30/06/2018 PM$ _{2.5}$ Exceedance Report
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1 BACKGROUND

In accordance with the Waterview Connection BOI Operational Air Quality Conditions, the NZTA is required to undertake ambient air quality monitoring in real time to monitor potential effects associated with the operation of the ventilation system from the tunnels. Ambient monitoring includes fine particulates ($PM_{10}$ and $PM_{2.5}$) and nitrogen dioxide. Results are to be compared with the relevant National Environmental Standards for air quality and/or the Auckland Regional Air Quality Targets.

The location of the ambient monitoring stations is shown in Appendix A.

Condition OA.5 requires that if the monitoring shows that concentrations of contaminates in ambient air at the monitoring locations exceeds the relevant standards, then the NZTA shall undertake an investigation into the cause of the exceedance and report this to the Peer Review Panel and the Major Infrastructure Team Manager, Auckland Council.

On the 30th June 2018, both North and South stations registered a daily average of 27.00 $\mu$g/m³ and 26.38 $\mu$g/m³ respectively for $PM_{2.5}$, exceeding the 25 $\mu$g/m³ limit set in the Regional Air Quality targets.

2 DATA ANALYSIS

The relevant data is included in Appendix B and includes:

- Waterview daily summary report 30/06/2018 of Hourly and daily averages of $NO_2$, $PM_{2.5}$ and $PM_{10}$.
- Waterview daily summary report 02/07/2018 of Hourly and daily averages of $NO_2$, $PM_{2.5}$ and $PM_{10}$.
- Graphs of Hourly $PM_{2.5}$ vs Temperature vs Traffic Volumes.

Analysis of the data shows that the $PM_{2.5}$ hourly concentrations above the limit of 25 $\mu$g/m³ happened before 4am and after 10pm, when the traffic inside both the Southbound and Northbound Tunnels was very low, under 900 vehicles/hour in the evening and 200 vehicles/hour in the morning. The exceedance also coincided with the temperatures dropping below 5°C in the North and 4°C in the South.

These conditions are very similar to the $PM_{2.5}$ exceedance in the first month of operation on the 16th July 2017.

The $NO_2$ concentrations, following the traffic data, don’t show any relevant increase during the periods of high $PM_{2.5}$ concentrations.

There was very little wind on the night, like that of the previous 3 days, so wind speed and direction don’t seem to be relevant factors.

The period from the night of the 26th June to the morning of the 1st July (5 nights), registered the lowest temperatures so far for the winter, reaching temperatures as low as 0°C. This, combined with the fact that the $PM_{2.5}$ concentration kept increasing while the traffic numbers were very low, indicates that tunnel traffic is not the cause for the exceedance.

The graphs of hourly concentrations for $PM_{2.5}$ vs Temperature vs Traffic from the 26th June to the 1st July indicate the conditions and relationships of the $PM_{2.5}$ increases and the minimal effect of the tunnel traffic. The night time temperatures from the start of the 26th June 2018 were significantly colder as can
be seen in the NORTH and SOUTH PM$_{2.5}$ (µg/m$^3$) HOURLY CONCENTRATION VS TEMPERATURE graph with a corresponding increase in the PM$_{2.5}$ as the temperature decreases.

In Appendix B the Waterview daily summary report 02/07/2018 shows the increased daily average of PM$_{2.5}$ from Wednesday the 27$^{th}$ June with PM$_{2.5}$ nearing the exceedance limit from the effect of the colder nights.

After the exceedance on the 30$^{th}$ June 2018 the night time temperature increased and the daily average of PM$_{2.5}$ returned to normal levels.

3 CONCLUSION

The most probable cause for the PM$_{2.5}$ concentration exceedance registered on the 30$^{th}$ June 2018 is domestic smoke and general pollution, similar to the elevated levels seen during the baseline monitoring prior to the tunnel opening, as shown in Appendix C and from the report of the exceedance on the 16/07/2017.

The days the 27$^{th}$ and 28$^{th}$ June 2018 showed both stations registering a daily average of greater than 22 µg/m$^3$, getting close to the limit as these nights were cooler.

The NO$_2$ pollution roses indicate that the main source of NO$_2$ is traffic emissions. The PM$_{10}$ and PM$_{2.5}$ pollution roses indicate that the main sources are domestic heating emissions in addition to traffic emissions.

