CAIRNS SHIPPING DEVELOPMENT PROJECT

Revised Draft Environmental Impact Statement

APPENDIX AW: Tingira Street Air Quality Impact Assessment

ACOUSTICS & AIR QUALITY

ASK Consulting Engineers Pty Ltd
ABN: 55 622 586 522 ACN: 128 491 967
PO Box 3901 South Brisbane QLD 4101
P: 07 3255 3355   F: 07 3844 7180
www.askconsulting.com.au
mail@askconsulting.com.au

Cairns Shipping Development Project Revised Draft EIS

Stiff Clay DMPA: Air Quality Impact Assessment

Report: 8483R04V03_Stiff Clay DMPA_Air Quality Impact Assessment.docx

Prepared for:

Ports North

22 June, 2017

Document Control				
W:\8400\8483\ASKout\R04 Tingira Air\8483R04V03_Stiff Clay DMPA_Air Quality Impact Assessment.docx				
Document Ref	**Date of Issue**	**Status**	**Author**	**Reviewer**
8483R04V01	8 June, 2017	Final	AM / MY	MY / AM
8483R04V02	21 June, 2017	Clarifications	AM	MY
8483R04V03	22 June, 2017	Clarifications	AM	MY

Document Approval			
Author Signature		Approver Signature	
Name	Andrew Martin	Name	Andrew Martin
Title	Air Quality Manager	Title	Air Quality Manager

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1. Introduction

1.1 Overview of this Assessment

ASK Consulting Engineers Pty Ltd (ASK) was commissioned by Flanagan Consulting Group to provide air quality consultancy services to describe the impacts of the revised Cairns Shipping Development Project (CSD Project) for the Revised Draft Environmental Impact Statement (EIS). ASK has separately provided the air quality impact assessment for the main project and soft clay placement area at Northern Sands (8483R03V01) for the revised EIS.

This report provides the impact assessment of the stiff clay dredged material placement area (DMPA) to be located at Tingira Street, Portsmith. It includes assessment of the existing air quality and the impacts of placement of stiff clay dredge material at the site (operation of the DMPA) together with impact minimisation, mitigation and management strategies.

Stiff clays are to be dredged by a backhoe dredger to split hopper barges for transport to the Tingira Street DMPA. It is expected that the stiff clay DMPA will operate 24 hours per day.

To aid in the understanding of the terms in this report a glossary is included in **Appendix A**.

2. Study Area Description

2.1 Identification of Existing Sensitive Receptors

Sensitive land uses are defined in the State Planning Policy (2014) as caretakers accommodation, child care centre, community care centre, community residence, detention facility, dual occupancy, dwelling house, dwelling unit, educational establishment, health care services, hospital, hotel, multiple dwelling, non-resident workforce accommodation, relocatable home park, residential care facility, resort complex, retirement facility, rooming accommodation, rural workers accommodation, short-term accommodation or tourist park.

The only sensitive receptor near the DMPA is the Great Barrier Reef International Marine College, which is located at the northern end of the property that includes the DMPA as shown in **Figure 2.1**.

Other buildings between the two placement areas and in close proximity to the northern placement area are occupied by Australian Maritime Safety Authority (AMSA), Maritime Safety Queensland, Queensland Police Service (Water Police) and Queensland Parks and Wildlife Service. Whilst these activities are not defined as sensitive, they are in close proximity so it is appropriate to mitigate any potential nuisance using good practice dust and odour control measures.

Figure 2.1 Location of Sensitive Receptor in Tingira Street DMPA Area (Image from Google Earth Pro)

3. Proposed Development

3.1 Project Definition (provided by Flanagan Consulting Group)

The CSDP will require the land based placement of approximately 900,000m^3 soft clays and up to 100,000m^3 stiff clay material at separate Dredge Material Placement Areas.

The soft clays are proposed for placement in the Northern Sands DMPA which is not part of this work scope. The stiff clays are proposed to be placed at Port North's Tingira Street property which has been progressively reclaimed (**Figure 3.1**).

It is proposed that the stiff clays will be transferred to shore in split hopper barges via a temporarily moored barge mounted excavator servicing heavy haulage vehicles at the barge ramp adjacent to the northern placement area; minor earthworks including temporary piles may be necessary at the ramp to facilitate unloading.

