Prepared for
National Ceramic Industries Australia
ABN: 83 100 467 267

AECOM

2022 Annual Environmental Management Report

1 August 2021 - 31 July 2022

31-Oct-2022

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2022 Annual Environmental Management Report

1 August 2021 - 31 July 2022

Client: National Ceramic Industries Australia

ABN: 83 100 467 267

Prepared by

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Table of Contents

1.0 Introduction 9
1.1 NCIA Background 9
1.1.1 Current Operations 9
1.1.2 Future Planned Operations 9
1.1.3 Historic and Current Production Volume 9
1.2 Regulatory Context 10
1.2.1 Current Approvals 10
1.2.2 AEMR Requirement 10
2.0 Standards and Performance Measures 12
3.0 Complaints 13
4.0 Environmental Monitoring Results 15
4.1 Ambient Air Monitoring Results 16
4.1.1 PM_{10} – Monitoring Results 18
4.1.2 PM_{10} – Assessment against Annual Criteria 18
4.1.3 PM_{10} – Assessment against 24 Hour Criteria 18
4.1.4 Fluoride – 24 Hour Monitoring Results 20
4.1.5 Fluoride – Weekly (7-Day) Monitoring Results 21
4.2 Fluoride Impact on Vegetation 23
4.3 Meteorological Monitoring 23
4.4 Stack Emissions Testing 24
4.5 Noise Monitoring 26
4.5.1 Site Boundary Monitoring 28
4.5.2 Predicted Noise Levels 28
4.5.3 Assessment Against Short-Term Night-time Criteria 29
4.6 Water 30
4.6.1 Water Usage 30
4.6.2 Stormwater Quality 30
4.7 Waste Generation 32
5.0 Discussion of Environmental Performance 33
5.1 Ambient Air Quality 33
5.2 Fluoride Impact on Vegetation 37
5.3 Meteorological Monitoring 38
5.4 Air Emissions 38
5.5 Noise 44
5.6 Water 46
5.6.1 Water Usage 46
5.6.2 Process Water Management 46
5.6.3 Stormwater Quality 47
5.6.4 Stormwater Management 48
5.7 Waste 49
5.7.1 Waste Generation 49
5.7.2 Waste Management 49
6.0 Non-Compliances 50
6.1 2021-2022 Non-Compliances Record 50
6.2 Audit Recommendations and Action Plan 50
7.0 Continuous Improvement Measures 55
7.1 General Environmental Management 55
7.2 Energy Efficiencies 57
8.0 References 58

Appendix A
Meteorological Monitoring - Wind Roses A

List of Tables

Table 1-1	Schedule 4, Condition 60 of Project Approval (MP 09_0006)	11
Table 3-1	Historical complaints received by NCIA	14
Table 4-1	Ambient Monitoring EPL Point Locations	16
Table 4-2	Summary of ambient air monitoring: PM_{10} results	18
Table 4-3	Summary of ambient air monitoring: 24-hour fluoride results	20
Table 4-4	Summary of ambient air monitoring: weekly fluoride results	21
Table 4-5	Emission source descriptions	24
Table 4-6	Summary of particulate emission monitoring results	25
Table 4-7	Summary of emission monitoring results – Kiln 1 and Kiln 2	25
Table 4-8	Received noise levels during attended noise monitoring (23 June 2022)	27
Table 4-9	June 2022 Site Boundary Measurement Results	28
Table 4-10	June 2022 – Calculated Noise Levels at the Receiver Locations	29
Table 5-1	Meteorological station data capture	38
Table 5-2	Comparison of emission concentrations used in 2010 EA modelling and measured in stack emission concentrations for the current reporting period	39
Table 5-3	Maximum pollutant load limits and assessable pollutant loads	41
Table 6-1	Audit recommendations and NCIA action plan	51
Table 7-1	Timetable for environmental improvement actions	55

List of Figures

Figure 1	Production volume since 2004	10
Figure 2	Ambient air monitoring locations	17
Figure 3	PM_{10} monitoring – northwest location	19
Figure 4	PM_{10} monitoring – southeast location	19
Figure 5	24-hour fluoride monitoring – northwest location	20
Figure 6	24-hour fluoride monitoring – southeast location	21
Figure 7	Weekly fluoride monitoring – northwest location	22
Figure 8	Weekly fluoride monitoring – southeast location	22
Figure 9	Average monthly rainfall and temperature range (1 August 2021 – 31 July 2022)	24
Figure 10	Stormwater quality monitoring – pH	30
Figure 11	Stormwater quality monitoring – Electrical Conductivity	31
Figure 12	Tile waste (green and fired) generation during the 2022 reporting period	32
Figure 13	24-hour PM_{10} monitoring – northwest location (2004 – 2022)	34
Figure 14	24-hour PM_{10} monitoring – southeast location (2004 – 2022)	34
Figure 15	24-hour fluoride monitoring – northwest location (2004 – 2022)	35
Figure 16	24-hour fluoride monitoring – southeast location (2004 – 2022)	35
Figure 17	Weekly fluoride monitoring – northwest location (2004 – 2022)	36
Figure 18	Weekly fluoride monitoring – southeast location (2004 – 2022)	36
Figure 19	Fine particulate annual load (2004 – 2022)	42
Figure 20	Coarse particulate annual load (2004 – 2022)	42
Figure 21	Fluoride annual load (2004 – 2022)	43
Figure 22	Sulfur oxides (as sulphuric acid mist and sulfur trioxide (as SO_3)) annual load (2004 – 2022)	43
Figure 23	Nitrogen oxides annual load (2004 – 2022)	44
Figure 24	Day noise levels, Kenvil Close, 2004 – 2022	45
Figure 25	Evening noise levels, Kenvil Close, 2004 – 2022	45
Figure 26	Night noise levels, Kenvil Close, 2004 – 2022	46
Figure 27	Stormwater quality, Pond 4 pH (2009-2022)	47
Figure 28	Stormwater quality, Pond 4 – EC (2009-2022)	48
Figure 29	Gas efficiency in tile manufacturing process	57

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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 2021 and 31 July 2022 (hereafter referred to as the '2022 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 55 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. Stage Three is currently under consideration as there is a strong demand for locally made tiles, due to supply chain disruptions in China and solid Australian market conditions. From approval of the facility, management estimates it would take between 18 to 24 months before production would commence.

1.1.3 Historic and Current Production Volume

Tile production volume since commissioning and inclusive of the 2022 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 2021 and 31 July 2022, the facility operated 330 days, for a total output of 99,326 tonnes of ceramic tiles (or approximately 5.5 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).

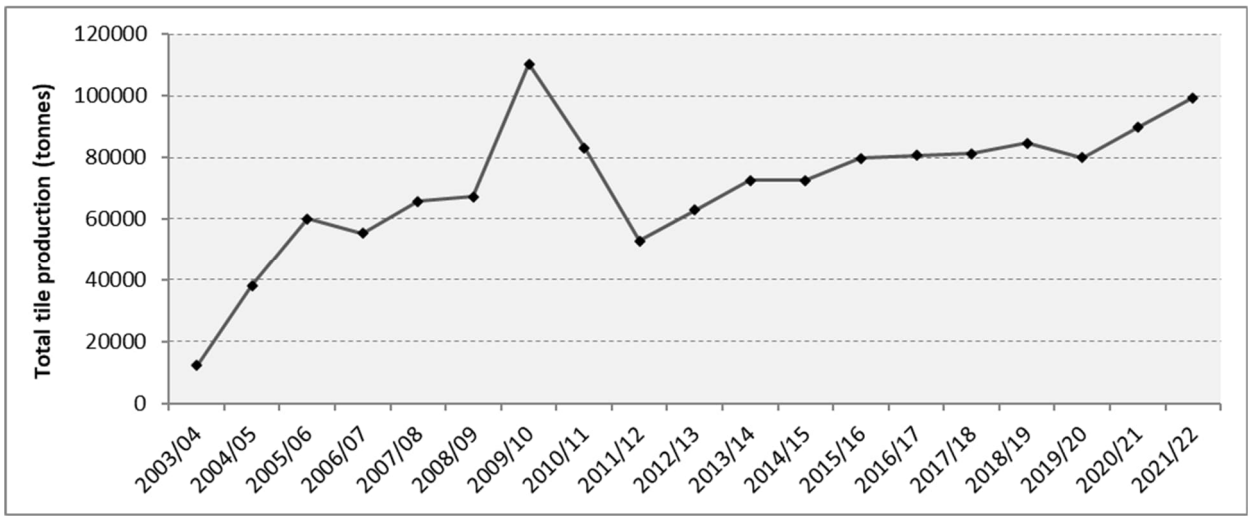


Figure 1 Production volume since 2004

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;	This AEMR (see note 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 • predictions in the EA.	**Section 5.0**
60 (g)	identify any trends in the monitoring;	**Section 5.0**
60 (h)	identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies;	**Section 5.0**
60 (i)	identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance; and	**Section 6.0**
60 (j)	identify continuous improvement measures, outlining new developments in air quality and noise control, and detailing practices that have been implemented on the site during the previous year, to reduce air quality and noise impacts.	**Section 7.0**

Note on timeline:

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.

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
- 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.

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**. No complaints were received for the 2022 reporting period. 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	Issue	Details
2022	Nil	Nil	None required.
2021	1	Air Quality	Complaint made from resident of Heritage Parc concerned with what is being emitted from the stacks after being told it is damaging his guttering. No details were left to contact the resident, so no action was taken.
2020	Nil	Nil	None Required.
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.

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})
  - Fluoride (particulate, gaseous and total).
- Fluoride Impact on Vegetation:
  - Quarterly visual assessment of vegetation
  - Quarterly fluoride content in vegetation.
- Meteorological monitoring:
  - Wind speed at 10 metres
  - Wind direction at 10 metres
  - Temperature at 5 metres
  - Rainfall.
- Stack emission testing (all stacks):
  - Total particulates
  - 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 as SO_3)
  - Sulfur Dioxide (SO_2 as SO_3).
- Noise monitoring:
  - L_{Aeq}(15 minute)
  - 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 **Table 4-1** and **Figure 2**).

For PM_{10} monitoring, two sampling locations have been established at the Northwest and Southeast to determine concentrations at the NCIA property boundary (with both locations identified as EPL Point 22), 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 the Northwest and Southeast monitoring locations (with both locations identified as EPL Point 23) 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 for discrete 24-hour periods according to the NSW EPA 6-day cycle to provide 24-hour averages for sampler operation days. These units are designated 'Northwest HF' and 'Southeast HF'.

Table 4-1 Ambient Monitoring EPL Point Locations

EPL Identification Number	Emission Source Description
22	PM_{10} – 24hr (Southeast & Northwest Locations)
23	HF – 24hr & Weekly (Southeast & Northwest Locations)
24	Meteorological Station (Southeast Location)

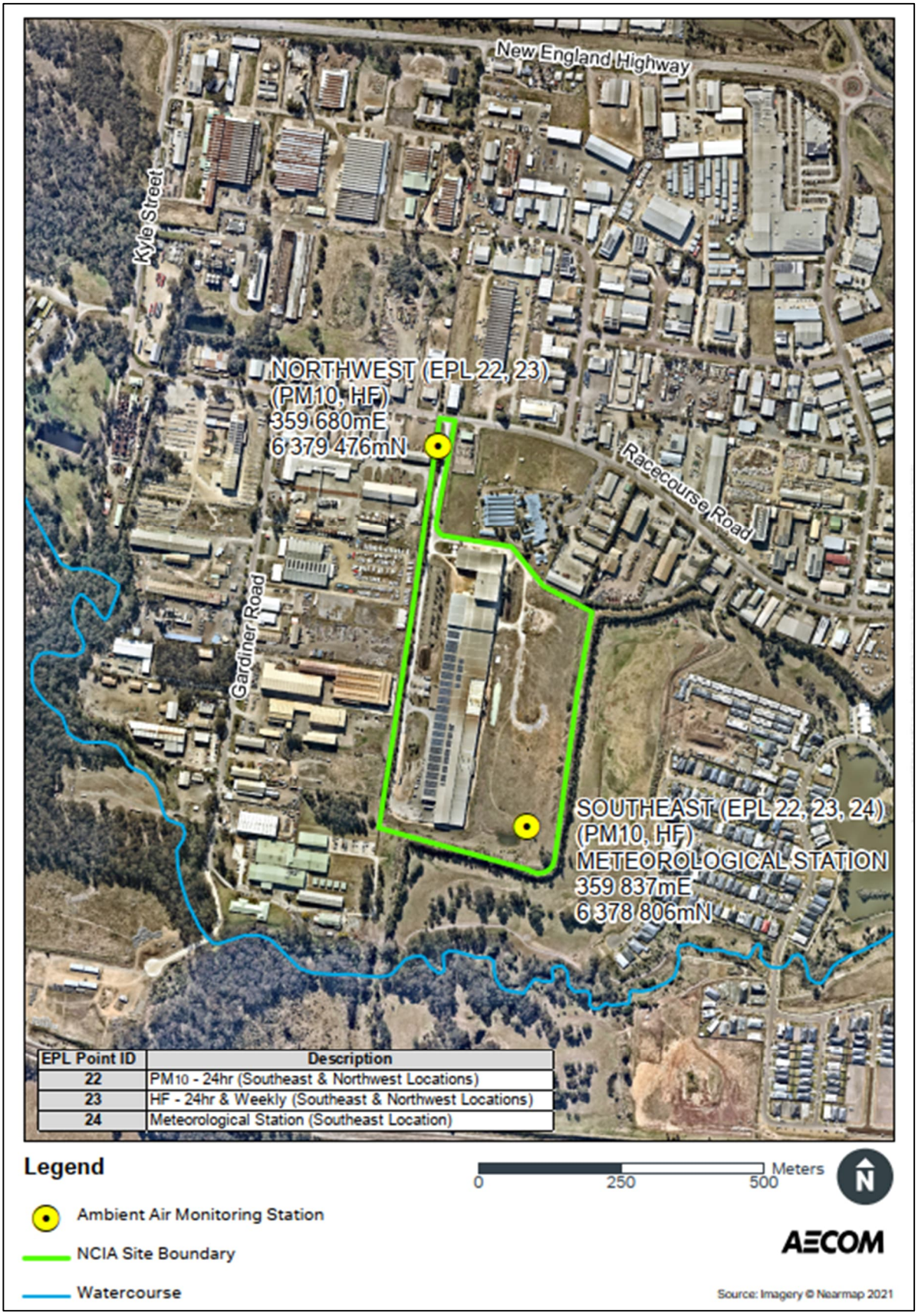


Figure 2 Ambient air monitoring locations

4.1.1 PM_{10} – Monitoring Results

The EPL does not specify ambient air concentration limits, however Condition 15 of the Project Approval defines criteria for PM_{10}.

A summary of PM_{10} monitoring results from both monitoring locations for the current reporting period is provided in **Table 4-2**, 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 4-2 Summary of ambient air monitoring: PM_{10} results

Parameter	NW Location	SE Location	Criteria
Annual Average Concentration (µg/m^3)	22.7	13.4	30
Standard Deviation (µg/m^3)	9.6	5.6	-
24-hour Minimum Concentration (µg/m^3)	2.9	4.0	-
24-hour Maximum Concentration (µg/m^3)	49.2	26.5	50

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

4.1.2 PM_{10} – Assessment against Annual Criteria

The North West and South East locations returned an average annual concentration of 22.7 µg/m^3 and 13.4 µg/m^3 respectively, which are below the 30 µg/m^3 annual criteria. This annual average remained below this criterion for the duration of the 12-month monitoring period.

4.1.3 PM_{10} – Assessment against 24 Hour Criteria

This section details any exceedances of the PM_{10} 24-hour maximum concentration. Any 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.

No exceedances of the PM_{10} 24-hour maximum concentration occurred at either monitoring location throughout the 12-month monitoring period.

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

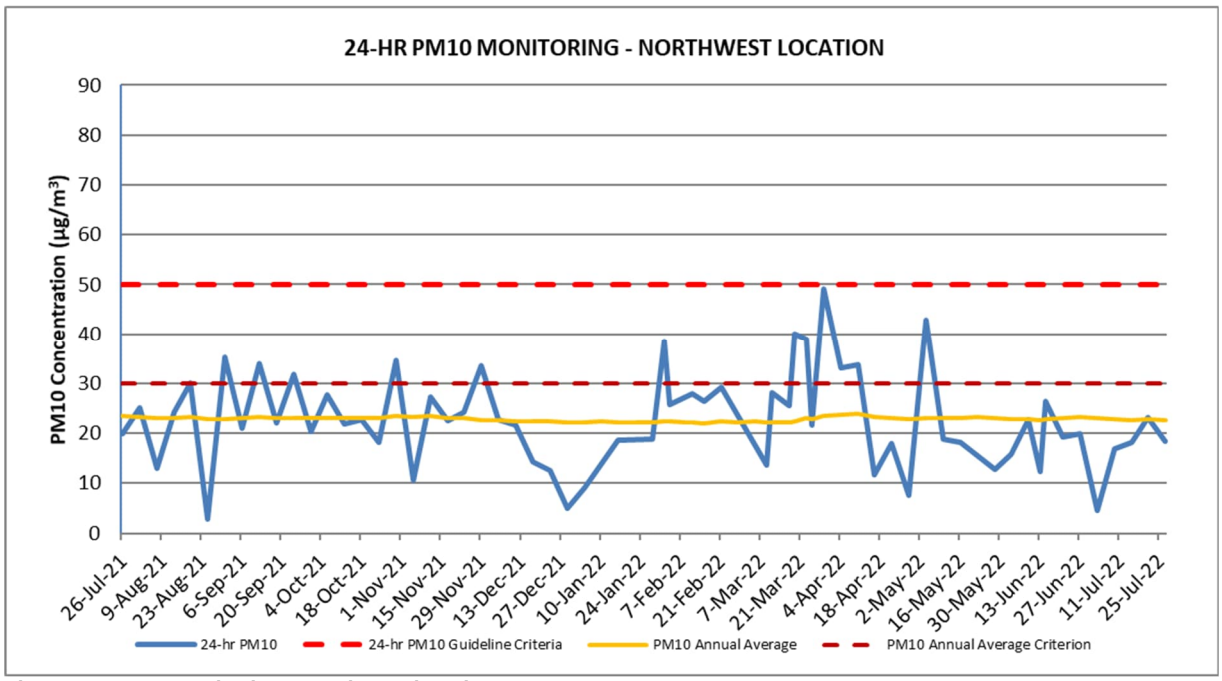


Figure 3 PM_{10} monitoring – northwest location

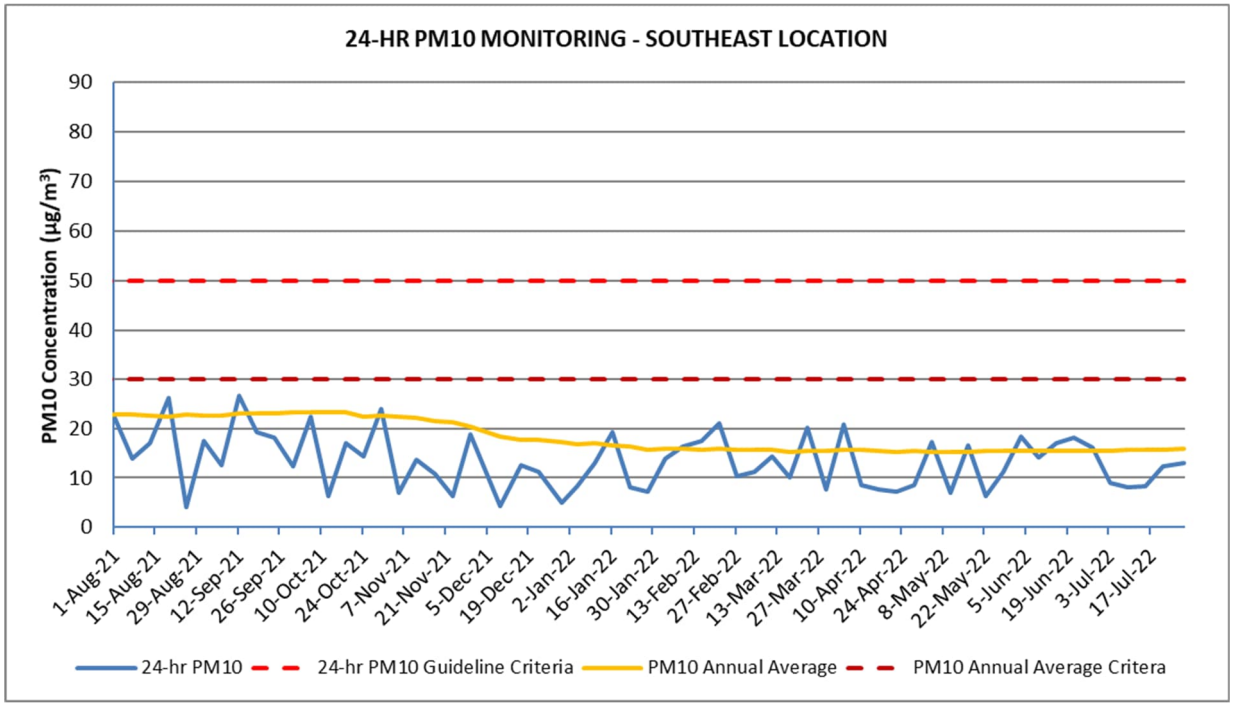


Figure 4 PM_{10} monitoring – southeast location

4.1.4 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 4-3**. The 24-hour fluoride monitoring results for the NW and SE locations are also graphed in **Figure 5** and **Figure 6** respectively.

