BURSWOOD POINT LOTS 305 & 306
PERTH, WA

PEDESTRIAN WIND ASSESSMENT

PROJECT # 2400245

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SUBMITTED TO

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DOCUMENT CONTROL

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NOTE

RWDI

RWDI is a team of highly specialised consulting engineers and scientists working to improve the built environment through three core areas of practice: building performance, climate engineering and environmental engineering. More information is available at www.rwdi.com.

QUALITY ASSURANCE

RWDI Australia Pty Ltd operates a Quality Management System which complies with the requirements of AS/NZS ISO 9001:2015. This management system has been externally certified by SAI Global and Licence No. QEC 13457 has been issued for the following scope: The provision of consultancy services in acoustic engineering, air quality and wind engineering; and the sale, service, support and installation of acoustic monitoring and related systems and technologies.

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1. INTRODUCTION

RWDI Australia Pty Ltd (RWDI) was retained to undertake a pedestrian wind assessment of the proposed towers located at Lots 305 and 306 of Burswood Point (Peninsula) in Perth, WA. The proposed development is situated towards the north end of the Precinct A and forms part of the larger redevelopment around the Belmont Park Racecourse. The surrounding context will include 2-3 storey residential townhouses along the outer foreshore edge and seven residential towers with their own separate podium substructures. The location of the site and the surrounding context within the larger Burswood Precinct is shown in Image 1.

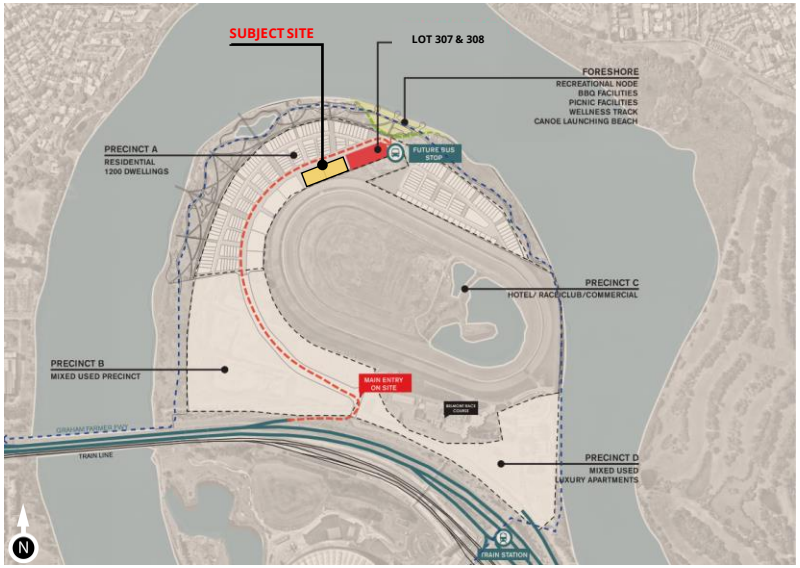

Image 1: Site Location and Surrounding Context

The proposed development consists of two high-rise residential towers (20-storey East Tower and 16-storey West Tower) situated atop a common podium substructure, as shown in Image 2. The proposed buildings consist of ground level activation and podium level parking. Amenities are also planned on the podium rooftop between the towers and the rooftop of West Tower. The key outdoor pedestrian accessible areas of interest associated with the development include the open public spaces on the ground level, pedestrian footpaths around the site, the primary entrances to the development, and the planned amenity spaces on ground and upper levels.

Image 2: View from the North of the Proposed Development

2. METHODOLOGY

Predicting wind speeds and occurrence frequencies around a building is a complex process and involves the combined assessment of building geometry, orientation, position and height of surrounding buildings, upstream terrain and the local wind climate. Over the years, RWDI has conducted thousands of wind-tunnel model studies and CFD assessments on pedestrian wind conditions around buildings, yielding a broad knowledge base of potential flow behaviour. This knowledge and experience, together with literature, allows for a reliable, consistent and efficient desktop estimation of pedestrian wind conditions without wind-tunnel testing or detailed CFD studies.

This qualitative approach provides a screening-level estimation of potential wind conditions and offers conceptual wind control measures to improve wind comfort, where deemed necessary. In order to quantify and confirm the predicted conditions or to refine any of the suggested conceptual wind control measures, physical scale model tests in a boundary-layer wind tunnel would be required.