3.2 Details of the Project Relevant to Air Quality

3.2.1 Overview of Air Emission Sources

Construction sources include:

- wind-blown dust from exposed soil at DMPA
- the backhoe dredger working at select channel locations and movement of barges and tugs between the dredge and the off loading points (Tingira St)
- material handling by land based plant and equipment to remove material from barges at the off loading points and transport to the Tingira St DMPA
- construction and placement activities at the Tingira St DMPA.

Section B11.5.2 of the draft EIS describes the substantial construction and operational sources. It is understood that no haulage or fill will be required for the project.

Dredging and DMPA operation are likely to be 24 hours per day seven days per week for approximately four to five weeks.

A plan of the Tingira Street DMPA is shown in **Figure 3.1**.

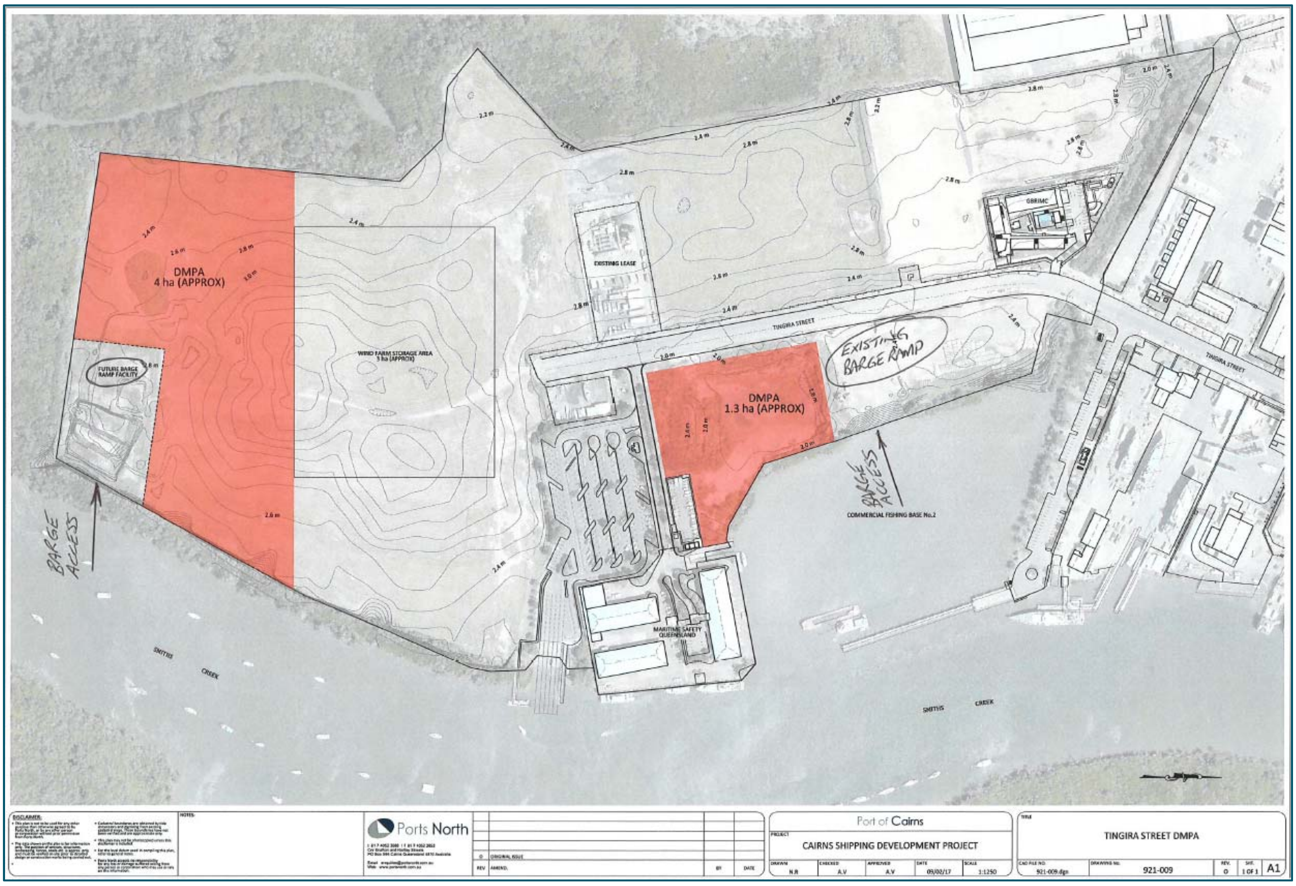

Figure 3.1 Plan of Tingira Street DMPA

3.2.2 Acid Sulphate Material

As reported by Akuna (2017), the majority of potential acid sulphate material (PASS) is classified as self-neutralising. The total quantity of other PASS material is estimated as 320,000 m^3. This material will be dredged as the first priority so that is can be covered with self-neutralising PASS.

