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Kings Hill Water and Wastewater Infrastructure

Air Quality Assessment

Addressee(s):	Kings Hill Development Pty Ltd
Report Reference:	19.1070.FR1V1
Date:	30 September 2019

Quality Control

Study	Status	Prepared by	Checked by	Authorised by
INTRODUCTION	Final	Northstar Air Quality	MD/GCG	MD
THE PROPOSAL	Final	Northstar Air Quality	MD/GCG	MD
LEGISLATION, REGULATION AND GUIDANCE	Final	Northstar Air Quality	MD/GCG	MD
EXISTING CONDITIONS	Final	Northstar Air Quality	MD/GCG	MD
METHODOLOGY	Final	Northstar Air Quality	MD/GCG	MD
ASSESSMENT	Final	Northstar Air Quality	MD/GCG	MD
MITIGATION AND MONITORING	Final	Northstar Air Quality	MD/GCG	MD
CONCLUSION	Final	Northstar Air Quality	MD/GCG	MD

Report Status

Northstar References		Report Status	Report Reference	Version
Year	Job Number	(Draft: Final)	(R*x*)	(V*x*)
19	1070	F	R1	V1
Based upon the above, the specific reference for this version of the report is:				**19.1070.FR1V1**

Final Authority

This report must by regarded as draft until the above study components have been each marked as final, and the document has been signed and dated below.

Martin Doyle **30th September 2019**

Non-Technical Summary

Resonate Consultants has engaged Northstar Air Quality Pty Ltd (Northstar) on behalf of Kings Hill Development Pty Ltd (KHD) to perform an air quality assessment for the proposed construction and operation of a water and wastewater supply pipeline and a wastewater pumping station. The pipelines and wastewater pumping station are planned to support the development of the Kings Hill Urban Release Area in Raymond Terrace, NSW.

This air quality assessment forms part of the Environmental Impact Statement which seeks approval for the Proposal as Designated Development under Part 4 of the *Environmental Planning and Assessment Act* 1979.

The air quality assessment presents an assessment of the impacts of the proposed construction and operation of the Proposal.

Potential construction impacts have been assessed using a published risk-based assessment methodology that has been adapted to reflect the specific operations of the Proposal. The assessment indicates that a range of mitigation measures can be applied during the construction phase to ensure that the risks (both health and amenity) to the surrounding community would not be significant.

The potential for air quality impacts during the operational phase have been identified to be minor, and easily controlled through the implementation of a range of measures and best practice techniques.

Based on the assessment provided, it is respectfully suggested that the Proposal should not be rejected on the grounds of air quality.

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1. INTRODUCTION

Resonate Consultants (Resonate) has engaged Northstar Air Quality Pty Ltd (Northstar) on behalf of Kings Hill Development Pty Ltd (KHD) to perform an air quality assessment (AQA) for the proposed construction and operation of a water and wastewater supply pipeline and a wastewater pumping station (the Proposal). The Proposal is planned to support the development of the Kings Hill Urban Release Area (Kings Hill URA) in Raymond Terrace, NSW. The Proposal is to be located in between Irrawong St and Rees James Rd, Raymond Terrace (broadly, the Proposal site).

This AQA forms part of the Environmental Impact Statement (EIS) which seeks approval for the Proposal as Designated Development under Part 4 of the *Environmental Planning and Assessment Act* 1979.

Secretary's Environmental Assessment Requirements (SEARs) have been provided for the Proposal by the NSW Department of Planning and Environment (DPE) on 19 February 2019 (SEAR number 1291). In relation to air quality, the SEARs state that the EIS must include:

- *"A description of all potential sources of air (including dust) and odour emissions, including from the wastewater pumping station, pipelines and air vents"*
- *"A description and appraisal of air quality impact mitigation and monitoring measures"*

The Proposal is comprised of a 6.7 kilometre (km) water main lead in and water pump station, from the Raymond Terrace Water Pump Station to Kings Hill URA, and a 4.2 km sewer rising main and transfer wastewater pump station, from the Kings Hill URA to the existing gravity network at MH K1950, Raymond Terrace. The Proposal terminates at the southern end of the URA and further development will be required for water and wastewater infrastructure to service the URA development in the future, however this further development does not comprise part of this Proposal.

The AQA presents an assessment of the impacts of activities within the Proposal site, associated with both the construction phase and operational phase of the Proposal. Potential construction impacts have been assessed using an adaptation of a published risk-based assessment methodology, and appropriate construction control measures have been proposed to manage that risk. Potential operational impacts have been assessed using a qualitative approach, identifying potential sources of emissions and proposing control measures to minimise their potential impact.

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2. THE PROPOSAL

The following provides a description of the Proposal and the potential emissions to air which would be anticipated to be associated with the construction and operational phases of the development.

2.1 Environmental Setting

The Proposal site is located along Irrawong St, Kangaroo St, Adelaide St, and Rees James Rd in Raymond Terrace. The Proposal site is located within the Local Government Area (LGA) of Port Stephens Council. A map illustrating the location of the Proposal site is presented in **Figure 1**.

Figure 1 Proposal site location

Source: Northstar Air Quality

For the purposes of this study the scope has been limited to a 350 metre (m) buffer around the pipeline. The 350 m buffer distance has been selected as it is the maximum screening distance determined by the Institute of Air Quality Management (IAQM) (Institute of Air Quality Management, 2016) for construction dust assessments, which has been adapted for this study. This threshold distance represents the distance over which construction dust impacts may be reasonably expected to be experienced and is therefore appropriate for this study. The methodology is further discussed in **Section 5.1**.

2.1.1 Specific Construction Details

The hours of construction of the Proposal are outlined in **Table 1**.

Table 1 Proposed construction hours

Activity	Construction hours
Construction (staffed)	7am to 6pm, Monday to Friday 8am to 1pm Saturday No work on Sundays and Public Holidays

It is noted that construction may be performed outside of the hours outlined in **Table 1**.

Some additional construction works would be undertaken outside of standard daytime construction working hours. This may include:

- Cut in to existing live water and wastewater networks. This may require the temporary shut-down (at night) of temporary services;
- Crossing of roads including (but not limited to) Irrawang St, Adelaide St, Tregenna St and Alton Rd, if open trenching methodology required; and,
- Relocation of other services, if required.

In addition to the above, outside of hours works may also include:

- Any works which would not result in audible noise emissions at any nearby sensitive receptors or an outside of hours noise protocol would be prepared;
- The delivery of oversized plant and/or structures that police or other authorities determine require special arrangements to transport along public roads;
- Emergency work to avoid the loss of lives, property and/or to prevent environmental harm;
- Maintenance and repair of public infrastructure where disruption to essential services and/or consideration of worker safety do not allow work within standard construction hours;
- Public infrastructure works that shorten the length of the project and are supported by minimisation of impacts at noise-sensitive receivers; and
- Construction works where it can be demonstrated and justified that these works are required to be undertaken outside of standard construction hours (e.g. during connection of water and wastewater infrastructure when shutdowns are necessary).

Extended hours could include the above works and any considered suitable may be undertaken 24 hours, six days per week.

The construction of the Proposal is anticipated to begin in the first quarter of 2020 and be completed over a period of nine-months. The duration of the construction phase is not critical to the performance of the AQA.

