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TransCity

Legacy Way Air Monitoring Network

Ambient Air Quality Monitoring

Validated Report - Amended

1st August 2015 – 31st August 2015

Report No.: DAT11094

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Refer to Appendix 3 for details of amendments

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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. TransCity is responsible for the design, construction and operation of the network (TransCity website http://transcityjv.com.au/the-project/).

Ecotech Pty Ltd has been commissioned by TransCity 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 15, Legacy Way VSO East and VSO West.

Percentage availability for some parameters at TransCity 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 were 4 exceedences of the air quality limits at TransCity 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 TransCity 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 2015.

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 TransCity 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: TransCity 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 05th May 2015 at Legacy Way East Victoria Park (E1), Eastern Centenary Pool (E2), West Anzac Park (W1) and West Botanic Gardens (W2) stations to assess for compliance with *AS/NZS equipment"*. 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: TransCity 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 TransCity 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 TransCity 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 - 2008	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 TransCity 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.
- Airgas cylinder used at TransCity Anzac Park (W1) is non compliant with NATA traceability requirements.

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, expect 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 a Microsoft Excel format file(s) *named "TransCity Legacy Way Monthly Data Report_August 2015.xls"* and *"TransCity Legacy Way Monthly Met Data Report_August 2015.xls".*

The *TransCity Legacy Way Monthly Data Report_August 2015* 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 *TransCity Legacy Way Monthly Met Data Report_August 2015* 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 TransCity 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	22:50
Centenary Pool (E2)	NO_x / NO_2 / NO	01:00 – 01:45	n/a
	CO	01:00 – 01:45	23:45 – 23:50
Anzac Park (W1)	NO_x / NO_2 / NO	01:00 – 01:45	n/a
	CO	01:00 – 01:45	23:40
Botanic Gardens (W2)	NO_x / NO_2 / NO	01:00 – 01:45	n/a
	CO	01:00 – 01:45	23:50 – 23:55
VSO East	NO_x / NO_2 / NO	01:00 – 01:40	n/a
	CO	01:00 – 01:40	23:50
VSO West	NO_x / NO_2 / NO	01:00 – 01:40	n/a
	CO	01:00 – 01:40	23:55

Missing data (excluding automatic spans/zeros and background checks) for all stations are explained in the "Valid Data Exception Report" spreadsheets in the "*TransCity Legacy Way Monthly Data Report_August 2015.xls*" and "*TransCity Legacy Way Monthly Met Data Report_August 2015"* files, as well as in Tables 27-34.

3.0 Air Quality Goals

The air quality goals and criteria for pollutants monitored at the TransCity 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

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

Table 6: TransCity 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
NO_2	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
$PM_{2.5}$	1 year	8	$\mu g/m^3$	Advisory goal only, no maximum

Table 7: TransCity Legacy Way Ventilation Outlet Stations Air Quality Criterias

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	± 18.7 µg/m³ k factor of 2.01	0 to 669 µg/m³
	mg/m^3	0.001 mg/m^3	± 0.018 mg/m³ k factor of 2.01	0 to 0.669 mg/m³
NO_2 (S40)	µg/m³	1 µg/m³	± 32.8 µg/m³ k factor of 2.01	0 to 1026 µg/m³
	mg/m^3	0.001 mg/m^3	± 0.033 mg/m³ k factor of 2.01	to 1.026 mg/m³
CO (S30)	ppm	0.1 ppm	± 1.1 ppm k factor of 2.00	0 to 50 ppm
	mg/m³	0.1 mg/m³	± 1.4 mg/m³ k factor of 2.00	0 to 62 mg/m³
PM_{10}, $PM_{2.5}$ (BAM 1020)	µg/m³	1 µg/m³	3.57% of reading k factor of 1.98	0 to 1000 µg/m³
PM_{10} (Fidas)	mg/m³	0.001 mg/m³	21% of reading k factor of 1.96	0 to 10 mg/m³

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

Parameter	Units	Resolution	Uncertainty	Measurement Range[2]
Vector Wind Speed	m/s	0.1 m/s	±0.22 m/s or 3 % of reading (whichever is greater) K factor of 1.96	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	±0.25 °C K factor of 2.01	0 to 50 °C
Relative Humidity	%	1 %	±5 % K factor of 2.31	0-100 %
Solar Radiation	W/m^2	1 W/m^2	±5 % of reading or ±32 W/m^2 or whichever is greater K factor of 1.96	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 2.14	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: TransCity East Victoria Park (E1) Maintenance Table August 2015

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	26/08/15	Monthly	26/08/15	Monthly
CO	26/08/15	6 monthly	26/08/15	Monthly
PM_{10}	26/08/15	6 monthly	26/08/15	3 monthly
$PM_{2.5}$	26/08/15	6 monthly	26/08/15	3 monthly

Table 10: TransCity Eastern Centenary Pool (E2) Maintenance Table August 2015

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	25/08/15	1 yearly	25/08/15	Monthly
CO	25/08/15	1 yearly	25/08/15	Monthly
PM_{10}	25/08/15	6 monthly	25/08/15	3 monthly
$PM_{2.5}$	25/08/15	6 monthly	25/08/15	3 monthly
Wind Speed	25/08/15	3 monthly	10/02/15	Yearly
Wind Direction	25/08/15	3 monthly	10/02/15	Yearly
Ambient Temperature	25/08/15	6 monthly	25/08/15	6 monthly
Relative Humidity	25/08/15	6 monthly	25/08/15	6 monthly
Solar Radiation	25/08/15	6 monthly	23/06/15	Yearly
Rain	25/08/15	3 monthly	11/05/15	Yearly

Table 11: TransCity West Anzac Park (W1) Maintenance Table August 2015

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	27/08/15	6 monthly	27/08/15	Monthly
CO	27/08/15	6 monthly	27/08/15	Monthly
PM_{10}	27/08/15	6 monthly	27/08/15	3 monthly
$PM_{2.5}$	27/08/15	6 monthly	27/08/15	3 monthly
Wind Speed	27/08/15	3 monthly	13/05/15	Yearly
Wind Direction	27/08/15	3 monthly	13/05/15	Yearly
Ambient Temperature	27/08/15	6 monthly	27/08/15	6 monthly
Relative Humidity	27/08/15	6 monthly	27/08/15	6 monthly
Solar Radiation	27/08/15	6 monthly	22/07/15	Yearly
Rain	27/08/15	3 monthly	13/05/15	Yearly

Table 12: TransCity West Botanic Gardens (W2) Maintenance Table August 2015

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	26/08/15	6 monthly	26/08/15	Monthly
CO	26/08/15	6 monthly	26/08/15	Monthly
PM_{10}	26/08/15	6 monthly	26/08/15	3 monthly
$PM_{2.5}$	26/08/15	6 monthly	26/08/15	3 monthly

Table 13: TransCity VSO East Maintenance Table August 2015

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	28/08/15	Unscheduled	28/08/15	Monthly
CO	28/08/15	Unscheduled	28/08/15	Monthly
PM_{10}	27/08/15	Monthly	27/08/15	3 monthly

Table 14: TransCity VSO West Maintenance Table August 2015

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	28/08/15	Unscheduled	28/08/15	Monthly
CO	28/08/15	Unscheduled	28/08/15	Monthly
PM_{10}	26/08/15	Monthly	26/08/15	3 monthly

5.0 Results

5.1. Data Capture

Data capture is based on 5 minute data, except for BAM1020 dust parameters which are based on hourly values, and refers to the amount of available data collected during the report period.

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

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

Where:

- Reported air quality data = Number of instrument readings which have been validated through a quality assured process and excludes all data errors, zero data collection due to calibration, failures and planned and unplanned maintenance.
- Total data = Total number of instrument readings since the start of the term assuming no maintenance, errors, loss of data or calibration.

Tables 15-20 below display data capture statistics for August 2015. **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 file.

Table 15: Monthly Data Capture for TransCity East Victoria Park (E1) for August 2015

Parameter	Data Capture (%)
NO, NO_2, NO_x	95.9
CO	95.2
PM_{10}	99.6
$PM_{2.5}$	99.6

Table 16: Monthly Data Capture for TransCity Eastern Centenary Pool (E2) for August 2015

Parameter	Data Capture (%)
NO, NO_2, NO_x	95.8
CO	**94.7**
PM_{10}	99.1
$PM_{2.5}$	99.1
Wind Speed	98.9
Wind Direction	98.9
Ambient Temperature (2m)	99.0
Ambient Temperature (10m)	99.0
Relative Humidity	99.0
Solar Radiation	99.0
Rain	99.0

Table 17: Monthly Data Capture for TransCity West Anzac Park (W1) for August 2015

Parameter	Data Capture (%)
NO, NO_2, NO_x	97.0
CO	95.9
PM_{10}	99.3
$PM_{2.5}$	99.3
Wind Speed	99.6
Wind Direction	99.6
Ambient Temperature (2m)	99.6
Ambient Temperature (10m)	99.6
Relative Humidity	99.6
Solar Radiation	97.8
Rain	99.6

Table 18: Monthly Data Capture for TransCity Botanic Garndens (W2) for August 2015

Parameter	Data Capture (%)
NO, NO_2, NO_x	97.1
CO	96.5
PM_{10}	99.3
$PM_{2.5}$	99.5

Table 19: Monthly Data Capture for TransCity VSO East for August 2015

Parameter	Data Capture (%)
NO, NO_2, NO_x	95.5
CO	**94.6**
PM_{10}	97.9

Table 20: Monthly Data Capture for TransCity VSO West for August 2015

Parameter	Data Capture (%)
NO, NO_2, NO_x	95.1
CO	**94.1**
PM_{10}	97.9

5.2. Air Quality Monthly Summary

Table 21: TransCity East – Victoria Park (E1) Exceedences Recorded for August 2015