Table 4-3 Summary of ambient air monitoring: 24-hour fluoride results

Parameter	NW Location	SE Location	Guideline Criterion
Annual Average Concentration (µg/m^3)	0.16	0.30	-
Standard Deviation (µg/m^3)	0.14	0.23	-
24-hour Minimum Concentration (µg/m^3)	0.01	0.03	-
24-hour Maximum Concentration (µg/m^3)	0.63	1.21	2.9

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

The results in **Table 4-3** show 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**.

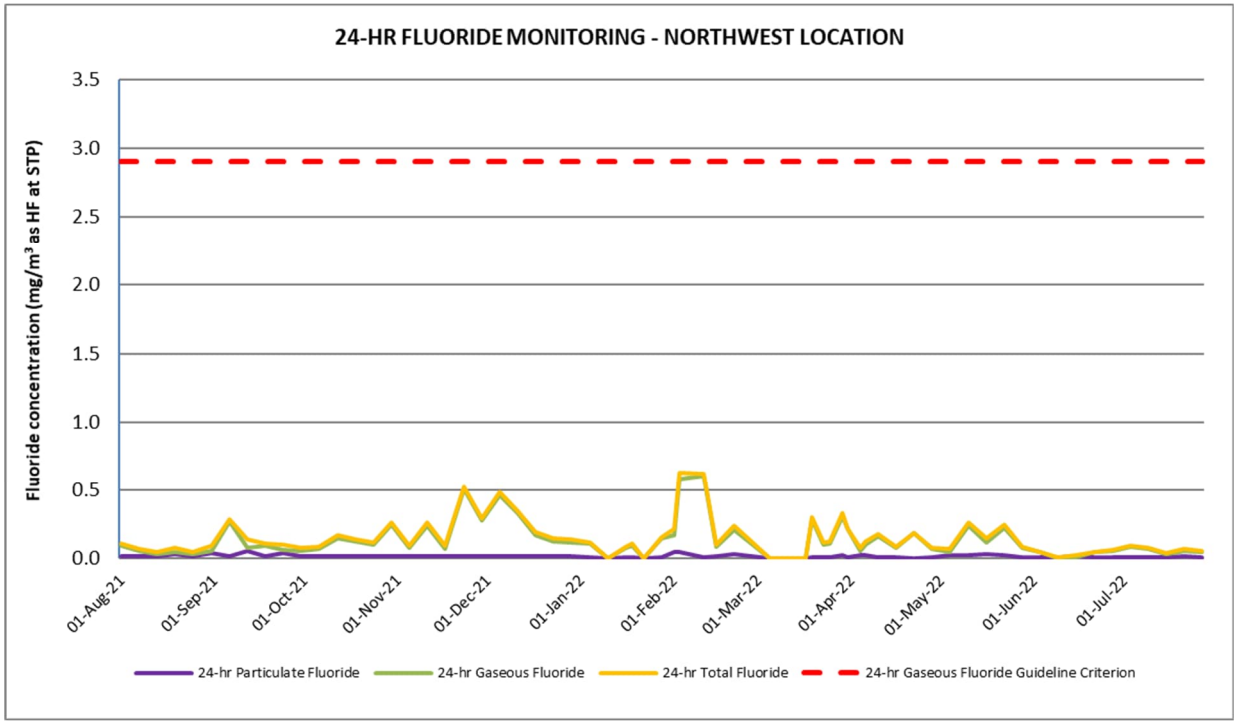


Figure 5 24-hour fluoride monitoring – northwest location

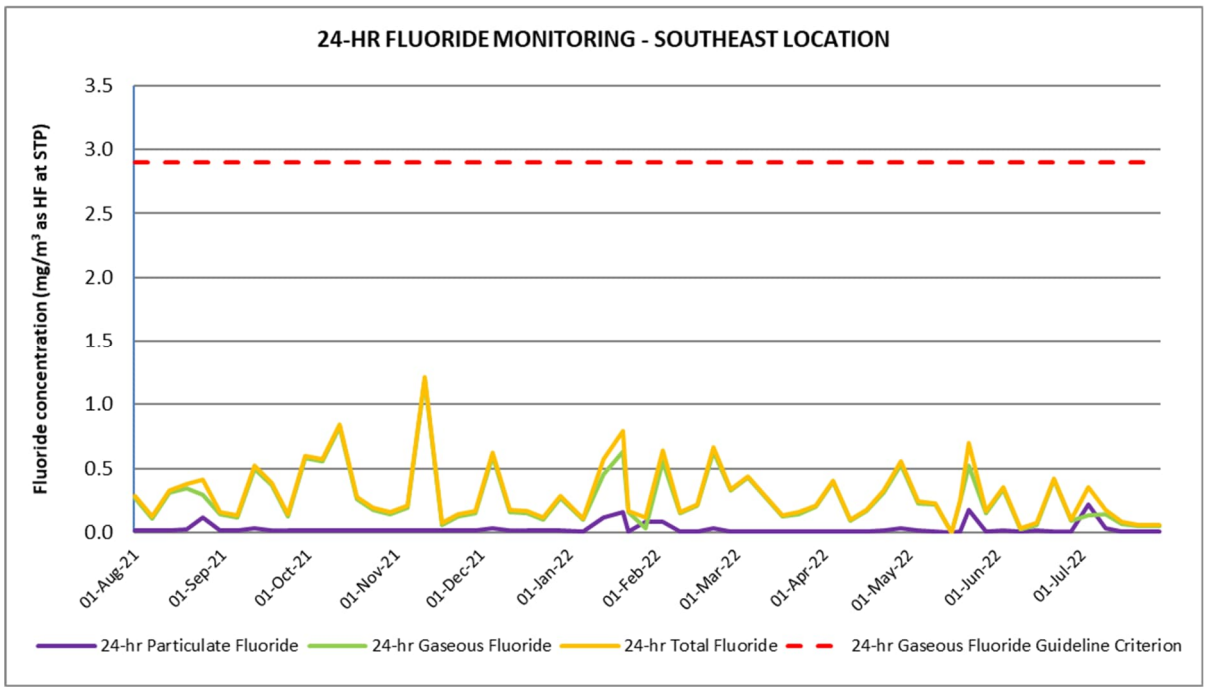


Figure 6 24-hour fluoride monitoring – southeast location

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 4-4**. The weekly Fluoride monitoring results for the NW and SE locations are also graphed in **Figure 7** and **Figure 8** respectively.

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

Parameter	NW Location	SE Location	Guideline Criterion
Annual Average Concentration (µg/m^3)	0.13	0.16	-
Standard Deviation (µg/m^3)	0.09	0.13	-
Weekly Minimum Concentration (µg/m^3)	0.02	0.01	-
Weekly Maximum Concentration (µg/m^3)	0.48	0.45	1.7

The results in **Table 4-4** show that both the NW and SE 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**.

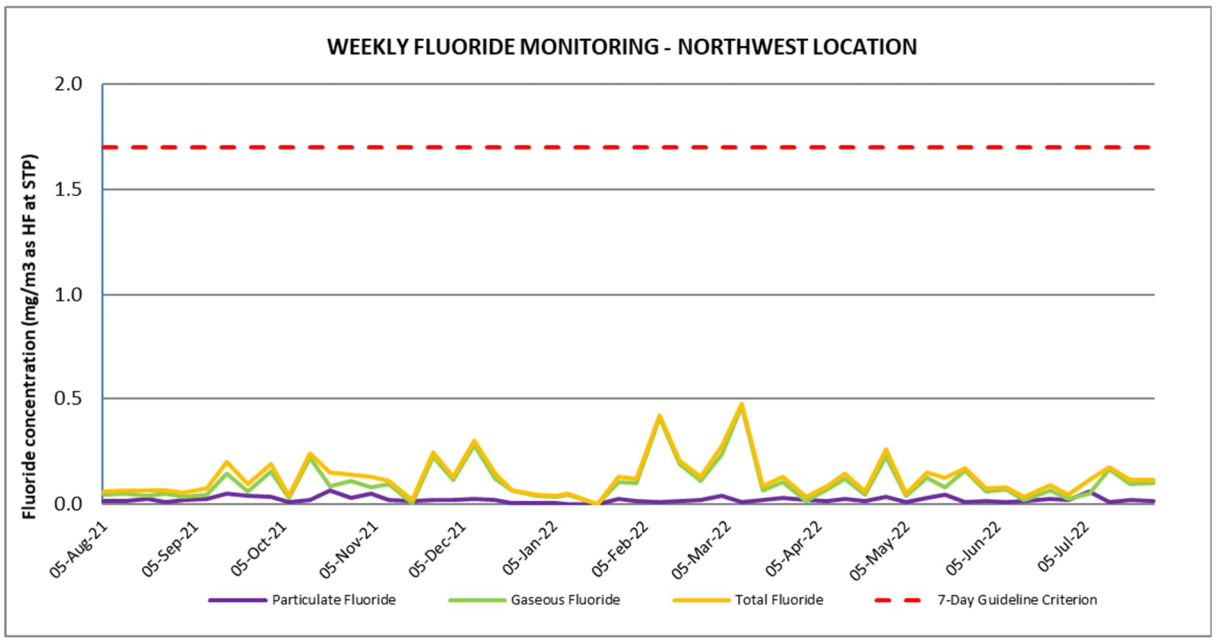


Figure 7 Weekly fluoride monitoring – northwest location

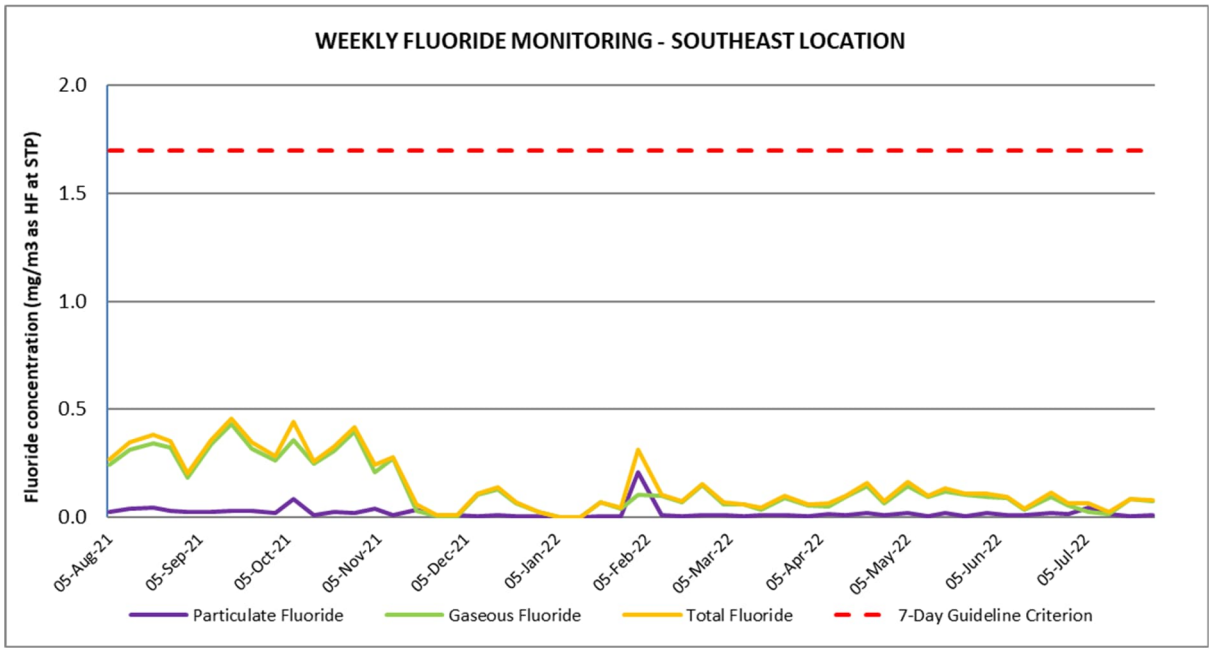


Figure 8 Weekly fluoride monitoring – southeast location

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 (September 2021, December 2021, March 2022 and June 2022) with the December 2021 round doubling as an Annual Vegetation Condition Assessment.

A detailed summary of the findings for each vegetation assessment (KORU, 2022) is presented in **Section 5.2**.

4.3 Meteorological Monitoring

Meteorological data is recorded at the onsite meteorological station (EPL Point 24) 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 9**. Rainfall data has been sourced from the nearby (4.4km) Maitland Airport BoM station. Monthly wind roses representing the wind speed and direction for the reporting period are provided in **Appendix A**. A summary of the dominant onsite wind patterns throughout the reporting period is provided below.

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

- From August to October 2021 winds were blowing predominantly from the northwest.
- In November 2021 winds were blowing predominantly from the northwest and southeast.
- From December 2021 to March 2022 winds were predominantly from the southeast.
- In April 2022 winds were predominately from the northwest and southeast.
- From May to July 2022 winds were predominately from the northwest.

Wind speeds recorded over the year were generally low to medium with an average wind speed of 1.9 m/s during the reporting period. The maximum hourly average wind speed during the reporting period was recorded at 11.08 m/s on 13 November 2021.

Total annual rainfall for the period was estimated at 1360mm, with above average rainfall recorded during November 2021, March 2022 and July 2022 accounting for 60% of the total recorded rainfall.

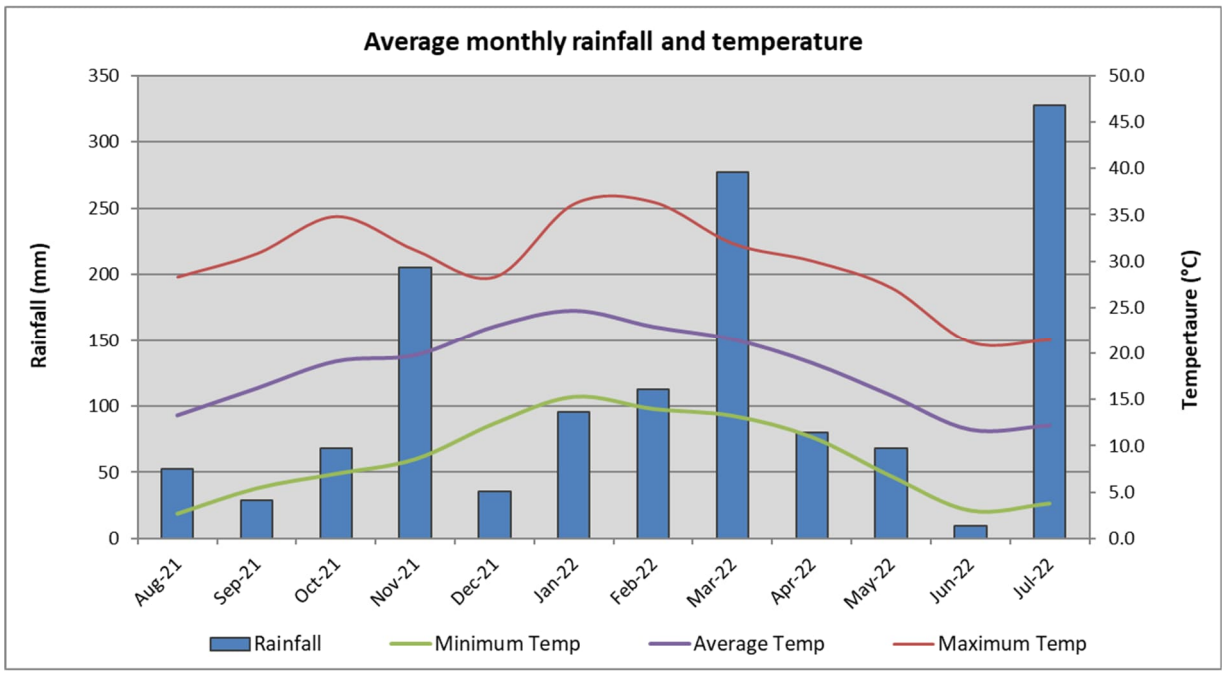


Figure 9 Average monthly rainfall and temperature range (1 August 2021 – 31 July 2022)

4.4 Stack Emissions Testing

Stack emissions testing is undertaken annually in accordance with the EPL requirements. Stack emissions testing was conducted during February, March, and May 2022. Emission sources assessed during the testing period were those defined in the EPL and listed in **Table 4-5**.

Table 4-5 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), Total Hazardous Substances (metals) including Cadmium and Mercury, and Nitrogen Oxides (NO, NO_2, NO_x and Equivalent NO_2). 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 4-6** and **Table 4-7**.

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 in line with EPL requirements.