RWDI's assessment is based on the following:

- A review of the regional long-term meteorological data;
- Drawings of the development received by RWDI in Aug 2023.
- Wind-tunnel studies, CFD simulations, and desktop assessments undertaken by the microclimate team for projects in the region and for Precinct A;
- Our engineering judgement, experience, and expert knowledge of wind flows around buildings[1, 2]; and,
- RWDI Criteria for pedestrian wind comfort.

Note that other microclimate issues such as those relating to cladding and structural wind loads, door operability, building air quality, noise, vibration, etc. are not part of the scope of this assessment.

1. H. Wu and F. Kriksic (2012). "Designing for Pedestrian Comfort in Response to Local Climate", Journal of Wind Engineering and Industrial Aerodynamics, vol.104-106, pp.397-407.
2. C.J. Williams, H. Wu, W.F. Waechter and H.A. Baker (1999), "Experience with Remedial Solutions to Control Pedestrian Wind Problems", 10th International Conference on Wind Engineering, Copenhagen, Denmark.

3. METEOROLOGICAL DATA

Wind statistics recorded at Perth International Airport were analysed between 2000 and 2021 (inclusive) for the summer (Nov-Apr) and winter (May-Oct) seasons. Image 3 graphically depicts the directional distributions of wind frequencies and speeds recorded at the station. It can be noted that winds from the northeast, east, and southwest directions are predominant in both seasons, as indicated by the wind roses. Strong winds of a mean speed greater than 30 km/h measured at the airport (at an anemometer height of 10 m) are more frequent during the summers and are an inland wind approaching from the east with secondary winds from southwest direction.

Long-term meteorological data recorded at Swanbourne Station located closer to the Perth coastline and approximately 12 km to the west of the project site were also examined to determine the local wind directionality of the region (Image 3). The analysis confirms the prevalence of southwesterly winds during the summers. However, areas closer to the coastline will generally be exposed to stronger westerly winter winds whereas the prevailing easterly winds inland, observed at Perth Airport, will present with a reduced intensity closer to the coastline. This is due to the traverse of winds over the urban terrain of Perth. A shift in the northeasterly winter winds is also observed with a more concentrated spread towards the east near the coastline. The current analysis method has accounted for all prevailing wind directions that are likely to occur at the project site.

Image 3: Directional Distribution of Winds Approaching Perth International Airport and Swanbourne Station (2000-2021)

4. RWDI PEDESTRIAN WIND CRITERIA

4.1 Safety Criterion

Pedestrian safety is associated with excessive gusts that can adversely affect a pedestrian's balance and footing. If strong winds that can affect a person's balance (83 km/h) occur more than 0.1% of the time or 9 hours per year, the wind conditions are considered severe. These can generally coincide with areas of high wind activity noted in the report.

4.2 Pedestrian Comfort Criteria

The RWDI pedestrian wind comfort criteria, depicted in Image 4, are used in the current study. These criteria have been developed by RWDI through research and consulting practice since 1974 and have also been widely accepted by municipal authorities, building designers and the city planning community worldwide. These are categorised based on typical / intended pedestrian activities.

Note that wind conditions are assessed at a typical pedestrian chest height and are considered suitable for the intended use of the space if the associated mean winds are expected for at least 80% of the time. Wind control measures are typically required at locations where the occurrence frequencies of wind speeds exceed the threshold values for specific pedestrian activities.

Furthermore, note that these criteria for wind forces represent average wind tolerance. These are sometimes subjective with regional differences in wind climate and thermal conditions as well as variations in age, health, clothing, etc. also affecting people's perception of the wind climate. For a full assessment of comfort, it is recommended that a thermal comfort study be undertaken.

Image 4: RWDI Pedestrian Wind Comfort Criteria

5. RESULTS AND DISCUSSION

5.1 General Wind Flow around Buildings

In our discussion of wind conditions on and around the proposed development, reference may be made to the following generalised wind flows (see Image 5). If these building / wind combinations occur for prevailing winds, there is a greater potential for increased wind activity and uncomfortable or potentially unsafe conditions. Design details such as setting back a tower from the edges of a podium for a prevailing wind direction, deep canopies close to ground level, wind screens / tall trees with dense landscaping, etc. can help reduce high wind activity. The choice and effectiveness of these measures would depend on the exposure and orientation of the site with respect to the prevailing wind directions and the size and massing of the proposed buildings.

