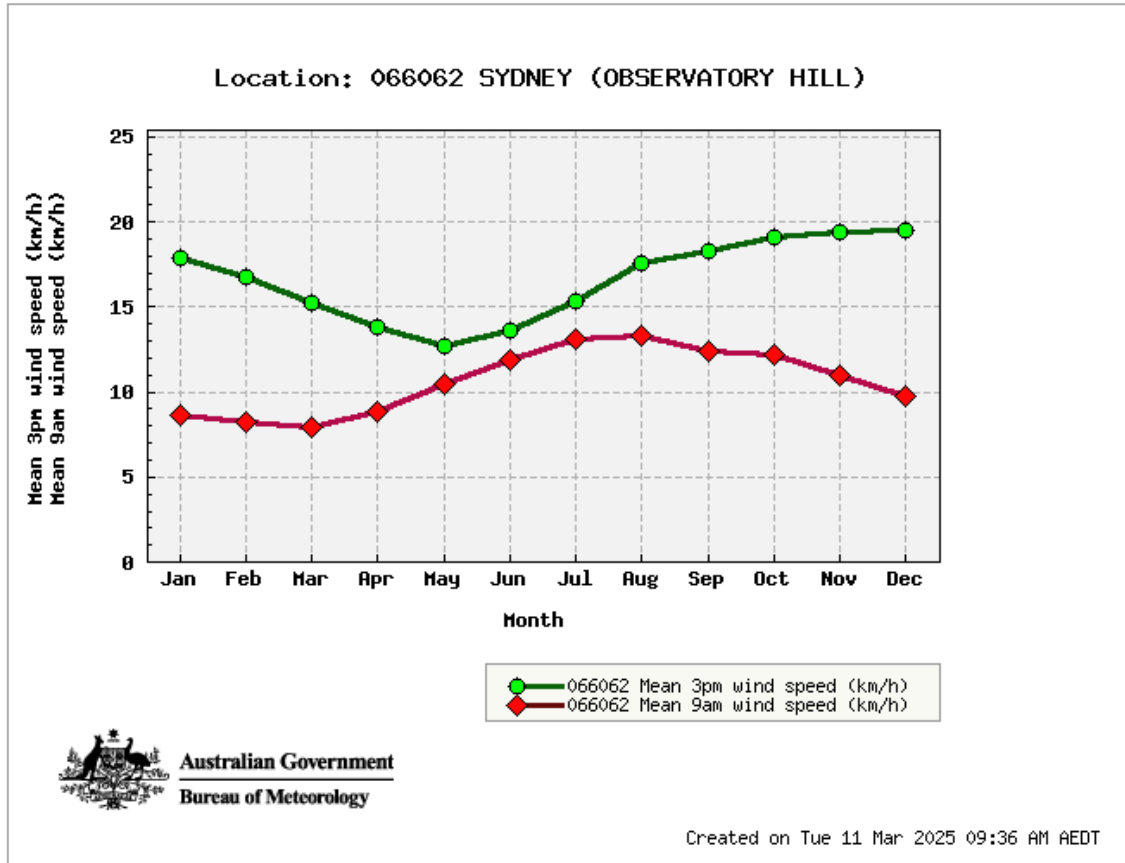


Figure 1 – Overview of 3D Geometry Model- IES Software

2. Methodology

A typical day with mean wind speed of 10.6 km/hr during 9AM (Figure: 2), at wind direction 270° (Figure: 3) was simulated to represent an average incoming wind in wintergardens.

