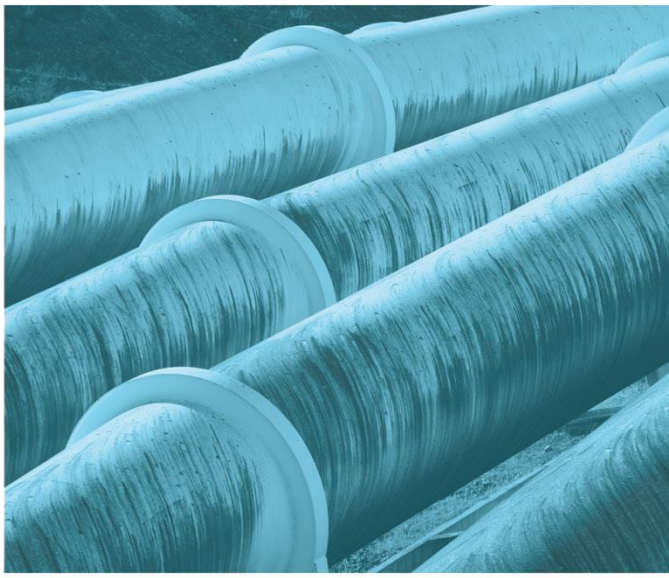



Independent Technical Review

Kariong Sand and Soil Supplies Facility - Air Quality Impact Assessment

Prepared for Department of Planning, Industry and Environment
May 2021

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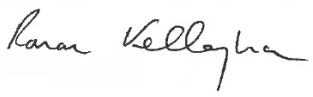

Ronan Kellaghan
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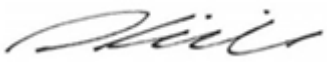
27 April 2021

Approved by



Scott Fishwick
National Technical Leader
27 April 2021

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1 Introduction

EMM Consulting Pty Ltd (EMM) has been commissioned by the NSW Department of Planning, Industry and Environment (DPIE) to provide independent technical review and advice relating to the air quality impact assessment of the Kariong Sand and Soil Supplies Facility (the Facility), prepared for the State Significant Development application (number SSD-8660). A summary of the timeline of reports and reviews relevant to this review is provided below:

1. 17 December 2018 – Northstar Air Quality Pty Ltd (Northstar) prepared an Air Quality Impact Assessment (AQIA) to accompany the Environmental Impact Assessment (EIS) submitted for the application (V2 AQIA);

2. 25 March 2019 - the NSW Environmental Protection Authority (EPA) were requested to prepare General Terms of Approval (GTA) for the Facility and, following review of the V2 AQIA, recommended that a revised AQIA was required prior to issuing GTAs;

3. 30 June 2020 - Northstar prepared a revised AQIA (V4 dated 30 June 2020) to address the inadequacies identified by EPA;

4. 22 September 2020 – Todoroski Air Sciences (TAS) was commissioned by adjacent landowners to peer review the revised V4 AQIA and provide a submission for the application;

5. 6 November 2020 – NSW EPA respond to the revised V4 AQIA and request additional information prior to issuing of GTAs;

6. 10 December 2020 – Northstar prepared an addendum to the AQIA as part of the Response to Submissions (RtS);

7. 5 February 2021 – NSW EPA respond to the Northstar addendum AQIA (RtS) noting that the RtS has addressed the remaining air quality issues and provide recommended conditions of approval;

8. 11 March 2021 – Todoroski Air Sciences prepared an additional peer review of the Northstar addendum AQIA (RtS); and

9. 1 April 2021 – Northstar responded to the additional TAS peer review of the addendum AQIA and the proponent commissioned their own peer review of the Northstar AQIAs and TAS peer reviews (the ERM peer review).

1.1 Objectives and scope of the review

The objective of this independent technical review is to review each of the documents identified above and provide a response to all matters raised in the peer review documents prepared by Todoroski Air Sciences (TAS). Issues raised by the NSW EPA are now largely addressed through design changes (as documented in the EPA response dated 5 February 2021), therefore our review discusses any issues relevant to matters raised in the TAS peer review. Reference is also be made to the proponent's independent peer review (the ERM peer review), noting any difference of opinion or inconsistency between the EMM peer review and the ERM peer review. Our report is structured to address each of the technical matters raised in the Todoroski Air Sciences reviews. Where these issues remain disputed, we provide our technical opinion on the validity of the issue and its likely importance in affecting the outcomes and conclusions of the AQIA. In the subsequent sections we present a summary of the issue, EMM's review of the issue and a summary of the peer review conclusions (for the EMM and ERM peer review).

2 Modelling approach

2.1 Summary of TAS issues and Northstar response

The initial TAS peer review (22 September 2020) found that the "*modelling approach is not ideal*", based on the opinion that "*AERMOD does not produce especially reliable results when modelling area sources such as wind erosion*".