Construction in the vicinity of Adelaide St between William Bailey St and the Sleepy Hill Motor Inn, as well as construction through Newbury Park, would occur between March and August only, whilst the remainder of the alignment would be constructed throughout the remainder of the year. Temporary compound areas would be included along the alignment and these would be decommissioned once construction is complete.

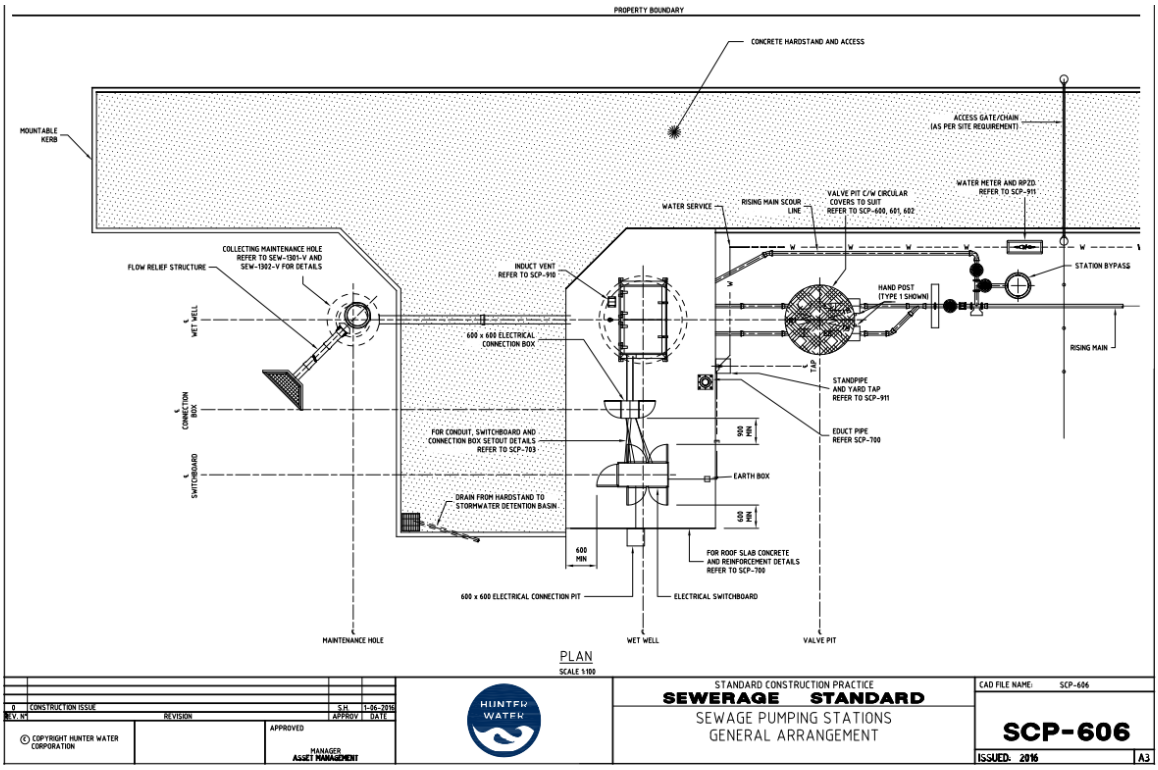
The pipelines will be principally trenched, with some under-boring where the pipeline crosses under local roads. Vegetation clearing will also be required.

Construction of a wastewater pumping station (WWPS) will also be required, to be located at the most northern end of the Proposal site within the Kings Hill URA. This WWPS will require the construction of hardstand areas and installation of relevant components. **Figure 2** illustrates the indicative location of the WWPS and **Figure 3** is the preliminary layout.

Figure 2 WWPS location

Source: Northstar Air Quality

Figure 3 WWPS general layout



Source: Hunter Water

2.1.2 Specific Operational Details

The proposed pipeline is expected to deliver approximately 1 080 megalitres (ML) of water to the Kings Hill URA each year. The proposed WWPS is anticipated to be required to pump approximately 1 420 ML of waste water from the Kings Hill URA each year.

Routine maintenance and inspections of valves, hydrants and scour locations along the pipeline, the chlorine injection point, and the WWPS would be required on an 'as needs' basis.

2.2 Identified Potential for Emissions to Air

2.2.1 Construction Phase

Construction of the Proposal would involve the movement of vehicles to and from the Proposal site, excavation and installation of new structures and services.

Due to the nature of the construction works and the layout of the Proposal, it is assumed that no demolition works are required. Subsequently, earthworks is the main activity being conducted at the Proposal site during the construction phase. Construction of pump stations will result in minor impacts which have been addressed.

An indicative list of equipment that may be used during the construction of the Proposal includes:

- Cranes;
- Earth moving vehicles;
- Light vehicles;
- Heavy vehicles;
- Pneumatic hand or power tools; and
- Commercial vans.

The methodology used in the construction phase air quality assessment is discussed in **Section 5.1**, and the assessment of the potential impacts upon local air quality resulting from construction activities is presented in **Section 6.1**.

The construction activities undertaken as part of the Proposal are anticipated to have the potential to generate short-term emissions of particulates (construction dust). Generally, these are associated with uncontrolled (or 'fugitive') emissions and may typically be experienced by neighbours at short distances from the construction activities as amenity impacts, such as dust deposition and/or visible dust plumes, rather than associated with health-related impacts. Construction particulate matter is generally typified by heavier size fractions. The risk of health impacts associated with smaller particles (less than 10 micrometres (µm) in diameter) is likely to be low.

Localised engine exhaust emissions from construction machinery and vehicles may impact upon the surrounding environment. Given the scale of the proposed works, it is considered that fugitive construction dust emissions would have the greatest potential to give rise to downwind air quality impacts. Construction phase vehicle emissions are therefore not considered further in this AQA. It is noted however that the construction mitigation recommendations (see **Section 6.1.2**) includes measures to minimise and manage these potential impacts. Furthermore, all vehicles operated as part of the Proposal would comply with the vehicle emission standards for general activities and plant as listed in Schedule 4 of the Protection of the Environment Operations (Clean Air) Regulation 2010.

2.2.2 Operational Phase

Given the nature of the Proposal, normal operational-phase emissions to air associated with the pipeline will be negligible. Periodically, there may be a requirement to perform maintenance tasks on the pipelines, which may necessitate invasive access. This would give rise to short-term, minor, and localised dust impacts, although the environmental consequences can be effectively minimised through good practice. Maintenance activities at valve, hydrant and scour locations may also give rise to emissions of odour, although this would again be short-term in nature.

The WWPS is a potential source of odour, although good design, adherence to Hunter Water standards including the use of Odour Control Units (OCU), would effectively ensure that emissions of odour would be negligible in routine operation or during maintenance activities.

Further discussion is provided in **Section 6.2**.

3. LEGISLATION, REGULATION AND GUIDANCE

3.1 NSW Protection of Environment Operations Act

Schedule 1 of the *Protection of Environment Operations Act* (1997) (POEO Act) provides definitions of processes, activities and premises that are deemed to be a 'scheduled activity' under the Act in NSW.

Part 1, Clause 36 relates to sewage treatment activities and an excerpt from that Clause is reproduced below:

"36 Sewage treatment

(1) This clause applies to sewage treatment, meaning the operation of sewage treatment systems (including the treatment works, pumping stations, sewage overflow structures and the reticulation system) that involve the discharge or likely discharge of wastes or by-products to land or waters.

