17 January 2023

Nick Owen
Willis Bond
P.O Box 24137
Wellington

One Tasman Pukeahu Park - Wind Mitigation Study (Amended Schene)

5-29P79.00

Dear Nick,

This letter describes the results of a wind tunnel study to investigate additional wind mitigation options for an amended design for the One Tasman Pukeahu Park development proposed for southern central Wellington.

Background

In September 2021 WSP Opus Research (now WSP Research Operations) conducted a pedestrian wind tunnel study of the proposed One Tasman Pukeahu Park development (WSP Research Report 21-5-29P79.00). The proposal comprised one large apartment building on the northern part of the site, one large apartment building on the southern part of the site, together with a number of lower-rise apartment blocks fronting onto Old Buckle and Tasman Streets and in the central part of the site.

Testing showed that, taken overall, the original development design causes an identifiable deterioration in wind conditions in some of the pedestrian areas surrounding the site, while improving it in others. Accordingly, partial testing of two modified designs was undertaken at locations where the modifications were expected to affect the wind. These modified designs were guided by a combination of heritage, urban design and wind advice, and influenced by the acquisition of the site to the south. The results of this additional testing are also included in Report 21-529P79.00.

The testing of design changes showed that the negative effects of the original design of the development could be partially mitigated. An aggregation of a number of design changes (Option 1) produced some significant improvements over the original design. The inclusion of a large canopy on the southern apartment building (Option 2) offered additional mitigation of some of the wind effects identified in Tasman Street. Both design changes (Options 1 and 2) were included in the development design submitted for resource consent.

During the consent process Wellington City Council requested additional improvements in wind conditions in several areas, including (1) around the northeast corner of the site, (2) the east side of Tasman St, south of the site, and (3) the west side of Tasman St. Accordingly, additional testing was carried out on the submitted development design and a range of wind mitigation options, the results of which were reported in our letter report dated 29th March 2022.

The applicant (One Tasman Development Limited Partnership) has subsequently amended the proposal by making changes to the building design but have maintained the original height of the northern apartment building at 9 to 10 levels and the southern apartment

WSP
Petone
33 The Esplanade
Petone
Lower Hutt 5012, New Zealand
+64 4 587 0600
wsp.com/nz

building at 9 levels. Included in this proposal are wind mitigation features from the original 2021 wind tunnel study and wind mitigation options from the March 2022 study.

These wind mitigation features included (1) the large canopy described above (2) a 1.5m high upstand around the outside perimeter of this canopy, (3) two evergreen trees, 5m high, located along the Tasman Street frontage of the northern apartment block, and (4) Large evergreen trees, 5m high, extending in a row along the east side of Tasman Street, from the southwest corner of the site to opposite the centre of the Seventh Day Adventist Church at 27 Tasman Street.

Additional Investigation of Wind Mitigation

Further wind tunnel testing has been carried out to:

(1) quantify the wind conditions for the amended design at those locations and for those wind directions where speeds in excess of the 20m/s District Plan Safety Criteria were identified in the original wind tunnel study;

(2) assess the need for further wind mitigation to reduce wind speeds to the 20m/s Safety Criteria or below; and

(3) test additional wind mitigation, if required.

Figure 1 on the following page shows the complete set of wind speed measurement locations used for the original wind tunnel study. A subset of these locations was used for the March 2022 mitigation study.

Table 1 lists a compilation of the maximum calculated directional gust speeds from the wind tunnel studies on the original design and the submitted design used to determine the measurement locations for this current study. The measurement locations are concentrated at those locations where the resulting speed for the submitted or original design was close to or above the 20m/s District Plan Safety Criteria.

Table 1: Directional Calculated Gust Speeds, V_C (m/s) – Submitted and Original Design

Notes: Exg = with existing situation, Sub = with submitted or original design

= calculated gust speed > 20m/s Safety Criteria (submitted design),

= calculated gust speed (submitted design)

= calculated gust speed (original design)

Location	320 Deg		340 Deg		360 Deg		170 Deg		190 Deg		210 Deg		Max	Max
	Exg	Sub	Exg	Sub	Exg	Sub	Exg	Sub	Exg	Sub	Exg	Sub	Exg	Sub
K	16	19	20	22	16	22	15	20	13	19	13	12	20	22
L	16	19	19	22	16	20	17	19	13	17	9	14	19	22
M	18	20	21	23	21	24	12	16	17	14	8	12	21	24
V	12	16	14	18	14	17	17	21	18	20	15	18	18	21
W	17	21	20	20	18	21	14	16	18	15	16	15	20	21
X	12	16	13	18	13	17	16	20	16	21	15	19	16	21
Z	12	17	14	18	13	15	16	21	16	21	14	20	16	21
A1	6	19	10	18	12	16	15	10	21	10	18	9	21	19
C1	8	20	12	20	13	18	17	19	19	20	18	18	19	20
E1	6	19	13	19	13	16	16	11	19	15	18	12	19	19
G1	8	21	13	19	14	18	15	13	17	16	16	13	17	21
I1	4	22	7	22	11	22	14	11	16	16	16	16	16	22