Parameter	Time Period	Value of Exceedence	Date of Exceedence
NO_2	1 hour	-	-
CO	1 hour	-	-
PM_{10}	24 hour	-	-
$PM_{2.5}$	24 hour	30.71 µg/m^3	08/08/15

Table 22: TransCity Eastern Centenary Pool (E2) Exceedences Recorded for August 2015

Parameter	Time Period	Value of Exceedence	Date of Exceedence
NO_2	1 hour	-	-
CO	1 hour	-	-
PM_{10}	24 hour	-	-
$PM_{2.5}$	24 hour	26.96 µg/m^3	08/08/15

Table 23: TransCity West Anzac Park (W1) Exceedences Recorded for August 2015

Parameter	Time Period	Value of Exceedence	Date and Time of Exceedence
NO_2	1 hour	-	-
CO	1 hour	-	-
PM_{10}	24 hour	-	-
$PM_{2.5}$	24 hour	-	-

Table 24: TransCity West Botanic Gardens (W2) Exceedences Recorded for August 2015

Parameter	Time Period	Value of Exceedence	Date and Time of Exceedence
NO_2	1 hour	-	-
CO	1 hour	-	-
PM_{10}	24 hour	-	-
$PM_{2.5}$	24 hour	-	-

Table 25: TransCity VSO East Exceedences Recorded for August 2015

Parameter	Time Period	Value of Exceedence	Date and Time of Exceedence
NO_2	1 hour	-	-
CO	1 hour	-	-
PM_{10}	1 hour	1.371 mg/m^3	08/08/15 01:00

Table 26: TransCity VSO West Exceedences Recorded for August 2015

Parameter	Time Period	Value of Exceedence	Date and Time of Exceedence
NO_2	1 hour	-	-
CO	1 hour	-	-
PM_{10}	1 hour	2.608 mg/m^3	08/08/15 02:00

5.3. Tabulated data

5.3.1. Maximum averages

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

Table 27: Maximum values at TransCity East Victoria Park (E1) for August 2015

Station	Parameter	Goal	Avering Period	Maximum Value	Date and Time
Victoria Park (E1)	NO_2 (µg/m^3)	250	1 hour	69.28	7/08/2015 20:00
	CO (mg/m^3)	11	8 hours	1.10	8/08/2015 02:00
	PM_{10} (µg/m^3)	50	24 hours	36.00	8/08/2015
	$PM_{2.5}$ (µg/m^3)	25	24 hours	30.71	8/08/2015

Table 28: Maximum values at Eastern Centenary Pool (E2) for August 2015

Station	Parameter	Goal	Avering Period	Maximum Value	Date and Time
Centenary Pool (E2)	NO_2 (µg/m^3)	250	1 hour	91.00	7/08/2015 20:00
	CO (mg/m^3)	11	8 hours	1.15	8/08/2015 02:00
	PM_{10} (µg/m^3)	50	24 hours	33.67	8/08/2015
	$PM_{2.5}$ (µg/m^3)	25	24 hours	26.96	8/08/2015

Table 29: Maximum values at TransCity West Anzac Park (W1) for August 2015

Station	Parameter	Goal	Avering Period	Maximum Value	Date and Time
Anzac Park (W1)	NO_2 ($\mu g/m^3$)	250	1 hour	100.75	8/08/2015 19:00
	CO (mg/m^3)	11	8 hours	0.89	8/08/2015 02:00
	PM_{10} ($\mu g/m^3$)	50	24 hours	20.75	8/08/2015
	$PM_{2.5}$ ($\mu g/m^3$)	25	24 hours	16.50	8/08/2015

Table 30: Maximum values at West Botanic Gardens (W2) for August 2015

Station	Parameter	Goal	Avering Period	Maximum Value	Date and Time
Botanic Gardens (W2)	NO_2 ($\mu g/m^3$)	250	1 hour	62.43	7/08/2015 07:00
	CO (mg/m^3)	11	8 hours	0.59	10/08/2015 09:00
	PM_{10} ($\mu g/m^3$)	50	24 hours	17.54	11/08/2015
	$PM_{2.5}$ ($\mu g/m^3$)	25	24 hours	11.29	8/08/2015

Table 31: Maximum values at VSO East for August 2015

Station	Parameter	Goal	Avering Period	Maximum Value	Date and Time
VSO East	NO_2 (mg/m^3)	2.0	1 hour	0.445	5/08/2015 07:00
	CO (ppm)	70	1 hour	3.90	5/08/2015 08:00
	PM_{10} (mg/m^3)	1.0	1 hour	1.371	8/08/2015 01:00

Table 32: Maximum values at VSO West for August 2015

Station	Parameter	Goal	Avering Period	Maximum Value	Date and Time
VSO West	NO_2 (mg/m^3)	2.0	1 hour	0.549	7/08/2015 16:00
	CO (ppm)	70	1 hour	4.34	28/08/2015 17:00
	PM_{10} (mg/m^3)	1.0	1 hour	2.608	8/08/2015 02:00

5.4. Graphic Representations

5.4.1. External Ambient

This section displays graphs of the pollutants and meteorological parameters monitored at the TransCity Legacy Way external ambient sites for August 2015. The graphs are based on validated 5 minute or 1 hour data as appropriate.