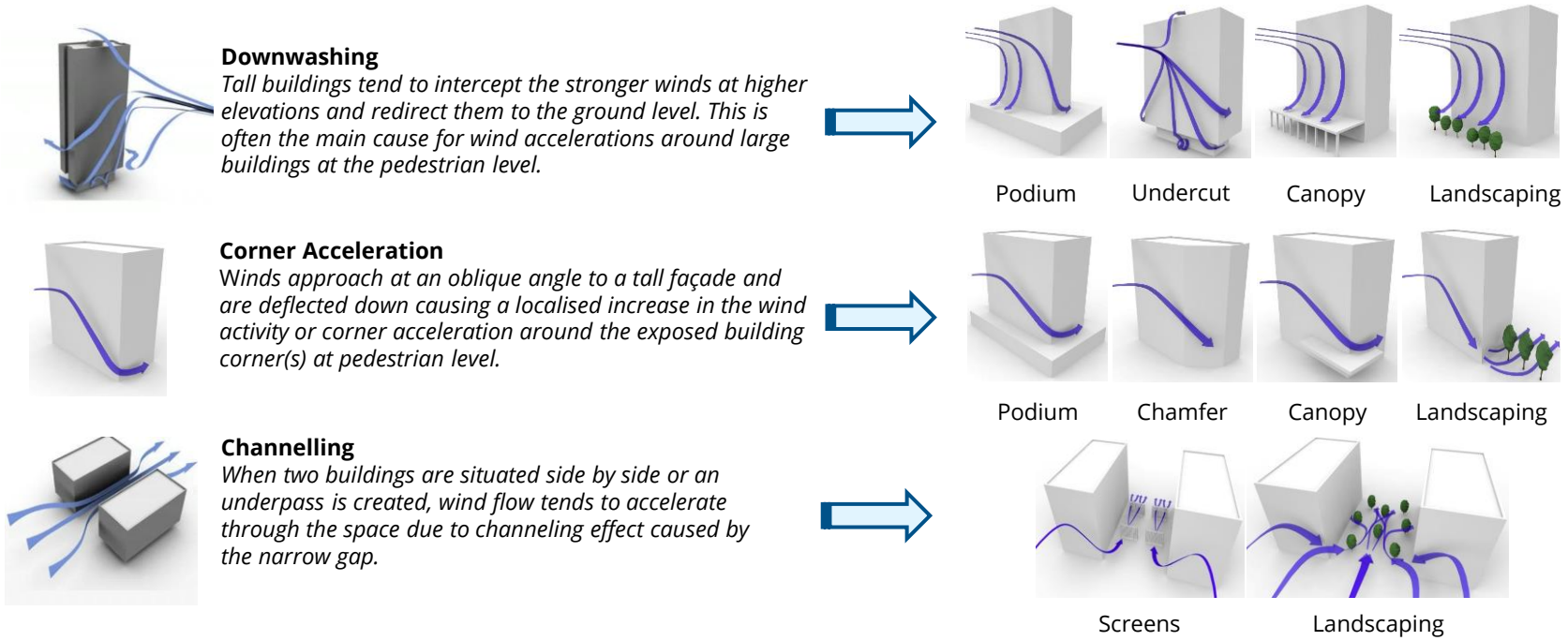

Image 5: General Wind Flow around Buildings with Examples of Common Wind Measures

5. RESULTS AND DISCUSSION

5.2 Site Exposure

The influence of regional prevailing winds on the project site is depicted in Image 6 for both summer and winter seasons. During the summer, the site benefits from partial protection against east sector winds due to the presence of Lots 307 & 308 Towers (assumed to be completed before Proposed Towers). However, it is worth noting that the podium of these existing towers may redirect a significant volume of winds towards the east and west laneways. Additionally, the future construction of Precincts A and B could help mitigate the impact of southwest winds approaching the site. Nevertheless, winter winds from the northeast may affect site conditions. Importantly, the proposed development is anticipated to be among the earliest structures erected on-site, resulting in substantial exposure to regional prevailing winds.