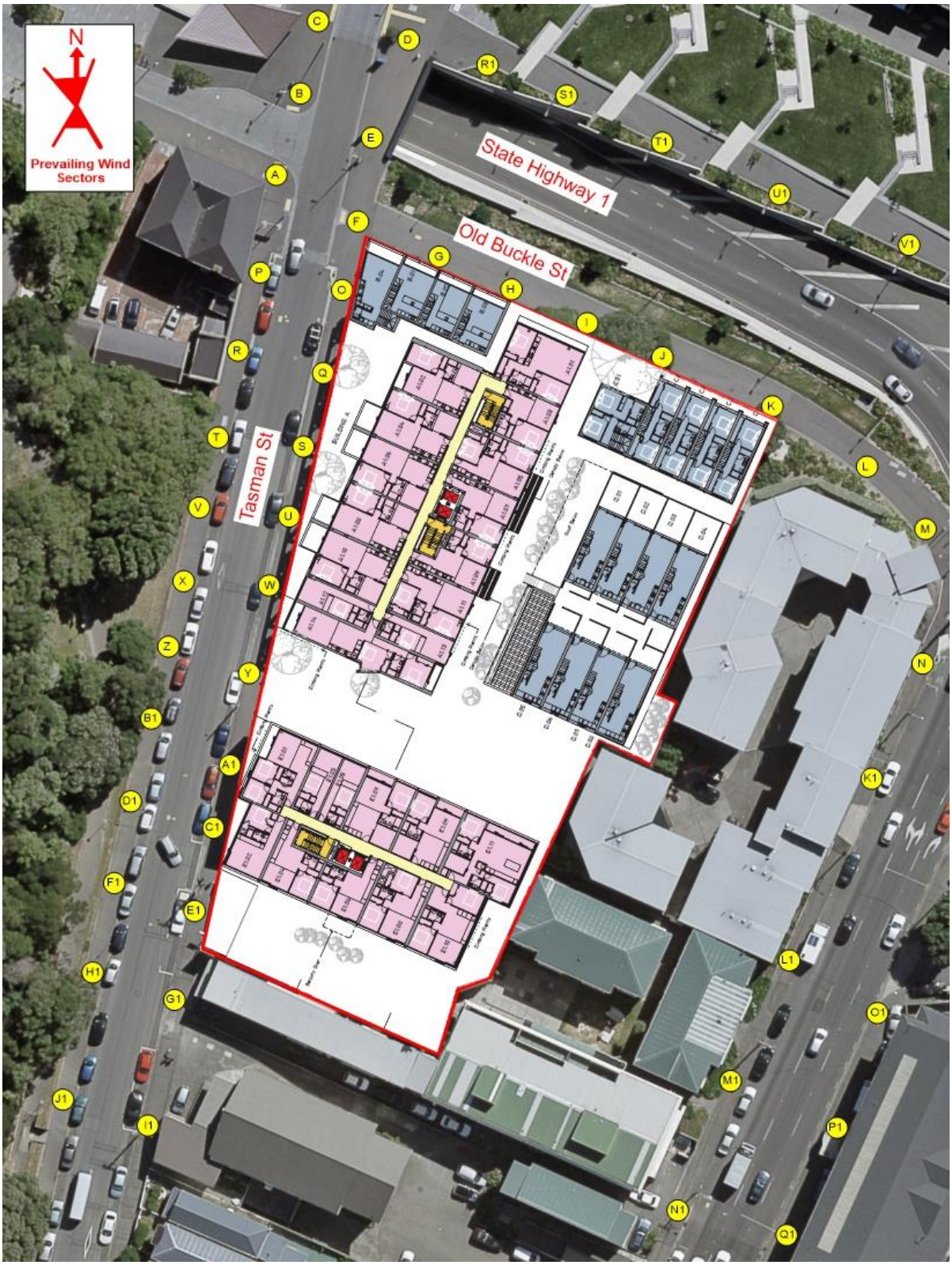

Figure 1: Site and surrounding area (aerial image – LINZ, 2021)
Notes: Red = site outline.
Yellow = measurement locations (public space)
Also shown are: (1) the building layouts for the amended scheme; and
(2) the prevailing directions for strong winds

Table 1 shows that most of the locations where the maximum gust speeds exceeded the 20m/s Safety Criteria occurred for northerly wind directions.

For this current study a model of the amended design was constructed at our wind tunnel model scale. A photograph of the wind tunnel model is shown in Figure 2.

