# Air Quality Monitoring at Buckle Street, Wellington: Final Report

**NIWA Client Report: AKL – 2008-036**
**May 2008**

**NIWAProject:TRZ08103**

# Air Quality Monitoring at Buckle Street, Wellington: Final Report


Authors

Nick Talbot, Sally Gray, Lou Reddish, Tony Bromley, Rowena Moss, Guy Coulson and Ian Longley


*Prepared for*

Transit New Zealand


NIWA Client Report: AKK 2008-048
June 2008

NIWA Project: TRZ08103



National Institute of Water & Atmospheric Research Ltd
269 Khyber Pass Road, Newmarket, Auckland
P O Box 109695, Auckland, New Zealand
Phone +64-9-375 2050, Fax +64-9-375 2051
www.niwa.co.nz

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*Reviewed by:*

*Gustavo Olivares*

*Approved for release by:*

*Ken Becker*

*Formatting checked*

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# Executive Summary

This report contains the results from the air quality monitoring programme run by NIWA; for Transit New Zealand, at Mt Cook School on Buckle Street, Wellington to assess possible worsening of air quality at the School's location due to a proposed relocation of Buckle Street 40 meters to the north of its present location.

This monitoring programme took place between October 2007 and April 2008 and included measurements of carbon monoxide (CO), nitrogen dioxide ($NO_2$) and particulate matter ($PM_{10}$). Meteorological conditions were also recorded, including humidity, temperature, wind direction and wind speed.

Results from the site indicate that concentrations for all 3 monitored substances were found to be under both the National Environmental Standards for Air Quality (AQNES) from the Resource Management Regulations 2004, and the Greater Wellington Regional Ambient Air Quality Guideline (RAAQG) Maximum Acceptable Levels.

The results from this monitoring were extrapolated to provide an estimate of the likely annual mean and maximum concentrations currently experienced at the School, i.e. the baseline air quality. The maximum baseline was summed with the maximum increase in concentrations predicted by dispersion modelling as a result of the proposed realignment. Simple summing of maxima is inherently conservative.

The maximum measured concentrations from the monitoring campaign and the maximum predicted concentrations from modelling are shown in Table ES1. They are compared to the Maximum Acceptable Levels and Maximum Desirable Levels from the RAAQG.

**Table ES1. Measured and predicted pollutant concentrations at Buckle St. Comparison with RAAQG**

| Contaminant | Averaging period | Maximum measured value | Seasonally adjusted baseline | Predicted max increase | **Maximum predicted value** | RAAQG Maximum Acceptable Level | RAAQG Maximum Desirable Level |
|---|---|---|---|---|---|---|---|
| CO ($mg\ m^{-3}$) | 8 hrs | 1.9 | 3.8 | 0.16 | **3.96** | 10 | 6 |
| | 1 hr | 3.5 | 7.0 | 0.42 | **7.42** | 30 | none |
| $PM_{10}$ ($\mu g\ m^{-3}$) | 24 hrs | 31.9 | 31.9 | 0.43 | **32.3** | 50 | none |
| | Annual | - | 14.7 | 0.064 | **15.4** | 20 | none |
| $NO_2$ ($\mu g\ m^{-3}$) | 1 hr | 32.4 | 48.6 | 2.8 | **51.4** | 200 | 95 |
| | 24 hrs | 16.1 | 24.2 | 2.3 | **28.5** | 100 | 30 |

In an extreme maximum traffic scenario, with the new road operating at maximum capacity, $NO_2$ concentrations may be higher than the 24 hour GWRC-AAQG Maximum Desirable Level for 24 hour $NO_2$ as shown in Table ES2. The MDL is exceedingly challenging. For instance, it is exceeded at Corner V (corner of Vivian St and Victoria St, Wellington) more than 50% of the time. It should be remembered that this assessment is highly conservative and that although this value could happen under extreme circumstances, it is highly unlikely. In this assessment, peak increase in pollutants due to the road has been simply summed with the peak background. In reality, the two very rarely coincide. Also note that the MDL exceeded is the 24Hour $NO_2$ guideline it is unlikely that anyone will be exposed for this length of time.

**Table ES2. Predicted $NO_2$ concentrations at Buckle St. With extreme traffic scenario**

| Contaminant | Averaging period | Maximum measured value | Seasonally adjusted baseline | Predicted max increase | **Maximum predicted value** | RAAQG Maximum Acceptable Level | RAAQG Maximum Desirable Level |
|---|---|---|---|---|---|---|---|
| $NO_2$ ($\mu g\ m^{-3}$) | 1 hr | 32.4 | 48.6 | 11.4 | **60** | 200 | 95 |
| | 24 hrs | 16.1 | 24.2 | 9.6 | **34.4** | 100 | 30 |

Results from the monitoring campaign (actual sampling and modelling) at Buckle Street indicate that $NO_2$ concentrations will be well within the RAAQG Maximum Acceptable Level for both 1 and 24-hour concentration averages, even with the worst case traffic scenario and with the highest recorded values from Buckle Street. These values suggest that the best estimate values used in the screening assessment yielded an overestimate in concentrations of $NO_2$ and therefore the expected impact from the road realignment will be lower than estimated in the screening report

We find that the realignment will not lead to any breach of the relevant health-based Standards or Guidelines. Any changes in pollutant concentrations will be small and any incremental worsening of air quality at the school is likely to be close to the limits of detection of air quality instrumentation and not considered significant.

# 1. Introduction and scope

A proposal has been made to realign a section of Buckle Street in Wellington as part of the development of New Zealand Memorial Park led by the Ministry of Culture and Heritage. It is proposed that the section of Buckle Street between Tory Street and Taranaki Street be moved up to 40 m to the north. A potential impact of this change could be a worsening of air quality at Mt Cook School, which is located on the northern side of the street and therefore the road would be located closer than at present.

Buckle Street forms part of Wellington's Inner City By-Pass. It is located in the Mt Cook district on the southern periphery of the CBD (see Figure 1). Traffic is westbound only in two lanes (increasing to three lanes at the western end), carrying 24,000 vehicles per day. The section of interest is delimited by traffic signals at the intersections of Taranaki Street at the west end and Tory Street/Tasman Street at the east end. Figure 2 shows an aerial view of the site with the proposed realignment marked in blue. The red square shows the location of Mt Cook School.