(2) The activity to which this clause applies is declared to be a scheduled activity if it has a processing capacity that exceeds:

(a) 2,500 persons equivalent, as determined in accordance with guidelines established by an EPA Gazettal notice, or

(b) 750 kilolitres per day,

whichever is the greater."

With regard to the of the Proposal, the water and wastewater pipelines would not be considered a scheduled activity, however it is anticipated that the WWPS is likely to be a 'scheduled activity' under the POEO Act as the daily quantity of waste water transferred through the WWPS would be approximately 3 890 kL per day (1 420 ML / 365 days).

The POEO Act emphasises the importance of preventing 'offensive odour' and the principles contained within the POEO framework are applicable.

For reference, "offensive odour" is defined within the POEO Act as:

an odour:

(a) that, by reason of its strength, nature, duration, character or quality, or the time at which it is emitted, or any other circumstances:

(i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or

(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or

(b) that is of a strength, nature, duration, character or quality prescribed by the regulations or that is emitted at a time, or in other circumstances, prescribed by the regulations.

3.2 NSW Air Quality Standards

State air quality guidelines adopted by the NSW Environment Protection Authority (EPA) are published in the *'Approved Methods for the Modelling and Assessment of Air Quality in NSW'* (the Approved Methods (NSW EPA, 2017)) which has been consulted during the preparation of this assessment report.

The criteria listed in the Approved Methods are derived from a range of sources (including NHMRC, NEPC, DoE and WHO) and are the defining ambient air quality criteria for NSW. The standards associated with pollutants anticipated to be emitted during the construction phase of the Proposal are presented in **Table 2**.

Table 2 NSW EPA air quality standards and goals

Pollutant	Averaging period	Units	Criterion
Particulates (as PM_{10})	24 hours	$\mu g \cdot m^{-3}$ (a)	50
	1 year	$\mu g \cdot m^{-3}$	25
Particulates (as $PM_{2.5}$)	24 hours	$\mu g \cdot m^{-3}$	25
	1 year	$\mu g \cdot m^{-3}$	8
Particulates (as Total Suspended Particulate [TSP])	1 year	$\mu g \cdot m^{-3}$	90
Deposited dust(d)	1 year	$g \cdot m^{-2} \cdot month^{-1}$ (b)	2
		$g \cdot m^{-2} \cdot month^{-1}$ (c)	4

Notes: (a): Micrograms per cubic metre of air
(b): Maximum increase in deposited dust level
(c): Maximum total deposited dust level
(d): Assessed as insoluble solids as defined by AS 3580.10.1

3.3 Odour Regulation and Control in NSW

Impacts from odorous air contaminants are often nuisance-related rather than health-related. Odour performance goals guide decisions on odour management, and are generally not intended to achieve "no odour", but manage odour impacts to an acceptable level.

3.3.1 Definitions of Odour

The detectability of an odour is a sensory property that refers to the theoretical minimum concentration that produces an olfactory response or sensation. This point is called the odour detection threshold (ODT) and defines one odour unit (OU). An odour goal of less than 1 OU would (by definition) result in no odour impact being detectable in laboratory conditions. In practice, the character of an odour can only be judged by the receiver's reaction to it, and preferably only compared to another odour under similar social and regional conditions.

Based on the literature available, the level at which an odour is perceived to be a nuisance can range from 2 OU to 10 OU depending on a combination of the following factors:

- **Odour quality**: whether an odour results from a pure compound or from a mixture of compounds. Pure compounds tend to have a higher threshold (lower offensiveness) than a mixture of compounds.
- **Population sensitivity**: any given population contains individuals with a range of sensitivities to odour. The larger a population, the greater the number of sensitive individuals it contains.
- **Background level**: whether a given odour source, because of its location, is likely to contribute to a cumulative odour impact. In areas with more closely-located sources it may be necessary to apply a lower threshold to prevent offensive odour.
- **Public expectation**: whether a given community is tolerant of a particular type of odour and does not find it offensive, even at relatively high concentrations. For example, background agricultural odours may not be considered offensive until a higher threshold is reached than for odours from a landfill facility.
- **Source characteristics**: whether the odour is emitted from a stack (point source) or from an area (diffuse source). Generally, the components of point source emissions can be identified and treated more easily using control equipment than diffuse sources. Point sources tend to be located in urban areas, while diffuse sources are more prevalent in rural locations.
- **Health effects**: whether a particular odour is likely to be associated with adverse health effects. In general, odours from agricultural activities are less likely to present a health risk than emissions from industrial facilities.

3.3.2 Odour Assessment Criteria in NSW

Experience gained through odour assessments from proposed and existing facilities in NSW indicates that an odour performance goal of 7 OU is likely to represent the level below which "offensive" odours should not occur (for an individual with a 'standard sensitivity' to odours). Therefore, the *Technical framework: Assessment and management of odour from stationary sources in NSW* (DECC, 2006) recommends that, as a design goal, no individual be exposed to ambient odour levels of greater than 7 OU. In modelling and assessment terms, this is expressed as the 99th percentile value, as a nose response time average (approximately one second).

Odour assessment criteria need to consider the range in sensitivities to odours within the community to provide additional protection for individuals with a heightened response to odours. This is addressed in the Technical Framework (DECC, 2006) by setting a population dependant odour assessment criterion, and in this way, the odour assessment criterion allows for population size, cumulative impacts, anticipated odour levels during adverse meteorological conditions and community expectations of amenity. A summary of odour performance goals for various population densities, as referenced in the Odour Technical Framework (DECC, 2006) is shown in **Table 3**. This table shows that in situations where the population of the affected community lies between 125 and 500 people, an odour assessment criterion of 4 OU at the nearest residence (existing or any likely future residences) is to be used. For isolated residences, an odour assessment criterion of 7 OU is appropriate.

Table 3 NSW EPA Technical Framework odour criteria

Population of Affected Community	Impact Assessment Criteria for Complex Mixture of Odours (OU)
Urban area (≥2000)	2.0
500 – 2000	3.0
125 – 500	4.0
30 – 125	5.0
10 – 30	6.0
Single residence (≤2)	7.0

Source: The Odour Technical Notes, DECC 2006

Given that residential areas are, and are proposed to be located in close proximity to the WWPS, the population of the area surrounding the Proposal site may be considered to be high and therefore an odour criterion of 2 OU is applicable.

4. EXISTING CONDITIONS

4.1 Air Quality

The air quality experienced at any location will be a result of emissions generated by natural and anthropogenic sources on a variety of scales (local, regional and global). The relative contributions of sources at each of these scales to the air quality at a location will vary based on a wide number of factors including the type, location, proximity and strength of the emission source(s), prevailing meteorology, land uses and other factors affecting the emission, dispersion and fate of those pollutants.

When assessing the impact of any particular source of emissions on the potential air quality at a location, the impact of all other sources of an individual pollutant should also be considered. This 'background' (sometimes called 'baseline') air quality will vary depending on the pollutants to be assessed and can often be characterised by using representative air quality monitoring data.

Particulate matter concentrations are measured by the NSW Department of Planning, Industry & Environment (NSW DPI&E) at their air quality monitoring station (AQMS) at Beresfield, located approximately 8.5 km to the southwest of the Proposal site. This is the closest AQMS to the Proposal site and is likely to provide an appropriate representation of air quality which might be experienced at the Proposal site.

