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2019 Annual Environmental Management Report

1 August 2018 - 31 July 2019

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1 August 2018 - 31 July 2019

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A	29-Oct-2019	Draft for Client Review	Simon Murphy Principal Environmental Planner	
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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 1 August 2018 and 31 July 2019 (hereafter referred to as the '2019 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, NSW. The facility has been operating since its commissioning in 2004. Prior to NCIA's operations, 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 are either supplied locally or imported. The tile manufacturing process 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 facility's kilns 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 stages of the facility. With these two operational stages 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 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 the 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 remains uncertain at the time this AEMR has been prepared.

1.1.3 Historic and Current Production Volume

Tile production volume since commissioning and inclusive of the 2019 reporting period is presented in Figure 1. Production volume is reported (and presented here) annually in accordance with the Environmental Protection Licence (EPL) annual reporting period, that is 1 August to 31 July each year.

NCIA's Project Approval (MP 09_0006) provides a staged approach to production limit in m^2 per annum, while NCIA's EPL No. 11956 provides for production in tonnes per annum.

Between 1 August 2018 and 31 July 2019 the facility operated 330 days, for a total output of 84,675 tonnes of ceramic tiles (or approximately 5.64 million m^2). These production levels are below the maximum production authorised under NCIA's current approvals (refer to Section 1.2) and are commensurate to the current stage of development of the facility (i.e. Stage Two).

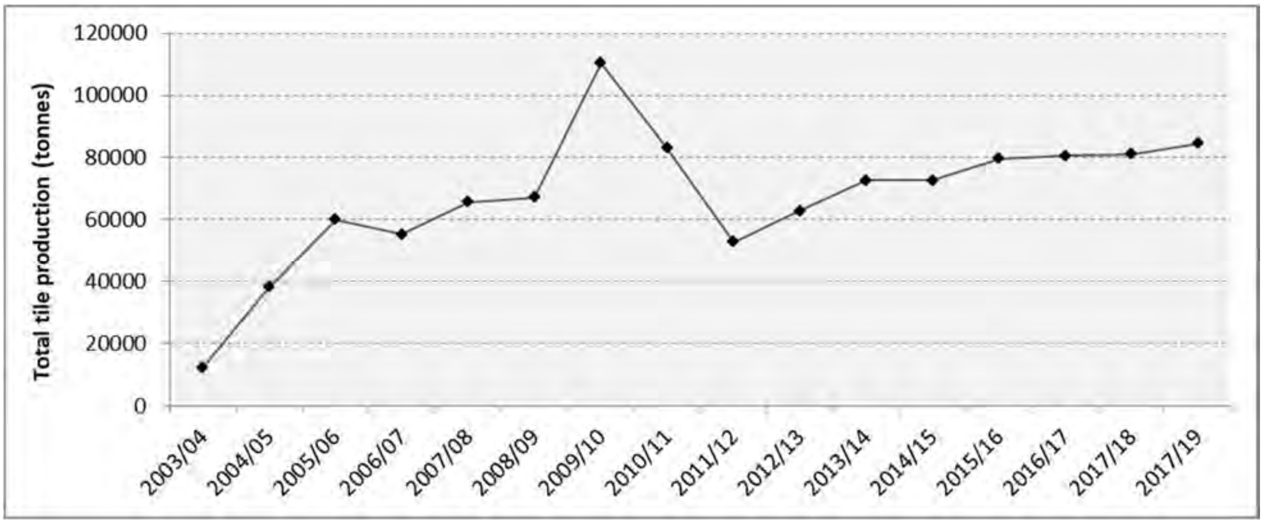

Figure 1 Production volume since 2004

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 relinquished the previous Development Consent with effect from 19 January 2013.

The NCIA facility is therefore currently operating in accordance with the conditions of Project Approval (MP 09_0006), issued by the Department of Planning Industry and Environment (DPIE).

The facility also operates in accordance with EPL No. 11956 issued by the NSW Environment Protection Authority (EPA), which authorises NCIA to produce 50,000 - 200,000 tonnes of ceramic tiles per annum.

It is noted that many of the requirements of the Project Approval are required prior to commencement of construction of the next stage of the approved operation (i.e. Stages Three–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.

1.2.2 AEMR Requirement

This AEMR has been prepared 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 EPL No. 11956.

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 1-1.

Table 1-1 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;	See comment 1 below
60 (c)	identify the standards and performance measures that apply to the development;	Section 2.0
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 4.0
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

<u>Note on timeline</u>

NCIA sought DPIE's approval (during a meeting with Leah Cook of DPIE held on 15 July 2015) to amend the AEMR reporting timeframes to align it with that of the EPL. The request was granted by DPIE on 17 July 2015. Therefore this AEMR and all subsequent AEMRs will cover the same reporting periods as the EPL, and report on NCIA's environmental performance between 1 August and 31 July each year.

[1] This condition is now superseded by DPIE'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 1 August and 31 July.

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2.0 Standards and Performance Measures

The NCIA OEMP provides the environmental management framework to guide the operation and environmental performance of the 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:

- Project Approval (MP 09_0006), granted by the Minister for Planning;
- EPL 11956, issued by the NSW 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 current reporting period are presented in Section 4.0 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 current reporting period compared to complaints received in previous years.

The history of complaints received by NCIA is presented in Table 3-1. Only one complaint was received for the monitoring period with NCIA being confirmed as not responsible. Overall, the history of complaints shows that very few community complaints are received in relation to NCIA operations.

Table 3-1 Historical complaints received by NCIA

Year	Number of Complaints	Issue	Details
2019	1	Noise	Complaint made from resident of Heritage Parc wondering whether alarm noise ongoing since 9am. was NCIA as it could be heard from Heritage Parc. NCIA supervisor confirmed the alarm was not from NCIA. Supervisor drove down Gardiner St and noted an alarm from a business at the South West corner of NCIA.
2018	Nil	Nil	None Required
2017	Nil	Nil	None Required.
2016	Nil	Nil	None Required.
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	1	1	Complaint made from neighbouring Heritage Green Residential Estate regarding storage of waste tiles causing visual nuisance. It is noted that this was previously considered to be a legal issue and therefore not previously recorded as a complaint.
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 environmental parameters are monitored 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; and
  - Fine particulates (PM_{10}).
- Additionally, for the kiln stacks:
  - 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. 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 current 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 One 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 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 3580.1.1:2016 Guide to siting air monitoring equipment*. Sampling and analyses of PM_{10} are undertaken as per *AS/NZS 3580.9.6:2015 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 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}.

A summary of PM_{10} monitoring results from both monitoring locations for the current reporting period is provided in Table 4-1, 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 4-1 Summary of ambient air monitoring: PM_{10} results

Parameter	Criteria	NW Location	SE Location
Annual Average Concentration (µg/m³)	30.0	**30.3**	19.9
Standard Deviation (µg/m³)	-	13.6	10.3
24-hour Minimum Concentration (µg/m³)	-	11.0	2.9
24-hour Maximum Concentration (µg/m³)	50.0	**73.4**	**57.7**

*Note: **Bold** font indicates an exceedance of the criteria*

4.1.2 PM_{10} – Assessment against Annual Criteria

The South East location returned an average annual concentration of 19.9 µg/m³ which is below the 30 µg/m³ annual criteria. This annual average remained below this criteria for the duration of the 12 month monitoring period.

At the completion of this 12 month period the North West location returned an annual average of 30.3 µg/m³ which is above the criteria. The annual average has decreased from the previous year value of 31.4 µg/m³ indicating a likely return to values below the criteria.

4.1.3 PM_{10} – Assessment against 24 Hour Criteria

This section details any exceedances of the PM_{10} 24-hour maximum concentration. Each of these elevated PM_{10} monitoring results were promptly notified to DPIE upon receipt of the validated laboratory results, in accordance with the reporting requirements specified in the Project Approval.

Apart from these isolated exceedances, the remainder of PM_{10} monitoring results for the NW and SE monitoring locations during the reporting period were below the 24-hour guideline criteria.

There were four exceedances of the PM_{10} 24-hour maximum concentration at the NW monitoring location:

- 13 February 2019 – PM_{10} concentration of 69.8 µg/m³;
- 19 February 2019 – PM_{10} concentration of 73.4 µg/m³;
- 8 April 2019 – PM_{10} concentration of 59.7 µg/m³;
- 26 May 2019 – PM_{10} concentration of 58.3 µg/m³;

There was one exceedance of the PM_{10} 24-hour maximum concentration at the SE monitoring location:

- 13 February 2019 – PM_{10} concentration of 57.7 µg/m³.

Ambient and meteorological conditions on these days were reviewed and discussed below.

13 and 19 February 2019

Elevated PM_{10} readings were recorded at both the North West and South East monitoring locations on 13 February. Meteorological data sourced from the OEH Beresfield site shows strong South to South East winds on this day. Under these conditions only the North West (downwind) monitoring site would be expected to have elevated results if NCIA was the primary source of PM_{10} emissions. Elevated upwind readings and data sourced from the Upper Hunter EPA ambient monitoring sites indicates regional PM_{10} concentrations were elevated on 13 February and the likely cause of exceedance at both locations.

Data from the Upper Hunter EPA monitoring sites indicates regional PM_{10} concentrations were also elevated on 19 February. Strong Easterly winds on this day show neither monitoring location was downwind of the NCIA site and that the elevated PM_{10} concentration recorded at the North West location is likely the result of elevated regional PM_{10} concentrations rather than the NCIA facility.

8 April 2019

EPA regional monitoring stations in the region recorded elevated PM_{10} concentrations on this day. On 8 April the EPA Beresfield monitoring station recorded a 24hr PM_{10} average of 38.9 $\mu g/m^3$ while the EPA Singleton monitoring station recorded a result of 40.5 $\mu g/m^3$. Both being the maximum 24hr concentrations recorded at these stations during April.

Meteorological data sourced from the on-site meteorological station shows strong north westerly winds on this day. Under these conditions the North West monitoring station is upwind of the NCIA site.

In Summary, elevated upwind readings and data sourced from the nearest EPA ambient monitoring sites indicate regional PM_{10} concentrations were elevated on 8 April with this being the likely cause of the measured exceedance.

26 May 2019

For comparison, the EPA regional monitoring stations in the region also recorded above average PM_{10} concentrations on this day. On 26 May the EPA Beresfield monitoring station recorded a 24hr PM_{10} average of 28.1 $\mu g/m^3$ while the EPA Singleton monitoring station recorded a result of 29.8 $\mu g/m^3$. Both readings being the third highest 24hr concentrations recorded at these stations during May.

More importantly, meteorological data sourced from the on-site meteorological station shows strong north westerly winds for 26 May. Under these conditions the North West monitoring station is upwind of the NCIA site

In summary, the PM_{10} result recorded at the North West monitoring location on 26 May 2019 is likely to be significantly influenced by an upwind source and strong north westerly winds. Both the EPA Beresfield and Singleton stations recorded their third highest 24hr PM_{10} concentrations for May on this day indicating the potential for elevated PM_{10} levels. Importantly, the North West monitoring station was upwind of the NCIA site on this day meaning the NCIA facility is unlikely to have contributed to this result.

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

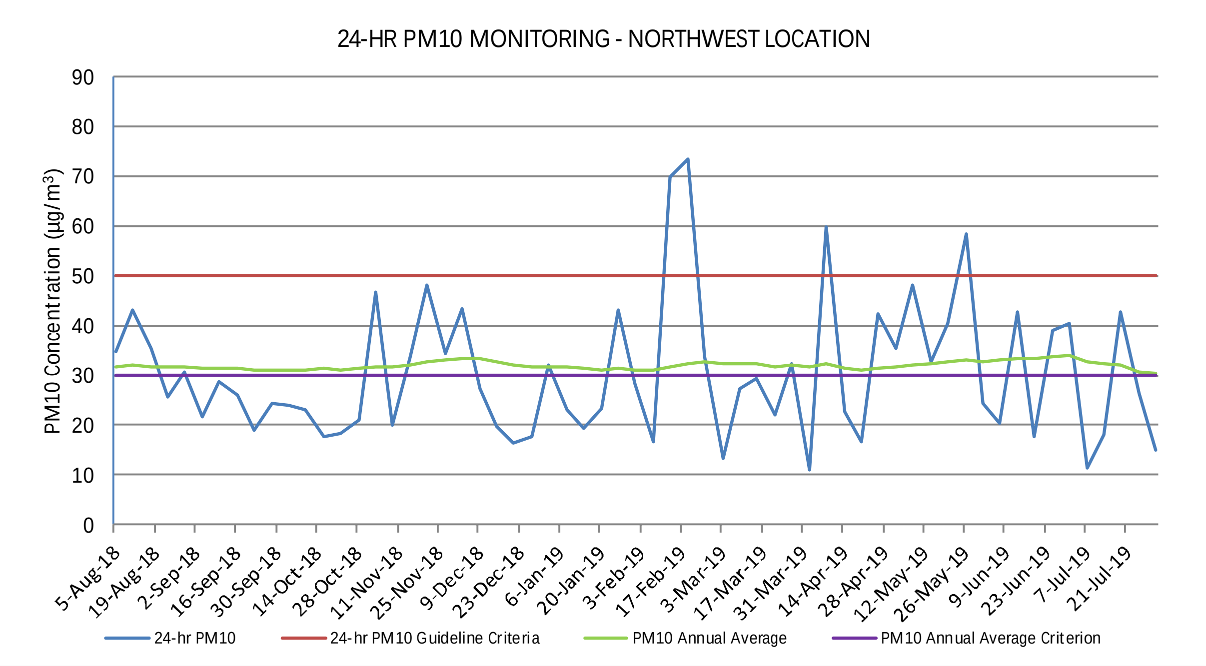


Figure 3 **PM_{10} monitoring – northwest location**

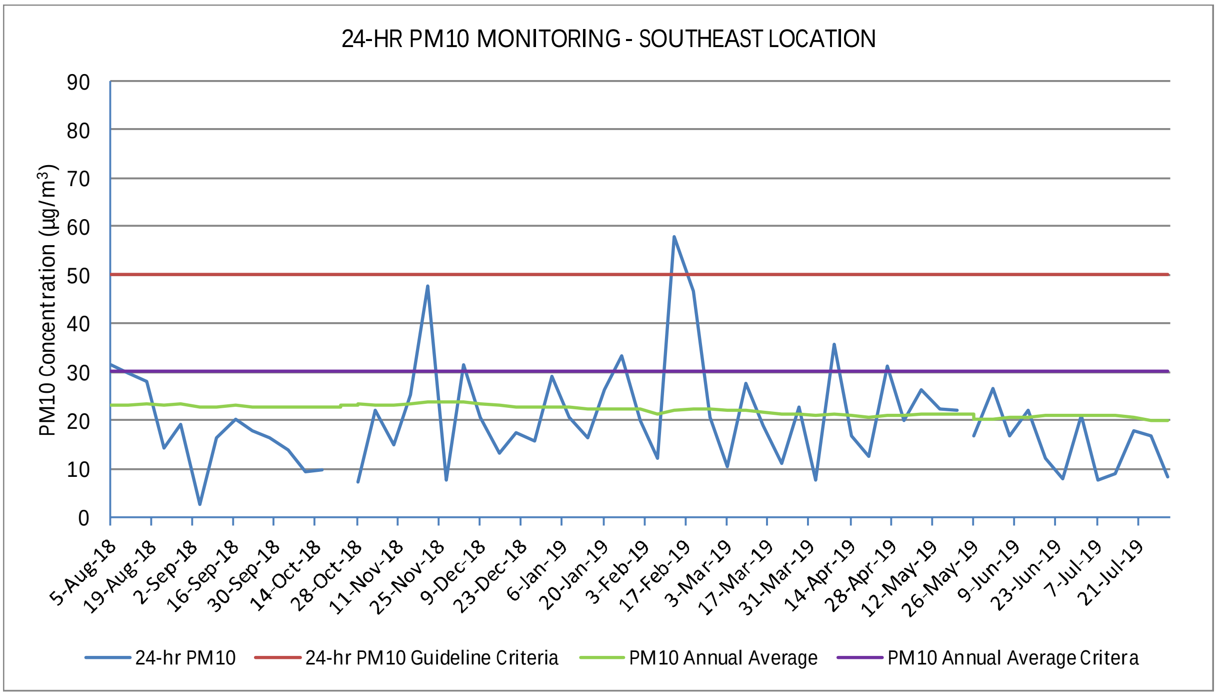


Figure 4 **PM_{10} monitoring – southeast location**

4.1.4 Fluoride – 24 Hour Monitoring Results

There is no ambient air fluoride concentration limit specified in the EPL or Project Approval. To provide context for the ambient air monitoring results, guideline levels have been taken from the NSW EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA, 2016).

A summary of 24-hour fluoride monitoring results from both monitoring locations for the current reporting period is provided in Table 4-2. The 24-hour fluoride monitoring results for the NW and SE locations are also graphed in Figure 5 and Figure 6 respectively.

Table 4-2 Summary of ambient air monitoring: 24-hour fluoride results

Parameter	Guideline Criteria	NW Location	SE Location
Annual Average Concentration (µg/m^3)	-	0.27	0.38
Standard Deviation (µg/m^3)	-	0.32	0.42
24-hour Minimum Concentration (µg/m^3)	-	0.03	0.06
24-hour Maximum Concentration (µg/m^3)	2.9	1.63	2.13

*Note: **Bold** font indicates an exceedance of the guideline criteria*

The results in Table 4-2 indicate that both the NW and SE monitoring locations results for the 24-hour total fluoride emissions satisfied the EPA (2016) guideline criterion for the entire reporting period.

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

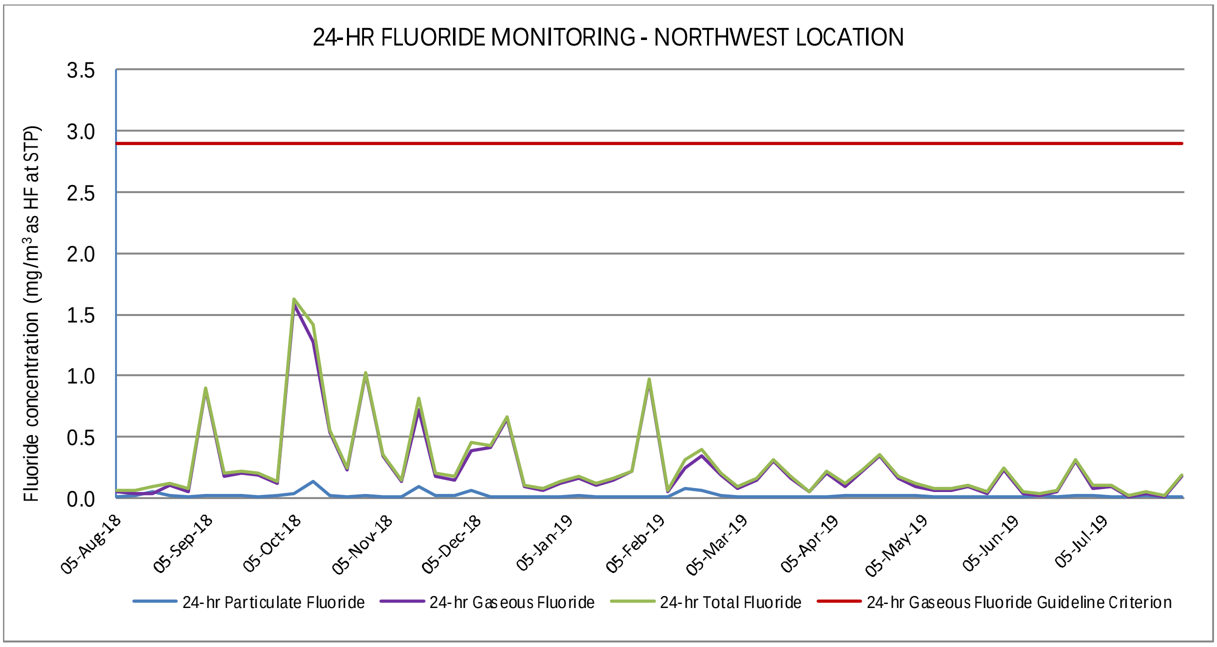


Figure 5 24-hour fluoride monitoring – northwest location

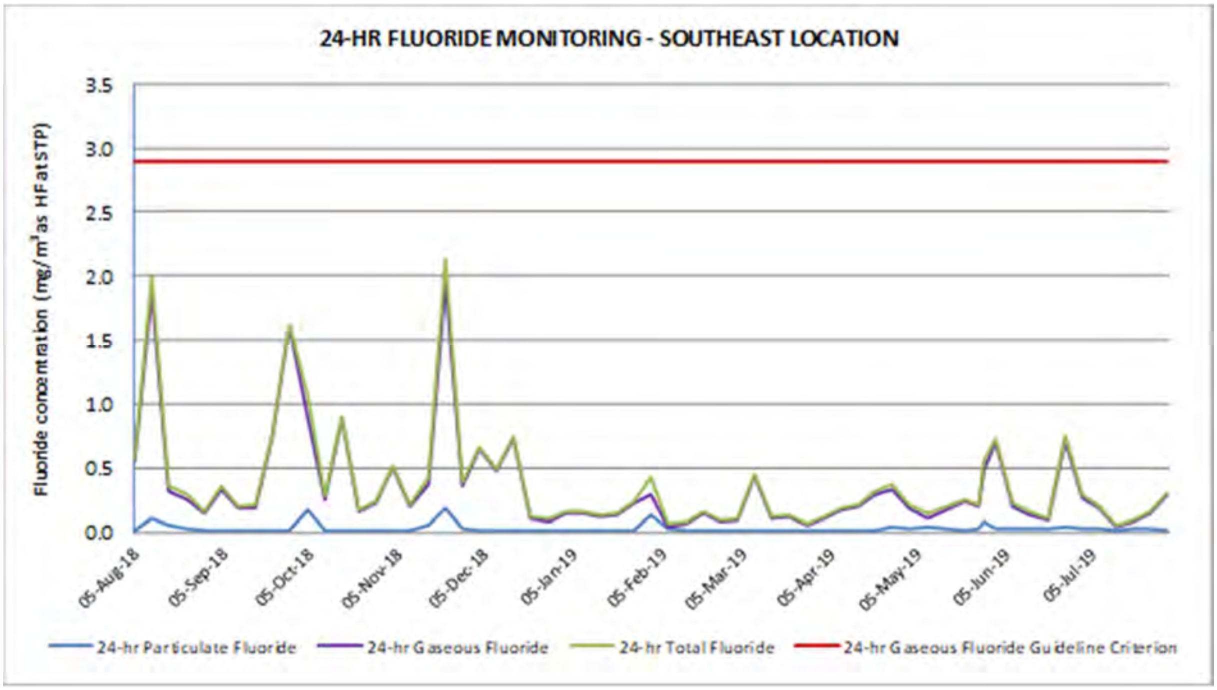


Figure 6 24 hour fluoride monitoring – southeast location

4.1.5 Fluoride – Weekly (7-Day) Monitoring Results

There is no ambient air fluoride concentration limit specified in the EPL or Project Approval. To provide context for the ambient air monitoring results, guideline levels have been taken from the NSW EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA, 2016).

A summary of weekly fluoride monitoring results from both monitoring locations for the current reporting period is provided in Table 4-3. The weekly Fluoride monitoring results for the NW and SE locations are also graphed in Figure 7 and Figure 8 respectively.

Table 4-3 Summary of ambient air monitoring: weekly fluoride results

Parameter	Guideline Criteria	NW Location	SE Location
Annual Average Concentration (µg/m^3)	-	0.19	0.26
Standard Deviation (µg/m^3)	-	0.13	0.18
Weekly Minimum Concentration (µg/m^3)	-	0.03	0.05
Weekly Maximum Concentration (µg/m^3)	1.7	0.50	0.74

The results in Table 4-3 indicate that for both the NW and SE monitoring locations the weekly Fluoride levels satisfied the EPA (2016) guideline criterion for the entire reporting period.

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

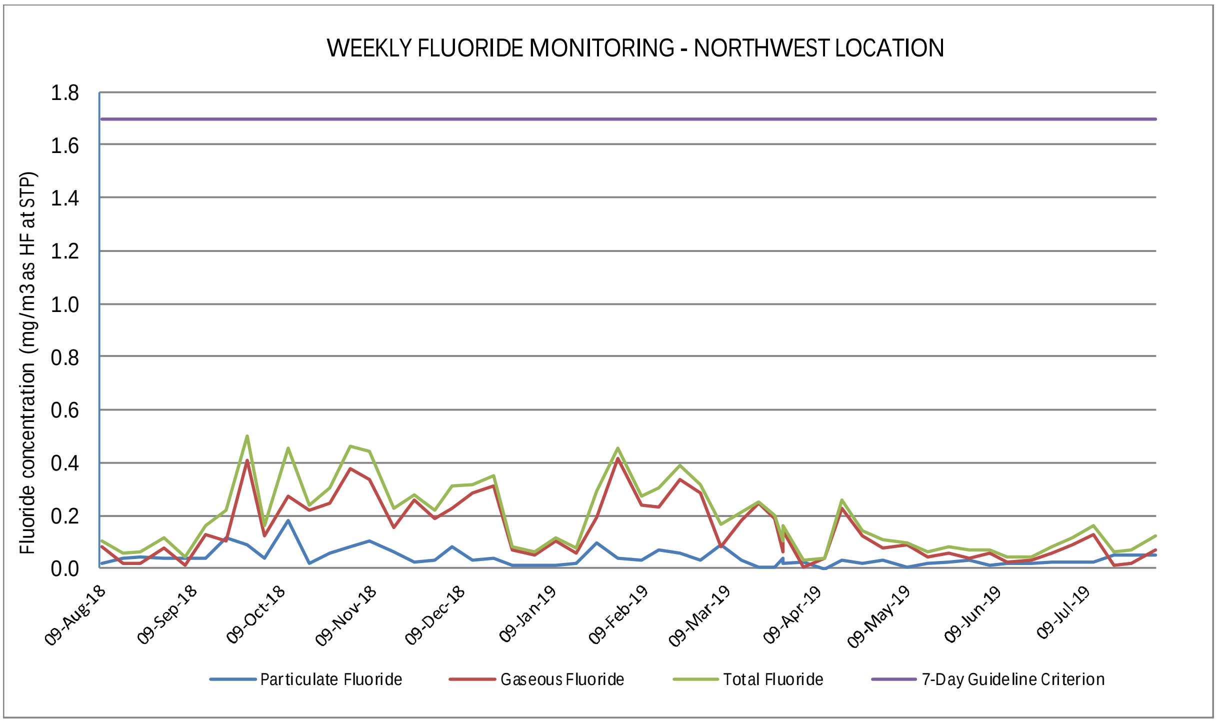


Figure 7 Weekly fluoride monitoring – northwest location

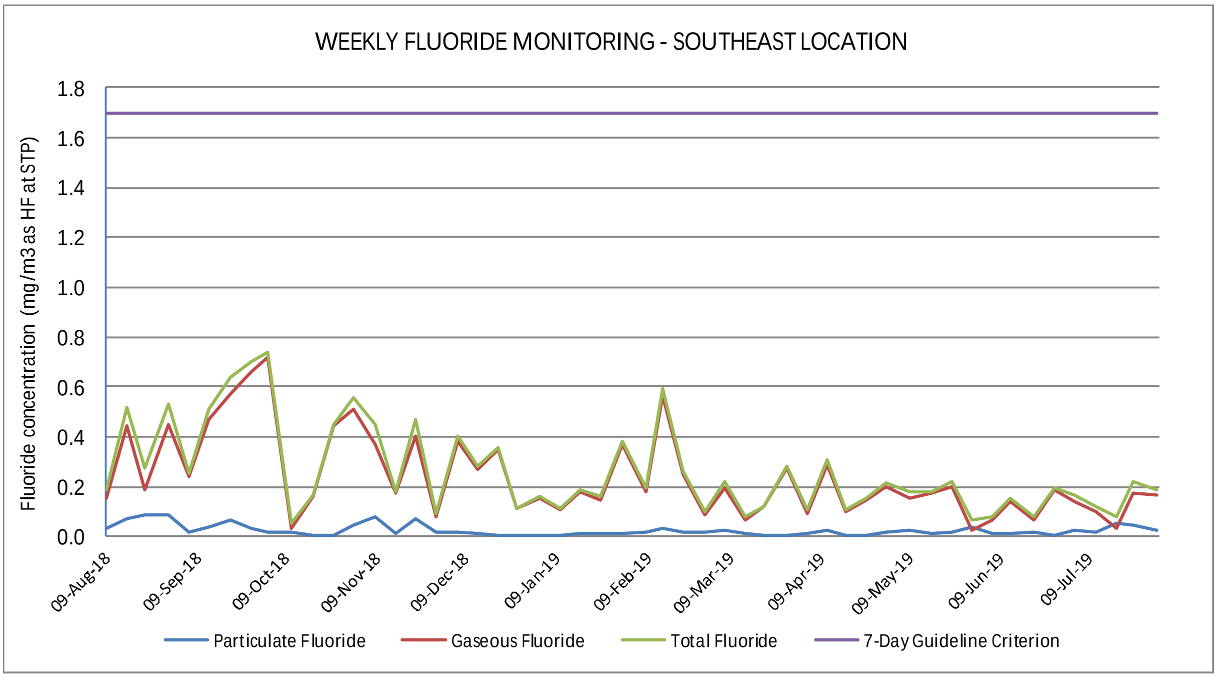


Figure 8 Weekly fluoride monitoring – southeast location

4.2 Fluoride Impact on Vegetation

Monitoring the impact of atmospheric fluoride on vegetation in the area surrounding the NCIA facility commenced in 2004. The monitoring program 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 facility 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 program were selected based on their known sensitivity to atmospheric fluoride impacts.