3.2.3 Details of Stiff Clay Dredging Activities

The Tingira Street DMPA will consist of two areas of port land previously reclaimed by Ports North at the southern end of Tingira Street, Portsmith. The site is located on the southern boundary of an industrial area within Strategic Port Land, abutting Smiths Creek to the east and a mangrove system to the west.

The Tingira Street DMPA will consist of the following elements:

- Two land parcels with a total area of approximately 5 hectares serviced by an existing northern barge loading ramp.
- Temporary barge mooring piles may be necessary at the barge landing ramp
- Placed material to a depth of approximately 1.5 metres under RPEQ supervision incorporating a self-draining surface with geotechnically stable batters and appropriate erosion and sediment control, as identified in the Site Preparation and Chapter C1 (Post Placement Management Plan).

The stiff clay dredge material will be placed as engineered fill over previously consolidated dredged material. Material will be barged to the smaller northern area of the Tingira Street DMPA where it will be transferred by crane or excavators to heavy vehicles for short hauling to each placement area. No bunding is proposed. There will be no tailwater discharge needed from the Tingira Street DMPA. General hours of work are to be 14 x twelve hour shifts per week.

3.2.4 DMPA Equipment

The equipment envisaged on-shore at the DMPA is:

- 180' spudded flat top barge with ramp
- unloading excavator such as a Hitachi ZX870 (Bucket Capacity = 5.0m^3) 10 hours per shift
- three dump trucks such as Cat 745C (Capacity 45 tonnes) 10 hours per shift
- one dozer such as Cat D6T LGP 10 hours per shift
- one grader such as Cat 12M 3 -4 hours per shift
- one water truck 6 - 8 hours per shift.

3.2.5 Off-shore Equipment

The equipment envisaged off-shore is:

- one backhoe dredge such as a Machiavelli De Donge 'D'Type with Bucket capacity = 4.5m^3 and engine between 700 to 1000 kW
- two non-propelled 1200m^3 split hopper barges (with 425 hp Cummins QSM11 engine for manoeuvring)
- two tug boats such as the PT May and PT Mary twin screw 17 tonne bollard pull, 2 x Cummins KTA-19-M3 engines (447kW each) with fuel consumption of 4 m^3/day
- One 25T Bollard Pull type tugboat (e.g. with two Cummins KTA19M engines 900 HP) will operate the sweep bar/plough, day time only.

The dredge and associated equipment will operate in 14 x 12-hour shifts per week. A typical program will be:

- barge loading time: 3.8 hours (continuous operation)
- average transit time (dredge to unloading facility): 1 hour
- barge unloading time: 4.8 hours (continuous operation)
- average transit time (unloading facility to dredge): 1 hour.

The estimated volume of material per 12-hour shift (dredged, transported to unloading facility, unloaded, trucked and placed) is 1,500 m^3. 100,000 m^3 of stiff clay is to be removed (90,000 by backhoe and 10,000 by drag bar). The drag bar is to work 170 hours (2 to 3 weeks @ 10 hours per day) and the backhoe 300 hours (2 to 3 weeks @ 20 hours per day). The total working duration is to be 4 to 5 weeks. A typical program with two barges is 4 hours of loading, one hour of towing and five hours of unloading.

3.3 Mitigation Inherent in Design

3.3.1 Construction

The air quality assessment assumes that the following measures are to be included in the detailed Contractors Construction Environmental Management Plan and are inherent in the proposal:

- Dust and wind will be monitored on site and work that may generate dust will cease or be subject to mitigation or corrective actions if strong winds occur.
- All project personnel and relevant sub-contractors will receive training in air quality control practices at induction, toolboxes and targeted training for specific activities.
- Water carts, sprinklers, sprays and dust screens will be used where appropriate to control dust emissions from exposed surfaces and dust generating activities at a frequency appropriate to conditions.

- Rumble grids and coarse aggregate will be installed at exit roads to prevent soil being deposited onto public roads. Manual cleaning of vehicles and roads will be conducted as required.
- Waste will be segregated and collected regularly to control odours.
- Construction equipment including dredging vessels will be properly maintained to ensure exhaust emissions comply with relevant standards.

