2015 Annual Environmental Management Report

National Ceramic Industries Australia

19 January 2015 to 31 July 2015

Revision 1 – 20-Oct-2015
Prepared for – National Ceramic Industries Australia – ABN: 83100467267

2015 Annual Environmental Management Report

Client: National Ceramic Industries Australia

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0	25-Sep-2015	Draft	James McIntyre Associate Director Environment - EP&M Team Leader	
1	20-Oct-2015	Final	James McIntyre Associate Director Environment - EP&M Team Leader	

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1.0 Introduction

National Ceramic Industries Australia Pty Ltd (NCIA) operates a tile manufacturing facility located in Rutherford, New South Wales. This Annual Environmental Management Report (AEMR) describes and discusses NCIA's environmental performance for the period between 19 January 2015 and 31 July 2015 (hereafter referred to as the '2015 reporting period'). This partial reporting period will bring the AEMR reporting period into alignment with the Environment Protection Licence (EPL) reporting period.

1.1 NCIA Background

1.1.1 Current Operations

NCIA manufactures ceramic wall and floor tiles for the Australian market from its facility located off Racecourse Road, Rutherford, within the Rutherford Industrial Estate. The facility has been operating since its commissioning in early 2004. Prior to the development of the facility at Rutherford NSW, the majority of Australia's domestic ceramic tile consumption was imported from China, South East Asia, Italy, Spain and Brazil.

Tiles are manufactured from raw materials including a mixture of clay, white granite, rhyolite and glazes. Clay, granite and rhyolite are naturally occurring and are supplied by quarries within Australia, whilst glazes and other consumables that are either supplied locally or imported. The manufacturing process in the existing production facilities involves mixing and preparing raw materials in specified proportions, pressing the prepared mix into the desired shape, and then drying prior to decorating and glazing. The tiles are then fired in the facilities kiln prior to sorting, packaging and dispatch. Finished tiles are stored and loaded for distribution outside of the building in the south western corner of the site. All transport to and from the site is via road, with semi-trailers and B-double trucks transporting the raw materials and finished product.

The operation currently comprises one spray drier, a clay mill, two tile production lines and two kilns, all housed within a single factory building approximately 488 m long and 80 m wide. The current operations represent the first two of eight approved operational stages for the facility. With these two operational stages active, the maximum production of the facility is approximately 6.4 million m^2 of ceramic tiles per annum.

The facility operates 24 hours per day, 7 days per week, and currently employs 52 full time staff.

1.1.2 Future Planned Operations

NCIA currently holds approval for the development of Stages Three–Eight of the facility, none of which are yet constructed or commissioned. Stages Three–Four would see the commissioning of an additional two production lines within the existing factory building, for an increased production rate of up to 12.8 million m^2 of tiles per annum. Stages Five–Eight would involve the construction and operation of a second factory building with four additional production lines on an adjacent parcel of land to the east of the existing facility. Once all eight development stages are operational, the facility's production capacity would increase to 25.6 million m^2 of tiles per annum.

The approval for the facility's expansion was sought by NCIA in response to the anticipated continuing increase in tile demand, both domestically and internationally. The timeline for construction of the remaining stages (i.e. Stages Three–Eight) is dependent upon market demand and remained uncertain at the time this AEMR has been prepared.

1.1.3 Historic and Current Production Levels

Tile production levels since commissioning and inclusive of the 2015 reporting period are presented in Figure 1. Production levels are reported (and presented here) annually in accordance with the Environmental Protection Licence (EPL) timeline, that is between 01st August and 31st July each year.

Note: NCIA's Project Approval (MP 09_0006) provides a staged approach to production limit in m^2 per annum, while NCIA's Environment Protection Licence (EPL 11956) provides for production in tonnes per annum.

Between 01st August 2014 and 31 July 2015 the facility operated 337 days, for a total output of 72,631 tonnes of ceramic tiles (or approximately 4.67 million m^2). These production levels are well below the maximum production authorised under NCIA's current approvals (refer to Section 1.2), but are commensurate to the current stage of development of the facility (i.e. stage two of eight).

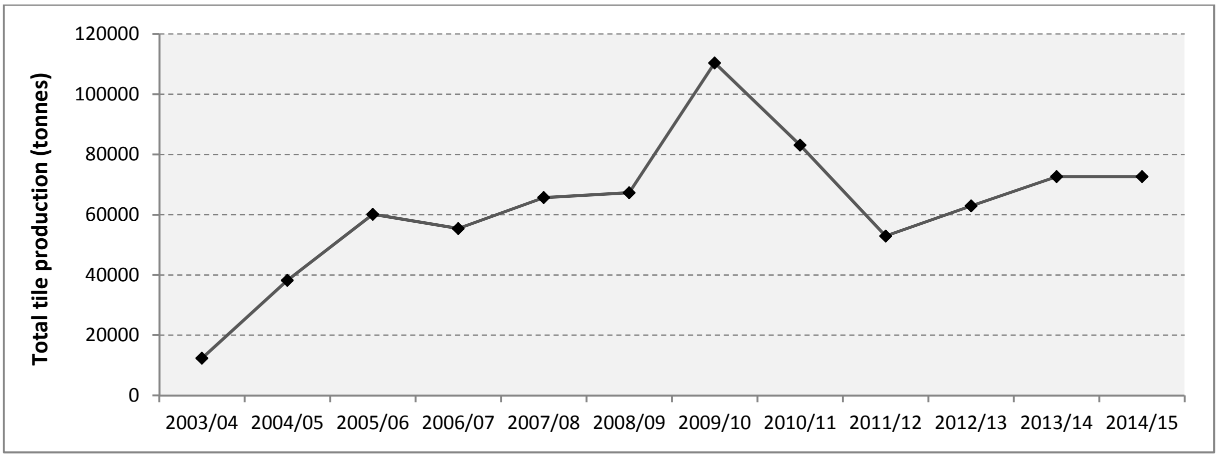

Figure 1 **NCIA Trend in Production Levels Since 2004**

1.2 Regulatory Context

1.2.1 Current Approvals

On 19 January 2012 NCIA was granted Project Approval (MP 09_0006), which rationalised and consolidated the development as approved under the previous Development Consent (DA 449-12-2002-i), and the proposed expansion of the facility. Subsequently, NCIA formally relinquished the previous Development Consent (DA 449-12-2002-i) with effect from 19 January 2013.

The NCIA facility is therefore currently operating under the conditions of Project Approval (MP 09_0006), issued by the Department of Planning and Environment (DP&E).

In addition, the facility also operates under the EPL No. 11956 issued by the NSW Environment Protection Authority (EPA), which authorises NCIA to produce greater than 50,000 - 200,000 tonnes of ceramic tiles per annum.

It is noted that many of the requirements of the current Project Approval are required prior to commencement of construction of the next stage of the approved operation (i.e. Stages Five–Eight). As commencement of construction of the next stage of the approved operation has not yet commenced, these conditions have not yet been activated.

Notably, an Operation Environmental Management Plan (OEMP) was prepared in accordance with the previous Development Consent to provide an environmental management framework for the facility. The current Project Approval does not require an OEMP, but instead requires the preparation of an Environmental Management Strategy (EMS) prior to commencement of construction works associated with development Stages Three–Eight. As this condition is not yet activated, NCIA continues to operate in accordance with the OEMP (AECOM, 2014). The OEMP was reviewed on a three yearly basis, and was last reviewed in June 2011. The OEMP has undergone a subsequent review and update through 2014 and was finalised in 2015.

1.2.2 AEMR Requirements

This AEMR has been prepared by AECOM Australia Pty Ltd (AECOM) on behalf of NCIA in accordance with Schedule 4, Condition 60 of the Project Approval. The AEMR outlines the environmental compliance and performance of the NCIA facility in relation to the conditions of the Project Approval and NCIA's Environment Protection Licence (EPL) No. 11956. The AEMR is distributed to the DP&E.

The requirements of Condition 60 of the Project Approval and the cross-reference to the AEMR section where the requirement is addressed are provided in Table 1.

Table 1 Schedule 4, Condition 60 of Project Approval (MP 09_0006)

Condition	Requirement	AEMR Section
60	Every year from the date of this approval[1], unless the Director-General agrees otherwise, the Proponent shall submit an AEMR to the Director-General and relevant agencies. The AEMR shall:	This AEMR
60 (a)	be conducted by suitably qualified team whose appointment has been endorsed by the Director-General;	Quality Information
60 (b)	be submitted within 3 months of the period being assessed by the AEMR;	AEMR to be submitted by 30 October 2015
60 (c)	identify the standards and performance measures that apply to the development;	Section 0
60 (d)	include a summary of the complaints received during the past year, and compare this to the complaints received in previous years;	Section 3.0
60 (e)	include a summary of the monitoring results for the development during the past year;	Section 0
60 (f)	include an analysis of these monitoring results against the relevant: - impact assessment criteria; - monitoring results from previous years; and - predictions in the EA;	Section 5.0
60 (g)	identify any trends in the monitoring;	Section 5.0
60 (h)	identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies;	Section 5.0
60 (i)	identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance; and	Section 6.0
60 (j)	identify continuous improvement measures, outlining new developments in air quality and noise control, and detailing practices that have been implemented on the site during the previous year, to reduce air quality and noise impacts.	Section 7.0

Note on timeline

Due to the AEMR reporting timeline as stated in the Project Approval (i.e. 19 January to 18 January each year), there has historically been some overlap in the timeline of environmental monitoring undertaken at NCIA which aligns to the EPL timeline requirements – namely from 1 August to 31 July of each year. As a result, previous years' AEMRs have in some cases been affected by:

- Gaps in monitoring data (e.g. where the monitoring data was incomplete at the time the AEMR was to be submitted); or
- Data and monitoring results presented and discussed in the AEMR actually occurring outside the AEMR reporting timeline, and in that sense being at odds with the intent of the AEMR.

With a view to address this inconsistency between the reporting timelines, NCIA sought DP&E's approval (during a meeting with Leah Cook of DP&E held on 15th July 2015) to amend the AEMR reporting timeframes with the objective to align it with that of the EPL. The request was granted by DP&E on 17 July 2015.

This AEMR has been prepared to cover the period between 19th January 2015 and 31st July 2015 only, which will allow for the overlapping period between the AEMR and EPL reporting timelines to be rectified. All subsequent AEMRs will cover the same reporting periods as the EPL, and report on NCIA's environmental performance between 01st August and 31st July each year.

[1] This condition is now superseded by DP&E's approval to amend the AEMR reporting period so that it is aligned with that of the EPL reporting timeline. The AEMR now covers the period between 01st August and 31st July

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2.0 Standards and Performance Measures

The NCIA OEMP provides the environmental management framework to guide the operation of the tile manufacturing facility. The OEMP defines the environmental management practices, procedures and personnel responsibilities to ensure compliance with conditions of statutory approvals and licences.

Specific environmental standards and performance measures used to assess the achievement of environmental objectives are drawn from requirements, obligations and initiatives listed within:

- The Project Approval (MP 09_0006), granted by the Minister for Planning;
- EPL 11956, issued by the NSW Environment Protection Authority (EPA); and
- The *National Ceramic Industries Australia Expansion - Environmental Assessment* (AECOM, 5 July 2010) hereafter referred to as '2010 EA'.

Commitments made within the 2010 EA have been incorporated into the Project Approval and EPL for the facility as compliance criteria. These compliance criteria are used to assess the environmental performance of the facility and to monitor the environmental impact on the surrounding environment. Compliance criteria and the monitoring results for the 2015 reporting period are presented in Section 0 of this AEMR.

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3.0 Complaints

Condition 60(d) of the Project Approval requires that the AEMR include a summary of complaints received during the 2015 reporting period compared to complaints received in previous years.

The history of complaints received by NCIA is summarised in Table 2. For the second consecutive reporting period, no complaints were received during the 2015 reporting period. Overall, the history of complaints shows that very few community complaints are received in relation to NCIA operations.

Table 2 Historical Complaints Received by NCIA

Year	Number of Complaints	Issue	Details
2015 (partial)	Nil	Nil	None Required.
2014	Nil	Nil	None required.
2013	1	Air Quality	Complaint made via email on 24 July 2013 regarding air quality in Rutherford area.
2012-13	Nil	Nil	None Required.
2011-12	Nil	Nil	None Required.
2010-11	Nil	Nil	None Required.
2009-10	1	Air Quality	Complaint made from neighbouring Heritage Green Residential Estate regarding non-compliances identified in the Environment Audit.
2008-09	Nil	Nil	None Required.
2007-08	1	Air Quality	Anonymous complaint to EPA regarding visible black smoke. Report submitted to EPA on 25 March 2008. Visible black smoke unlikely to have originated from NCIA. No further action required.
2006-07	1	Odour	Anonymous complaint to EPA regarding odour. Discussed with EPA. Odour unlikely to have originated from NCIA. No further action required.
2005-06	2	Air Quality / Odour	Complaint made regarding visible plume. Complainant contacted and issue discussed. No further action required. Anonymous complaint to EPA regarding odour. Discussed with EPA. Odour unlikely to have originated from NCIA. No further action required.
2004-05	1	Air Quality	Complaint made regarding visible plume. Complainant contacted and issue discussed. No further action required.

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4.0 Environmental Monitoring Results

The following parameters are monitored for the facility in accordance with the conditions of the Project Approval and / or the EPL and / or for internal due diligence requirements:

- Ambient air monitoring (northwest and southeast of the facility):
  - Fine Particulates (PM_{10}); and
  - Fluoride (particulate, gaseous and total).
- Fluoride Impact on Vegetation:
  - Quarterly visual assessment of vegetation; and
  - Quarterly fluoride content in vegetation.
- Meteorological monitoring:
  - Wind speed at 10 metres;
  - Wind direction at 10 metres;
  - Temperature at 5 metres; and
  - Rainfall.
- Stack emission testing (all stacks):
  - Total particulates (TSP); and
  - Fine particulates (PM_{10}).
- Additionally, for the kiln stack:
  - Mercury (Hg);
  - Cadmium (Cd);
  - Nitrogen Oxides (NOx);
  - Hazardous substances (metals);
  - Hydrogen Fluoride (HF);
  - Sulfuric acid mist (H_2SO_4); and
  - Sulfur trioxide (SO_3).
- Noise monitoring:
  - L_{Aeq}(15 minute); and
  - L_{A1}(1 minute).

In addition to the above-listed parameters, NCIA also keeps internal records of water usage and waste production associated with the facility’s operation. Water quality monitoring is also undertaken of the stormwater contained in the water retention basins.

A summary of the monitoring results for these parameters during the 2015 reporting period is provided below.

4.1 Ambient Air Monitoring Results

The ambient air quality monitoring program commenced on 12 March 2004 to record background data prior to commencement of Stage 1 operations. The program was designed and implemented in accordance with the requirements of NCIA's EPL. The monitoring program also satisfies the requirements of the current Project Approval.

In accordance with EPL condition M2.1, PM_{10} (24-hour) and Fluoride (24-hour and weekly) are monitored at two locations: northwest and southeast of the facility (refer Figure 2).

For PM_{10} monitoring, two sampling locations have been established to determine concentrations at the NCIA property boundary, along the dominant southeast-northwest wind axis. The monitors are sited in accordance with *AS/NZS 3580.1.1:2007 Guide to siting air monitoring equipment*. Sampling and analyses of PM_{10} are undertaken as per *AS/NZS 3580.9.6:2003 Determination of suspended particulate matter*. Discrete 24-hour samples are collected every 6 days according to the NSW EPA schedule.

Two fluoride monitoring units (manual, double filter paper samplers) have been sited at each of the two locations identified for monitoring of PM_{10}, and are operated in accordance with *AS3580.13.2:2013 Determination of gaseous and acid-soluble particulate fluorides*. At each location, one monitor operates continuously over a 7-day period to provide weekly fluoride concentration averages. These units are designated 'Northwest HF_7' and 'Southeast HF_7'. The remaining unit at each site operates continuously for discrete 24-hour periods according to the NSW EPA 6-day cycle to provide 24-hour averages for sampler operation days. Units are designated 'Northwest HF' and 'Southeast HF'.

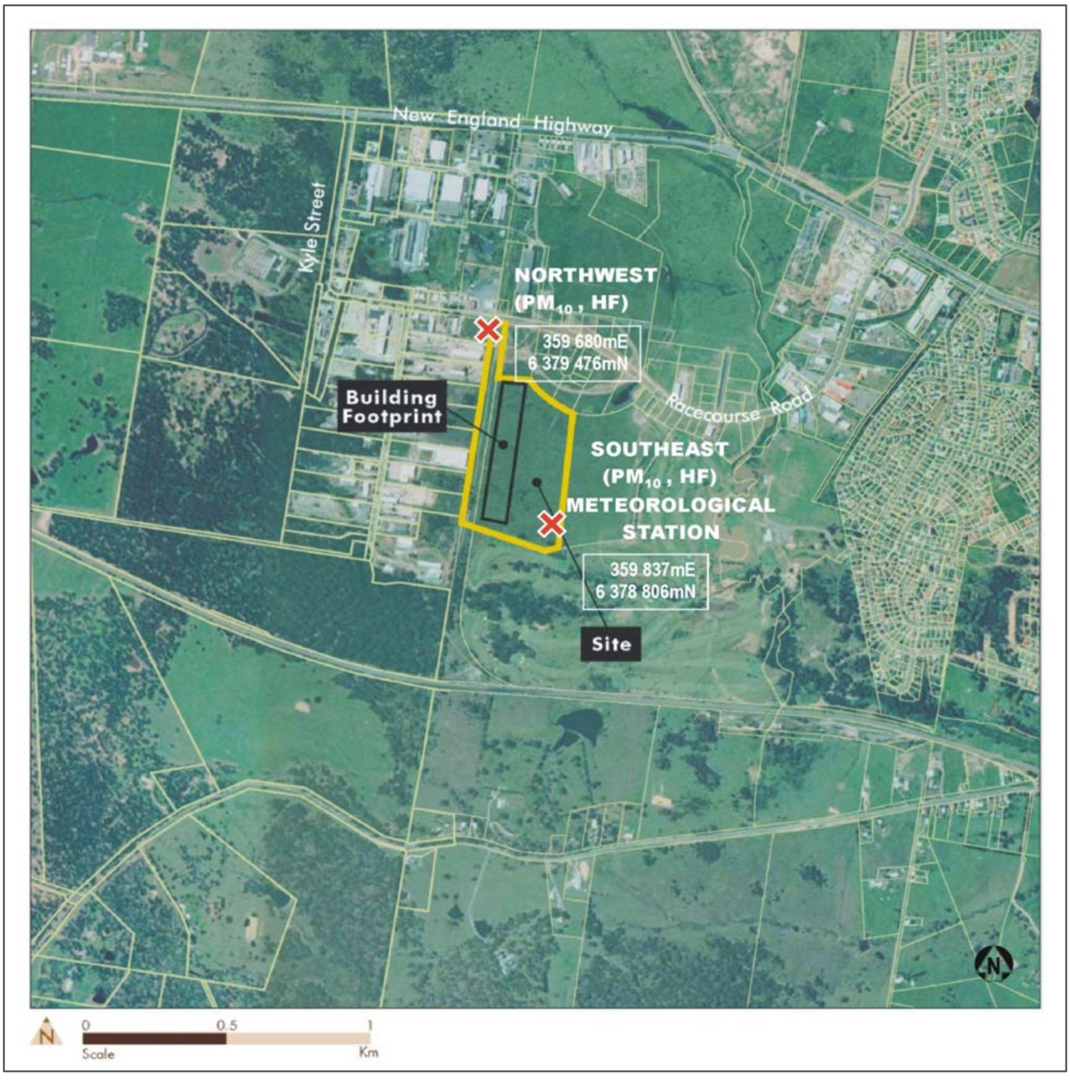

Figure 2 **Ambient Air Monitoring Site Locations**

4.1.1 PM_{10} – Monitoring Results

The EPL does not specify ambient air concentration limits, however Condition 15 of the Project Approval sets out criteria for PM_{10}. The criteria are the same as those set out in the EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (NSW DECC, 2005).

A summary of PM_{10} monitoring results from both monitoring locations for the 2015 reporting period is provided in Table 3, alongside the relevant criteria. The PM_{10} results for the NW and SE locations are also graphed in Figure 3 and Figure 4 respectively.

Table 3 Summary of Ambient Air Monitoring: PM_{10} Results

Parameter	Criteria	NW Location	SE Location
Annual Average Concentration (µg/m^3)	30.0	18.7	16.3
Standard Deviation (µg/m^3)	-	8.4	6.5
24-hour Minimum Concentration (µg/m^3)	-	6.8	6.1
24-hour Maximum Concentration (µg/m^3)	50.0	40.9	30.2

The results in Table 3 show that for both the NW and SE monitoring locations the PM_{10} concentrations were below the 24-hour and annual average guideline criteria for the entire 2015 reporting period.

Comparison to historical monitoring results and analysis of trends is discussed further in Section 5.1.

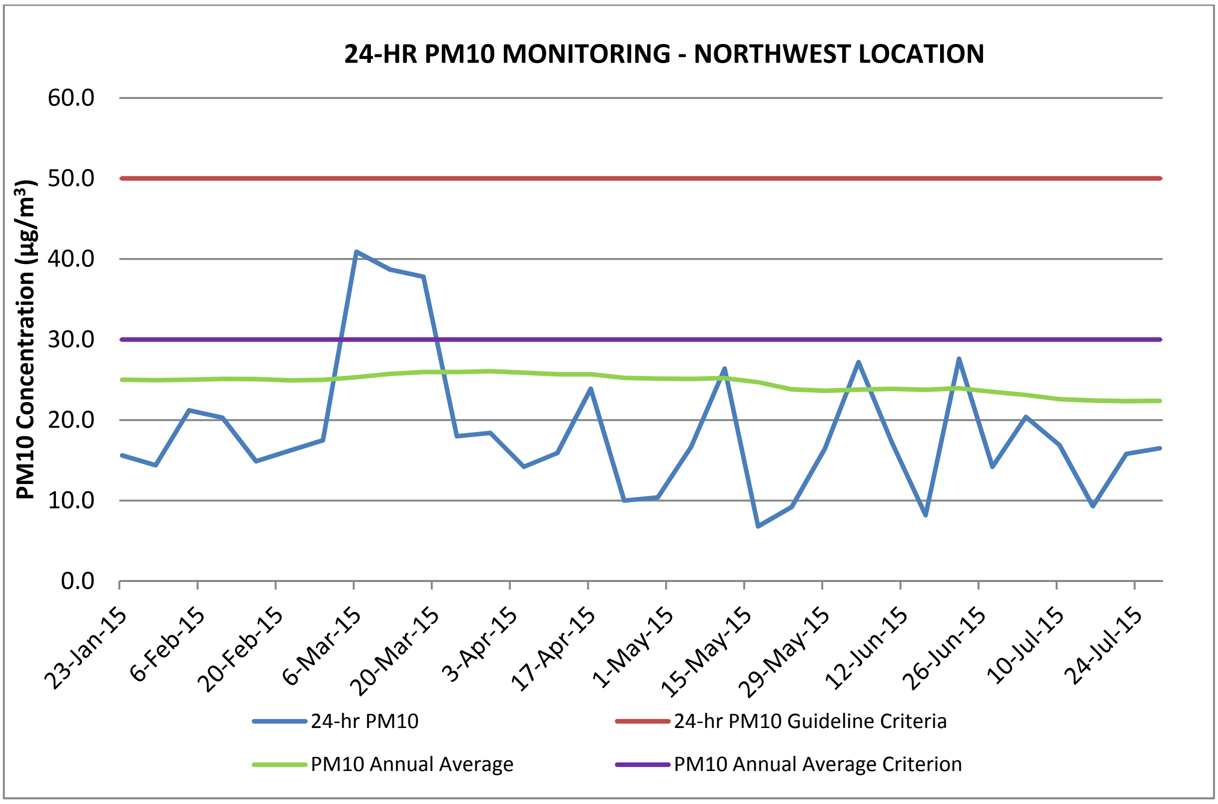

Figure 3 **PM_{10} Monitoring – northwest location**

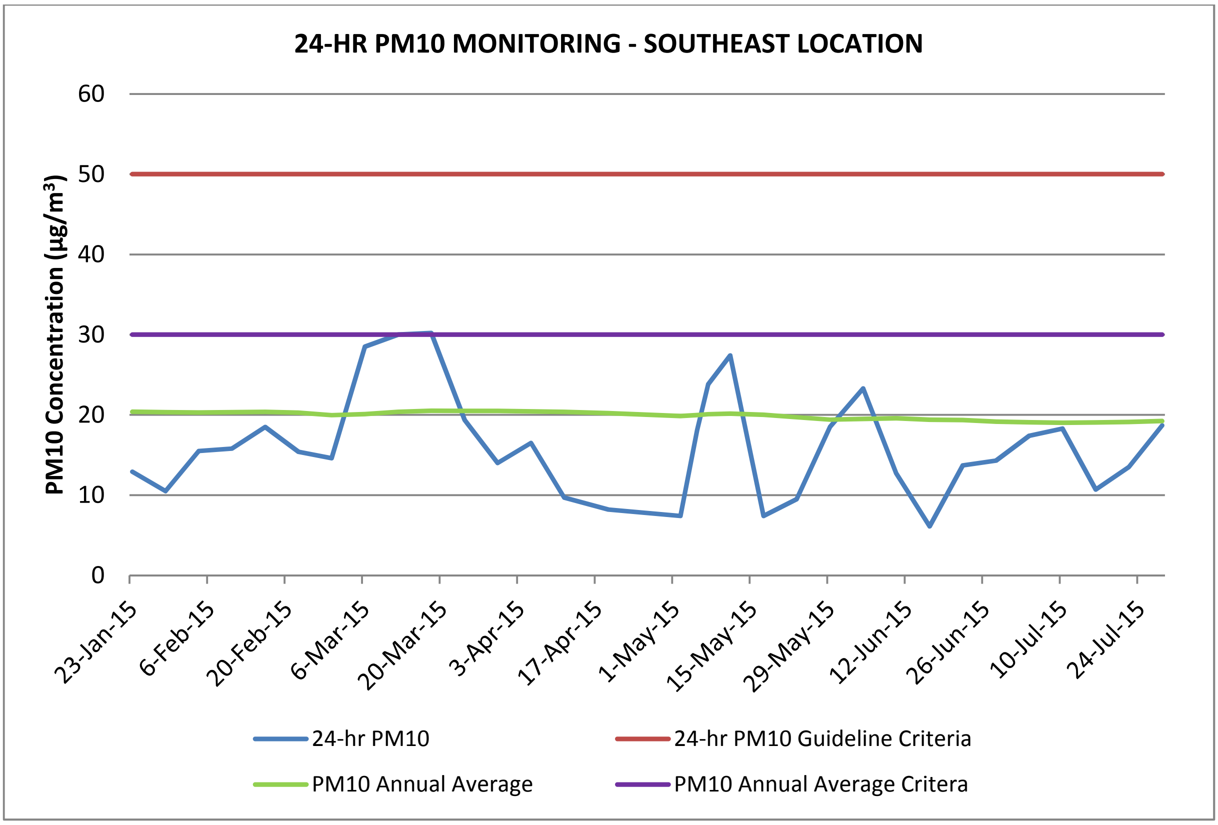

Figure 4 **PM_{10} Monitoring – southeast location**

4.1.2 Fluoride – 24 Hour Monitoring Results

There are no ambient air fluoride concentration limits specified in the EPL or Project Approval. To provide context for the ambient air monitoring results, guideline levels have been taken from the EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (NSW DECC, 2005).

A summary of 24-hour fluoride monitoring results from both monitoring locations for the current reporting period is provided in Table 4. The 24-hour fluoride monitoring results for the NW and SE locations are also graphed in Figure 5 and Figure 6 respectively.

Table 4 Summary of Ambient Air Monitoring: 24-hour Fluoride Results

Parameter	Guideline Criteria	NW Location	SE Location
Annual Average Concentration (µg/m^3)	-	0.29	0.34
Standard Deviation (µg/m^3)	-	0.17	0.30
24-hour Minimum Concentration (µg/m^3)	-	0.05	0.05
24-hour Maximum Concentration (µg/m^3)	2.9	0.55	1.45

The results in Table 4 indicate that for both the NW and SE monitoring locations the 24-hour total fluoride emissions satisfied the DECC (2005) guideline criterion for the entire 2015 reporting period.

Comparison to historical monitoring results and analysis of trends is discussed further in Section 5.1.