It is also recognised that domestic heating emissions will tend to occur predominantly in the cooler months and general pollution from Auckland City has an effect as with the cooler nights there is usually less wind and an inversion layer forms that is unable to disperse the pollution.
APPENDIX A

Air Quality Monitoring Stations
AIR QUALITY MONITORING STATIONS

Location of portal and southern Air Quality monitoring stations

Location of southern Air Quality monitoring station
Location of northern Air Quality monitoring station
APPENDIX B

Waterview daily summary report 30/06/2018

Waterview daily summary report 02/07/2018

Graphs PM$_{2.5}$ vs Temperature vs Traffic
WATERVIEW DAILY SUMMARY REPORT 30/06/2018

Waterview North Non-Validated Daily Summary Report

PM$_{2.5}$ (µg/m$^3$)

<table>
<thead>
<tr>
<th>Date</th>
<th>Daily Average</th>
<th>Maximum (Hourly)</th>
<th>Minimum (Hourly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30/06/2018</td>
<td>27</td>
<td>69</td>
<td>2</td>
</tr>
</tbody>
</table>

Dust Scatter

Wind Rose

PM$_{2.5}$ Hourly Averages (µg/m$^3$)

PM$_{2.5}$ Daily Averages (µg/m$^3$)

Note: The data presented in this report has not been validated and is subject to change in the monthly validated report. All dates/times used in this report are NZST.
Waterview North Non-Validated Daily Summary Report

\( \text{PM}_{10} \) (\( \mu \text{g/m}^3 \))

<table>
<thead>
<tr>
<th>Date</th>
<th>Daily Average</th>
<th>Maximum (Hourly)</th>
<th>Minimum (Hourly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30/06/2018</td>
<td>34</td>
<td>78</td>
<td>8</td>
</tr>
</tbody>
</table>

Date: 09/08/2018

Note: The data presented in this report has not been validated and is subject to change in the monthly validated report. All dates/times used in this report are NZST.
Waterview North Non-Validated Daily Summary Report

**NO$_2$ ($\mu$g/m$^3$)**

<table>
<thead>
<tr>
<th>Date</th>
<th>Daily Average</th>
<th>Maximum (Hourly)</th>
<th>Minimum (Hourly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30/09/2018</td>
<td>34.3</td>
<td>62.4</td>
<td>12.6</td>
</tr>
</tbody>
</table>

**NO$_2$ Scatter**

Wind Rose

**NO$_2$ Hourly Rolling Averages ($\mu$g/m$^3$)**

**NO$_2$ Daily Averages ($\mu$g/m$^3$)**

Note: The data presented in this report has not been validated and is subject to change in the monthly validated report. All dates/times used in this report are NZST.
Waterview South Non-Validated Daily Summary Report

PM$_{2.5}$ (µg/m$^3$)

<table>
<thead>
<tr>
<th>Date</th>
<th>Daily Average</th>
<th>Maximum (Hourly)</th>
<th>Minimum (Hourly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30/06/2018</td>
<td>26</td>
<td>65</td>
<td>2</td>
</tr>
</tbody>
</table>

Dust Scatter

Wind Rose

100.0% valid data present

PM$_{2.5}$ Hourly Averages (µg/m$^3$)

PM$_{2.5}$ Daily Averages (µg/m$^3$)

Note: The data presented in this report has not been validated and is subject to change in the monthly validated report. All dates/times used in this report are NZST.
Waterview South Non-Validated Daily Summary Report

PM$_{10}$ (µg/m$^3$)

<table>
<thead>
<tr>
<th>Date</th>
<th>Daily Average</th>
<th>Maximum (Hourly)</th>
<th>Minimum (Hourly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30/06/2018</td>
<td>30</td>
<td>75</td>
<td>2</td>
</tr>
</tbody>
</table>

Dust Scatter

Wind Rose

PM$_{10}$ Hourly Averages (µg/m$^3$)

PM$_{10}$ Daily Averages (µg/m$^3$)

Saturday, 30 June 2018

Note: The data presented in this report has not been validated and is subject to change in the monthly validated report.

All dates/times used in this report are NZST.
Waterview South Non-Validated Daily Summary Report

NO₂ (µg/m³)

<table>
<thead>
<tr>
<th>Date</th>
<th>Daily Average</th>
<th>Maximum (Hourly)</th>
<th>Minimum (Hourly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30/09/2018</td>
<td>25.1</td>
<td>61.6</td>
<td>12.8</td>
</tr>
<tr>
<td>Hour ending</td>
<td>10:00</td>
<td>Hour ending</td>
<td>14:00</td>
</tr>
</tbody>
</table>

NO₂ Scatter

Wind Rose

Saturday, 30 June 2018

NO₂ Hourly Rolling Averages (µg/m³)

Saturday, 30 June 2018

Note: The data presented in this report has not been validated and is subject to change in the monthly validated report. All dates/times used in this report are NZST.
Waterview Portal Non-Validated Daily Summary Report

NO₂ (µg/m³)

<table>
<thead>
<tr>
<th>Date</th>
<th>Daily Average</th>
<th>Maximum (Hourly)</th>
<th>Minimum (Hourly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30/06/2018</td>
<td>24.1</td>
<td>50.0</td>
<td>19.8</td>
</tr>
</tbody>
</table>

NO₂ Hourly Rolling Averages (µg/m³)

- Saturday, 30 June 2018

NO₂ Daily Averages (µg/m³)

- 24/06/2018 to 30/06/2018

Note: The data presented in this report has not been validated and is subject to change in the monthly validated report.