24-hour average PM_{10} and $PM_{2.5}$ concentrations as measured at the Beresfield AQMS are presented in **Figure 4** and **Figure 5**, respectively. The data indicate that short term elevations above the NSW EPA criterion for PM_{10} are experienced (eight times in 2018), although the general trend is for the average background to be much lower than the short-term criterion. Annual average PM_{10} concentrations measured at Beresfield in 2018 were 21.6 $\mu g \cdot m^{-3}$, below the criterion of 25 $\mu g \cdot m^{-3}$. Short term elevations in PM_{10} concentrations were experienced in metropolitan and regional population centres in 2018, mainly due to intense drought conditions, and an increase in the frequency of widespread dust storms throughout the year (NSW OEH, 2019).

$PM_{2.5}$ concentrations measured at the Beresfield AQMS in 2018 were all below the 24-hour criterion of 25 $\mu g \cdot m^{-3,}$ with a measured annual average $PM_{2.5}$ concentration of 8.7 $\mu g \cdot m^{-3}$. This is above the annual average $PM_{2.5}$ criterion of 8 $\mu g \cdot m^{-3}$. During 2018, about half of the NSW AWMS recorded annual average $PM_{2.5}$ concentrations above the national standard, mainly due to an increase in particles due to the intense drought (NSW OEH, 2019).

Short term elevations in particulate can be due to sources which are more controllable, and the aim of this AQA is to provide a range of measures which can be adopted to ensure that the contribution of the Proposal to particulate air pollution is minimised, as far as possible.

Figure 4 Measured PM_{10} concentrations – Beresfield AQMS, 2018

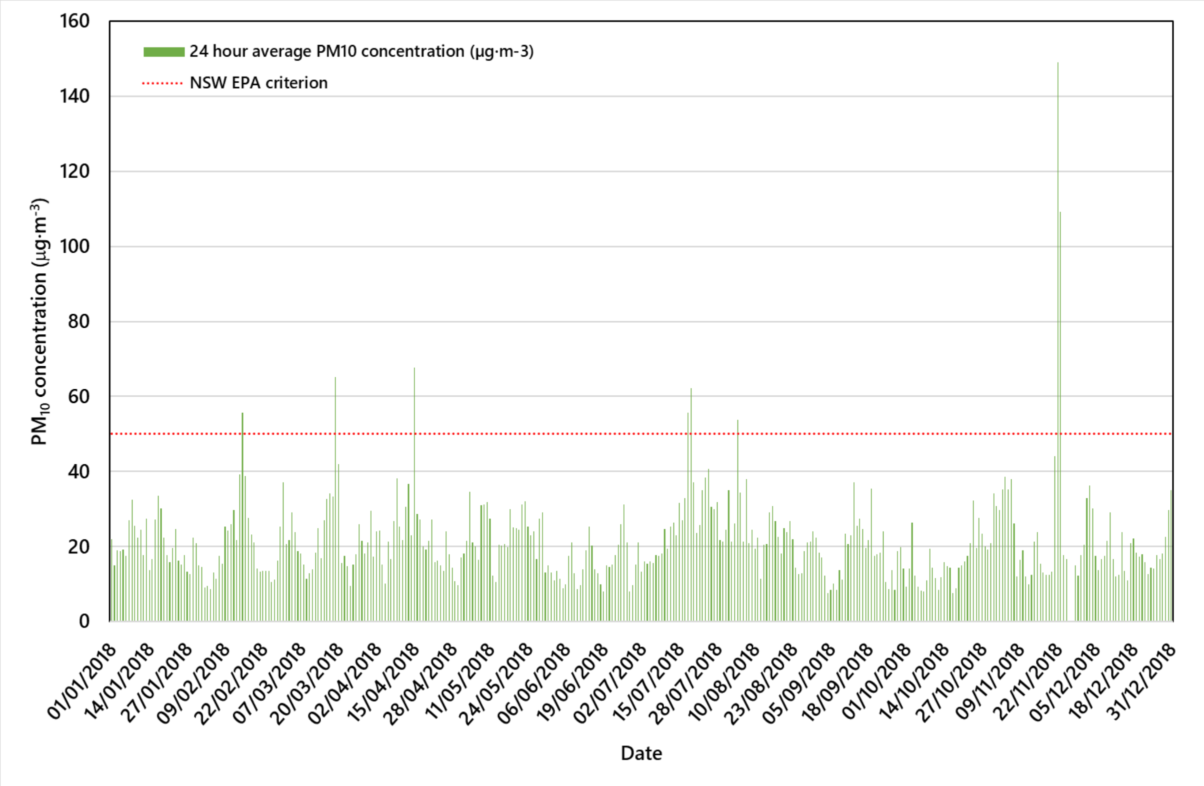
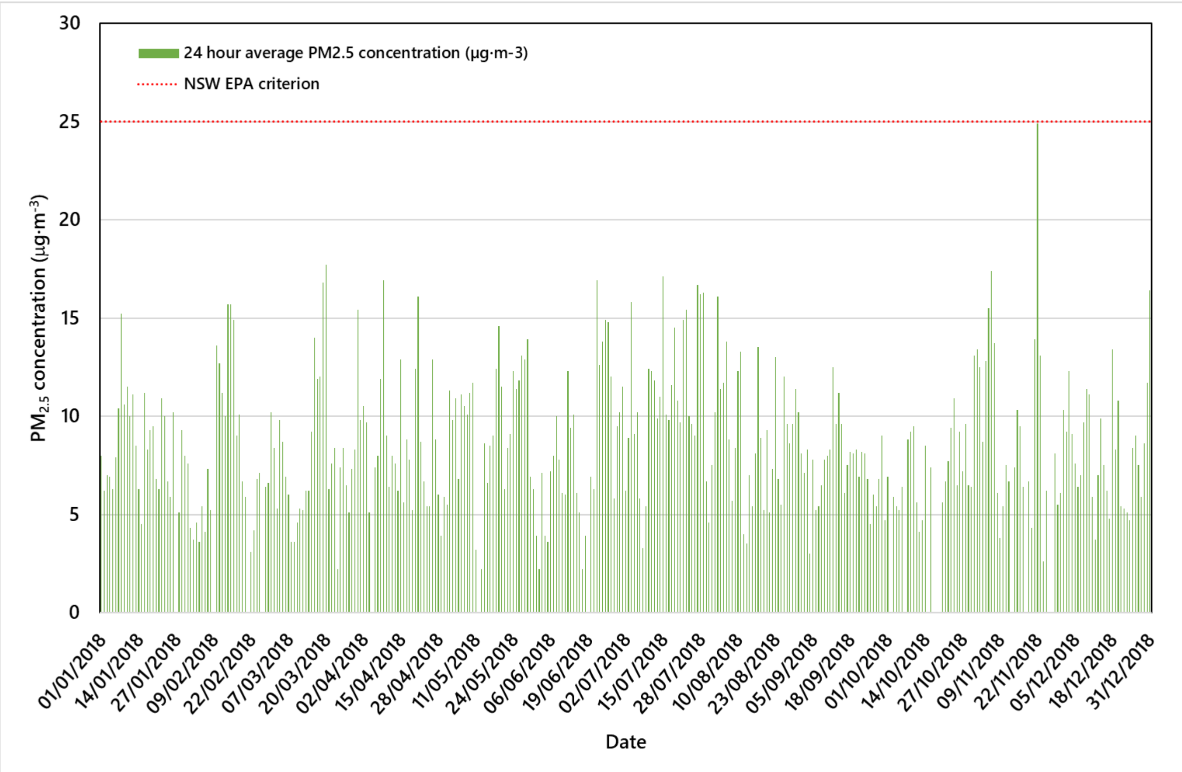