5.3 Existing Site Conditions

The existing site conditions are influenced by Lot 307 and 308 Towers leading to the likelihood of strong wind effects in the laneways surrounding these towers. Given the open exposure to prevailing winds from the other directions, it is generally anticipated that wind conditions in and around the existing site will be suitable for active walking use. Areas lacking direct shielding from trees or screening on the site may be less comfortable, particularly within the laneways.

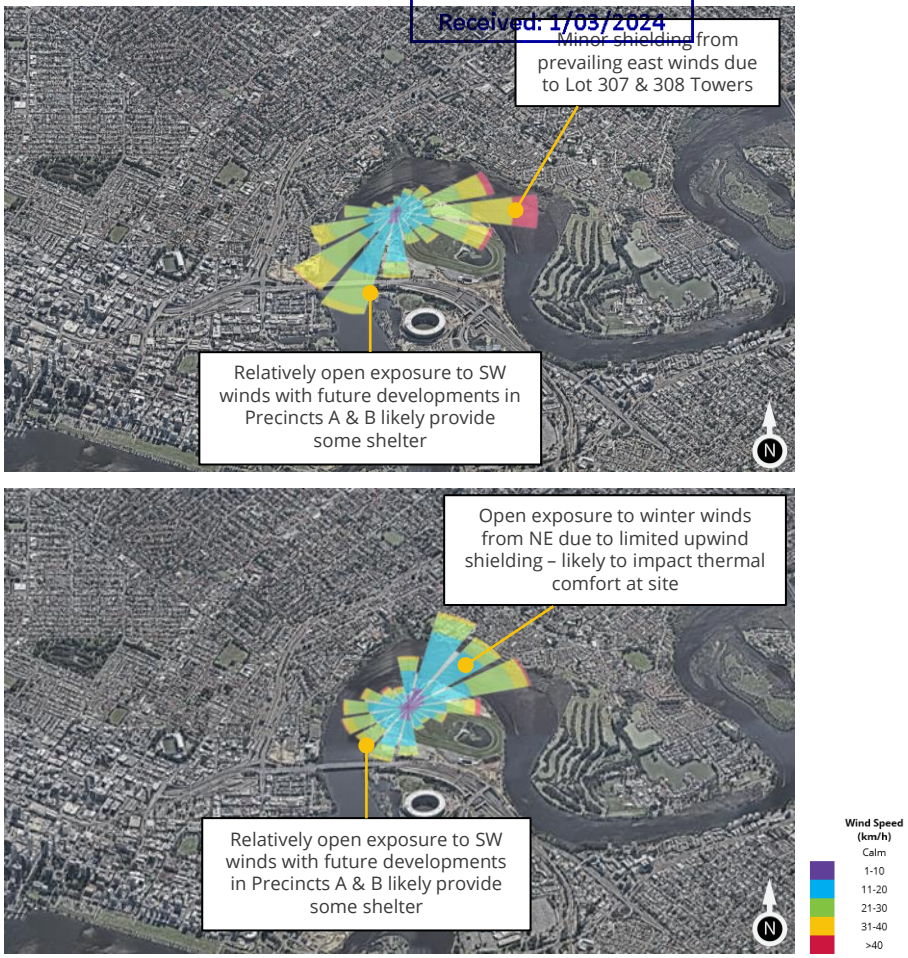

Image 6: Exposure of Site to Regional Prevailing Winds
Top: Summer | Bottom: Winter

5. RESULTS AND DISCUSSION

5.4 Proposed Site Wind Conditions

Following is a discussion on the proposed site conditions for the different areas around the site:

- With the inclusion of the Proposed Lots 305 & 306 Towers, the overall wind environment around the site will generally remain similar to the existing site conditions on the ground level. The existing Lots 307 & 308 Towers to the east will likely provide some shelter to the site from the prevailing wind effects.
- Wind are likely to channel between the podia of the existing (Lots 307 & 308) and the proposed (Lots 305 & 306) developments. The wind conditions are likely to be uncomfortable within the laneways during the summers and suitable for active strolling to walking use during the winters without the inclusion of landscaping. However, as noted in Image 7, the perimeter screening and dense landscaping between the podia is likely to buffer overall wind impacts.
- The entrances to the two towers are recessed and shielded from prevailing wind effects due to the inclusion of full-height screens and dense landscape, as shown in Image 7.