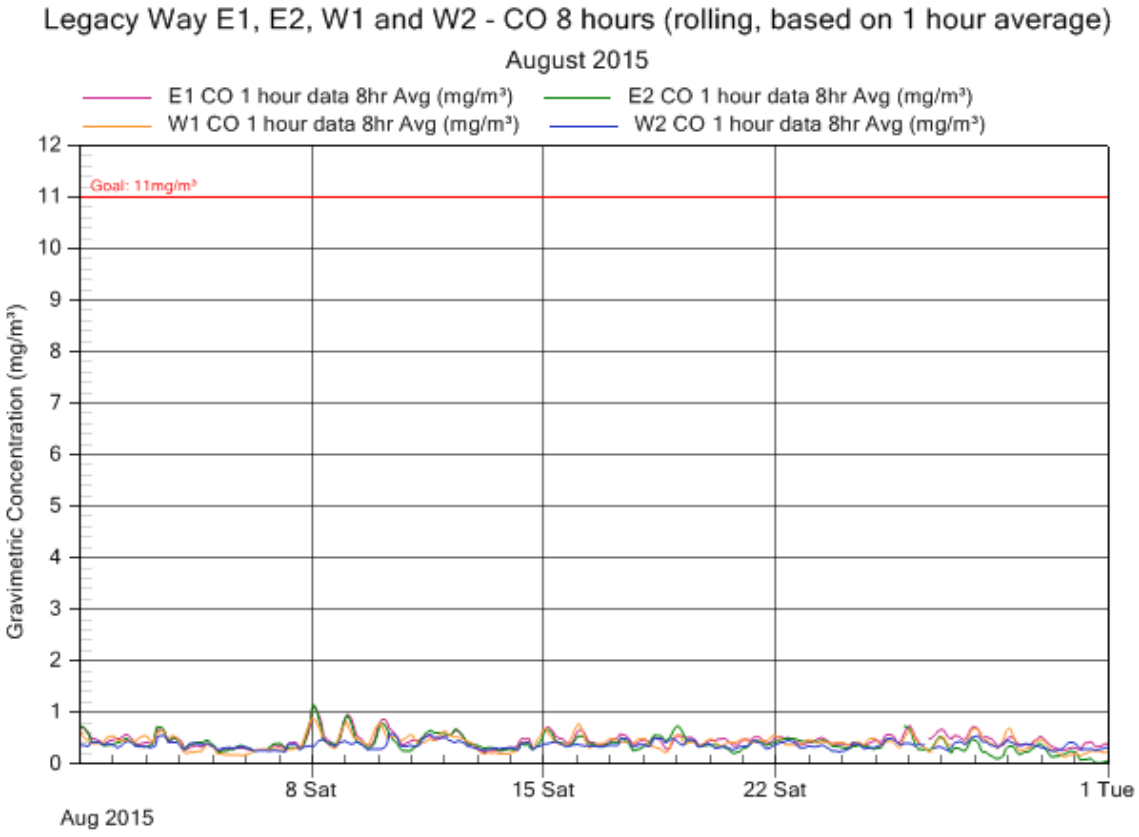

Figure 2: TransCity Legacy Way (E1, E2, W1 and W2) - CO graph for August 2015

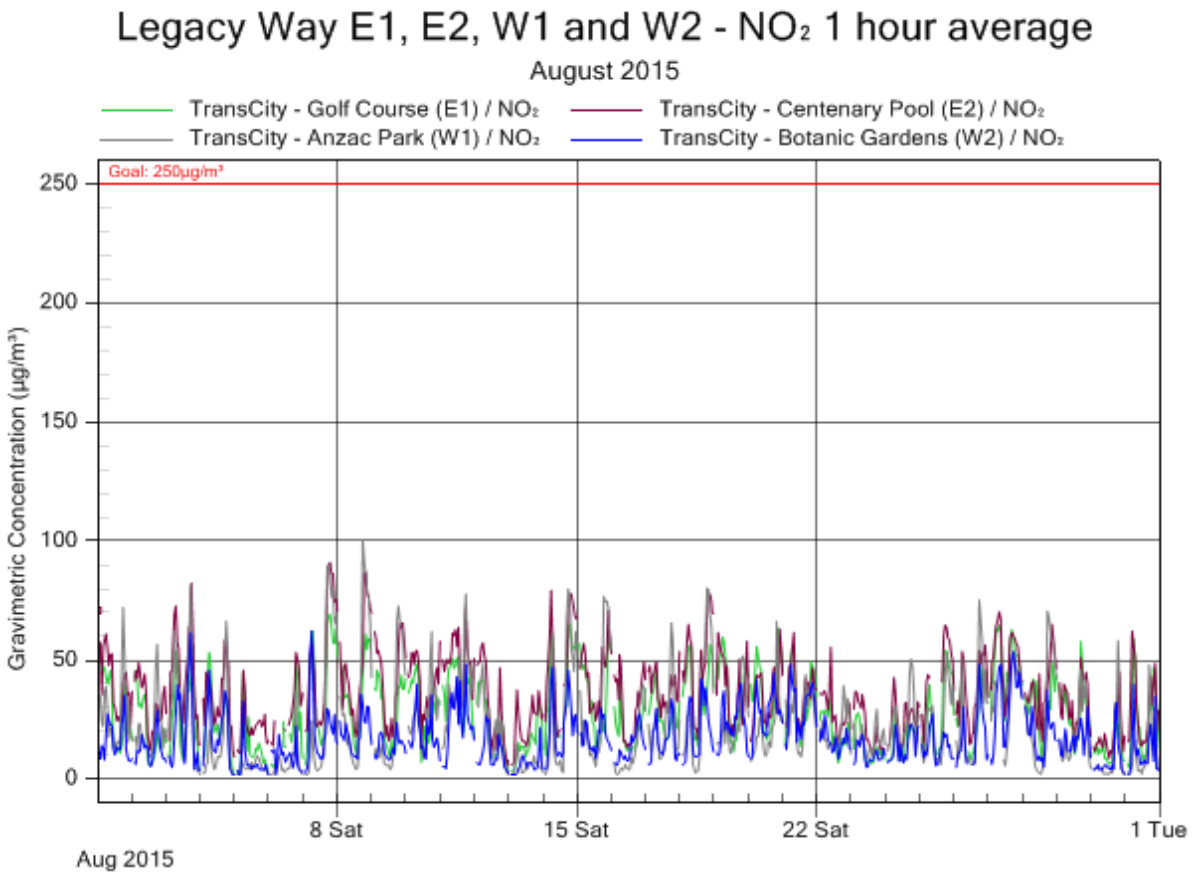

Figure 3: TransCity Legacy Way (E1, E2, W1 and W2)- NO_2 graph for August 2015

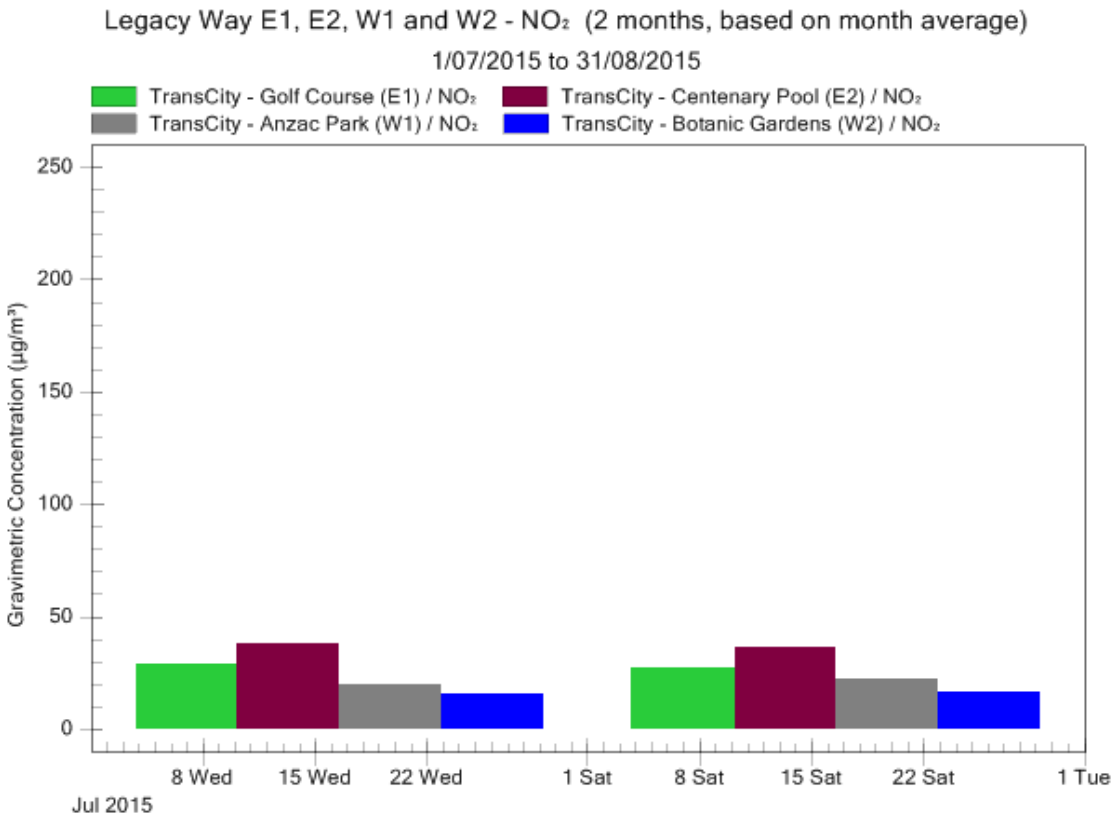

Figure 4: TransCity Legacy Way (E1, E2, W1 and W2)- NO2 graph 12 months to August 2015

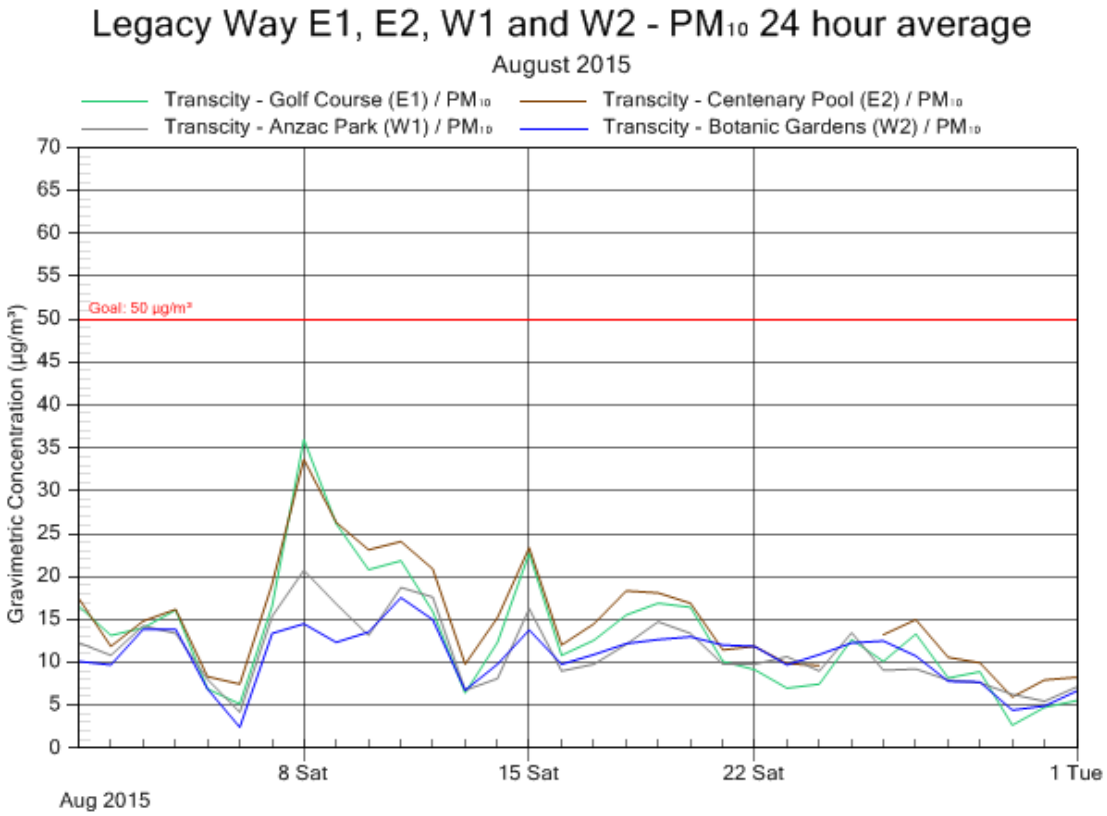

Figure 5: TransCity Legacy Way (E1, E2, W1 and W2) - PM_{10} graph for August 2015