4. Summary of Air Quality Values and Criteria

The air quality values and criteria have been discussed in the baseline air quality assessment (ASK 2016. Those criteria adopted for the assessment are summarised in **Table 4.1**.

Table 4.1 Adopted Criteria for this Assessment

Air Quality Indicator	Period	Criteria (µg/m^3)
benzene	1 year	10
benzo(a)pyrene	1 year	0.3 ng/m^3
CO	8 hours	11,000 [2]
formaldehyde	1 day	54
NO_2	1 hour	250 [2]
	1 year	62
$PM_{2.5}$	1 day	25
	1 year	8
PM_{10}	1 day	50 [1]
sulfur dioxide	1 hour	570
	1 day	230
	1 year	57
toluene	30 minutes	1100
	1 day	4100
	1 year	410
TSP	1 year	90
xylenes	1 day	1,200
	1 year	950
odour from fugitives	99.5% 1 hour	2.5 ou
dust deposition	1 month	120 mg/m^2/day

Notes:

1. *Five allowable exceedances are currently allowed although the intent of this was to cater for regional events.*
2. *Allowance is made to exclude one day.*

5. Impact Assessment Methodology

5.1 TAPM Meteorological Modelling

The meteorological component of The Air Pollution Model (TAPM) was used to provide wind fields over the region. Wind speed and direction has been monitored at the Cairns airport and this data was assimilated into the modelling. No other site specific meteorological data is publicly available for the vicinity.

Detailed configuration of the model is described in ASK 2016 (report 8434R01V01).

5.2 Calmet Modelling Configuration.

Calmet modelling of the wharf and inner channel domain was undertaken previously as described in the baseline air quality study (ASK 2016) .

6. Existing Air Quality

6.1 Air Emission Sources in the Vicinity

Existing wharf and shipping operations are discussed in ASK 2017 (report 8434R03V01).

A Hastings asphalt plant is situated across Tingira Street from the northern DMPA area. This will contribute odour to the local air quality. However the odour will have a petrochemical character different to the sulphur character from dredged material.

Tingira Street is close to the tidal mudflat areas of Trinity Inlet. Hence the background concentrations of odour associated with inter-tidal areas will be moderate. This odour will have similar character to emissions from dredged material. This may have two potential outcomes:

- Hydrogen sulphide is known to cause desensitivity of the olfactory senses more than other odorous gases. Thus this background odour may desensitise locals to odour from dredged material and reduce its impacts.
- Background odour and DMPA odour may occur at different times of day and the frequency of odour impacts may therefore increase.

6.2 Background Ambient Air Quality

The air quality values and criteria in the region have been discussed in ASK (2016). The expected background air quality for key pollutants has been summarised with the estimated concentrations listed in **Table 6.1**. These are well within the criteria contained in **Table 4.1**.

Table 6.1 Existing and Projected Background Air Quality

Pollutant	Averaging period	Assumed Background (µg/m^3)
TSP	1 year	24
PM_{10}	24 hours	18
$PM_{2.5}$	24 hours	6.7
	1 year	5.8
NO_2	1 hour	30
	1 year	9
CO	8 hours	2.2
Benzene	1 year	5
Toluene	24 hours	12
	Annual average	6
Xylene	24 hours	79
	Annual average	44
Formaldehyde	24 hours	5
Dust deposition	Annual average	50 mg/m^2/day

7. Pollution Modelling Methodology

7.1 Overview

Modelling of dispersion of pollutants was conducted with Calpuff using the same domain and configuration used for shipping emissions as described in ASK 2017 (report 8434R03V01). Modelled emission sources are summarised in **Table 7.1**, **Table 7.2** and **Table 7.3**. The point sources backhoe dredger and barges were modelled to be constantly emitting. The backhoe dredger and barge point sources were assumed to be loading stiff clay relatively close to the wharves as a worst case assumption while the other barge point source was assumed to be unloading near Tingira St as shown in **Figure 7.1**.

Table 7.1 Dredging point sources

Source	Easting (m) WGS84	Northing (m) WGS84	Base elevation (m)	Release height (m)	Exit temperature (°C)	Diameter of stack (m)	Exit velocity (m/s)
Backhoe dredger	370296	8128096	0	20	300	0.5	8
Barge	370283	8128054	0	15	300	0.2	8
Barge	369238	8125526	0	15	300	0.2	8

The barges and tugs were also modelled as buoyant area sources emitting every 5 and 6 hours alternating which represents the transit of the pair between the backhoe dredger and Tingira St DMPA. The drag bar was also modelled as buoyant area sources constantly emitting between 7am to 7pm, while the TSHD was modelled as constantly emitting 24 hours per day moving over the length of the channel.