Figure 5 Measured $PM_{2.5}$ concentrations – Beresfield AQMS, 2018

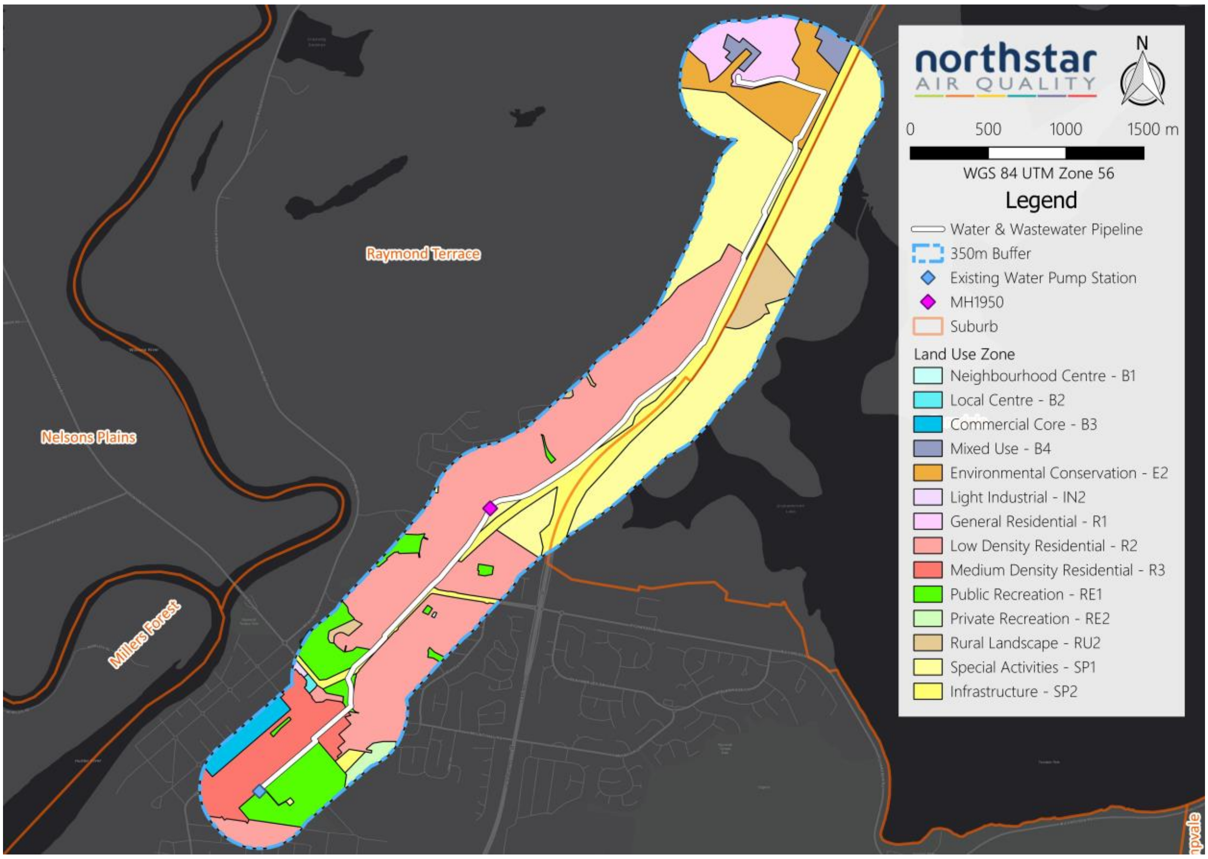


4.2 Surrounding Land Sensitivity

Air quality assessments typically use a desk-top mapping study to identify 'discrete receptor locations', which are intended to represent a selection of locations that may be susceptible to changes in air quality. In broad terms, the identification of sensitive receptors refers to places at which humans may be present for a period representative of the averaging period for the pollutant being assessed (see **Section 3**). Typically, these locations are identified as residential properties although other sensitive land uses may include schools, medical centres, places of employment, recreational areas or ecologically sensitive locations.

Given the linear nature of the Proposal, the selection of individual receptor locations has not been performed. Sensitive receptor areas have been identified based on review of land use zoning in an area within 350 m of the Proposal site (the screening distance discussed in **Section 2.1**). Land use zones included in the Port Stephens Local Environment Plan (2013) (LEP) indicate that a number of residential, commercial and recreational land uses surround the Proposal site and these land uses have been adopted for use within this AQA as presented in **Figure 6**.

Figure 6 Land uses surrounding the Proposal site



4.3 Topography

The elevation of the Proposal site ranges between approximately 3 m to 30 m Australian Height Datum (AHD). The path that a pollutant may take between the source of emission and the point of impact can be altered by the local topography. From the perspective of an AQA, the more 'complicated' the topography (i.e. the greater the vertical range in height over horizontal distance, such as hills and valleys), the more likely pollutant dispersion would be affected by terrain-affected airflow. The topography between the Proposal site and nearest sensitive receptor locations is not considered to be 'complicated' and therefore no further consideration of topographical effects would be required (e.g. through modelling) to support the conclusions drawn from this AQA.

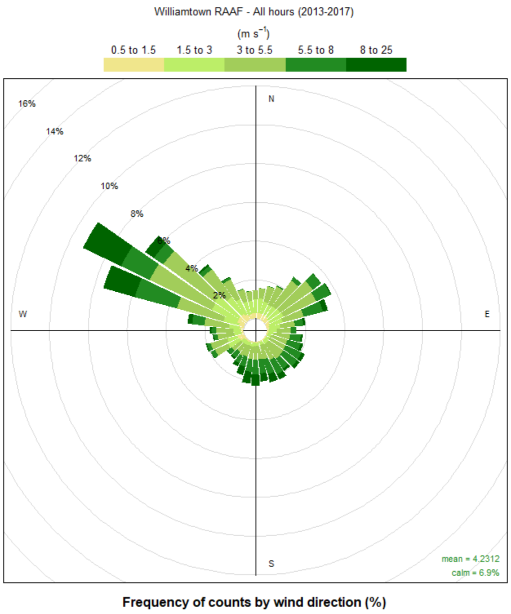
4.4 Meteorology

The meteorology experienced within an area can govern the generation (in the case of wind dependent emission sources), dispersion, transport and eventual fate of pollutants in the atmosphere. The meteorological conditions surrounding the Proposal site have been characterised using data collected by the Australian Government Bureau of Meteorology (BoM) at the closest and most representative station which is Williamtown RAAF Automatic Weather Station (AWS) (Station ID: 061078) which is located approximately 7 km to the southeast of the Proposal site.

The majority of wind speeds experienced at Williamtown AWS over the 5-year period 2013 to 2017, are generally in the range of 1.5 metres per second ($m \cdot s^{-1}$) to 8.0 $m \cdot s^{-1}$ with the highest wind speeds (greater than 8 $m \cdot s^{-1}$) occurring from a north-westerly direction. Winds of this speed are not uncommon, occurring during 9.4 % of the observed hours over the 5-year period at Williamtown AWS. Calm winds (<0.5 $m \cdot s^{-1}$) occur during 6.8 % of hours on average across the 5-year period.