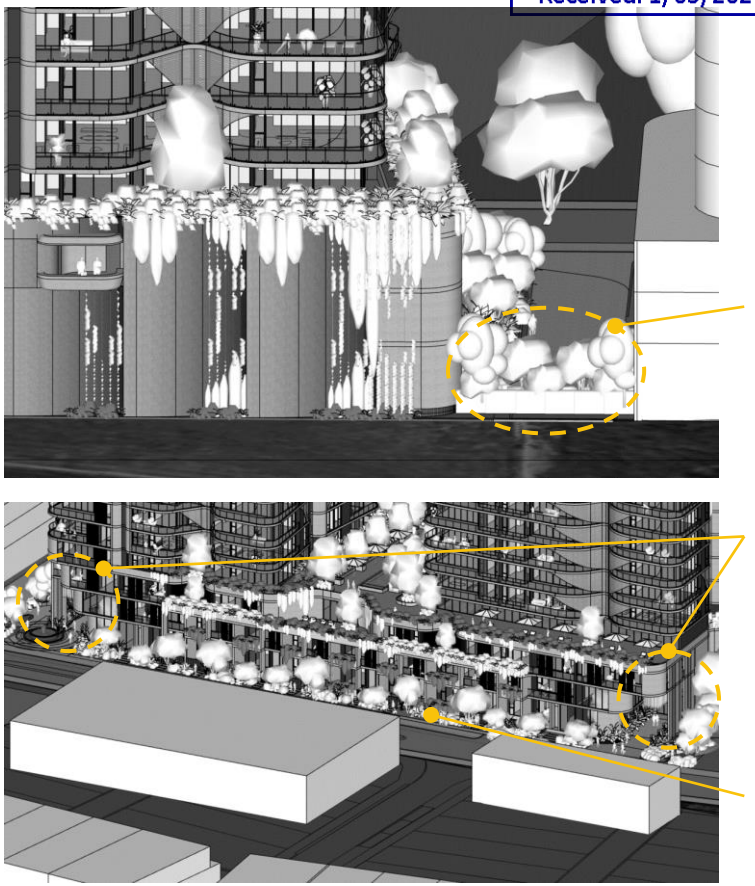

Image 7: Design Features of the Proposed Development

5. RESULTS AND DISCUSSION

- The Perth Racing Caller Box integrated within the podium is recessed and will be shielded from prevailing winds effects. Wind conditions are likely to be comfortable for passive use throughout the year.
- Regional winds are likely to be redirected by the proposed towers and channel through the central courtyard space on the podium. This area, however, features a robust landscape design comprising of interlocking trees and centrally-located canopies which are likely to provide a degree of wind protection. Nevertheless, wind tunnel testing will be required to validate the precise position and extents of the canopies required on this level.
- Corner balconies situated on Levels 5 and above are designed to enhance their functionality through the incorporation of perforated screening, as specified in the plans. Furthermore, impermeable screening is designated for the southeast and northwest corner balconies of both towers, as outlined in the 3D model. It is recommended that these screening measures be extended to encompass all corner balconies to optimise their utility.
- The rooftop terrace on the east tower benefits from perforated perimeter screening, dense landscape buffer, and overhead canopy. These elements collectively will likely mitigate the impact of regional winds, making conditions conducive to the intended passive utilisation of this space.