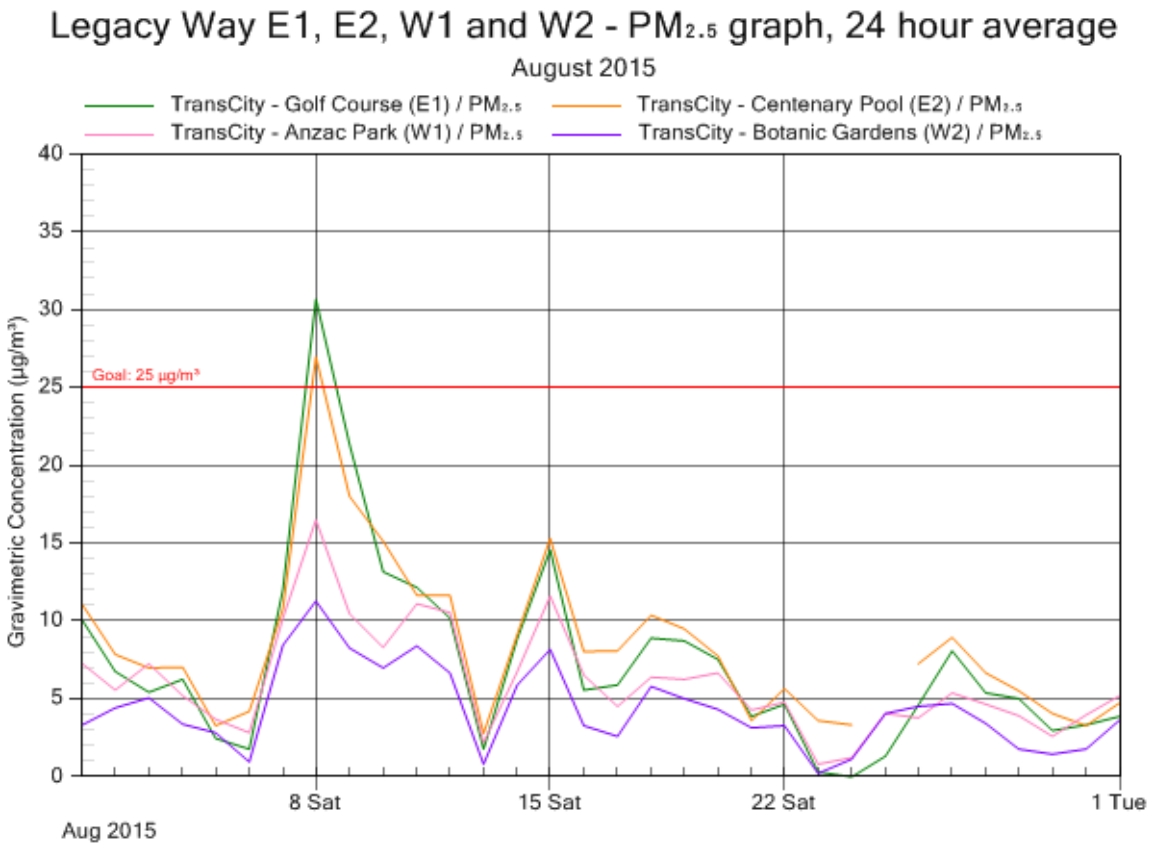

Figure 6: TransCity Legacy Way (E1, E2, W1 and W2) - $PM_{2.5}$ graph for August 2015

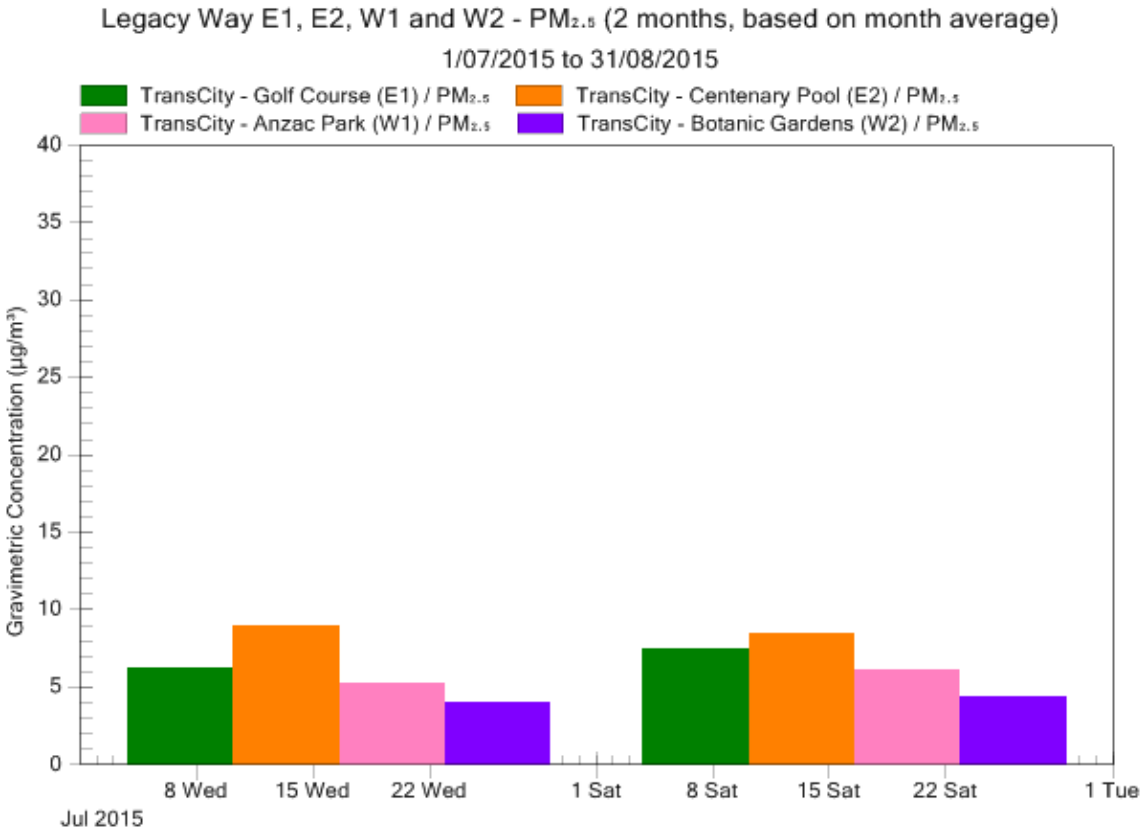

Figure 7: TransCity Legacy Way (E1, E2, W1 and W2) - $PM_{2.5}$ graph 12 months to August 2015