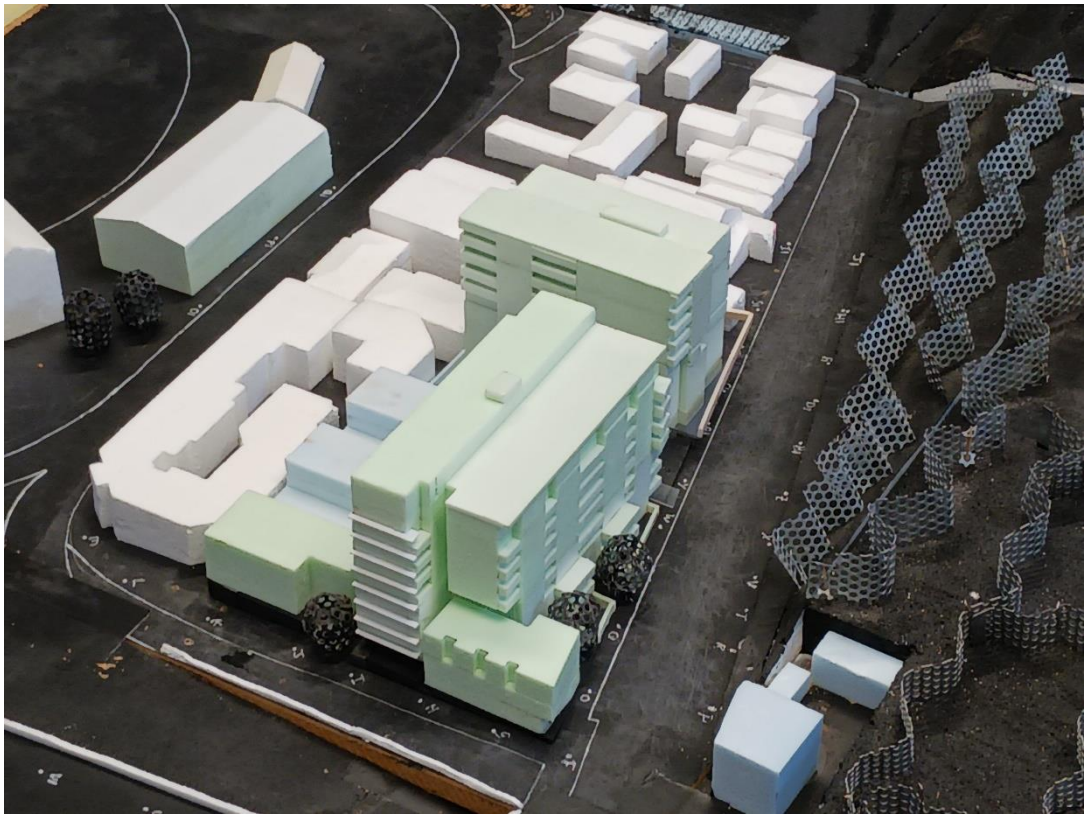

Figure 2: View of the wind tunnel model – amended scheme.

The wind tunnel setup, procedures and analysis used for this current investigation replicate those used for the original wind tunnel study. These are detailed in the WSP Research Report 21-5-29P79.00.

Wind speed measurements were taken for the amended development design for selected wind directions and measurement locations. The resulting directional gust speed data is listed in Table 2.

Table 2 shows that the amended design eliminates the maximum gust speeds at those locations shown in Table 1 that are over 20m/s at all locations, except K, L and M, i.e in the area around the northeast corner of the site, for a wind direction of 340°. At some locations the amended design reduces the maximum gust speed to below that for the existing situation.

Table 2: Directional Calculated Gust Speeds, V_C (m/s) – Submitted/Original/Amended

Notes: Exg = with existing situation, Sub = with submitted or original design
Amn = with amended design

= calculated gust speed > 20m/s Safety Criteria (submitted design),

= calculated gust speed (submitted design)

= calculated gust speed (original design)