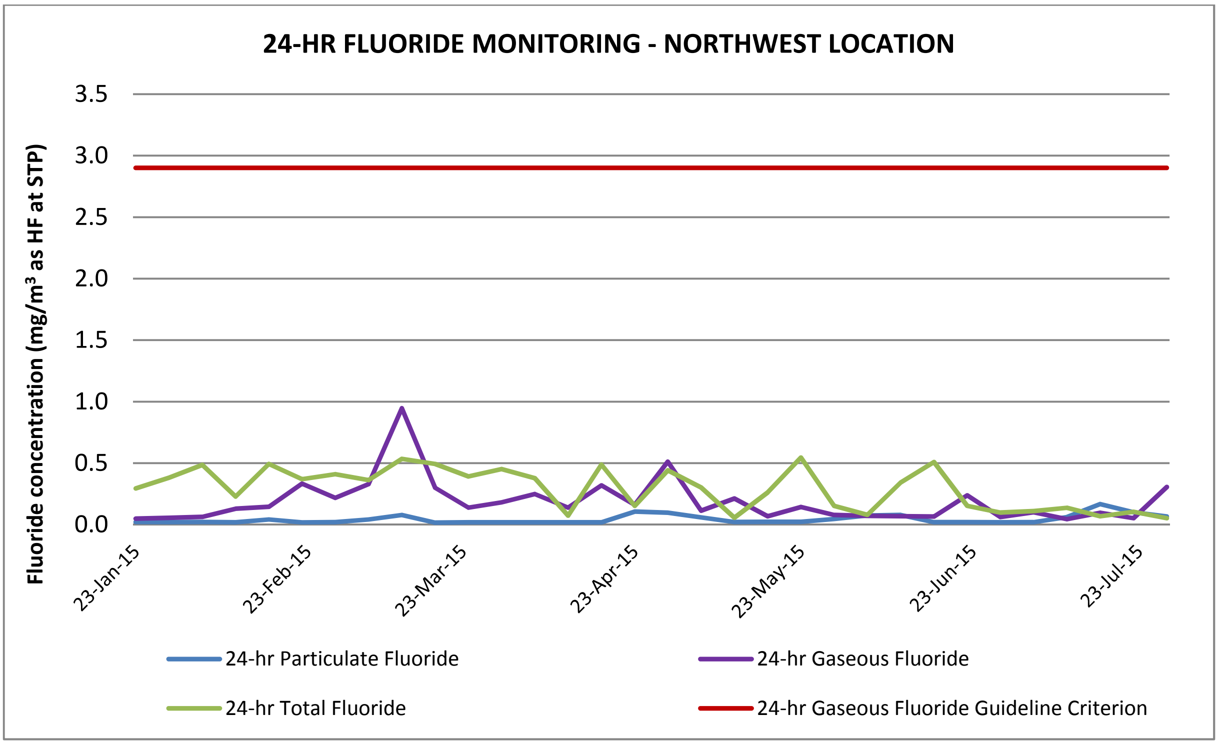

Figure 5 **24-hour Fluoride Monitoring – northwest location**

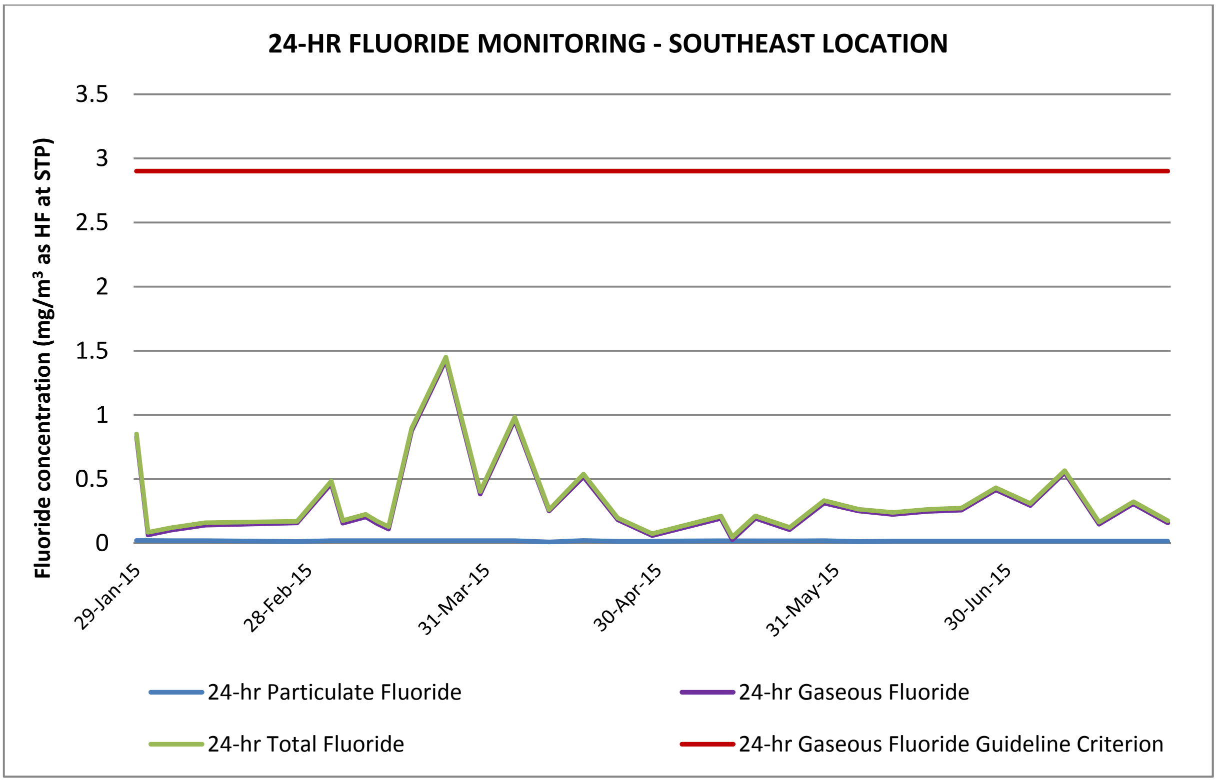

Figure 6 **24-hour Fluoride Monitoring – southeast location**

4.1.3 Fluoride – Weekly Monitoring Results

There are no ambient air fluoride concentration limits specified in the EPL or Project Approval. To provide context for the ambient air monitoring results, guideline levels have been taken from the EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (NSW DECC, 2005).

A summary of weekly fluoride monitoring results from both monitoring locations for the current reporting period is provided in Table 5. The weekly Fluoride monitoring results for the NW and SE locations are also graphed in Figure 7 and Figure 8 respectively.

Table 5 Summary of Ambient Air Monitoring: Weekly Fluoride Results

Parameter	Guideline Criteria	NW Location	SE Location
Annual Average Concentration (µg/m^3)	-	0.31	0.12
Standard Deviation (µg/m^3)	-	0.29	0.07
Weekly Minimum Concentration (µg/m^3)	-	0.01	0.02
Weekly Maximum Concentration (µg/m^3)	1.7	1.15	0.32

The results in Table 5 indicate that for both the NW and SE monitoring locations the 7-day Fluoride levels satisfied the DECC (2005) guideline criterion for the entire 2015 reporting period.

Comparison to historical monitoring results and analysis of trends is discussed further in Section 5.1.

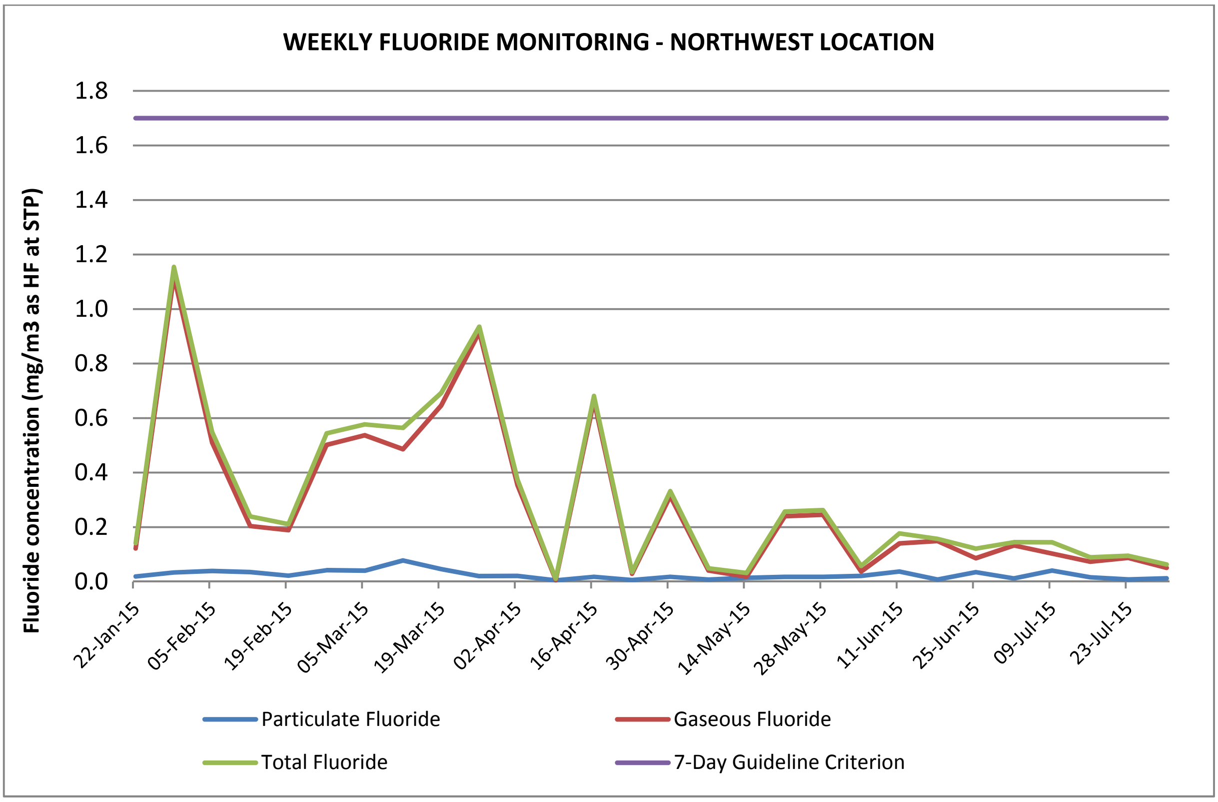

Figure 7 **Weekly Fluoride Monitoring – northwest location**

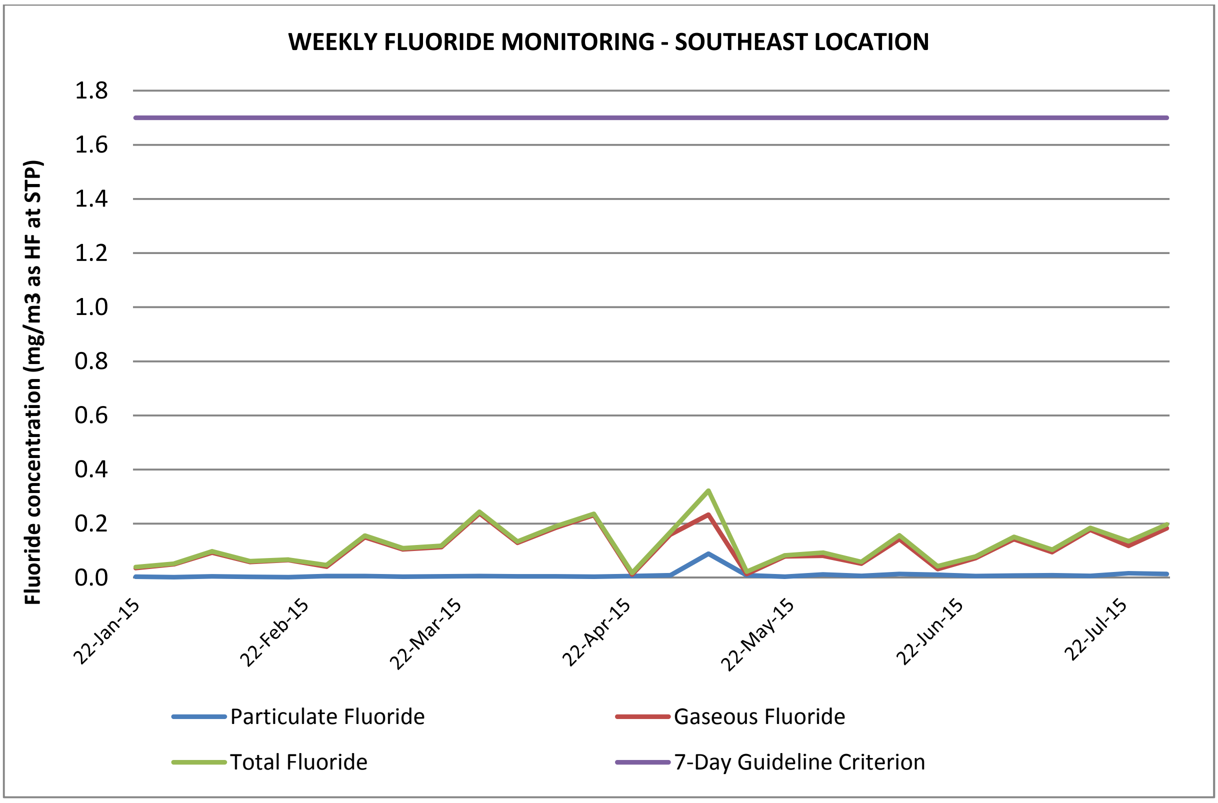

Figure 8 **Weekly Fluoride Monitoring – southeast location**

4.2 Fluoride Impact on Vegetation

Monitoring of the impact of atmospheric fluoride on vegetation in the area surrounding the NCIA plant commenced in 2004. The monitoring programme was designed by AECOM based on the assessment methods developed by Dr David Doley of the University of Queensland.

In accordance with condition M4.1 of the EPL, the impact of fluoride on vegetation was monitored by undertaking visual assessments of the condition of local vegetation surrounding the NCIA plant, and by foliar sampling of selected flora species for laboratory analysis of fluoride content. Samples chosen for fluoride content analysis were selected on the basis of known species sensitivity toward fluoride, representation of certain species and vegetation type (over storey, cultivated vegetation and forage crops). Generally, the species assessed in the monitoring programme were selected based on their known sensitivity to atmospheric fluoride impacts.

AECOM conducted two quarterly vegetation assessments during the reporting period – Q1 2015 (AECOM, 2015a) and Q2 2015 (AECOM, 2015b). The results of the Q1 and Q2 surveys are summarised below.

The sites monitored for vegetation condition assessments during the reporting period are shown in Figure 9 and listed in Table 6, with a photograph of each site provided in Appendix A1. The monitoring locations included eight 'impact' sites and one 'reference' site. All impact sites were selected to be generally within the areas of highest predicted ambient fluoride concentration – i.e. within the prevailing wind directions for the region (northwest-southeast axis), whilst the reference site location was selected to be outside the prevailing winds.

Table 6 Vegetation Monitoring Sites

Area	Site #	Site Location	Species Assessed	Location from the kiln stack
Rutherford and Farley residential areas	1	Southeast corner of NCIA site	*Eucalyptus moluccana*	290m SE
	2	3 Gillette Close	*Eucalyptus acmenoides*	1350m SE
			Corymbia maculata	1325m SE
	3	Hill top on Wollombi Road west of Owl Pen Lane, Farley	*Corymbia maculata*	1420m SSE
			Eucalyptus paniculata	1385m SSE
	4	Western end of Quarry Road, Farley	*Corymbia maculata*	2280m S
			Eucalyptus paniculata	2280m S
Rutherford industrial estate	5	NCIA entrance, Racecourse Road	*Corymbia maculata*	495m N
			Eucalyptus amplifolia	495m N
	6	99 Kyle Street	*Angophora floribunda*	600m NW
			Eucalyptus amplifolia	600m NW
	7	11 Gardiner Road	*Corymbia maculata*	475m NW
			Eucalyptus paniculata	475m NW
	8	Maitland Saleyards entrance, Kyle Street	*Corymbia maculata*	920m NW
			Eucalyptus moluccana	975m NW
			Eucalyptus amplifolia	975m NW
			Eucalyptus resinifera	970m NW
Anambah homestead	9	200 Anambah Road – Reference site	Various	3,000m N

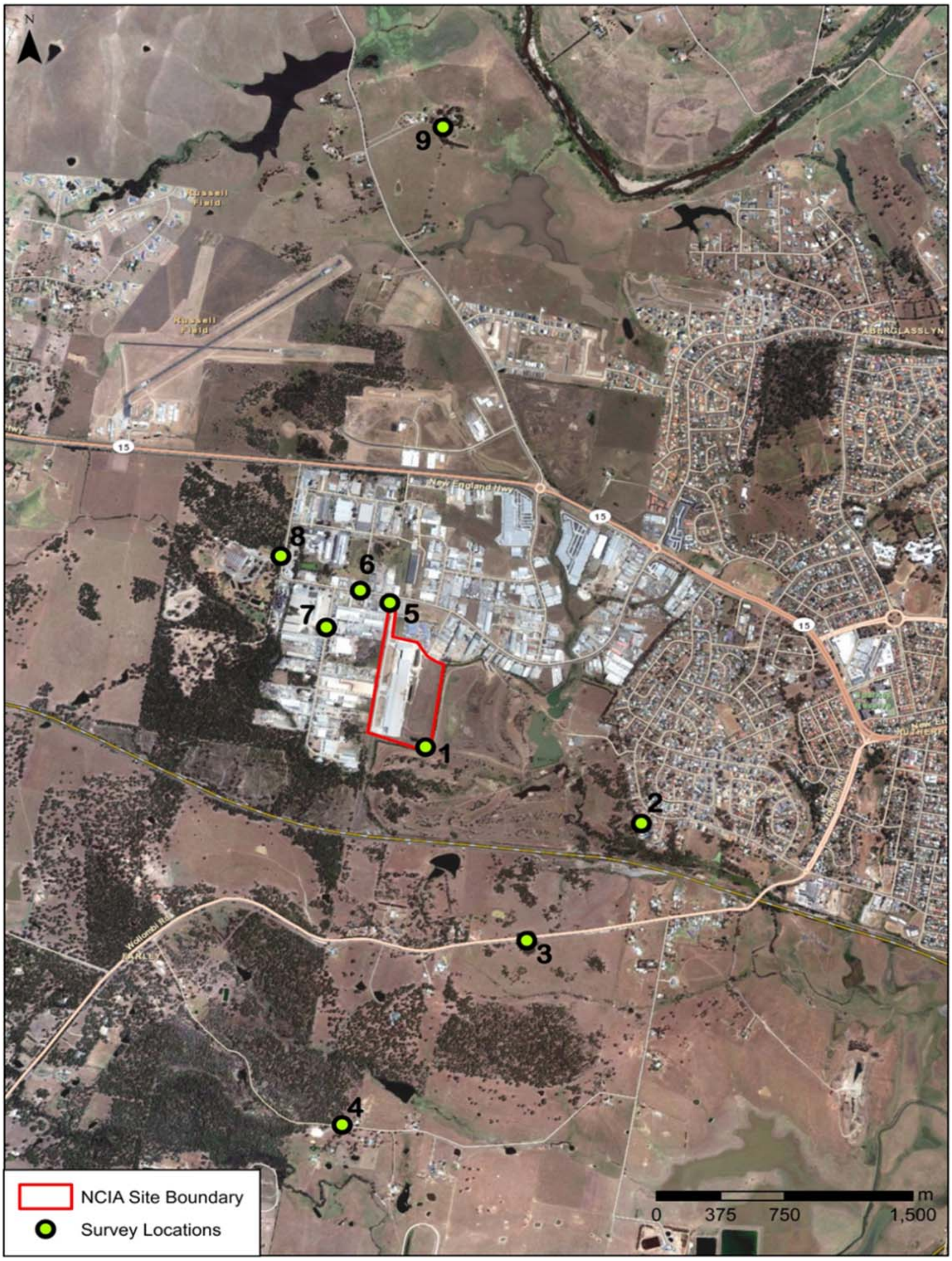

Figure 9 Vegetation Survey Monitoring Locations

4.2.1 Visual Condition Assessment – Impact Sites

Table 7 describes the scoring criteria and injury categories used to define the classification of visible injury symptoms to leaves of the monitored flora species.

Table 7 Symptom Code for Visible Injury to Vegetation with Particular Reference to Fluoride

Injury Symptom	Chlorosis / Marginal necrosis	Tip necrosis	Cupping / Branch dieback / Canopy thinning	Insect attack injury (leaf chewing / sap sucking)
Category	**% of leaf width / area**	**% of leaf length**	**Entire leaf or tree**	**% of leaf area**
0	nil	nil	nil	nil
1	very slight <2%	very slight <2%	very slight	very slight <2%
2	slight <5%	slight <5%	slight	slight <5%
3	distinct <10%	distinct <10%	distinct	distinct <10%
4	marked <25%	marked <25%	marked	marked <25%
5	severe <50%	severe <50%	severe	severe <50%
6	very severe <75%	very severe <75%	very severe	very severe <75%
7	extreme >75%	extreme >75%	extreme	extreme >75%

The complete tabulated results of the visible injury assessments performed during the Q1 2015 and Q2 2015 surveys are provided in Appendix A2, with photographs of the foliage assessed included in Appendix A3. The results have been summarised below and supported graphically in Figure 10 to Figure 13.

The visual assessments found that for the combined Q1 and Q2 surveys and inclusive of all flora species assessed at all sampling locations, the foliage of over 75% of species displayed some level of emission related injury symptoms (i.e. chlorosis, cupping, necrosis, anthocyanin accumulation).

Figure 10 shows that of all the symptoms observed during the surveys, tip necrosis was the most common (37% of all observations), followed by leaf undulation / cupping (33%) and chlorosis (26%), whilst marginal necrosis symptoms were generally uncommon (4% of all observations, respectively). Although no graphed, insect attack injury symptoms were present in the foliage of all flora species assessed.

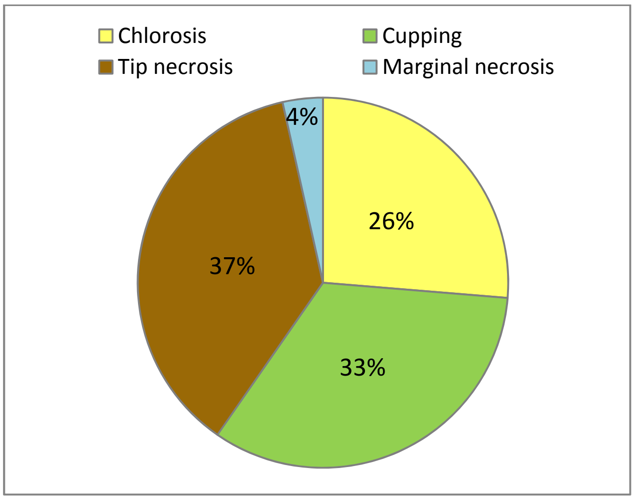

Figure 10 Relative prevalence of fluoride related symptoms

The severity of the emission related symptoms overall ranged from very slight to marked (refer to Table 7). Of all flora species affected, ~41% (in Q1 2015) and ~53% (in Q2 2015) only showed slight or very slight injury symptoms at worst (i.e. less than 5% of leaf area impacted), whilst approximately a third presented distinct and/or marked fluoride injury symptoms in both Q1 and Q2 (see Figure 11 and Figure 12). No species displayed severe (or worse) impacts. Particular species presenting the most severe symptoms included five *Corymbia maculata* trees (at Site 2, Site 4, Site 5, Site 7 and Site 8), an *Angophora floribunda* tree (Site 6) and a *Eucalyptus paniculata* tree (Site 7).

The severity of visual injury symptoms to foliage was greater in those species located to the northwest of the NCIA facility than in those located to the southeast. At monitoring sites located to the northwest, 40% of the total flora species assessed displayed distinct or higher injury symptoms (both in Q1 and Q2), against 28% (in Q1) and 14% (in Q2) of species assessed in locations to the southeast (refer to Figure 11 and Figure 12).

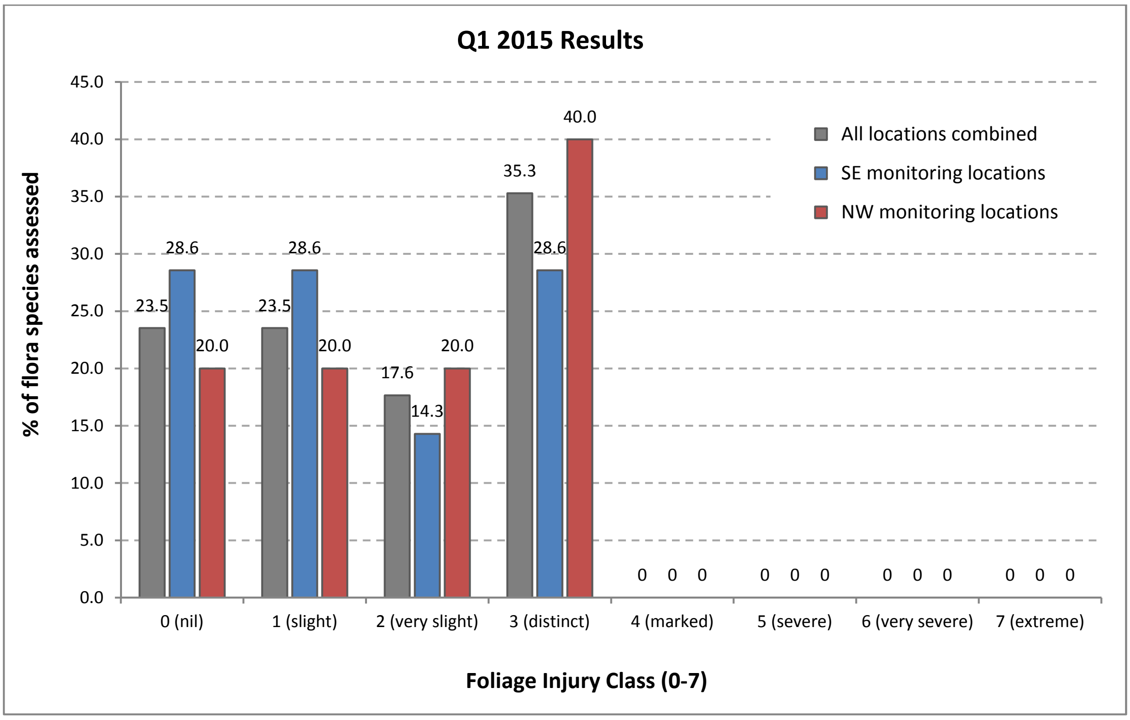

Figure 11 Proportion of Flora Species Affected by Emission Related Visual Injury Symptoms during the Q1 2015 Survey

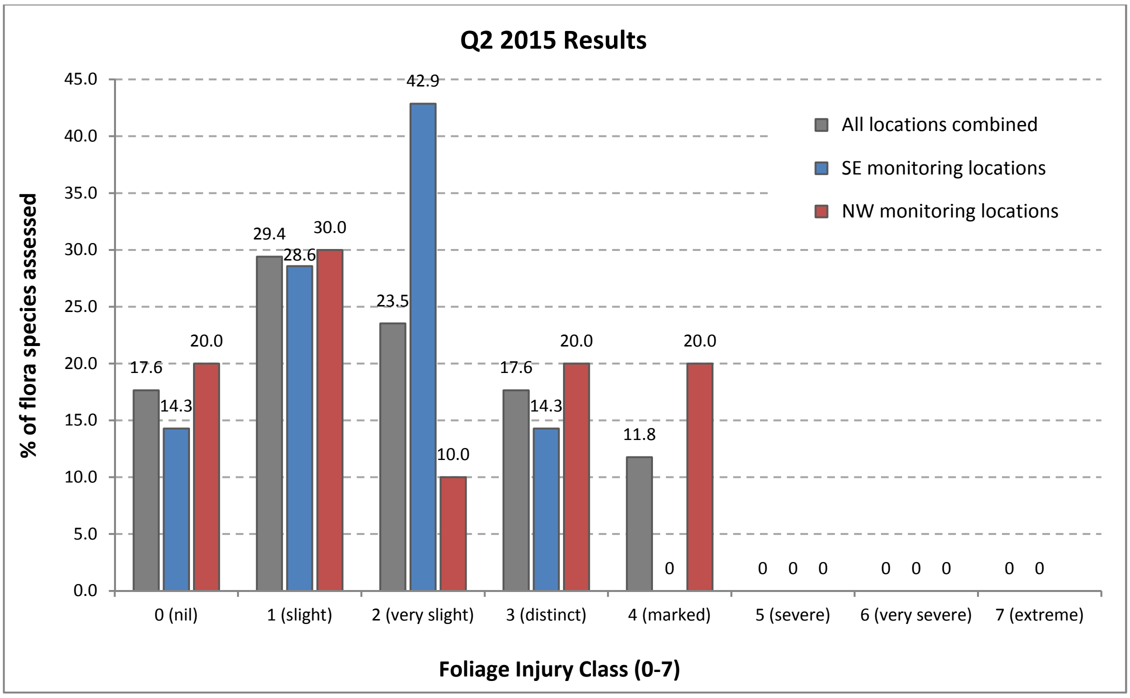

Figure 12 Proportion of Flora Species Affected by Emission Related Visual Injury Symptoms during the Q2 2015 Survey

Figure 13 depicts the relationship between the maximum emission related visual injury score observed in all species assessed (during combined Q1 and Q2 surveys) and their distance from the kiln stacks at NCIA. The results showed some level of relationship between foliage injury and the distance to the emission source, albeit at a low level of confidence (r^2 = 0.11). Category 4 injury symptoms were observed up to 920m away from the NCIA facility at Site 8, while category 3 symptoms occurred as far as Site 4 (2,280m from the NCIA facility).