Quarterly vegetation assessments were conducted during the reporting period (Q3 September 2018, Q1 March 2019, and Q2 June 2019) as well as an Annual Vegetation Condition Assessment (Q4 December 2018). The results of these surveys are summarised below.

The sites monitored for vegetation condition assessments during the reporting period are shown in Figure 9. Details on the monitoring sites as well as a photograph of each monitoring site location (at the time of the annual Q4 2018 survey) are provided in Appendix A1. The monitoring locations included eighteen 'impact' sites (comprising eight sites monitored quarterly plus an additional ten sites monitored during the annual survey only) 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.

At each monitoring site and for each of the monitored flora species, the visible injury symptoms to leaves were classified in accordance with the scoring criteria and injury categories presented in Table 4-4.

Table 4-4 Symptom code for visible injury to vegetation with particular reference to fluoride

Injury Symptom	Emission injury			Insect attack injury
	Chlorosis / Marginal necrosis	Tip necrosis	Cupping	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%

Figure 9 Vegetation survey monitoring location

4.2.1 Visual Condition Assessment Results – Impact Sites

The complete tabulated results of the visible injury assessments performed during the quarterly and annual surveys are provided in Appendix A2 and a selection of photographs of impacted foliage included in Appendix A3. The results have been summarised below and supported graphically in Figure 10 to Figure 12.

The visual assessments found that inclusive of all quarterly surveys during the reporting period, emission related injury symptoms (i.e. chlorosis, cupping, necrosis, anthocyanin accumulation) were present in the foliage of approximately 100% of all species assessed, whilst approximately 75% of all species assessed displayed some level of insect attack injury symptoms (refer to Table 4-5). The lower prevalence of emissions and insect attack injury symptoms recorded during the Q4 annual survey is largely due the inclusion in this survey of several species that are known to be less sensitive to injury symptoms (e.g. *acacia*, *casuarina*, *pinus*, and *hakea* spp.), whereas quarterly surveys only include sensitive eucalypt species.

Table 4-5 Proportion of surveyed species showing injury symptoms

	Emission related injury symptoms					Insect injury symptoms				
	Q3 2018	Q4 2018	Q1 2019	Q2 2019	TOTAL	Q3 2018	Q4 2018	Q1 2019	Q2 2019	TOTAL
No. species assessed	17 (100%)	67 (100%)	17 (100%)	17 (100%)	**118 (100%)**	17 (100%)	67 (100%)	17 (100%)	17 (100%)	**118 (100%)**
Injury symptoms present	15 (88%)	53 (79%)	15 (88%)	16 (94%)	**99 (84%)**	17 (100%)	40 (60%)	17 (100%)	17 (100%)	**91 (77%)**
Injury symptoms absent	2 (12%)	14 (21%)	2 (12%)	1 (6%)	**19 (16%)**	0 (0%)	27 (40%)	0 (0%)	0 (0%)	**27 (23%)**

Figure 10 shows the prevalence of each visual foliage injury symptom observed in all species during the surveys. It indicates that tip necrosis, leaf undulation / cupping, and chlorosis were the most commonly occurring symptoms (with 88% of all observations), followed by marginal necrosis (8%), whilst symptoms of anthocyanin accumulation were generally uncommon (4% of all observations).

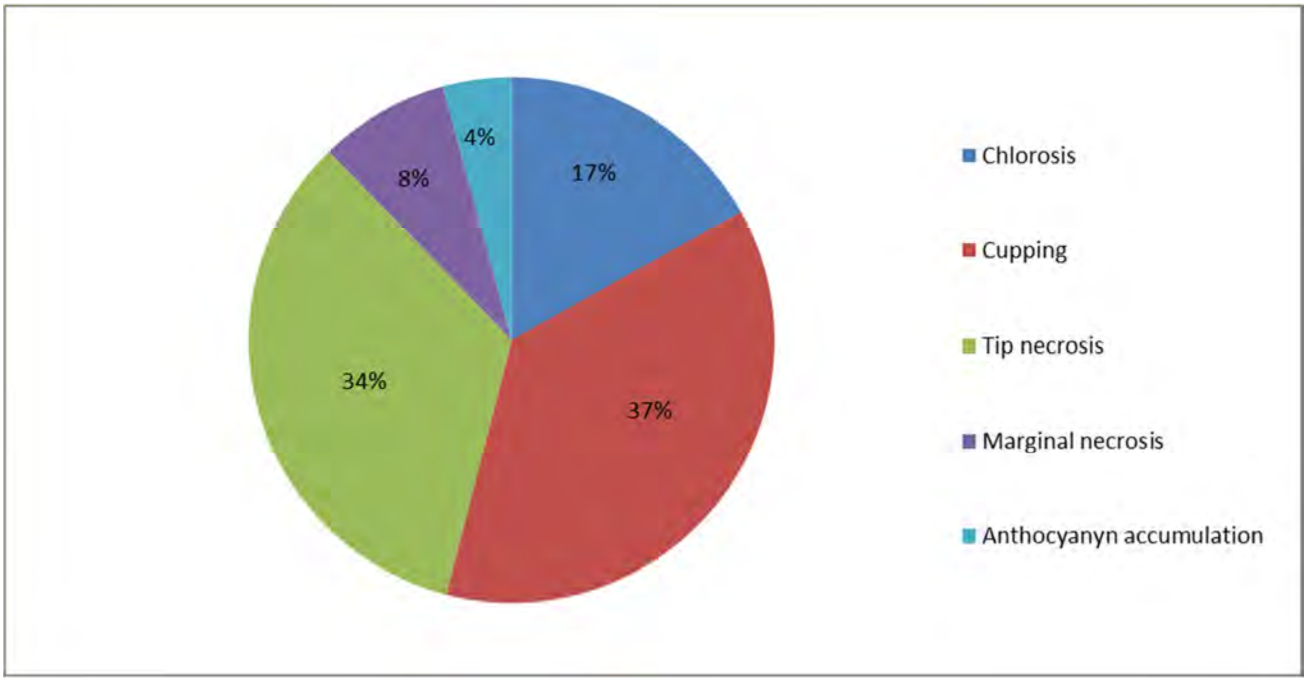


Figure 10 Relative prevalence of fluoride related symptoms

The severity of recorded emission related injury symptoms overall ranged from very slight to very severe (i.e. between 2% and 75% of leaf area affected – refer to Table 4-4). For each quarterly survey during the reporting period, Figure 11 depicts the distribution of injury severity classes recorded in all flora species surveyed. The results indicate the following:

- For each survey between 54% and 69% of plants surveyed were affected at worst by slight injury symptoms (i.e. injury class 2 and less, maximum of 5% leaf area impacted);
- For each survey between 29% and 47% of plants surveyed were affected by distinct or marked injury symptoms (i.e. injury class 3 or 4, 10-25% of leaf area impacted);
- During the annual Q4 2018 survey only, 2% of plants surveyed displayed severe to very severe visual injury symptoms (i.e. injury class 5 or 6, 50-75% of leaf area impacted); and
- Only one species displayed extreme injury symptoms (i.e. injury class 7, >75% of leaf area impacted) during the four surveys.

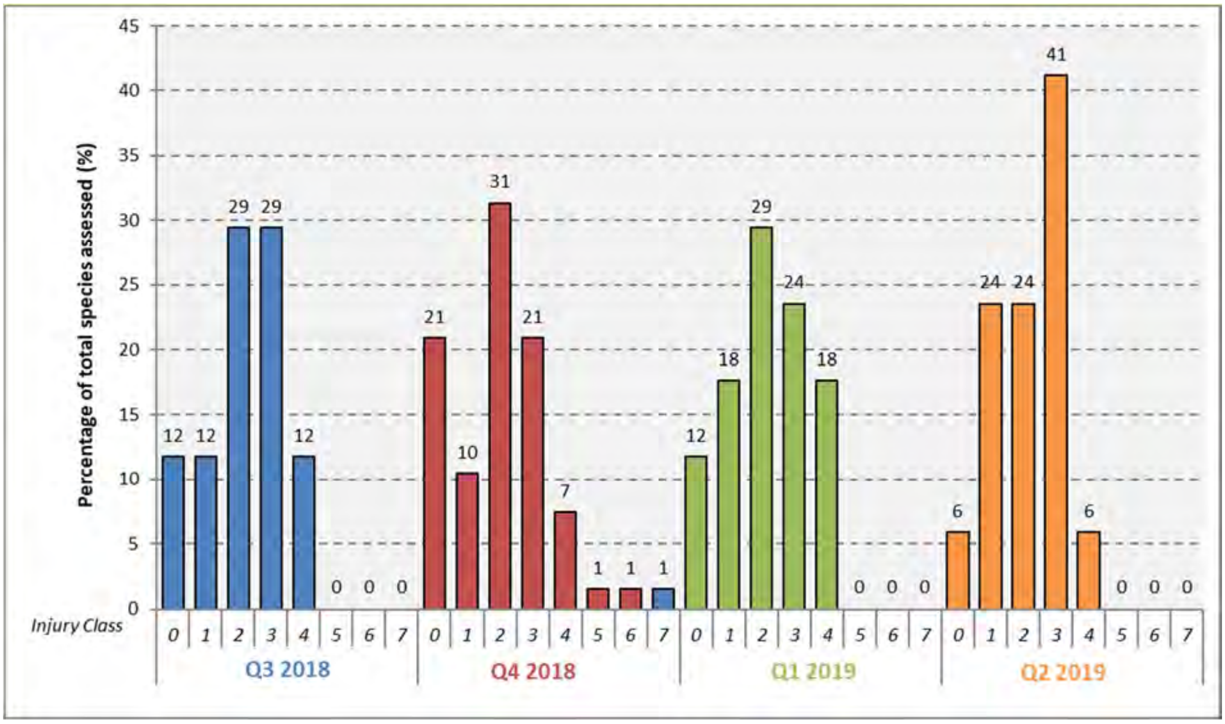


Figure 11 Proportion of flora species affected by emissions related visual injury symptoms during the surveys

In relation to insect attack injury, approximately 29% of all symptoms recorded were very slight (i.e. less than 2% leaf area affected), approximately 31% were slight (i.e. 2–5% leaf area affected) and approximately 15% were distinct (i.e. 5–10% leaf area affected). No marked (or higher) insect injury symptoms were recorded.

Figure 12 depicts the relationship between the maximum emission related visual injury score recorded for each species (inclusive of all surveys) and their distance from the kiln stacks at NCIA. The results showed little correlation between foliage injury and the distance to the emission source ($r^2 = 0.07$), indicating that emission impacts to foliage may spread further from the NCIA site than the furthest monitoring site. For instance, category 4 injury symptoms were observed up to ~1,400m away from the NCIA facility at Site 6 and Site 7, while category 3 symptoms occurred as far as Site 12 (~2,300m from the NCIA facility). This also suggests that within the current suite of monitoring sites, variables such as flora species type or the sensitivity of specific individuals are more relevant than the distance from emission source in determining atmospheric fluoride impacts on local vegetation. However and importantly, there are several other air pollution sources in the region which may impact vegetation and foliage condition. Therefore the geographical extent of fluoride impacts to foliage attributable to NCIA activities alone cannot be confidently determined.

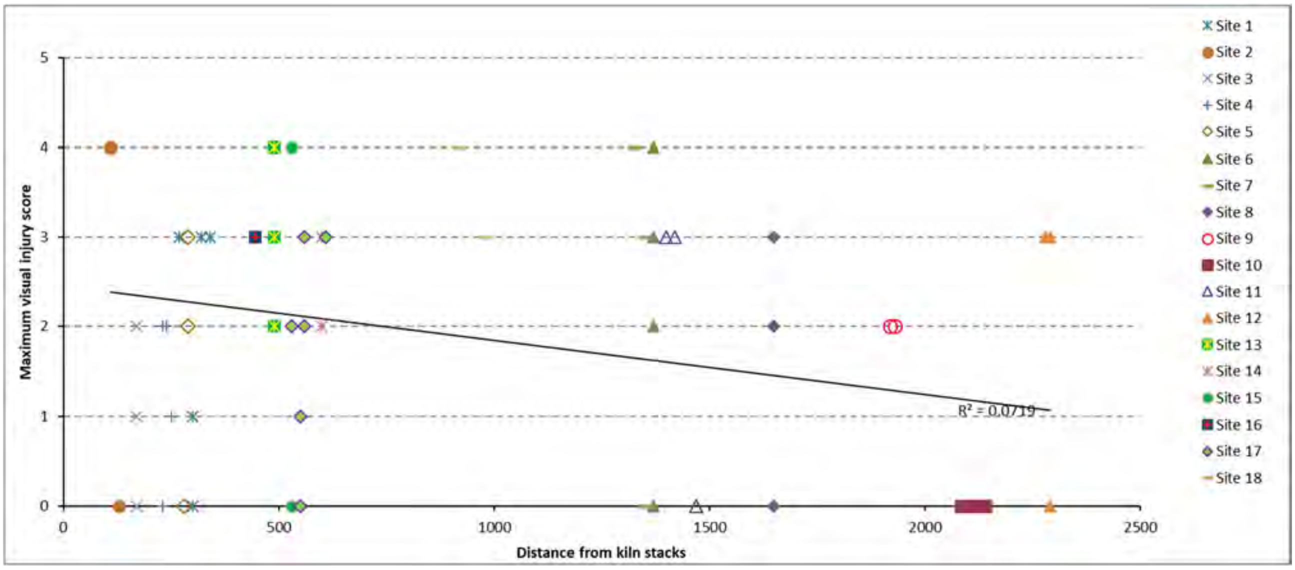


Figure 12 Relationship between distance from kiln stacks and maximum visual injury score in foliage of species assessed

4.2.2 Visual condition Assessment Results – Reference Site

A broad diversity of species was assessed at this site, which is located approximately 3km north of the kiln stacks at NCIA. Generally the surveyed vegetation was in a 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 their severity was typically limited to class 1 (very slight) or class 2 (slight) injuries (with three exceptions in the *Corymbia maculata*, *Macadamia integrifolia and Eucalyptus tereticornis* individuals. *Corymbia maculata* showed marked (class 4) cupping symptoms during Q1 2019, *Macadamia integrifolia* individuals showed distinct (class 3) cupping during Q4 2018 and *Eucalyptus tereticornis* individuals showed Class 3 Tip Necrosis in Q3 2018 and Q1 2019.

Insect attack injury symptoms were recorded in 34% of all species assessed at the reference site (mostly in eucalypt species) with their severity ranging from very slight to marked (class 4 injury).

4.2.3 Fluoride Content Assessment Results

Foliage samples for fluoride content assessment were collected from various established locations during each of the surveys undertaken during the reporting period. Where possible both current and previous season leaves were collected for analysis and mixed to create a bulk sample for the site. Grasses at Wollombi Road (Site 11) were sampled in approximate 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 and roots).

Samples were sent to a NATA accredited laboratory for analysis and the results are provided in Table 4-6. Detailed results as provided by the laboratory (certificates of analysis) have been included in Appendix A4.

Foliar fluoride content results generally show that:

- Individual species and plants show varying degrees of resistance and/or sensitivity to impacts caused by atmospheric fluoride impacts with recorded foliar fluoride concentrations ranging from <10.0mg/kg to 91.9mg/kg; and
- For each individual species sampled, foliar fluoride concentrations show seasonal variations, reflecting the dominant wind patterns in the area – i.e. with concentrations increasing (or decreasing) as the dominant winds blow toward (or away from) the monitoring sites from the NCIA kiln stacks.

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

Table 4-6 Sites and species within the survey area selected for foliage fluoride content assessment

Site #	Species	Foliage Season Sampled	Fluoride Content (µg/g, dry)			
			Q3 2018	Q4 2018	Q1 2019	Q2 2019
5	*Eucalyptus moluccana*	Mixed	50.2	35.3	21.7	<10.0
11	Grasses	Current	12.7	<10.0	<10.0	<10.0
13	*Corymbia maculata*	Mixed	15.4	16.5	<10.0	<10.0
13	*Eucalyptus amplifolia*	Mixed	107	56.3	77.8	23.2
15	*Corymbia maculata*	Mixed	73.9	120	58.5	24.5
19	*Vitis vinifera*	Current	<10.0	<10.0	12.7	Not Sampled

 # being a deciduous species, vitis vinifera had no foliage present at the time of the Q4 2018 survey and hence could not be sampled for analysis.

4.3 Meteorological Monitoring

Meteorological data is recorded at the meteorological station established at the South East air monitoring location. The station is sited and operated in accordance with approved methodologies (EPA, 2016) 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 deployed to record daily rainfall rates.

The monthly data for temperature and rainfall are provided in Figure 13. Monthly wind roses representing the wind speed and direction for the reporting period are provided in Appendix B. A summary of the dominant wind patterns throughout the reporting period is provided below. Wind data for January and February 2019 was sourced from the OEH Beresfield station and rainfall data was sourced from the BOM Maitland Airport station after a data collection error resulted in no on-site data for these months.

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

- In August 2018 winds were blowing predominantly from the northwest;
- In September 2018 winds were blowing predominantly from the northwest and southeast;
- Between October 2018 and January 2019 winds were predominantly from the southeast to south with some northwest components;
- In February 2019 winds were predominately from the northeast to east;
- During March and April 2019 winds were from the northwest and southeast; and
- During May to July 2019 winds were blowing predominantly from the northwest.

Wind speeds recorded over the year were generally low to medium with an average wind speed of 1.8 m/s during the reporting period. The maximum hourly average wind gust during the reporting period was recorded at 11.1 m/s on 23 November 2018 and 27 May 2019.

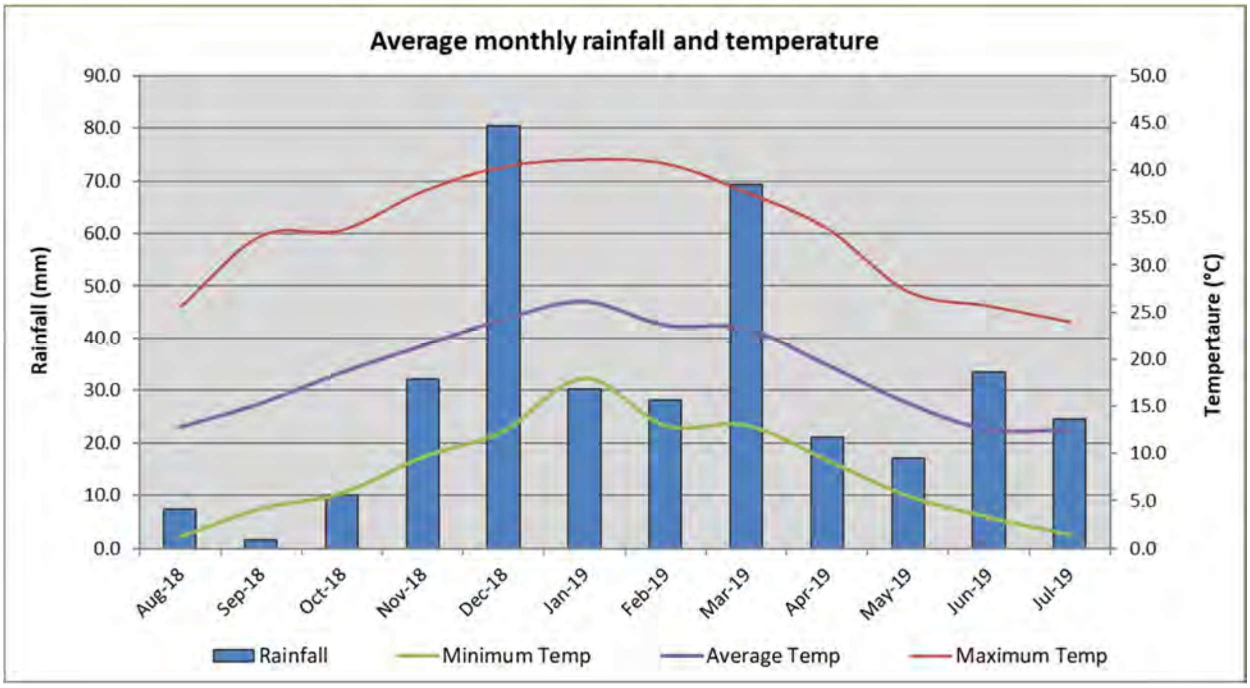


Figure 13 Average monthly rainfall and temperature range (1 August 2018 – 31 July 2019)

4.4 Stack Emissions Testing

Stack emissions testing is undertaken annually in accordance with the EPL requirements. Stack emissions testing was conducted during July 2019. Emission sources assessed during the testing period were those defined in the EPL and listed in Table 4-7.

Table 4-7 Emission source descriptions

EPL Identification Number	Emission Source Description
1	Clay Preparation (CP1)
3	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 Particulates and Fine Particulates (PM_{10}). Testing conducted on the Kiln 1 and Kiln 2 stacks also 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), Nitrogen Oxides (NO, NO_2, NO_x and Equivalent NO_2), Cadmium and Mercury. All sampling was conducted in accordance with the applicable EPA test methods with analyses conducted by a NATA-accredited laboratory.

The Project Approval does not specify pollutant concentration limits for the facility. Pollutant concentration limits are specified in Condition L3 of the EPL. Summaries of the emission testing results, along with the EPL pollutant discharge limits, are provided in **Table 4-8** and **Table 4-9**.

All emission concentrations are converted to standard conditions of 0°C, dry gas and 1 atmosphere pressure for comparison with appropriate regulatory limits. The Nitrogen Oxides, Total Particulate and PM_{10} emission concentrations from the Kiln stacks are corrected to 18% O_2.

During the reporting period there was an exceedance of the Total Fluoride discharge limit at EPL point 14 (Kiln 1). The July 2019 Kiln 1 fluoride emission concentration was recorded to be 8.1 mg/m^3. For comparison purposes, production was running comparably with the other kiln (Kiln 2) which was being fed the same input material as Kiln 1, and the Kiln 2 total fluoride concentration was 1.49 mg/m^3 during July 2019. The reason for the difference between these results has not been ascertained.

Table 4-8 Summary of particulate emission monitoring results (July 2019)

Stack	Fine Particulate (PM_{10}) (mg/m³)	Total Particulate (mg/m³)	Regulatory Limit (mg/m³)*
Clay Preparation (CP1) (EPL 1)	1.6	5.2	20
Pressing and Drying (PD1) (EPL 3)	N/A[2]	4.6	20
Dryer (D1) (EPL 5)	3.0	7.2	20
Dryer (D2) (EPL 6)	8.1	14	20
Glaze Line (EPL 9)	0.82	19	20
Selection Line (SL 1,2,3,4) (EPL 10)	0.8	1.5	20
Spray Dryer (SD1) (EPL 12)	1.4	1.9	20
Hot Air Cooler (HAC 1) (EPL 18)	2.6	3.9	5
Hot Air Cooler (HAC 2) (EPL 19)	0.68	3.6	5

[1]Note: Regulatory limit only applies to Total Particulate.

[2] During analysis of the thimble the lab noted that some of the interior wall of the thimble showed friability and compromised the sample, contributing to the reported particulate mass. The result was discarded on this basis as it would not be an accurate representation of the PM_{10} emissions from that stack.

Table 4-9 Summary of emission monitoring results – Kiln 1 and Kiln 2 (July 2019)

Pollutant	Kiln 1 (EPL 14) (mg/m³)	Kiln 2 (EPL 15) (mg/m³)	Regulatory Limit (mg/m³)
Fine Particulate (PM_{10}) (at 18% O_2)	7.1	11	N/A
Total Particulate (at 18% O_2)	8.3	14	20
Gaseous Fluoride (as HF)	6.7	0.56	N/A
Particulate Fluoride (as HF)	1.4	0.93	N/A
Total Fluoride (as HF)	**8.1**	1.49	5
Sulfuric Acid Mist (H_2SO_4 as SO_3)	19	7.6	100
Sulfur Dioxide (SO_2 as SO_3)	160	200	NA
Total Hazardous Substances (Metals)	0.074	0.084	1
Cadmium	0.0082	0.0038	0.1
Mercury	0.0035	0.0034	0.1

Note: ***Bold*** *font indicates an exceedance of the criteria.*

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 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 (as specified in Condition 26 of the Project Approval). 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 set out in the *NSW Industrial Noise Policy* (INP) (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 in May 2019. A series of attended noise measurements of 15 minutes duration were made in Kenvil Close and in Wollombi Road on Wednesday 1 May 2019 during the day, evening and night time periods Measurements were also made during the day time period on the NCIA site. Operator field notes allow for individual noise sources and events to be isolated and the contributions of the various noise sources can then be quantified. At the time of the monitoring operational activities at NCIA were being carried out under typical conditions.

The results of the attended noise measurements at each location and time are summarised in Table 4-10.

Table 4-10 Received noise levels during attended noise monitoring (1 May 2019)

Location	Time	dB(A), $L_{eq\ (15\ min)}$	Wind speed / direction	Identified Noise Sources	dB(A), L_{max}
Kenvil Close	1:27 pm	44	0.8 / 223	Birds & insects (42), dogs (36), planes (34), traffic (30), **NCIA inaudible**	n/a
Kenvil Close	9:13 pm	53	0.6 / 174	Insects (53), traffic (34), **NCIA inaudible**	n/a
Kenvil Close	10:30 pm	42	0.8 / 176	Insects, (41), traffic (33) other industry (30), **NCIA inaudible**	n/a
Wollombi Rd	1:52 pm	60	0.9 / 239	Traffic, (60), birds & insects (32), trains (30), **NCIA inaudible**	n/a
Wollombi Rd	8:59 pm	56	0.6 / 174	Traffic (52), trains (51), insects (50), **NCIA inaudible**	n/a
Wollombi Rd	10:06 pm	56	0.9 / 183	Traffic (53), trains (50), insects (50), **NCIA inaudible**	n/a

The results show that the received noise from the NCIA facility was inaudible during the day, evening and night periods at both the Kenvil Close and Wollombi Road locations. Received noise from the NCIA site was audible and measurable at each of the monitoring locations during the night time period. On all occasions and at all times, the noise from NCIA did not exceed the relevant criterion, including the sleep disturbance criterion.

During each of the monitoring periods at the Kenvil Close location there was significant contribution from traffic noise on the New England Highway as well as from birds and insects.

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. Noise from trains, birds and insects were shown to be significant contributors to the overall received noise at this location.

As the noise from NCIA was inaudible during the night time monitoring there were no measured Lmax noise levels and the operation of NCIA therefore was in compliance with the applicable sleep disturbance criterion.

The noise emissions from NCIA, as measured on the site during the day time period, are relatively constant and steady with some intermittent impact noises audible. Lmax noise levels measured on the NCIA site did not vary by more than 4 dB(A) from the measured Leq noise levels. Based on the results in **Table 4-10**, any Lmax noise at the closest receivers in Kenvil Close and Wollombi Road would be significantly lower than the 45 dB(A) criterion for the site.

