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Transurban QLD

Legacy Way Air Monitoring Network

Ambient Air Quality Monitoring

Validated Report_Amended

1st August 2017 – 31st August 2017

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ECOTECH PTY LTD. ABN: 32005752081

1492 Ferntree Gully Rd, Knoxfield VIC. 3180. AUSTRALIA

Tel No: 1300 364 946 Fax No: 1300 668 763

Email ecotech@ecotech.com WEB www.ecotech.com

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Customer Details	
Customer	Transurban QLD
Contact name	Michael Coombes
Email	mcoombes@transurban.com
Phone	0429 218 675

Revision History			
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0	DAT12349	7/09/2017	Camila Trindade
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Refer to Appendix 3 for details of amendments

Report by: **Camila Trindade**

Approved Signatory: **Jon Alexander**

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Executive Summary

Legacy Way is a tunnel network located in Brisbane QLD linking the Western Freeway at Toowong with the Inner City Bypass (ICB) at Kelvin Grove. Transurban QLD is responsible for the design, construction and operation of the network.

Ecotech Pty Ltd has been commissioned by Transurban QLD for air quality monitoring, data collection and reporting at four external ambient air quality monitoring stations, Legacy Way East Victoria Park (E1), Eastern Centenary Pool (E2), West Anzac Park (W1) and West Botanic Gardens (W2). Two new ventilation outlet air quality stations were commissioned in June 2015, Legacy Way VSO East and VSO West.

Percentage availability for some parameters at Transurban QLD Legacy Way Monitoring Network was below 95% for the reporting month. Please refer to Table 15-20 in *Section 5.1 – Data Capture* for further information.

There was one reported exceedence of the air quality limits at Transurban QLD Legacy Way Monitoring Network for the reporting month. Please refer to Table 21-26 in *Section 5.2 – Air Quality Summary* for further information.

1.0 Introduction

Ecotech Pty Ltd was commissioned by Transurban QLD to provide monitoring and data reporting for the Legacy Way ambient air quality monitoring network, located as detailed in Table 1. Ecotech commenced data collection on 18th February 2014 for the external ambient sites.

This report presents the available data for August 2017.

The data presented in this report:

- Describes air quality measurements;
- Compares monitoring results;
- Has been quality assured;
- Complies with NATA accreditation requirements, where applicable.

2.0 Monitoring and Data Collection

2.1. Siting Details

The Transurban QLD Legacy Way monitoring network consists of four ambient air quality monitoring stations and two ventilation outlet air quality stations. The stations location and siting details are described below.

Table 1: Transurban QLD Legacy Way monitoring site locations

Site Name	Geographical Coordinates	Height Above Sea Level (m)
East Victoria Park (E1)	S 27° 27' 19.9578", E 153° 1' 0.5982"	32
Eastern Centenary Pool (E2)	S 27° 27' 18.0426", E 153° 1' 31.1874"	32
West Anzac Park (W1)	S 27° 28' 49.8792", E 152° 58' 37.7466"	49
West Botanic Gardens (W2)	S 27° 28' 35.7918", E 152° 58' 45.5016"	30
VSO East[1]	S 27° 27' 20.6856", E 153° 01' 06.8520"	39
VSO West[1]	S 27° 28 '40.1160", E 152° 58' 42.1068"	32

[1] Geographical Coordinates for VSO East and West were taken from online maps

A siting audit was conducted on the 5th June 2017 at Legacy Way East Victoria Park (E1), on the 03rd May 2017 at West Botanic Gardens (W2), on the 05th June 2017 at Eastern Centenary Pool (E2) and on the 07th June 2017 at West Anzac Park (W1) stations to assess for compliance with *AS/NZS 3580.1.1:2007"*. The siting of these stations does not comply fully with *AS/NZS 3580.1.1:2007* due to the proximity of nearby trees.

Figure 1: Transurban QLD Legacy Way Monitoring Station Locations

2.2. Monitored Parameters

Tables 2 and 3 below detail the parameters monitored and the instruments used at the Legacy Way monitoring stations. Appendix 1 defines any abbreviated parameter names used throughout the report.

Table 2: Parameters measured at the Transurban QLD Legacy Way external ambient monitoring stations

Station(s)	Parameter Measured	Instrument and Measurement Technique
Victoria Park (E1) Centenary Pool (E2) Anzac Park (W1) Botanic Gardens (W2)	CO	Ecotech Serinus 30 – NDIR gas filter
	NO, NO_2, NO_x	Ecotech Serinus 40 – gas phase chemiluminescence
	PM_{10}, $PM_{2.5}$	Met One BAM 1020 – Beta ray attenuation
Centenary Pool (E2) Anzac Park (W1)	Wind Speed (horizontal, elevation 10m)	RM Young 85000 - ultrasonic
	Wind Direction (elevation 10m)	RM Young 85000 - ultrasonic
	Ambient Temperature (elevation 2m)	MetOne 062MP
	Ambient Temperature (elevation 10m)	MetOne 062MP
	Relative Humidity (elevation 2m)	MetOne 083E-1-35
	Solar Radiation	Middleton Solar Pyranometer SK- 01-D2
	Rain Gauge	Hydrological Services TB6

Table 3: Parameters measured at the Transurban QLD Legacy Way ventilation outlets stations

Parameter Measured	Instrument and Measurement Technique
CO	Ecotech Serinus 30 – NDIR gas filter
NO, NO_2, NO_x	Ecotech Serinus 40 – gas phase chemiluminescence
PM_{10}	Fidas 200 – optical light scattering

2.3. Data Collection Methods

Table 4 below shows the methods used for data collection. Any deviations from the stated methods are detailed in section 2.3.1.

Table 4: Methods

Parameter Measured	Data Collection Methods Used	Description of Method
NO, NO_2, NO_x	AS/NZS 3580.5.1 - 2011	Methods for sampling and analysis of ambient air - Method 5.1: Determination of oxides of nitrogen-Chemiluminescence method
	Ecotech Laboratory Manual	In-house method 6.1 - Oxides of nitrogen by chemiluminescence
CO	AS/NZS 3580.7.1 - 2011	Methods for sampling and analysis of ambient air. Method 7.1: Determination of carbon monoxide—Direct-reading instrumental method
	Ecotech Laboratory Manual	In-house method 6.3 – Carbon monoxide by gas filter correlation spectrophotometry
PM_{10} (BAM 1020)	AS/NZS 3580.9.11 - 2016	Methods for sampling and analysis of ambient air Method 9.11: Determination of suspended particulate matter—PM_{10} beta attenuation monitors
	Ecotech Laboratory Manual	In-house method 7.5 – Measurement of PM_{10}, $PM_{2.5}$ and TSP using Beta Attenuation Monitor
$PM_{2.5}$ (BAM 1020)	AS/NZS 3580.9.12-2013	Methods for sampling and analysis of ambient Air - Method 9.12: Determination of suspended particulate matter—$PM_{2.5}$ beta attenuation monitors
	Ecotech Laboratory Manual	In-house method 7.5 – Measurement of PM_{10}, $PM_{2.5}$ and TSP using Beta Attenuation Monitor
PM_{10} (Fidas 200)	Ecotech Laboratory Manual	In-house method 9.7 – PM_{10} and $PM_{2.5}$ Particulate Matter – Light Scattering Method Using Palas Fidas® 200 Series Monitors

Parameter Measured	Data Collection Methods Used	Description of Method
Vector Wind Speed (Horizontal)	AS 3580.14 2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.1 - Wind speed (Horizontal) by anemometer
Vector Wind Direction	AS 3580.14 2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.3 - Wind direction by anemometer
Differential Temperature	AS 3580.14 2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.4 - Temperature ambient by thermoelectric techniques
Relative Humidity	AS 3580.14 2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.5 – Relative humidity by hygrometer
Solar Radiation	AS 3580.14 2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.6 – Global solar radiation and Net radiation by pyranometer and net pyrradiometer
Rain	AS 3580.14 2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.7 – Rainfall by tipping bucket rain gauge

2.3.1. Compliance with Standards

Unless stated below, parameters are monitored at the Transurban QLD Network according to the methods detailed in Table 4.

- The siting of external ambient monitoring stations does not comply fully with *AS/NZS 3580.1.1:2007* due to the proximity of nearby trees.

- Measurement of CO and NOx at Transurban QLD VSO East and West does not fully comply with requirements of AS/NZS 3580.7.1 -2011 and AS/NZS 3580.5.1-2011 respectively and is not covered by Ecotech's NATA scope of accreditation as NATA have advised that the ambient standard cannot be directly applied to the ventilation stack sampling method. Ecotech are in the process of applying for accreditation for monitoring these parameters in stacks (including tunnel ventilation stacks) using a direct extraction method which will allow results to be fully endorsed.

2.3.2. Data Acquisition

Data acquisition is performed using a PC based WinAQMS logger (using WinAQMS® Version 2.0) situated at each of the monitoring sites. Each logger is equipped with a 3G modem for remote data collection. The recorded data is remotely collected from the AQMS loggers on a daily basis (using AirodisTM version 5.1.0) and stored at Ecotech's Environmental Reporting Services (ERS) department in Melbourne, Australia. Data samples are logged in 5 minute intervals, except for beta attenuation monitor dust parameters which are logged in 1 hour intervals.

2.4. Data Validation and Reporting

2.4.1. Validation

The Ecotech ERS department performs daily data checks to ensure maximum data capture rates are maintained. Any equipment failures are communicated to the responsible field engineers for urgent rectification. Ecotech ERS maintains two distinct databases containing non-validated and validated data respectively.

The validated database is created by duplicating the non-validated database and then flagging data affected by instrument faults, calibrations and other maintenance activities. The data validation software requires the analyst to supply a valid reason (e.g. backed by maintenance notes, calibration sheets etc) in the database for flagging any data as invalid.

Details of all invalid or missing data are recorded in the Valid Data Exception Tables.

Validation is performed by the analyst, and the validation is reviewed. Graphs and tables are generated based on the validated five minute and one hour data.

2.4.2. Reporting

Data is reported separately in two Microsoft Excel format files named *"Transurban QLD Legacy Way Monthly Data Report_August 2017.xls"* and *"Transurban QLD Legacy Way Monthly Met Data Report_August 2017.xls".*

The *Transurban QLD Legacy Way Monthly Data Report_August 2017* Excel file consists of nine worksheets:

1. Cover
2. 5 Minute Data
3. 1 Hour Data
4. 1 Day Data
5. CO 8hr Rolling
6. Span
7. Zero
8. Precision
9. Valid Data Exception Report

The *Transurban QLD Legacy Way Monthly Met Data Report_August 2017* Excel file consists of five worksheets:

1. Cover
2. 5 Minute Data
3. 1 Hour Data
4. 1 Day Data
5. Valid Data Exception Report

The data contained in this report is based on Australian Eastern Standard Time.

All averages are calculated from the five minute data, except dust parameters from BAM1020 instruments which are calculated from one hour data. Averages are based on a minimum of 75% valid readings within the averaging period.

As the Fidas® 200 instrument records mass concentrations values in µg/m³ referenced to the local ambient temperature and pressure, the PM_{10} data is corrected to Australian STP.

Averaging periods of eight hours or less are reported for the end of the period, i.e. the hourly average 02:00am is for the data collected from 1:00am to 2:00am. One hour averages are calculated based on a clock hour. One day averages are calculated based on calendar days.

Table 5: Automatic Span / Zero and Background checks at Transurban QLD Legacy Way

Station	Parameter	Span / Zero	Background
Victoria Park (E1)	NO_x / NO_2 / NO	01:00 – 01:45	n/a
	CO	01:00 – 01:45	23:50
Centenary Pool (E2)	NO_x / NO_2 / NO	01:00 – 01:45	n/a
	CO	01:00 – 01:45	23:50 – 00:00
Anzac Park (W1)	NO_x / NO_2 / NO	01:00 – 01:45	n/a
	CO	01:00 – 01:45	23:45 - 23:50
Botanic Gardens (W2)	NO_x / NO_2 / NO	01:00 – 01:45	n/a
	CO	01:00 – 01:45	00:00 – 00:05
VSO East	NO_x / NO_2 / NO	01:00 – 01:40	n/a
	CO	01:00 – 01:40	23:50 - 23:55
VSO West	NO_x / NO_2 / NO	01:00 – 01:40	n/a
	CO	01:00 – 01:40	23:50

Missing data (excluding automatic spans/zeros and background checks) for all stations are explained in the "Valid Data Exception Report" spreadsheets in the "*Transurban QLD Legacy Way Monthly Data Report_August 2017.xls*" and "*Transurban QLD Legacy Way Monthly Met Data Report_August 2017"* files, as well as in Tables 35-42.

3.0 Air Quality Goals

The air quality goals and criteria for pollutants monitored at the Transurban QLD Legacy Way ambient monitoring sites are based on the Coordinator- General's report on project changes. The air quality goals and criteria are shown in

Table 6 and Table 7, for external ambient air monitoring and for ventilation outlet monitoring respectively.

Table 6: Transurban QLD Legacy Way External Ambient Stations Air Quality Goals

Parameter	Time Period	Goal Level	Units	Maximum allowable exceedences
CO	8 hours (rolling, based on 1 hour averages)	11.0	mg/m^3	1 day a year
NO_2	1 hour	250	$\mu g/m^3$	1 day a year
	1 year	62	$\mu g/m^3$	None
PM_{10}	1 day	50	$\mu g/m^3$	5 days a year
$PM_{2.5}$	1 day	25	$\mu g/m^3$	Advisory goal only, no maximum
	1 year	8	$\mu g/m^3$	Advisory goal only, no maximum

Table 7: Transurban QLD Legacy Way Ventilation Outlet Stations Air Quality Criteria

Parameter	Time Period	Criteria Level	Units
CO	1 hour	70.0	ppm
NO_2	1 hour	2	mg/m^3
PM_{10}	1 hour	1	mg/m^3

4.0 Calibrations and Maintenance

4.1. Units and Uncertainties

The uncertainties for each parameter have been determined by the manufacturer's tolerance limits of the equipment's parameters, and by the data collection standard method.

The reported uncertainties are expanded uncertainties, calculated using coverage factors which give a level of confidence of approximately 95%.