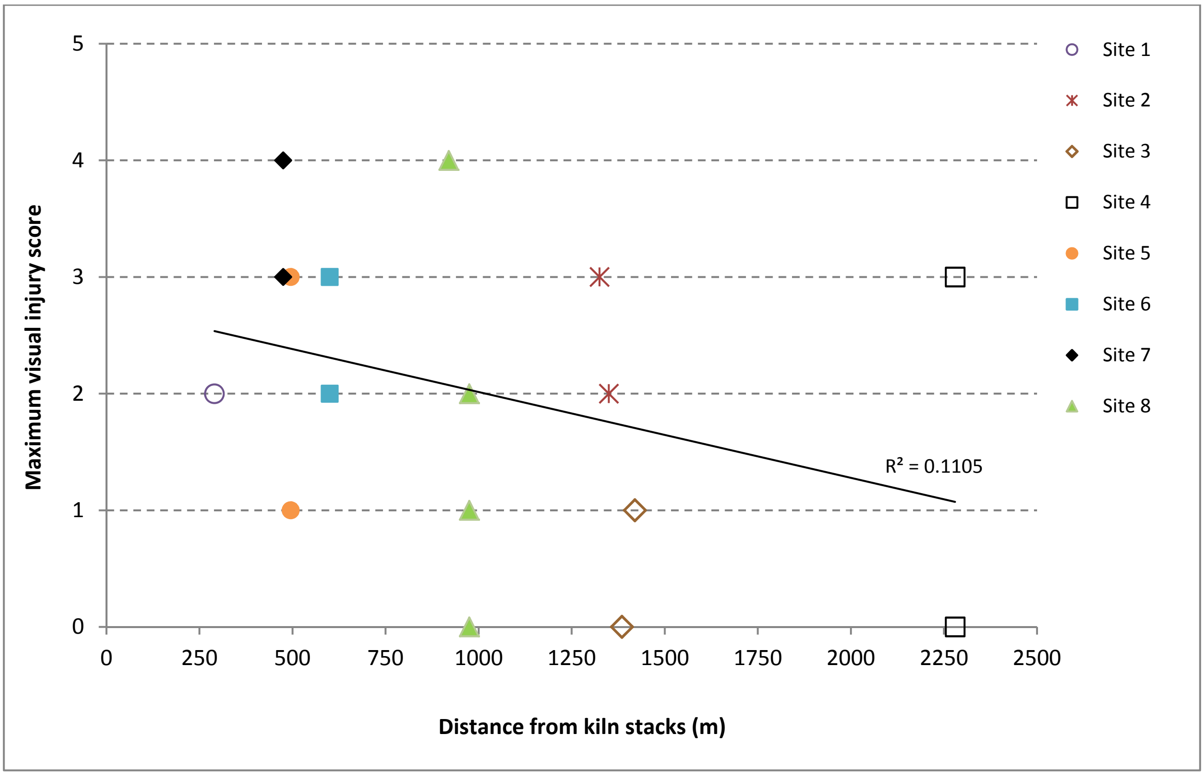

Figure 13 **Relationship Between Distance from Kiln Stacks and Maximum Visual Injury Score in Foliage of All Species Assessed (inclusive of Q1 and Q2 2015 surveys)**

4.2.2 Visual Condition Assessment – Reference Site

A broad diversity of species was assessed at this site. Generally the surveyed vegetation was in good and healthy condition, with species not showing signs of chlorosis, marginal necrosis or anthocyanin accumulation. Some foliage injury symptoms were recorded including leaf cupping and tip necrosis, however those were only detected in a minority of the species surveyed, and in all cases symptoms were only very slight (Class 1 injury) to slight (Class 2 injury).

Insect attack injury symptoms were present in several species, with their severity ranging from very slight to distinct (Class 3 Injury).

4.2.3 Fluoride Content Assessment

Foliage samples for fluoride content assessment were collected from various established locations during each of the Q1 and Q2 2015 surveys. Where possible, both current and previous season leaves were collected for analysis and mixed to create a bulk sample for the site. Native grasses at Wollombi Road (Site 5) were sampled in proportion to their representation or percentage ground cover at the sampling site and were collected at a height judged to be that at which cattle would graze (thereby avoiding the inclusion of soil).

Samples were sent to a NATA accredited laboratory for analysis, and the results are provided in Table 8. Foliar fluoride content results of most species sampled overall showed consistency between the two quarterly surveys, the exception being the vine leaves at the analogue site (Site 9) where fluoride concentrations nearly doubled between Q1 and Q2 2015. The results show that individual species and plants generally show varying degrees of resistance and/or sensitivity to fluoride impacts.

A comparison of these results to previous years and further discussion are provided in Section 5.2 of this AEMR.

Table 8 Sites and Species within the Survey Area Selected for Foliage Fluoride Content Assessment

Site	Location	Species	Foliage Season Sampled	Fluoride Content (µg/g, dry)	
				Q1	Q2
1	NCIA – SE corner of site	*Eucalyptus moluccana*	Mixed	39.3	34.1
3	Hill-top – Wollombi Rd	Native grasses	Current	<10.0	10.9
5	NCIA site entrance	*Corymbia maculata*	Mixed	146.0	163.0
5	NCIA site entrance	*Eucalyptus amplifolia*	Mixed	15.8	17.6
7	11 Gardiner Rd	*Corymbia maculata*	Mixed	58.9	51.0
9	200 Anambah Rd	*Vitis vinifera*	Current	10.4	20.1

4.3 Meteorological Monitoring

Meteorological data is recorded at the meteorological station established at the southeast air monitoring site. The station is sited and operated in accordance with approved methodologies (NSW EPA, 2001) for the continuous measurement of wind speed (10 m), wind direction (10 m), sigma theta (10 m) and temperature (5 m). A tipping bucket rain gauge is also located at the site to provide daily average rainfall rates.

The dominant function of meteorological monitoring at NCIA is to gain an understanding of the influence that NCIA operations and background pollutant sources have on the results of the ambient air quality monitoring program.

The monthly data for temperature and rainfall are provided in Figure 14. Monthly wind roses presenting the wind speed and direction for the reporting period are provided in Appendix B. A summary of the dominant wind patterns throughout the 2015 reporting period is provided below.

Review of the monthly wind roses for the reporting period indicated the following:

- In January and February 2015 prevailing winds were largely from the south-southeast;
- In March 2014 prevailing winds were generally from the south-southeast, however winds also commonly came from the west and west-northwest; and
- Between April and July 2014 winds were nearly exclusively coming from the west-northwest and north-west.

Wind speeds recorded over the year from the NCIA on-site weather station were generally low to medium with an average wind speed of 2.0 m/s during the reporting period. The maximum hourly average wind gust during the reporting period was recorded at 10.0 m/s on 10 May 2015.

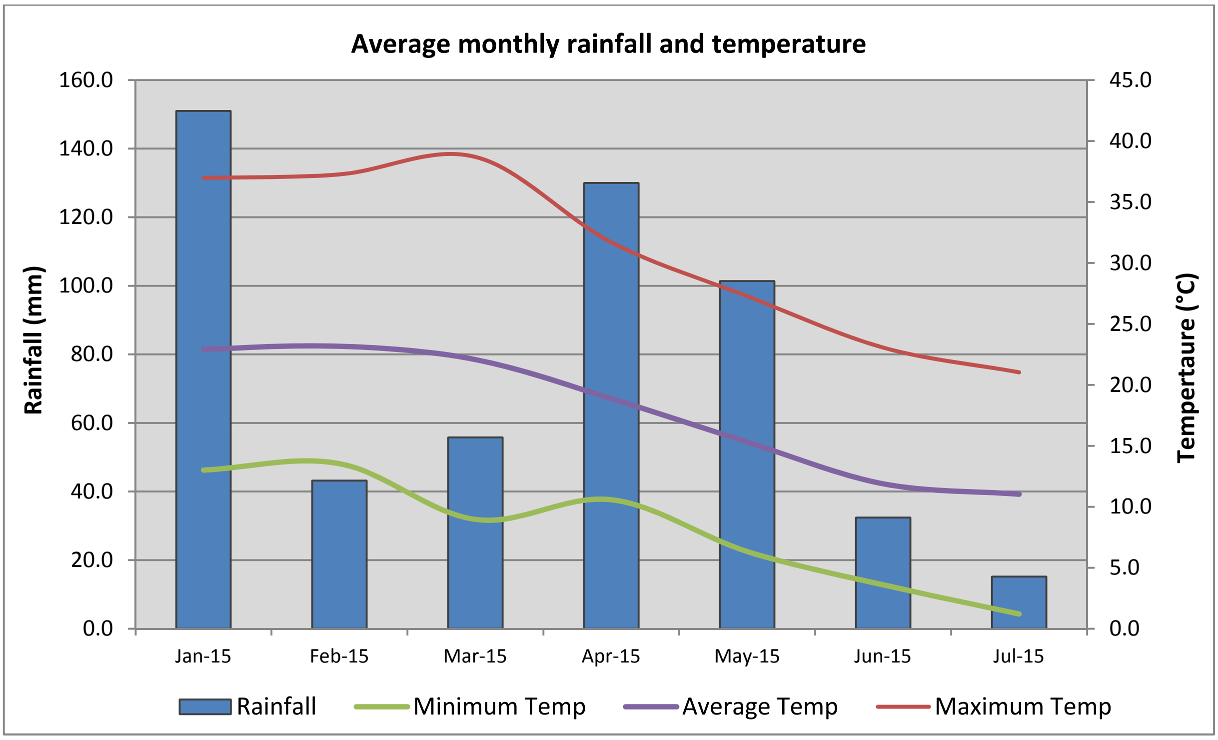

Figure 14 **Average Monthly Rainfall and Temperature Range (19 January 2015 – 31 July 2015)**

4.4 Stack Emissions Testing

Stack emissions testing is undertaken annually in accordance with the EPL reporting period. As explained in Section 1.2, this 2015 partial AEMR has been prepared with a view to align the AEMR and EPL reporting periods (thereby removing the timeframe overlaps and data gaps that affected previous years' AEMRs). As such, the stack emissions data presented in this AEMR are those corresponding to the 01 August 2014 to 31 July 2015 EPL reporting period. The data are from testing performed during September 2014, March 2015 and June 2015.

Emission sources assessed during the testing period were those defined in the EPL and listed in Table 9.

Table 9 **Emission Source Descriptions**

OEH Identification Number (EPL)	Emission Source Description
1	Clay Preparation (CP1)
2	Pressing and Drying (PD1)
5	Dryer (D1)
6	Dryer (D2)
9	Glaze Line
10	Selection Line (SL 1,2,3,4)
12	Spray Dryer (SD1)
14	Kiln 1 (KP1)
15	Kiln 2 (KP2)
18	Hot Air Cooler 1 (HAC1)
19	Hot Air Cooler 2 (HAC2)

Each source was tested for Total Particulate Matter and Fine Particulate (PM_{10}). Additional testing conducted on the Kiln 1 and Kiln 2 stacks measured concentrations of total fluoride (as HF), sulfuric acid mist (H_2SO_4 as SO_3), sulfur dioxide (SO_2 as SO_3), total hazardous substances (metals), oxides of nitrogen (NO, NO_2, NO_x), cadmium and mercury. All sampling was conducted in accordance with the applicable OEH test methods, with analyses conducted by a NATA-accredited laboratory.

The Project Approval does not specify pollutant concentration limits for the facility, however these are specified in Condition L3 of the EPL for the Site. Summaries of the emission testing results, along with the EPL pollutant discharge limits, are provided in Table 10 and Table 11.

All emission concentrations are converted to standard conditions of 0°C, dry gas and 1 atmosphere pressure for comparison with appropriate regulatory limits. The NOx, Total Particulate and Fine Particulate (PM_{10}) emission concentrations from the Kiln stack exhausts have been corrected to 18% O_2.

Concentrations of all pollutants were below the limits specified for each source in the EPL.

Table 10 Summary of Particulate Emission Monitoring Results (September 2014 and March 2015)

Source	Fine Particulate (PM_{10}) (mg/m^3)	Total Particulate (mg/m^3)	Regulatory Limit (mg/m^3) *
Clay Preparation (CP1) (EPL 1)	0.76	4.3	20.0
Pressing and Drying (PD1) (EPL 2)	4.7	6.9	20.0
Dryer (D1) (EPL 5)	2.3	3.3	20.0
Dryer (D2) (EPL 6)	4.2	7.5	20.0
Glaze Line (EPL 9)	<0.21	0.41	20.0
Selection Line (SL 1,2,3,4) (EPL 10)	<0.3	<0.3	20.0
Spray Dryer (SD1) (EPL 12)	0.55	3.4	20.0
Hot Air Cooler 1 (HAC1) (EPL 18)	0.30	0.75	5.0
Hot Air Cooler 2 (HAC2) (EPL 19)	0.19	0.21	5.0

** Note – Regulatory limit only applies to Total Particulate.*

Table 11 Summary of Emission Monitoring Results – Kiln 1 and Kiln 2 (September 2014, March 2015 and June 2015)

Pollutant	Kiln 1 (EPL 14)	Kiln 2 (EPL 15)	Regulatory Limit (mg/m^3)
Fine Particulate (at 18% O_2) (PM_{10}) (mg/m^3)	3.1	11	N/A
Total Particulate (at 18% O_2) (mg/m^3)	2.9	14	20.0
Total Fluoride (as HF) (mg/m^3)	4.8	3.1	5.0
Sulfuric Acid Mist (H_2SO_4 as SO_3) (mg/m^3)	52	25	100.0
Sulfur Dioxide (SO_2 as SO_3) (mg/m^3)	160	200	N/A
Total Hazardous Substances (Metals) (mg/m^3)	0.031	0.25	1.0
Total Oxides of Nitrogen (at 18% O_2) (as equivalent NO_2) (mg/m^3)	39	50	100.0
Cadmium (mg/m^3)	0.0015	0.0089	0.1
Mercury (mg/m^3)	0.00026	0.003	0.1

4.5 Noise Monitoring

Noise limits set out in NCIA's Project Approval are more stringent than those set out in the EPL and therefore the Project Approval limits are used to assess the Site's compliance with noise requirements. The Project Approval states that noise generated from NCIA should not exceed 35 dB(A), $L_{eq(15\ min)}$ during the day, evening or night periods, at the Kenvil Close and Wollombi Road noise monitoring locations. The Project Approval also sets a night time sleep disturbance criteria of 45 dB(A) L_{max}.

Noise levels are measured in accordance with NCIA's Project Approval, EPL, and the procedures in the *NSW Industrial Noise Policy* (INP) (NSW EPA, 2000). In accordance with the INP, the noise criteria apply under all meteorological conditions except during rain, wind speeds greater than 3m/s (at 10 m above ground level) and intense temperature inversions (greater than +3°/100) between 6 pm and 7 am. Data obtained during these meteorological conditions were omitted.

The noise monitoring was undertaken by Spectrum Acoustics on 14 May 2015. A series of attended noise measurements, of 15 minutes duration, were made in Kenvil Close and in Wollombi Road on Thursday 14 May 2015 during the day, evening and night time periods. Measurements were also made during the day time period on the NCIA site. At the time of the monitoring activities at NCIA were being carried out under typical operating conditions.

The results of the attended noise measurements at each location and time are summarised in Table 12.

Table 12 Received Noise Levels During Attended Noise Monitoring (14 May 2015)

Location	Time	dB(A), $L_{eq\ (15\ min)}$	Wind speed / direction	Identified Noise Sources	dB(A), L_{max}
Kenvil Close	3:53 pm (day)	48	2.8/NNW	Traffic (47), construction (40), dogs (30), **NCIA not measureable**	N/A
Kenvil Close	8:20 pm (evening)	47	1.1/SW	Traffic (46), train (40), dogs (35), **NCIA (32)**	N/A
Kenvil Close	11:46 pm (night)	43	1.1/SW	Traffic (42), **NCIA (33)**, train (33), insects (28)	37
Wollombi Rd	4:15 pm (day)	65	2.8/NNW	Traffic (65), trains (50), **NCIA inaudible**	N/A
Wollombi Rd	8:45 pm (evening)	58	1.1/SW	Traffic (58), trains (35),insects (30), **NCIA inaudible**	N/A
Wollombi Rd	12:08 am (night)	55	1.7/S	Traffic (55), **NCIA barely audible**	<30

The results show that the received noise from the NCIA facility was audible and measureable at the Kenvil Close monitoring location during the evening and night time periods. At Wollombi Road the noise from NCIA was barely audible only at night. However on all occasions and at all times the noise from NCIA did not exceed the relevant criterion, including the sleep disturbance criterion.

During the day time the monitoring of the acoustic environment at the Kenvil Close location was impacted by noise from the construction of the Heritage Park (old golf course site). At this location there was also a significant contribution from traffic noise on the New England Highway during each of the monitoring periods.

At the Wollombi Road monitoring location, noise from traffic on Wollombi Road was the most significant contributor to the measured noise. Analysis of data from those times when the traffic noise was low allowed for the determination of the contribution of other noise sources to the overall acoustic environment.

Generally, the noise emissions from NCIA are relatively constant and steady with very few easily discernible L_{max} events. L_{max} noise levels measured on the NCIA site (during the day) did not vary by more than 2-4 dB(A) from the measured L_{eq} noise levels. Based on the results shown in Table 12 this means that the L_{max} noise at the closest receivers in Kenvil Close and Wollombi Road would be significantly lower than the 45 dB(A) criterion for the site. Likewise, the measured L_{max} noise level attributed to NCIA also shows compliance with the sleep disturbance criterion, as shown in Table 12.

4.6 Water

4.6.1 Water Usage

Water usage at NCIA is principally for use in the tile manufacturing process and wash down requirements. Water is also required for staff amenities, landscaping and firefighting if required.

Although there is no regulatory limit on water usage, Schedule 3 Condition 44 of the Project Approval stipulates that NCIA will need to seek approval from Hunter Water Corporation (HWC) before its water consumption is expected to exceed 92ML/year.

NCIA used a total of approximately 47 ML of process water during the 2014-15 annual return reporting period (i.e. including this 2015 partial AEMR reporting period). This is well below the threshold value of 92ML/year for which HWC approval is required.

4.6.2 Stormwater Quality

Stormwater quality is monitored on a weekly basis within Pond 4, which is located in the south-east corner of the property. Monitoring started in 2009 and is ongoing, with the parameters monitored including pH value, Electrical Conductivity (EC) (as a measure of salinity) and water temperature, as well as visual observations of turbidity levels, odour and colour. The intent of the monitoring is to assess the suitability of stormwater as an alternative water supply for use in plant processes in the future, with a view to reduce NCIA's water consumption.

The results of the stormwater monitoring during the 2015 reporting period for pH and EC are presented in Figure 15 and Figure 16, respectively. For assessment purposes the monitoring results are compared against the ANZECC Water Quality Guidelines for industrial use (2000). The data shows that:

- pH values during the 2015 reporting period oscillated between 6.5 and 8.0, and were within the ANZECC guidelines at all time; and
- EC values were low and overall stable throughout the reporting period, with levels generally below 500µS/cm, indicating that the water is non-saline. The EC values were also within the ANZECC guidelines for the entire reporting period.

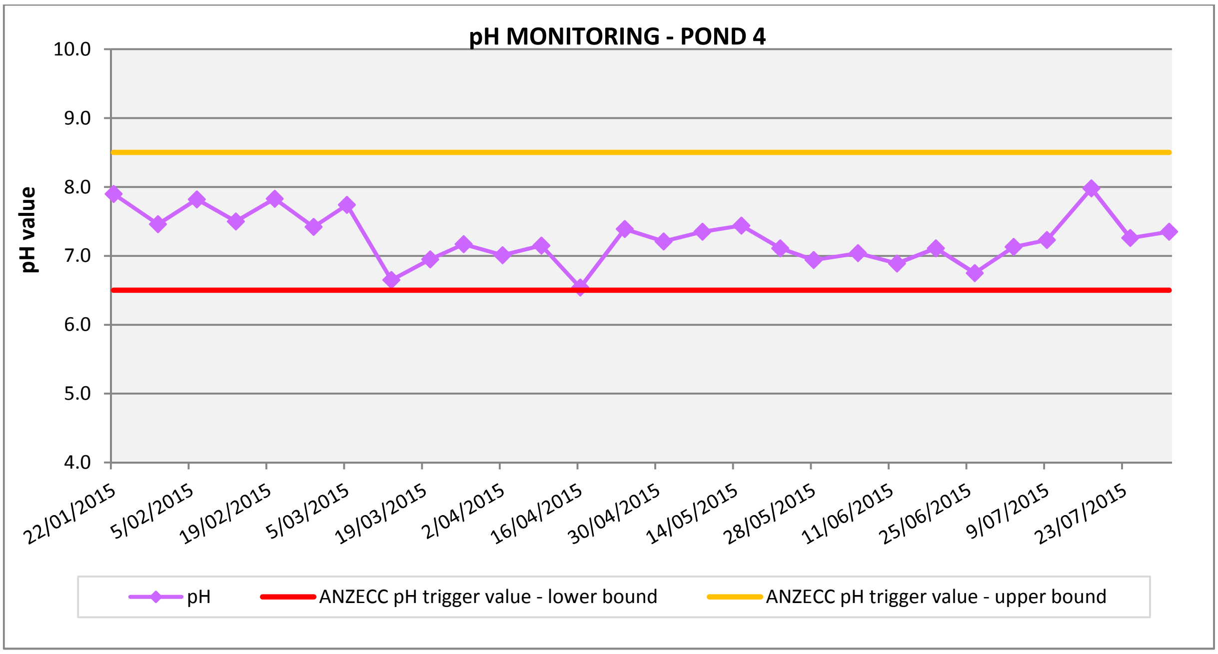

Figure 15 Stormwater Quality Monitoring – pH

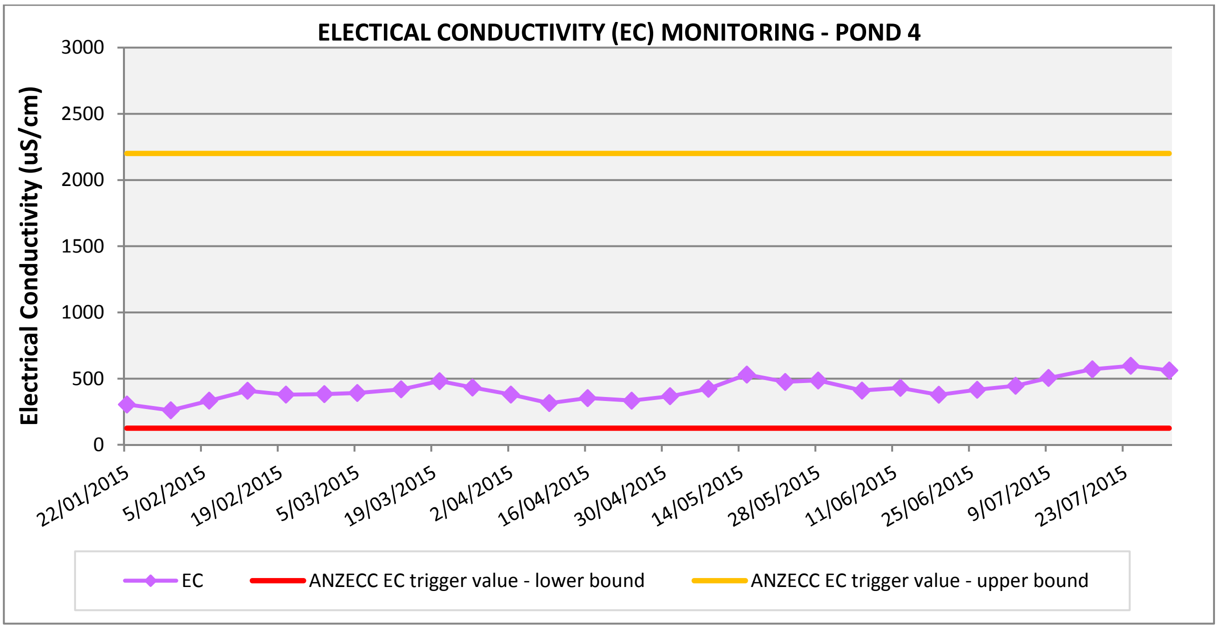

Figure 16 Stormwater Quality Monitoring – EC

4.7 Waste Generation

There are no regulatory requirements in terms of waste generation quantities, types or production efficiency targets pertaining to the facility operations. The Project Approval simply stipulates that a designated area for the storage and collection of waste and recyclable material must be provided at the facility (Schedule 3 Condition 52).

The main waste generated from the operation includes tile waste and baghouse waste. Tile waste comprises both 'green tiles' (or green waste) (i.e. raw material waste from unfired tiles) and broken fired tiles. Baghouse waste largely consist of the fine grade lime that is used to filter the kiln exhaust stream and neutralise the emitted fluoride. Other types of waste generated from the facility include consumables, packaging waste and general domestic waste generated within the office and lunchroom., however these wastes represent an extremely minor part of the total waste stream.

The amounts of tile waste generated during the 2015 reporting period (shown as a proportion of the total tile production) is presented in Figure 17.

NCIA's targets for tile waste are to not exceed 1% (for green waste) and 10% (for fired waste) of the total tile production, respectively. The green tile waste target was achieved every month throughout the reporting period. The amount of fired waste exceeded the target for each of the seven month reporting period . Approximately 5% of the fired waste is currently reused in the manufacturing process (i.e. milled again and re-sent through the production line), bringing the actual waste levels down by 5%. Consequently, the fired waste target was only slightly exceeded with approximately 12% of the total production as fired waste and achieving the 10% target three out of the seven months of this AEMR reporting period.

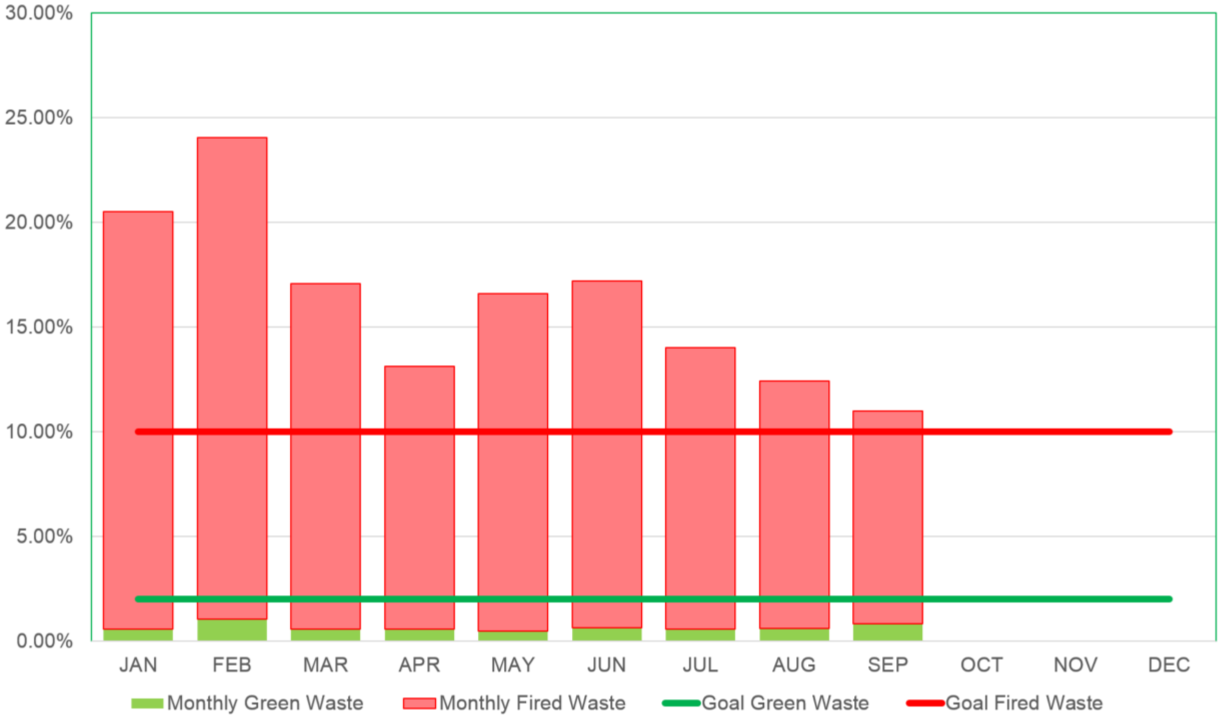

Figure 17 Tile Waste (Green and Fired) Generation during the Reporting Period

5.0 Discussion of Environmental Performance

This section provides an assessment of the monitoring results for this 2015 reporting period against the criteria set out in the Project Approval and EPL, the predictions made in the 2010 EA, and the monitoring results from previous years. Any trends observed in the monitoring results or discrepancies between predicted and actual impacts are discussed.