A windrose depicting the wind speed frequency and direction is presented in **Figure 7**.

Figure 7 Annual windrose for Williamtown RAAF AWS (2013-2017)



Maximum temperatures have historically been recorded at Williamtown AWS in January, with a mean maximum temperature between the years 1949 to 2019 of 28.2ºC. The mean minimum temperature has historically been recorded in July, as 6.4ºC.

Mean rainfall generally peaks in June at Williamtown AWS, with an average of 125.2 mm falling. The lowest monthly mean rainfall has historically been experienced in the month of September, with 60.4 mm falling.

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5. METHODOLOGY

5.1 Construction Phase Assessment

Modelling of dust from construction Proposals is generally not considered appropriate, as there is a lack of reliable emission factors from construction activities upon which to make predictive assessments, and the rates would vary significantly depending upon local conditions and the construction management practices employed. In lieu of a modelling assessment, the construction phase impacts associated with the Proposal have been assessed using a risk-based assessment procedure. The advantage of this approach is that it determines the activities that pose the greatest risk, which allows the Construction Environmental Management Plan (CEMP) to focus controls to manage that risk appropriately and reduce the impact through proactive management.

For this risk assessment, Northstar has adapted a methodology presented in the *IAQM Guidance on the Assessment of Dust from Demolition and Construction* developed in the United Kingdom by the Institute of Air Quality Management (Institute of Air Quality Management, 2016)[1].

It is noted that the method does not allow the quantification of impacts and therefore the achievement or exceedance of a criterion value cannot be stated. The method does however present a risk of exceedance, or elevated concentration due the activities performed and allows targeted implementation of measures to reduce that impact/risk.

5.1.1 Impact Assessment

The impact assessment presented in this report is performed in two stages:

- **Step 1: Pre-mitigated impact:** This is used to identify any significant impacts and identify the need for control.
- **Step 2: Control and mitigation:** An examination of what constitutes best practice particulate control.

The impact assessment procedure adopted in this instance uses the outcomes of the following to determine risk of impact:

- **impact magnitude**; and
- **land use sensitivity**.

These terms are defined and discussed in the following subsections.

[1] www.iaqm.co.uk/text/guidance/construction-dust-2014.pdf

5.1.2 Impact Magnitude

Impact magnitude is a descriptor for the predicted scale of change to the air quality environment that may be attributed to the construction of the Proposal, and is evaluated on a scale from 'large' to 'negligible' (see **Table 4**).

The magnitude scale adopted for this assessment has been derived from the UK IAQM construction dust guidance (Institute of Air Quality Management, 2016), which identifies threshold screening distances from construction sites. Consequently, the levels of magnitude have been evaluated by the distance from the Proposal site footprint, whereby a receptor outside of the threshold screening distance of 350 m is considered to have a negligible risk of impact from construction activities. These definitions are considered to be reasonable given the typically larger particle size associated with construction-phase activities, and the rate at which those larger particles are transported and deposited from activities being performed at construction sites.

The impact magnitude is a function of the nature and scale of the activities being performed at the construction site. The impact magnitude category of 'large' has been taken to be associated with major construction works including demolition, earthworks and above ground construction on a significant scale. In this instance, the 'large' magnitude category is not considered to be relevant to the Proposal under assessment and has not been used further, but is presented for information.

Impact magnitude can be effectively managed through employment of good construction practices. It is expected that a range of control measures will be employed at the Proposal site as required.

The criteria and definitions used to categorise potential impact magnitudes in this assessment are defined in **Table 4**.

Table 4 Methodology - impact magnitude

Category	Distance from Proposal alignment	Impact magnitude
Large	<50 m - associated with major construction works	Widespread major short-term exceedance of air quality standards resulting in hospitalisation of members of the public.
Medium	<50 m – all other construction works	Local minor ongoing exceedance of air quality standards. Widespread minor short-term exceedance of air quality standard. Ongoing impacts on wellbeing and air quality complaints.
Small	50-350 m – all other construction works	Isolated and localised exceedance of air quality standards. Short-term impacts of wellbeing. Complaints received about air quality that are resolved within days.
Negligible	>350 m – all other construction works	Air quality standards met at all times

5.1.3 Land Use Sensitivity

Locations may be attributed different sensitivities based on the land use, and may be classified as having high, medium or low sensitivity relative to dust deposition and human health impacts. This scale is derived directly from the UK IAQM construction dust guidance (Institute of Air Quality Management, 2016). The IAQM method provides guidance on the land use sensitivity with regard to dust soiling and health effects and is shown in **Table 5**. It is noted that user expectations of amenity levels (dust soiling) is dependent on existing deposition levels.

Table 5 Methodology – land use sensitivity

Value	High Land Use Sensitivity	Medium Land Use Sensitivity	Low Land Use Sensitivity
Health effects	• Locations where the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for more than 8 hours and up to 24 hours in a day).	• Locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).	• Locations where human exposure is transient.
Dust soiling	• Users can reasonably expect a high level of amenity; or • The appearance, aesthetics or value of their property would be diminished by soiling, and the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods as part of the normal pattern of use of the land.	• Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or • The appearance, aesthetics or value of their property could be diminished by soiling; or • The people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land.	• The enjoyment of amenity would not reasonably be expected; or • Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or • There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land.

Specific to this assessment each land use identified (see **Section 4.1** for more detail) has been given a land use sensitivity in **Table 6** according to the table above. Similar land uses have been amalgamated for ease of reference.

Table 6 Land use sensitivity surrounding the Proposal site

Land Use	Value
Residential (Low, General & Medium)	High
Public & Private Recreation	Medium
Environmental Conservation	Medium
Neighborhood Centre, Local Centre, Commercial Core, Mixed Use	Medium

Land Use	Value
Light Industrial	Medium
Rural Landscape	Low
Special Activities & Infrastructure	Low

5.1.4 Methodology - Land Use Risk

The risk matrix constructed from the impact magnitude and the land use sensitivity is presented in **Table 7**.

Table 7 Methodology - risk

Category		Impact Magnitude			
		Large	Medium	Small	Negligible
Land Use Sensitivity	High	High Risk	Medium Risk	Low Risk	Negligible
	Medium	Medium Risk	Medium Risk	Low Risk	Negligible
	Low	Low Risk	Low Risk	Negligible	Negligible

5.2 Operational Phase Assessment

The operational phase assessment examines the potential sources of emission and provides controls to manage any associated risks. Given that the majority of impacts are anticipated to be experienced during the construction phase, this approach is considered to be appropriate.