The Northstar addendum AQIA (RtS) acknowledges that concentration predictions from area sources may be overestimated under light wind conditions. However, Northstar does not believe this to be an issue because the input meteorological data from Gosford would not record conditions that would cause this issue and even if it did, an overprediction of impact would be an acceptable conservative approximation of impact.

The follow up TAS peer review of the RtS (11 March 2021) found that this issue remains unresolved. The TAS peer review of the RtS clarifies the opinion that AERMOD displays poor model performance under all wind conditions (not just light winds) and also disputes the representativeness of the meteorological input data for modelling.

2.2 EMM's review of issues

2.2.1 General suitability of the model

AERMOD is the United States Environmental Protection Agency's (US EPA) recommended steady-state plume dispersion model for regulatory purposes. AERMOD replaced the Industrial Source Complex (ISC) model for regulatory purposes in the US in December 2006. It is noted that a modified version of ISC (ISCMOD) was used for the approval of most of the operating coal mines in the Hunter Valley. In other words, the predecessor upon which AERMOD is largely based, was considered suitable by regulators and practitioners for modelling ground-based dust sources. AERMOD has replaced Ausplume as the regulatory model for EPA Victoria (EPA Victoria, 2013) and is accepted by the NSW EPA as an appropriate modelling tool for ground level dust sources (for example, see EPA's submission on the Balranald Sand project here[1]). It is noted that AERMOD replaced ISC in 2006, one year after the NSW EPA published the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW. It is expected that future updates to the Approved Methods would reference AERMOD instead of Ausplume.

Compared to ISC and Ausplume, AERMOD represents an advanced new-generation model, which requires additional meteorological and land use inputs to provide more refined predictions. The most important feature of AERMOD, compared to ISC and Ausplume, is its modification of the basic dispersion model to account more effectively for a variety of meteorological factors and surface characteristics. In particular, it uses the Monin-Obukhov length scale rather than Pasquill-Gifford stability categories to account for the effects of atmospheric stratification. Whereas Ausplume and ISC parameterise dispersion based on semi-empirical fits to field observations and meteorological extrapolations, AERMOD uses surface-layer and boundary layer theory for improved characterisation of the planetary boundary layer turbulence structure.

It is noted that the statement in the TAS peer review (22 September 2020) that "*AERMOD does not produce especially reliable results when modelling area sources such as wind erosion*" is not explained or supported with corroborating evidence or context. It is noted, however, that AERMOD does not apply plume meander to predictions from an area source. As identified by US EPA[2] in 2019, plume meander "*decreases the likelihood of observing a coherent plume after long travel times and results in a greater plume spread and increased dispersion downwind*". With the exclusion of plume meander from area source dispersion calculations, resultant predicted

1 https://majorprojects.affinitylive.com/public/c254b6926cbde2e6358bdbc1aaaca9b4/Agency%20Submission_%20EPA.pdf

2 https://www.epa.gov/sites/production/files/2021-01/documents/lowwind_plume_meander_white_paper.pdf

downwind concentrations under low wind speed conditions can be overpredicted. This is supported by Victoria EPA[3] who identify that "*it is recognised that AERMOD concentration predictions for area sources in the current approved version of AERMOD are likely to be overestimated under very light wind conditions (i.e. for wind speeds less than 1 m/sec)*".

In the addendum AQIA RtS, Northstar acknowledges that concentration predictions from area sources may be overestimated under light wind conditions, which is supported by the US EPA's documentation on the AERMOD model[4]. It is noted that recent developments have been made to address known issues with low wind speed / stable conditions by accounting for meander and local-scale turbulence (addition of the ADJ_U* and LOWWIND options within the model)[5]. It is not documented in the Northstar V4 AQIA whether these options were used in the model.

AERMOD's tendency to overpredict in low wind conditions may not be what the TAS review is referring to, as the TAS peer review of the RtS clarifies the opinion that AERMOD displays poor model performance under all wind conditions. TAS has not provided corroborating evidence to support this statement, making it difficult to comment on the validity of the statement.

Finally, it is noted that the Northstar AQIA does not explain how fugitive dust emissions were represented in the model (ie as area or volume sources). However, it is unlikely that all dust sources were represented as 'area sources' within the model. Our guess is that most dust sources were represented as volume sources and possibly only wind erosion was represented as an area source. Therefore, if this is the case, any potential overprediction in the model for area sources would be limited to wind erosion sources only.

2.2.2 Suitability of the model for meteorological environment

A separate but related issue raised in the TAS peer review of the RtS (11 March 2021) refers to the suitability of the model for the selected meteorological input data. Further discussion of the suitability of the meteorological input data is provided in Section 4, however discussion related to model suitability is provided here.