5.1 Ambient Air Quality

The 2010 EA predicted that, with the exception of PM_{10}, emissions from NCIA would meet all of the ambient air criteria. The 2010 EA stated that existing background 24-hour PM_{10} concentrations already exceeded the EPA criterion. While it was predicted that the annual average PM_{10} criterion would be met, the 2010 EA indicated that the 24 hour average PM_{10} concentrations may exceed the criteria under worst case dispersion conditions. Specifically, predictions made in the 2010 EA for the project included the following:

- The maximum cumulative 24 hour average PM_{10} concentration at the closest existing private receptor was predicted to be 53.4 µg/m^3 (compared to the criterion of 50 µg/m^3);
- The maximum cumulative 24 hour average PM_{10} concentration for residential receptors within the Heritage Park (located at 99 Racecourse Road, Rutherford) was predicted to be 57.7 µg/m^3 (compared to the criterion of 50 µg/m^3);
- The cumulative impact of predicted maximum PM_{10} concentrations at all existing residential receptors was considered to be minor despite the predicted cumulative results being above the guidelines. It was not expected that the predicted PM_{10} impacts would be beyond levels already experienced due to the minor contribution of the project when compared to the elevated background PM_{10} levels;
- No exceedances of 24 hour or weekly Fluoride concentrations at existing residential receptors were predicted;
- The maximum cumulative 24 hour Fluoride concentration for residential receptors within Heritage Park was predicted to be 3.2 µg/m^3 (compared to the criterion of 2.9 µg/m^3); and
- The predicted exceedances of the Fluoride criterion represent a worst case scenario with NCIA operating at its fluoride licence limit of 5 mg/m^3. Stack emission testing has demonstrated that NCIA operates at levels much lower than this limit.

Ambient air quality monitoring during the 2015 reporting period indicated that the levels of PM_{10}, 24-hour fluoride and weekly fluoride (presented in Section 4.1) were all compliant with the relevant guidelines criteria, and consistent with the predictions made in the 2010 EA.

Historical ambient air monitoring results recorded since commencement of operations (15 March 2004 to current) are shown in Figure 18 to Figure 23. An analysis of historical trends in air pollutants concentrations (and where relevant comparisons against the 2015 reporting period results) reveals the following:

- Data since 2004 indicate that there are no discernible trends in PM_{10} concentrations, with variable results generally oscillating around a relatively stable annual average, and isolated increases in concentrations occurring episodically.
- PM_{10} levels during the 2015 reporting period were within the lower range of values when compared against historical data, and showed a slight decrease from the 2014 reporting period. Notably – and although the 2015 reporting period only covers a partial year, this is the first AEMR reporting no PM_{10} criterion exceedances since the commencement of operations at NCIA.
- Following seven years of relatively low and steady levels of fluoride emissions between 2004 and 2011 (despite isolated and episodic increases), the 2014 AEMR noted an increasing trend in gaseous fluoride between 2012 and 2014, which was observable in both the 24-hour and weekly fluoride levels. Although it is too early to establish whether that trend has been broken (given the shorter reporting period of the current AEMR), the results from the 2015 monitoring results seem to indicate decreasing levels of fluoride emissions in comparison to the previous two years. This idea is supported by the absence of exceedances of the fluoride 24-hour guideline criterion during the 2015 reporting period. Future monitoring data will be needed to ascertain the current trend in fluoride emissions, which will be reported in future AEMRs.

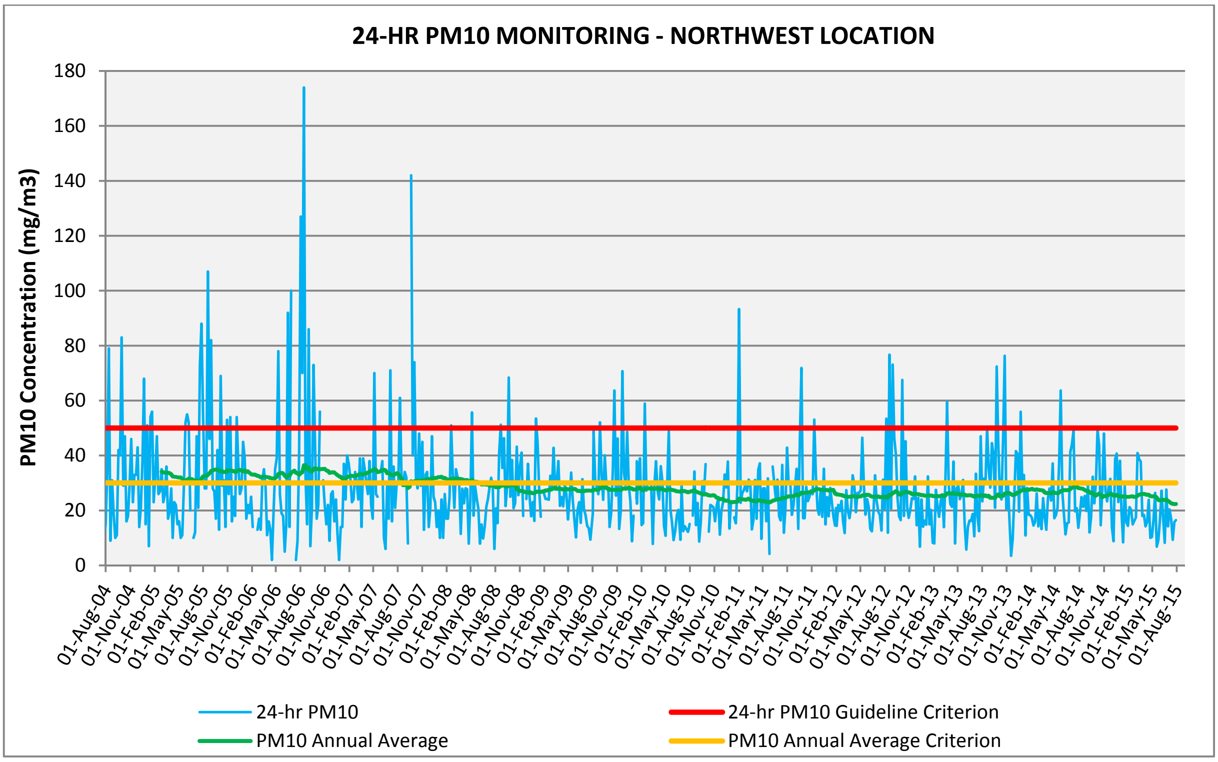

Figure 18 24-Hour PM$_{10}$ Monitoring – northwest location (2004 – 2015)

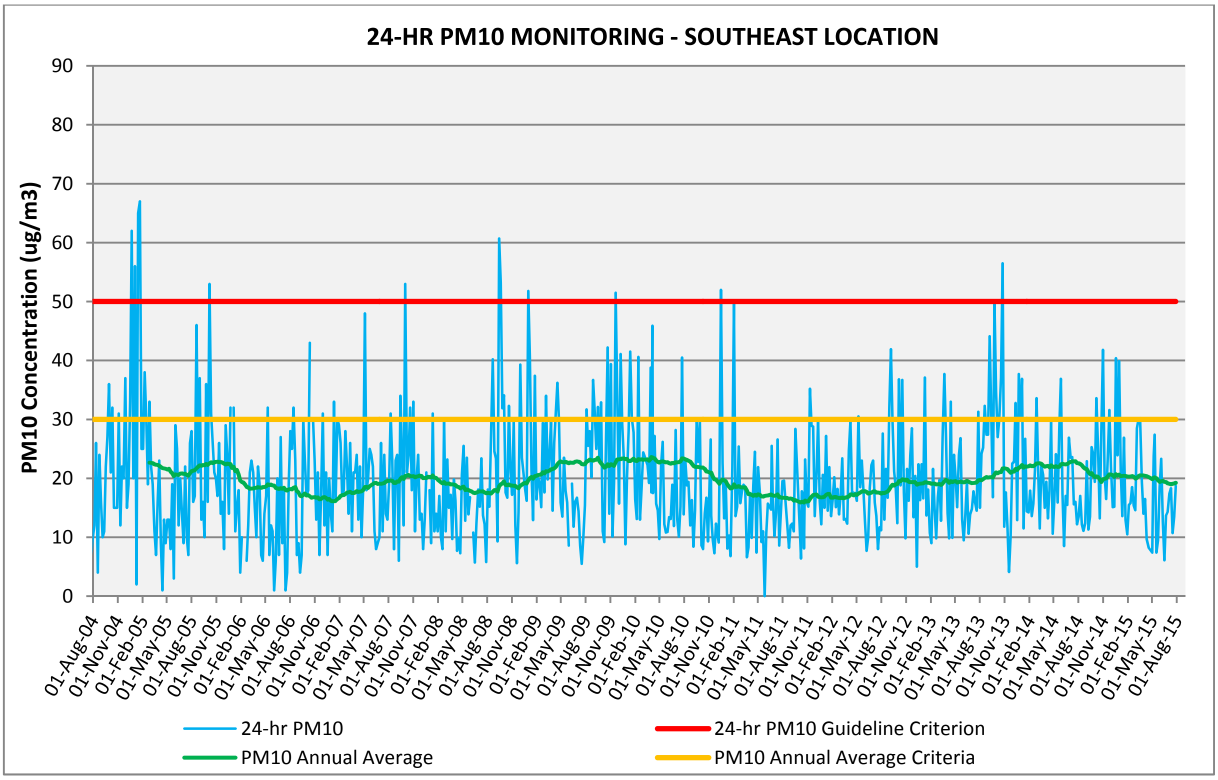

Figure 19 24-Hour PM$_{10}$ Monitoring – southeast location (2004 – 2015)

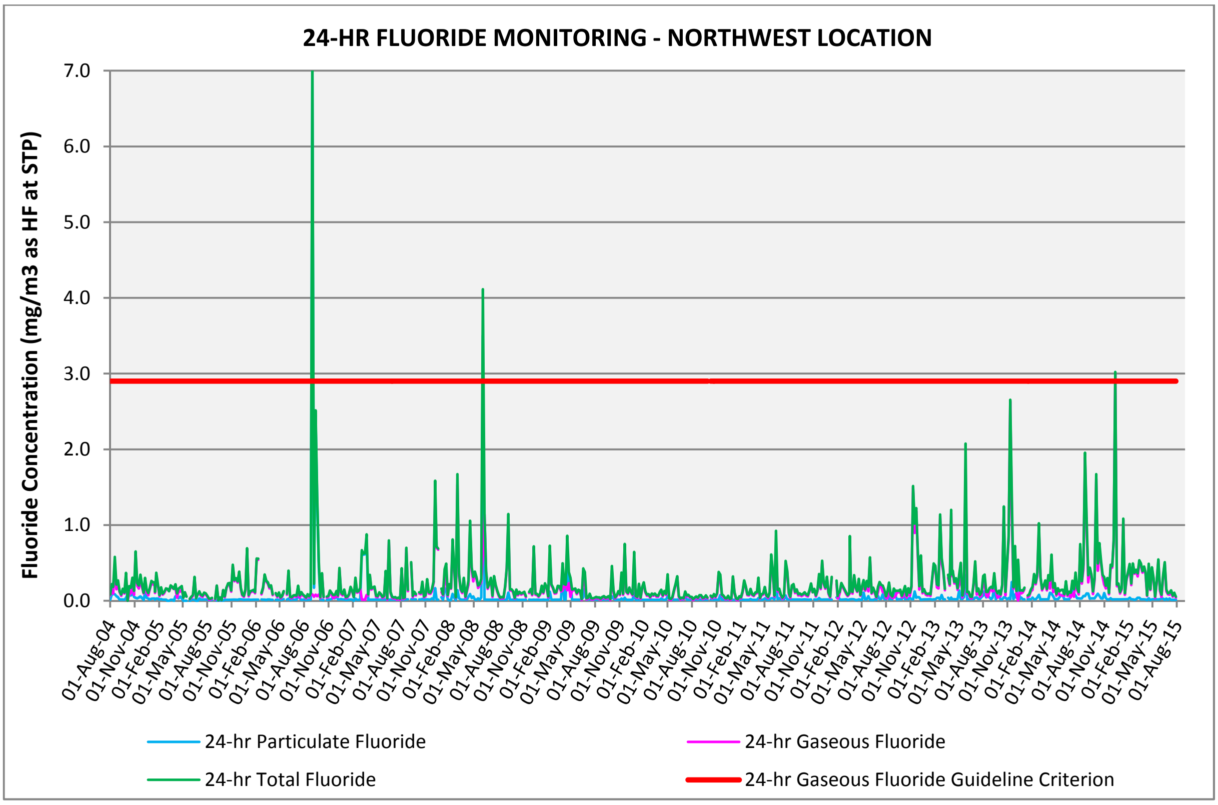

Figure 20 24-Hour Fluoride Monitoring – northwest location (2004 – 2015)

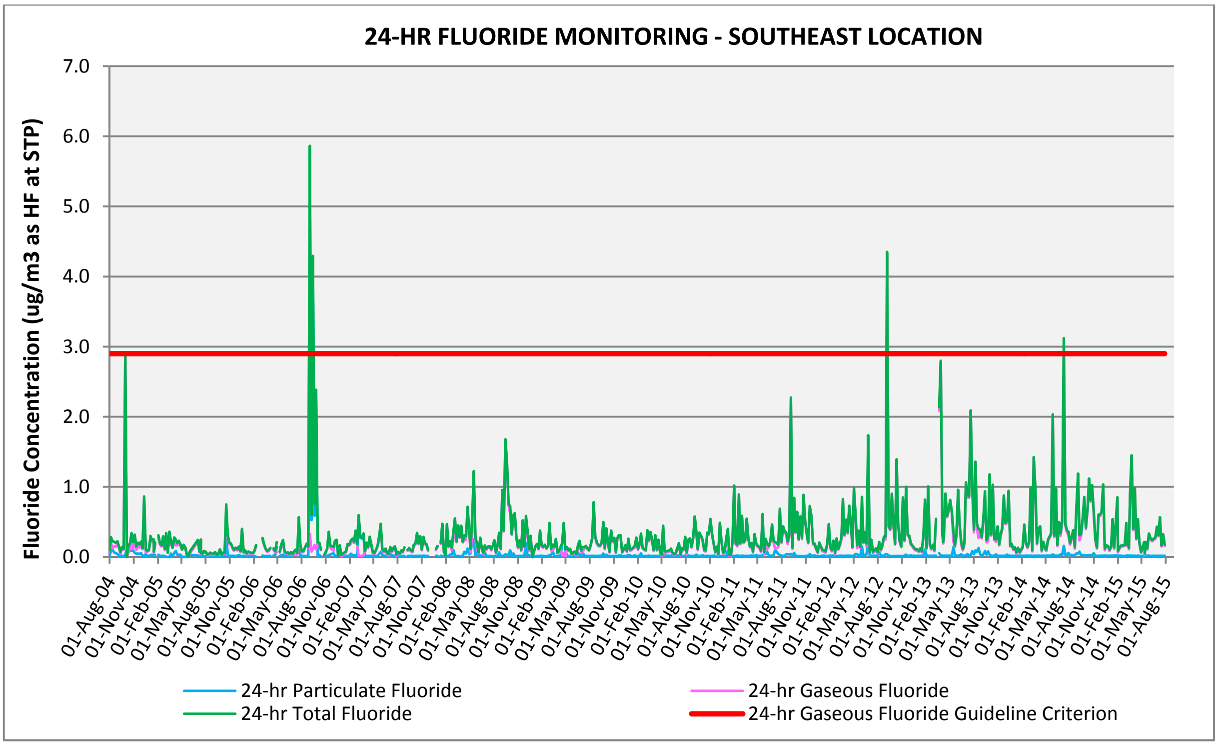

Figure 21 24-Hour Fluoride Monitoring – southeast location (2004 – 2015)

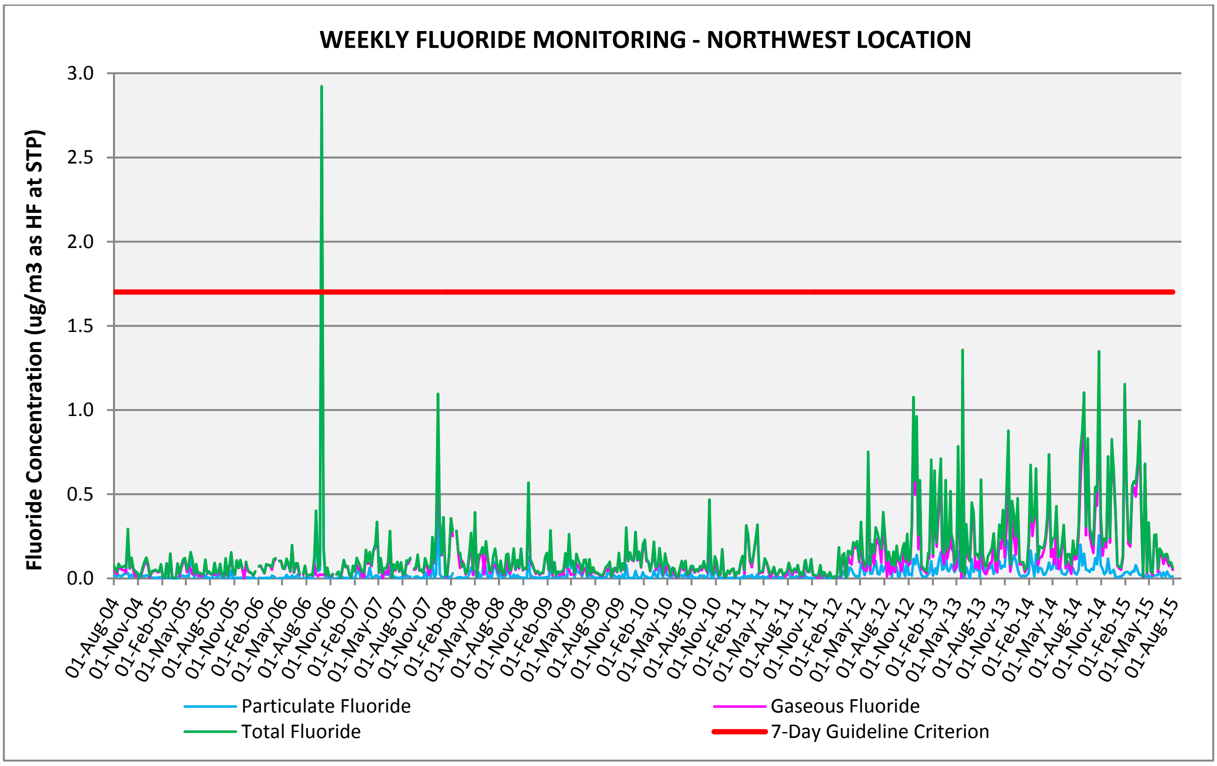

Figure 22 **Weekly Fluoride Monitoring – northwest location (2004 – 2015)**

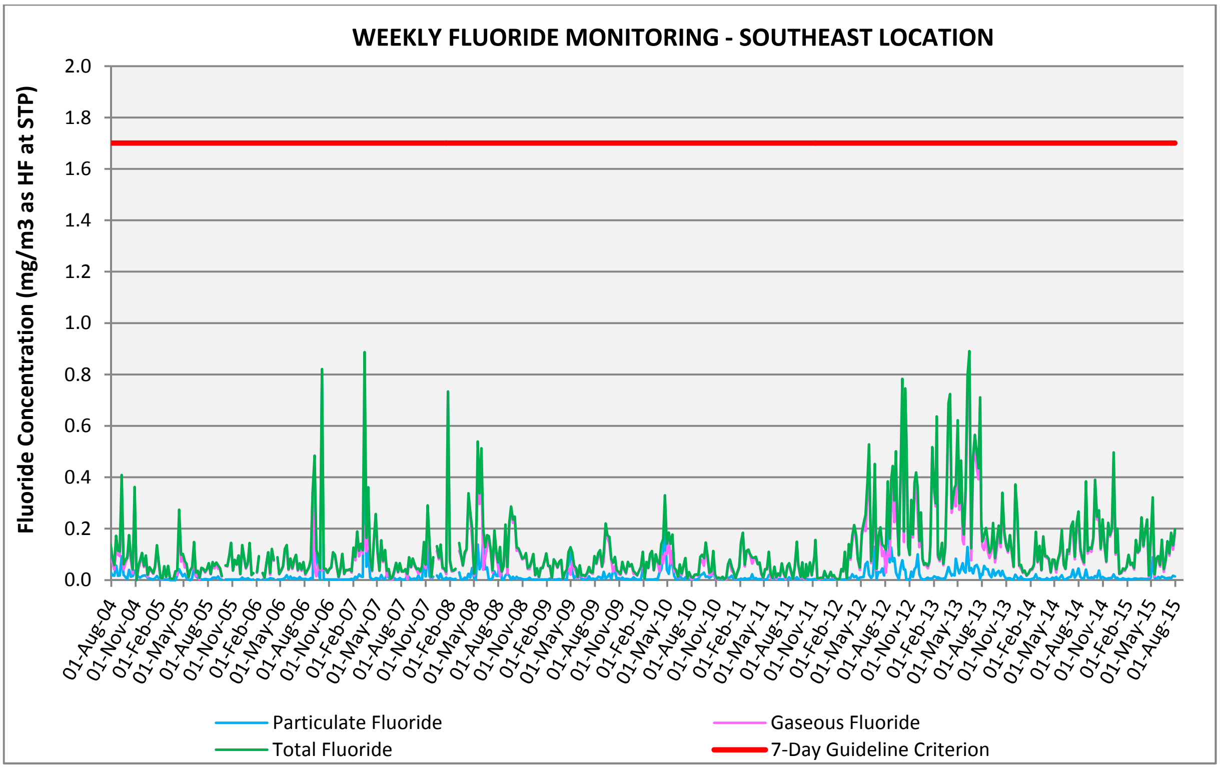

Figure 23 **Weekly Fluoride Monitoring – southeast location (2004 – 2015)**

5.2 Fluoride Impact on Vegetation

The 2010 EA concluded that the expansion project was unlikely to have a significant impact on threatened flora and fauna species. The site is highly modified and contains little habitat value for native species. The 2010 EA did not specifically discuss fluoride impact on vegetation and therefore no predictions are available for comparison.

As required by the EPL, the potential impact of NCIA's operations on vegetation surrounding the site is monitored through assessment of seasonal fluoride impacts on vegetation – including visual assessments of injury symptoms to leaves and foliar fluoride content. There are no limits or criteria set out in the EPL or Project Approval by which to assess compliance. Instead the assessments are used to provide an indication of trends in fluoride injury and concentrations at set locations surrounding the facility and for a suite of particular species.

5.2.1 Trends in Visual Impact on Vegetation

Historical results for vegetation visual assessments since the start of the monitoring programme have been presented in Figure 24. For each quarterly survey, the data have been presented to show the proportion of total species assessed that were impacted by fluoride related injury symptoms of varying severity. The results were grouped into the following four categories also refer to Table 7 in Section 4.2 for definitions of injury classes):

- Species showing no visible fluoride injury symptoms;
- Species displaying at worst Class 1 (very slight) or Class 2 (slight) injury symptoms;
- Species displaying at worst Class 3 (distinct) or Class 4 (marked) injury symptoms; and
- Species displaying Class 5 injury symptoms and above (severe to extreme).

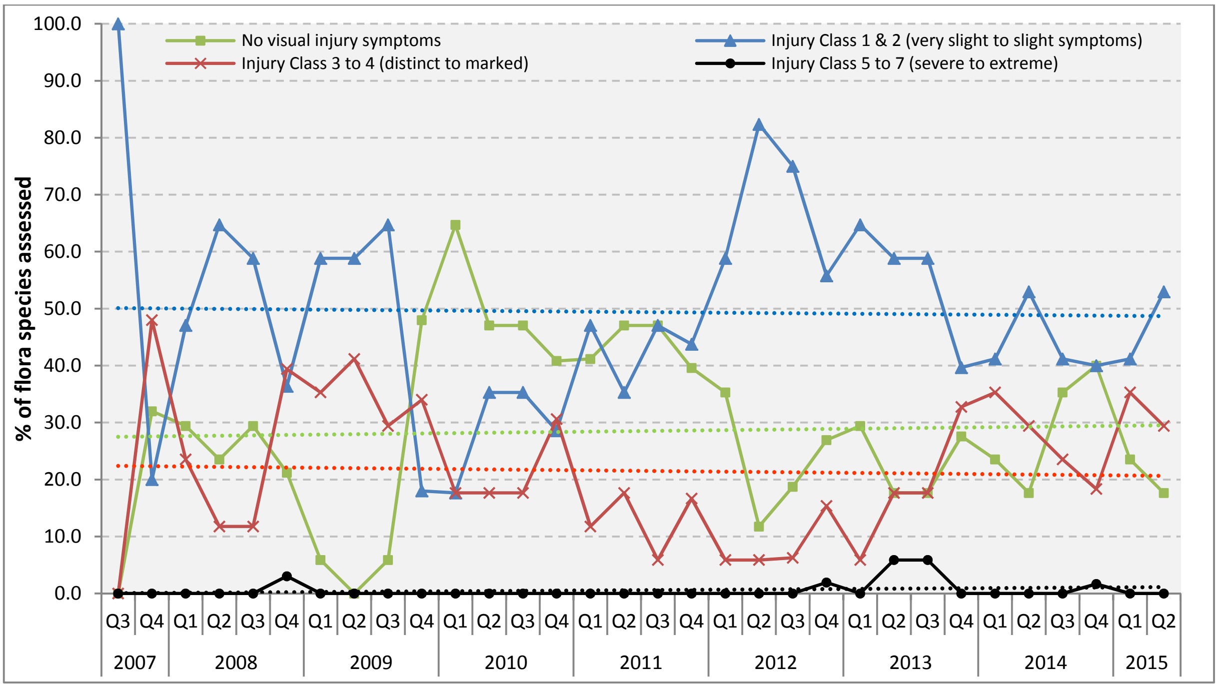

Figure 24 Proportion of Flora Species Affected by Emission Related Visual Injury Symptoms (2007-2015)

Historical data show that there are no clear trends (improving nor worsening) in the health condition of the vegetation surrounding the NCIA factory (as depicted by the corresponding trend lines in Figure 24). Although the severity of visual fluoride injury symptoms in the foliage of the species assessed generally varies on a quarterly basis, variations tend to oscillate around a relatively consistent average over the long term. The following observations generally apply to the long term data:

- The majority of flora species assessed during the monitoring programme (>70%) display at least some level of fluoride related injury symptom;
- Of all impacted individual, most (~50%) only show very slight or slight fluoride injury symptoms (i.e. less than 5% of leaf area affected);

- Approximately 20% of all species are distinctly or markedly impacted by fluoride injuries (i.e. between 10% and 25% of leaf area affected); and
- Generally no individual assessed (or very few) present severe symptoms or worse (i.e. >25% of leaf area impacted).

Amongst the full suite of flora individuals assessed during the 2015 (Q1 and Q2) surveys, minor variations in foliage condition were observed in comparison to observations made in previous years surveys, with some specimens studied experiencing either a slight deterioration or slight improvement in foliage condition – whilst others showed relatively consistent symptoms. Although the data showed a slight increase in the prevalence of injury symptoms during the reporting period (refer to Figure 24), none of the 2015 visual survey results could be flagged as exceptional in the context of the long-term monitoring programme and associated historical data.

With a view to provide a more detailed assessment of the evolution in visual foliage fluoride impacts over time, the quarterly variation in visible injury symptoms in one year old foliage in a selection of fluoride-sensitive tree species at Sites 1 (*E. moluccana*), 5 (*E. amplifolia* and C. maculata) and 7 (C. maculata) are provided in Appendix A4, inclusive of data collected since the commencement of monitoring at these respective locations. The species studied are the same as those sampled for foliar fluoride content. Long term data results show the expression of fluoride injury symptoms in the foliage of individual trees across years to be variable.