Table 4-6 Summary of particulate emission monitoring results

Stack	Fine Particulate (PM_{10}) (mg/m^3)	Total Particulate (mg/m^3)	Regulatory Limit (mg/m^3)*
Clay Preparation (CP1) (EPL 1)	<0.14	0.54	20
Pressing and Drying (PD1) (EPL 3)	0.93	7.6	20
Dryer (D1) (EPL 5)	2.8	6.1	20
Dryer (D2) (EPL 6)	<0.17	4.8	20
Glaze Line (EPL 9)	1.8	4.1	20
Selection Line (SL 1,2,3,4) (EPL 10)	0.14	3.3	20
Spray Dryer (SD1) (EPL 12)	0.15	<0.01	20
Hot Air Cooler (HAC 1) (EPL 18)	1.7	2.0	5
Hot Air Cooler (HAC 2) (EPL 19)	1.7	1.6	5

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

Table 4-7 Summary of emission monitoring results – Kiln 1 and Kiln 2

Pollutant	Kiln 1 (EPL 14) (mg/m^3)	Kiln 2 (EPL 15) (mg/m^3)	Regulatory Limit (mg/m^3)
Fine Particulate (PM_{10}) (at 18% O_2)	2.5	1.3	N/A
Total Particulate (at 18% O_2)	10	1.1	20
Gaseous Fluoride (as HF)	0.93	1.6	N/A
Particulate Fluoride (as HF)	0.023	0.0099	N/A
Total Fluoride (as HF)	1.0	1.6	5
Sulfuric Acid Mist (H_2SO_4 as SO_3)	16	17	100
Sulfur Dioxide (SO_2)	350	230	NA
Total Hazardous Substances (Metals)	0.033	0.059	1
Cadmium	0.00017	0.0038	0.1
Mercury	0.00060	0.0018	0.1
Equivalent Nitrogen Dioxide (NO_2) at 18% O_2	33	20	100

*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 *Noise Policy for Industry 2017 (NPfI)*. In accordance with the *NPfI* 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.

Noise monitoring was undertaken by AECOM in June 2022. A series of attended noise measurements of 15 minutes duration were made in Kenvil Close and Wollombi Road on Thursday 23 June 2022 during the day, evening and night-time periods. Measurements were also made at the NCIA site boundary during these periods. 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 4-8**.

Table 4-8 Received noise levels during attended noise monitoring (23 June 2022)

Location	Date/ Time	dB(A), $L_{eq\ (15\ min)}$	Wind speed / direction	Identified Noise Sources	dB(A), L_{max}
Kenvil Pl Daytime	23/6/22 13:55	**49.1**	(4.7 m/s) and generally from the west	• Site inaudible • Highway traffic and bird's dominant • Plane overhead • Reversing beeper from trucks • Trains	n/a
Kenvil Pl Evening	23/6/22 20:50	**45.8**	(2.5 m/s) and generally from the west northwest.	• Some industrial noise audible, likely some site contribution • Highway traffic dominant with minimal local traffic • Trucks on the highway particularly audible. • Some local residential noise • Crickets • Attempted pause for passing trains and loud vehicles	n/a
Kenvil Pl Night	23/6/22 22:55	**44.2**	(3.1 m/s) and generally west northwest.	• Some industrial noise audible, likely some site contribution • Highway traffic the dominant source • Attempted to pause for loud vehicles and passing trains	n/a
Wollombi Rd Day	23/6/22 13:30	**66.9**	(4.7 m/s) and generally from the west	• Site inaudible • Traffic on Wollombi Rd dominant • Dog barking occasionally but minimal local residential noise • Construction site across the road, 4 x diggers and trucks • Birds and trees rustling	n/a
Wollombi Rd Evening	23/6/22 20:25	**43.5**	(2.5 m/s) and generally from the west northwest.	• Site inaudible • Crickets at times but otherwise minimal local noise • Barking dog • Paused for regular traffic on Wollombi Rd • Paused for passing trains	n/a
Wollombi Rd Night	23/6/22 23:20	**43.1**	(2.5 m/s) and generally from the west northwest.	• Some industrial noise audible, likely some site contribution • Crickets at times but otherwise minimal local noise • Paused for regular traffic on Wollombi Rd • Paused for passing trains	n/a

The results show that the measured $L_{Aeq(15\ min)}$ noise levels at both the Kenvil Place and Wollombi Rd monitoring locations are above the 35 dB(A) Project Approval limit for each of the three time periods.

In most cases traffic was noted to be the dominant noise source with the site noted to be inaudible during the day, potentially audible in the evening and barely audible at night.

In order to determine the noise contribution from the facility alone at the receiver locations, an alternative method of determining compliance, in accordance with the NPfI was considered appropriate. In this case site boundary measurements were used to predict noise impacts for each receiver location.

4.5.1 Site Boundary Monitoring

Boundary noise measurements were conducted during the day, evening and night-time periods at a single location considered to be representative on the eastern boundary of the site. Results from the site boundary monitoring carried out on 23 June 2022 are presented in **Table 4-9** below.

Table 4-9 June 2022 Site Boundary Measurement Results

Location	Time		Measured Noise Level, $L_{Aeq(15\ min)}$ and $L_{A90(15\ min)}$ dB(A)		Site Operation
			$L_{Aeq(15\ min)}$	$L_{A90(15\ min)}$	
Boundary	Day	23/6/22 14:23	53.1	51.8	• Site dominant with majority of noise generated by continuous processes. • Highway traffic occasionally audible • Moderate wind, rustling trees • Birds • Minimal extraneous noise
	Evening	23/6/22 21:30	53.6	52.1	• Plant noise dominant and very constant • Dogs occasionally barking at nearby RSPCA facility • Paused for passing trains and planes
	Night	23/6/22 22:02	54.6	53.2	• Plant noise dominant • Very little other noise • Paused for passing trains

The results of the site boundary measurements demonstrate there is very little extraneous noise present at this location with the L_{A90} results relatively close to the LA_{eq} results for all three time periods. The LA_{90} represents the lowest 10% of the noise measured.

4.5.2 Predicted Noise Levels

In order to predict resultant noise levels at each receiver from the NCIA facility alone, a 'flat ground' model was used based on hemispherical spreading, conservatively assuming no topographical shielding, ground or air absorption, directivity or meteorological effects. Calculated noise levels at each receiver location are presented in **Table 4-10**.

Table 4-10 June 2022 – Calculated Noise Levels at the Receiver Locations

Receiver Location	Time	Calculated noise impact, dB(A)	Project Approval Limit, dB(A)	Comply
Kenvil Place	Day	34	35	Yes
	Evening	34	35	Yes
	Night	35	35	Yes
Wollombi Road	Day	31	35	Yes
	Evening	32	35	Yes
	Night	33	35	Yes

Calculated results show that all predicted results are either below or equivalent to the 35dB Project Approval limit at both receiver locations.

4.5.3 Assessment Against Short-Term Night-time Criteria

Both the Project Approval and EPL state that a 45dB short term limit applies during the night time period (10pm – 7am). The Project Approval stipulates the L_{AMax} must not exceed 45 dB at the two receiver locations (Kenvil Place and Wollombi Road) while the EPL stipulates that the L_{A1} must not exceed 45 dB at the nearest residential receiver most affected by noise from activities at the premises (deemed to be 26 Fairway Street).

L_{AMax} measurements performed at the Project Approval locations were elevated due to localised noise sources and are not representative of the site contribution. While an L_{A1} measurement was not directly obtained at 26 Fairway Street, the L_{AMax} measured at this location was 47 dB, The L_{Amax} reading is a shorter time period than the L_{A1} and provides a conservative assessment of short-term noise potentially impacting sleep. An exceedance within 2 dB of the criteria is considered negligible under the NPfI and it is likely that an L_{A1} result if available would be compliant. For reference the L_{A10} result of 44dB at this location is below the 45dB L_{A1} criteria.

Due to the proximity of the Fairway Street location to the site (357m) and the significant distance between the two Project Approval locations and the site (1050m and 1350m), a compliant result at Fairway Street implies the L_{AMax} is also compliant at both the Kenvil Place and Wollombi Road locations.

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 58.9 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 10** and **Figure 11** 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 6.7 and 10.3 with a varying trend throughout the reporting period.

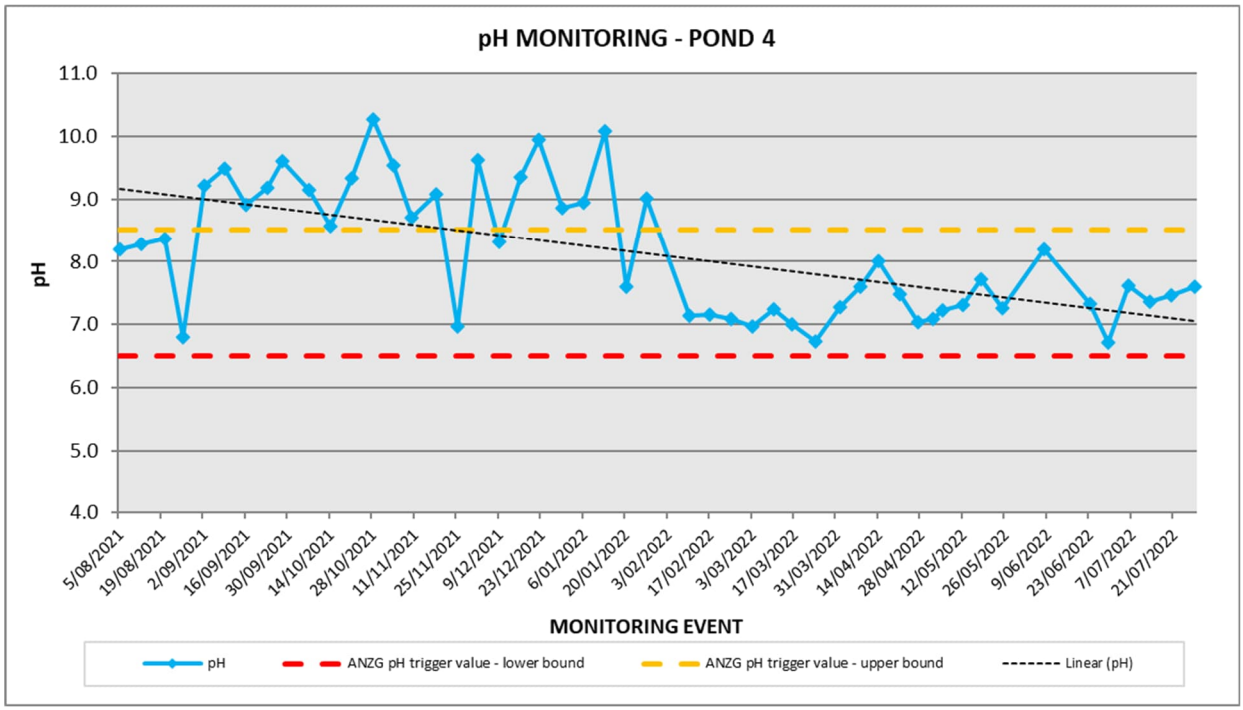


Figure 10 Stormwater quality monitoring – pH

Electrical Conductivity values were low and show a very slight decreasing trend throughout the reporting period with levels ranging 75 to 458 µS/cm indicating that the water is non-saline. The EC values were generally within the ANZG guidelines for the reporting period with the exception of two occasions falling below the lower limit of 125 µS/cm.

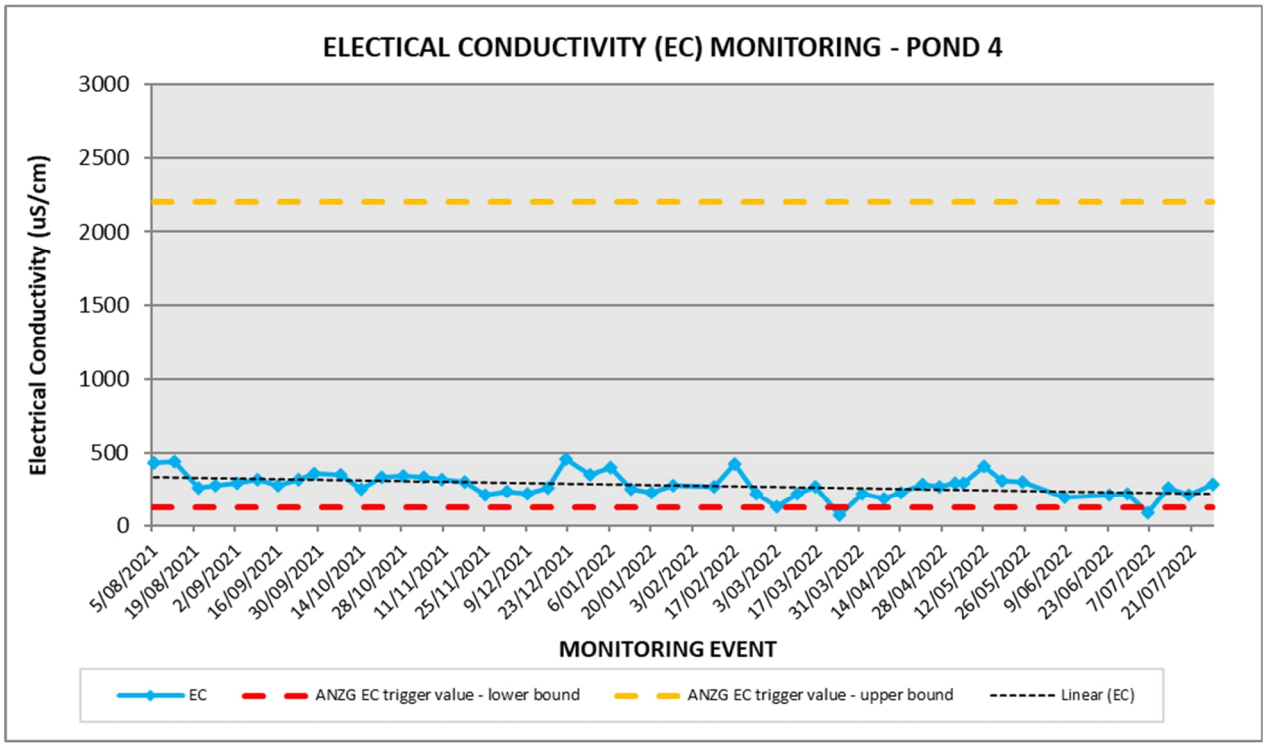


Figure 11 Stormwater quality monitoring – Electrical Conductivity

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 12**.

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. From the previous reporting period the amount of green waste has increased as a result of capturing more defective product prior to firing resulting in all months except September 2021 exceeding the green tile waste target. It must be noted that all green waste is recycled. The increased capture of green waste has resulted in the reduced amount of fired tile waste from a monthly average of 7.8% recorded in the previous reporting period to a monthly average of 5.9% with only the months of August 2021 and January 2022 exceeding the target in the 2021-22 reporting period.

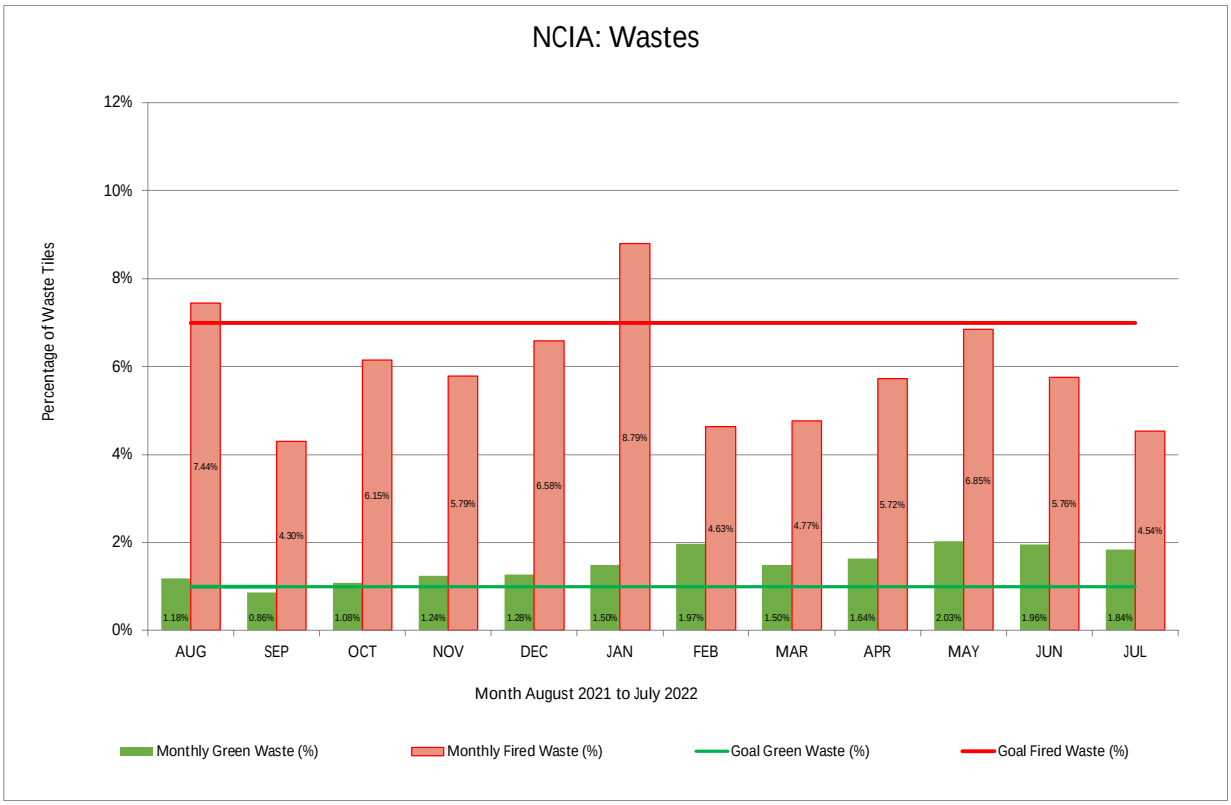


Figure 12 Tile waste (green and fired) generation during the 2022 reporting period

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).
    - 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**) indicates that the levels of 24 hour PM_{10}, annual average PM_{10}, 24 hour fluoride and weekly fluoride were compliant with the relevant guidelines and criteria, with no exceedances recorded during the 2022 reporting period. 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 13** to **Figure 18**. 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 2022 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 concentrations 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 concentrations during the 2022 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.