The Northstar addendum AQIA (RtS) acknowledges that concentration predictions from area sources may be overestimated under light wind conditions, however Northstar does not believe this to be an issue because the input meteorological data from Gosford would not record conditions that would cause this issue. This statement from Northstar is misleading, as the Gosford AWS records winds speeds down to 0.1 m/s and light wind conditions would therefore be represented in the model.

Similarly, the TAS peer review of the RtS (11 March 2021) contents that low wind speed conditions are excluded by the selection of the Gosford data. This statement from TAS also appears to be misleading, as the Gosford AWS data records almost 30% calm wind speed conditions for 2015 (ie less than 0.5 m/s). However, although not discussed in the TAS peer review, the AERMET generated wind rose for the project site records significantly lower calm wind conditions (8.4%) compared to the Gosford AWS input data (29.8%) and higher annual average wind speeds (2.4 m/s) compared to the Gosford AWS input data (1.9 m/s) (discussed further in Section 4).

It is, however, EMM's view that the issue relating to low wind conditions is overstated by TAS. Hourly average wind speed data from the BoM Gosford station recorded between 2013 and 2020 was reviewed and percentage of calm conditions by hour of the day was calculated. As stated in the Northstar addendum AQIA, emissions were modelled between the hours of 7.00 am and 5.00 pm for the delivery of waste materials and product sales and 8.00 am and 5.00 pm for the processing of waste. As shown in Figure 2.1, the percentage of calm winds decreases significantly during the day. The periods of highest calm winds occur outside the modelled operating hours of the proposed Facility. Consequently, the influence of calm winds on model prediction are unlikely to be as significant as inferred by the TAS review.