Table 8: Units and Uncertainties

Parameter	Units	Resolution	Uncertainty	Measurement Range[2]
NO, NO_x (S40)	µg/m³	1 µg/m³	± 17.4 µg/m³ or 10% of reading, whichever is the greater k factor of 2.0	0 to 669 µg/m³
	mg/m^3	0.001 mg/m^3	± 0.017 mg/m³ or 10% of reading, whichever is the greater k factor of 2.0	0 to 0.669 mg/m³
NO_2 (S40)	µg/m³	1 µg/m³	± 34.9 µg/m³ k factor of 2.0	0 to 1026 µg/m³
	mg/m^3	0.001 mg/m^3	± 0.035 mg/m³ k factor of 2.0	0 to 1.026 mg/m³
CO (S30)	ppm	0.1 ppm	± 1 ppm or 10% of reading, whichever is the greater k factor of 2.0	0 to 50 ppm
	mg/m³	0.1 mg/m³	± 1.3 mg/m³ or 10% of reading, whichever is the greater k factor of 2.0	0 to 62 mg/m³
PM_{10}, $PM_{2.5}$ (BAM 1020)	µg/m³	1 µg/m³	±5.0 µg/m³ or 5.4% of reading, whichever is greater K factor of 2.0	0 to 1000 µg/m³

[2] Uncertainties may not be calculated based on the full measurement range.

Parameter	Units	Resolution	Uncertainty	Measurement Range[2]
PM_{10} (Fidas)	mg/m^3	0.001 mg/m^3	±21% of reading k factor of 1.96	0 to 10 mg/m^3
Vector Wind Speed	m/s	0.1 m/s	±0.4 m/s or 2 % of reading, whichever is greater K factor of 2.0	0 to 20 m/s
Vector Wind Direction	°	1°	±4° K factor of 2.11	0 to 360° Starting threshold: 0 m/s
Ambient Temperature	°C	0.1 °C	±0.6 °C K factor of 2.0	0 to 50 °C
Relative Humidity	%	1 %	±6 % K factor of 2.31	0-100 %
Solar Radiation	W/m^2	1 W/m^2	±15 W/m^2 or 3 % of reading whichever is greater K factor of 2.0	0 to 1100 W/m^2
Rain	mm	0.2 mm	±0.60 mm or 7.5 % of reading, whichever is the greater K factor of 2.1	Rainfall rates of 0 to 80 mm/hr

4.2. Maintenance

4.2.1. Calibration & Maintenance Summary Tables

The last calibrations for the following parameters were performed on the indicated dates. Data supplied after this time is subject to further validation, to be performed at the next calibration cycle.

Note: Maintenance and calibration dates may differ, as calibrations may be less frequent than scheduled maintenance visits.

Tables 9-14 indicate when the particulate and gas equipment were last maintained/calibrated.

Table 9: Transurban QLD East Victoria Park (E1) Maintenance Table August 2017

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	03/08/17	Unscheduled	01/08/17	Monthly
CO	01/08/17	6 monthly	01/08/17	Monthly
PM_{10}	11/08/17	Unscheduled	01/08/17	3 monthly
$PM_{2.5}$	11/08/17	Unscheduled	01/08/17	3 monthly

Table 10: Transurban QLD Eastern Centenary Pool (E2) Maintenance Table August 2017

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	02/08/17	6 monthly	02/08/17	Monthly
CO	02/08/17	6 monthly	02/08/17	Monthly
PM_{10}	11/08/17	Unscheduled	02/08/17	3 monthly
$PM_{2.5}$	11/08/17	Unscheduled	02/08/17	3 monthly
Wind Speed	03/08/17	Monthly	18/03/16	2-yearly
Wind Direction	03/08/17	Monthly	18/03/16	2-yearly
Ambient Temperature	03/08/17	6 monthly	03/08/17	6 monthly
Relative Humidity	03/08/17	6 monthly	03/08/17	6 monthly
Solar Radiation	03/08/17	6 monthly	01/03/17	Yearly
Rain	02/08/17	3 monthly	06/03/17	Yearly

Table 11: Transurban QLD West Anzac Park (W1) Maintenance Table August 2017

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	02/08/17	6 monthly	02/08/17	Monthly
CO	02/08/17	6 monthly	02/08/17	Monthly
PM_{10}	11/08/17	Unscheduled	02/08/17	3 monthly
$PM_{2.5}$	11/08/17	Unscheduled	02/08/17	3 monthly
Wind Speed	02/08/17	Monthly	12/02/16	2-yearly
Wind Direction	02/08/17	Monthly	12/02/16	2-yearly
Ambient Temperature	08/08/17	Unscheduled	02/08/17	6 monthly
Relative Humidity	02/08/17	6 monthly	02/08/17	6 monthly
Solar Radiation	02/08/17	6 monthly	03/05/17	Yearly
Rain	02/08/17	3 monthly	06/03/17	Yearly

Table 12: Transurban QLD West Botanic Gardens (W2) Maintenance Table August 2017

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	18/08/17	Unscheduled	18/08/17	Monthly
CO	11/08/17	Unscheduled	02/08/17	Monthly
PM_{10}	11/08/17	Unscheduled	02/08/17	3 monthly
$PM_{2.5}$	11/08/17	Unscheduled	02/08/17	3 monthly

Table 13: Transurban QLD VSO East Maintenance Table August 2017

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	15/08/17	Unscheduled	15/08/17	Monthly
CO	03/08/17	Unscheduled	01/08/17	Monthly
PM_{10}	04/08/17	3 monthly	04/08/17	3 monthly

Table 14: Transurban QLD VSO West Maintenance Table August 2017

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	15/08/17	Unscheduled	15/08/17	Monthly
CO	01/08/17	Yearly	01/08/17	Monthly
PM_{10}	18/08/17	Unscheduled	06/06/17	3 monthly

4.2.2. Maintenance notes

Fidas analyser at TransCity VSO West was out of manufacturer specifications and the measurement of PM_{10} from 14/08/17 to 01/09/17 has been deemed as invalid.

5.0 Results

5.1. Data Capture

Valid data capture refers to the amount of valid data collected during the report period. It is based on 5 minute data, for all continuously monitored parameters. Except for BAM1020 dust parameters which are based on hourly values.

The percentage of valid data captured is calculated using the following equation:

Valid Data capture = (Reported air quality data / Total data) x 100%

Where:

- Reported air quality data = Number of samples (instrument readings) which have been validated through a quality assured process and excludes all data errors, zero data collection due to calibration, equipment failures, planned and unplanned maintenance.
- Total data = Total number of samples (instrument readings) expected for the sampling period. Total data is calculated based on the same averaging period as "reported air quality data" and the duration of the corresponding report period. e.g. for 5 minute data collected over a month of 31 days, the total data would be equal to 12 (5 minute samples in an hour) x 24 (hours in a day) x 31 (days in a month) = 8928 samples.

Tables 15-20 below display data capture statistics for August 2017. **Bold** values in the table indicate data capture below 95%.

Details of all invalid or missing data affecting data affecting data capture are included in the Valid Data Exception Tables, see section 6.0 and attached Excel files.

Table 15: Data Capture for Transurban QLD East Victoria Park (E1)

Month	NO, NO_2, NO_X (%)	CO (%)	PM_{10} (%)	$PM_{2.5}$ (%)
Sep/16	97.5	96.7	99.3	99.4
Oct/16	97.5	96.6	98.8	99.6
Nov/16	97.6	97.0	99.6	**56.7**
Dec/16	97.7	97.2	99.6	**37.0**
Jan/17	97.7	97.1	99.6	99.2
Feb/17	**94.3**	**94.5**	95.8	**88.1**
Mar/17	**93.5**	**91.5**	95.3	95.6
Apr/17	97.7	97.2	99.7	99.9
May/17	95.5	95.1	99.7	99.7
Jun/17	97.5	97.1	99.7	99.7
Jul/17	97.3	96.9	99.7	99.7
Aug/17	97.7	97.0	99.6	99.7
Data Capture 12 months to date	96.8	96.2	98.9	**89.5**
Data Capture Calendar year	96.4	95.8	98.7	97.8

Table 16: Data Capture for Transurban QLD Eastern Centenary Pool (E2)

Month	NO, NO_2, NO_X (%)	CO (%)	PM_{10} (%)	$PM_{2.5}$ (%)	WS (%)	AT 2m (%)	AT 10m (%)	RH (%)	Solar Rad (%)	Rain (%)
Sep/16	96.7	96.0	**21.4**	99.6	99.6	99.6	99.6	99.6	97.6	99.6
Oct/16	**93.3**	95.3	99.6	99.6	99.6	99.7	99.7	99.7		99.7
Nov/16	96.8	96.2	99.6	**67.6**	99.7	99.7	99.7	99.7	**48.3**	99.7
Dec/16	95.4	95.1	99.2	**37.8**	99.3	99.4	99.4	99.4	99.4	99.4
Jan/17	95.2	**94.4**	97.4	96.8	95.9	99.6	99.6	99.6	99.6	99.6
Feb/17	**93.7**	**92.9**	**90.2**	**83.6**	99.9	98.7	**91.8**	100.0	99.8	100.0
Mar/17	95.8	**94.9**	99.2	98.0	99.5	99.5	99.5	**57.4**	99.5	99.5
Apr/17	95.3	95.8	99.4	99.4	100.0	100.0	100.0	100.0	100.0	100.0
May/17	95.5	**94.7**	97.7	96.1	100.0	100.0	100.0	100.0	100.0	99.9
Jun/17	96.6	95.7	97.2	98.2	100.0	100.0	100.0	100.0	100.0	100.0
Jul/17	96.6	95.8	**89.1**	**89.1**	99.8	99.8	99.8	99.8	99.8	99.8
Aug/17	96.7	95.8	99.5	99.7	100.0	100.0	100.0	100.0	100.0	100.0
Data Capture 12 months to date	95.6	95.2	**90.9**	**88.8**	99.4	99.7	99.1	96.2	**86.9**	99.7
Data Capture Calendar year	95.7	95.0	96.3	95.2	99.3	99.7	98.9	**94.5**	99.8	99.8

Table 17: Data Capture for Transurban QLD West Anzac Park (W1)

Month	NO, NO_2, NO_X (%)	CO (%)	PM_{10} (%)	$PM_{2.5}$ (%)	WS (%)	AT 2m (%)	AT 10m (%)	RH (%)	Solar Rad (%)	Rain (%)
Sep/16	96.5	**94.7**	99.4	99.4	99.8	99.8	99.8	99.8	97.0	99.8
Oct/16	97.5	96.0	99.5	99.5	99.7	99.7	99.7	99.7	98.0	99.7
Nov/16	97.6	96.5	96.4	99.4	99.7	99.7	99.7	99.7	97.2	99.7
Dec/16	97.6	96.1	99.7	99.5	99.8	99.7	99.7	99.7	**94.9**	99.7
Jan/17	97.5	**93.8**	99.3	98.4	99.8	99.7	99.7	99.7	95.9	99.7
Feb/17	95.2	**94.8**	**94.3**	**94.2**	99.6	99.5	99.5	99.5	98.5	**52.6**
Mar/17	95.7	96.2	99.3	**66.9**	99.7	99.4	99.4	99.4	**16.7**	99.4
Apr/17	97.6	96.6	99.0	99.0	98.5	98.4	98.4	98.4		98.4
May/17	97.7	96.6	99.7	99.9	100.0	100.0	100.0	100.0	**92.2**	100.0
Jun/17	97.8	96.2	97.6	97.8	100.0	100.0	100.0	100.0	**89.9**	100.0
Jul/17	97.8	97.0	98.8	98.8	99.9	99.9	99.9	99.9	**90.3**	99.9
Aug/17	97.7	96.8	98.8	98.9	100.0	100.0	100.0	100.0	**89.7**	99.8
Data Capture 12 months to date	97.2	96.0	98.5	96.0	99.7	99.7	99.7	99.7	**80.0**	96.0
Data Capture Calendar year	97.1	96.0	98.4	**94.2**	99.7	99.6	99.6	99.6	**71.5**	**94.2**

Table 18: Data Capture for Transurban QLD Botanic Gardens (W2)

Month	NO, NO_2, NO_X (%)	CO (%)	PM_{10} (%)	$PM_{2.5}$ (%)
Sep/16	**94.7**	**93.7**	**55.6**	**74.3**
Oct/16	**82.3**	**80.3**	**68.4**	**84.1**
Nov/16	96.9	96.4	99.6	99.6
Dec/16	**87.9**	95.3	99.2	99.5
Jan/17	96.9	96.5	99.2	97.3
Feb/17	97.0	96.4	95.1	**94.5**
Mar/17	96.3	95.3	99.2	98.9
Apr/17	**91.7**	95.7	98.1	97.8
May/17	**7.7**	96.4	99.6	99.6
Jun/17	**70.7**	95.6	**72.2**	**72.1**
Jul/17	95.7	96.3	99.6	99.5
Aug/17	95.6	95.9	99.7	99.6
Data Capture 12 months to date	**84.3**	**94.5**	**90.5**	**93.1**
Data Capture Calendar year	**81.3**	96.0	95.4	95.0

Table 19: Data Capture for Transurban QLD VSO East

Month	NO, NO_2, NO_X (%)	CO (%)	PM_{10} (%)
Sep/16	95.8	95.5	98.6
Oct/16	**94.7**	**94.0**	97.0
Nov/16	**90.4**	**87.8**	**92.5**
Dec/16	96.0	95.5	98.5
Jan/17	95.3	**94.8**	**88.1**
Feb/17	**94.8**	**93.9**	96.9
Mar/17	96.4	**94.6**	98.9
Apr/17	**94.7**	**94.1**	96.9
May/17	95.1	**94.5**	97.3
Jun/17	96.6	96.0	99.1
Jul/17	**94.9**	**94.4**	98.2
Aug/17	**94.5**	**94.3**	97.1
Data Capture 12 months to date	**94.9**	**94.1**	96.6
Data Capture Calendar year	95.3	**94.6**	96.6