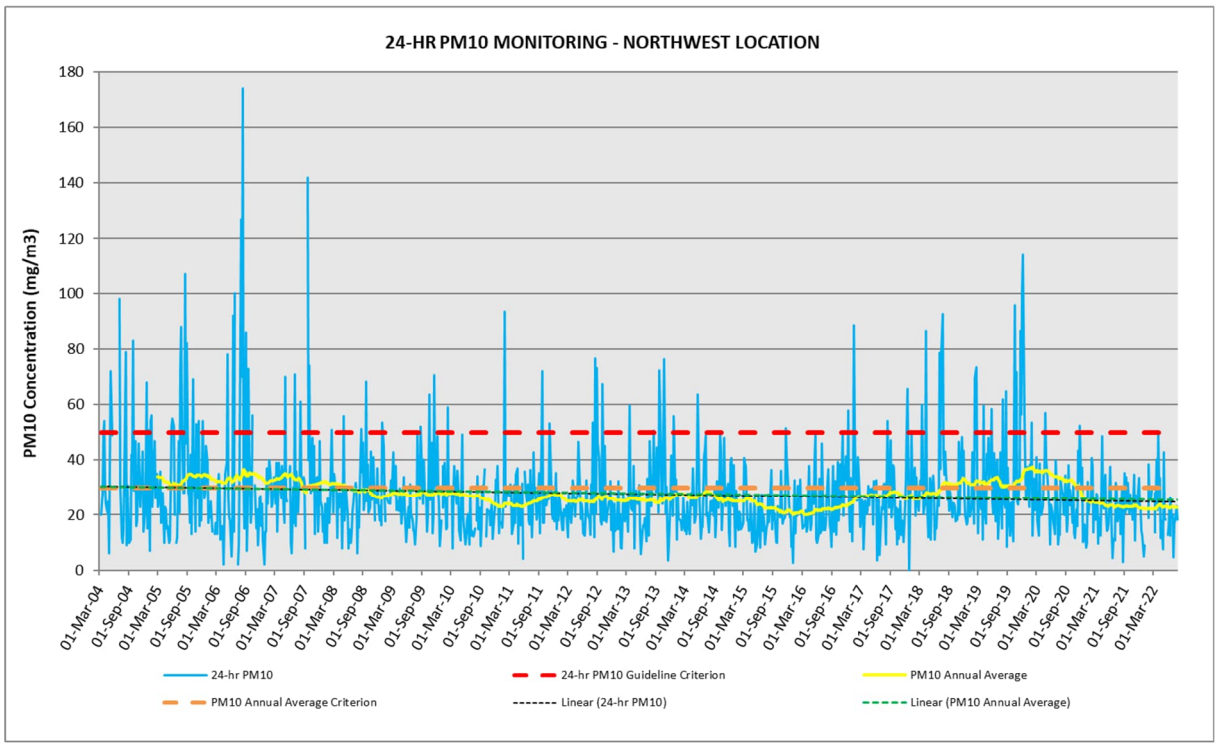


Figure 13 24-hour PM_{10} monitoring – northwest location (2004 – 2022)

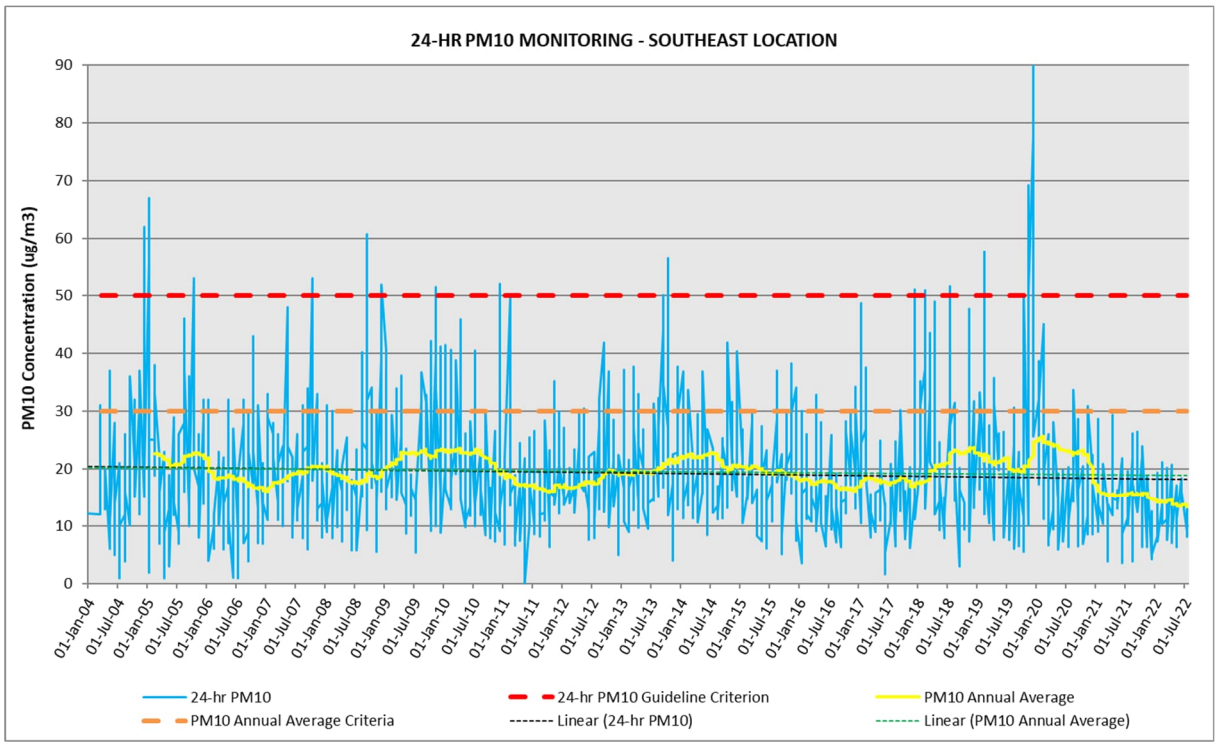


Figure 14 24-hour PM_{10} monitoring – southeast location (2004 – 2022)

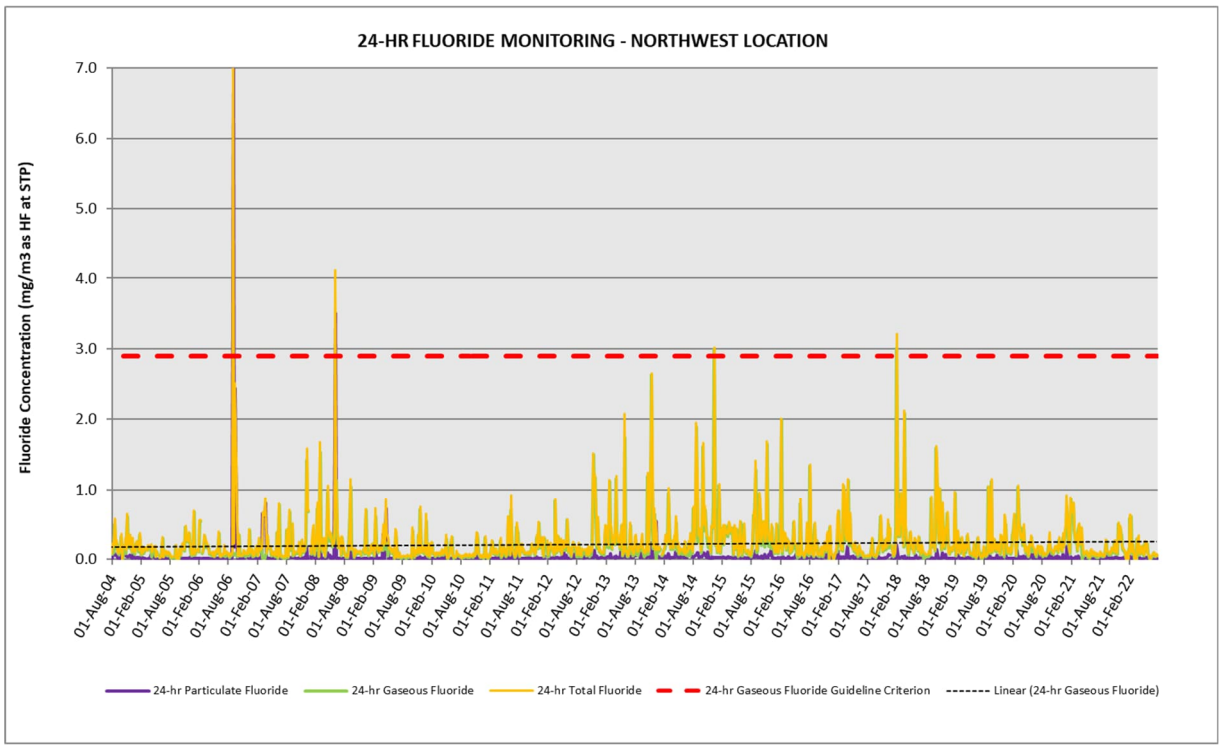


Figure 15 24-hour fluoride monitoring – northwest location (2004 – 2022)

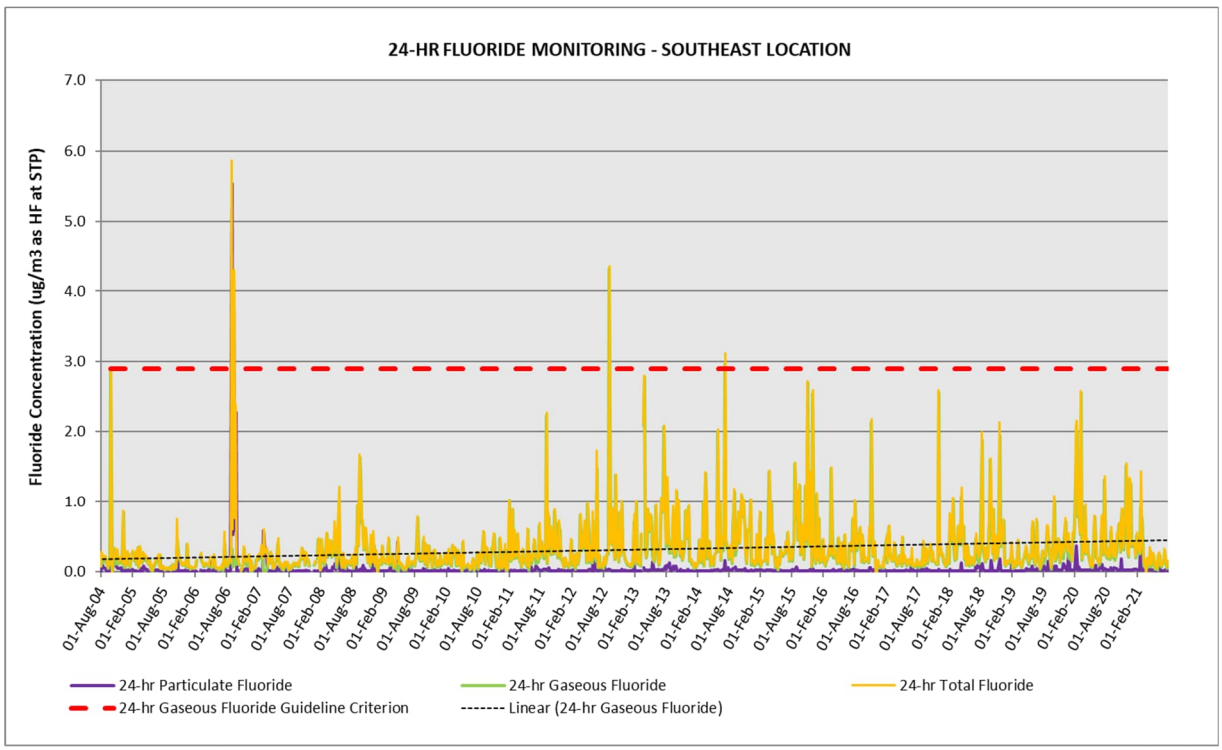


Figure 16 24-hour fluoride monitoring – southeast location (2004 – 2022)

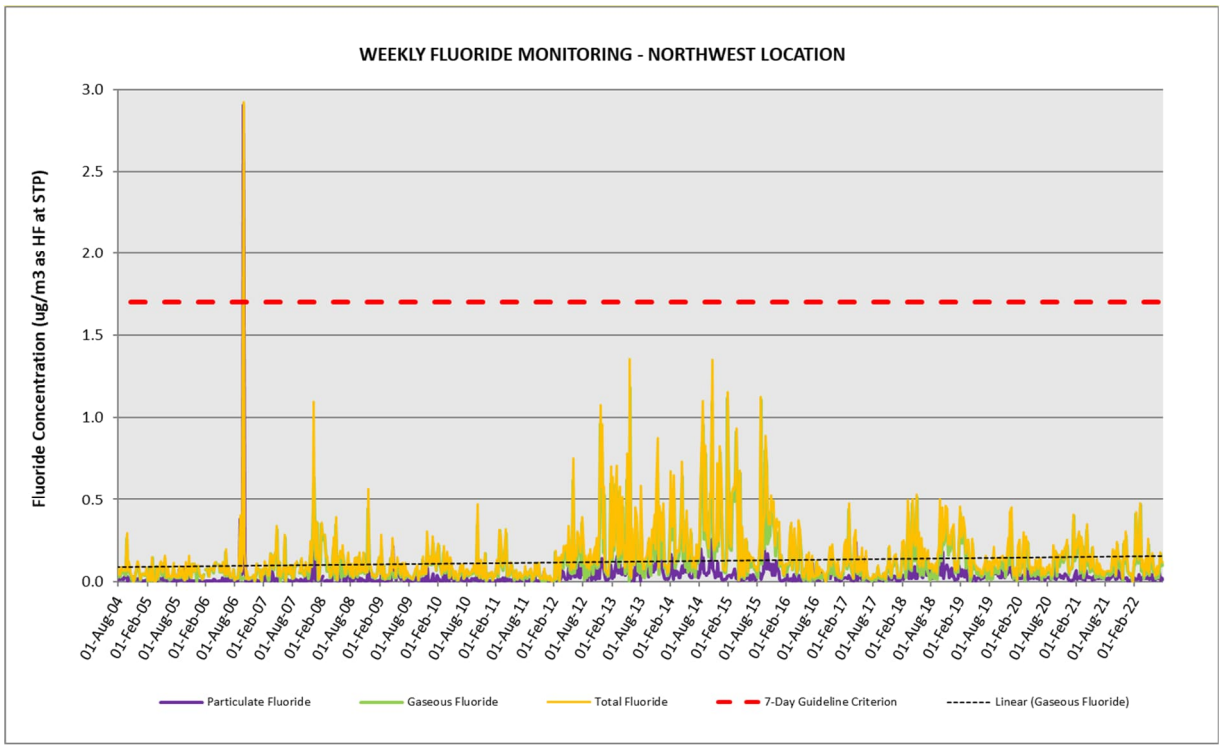


Figure 17 Weekly fluoride monitoring – northwest location (2004 – 2022)

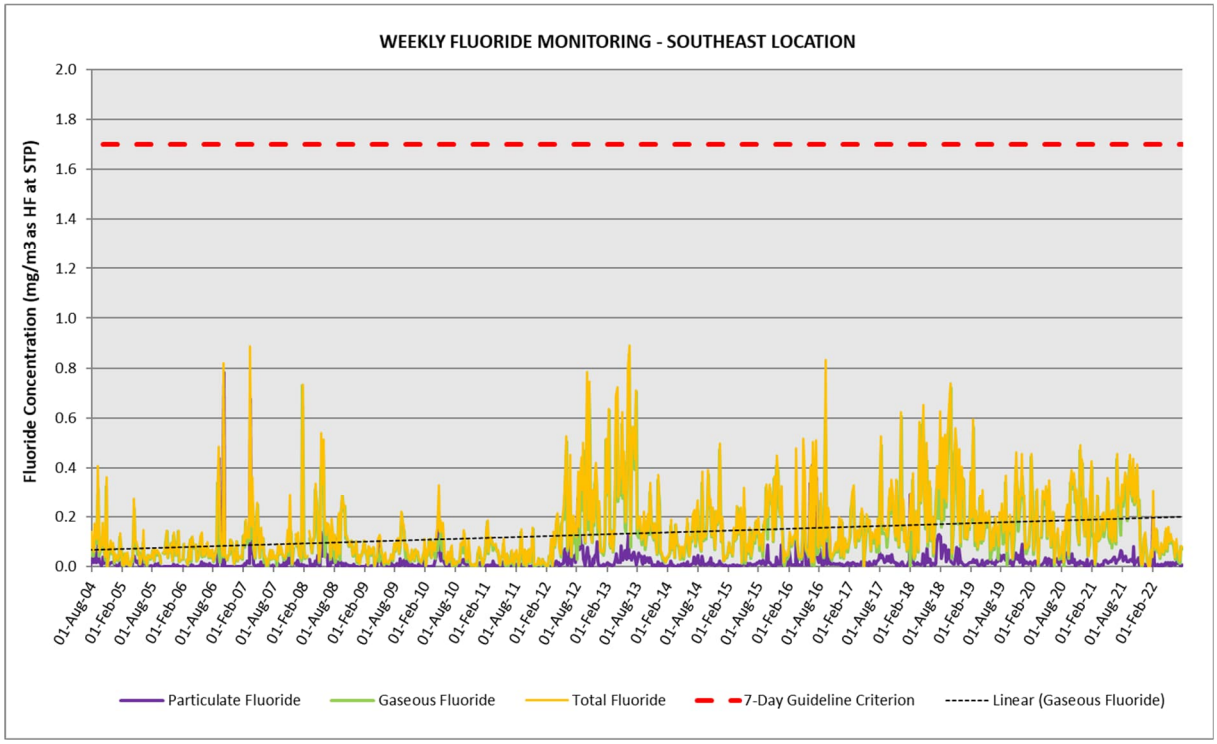


Figure 18 Weekly fluoride monitoring – southeast location (2004 – 2022)

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.

A total of 19 locations were surveyed during the current reporting period over the course of four surveys (one survey per calendar quarter). A total of 64 plant specimens were assessed for fluoride-related visual injury symptoms to foliage, and foliar sampling undertaken on six plant specimens and analysed for fluoride concentration levels.

Monitoring locations were selected based on the modelling in the EIS (Parsons Brinkerhoff 2002) and EA (AECOM 2010) and an understanding of the prevailing meteorological conditions. The specimens chosen to be sampled for foliar fluoride content were selected by Dr David Doley for their sensitivity to plant fluoride interactions.

Elevated regional background fluoride concentrations are found in air within the Lower Hunter Region. As a result, foliar fluoride concentrations in the vicinity of NCIA may be influenced by the elevated background fluoride concentration. The existing sampling regime provides an acceptable data set that may, over time, together with other data sets which relate to other fluoride source points indicate any long-term trends in fluoride emissions impacts in the local area.

Unfortunately, one historical foliar sampling location site was lost due to vegetation clearing after the Q3 2021 survey, interrupting long-term data trends. Suitable replacement sampling sites and specimens were identified and selected to be of the same species at the nearest existing monitoring site. Sampling of the two replacement foliar sampling specimens commenced in the Q4 2021 survey.

Results of the field-based visual assessment of vegetation condition during the current reporting period were generally within historical values and long-term trends, the following key findings were noted:

- Majority of specimens assessed displayed at least some level of fluoride-related visual injury symptoms. Of all specimens surveyed on average ~8.2% displayed no injury symptoms, ~54.4% displayed only very slight or slight injury symptoms, ~37.1% distinct or marked injury symptoms and only ~0.4% severe or greater injury symptoms.
- Tip necrosis and leaf undulation/cupping remained the more commonly observed symptoms (with 32.5% and 26.5% of specimens impacted respectively), followed by chlorosis (20.5%) and marginal necrosis (12.8%), whilst symptoms of anthocyanin accumulation remained relatively uncommon (observed in only 7.7% of all assessments)
- The collected data support no statistically significant long-term trends (increasing or decreasing) since the start of the monitoring program, and any potential impact from NCIA on the health of local vegetation would be inconclusive.
- The symptoms of emission-related injury can be mimicked by natural environmental impacts such as climatic conditions and insect attack. Insect attack was variable and evident at most locations during the reporting period.