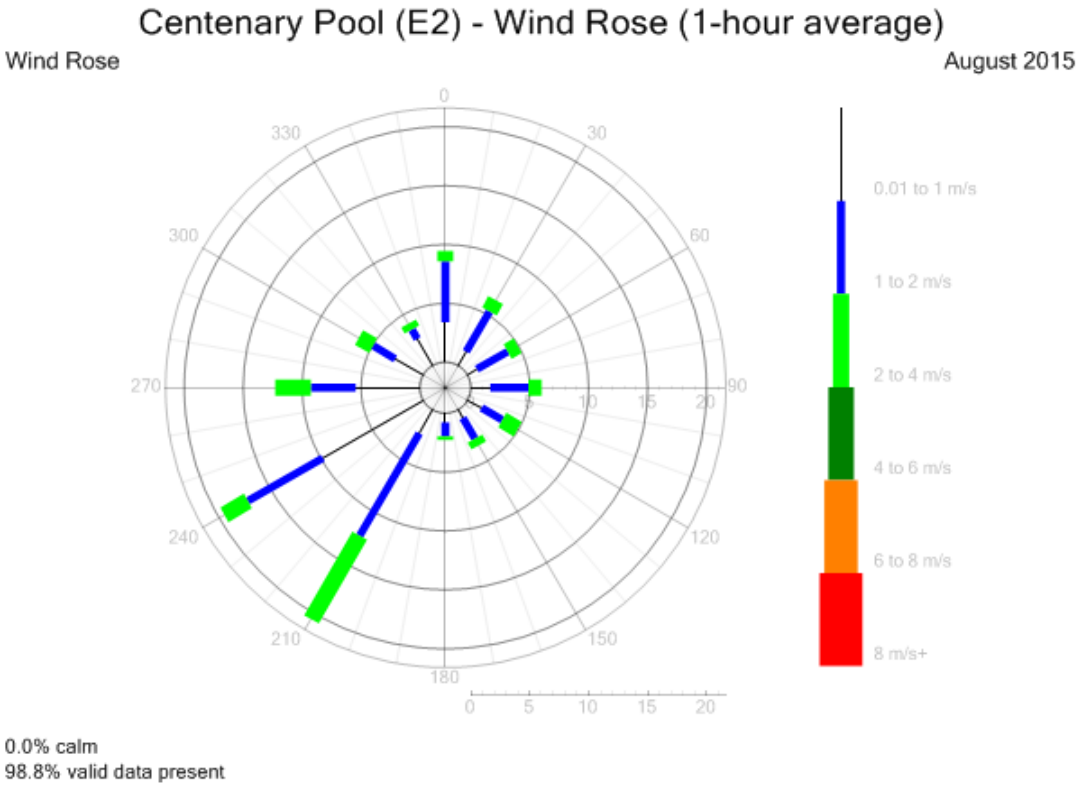

Figure 8: TransCity Legacy Way E2 – Wind Rose for August 2015

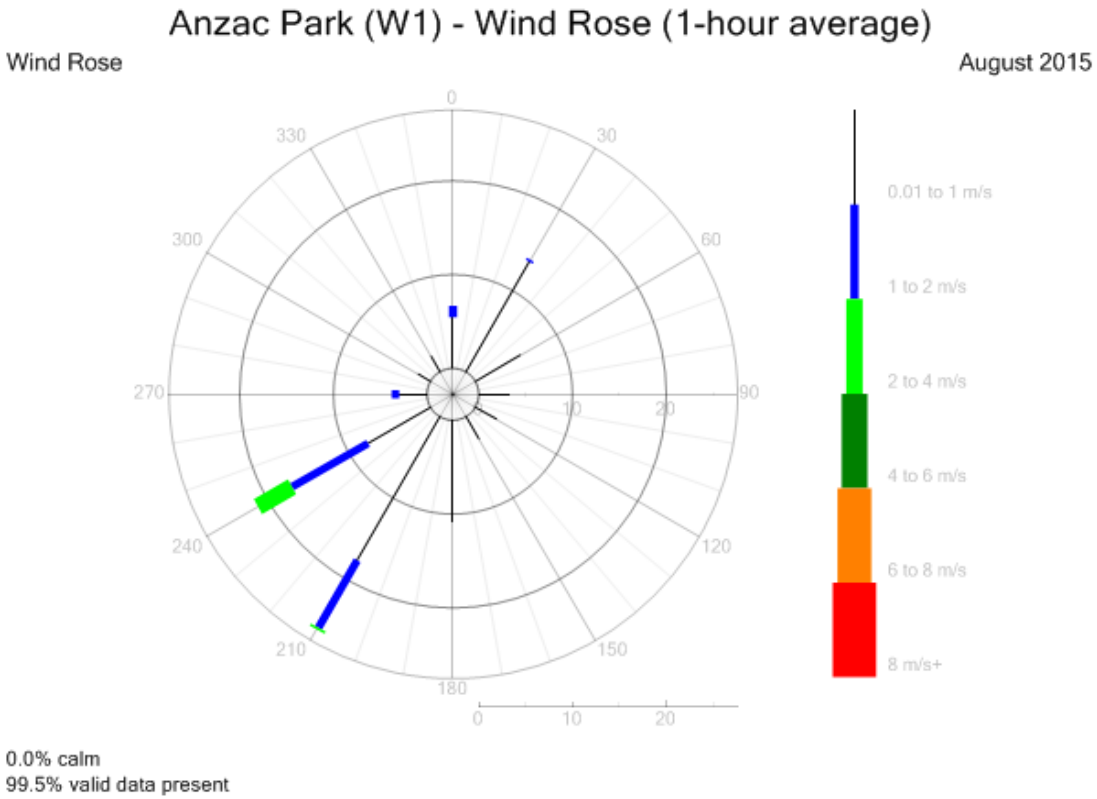

Figure 9: TransCity Legacy Way W1 – Wind Rose for August 2015

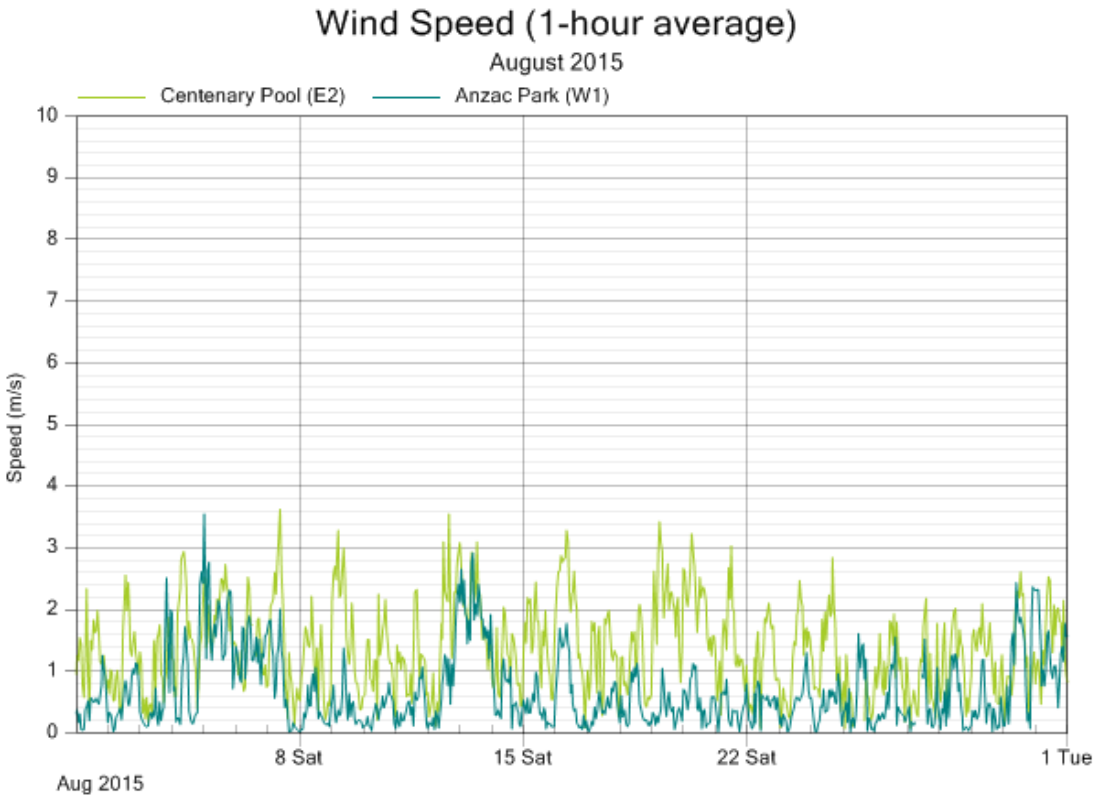

Figure 10: TransCity Legacy Way E2 and W1 – Wind Speed for August 2015

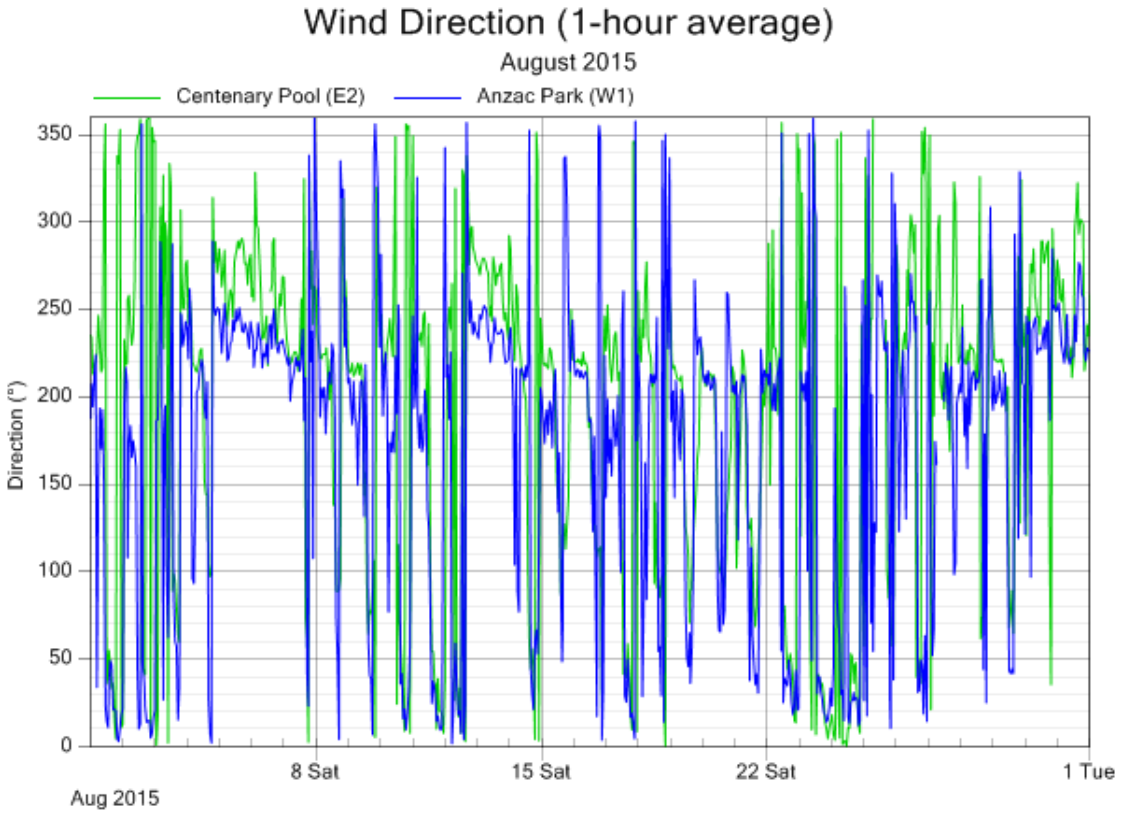

Figure 11: TransCity Legacy Way E2 and W1 – Wind Direction for August 2015