- The *E. moluccana* at Site 1 has consistently displayed little fluoride injury symptoms since 2007, with generally only very slight to slight symptoms visible (with the exception of the Q4 2013 survey where distinct chlorosis was recorded). However the exhibited symptoms have changed over the years with chlorosis symptoms first evident between 2007 and 2009 before disappearing until 2012 and consistently re-appearing from 2013 onwards. Insect attack injury has generally declined over time and since 2013 has remained only slight or very slight. With slight chlorosis, no sign of anthocyanin accumulation and very slight to slight insect attack injury symptoms, the 2015 survey results for this species were overall consistent with those observed in recent years.
- The *E. amplifolia* at Site 5 has consistently displayed little fluoride injury symptoms since 2007, with only very slight to slight visible symptoms recorded. Although chlorosis and anthocyanin accumulation symptoms were regularly evidenced in the foliage of this species early in the monitoring programme, they have consistently been absent since 2010. Necrosis of leaves tips (low severity) is commonly recorded in this species at this location. Some level of insect attack injury has been recorded in every survey since 2007, usually ranging from very slight to distinct. The foliage of this species appeared healthy during the 2015 surveys with only very slight tip necrosis and slight insect damage recorded, which is in line with the historical results for this tree.
- The *C. maculata* at Site 5 – despite being adjacent to the *E. amplifolia* specimen discussed above, has historically presented more severe visual fluoride injury symptoms, as well as more variability in symptoms severity over the years (this demonstrates differing levels of sensitivity to atmospheric fluoride between the species or the individuals). With the exception of the 2012 surveys during which fluoride injury symptoms were at worse very slight, the foliage of this *C. maculata* has commonly showed chlorosis and tip necrosis symptoms, varying in severity between surveys and generally ranging from slight to marked. Very slight to marked insect damage has also been commonly recorded, although the severity of insect attack injury symptoms has seemingly decreased since 2013. During the 2015 surveys, this tree has displayed distinct chlorosis and slight cupping and tip necrosis symptoms, as well as slight insect damage, which is consistent with previous years' results.
- Of all species surveyed during the monitoring programme, the *C. maculata* at Site 7 has historically been one of the most severely impacted by fluoride visual injury symptoms. This tree has commonly returned distinct or marked emission injury scores since 2007, and usually displayed a wide range of symptoms including chlorosis, tip and marginal necrosis and leaf cupping. Signs of anthocyanin accumulation were commonly recorded between 2003 and 2007, however have been absent since between. The severity of insect attack symptoms has generally been minor (very slight and to slight). The 2015 survey results showed distinct chlorosis impacts, slight to distinct tip necrosis and cupping, no signs of anthocyanin accumulation and only very slight insect damage. These symptoms represent a marginal improvement in condition from that observed in 2014 (where marked symptoms were recorded), however are within the historical range of scores.

5.2.2 Trends in Fluoride Content in Vegetation

Historical fluoride concentrations in vegetation sampled during each of the quarterly and annual surveys are presented in Figure 25 to Figure 28.

Overall, foliar fluoride concentrations for the 2015 sampling events were within the long-term range of data for all species at all locations. Notably, the following comments apply to the 2015 results when compared against previous year's data:

- During both Q1 and Q2 foliar fluoride concentrations in *E. moluccana* at Site 1 were within the medium range of historical values for this species;
- The samples of grasses collected at Site 3 returned low fluoride contents (i.e. ≤10.0µg/g) which is consistent with the long term seasonal pattern observed in grasses fluoride concentration in Q1 and Q2 surveys (concentrations usually tend to rise in winter (Q3) when wind pattern is dominated by north-westerlies blowing towards this site from the NCIA emission stacks);
- During each of the Q1 and Q2 sampling events, the foliage of *E. amplifolia* at Site 5 returned very high fluoride concentrations for the season (146.0µg/g and 163.0µg/g, respectively), and some of the highest values recorded in the last five years. In addition, the Q2 2015 sample analysis result constituted the fifth consecutive quarterly increase in foliar fluoride concentration for this species. Although fluoride content appears to be highly variable in this specimen, historical data as depicted in Figure 27 show that it usually tend to decrease in late summer / autumn every year (i.e. at the time of Q4 or Q1). The 2014 and 2015 results indicate that this drop in concentration had not yet occurred by the time Q2 2015 was undertaken, and this will need to be closely monitored during future surveys to ensure that these levels are not sustained;
- The foliage samples of *C. maculata* at Site 5 returned low fluoride concentration levels in both surveys (i.e. comprised between 15.0-20.0µg/g), which is in line with the historical patterns for this species which consistently returns low fluoride contents with little seasonal concentrations fluctuations; and
- During both Q1 and Q2 foliar fluoride concentrations in *C. maculata* at Site 7 were consistent (i.e. ~50.0-60.0µg/g) and within the medium range of values for this tree at this site. High variability in fluoride content has been observed for this tree since 2007, with a seemingly stochastic and unpredictable pattern that appears independent from seasonal wind patterns (refer to Figure 28).

Overall, historical data show wide fluctuations in foliar fluoride content between quarterly surveys, and it is not uncommon for fluoride concentrations to experience and display episodic increases on a seasonal basis, usually reflecting the changing dominant wind patterns occurring with the change of season. On the longer term however, there seems to be a distinguishable annual pattern in the fluctuating of fluoride concentration, and historical data shows that for each species fluoride concentrations tend to oscillate from within a set range of values.

Finally, the long-term data shows that there is an obvious variability in the sensitivity of tree species and individuals to the impacts of atmospheric fluoride, with different individuals clearly absorbing varying levels of atmospheric fluoride through their leaf tissue.

It is also possible that environmental and climatic conditions play a role in foliar fluoride concentration levels – for instance higher rainfall may lead to emission particulates deposited on leaves being quickly washed from the leaf surface, and therefore not able to be absorbed and accumulated in the leaf tissue.

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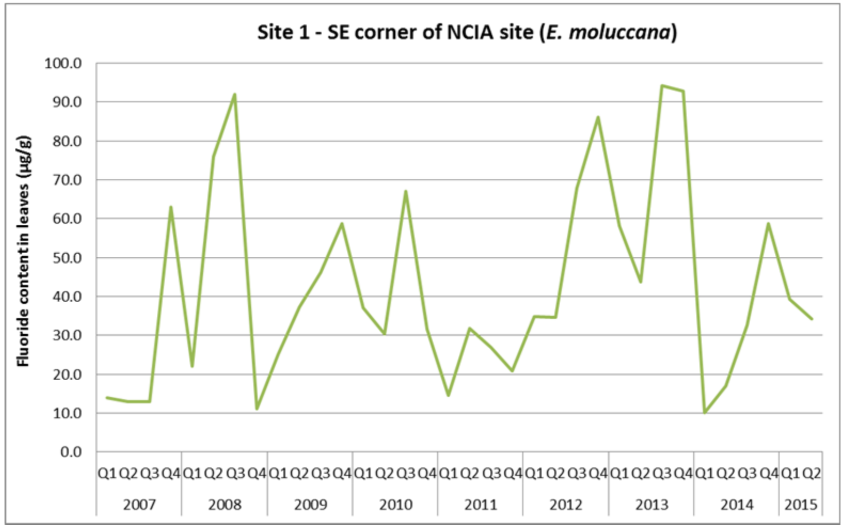

Figure 25 **Fluoride Content in *E. moluccana* Foliage at Site 1 (Q1 2007 – Q2 2015)**

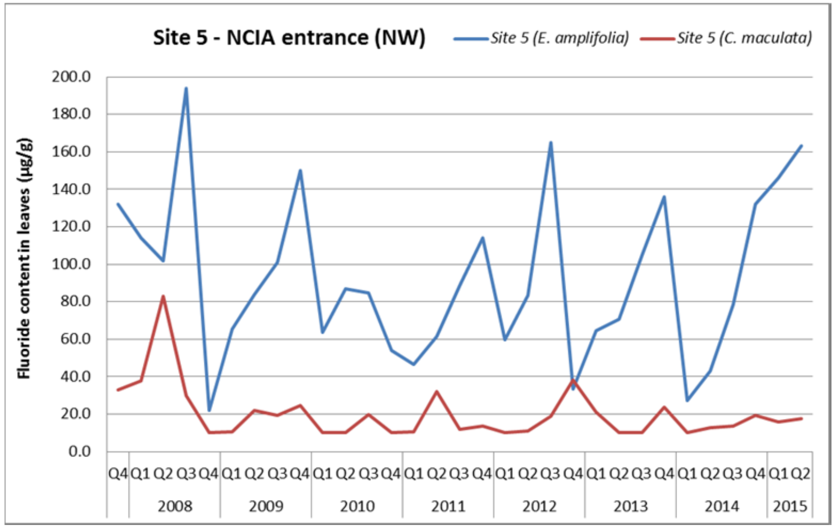

Figure 27 **Fluoride Content in *E. amplifolia* and *C. maculata* Foliage at Site 5 (Q4 2007 – Q2 2015)**

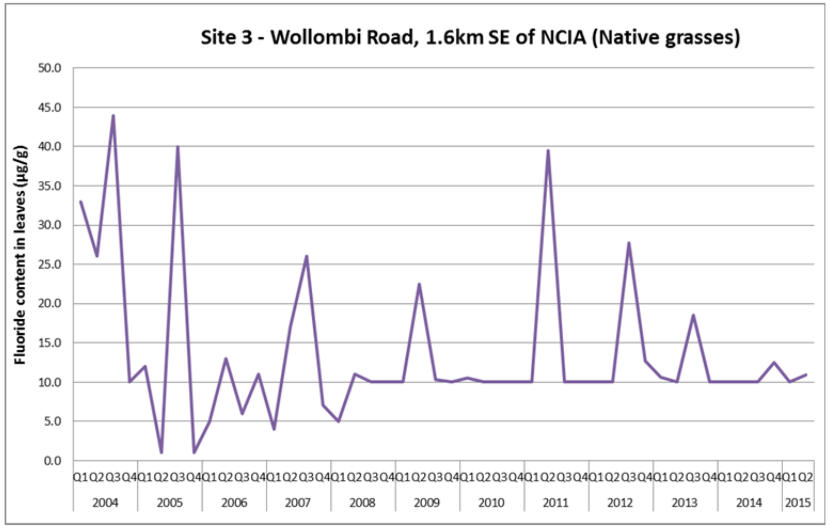

Figure 26 **Fluoride Content in Grasses at Site 3 (Q1 2004 – Q2 2015)**

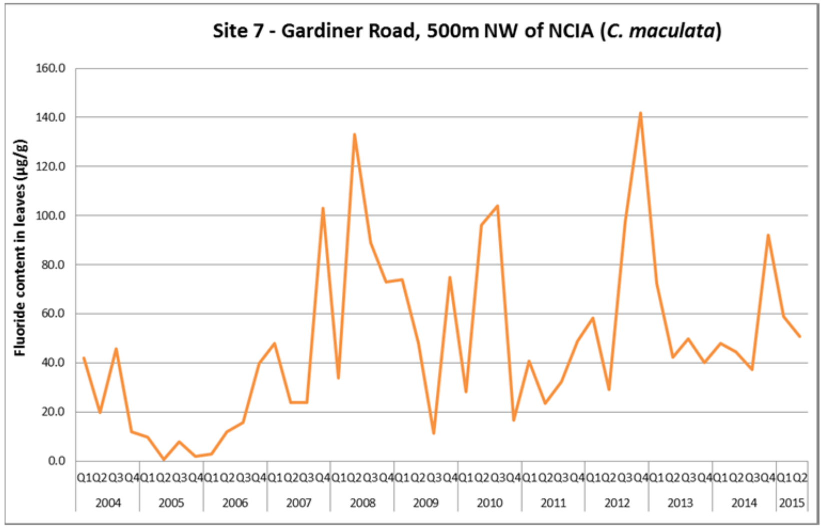

Figure 28 **Fluoride Content in *C. maculata* Foliage at Site 7 (Q1 2004 – Q2 2015)**

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5.2.3 Reference Site

The reference site is located approximately 3 km to the north of the NCIA plant thus outside the prevailing wind direction. Being a reference site, it is expected that there should be no impacts to the vegetation as a result of fluoride emissions from the NCIA facility.

Long term results of the visual assessments of foliage injury symptoms undertaken at this location show that vegetation has historically been in good and healthy condition at the selected location. However, some injury symptoms have commonly been recorded over the years, particularly symptoms of cupping and tip necrosis – albeit of very slight severity, as well as insect damage. As the link to fluoride emission as a cause for these symptoms cannot be confidently determined for this monitoring location, this suggests that some species will exhibit foliar injury symptoms under 'natural' conditions, which should be considered when assessing the performance of the impact sites. Other factors may therefore play a role in the expression of injury, which may include environmental conditions, stress (e.g. drought, wind, diseases, etc.) or impacts from insects.

Given the social and economical of the viticultural industry in the Hunter Valley, there has been traditionally been concerns around the potential impact of atmospheric pollutants emissions from industrial sources on the health of the grape vine *Vitis vinifera* (a known sensitive species). Consequently, foliar sampling and analysis of *Vitis vinifera* foliage from the reference site has historically been included as part of this vegetation monitoring programme. Historical concentrations since the commencement of the monitoring programme are presented in Figure 29.

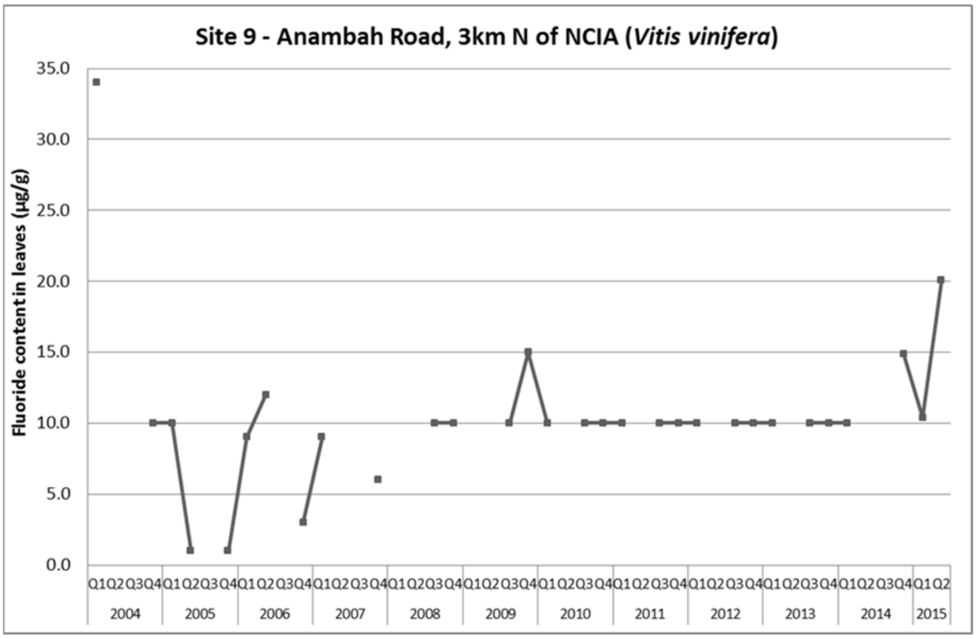

Figure 29 Fluoride Content in *Vitis vinifera* Foliage at Site 9 (Q1 2004 – Q2 2015)[2]

Long term data show that foliar fluoride has consistently returned very low concentrations for this species. However, the last three quarterly surveys (when undertaken during the vegetative stage of this deciduous species) indicated an apparent increase in foliar fluoride in comparison to the previous 4.5 years, with the Q2 2015 concentration result being the highest concentration recorded in this species in over eleven years and since the baseline survey undertaken in Q1 2004. Although it is difficult to ascertain the reason behind this sudden elevation, the following points are made:

- The property at the reference site has undergone significant maintenance and clean up in the last 24 months (following its acquisition by a new owner). This has included the maintenance and clean-up of the vines and the re-instatement of a functional irrigation system. Some scientific literature suggests that the use of municipal water injected with fluoride (which is the case in Australia) for irrigation can result in toxicity symptoms on sensitive plants such as grape vines (Pscheidt, 2015). In this regard the elevated fluoride

[2] Note that the breaks in the line result from leaf sampled not being collected and analysed for a particular quarter due to the absence of foliage on the vine (i.e. the species is deciduous).

levels returned in the last three quarterly surveys correlate well with the recent maintenance activities (and irrigation) undertaken on site;

- As noted above, leaf samples are usually not available in Q2 surveys due to the deciduous nature of the species, it therefore cannot be excluded that the result of the present survey reflects the normal seasonal fluctuation pattern in foliar fluoride for the species (e.g. reflecting a gradual increase in fluoride deposition and intake in leaf tissue throughout the growing season); and
- Although no scientific literature could be found to support (or refute) such an assumption, the level or stage of senescence in foliage may have an effect of fluoride concentration.

Regardless of the potential causalities behind the recent results, the fluoride concentration levels in the new foliage for the 2015 growing season (i.e. to grow in spring 2015) will be closely monitored in future quarterly surveys.

5.2.4 Relationship Between Visual Symptoms and Foliar Fluoride Content

The results of the 2015 surveys – as well as historical data, seemed to indicate a poor correlation between foliar fluoride content and the visible expression of injury symptoms in foliage. For instance, although the *E. amplifolia* at Site 5 returned the highest fluoride concentration (>150.0 µg/g), its foliage only showed very slight visible injury symptoms (and notably no chlorosis symptoms). Conversely, the foliage of *C. maculata* at the same location exhibited distinct fluoride visual injury symptoms while the laboratory results showed that its foliar fluoride concentration was the lowest of all tree species sampled (<20.0 µg/g). This has already been noted in previous quarterly reports, and may be due to:

- A lag in the visible expression injury symptoms following exposure to atmospheric fluoride emissions;
- Various sensitivity of individual specimens in exhibiting visible injury symptoms; or
- Emissions related visual injury symptoms being ‘mimicked’ by natural environmental impacts such as climatic conditions and insect attack.

Overall, there is an inherent level of unpredictability in the expression of visual symptoms between monitoring events, as well as an obvious variability in sensitivity to fluoride impacts both inter and intra-species, with different individuals clearly being more resistant or sensitive to emission related impacts than others.

5.3 Meteorological Monitoring

NCIA have been monitoring the local meteorological conditions in accordance with Condition M5 – Weather Monitoring of its EPL. Table 13 demonstrates compliance with the EPL conditions with all monitoring equipment achieving continuous monitoring greater than 95% of the reporting period .

Table 13 Meteorological Station up-time

Meteorological Parameter	Frequency	Percentage uptime during reporting period
Wind speed @10m (m/s)	Continuously	>95%
Wind direction @ 10m (degrees)	Continuously	>95%
Sigma theta @ 10m (degrees)	Continuously	>95%
Ambient temperature @ 5m (degrees Celsius)	Continuously	>95%
Rainfall (mm)	Continuously	>95%

5.4 Air Pollutant Load Limits

The 2010 EA included dispersion modelling to predict ground level pollutant concentrations. No source emission predictions were made in the 2010 EA, so stack emission monitoring results are not directly comparable to air quality impact predictions.

Trends in the air quality pollutants discharged to air as a result of NCIA operations over time can be established using the pollutant loads reported to the EPA in the Annual Returns since 2003. As a function of the difference between the AEMR and EPL reporting periods (as previously discussed), the pollutant loads presented and discussed in this 2015 (partial) AEMR are those corresponding to the 2014-2015 EPL reporting timeline (i.e. 01 August 2014 to 31 July 2015).

Table 14 provides the assessable pollutant loads discharged by NCIA during the 2014-2015 Annual Return reporting period, alongside the maximum load limits set out in both the EPL and Project Approval. Historical pollutant loads discharges (2004-present) have also been included for comparison purposes, and presented graphically in Figure 30 to Figure 34.

All assessable pollutants were within the relevant pollutant load limits for 2014-2015.

Historical data show that there is a high level of variability in pollutant emissions between reporting years with no clear trend or consistency in results. This renders difficult any analysis of the 2014-2015 emissions results against the long term data. The following points are nonetheless made in relation to the 2014-2015 results:

- The levels of fine particulates emissions were consistent with those recorded in the previous reporting period (2013-2014), whilst the levels of coarse particulates were about a third lower than during 2013-2014. Overall, levels of particulate emissions in 2014-2015 were relatively low and well below the maximum load limits;
- The total amount of fluoride discharged in 2014-2015 showed a slight increase from the 2013-2014 emissions and were the highest recorded since the 2008-2009 reporting period. However levels remained within the load permitted in the EPL;
- The amount of nitrogen oxides discharged in 2014-2015 was consistent with the 2013-2014 levels, and well below the permitted load limits; and
- The volume of sulfur oxides discharged in 2014-2015 was less than half that permitted under the EPL.

Table 14 Maximum Pollutant Load Limits and Assessable Pollutant Loads

Pollutants loads		Pollutant				
		Fine particulates	Coarse particulates	Fluoride	Sulfur oxides[3]	Nitrogen oxides
Current Maximum Load Limit (kg)	EPL	26,629	14,338	1,850	36,828	36,828
	Project Approval	74,210	32,073	3,701	73,657	110,000
Actual Load (kg) in reporting period	2014-2015	**4,963**	**2,302**	**1,353**	**15,240**	**24,016**
	2013-2014	5,369	3,289	928	37,974	25,059
	2012-2013 [1]	1,249	1,640	1,109	42,235	4,704
	2011-2012	997	5,550	91	26,946	20,306
	2010-2011	2,902	1,774	295	7,699	18,322
	2009-2010 [2]	6,524	475	621	86,704	79,375
	2008-2009	5,476	2,564	1,529	62,426	70,565
	2007-2008	4,449	3,881	336	16,633	18,073
	2006-2007	7,289	12,657	1,989	15,850	12,423
	2005-2006	25,751	11,986	4,085	13,239	12,422
	2004-2005	4,034	2,100	2,154	21,335	6,721
	2003-2004	1,028	1,089	150	5,813	1,151

1 The Project Approval came into effect on January 2013 and the previous Consent was relinquished.
2 2009-2010 marked the commencement of stage 2 of the development.
3 Sulfur oxides (as sulphuric acid mist and sulfur trioxide (as SO3))

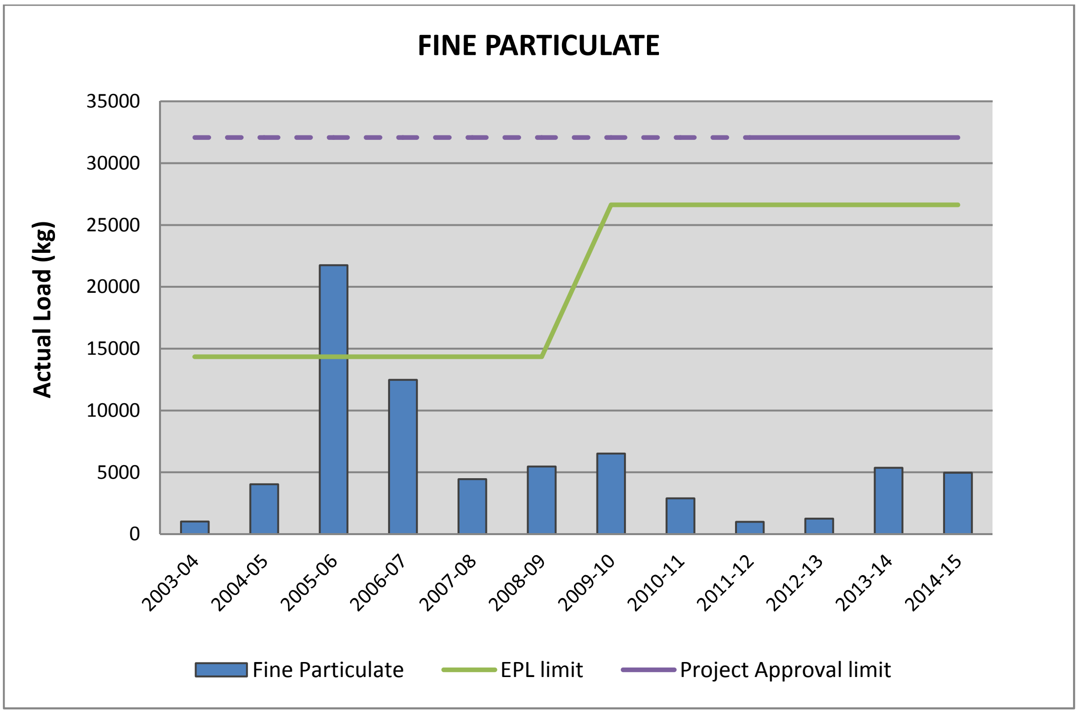

Figure 30 Fine Particulate Annual Load (2004 – 2015)

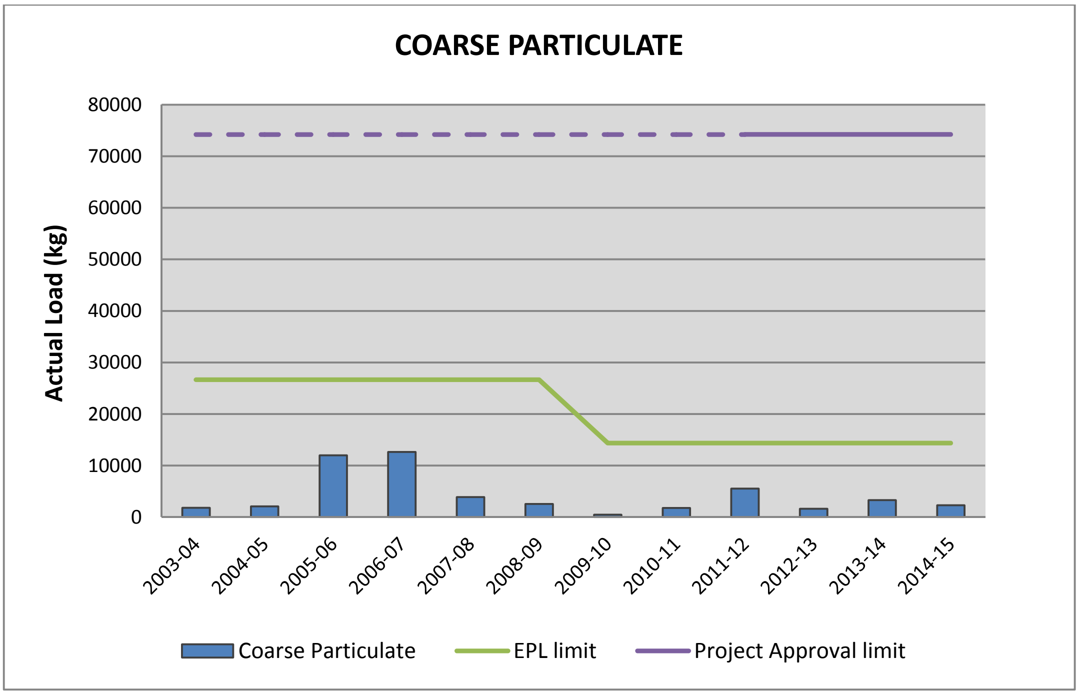

Figure 31 Coarse Particulate Annual Load (2004 – 2015)

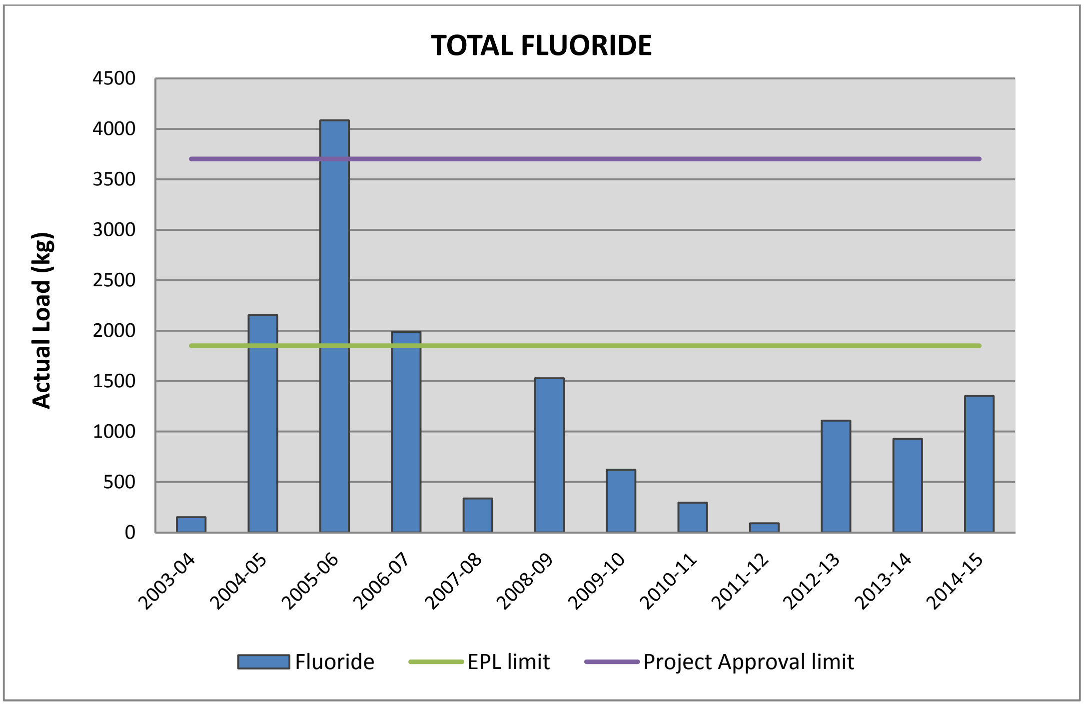

Figure 32 Fluoride Annual Load (2004 – 2015)