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6. ASSESSMENT

6.1 Construction Phase Assessment

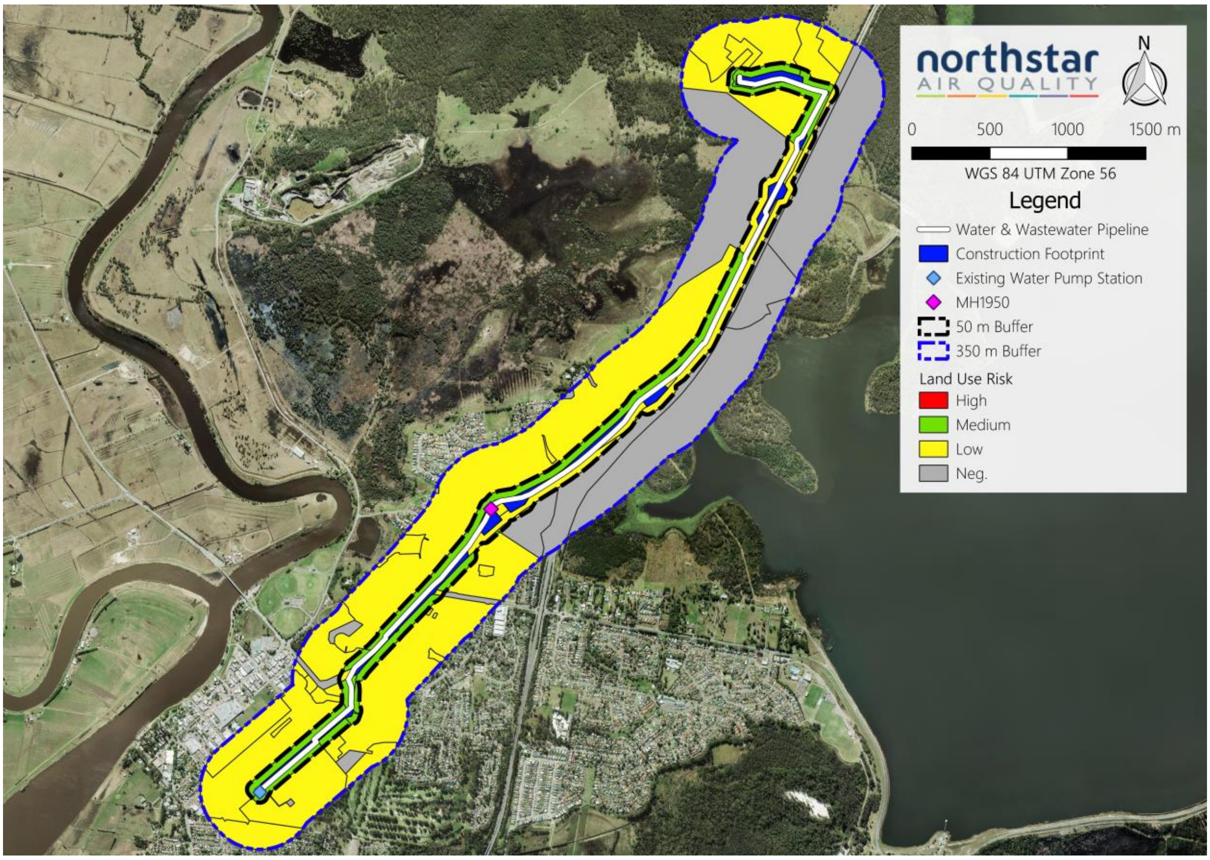
The following represents the impact assessment that is used to identify the risk associated with construction activities without any supplementary mitigation and identify the type and nature of controls that are required to be applied to avoid unreasonable emissions of particulates.

It is noted that the screening distance of 350 m applied to the construction activities at the Proposal site include earthworks, transport and construction, including construction of the WWPS.

6.1.1 Pre-Mitigated Risk

The impact magnitudes for the various distances from the construction alignment are described in **Table 4** and the sensitivity of the identified land uses within 350 m of the Proposal site are classified according to **Table 6**. The resulting risk of air quality impacts (without mitigation) is calculated as outlined in **Table 7** and presented in **Figure 8**.

Figure 8 Risk of air quality impacts from construction activities



Note: No colour shading = negligible impact magnitude (>350m).

The preliminary risk assessment illustrated in **Figure 8** indicates that with no mitigation measures there is a *medium* to *negligible risk* of human health and dust soiling (amenity) impacts associated with construction phase activities at all distances from the Proposal site. This preliminary risk assessment is used to identify appropriate construction-phase mitigation controls to be applied to those activities during the construction phase.

Analysis of the alignment shows that the majority intersects with land uses associated with *medium* and *low risk* construction activities. Following a review of the mitigation measures related to *low risk* construction activities, it is considered that the application of control measures associated with *medium risk* sites would be equally appropriate. Additionally, the application of a consistent set of controls along the entire alignment would ensure that the CEMP can be more easily adopted and followed by contractors as construction along the alignment progresses.

6.1.2 Dust Control and Management

The following represents a selection of mitigation measures recommended by the IAQM methodology for the criteria stated above. Those clearly not relevant have been removed.

Table 8 lists the relevant mitigation measures identified, and have been presented as follows:

- **N** = not required (although they may be implemented voluntarily).
- **D** = desirable (to be considered as part of the CEMP, but may be discounted if justification is provided).
- **H** = highly recommended (to be implemented as part of the CEMP, and should only be discounted if site-specific conditions render the requirement invalid or otherwise undesirable).

Table 8 Site-specific management measures

Identified Mitigation		Unmitigated Risk
1	Site Management	Medium
1.1	Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the relevant regulatory bodies. This may be incorporated into the broader Construction Environmental Management Plan (CEMP) for the Proposal.	H
1.2	Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.	H
1.3	Make the complaints log available to the local authority when asked.	H
1.4	Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book.	H
2	Monitoring	Medium
2.1	Undertake daily on-site and off-site inspections where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of site boundary.	D
2.2	Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.	H
2.3	Agree dust deposition, dust flux, or real-time continuous monitoring locations with the relevant regulatory bodies. Where possible commence baseline monitoring at least three months before work commences on site or, if it a large site, before work on a phase commences.	H
3	Preparing and Maintaining the Site	Medium
3.1	Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.	H
3.2	Erect solid screens or barriers around dusty activities or the site boundary that they are at least as high as any stockpiles on site.	H
3.3	Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below	H
3.4	Cover, seed or fence stockpiles to prevent wind erosion	H

Identified Mitigation		Unmitigated Risk
4	Operating Vehicle/Machinery and Sustainable Travel	Medium
4.1	Ensure all on-road vehicles comply with relevant vehicle emission standards, where applicable	H
4.2	Ensure all vehicles switch off engines when stationary - no idling vehicles	H
4.3	Avoid the use of diesel or petrol-powered generators and use mains electricity or battery powered equipment where practicable	H
4.4	Impose and signpost a maximum-speed-limit of 25 $km \cdot h^{-1}$ on surfaced and 15 $km \cdot h^{-1}$ on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate	D
5	Operations	Medium
5.1	Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems	H
5.2	Ensure an adequate water supply on the site for effective dust/particulate matter suppression/ mitigation, using non-potable water where possible and appropriate	H
5.3	Use enclosed chutes and conveyors and covered skips	H
5.4	Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate	H
5.5	Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.	H
6	Waste Management	Medium
6.1	Avoid bonfires and burning of waste materials.	H
7	Measures Specific to Construction	Medium
7.1	Avoid scabbling (roughening of concrete surfaces) if possible	D
7.2	Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.	H

Identified Mitigation		Unmitigated Risk
7.3	Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.	D
7.4	For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust	D
8	**Measures Specific to Track-Out**	**Medium**
8.1	Use water-assisted dust sweeper(s) on the access and local roads to remove, as necessary, any material tracked out of the site.	H
8.2	Avoid dry sweeping of large areas.	H
8.3	Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.	H
8.4	Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.	H
8.5	Record all inspections of haul routes and any subsequent action in a site log book.	H
8.6	Ensure hard surfaced haul routesare regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.	H
8.7	Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).	H
8.8	Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.	H

Notes D = desirable (to be considered), H = highly recommended (to be implemented), N = not required (although can be voluntarily implemented)

6.1.3 Residual Consequence

For almost all construction activity, the adapted methodology notes that the aim should be to prevent significant effects on receptors through the use of effective mitigation and experience shows that this is normally possible.