Table 20: Data Capture for Transurban QLD VSO West

Month	NO, NO_2, NO_X (%)	CO (%)	PM_{10} (%)
Sep/16	95.6	**94.6**	**35.3**
Oct/16	**94.9**	**93.9**	**79.0**
Nov/16	95.2	**94.2**	97.2
Dec/16	95.0	**89.7**	**87.9**
Jan/17	**92.4**	**86.7**	96.8
Feb/17	95.8	**95.0**	98.2
Mar/17	95.9	**94.8**	98.2
Apr/17	**94.7**	**93.8**	96.8
May/17	95.5	**94.6**	**1.6**
Jun/17	96.0	95.0	**77.5**
Jul/17	**87.8**	**91.1**	97.5
Aug/17	**94.3**	**93.3**	**43.7**
Data Capture 12 months to date	**94.4**	**93.0**	**75.6**
Data Capture Calendar year	**94.0**	**93.0**	**75.9**

5.2. Air Quality Monthly Summary

Table 21: Transurban QLD East – Victoria Park (E1) Exceedences Recorded for August 2017

Parameter	Time Period	Value of Exceedence	Date of Exceedence
NO_2 (µg/m^3)	1 hour	-	-
CO (mg/m^3)	1 hour	-	-
PM_{10} (µg/m^3)	24 hour	-	-
$PM_{2.5}$ (µg/m^3)	24 hour	-	-

Table 22: Transurban QLD Eastern Centenary Pool (E2) Exceedences Recorded for August 2017

Parameter	Time Period	Value of Exceedence	Date of Exceedence
NO_2 (µg/m^3)	1 hour	-	-
CO (mg/m^3)	1 hour	-	-
PM_{10} (µg/m^3)	24 hour	-	-
$PM_{2.5}$ (µg/m^3)	24 hour	30.43	11/08/2017

Table 23: Transurban QLD West Anzac Park (W1) Exceedences Recorded for August 2017

Parameter	Time Period	Value of Exceedence	Date of Exceedence
NO_2 (µg/m^3)	1 hour	-	-
CO (mg/m^3)	1 hour	-	-
PM_{10} (µg/m^3)	24 hour	-	-
$PM_{2.5}$ (µg/m^3)	24 hour	-	-

Table 24: Transurban QLD West Botanic Gardens (W2) Exceedences Recorded for August 2017

Parameter	Time Period	Value of Exceedence	Date of Exceedence
NO_2 (µg/m^3)	1 hour	-	-
CO (mg/m^3)	1 hour	-	-
PM_{10} (µg/m^3)	24 hour	-	-
$PM_{2.5}$ (µg/m^3)	24 hour	-	-

Table 25: Transurban QLD VSO East Exceedences Recorded for August 2017

Parameter	Time Period	Value of Exceedence	Date of Exceedence
NO_2 (mg/m^3)	1 hour	-	-
CO (ppm)	1 hour	-	-
PM_{10} (mg/m^3)	1 hour	-	-

Table 26: Transurban QLD VSO West Exceedences Recorded for August 2017

Parameter	Time Period	Value of Exceedence	Date of Exceedence
NO_2 (mg/m^3)	1 hour	-	-
CO (ppm)	1 hour	-	-
PM_{10} (mg/m^3)	1 hour	-	-

5.3. Tabulated data

5.3.1. Maximum averages

This section contains maximum averages of the gaseous and particulate collected at Transurban QLD monitoring station during the reporting period.

Table 27: Maximum values at Transurban QLD East Victoria Park (E1) for August 2017

Station	Parameter	Goal	Averaging Period	Maximum Value	Date and Time
Victoria Park (E1)	NO_2 (µg/m^3)	250	1 hour	72.87	11/08/2017 11:00
	CO (mg/m^3)	11	8 hours	0.83	13/08/2017 05:00
	PM_{10} (µg/m^3)	50	24 hours	35.42	12/08/2017
	$PM_{2.5}$ (µg/m^3)	25	24 hours	21.54	12/08/2017

Table 28: Maximum values at Eastern Centenary Pool (E2) for August 2017

Station	Parameter	Goal	Averaging Period	Maximum Value	Date and Time
Centenary Pool (E2)	NO_2 (µg/m^3)	250	1 hour	102.80	9/08/2017 19:00
	CO (mg/m^3)	11	8 hours	0.79	11/08/2017 11:00
	PM_{10} (µg/m^3)	50	24 hours	40.09	11/08/2017
	$PM_{2.5}$ (µg/m^3)	25	24 hours	30.43	11/08/2017

Table 29: Maximum values at Transurban QLD West Anzac Park (W1) for August 2017

Station	Parameter	Goal	Averaging Period	Maximum Value	Date and Time
Anzac Park (W1)	NO_2 (µg/m^3)	250	1 hour	98.18	9/08/2017 18:00
	CO (mg/m^3)	11	8 hours	0.71	13/08/2017 02:00
	PM_{10} (µg/m^3)	50	24 hours	28.58	12/08/2017
	$PM_{2.5}$ (µg/m^3)	25	24 hours	23.21	12/08/2017

Table 30: Maximum values at West Botanic Gardens (W2) for August 2017

Station	Parameter	Goal	Averaging Period	Maximum Value	Date and Time
Botanic Gardens (W2)	NO_2 (µg/m^3)	250	1 hour	68.25	31/08/2017 07:00
	CO (mg/m^3)	11	8 hours	0.54	31/08/2017 09:00
	PM_{10} (µg/m^3)	50	24 hours	23.25	31/08/2017
	$PM_{2.5}$ (µg/m^3)	25	24 hours	17.33	12/08/2017

Table 31: Maximum values at VSO East for August 2017

Station	Parameter	Goal	Averaging Period	Maximum Value	Date and Time
VSO East	NO_2 (mg/m^3)	2.0	1 hour	0.480	18/08/2017 16:00
	CO (ppm)	70	1 hour	4.39	21/08/2017 09:00
	PM_{10} (mg/m^3)	1.0	1 hour	0.645	12/08/2017 15:00

Table 32: Maximum values at VSO West for August 2017

Station	Parameter	Goal	Averaging Period	Maximum Value	Date and Time
VSO West	NO_2 (mg/m^3)	2.0	1 hour	0.496	17/08/2017 16:00
	CO (ppm)	70	1 hour	4.11	11/08/2017 16:00
	PM_{10} (mg/m^3)	1.0	1 hour	0.572	13/08/2017 07:00

5.3.2. Annual average

This section contains 12 months average and calendar year average of the $PM_{2.5}$ and NO_2 parameters collected at Transurban QLD external ambient air monitoring station during the reporting period.

Table 33 displays monthly average based on 5 minutes data during the last 12 months and the average based on 5 minutes data during the last 12 months. Table values required at least 75% of capture rate.

Table 33: 12 month to date averages of $PM_{2.5}$ and NO_2 at the Transurban QLD external ambient air monitoring station

Month	Victoria Park (E1)		Centenary Pool (E2)		Anzac Park (W1)		Botanic Gardens (W2)	
	NO_2 (µg/m³)	$PM_{2.5}$ (µg/m³)	NO_2 (µg/m³)	$PM_{2.5}$ (µg/m³)	NO_2 (µg/m³)	$PM_{2.5}$ (µg/m³)	NO_2 (µg/m³)	$PM_{2.5}$ (µg/m³)
Sep/16	17.95	7.71	19.73	9.68	18.39	6.23	13.50	
Oct/16	16.18	9.19	21.82	11.51	19.00	6.80	13.35	6.81
Nov/16	14.41		17.80		17.42	8.48	12.59	6.22
Dec/16	11.51		13.84		13.55	6.98	10.58	4.99
Jan/17	10.67	3.69	15.38	5.02	11.29	4.05	11.88	1.75
Feb/17	13.55	5.82	19.49	6.51	12.47	4.91	13.62	2.26
Mar/17	16.11	4.14	37.45	6.28	14.67		16.08	1.88
Apr/17	21.19	6.30	37.35	7.48	13.50	5.17	17.77	4.28
May/17	30.11	8.09	45.73	8.45	20.95	6.51		4.91
Jun/17	29.87	5.95	43.45	9.49	17.16	5.22		
Jul/17	31.44	8.81	44.38	11.63	27.09	8.09	20.18	5.12
Aug/17	27.31	10.06	40.56	10.26	26.22	9.73	18.24	6.54
Average	20.08	7.16	29.89	8.86	17.71	6.44	15.25	4.57

Table 34 displays calendar year average based on 1 hourly average with 75% capture rate in each calendar quarter.

Table 34: Calendar year average of $PM_{2.5}$ and NO_2 at Transurban QLD external ambient air monitoring station

Month	Victoria Park (E1)		Centenary Pool (E2)		Anzac Park (W1)		Botanic Gardens (W2)	
	NO_2 (µg/m³)	$PM_{2.5}$ (µg/m³)	NO_2 (µg/m³)	$PM_{2.5}$ (µg/m³)	NO_2 (µg/m³)	$PM_{2.5}$ (µg/m³)	NO_2 (µg/m³)	$PM_{2.5}$ (µg/m³)
Jan/17- Aug/17	22.66	6.65	35.71	8.15	18.03	6.07	16.78	3.82

5.4. Graphic Representations

5.4.1. External Ambient

This section displays graphs of the pollutants and meteorological parameters monitored at the Transurban QLD Legacy Way external ambient sites for August 2017. The graphs are based on validated 5 minute or 1 hour data as appropriate.

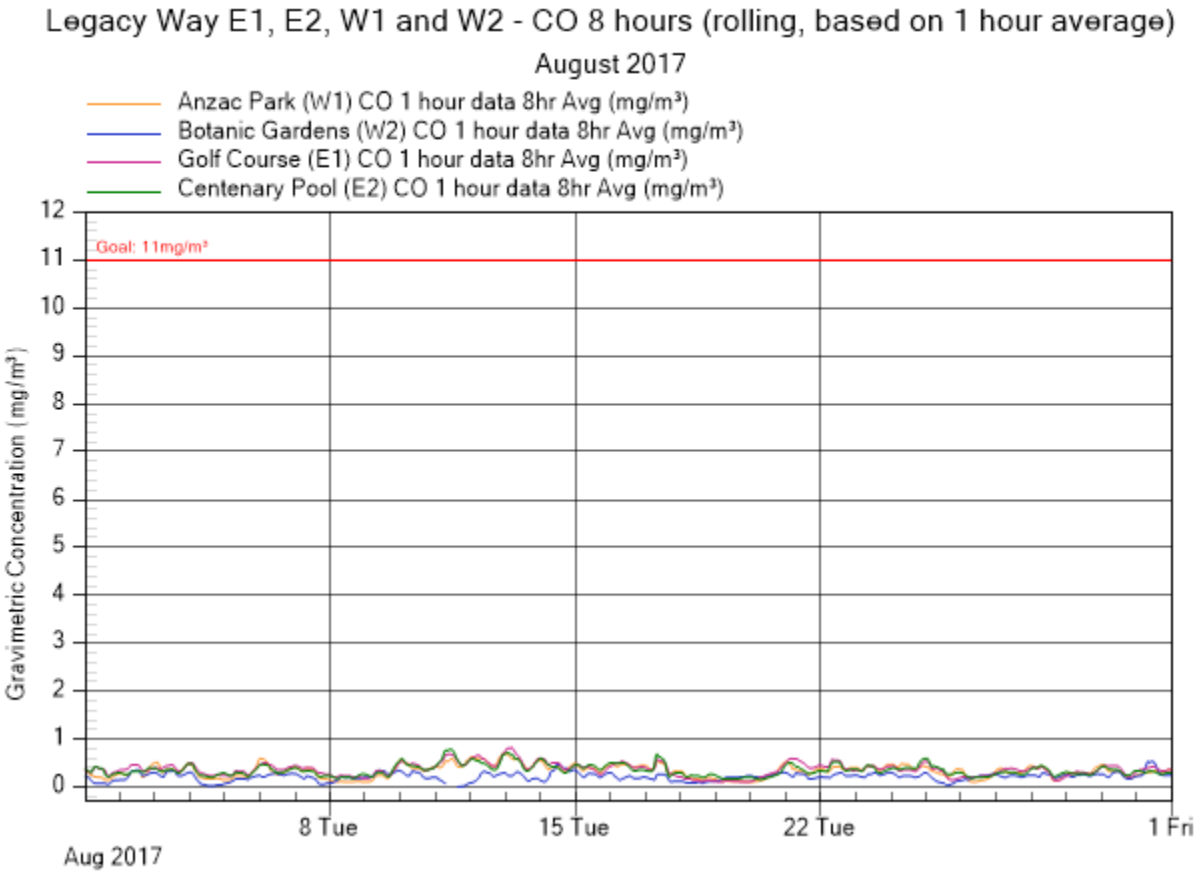

Figure 2: Transurban QLD Legacy Way (E1, E2, W1 and W2) - CO graph for August 2017