[3] https://www.epa.vic.gov.au/-/media/epa/files/publications/1551.pdf

[4] https://www.epa.gov/scram/aermod-modeling-system-development

[5] https://pubs.awma.org/flip/EM-July-2017/paine.pdf

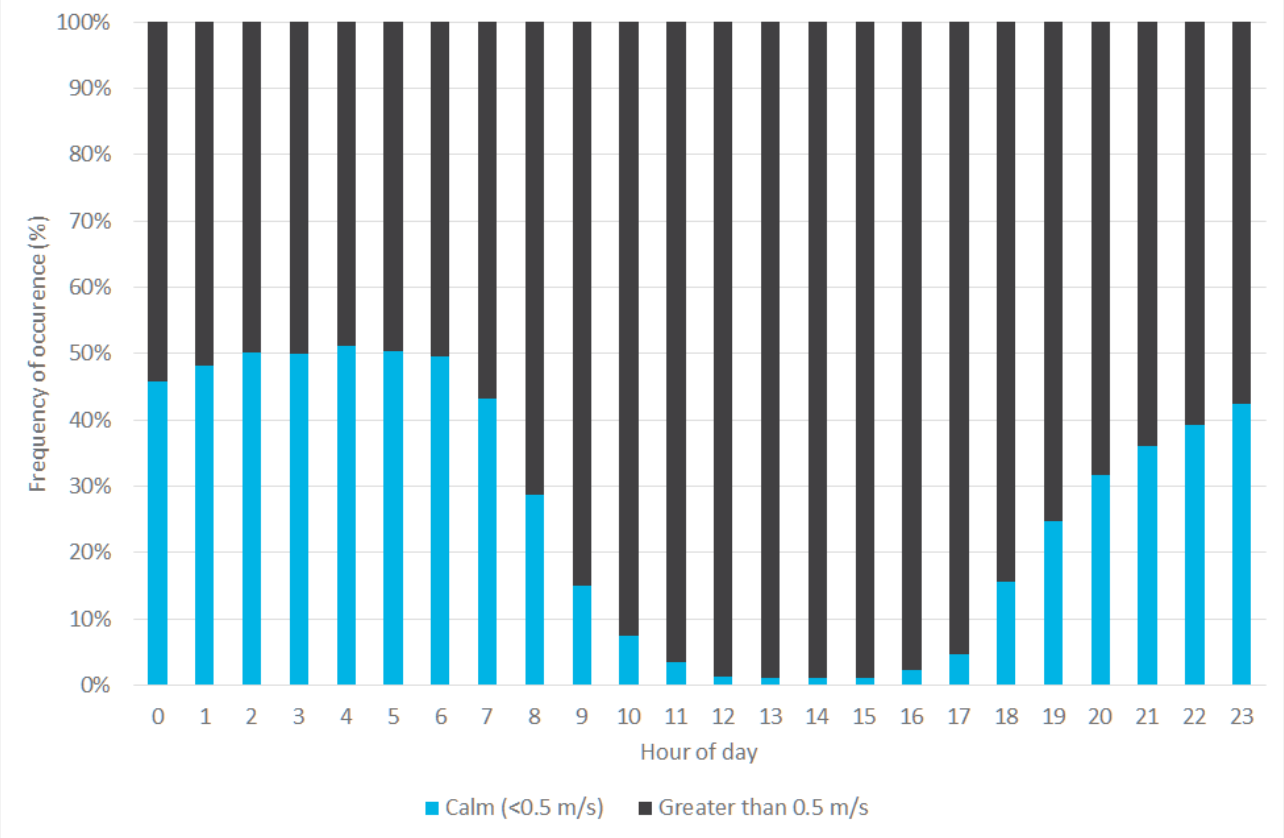

Figure 2.1 Diurnal variation of calm conditions – BoM Gosford AWS – 2013 to 2020

Finally, it is noted that AERMOD includes the option to select a threshold wind speed for defining calm hours, which is important as AERMOD will exclude calm wind hours from the calculation of average concentrations. It is not clear which minimum wind speed was selected by Northstar and therefore what percentage of hours are excluded from their calculation of average concentrations.

2.3 Peer review conclusions on the modelling approach

It is EMM's opinion that the selection of AERMOD as the dispersion model is acceptable and suitable for the modelling of dust sources for the Facility. Model options used by Northstar for low wind speeds and treatment of calms are unclear, therefore some uncertainty regarding the meteorological input data remains. This is discussed further in Chapter 4.

EMM's findings relating to the choice of model and meteorological input data uncertainty is consistent with the ERM peer review findings.

3 Construction assessment

3.1 Summary of TAS issues and Northstar response

The initial TAS peer review (22 September 2020) noted that construction impacts would be governed by the practices of the builders, rather than anything discussed in the air quality assessment. Northstar took this as an observation and did not provide a specific response, other than to reiterate that they considered their approach to be appropriate.

3.2 EMM's review of issues

The initial TAS peer review (22 September 2020) appears to imply that the proposed construction dust management measures outlined in the Northstar air quality assessment would not help control dust because impacts would be governed by the practices of the builders.

EMM does not agree with this observation from the TAS peer review. The proposed construction dust management measures would form part of a construction environmental management plan which the contracted builders would be obliged to follow.

3.3 Peer review conclusion on construction phase impacts

It is EMM's opinion that approach taken in the Northstar air quality assessment is appropriate for assessing and managing construction dust impacts.

The ERM peer review is silent on this issue.

4 Meteorological modelling

4.1 Summary of TAS issues and Northstar response

The initial TAS peer review (22 September 2020) identified a number of issues with the meteorological modelling and input data, summarised as follows:

- due to differing geographical features, winds at the project site will be significantly different to those at Gosford AWS, which means the AERMET data used in the air dispersion modelling is not representative of the project location;
- the unrepresentative meteorological data may in turn cause invalid or incorrect dust modelling results; and
- the selected meteorological data are not compared to long term climate data of at least five years.

The Northstar addendum AQIA (RtS) acknowledges the uncertainty in meteorological input data and therefore proposed changes to the project design, including reduced throughput and commitments for site specific meteorological monitoring. Additional data (6 years) was presented to demonstrate the representativeness of the modelled year.

The follow up TAS peer review of the RtS (11 March 2021) found that this issue remains unresolved and that the approach is unacceptable as it will lead to underestimation of impacts.

4.2 EMM's review of issues

The approach to meteorological modelling has gone through a series of iterations since the original Northstar AQIA (17 December 2018). The Northstar AQIA submitted for the EIS used meteorological input data based on the prognostic model TAPM. Two approaches were compared, one using no observation data and the other using observation data from the Gosford AWS site. Sensitivity analysis was performed using two different meteorological inputs files, constructed using a combination of TAPM and observations at Gosford AWS. It is noted that CALPUFF was run in 2-D mode, which uses a single meteorological input file in lieu of a CALMET generated wind field.

Northstar prepared a revised AQIA (V4 dated 30 June 2020) to address issues identified by EPA. An additional approach was modelled (using WRF model inputs into CALMET), however, similar to the previous two approaches, this was determined to be unsatisfactory. Northstar then changed the overall modelling approach and reverted to using the AERMOD model, with meteorological data from Gosford AWS and other sources used in the AERMET pre-processor.

It is noted that the rationale used by Northstar for shifting to AERMOD was to allow for observational data (including that from Gosford AWS) to be used as input to the dispersion model instead of prognostic or diagnostic modelled data. However, Northstar had effectively already done this by running CALPUFF in in 2-D mode, driven largely by the Gosford AWS data. Therefore, the shift to AERMOD is not completely understood by EMM. In the absence of site-specific meteorological input data (or suitable site representative data), it would be EMM's general preference to use CALPUFF over AERMOD. This does not mean AERMOD is not acceptable in this case, indeed it is considered an appropriate dispersion model for application (Chapter 2), it simply re-iterates the issue regarding uncertainty with the meteorological inputs data.