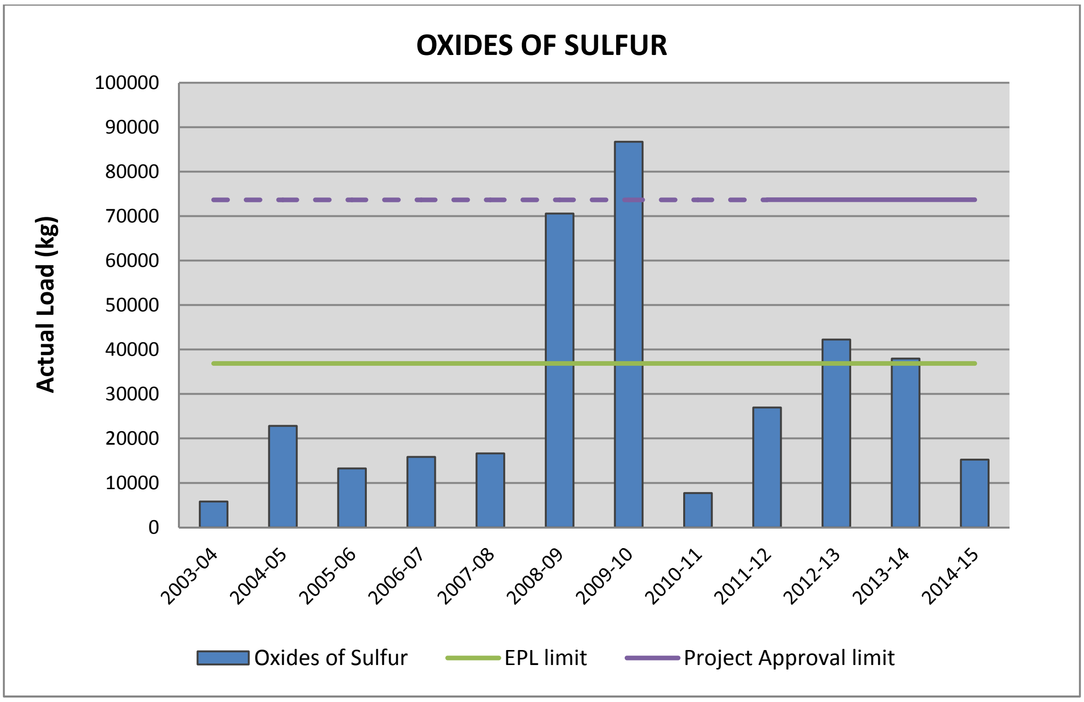

Figure 33 Sulfur Oxides (as sulphuric acid mist and sulfur trioxide (as SO3)) annual load (2004 – 2015)

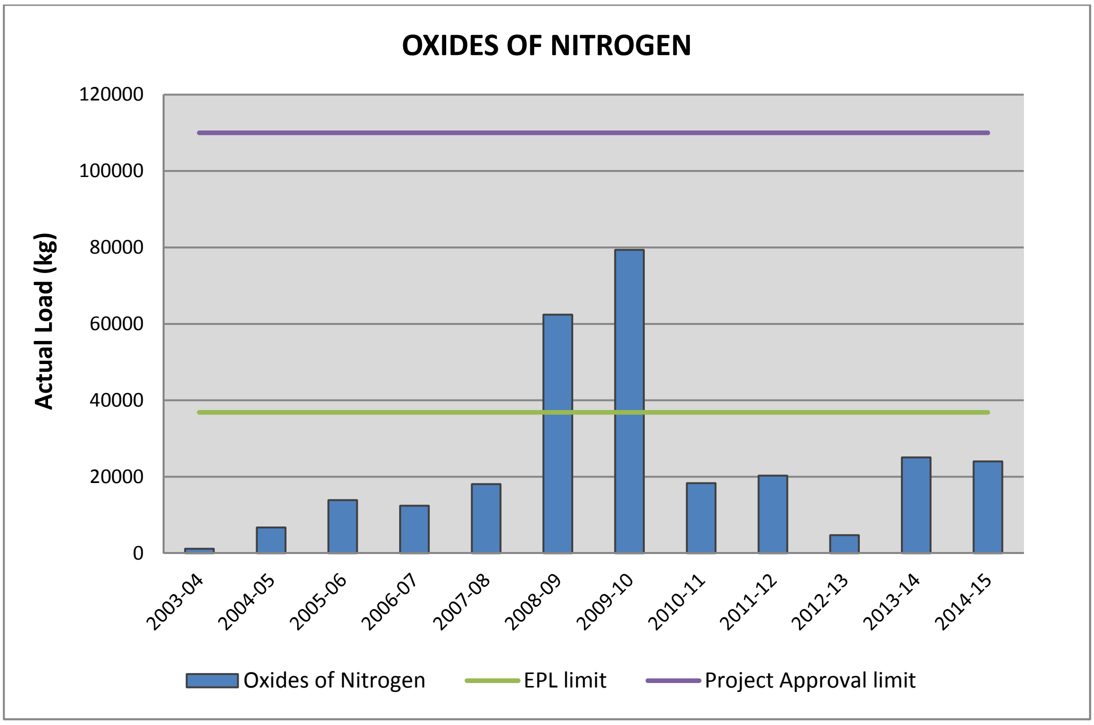

Figure 34 **Nitrogen Oxides Annual Load (2004 – 2015)**

5.5 Noise

The 2010 EA predicted that the operational noise levels from the expanded facility would not change significantly from that already approved, and would be below the project specific noise criteria at all existing receptors under calm and prevailing weather conditions.

The Project Approval specifies more stringent noise limits than those set out in the EPL. Under the Project Approval, the noise generated from the facility must not exceed 35 dB(A) for all periods including day, evening and night.

Monitoring results for the 2015 reporting period indicate that noise emissions from NCIA were in compliance with the EPL and Project Approval noise criteria for all time periods, including the sleep disturbance criteria.

Historical noise monitoring results at the closest sensitive residential receiver (Kenvil Close) are provided in Figure 35 – Figure 37. Noise levels from the facility for the day, evening and night periods were estimated based on operator notes taken during the noise survey and free field calculations. On many occasions the NCIA facility was not clearly audible over other dominant industrial and traffic noise sources nearby.

No trends in the noise monitoring are clearly discernible, with historical noise emissions overall consistent over time and generally complying with noise limits. No exceedance of the day, evening or night criteria has been recorded since 2009.

During the daytime for the past seven years, the NCIA noise contribution was audible but not measurable. The current noise monitoring report noted that the acoustic environment at the Kenvil Close monitoring locations was impacted by noise from the construction of the Heritage Park subdivision on the old golf course site located between the monitoring location and the NCIA site. At Kenvil Close during each of the monitoring periods traffic noise from the New England Highway also contributed significantly to the background noise levels.

The 2010 EA indicated that the increase in background levels in the Rutherford region was likely to be due to the development of new industrial facilities in the Rutherford Industrial Estate.

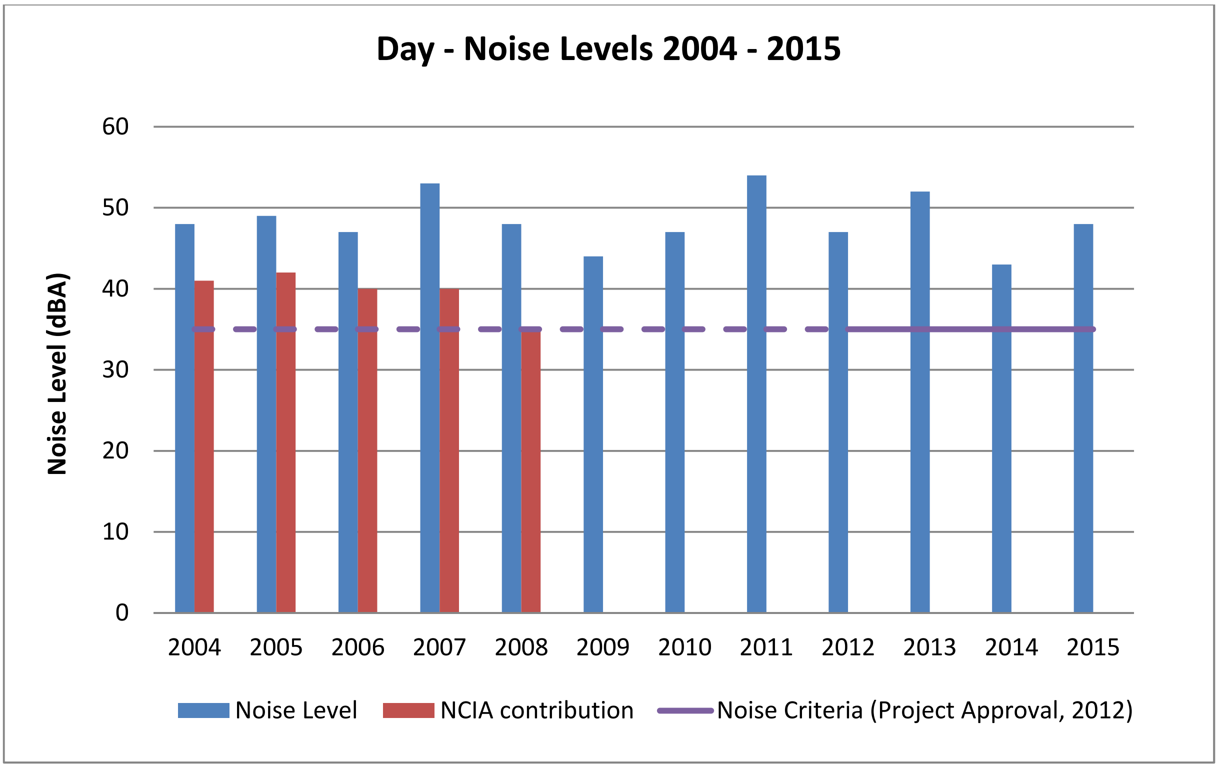

Figure 35 Day Noise Levels 2004 – 2015

Note 1: 2009, 2010, 2011, 2012, 2013, 2014 and 2015 – NCIA contribution audible but not measurable.

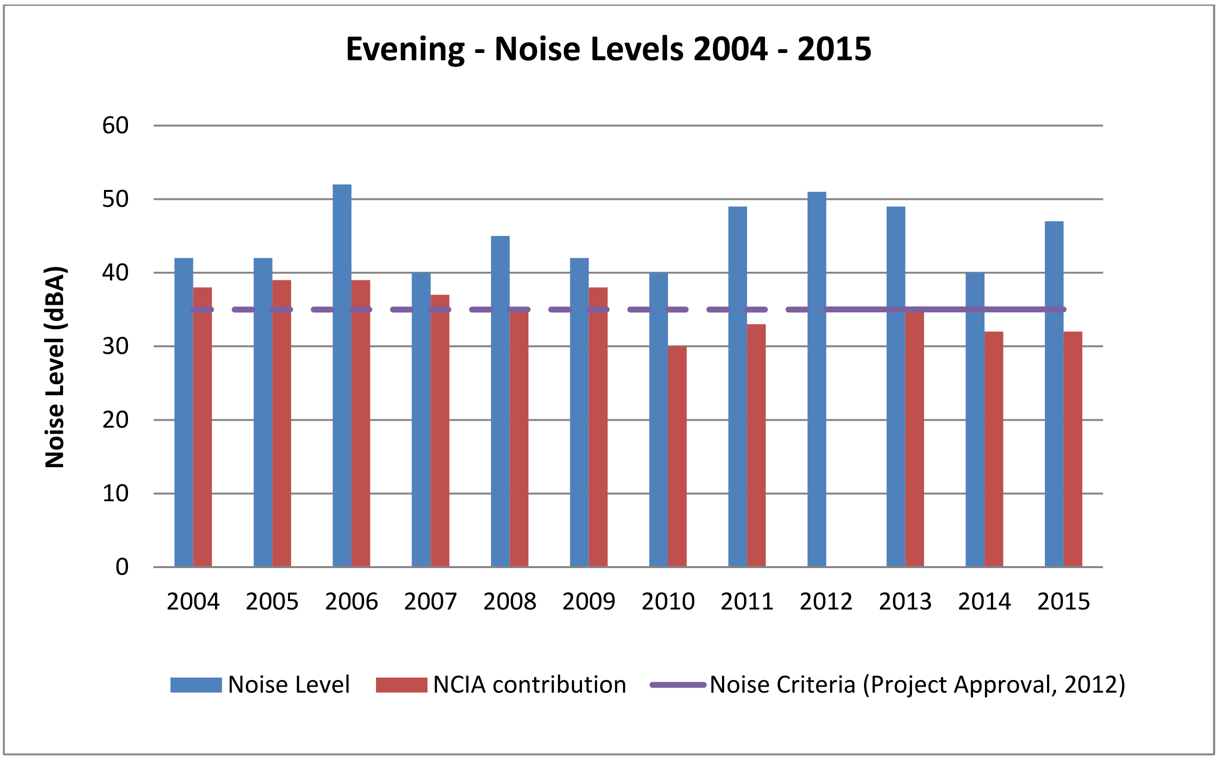

Figure 36 Evening Noise Levels 2004 – 2015

Note: 2012 – NCIA contribution audible but not measurable.

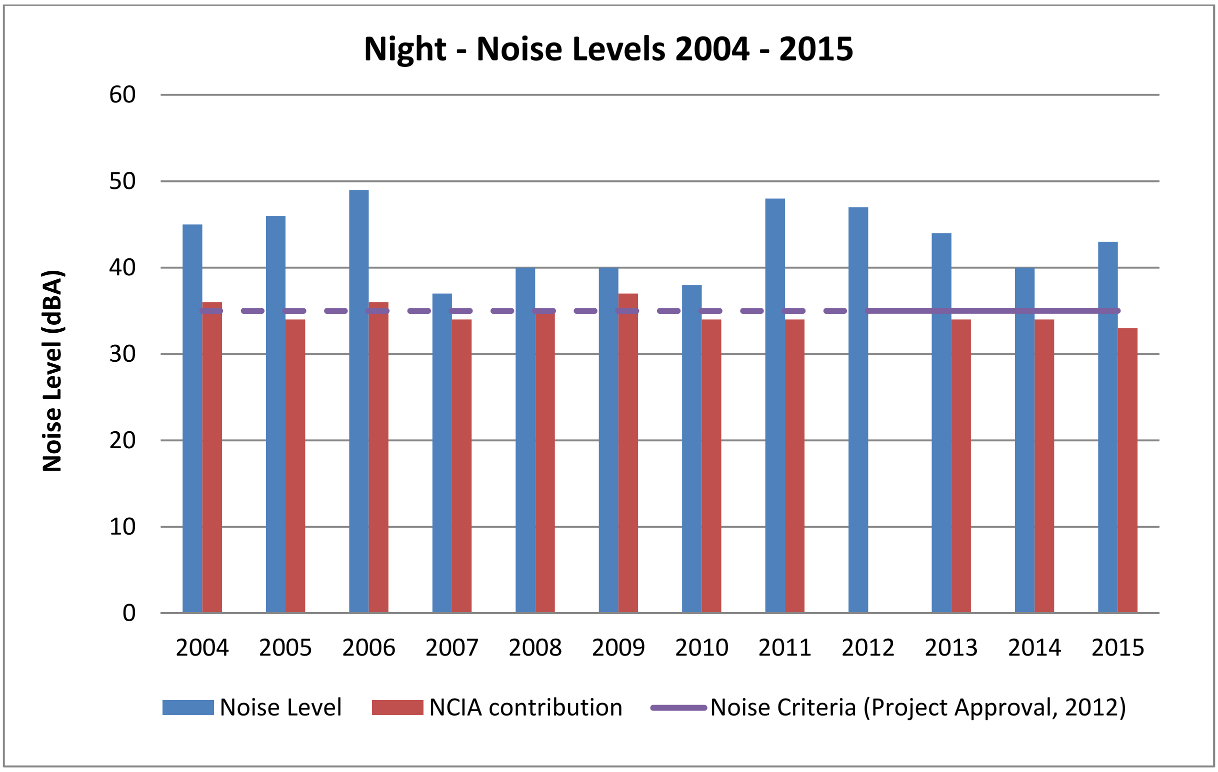

Figure 37 Night Noise Levels 2004 – 2015

Note: 2012 – NCIA contribution audible but not measurable.

5.6 Water

5.6.1 Water Usage

The 2010 EA indicated that water consumption for the facility during Stages One–Four of the development would be approximately 1,772kL per week (approximately 92ML per annum). Stages Five–Eight of the development would be expected to use an equivalent volume of potable water as Stage One–Four, for a cumulative expected consumption of up to 3,544kL per week (approximately 184ML per annum).

Consumption of town-supplied water during the 2014-2015 annual return reporting period (i.e. 01 August 2014 – 31 July 2015) was approximately 47,000 kL (or 47ML), which is proportionally within the predictions of the EA provided that only Stages One–Two were operational.

Likewise, it is anticipated that the 92ML/year threshold value over which NCIA will require HCW approval will not be reached until further stages of development are constructed and commissioned. Regardless, consultation with HWC was started during the 2010 EA process in provision of future developments. NCIA will resume the consultation process as required when further development stages are planned.

5.6.2 Process Water Management

As the requirement for water from NCIA has the potential to place stress on the current town-water reticulation system (particularly during periods of drought), NCIA has endeavoured to minimise its reliance and demand for town water. Particularly, all process and wash-down water is recycled within the operation of the facility, and rainwater is captured as efficiently as possible and reused.

The NCIA facility does not result in the discharge of process or washdown water to the natural system. Rather, water used for process requirements is discharged in the form of steam to the atmosphere. Approximately 95% of all washdown water is captured within an internal reticulation system and recirculated for reuse as process water. The remaining 5% of washdown water would evaporate.

Apart from discharges to the sewer, there is no discharge of process or washdown water from the site other than as steam. Materials stored for the manufacturing process are housed within the building to ensure that there are no spills from the site.

Plant equipment operated at the facility is maintained regularly and in accordance with manufacturer's specifications to ensure that water use, reuse and recycling efficiencies are optimised. The consumption of water is continually monitored via metering systems associated with plant equipment.

5.6.3 Stormwater Quality

Historical trends (2009-present) in water quality for pH and EC are presented in Figure 38 and Figure 39, respectively. The 2010 EA made no provision of stormwater quality performance measures or indicators.

- Long term data shows that pH levels in pond 4 have generally been on a slowly increasing trend since 2009. On occasion since 2009 recorded pH values occurred beyond the ANZECC pH trigger values, with the upper threshold limit exceeded more often than the lower limit (refer to Figure 38) , highlighting a potential alkalinity issue. However, the 2015 data seem to indicate a decrease in pH levels during the reporting period, noticeably reversing a trend of several years of apparently increasing average pH values. Future monitoring and reporting will established more confidently whether pH levels are decreasing.
- EC results since 2011 and inclusive of the 2015 reporting period have remained relatively constant, and oscillating around a relatively low average (refer to Figure 39). EC values are generally within the ANZECC guidelines trigger values and indicate that the stormwater is non-saline.

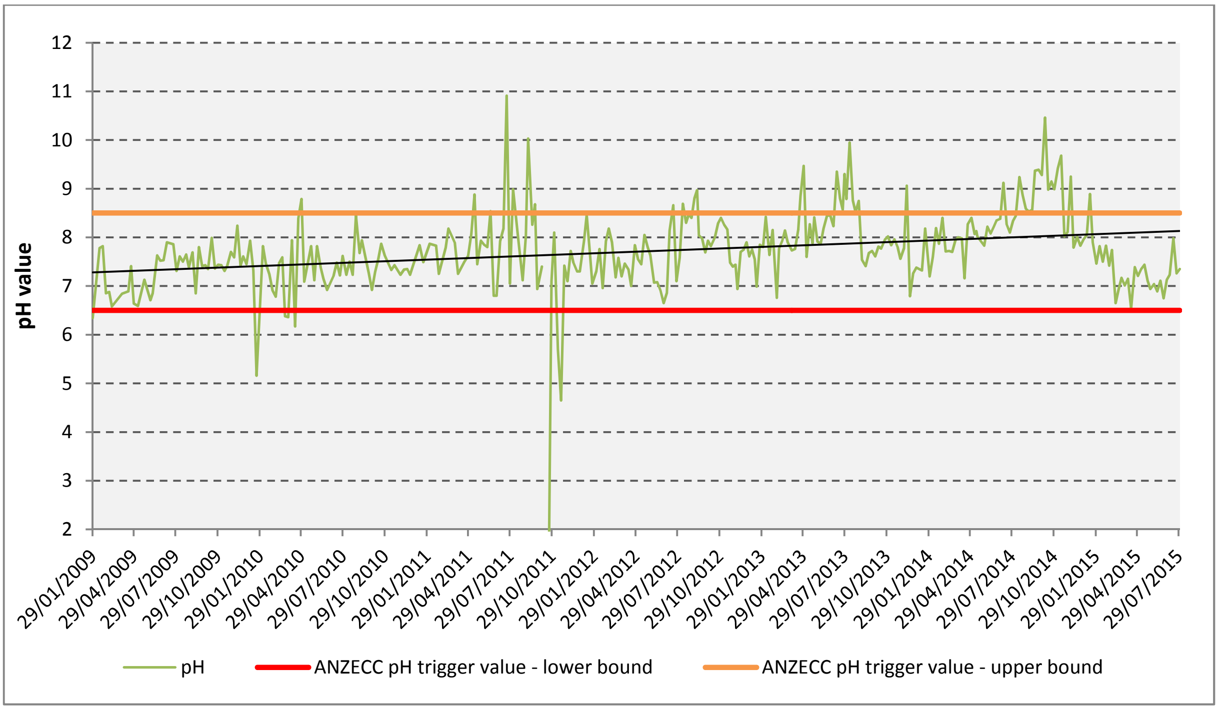

Figure 38 Stormwater Quality, pH – Pond 4 (2009-2015)

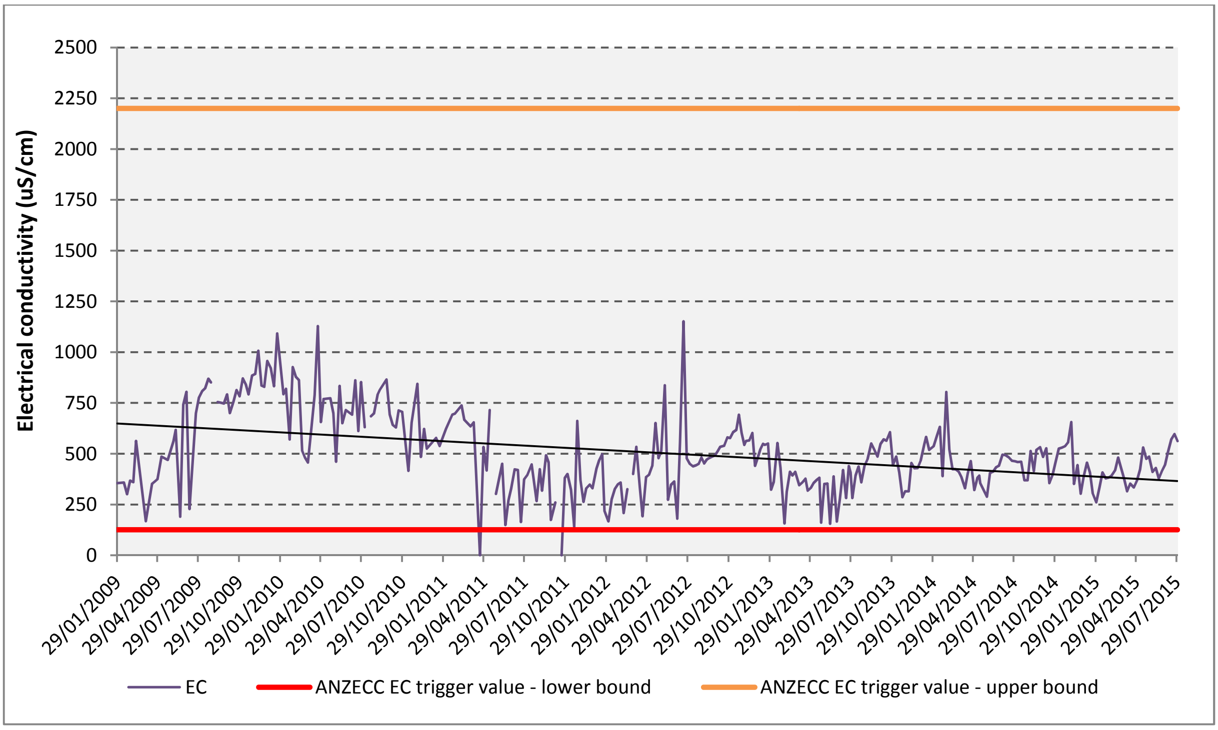

Figure 39 Stormwater Quality, EC – Pond 4 (2009-2015)

5.6.4 Stormwater Management

The existing stormwater management system was designed to minimise the changes to the flow regime from Stages One–Four of the project. The management of stormwater at the site is achieved via four water detention basins which are connected by grass swales (surface water flows from roof, roadway and landscaped areas) and a series of pits and pipe work (servicing the car park and hardstand areas).

The grass swales have been designed to control surface flow velocities from runoff areas to no greater than 2 m/s. Final low flow stormwater discharges from the site occur at the channel outlet, located at south eastern corner of the site. Discharged water is then connected directly to the existing artificial wetland.

The detention basins have been designed with sufficient retention to reduce peak stormwater flows and improve the quality of water ultimately discharged from the site. The combined surface area of the four water detention basins is approximately 6,600 m^2, which represents approximately 6.6% of the total catchment area. This exceeds the minimum requirement of 2% permanent water area defined in the Constructed Wetlands Manual (DLWC, 1998). As such, the level of water treatment offered by the wet detention system surpasses the guideline requirements.

As detailed in the 2010 EA, the existing stormwater management system will be modified and expanded if and when development Stages Five–Eight are constructed and commissioned.

5.7 Waste

5.7.1 Waste Generation

The 2010 EA stated that current production levels at the time, approximately 1% of all fired tiles were not eligible for sale (either as broken tiles or not passing NCIA's strict quality assurance process). That figure was used to estimate the total amount of fired waste tile at maximum production rate (i.e. with Stages Five – Eight operational), and predicted that approximately 2,720 tonnes of fired tiles waste would be generated per annum. The EA did not predict or specify the amount of green waste to be generated by the project.

The amount of fired waste during the reporting period (12% of total production) was higher than the predictions made in the EA, however close to NCIA's current operation targets.

5.7.2 Waste Management

The totality of green tile waste generated during production is reused in the manufacturing process and as such does not enter the overall waste stream leaving the site. Likewise, since 2013 approximately 5% of the total amount of fired waste has been reused in the manufacturing process (i.e. milled again and re-sent through production line). The remaining fired waste is stored in a bunker on site ensuring that it is free of cardboard and other debris. It is ultimately reused in the construction industry for road base material and other developments, which greatly minimises the total amount of waste NCIA sends to landfill.

All fluoride compound waste is collected and disposed at an off-site licensed landfill.

All other waste (i.e. packaging waste, general office waste and lunch room waste is collected by a licenced recycling contractor. Incoming packaging waste such as pallets are reused wherever possible.

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6.0 Non-Compliances

6.1 2015 Non-Compliances Record

Although only reporting on a partial year, no non-compliances occurred during this AEMR's reporting period. This represents a better environmental performance than in the previous reporting periods during which non-compliances have been consistently recorded.

6.2 Incident Notification

As required by DP&E, NCIA duly notifies any incidents occurring on site and exceedances of regulatory criteria. Wherever possible, an email is sent to compliance@planning.nsw.gov.au within 24 hour of the incident / exceedance occurring (or being aware of the exceedance), detailing the nature of the incident and the response applied.

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7.0 Continuous Improvement Measures

Condition 60(j) of the Project Approval requires the AEMR to identify continuous improvement measures, outlining new developments in air quality and noise control, and detailing practices that have been implemented on the site during the previous year, to reduce air quality and noise impacts.

Emission concentrations of pollutants were all in accordance with EPL and Project Approval limits throughout the 2015 reporting period.