Table 7.2 Dredging buoyant area sources

Source	Effective height of emission (m)	Elevation of ground (m)	Exit temperature (°C)	Effective rise velocity (m/s)	Effective radius (m) for rise calculation	Initial vertical spread (m)
Barges, and tugs and drag bar	7.5	0	300	8	0.1	2.8
TSHD	10	0	300	8	0.25	5.1

The land emission sources near Tingira Street were modelled to be emitting 24/7.

Table 7.3 Land construction sources

Source	Source Type	Easting (m) WGS84	Northing (m) WGS84	Base elevation (m)	Release height (m)	Initial horizontal spread (m)	Initial vertical spread (m)
Dozer	Volume	369167	8125440	5	2.5	40	9.3
Unpaved road	Volume	369168	8125158	5	4	100	23.3
Grader	Volume	369168	8125158	5	2	100	23.3
Excavator	Volume	369156	8125532	4	5	20	4.7
DMPA (wind erosion)	Area	-	-	5 and 6	1.5	-	1.9

Figure 7.1 Modelled sources and channel/dredge path centreline

7.2 DMPA Emission Inventory

7.3 Emission Inventory Calculations for Particulates

The emission rates entered into the dispersion modelling are based on the activity and source information provided by Ports North.

7.4 Dust Control Measures

Emission controls proposed to be used to reduce particulate emissions that have been included in the dispersion modelling are presented in **Table 7.4**.

Table 7.4 Dust Emission Controls

Emission Source	Control(s) Utilised	Control Efficiency Applied
Vehicles on surfaces	Water truck spraying trafficable surfaces	75%
Excavator	Water sprays during dry, windy conditions	75%

7.5 Building Downwash

Building downwash was modelled using the BPIP processor and the Prime algorithm since the length to width ratio of the buildings were less than 10. Buildings included were:

- Backhoe dredger with 15 metre height
- Barges with 10 metre height.

7.6 Nitrogen Dioxide Modelling

7.6.1 Overview

Most of the NO_x emitted by combustion engines are in the form of nitric oxide (NO). This reacts with other gases in the atmosphere to form NO_2. Because the fraction of NO_2 emitted by vehicles is highly dependent on the configuration of each individual vehicle, emission factors are only available as NO_x.

A typical proportion of NO_2 in urban airsheds during peak concentration events is 20%. This includes both regional sources and local sources. The contribution from regional sources would have built up over a longer time period i.e. NO emissions would have had substantial time to react to form NO_2. In a rural environment, the proportion would be lower.

The rate of conversion from NO to NO_2 is related to a large number of factors. The most critical are ozone concentration, hydrocarbon concentration and the amount of sunlight, which increases the rate of the reverse reaction. Both hydrocarbons and ozone can be responsible for oxidising NO to form NO_2. Generally, the conditions that favour NO_2 formation are when ozone concentrations are high and sunlight low. This scenario could occur in the late afternoons following a clear day. In rural areas, ozone concentrations are low, so NO_2 formation is not favoured.

As a guide, under worst conditions, ozone can oxidise approximately 5% of NO in 10 minutes. Oxidation by hydrocarbons is more dependent on pre-existing quantities of different species. Over time periods longer than 10 minutes, polluted air will be substantially mixed with the regional background air.

7.6.2 Janssen Method

The Janssen Method (Middleton et al 2007) is a popular technique for estimating conversion of nitrogen oxides to NO_2 downwind of a source. It is based on aircraft-based measurements taken downwind of power stations. The Janssen equation is as follows:

$$\frac{NO_2}{NO_x} = A(1 - e^{-\alpha x})$$

Where the values of A and α are presented in Janssen et al (1988) and varies according to ozone concentration, wind speed and season of the year, and x is the distance travelled by the plume.

7.6.3 Conversion Relevant to this Study

The Janssen Method was used in this assessment as the sources are similar to power stations which are applicable to this method.

Typical ozone concentrations in Brisbane are 20 ppb. Using the factors for spring/autumn and ozone concentration between 10-20ppb, and distance of 2,000 metres, the Jansenn method gives a NO_2 to NO_X ratio of 0.115. This calculated ratio has been used in the assessment of NO_2 concentrations. A distance of 2,000 metres has been chosen for conservatism and also because the closest distance that Janssen et al. (1988) could practically measure the plume to determine the best value of α was between 1 to 2 kilometres.