Based on information provided in Table B2 of the revised AQIA, Northstar's have used data from the Williamtown RAAF BoM station as input to the 'surface station' and 'upper air' pathways and data from Gosford AWS for input to the 'onsite' pathway. The AERMET pre-processor merges data from the surface and onsite pathways to produce a single AERMOD ready meteorological input file. As mentioned previously, this is the likely reason for why the

AERMET generated wind rose for the project site records significantly lower calm wind conditions (8.4%) compared to the Gosford AWS input data (29.8%) and higher annual average wind speeds (2.4 m/s) compared to the Gosford AWS input data (1.9 m/s).

However, it is difficult to determine whether this reduction in calm winds and generally higher wind speeds is representative of the project site, as there are no local data against which a comparison can be made. This is the crux of the argument, although there is general agreement about the uncertainty of the meteorological input data. The point of difference is that the TAS peer review believes the approach is unacceptable as it will lead to underestimation of impacts based on the assertion that the project site would experience lower winds speeds (ie poorer dispersion conditions) and more westerly winds (ie blowing towards receptors) than what was modelled.

EMM agrees that there is uncertainty in the use of meteorological input data, however we cannot substantiate the claim that the project site would experience lower winds speeds and more westerly winds than what was modelled.

As described above, this uncertainty is also acknowledged by Northstar and the addendum AQIA (RtS) proposes a number of changes to account for the uncertainty, as follows:

- the proposed throughput for the Facility is reduced to 100,000 tonnes per annum;
- additional mitigation was proposed to reduce dust emissions, with reactive management to control potential short-term impacts;
- commitment to install a meteorological monitoring station to record site-specific meteorology; and
- updating the air quality modelling for ramp up from 100,000 tpa to 150,000 tpa and 200,000 tpa, using the site-specific meteorological data.

This was accepted by the EPA as a suitable way to circumvent the uncertainty in meteorological inputs in their response to the RtS.

4.3 EMM's conclusion on meteorological modelling

While some uncertainty remains in the meteorological inputs and approach to the air quality modelling, EMM agrees that the proposed approach of design changes, reduced throughput and commitments for site specific meteorological monitoring is a suitable way to circumvent this uncertainty.

EMM's conclusion is consistent with the ERM peer review findings.

5 Emissions estimates

5.1 Summary of TAS issues and Northstar response

The initial TAS peer review (22 September 2020) concluded that the Northstar AQIA had significantly underestimated operational emissions from the Facility, based on the following issues:

- the application of annualised emission rates vs peak day emissions rates;
- the use of a silt loading of 0.6 g/m^2 for emissions generated by the movement of trucks on paved roads, combined with a 30% reduction for the application of water sprays;
- the exclusion of particulate matter emissions associated with the movement of a FEL within the Facility;
- the application of a 30% reduction for wind breaks for FEL material handling activities at storage bunkers;
- the wind erodible area should be 3.9 ha vs 1.59 ha; and
- incorrect or inappropriate application of emission control factors.

The Northstar addendum AQIA included a number of revisions to the emissions inventory prepared for the Facility. These include increasing the paved road silt loading assumption, increasing the potential wind erosion area to the maximum operational area of site, reduction of applied emission control factors for processing and handling where disputed and inclusion of enclosure for all processing plant components.

The TAS review of the addendum AQIA acknowledges these revisions however retains concerns relating to:

- peak to average day emissions, with TAS claiming that peak 24-hour operational emissions are typically two to five times higher than average operations(no specific reference is given to support this claim);
- the exclusion of emissions generated by FEL movements; and
- the use of control factors not appropriate for the proposed mitigation method.

In response to the addendum AQIA, the NSW EPA acknowledges that while some uncertainty remains regarding the assessment and the associated impacts on air quality, the uncertainty can be addressed through conditions of approval for the Facility including:

- the development of an operation air quality management plan;
- the development and implementation of an air quality monitoring program at the Facility, including continuous PM_{10} monitoring; and
- the installation of a real-time meteorological monitoring station at the Facility.

5.2 EMM's review of issues

EMM consider that several the comments raised by the TAS review in relation to the original AQIA emissions inventory are reasonable, including the application of the 0.6 g/m^2 silt loading for paved roads and application of derived emission reduction factors.

It is considered that the Northstar addendum AQIA revised emissions inventory addresses the majority of the concerns or uncertainties from the original AQIA. In general, it is considered that the emission factors and emission control factors adopted are appropriate for the purpose of quantifying operational emissions from the Facility.

However, EMM do note that emissions from the movement of FEL about the Facility have not been explicitly accounted for in the addendum AQIA. Emissions generated by the handling of material by FEL are accounted for using the US-EPA AP-42 Chapter 13.2.4 *Aggregate Handling and Storage Piles* equation (US-EPA 2006a)[6]. As stated in Section 13.2.4.3 of US-EPA 2006a, emissions quantified by this equation are associated with the handling of material only. Furthermore, US-EPA (2006a) make the following statement regarding emissions from the movement of FEL:

> For emissions from equipment traffic (trucks, front-end loaders, dozers, etc.) traveling between or on piles, it is recommended that the equations for vehicle traffic on unpaved surfaces be used (see Section 13.2.2). For vehicle travel between storage piles, the silt value(s) for the areas among the piles (which may differ from the silt values for the stored materials) should be used.