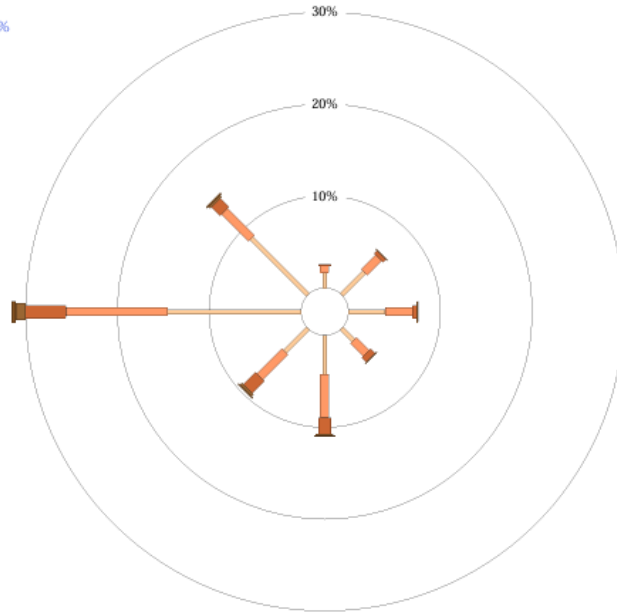


| Statistics | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|------|------|------|------|------|------|------|------|------|------|------|------|--------|
| Mean 3pm wind speed (km/h) for years 1955 to 1991 | 17.9 | 16.8 | 15.2 | 13.8 | 12.7 | 13.6 | 15.3 | 17.6 | 18.3 | 19.1 | 19.4 | 19.5 | 16.6 |
| Statistics | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
| Mean 9am wind speed (km/h) for years 1955 to 1992 | 8.6 | 8.2 | 7.9 | 8.8 | 10.5 | 11.9 | 13.1 | 13.3 | 12.4 | 12.2 | 11.0 | 9.8 | 10.6 |

Figure 2 – Wind statistics (Source: Bureau of Meteorology)

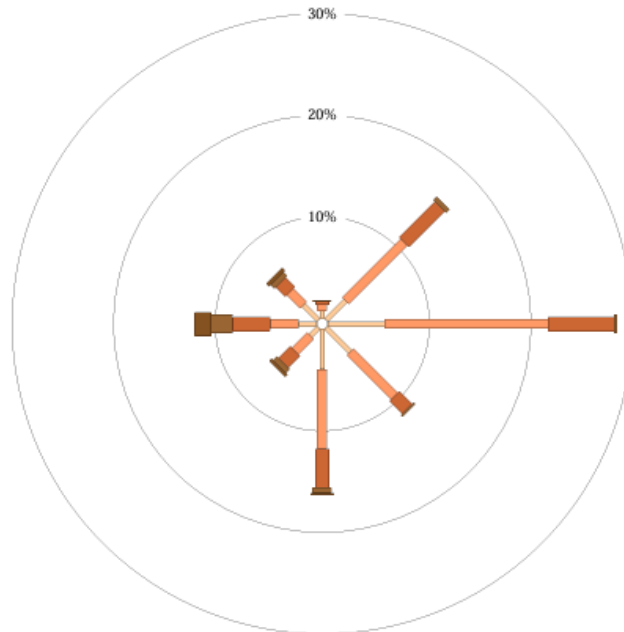
9 am
13502 Total Observations

Calm 13%



3 pm
13347 Total Observations

Calm 3%



LEGEND

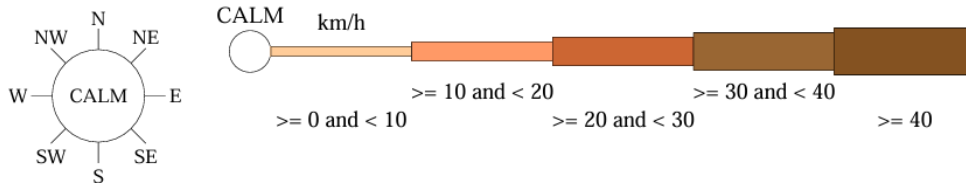


Figure 3: Wind roses (Source: Bureau of Meteorology)

3. Natural Ventilation

The National Construction Code Volume One (NCC) 2022 states that natural ventilation must consist of openings with a ventilating area not less than 5% of the combined floor area of both rooms required to be ventilated. In the most conservative of scenarios in this project, some apartment bedrooms are served only by the wintergardens. The area of the openable windows in the wintergardens is maintained above 5% of the combined floor area of both the wintergarden and bedroom in these instances, thereby maintaining compliance with NCC 2022 F6D7 Natural ventilation.

4. Wind Speed

Results from the modelling show wind speed inside the Wintergardens is observed to be 0.0 – 0.35 m/s which is generally considered to be comfortable.