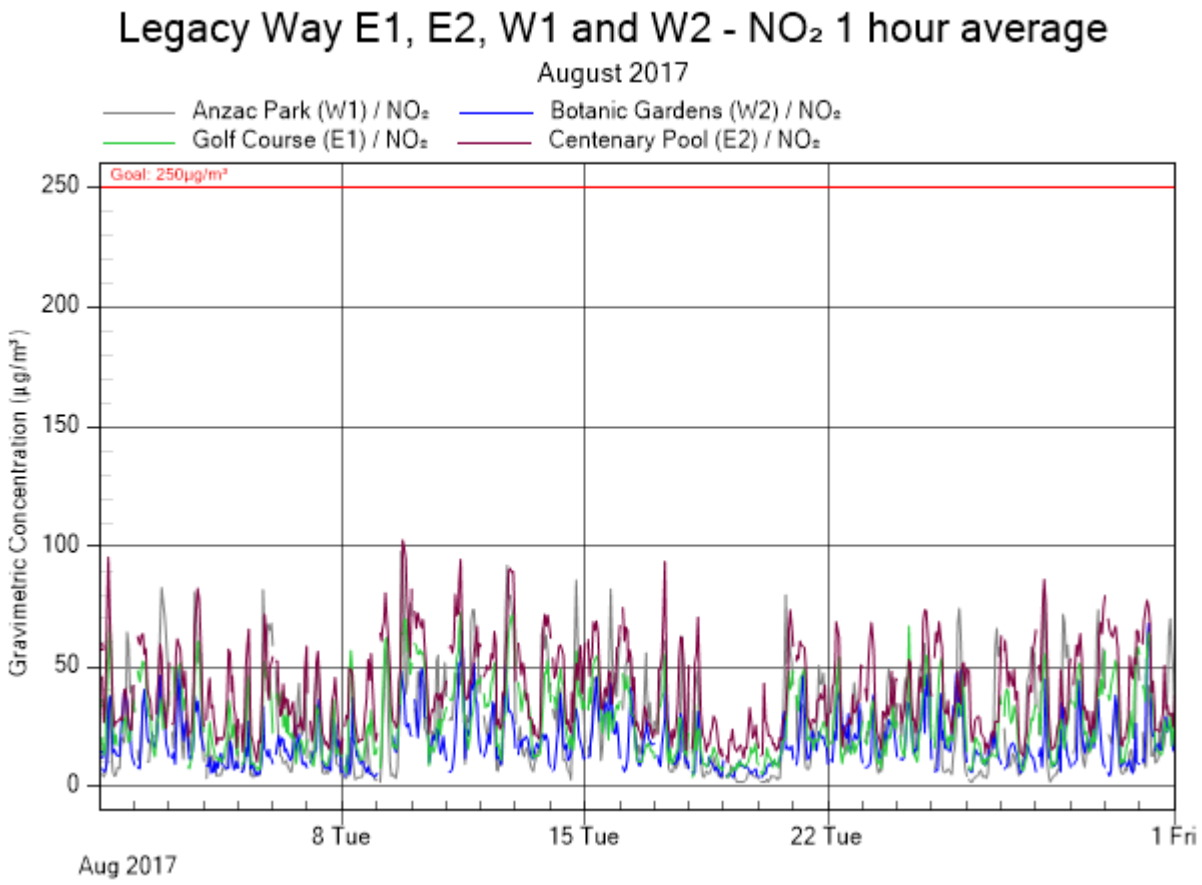

Figure 3: Transurban QLD Legacy Way (E1, E2, W1 and W2) - NO_2 graph for August 2017

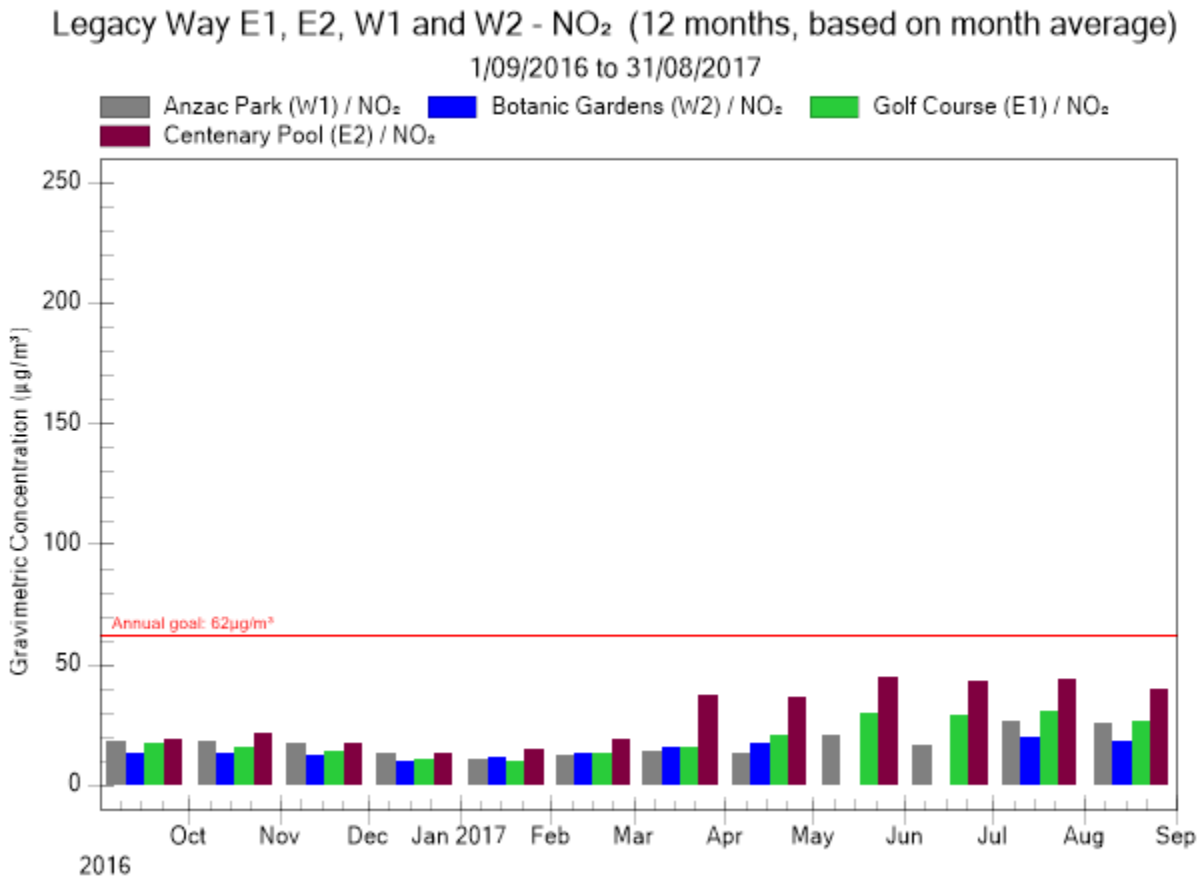

Figure 4: Transurban QLD Legacy Way (E1, E2, W1 and W2) - NO_2 graph 12 months to August 2017

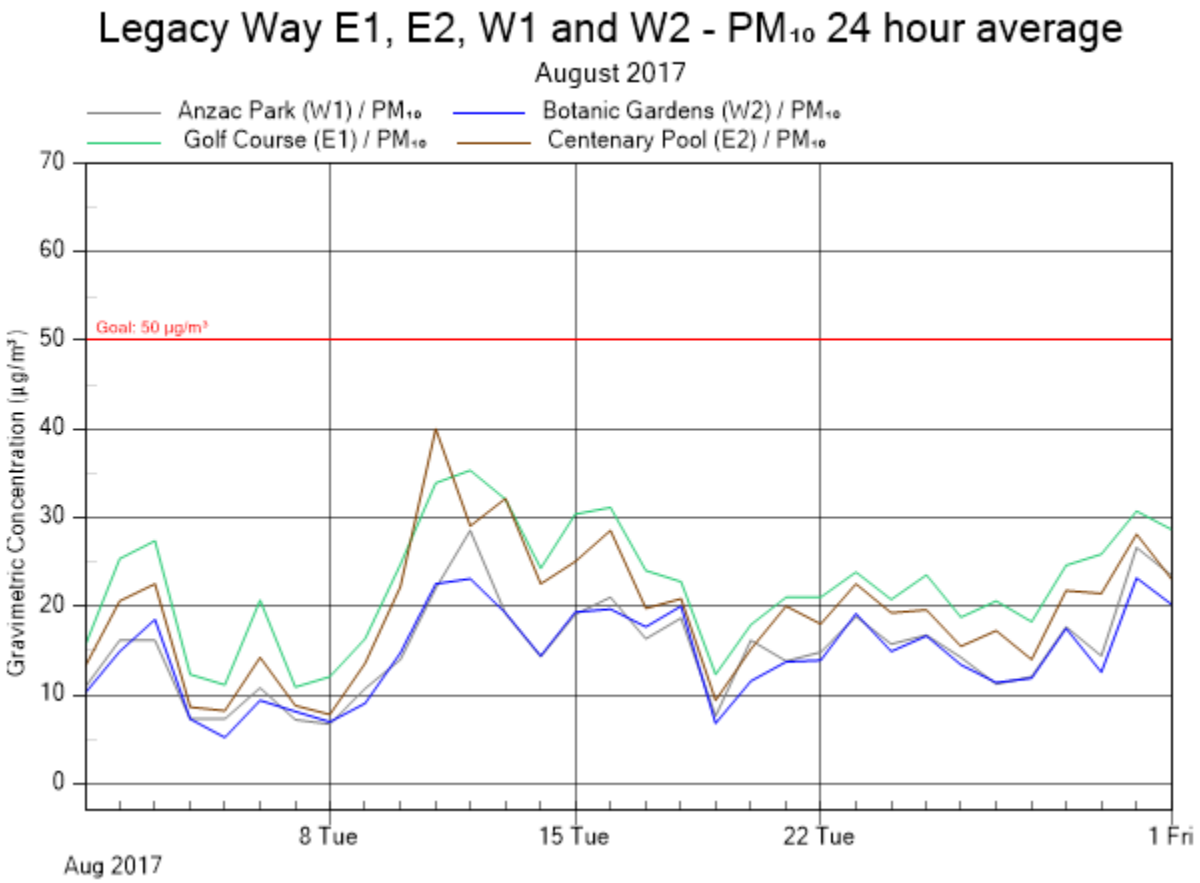

Figure 5: Transurban QLD Legacy Way (E1, E2, W1 and W2) - PM_{10} graph for August 2017

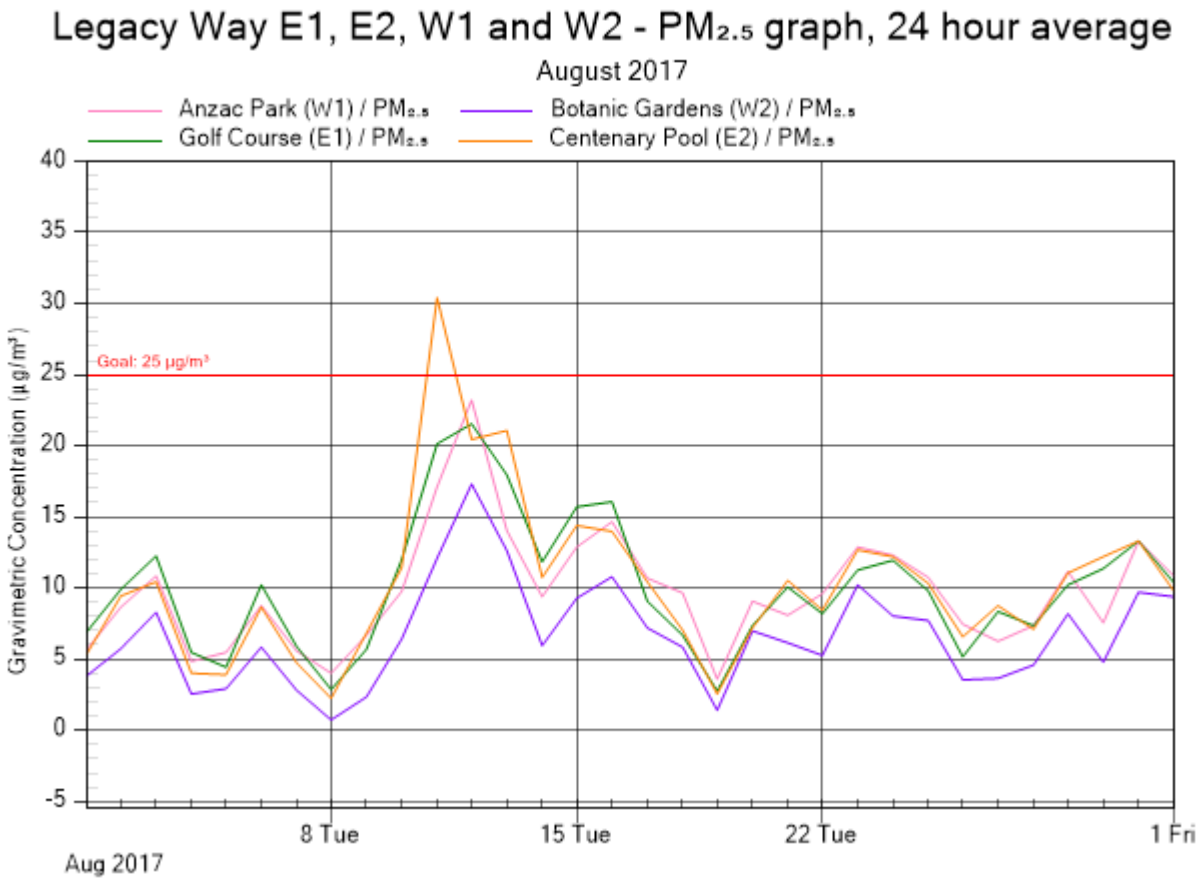

Figure 6: Transurban QLD Legacy Way (E1, E2, W1 and W2) - $PM_{2.5}$ graph for August 2017