All dates/times used in this report are NZST.
WATERVIEW DAILY SUMMARY REPORT 02/07/2018

Waterview North Non-Validated Daily Summary Report
PM$_{2.5}$ (µg/m$^3$)

<table>
<thead>
<tr>
<th>Date</th>
<th>Daily Average</th>
<th>Maximum (Hourly)</th>
<th>Minimum (Hourly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>02/07/2018</td>
<td>9</td>
<td>17</td>
<td>4</td>
</tr>
</tbody>
</table>

Hour ending: 08:00
Hour ending: 04:00

Dust Scatter

Wind Rose

PM$_{2.5}$ Hourly Averages (µg/m$^3$)

PM$_{2.5}$ Daily Averages (µg/m$^3$)

Note: The data presented in this report has not been validated and is subject to change in the monthly validated report.

All dates/times used in this report are NZST.
Waterview North Non-Validated Daily Summary Report

PM$_{10}$ (µg/m$^3$)

<table>
<thead>
<tr>
<th>Date</th>
<th>Daily Average</th>
<th>Maximum (Hourly)</th>
<th>Minimum (Hourly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/07/2018</td>
<td>26</td>
<td>38</td>
<td>17</td>
</tr>
<tr>
<td>Hour ending</td>
<td>11:00</td>
<td>Hour ending</td>
<td>22:00</td>
</tr>
</tbody>
</table>

Dust Scatter

Wind Rose

PM$_{10}$ Hourly Averages (µg/m$^3$)

PM$_{10}$ Daily Averages (µg/m$^3$)

Note: The data presented in this report has not been validated and is subject to change in the monthly validated report. All dates/times used in this report are NZST.
Waterview North Non-Validated Daily Summary Report

NO₂ (µg/m³)

<table>
<thead>
<tr>
<th>Date</th>
<th>Daily Average</th>
<th>Maximum (Hourly)</th>
<th>Minimum (Hourly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20/07/2018</td>
<td>48.2</td>
<td>152.1</td>
<td>6.7</td>
</tr>
</tbody>
</table>

NO₂ Scatter

Wind Rose

Monday, 2 July 2018

NO₂ Hourly Rolling Averages (µg/m³)

Monday, 2 July 2018

NO₂ Daily Averages (µg/m³)

26/06/2018 to 2/07/2018

Note: The data presented in this report has not been validated and is subject to change in the monthly validated report. All dates/times used in this report are NZST.
## Waterview South Non-Validated Daily Summary Report

**PM$_{2.5}$ (µg/m$^3$)**

<table>
<thead>
<tr>
<th>Date</th>
<th>Daily Average</th>
<th>Maximum (Hourly)</th>
<th>Minimum (Hourly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/07/2018</td>
<td>7</td>
<td>15</td>
<td>2</td>
</tr>
</tbody>
</table>

**Note:** The data presented in this report has not been validated and is subject to change in the monthly validated report. All dates/times used in this report are NZST.
Waterview South Non-Validated Daily Summary Report
PM$_{10}$ (µg/m$^3$)

<table>
<thead>
<tr>
<th>Date</th>
<th>Daily Average</th>
<th>Maximum (Hourly)</th>
<th>Minimum (Hourly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20/07/2018</td>
<td>20</td>
<td>26</td>
<td>14</td>
</tr>
</tbody>
</table>

Dust Scatter

Wind Rose

Monday, 2 July 2018

PM$_{10}$ Hourly Averages (µg/m$^3$)

PM$_{10}$ Daily Averages (µg/m$^3$) 26/06/2018 to 2/07/2018

Note: The data presented in this report has not been validated and is subject to change in the monthly validated report. All dates/times used in this report are NZST.
Waterview South Non-Validated Daily Summary Report

NO₂ (µg/m³)

<table>
<thead>
<tr>
<th>Date</th>
<th>Daily Average</th>
<th>Maximum (Hourly)</th>
<th>Minimum (Hourly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/07/2018</td>
<td>26.6</td>
<td>67.9</td>
<td>3.9</td>
</tr>
</tbody>
</table>