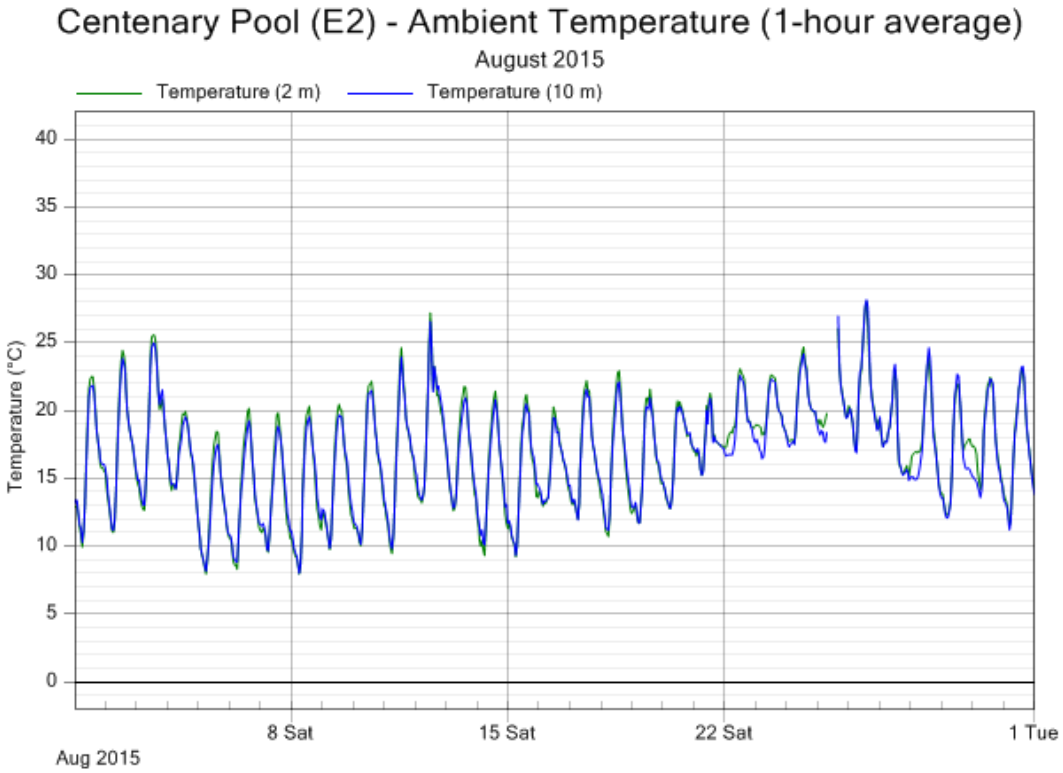

Figure 12: TransCity Legacy Way E2– Ambient Temperature for August 2015

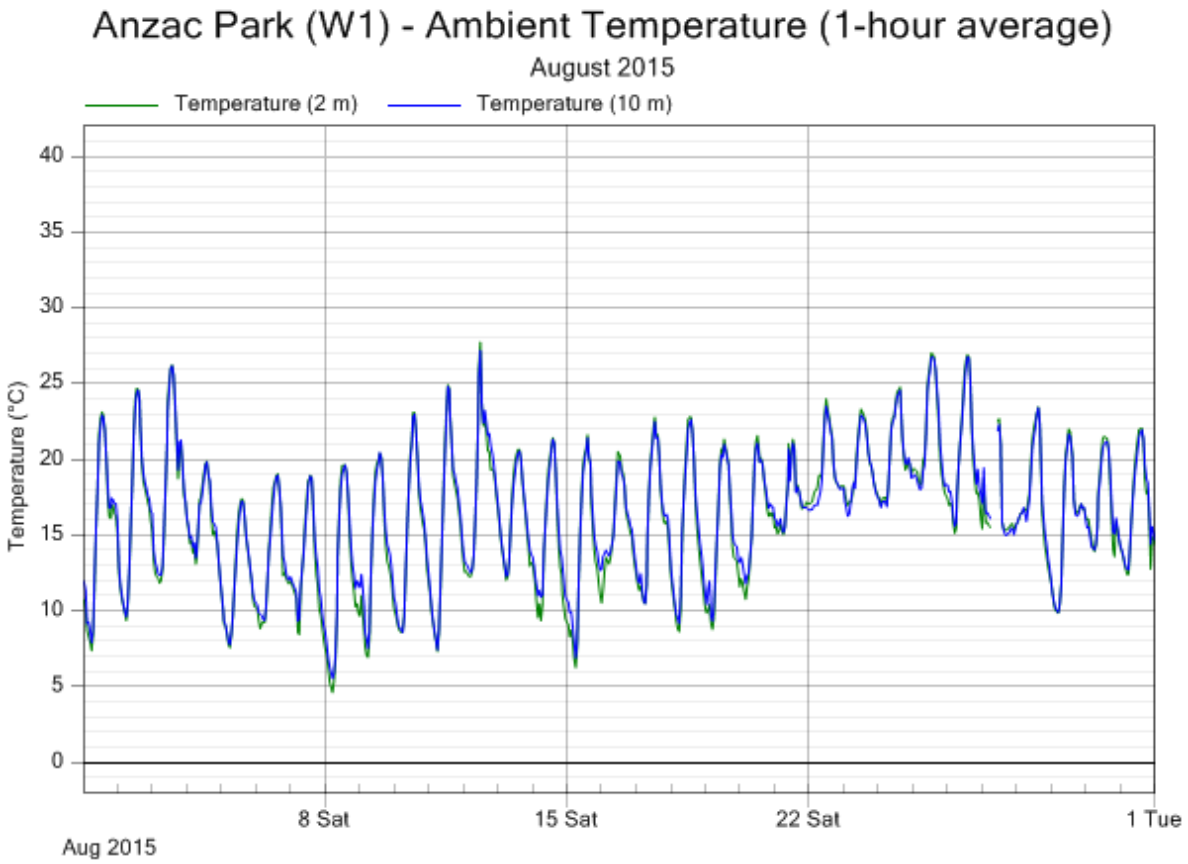

Figure 13: TransCity Legacy Way W1– Ambient Temperature for August 2015

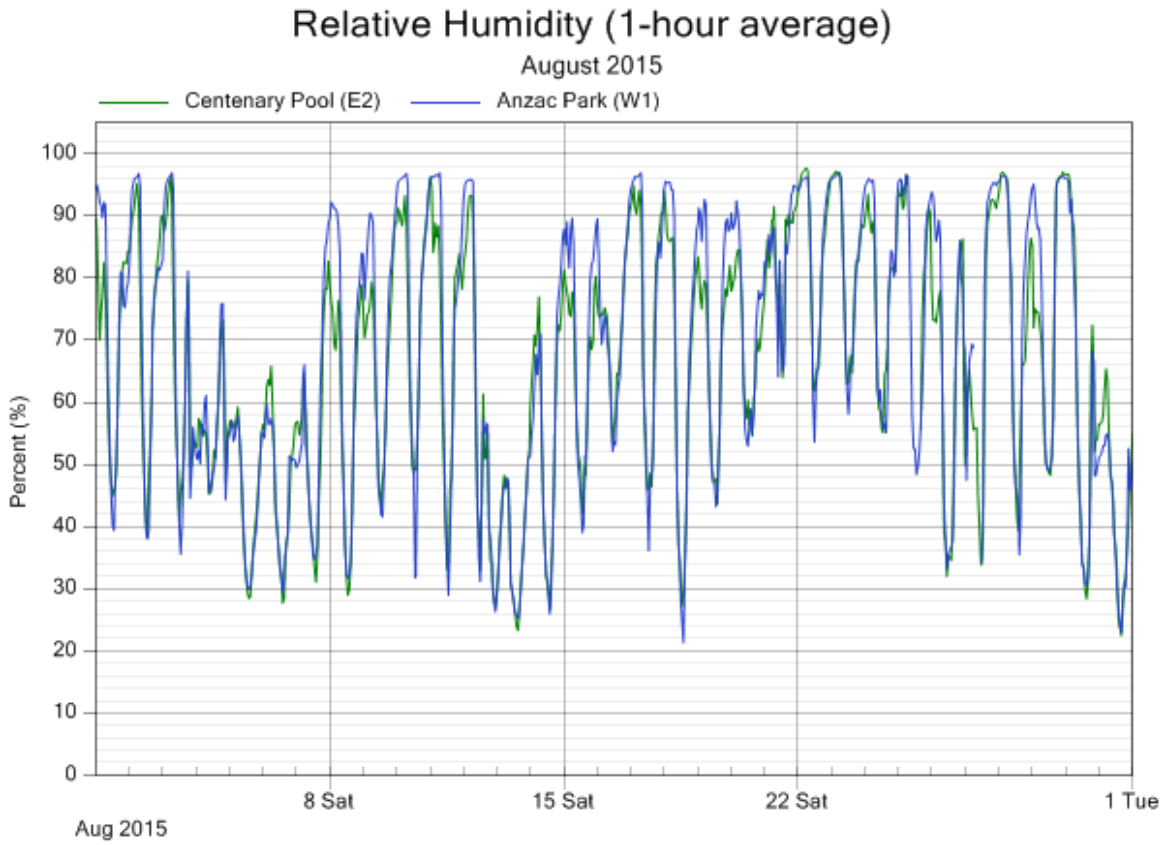

Figure 14: TransCity Legacy Way E2 and W1– Relative Humidity for August 2015

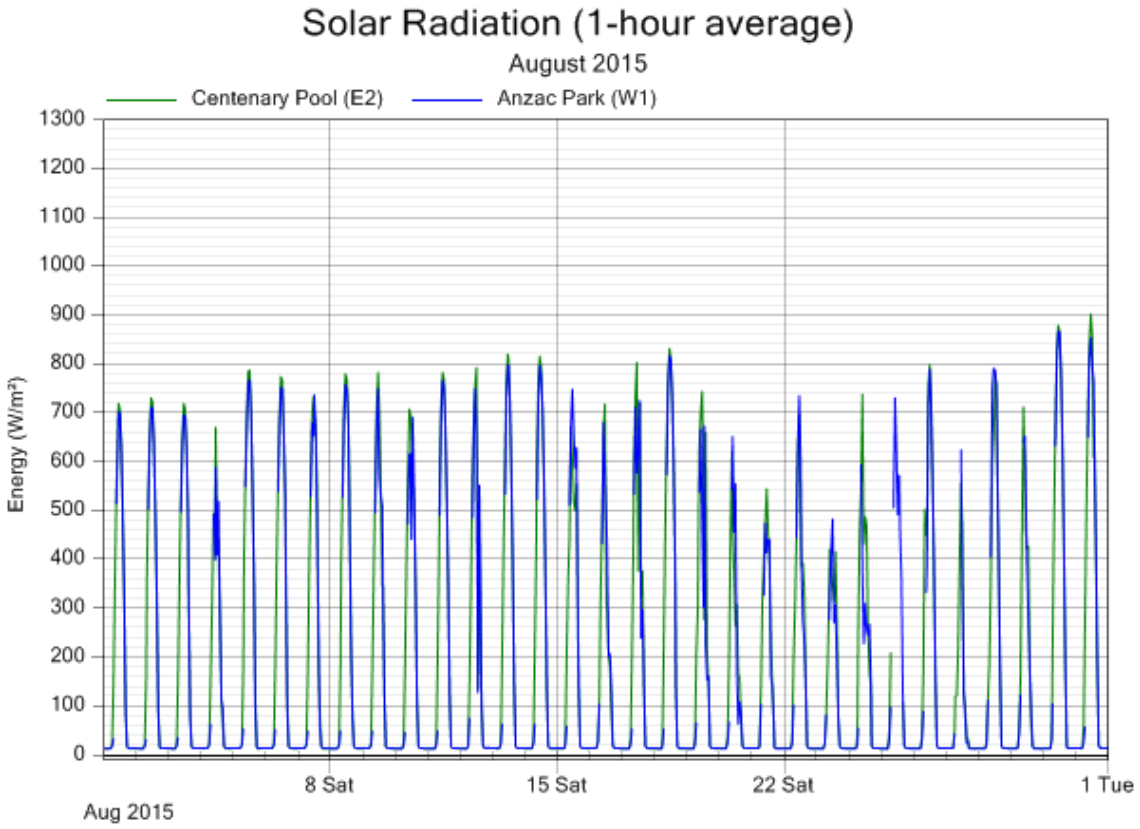