After a screening level assessment took place in July 2007, (NIWA Client Report: AKL2007-057) Transit New Zealand asked NIWA to carry out a full monitoring programme from October 2007 to run for a full 6 month period. This monitoring programme involved the collection of data at a site at the boundary of Mt Cook School closest to the road. Monitoring took place between 17$^{th}$ October 2007 and 21$^{st}$ April 2008 and included measurements of ambient concentrations of carbon monoxide (CO), nitrogen dioxide ($NO_2$), and the mass concentration of particulate matter with an aerodynamic diameter of ten micrometers or less ($PM_{10}$). Meteorological conditions were also recorded, including humidity, temperature, wind direction and wind speed. Figure 3 shows a view of the air quality monitoring station at the southern boundary of Mt. Cook School, looking South towards the National Memorial

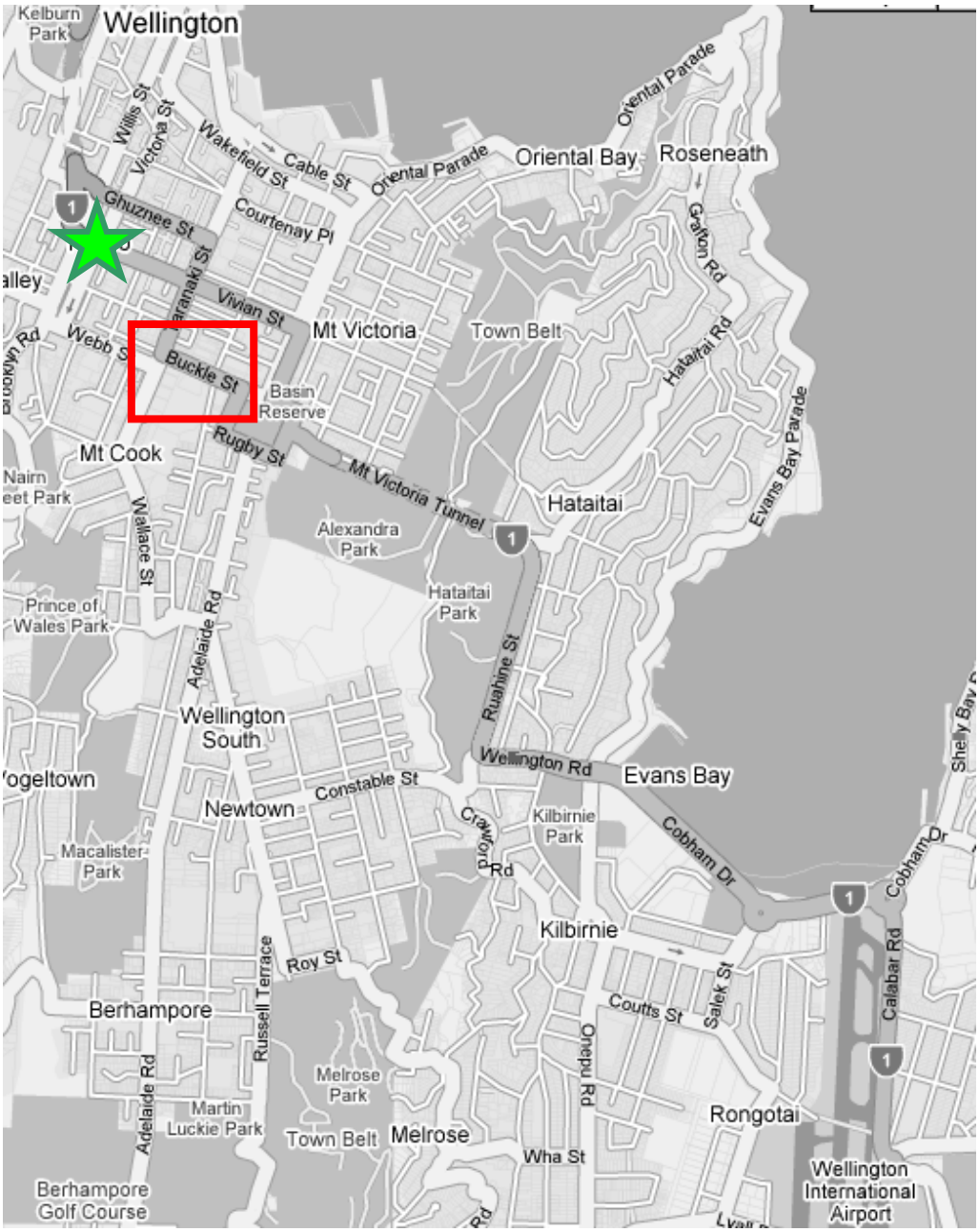


**Figure 1Map of Wellington, indicating the Buckle Street site (red square), and Corner V air quality monitoring site (green star).**


**Figure 2. Aerial view of the Buckle Street site. The grounds of Mt Cook School are coloured red. The approximate realignment is shown as a blue dashed line.**

**Figure 3. View of the air quality monitoring station at the southern boundary of Mt. Cook School, looking South towards the National Memorial**

Changes in air quality are assessed in the context of the National Environmental Standards for Air Quality (AQNES) from the Resource Management Regulations 2004, and the Greater Wellington Regional Ambient Air Quality Guidelines. The Air Quality National Environmental Standards for CO, $NO_2$ and $PM_{10}$ are shown in Table 1 and the GWRC Regional Ambient Air Quality Guidelines (AAQG) in Table 2.

**Table 1. The Air Quality National Environmental Standards for CO, $NO_2$ and $PM_{10}$**

| Contaminant | Threshold concentration | Permissible excess |
|---|---|---|
| Carbon monoxide | 10 mg $m^{-3}$ as a running 8-hr mean | One 8-hr period in 12 months |
| Nitrogen dioxide | 200 µg $m^{-3}$as a 1-hr mean | 9 hours in 12 months |
| $PM_{10}$ | 50 µg $m^{-3}$as a 24-hr mean | One 24-hr period in 12 months |

**Table 2. GWRC Regional Ambient Air Quality Guidelines (RAAQG). Those in bold are the same as the AQNES.**

| Contaminant | Averaging period | RAAQG Maximum Acceptable Level | RAAQG Maximum Desirable Level |
|---|---|---|---|
| CO (mg $m^{-3}$) | 8 hrs | **10** | 6 |
| | 1 hr | 30 | none |
| $PM_{10}$ (µg $m^{-3}$) | 24 hrs | **50** | none |
| | Annual | 20 | none |
| $NO_2$ (µg $m^{-3}$) | 1 hr | **200** | 95 |
| | 24 hrs | 100 | 30 |

The Regional Maximum Acceptable Level (MAL) Guidelines are recommended only as minimum standards of air quality to protect public health. They are **not** maximum permissible concentrations of pollutants in air or limits that can be polluted 'up to' safely as the more sensitive members of the population to air pollution may experience adverse health effects below these levels.

The Maximum Desirable Level (MDL) is defined as the level that will provide maximum protection to the environment (including soil, water, flora, fauna, structures, and amenity values), taking into account existing air quality, community expectations, economic implications, and the purpose and principles of the Resource Management Act 1991. Desirable levels are appropriate guidelines or targets in rural or residential areas and in other areas where good air quality is considered a priority.