On this basis, EMM considered that the review comments from TAS relating to the exclusion of emissions from FEL movements are valid. Given the low vehicle travel speeds (<5 km/hr) relative to the speed range in the AP-42 emissions inventory literature (8 km/hr to 69 km/hr, US-EPA 2006b[7]), it is considered that the emissions generated by the movement of FEL would be overstated using the AP-42 Unpaved Roads equation. While this adds uncertainty to the emission quantification, EMM do not consider that the inclusion of FEL emissions would alter the ultimate conclusions of the addendum AQIA.

The design of the Facility to feature areas of crushed concrete over geotextile fabric, as illustrated in Figure 6 of the AQIA is also questioned. It is the experience of EMM that best practice for a materials recycling facility includes the use of hardstand wherever vehicle movements, including FEL, are proposed to occur. It is recommended that the paving of the site is considered to improve dust mitigation performance.

The claims by TAS regarding the average to peak-day fluctuations are considered speculative. In the experience of EMM, while the relationship between peak and average day operations is variable and site specific, a difference of up to a factor of five is considered extreme. The assumption of upscaled 24-hour period emissions for an entire 12-month modelling period, as completed in the Northstar addendum AQIA, is considered highly conservative as peak operational emissions are combined with all possible dispersion conditions.

The commitment to incorporate real-time air quality monitoring at the Facility, complete with reactive trigger action responses to air quality management, will assist with addressing the uncertainty relating to FEL movement emissions and peak vs average day operational impacts. The recommended consent conditions from the NSW EPA are considered appropriate.

5.3 EMM's conclusion on emission estimates

EMM is of the opinion that there remains some uncertainty associated with the Northstar addendum AQIA relating to the exclusion of emissions from the movement of FEL within the Facility. Despite this exclusion, EMM do not consider that the inclusion of this emission source will significantly alter the Facility emissions inventory, nor the conclusions of the addendum AQIA. Further, it is considered that the implementation of real-time air quality monitoring and associated reactive management practices will address the identified uncertainty.

EMM consider that the areas of the Facility currently proposed for crushed concrete over geotextile fabric should be altered to hardstand (concrete or asphalt) to better align with observed industry best practice. At a minimum,

6 US-EPA 2006a - https://www.epa.gov/sites/production/files/2020-10/documents/13.2.4_aggregate_handling_and_storage_piles.pdf

7 US-EPA 2006b - https://www3.epa.gov/ttn/chief/ap42/ch13/final/c13s0202.pdf

this should be extended to the areas of FEL activity. It is noted that the feasibility of installing hardstand to proposed operations were not considered in this conclusion.

The ERM peer review completed considers that the emissions inventory is robust and the inclusion of FEL movements is not justified. ERM are of the opinion that the emissions inventory is sound and mitigation measures are appropriate and represent best practice.

6 Modelled receptors

6.1 Summary of TAS issues and Northstar response

The initial TAS peer review (22 September 2020) noted that not all existing and likely future receptors were modelled, including a proposed dwelling at Lot 3 239 Debenham Rd East and the juvenile corrections centre.

The Northstar addendum AQIA (RtS) clarifies that the juvenile corrections centre was included and suggests adjacent receptor locations can be used as a proxy for assessing impacts at 239 Debenham Rd East.

The follow up TAS peer review of the RtS (11 March 2021) found that this issue remains unresolved because:

- annual average contours were not provided and therefore impacts cannot be inferred at 239 Debenham Rd East; and
- the alternative assessment locations cannot be used as a proxy for assessing 24-hour average impacts at 239 Debenham Rd East as the maximum may occur on a different day.

Northstar responded to the additional TAS peer review of the addendum AQIA (1 April 2020) by providing modelling results at location 239 Debenham Rd East for 24-hour average PM_{10}, extracted from the model grid files.

6.2 EMM's review of issues

The modelling results provided by Northstar for 239 Debenham Rd East demonstrate compliance with the impact assessment criteria for 24-hour PM_{10}. It is noted that the location at which Northstar extracted from the grid file is not provided, therefore it is unclear where within the Lot the modelling prediction is provided. However, it is also unclear where a future proposed dwelling might sit, therefore an approximation within the lot is considered sufficient.

Northstar have not provided modelling results for annual average periods or other pollutants (ie $PM_{2.5}$). However, annual average PM_{10} concentrations will decrease with distance from the site and, as noted in the Northstar addendum AQIA (RtS), the assessment location R1 is adjacent to 239 Debenham Rd East and closer to the Project site, therefore compliance at this location can be used to infer compliance 239 Debenham Rd East. Although modelling results for $PM_{2.5}$ were not provided, it is likely that if compliance is demonstrated for PM_{10}, compliance can also be assumed for $PM_{2.5}$ (as PM_{10} is the more likely limiting pollutant for projects of this nature.