Results of foliar fluoride content for the reporting period were generally consistent with long-term seasonal patterns and consistently within the lower range of historical values for all sampled specimens, which may have been influenced by the above-average rainfall received in the region in 2021-2022.

Overall, long-term observations and results highlight 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 100.0% for wind speed, 99.8% for wind direction, 100.0% for ambient temperature and 100.0% for rainfall during the reporting period.

Table 5-1 Meteorological station data capture

Meteorological Parameter	Frequency	Percentage up-time during reporting period
Wind speed @10m (m/s)	Continuously	100.0%
Wind direction @ 10m (degrees)	Continuously	99.8%
Sigma theta @ 10m (degrees)	Continuously	99.8%
Ambient temperature @ 5m (degrees Celsius)	Continuously	100.0%
Rainfall (mm)	Continuously	100.0%

5.4 Air Emissions

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 with some of the measured emission concentrations during the reporting period lower and some 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 limits (refer to **Section 4.4**).

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/m^3)							
	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)	2.5 (5.3)	**10** (5.3)	1.0 (5.0)	**16** (9.6)	0.033 (0.2)	30 (50)	0.00017 (0.003)	0.0006 (0.01)
Kiln 2 (EPL 15)	1.3 (5.3)	1.1 (5.3)	1.6 (5.0)	**17** (9.6)	0.059 (0.2)	16 (50)	**0.0038** (0.003)	0.0018 (0.01)
Clay preparation (CP1) (EPL 1)	<0.14 (2.0)	0.54 (2.3)	-	-	-	-	-	-
Pressing and Drying (PD1) (EPL 2)	0.93 (2.5)	**7.6** (4.8)	-	-	-	-	-	-
Dryer (D1) (EPL 5)	2.8 (8.4)	6.1 (12.8)	-	-	-	-	-	-
Dryer (D2) (EPL 6)	<0.17 (8.4)	4.8 (12.8)	-	-	-	-	-	-
Glaze Line (EPL 9)	1.8 (1.9)	4.1 (4.3)	-	-	-	-	-	-
Selection Line (SL 1,2,3,4) (EPL 10)	0.14 (6.3)	3.3 (6.3)	-	-	-	-	-	-
Spray Dryer (SD1) (EPL 12)	0.15 (13.1)	<0.1 (13.1)	-	-	-	-	-	-
Hot Air Cooler 1 (HAC1) (EPL 18)	**1.7** (0.3)	2.0 (2.3)	-	-	-	-	-	-
Hot Air Cooler 2 (HAC2) (EPL 19)	**1.7** (0.3)	1.6 (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.*
**Results corrected to 18% O2 for Kiln 1 and Kiln 2.*

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 19** to **Figure 23**.

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, nitrogen oxides and fluoride discharged to air were all within the pollutant load limits.

Historical data show that there is a high level of variability in pollutant emissions between reporting years with no clear trend or consistency in results. This renders 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:

- Fine particulate (PM_{10}) emissions recorded a decrease from the previous reporting period, with levels remaining below the permitted EPL load limit.
- Coarse particulate emissions remained relatively consistent with the previous reporting period, with levels below the permitted EPL load limit.
- Total fluoride recorded a decrease from the previous reporting period to a level below the permitted EPL load limit.
- Sulfur oxides recorded a decrease from the previous reporting period, with levels below the permitted EPL load limit.
- Nitrogen oxides recorded a decrease from the previous reporting period, with levels below the permitted EPL load limit.

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

Pollutants loads		Pollutant				
		Fine particulates (PM_{10})	Coarse particulates	Total Fluoride	Sulfur oxides[3,4]	Nitrogen oxides
Current Maximum Load Limit (kg)	EPL	26,629	14,338	1,850	36,828	36,828
Actual Load in reporting period (kg)	2021-2022	2,476	4,212	581	7,054	8,582
	2020-2021	7,805	4,650	**3,034**	8,782	35,962
	2019-2020	12,966	4,482	1,563	6,678	18,293
	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	25,059
	2012-2013 [1]	1,249	1,640	1,109	1,235	4,704
	2011-2012	997	5,550	91	26,946	20,306
	2010-2011	2,902	1,774	295	7,699	18,322
	2009-2010 [2]	6,524	475	621	**86,704**	**79,375**
	2008-2009	5,476	2,564	1,529	**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

*Note: **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 from the 2012-13 reporting year onward have been corrected to only include sulfuric acid mist as sulfur trioxide, as agreed with regulatory authorities, and not sulfur dioxide as previously calculated and reported.*

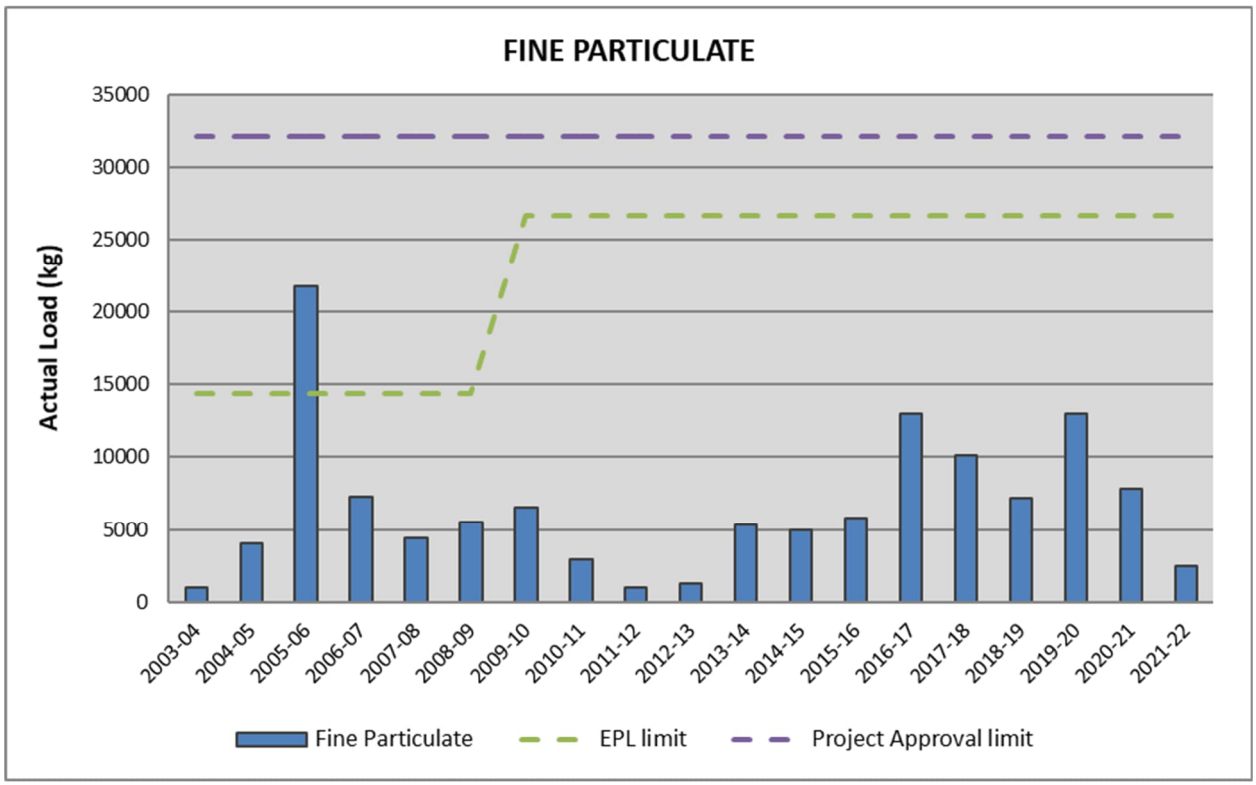


Figure 19 Fine particulate annual load (2004 – 2022)

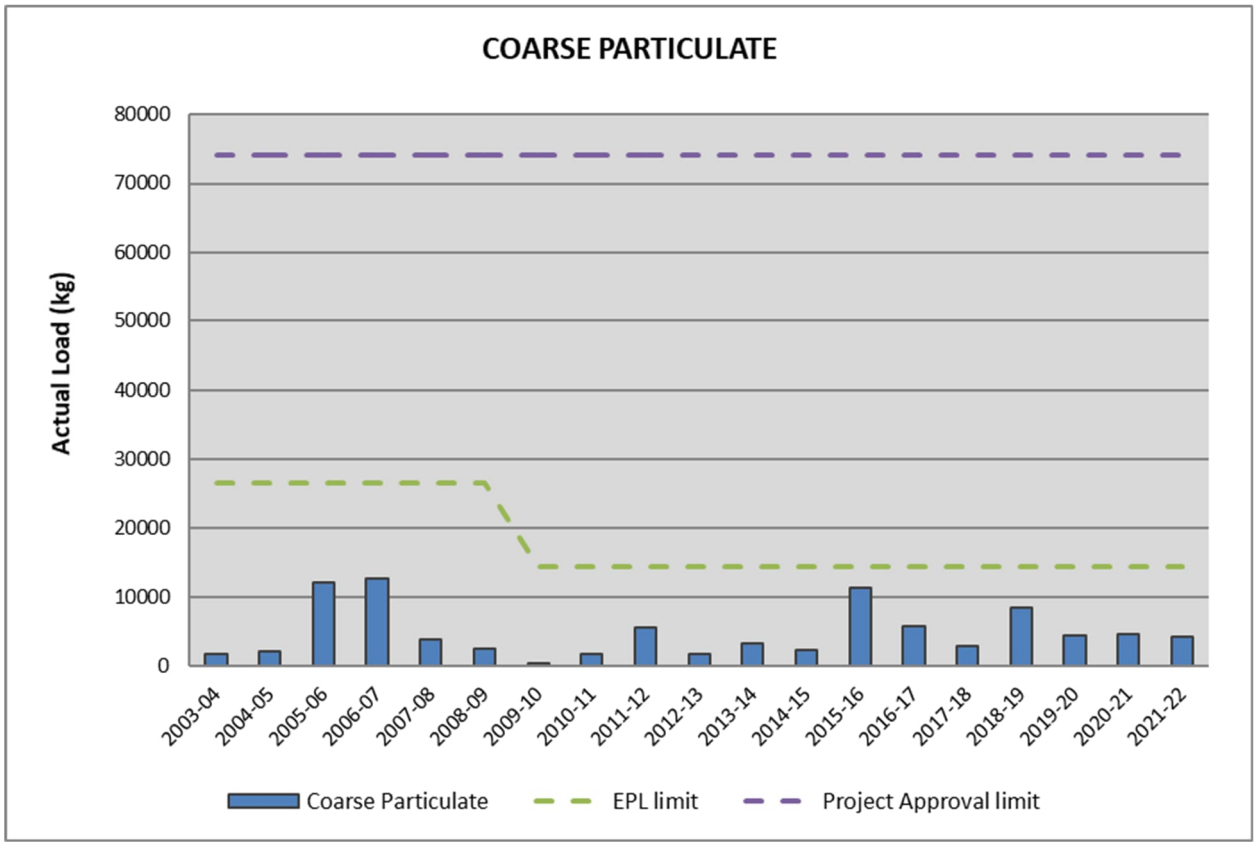


Figure 20 Coarse particulate annual load (2004 – 2022)

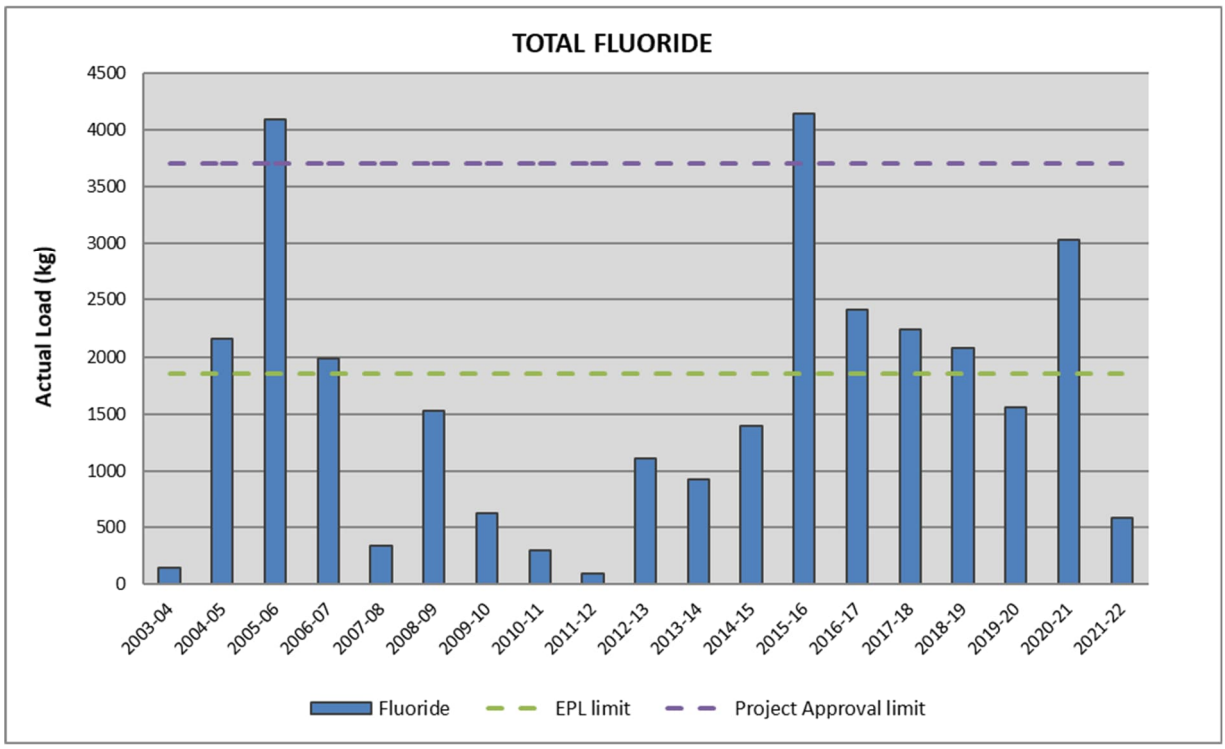


Figure 21 Fluoride annual load (2004 – 2022)

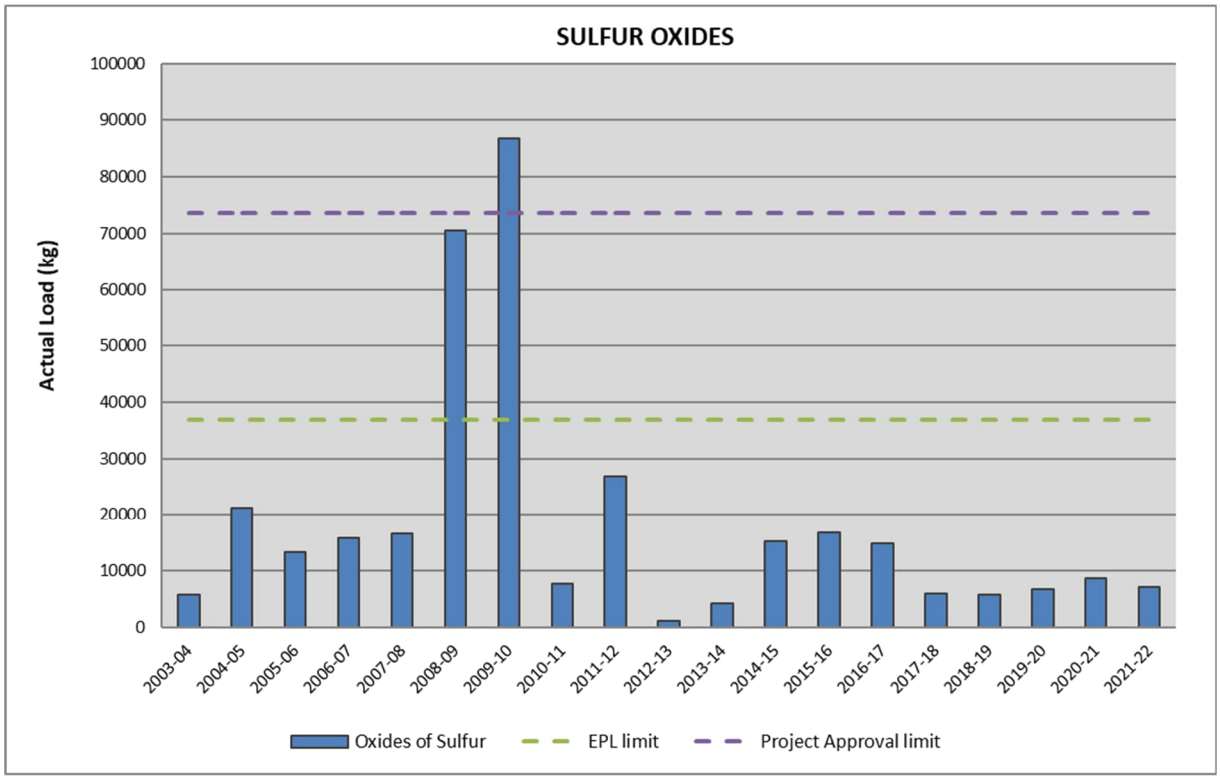


Figure 22 Sulfur oxides (as sulphuric acid mist and sulfur trioxide (as SO_3)) annual load (2004 – 2022)