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 needs to seek approval from Hunter Water Corporation (HWC) before its water consumption is expected to exceed 92ML/year.

NCIA used a total of approximately 60 ML of process water during the current 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 site. The channel outlet connected to Pond 4 is the location of potential stormwater discharge from the site. Monitoring is therefore undertaken within Pond 4 in order to ascertain water quality data in the event of such discharge occurring. Monitoring started in 2009 and is ongoing with the following parameters monitored: 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 results of the stormwater quality monitoring during the reporting period for pH and EC are presented in Figure 14 and Figure 15 respectively. For assessment purposes the monitoring results are compared against the *ANZG Guidelines for Fresh and Marine Water Quality* (ANZG 2018). The adopted ANZG 2018 guidelines for pH and conductivity are the default trigger values for slightly disturbed aquatic ecosystems in NSW lowland rivers. The data for the current monitoring period shows that:

- pH values ranged between 6.6 and 10.3 with an increasing trend throughout the reporting period. Results were generally within the ANZG guidelines with the exception of 21 monitoring events.

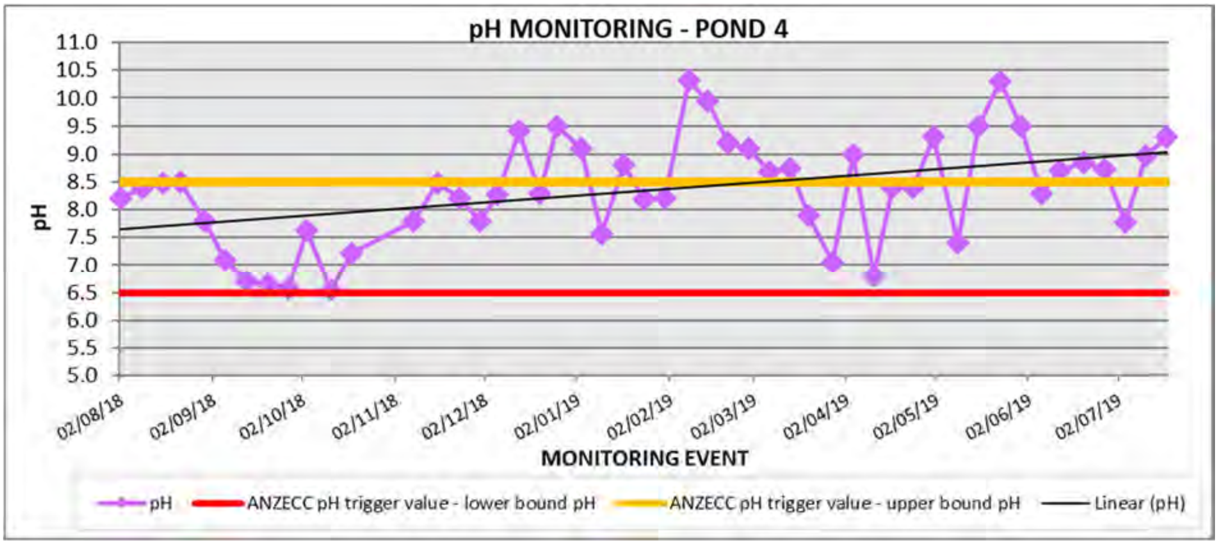


Figure 14 Stormwater quality monitoring – pH

- EC values were low and show a very slight decreasing trend throughout the reporting period with levels generally around 500 µS/cm indicating that the water is non-saline. The EC values were within the ANZG guidelines for the entire reporting period.

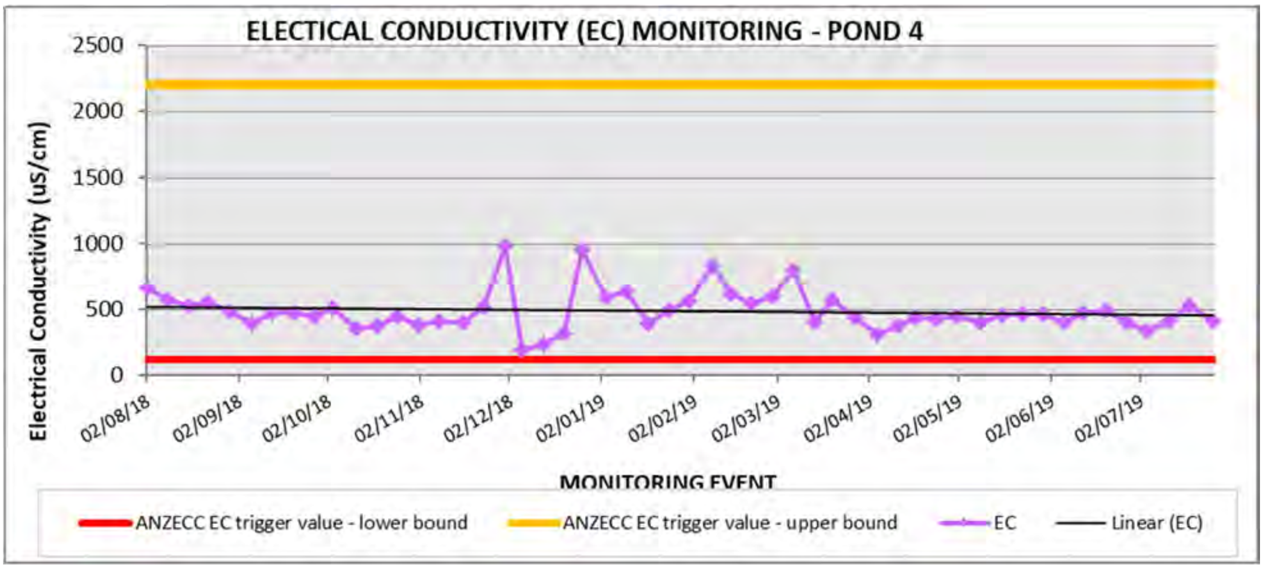


Figure 15 Stormwater quality monitoring – EC

Pond 4 was noted to be discharging on one occasion throughout the reporting period on 4 July 2019. Pond 4 water parameters were all within relevant criteria on this date.

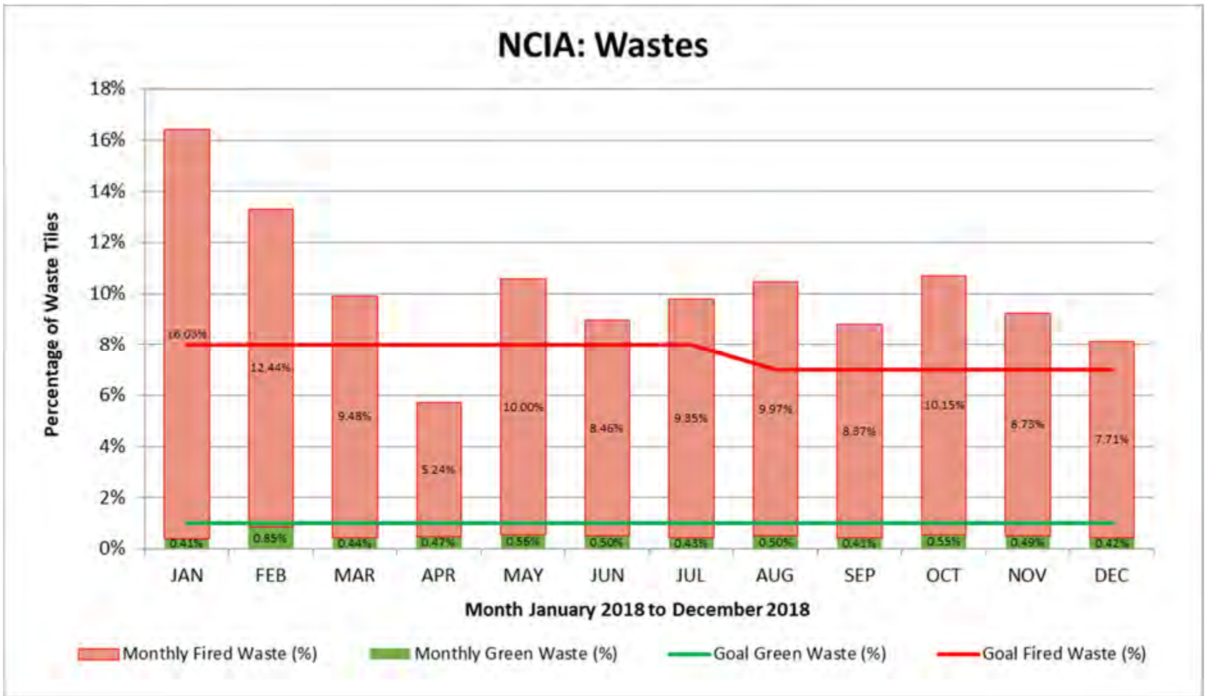
4.7 Waste Generation

There are no regulatory requirements in terms of waste generation quantities, types or production efficiency targets pertaining to NCIA's 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). Designated areas are provided on site for the storage of fired waste and other wastes (e.g. general office and packaging wastes) in accordance with the requirements of the Project Approval.

The main waste generated from the operation is tile waste. Tile waste comprises both green tiles (i.e. raw material waste from unfired tiles) and broken fired tiles. 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 current reporting period (shown as a proportion of the total tile production) are presented in Figure 16.

NCIA's targets for tile wastes were lowered in July 2018 to not exceed 1% (for green tile waste) and 7% (for fired tile waste) of the total tile production, respectively. The green tile waste target was achieved every month except for January 2019 with a result of 1.32%. The amount of fired tile waste exceeded the target for twelve months of the 2018 to 2019 reporting period, with a monthly average of 10.13%. However, fired tile waste levels were decreasing during the 2019 reporting period.



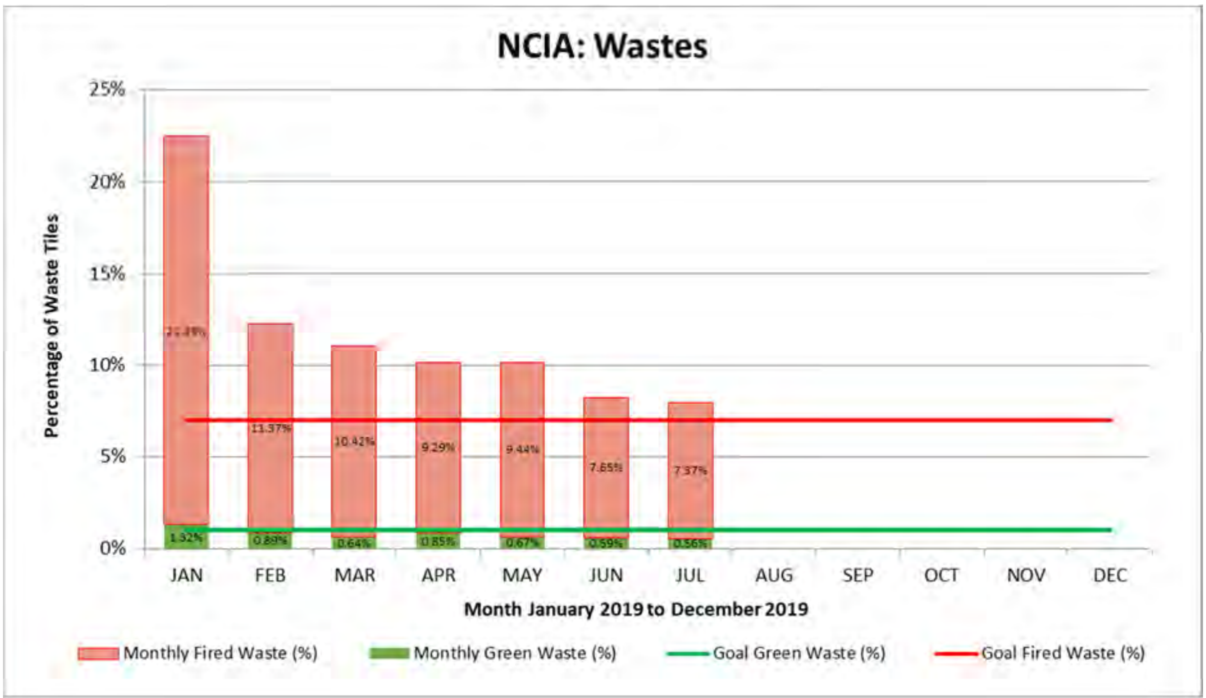


Figure 16 Tile waste (green and fired) generation during 2018-2019

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5.0 Discussion of Environmental Performance

This section provides an assessment of the monitoring results for the reporting period against the criteria set out in the Project Approval and EPL, predictions made in the 2010 EA, and the monitoring results from previous years. 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 Parc subdivision (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 future residential receptors within Heritage Parc was predicted to be 3.2 µg/m^3 (compared to the criterion of 2.9 µg/m^3); and
- The above exceedance of the 24 hour Fluoride criterion was predicted during a worst case scenario with NCIA operating all eight Stages. Only two Stages of the development are currently operational.

Ambient air quality monitoring during the reporting period (presented in Section 4.1) indicated that the levels of 24 hour PM_{10}, annual average PM_{10}, 24 hour fluoride and weekly fluoride were generally compliant with the relevant guidelines criteria, with five exceedances of the 24 hour PM_{10} criteria of 50 µg/m^3 recorded. NCIA were not considered to be a major contributor to any of these exceedances (as discussed in Section 4.1.1). The monitoring results for the reporting period are considered to be 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 17 to Figure 22. An analysis of historical trends in air pollutant concentrations (and where relevant comparisons against the current reporting period) reveals the following:

- Historical PM_{10} concentrations are variable with results generally oscillating around a relatively stable annual average and isolated elevated concentrations occurring episodically. PM_{10} concentrations during the 2019 reporting period were consistent with historical data and there is a decreasing linear trend in PM_{10} concentrations, which is more apparent at the NW monitoring location compared to the SE monitoring location.
- Following seven years of relatively low and steady levels of fluoride emissions between 2004 and 2011 (despite isolated and episodic increases), gaseous fluoride levels have slightly increased since 2012 in both the 24-hour and weekly fluoride levels. Fluoride emissions during the 2019 reporting period were similar to the previous five years. Nonetheless, there is an overall increasing linear trend in 24 hour and weekly fluoride levels at both monitoring locations.

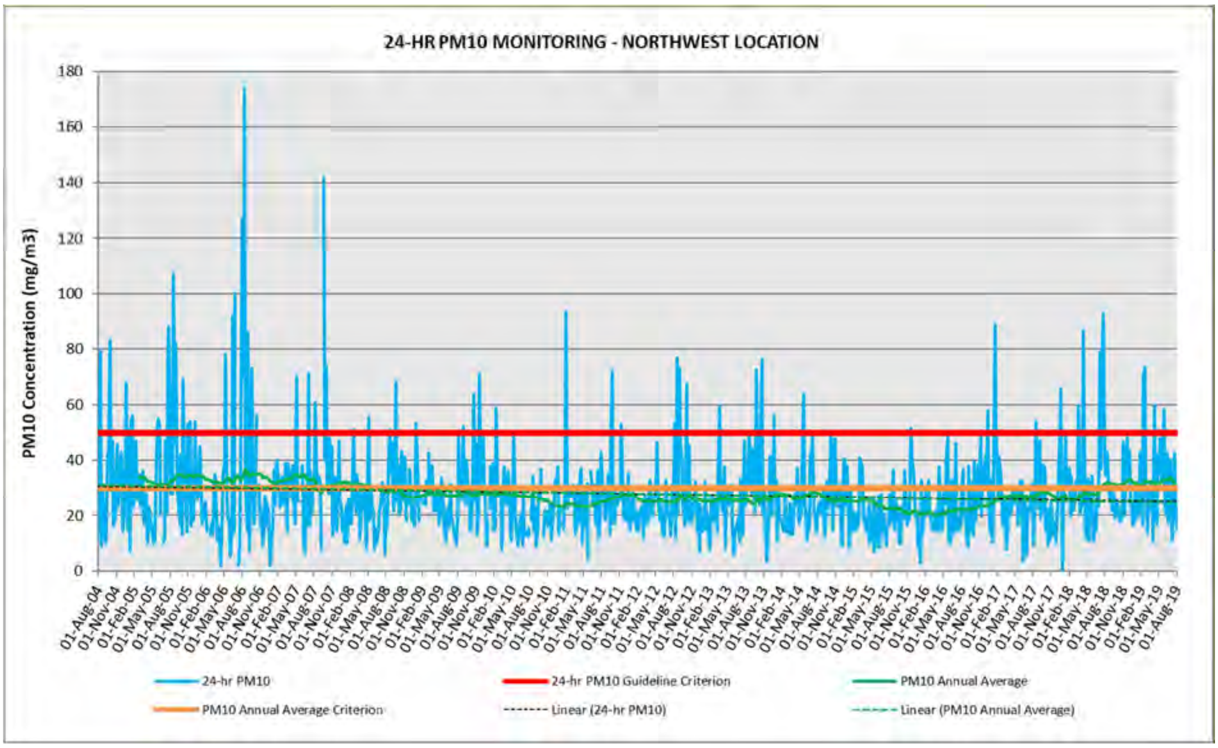

Figure 17 24-hour PM_{10} monitoring – northwest location (2004 – 2019)

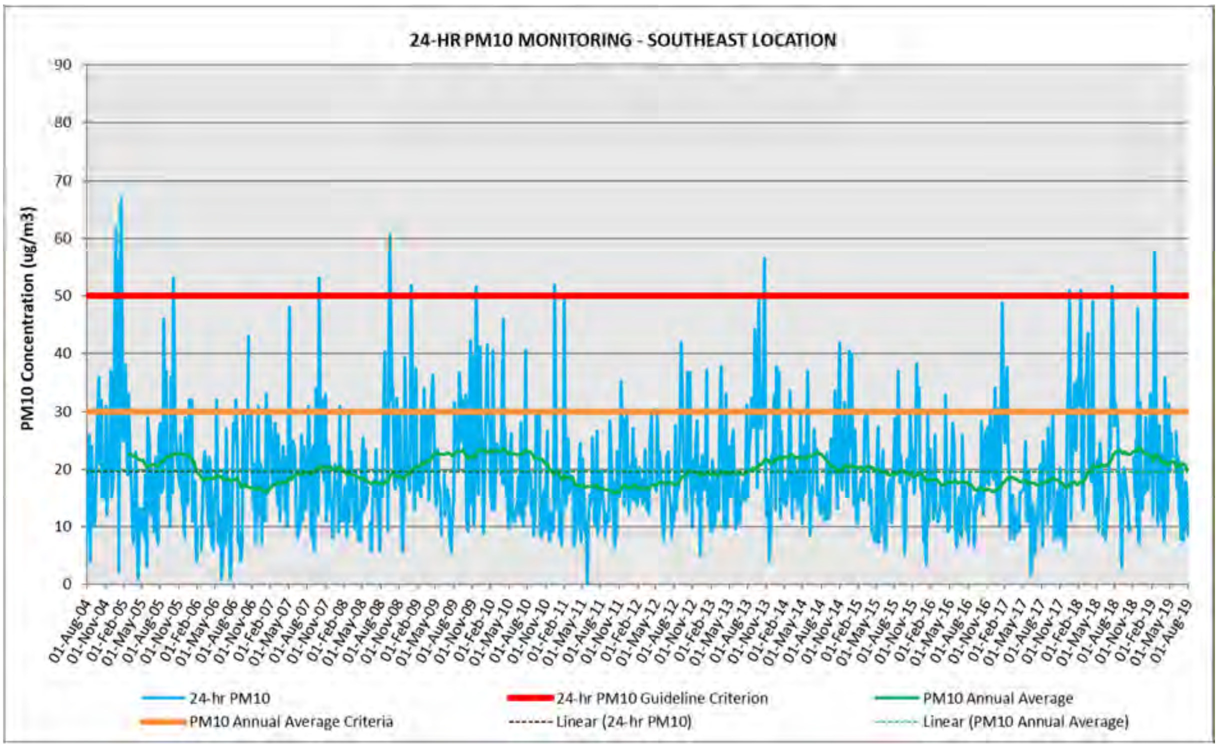

Figure 18 24-hour PM_{10} monitoring – southeast location (2004 – 2019)

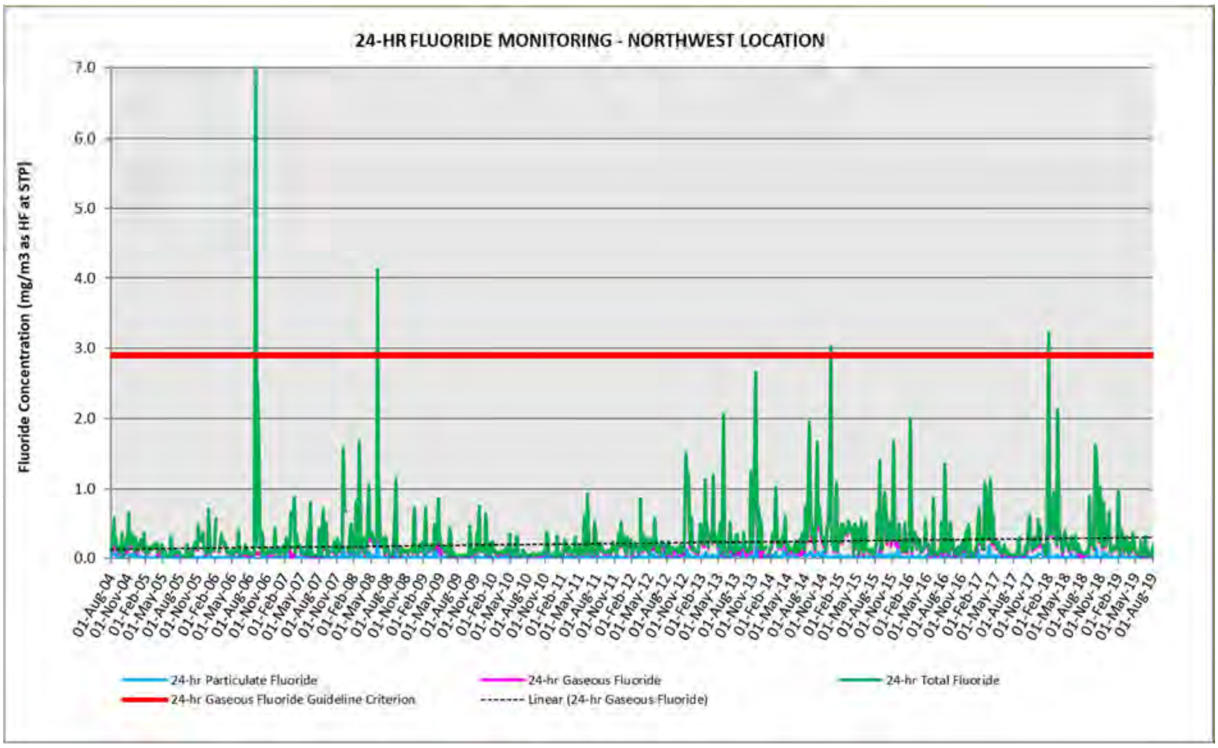

Figure 19 24-hour fluoride monitoring – northwest location (2004 – 2019)

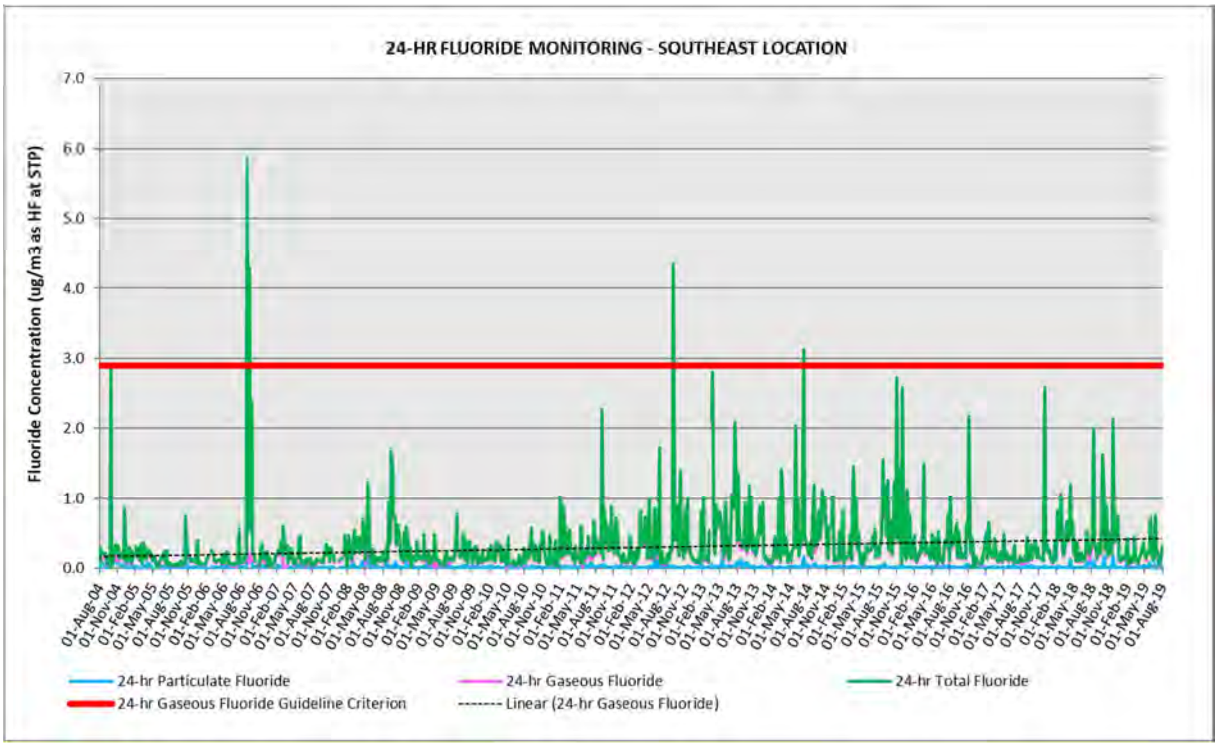

Figure 20 24-hour fluoride monitoring – southeast location (2004 – 2019)

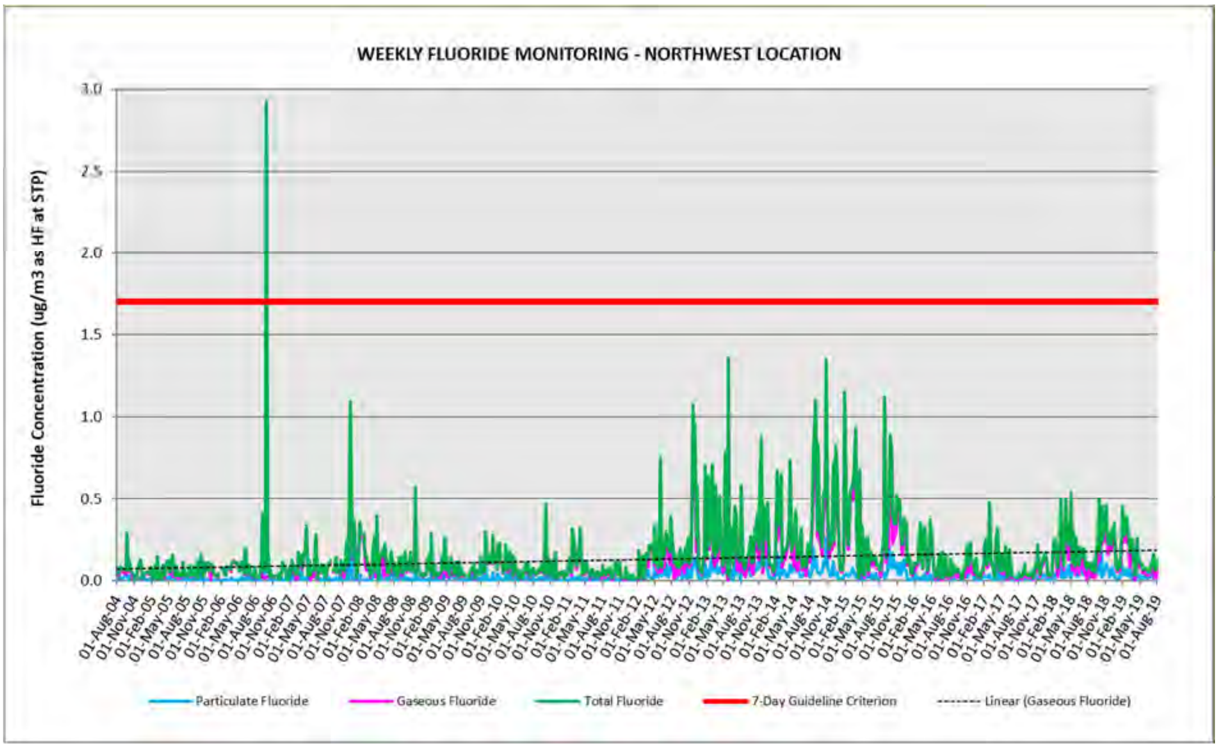

Figure 21 Weekly fluoride monitoring – northwest location (2004 – 2019)

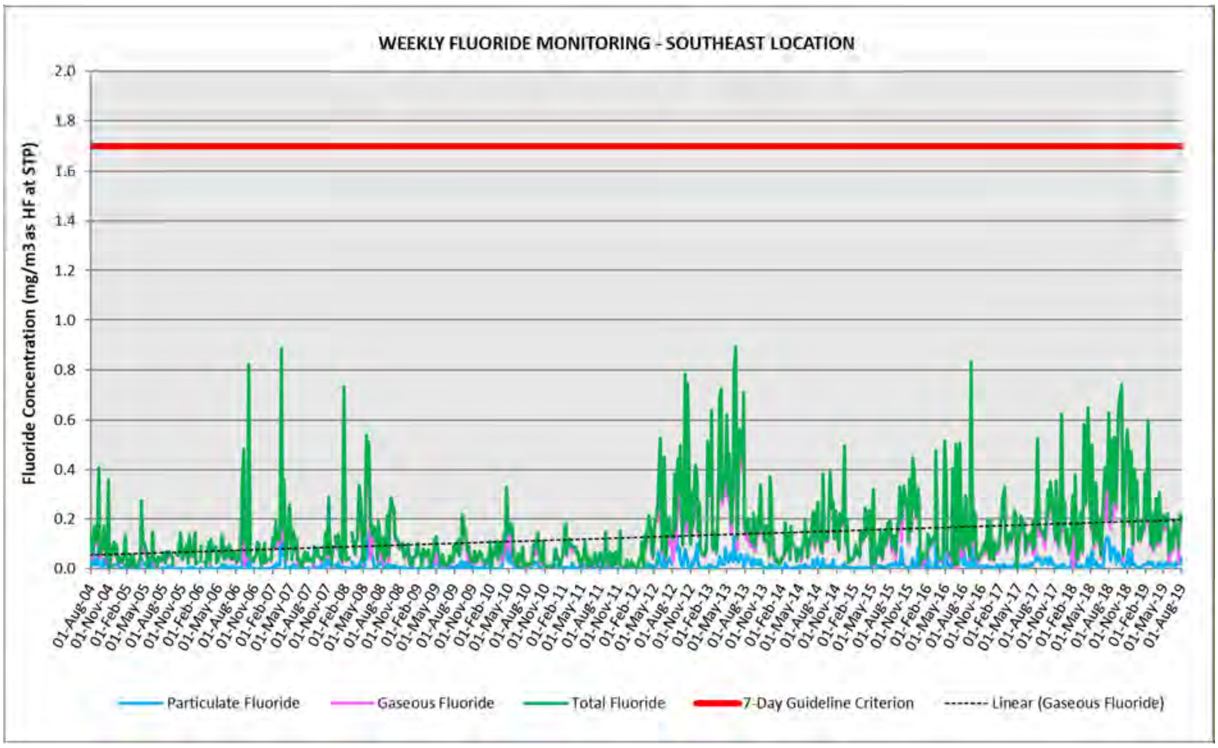

Figure 22 Weekly fluoride monitoring – southeast location (2004 – 2019)

5.2 Fluoride Impact on Vegetation

As required by the EPL the potential impact of NCIA's operations on vegetation surrounding the facility is monitored through assessment of fluoride impacts on local 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. Likewise, the 2010 EA did not specifically discuss fluoride impact on vegetation and therefore no predictions are available for comparison. 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 program are presented in Figure 23. For each quarterly survey the data has 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 4-4 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).