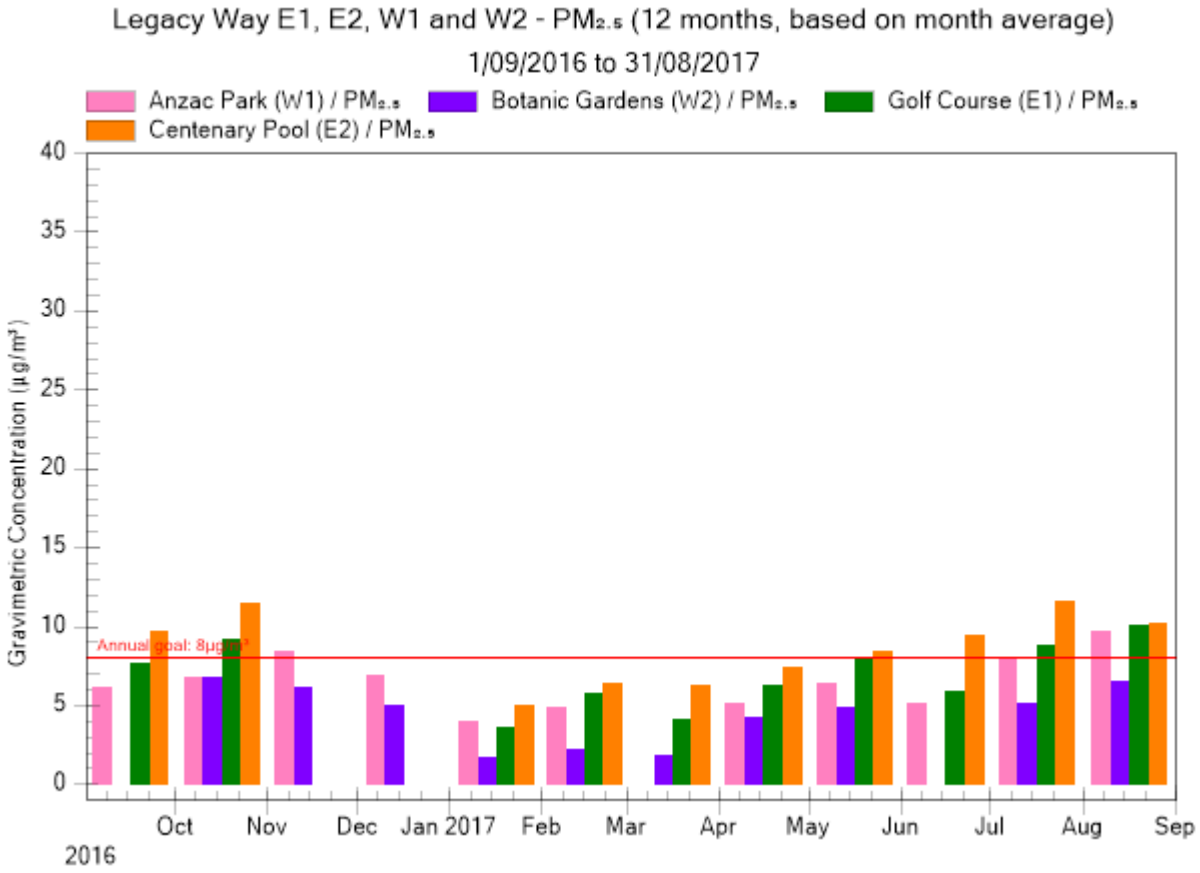

Figure 7: Transurban QLD Legacy Way (E1, E2, W1 and W2) - $PM_{2.5}$ graph 12 months to August 2017