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

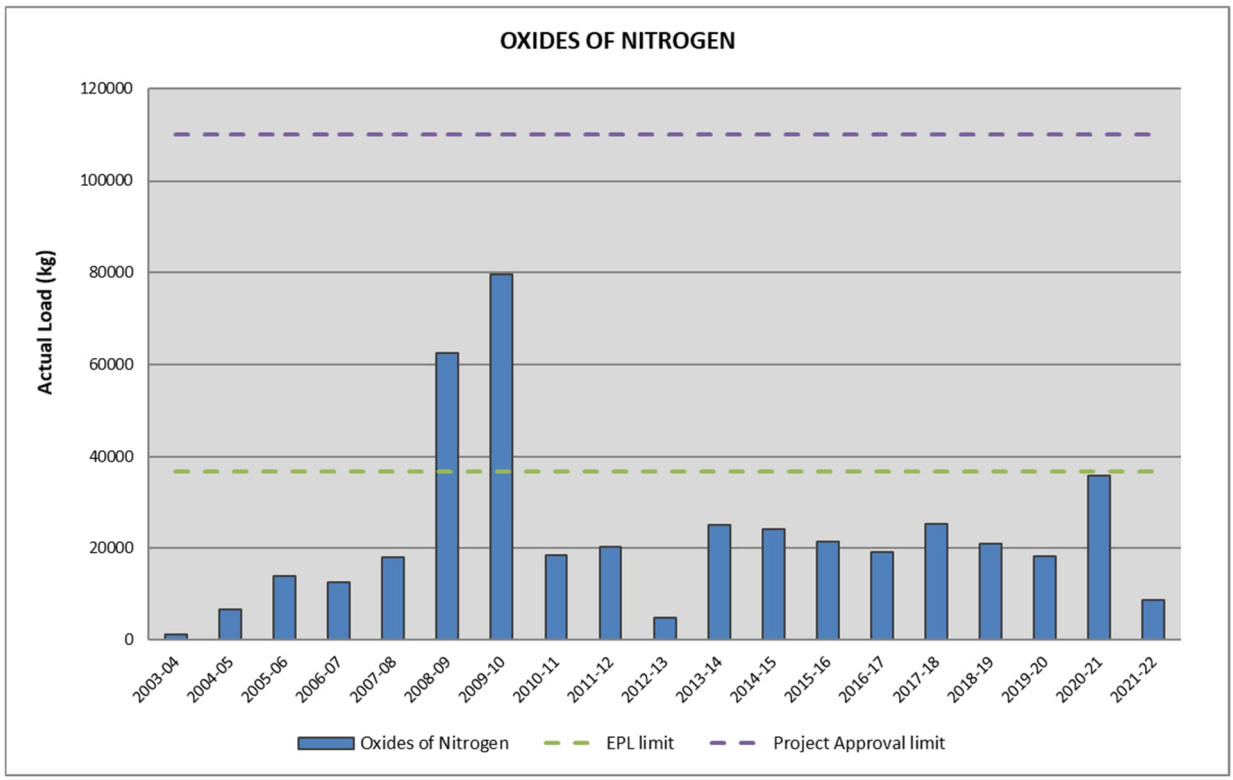


Figure 23 Nitrogen oxides annual load (2004 – 2022)

5.5 Noise

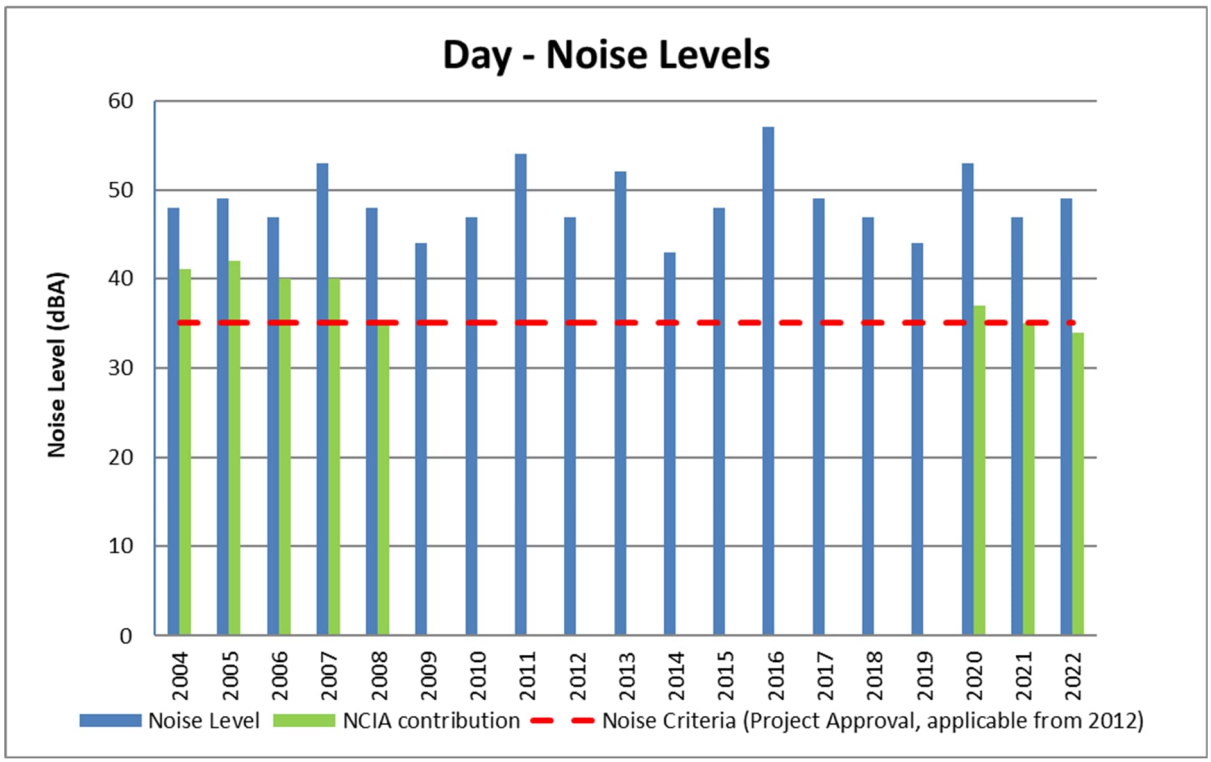
The Project Approval specifies more stringent noise limits than those set out in the EPL. Under the Project Approval noise generated from NCIA must not exceed 35 dB(A) for the day, evening and night periods.

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. It should be noted that calculated noise levels within 2dB of statutory noise limit are considered negligible as per the NPfI. No exceedances were recorded during the 2022 monitoring event.

Historical noise monitoring results at the Kenvil Close monitoring location are provided in **Figure 24 – Figure 26** 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.

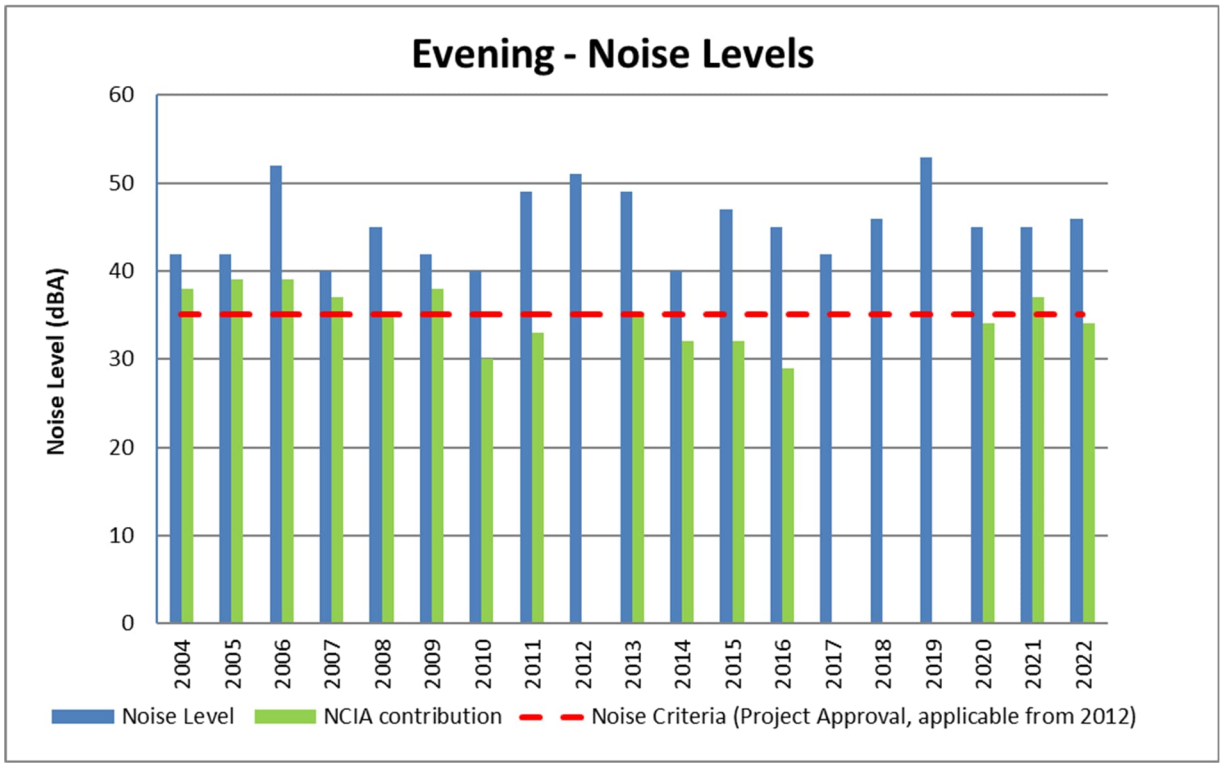
No trends in the noise monitoring are clearly discernible with historical noise emissions generally complying with noise limits. No exceedance of the day, evening or night criteria has been recorded since 2009.

The current noise monitoring report noted that traffic noise from the New England Highway contributed significantly to the background noise levels at both offsite locations.



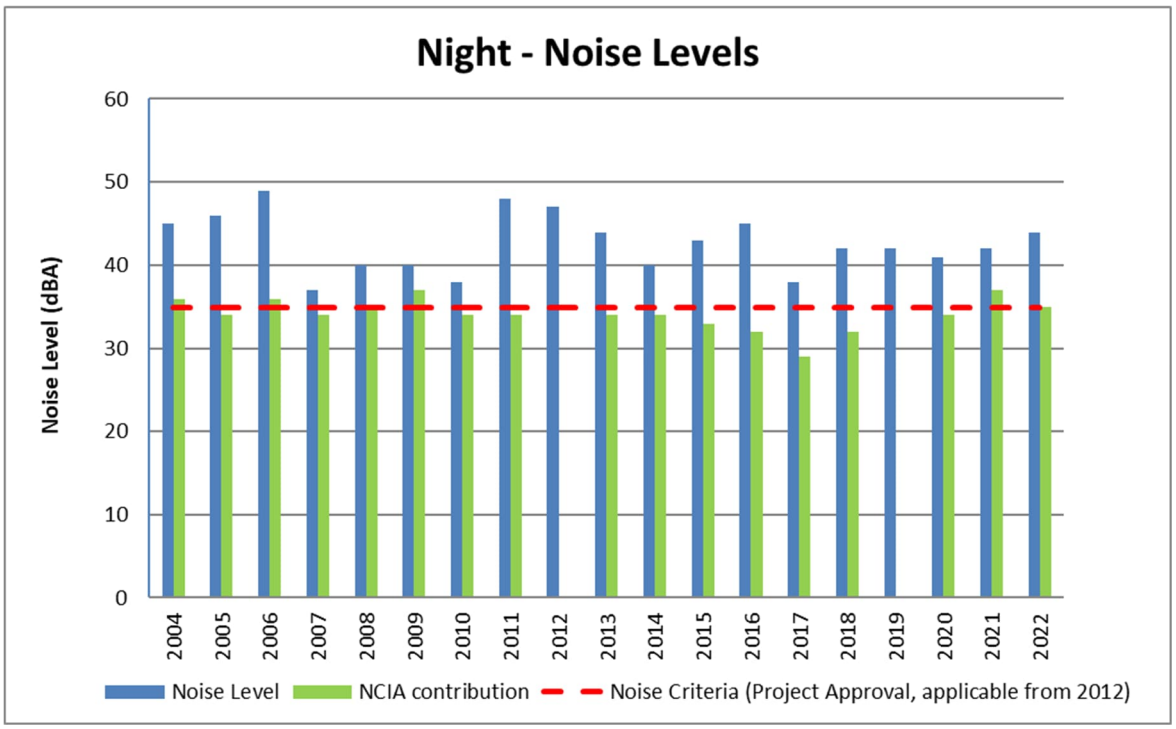
Note 1: 2009 to 2019: NCIA contribution was either inaudible or not measurable.

Figure 24 Day noise levels, Kenvil Close, 2004 – 2022



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

Figure 25 Evening noise levels, Kenvil Close, 2004 – 2022



Note: 2012 and 2019: NCIA contribution audible but not measurable.

Figure 26 Night noise levels, Kenvil Close, 2004 – 2022

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 2021 to July 2022 was approximately 58.9 ML. The consumption of approximately 58.9ML of potable water is proportionally within the predictions of the EA given that only Stages One–Two were operational.

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 Electrical Conductivity are presented in **Figure 27** and **Figure 28**, 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 2015 to 2018 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 27**), highlighting a trend towards alkalinity. This trend has continued during the current reporting period with 26 monitoring events showing pH results higher than the ANZG trigger values and only three recorded below (refer to **Section 4.6.2**).

EC results during 2022 are comparable to previous years with a stable average and no exceedances of the criteria bar 2 detections below the lower limits (refer to **Figure 28**). 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.

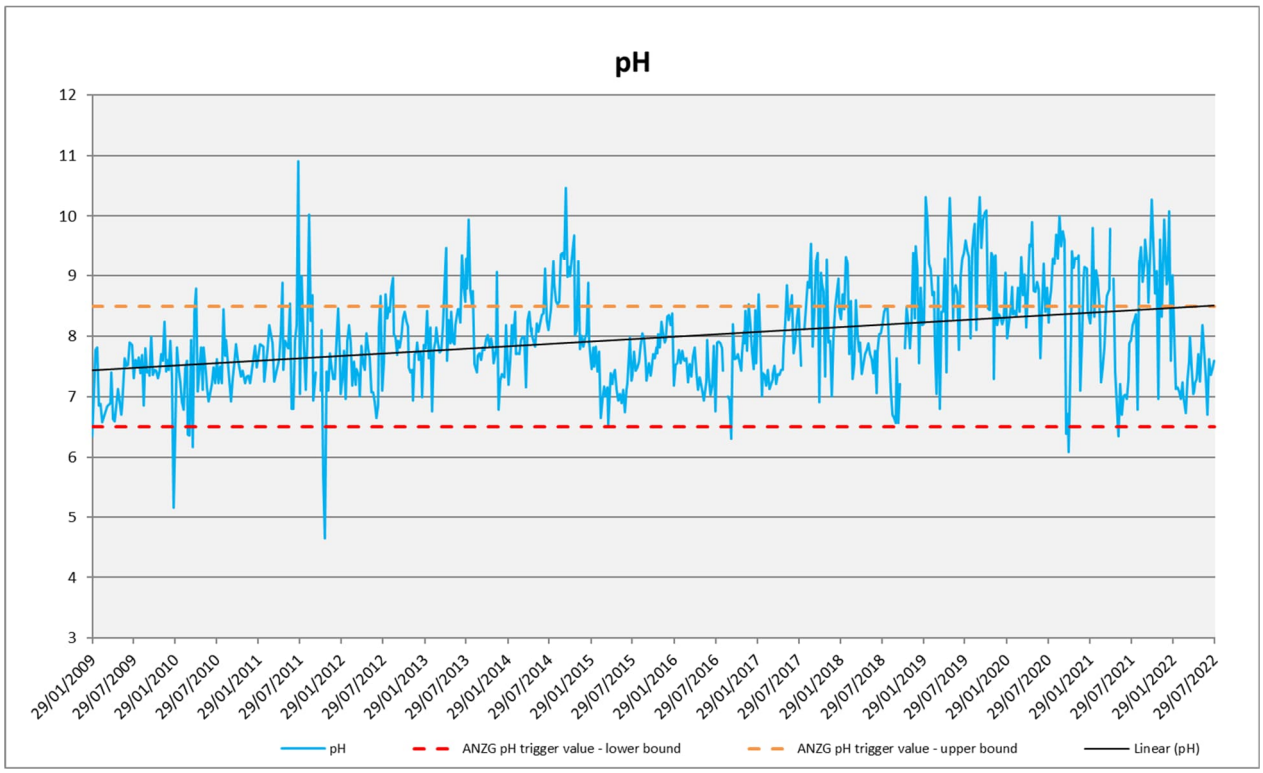


Figure 27 Stormwater quality, Pond 4 pH (2009-2022)

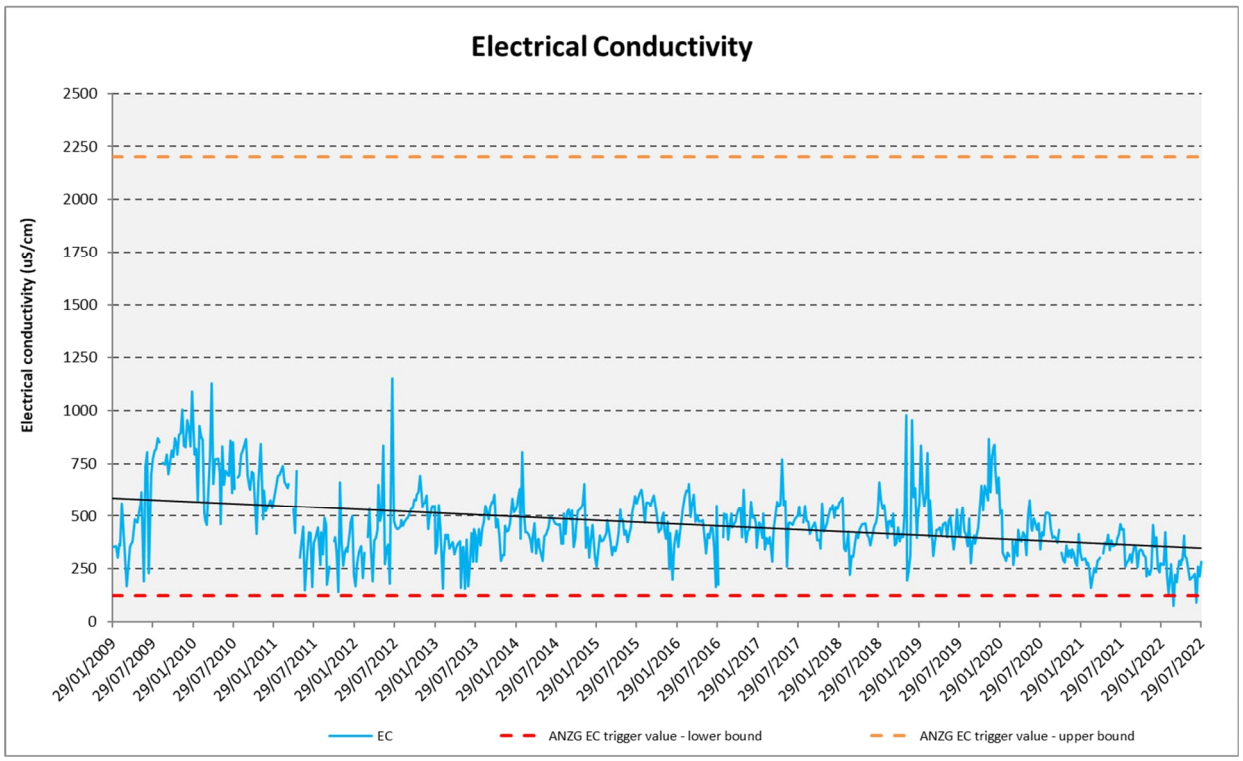


Figure 28 Stormwater quality, Pond 4 – EC (2009-2022)

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 is inspected on a weekly basis and was noted to be discharging on fifteen occasions throughout the reporting period between the months of February 2022 to July 2022. Pond 4 water parameters were all within relevant criteria on these dates with the exception of 24 March 2022 and 6 July 2022 where EC dropped below the relevant guidelines.

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 5.9% of total production) was higher than the predictions made in the EA, however below NCIA's current operation target of 7% and down on previous years.