Figure 15: TransCity Legacy Way E2 and W1– Solar Radiation for August 2015

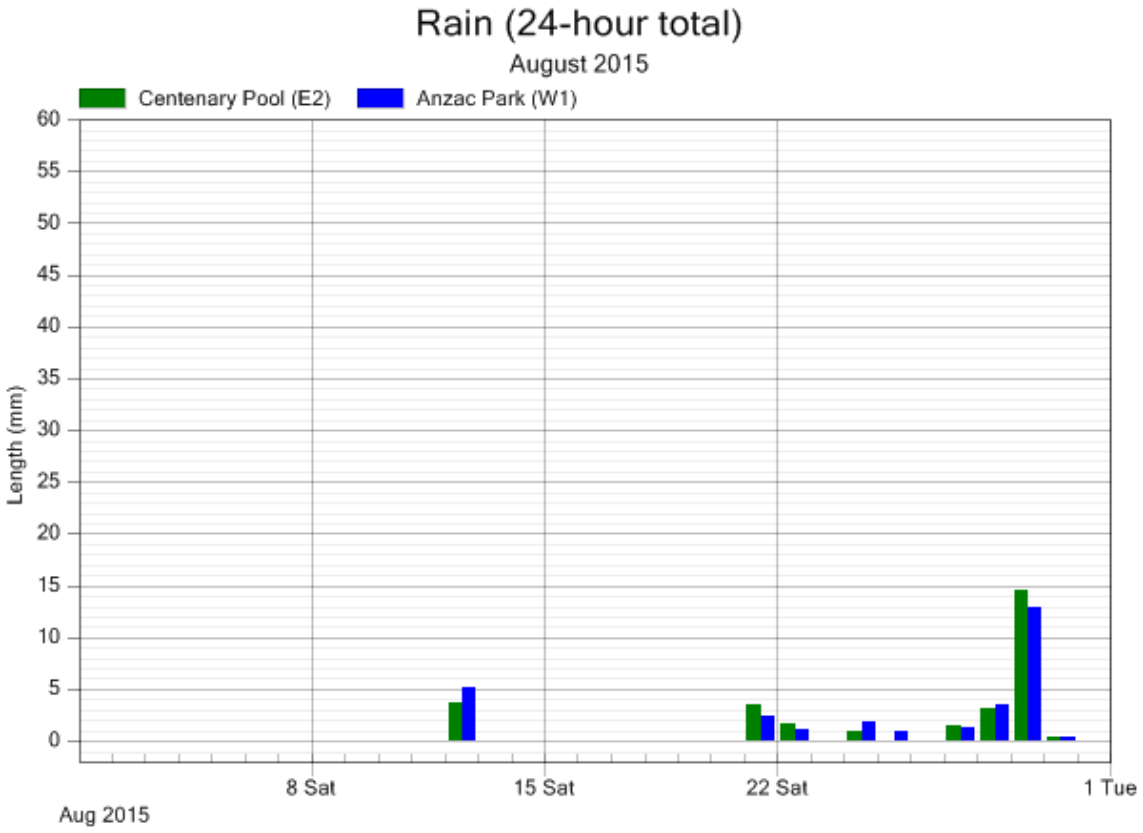

Figure 16: TransCity Legacy Way E2 and W1– Rain for August 2015

5.4.2. Ventilation outlet

This section displays graphs of the pollutants parameters monitored at the TransCity Legacy Way ventilation sites for August 2015. The graphs are based on validated 5 minute data.