# 2. Sampling Methods

The following sub-sections describe the methods and equipment used during the monitoring of substances at Buckle Street.

## 2.1 Carbon Monoxide CO

An API Model 300 CO analyser was used to monitor CO. This unit continuously measures the concentrations of CO in ambient air by collecting a sample of air and then passing a beam of infrared light through the sample. The amount of infrared energy absorbed by the gas sample is measured and the Beer-Lambert law used to calculate the CO concentration. The API Model 300 analyser measures CO in the range of 0 to 62 $mg/m^3$.

## 2.2 Nitrogen Dioxide $NO_2$

An API Model 200 $NO_x$ analyser was used to measure $NO_2$. This unit continuously caluculates the levels of $NO_2$ in ambient air by collecting a sample of air, which is introduced into an ozone reaction chamber. The NO in that sample is reacted with ozone to produce $NO_2$. Light is released as a product of this reaction in a process known as chemiluminescence. The amount of light released is proportional to the number of NO molecules that have just been converted from NO to $NO_2$.

The sample is then passed through a molybdenum converter where all the $NO_2$ is converted to (or back to) NO. The sample is reintroduced into the ozone reaction chamber, where again the NO reacts with ozone to produce $NO_2$ and light. The difference in the amount of light released between the first and second pass through the reaction chamber is proportional to the amount of $NO_2$ in the original sample. The API Model 200 analyser measures $NO_2$ in the range of 0 to 2053 $\mu g/m^3$.

## 2.3 Particulate Matter ($PM_{10}$)

A Thermo Model FH62C14 Beta Attenuation Monitor (BAM) was used to measure Particulate Matter with an aerodynamic diameter of 10 micrometers (μm) or less ($PM_{10}$). The BAM works by measuring the attenuation of a stream of β particles as it passes through PM accumulating on a filter tape. The instrument is listed as an "*acceptable method*" to monitor fine particulate in MfE's User's Guide to the National Environmental Standards. The Thermo FH62C14 monitor measures PM10 in the range of 0 to 1000 $\mu g/m^3$.

### 2.4 Meteorological Data

Weather, particularly wind speed and direction, has a very strong influence on contaminant dispersion and concentrations, and without meteorological data the air quality data is almost impossible to interpret. Therefore wind speed and direction, air temperature and relative humidity were all monitored at the Buckle Street site.

Wind speed data were collected by a Vector A101M anemometer (m/s to 0.1), and wind direction by a Vector W200P wind vane (ºT to ± 2º). Air temperature and relative humidity data were collected with a Vaisala 50Y air temp /RH sensor (ºC to ± 5%, %RH to ± 5%).

## 3. Data Management

### 3.1 Data Logging and monitoring

The raw data from the CO, $NO_x$ and the Beta Attenuation Monitors, as well as from the meteorological sensors were recorded on Campbell CR10 data loggers. The data were downloaded from the loggers via cell phone telemetry and checked on each working day.

### 3.2 Fine Particulate Matter ($PM_{10}$)

Data was collected over a 10 minute averaging period. The one-hour average was calculated using the five 10-minute measurements proceeding the hour and the measurement taken on the hour. A fixed 24-hour average was calculated using the 144 ten minute measurements of $PM_{10}$. The analyser was checked weekly. At the end of each month the data were graphed and quality assured.

### 3.3 Nitrogen Dioxide $NO_2$

Data for $NO_2$ were collected over a 10 minute averaging period. The one-hour average was calculated using the five 10-minute measurements proceeding the hour and the measurement taken on the hour. A fixed 24-hour average was calculated using the 144 ten minute measurements of NO2. The analyser was checked and the calibration verified weekly with a more substantial calibration done on a monthly basis. At the end of each month the data was graphed and quality assured.

### 3.4 Carbon Monoxide CO

Data for CO was collected over a 10 minute averaging period. A one-hour average was calculated using the five 10-minute measurements proceeding the hour and the measurement taken on the hour. A moving 8-hour average was calculated from the 48 ten minute values ending on the hour. The analyser was checked and the calibration verified weekly with a more substantial calibration done on a monthly basis. At the end of each month the data was graphed and quality assured.

### 3.5 Meteorological Data

All data was logged and analysed at 10 minute intervals to correspond with the air quality data.

## 4. Results and Interpretation

### 4.1 Analysis of Buckle Street data

Table 3 shows the maximum, minimum and mean values recorded for the full record of the site (17th October 2007 to 21st April 2008) for the different pollutants monitored and the associated NES or AAQG target values. All the monitored substances fell below both the NES and AAQG standards.

**Table 3. Statistics – full period 17th October 2007 to 21st April 2008**

| Pollutant | Target values | Maximum | Minimum | Average |
|---|---|---|---|---|
| 1 hr $NO_2$ | NES = 200 µg/m$^3$ | 32.4 µg/m$^3$ | Below detection limits | 6.5 µg/m$^3$ |
| 24 hr $NO_2$ | AAQG = 100 µg/m$^3$ | 16.1 µg/m$^3$ | 1.1 µg/m$^3$ | 6.5 µg/m$^3$ |
| 1 hr CO | AAQG = 30 mg/m$^3$ | 3.5 mg/m$^3$ | Below detection limits | 0.1 mg/m$^3$ |
| 8 hr CO | NES = 10 mg/m$^3$ | 1.9 mg/m$^3$ | Below detection limits | 0.1 mg/m$^3$ |
| 24 hr $PM_{10}$ | NES = 50 µg/m$^3$ | 31.9 µg/m$^3$ | 4.8 µg/m$^3$ | 14.6 µg/m$^3$ |

Variations in concentrations can often be related to observed seasonal factors. For instance $PM_{10}$, CO and $NO_2$ concentrations are known to be generally higher in winter

in urban areas of New Zealand due to factors such as increased emissions from home heating and poor dispersion conditions. On the other hand, $PM_{10}$ concentration can be enhanced through aerosol sea-salt particles in the summer months in coastal areas.

Figure 4 shows the concentration of ambient CO measured at Mt Cook School ($mg/m^3$) 8 hour moving average for the period 17th October 2007 to 21st April 2008 and Figure 5 the 24 hour average ambient $NO_2$ concentrations. Figure 6 shows the mass concentration of ambient $PM_{10}$ during the campaign.