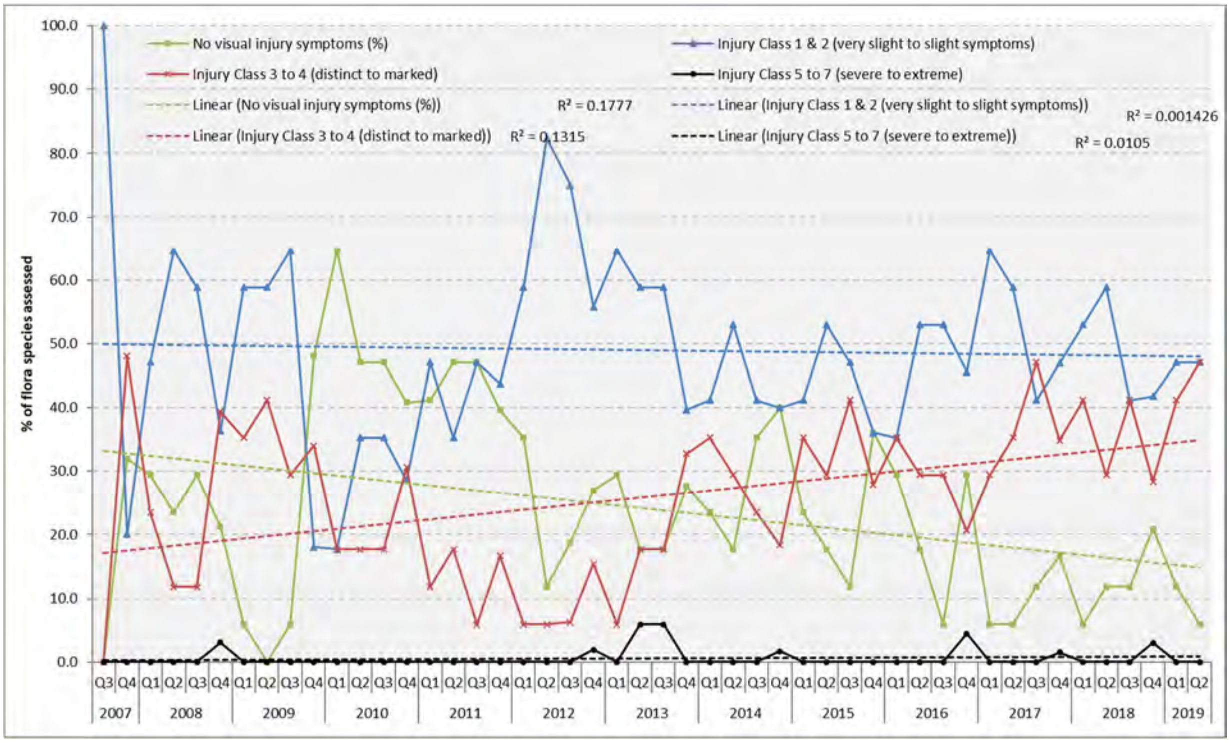

Figure 23 Proportion of flora species affected by emission related visual injury symptoms (2007-2019)

Despite clear seasonal variations, historical data show little long-term variability in the severity of fluoride impacts to vegetation surrounding the NCIA facility. The data supports no statistically significant increase or decrease in the severity of injury symptoms since the start of the monitoring program (as justified by the correlation r^2 values for all severity classes being <0.1777).

Interrogation of the long term monitoring data indicates the following:

- The majority of flora species assessed since the start of the monitoring program have commonly displayed at least some level of fluoride related injury symptom (87% on average during each quarterly survey). Of all plants showing emission related impacts to foliage:
  - On average 49% displayed very slight or slight visual injury symptoms (i.e. less than 5% of leaf area affected) and 26% displayed distinct or marked fluoride injuries (i.e. between 10% and 25% of leaf area affected);
  - Severe injury symptoms (i.e. 25–50% of leaf area impacted) have rarely been recorded during the monitoring program (Eight instances in a total of 1241 observations since 2007) and where this has been the case, injury symptoms did not persist; and
  - Only three instances of very severe injury symptoms (i.e. 50-75% of leaf area impacted) have been recorded throughout the monitoring program and extreme injury symptoms (i.e. greater than 75% of leaf area impacted) have never been recorded.
- The majority of flora species assessed since the start of the monitoring program have commonly displayed at least some level of insect attack injury symptoms (approximately 77% of all species affected on average). Of all plants showing impacts from insect attack: injury severity was very slight in 24% of cases, slight in 25% of cases, distinct in 19% of cases, marked in 7% of cases and severe in less than 1% of cases.

The monitoring data obtained during the current reporting period (as presented in Section 4.0) are generally well aligned with these long term trends. As is commonly observed, this year's results have shown some minor variations in foliage condition against previous year's results, with some specimens showing either slight deteriorations or slight improvements in foliage condition (whilst most showed relatively consistent symptoms). None of this year's survey results could be flagged as exceptional in the context of the long-term monitoring program and associated historical data.

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 24 to Figure 27.

Overall foliar fluoride concentrations for the samples collected during this monitoring period's surveys were consistent with the long-term range of data for all species at all locations. The following comments apply to this year's results when compared against previous year's data:

- Historic data for *E. moluccana* at Site 5 indicates that there is typically a seasonal increase in foliar fluoride concentrations during spring (Q3) or summer (Q4) before levels settle down during autumn (Q1) and winter (Q2), which reflects changing dominant wind patterns occurring with the change of season. Overall this year's foliar fluoride concentrations values in this species were within the lower range of historical values.
- Samples of grasses collected at Site 11 consistently returned low fluoride contents (i.e. ≤10.0µg/g) during the current reporting period, which is consistent with the long term results (Figure 25). Seasonal increases in fluoride concentration are commonly observed in grasses at this location in response to changing wind patterns. Historical records show that fluoride concentrations often peak during Q2 or Q3 (i.e. in late spring or winter when winds have been dominated by north-westerlies blowing towards the monitoring site from the NCIA kiln stacks).
- Sampling results of *E. amplifolia* at Site 13 during the current reporting period were within the medium to low range of historical values for this species (Figure 26) The long term trend in this specimen emphasises the high seasonal / annual variability and relative unpredictability in foliar fluoride concentrations in individual species.
- Consistent with long term data, fluoride concentrations in the foliage of *C. maculata* at Site 13 have been relatively low throughout the current reporting period (i.e. generally below 12.0 µg/g).
- Foliar fluoride concentrations in *C. maculata* at Site 15 observed an episodic fluoride concentration peak (120 µg/g), being common in this species, peak during Q4 2018, with the remaining quarters containing low range of historical values (Figure 27). Historical records

indicate a very high variability in fluoride content for this species since 2007, with a seemingly stochastic and unpredictable pattern that appears independent from seasonal wind changes.

Historical data show wide fluctuations in foliar fluoride content between quarterly surveys, and it is common 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 fluctuating fluoride concentrations and historical data shows that for each species fluoride concentrations tend to oscillate within a set range of values.

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.

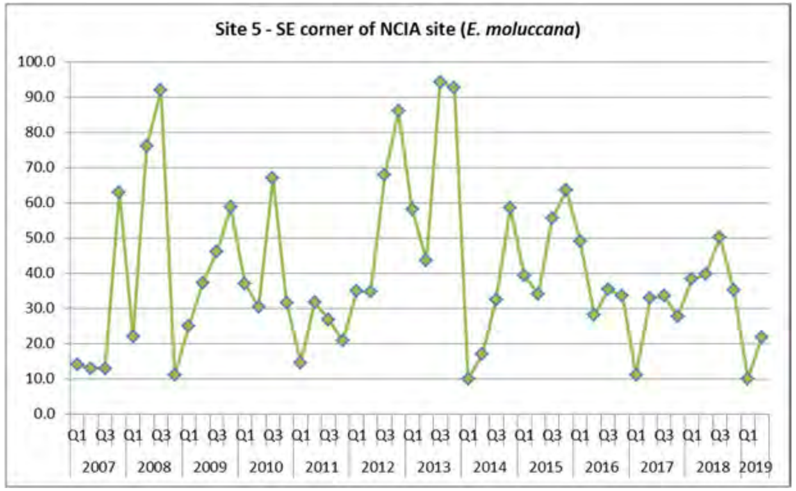

Figure 24 Fluoride content in *E. moluccana* foliage at Site 5 (Q1 2007 – Q2 2019)

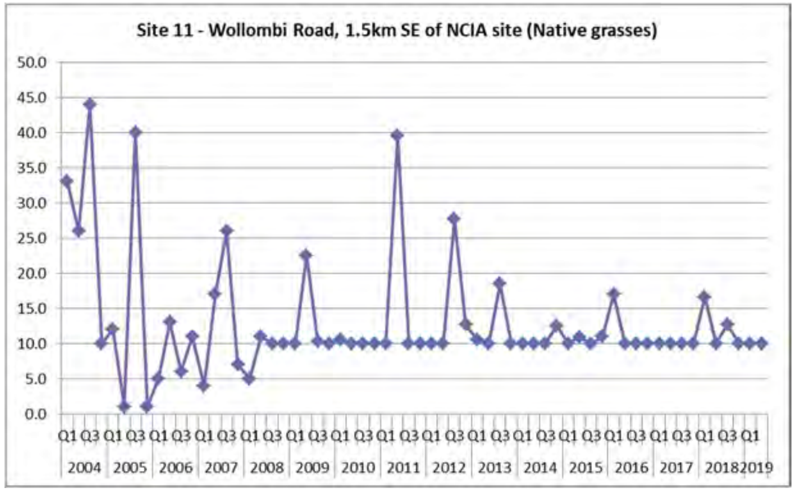

Figure 25 Fluoride content in grasses at Site 11 (Q1 2004 – Q2 2019)

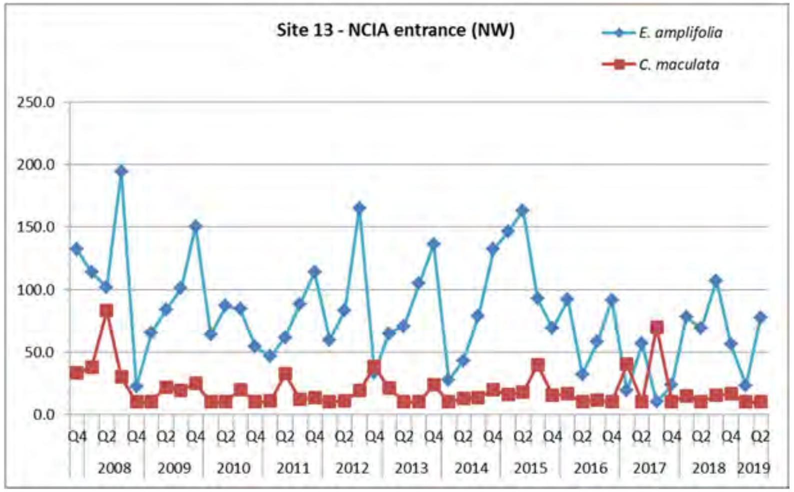

Figure 26 Fluoride content in *E. amplifolia* and *C. maculata* foliage at Site 13 (Q4 2007 – Q2 2019)

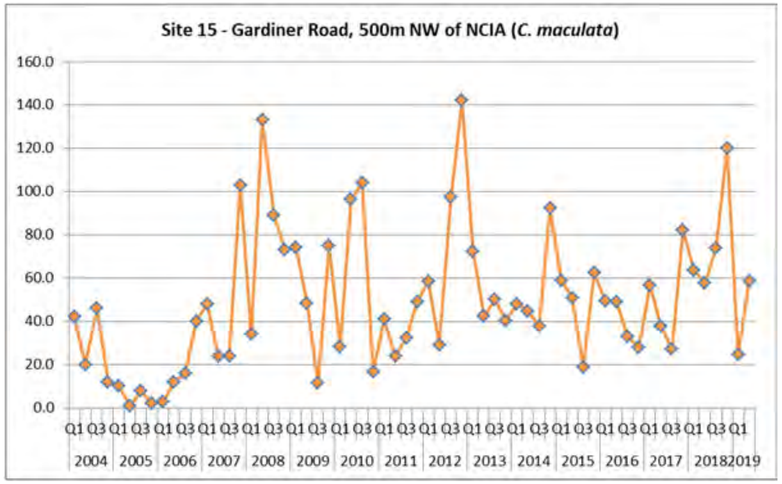

Figure 27 Fluoride content in *C. maculata* foliage at Site 15 (Q1 2004 – Q2 2019)

5.2.3 Reference Site

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

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. 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 attack injuries. The link to fluoride emission as a cause for these symptoms cannot be confidently determined for this monitoring location. It is possible that some species will exhibit foliar injury symptoms under 'natural' conditions. Other factors may play a role in the expression of injury, which may include environmental conditions, stress (e.g. drought, wind, diseases, etc.), and pollutants from other sources or impacts from insects.

Given the social and economic importance of the viticultural industry in the Hunter Valley the potential impact of atmospheric pollutant emissions from industrial sources on the health of the grape vine *Vitis vinifera* (a known sensitive species) has traditionally been a concern for the industry. Consequently, foliar sampling and analysis of *Vitis vinifera* foliage from the reference site has historically been included as part of this vegetation monitoring program. Historical concentrations since the commencement of the monitoring programme are presented in Figure 28.

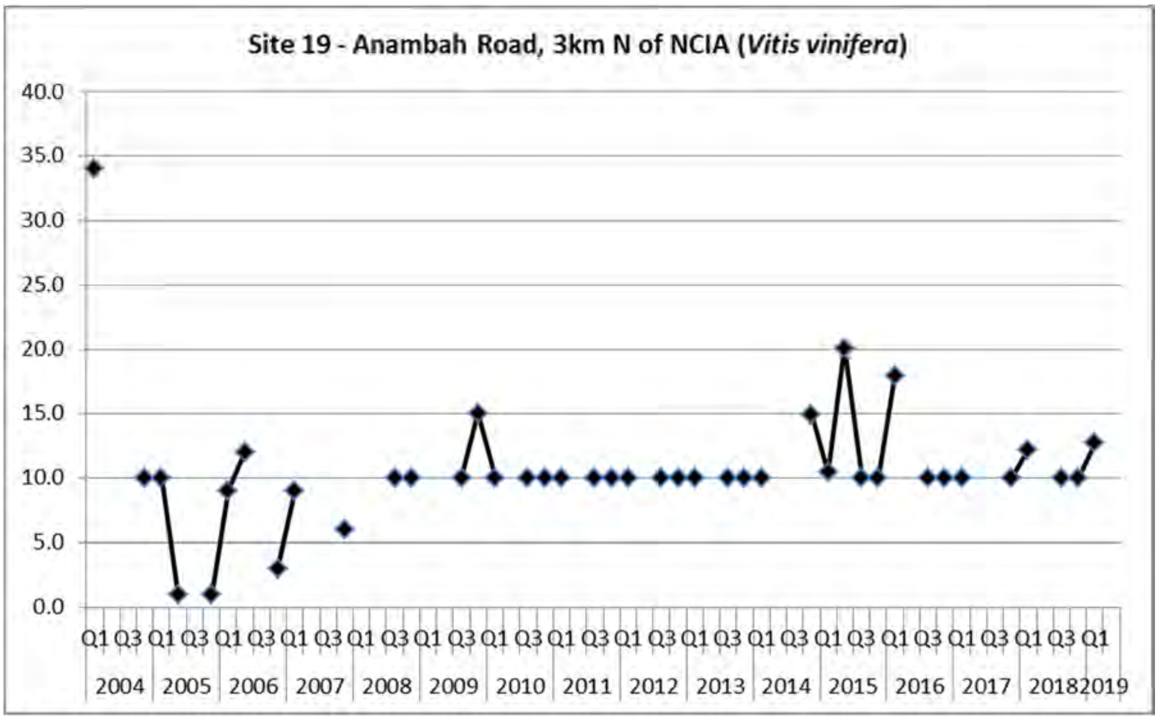

Figure 28 Fluoride content in *Vitis vinifera* foliage at Site 19 (Q1 2004 – Q2 2019)[2]

Long term data show that foliar fluoride has consistently returned very low concentrations for this species (<10.0 µg/g).

Recurrent elevated fluoride levels were recorded in the species between Q4 2014 and Q1 2016 (Figure 28). As noted in last year's AEMR, the property at the reference site underwent significant maintenance during that period, including 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) used for irrigation can result in toxicity symptoms on sensitive plants such as grape vines (Psheidt, 2015). In this regard the elevated fluoride levels returned during that period may have been

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

linked to the maintenance activities (and irrigation) undertaken on site. However, fluoride concentration levels recorded in the grape vine appear to have stabilised during the current reporting period. This indicates that the species may have adjusted to the new irrigation water.

5.2.4 Relationship between Visual Symptoms and Foliar Fluoride Content

The results of the vegetation surveys undertaken during the reporting period together with historical data seem 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 13 commonly returns the highest fluoride concentrations its foliage only shows very slight visible injury symptoms (and notably no chlorosis symptoms). Conversely, the foliage of *C. maculata* at the same location consistently exhibits distinct fluoride visual injury symptoms while the laboratory results show that its foliar fluoride concentrations are the lowest of all tree species sampled. The discrepancy between visual injury symptoms and foliar fluoride concentrations may be due to:

- A lag in the visible expression injury symptoms following exposure to atmospheric fluoride emissions;
- Varying sensitivity of individual specimens in exhibiting visible injury symptoms; and/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 the EPL. Table 5-1 demonstrates the percentage uptime of monitoring equipment achieved throughout the reporting period. The meteorological monitoring equipment achieved continuous monitoring of 90.3% of the reporting period except wind direction which achieved 90.1% continuous monitoring.

Table 5-1 Meteorological station up-time

Meteorological Parameter	Frequency	Percentage up-time during reporting period
Wind speed @10m (m/s)	Continuously	90.3%
Wind direction @ 10m (degrees)	Continuously	90.1%
Sigma theta @ 10m (degrees)	Continuously	90.3%
Ambient temperature @ 5m (degrees Celsius)	Continuously	90.3%
Rainfall (mm)	Continuously	90.3%

5.4 Air Pollutant Load Limits

The 2010 EA included dispersion modelling to predict ground level pollutant concentrations. The source emission concentrations used in the modelling (Table 17 of the 2010 EA) were based on the results of stack emission testing conducted between 2007 and 2009. A comparison of the measured in stack emission concentrations for the reporting period and the emission concentrations used in the 2010 EA modelling is provided in Table 5-2. The results are variable - some of the measured emission concentrations during the reporting period are lower than the emission concentrations used in the 2010 EA modelling, and some are higher than those used in the 2010 EA modelling. However, where measured stack concentrations were higher than those used in the 2010 EA, these did not result in an exceedance of the EPL criteria (refer to Section 4.4) with the exception of total fluoride for Kiln 1.

Trends in the air quality pollutants discharged to air as a result of NCIA operations over time can be established using the assessable pollutant loads reported to the EPA in the Annual Returns since 2003. The actual load of assessable pollutants reported in the Annual Returns is calculated in accordance with the relevant Load Calculation Protocol for ceramics production. Table 5-3 provides the assessable pollutant loads discharged by NCIA during the reporting period. The maximum load limits set out in both the EPL and Project Approval and the historical pollutant loads discharged (2004-present) have also been included for comparison purposes and are presented graphically in Figure 29 to Figure 33.

The load limits specified in the Project Approval and EPL differ. Condition 16 of the Project Approval states:

> *Unless the OEH specifies otherwise, the Proponent shall ensure that the annual total load discharged from the site does not exceed the load limit specified for that pollutant in Table 3.*

As the EPA has 'specified otherwise' by specifying different load limits in the EPL (that are equivalent to Stage Two operations), the load limits in the EPL prevail over those in the Project Approval.

For the current reporting period, fine particulates (PM_{10}), coarse particulates, sulfur oxides and nitrogen oxides were all within the pollutant load limits. However fluoride discharged to air exceeded the EPL load limit during the reporting period. This is likely to be due to the normal variability in process and annual stack testing results. It is noted that all weekly and 24 hour fluoride ambient monitoring to the North West and South East of the facility returned results below the relevant EPA guideline criteria.

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. These fluctuations are likely due to the normal variation in stack emission testing results. This renders difficulty in any comparison of this year's emission results against the long term data. The following points are made in relation to the current load limit results:

- PM_{10} emissions recorded a decrease in levels from the previous 2017-18 period, with levels remaining well below the permitted EPL load limit;
- Coarse particulate emissions increased in levels than those reported last year, with levels less than the permitted EPL load limits;
- The total amount of fluoride discharged during reporting period exceeded the EPL load limit. However fluoride emission levels were lower than the previous fluoride load levels reported in the last three years (2015-2016, 2016-2017 and 2017-2018).
- The sulfur oxides pollutant load was similar to or lower than previous reporting periods and was less than a quarter that permitted under the EPL; and
- The nitrogen oxides pollutant load was similar to previous reporting periods and well below the permitted load limits.

Table 5-2 Comparison of emission concentrations used in 2010 EA modelling and measured in stack emission concentrations for the current reporting period

Source	Emission Concentration (mg/m³)							
	Fine particulate (PM_{10})	Total Particulate	Total Fluoride (as HF)	Sulfuric acid mist (H_2SO_4 as SO_3)	Total Hazardous substances (Metals)	Total Oxides of Nitrogen	Cadmium	Mercury
Kiln 1 (EPL 14)	**7.1** (5.3)	**8.3** (5.3)	**8.1** (5.0)	**19** (9.6)	0.074 (0.2)	27 (50.0)	**0.0082** (0.003)	0.0035 (0.01)
Kiln 2 (EPL 15)	**11** (5.3)	**14** (5.3)	1.49 (5.0)	7.6 (9.6)	0.084 (0.2)	26 (50.0)	**0.0038** (0.003)	0.0034 (0.01)
Clay preparation (CP1) (EPL 1)	1.6 (2.0)	**5.2** (2.3)	-	-	-	-	-	-
Pressing and Drying (PD1) (EPL 2)	N/A (2.5)	4.6 (4.8)	-	-	-	-	-	-
Dryer (D1) (EPL 5)	3.0 (8.4)	7.2 (12.8)	-	-	-	-	-	-
Dryer (D2) (EPL 6)	8.1 (8.4)	**14** (12.8)	-	-	-	-	-	-
Glaze Line (EPL 9)	0.82 (1.9)	**19** (4.3)	-	-	-	-	-	-
Selection Line (SL 1,2,3,4) (EPL 10)	0.8 (6.3)	1.5 (6.3)	-	-	-	-	-	-
Spray Dryer (SD1) (EPL 12)	1.4 (13.1)	1.9 (13.1)	-	-	-	-	-	-
Hot Air Cooler 1 (HAC1) (EPL 18)	**2.6** (0.3)	**3.9** (2.3)	-	-	-	-	-	-
Hot Air Cooler 2 (HAC2) (EPL 19)	**0.68** (0.3)	**3.6** (2.3)	-	-	-	-	-	-

Note – Emissions concentrations used in 2010 EA modelling are shown in parentheses.
Bold text identifies where measured in stack emission concentrations during the reporting period are greater than emission concentrations used in 2010 EA modelling.

Table 5-3 Maximum pollutant load limits and assessable pollutant loads

Pollutants loads		Pollutant				
		Fine particulates (PM10)	Coarse particulates	Fluoride	Sulfur oxides[3]	Nitrogen oxides
Current Maximum Load Limit (kg)	EPL	26,629	14,338	1,850	36,828	36,828
Actual Load (kg) in reporting period	2018-2019	7,140	8,346	**2,076**	5,699	20,996
	2017-2018	10,145	2,878	**2,239**	6,059	25,165
	2016-2017	13,028	5,800	**2,411**	14,835	19,023
	2015-2016	5,816	11,310	**4,146**	16,835	21,360
	2014-2015	4,963	2,302	1,400	15,240	24,016
	2013-2014	5,369	3,289	928	4.280[4]	25,059
	2012-2013 [1]	1,249	1,640	1,109	1,235[4]	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	**70,565**	**62,426**
	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	21,751	11,986	**4,085**	13,239	13,887
	2004-2005	4,034	2,100	**2,154**	21,335	6,721
	2003-2004	1,028	1,089	150	5,813	1,151

Bold represents an exceedance

[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)).