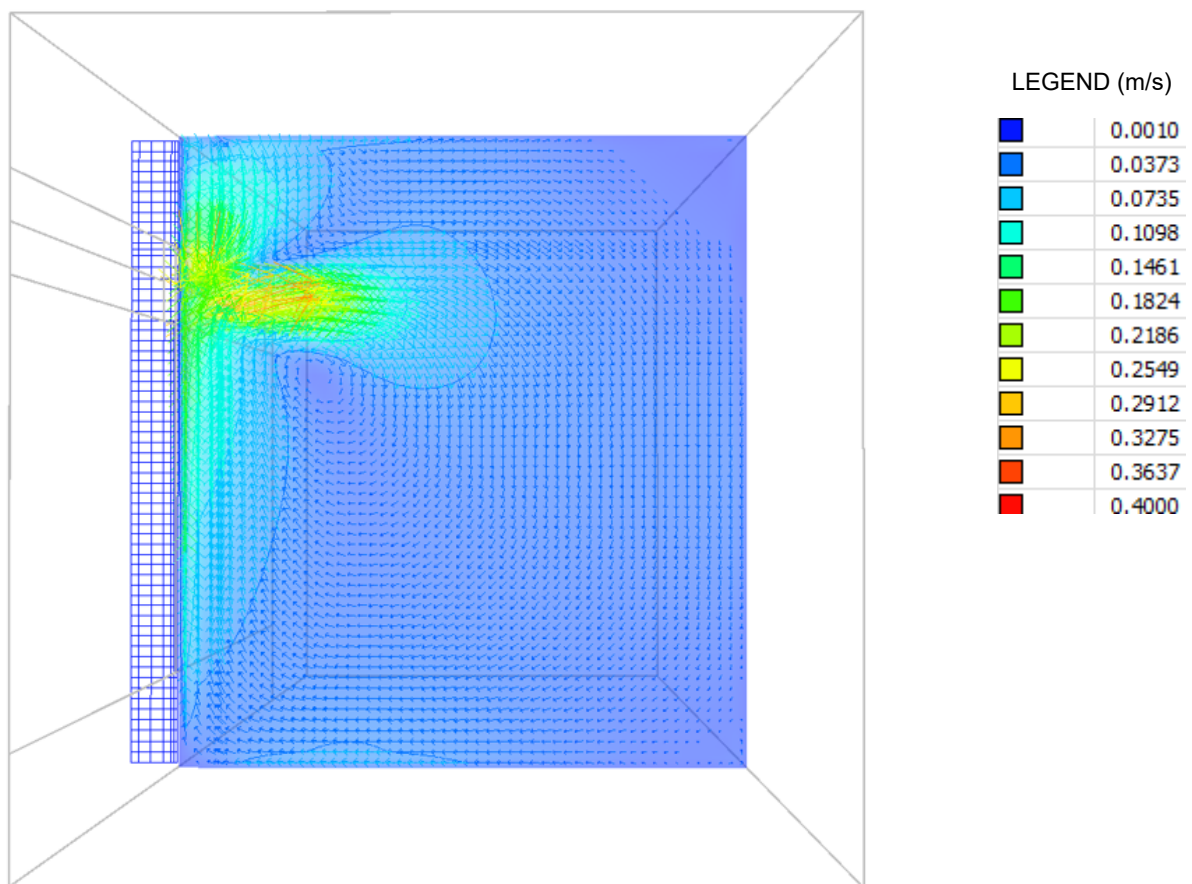


Figure 4 – Section view of wind velocity in a wintergarden.

5. Local Air Change Effectiveness

LACE is a measure indicating how efficiently outdoor (fresh) air is delivered and distributed to a specific location within a naturally ventilated space, compared to a perfectly mixed scenario. It is defined as the ratio of the age of air in an ideally mixed space (average room age) to the local mean age of air at a specific location. In naturally ventilated spaces, LACE helps designers evaluate whether fresh air from external openings effectively reaches occupant breathing zones, ensuring good indoor air quality and occupant comfort.

Mathematically, it is expressed as:

$$\text{LACE} = \frac{\text{Average room air age (ideal mixing)}}{\text{Local mean age of air at a specific point}}$$

Threshold:

LACE = 1: Local ventilation efficiency equals perfect mixing.