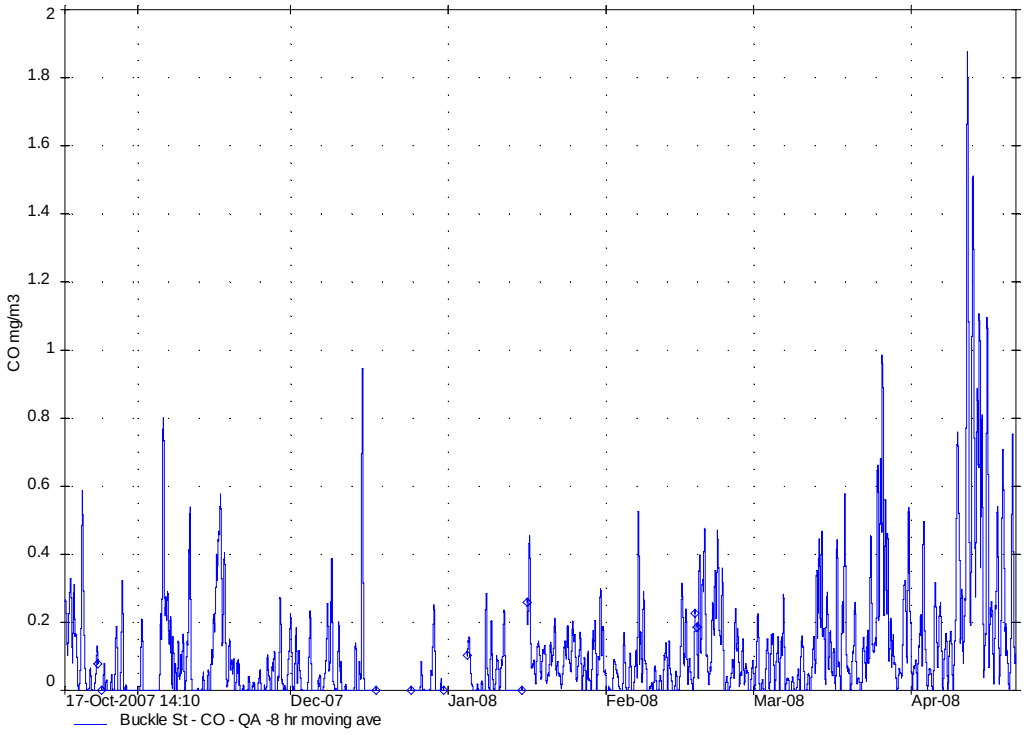


**Figure 4. Concentration of ambient CO measured at Mt Cook School ($mg/m^3$) 8 hour moving average for the period 17th October 2007 to 21st April 2008**

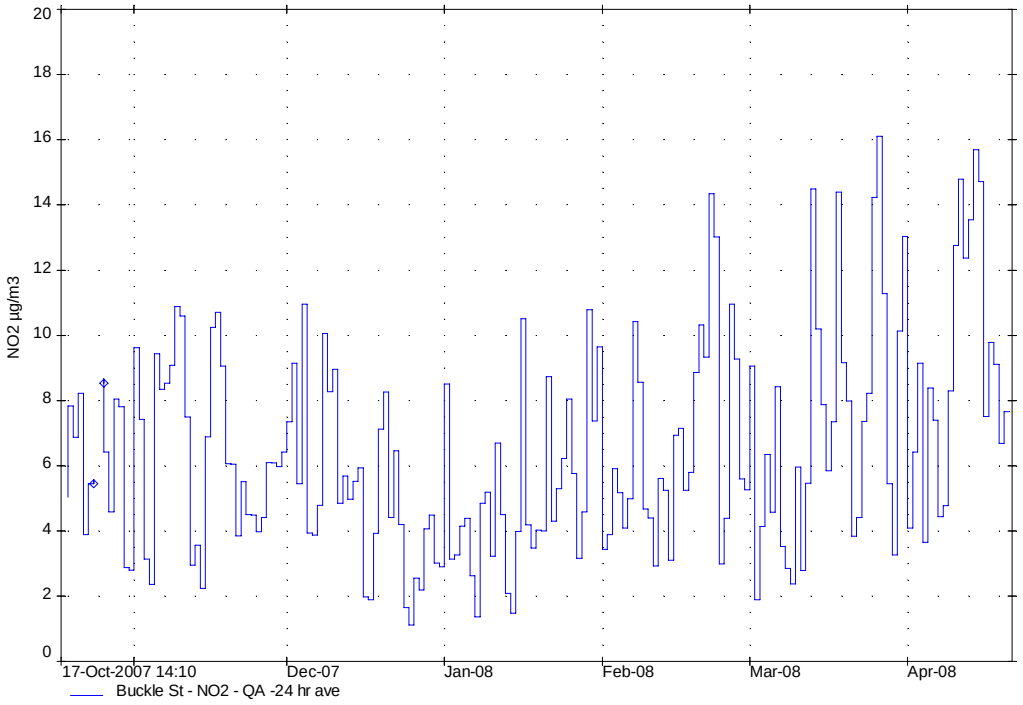


**Figure 5. Concentration of ambient $NO_2$ measured at Mt Cook School (µg/m$^3$) 24 hour average for the period 17$^{th}$ October 2007 to 21$^{st}$ April 2008**

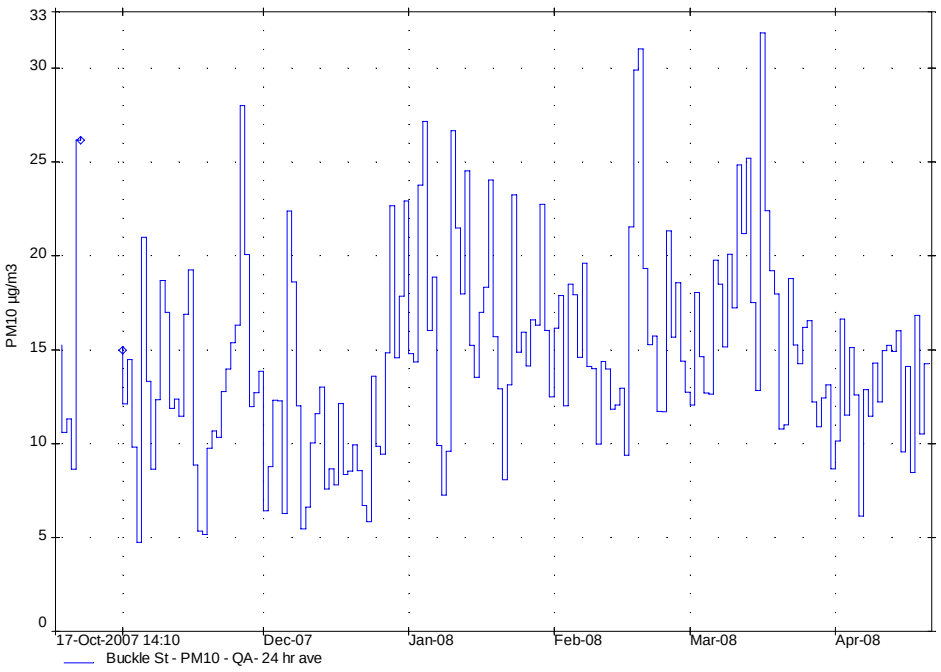


**Figure 6. Mass concentration of ambient $PM_{10}$ measured at Mt Cook School (µg/m$^3$) 24 hour average for the period 17$^{th}$ October 2007 to 21$^{st}$ April 2008**

Figure 4Figure 5 show both CO and $NO_2$ concentrations remaining fairly constant during the early part of the campaign but then exhibit a slight upward trend during the end of March and April, with higher and more frequent high concentrations during the autumnal months.