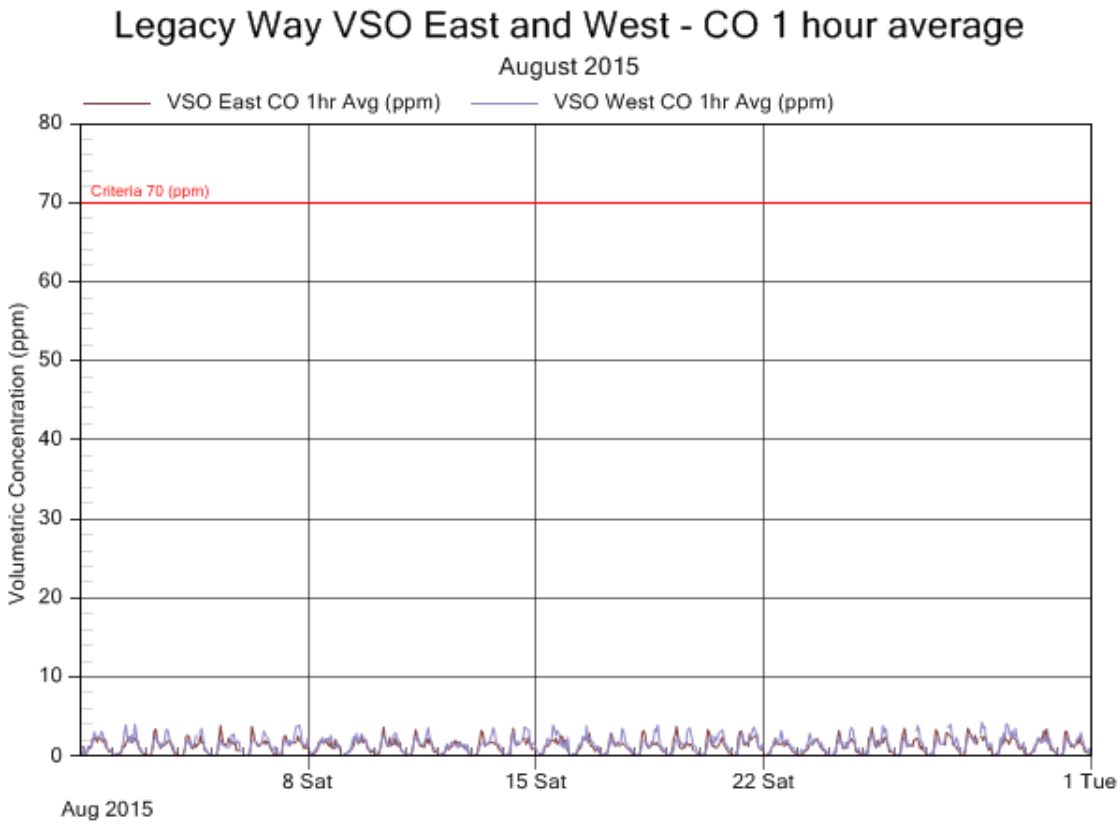

Figure 17: TransCity Legacy Way VSO East and West - CO graph for August 2015

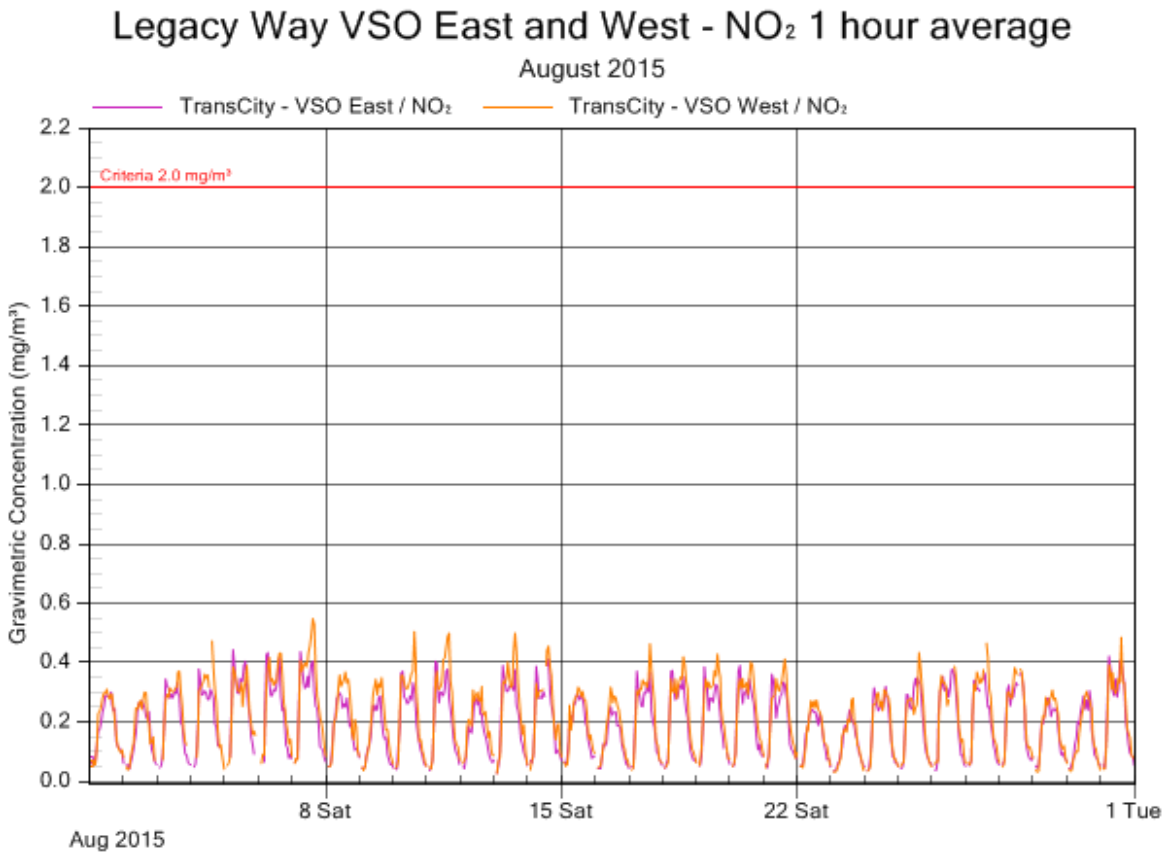

Figure 18: TransCity Legacy Way East and West – NO_2 graph for August 2015

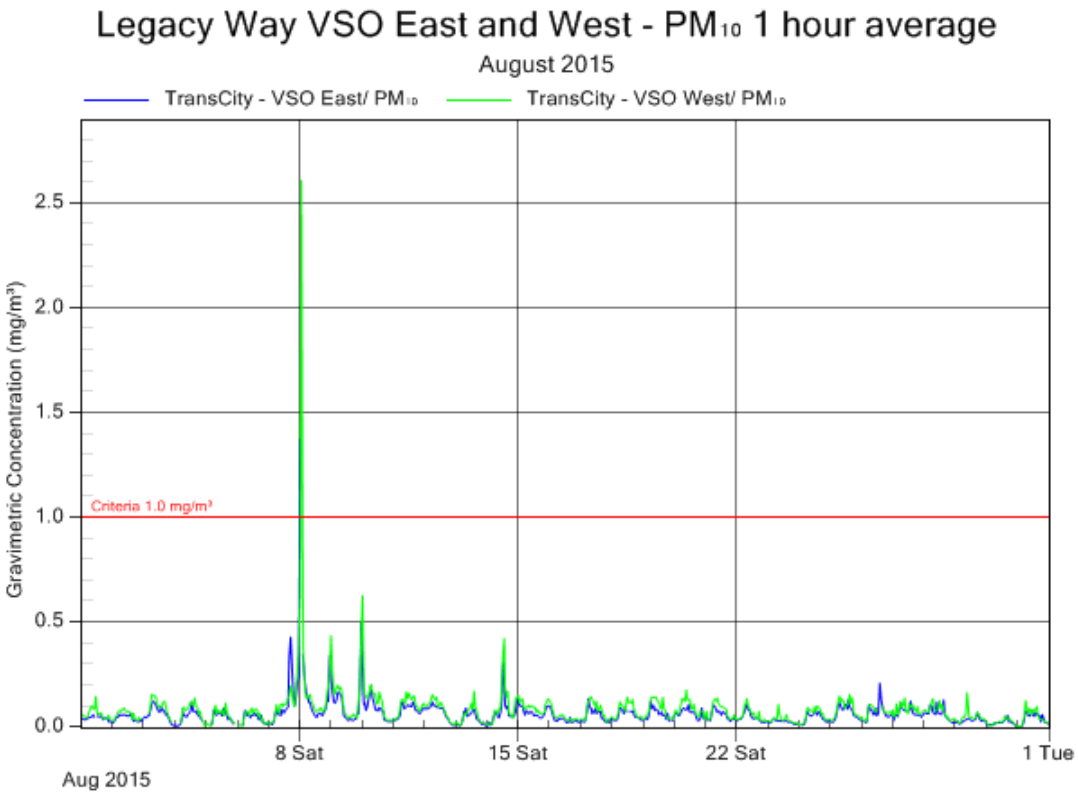

Figure 19: TransCity Legacy Way East and West – PM_{10} graph for August 2015

6.0 Valid Data Exception Tables

Tables 33 to 40 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 33: TransCity East – Victoria Park (E1) Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
03/08/15 06:15	31/08/15 06:30	Intermittent data transmission errors	CO, NO, NO_2, NO_X	CT	21/09/2015
06/08/15 05:00	06/08/15 09:45	Instrument fault - in calibration mode	CO, NO, NO_2, NO_X	CT	21/09/2015
06/08/15 13:35	06/08/15 14:20	Unscheduled maintenance - fixed instrument	CO, NO, NO_2, NO_X	CT	21/09/2015
14/08/15 13:40	14/08/15 16:35	Unscheduled maintenance - remote calibration	CO, NO, NO_2, NO_X	CT	21/09/2015
26/08/15 06:00	26/08/15 08:00	6 monthly maintenance	$PM_{2.5}$, PM_{10}	CT	22/09/2015
26/08/15 06:45	26/08/15 09:25	6 monthly maintenance	CO, NO, NO_2, NO_X	CT	21/09/2015

Table 34: TransCity Eastern Centenary Pool (E2) Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
05/08/15 23:35	31/08/15 10:10	Intermittent data transmission errors	CO, NO, NO_2, NO_X	CT	21/09/2015
06/08/15 05:00	06/08/15 09:45	Instrument fault - in calibration mode	CO, NO, NO_2, NO_X	CT	21/09/2015
06/08/15 13:00	06/08/15 14:00	Unscheduled maintenance - fixed instrument	CO, NO, NO_2, NO_X	CT	21/09/2015
14/08/15 14:05	14/08/15 14:25	Unscheduled maintenance - remote calibration	CO, NO, NO_2, NO_X	CT	21/09/2015
25/08/15 08:00	25/08/15 14:00	6 monthly maintenance	$PM_{2.5}$, PM_{10}	CT	22/09/2015

Start Date	End Date	Reason	Change Details	User Name	Change Date
25/08/15 08:35	25/08/15 15:40	6 monthly maintenance	CO, NO, NO_2, NO_X	CT	21/09/2015
25/08/15 15:45	25/08/15 23:30	Linear offset of applied to correct data drift where A = 0.0 and B = -0.46	CO	CT	22/09/2015

Table 35: TransCity Eastern Centenary Pool (E2) Valid Data Exception Table – Met Data

Start Date	End Date	Reason	Change Details	User Name	Change Date
06/08/15 10:30	06/08/15 13:55	Intermittently data affected by maintenance	All channels	CT	29/08/2016
14/08/15 14:20	14/08/15 14:20	Data affected by maintenance	WS, WD	CT	29/08/2016
25/08/15 08:35	25/08/15 15:30	6 monthly maintenance	All channels	CT	29/08/2016

Table 36: TransCity West Anzac Park (W1) Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
01/08/15 18:05	30/08/15 20:50	Intermittent data transmission errors	CO	CT	22/09/2015
09/08/15 03:00	09/08/15 03:00	Data transmission error	$PM_{2.5}$, PM_{10}	CT	22/09/2015
27/08/15 07:00	27/08/15 10:00	6 monthly maintenance	$PM_{2.5}$, PM_{10}	CT	22/09/2015
27/08/15 07:10	27/08/15 10:45	6 monthly maintenance	CO, NO, NO_2, NO_X	CT	22/09/2015
27/08/15 10:45	01/09/15 00:00	Static multiplier of 1.1 applied to correct overnight span value	NO, NO_2, NO_X	CT	22/09/2015

Table 37: TransCity West Anzac Park (W1) Valid Data Exception Table – Met Data

Start Date	End Date	Reason	Change Details	User Name	Change Date
01/08/15 00:00	01/09/15 00:00	Daily shadow on sensor between approx. 8:25 to 08:50	SR	CT	29/08/2016
27/08/15 07:10	27/08/15 10:25	6 monthly maintenance	All channels	CT	29/08/2016

Table 38: TransCity West Botanic Gardens (W2) Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
07/08/15 06:50	27/08/15 18:25	Intermittent data transmission errors	CO, NO, NO_2, NO_X	CT	22/09/2015
25/08/15 21:00	25/08/15 21:00	Unrealistic spike	$PM_{2.5}$	CT	22/09/2015
26/08/15 10:00	26/08/15 14:00	6 monthly maintenance & subsequent instrument stabilisation	$PM_{2.5}$, PM_{10}	CT	22/09/2015
26/08/15 10:20	26/08/15 13:10	6 monthly maintenance	CO, NO, NO_2, NO_X	CT	22/09/2015

Table 39: TransCity VSO East Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
01/08/15 00:00	01/09/15 00:00	Data reprocessed with tunnel algorithm	PM_{10}	CT	08/09/16
01/08/15 09:35	31/08/15 09:35	Intermittent data transmission errors	CO, NO, NO_2, NO_X	CT	22/09/2015
01/08/15 11:10	18/08/15 13:50	Intermittent instrument fault - sensor flow	PM_{10}	CT	23/09/2015
04/08/15 22:10	19/08/15 21:40	Intermittent data affected by internal maintenance	CO, NO, NO_2, NO_X, PM_{10}	CT	8/09/2016

Start Date	End Date	Reason	Change Details	User Name	Change Date
14/08/15 13:15	14/08/15 13:35	Unscheduled maintenance - remote calibration	CO, NO, NO_2, NO_X	CT	23/09/2015
27/08/15 11:00	27/08/15 12:50	3 monthly maintenance	CO, NO, NO_2, NO_X, PM_{10}	CT	8/09/2016
27/08/15 12:55	28/08/15 13:45	Static multiplier of 1.12 applied to correct overnight span value	CO	CT	23/09/2015
28/08/15 13:50	28/08/15 14:30	Unscheduled maintenance - remote calibration. NO_X and CO precision values changed	CO, NO, NO_2, NO_X	CT	23/09/2015

Table 40: TransCity VSO West Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
01/08/15 00:00	01/09/15 00:00	Data reprocessed with tunnel algorithm	PM_{10}	CT	08/09/16
01/08/15 09:20	31/08/15 07:40	Intermittent data transmission errors	All channels	CT	23/09/2015
02/08/15 23:20	06/08/16 01:05	Intermittent data affected by internal maintenance	CO, NO, NO_2, NO_X, PM_{10}	CT	8/09/2016
04/08/15 14:10	04/08/15 15:00	Unscheduled maintenance - remote calibration	CO, NO, NO_2, NO_X	CT	23/09/2015
08/08/15 01:40	08/08/15 01:45	Instrument fault - sensor flow	PM_{10}	CT	29/09/2016
14/08/15 12:20	14/08/15 13:00	Unscheduled maintenance - remote calibration	CO, NO, NO_2, NO_X	CT	23/09/2015
26/08/15 13:25	26/08/15 15:45	3 monthly maintenance	All channels	CT	23/09/2015
28/08/15 14:40	28/08/15 15:10	Unscheduled maintenance - remote calibration. NO_X and CO precision values changed	CO, NO, NO_2, NO_X	CT	23/09/2015

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

7.0 Report Summary

- Percentage availability for some parameters at TransCity 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 were 4 exceedences of the air quality limits at TransCity 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 for Fidas analyser at VSO East and VSO West stations was reprocessed using an improved tunnel algorithm for the entire months data.
- Data was revalidated for the period 8/8/16 1:50-1:55 when the VSO West Fidas flow sensor alarm was no longer active.
- CO, NO, NO_2, NO_X and PM_{10} data was invalidated intermittently during internal night time maintenance.