Noise monitoring results for the 2015 reporting period indicated that noise emissions from NCIA were in compliance with the EPL and Project Approval noise criteria for all time periods, including the sleep disturbance criteria. Noise monitoring confirmed that background noise levels during the day in the Rutherford industrial area remain high, and the NCIA contribution was audible but was not measurable.

Other environmental improvement measures recently implemented by NCIA are summarised in the following sections.

7.1 General Environmental Management

General environmental management actions undertaken by NCIA are outlined in Table 15.

Table 15 Timetable for Environmental Improvement Actions

Area of Concern	Identified Action	Completion Date
Baghouse equipment life time	Enclose Kiln baghouse.	Complete
Air quality	NCIA continues to research and test extensively to improve its raw materials and emissions. Particular attention is given to fluoride and sulphur when investigating new materials.	Ongoing
	Consider and implement more routine emissions testing.	
General stack maintenance	Install new components and perform repairs when necessary.	Ongoing
Plant maintenance	General housekeeping and investment in best practice.	Ongoing
Lighting review	Changed all factory lighting in 2014 for lower energy LED lights.	Monitoring electricity efficiency improvements
Vegetation planting	Native vegetation planting and maintenance as per the proposed landscape vegetation planting plan in the 2010 EA.	Ongoing for care and maintenance

7.2 Energy Efficiencies

A lot of NCIA's focus in recent times has been on achieving greater efficiencies. The objective is to achieve a greater tile production output for the same amount of power consumption and raw material input. For example, NCIA currently endeavours to improve the gas efficiency of the manufacturing process. Figure 40 shows the evolution in the last year (July 2014 to July 2015) of the amount of gas required (in gigajoules GJ) to produce one square metre of tiles, with data showing a steadily improving trend in gas efficiency.

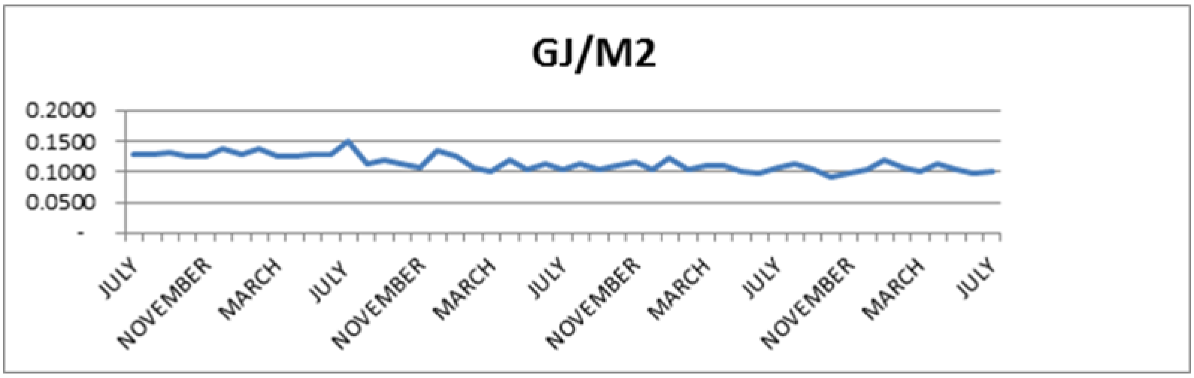

Figure 40 Gas Efficiency in Tile Manufacturing Process

In addition, NCIA is currently in the process of reducing the size and weight of their tiles with a view to reduce the amount of raw material inputs, energy and transport components whilst still achieving the same amount of saleable product output (m^2 of tiles).

Further, NCIA has recently installed on one production line a quality assurance machine before the kiln. This effectively reduces waste tiles going through the kiln and being fired, creating both a reduction in waste and a saving in energy consumption. Following on the effectiveness of this QA machine in reducing the amount of waste in the last year, NCIA has purchased an additional three that are to be installed in September/October 2015.

Finally, in early 2015 NCIA engaged with the NSW OEH to identify potential opportunities in relation to energy efficiency and research. A summary of identified opportunities and associated potential savings are provided in Table 16. The identified opportunities are being evaluated with some initiatives currently being trialled or rolled out in some of the NCIA groups other facilities in South Africa (for example the efficiency gas burners). NCIA will closely monitor the progress of these initiatives being implemented and will consider adopting measures accordingly and where consistent with business objectives.

Table 16 Efficiency Reviews – Summary of Opportunities

Description of Opportunity	Potential Electricity Savings (MWh per annum)	Potential Gas Savings (GJ per annum)	Potential GHG Savings (tonnes CO_2 per annum)
Notched V belts	151	-	160
Avoid leaving glazing line equipment running	155	-	164
Turn off second air wipe after press and install blower wipes	44	-	47
Install timer and switch to turn off warehouse induction lights at night	24	-	25
Install cooling chamber for tile cooling prior to inkjet	43	-	46
VSD on Comb air fan	234	-	248
Stop running scrap line v belt conveyor after kiln 1 (programming)	4	-	4
Install switches to allow switching off of T8 fluorescent lights	54	-	57
Purchasing policy for High Efficiency (E3) Motors	113	-	120
High efficiency burners (half replaced)	0	9,933	651
Poppi heat recovery option	-474	50,473	2,804
Stop bucket elevator when not required, resolve mechanical issues first	11	-	12

Description of Opportunity	Potential Electricity Savings (MWh per annum)	Potential Gas Savings (GJ per annum)	Potential GHG Savings (tonnes CO_2 per annum)
OEM Kiln heat recovery	76	26,488	1,816
Alternative combustion air preheat	0	8,500	557
Solar PV	139		147
TOTAL	**498**	**68,906**	**5,041**

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8.0 References

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Appendix A

Fluoride Impact on Vegetation – Visible Injury Expression

Appendix A Fluoride Impact on Vegetation Data

Appendix A 1 – Photographs of Monitoring Sites Locations (at time of Q2 2015)

Site 1 – Southeast corner of NCIA site

Site 2 – Gillette Close

Site 3 – Hill Top, Wollombi Road

Site 4 – Quarry Road, West End

Site 5 – NCIA Entrance

Site 6 – 100-104 Kyle Street

Site 7 – Gardiner Road

Site 8 – Maitland Saleyards

Site 9 – 200 Anambah Road (Analogue Site)

Appendix A 2 – Visual Injury Expression Survey Results (Q1 & Q2 2015)

Table A 1 Condition Assessment of Selected Flora Species at the Monitoring Sites Located Southeast of NCIA Premises

Site/Species	Assessment period	Emissions injury	Total injury	Foliar age years *	Chlorosis index	Cupping index	Tip Necrosis index	Marginal Necrosis index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction# – buds or flowers	Reproduction# – fruits
Site 1 – Southeast corner of NCIA site															
E. moluccana	Q1 2015	**0**	**2**	*new*	*0*	*0*	*0*	*0*	*0*	*2*	*0*	*0*	*0*	*x*	*x*
		2	**2**	*old*	*2*	*2*	*0*	*0*	*0*	*1*	*2*				
	Q2 2015	**0**	**1**	*new*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	*0*	*x*	*x*
		2	**2**	*old*	*2*	*1*	*0*	*0*	*0*	*1*	*1*				
Site 2 – Gillette Close															
E. acmenoides	Q1 2015	**0**	**1**	*new*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	*0*	✓	*x*
		1	**1**	*old*	*0*	*1*	*0*	*0*	*0*	*0*	*1*				
	Q2 2015	**0**	**0**	*new*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	✓	✓
		2	**2**	*old*	*2*	*0*	*1*	*0*	*0*	*1*	*1*				
C. maculata	Q1 2015	**-**	**-**	*new*	-	-	-	-	-	-	-	*2*	*2*	*x*	*x*
		3	**3**	*old*	*1*	*3*	*2*	*0*	*0*	*1*	*1*				
	Q2 2015	**-**	**-**	*new*	-	-	-	-	-	-	-	*2*	*0*	*x*	*x*
		3	**3**	*old*	*1*	*3*	*1*	*1*	*1*	*1*	*0*				
Site 3 – Hill top, Wollombi Road															
C. maculata	Q1 2015	**-**	**-**	*new*	-	-	-	-	-	-	-	*0*	*0*	✓	*x*
		1	**1**	*old*	*0*	*1*	*1*	*0*	*0*	*1*	*1*				
	Q2 2015	**-**	**-**	*new*	-	-	-	-	-	-	-	*0*	*0*	✓	*x*
		1	**1**	*old*	*0*	*0*	*1*	*0*	*0*	*1*	*1*				
E. paniculata	Q1 2015	**0**	**3**	*new*	*0*	*0*	*0*	*0*	*0*	*3*	*0*	*0*	*0*	✓	*x*
		0	**3**	*old*	*0*	*0*	*0*	*0*	*0*	*3*	*1*				
	Q2 2015	**0**	**2**	*new*	*0*	*0*	*0*	*0*	*0*	*2*	*0*	*0*	*0*	*x*	✓
		0	**1**	*old*	*0*	*0*	*0*	*0*	*0*	*1*	*1*				
Site 4 – Quarry Road, west end															
C. maculata	Q1 2015	**-**	**-**	*new*	-	-	-	-	-	-	-	*0*	*0*	*x*	*x*
		3	**3**	*old*	*0*	*3*	*1*	*0*	*0*	*3*	*2*				
	Q2 2015	**-**	**-**	*new*	-	-	-	-	-	-	-	*0*	*0*	*x*	*x*
		2	**4**	*old*	*0*	*2*	*0*	*0*	*0*	*4*	*2*				
E. paniculata	Q1 2015	**0**	**1**	*new*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	*0*	*x*	✓
		0	**2**	*old*	*0*	*0*	*0*	*0*	*0*	*2*	*1*				
	Q2 2015	**0**	**3**	*new*	*0*	*0*	*0*	*0*	*0*	*3*	*2*	*0*	*0*	✓	*x*
		0	**2**	*old*	*0*	*0*	*0*	*0*	*0*	*1*	*2*				

* *'new' = assessment undertaken on current season leaves, 'old' = assessment undertaken on previous seasons leaves.*

\# *For the assessment of reproductive strictures, '✓' means presence and 'x' means absence*

\- *Indicates no visual assessment was undertaken due to the absence of foliage.*

Table A 2 Condition Assessment of Selected Flora Species at the Monitoring Sites Located in Rutherford and Farley Residential Areas

Site/Species	Assessment period	Emissions injury	Total injury	Foliar age years *	Chlorosis index	Cupping index	Tip Necrosis index	Marginal Necrosis index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction# – buds or flowers	Reproduction# – fruits
Site 5 – NCIA entrance															
C. maculata	Q1 2015	**-**	**-**	*new*	-	-	-	-	-	-	-	*2*	*2*	*x*	*x*
		3	**3**	*old*	*3*	*2*	*2*	*0*	*0*	*1*	*2*				
	Q2 2015	**-**	**-**	*new*	-	-	-	-	-	-	-	*2*	*2*	*x*	*x*
		3	**3**	*old*	*3*	*2*	*2*	*0*	*0*	*2*	*2*				
E. amplifolia	Q1 2015	**0**	**1**	*new*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*2*	*2*	✓	*x*
		1	**1**	*old*	*0*	*0*	*1*	*0*	*0*	*1*	*1*				
	Q2 2015	**-**	**-**	*new*	-	-	-	-	-	-	-	*2*	*2*	✓	*x*
		1	**2**	*old*	*0*	*0*	*1*	*0*	*0*	*2*	*1*				
Site 6 – 99-108 Kyle Street															
A. floribunda	Q1 2015	**3**	**3**	*new*	*0*	*3*	*1*	*0*	*0*	*2*	*3*	*0*	*4*	*x*	*x*
		2	**2**	*old*	*2*	*1*	*0*	*0*	*0*	*1*	*2*				
	Q2 2015	**1**	**2**	*new*	*0*	*0*	*1*	*0*	*0*	*1*	*2*	*0*	*4*	*x*	*x*
		1	**1**	*old*	*2*	*2*	*1*	*1*	*0*	*0*	*0*				
E. amplifolia	Q1 2015	**2**	**2**	*new*	*0*	*0*	*2*	*0*	*0*	*0*	*0*	*0*	*0*	✓	*x*
		2	**2**	*old*	*0*	*1*	*2*	*0*	*0*	*2*	*2*				
	Q2 2015	**-**	**-**	*new*	-	-	-	-	-	-	-	*0*	*0*	✓	*x*
		2	**2**	*old*	*0*	*2*	*1*	*0*	*0*	*2*	*2*				
Site 7 – Gardiner Road															
C. maculata	Q1 2015	**2**	**2**	*new*	*0*	*2*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	✓	*x*
		3	**3**	*old*	*3*	*2*	*2*	*0*	*0*	*1*	*1*				
	Q2 2015	**4**	**4**	*new*	*4*	*2*	*0*	*0*	*0*	*1*	*1*	*0*	*0*	✓	*x*
		3	**3**	*old*	*3*	*3*	*2*	*0*	*0*	*1*	*1*				
E. paniculata	Q1 2015	**-**	**-**	*new*	-	-	-	-	-	-	-	*0*	*0*	✓	*x*
		1	**1**	*old*	*0*	*0*	*1*	*0*	*0*	*1*	*0*				
	Q2 2015	**-**	**-**	*new*	-	-	-	-	-	-	-	*0*	*0*	✓	✓
		3	**3**	*old*	*0*	*0*	*3*	*0*	*0*	*1*	*2*				
Site 8 – Maitland saleyards, Kyle Street															
C. maculata	Q1 2015	**0**	**1**	*new*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	*0*	*x*	*x*
		3	**3**	*old*	*2*	*3*	*2*	*0*	*0*	*0*	*1*				
	Q2 2015	**4**	**4**	*new*	*4*	*3*	*2*	*0*	*0*	*1*	*0*	*0*	*0*	*x*	*x*
		4	**4**	*old*	*2*	*2*	*4*	*0*	*0*	*0*	*1*				
E. moluccana	Q1 2015	**0**	**0**	*new*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	✓	*x*

Site/Species	**Assessment period**	**Emissions injury**	**Total injury**	**Foliar age years ***	**Chlorosis index**	**Cupping index**	**Tip Necrosis index**	**Marginal Necrosis index**	**Anthocyanin index**	**Leaf chewing index**	**Sap sucking index**	**Branch dieback**	**Crown density**	**Reproduction# – buds or flowers**	**Reproduction# – fruits**
		0	**1**	*old*	*0*	*0*	*0*	*0*	*0*	*1*	*1*				
	Q2 2015	**0**	**1**	*new*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	*0*	*x*	*x*
		1	**1**	*old*	*0*	*0*	*1*	*0*	*0*	*0*	*1*				
E. amplifolia	Q1 2015	**0**	**0**	*new*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	✓	*x*
		0	**1**	*old*	*0*	*0*	*0*	*0*	*0*	*1*	*1*				
	Q2 2015	**-**	**-**	*new*	*0*	*0*	*1*	*0*	*0*	*0*	*1*	*0*	*0*	✓	*x*
		0	**1**	*old*	*0*	*0*	*0*	*0*	*0*	*1*	*1*				
E. resinifera	Q1 2015	**2**	**2**	*new*	*0*	*2*	*0*	*0*	*0*	*0*	*2*	*0*	*0*	✓	*x*
		1	**1**	*old*	*0*	*0*	*1*	*0*	*0*	*1*	*1*				
	Q2 2015	**-**	**-**	*new*	-	-	-	-	-	-	-	*0*	*0*	✓	*x*
		0	**1**	*old*	*0*	*0*	*0*	*0*	*0*	*1*	*0*				

* *'new' = assessment undertaken on current season leaves, 'old' = assessment undertaken on previous seasons leaves.*

\# *For the assessment of reproductive strictures, '✓' means presence and 'x' means absence*

\- *Indicates no visual assessment was undertaken due to the absence of foliage.*

Table A 3 Summary Condition Assessment of Selected Tree Species at Anambah Homestead (Reference Site)

Site/Species	Assessment period	Emissions injury	Total injury	Foliar age years *	Chlorosis index	Cupping index	Tip Necrosis index	Marginal Necrosis index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction# – buds or flowers	Reproduction# – fruits
Site 9 – 200 Anambah Road (Reference site)															
Vitis vinifera	Q1 2015	**0**	**0**	*new*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*x*	*x*
	Q2 2015	**-**	**-**	-	-	-	-	-	-	-	-	-	-	-	-
Araucaria cunninghamii	Q1 2015	**0**	**0**	*mix*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*x*	*x*
	Q2 2015	**0**	**0**	*mix*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*x*	*x*
Casuarina torulosa	Q1 2015	**0**	**0**	*mix*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	✓	*x*
	Q2 2015	**0**	**0**	*mix*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*x*	*x*
Corymbia maculata	Q1 2015	**1**	**1**	*mix*	*0*	*1*	*1*	*0*	*0*	*1*	*1*	*0*	*0*	*x*	*x*
	Q2 2015	**3**	**3**	*mix*	*0*	*3*	*1*	*0*	*0*	*1*	*1*	*0*	*0*	*x*	*x*
E. tereticornis	Q1 2015	**0**	**1**	*mix*	*0*	*0*	*0*	*0*	*0*	*1*	*1*	*0*	*0*	*x*	*x*
	Q2 2015	**0**	**2**	*mix*	*0*	*0*	*1*	*0*	*0*	*2*	*1*	*0*	*0*	*x*	*x*
Ficus macrophylla	Q1 2015	**0**	**1**	*mix*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	*0*	✓	*x*
	Q2 2015	**0**	**2**	*mix*	*0*	*0*	*0*	*0*	*0*	*2*	*0*	*0*	*0*	✓	*x*
Grevillea robusta	Q1 2015	**0**	**0**	*mix*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*x*	*x*
	Q2 2015	**0**	**0**	*mix*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*x*	*x*
E. acmenoides	Q1 2015	**0**	**2**	*mix*	*0*	*0*	*0*	*0*	*0*	*2*	*0*	*0*	*0*	*x*	✓
	Q2 2015	**0**	**3**	*mix*	*0*	*0*	*0*	*0*	*0*	*3*	*0*	*0*	*0*	*x*	✓
Olea europea	Q1 2015	**1**	**1**	*mix*	*0*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*x*	*x*
	Q2 2015	**2**	**2**	*mix*	*0*	*2*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*x*	*x*

* *'new' = assessment undertaken on current season leaves, 'mix' = combined assessment undertaken on both current and previous seasons leaves.*

\# *For the assessment of reproductive strictures, '✓' means presence and 'x' means absence*

\- *Indicates no visual assessment was undertaken due to the absence of foliage.*

Appendix A 3 – Foliage Condition Photographs (Q1 & Q2 2015)

Site 1 – Southeast corner of NCIA site		
Species	**Q1 2015**	**Q2 2015**
Eucalyptus moluccana		
Site 2 – Gillette Close		
Species	**Q1 2015**	**Q2 2015**
Eucalyptus acmenoides		
Corymbia maculata		

<table>
<tr><th colspan="3">Site 3 – Hill top, Wollombi Road</th></tr>
<tr><th>Species</th><th>Q1 2015</th><th>Q2 2015</th></tr>
<tr><td>Corymbia maculata</td><td></td><td></td></tr>
<tr><td>Eucalyptus paniculata</td><td></td><td></td></tr>
<tr><th colspan="3">Site 4 – Quarry Road, West End</th></tr>
<tr><th>Species</th><th>Q1 2015</th><th>Q2 2015</th></tr>
<tr><td>Corymbia maculata</td><td></td><td></td></tr>
</table>

Site 4 – Quarry Road, West End		
Species	**Q1 2015**	**Q2 2015**
Eucalyptus paniculata		

Site 5 – NCIA Entrance		
Species	***Q1 2015***	***Q2 2015***
Corymbia maculata		
Eucalyptus amplifolia		

Site 6 – 100-104 Kyle Street		
Species	**Q1 2015**	**Q2 2015**
Angophora floribunda		
Eucalyptus amplifolia		
Site 7 – Gardiner Road		
Species	**Q1 2015**	**Q2 2015**
Corymbia maculata		

Site 7 – Gardiner Road		
Species	**Q1 2015**	**Q2 2015**
Eucalyptus paniculata		
Site 8 – Maitland Saleyards		
Species	**Q1 2015**	**Q2 2015**
Corymbia maculata		
Eucalyptus moluccana		

<table>
<tr><th colspan="3">Site 8 – Maitland Saleyards</th></tr>
<tr><th>Species</th><th>Q1 2015</th><th>Q2 2015</th></tr>
<tr><td>Eucalyptus amplifolia</td><td></td><td></td></tr>
<tr><td>Eucalyptus resinifera</td><td></td><td></td></tr>
</table>

Appendix A 4 – Historical Visible Expression of Injury Symptoms in Selected Species

Table A 4 Annual Comparison of Visible Injury Expression in one-year-old Foliage from Selected Tree Species in the Rutherford Area

Site	Survey Quarter	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits
NCIA Premises – *Eucalyptus moluccana*															
	Q4 2007	**2**	2	1	2	0	0	0	0	2	0	0	0	✓	✓
	Q1 2008	**1**	4	1	1	0	0	0	0	4	3	0	0	0	0
	Q2 2008	**1**	4	1	1	0	1	1	2	4	3	0	0	0	0
	Q3 2008	**2**	3	1	2	1	1	1	2	3	3	0	0	0	0
	Q4 2008	**0**	5	1	0	0	0	0	2	5	3	0	0	0	0
	Q1 2009	**2**	3	1	2	1	1	0	2	3	3	0	0	0	0
	Q2 2009	**1**	3	1	1	1	1	0	3	3	3	0	0	0	0
	Q3 2009	**1**	3	1	1	1	1	0	3	3	3	0	0	0	0
	Q4 2009	**0**	4	1	0	0	0	0	0	4	2	0	0	0	0
	Q1 2010	**0**	3	1	0	0	0	0	3	3	2	0	0	0	0
	Q2 2010	**0**	3	1	0	0	0	0	3	3	2	0	0	0	0
	Q3 2010	**0**	3	1	0	0	0	0	3	3	2	0	0	0	0
	Q4 2010	**2**	4	1	0	0	0	2	3	4	2	0	0	0	0
	Q1 2011	**0**	3	1	0	0	0	0	2	3	2	0	0	0	0
	Q2 2011	**-**	-	1	-	-	-	-	-	-	-	-	-	-	-
1	Q3 2011	**0**	4	1	0	0	0	0	4	3	2	0	0	0	0
	Q4 2011	**2**	3	1	0	0	0	0	2	3	2	1	1	0	0
	Q1 2012	**2**	3	1	2	0	1	0	0	3	2	1	0	0	0
	Q2 2012	**1**	3	1	1	1	0	0	2	3	2	1	0	0	0
	Q3 2012	**1**	3	1	0	1	1	0	3	2	2	2	0	0	0
	Q4 2012	**1**	2	1	0	0	0	0	0	2	2	1	1	0	0
	Q1 2013	**1**	3	1	0	1	0	0	0	3	2	2	1	0	0
	Q2 2013	**2**	2	1	2	1	0	0	0	1	1	2	2	0	0
	Q3 2013	**2**	2	1	2	1	0	0	0	1	1	2	2	0	0
	Q4 2013	**3**	3	1	3	2	0	0	0	2	2	1	1	0	0
	Q1 2014	**1**	1	1	1	1	0	0	0	0	1	0	0	0	0
	Q2 2014	**1**	1	1	1	1	0	0	0	1	1	0	0	0	0
	Q3 2014	**1**	1	1	0	0	1	0	1	0	1	0	0	0	0
	Q4 2014	**2**	2	1	2	1	0	0	0	1	1	0	0	0	0
	Q1 2015	**2**	2	1	2	2	0	0	0	1	2	0	0	0	0
	Q2 2015	**2**	2	1	2	1	0	0	0	1	1	0	0	0	0

Site	Survey Quarter	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits
NCIA Entry – *Eucalyptus amplifolia*															
5	Q3 2007	**1**	1	1	0	0	1	1	1	1	1	0	0	✓	0
	Q4 2007	**2**	4	1	2	0	2	0	3	4	2	0	0	✓	✓
	Q1 2008	**2**	2	1	2	0	2	0	0	1	2	0	0	✓	✓
	Q2 2008	**2**	2	1	2	0	2	0	0	2	2	0	0	✓	✓
	Q3 2008	**1**	1	1	1	0	1	0	0	1	1	0	0	✓	✓
	Q4 2008	**2**	3	1	0	0	2	0	2	3	2	0	0	✓	✓
	Q1 2009	**2**	2	1	1	0	2	1	0	1	2	0	0	0	0
	Q2 2009	**2**	2	1	1	0	2	1	0	2	2	0	0	✓	✓
	Q3 2009	**2**	3	1	1	0	2	0	0	3	3	0	0	✓	✓
	Q4 2009	**2**	3	1	0	0	2	0	3	3	2	0	1	0	0
	Q1 2010	**0**	3	1	0	0	0	0	3	3	2	0	0	0	0
	Q2 2010	**-**	-	1	-	-	-	-	-	-	-	-	-	-	-
	Q3 2010	**-**	-	1	-	-	-	-	-	-	-	-	-	-	-
	Q4 2010	**2**	3	1	0	0	2	0	0	3	2	0	0	0	0
	Q1 2011	**-**	-	1	-	-	-	-	-	-	-	-	-	-	-
	Q2 2011	**-**	-	1	-	-	-	-	-	-	-	-	-	-	-
	Q3 2011	**1**	3	1	0	0	1	0	0	3	3	0	0	✓	0
	Q4 2011	**0**	2	1	0	0	0	0	0	1	2	0	0	✓	0
	Q1 2012	**1**	3	1	0	1	1	0	0	3	3	0	0	✓	✓
	Q2 2012	**1**	3	1	1	1	0	0	0	3	2	0	1	✓	✓
	Q3 2012	**2**	3	1	0	1	2	1	1	2	3	0	1	✓	✓
	Q4 2012	**1**	1	1	0	0	1	0	0	1	1	1	0	✓	✓
	Q1 2013	**0**	1	1	0	0	0	0	0	1	1	1	0	✓	✓
	Q2 2013	**0**	1	1	0	0	0	0	0	1	1	2	2	✓	0
	Q3 2013	**0**	1	1	0	0	0	0	0	1	1	2	2	✓	0
	Q4 2013	**1**	1	1	0	0	1	0	0	1	1	1	2	✓	0
	Q1 2014	**1**	1	1	0	0	1	0	0	1	1	2	2	✓	0
	Q2 2014	**0**	3	1	0	0	0	0	0	3	0	2	2	0	0
	Q3 2014	**2**	2	1	0	0	2	0	0	2	2	2	2	✓	0
	Q4 2014	**1**	2	1	0	0	1	0	0	1	2	2	2	✓	0
	Q1 2015	**1**	1	1	0	0	1	0	0	1	1	2	2	✓	0
	Q2 2015	**1**	2	1	0	0	1	0	0	2	1	2	2	✓	0

Site	Survey Quarter	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits
NCIA Entry – *Corymbia maculata*															
5	Q3 2007	**2**	2	1	2	0	1	1	0	1	1	0	0	✓	0
	Q4 2007	**4**	4	1	4	0	2	0	0	2	4	0	0	0	0
	Q1 2008	**4**	3	1	4	1	2	0	0	1	3	0	0	✓	0
	Q2 2008	**4**	4	1	4	1	2	0	0	1	3	0	0	✓	0
	Q3 2008	**3**	3	1	3	0	2	0	0	1	3	0	0	0	0
	Q4 2008	**1**	2	1	1	0	0	0	0	0	2	0	0	0	0
	Q1 2009	**3**	3	1	3	0	3	0	0	1	2	0	0	0	0
	Q2 2009	**3**	3	1	2	0	3	0	0	1	2	0	0	0	0
	Q3 2009	**2**	2	1	1	0	2	0	0	1	2	0	0	0	0
	Q4 2009	**3**	4	1	2	0	3	1	3	4	2	0	2	✓	0
	Q1 2010	**3**	4	1	2	2	3	1	3	4	2	0	0	0	0
	Q2 2010	**3**	3	1	3	2	2	1	1	3	2	0	0	0	0
	Q3 2010	**3**	3	1	3	2	2	0	3	3	2	0	0	0	0
	Q4 2010	**3**	3	1	3	0	3	0	0	3	1	0	0	1	0
	Q1 2011	**3**	3	1	3	2	2	0	3	3	2	0	0	✓	0
	Q2 2011	**-**	-	1	-	-	-	-	-	-	-	-	-	-	-
	Q3 2011	**2**	3	1	2	2	2	0	0	2	3	0	0	✓	0
	Q4 2011	**3**	3	1	3	1	2	1	0	2	3	1	0	✓	0
	Q1 2012	**1**	3	1	1	1	1	0	0	2	3	0	0	✓	✓
	Q2 2012	**1**	3	1	1	1	1	0	0	1	3	0	0	0	✓
	Q3 2012	**1**	3	1	1	1	1	0	0	1	3	1	0	✓	0
	Q4 2012	**1**	2	1	0	1	1	0	0	0	2	1	0	✓	0
	Q1 2013	**2**	2	1	1	2	1	0	0	1	2	1	0	✓	0
	Q2 2013	**4**	4	1	4	2	2	0	0	1	1	2	2	0	0
	Q3 2013	**4**	4	1	4	2	2	0	0	1	1	2	2	0	0
	Q4 2013	**2**	2	1	2	1	2	0	0	1	2	1	2	✓	0
	Q1 2014	**3**	3	1	3	2	3	0	0	1	1	2	2	✓	0
	Q2 2014	**4**	4	1	4	1	2	0	0	1	1	2	2	✓	0
	Q3 2014	**2**	2	1	2	1	2	0	0	2	2	2	2	✓	0
	Q4 2014	**3**	3	1	3	2	3	0	0	0	1	2	2	0	0
	Q1 2015	**3**	3	1	3	2	2	0	0	1	2	2	2	0	0
	Q2 2015	**3**	3	1	3	2	2	0	0	2	2	2	2	0	0