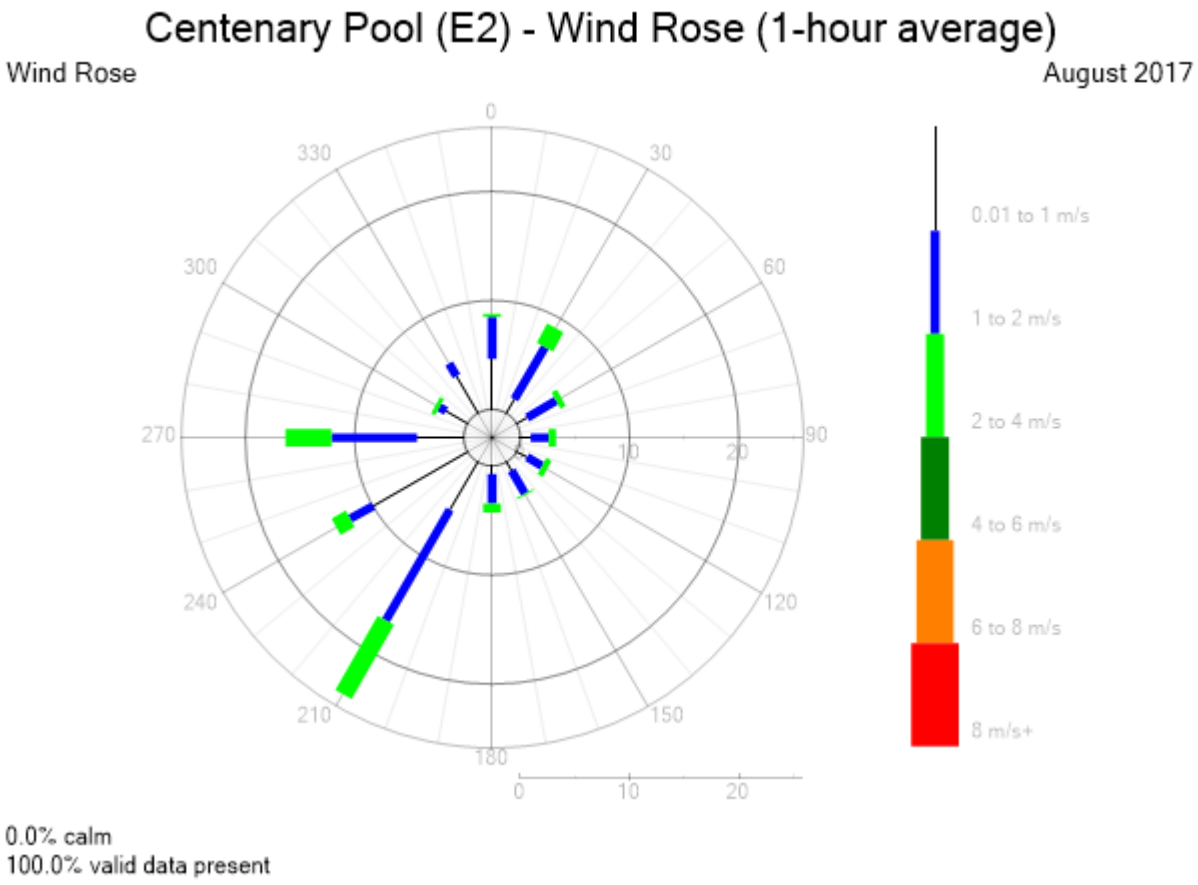

Figure 8: Transurban QLD Legacy Way E2 – Wind Rose for August 2017

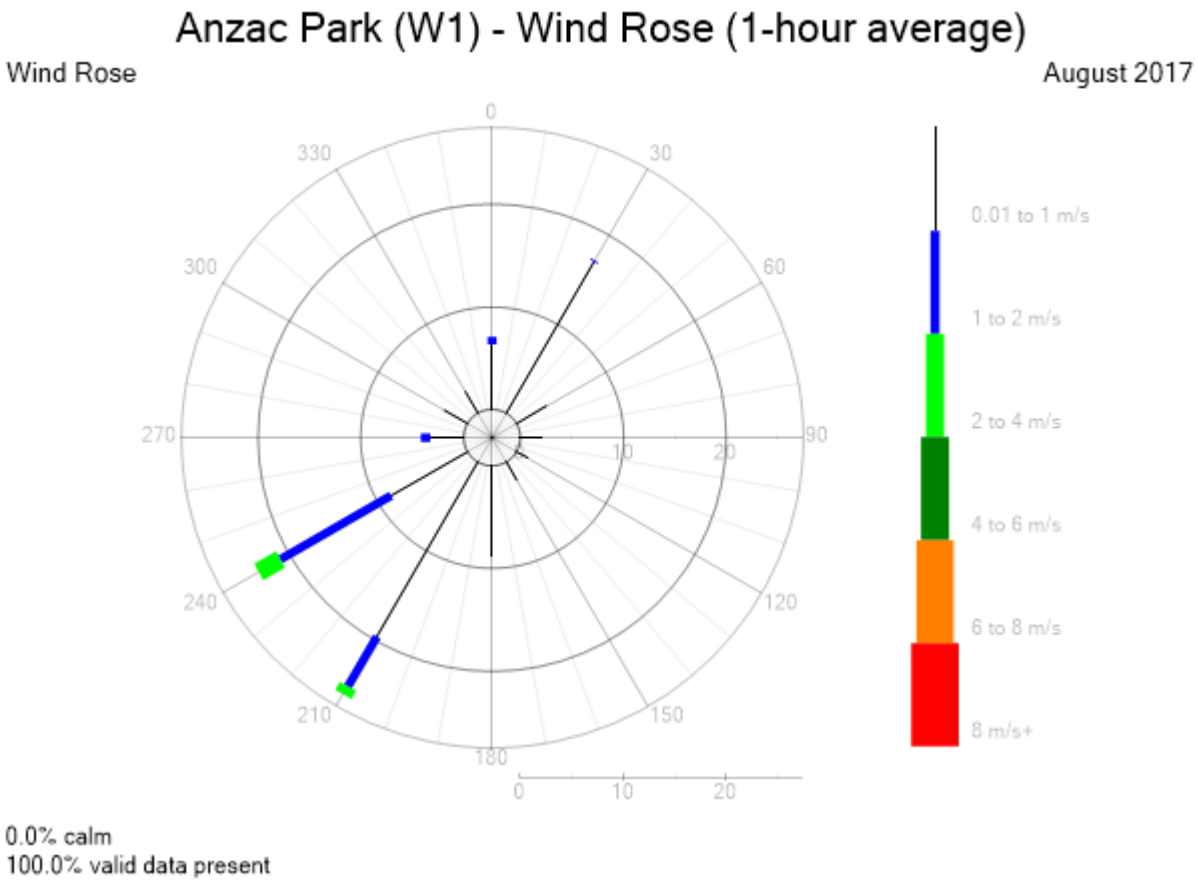

Figure 9: Transurban QLD Legacy Way W1 – Wind Rose for August 2017

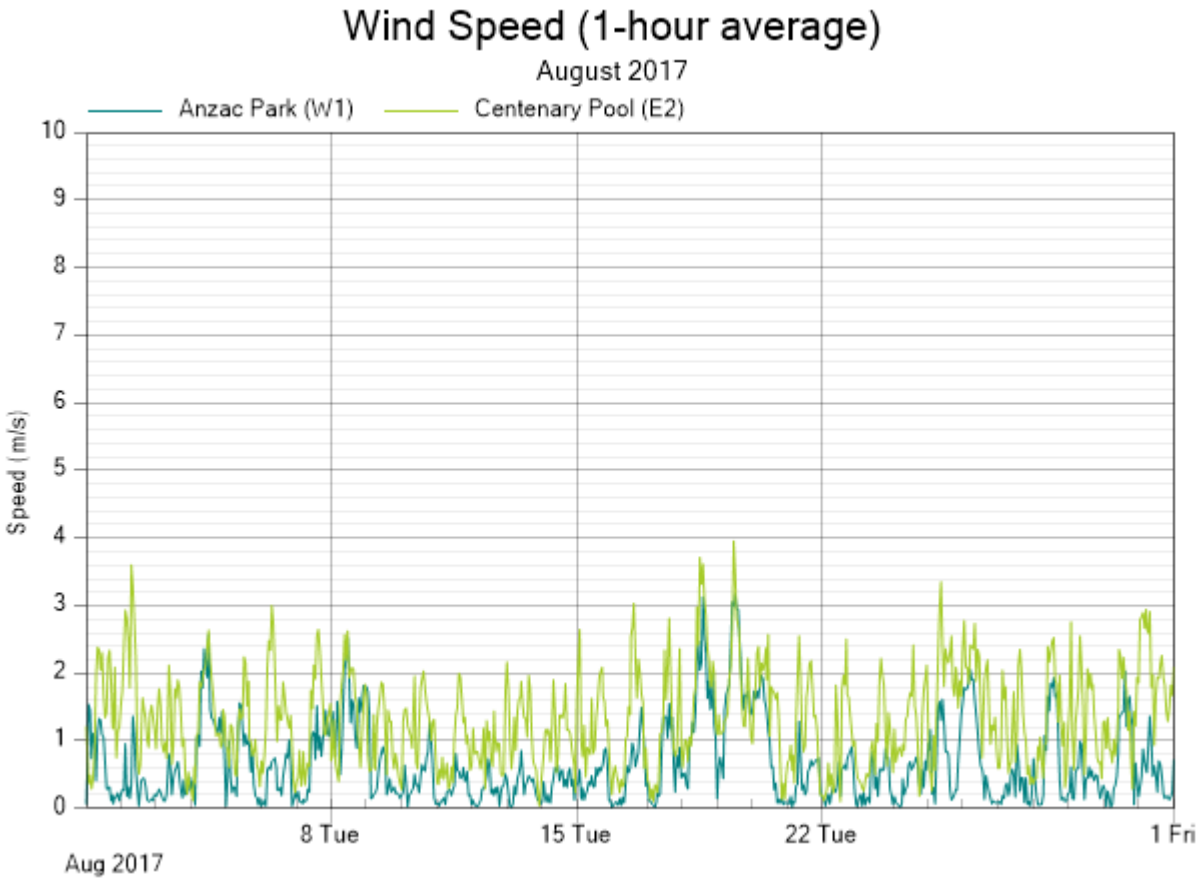

Figure 10: Transurban QLD Legacy Way E2 and W1 – Wind Speed for August 2017

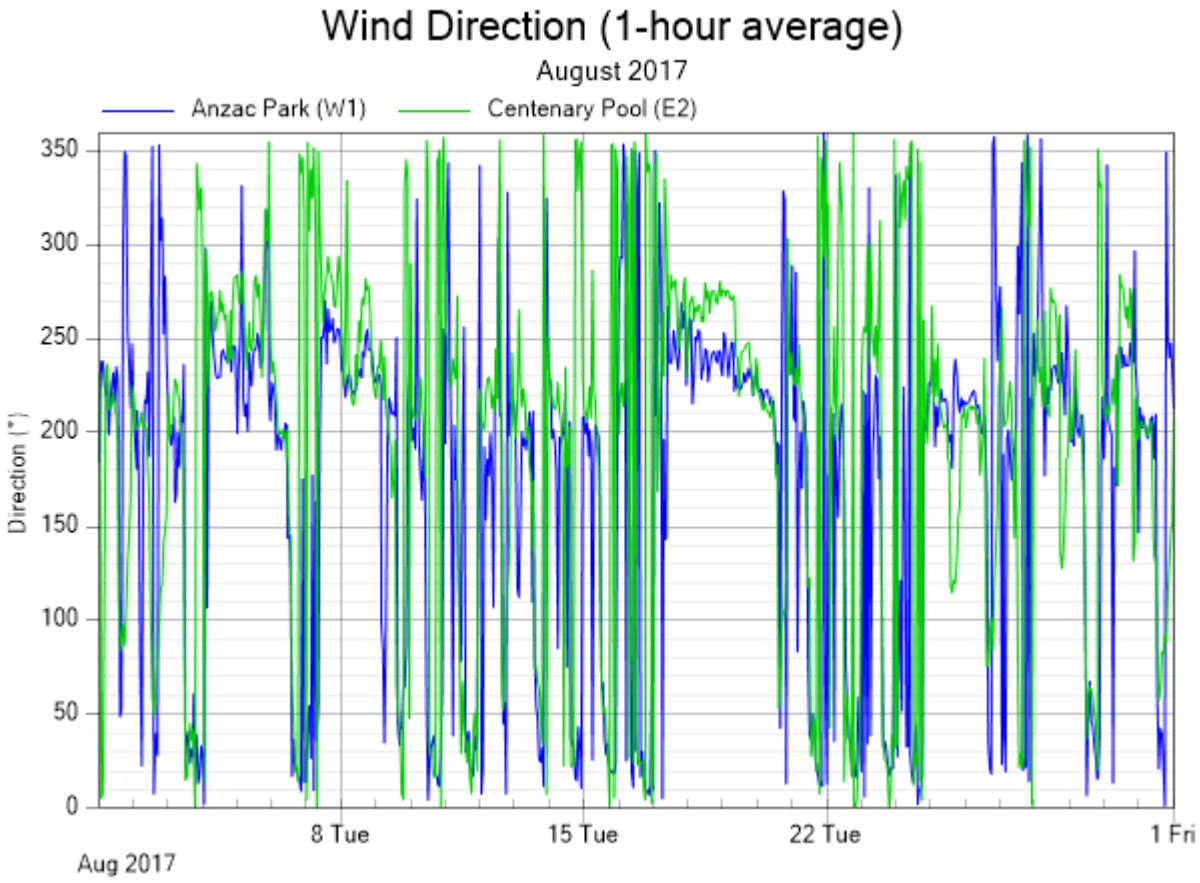

Figure 11: Transurban QLD Legacy Way E2 and W1 – Wind Direction for August 2017

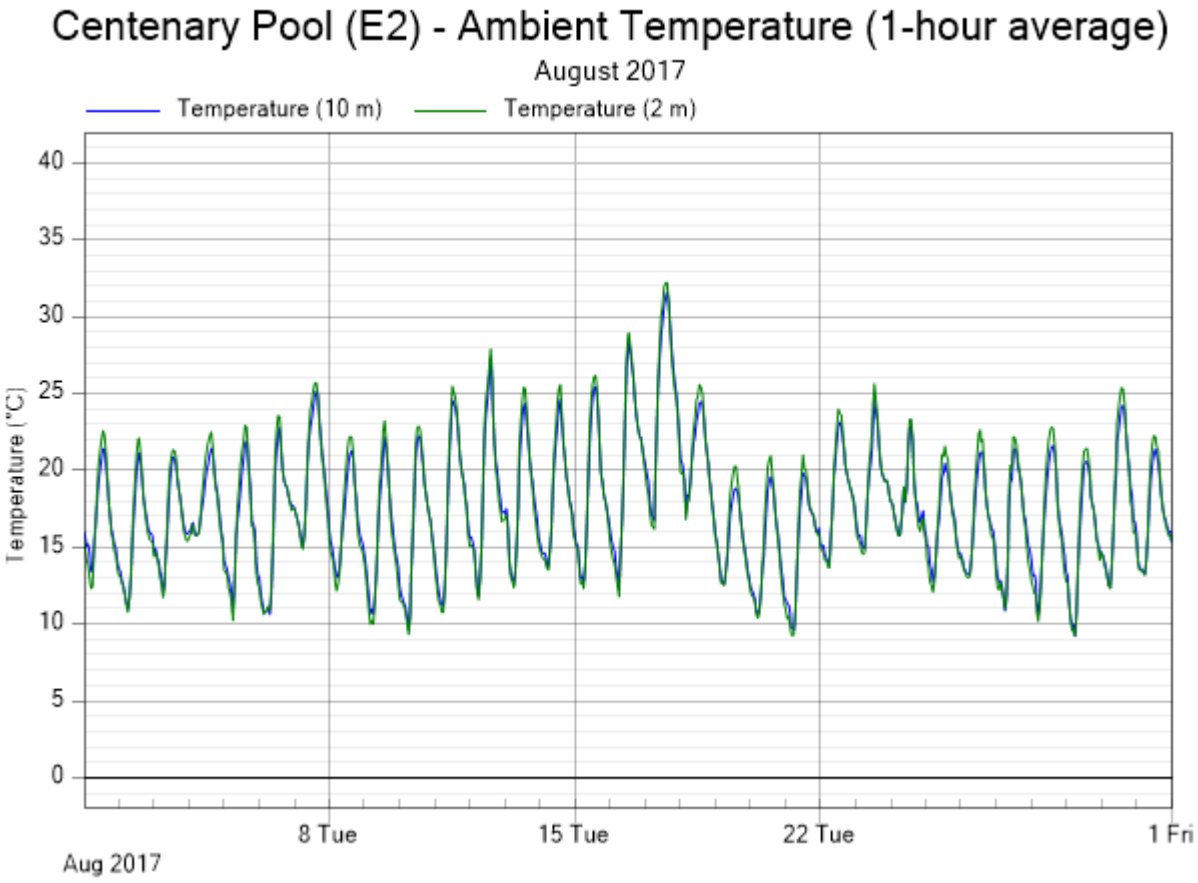

Figure 12: Transurban QLD Legacy Way E2– Ambient Temperature for August 2017

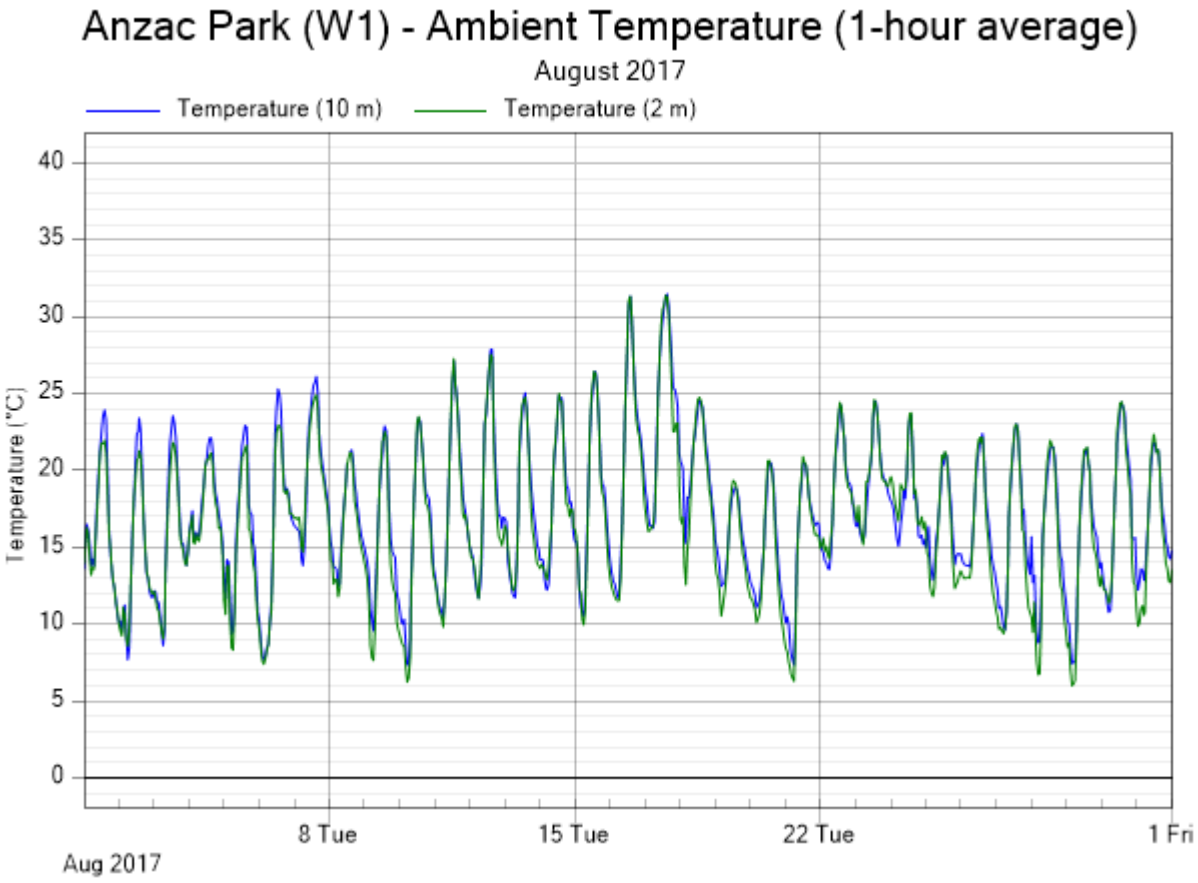

Figure 13: Transurban QLD Legacy Way W1– Ambient Temperature for August 2017

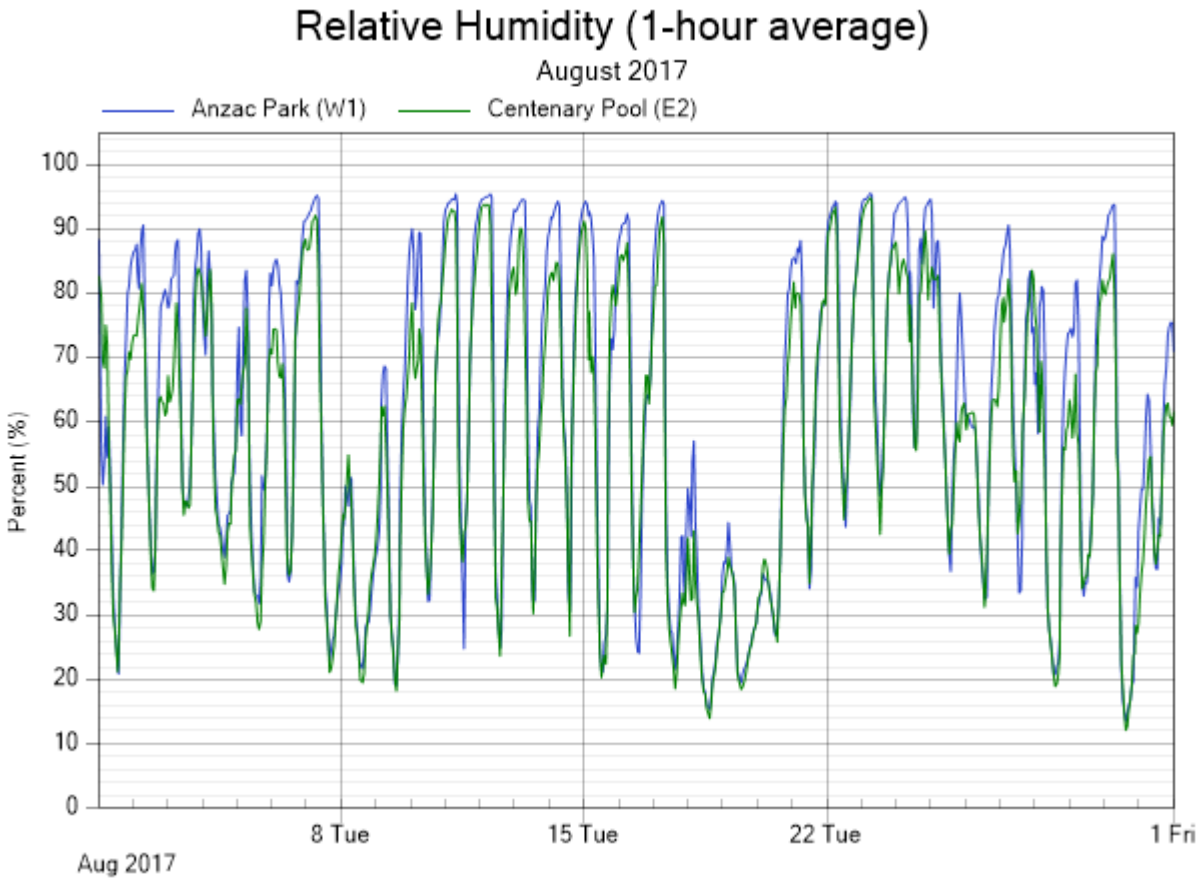

Figure 14: Transurban QLD Legacy Way E2 and W1– Relative Humidity for August 2017