Monthly green tile waste levels have exceeded the 1% target during the reporting period except for September 2021. Green tile waste levels increased above the 1 % target due to more defect product being captured before firing. 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 lunchroom waste) is collected by a licenced recycling or waste contractor. Incoming packaging waste such as pallets are reused wherever possible.

6.0 Non-Compliances

6.1 2021-2022 Non-Compliances Record

There were no non-compliances reported during the 2021-2022 reporting period.

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 6-1**.

Table 6-1 Audit recommendations and NCIA action plan

#	Reference	Condition	Recommendation	Management Response	Status
1	Project Approval 16 Load Limits	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, of the Project Approval. *Table 3: Maximum Allowable Load Limits (Air)* **Assessable Pollutant** / **Maximum Allowable Load Limit (kg/yr)** Fine Particulates: 74,210 Coarse Particulates: 32,073 Fluoride: 3,701 Sulfur oxides (as sulphuric acid mist and sulfur trioxide (as SO_3)): 73,657 Nitrogen oxides: 110,000 *Note: The total load of the assessable pollutant shall be calculated in accordance with the relevant load calculation protocol, as defined by OEH guidelines.* **Load limits as prescribed in EPL 11956** **Assessable Pollutant** / **Load limit (kg)** Coarse Particulates (Air): 14338.00 Fine Particulates (Air): 26629.00 Fluoride (Air): 1850.00 Nitrogen Oxides (Air): 36828.00 Sulfur Oxides (Air): 36828.00	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).	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 EPA in regard to EPL limits.	Capital works have been completed and are operational as of 2021-2022 reporting period
2	Project Approval Discharge limits and Stack Discharge Design Requirements 18	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	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.	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.	Capital works have been completed and are operational as of 2021-2022 reporting period

#	Reference	Condition	Recommendation	Management Response	Status
				Once compliance is demonstrated Management would like to seek discussions with the EPA in regard to EPL limits.	
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 18a).	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 EPA in regard to EPL limits.	Capital works have been completed and are operational as of 2021-2022 reporting period
4	Project Approval 32 Lighting	The Proponent shall ensure that the lighting associated with the project: c. 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	One oversize load which Management disclosed to the auditor that arrived during the	Not applicable

#	Reference	Condition	Recommendation	Management Response	Status
			the one oversized load received in 2018.	period was coordinated by our customs broker, Tolsaf Cranes and Hogan's Heavy Haulage. RMS were contacted and approval gained to move 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	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	Not applicable as condition not triggered

#	Reference	Condition	Recommendation	Management Response	Status
			parking will need to be in compliance with AS2890.	extension management will ensure compliance with relevant standards. Management have no reason to believe that current car parking does not meet relevant standards.	
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 have been completed and are operational as of 2021-2022 reporting period
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

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.

Ambient emission concentrations of pollutants were in accordance with EPL and Project Approval limits throughout the 2021 - 2022 reporting period.

Stack emissions testing identified no exceedances of the current criteria and in accordance with EPL and Project Approval limits throughout the 2021-2022 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.

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	Status
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.	Completed and operational during the 2021-2022 emissions testing period
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 10-12.5%. 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
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	Completed

Area of Concern	Identified Action	Status
	to time. Samples have previously been sent to Italy for testing but sending locally expedites the process and also generates local capacity building.	
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
Camera's	16 Cameras have been installed in and outside the factory building. The cameras can be viewed live and record history. In the event of environmental issues, the camera history is available to be reviewed	Ongoing
Formalised daily conditions	Each afternoon a snapshot of the factory conditions are recorded and sent to senior management for review. These include the raw feed being processed, the glaze's being used and environmental checks.	Ongoing
Vacuum pipes	The internal dust vacuum pipes have been replaced.	Completed
Bins	Dedicated carboard waste bins have been distributed on site. A metal waste bin has been provided to the site and is generally collected annually.	Ongoing
Energy efficiency	LED lights and energy efficient electric motors are being used to replace older redundant equipment. Working from home is encouraged at NCIA where work is practicable.	Ongoing
Waste ceramic material	Utilising old bulk raw ceramic materials that is expired or can't be used for its intended purpose anymore in the ceramic body of the tiles	Ongoing
Truck washdown pit	The truck washdown pit now captures solid waste, before entering the public roads.	Ongoing
NATA	The NCIA laboratory is now NATA accredited.	Ongoing

Area of Concern	Identified Action	Status
Transport Emissions	New input material sourced closer to the factory reducing emissions from truck haulage.	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 energy consumption and raw material input. For example, NCIA currently endeavours to improve the gas efficiency of the manufacturing process. **Figure 29** 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.

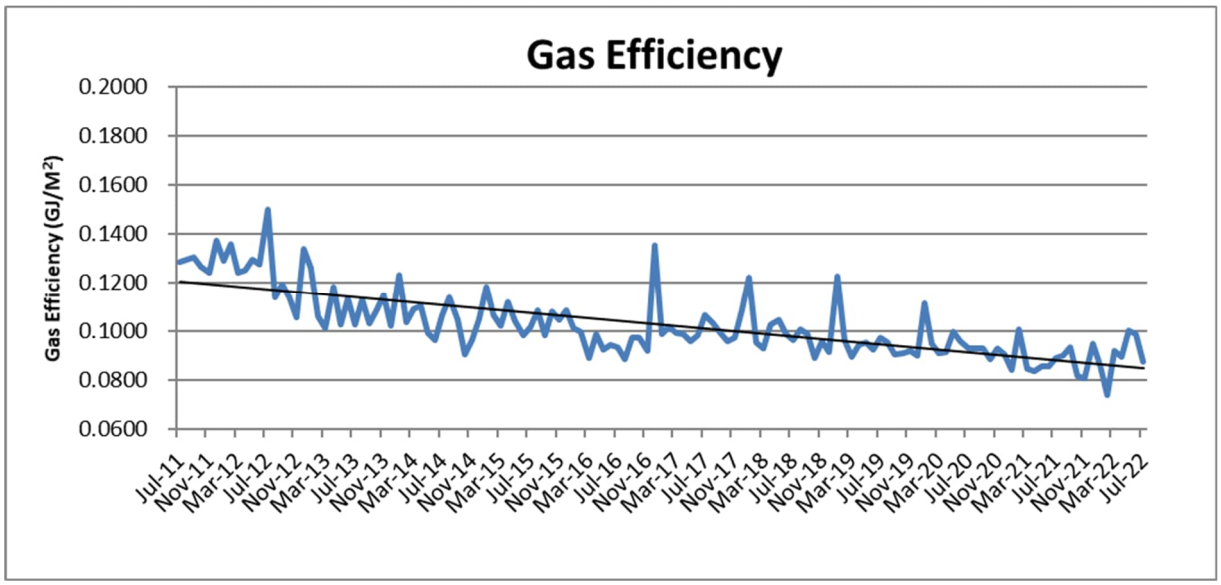


Figure 29 Gas efficiency in tile manufacturing process

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Appendix A

Meteorological Monitoring - Wind Roses

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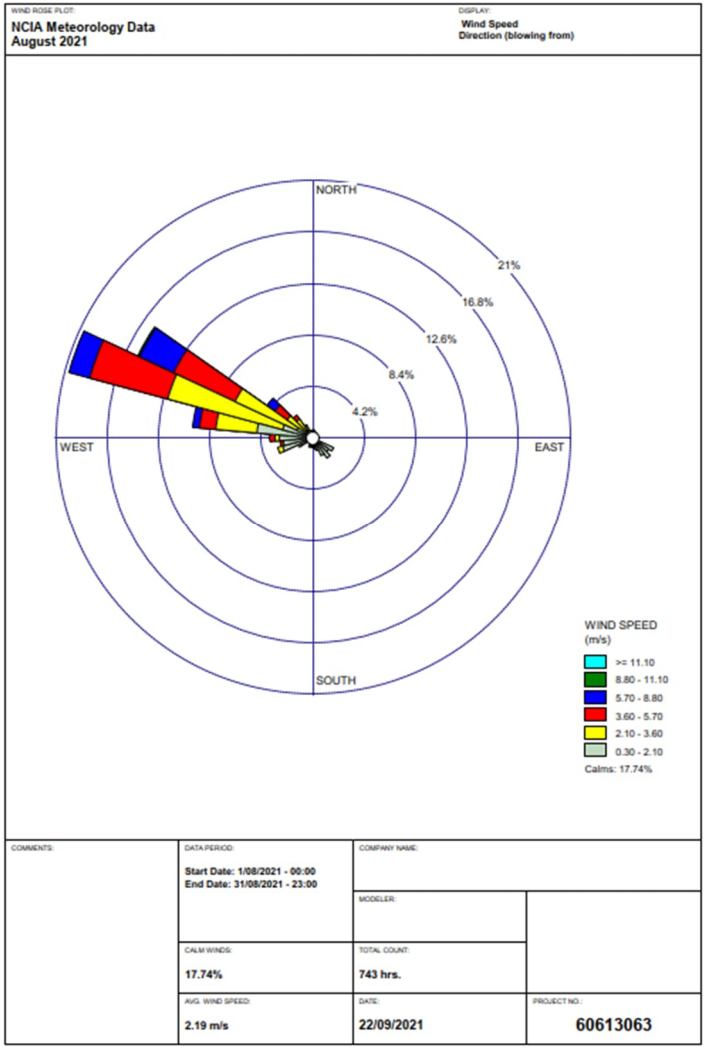

Figure A1 Wind Speed and Direction (August 2021)

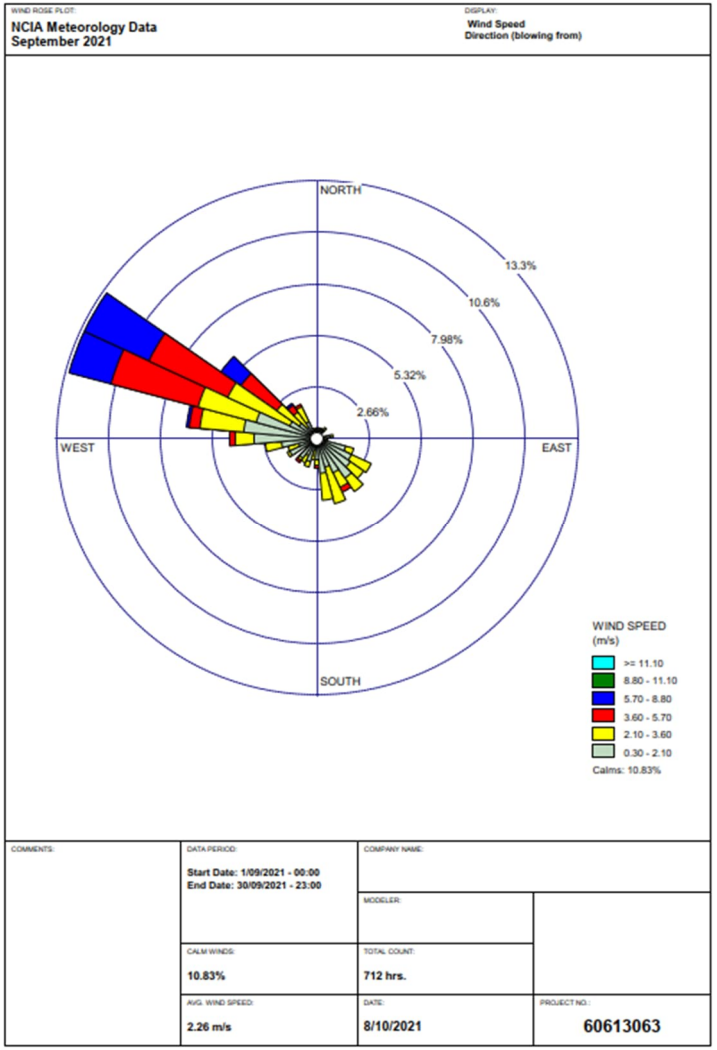

Figure A2 Wind Speed and Direction (September 2021)

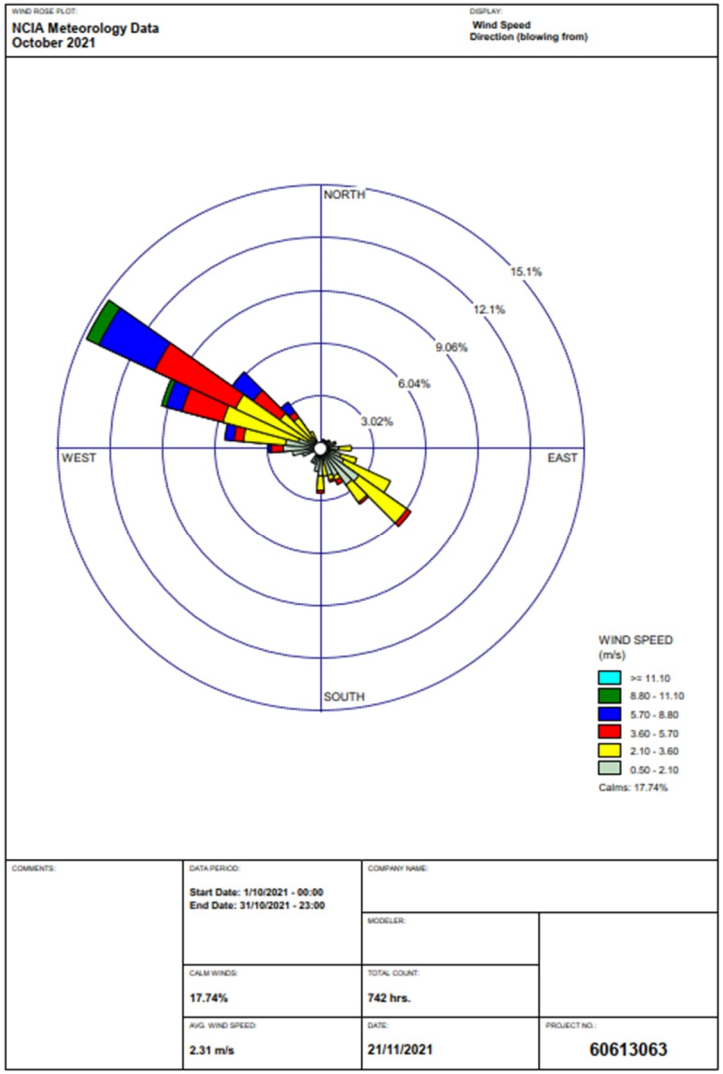

Figure A3 Wind Speed and Direction (October 2021)

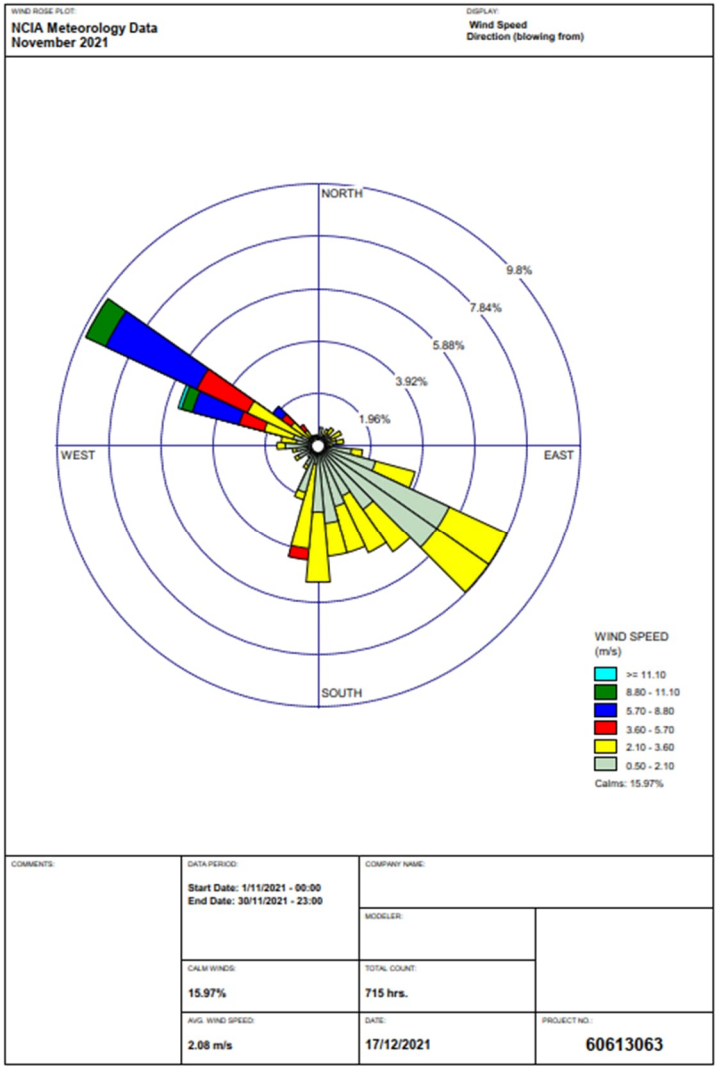

Figure A4 Wind Speed and Direction (November 2021)

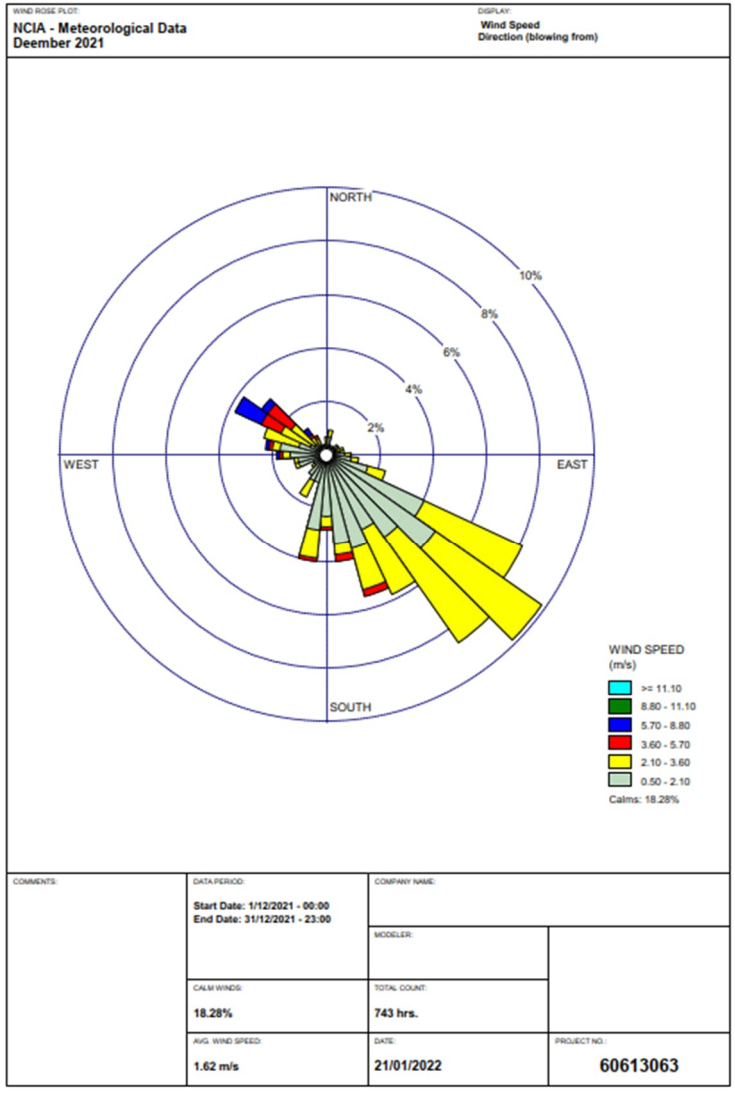

Figure A5 Wind Speed and Direction (December 2021)