6.3 Peer review conclusion on modelled receptors

It is EMM's opinion that this issue is resolved by the Northstar response dated 1 April 2020. ERM has also accepted that this issue is resolved by the modelling results presented in the Northstar response.

7 Background dust data

7.1 Summary of TAS issues and Northstar response

The initial TAS peer review (22 September 2020) considered that the use of data from the DPIE Wyong air quality monitoring station (AQMS) would underestimate background dust concentrations at the Facility site.

Northstar refute this claim in the addendum AQIA (RtS) identifying that the use of a regional DPIE air quality monitoring dataset is appropriate in the absence of onsite measurements. The addendum AQIA also states the commitment of the proponent to implement real-time air quality monitoring during the operation of the Facility.

The TAS response to the addendum AQIA (RtS) further claims that additional justification of the Wyong dataset is required, or that "some other reasonable factor to compensate" for the perceived underestimation of background concentrations is completed, such as modelling of local emission sources.

7.2 EMM's review of issues

It is considered that the use of daily-varying PM_{10} concentrations from the NSW DPIE Wyong air quality monitoring station is entirely appropriate to represent ambient background concentrations at the Facility, in the absence of site-specific air quality monitoring data.

All available daily varying PM_{10} concentrations recorded between 2014 and 2020 were sourced from the NSW DPIE air quality monitoring stations at Wyong, Wallsend (approximately 68 km north-north-east of the Facility), Morriset (40 km north-east of the Facility) and Macquarie Park (approximately 42 km south-south-west of the Facility).

The Pearson corelation coefficient was calculated for the four monitoring datasets to understand the relationship between concurrent daily-varying concentrations. Relative to the Wyong station, the Wallsend, Morriset and Macquarie Park stations returned a Pearson corelation coefficient of 0.9, 0.85 and 0.8 (with 1 being a perfect relationship). Consequently, the three reviewed datasets correlate well with the Wyong dataset, despite the separation distance between the sites. Therefore, the day-to-day variation in particulate matter concentrations experienced across the region between northwest Sydney and Newcastle is closely correlated and largely driven by regional influences. The claim by TAS that the Wyong dataset would significantly underestimate background concentrations in the vicinity of the Facility is not supported.

Further, it is noted that the Northstar addendum AQIA (RtS) has accounted for contributions to cumulative impacts from the neighbouring Gosford Quarry, by explicitly modelling the as a local dust source (see Chapter 8).

Finally, it is identified that the proponent has committed to real-time air quality monitoring at the Facility. Any perceived uncertainty associated with ambient background concentrations would be addressed through the inclusion of local air quality monitoring.

7.3 Peer review conclusion on background data

It is EMM's opinion that approach adopted by Northstar to account for background particulate matter is entirely appropriate for the purpose of air quality impact assessment.

The ERM peer review also considered that the use of the DPIE Wyong dataset is appropriate for the purpose representing background air quality in the vicinity of the Facility. Further, ERM do not agree with the conclusion of the TAS review that the DPIE Wyong dataset would underestimate background concentrations at the Facility.

8 Cumulative Impacts

8.1 Summary of TAS issues and Northstar response

The initial TAS peer review (22 September 2020) considered that neighbouring sources of emissions, specifically the proposed Bingo Industries site and existing Gosford Quarries site, should be explicitly included in the dispersion modelling. This view was shared by the NSW EPA.

In the addendum AQIA (RtS), Northstar identified that the proposed Bingo facility was no longer proceeding and should not be included in cumulative modelling, while emissions from the Gosford Quarry site were quantified based on an assumed 30,000 tpa throughput. Modelling of the Gosford Quarry operations was included in the model, on an annual average basis. Cumulative 24-hour average impacts from the Gosford Quarry were not quantified due to a lack of detail on day-to-day operations in the public domain.

The TAS review of the Addendum AQIA comments that the predicted impacts from the Quarry remain significantly underestimated.

8.2 EMM's review of issues

No detailed emissions inventory for the Quarry is provided in the Northstar AQIA, therefore confirmation of emissions calculations is not possible. Furthermore, it is apparent that the throughput of the Quarry is not publicly available, leading to Northstar applying the limit for a scheduled activity (30,000 tpa). This results in some uncertainty in the quantification of emissions from the Quarry and the prediction of cumulative impacts with the Facility.

However, in the event that the operational throughput of the Quarry is indeed less than 30,000 tpa, EMM consider that the potential for cumulative impacts from this existing emission source would be low.

Taking the dominant wind directions in the input meteorology (ie southerly, north-easterly and north-westerly) into consideration with the location of the Facility, the Quarry and the surrounding sensitive receptor locations, EMM considered that there are unlikely to be significant periods where the two emissions sources are impacting on an individual receptor location at the same time.