Figure 6 shows $PM_{10}$ to be highest during the summer months of January, February and March and with a downward trend in April; this again could indicate a presence of seasonal factors such as sea salt aerosol, traditionally higher in summer months for coastal towns.

Analysis of the high values of all three species suggests that most of the high values are not easily attributable to one-off episodes except for the night of 5th November 2007. Figure 7 shows ambient concentrations of CO and $PM_{10}$ and wind speed at Buckle St on the night of 5th and 6th of November 2007. A nearby fireworks display caused a traffic jam as people left the display. Traffic emissions combined with the effects of the fireworks caused a short lived peak with $PM_{10}$ reaching an hourly concentration of 66 µg/m$^3$ although the 24 hour averages for the 5th and 6th were not high (21 µg/m$^3$ and 13 µg/m$^3$ respectively). Therefore we conclude that the maximum measured values are representative of conditions related to the Buckle Street and do not need to be removed as episodic.

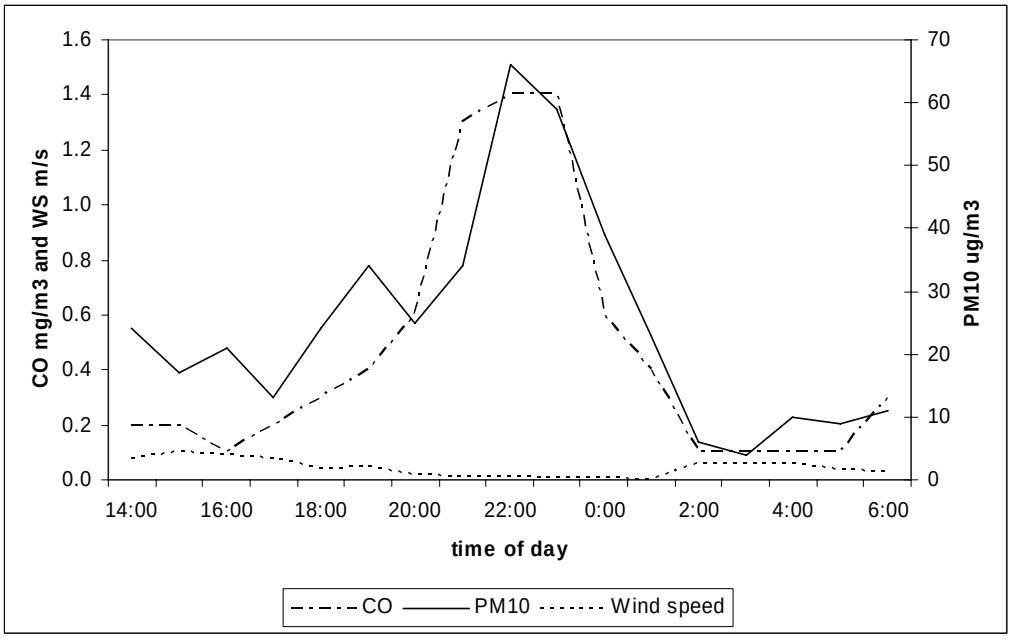


**Figure 7. Ambient concentrations of CO and $PM_{10}$ and wind speed at Buckle St on the night of 5th and 6th of November 2007**

### 4.2 Comparison with Screening Assessment carried out in June 2007

It should be noted that the monitoring data should not be directly compared to the estimates adopted in the screening assessment or to the RAAQG. Such a comparison requires annual data because ambient concentrations of CO and $NO_2$ are known to be generally higher during winter in urban areas of New Zealand. As the monitoring data only covered the summer period, it is likely that the measured values underestimate the actual annual means and maxima at this site.

The existence of established seasonal patterns in concentrations allows us to extrapolate from our monitored data to estimate annual statistics, based upon seasonal relationships established at other monitoring sites. Analysis of the data from other roadside sites in Greater Wellington (Corner V, Ngauranga, Melling, Lower Hutt and Upper Hutt) shows that the ratio of annual mean concentration to mean concentration over the period 17th Oct - 21st April is a maximum of 1.5 for NO2 and 2 for CO. Similar values are found for Auckland monitoring sites. These numbers were used as seasonal adjustment factors. The measured baseline values from Buckle Street were multiplied by these factors to derive the estimated seasonally adjusted baseline. No such consistent seasonal variation can be defined for PM10 in Wellington with the available information - therefore no seasonal adjustment has been applied.

For the screening exercise, estimates for CO and $PM_{10}$ were based on 2004 data from Corner V. For $NO_2$ a conservative estimate was made in the absence of available monitoring data at the time in Wellington. Table 4 shows the values used in the screening process compared to the values obtained from the monitoring.

**Table 4. Maximum baseline values**

| | Value used in Screening Assessment | Buckle Street monitoring | Seasonally adjusted baseline |
|---|---|---|---|
| Max 8 hr CO / mg $m^{-3}$ | 4.3[1] | 1.9 | 3.8 |
| Max 1 hr CO / mg $m^{-3}$ | 7.8[1] | 3.5 | 7 |
| Max 24 hr $PM_{10}$ / μg $m^{-3}$ | 49[1] | 31.9 | 31.9 |
| Max 24 hr $NO_2$ / μg $m^{-3}$ | 140[2] | 16.1 | 24.2 |
| Max 1 hr $NO_2$ / μg $m^{-3}$ | 140[2] | 32.4 | 48.6 ($99.5^{th}$%ile: 37.2) |

[1] Based on 2004 data from Corner V site
[2] Best guess in lieu of data

The six months of monitoring show that the values used in the screening assessment were around 12% higher for CO, 50% higher for $PM_{10}$ and more than 4 times higher for $NO_2$ in comparison to the results obtained at Buckle Street.

The seasonally adjusted baseline data is now summed with the predictions of the peak impact of the realignment as detailed in the screening assessment. Such a simple summing is inherently conservative, as peak baseline and peak road impact may not coincide in time. The results are shown in Table 5 alongside the relevant regional Ambient Air Quality Guidelines.