7.7 Calpost Processing

To calculate 30 minute averages from one hour averages, the power law was used:

$$C_p / C_m = A\left(T_m / T_p\right)^p$$

where C_p = peak concentration;
C_m =mean hourly average concentration;
T_m = mean time of 60 minutes;
T_p = peak time of 30 minutes;
A = constant close to unity;
p = coefficient ranges from 0.15 for volume sources up to 0.4 for tall stacks.

For A=1 and p = 0.3, the ratio for converting 60 minutes to 30 minutes is 1.2.

8. Qualitative Assessment

8.1 Odour from Dredging, Placement and Tailwater

According to EPA (2001), odour from anaerobic sediments from dredging is rarely more than a temporary problem. When first discharged it is initially anaerobic and may smell, but the smell is lost within a few days of its exposure to air.

Odour is also associated with hydrogen sulphide (H_2S) released from acid sulphate materials. Sulphur varies according to soil texture as listed in **Table 8.1**.

Table 8.1 Oxidisable Sulphur Typical of Soil Textures

Sediment texture	Oxidisable Sulphur (% dry basis)
Sandy to loamy sands	0.03
Sandy loams to light clay	0.06
Medium to heavy clays and silty clays	0.1

Note: 1. Source is EPA (2007).

Soft silty clay has potential to form H_2S as a by-product of the oxidation of pyrite. If that material is drained, it will be readily oxidised. However, stiff clay from the older sediments that will be raised by the backhoe dredge has lower potential for H_2S formation than the soft clays. It is anticipated that this will have less odour than mangrove mud. However it will still vary spatially, requiring ongoing monitoring by personnel to ensure that soft clays are not accepted by the backhoe dredge.

9. Dispersion Modelling Results

The predicted concentrations at the sensitive receptor (the Marine College) are shown in **Table 9.1** along with the criterion. The estimated background levels are shown in the tables separately but have not been added to the predicted concentrations shown.

Although the sensitive receptor was modelled at two heights (at ground level and at 4.5 metre height), the predicted concentrations at the two receptor heights were similar. Thus, only the results at ground-level are presented.

Concentrations provided in tabular form are a prediction at a point in space and hence more accurate than contours, which are graphical interpolations.

For haul roads, dozer and grader, a control factor of 75% has been applied to the result. This is based on the following factors relevant to the dominant emission sources (Environment Australia 2012):

- The standard wind erosion equation assumes no wind erosion on days with greater than 0.25 millimetres of rain, whereas the model used in this report assumed no rain.
- The control factor for hauling is doubled for a higher level of watering.
- Loading and unloading of trucks with wet dredge material was not included in the dust emissions due to the high degree of water present.

Table 9.1 Predicted Concentrations

Pollutant	Averaging period	Modelling prediction at sensitive receptor (µg/m^3)	Background (µg/m^3)	Cumulative Impact (µg/m^3)	Criterion (µg/m^3)
TSP	1 year	13	24	37	90
PM_{10}	24 hours	19	18	37	50
$PM_{2.5}$	24 hours	13	6.7	20	25
	1 year	2.6	5.8	**8.4**	8
NO_2	1 hour	201	30	231	250
	1 year	10	9	19	62
CO	8 hours	254	2.2	256	11,000
Benzene	1 year	0.06	5	5	10
Toluene	30 minutes	0.05	-	0.05	1,100
	24 hours	0.008	12	12	4,100
	Annual average	0.0009	6	6	410
Xylene	24 hours	0.005	79	79	1,200
	Annual average	0.0006	44	44	950
Formaldehyde	24 hours	5	5	10	54
Dust deposition	One month	66 mg/m^2/day	50 mg/m^2/day	116 mg/m^2/day	120 mg/m^2/day

The cumulative impact is assessed by adding the background to the predicted values provided in the data tables.

The cumulative (including background) annual average $PM_{2.5}$ at the sensitive receptor is 8.4 µg/m^3, slightly exceeding the criterion of 8 µg/m^3. It should be noted that the modelled activities at Tingira St DMPA would only occur for approximately 30 days and has been modelled to be occurring for a full calendar year, since the month of activity is unknown. Hence in reality, the annual average $PM_{2.5}$ concentration at the sensitive receptor due to the modelled activities is likely to be significantly lower than predicted.