[4] Sulfur oxide loads for the 2012-13 and 2013-14 reporting years have been corrected to only include sulfuric acid mist and sulfur trioxide, as agreed with regulatory authorities, and not sulfur dioxide as previously calculated and reported.

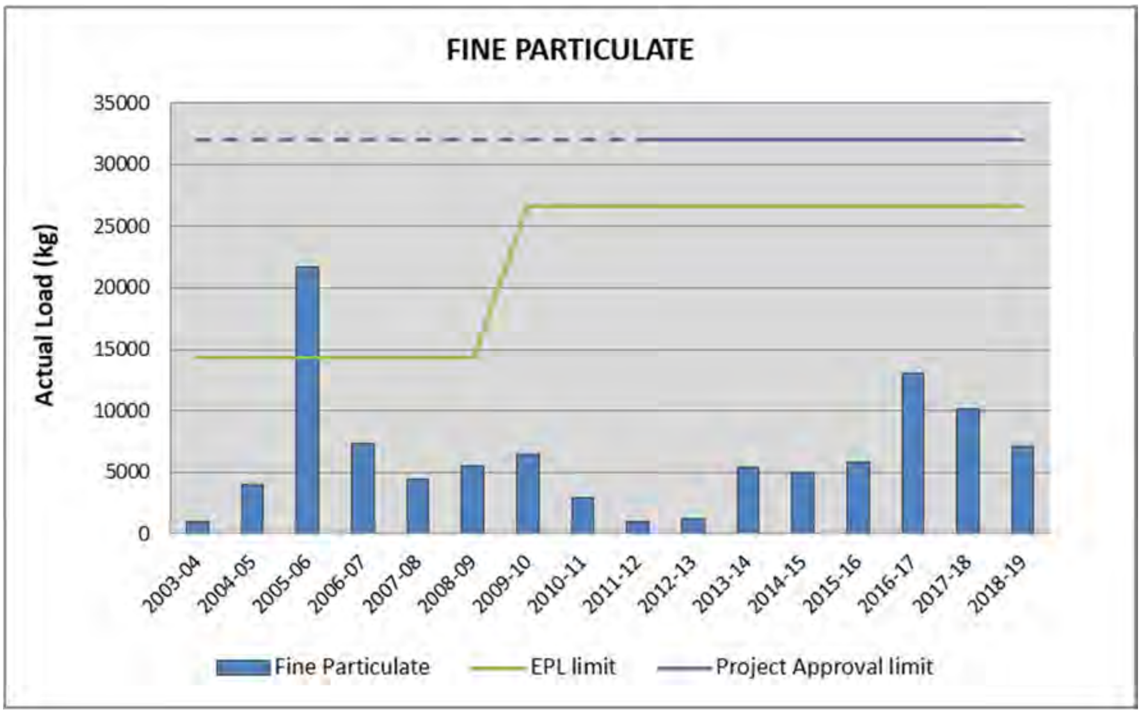

Figure 29 Fine particulate annual load (2004 – 2019)

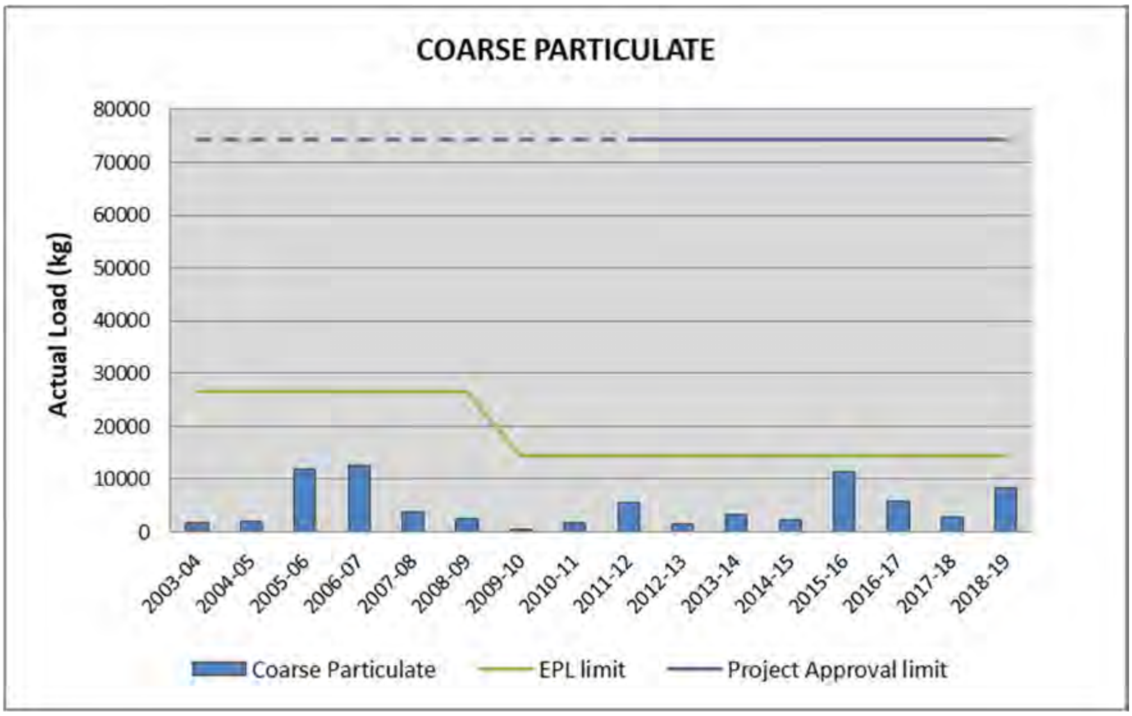

Figure 30 Coarse particulate annual load (2004 – 2019)

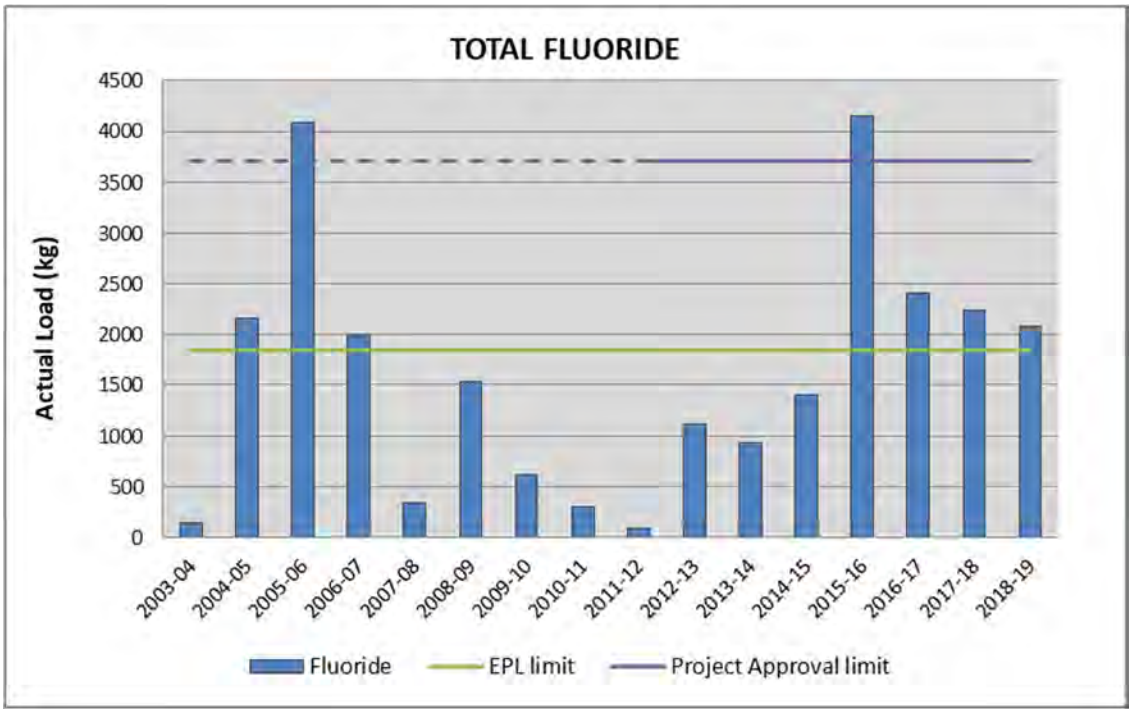

Figure 31 Fluoride annual load (2004 – 2019)

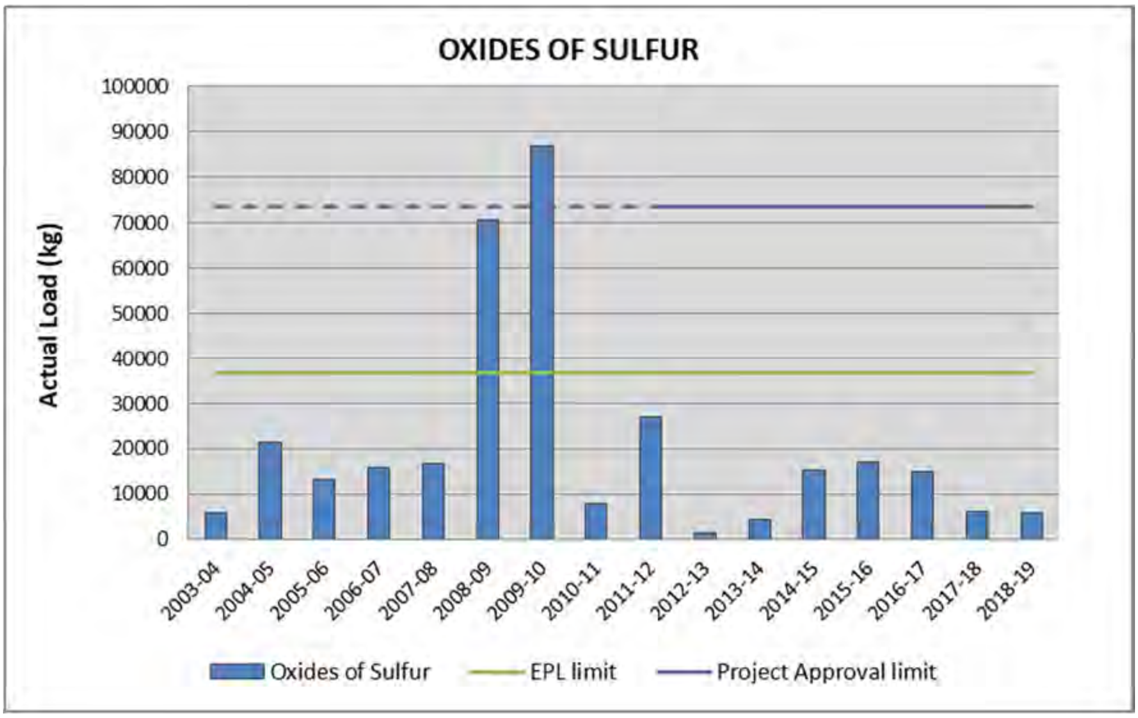

Figure 32 Sulfur oxides (as sulphuric acid mist and sulfur trioxide (as SO_3)) annual load (2004 – 2019)

Note: Sulfur oxide loads for the 2012-13 and 2013-14 reporting years have been corrected to only include sulfuric acid mist and sulfur trioxide, as agreed with regulatory authorities in 2012, and not sulfur dioxide as previously calculated.

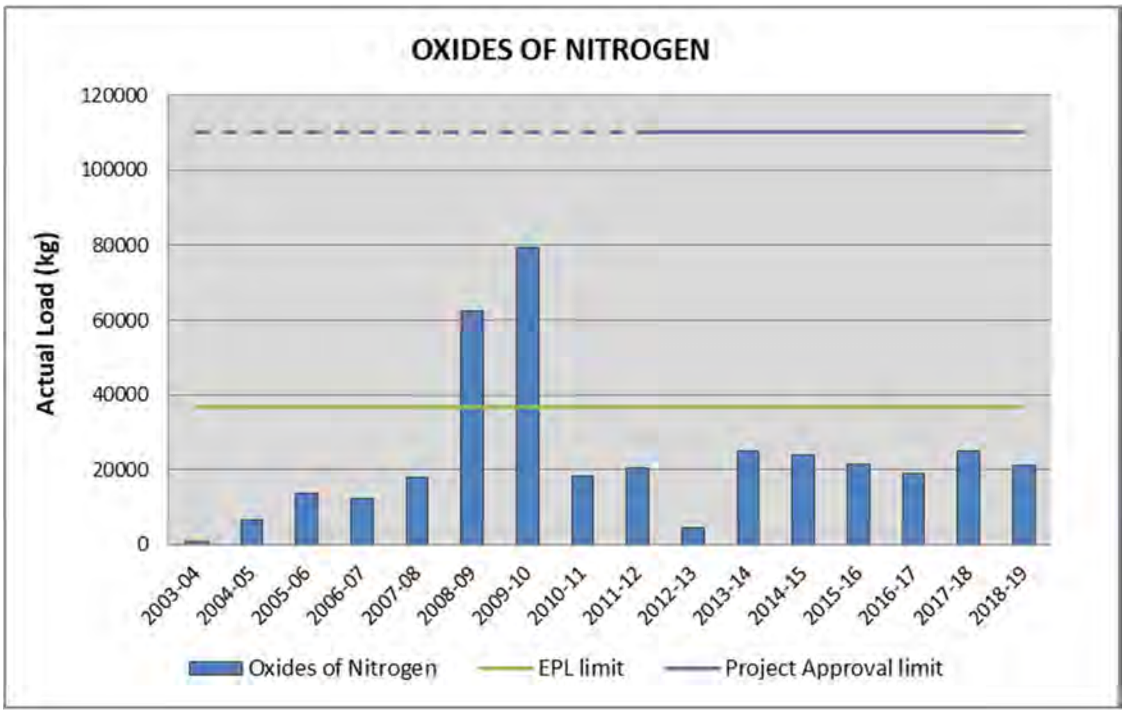

Figure 33 Nitrogen oxides annual load (2004 – 2019)

5.5 Noise

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. The 2010 EA predicted that the operational noise levels from the expanded facility would not change considerably 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 noise generated from NCIA must not exceed 35 dB(A) for the day, evening and night periods.

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

Historical noise monitoring results at the Kenvil Close monitoring location are provided in Figure 34 – Figure 36 for the day, evening and night periods respectively. On many occasions NCIA was not clearly audible over other dominant nearby industrial and traffic noise sources.

No trends in the noise monitoring are clearly discernible with historical noise emissions 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 ten years the NCIA noise contribution was either inaudible or audible but not measurable. The current noise monitoring report noted that traffic noise from the New England Highway contributed significantly to the background noise levels at Kenvil Close.

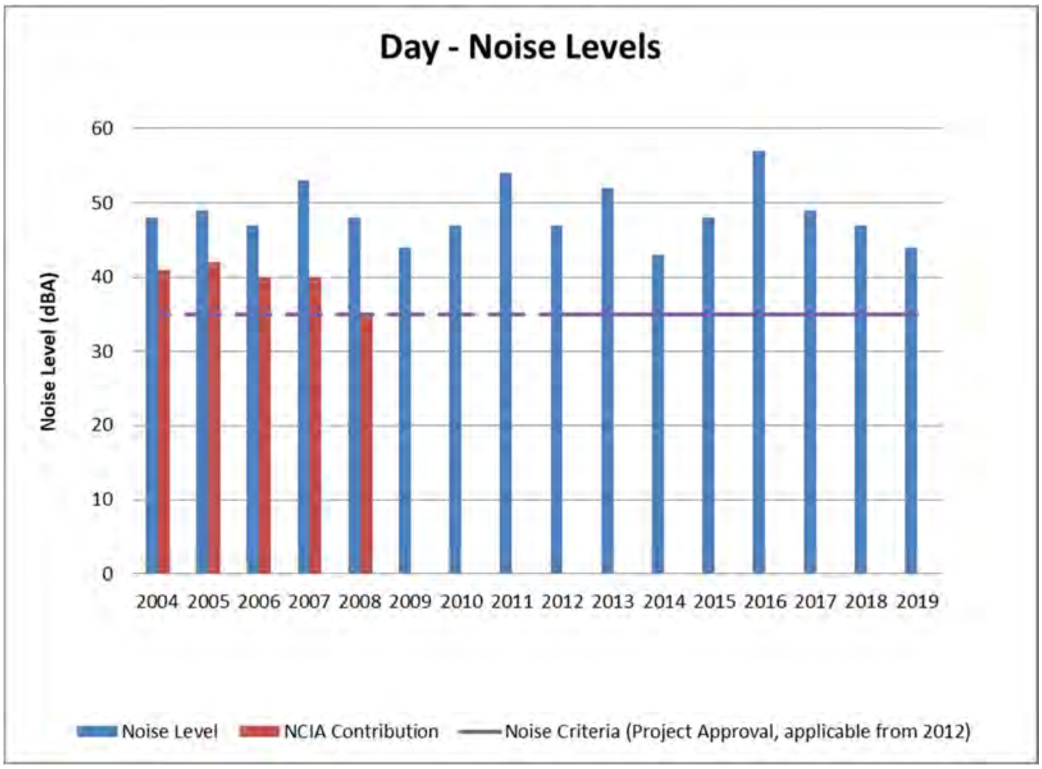

Figure 34 Day noise levels 2004 – 2019

Note 1: 2009 - 2019: NCIA contribution was either inaudible or not measurable.

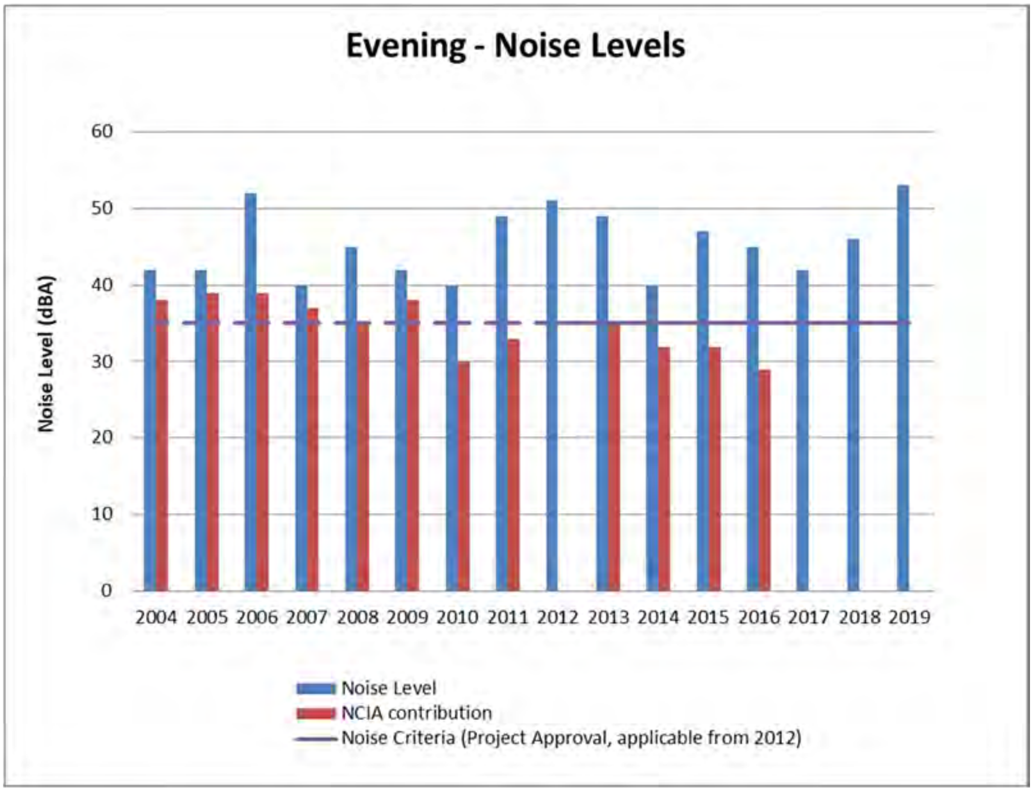

Figure 35 Evening noise levels 2004 – 2019

Note: 2012, 2017, 2018 and 2019: NCIA contribution was either inaudible or not measurable.

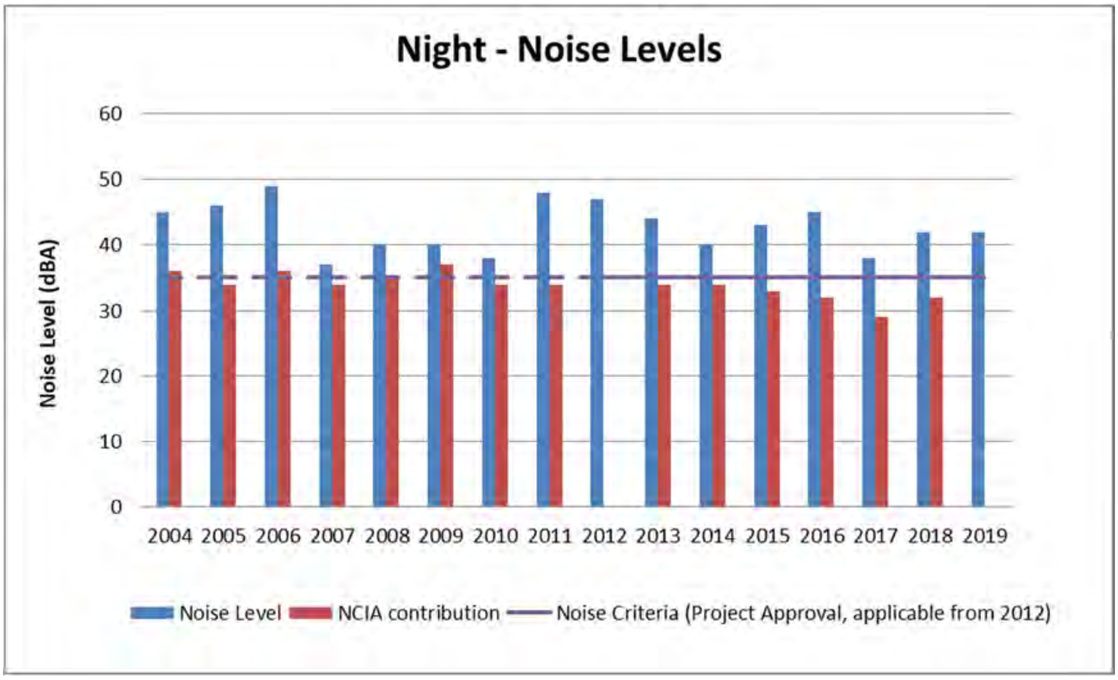

Figure 36 Night noise levels 2004 – 2019

Note: 2012 and 2019: 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 potable water during the reporting period August 2018 to July 2019 was approximately 60 ML. The consumption of approximately 60ML of potable water is proportionally within the predictions of the EA given that only Stages One–Two were operational. NCIA have held preliminary discussions on site with Hunter Water representatives regarding potential Water Saving Initiatives.

It is anticipated that the 92ML/year threshold usage over which NCIA will require HWC 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 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.

The NCIA facility does not discharge process or washdown water to the storm water system. Water used for process requirements is only 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 evaporates.

Apart from discharges to the sewer from staff amenities 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 NCIA 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 37 and Figure 38, 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, with the exception of the past two reporting periods. On occasion since 2009 recorded pH values occurred beyond the ANZG pH trigger values, with the upper threshold limit exceeded more often than the lower limit (refer to Figure 37), highlighting a trend towards alkalinity. This trend has continued during the current reporting period with 21 monitoring events showing pH results higher than the ANZG trigger values (refer to Section 4.6.2).

EC results during 2019 are comparable to previous years with a stable average and no exceedances of the criteria (refer to Figure 38). A review of historical EC values indicates an overall decreasing trend. EC values are generally within the ANZG guidelines trigger values and indicate that the stormwater is non-saline.

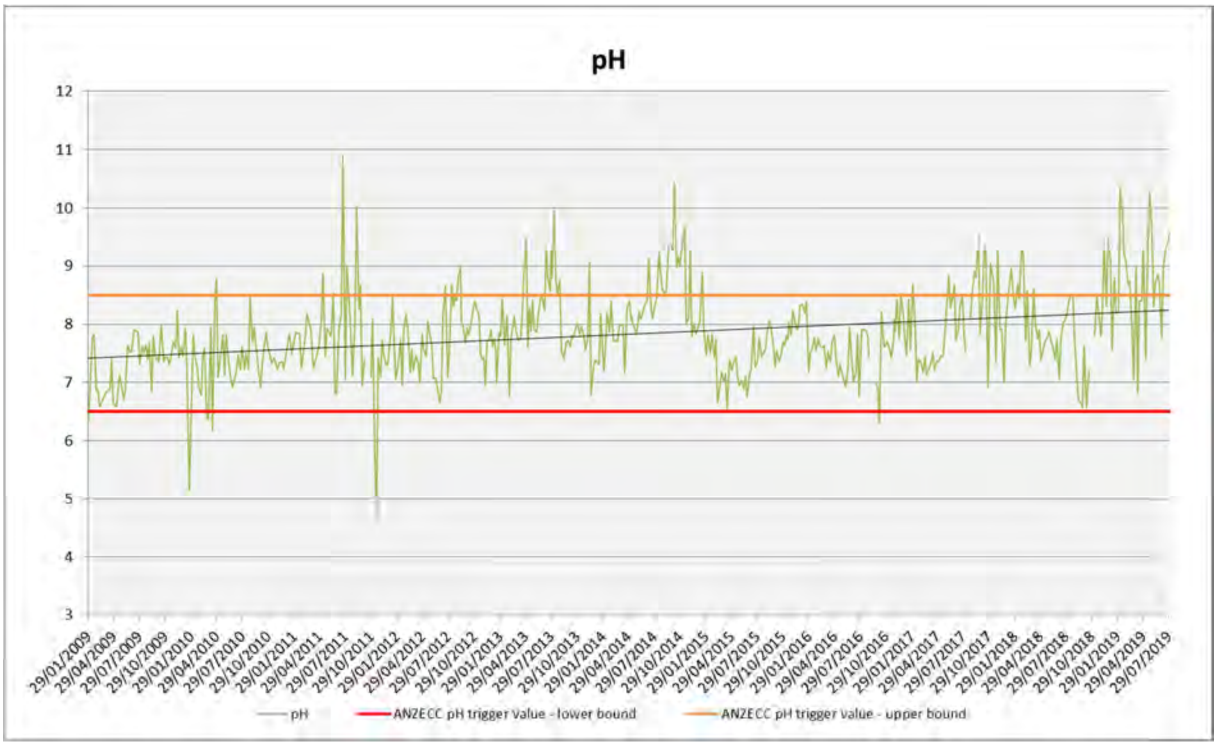

Figure 37 Stormwater quality, pH – Pond 4 (2009-2019)

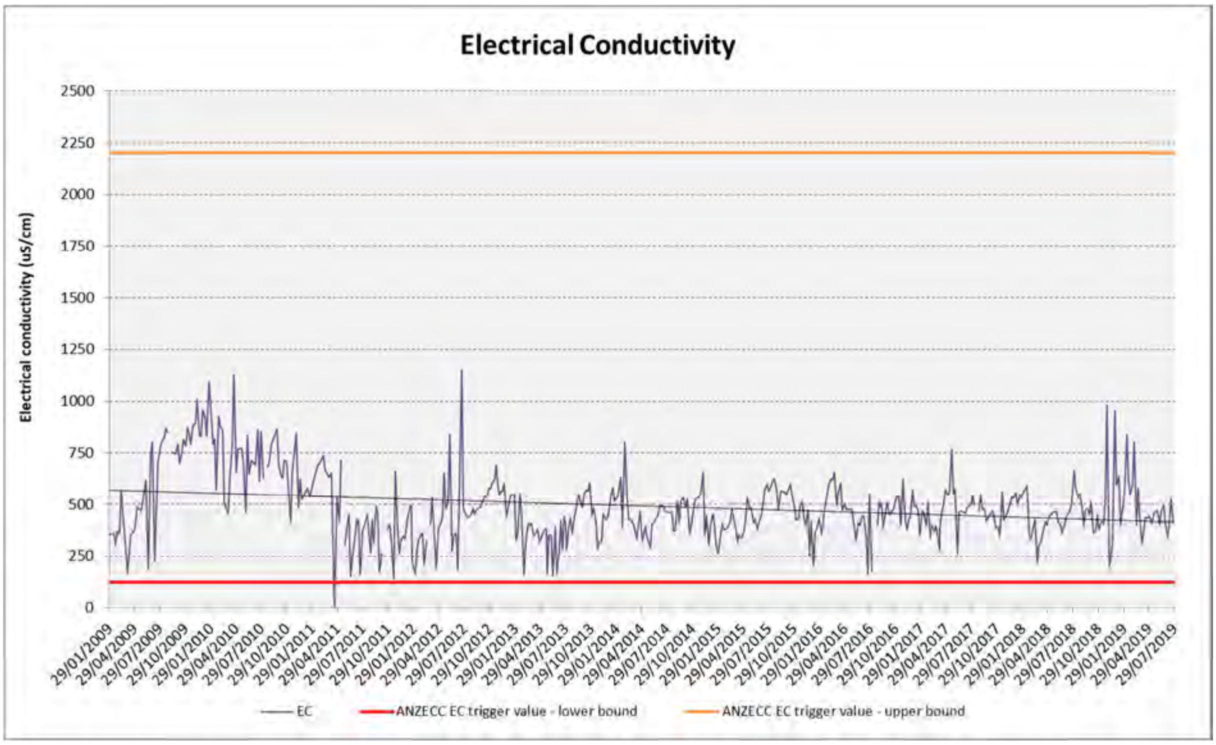

Figure 38 Stormwater quality, EC – Pond 4 (2009-2019)

5.6.4 Stormwater Management

The 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 NCIA is achieved via four water detention basins which are connected by grass swales (managing 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 the south eastern corner of the site (connected to Pond 4). Discharged storm water then connects directly to the existing neighbouring artificial wetland. Pond 4 was noted to be discharging on one occasion throughout the reporting period on 4 July 2019. Pond 4 water parameters were all within relevant criteria on this date.