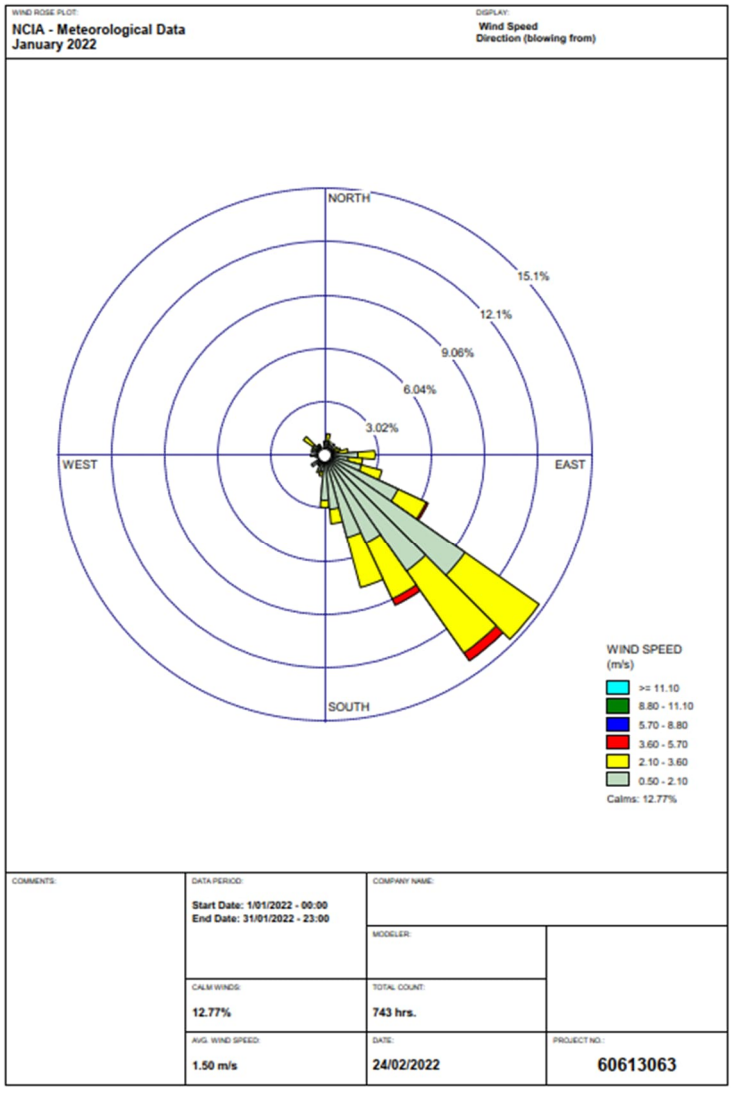

Figure A6 Wind Speed and Direction (January 2022)

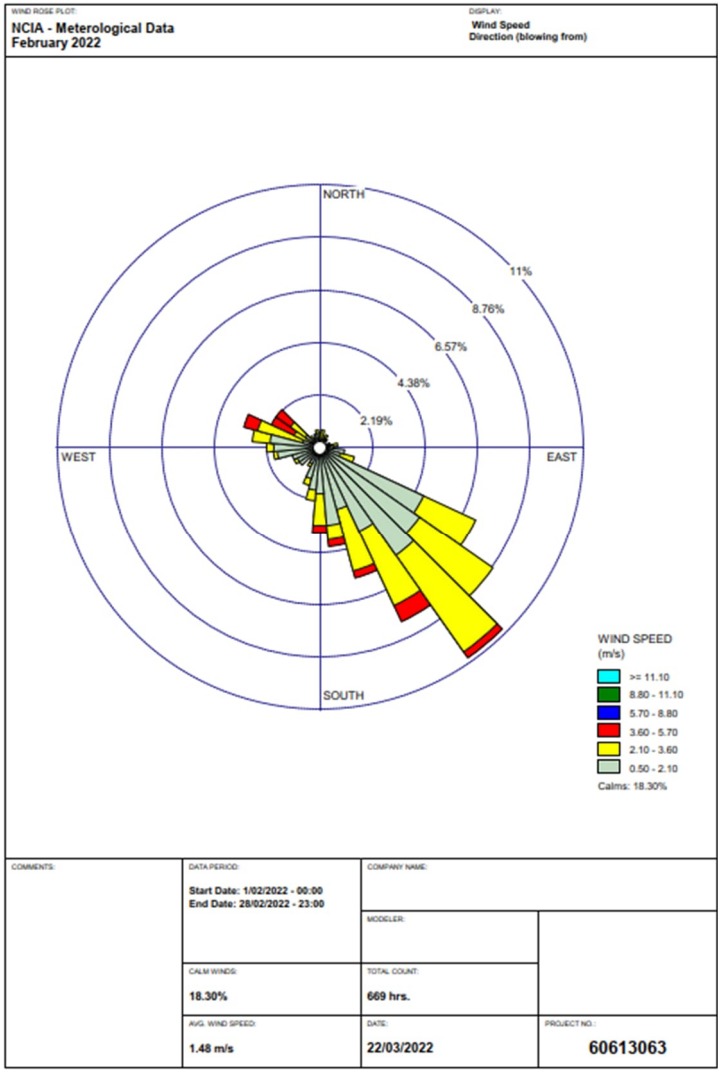

Figure A7 Wind Speed and Direction (February 2022)

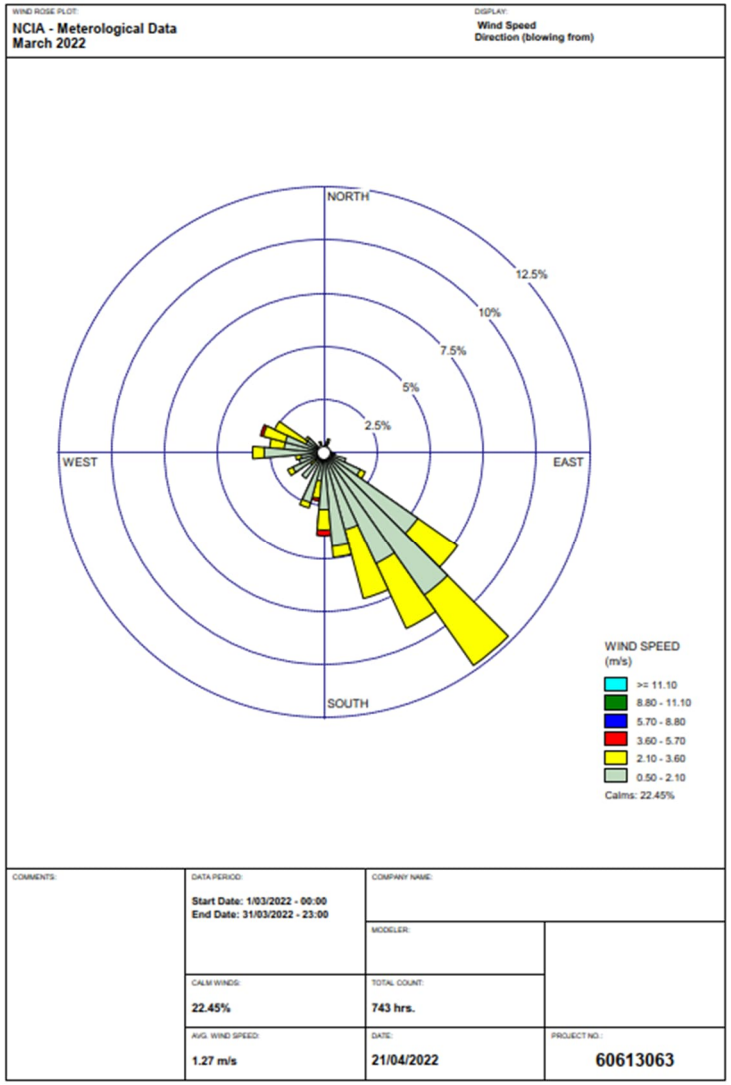

Figure A8 Wind Speed and Direction (March 2022)

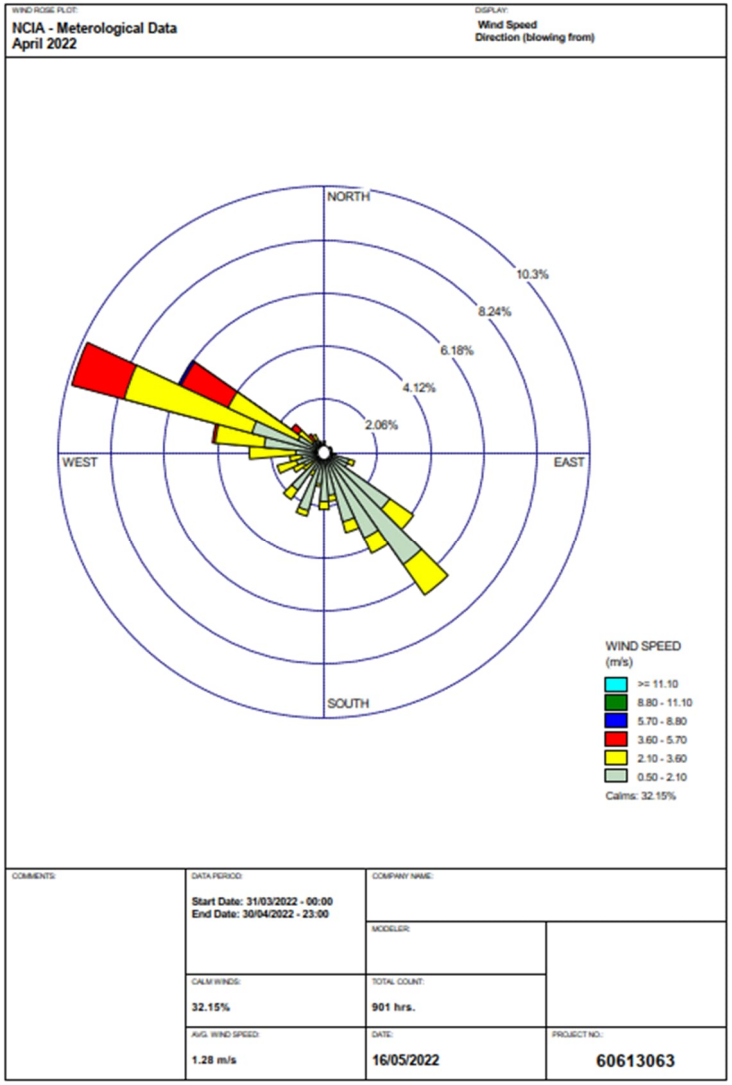

Figure A9 Wind Speed and Direction (April 2022)

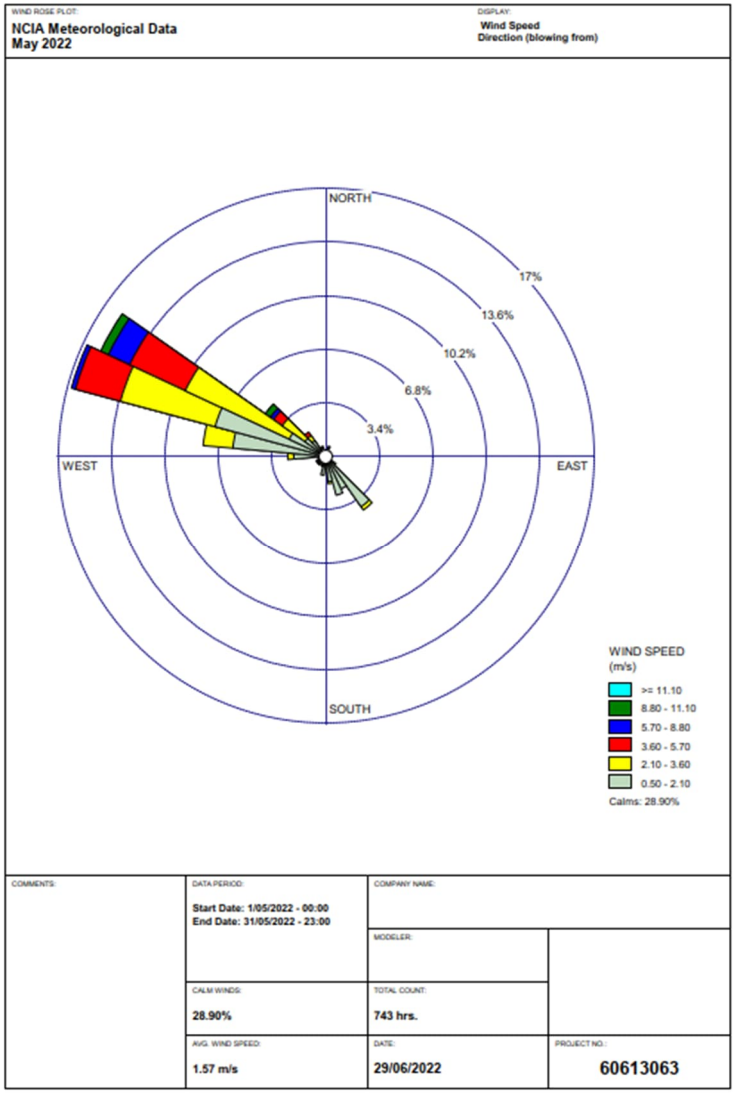

Figure A10 Wind Speed and Direction (May 2022)

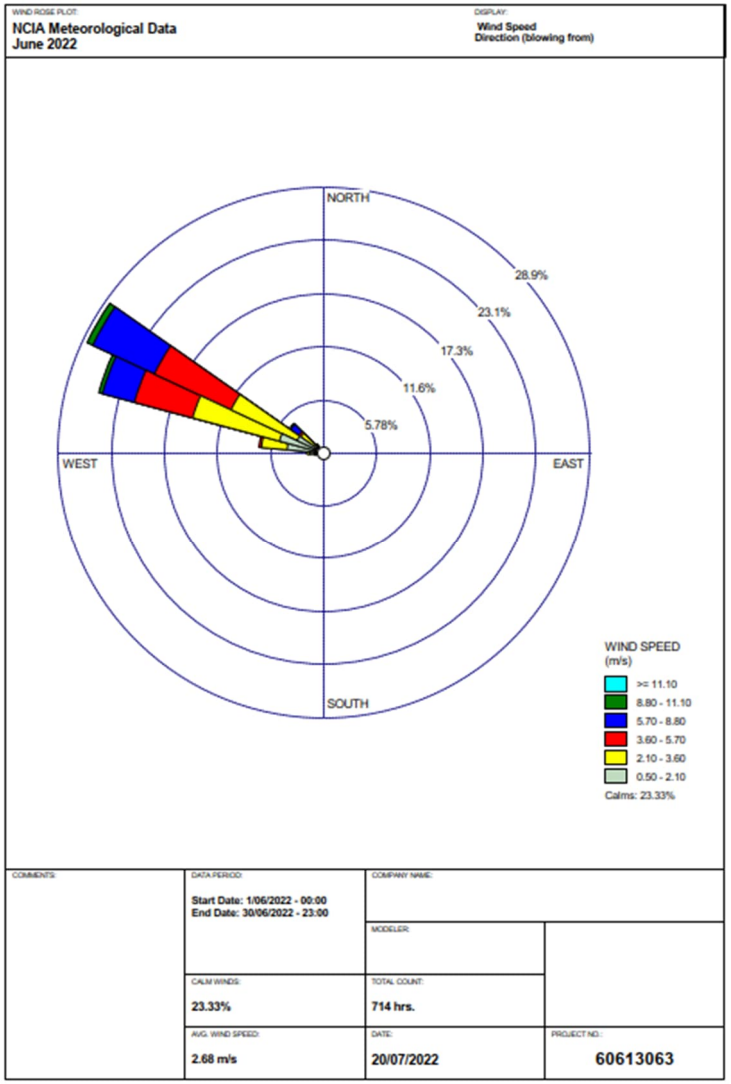

Figure A11 Wind Speed and Direction (June 2022)

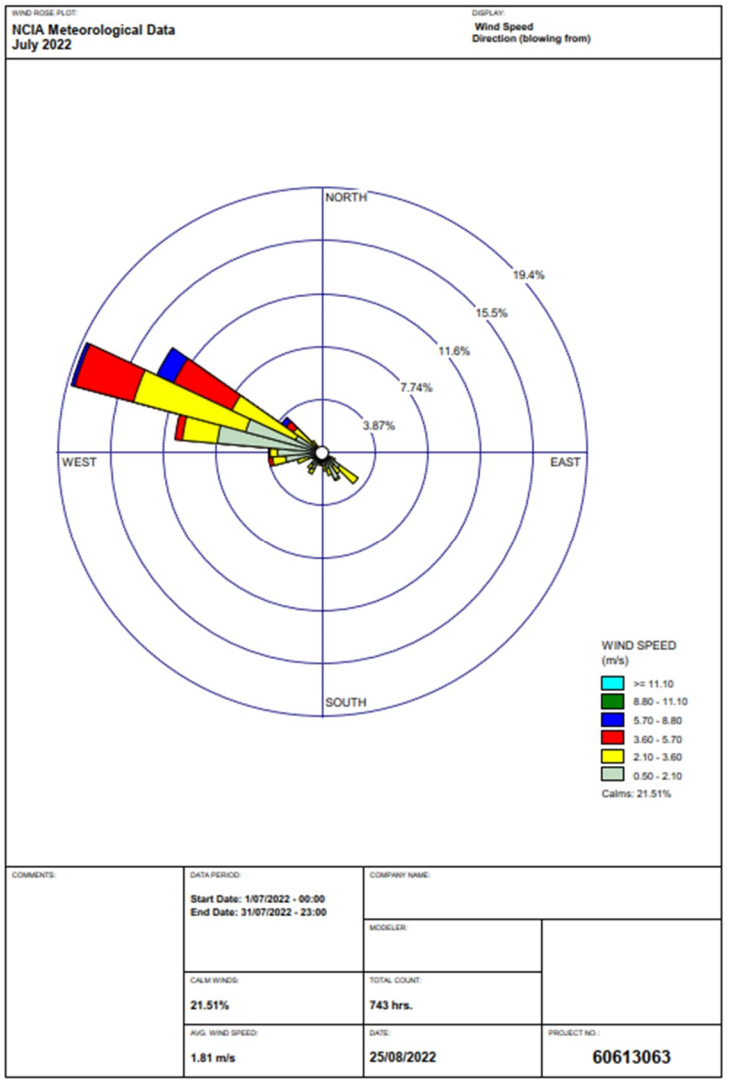

Figure A12 Wind Speed and Direction (July 2022)

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