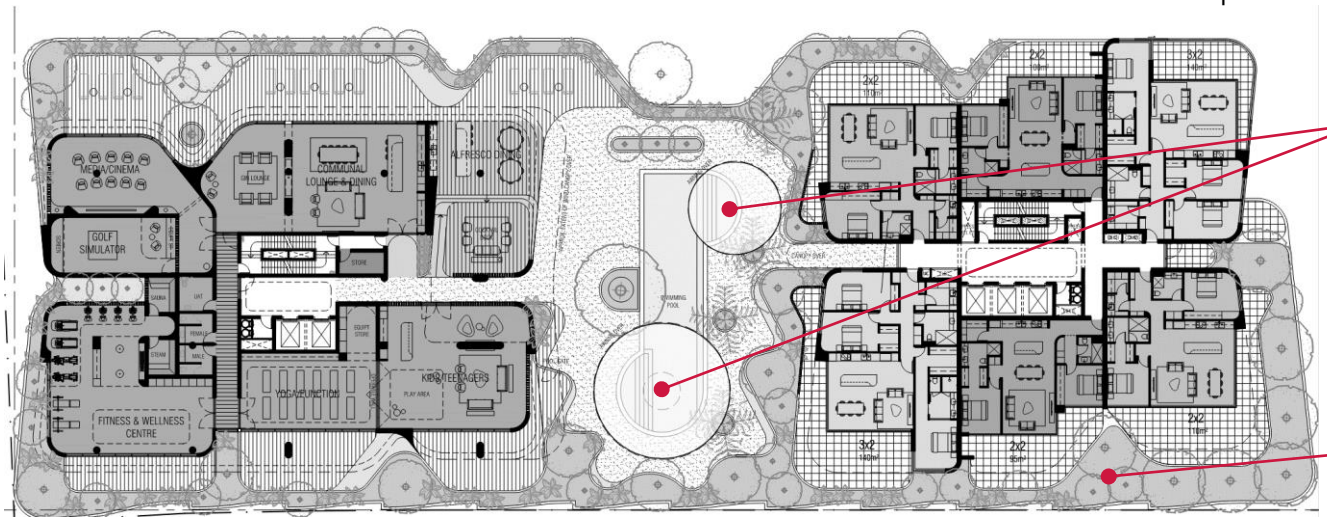

Image 8: Landscaping and Architectural Element on Podium Top

6. SUMMARY

Wind conditions on and around the proposed towers located at Lots 305 and 306 of Burswood Point (Peninsula) in Perth, WA are discussed in this report. The qualitative assessment is based on the review of local wind climate and the current design of the proposed development. The impact of the surrounding buildings and the local land topography has also been considered. The assessment is based on our experience with wind tunnel testing and CFD analysis of similar buildings within the region.

The report assess the conceptual wind flows and conditions within the proposed precinct with a particular focus on the prevalent wind directions in order to identify key areas sensitive to wind effects. It is important to emphasize that the development plan incorporates numerous design elements that are anticipated to positively influence the overall wind conditions throughout the site. However, high wind activity is likely to impact the conditions on upper-level corner balconies. The wind control measures incorporated for the podium terrace might also require small adjustments subject to the wind tunnel tests during the detailed design phase of the project.

It should be acknowledged that the mitigation strategies outlined herein are contingent upon the assumptions and flow patterns discussed in this assessment. As the design and programming of the proposed buildings progress, these measures will undergo further refinement and adaptation. Furthermore, it is important to recognise that the wind conditions around the site will exhibit significant variability as the overall masterplan evolves. Therefore, it is proposed a staging assessment be undertaken during detailed design phase to corroborate and fine-tune the conceptual wind control measures discussed in this report to ensure their continued effectiveness.

7. APPLICABILITY OF ASSESSMENT

The assessment discussed in this report pertains to the proposed development in accordance with the drawings and information received in August 2023. In the event of any significant changes to the design, construction or operation of the building or addition of surroundings in the future, RWDI could provide an assessment of their impact on the wind conditions discussed in this report. It is the responsibility of others to contact RWDI to initiate this process.

Statement of Limitations

This report entitled '*Burswood Point Lots 305 & 306 Pedestrian Wind Assessment*', dated 08 September 2023, was prepared by RWDI Australia Pty Ltd ("RWDI"). The findings and conclusions presented in this report have been prepared for the Client and are specific to the project described herein ("Project"). The conclusions and recommendations contained in this report are based on the information available to RWDI when this report was prepared. Because the contents of this report may not reflect the final design of the Project or subsequent changes made after the date of this report, RWDI recommends that it be retained by Client during the final stages of the project to verify that the results and recommendations provided in this report have been correctly interpreted in the final design of the Project.

The conclusions and recommendations contained in this report have also been made for the specific purpose(s) set out herein. Should the Client or any other third party utilise the report and/or implement the conclusions and recommendations contained therein for any other purpose or project without the involvement of RWDI, the Client or such third party assumes any and all risk of any and all consequences arising from such use and RWDI accepts no responsibility for any liability, loss, or damage of any kind suffered by Client or any other third party arising therefrom.

Finally, it is imperative that the Client and/or any party relying on the conclusions and recommendations in this report carefully review the stated assumptions contained herein and to understand the different factors which may impact the conclusions and recommendations provided.