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 based on 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 One – Eight operational) and predicted that approximately 2,720 tonnes of fired tiles waste would be generated per annum. The 2010 EA did not predict or specify the amount of green tile waste to be generated by the project.

The amount of fired tile waste during the reporting period (monthly average of 10.13% of total production) was higher than the predictions made in the EA, however close to NCIA's current operation target of 7%.

Monthly green tile waste levels have consistently been low and are below the 1% target throughout the reporting period, consistent with previous reporting years. NCIA continues to focus on reducing waste and increasing operational efficiency.

5.7.2 Waste Management

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

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6.0 Non-Compliances

6.1 2019 Non-Compliances Record

Seven non-compliances were recorded during the 2019 reporting period. Details relating to the non-compliances and the actions taken to investigate or to prevent a recurrence are summarised in Table 6-1.

Table 6-1 Details of non-compliance with EPL or Project Approval conditions during the 2019 reporting period

Condition No / Reference	Details of Non-compliance	Action taken
Non-compliances recorded during the reporting period		
EPL Condition L2.2	The assessable pollutant load for fluoride discharged to air (2,076 kg) exceeded the pollutant load limit (1,850 kg) specified in this condition.	The pollutant fee was calculated in accordance with the Load Calculation Protocol for ceramics production, as set out in the Annual Return worksheets. The cause of the non-compliance is considered to be variability in process and annual stack testing results. As a comparison, the fluoride emission result for Kiln 2 (EPL Point 15) using the same source material was 1.49 mg/m^3.
EPL Condition L3.4	Annual stack emissions testing identified one exceedance of the Fluoride concentration limit of 5 mg/m^3: • 8.1 mg/m^3 at EPL Point 14 (Kiln 1);	As per EPL Condition L2.2 above.
Project Approval Condition 15	There were four exceedances of the 24 hour PM_{10} criterion (50 µg/m^3) at the NW monitoring station: There was one exceedances of the 24 hour PM_{10} criterion (50 µg/m^3) at the SE monitoring station:	DPIE were notified of the non-compliances upon receipt of the laboratory analytical results. A review of the exceedances and external contributing factors to these exceedances is undertaken in Section 4.1.1). NCIA were found to not be the main contributing factor in each of these exceedances.

6.2 Audit Recommendations and Action Plan

In 2018, an Independent Environmental Compliance Audit of the NCIA facility was undertaken by Jacobs (Final Report dated 31 January 2019. The audit found that NCIA is generally in compliance with the conditions of its regulatory documents. A total of 159 compliance requirements were audited, of which 13 issues were identified as Not Compliant, 88 as Compliant and 58 as Not triggered.

The auditors made recommendations against each non-compliance, as well as recommendations where compliance was achieved but an improvement in performance could be made. A full summary of the non-compliances identified, recommendations made by the auditors, and the action taken by NCIA to address each of the recommendations is provided Table 6-2.

In addition to the audit non-compliances, the audit also made several recommendations for improvement opportunities and these are identified in Table 6-3.

Table 6-2 Audit recommendations and NCIA action plan

<table>
<tr><th>#</th><th>Reference</th><th>Condition</th><th>Recommendation</th><th>Management Response</th><th>Status</th></tr>
<tr><td>1</td><td>Project Approval 16
Load Limits</td><td>Unless the OEH specifies otherwise, the Proponent shall ensure that the annual total load discharged from the site does not exceed the load limit specified for that pollutant in Table 3.
<table>
<tr><th>Assessable Pollutant</th><th>Load limit (kg)</th></tr>
<tr><td>Coarse Particulates (Air)</td><td>14338.00</td></tr>
<tr><td>Fine Particulates (Air)</td><td>26629.00</td></tr>
<tr><td>Fluoride (Air)</td><td>1850.00</td></tr>
<tr><td>Nitrogen Oxides (Air)</td><td>36828.00</td></tr>
<tr><td>Sulfur Oxides (Air)</td><td>36828.00</td></tr>
</table></td><td>NCIA to implement relevant measures to ensure compliance with the Project Approval load limits. NCIA to review and address stack concentrations that are above values used in the NCIA Expansion EIS (AECOM, 2010).</td><td>Management are committed to achieving compliance. Management acknowledge ongoing compliance issues with Fluoride concentration although the testing results raise questions. Management have committed to a complete refit of the baghouse at an estimated project cost of $2.5m with a view to achieving short and long term compliance. Once compliance is demonstrated Management would like to seek discussions with the Department in regard to limits.</td><td>Capital works ongoing as at 3 February 2020.</td></tr>
<tr><td>2</td><td>Project Approval Discharge limits and Stack Discharge Design Requirements
18</td><td>Unless otherwise specified by the Director-General, the Proponent shall:
a) comply with all monitoring (points) requirements and pollutant discharge concentrations as specified by the OEH in the EPL; and</td><td>NCIA to review and address stack concentrations that are above values used in the NCIA Expansion EIS (AECOM, 2010) and this condition of the approval.</td><td>Management are committed to achieving compliance. Management acknowledge ongoing compliance issues with Fluoride concentration although the testing results raise questions. Management have committed to a complete refit of the baghouse at an estimated project cost of $2.5m with a view to achieving short and long term compliance. Once compliance is demonstrated Management would like to seek discussions with the Department in regard to limits.</td><td>Capital works ongoing as at 3 February 2020.</td></tr>
</table>

#	Reference	Condition	Recommendation	Management Response	Status
3	Project Approval Discharge limits and Stack Discharge Design Requirements 18	b) ensure that the stack discharge design requirements comply with the EPL.	Refer to recommendation above for Condition 18 a).	Management are committed to achieving compliance. Management acknowledge ongoing compliance issues with Fluoride concentration although the testing results raise questions. Management have committed to a complete refit of the baghouse at an estimated project cost of $2.5m with a view to achieving short and long term compliance. Once compliance is demonstrated Management would like to seek discussions with the Department in regard to limits.	Capital works ongoing as at 3 February 2020.
4	Project Approval 32 Lighting	The Proponent shall ensure that the lighting associated with the project: a) complies with the latest version of Australian Standard *AS 4282(INT) - Control of Obtrusive Effects of Outdoor Lighting*	When the construction of the project extension commences carry out a review of the existing lighting on site to determine if it complies with the relevant standards and upgrade as required. All new lighting to comply with AS 4282.	On commencement of construction of the project extension management will ensure compliance with relevant standards. Management have no reason to believe that current lighting does not meet the relevant standards	Not applicable as condition not triggered
5	Project Approval Oversized Transportation 35	The Proponent shall obtain a permit for an oversized and over mass load from the RTA, if transportation of oversized or over mass materials or machinery is required for the project.	NCIA should attempt to locate the oversized transportation approval for the one oversized load received in 2018.	One oversize load which Management disclosed to the auditor that arrived during the period was coordinated by our customs broker, Tolsaf Cranes and Hogan's Heavy Haulage. RMS were contacted and approval gained to move	Not applicable

#	Reference	Condition	Recommendation	Management Response	Status
				the load including dates and times. Management could not source the documentation for the auditor from those coordinating the load. In future Management will appoint a project manager for such events to ensure appropriate records are maintained	
6	Project Approval 38 Vehicle Queuing and Parking	The Proponent shall ensure that the parking dimensions, internal circulation, aisle widths, kerb splay corners, head clearance heights, ramp widths and grades of the car parking area in accordance with the current relevant Australian Standards *AS2890.1:2004*, except where amended by other conditions of this approval.	When the construction of the project extension commences car parking to be realigned to comply with AS2890. Any additional car parking will need to be in compliance with AS2890.	On commencement of construction of the project extension management will ensure compliance with relevant standards. There is enough space allocated, including marked spaces to comfortably accommodate all staff and visitors on site at all times. Management have no reason to believe that current car parking does not meet relevant standards.	Not applicable as condition not triggered
7	Project Approval 39 Vehicle Queuing and Parking	The Proponent shall ensure that disabled parking and assess is provided on-site and shall comply with Australian Standard *AS1428.1 (2001) - Design for Access and Mobility - Part 1 General Requirements for Access – Buildings*.	When the construction of the project extension commences car parking to be realigned to comply with AS2890. Any additional car parking will need to be in compliance with AS2890.	One disabled car part is provided and marked on site. This car park is adjacent to the showroom entry with a ramp provided. On commencement of construction of the project extension management will ensure compliance with relevant standards. Management have no reason to believe that current car parking does not meet relevant standards.	Not applicable as condition not triggered

#	Reference	Condition	Recommendation	Management Response	Status
8	Project Approval Environmental Reporting 59	Within 7 days of the detection of the incident, the Proponent shall provide the Director-General and any relevant agencies with a detailed report on the incident.	Continue to report incidents within the allocated timeframes.	Management will continue to report incidents as required under the project approval.	Ongoing
9	SoC Operation	Fluoride emissions would be managed within the kiln baghouses by implementing a mechanism where a fine spray of lime is injected into the kiln exhaust flow to scrub the HF emissions;	Implement the mechanism where a fine spray of lime is injected into the kiln exhaust flow to scrub the HF emissions.	Management have engaged POLEX Engineering to complete a full refit of the baghouse. The POLEX design includes mechanisms for a fine spray of lime to scrub the HF emissions	Capital works ongoing as at 3 February 2020.
10	IER 2015 Recommendation S3.28	3.28.1 NCIA should attempt to locate the Stage 1 Noise Validation Report.	NCIA should continue to attempt to locate the Stage 1 Noise Validation Report.	Management tried to source this as part of the 2015 audit.	Future compliance to be considered on triggering next stage
11	IER 2015 Recommendation S3.32	3.32.1 NCIA should either review the construction contract for the facility to assess if lighting was required to be installed in accordance with AS 4282:1997; or if this information is not available or is inconclusive, commission a qualified lighting expert to undertake a survey or audit of the outdoor lighting against AS 4282:1997 to verify its	No further recommendations provided. Refer to Project Approval 32 Lighting above.	No further comment	Refer to RAR # 4 in this document
12	IER 2015 Recommendation S3.38	3.38.1 To comply with this condition, NCIA must provide markings in accordance with Australian Standard AS2890.1:2004.	No further recommendations provided. Refer to Project Approval 38 above.	No further comment	Refer to RAR # 6 in this document
13	IER 2015 Recommendation S3.39	3.39.1 To comply with this condition, NCIA must provide markings in accordance with Australian Standard AS1428.1:2001.	No further recommendations provided. Refer to Project Approval 38 above.	No further comment	Refer to RAR # 7 in this document

Table 6-3 Audit recommendations and NCIA action plan

#	Description	Opportunity of improvement	Management Response	Status
1	2015 IER recommendation 3.16.1 related to future AEMRs verification of actual load of accessible pollution	It is recommended that future AEMRs include reference to the specific load calculation methodology (including input data) from within the Load Calculation Protocol for ceramics production that has been applied.	Management will work with our advisors to update future reporting	2019 AEMR Updated (Appendix C)
2	Waste tiles	It is recommended that NCIA formalise a long term strategy and seek relevant approvals for waste tiles.	Management continue to focus on the compliant removal of waste tiles from site. Management's long term strategy is to consume all waste tiles and be a waste neutral facility	As at 3 February 2020 there are no waste tiles on site.
3	Erosion and sediment control plan	Although the site erosion and sediment control devices are generally consistent with the OEMP ESCP, it is recommended that the ESPC figure in Appendix F of the OEMP be updated during the next three-yearly OEMP review.	Management will work with our advisors to update future reporting	Ongoing
4	Noise monitoring for Project Approval 09_0006 Condition 26	Alternative approaches to monitoring could be applied during compliance monitoring by measuring at/near the facility, and conservatively applying distance attenuation to estimate contributions at nearby receiver locations. This approach would provide a clear, appraisal of any contributions from NCIA's operations.	Management will work with our advisors in regard to different approaches to monitoring	Ongoing
5	NPI updates to minimum operational noise limits	As per Section 2.3 of the NPI, minimum intrusiveness noise levels during day time periods are LAeq 15 minute 40 dB(A). Though operational noise from the facility did not present any issue in the 2015-2018 period reviewed, it is possible that the more stringent LAeq 15 minute 35 dB(A) could be updated to be consistent with present guidance from the NPI. Similarly, the LAFMax sleep disturbance limit could also be updated from 40 to 52 dB(A), consistent with guidance in Section 2.5.	Management will work with our advisors to update future reporting	Ongoing

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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 site during the previous year to reduce air quality and noise impacts.

Emission concentrations of pollutants were generally in accordance with EPL and Project Approval limits throughout the 2019 reporting period. There were five exceedances of the PM_{10} 24 hour criterion however a review of processing and meteorological conditions on those days indicate that NCIA was not a major contributor to the exceedances.

Stack emissions testing identified one exceedance of the Total Fluoride discharge limit at one emission source location (Kiln 1). Consequently the air pollutant load limit for fluoride was exceeded during the current reporting period.

Noise monitoring results for the current 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 inaudible.

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 7-1.

Table 7-1 Timetable for environmental improvement actions

Area of Concern	Identified Action	Completion Date
Solar Electricity	NCIA are currently installing a solar panel array that will generate 1MW of electricity during daylight hours. During operation all of this energy will be used by NCIA reducing electricity consumption by 10-15%. Feasibility works have been done on installing a further 2MW on the roof of the factory and ground mounted options are also being assessed.	Completed
Waste Heat Recovery	Through NCIA’s manufacturing process a significant amount of hot air is exhausted into the atmosphere. NCIA are investigating piping the hot air currently exhausted through Hot Air Cooler 1 and 2 (HAC 1 and 2 / EPL 18 and EPL 19) back through insulated stainless steel piping to the spray dryer. The spray dryer uses ambient air and a gas burner to dry water from a liquid slip into a powder which is then pressed to form the tiles. Once operational this is expected to reduce gas consumption by 10-15%.	Completed
New Kiln Baghouse	NCIA have engaged Polex Environmental Engineering Pty Ltd to completely refurbish the original kiln baghouse. This new purpose built baghouse together with the expertise of Polex, and a continued focus on raw materials will ensure compliance with regulatory requirements.	Ongoing

Area of Concern	Identified Action	Completion Date
Compliance Committee	NCIA have formalised a compliance committee meeting once per month. The committee consists of a company director, factory manager, assistant factory manager, office manager and compliance manager.	Completed
University of NSW	Raw materials and finished products are now sent to the University of NSW for testing on a routine basis. NCIA is leveraging off the University of NSW for assistance from time to time. Samples have previously been sent to Italy for testing but sending locally expedites the process and also generates local capacity building.	Completed
Hong Lu	Hong Lu joined the NCIA team in early 2018 with a focus on internal and external compliance. Hong Lu has a PHD in Materials Science and Engineering from the University of NSW. Whilst still developing in her role at NCIA, when settled it is hoped Hong Lu will provide benefits in the environmental and compliance space.	Completed
Gas Monitoring	A project has been undertaken to monitor gas consumption on individual pieces of equipment. Information is now available in real time. From this information NCIA has been able to focus on reducing consumption while maintaining production efficiency.	Completed
Continuous Gas Emission Monitoring	NCIA remains committed to establishing continuous gas emission monitors within the kilns. NCIA has trialled different monitors over the past 12-24 months but have not yet committed to purchase and install.	Ongoing
Water efficiency	NCIA have engaged Hunter Water to potentially capture and store roof water.	Ongoing

7.2 Energy Efficiencies

As noted in previous AEMRs, 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 39 shows the evolution since 2011 of the amount of gas required (in gigajoules GJ) to produce one square metre of tiles, with data showing an overall improving trend in gas efficiency.

NCIA is currently in the process of reducing the size and weight of 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).

NCIA has installed a Quality Assurance (QA) machine before the kiln on each of its production lines. This effectively reduces waste tiles going through the kiln and being fired, creating both a reduction in waste and a saving in energy consumption.

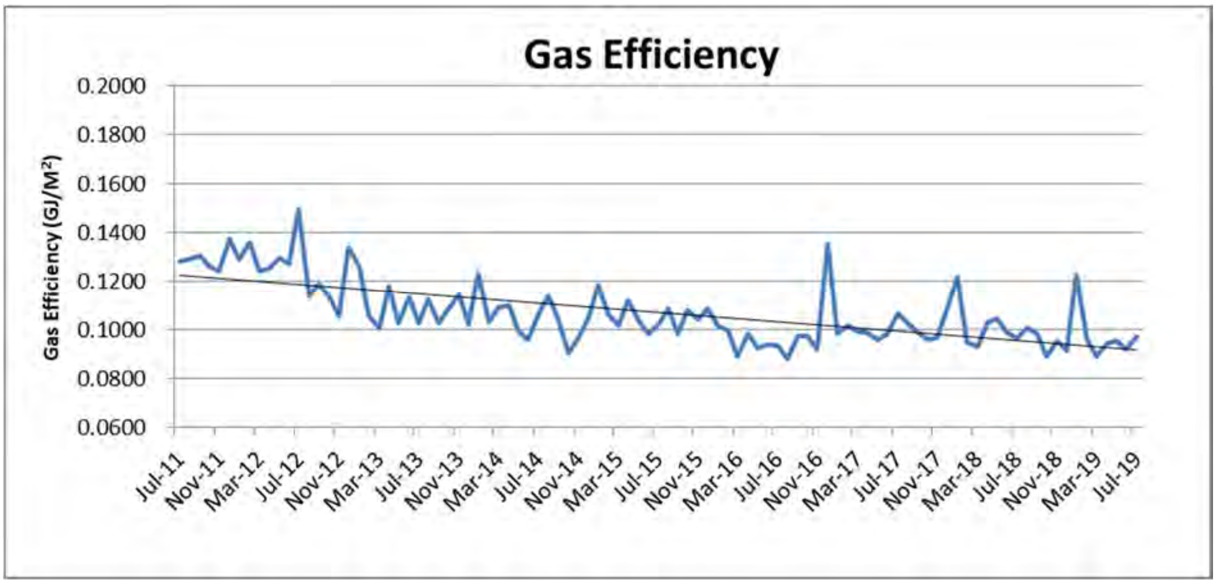

Figure 39 Gas efficiency in tile manufacturing process

In early 2015 NCIA engaged with the NSW EPA to identify potential opportunities in relation to energy efficiency and research. A summary of identified opportunities and associated potential savings are provided in Table 7-2. A number of these projects have been implemented or are in the process of being completed (as discussed in Table 7-1), including the solar PV project and the heat recovery project.

Other identified opportunities are being evaluated with some initiatives currently being trialled or rolled out in some of the National Ceramic Industries group's other facilities. NCIA will closely monitor the progress of these initiatives being implemented and will consider adopting measures accordingly and where consistent with business objectives.

Table 7-2 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
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**

8.0 References

AECOM (2019) Emissions Testing Report 2018-19, 13 August 2019.

AECOM (2018) 2018 Annual Environmental Management Report 1 August 2017 – 31 July 2018, prepared for NCIA by AECOM Australia Pty Ltd, Newcastle, 19 October 2018.

AECOM (2014) *Operational Environmental Management Plan*, prepared for NCIA by AECOM Australia Pty Ltd, Newcastle, 18 September 2014.

ANZG (2018) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* – October 2000.

Australian Standard (2015) *AS/NZS 3580.9.6:2015 Methods for sampling and analysis of ambient air - Determination of suspended particulate matter - PM_{10} high volume sampler with size-selective inlet - Gravimetric method*. Retrieved from Australian Standards Online.

Australian Standard (2013) *AS/NZS 3580.13.2:2013 Methods for sampling and analysis of ambient air - Determination of gaseous and acid-soluble particulate fluorides - Manual, double filter paper sampling*. Retrieved from Australian Standards Online.

Australian Standard (2016) *AS/NZS 3580.1.1:20016 Methods for sampling and analysis of ambient air - Guide to siting air monitoring equipment*. Retrieved from Australian Standards Online.

EPA (2016) *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*. Environment Protection Authority, NSW Government, Sydney.

EPA (2017) *NSW Industry Noise Policy.* Environment Protection Authority, NSW Government, Sydney.

Pscheidt, J.W. (2015) *Fluorine Toxicity in Plants*, Pacific Northwest Plant Disease Management Handbook, Oregon State University.

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Appendix A

Fluoride Impact on Vegetation Data

Appendix A1 – Vegetation Monitoring Sites

Area	Site #	Site location	Monitoring frequency	Location from the kiln stack
NCIA premises	1	Access road north of office	Annual	280m NW
	2	Office car park	Annual	120m W
	3	Access road south of office	Annual	160m W
	4	South-west corner of site	Annual	220m SW
	5	South-east corner of site	Quarterly	300m SE
Rutherford and Farley residential areas	6	3 Palisade Street	Annual	1.4km E
	7	3 Gillette Close	Quarterly	1.4km SE
	8	Regiment Road east of Dumont Court	Annual	1.5km SE
	9	Regiment Road south-east of Squadron Crescent	Annual	1.8kmSE
	10	Wollombi Road between sewage works and creek	Annual	2km SE
	11	Hill top on Wollombi Road, Farley	Quarterly	1.5km SE
	12	Western end of Quarry Road, Farley	Quarterly	2.3km S
Rutherford industrial estate	13	NCIA entrance, Racecourse Road	Quarterly	480m N
	14	99 Kyle Street	Quarterly	570m NW
	15	20 Gardiner Road	Quarterly	500m NW
	16	56 Gardiner Road	Annual	450m W
	17	Gardiner Road, southern end	Annual	550 SW
	18	Maitland Saleyards, Kyle Street	Quarterly	920m NW
Anambah homestead	19	200 Anambah Road – Reference site	Quarterly	3km N

Site 1 – Access road north of office

Site 2 – Office car park

Site 3 – Access road south of office

Site 4 – South-west corner of site

Site 5 – South-east corner of site

Site 6 – 3 Palisade Street

Site 7 – 3 Gillette Close

Site 8 – Regiment Road east of Dumont Court

Site 9 – Regiment Road south-east of Squadron Crescent

Site 10 – Wollombi Road between sewage works and creek

Site 11 – Hill top on Wollombi Road, Farley

Site 12 – Western end of Quarry Road, Farley

Site 13 – NCIA entrance, Racecourse Road

Site 14 – 99 Kyle Street

Site 15 – 20 Gardiner Road

Site 16 – 56 Gardiner Road

Site 17 – Gardiner Road, southern end

Site 18 – Maitland Saleyards, Kyle Street

Site 19 – 200 Anambah Road (Reference site)

Appendix A2 – Visual Injury Expression Survey Results

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 – Access road north of office															
Acacia filicifolia	Q4 2018	0	0	1	0	0	0	0	0	0	0	0	0	✓	0
Acacia longifolia	Q4 2018	1	1	1	0	0	1	0	0	0	0	0	0	0	0
Corymbia citriodora	Q4 2018	6	6	0	6	5	3	0	0	0	0	0	0	0	0
		7	7	1	7	4	4	0	0	0	2				
Eucalyptus moluccana	Q4 2018	2	3	0	0	2	0	0	0	3	2	0	0	✓	✓
		3	3	1	0	3	2	0	0	2	2				
Eucalyptus robusta 1	Q4 2018	1	2	0	1	1	0	0	0	2	0	0	0	0	0
		3	3	1	3	1	1	0	0	0	0				
Eucalyptus robusta 2	Q4 2018	1	2	0	0	1	0	0	0	2	1	0	0	0	✓
		2	2	1	0	1	2	0	0	1	2				
*Eucalyptus amplifolia (*new*)*	Q4 2018	0	2	0	0	0	0	0	0	2	0	0	0	0	✓
		1	3	1	0	1	1	1	1	0	3				
Site 2 – Office car park															
Corymbia maculata	Q4 2018	5	5	0	5	4	4	3	0	0	0	6	6	0	0
		4	4	1	2	3	4	4	4	0	2				
Eucalyptus robusta	Q4 2018	4	4	0	4	2	0	0	0	0	1	1	1	0	0
		4	4	1	2	4	3	0	0	1	3				
Fraxinus pennsylvanica	Q4 2018	1	1	0	1	0	0	0	0	0	0	0	0	0	0
		1	1	1	0	0	0	0	0	0	0				
Site 3 – Access road south of office															
Acacia parramattensis	Q4 2018	0	0	1	0	0	0	0	0	0	0	2	2	✓	0
Hakea salicifolia	Q4 2018	1	1	1	0	0	1	0	0	0	0	0	0	0	✓
Corymbia (?)citriodora	Q4 2018	2	2	0	2	2	2	1	0	0	0	0	0	0	0
		3	3	1	2	3	2	3	0	1	1				
Eucalyptus sp.	Q4 2018	1	1	0	0	1	0	0	0	1	0	0	0	0	0
		2	2	1	0	1	2	0	0	1	0				
Site 4 – South-west corner of site															
Acacia longifolia	Q4 2018	1	1	1	1	0	1	0	0	0	0	0	0	0	0

Bursaria spinosa	Q4 2018	0	0	1	0	0	0	0	0	0	0	0	0	✓	0
Typha sp.	Q4 2018	2	2	1	0	0	2	0	0	0	0	0	0	0	0
Eucalyptus amplifolia	Q4 2018	1	2	0	0	1	0	0	0	1	2	0	0	✓	0
		0	2	1	0	2	2	0	0	1	2				
Site 5 – South-east corner of site															
Eucalyptus moluccana	Q3 2018	2	2	0	0	2	2	0	0	2	0	0	0	0	✓
		2	2	1	0	2	2	0	2	2	1				
	Q4 2018	3	3	0	0	3	0	0	0	3	0	0	0	0	0
		3	3	1	0	3	2	0	1	2	2				
	Q1 2019	1	1	0	0	1	0	0	0	1	0	0	0	0	0
		2	3	1	0	2	0	0	0	3	1				
	Q2 2019			0	0	2	1	0	0	2	1	0	0	✓	0
				1	0	3	1	0	1	3	1				
Bursaria spinosa	Q4 2018	2	2	1	2	0	0	0	0	0	0	1	1	0	0
Acacia longifolia	Q4 2018	n/a	n/a	Specimen died off											
Site 6 – 3 Palisade Street															
Corymbia maculata 1	Q4 2018	3	3	0	0	3	1	0	0	0	2	0	0	0	0
		4	4	1	0	4	1	0	0	0	2				
Corymbia maculata 2	Q4 2018	1	2	0	0	1	0	0	0	0	2	0	0	0	0
		3	3	1	0	3	1	0	0	0	2				
Bursaria spinosa	Q4 2018	n/a	n/a	Specimen removed following site clearing / clear up											
Olea europaea	Q4 2018	2	2	1	2	0	0	0	0	0	0	0	0	0	0
Site 7 – 3 Gillette Close															
Eucalyptus acmenoides	Q3 2018	1	1	0	0	0	1	0	0	1	0	0	0	✓	✓
		2	2	1	2	0	2	0	0	1	1				
	Q4 2018	0	1	0	0	0	0	0	0	1	0	0	0	0	✓
		3	3	1	3	0	1	0	0	1	0				
	Q1 2019	0	1	0	0	0	0	0	0	1	0	0	0	0	✓
		2	2	1	2	0	1	0	0	1	1				
	Q2 2019			0	0	0	0	1	0	1	0	0	0	✓	✓
				1	2	0	1	0	0	1	2				
Corymbia maculata	Q3 2018	3	3	0	3	1	2	0	0	0	1	2	2	0	0
		2	2	1	2	2	1	2	0	2	1				