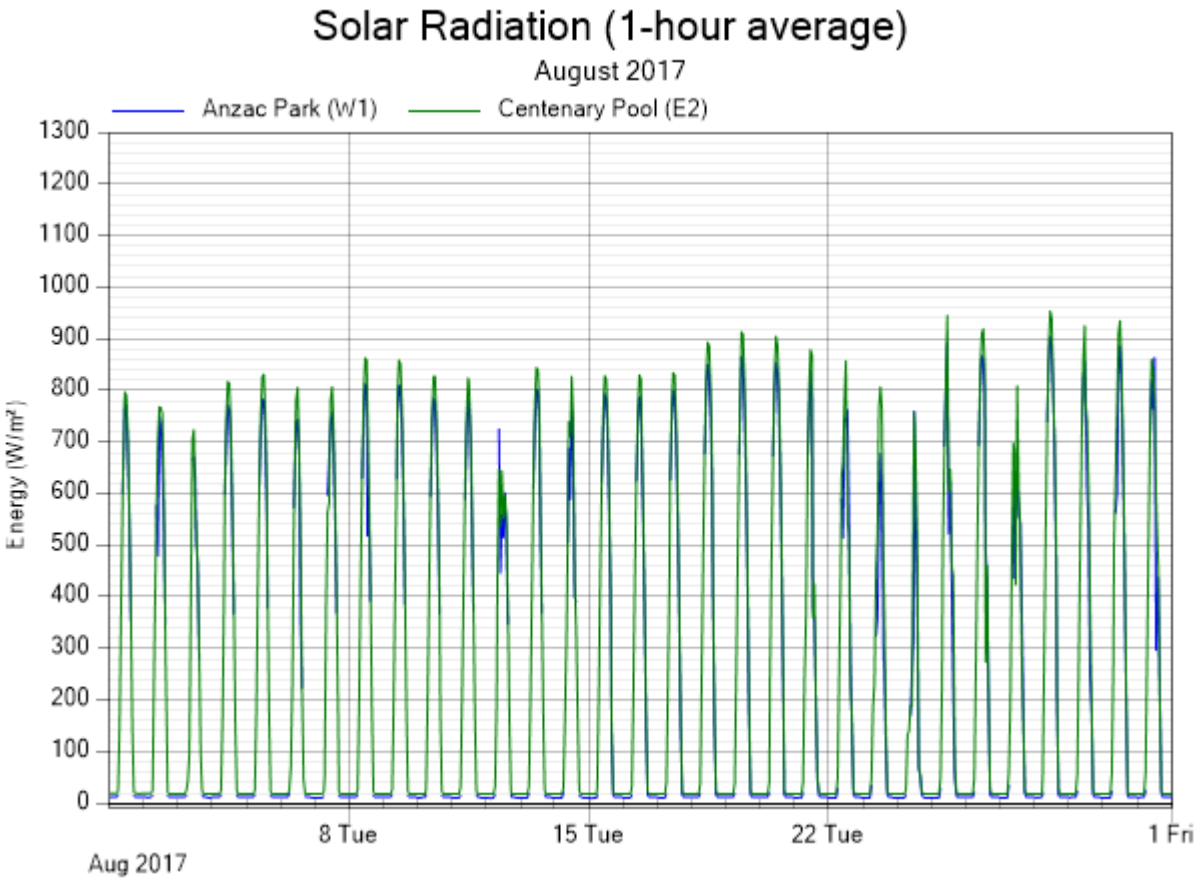

Figure 15: Transurban QLD Legacy Way E2 and W1– Solar Radiation for August 2017

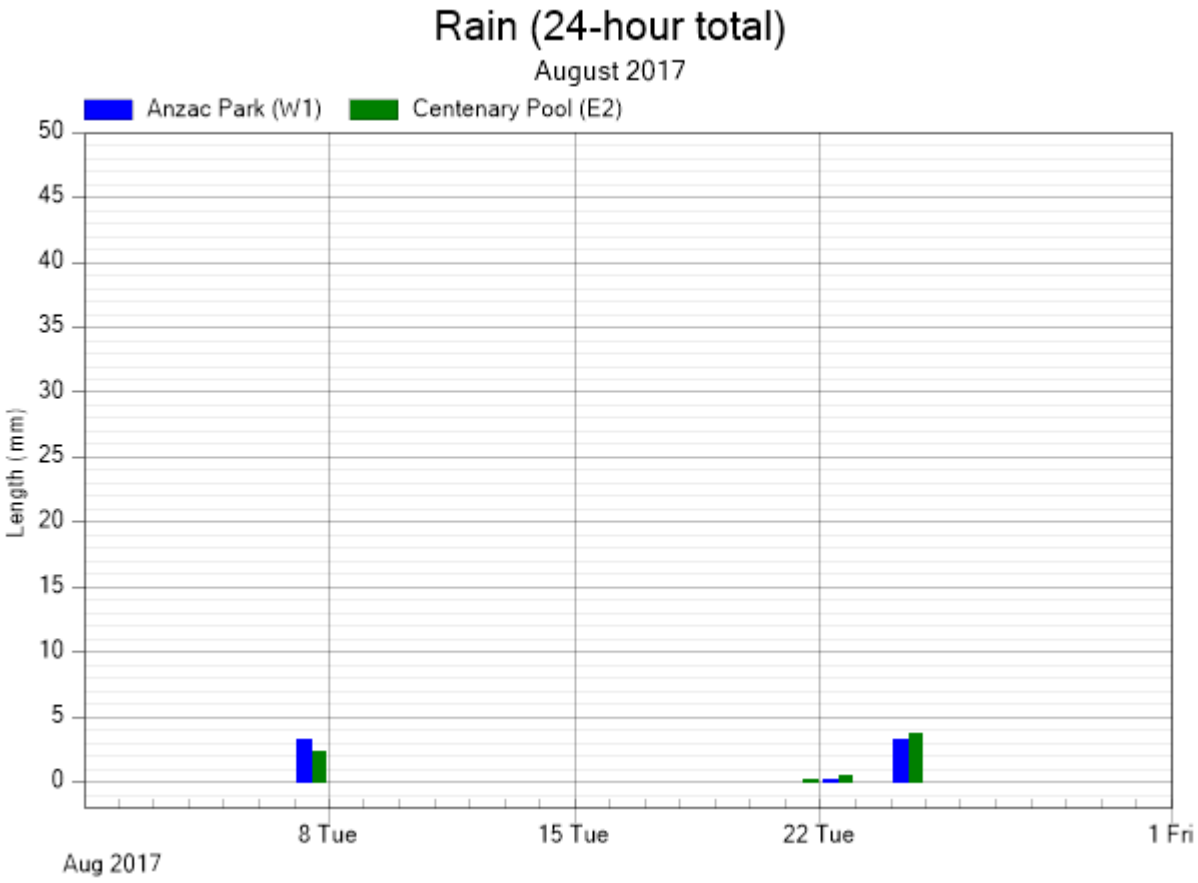

Figure 16: Transurban QLD Legacy Way E2 and W1– Rain for August 2017

5.4.2. Ventilation outlet

This section displays graphs of the pollutants parameters monitored at the Transurban QLD Legacy Way ventilation sites for August 2017. The graphs are based on validated 5 minute data.

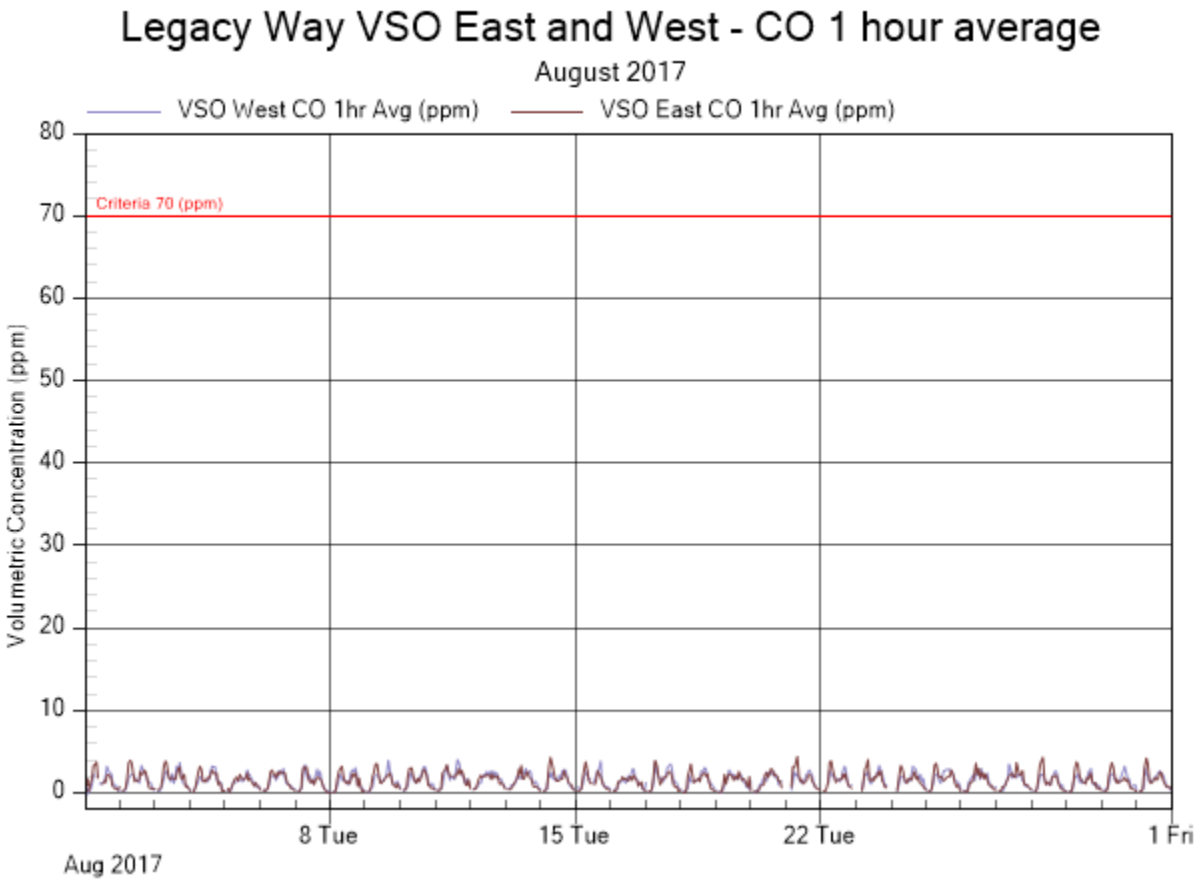

Figure 17: Transurban QLD Legacy Way VSO East and West - CO graph for August 2017

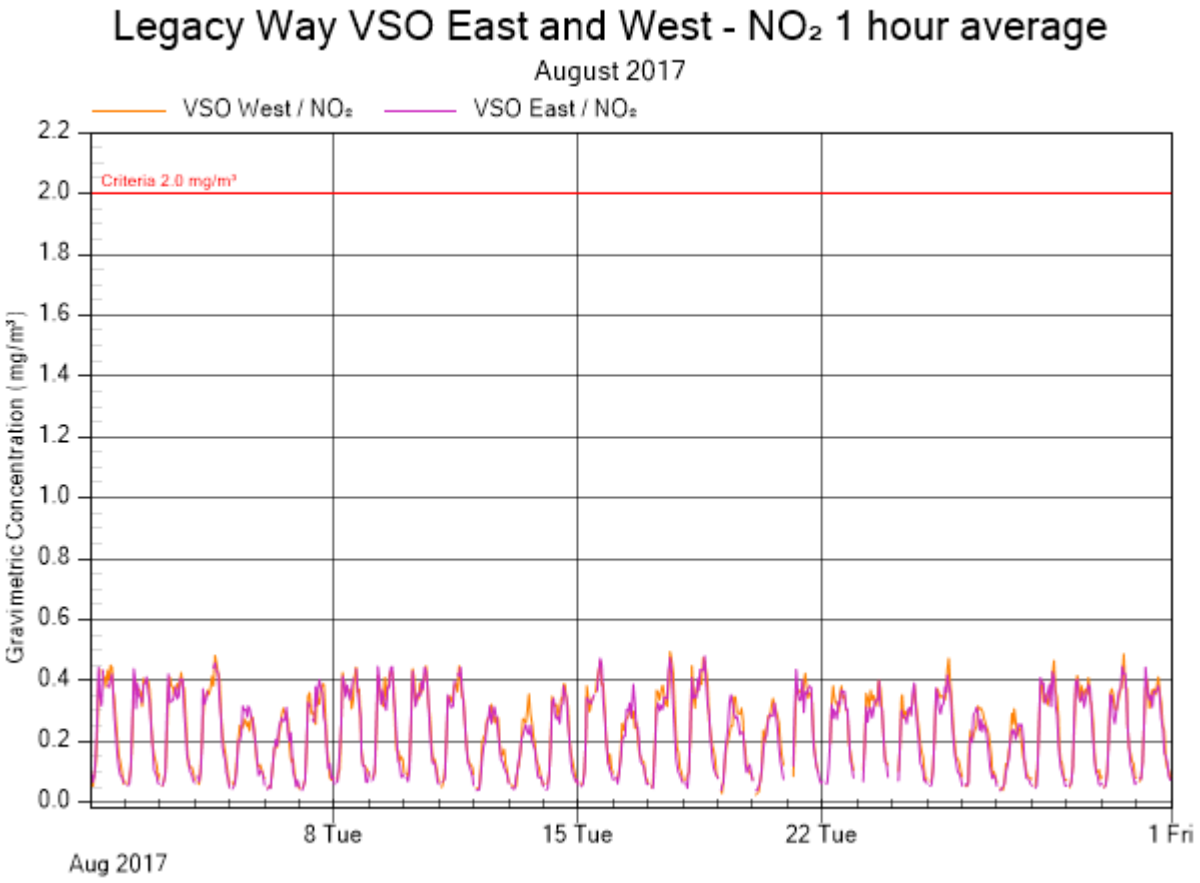

Figure 18: Transurban QLD Legacy Way East and West – NO_2 graph for August 2017

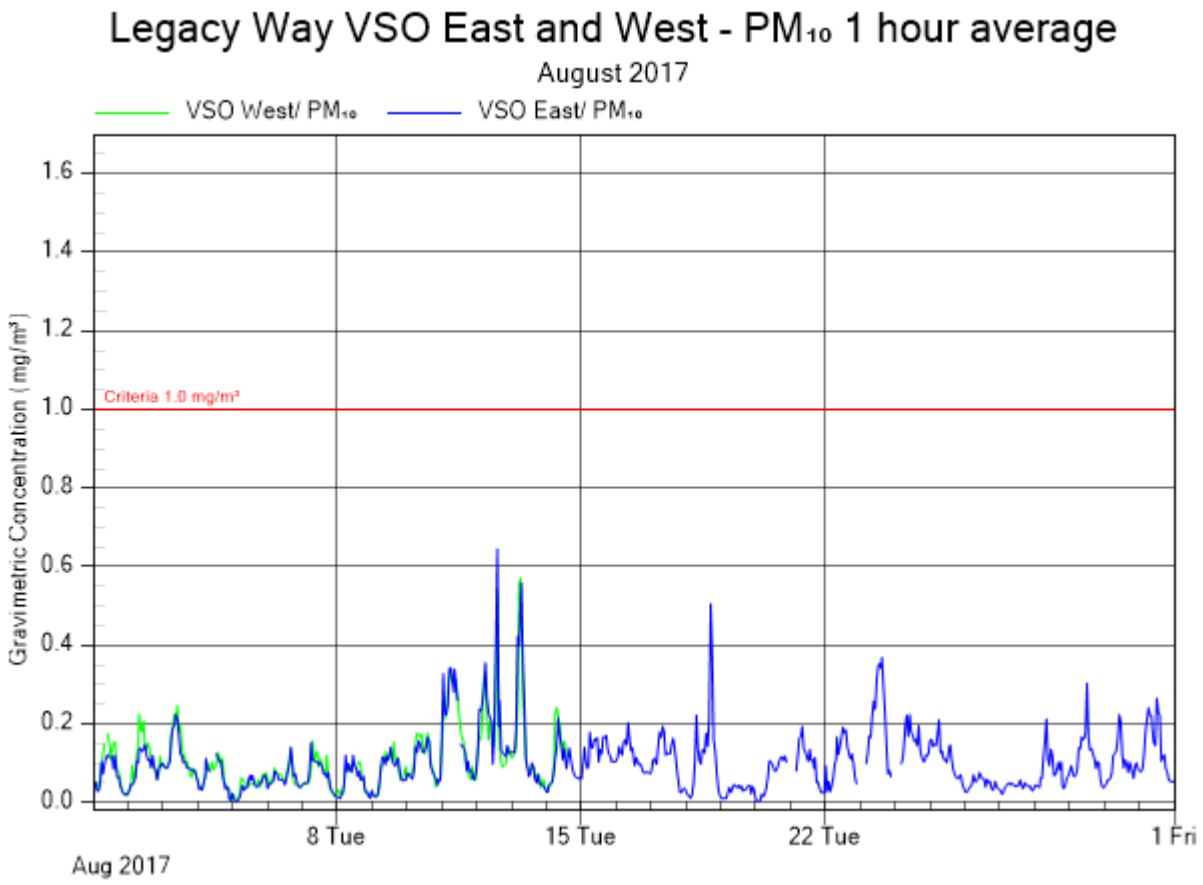

Figure 19: Transurban QLD Legacy Way East and West – PM_{10} graph for August 2017

6.0 Valid Data Exception Tables

Tables 35 to 42 below detail all changes made to the raw data set during the validation process. An explanation of reasons given in the table can be found in Appendix 2.