**Table 5. Comparison with RAAQG**

| Contaminant | Averaging period | Predicted max increase | Seasonally adjusted baseline | **Predicted max impact** | RAAQG Maximum Acceptable Level | RAAQG Maximum Desirable Level |
|---|---|---|---|---|---|---|
| CO ($mg\ m^{-3}$) | 8 hrs | 0.16 | 3.8 | **3.96** | 10 | 6 |
| | 1 hr | 0.42 | 7.0 | **7.42** | 30 | none |
| $PM_{10}$ ($\mu g\ m^{-3}$) | 24 hrs | 0.43 | 31.9 | **32.3** | 50 | none |
| | Annual | 0.064 | 14.7 | **15.4** | 20 | none |
| $NO_2$ ($\mu g\ m^{-3}$) | 1 hr | 2.8 | 48.6 | **51.4** | 200 | 95 |
| | 24 hrs | 2.3 | 24.2 | **28.5** | 100 | 30 |

Despite the inherent conservatism of the method, the maximum predicted impact of the realignment results in concentrations below the Maximum Acceptable Levels and Maximum Desirable Levels. The most marginal case is for 24 hr $NO_2$ which falls just below the MDL. The MDL is exceedingly challenging. For instance, it is exceeded at Corner V more than 50% of the time.

The Screening Assessment Addendum considered an extreme 'Maximum Traffic' scenario, which describes the theoretical maximum capacity of a 3 lane road with a 50 kph limit, and is 3 times greater than the traffic flow at the time of reporting. Table 6 presents the predicted maximum impact for the case of this maximum scenario. All measures are below the MALs and MDLs, with the exception of 24 hr $NO_2$, which is slightly above the MDL level. . It should be remembered that this assessment is highly conservative and that although this value could happen under extreme circumstances, it is highly unlikely. In this assessment, peak increase in pollutants due to the road has been simply summed with the peak background. In reality, the two very rarely coincide. Also note that the MDL exceeded is the 24Hour $NO_2$ guideline it is unlikely that anyone will be exposed for this length of time.

**Table 6. Worst case predictions of $NO_2$ concentrations using the maximum traffic scenario**

| Contaminant | Averaging period | Predicted max increase | Seasonally adjusted baseline | **Predicted max impact** | RAAQG Maximum Acceptable Level | RAAQG Maximum Desirable Level |
|---|---|---|---|---|---|---|
| $NO_2$ ($\mu g\ m^{-3}$) | 1 hr | 11.4 | 48.6 | **60.0** | 200 | 95 |
| | 24 hrs | 9.6 | 24.8 | **34.4** | 100 | 30 |

The Screening Assessment also considered annual $NO_2$ concentrations. There is no Standard or Guideline set by the GWRC or MfE covering this metric. However, the World Health Organisation has published an ambient air quality guideline for this metric of 40 $\mu g\ m^{-3}$. Table 7 shows that annual $NO_2$ at Mt Cook School was conservatively predicted to increase from 9.7 $\mu g\ m^{-3}$ to 10.1 $\mu g\ m^{-3}$.

**Table 7. Worst case predictions of annual average $NO_2$ concentrations using the maximum traffic scenario and compared to the WHO guideline for annual $NO_2$.**

| Contaminant | Predicted max increase | Mean during monitoring period | Seasonally adjusted baseline | **Predicted max impact** | WHO guideline |
|---|---|---|---|---|---|
| $NO_2$ ($\mu g\ m^{-3}$) | 0.35 | 6.5 | 9.7 | **10.1** | 40 |

# 5. Conclusions from the monitoring programme

Before summarising it should be remembered that the data used for analysis and comparisons are peak concentrations obtained throughout the 6 month summer monitoring programme and may be attributed to sources other than the road. This has been done to allow for worst case scenarios and winter concentrations, a period not covered during this monitoring programme.

Results from the monitoring campaign (actual sampling and modelling) at Buckle Street indicate that $NO_2$ concentrations will be well within the RAAQG Maximum Acceptable Level for both 1 and 24-hour concentration averages, even with the worst case traffic scenario and with the highest recorded values from Buckle Street. These values suggest that the best estimate values used in the screening assessment yielded an overestimate in concentrations of $NO_2$ and therefore the expected impact from the road realignment will be lower than estimated in the screening report

$PM_{10}$ results were again well within both NES and RAAQG guidelines, with a peak concentration of 31.9 μg $m^{-3}$ set against RAAQG maximum acceptable level of 50 μg $m^{-3}$.

Maximum CO concentrations were found to be 1.9 mg $m^{-3}$ and 3.5 mg $m^{-3}$ for 8-hourly average and 1-hourly average respectively. These are based on the maximum measured values and still result in less than half the concentrations measured at Corner V and used in the screening assessment.

From this data it can be taken that despite a continuing policy of attaching the peak concentrations obtained by the monitoring programme for each substance and applying the worst case scenario in traffic build-up, no regional AAQG maximum acceptable levels or NES levels were exceeded.

We conclude that the realignment, as modelled in the Screening Assessment, is not expected to lead to the exceedence of any health-based air quality standards or guidelines at Mt Cook School. The incremental worsening of air quality at the school is likely to be close to the limits of detection of air quality instrumentation and not considered significant.

# Appendix One – Site Log

## Instrument & Site History Summary

**Site:** Buckle St
**Pollutant:** CO
**Instrument Description:** API Model 300
**Owner:** NIWA

| Start Date | Finish Date | Data affected ? (y/n) | Event |
|---|---|---|---|
| 16/10/2007 | | n | Analyser **API M300 serial no 713** installed. |
| **16/10/2007 11:00** | | n | **VALID DATA BEGINS** |
| 19/10/2007 09:00 | 19/10/2007 10:20 | y | Initial calibration check |
| 24/10/2007 03:20 | 24/10/2007 13:10 | y | Data logger fault |
| 29/10/2007 12:30 | 29/10/2007 13:20 | y | Zero/Span check |
| 05/11/2007 11:50 | 05/11/2007 12:20 | y | Zero/Span check |
| 12/11/2007 14:10 | 12/11/2007 15:20 | y | Calibration check |
| 14/11/2007 | | n | Data 17/10/2007 to 12/11/2007 processed and QA'd by S. Gray. Data and report for October supplied to Transit. |
| 20/11/2007 10:20 | 20/11/2007 11:30 | y | Zero/Span check |
| 26/11/207 10:20 | 26/11/2007 11:40 | y | Zero/Span check |
| 05/122/07 10:20 | 05/12/2007 10:50 | y | Zero/Span check |
| 10/122/07 12:00 | 10/12/2007 12:50 | y | Zero/Span check |
| 13/122/07 10:00 | 13/12/2007 11:30 | y | Calibration check |
| 14/12/207 | | n | Data 12/11/2007 to 13/12/2007 processed and QA'd by L. Reddish. Data and report for November supplied to Transit. |
| 17/12/2007 12:10 | 17/12/2007 13:10 | y | Zero/Span check |
| 17/12/2007 19:00 | 24/12/2007 10:00 | y | Analyser fault |
| 30/12/2007 08:40 | 30/12/2007 08:50 | n | Spike in the data not deleted as the cause is unknown. The wind was from N-NE at approx 4-5 m/s |
| 31/12/2007 04:30 | 04/01/2008 09:00 | y | Analyser fault |
| 04/01/2008 14:40 | 04/01/2008 16:00 | y | Calibration check |
| 09/01/2008 | | n | Data 13/12/2007 to 04/01/2008 processed and QA'd by S. Gray. Data and report for December supplied to Transit. |
| 15/01/2008 10:10 | 16/01/2008 04:30 | y | Calibration check then **analyser sn 713 replaced with analyser sn 1483** |
| 23/01/2008 12:40 | 23/01/2008 14:00 | y | Calibration check |
| 24/01/2008 10:58 | | n | Site Visit |
| 28/01/2008 10:20 | 28/01/2008 11:10 | y | Zero/Span check |
| 04/02/2008 13:30 | 04/02/2008 15:00 | y | Calibration check |