All the other assessed pollutants are within their respective criteria.

10. Recommendations

10.1 Generic Emission Controls

The following generic measures or equivalent (subject to final detailed project design and procurement process) should be implemented during construction and operation:

- Undertake watering of all haul routes at a rate suitable for the conditions.
- Water sprays should be used on dredge material after placement at the DMPA to avoid it drying out until placement is completed and vegetation cover is established.
- Haul truck loads are to be covered.
- Mobile plant engines are to be maintained to adhere to relevant emission criteria.
- Unsealed tracks and area are to be watered as required.
- A speed limit of 20 km/h is to be enforced on site.
- A rumble strip is to be used to shake dust of wheels leaving the site.
- Vegetation is to be maintained on the site boundaries.
- Daily monitoring is to be undertaken by site supervisors including visual checks for dust crossing the site boundary and odour surveys close to the site boundary.
- Any complaints from public are to trigger assessment by the operator and liaison between the operator, Ports North, EHP and the complainant to determine appropriate control measures.

10.2 Mitigation by Further Design Changes

From an air quality perspective, the design of the DMPA is acceptable provided the management measures in **Section 10.3** are implemented.

10.3 Mitigation by Management

The operations will handle damp sticky clay material with low potential for dust emissions, however management for odour is possibly required. Thus it may be necessary to manage the material during dredging and also after placement to minimise potential for emissions as follows:

- The operators of the backhoe dredging are to ensure that no soft materials are taken to the Tingira Street DMPA due to the higher potential for odour.
- Placed material is to be handled the least amount necessary so as to reduce the potential for odour release.
- On completion, the placement area is to be kept damp until covered by vegetation or covered with coarse material suitable to minimise dust or odour generation.

11. Risk Assessment of Impacts With and Without Mitigation

11.1 Risk Assessment

Based on the results of the air quality assessment and the identified mitigation measures, a risk assessment has been undertaken for impacts associated with the construction and operation of the CSD Project. The risk assessment has applied the significance criteria outlined in **Table 11.1**, and the likelihood of impact criteria in **Table 11.2** to determine the overall risk of impact for individual project activities based on **Table 11.3**. The derived risk rating for each of the project activities is then summarised in **Table 11.4**, with and without the additional mitigation measures discussed in **Section 10** and summarised in **Section 11.2**.

Table 11.1 Significance Criteria

Impact Significance/Consequence	Description of Significance
Very High	The impact is considered critical to the decision-making process. A substantial exceedance of an air quality criterion occurs that may lead to death.
High	The impact is considered likely to be important to decision-making. An exceedance of an air quality criterion occurs that may lead to serious but non-fatal health effects.
Moderate	The effects of the impact are relevant to decision-making including the development of management measures. Predictions are that the cumulative impacts will exceed a health criterion by up to a factor of two, or exceed a nuisance criterion.
Minor	Impacts are recognisable/detectable but acceptable. Predictions are that incremental impacts are below the criterion, but within an order of magnitude, and cumulative impacts are also below the criterion.
Negligible	Minimal change to the existing situation. Predictions are that incremental impacts will be an order of magnitude below the criterion.
Beneficial	Action results in an improvement to air quality.

Table 11.2 Likelihood of Impact

Likelihood of Impacts	Risk Probability Categories
Highly Unlikely	Highly unlikely to occur but theoretically possible
Unlikely	May occur during construction of the project but probability well below 50%; unlikely, but not negligible
Possible	Less likely than not but still appreciable; probability of about 50%
Likely	Likely to occur during construction or during a 12 month timeframe; probability greater than 50%
Almost Certain	Very likely to occur as a result of the proposed project construction and/or operations; could occur multiple times during relevant impacting period

Table 11.3 Risk Matrix

Likelihood	Significance				
	Negligible	Minor	Moderate	High	Very High
Rare	Negligible	Negligible	Low	Medium	High
Unlikely	Negligible	Low	Low	Medium	High
Possible	Negligible	Low	Medium	Medium	High
Likely	Negligible	Medium	Medium	High	Extreme
Almost Certain	Low	Medium	High	Extreme	Extreme

Table 11.4 Air Emission Impact Assessment Table

Sources and Location	Impacts	Initial Assessment with Standard Mitigation Measures			Residual Assessment with Additional Mitigation in Place		
		Significance	Likelihood	Risk Rating	Significance	Likelihood	Risk Rating
Construction							
Operation of DMPA at Tingira Street	Exceedance of 24h particulate criteria	minor	possible	low	minor	possible	low
	Exceedance of annual $PM_{2.5}$ criterion	minor	possible	low	minor	possible	low
	Exceedance of dust deposition criterion	minor	possible	low	minor	possible	low
	Exceedance of gas criteria	minor	possible	low	minor	possible	low
	Odour from dredged material	negligible	possible	negligible	negligible	possible	negligible

Notes: 1. NA = Not applicable as no risk associated with benefit.