LACE > 1: Better than ideal mixing; fresh air efficiently reaches occupants.

LACE < 1: Poor ventilation effectiveness; stagnant or poorly ventilated areas.

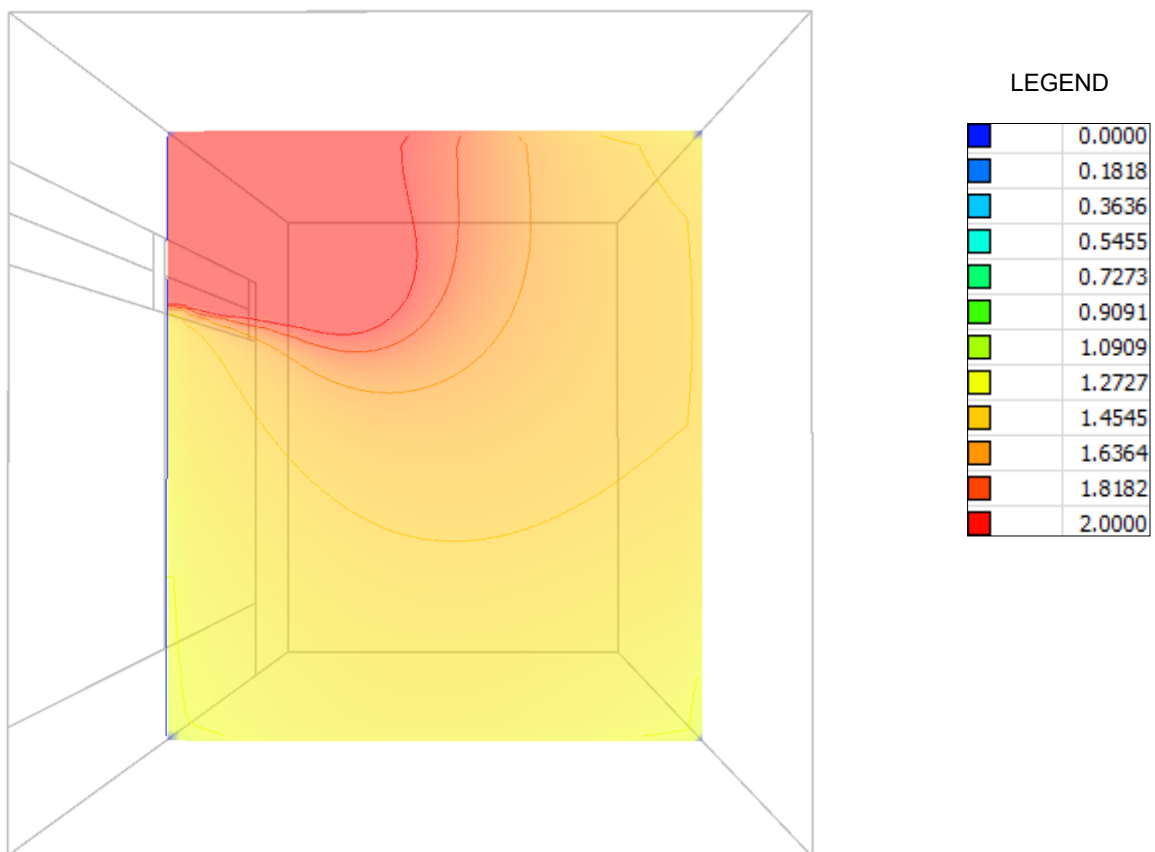


Figure 5 – Section view of LACE in a wintergarden.

6. Local Mean Air Age

LMAA is defined as the average time elapsed since air entered the indoor space from outdoors to the specific location being considered within a naturally ventilated room or building. It quantifies how long, on average, air has remained in the space before reaching a certain location.

Mathematically, it is expressed as:

Local Mean Air Age at a point=Average time (in minutes or seconds) since air entered from outside to that specific point.