Wind Rose

Monday, 2 July 2018

NO₂ Scatter

Monday, 2 July 2018

Note: The data presented in this report has not been validated and is subject to change in the monthly validated report.
All dates/times used in this report are NZST.
Waterview Portal Non-Validated Daily Summary Report

\[ \text{NO}_2 \ (\mu g/m^3) \]

<table>
<thead>
<tr>
<th>Date</th>
<th>Daily Average</th>
<th>Maximum (Hourly)</th>
<th>Minimum (Hourly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>207/2018</td>
<td>31.7</td>
<td>79.5</td>
<td>3.0</td>
</tr>
<tr>
<td>Hour ending</td>
<td>18:00</td>
<td>Hour ending</td>
<td>01:00</td>
</tr>
</tbody>
</table>

**NO\textsubscript{2}** Hourly Rolling Averages (\mu g/m\textsuperscript{2})

- Monday, 2 July 2018

**NO\textsubscript{2}** Daily Averages (\mu g/m\textsuperscript{2})

- 20/06/2018 to 20/07/2018

**Note:** The data presented in this report has not been validated and is subject to change in the monthly validated report.

All dates/times used in this report are NZST.
GRAPHS PM$_{2.5}$ VS TEMPERATURE VS TRAFFIC

North Station 24 Hour Average

<table>
<thead>
<tr>
<th>Date</th>
<th>PM$_{2.5}$ ($\mu$g/m$^3$)</th>
<th>PM$_{10}$ ($\mu$g/m$^3$)</th>
<th>WS (m/s)</th>
<th>WD (*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>26/06/2018</td>
<td>6</td>
<td>18</td>
<td>1.4</td>
<td>225</td>
</tr>
<tr>
<td>27/06/2018</td>
<td>22</td>
<td>37</td>
<td>0.3</td>
<td>181</td>
</tr>
<tr>
<td>28/06/2018</td>
<td>22</td>
<td>30</td>
<td>0.1</td>
<td>199</td>
</tr>
<tr>
<td>29/06/2018</td>
<td>19</td>
<td>26</td>
<td>0.5</td>
<td>164</td>
</tr>
<tr>
<td>30/06/2018</td>
<td>27</td>
<td>34</td>
<td>0.2</td>
<td>9</td>
</tr>
<tr>
<td>1/07/2018</td>
<td>12</td>
<td>20</td>
<td>0.5</td>
<td>335</td>
</tr>
<tr>
<td>2/07/2018</td>
<td>9</td>
<td>26</td>
<td>2.1</td>
<td>247</td>
</tr>
</tbody>
</table>
### South Station 24 Hour Average

<table>
<thead>
<tr>
<th>Date</th>
<th>PM$_{2.5}$ (µg/m$^3$)</th>
<th>PM$_{10}$ (µg/m$^3$)</th>
<th>WS (m/s)</th>
<th>WD (°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>26/06/2018</td>
<td>7</td>
<td>13</td>
<td>1.6</td>
<td>242</td>
</tr>
<tr>
<td>27/06/2018</td>
<td>22</td>
<td>34</td>
<td>0.2</td>
<td>174</td>
</tr>
<tr>
<td>28/06/2018</td>
<td>22</td>
<td>26</td>
<td>0.2</td>
<td>252</td>
</tr>
<tr>
<td>29/06/2018</td>
<td>17</td>
<td>19</td>
<td>0.6</td>
<td>146</td>
</tr>
<tr>
<td>30/06/2018</td>
<td>26*</td>
<td>30</td>
<td>0.1</td>
<td>1</td>
</tr>
<tr>
<td>1/07/2018</td>
<td>9</td>
<td>13</td>
<td>0.8</td>
<td>306</td>
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<tr>
<td>2/07/2018</td>
<td>7</td>
<td>20</td>
<td>2.9</td>
<td>258</td>
</tr>
</tbody>
</table>
NORTH NO₂ (µg/m³) HOURLY CONCENTRATION VS NORTHBOUND TRAFFIC

SOUTH NO₂ (µg/m³) HOURLY CONCENTRATION VS SOUTHBOUND TRAFFIC
APPENDIX C

Baseline data prior to tunnel opening 27/06/2017
BASELINE DATA PRIOR TO TUNNEL OPENING 27/06/2017

Waterview North Non-Validated Daily Summary Report
PM$_{2.5}$ (μg/m$^3$)

<table>
<thead>
<tr>
<th>Date</th>
<th>Daily Average</th>
<th>Maximum (Hourly)</th>
<th>Minimum (Hourly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>27/06/2017</td>
<td>25</td>
<td>54</td>
<td>2</td>
</tr>
</tbody>
</table>