Site	Survey Quarter	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits
11 Gardiner Road – *Corymbia maculata*															
7	Q3 2007	**1**	1	1	1	0	1	1	0	1	0	0	0	✓	0
	Q4 2007	**2**	3	1	2	0	2	0	3	3	0	0	0	0	0
	Q1 2008	**2**	2	1	2	0	2	1	0	1	2	0	0	✓	0
	Q2 2008	**2**	2	1	2	0	2	1	0	1	2	0	0	✓	0
	Q3 2008	**2**	2	1	2	0	1	1	1	2	2	0	0	0	0
	Q4 2008	**4**	4	1	4	0	3	2	3	3	3	0	2	✓	✓
	Q1 2009	**4**	4	1	4	0	3	2	2	3	2	0	2	0	0
	Q2 2009	**3**	3	1	3	1	3	2	2	1	2	0	2	0	0
	Q3 2009	**3**	3	1	3	1	3	2	2	1	2	0	1	0	0
	Q4 2009	**3**	3	1	3	2	3	0	2	3	2	0	1	0	0
	Q1 2010	**3**	3	1	3	2	3	0	1	3	2	0	1	0	0
	Q2 2010	**4**	4	1	3	2	4	3	2	3	2	0	1	0	0
	Q3 2010	**4**	4	1	4	2	3	3	2	2	2	0	0	0	0
	Q4 2010	**3**	3	1	3	2	3	0	0	3	1	0	1	0	✓
	Q1 2011	**3**	3	1	3	2	3	2	2	2	2	0	0	0	0
	Q2 2011	**-**	-	1	-	-	-	-	-	-	-	-	-	-	-
	Q3 2011	**3**	3	1	2	3	2	1	1	1	2	0	0	0	0
	Q4 2011	**1**	1	1	1	1	1	1	0	1	1	0	0	0	0
	Q1 2012	**3**	3	1	3	3	2	2	0	1	1	1	0	✓	✓
	Q2 2012	**3**	3	1	3	2	2	2	0	1	1	0	0	0	✓
	Q3 2012	**3**	3	1	3	2	3	1	0	1	1	1	0	✓	0
	Q4 2012	**3**	3	1	2	1	3	1	0	0	2	1	0	✓	0
	Q1 2013	**3**	3	1	3	3	3	1	0	0	1	1	0	0	0
	Q2 2013	**2**	2	1	2	1	2	0	0	0	1	2	2	0	0
	Q3 2013	**2**	2	1	2	1	2	0	0	0	1	2	2	0	0
	Q4 2013	**3**	3	1	3	3	3	0	0	0	2	0	0	0	0
	Q1 2014	**3**	3	1	3	1	3	0	0	0	1	0	0	0	0
	Q2 2014	**4**	4	1	2	1	4	1	0	0	1	0	0	✓	0
	Q3 2014	**4**	4	1	3	2	4	1	0	1	0	0	0	0	0
	Q4 2014	**3**	3	1	2	3	3	0	0	0	3	0	0	0	0
	Q1 2015	**3**	3	1	3	2	2	0	0	1	1	0	0	✓	0
	Q2 2015	**3**	3	1	3	3	2	0	0	1	1	0	0	✓	✓

Appendix A 5 – Analytical Laboratory Documentation (Q1 & Q2 2015)

CERTIFICATE OF ANALYSIS

Work Order	: **EN1510922**	Page	: 1 of 4
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: MR MATTHIEU CATTEAU	Contact	: Peter Keyte
Address	: 17 WARABROOK BOULEVARDE WARABROOK NSW, AUSTRALIA 2304	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
E-mail	: matthieu.catteau@aecom.com	E-mail	: peter.keyte@alsglobal.com
Telephone	: +61 02 4911 4900	Telephone	: +61 2 4014 2500
Facsimile	: +61 02 4911 4999	Facsimile	: +61 2 4967 7382
Project	: 60329408 Task 1.2	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: 60329408 Task 1.2	Date Samples Received	: 19-Mar-2015 14:43
C-O-C number	: ----	Date Analysis Commenced	: 21-Mar-2015
Sampler	: ----	Issue Date	: 25-Mar-2015 20:40
Site	: ----		
		No. of samples received	: 6
Quote number	: ----	No. of samples analysed	: 6

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

WORLD RECOGNISED ACCREDITATION

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.

Analytical Results

Sub-Matrix: **VEGETATION**
(Matrix: **BIOTA)**

			Client sample ID	**E. Moluccana Site 1**	**Native Grasses Site 3**	**E. Amplifolia Site 5**	**C. Maculata Site 5**	**C. Maculata Site 7**
			Client sampling date / time	[19-Mar-2015]	[19-Mar-2015]	[19-Mar-2015]	[19-Mar-2015]	[19-Mar-2015]
Compound	*CAS Number*	*LOR*	*Unit*	**EN1510922-001**	**EN1510922-002**	**EN1510922-003**	**EN1510922-004**	**EN1510922-005**
				Result	Result	Result	Result	Result
EK040V: Fluoride in Vegetation								
Fluoride	16984-48-8	10	mg/kg	**39.3**	<10.0	**146**	**15.8**	**58.9**

Analytical Results

Sub-Matrix: VEGETATION (Matrix: BIOTA)			Client sample ID	Vitis Vinifera Site 9	----	----	----	----
			Client sampling date / time	[19-Mar-2015]	----	----	----	----
Compound	CAS Number	LOR	Unit	EN1510922-006	--------	--------	--------	--------
				Result	Result	Result	Result	Result
EK040V: Fluoride in Vegetation								
Fluoride	16984-48-8	10	mg/kg	**10.4**	----	----	----	----

CERTIFICATE OF ANALYSIS

Work Order	: **EN1511677**	Page	: 1 of 4
Amendment	: **1**		
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: MS MAREE WELCH	Contact	: Peter Keyte
Address	: PO BOX 73 HUNTER REGION MC HRMC NSW NSW 2310	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
E-mail	: maree.welch@aecom.com	E-mail	: peter.keyte@alsglobal.com
Telephone	: +61 02 4911 4900	Telephone	: +61 2 4014 2500
Facsimile	: +61 02 4911 4999	Facsimile	: +61 2 4967 7382
Project	: 60329408 Task 1.2	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: 60329408 Task 1.2	Date Samples Received	: 19-May-2015 14:39
C-O-C number	: ----	Date Analysis Commenced	: 22-May-2015
Sampler	: MATTHIEU CATTEAU	Issue Date	: 27-May-2015 20:22
Site	: ----		
		No. of samples received	: 6
Quote number	: ----	No. of samples analysed	: 6

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

WORLD RECOGNISED ACCREDITATION

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Merrin Avery	Supervisor - Inorganic	Newcastle - Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.

- This report has been amended as a result of an error in sample identification numbers (IDs). All analysis results are as per the previous report

Analytical Results

Sub-Matrix: **VEGETATION**
(Matrix: **BIOTA)**

			Client sample ID	E. Moluccana Site 1 Leaves	Native Grasses Site 3 Grasses	C. Maculata Site 5 Leaves	E.Amplifolia Site 5 Leaves	C. Maculata Site 7 Leaves
			Client sampling date / time	[19-May-2015]	[19-May-2015]	[19-May-2015]	[19-May-2015]	[19-May-2015]
Compound	CAS Number	LOR	Unit	EN1511677-001	EN1511677-002	EN1511677-003	EN1511677-004	EN1511677-005
				Result	Result	Result	Result	Result
EK040V: Fluoride in Vegetation								
Fluoride	16984-48-8	10	mg/kg	**34.1**	**10.9**	**17.6**	**163**	**51.0**

Analytical Results

Sub-Matrix: **VEGETATION** (Matrix: **BIOTA**)			Client sample ID	**Vitis Vinifera Site 9 Leaves**	**----**	**----**	**----**	**----**
			Client sampling date / time	[19-May-2015]	----	----	----	----
Compound	CAS Number	LOR	Unit	**EN1511677-006**	**--------**	**--------**	**--------**	**--------**
				Result	Result	Result	Result	Result
EK040V: Fluoride in Vegetation								
Fluoride	16984-48-8	10	mg/kg	**20.1**	----	----	----	----

Appendix B

Meteorological Monitoring - Wind Roses

Appendix B Meteorological Monitoring - Wind Roses

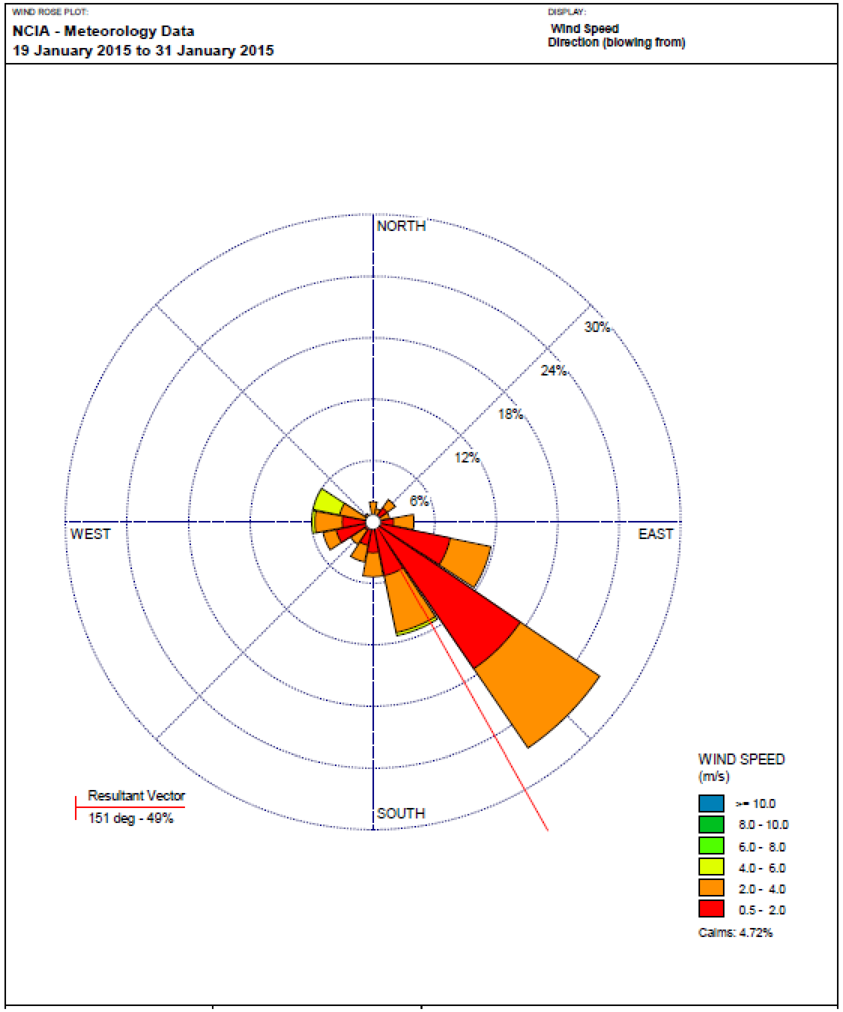

Figure B 1 Wind Speed and Direction (January 2015)

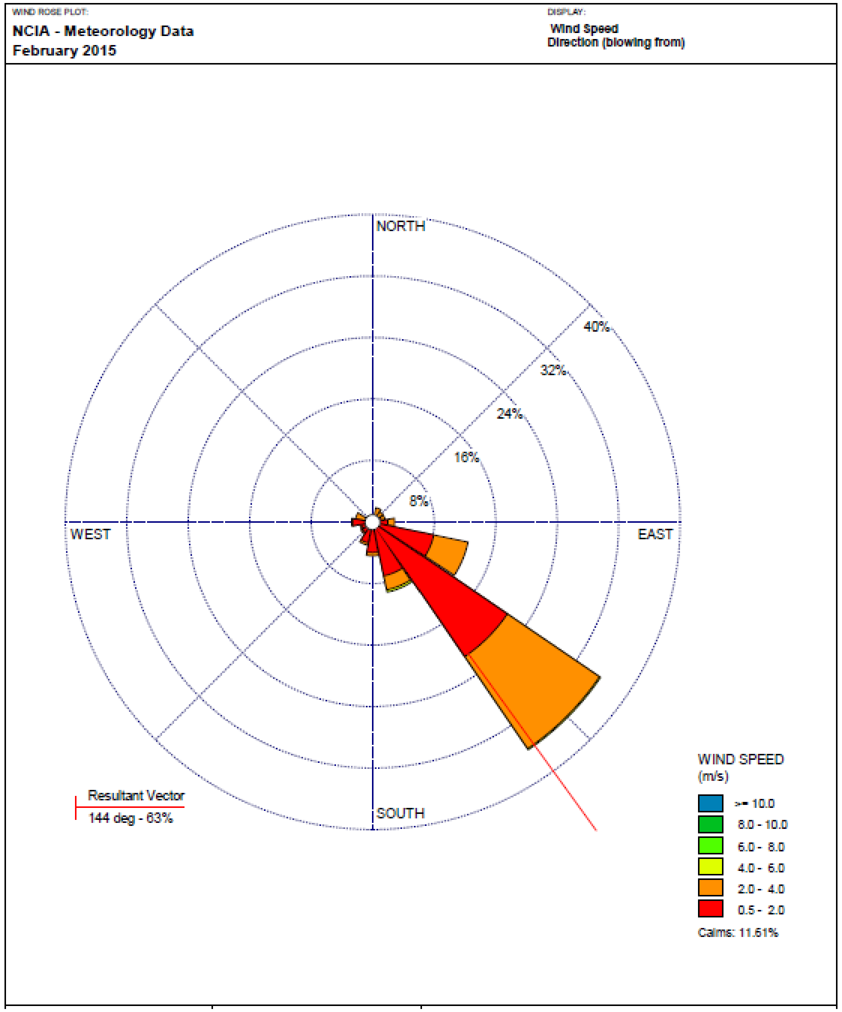

Figure B 2 Wind Speed and Direction (February 2015)

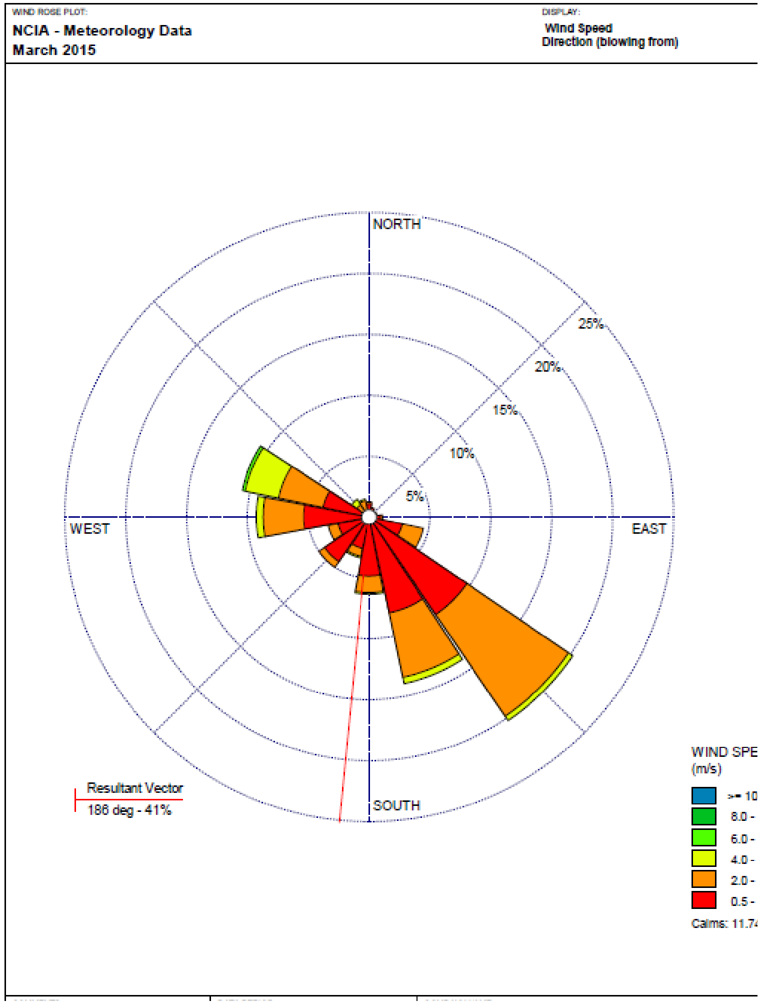

Figure B 3 Wind Speed and Direction (March 2015)

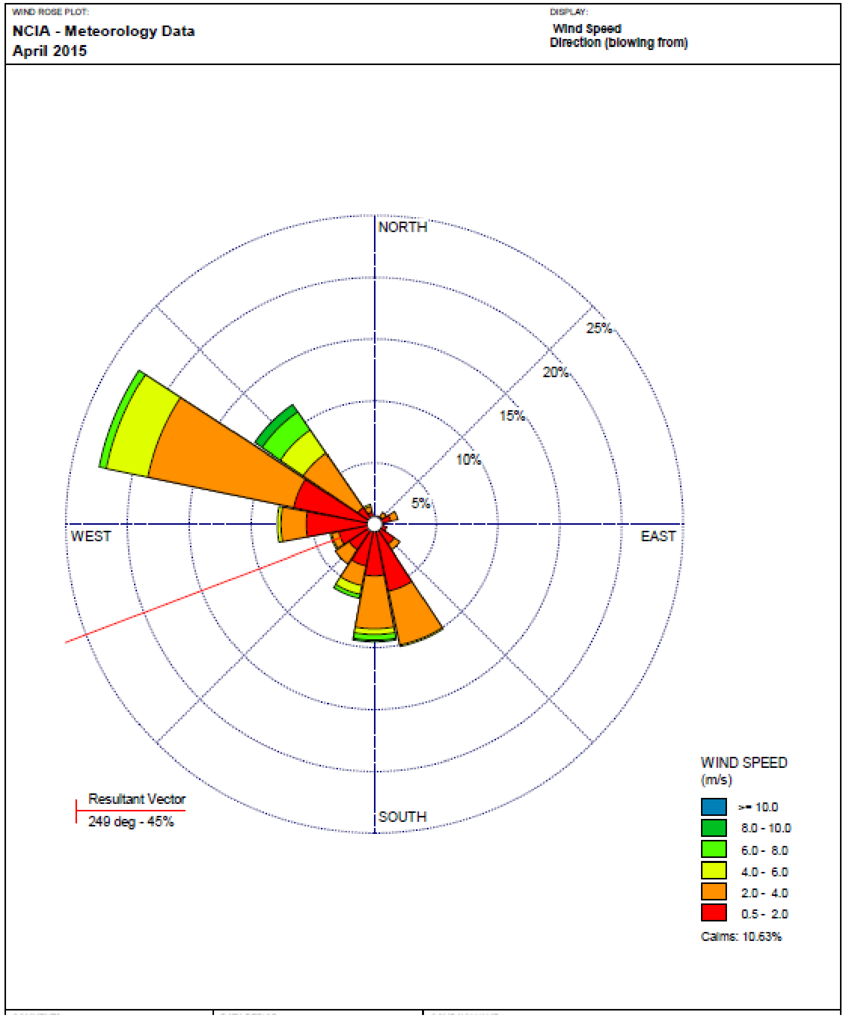

Figure B 4 Wind Speed and Direction (April 2015)

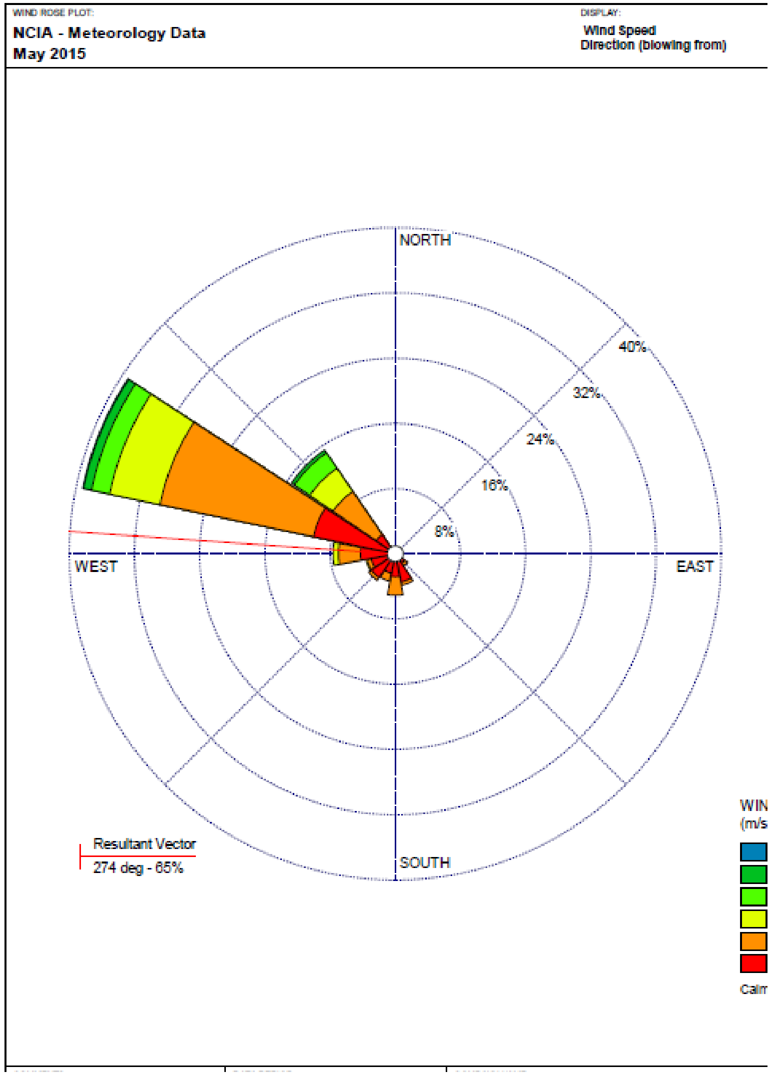

Figure B 5 Wind Speed and Direction (May 2015)

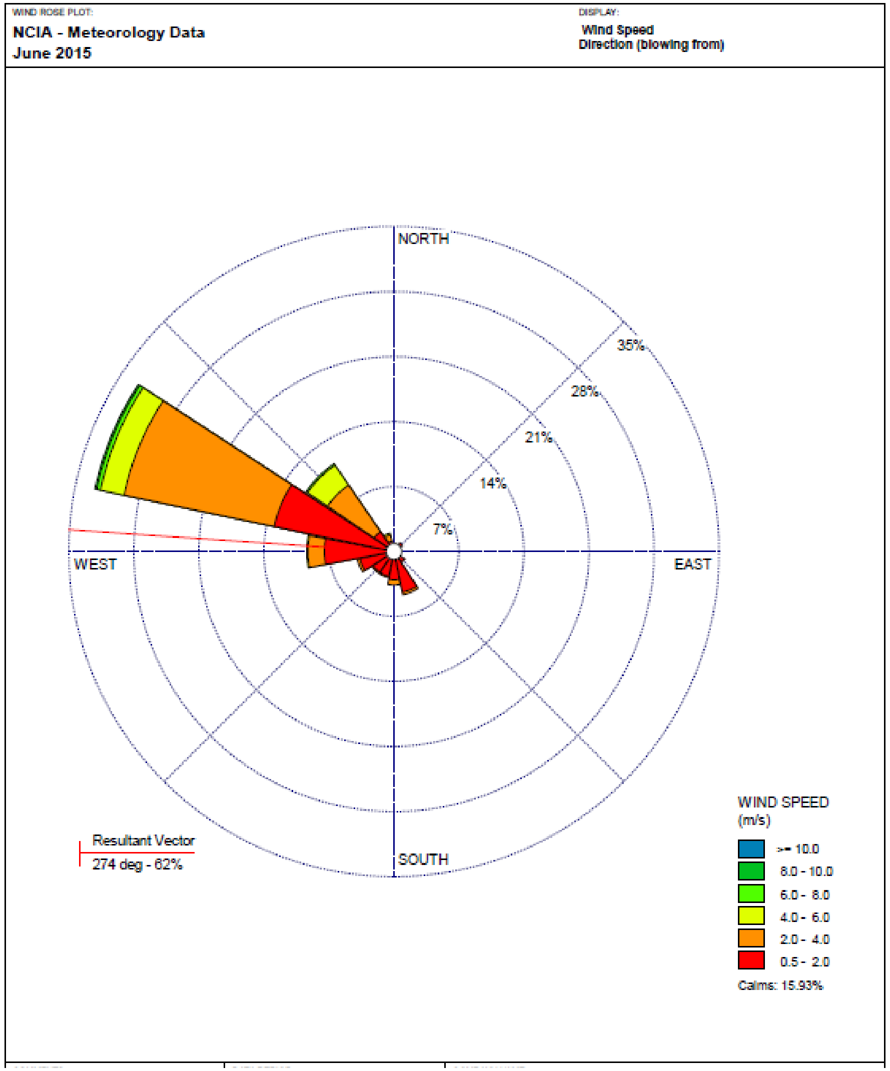

Figure B 6 Wind Speed and Direction (June 2015)

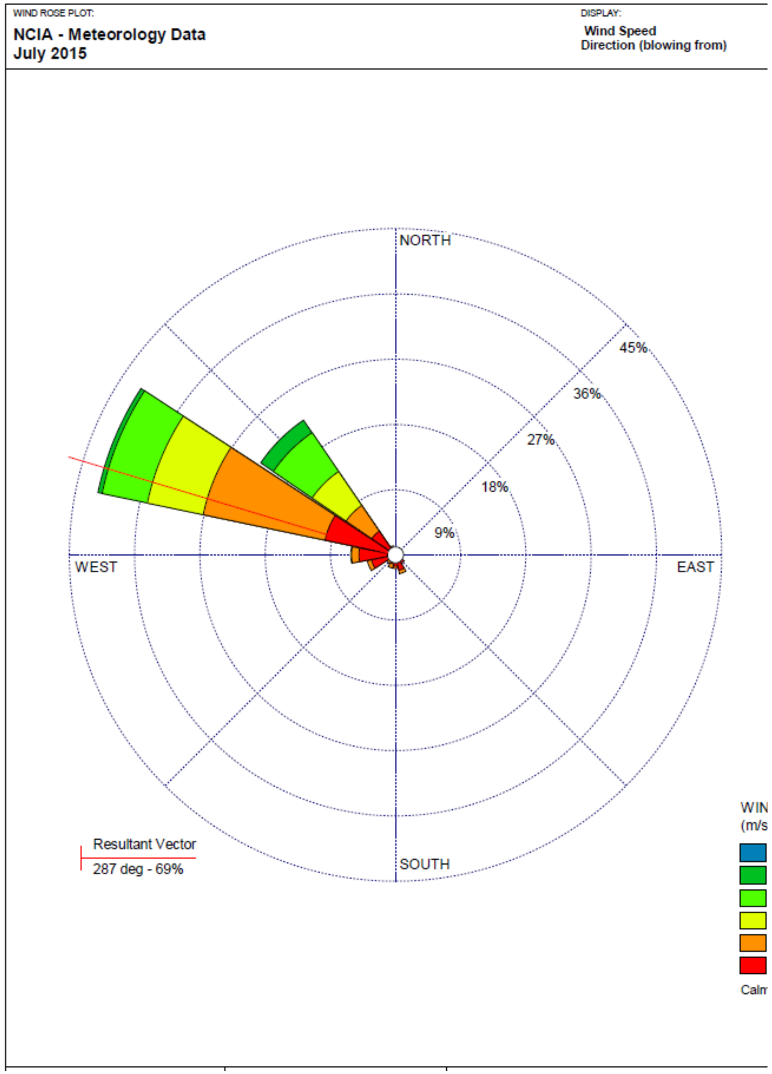

Figure B 7 Wind Speed and Direction (July 2015)