Threshold:

≤ 5–10 minutes LMAA – Extremely fresh: seen near supply openings or with very high ventilation

~10–30 minutes LMAA – Good practice range for comfort and offices

~30–60 minutes LMAA – Marginal range. The upper end (1 ACH ~ 60 min) is often used as a limit for acceptability

> 60 minutes LMAA – Unacceptable/stale.

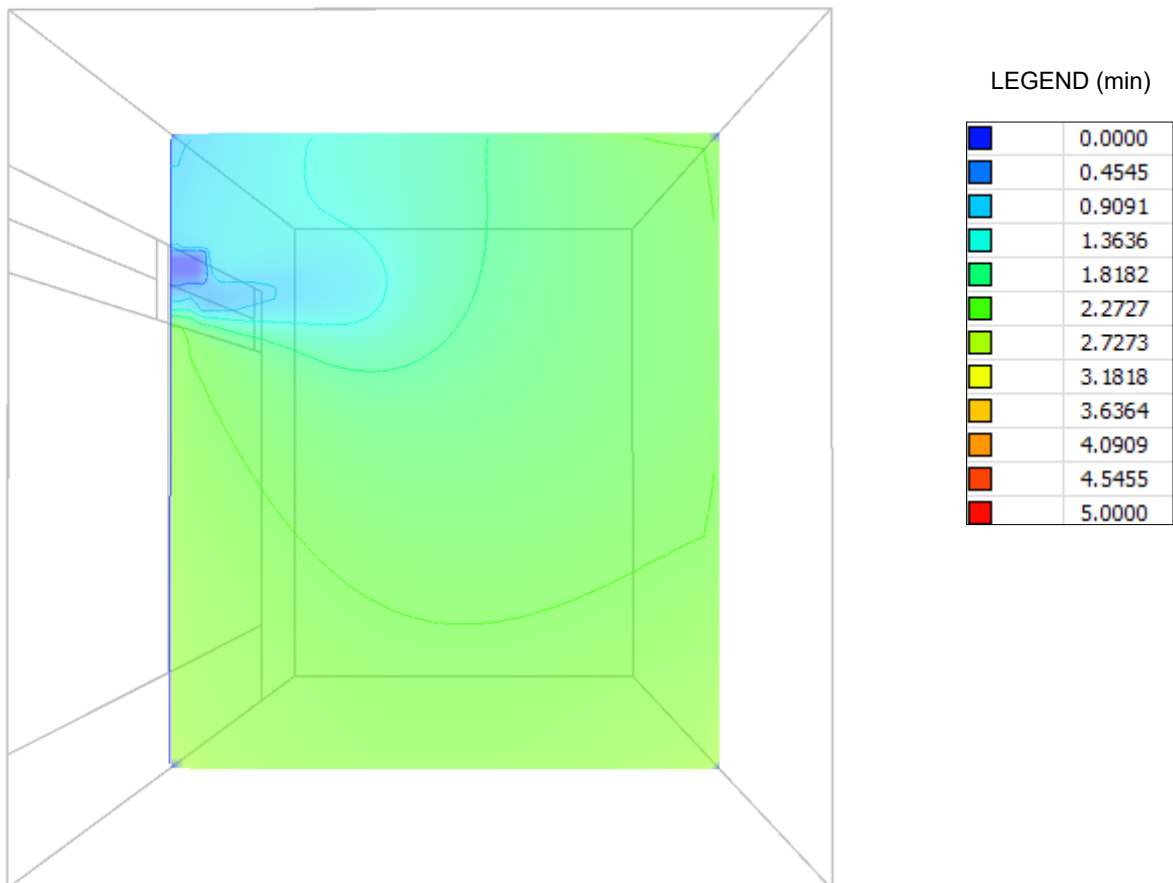


Figure 6 – Section view of LMAA in a wintergarden.

7. Key Observations

The wintergardens are provided with openable windows for natural ventilation with ventilating areas greater than 5% of the floor area of the spaces they are serving.

During a typical average day with mean outdoor wind condition as per the, the wintergarden is observed to have:

- Air speed within comfortable range of 0 .0 -3.5 m/s
- Local Air Change Effectiveness > 1: Better than ideal mixing; fresh air efficiently reaches occupants.
- Local Mean Air Age < 5: Extremely fresh air in the Wintergardens.