	Q4 2018	2	2	0	0	2	0	0	0	2	0	0	0	0	0
		3	3	1	3	3	2	3	0	0	0				
	Q1 2019	4	4	0	0	4	1	0	0	1	0	0	0	0	0
		4	4	1	1	4	4	2	0	3	3				
	Q2 2019			0	0	2	1	0	0	1	2	0	0	0	0
				1	0	3	2	2	0	3	3				
Site 8 – Regiment Road east of Dumont Court															
Acacia baileyana	Q4 2018	0	0	1	0	0	0	0	0	0	0	0	0	✓	0
Corymbia maculata	Q4 2018	1	1	0	0	1	0	0	0	1	1	0	0	0	0
		3	3	1	3	2	2	0	0	1	1				
Eucalyptus robusta	Q4 2018	2	2	0	2	1	0	0	0	1	1	0	0	0	0
		2	2	1	0	1	2	0	0	1	1				
Bursaria spinosa	Q4 2018	2	2	1	2	0	0	0	0	0	0	0	0	0	0
Eucalyptus acmenoides	Q4 2018	1	1	0	0	1	1	0	0	1	0	0	0	0	✓
		3	3	1	0	1	3	0	0	0	1				
Lophostemon confertus	Q4 2018	0	0	1	0	0	0	0	0	0	0	0	0	✓	0
Grevillea robusta	Q4 2018	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Site 9 – Regiment Road south-east of Squadron Crescent															
Bursaria spinosa	Q4 2018	2	2	1	2	0	0	0	0	0	0	0	0	0	0
Eucalyptus resinfera	Q4 2018	0	3	0	0	0	0	0	0	3	0	0	0	0	✓
		2	2	1	0	1	2	0	0	1	1				
Site 10 – Wollombi Road between sewage works and creek															
Casuarina glauca	Q4 2018	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Fraxinus excelsior	Q4 2018	0	0	1	0	0	0	0	0	0	0	0	0	0	✓
Grevillea robusta	Q4 2018	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Populus nigra	Q4 2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acacia podalyriifolia	Q4 2018	3	3	1	3	0	0	0	0	0	0	0	0	0	✓
Bursaria spinosa	Q4 2018	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Site 11 – Hill top on Wollombi Road, Farley															
Corymbia maculata	Q3	3	3	0	0	3	0	0	0	1	0	0	0	0	0

	2018	2	2	1	0	1	2	0	0	2	2				
	Q4 2018	0	2	0	0	0	0	0	0	2	0	0	0	0	0
		2	2	1	0	2	1	0	0	1	1				
	Q1 2019	2	2	0	0	2	2	0	0	0	0	0	0	0	0
		3	3	1	0	2	3	0	0	1	3				
	Q2 2019			0	0	3	2	0	0	0	0	0	0	✓	0
				1	0	1	2	0	0	2	2				
Eucalyptus paniculata	Q3 2018	n/a	n/a	0	No new growth / foliage							0	0	✓	0
		0	3	1	0	0	0	0	0	3	1				
	Q4 2018	1	1	0	0	1	0	0	0	1	0	0	0	0	✓
		2	2	1	0	2	0	0	0	2	0				
	Q1 2019	0	3	0	0	0	0	0	0	3	0	0	0	0	✓
		0	3	1	0	0	0	0	0	3	1				
	Q2 2019			0	0	1	0	0	0	2	1	0	0	✓	0
				1	0	0	1	0	0	3	1				
Bursaria spinosa	Q4 2018	0	0	1	0	0	0	0	0	0	0	2	2	0	0
Hakea gibbosa	Q4 2018	0	0	1	0	0	0	0	0	0	0	0	0	0	✓
Site 12 – Western end of Quarry Road, Farley															
Corymbia maculata	Q3 2018	n/a	n/a	0	No new growth / foliage							0	0	0	0
		2	2	1	0	2	0	0	0	2	2				
	Q4 2018	2	2	0	0	2	0	0	0	2	0	0	0	0	0
		3	3	1	0	3	2	0	0	2	1				
	Q1 2019	1	1	0	0	1	0	1	0	0	1	0	0	0	0
		2	2	1	0	1	0	2	0	2	2				
	Q2 2019			0	0	1	0	0	0	1	1	0	0	✓	0
				1	0	1	1	0	0	2	2				
Eucalyptus paniculata	Q3 2018	0	1	0	0	0	0	0	0	1	1	0	0	✓	0
		1	2	1	0	0	0	0	0	2	1				
	Q4 2018	1	2	0	0	0	1	0	0	2	0	0	0	0	✓
		1	3	1	0	0	1	0	0	3	1				
	Q1 2019	0	2	0	0	0	0	0	0	2	1	0	0	✓	✓
		0	2	1	0	0	0	0	0	2	2				
	Q2 2019			0	0	0	0	0	0	1	0	0	0	0	✓
				1	0	0	1	0	0	2	1				
Pinus radiata	Q4 2018	0	0	1	0	0	0	0	0	0	0	0	0	0	0

Site 13 – NCIA entrance, Racecourse Road															
Corymbia maculata	Q3 2018	1	1	0	0	0	1	0	0	0	0	2	2	0	0
		3	3	1	2	2	3	0	0	1	2				
	Q4 2018	3	3	0	2	3	3	0	0	0	1	2	2	0	0
		4	4	1	3	4	3	0	0	0	2				
	Q1 2019	1	1	0	0	0	1	0	0	1	0	2	2	0	0
		3	3	1	3	2	2	0	0	0	1				
	Q2 2019			0	1	2	1	0	0	1	1	2	2	0	0
				1	3	3	2	1	0	0	2				
Eucalyptus amplifolia	Q3 2018	n/a	n/a	0	No new growth / foliage							2	2	0	0
		3	3	1	0	1	3	0	0	1	0				
	Q4 2018	0	1	0	0	0	0	0	0	1	0	2	2	✓	0
		2	2	1	0	1	2	0	0	0	1				
	Q1 2019	0	2	0	0	0	0	0	0	2	2	2	2	✓	✓
		1	2	1	0	1	1	0	0	2	1				
	Q2 2019			0	No new growth / foliage							2	2	✓	0
				1	0	2	2	0	0	1	2				
Olea Europea	Q4 2018	2	2	1	0	2	0	0	0	0	0	0	0	✓	0
Site 14 – 99 Kyle Street															
Angophora floribunda	Q3 2018	2	2	0	2	1	1	1	0	0	1	0	3	0	✓
		2	2	1	2	1	1	1	1	0	2				
	Q4 2018	2	2	0	2	0	1	0	0	0	0	3	3	✓	0
		2	2	1	2	2	2	0	0	0	1				
	Q1 2019	2	2	0	2	2	0	0	0	1	1	0	0	0	0
		2	2	1	1	1	2	0	1	0	2				
	Q2 2019			0	No new growth / foliage							0	0	0	0
				1	1	2	1	0	1	0	2				
Eucalyptus amplifolia	Q3 2018	n/a	n/a	0	No new growth / foliage							0	0	✓	0
		2	2	1	0	2	2	0	0	1	1				
	Q4 2018	0	0	0	0	0	0	0	0	0	0	0	0	✓	0
		2	2	1	0	2	2	0	0	1	2				
	Q1 2019	1	1	0	0	0	1	0	0	0	0	0	0	✓	0
		2	2	1	0	0	2	0	0	0	1				
	Q2 2019			0	0	0	2	0	0	1	1	0	0	✓	0
				1	0	3	3	0	0	1	1				
Site 15 – 20 Gardiner Road															

Corymbia maculata	Q3 2018	3	3	0	3	0	0	0	0	1	1	0	0	0	0
		4	4	1	3	4	3	1	0	1	1				
	Q4 2018	4	4	0	4	4	3	0	0	0	1	0	0	0	0
		4	4	1	3	3	4	3	0	0	1				
	Q1 2019	4	4	0	4	2	2	0	0	0	0	0	0	0	0
		4	4	1	4	3	3	2	0	0	1				
	Q2 2019			0	4	3	2	0	0	1	1	0	0	✓	0
				1	3	4	3	3	0	1	1				
Eucalyptus Fibrosa	Q3 2018	n/a	n/a	0	No new growth / foliage							0	0	0	✓
		3	3	1	0	0	3	0	0	1	1				
	Q4 2018	1	1	0	0	1	1	0	0	1	1	0	0	0	✓
		2	2	1	0	0	2	0	0	2	0				
	Q2 2019			0	0	0	1	0	0	0	1	0	0	✓	0
				1	0	0	2	0	0	2	1				
Site 16 - 56 Gardiner Road															
Corymbia maculata	Q4 2018	3	3	0	3	2	3	0	0	1	2	0	0	0	0
		3	3	1	2	3	3	0	0	0	2				
Site 17 – Gardiner Road, Southern end															
Bursaria spinosa	Q4 2018	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Olea europaea	Q4 2018	1	1	1	0	1	0	0	0	0	0	0	0	✓	0
Corymbia maculata 1	Q4 2018	2	2	0	0	2	1	0	0	1	0	0	0	0	0
		3	3	1	1	3	2	1	0	1	1				
Corymbia maculata 2	Q4 2018	1	1	0	0	1	0	0	0	1	0	0	0	0	0
		3	3	1	0	3	2	0	0	1	3				
Eucalyptus fibrosa	Q4 2018	n/a	n/a	0	No new growth / foliage							0	0	0	0
		2	2	1	0	0	2	0	0	1	2				
Eucalyptus punctata	Q4 2018	0	1	0	0	0	0	0	0	1	0	0	0	✓	✓
		2	2	1	0	1	2	1	0	0	1				
Site 18 – Maitland Saleyards, Kyle Street															
Corymbia maculata	Q3 2018	2	2	0	0	1	2	0	0	1	1	0	0	✓	0
		4	4	1	0	1	4	0	0	1	1				
	Q4 2018	4	4	0	4	3	3	0	0	0	1	0	0	0	0
		3	3	1	0	1	3	1	0	0	2				

	Q1 2019	3	3	0	0	3	2	0	0	0	2	0	0	✓	0
		4	4	1	3	4	3	0	0	0	2				
	Q2 2019			0	0	2	2	0	0	0	1	0	0	✓	0
				1	3	3	3	0	0	0	2				
Eucalyptus amplifolia	Q3 2018	n/a	n/a	0	No new growth / foliage							0	0	0	0
		1	2	1	0	0	1	0	0	2	2				
	Q4 2018	0	1	0	0	0	0	0	0	1	1	0	0	0	0
		2	3	1	2	2	2	1	0	1	3				
	Q1 2019	0	0	0	No new growth / foliage							0	0	✓	0
		1	1	1	0	0	1	0	0	0	1				
	Q2 2019			0	0	1	1	0	0	1	1	0	0	✓	0
				1	0	0	1	0	0	3	1				
Eucalyptus moluccana	Q3 2018	n/a	n/a	0	No new growth / foliage							0	0	✓	0
		1	2	1	0	0	1	0	1	2	1				
	Q4 2018	2	2	0	0	0	2	0	0	1	0	0	0	0	✓
		2	2	1	1	2	2	0	1	1	2				
	Q1 2019	1	1	0	0	0	1	0	0	1	0	0	0	0	0
		3	3	1	0	1	3	0	0	1	2				
	Q2 2019			0	0	1	1	0	0	2	1	0	0	0	✓
				1	0	1	2	0	0	1	2				
Eucalyptus resinfera	Q3 2018	n/a	n/a	0	No new growth / foliage							0	0	0	✓
		2	2	1	0	2	1	0	0	1	1				
	Q4 2018	0	0	0	0	0	0	0	0	0	0	0	0	0	✓
		2	2	1	0	2	1	0	0	0	0				
	Q1 2019	3	3	0	0	3	0	0	0	1	0	0	0	✓	✓
		2	2	1	0	1	2	0	0	1	0				
	Q2 2019			0	0	0	1	0	0	1	0	0	0	✓	0
				1	0	3	2	0	0	1	1				
Site 19 – 200 Anambah Road – Reference site															
Angophora costata	Q4 2018	0	0	mixed	0	0	0	0	0	0	0	0	0	✓	0
Araucaria cunninghamii	Q3 2018	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Q4 2018	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Q1 2019	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Q2 2019			1	0	0	0	0	0	0	0	0	0	0	0

Brachychiton populneus	Q4 2018	0	0	1	0	0	0	0	0	0	0	0	0	✓	0
Casuarina torulosa	Q3 2018	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Q4 2018	0	0	1	0	0	0	0	0	0	0	0	0	0	✓
	Q1 2019	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Q2 2019			1	0	0	0	0	0	0	0	0	0	0	0
Corymbia citriodora	Q4 2018	1	1	mixed	0	0	1	0	0	1	0	0	0	0	0
Corymbia maculata	Q3 2018	3	3	1	0	3	1	0	0	1	1	0	0	0	0
	Q4 2018	3	3	1	0	3	1	0	0	1	0	0	0	0	0
	Q1 2019	4	4	mixed	0	4	0	0	0	1	2	0	0	0	0
	Q2 2019			mixed	0	3	0	0	0	2	2	0	0	0	0
Ficus macrophylla	Q3 2018	0	0	1	0	0	0	0	0	0	0	0	0	✓	0
	Q4 2018	0	0	1	0	0	0	0	0	0	0	0	0	0	✓
	Q1 2019	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Q2 2019			1	0	0	0	0	0	1	0	0	0	0	0
Grevillea robusta	Q3 2018	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Q4 2018	0	0	1	0	0	0	0	0	0	0	2	2	0	0
	Q1 2019	1	1	1	0	0	0	1	0	0	0	0	0	0	0
	Q2 2019			1	0	0	0	0	0	0	0	0	0	0	0
Macadamia integrifolia	Q4 2018	3	3	1	0	3	0	0	0	0	0	0	0	0	✓
Eucalyptus acmenoides	Q3 2018	1	3	1	0	1	0	0	0	3	1	0	0	0	✓
	Q4 2018	1	1	mixed	0	1	0	0	0	1	0	0	0	0	✓
	Q1 2019	1	2	mixed	0	1	0	0	0	2	1	0	0	0	✓
	Q2			mixed	0	1	0	0	0	3	1	0	0	✓	✓

	2019														
Eucalyptus dives	Q4 2018	2	3	mixed	0	2	1	0	0	2	3	0	0	0	✓
Eucalyptus grandis	Q4 2018	1	2	mixed	0	1	0	0	0	2	2	0	0	0	✓
Eucalyptus robusta	Q4 2018	2	2	mixed	0	1	2	0	0	0	1	0	0	0	✓
Eucalyptus tereticornis	Q3 2018	3	3	1	0	0	3	0	0	2	1	0	0	0	0
	Q4 2018	2	2	1	0	0	2	0	0	0	0	0	0	0	0
	Q1 2019	3	3	mixed	0	0	3	0	0	1	2	0	0	✓	0
	Q2 2019			mixed	0	0	2	0	0	2	2	0	0	✓	0
Olea europaea	Q3 2018	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Q4 2018	1	1	1	0	1	0	0	0	0	0	0	0	✓	0
	Q1 2019	1	1	1	0	1	0	0	0	0	0	0	0	0	✓
	Q2 2019			1	0	2	0	0	0	0	0	0	0	0	✓
Vitis vinifera	Q3 2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Q4 2018	0	0	0	0	0	0	0	0	0	0	0	0	0	✓
	Q1 2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Q2 2019			0	No foliage (winter)							n/a	n/a	n/a	n/a
Vitus Vinifera - lower block	Q4 2018	0	0	0	0	0	0	0	0	0	0	0	0	0	✓

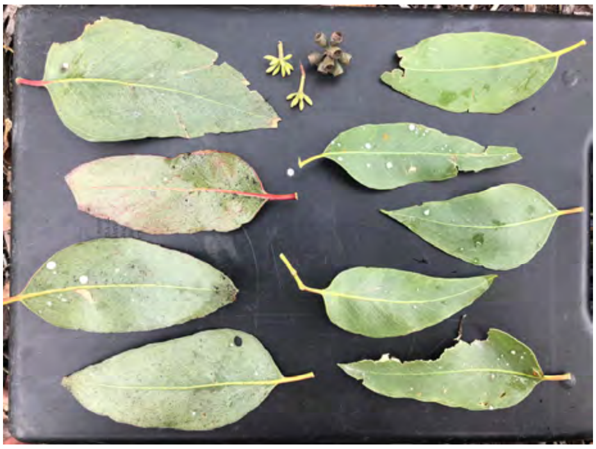
<u>*Table key:*</u>

* *'new' = assessment undertaken on current season leaves, 'old' = assessment undertaken on previous seasons leaves, 'mix' = assessment undertaken on both current and previous season 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 A3 – Foliage Condition Photographs

<table>
<tr><th colspan="2">Site 1 – Access road north of office</th></tr>
<tr><td>Eucalyptus robusta 1 (Q4 2018)</td><td>Eucalyptus robusta 2 (Q4 2018)</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Corymbia citriodora (Q4 2018)</td><td>Eucalyptus moluccana (Q4 2018)</td></tr>
<tr><td></td><td></td></tr>
<tr><th colspan="2">Site 2 – Office car park</th></tr>
<tr><td>Corymbia maculata (Q4 2018)</td><td>Eucalyptus robusta (Q4 2018)</td></tr>
<tr><td></td><td></td></tr>
</table>

Site 3 – Access road south of office	
Hakea salicifolia **(Q4 2018)**	***Eucalyptus sp.*** **(Q4 2018)**
	
Site 4 – South-west corner of site	
Acacia longifolia **(Q4 2018)**	***Eucalyptus amplifolia*** **(Q4 2018)**
	
Site 5 – South-west corner of site	
Eucalyptus moluccana **(Q4 2018)**	***Bursaria spinosa*** **(Q4 2018)**
	

Site 6 – 3 Palisade Street	
***Corymbia maculata 1* (Q4 2018)**	***Bursaria spinosa* (Q4 2018)**
	
Site 7 – 3 Gillette Close	
***Eucalyptus acmenoides* (Q4 2018)**	***Corymbia maculata* (Q4 2018)**
	
Site 8 – Regiment Road east of Dumont Court	
***Corymbia maculata* (Q4 2018)**	***Eucalyptus acmenoides* (Q4 2018)**
	

Site 8 – Regiment Road east of Dumont Court (continued)	
Acacia baileyana **(Q4 2018)**	***Bursaria spinosa*** **(Q4 2018)**
	

Site 9 – Regiment Road south-east of Squadron Crescent	
Bursaria spinosa **(Q4 2018)**	***Eucalyptus resinfera*** **(Q4 2018)**
	

Site 10 – Wollombi Road between sewage works and creek	
Fraxinus excelsior **(Q4 2018)**	***Populus nigra*** **(Q4 2018)**
	

Site 11 – Hill top on Wollombi Road, Farley	
Corymbia maculata **(Q4 2018)**	***Eucalyptus paniculata*** **(Q4 2018)**
	
Site 12 – Western end of Quarry Road, Farley	
Corymbia maculata **(Q4 2018)**	***Eucalyptus paniculata*** **(Q1 2019)**
	
Site 13 – NCIA entrance, Racecourse Road	
Corymbia maculata **(Q4 2018)**	***Eucalyptus amplifolia*** **(Q4 2018)**
	

<table>
<tr><th colspan="2">Site 14 – 99 Kyle Street</th></tr>
<tr><th>Angophora floribunda (Q4 2018)</th><th>Eucalyptus amplifolia (Q4 2018)</th></tr>
<tr><td></td><td></td></tr>
<tr><th colspan="2">Site 15 – 20 Gardiner Road</th></tr>
<tr><th>Corymbia maculata (Q4 2018)</th><th>Eucalyptus fibrosa (Q1 2019)</th></tr>
<tr><td></td><td></td></tr>
<tr><th colspan="2">Site 16 - 56 Gardiner Road</th></tr>
<tr><th>Corymbia maculata (Q4 2018)</th><td></td></tr>
<tr><td></td><td></td></tr>
</table>

Site 17 – Gardiner Road, Southern end	
Corymbia maculata 1 **(Q4 2018)**	***Corymbia maculata 2*** **(Q4 2018)**
	
Eucalyptus fibrosa **(Q4 2018)**	***Eucalyptus punctata*** **(Q4 2018)**
	
Site 18 – Maitland Saleyards, Kyle Street	
Corymbia maculata **(Q4 2018)**	***Eucalyptus moluccana*** **(Q4 2018)**
	

Site 18 – Maitland Saleyards, Kyle Street (continued)	
***Eucalyptus amplifolia* (Q4 2018)**	***Eucalyptus resinfera* (Q4 2018)**
	
Site 19 – 200 Anambah Road – Reference site	
***Corymbia citriodora* (Q4 2018)**	***Corymbia maculata* (Q4 2018)**
	
***Eucalyptus acmenoides* (Q4 2018)**	***Eucalyptus robusta* (Q4 2018)**
	

Site 19 – 200 Anambah Road – Reference site (continued)	
***Eucalyptus tereticoris* (Q4 2018)**	***Vitis vinifera* (Q4 2018)**
	
***Eucalyptus dives* (Q4 2018)**	***Ficus macrophylla* (Q4 2018)**
	

Appendix A4 – Analytical Laboratory Documentation

Appendix B

Meteorological Monitoring - Wind Roses

Appendix B Meteorological Monitoring - Wind Roses

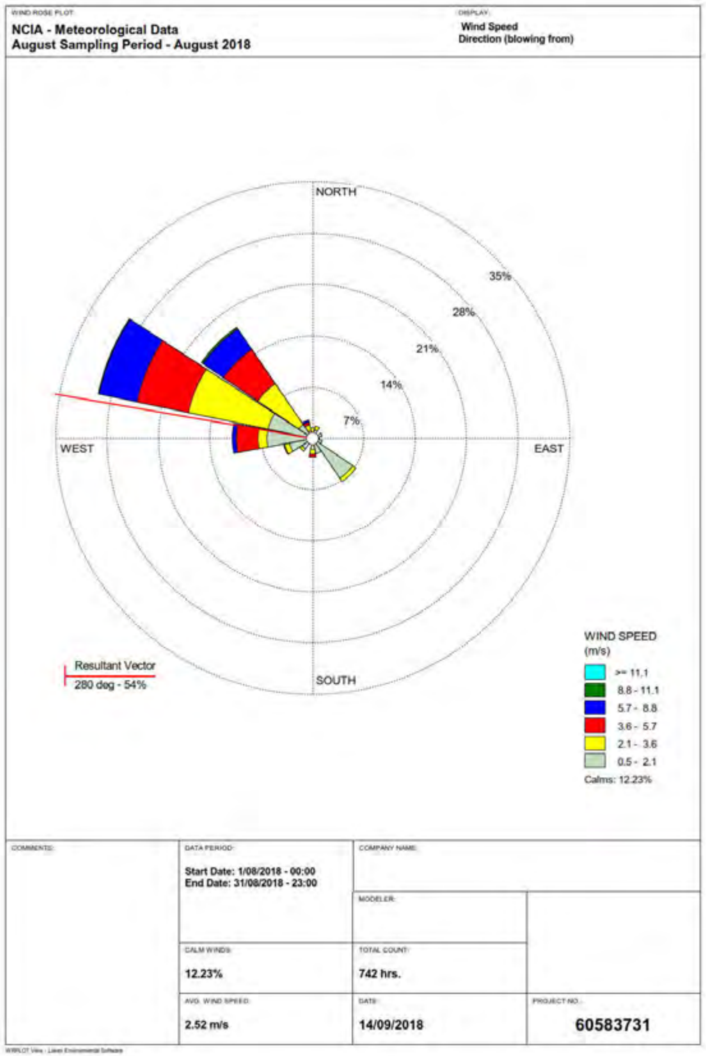


Figure B 1 Wind Speed and Direction (August 2018)

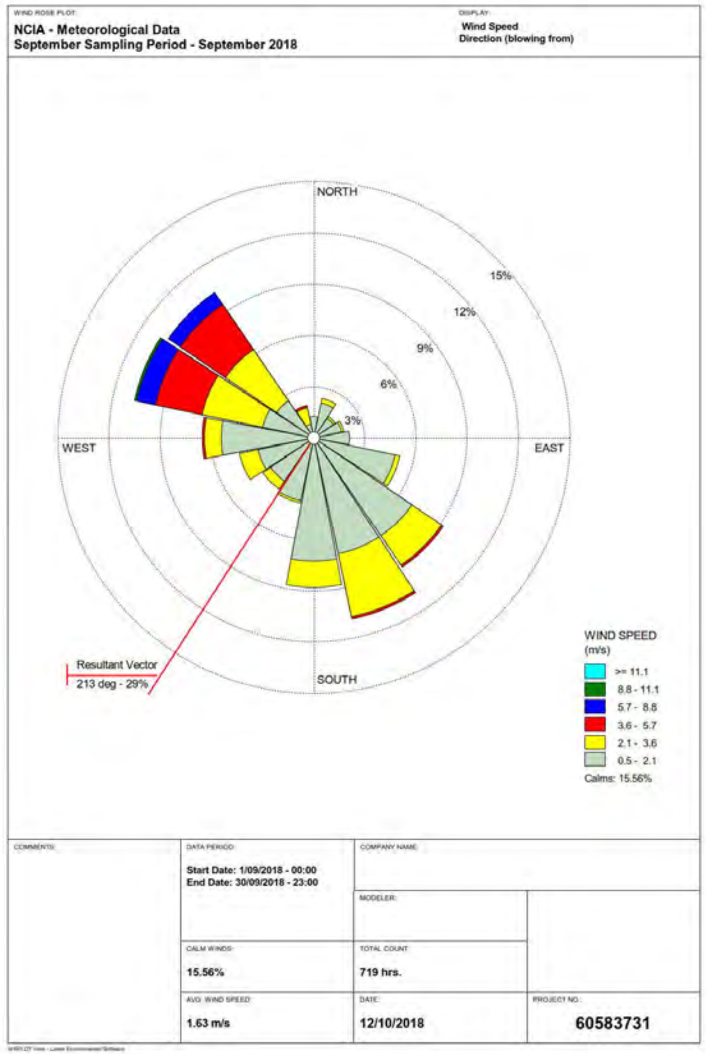


Figure B 2 Wind Speed and Direction (September 2018)