| | | | |
|---|---|---|---|
| 11/02/2008 11:40 | 11/02/2008 12:50 | y | Zero/Span check |
| 15/02/2008 | | n | Data 04/01/2008 to 04/02/2008 processed and QA'd by S. Gray. Data and report for January supplied to Transit. |
| 18/02/2008 11:40 | 18/02/2008 14:10 | y | Calibration adjustment |

| **Buckle St – CO** | | | |
|---|---|---|---|
| **Start Date** | **Finish Date** | **Data affected ? (y/n)** | **Event** |
| 25/02/2008 14:30 | 25/02/2008 15:40 | y | Zero/Span check |
| 29/02/2008 13:40 | 29/02/2008 15:00 | y | Calibration check |
| 13/03/2008 00:00 | 17/03/2008 24:00 | n | Spikes in the data may be associated with the school grounds and the adjacent construction area being used as a car park during the period of the 5 day international cricket test. |
| 14/03/2008 | | n | Data 04/02/2008 to 29/02/2008 processed and QA'd by S. Gray. Data and report for February supplied to Transit. |
| 14/03/2008 11:10 | 14/03/2008 12:10 | y | Zero/Span check |
| 03/04/2008 13:30 | 03/04/2008 14:40 | y | Calibration check |
| 08/04/2008 | | n | Data 29/02/2008 to 03/04/2008 processed and QA'd by S. Gray. Data and report for March supplied to Transit. |
| 10/04/2008 11:00 | 10/04/2008 12:20 | y | Zero/Span check |
| **21/04/2008 14:10** | **21/04/2008 14:10** | y | **VALID DATA ENDS** and site closed down |
| 30/04/2008 | | n | Data 03/04/2008 to 21/04/2008 processed and QA'd by S. Gray. Data and report for April supplied to Transit. |

# Instrument & Site History Summary

**Site:** Buckle St
**Pollutant:** NOx
**Instrument Description:** API Model 200
**Owner:** NIWA

| Start Date | Finish Date | Data affected ? (y/n) | Event |
|---|---|---|---|
| 16/10/2007 | | n | Analyser **API M200A serial no 2480** installed. |
| **17/10/2007 14:20** | | n | **VALID DATA BEGINS** |
| 18/10/2007 10:40 | 18/10/2007 15:50 | y | Initial calibration check |
| 19/10/2007 10:23 | | n | Site visit |
| 24/10/2007 03:20 | 24/10/2007 13:10 | y | Data logger fault |
| 29/10/2007 10:10 | 29/10/2007 12:20 | y | Zero/Span check |
| 30/10/2007 10:56 | | n | Site visit |
| 05/11/2007 10:10 | 05/11/2007 11:40 | y | Zero/Span check |
| 12/11/2007 10:10 | 12/11/2007 14:00 | y | Calibration check |
| 15/11/2007 | | n | Data 17/10/2007 to 12/11/2007 processed and QA'd by S. Gray. Data and report for October supplied to Transit. |
| 20/11/2007 09:00 | 20/11/2007 10:20 | y | Zero/Span check |
| 26/11/2007 09:10 | 26/11/2007 10:20 | y | Zero/Span check |
| 04/12/2007 08:20 | 04/12/2007 12:50 | y | Calibration check |
| 10/12/2007 10:50 | 10/12/2007 12:00 | y | Zero/Span check |
| 12/12/2007 | | n | Data 12/11/2007 to 04/12/2007 processed and QA'd by S. Gray. Data and report for November supplied to Transit. |
| 17/12/2007 10:50 | 17/12/2007 12:10 | y | Zero/Span check |
| 04/01/2008 09:30 | 04/01/2008 14:30 | y | Calibration check |
| 09/01/2008 | | n | Data 04/12/2007 to 04/01/2008 processed and QA'd by S. Gray. Data and report for December supplied to Transit. |
| 15/01/2008 11:30 | 15/01/2008 12:30 | y | Zero/Span check |
| 24/01/2008 11:10 | 24/01/2008 12:30 | y | Zero/Span check |
| 28/01/2008 09:10 | 28/01/2008 10:20 | y | Zero/Span check |
| 04/02/2008 09:10 | 04/02/2008 13:40 | y | Calibration check |
| 11/02/2008 10:40 | 11/02/2008 11:40 | y | Zero/Span check |
| 18/02/2008 | | n | Data 04/01/2008 to 04/02/2008 processed and QA'd by S. Gray. Data and report for January supplied to Transit. |
| 18/02/2008 10:20 | 18/02/2008 11:40 | y | Zero/Span check |
| 25/02/2008 13:40 | 25/02/2008 14:30 | y | Zero/Span check |
| 29/02/2008 10:30 | 29/02/2008 14:30 | y | Calibration check |

| Buckle St – NOx | | | |
|---|---|---|---|
| **Start Date** | **Finish Date** | **Data affected ? (y/n)** | **Event** |
| 13/03/2008 00:00 | 17/03/2008 24:00 | n | Spikes in the data may be associated with the school grounds and the adjacent construction area being used as a car park during the period of the 5 day international cricket test. |
| 14/03/2008 10:10 | 14/03/2008 11:10 | y | Zero/Span check |
| 20/03/2008 | | n | Data 04/02/2008 to 29/02/2008 processed and QA'd by S. Gray. Data and report for February supplied to Transit. |
| 03/04/2008 09:30 | 03/04/2008 13:30 | y | Calibration check |
| 09/04/2008 | | n | Data 29/02/2008 to 03/04/2008 processed and QA'd by S. Gray. Data and report for March supplied to Transit. |
| 10/04/2008 09:50 | 10/04/2008 11:00 | y | Zero/Span check |
| **21/04/2008 14:10** | **21/04/2008 14:10** | y | **VALID DATA ENDS** and site closed down |
| 30/04/2008 | | n | Data 03/04/2008 to 21/04/2008 processed and QA'd by S. Gray. Data and report for April supplied to Transit |