Given the size of the Proposal area, the distance to sensitive receptors and of the activities to be performed, residual risks associated with fugitive dust emissions from the Proposal post-mitigation are anticipated to be 'negligible'.

6.2 Operational Phase Assessment

Impacts during the operational phase are likely to be associated with maintenance works along the water and wastewater pipeline, and the ongoing operation of the WWPS.

Impacts associated with maintenance works are likely to be highly localised, short-term and minor in nature. These impacts can be managed through the implementation of a selection of the most appropriate mitigation measures outlined in **Section 6.1.2**.

Impacts associated with the operation of the WWPS would be related to odour emissions from the pump well (wet well), valve pit and any educt ventilation stacks associated with the WWPS. Hunter Water Corporation (HWC) standard design for wet well and pit covers is for these to be 'gas-tight' (Hunter Water Corporation, 2009). Emissions of odour from the gas-tight covers are therefore anticipated to be negligible/zero.

With regard to odour control in WWPS, HWC (Hunter Water Corporation, 2008) state that:

> *"Where natural venting is unacceptable, due to visual aesthetics or the likelihood of unacceptable levels of offensive odours, consideration should be given to the installation of odour control equipment such as soil absorption beds with forced air removal. Such units strip out the offensive odours and the remaining air may be vented to the atmosphere. This control is recommended wherever the size of incoming sewer exceeds 600 mm and may be justified in many smaller situations. The soil beds must be of sufficient size to deal with the expected air quantities and replacement of the soil bed media may be found necessary depending on the actual concentrations of hydrogen sulphide passed through the soil bed. Odour control systems may be either a bypass to the wet well extraction system or a separate system. Odour control systems should have an air flowrate of 4 to 6 well volume air changes per hour and be controlled by a time switch."*

Based on the above, and given that the exact location of the WWPS has yet to be determined, any odour emitted through the educt ventilation stack can be appropriately managed to ensure that impacts on the surrounding community would be below the odour criterion outlined in **Section 3**.

7. MITIGATION AND MONITORING

7.1 Air Quality

7.1.1 Construction Phase

Based on the findings of the construction phase air quality assessment, with no mitigation measures there is a *low risk* to *medium risk* of human health and adverse dust soiling (amenity) effects associated with construction phase activities.

A range of mitigation and management measures are presented in **Section 6.1.2**, which would result in the risks associated with construction to be reduced to *'negligible'*.

Given the potential scale of impacts, air quality monitoring is not proposed, but may be performed to provide assurances to the community that the impacts are as predicted within this assessment.

7.1.2 Operational Phase

Operational phase emissions associated with maintenance activities are anticipated to be minimal. The mitigation and management measures identified for the construction phase can be applied during maintenance activities on the pipelines, especially where invasive access is required (i.e. removal of earth to allow access).

Emissions of odour associated with the WWPS can be managed through the implementation of Hunter Water guidelines. The wet well and pit covers should be gas-tight, and appropriate odour control should be applied to ensure that any odours through the educt ventilation stacks are minimised.

Ongoing monitoring is not proposed, although an air quality (including odour) complaints log should be kept to allow identification of any issues which may arise and require rectification.

8. CONCLUSION

Resonate Consultants (Resonate) has engaged Northstar Air Quality Pty Ltd (Northstar) on behalf of Kings Hill Development Pty Ltd (KHD) to perform an air quality assessment for the proposed construction and operation of a water and wastewater supply pipeline and a wastewater pumping station. The pipelines and wastewater pumping station are planned to support the development of the Kings Hill Urban Release Area in Raymond Terrace, NSW.

This air quality assessment forms part of the Environmental Impact Statement which seeks approval for the Proposal as Designated Development under Part 4 of the *Environmental Planning and Assessment Act* 1979.

The air quality assessment presents an assessment of the impacts of the proposed construction and operation of the Proposal.

Potential construction impacts have been assessed using a published risk-based assessment methodology that has been adapted to reflect the specific operations of the Proposal. The assessment indicates that a range of mitigation measures can be applied during the construction phase to ensure that the risks (both health and amenity) to the surrounding community would not be significant.

The potential for air quality impacts during the operational phase have been identified to be minor, and easily controlled through the implementation of a range of measures and best practice techniques.

Based on the assessment provided, it is respectfully suggested that the Proposal should not be rejected on the grounds of air quality.

9. REFERENCES

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APPENDIX A

Report Units and Common Abbreviations

Units Used in the Report

All units presented in the report follow the International System of Units (SI) conventions, unless derived from references using non-SI units. In this report, units formed by the division of SI and non-SI units are expressed as a negative exponent, and do not use the solidus (/) symbol. For example:

50 micrograms per cubic metre would be presented as 50 $\mu g \cdot m^{-3}$ and not 50 $\mu g/m^3$; and,
0.2 kilograms per hectare per hour would be presented as 0.2 $kg \cdot ha^{-1} \cdot hr^{-1}$ and not 0.2 kg/ha/hr.

Table A1 Common Abbreviations

Abbreviation	Term
AADT	annual average daily traffic
ABS	Australian Bureau of Statistics
ACH	air changes per hour
AHD	Australian height datum
AQA	air quality assessment
AQMS	air quality monitoring station
AWS	automated weather station
BoM	Bureau of Meteorology
°C	degrees Celsius
CO	carbon monoxide
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCP	Development Control Plan
DPE	NSW Department of Planning and Environment
EETM	emission estimation technique manual
EPA	Environmental Protection Authority
F	fluoride
FEL	front end loader
GDA	Geocentric Datum of Australia
GHG	Greenhouse gas
GIS	geographical information system
HCL	hydrogen chloride
HF	hydrogen fluoride
K	kelvin (-273°C = 0 K, ±1°C = ±1 K)
kW	kilowatt
MGA	Map Grid of Australia

Abbreviation	Term
$mg \cdot m^{-3}$	milligram per cubic metre of air
$mg \cdot Nm^{-3}$	Milligram per normalised cubic metre of air
$\mu g \cdot m^{-3}$	microgram per cubic metre of air
NCAA	National Clean Air Agreement
NEPM	National Environment Protection Measure
NO	nitric oxide
NO_X	oxides of nitrogen
NO_2	nitrogen dioxide
O_3	ozone
ODT	odour detection level
OEH	NSW Office of Environment and Heritage
OIA	odour impact assessment
OU	odour Unit
Pa	Pascals
PM	particulate matter
PM_{10}	particulate matter with an aerodynamic diameter of 10 µm or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 µm or less
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SEE	Statement of Environmental Effects
SO_X	oxides of sulphur
SO_2	sulphur dioxide
SSD	State Significant Development
STP	standard temperature and pressure (273.15 K, 101.3 kPa)
TAPM	The Air Pollution Model
TPM	total particulate matter
TSP	total suspended particulates
US EPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
VKT	vehicle kilometres travelled
VOC	volatile organic compounds