Dust Scatter

Wind Rose

PM$_{2.5}$ Hourly Averages (μg/m$^3$)

PM$_{2.5}$ Daily Averages (μg/m$^3$)

Note: The data presented in this report has not been validated and is subject to change in the monthly validated report.
All dates/times used in this report are NZST.
Waterview North Non-Validated Daily Summary Report

$PM_{10}$ (µg/m$^3$)

<table>
<thead>
<tr>
<th>Date</th>
<th>Daily Average</th>
<th>Maximum (Hourly)</th>
<th>Minimum (Hourly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>27/06/2017</td>
<td>33</td>
<td>68</td>
<td>8</td>
</tr>
</tbody>
</table>

Dust Scatter: Tuesday, 27 June 2017

Wind Rose: Tuesday, 27 June 2017

PM$_{10}$ Hourly Averages (µg/m$^3$)

PM$_{10}$ Daily Averages (µg/m$^3$)

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Waterview North Non-Validated Daily Summary Report

NO₂ (µg/m³)

<table>
<thead>
<tr>
<th>Date</th>
<th>Daily Average</th>
<th>Maximum (Hourly)</th>
<th>Minimum (Hourly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>27/06/2017</td>
<td></td>
<td>68.4</td>
<td>14.2</td>
</tr>
</tbody>
</table>

NO₂ Scatter

Wind Rose

Polar Scatter

61.8% valid data present

67.2% valid data present

NO₂ Hourly Rolling Averages (µg/m³)

NO₂ Daily Averages (µg/m³)

Note: The data presented in this report has not been validated and is subject to change in the monthly validated report.

All dates/times used in this report are NZST.
Waterview South Non-Validated Daily Summary Report
PM$_{2.5}$ (µg/m$^3$)

<table>
<thead>
<tr>
<th>Date</th>
<th>Daily Average</th>
<th>Maximum (Hourly)</th>
<th>Minimum (Hourly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>27/06/2017</td>
<td>19</td>
<td>40</td>
<td>2</td>
</tr>
</tbody>
</table>

Dust Scatter

Wind Rose

Tuesday, 27 June 2017

PM$_{2.5}$ Hourly Averages (µg/m$^3$)
Tuesday, 27 June 2017

PM$_{2.5}$ Daily Averages (µg/m$^3$)
21/06/2017 to 27/06/2017

Note: The data presented in this report has not been validated and is subject to change in the monthly validated report. All dates/times used in this report are NZST.
Waterview South Non-Validated Daily Summary Report
PM$_{10}$ (µg/m$^3$)

<table>
<thead>
<tr>
<th>Date</th>
<th>Daily Average</th>
<th>Maximum (Hourly)</th>
<th>Minimum (Hourly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>27/06/2017</td>
<td>32</td>
<td>119</td>
<td>6</td>
</tr>
</tbody>
</table>

Dust Scatter

Wind Rose

PM$_{10}$ Hourly Averages (µg/m$^3$)  
Tuesday, 27 June 2017

PM$_{10}$ Daily Averages (µg/m$^3$)  
21/06/2017 to 27/06/2017

Note: The data presented in this report has not been validated and is subject to change in the monthly validated report.
All dates/times used in this report are NZST.
Waterview South Non-Validated Daily Summary Report

NO₂ (µg/m³)

<table>
<thead>
<tr>
<th>Date</th>
<th>Daily Average</th>
<th>Maximum (Hourly)</th>
<th>Minimum (Hourly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>27/06/2017</td>
<td>20.5</td>
<td>154.1</td>
<td>4.1</td>
</tr>
</tbody>
</table>

Polar Scatter  
NO₂ Scatter  
Wedge Rose  
Wind Rose  

Note: The data presented in this report has not been validated and is subject to change in the monthly validated report.  
All dates/times used in this report are NZST.
Waterview Portal Non-Validated Daily Summary Report

NO₂ (µg/m³)

<table>
<thead>
<tr>
<th>Date</th>
<th>Daily Average</th>
<th>Maximum (Hourly)</th>
<th>Minimum (Hourly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>27/06/2017</td>
<td>24.6</td>
<td>111.4</td>
<td>5.0</td>
</tr>
</tbody>
</table>

NO₂ Hourly Rolling Averages (µg/m³)
Tuesday, 27 June 2017

NO₂ Daily Averages (µg/m³)
21/06/2017 to 27/06/2017

Note: The data presented in this report has not been validated and is subject to change in the monthly validated report. All dates/times used in this report are NZST.