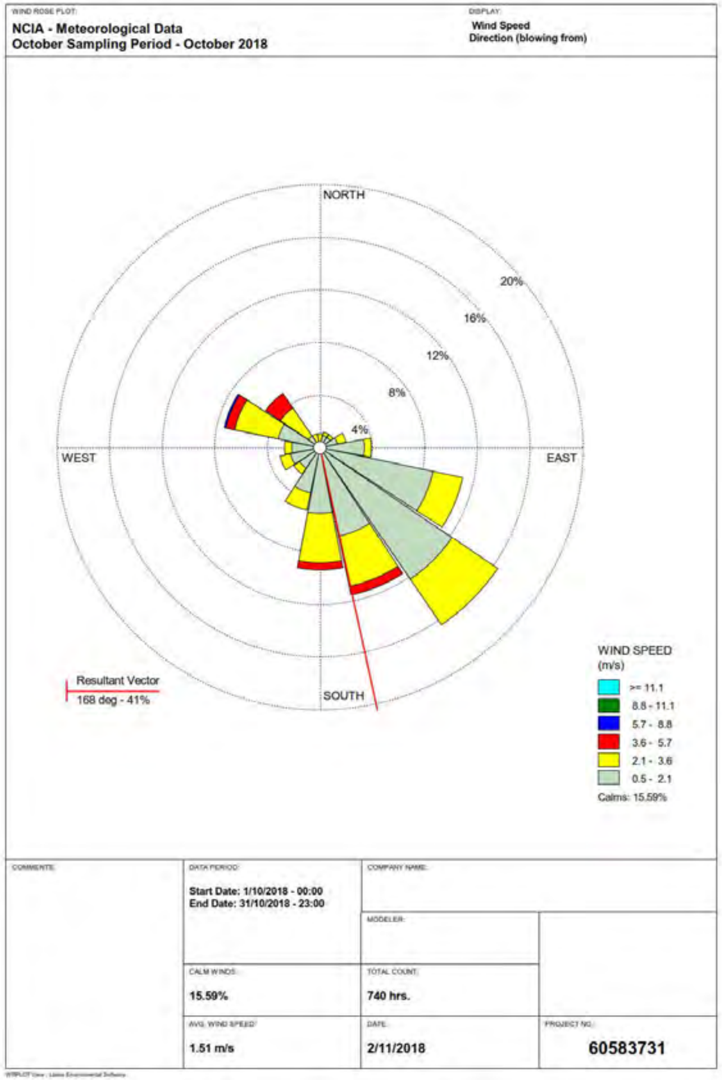


Figure B 3 Wind Speed and Direction (October 2018)

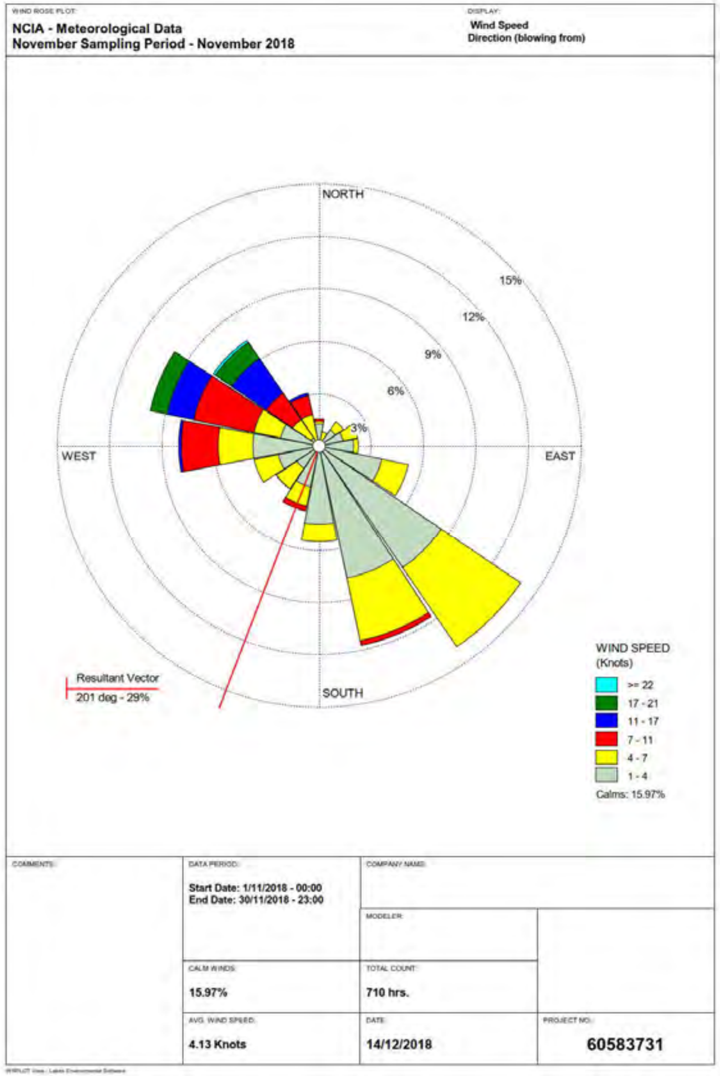


Figure B 4 Wind Speed and Direction (November 2018)

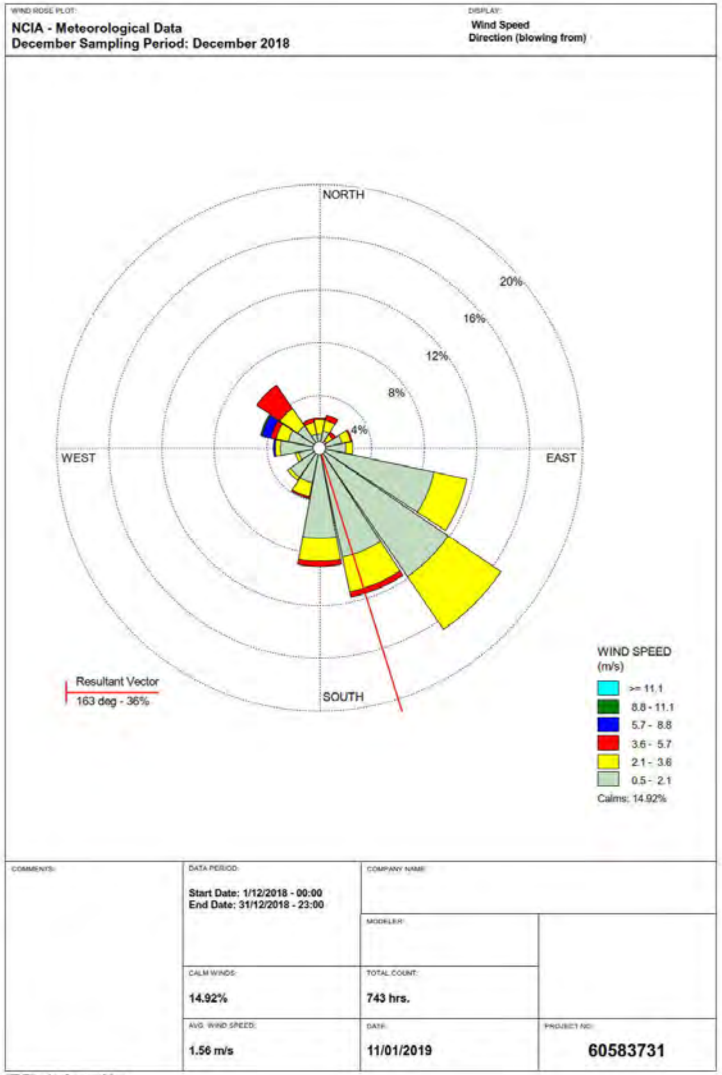


Figure B 5 Wind Speed and Direction (December 2018)

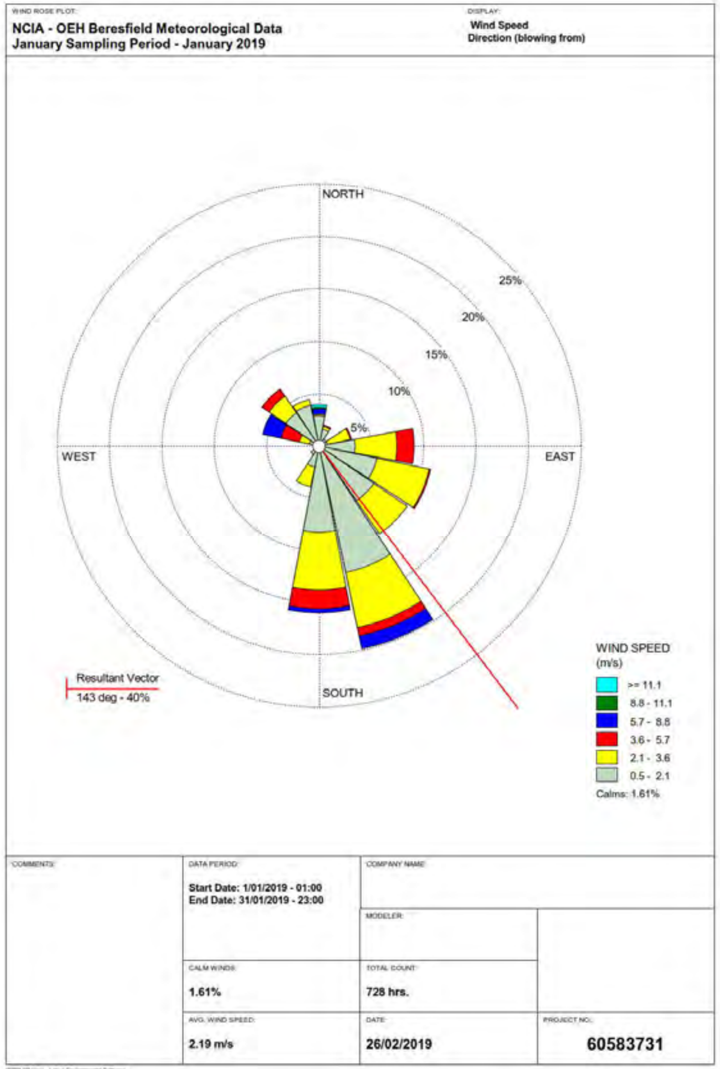


Figure B 6 Wind Speed and Direction (January 2019)

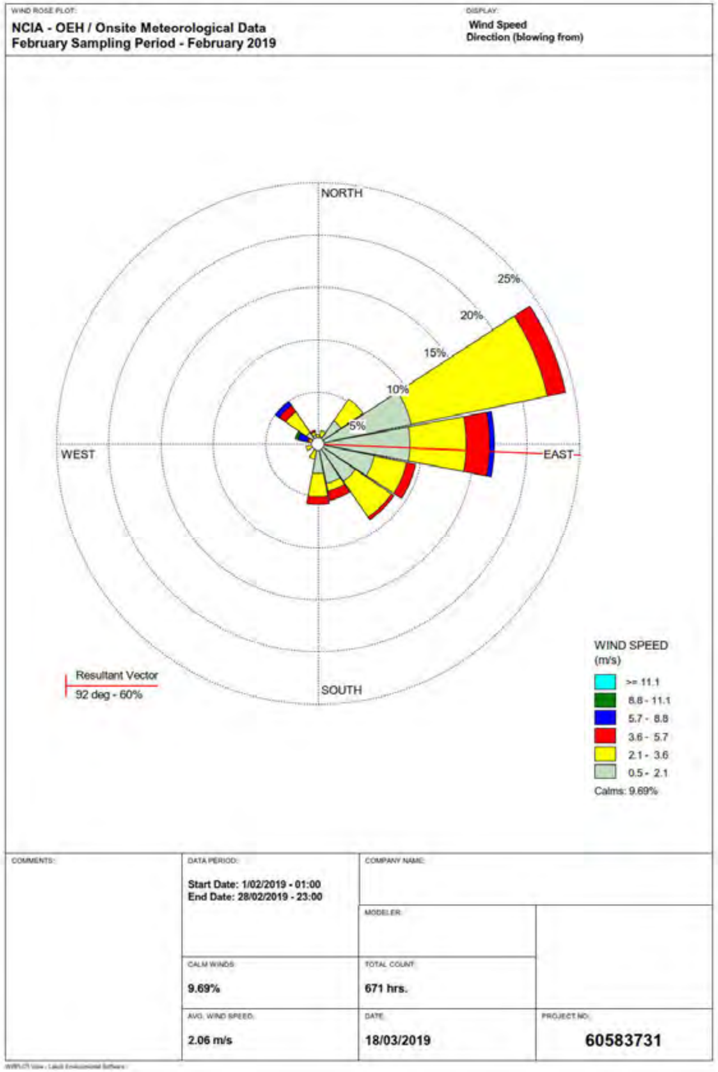


Figure B 7 Wind Speed and Direction (February 2019)

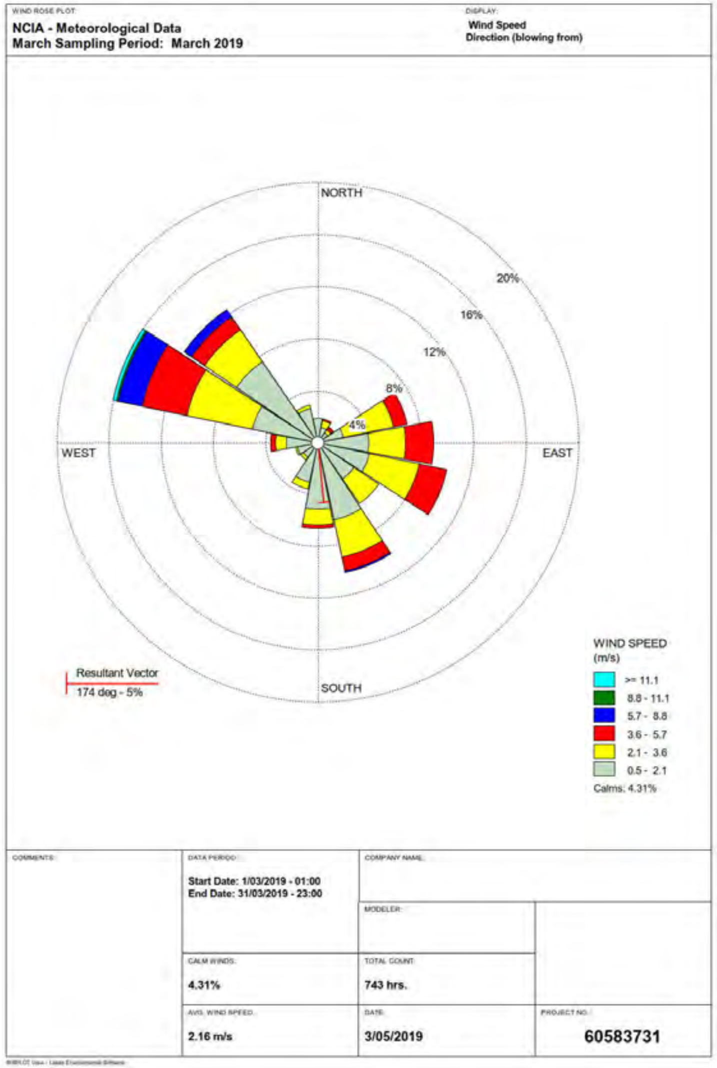


Figure B 8 Wind Speed and Direction (March 2019)

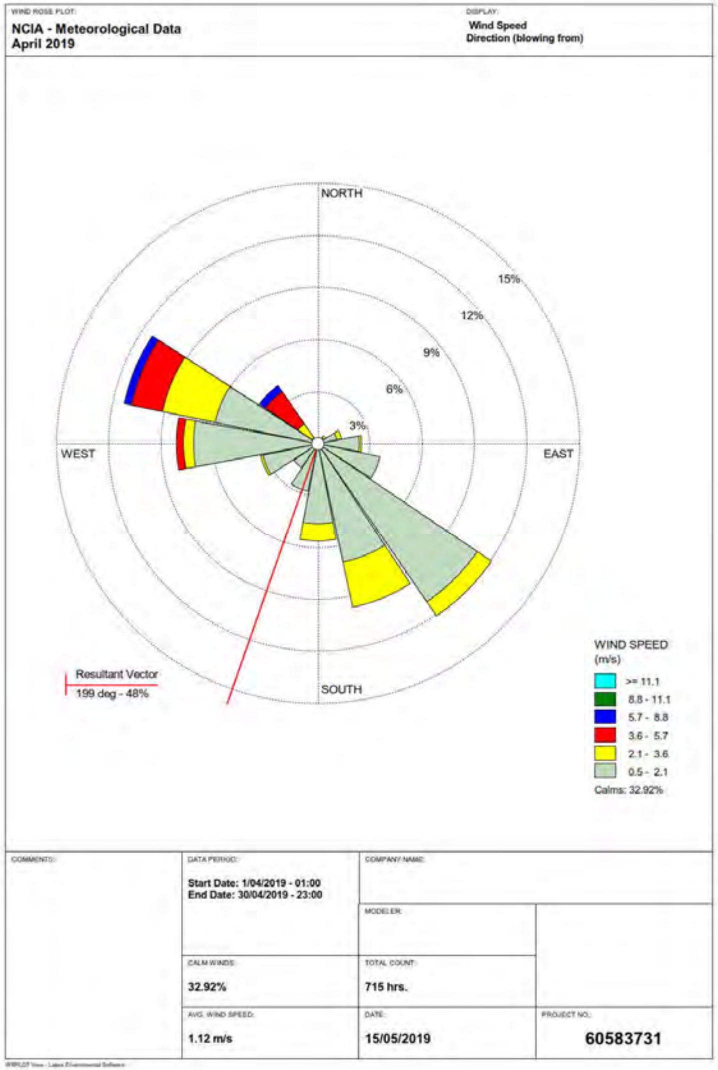


Figure B 9 Wind Speed and Direction (April 2019)

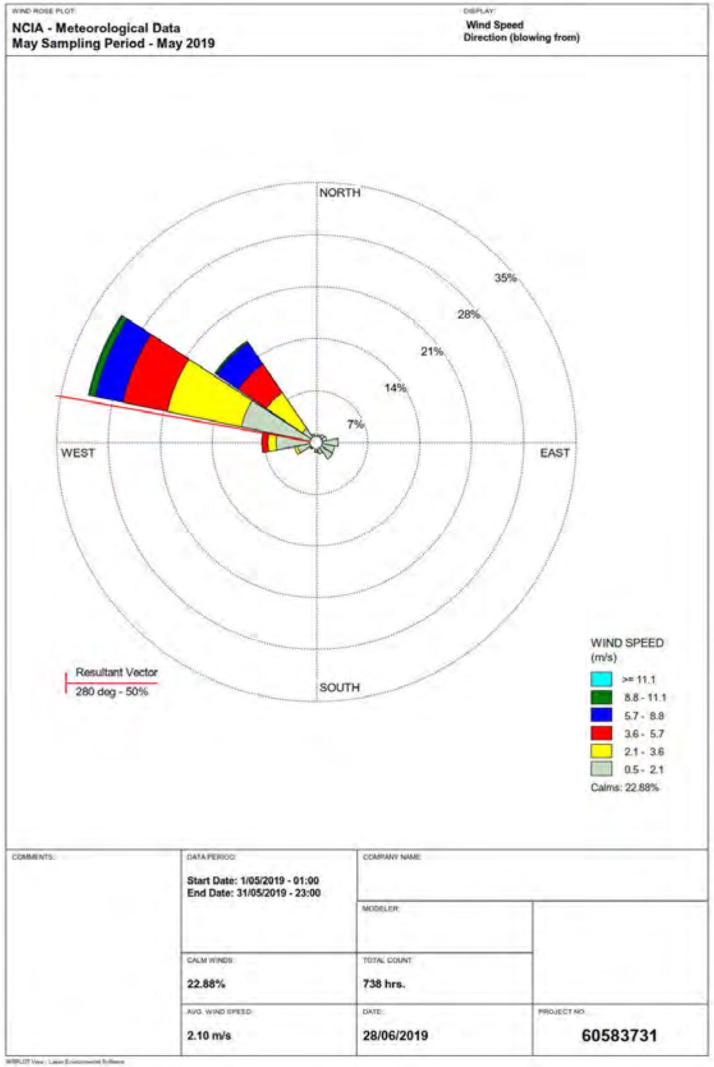


Figure B 10 Wind Speed and Direction (May 2019)

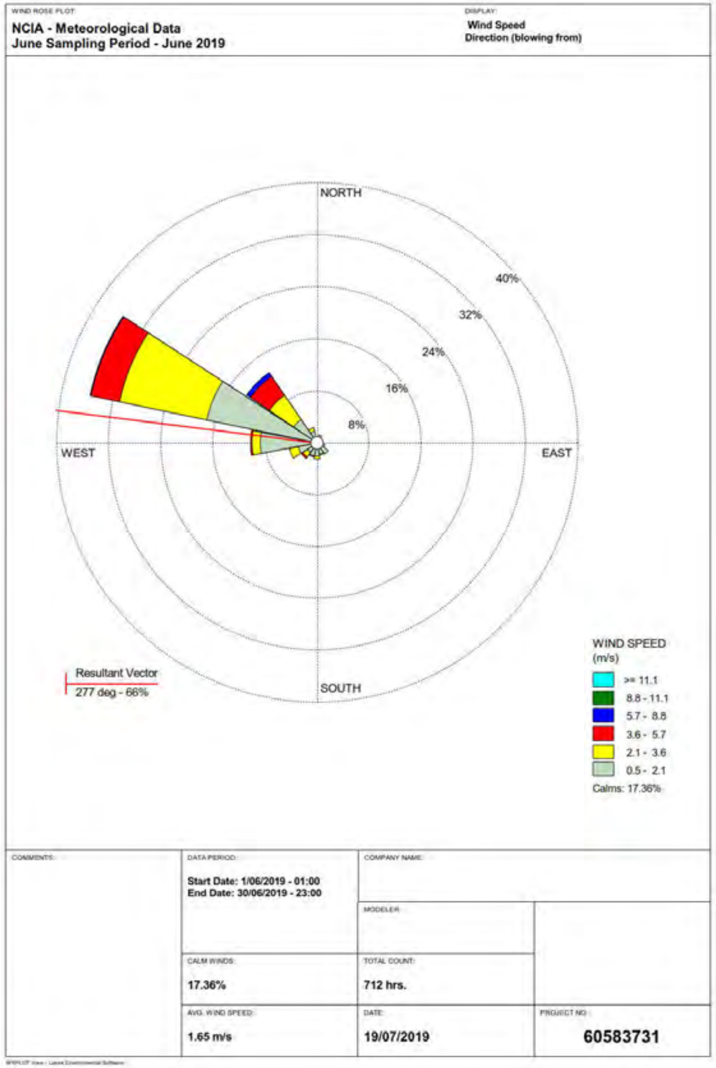


Figure B 11 Wind Speed and Direction (June 2019)

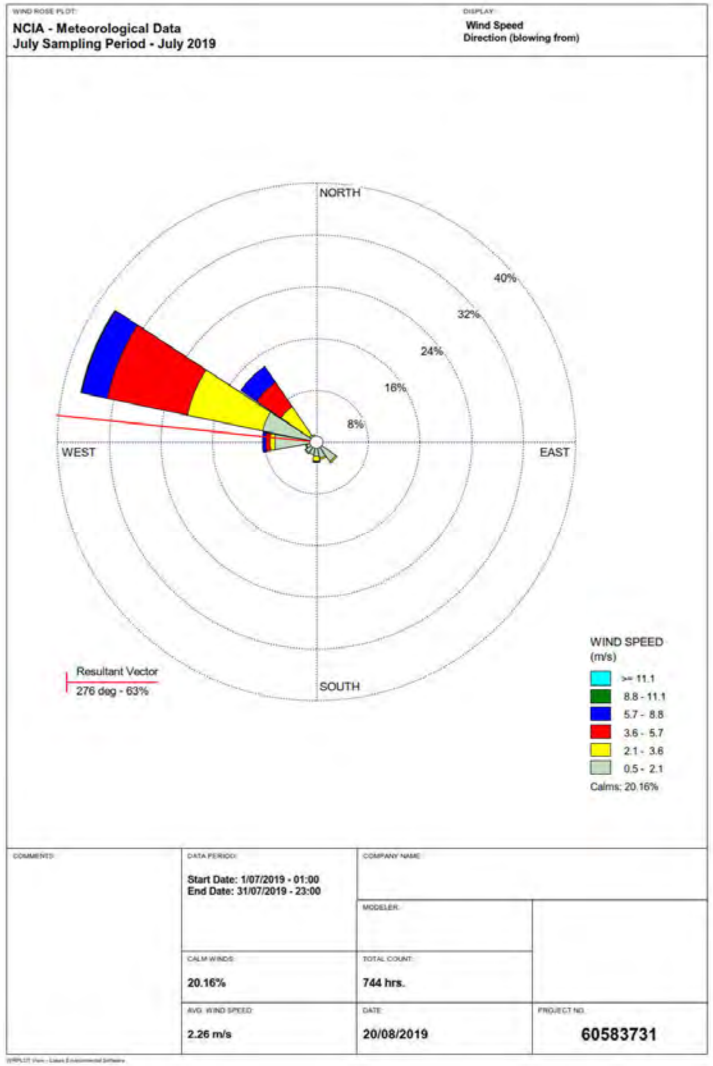


Figure B 12 Wind Speed and Direction (July 2019)

Appendix C

LBL Calculations

Appendix C LBL Calculations

2019 LBL Calculations

Operating Data		
Days Operating Per Year =	330	days
Base hours Per Day =	24	hours
Alternate hours per day =	12	hours
Production =	5,343,076	m^2
Tonnes Produced =	84,675	tonnes

Parameter	Clay Prep (EPA 1)			Press Dryer (EPL 3)			Dryer 1 (EPL 5)			Dryer 2 (EPL 6)		
	TP	CP	PM_{10}	TP	CP	PM_{10}	TP	CP	PM_{10}	TP	CP	PM_{10}
Concentration (mg/m^3) @ STP =	5.2	3.6	1.6	4.6	2.1	2.5	7.2	3.9	3.3	14	5.9	8.1
Volumetric Flow Rate (m^3/s) @ STP =	12	12	12	11	11	11	1.5	1.5	1.5	1.4	1.4	1.4
Mass Emission Rate (mg/s) =	62	43	19	51	23	28	10.80	5.85	4.95	19.60	8.26	11.34
Annual Mass Emitted (kg) =	889.6	615.9	273.7	1442.7	658.6	784.1	307.9	166.8	141.1	558.8	235.5	323.3

Parameter	Glaze Line (EPL 9)			Selection Line (EPL 10)			Sprayer Dryer (EPL 12)			Hot Air Cooler 1 (EPA 18)			Hot Air Cooler 2 (EPA 19)		
	TP	CP	PM_{10}	TP	CP	PM_{10}	TP	CP	PM_{10}	TP	CP	PM_{10}	TP	CP	PM_{10}
Concentration (mg/m^3) @ STP =	19	18.2	0.8	1.5	0.7	0.8	1.9	0.5	1.4	3.9	1.3	2.6	3.6	2.92	0.68
Volumetric Flow Rate (m^3/s) @ STP =	9.7	9.7	9.7	1.0	1.0	1.0	21	21	21	3.3	3.3	3.3	2.4	2.4	2.4
Mass Emission Rate (mg/s) =	184.30	176.35	7.95	1.50	0.70	0.80	40	11	29	13	4	9	8.64	7.01	1.63
Annual Mass Emitted (kg) =	5254.8	5028.0	226.8	42.8	20.0	22.8	568.8	149.7	419.1	366.9	122.3	244.6	246.3	199.8	46.5

Parameter	Kiln 1 (EPL 14)						Kiln 2 (EPL 15)					
	TP	CP	PM_{10}	Total F	NO_x	SO_x	TP	CP	PM_{10}	Total F	NO_x	SO_x
Concentration (mg/m^3) @ STP =	11	1.6	9.4	8.1	52	19	17	4	13	1.49	48	7.6
Volumetric Flow Rate (m^3/s) @ STP =	7.7	7.7	7.7	7.7	7.7	7.6	7.0	7.0	7.0	7.0	7.0	7.3
Mass Emission Rate (mg/s) =	84.70	12.32	72.38	62.4	400.40	144.40	119.00	28.00	91.00	10.4	336.00	55.48
Annual Mass Emitted (kg) =	2415.0	351.3	2063.7	1778.3	11416.2	4117.1	3392.9	798.3	2594.6	297.4	9580.0	1581.8

LBL Summary		D2		D3	D4		
Assessable Pollutant	**Load Limit (kg)**	**Assessable Load (AL)**	**Fee Rate Threshold factor**	**Fee Rate Threshold (kg)**	**2x Assessable Load**	**Assessable Load (AL1)**	**Exceedance of Load Limits**
Coarse Particulates (Air)	14,338	8,346	0.085	7,197.375	16,692	9,494.625	FALSE
Fine Particulates (Air)	26,629	7,140	0.110	9,314.25	14,280	-	FALSE
Fluoride (Air)	1,850	2,076	0.120	10,161	4,152	-	**TRUE**
Nitrogen Oxides (Air)	36,828	20,996	0.220	18,628.5	41,992	23,363.5	FALSE
Sulfur Oxides (Air)	36,828	5,699	0.530	44,877.75	11,398	-	FALSE

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