Table 35: Transurban QLD East – Victoria Park (E1) Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
01/08/17 12:55	01/08/17 14:15	Scheduled 6 monthly maintenance	CO, NO, NO_2, NOx	CT	1/09/2017
01/08/17 14:00	01/08/17 15:00	Scheduled 6 monthly maintenance	$PM_{2.5}$, PM_{10}	CT	1/09/2017
02/08/17 07:55	31/08/17 07:10	Intermittent data transmission errors	CO, NO, NO_2, NOx	CT	1/09/2017
03/08/17 12:05	03/08/17 12:25	Unscheduled maintenance - check NOx span	CO, NO, NO_2, NOx	CT	1/09/2017
11/08/17 09:00	11/08/17 09:00	Unscheduled maintenance - installed high humidity tape	$PM_{2.5}$, PM_{10}	CT	1/09/2017

Table 36: Transurban QLD Eastern Centenary Pool (E2) Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
02/08/17 13:40	02/08/17 14:45	Scheduled 6 monthly maintenance	CO, NO, NO_2, NOx	CT	1/09/2017
02/08/17 15:00	02/08/17 15:00	Scheduled 6 monthly maintenance	$PM_{2.5}$, PM_{10}	CT	1/09/2017
03/08/17 07:50	28/08/17 11:25	Intermittent data transmission errors	CO, NO, NO_2, NOx	CT	1/09/2017
11/08/17 09:00	11/08/17 10:00	Unscheduled maintenance - installed high humidity tape	$PM_{2.5}$, PM_{10}	CT	1/09/2017
27/08/17 21:00	27/08/17 21:00	Tape alarm	PM_{10}	CT	1/09/2017

Table 37: Transurban QLD Eastern Centenary Pool (E2) Valid Data Exception Table – Met Data

Start Date	End Date	Reason	Change Details	User Name	Change Date
02/08/17 13:50	02/08/17 13:50	Scheduled 3 monthly maintenance	Rain	CT	4/09/2017

Table 38: Transurban QLD West Anzac Park (W1) Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
01/08/17 02:10	30/08/17 17:35	Intermittent data transmission errors	CO, NO, NO_2, NOx	CT	1/09/2017
01/08/17 12:00	29/08/17 01:00	Intermittent unrealistic readings	$PM_{2.5}$, PM_{10}	CT	1/09/2017
02/08/17 07:30	02/08/17 09:25	Scheduled 6 monthly maintenance	CO, NO, NO_2, NOx	CT	1/09/2017
02/08/17 09:00	02/08/17 10:00	Scheduled 6 monthly maintenance	$PM_{2.5}$, PM_{10}	CT	1/09/2017
11/08/17 08:00	11/08/17 08:00	Unscheduled maintenance - installed high humidity tape	$PM_{2.5}$, PM_{10}	CT	1/09/2017

Table 39: Transurban QLD West Anzac Park (W1) Valid Data Exception Table – Met Data

Start Date	End Date	Reason	Change Details	User Name	Change Date
01/08/17 07:10	31/08/17 09:10	Daily shadow on sensor between approx. 07:10 - 09:10 and 16:10 - 16:55	SR	CT	5/09/2017
02/08/17 07:55	02/08/17 09:20	Scheduled 3 monthly maintenance	Rain	CT	4/09/2017
03/08/17 09:35	28/08/17 23:30	Intermittent data transmission error	AT Upper, AT Lower, RH, SR, Rain	CT	4/09/2017
08/08/17 13:10	08/08/17 13:40	Unscheduled maintenance - replaced fan	AT Upper	CT	5/09/2017

Table 40: Transurban QLD West Botanic Gardens (W2) Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
01/08/17 14:15	30/08/17 18:20	Intermittent data transmission errors	CO, NO, NO_2, NOx	CT	4/09/2017
02/08/17 11:00	02/08/17 12:00	Scheduled 6 monthly maintenance	$PM_{2.5}$, PM_{10}	CT	4/09/2017
02/08/17 11:05	02/08/17 11:40	Scheduled 6 monthly maintenance	CO, NO, NO_2, NOx	CT	1/09/2017
09/08/17 01:40	09/08/17 10:25	Calibration system error - stuck in span mode	NO, NO_2, NOx	CT	1/09/2017
09/08/17 10:30	09/08/17 10:45	Unscheduled maintenance - calibration system reset	CO, NO, NO_2, NOx	CT	1/09/2017
11/08/17 01:40	11/08/17 07:15	Static offset of 0.09 mg/m^3 to correct reference adjustment failure	CO	CT	4/09/2017
11/08/17 07:00	11/08/17 07:00	Unscheduled maintenance - installed high humidity tape	$PM_{2.5}$, PM_{10}	CT	4/09/2017
11/08/17 07:20	11/08/17 10:10	Data affected by unstable rack temperature during maintenance. Subsequent remote maintenance to fix background	CO	CT	4/09/2017
15/08/17 11:05	15/08/17 11:30	Unscheduled maintenance - remote calibration on NO_X	NO, NO_2, NOx	CT	4/09/2017
18/08/17 11:25	18/08/17 12:25	Unscheduled maintenance - adjusted NOx gas pressure	CO, NO, NO_2, NOx	CT	4/09/2017

Table 41: Transurban QLD VSO East Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
26/07/17 16:10	01/08/17 11:25	Linear offset of A= -0.14 and B=-0.5 to correct zero drift	CO	CT	3/08/2017
30/07/17 01:35	01/08/17 11:25	Linear multiplier of A=1.06 and B=1.08 to correct span drift	NO, NO_2, NOx	CT	3/08/2017

Start Date	End Date	Reason	Change Details	User Name	Change Date
01/08/17 10:25	01/08/17 12:45	Scheduled monthly maintenance	CO, NO, NO_2, NOx, PM_{10}	CT	4/09/2017
02/08/17 01:35	07/08/17 08:35	Linear multiplier of A=1.02 and B=1.08 to correct span drift	NO, NO_2, NOx	CT	4/09/2017
03/08/17 13:25	03/08/17 13:35	Unscheduled maintenance - remote fix settings for CO background	CO	CT	4/09/2017
04/08/17 10:10	04/08/17 13:10	3 monthly maintenance. And additional yearly maintenance - installed filters on Partisol for correlation with Fidas	NO, NO_2, NOx, PM_{10}	CT	4/09/2017
07/08/17 08:40	07/08/17 09:10	Unscheduled maintenance - remote calibration on NO_X	CO, NO, NO_2, NOx, PM_{10}	CT	4/09/2017
08/08/17 14:10	08/08/17 14:30	Unscheduled maintenance - replaced pump for NOx analyser	CO, NO, NO_2, NOx	CT	4/09/2017
11/08/17 12:05	11/08/17 12:25	Unscheduled additional yearly maintenance - removed filter on Partisol	CO, NO, NO_2, NOx, PM_{10}	CT	4/09/2017
14/08/17 10:15	14/08/17 10:15	Data transmission errors	CO, NO, NO_2, NOx, PM_{10}	CT	4/09/2017
15/08/17 12:05	15/08/17 12:30	Unscheduled maintenance - remote calibration on NO_X	CO, NO, NO_2, NOx	CT	4/09/2017
20/08/17 22:05	24/08/17 04:05	Intermittent data affected by night time maintenance in the tunnel	CO, NO, NO_2, NOx, PM_{10}	CT	4/09/2017

Table 42: Transurban QLD VSO West Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
01/08/17 07:45	01/08/17 09:40	Scheduled monthly maintenance	CO, NO, NO_2, NOx, PM_{10}	CT	4/09/2017
02/08/17 06:05	30/08/17 20:05	Intermittent data transmission errors	CO, NO, NO_2, NOx, PM_{10}	CT	4/09/2017
08/08/17 11:55	08/08/17 12:40	Unscheduled maintenance - cleaned measurement cell and optic lenses	PM_{10}	CT	4/09/2017

Start Date	End Date	Reason	Change Details	User Name	Change Date
14/08/17 14:45	01/09/17 00:00	Instrument fault - Fidas channel calibration out of tolerance	PM_{10}	CT	5/10/2017
15/08/17 11:35	15/08/17 12:00	Unscheduled maintenance - remote calibration on NO_X	CO, NO, NO_2, NOx	CT	4/09/2017
18/08/17 12:35	18/08/17 12:55	Unscheduled maintenance - cleaned measurement cell and optic lenses	PM_{10}	CT	4/09/2017
20/08/17 22:10	24/08/17 03:40	Intermittent data affected by night time maintenance in the tunnel	CO, NO, NO_2, NOx, PM_{10}	CT	4/09/2017

These tables include all changes made to data during the validation process

7.0 Report Summary

- Percentage availability for some parameters at Transurban QLD Legacy Way Monitoring Network was below 95% for the reporting month. Please refer to Table 15-20 in *Section 5.1 – Data Capture* for further information.
- There was one reported exceedence of the air quality limits at Transurban QLD Legacy Way Monitoring Network for the reporting month. Please refer to Table 21-26 in *Section 5.2 – Air Quality Summary* for further information.

----------END OF REPORT----------

Appendix 1 - Definitions & Abbreviations

°	Degrees (True North)
°C	Degrees Celsius
µg/m³	Micrograms per cubic metre at standard temperature and pressure (0°C and 101.3 kPa)
AT	Ambient Temperature
calm	Wind conditions where the wind speed is below the operating range of the wind sensor
CO	Carbon monoxide
mg/m^3	Milligrams per cubic metre at standard temperature and pressure (0°C and 101.3 kPa)
mm	Millimeters
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
PM_{10}	Particulate less than 10 microns in equivalent aerodynamic diameter
$PM_{2.5}$	Particulate less than 2.5 microns in equivalent aerodynamic diameter
ppb	Parts per billion
ppm	Parts per million
RH	Relative Humidity
SR	Solar Radiation
W/m^2	Watts per square metre
WD	Vector Wind Direction

WS	Vector Wind Speed

Appendix 2 - Explanation of Exception Table

Automatic filter tape advance refers to the movement of the filter paper by the analyser to an un-used spot.

Automatic background check refers to when analyser samples zero air and measures the level of the concentration voltage. This voltage is taken as the zero signal level and this value is subtracted from any subsequent readings as an active zero compensation. This is the analyser's fine zero measurement.

Automatic span/zero check. The E-Sampler is programmed to perform a zero calibration check whereby air is passed through filter element, removing particulates, before entering the sensor in the analyser. Data is invalidated when these checks occur.

Beta count failure refers to a fault in the functioning of the EBAM. A one minute beta count was less than the maximum acceptable counts during operation.

Calibration check outside tolerance refers to when the calibration values are outside the tolerance limits set for the precision check.

Calibration correction factor applied to data refers to an offset or multiplier applied to the data. This operation may be performed for a number of reasons including: (a) when a clear trend / drift outside the tolerance limit can be demonstrated by repeated operation precision checks, (b) when a correction is required on previously logged data due to a calibration check being outside the allowable tolerance

Commissioning refers to the initial setup and calibration of the instrument when it is first installed. For some instruments there may be a stabilisation period before normal operation commences.

Data transmission error refers to a period of time when the instrument could not transmit data. This may be due to interference, or a problem with the phone line or modem.

Equipment malfunction/instrument fault refers to a period of time when the instrument was not in the normal operating mode and did not measure a representative value of the existing conditions.

Gap in data/data not available refers to a period of time when either data has been lost or could not be collected.

Instrument Alarm refers to an alarm produced by the instrument. A range of alarms can be produced depending on how operation of the instrument is being affected.

Instrument out of service refers to a lack of data due to an instrument being shut down for repair, maintenance, or factory calibration.

Linear offset or multiplier refers to when an offset or multiplier has been applied between two points where the values of the offset or multiplier are different and the correction is interpolated between the two points.

Logger error refers to when an error occurs and instrument readings are not correctly recorded by the logger.

Maintenance refers to a period of time when the logger/instrument was switched off due to maintenance.

Overnight span/zero out of tolerance refers to when the span/zero reading measured by the analyser during an automatic precision check falls outside of the expected concentration limits.

Overnight zero out of tolerance refers to when the automatic zero reading measured by the analyser falls outside the expected limits.

Power Interruption refers to no power to the station therefore no data was collected at this time.

Remote Calibration refers to when a technician remotely connects to the station and manually performs a span check.

Static offset or multiplier refers to when a single offset or multiplier has been applied to the data between two points either to increase or decrease the measured value.

Tape break refers to the breaking of the EBAM/BAM sample tape during operation.

Warm up after power interruption refers to the start up period of an instrument after power has been restored.

Appendix 3 - Amendments

This amended report supersedes previously issued versions of the report. Refer to the revision history table on page 2 for details of previous revisions. The following modifications have been made in this revision:

- PM_{10} data from 14/08/17 14:45 to 01/09/17 00:00 at TransCity VSO West was invalidated. Fidas instrument showing excessive channel calibration drift and it was replaced on 10th October.