# Instrument & Site History Summary

**Site:** Buckle St
**Pollutant:** Particulate Matter <10µm
**Instrument Description:** Thermo FH62C14 Beta Gauge
**Owner:** NIWA

| Start Date | Finish Date | Data affected ? (y/n) | Event |
|---|---|---|---|
| 16/10/2007 | | n | Analyser **Thermo serial no E1598** installed. |
| **17/10/2007 10:40** | | n | **VALID DATA BEGINS** |
| 18/10/2007 13:49 | | n | Site visit |
| 19/10/2007 10:17 | | n | Site visit |
| 23/10/2007 11:00 | 30/10/2007 15:30 | y | Analyser developed a fault. Inlet unit replaced on 30th October |
| 05/11/2007 09:55 | | n | Site visit |
| 05/11/2007 20:50 | 05/11/2007 23:40 | n | Spike in the data not deleted - caused by a back up of traffic following the fireworks display on the waterfront. |
| 12/11/2007 13:23 | | n | Site visit |
| 14/11/2007 | | n | Data 17/10/2007 to 12/11/2007 processed and QA'd by S. Gray. Data and report for October supplied to Transit. |
| 20/11/2007 10:24 | | n | Site visit |
| 26/11/2007 09:02 | | n | Site visit |
| 04/12/2007 08:34 | | n | Site visit |
| 10/12/2007 12:30 | | n | Site visit |
| 12/12/2007 | | n | Data 12/11/2007 to 10/12/2007 processed and QA'd by S. Gray. Data and report for November supplied to Transit. |
| 13/12/2007 10:27 | | n | Site visit |
| 17/12/2007 10:25 | | n | Site visit |
| 30/12/2007 08:40 | 30/12/2007 09:40 | n | Spike in the data not deleted as the cause is unknown. The wind was from the N-NE at approx 4-5 m/s. |
| 04/01/2008 08:51 | | n | Site visit |
| 09/01/2008 | | n | Data 10/12/2007 to 04/01/2008 processed and QA'd by S. Gray. Data and report for December supplied to Transit. |
| 15/01/2008 10:12 | | n | Site visit |
| 23/01/2008 13:12 | | n | Site visit |
| 24/01/2008 11:06 | | n | Site visit |
| 28/01/2008 09:07 | | n | Site visit |
| 04/02/2008 09:09 | | n | Site visit |
| 11/02/2008 10:38 | | n | Site visit |
| 14/02/2008 | | n | Data 04/01/2008 to 04/02/2008 processed and QA'd by S. Gray. Data and report for January supplied to Transit. |
| 18/02/2008 10:21 | | n | Site visit |

| **Buckle St – $PM_{10}$** | | | |
|---|---|---|---|
| **Start Date** | **Finish Date** | **Data affected ? (y/n)** | **Event** |
| 25/02/2008 13:35 | | n | Site visit |
| 26/08/2008 08:50 | | n | Site visit |
| 29/02/2008 11:07 | | n | Site visit |
| 13/03/2008 | | n | Data 04/02/2008 to 2902/2008 processed and QA'd by S. Gray. Data and report for February supplied to Transit. |
| 13/03/2008 00:00 | 17/03/2008 24:00 | n | Spikes in the data may be associated with the school grounds and the adjacent construction area being used as a car park during the period of the 5 day international cricket test. |
| 14/03/2008 10:10 | | n | Site visit |
| 03/04/2008 14:21 | | n | Site visit |
| 08/04/2008 | | n | Data 29/02/2008 to 03/04/2008 processed and QA'd by S. Gray. Data and report for March supplied to Transit. |
| 10/04/2008 12:13 | | n | Site visit |
| 18/04/2008 12:00 | 18/04/2008 22:50 | n | Spike in the data appears to be associated with a wind change from north around to the south. |
| **21/04/2008 12:10** | **21/04/2008 12:10** | y | **VALID DATA ENDS** and equipment removed |
| 30/04/2008 | | n | Data 03/04/2008 to 21/04/2008 processed and QA'd by S. Gray. Data and report for April supplied to Transit. |

## Instrument & Site History Summary

**Site:** Buckle St
**Pollutant:** Meteorological
**Instrument Description:** various
**Owner:** NIWA

| Start Date | Finish Date | Data affected ? (y/n) | Event |
|---|---|---|---|
| 17/10/2007 | | n | Sensors in use:<br>**Wind speed** - Vector A101M<br>**Wind Direction** - Vector W200P<br>**Air Temp / Relative Humidity** - Vaisala 50Y |
| 17/10/2007 14:00 | 17/10/2007 15:45 | n | Calibration |
| **17/10/2007 16:00** | | n | **VALID DATA BEGINS** |
| 18/10/2007 10:00 | 18/10/2007 10:00 | y | **All parameters -** New data logger program loaded |
| 24/10/2007 11:30 | 24/10/2007 13:20 | y | **All parameters -** Data logger fault |
| 29/10/2007 13:40 | 29/10/2007 13:40 | y | **Wind Speed and Direction only –** mast adjusted due to movement during recent strong winds |
| 16/10/2007 | | n | Data 17/10/2007 to 12/11/2007 processed and QA'd by S. Gray. Data and report for October supplied to Transit. |
| 12/12/2007 | | n | Data 12/11/2007 to 10/12/2007 processed and QA'd by S. Gray. Data and report for November supplied to Transit. |
| 09/01/2008 | | n | Data 10/12/2007 to 04/01/2008 processed and QA'd by S. Gray. Data and report for December supplied to Transit. |
| 18/02/2008 | | n | Data 04/01/2008 to 04/02/2008 processed and QA'd by S. Gray. Data and report for January supplied to Transit. |
| 20/03/2008 | | n | Data 04/02/2008 to 29/02/2008 processed and QA'd by S. Gray. Data and report for February supplied to Transit. |
| 08/04/2008 | | n | Data 29/02/2008 to 03/04/2008 processed and QA'd by S. Gray. Data and report for March supplied to Transit. |
| **21/04/2008 14:20** | **21/04/2008 14:20** | y | **VALID DATA ENDS** when site is closed down. |
| 30/04/2008 | | n | Data 03/04/2008 to 21/04/2008 processed and QA'd by S. Gray. Data and report for April supplied to Transit. |