The TAS review implies that the relative contribution from a source to total facility emissions will equate to the same level of contribution to predicted impacts. The case given relates to wind erosion emissions, however this statement gives no consideration to the temporal distribution of emissions in dispersion modelling calculation, whereby a higher proportion of total wind erosion emissions coincide with elevated wind speeds and improved atmospheric dispersion conditions. Uncertainty regarding the magnitude of quantified emissions from the Quarry aside, EMM consider the TAS comments relating to an underprediction of impacts from the Quarry are overstated.

Finally, it is identified that the Proponent has committed to real-time air quality monitoring at the Facility. Any perceived uncertainty associated with cumulative impacts would be addressed through the inclusion of local air quality monitoring.

8.3 Peer review conclusion on cumulative impacts

Despite remaining uncertainty regarding the magnitude of the Quarry operations, it is EMM's opinion that approach adopted by Northstar in the addendum AQIA (RtS) to assess cumulative impacts from the Quarry is generally appropriate for the purpose of the air quality impact assessment. Furthermore, it is considered that the inclusion of site real-time air quality monitoring at the Facility will cover any remaining uncertainty in the modelling.

The ERM peer review discounts the claims of the TAS review regarding underprediction of impacts from the neighbouring Quarry, however provides no opinion on the robustness of the emissions quantified for the Quarry. ERM consider that the inclusion of real-time air quality monitoring at the Facility will allow for the contribution of the Quarry to cumulative impacts to be accounted for.

9 Summary and conclusion

EMM have completed an independent technical review of the AQIA and associated peer review and addendum AQIA documents prepared for the Facility (SSD-8660). The key findings of the EMM review are as follows:

- the selection of AERMOD as the dispersion model is considered acceptable and suitable for the modelling of dust sources for the Facility;
- some of the selected model options are unclear (low wind speeds and treatment of calms) and some uncertainty remains regarding the suitability of meteorological input data. However, while some uncertainty remains in the meteorological input data and approach to the air quality modelling, EMM agrees that the proposed approach of design changes, reduced throughput and commitments for site specific meteorological monitoring is a suitable way to circumvent this uncertainty;
- the Northstar air quality assessment is appropriate for assessing and managing construction dust impacts;
- the revisions to the addendum AQIA emissions inventory are considered to address the majority of issues identified in the original AQIA;
- the adopted emission factors and emission reduction factors in the Northstar addendum AQIA are considered to be generally appropriate for representing operational emissions;
- there remains some uncertainty with the Northstar addendum AQIA relating to the exclusion of emissions from the movement of front-end loader within the Facility, however this is unlikely to alter the conclusions of the report;
- consideration should be given to extending the pavement/hardstand to areas of the Facility marked for crushed concrete over geotextile fabric;
- issues relating to the modelled receptors were sufficiently addressed in the addendum AQIA;
- the use of the DPIE Wyong air quality monitoring dataset is appropriate to represent background air quality at the Facility in the absence of onsite monitoring data; and
- the approach adopted by Northstar in the Addendum AQIA to assess cumulative impacts from the Quarry is generally appropriate for the purpose of the air quality impact assessment.

9.1 Conclusion

Following on from EMM's review, DPIE requested clarification from Jackson Environment and Planning (as a representative for the proponent) on three remaining areas of uncertainty, as follows:

- the omission of front-end loader movements from the emission inventory;
- the rationale for using crushed concrete on top of geomembrane in lieu of a concrete hardstand surface for certain parts of the site; and
- the approach for cumulative assessment of emissions from Gosford Quarry.

To close out these remaining questions, DPIE convened a meeting between EMM, Northstar and Jackson Environment and Planning. The outcomes of the meeting are summarised as follows:

1. Regarding the omission of front-end loader movements from the emission inventory, EMM recommended that this source is included in modelling done for any future production increase. No further updates to the air quality assessment required at this stage.

2. Jackson Environment and Planning confirmed that the use of crushed concrete on top of a geomembrane is the most appropriate surface for the facility given the type of vehicle and mobile plant and equipment that will need to be operating across the pavement and that a concrete or asphalt pavement is not durable enough given the nature of the operations. The unpaved surfaces are to be watered, and vehicle speeds will be limited, to minimise emissions. EMM were satisfied with this response.

3. Regarding the approach for cumulative assessment of emissions from Gosford Quarry, while there remains uncertainty regarding potential emissions from the quarry, EMM are satisfied that the implementation of a site-specific monitoring, TARP, and a staged approvals process is sufficient to address these uncertainties.

In summary, EMM consider that the proposed design changes, reduced throughput, and inclusion of onsite real-time air quality and meteorological monitoring at the Facility is sufficient to address any remaining uncertainty in the assessment.