The implications of the risk ratings are listed in **Table 11.5**. Impacts are summarised in **Table 11.7** including reference to the duration criteria in **Table 11.6**.

Table 11.5 Risk Rating Legend

Risk Rating	Risk Probability Categories
Extreme	An issue requiring change in project scope to reduce risk.
High	An issue requiring further detailed investigation and planning to manage and reduce risk. For air quality this rating requires gathering of detailed project-specific data to improve the accuracy of the assessment, and/or extensive monitoring to ensure control measures are effective.
Medium	An issue requiring project scope specific controls and procedures to manage.
Low	Manageable by standard mitigation and similar operating procedures.
Negligible	No additional management required.

Table 11.6 Duration Criteria

Classification	Duration
Temporary	Days (criteria averaging periods from 30 mins to 24 hour)
Short Term	Weeks
Medium Term	Months (criteria averaging period of one month)
Long Term	3 Months (12 Weeks) (annual average criteria)
Permanent	In excess of 10 Years

Table 11.7 Air Quality Impact Category Summary

Element	Adverse Impact	Consequential Impact	Cumulative Impact	Duration	Reversibility	Predictability
Operation of Tingira Street DMPA	Nuisance from dust and odour.	Increase in occurrence of detectable odour. Dust leaving site boundary.	Odour nuisance Dust nuisance	Temporary Medium term	Reversible Reversible	Predictable provided standard practices are implemented.

11.2 Management and Monitoring Commitments

The following measures are recommended so that the risk of impacts is reduced to a low level:

(1) The operators of the backhoe dredging are to ensure no soft materials are taken to the Tingira Street DMPA due to the higher potential for odour.

(2) Placed material is to be handled the least amount necessary so as to reduce the potential for odour release.

(3) On completion, the placement area is to be kept damp until covered by vegetation or covered with coarse material suitable to minimise dust or odour generation.

12. Conclusion

An air quality assessment has been conducted for the Tingira Street DMPA associated with the proposed Cairns Shipping Development Project. The results of the assessment are summarised as follows:

- With the observance of proper mitigation measures, no exceedances of the air quality criteria are likely to occur at the sensitive receptor in Tingira Street.
- In summary, there is low risk associated with operation of the DMPA provided the recommendations in **Section 10** are implemented.

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Appendix A Glossary

Parameter or Term	Description
AMSA	Australian Maritime Safety Authority
ASK	ASK Consulting Engineers Pty Ltd
BoM	Bureau of Meteorology
CO	Carbon monoxide
CSD	Cairns Shipping Development
DMPA	Dredge material placement area
DSITI	Department of Science, Information Technology and Innovation
Dust fallout deposition	Dust that has fallen out of the air onto a horizontal surface
EHP	Queensland Department of Environment and Heritage Protection
EPP (Air)	Queensland Environmental Protection (Air) Policy 2008
FEL	Front end loader
g/m^2/month	Grams per square metre per month
m/s	Metres per second
mg/m^2/day	Milligrams per square metre per day
mg/m^3	Milligrams per cubic metre
NPI	National Pollutant Inventory
NO_x	Oxides of nitrogen including nitric oxide and nitrogen dioxide
NO_2	Nitrogen dioxide
NSW OEH	New South Wales Office of Environment and Heritage
$PM_{2.5}$	Particulates suspended in air with aerodynamic diameter less than 2.5 microns
PM_{10}	Particulates suspended in air with aerodynamic diameter less than 10 microns
ppm	Parts per million by volume
SO_2	Sulphur dioxide
TAPM	The Air Pollution Model developed by CSIRO and used by ASK for meteorological modelling
TSHD	Trailing suction hopper dredge
TSP	Total particulates suspended in air
$\mu g/m^3$	Micrograms per cubic metre
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UTM	Universal Transverse Mercator coordinate system
VOCs	Volatile organic compounds