	320 Deg			340 Deg			360 Deg			170 Deg			190 Deg			210 Deg			Max	Max	Max
Location	Exg	Sub	Amn	Exg	Sub	Amn	Exg	Sub	Amn	Exg	Sub	Amn	Exg	Sub	Amn	Exg	Sub	Amn	Exg	Sub	Amn
K	16	19	17	20	22	22	16	22	19	15	20	-	13	19	-	13	12	-	20	22	22
L	16	19	18	19	22	23	16	20	19	17	19	-	13	17	-	9	14	-	19	22	23
M	18	20	19	21	23	24	21	24	20	12	16	-	17	14	-	8	12	-	21	24	24
V	12	16	-	14	18	-	14	17	-	17	21	18	18	20	18	15	18	15	18	21	18
W	17	21	13	20	20	15	18	21	15	14	16	-	18	15	-	16	15	-	20	21	15
X	12	16	-	13	18	-	13	17	-	16	20	19	16	21	18	15	19	16	16	21	19
Z	12	17	-	14	18	-	13	15	-	16	21	20	16	21	20	14	20	16	16	21	20
A1	6	19	17	10	18	18	12	16	16	15	10	11	21	10	11	18	9	8	21	19	18
C1	8	20	15	12	20	17	13	18	16	17	19	8	19	20	9	18	18	9	19	20	17
E1	6	19	18	13	19	20	13	16	18	16	11	-	19	15	-	18	12	-	19	19	20
G1	8	21	16	13	19	17	14	18	19	15	13	-	17	16	-	16	13	-	17	21	19
I1	4	22	14	7	22	16	11	22	16	14	11	-	16	16	-	16	16	-	16	22	16

As the maximum gust speeds at locations K, L and M remained over the 20m/s criteria, additional testing of wind mitigation options was carried out. This comprised of combinations of large evergreen trees, around 5m high, at the locations shown in Figure 3. These were tested only for a wind direction of 340˚.

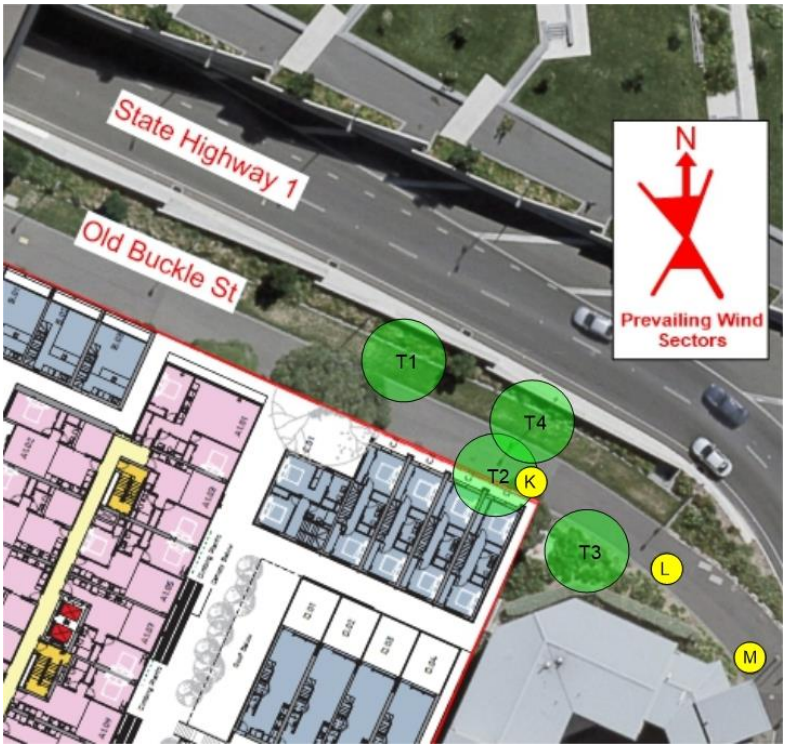

Figure 3: Locations of wind mitigation (trees, T1, T2, T3 and T4) and measurement locations K, L and M.

The results of these measurements are listed in Table 3.

Table 3: Directional Calculated Gust Speeds, V_C (m/s) – Options (T1, T2, T3) - 340°
Notes: Exg = with existing situation, Sub = with submitted or original design
Amn = with amended design
= calculated gust speed > 20m/s Safety Criteria.

	340 Deg						
Location	Exg	Sub	Amn	T1	T2	T2 + T3	T3+T4
K	20	22	22	22	21	16	16
L	19	22	23	17	23	19	20
M	21	23	24	19	20	19	20

Table 3 shows that each of the configurations of large evergreen trees has a beneficial effect on overall wind conditions across locations K, L and M. Of these combinations, trees at T2 plus T3 reduce the maximum gust speeds at these locations to below the 20m/s Safety Criteria.

Concluding Comments

The wind tunnel study to investigate additional wind mitigation options for the One Pukeahu Park development show that:

(1) Compared to the submitted design, the amended design, which includes a range of specific wind mitigation features, significantly reduces the numbers of locations where the calculated gust speeds exceed the 20m/s District Plan Safety Criteria.

(2) On the footpaths around the northeast corner of the site are three locations where the maximum gust speeds with the amended design remain above the 20m/s threshold.

(3) Additional wind mitigation, comprising large evergreen trees, reduce the maximum gust speeds at the locations around the northeast corner of the site below the 20m/s safety threshold.

If there are any questions regarding the wind tunnel study or the results, please do not hesitate to call me (021 243 9386).

Regards

Neil Jamieson
Research Leader - Wind Engineering