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CAIRNS SHIPPING DEVELOPMENT PROJECT

Revised Draft Environmental Impact Statement

APPENDIX AT: Tingira Street Baseline Noise

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Cairns Shipping Development Project - Tingira Street DMPA

Noise Impact Assessment

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1. Introduction

1.1 Overview

ASK Consulting Engineers Pty Ltd (ASK) was commissioned by Flanagan Consulting Group to provide acoustic consultancy services to assess the impacts of the revised Cairns Shipping Development Project (CSD Project) for the Revised Draft Environmental Impact Statement (EIS).

ASK has separately provided the noise impact assessment for the main project and soft clay placement area at Northern Sands (ASK report 8483R07) 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 noise environment and the noise 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 both 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.**

1.2 Study Team Details

Table 1.1 Noise Assessment Study Team Details

Name	Relevant Experience	Role
Stephen Pugh	An ASK Director with 20 years relevant experience, Stephen has undertaken numerous noise impact assessments for EIS projects within multiple engineering sectors. Stephen has local experience in Cairns, having undertaken the noise impact assessment for the EIS for the AQUIS project. • Stephen is a Registered Professional Engineer of Queensland (RPEQ). Bachelor of Engineering (Mechanical) • Member of Australian Acoustic Society • Member of the Institute of Engineers Australia. • Registered Professional Engineer of Queensland (RPEQ).	Technical review and guidance for the noise impact assessment (Technical Study 10 (TS10) Noise and Vibration).
Mitch Ryan	Mitch Ryan has more than 5 years experience in the fields of environmental noise and air quality. Mitch has undertaken noise and air quality impact assessments for numerous EIS projects in Queensland within the transport and extractive industry sectors. Mitch has considerable knowledge of environmental noise, including both field monitoring and noise propagation modelling, in addition to significant knowledge in air quality dispersion modelling and emission inventory development. • Bachelor of Engineering (Environmental) • Bachelor of Science • Member of Australian Acoustic Society • Member of the Institute of Engineers Australia.	Principal author on the noise impact assessment (Technical Study 10 (TS10) Noise and Vibration). Responsible for undertaking the noise impact assessment and propagation modelling, undertaking the baseline environmental noise survey and field survey field of sensitive receptors.

Name	Relevant Experience	Role
Bill Elder	Bill Elder has 2 years experience as a graduate acoustic engineer. Bill is experienced in environmental noise monitoring in accordance with the requirements of Queensland environmental noise policy. • Bachelor of Engineering (Mechanical) • Member of Australian Acoustic Society • Member of the Institute of Engineers Australia.	Responsible for undertaking baseline environmental noise survey at Wharf Street and field survey of sensitive receptors at Tingira Street.

2. Proposed Development

2.1 Project Definition

The objective of the Cairns Shipping Development Project (CSDP) is to accommodate larger cruise ships and a potential expansion of HMAS Cairns Navy Base through widening and deepening of the Cairns Shipping Channel and improvement of navigation and wharf facilities.

The channel design to be assessed in the Revised Draft EIS will involve the following elements:

- -8.8m Declared Channel depth
- Expanded Crystal Swing Basin to 380m
- Smith's Creek Swing Basin to 310m
- Outer Channel width 90 -100m
- Inner Channel width generally to 110m (outer bend to 180m)
- Further optimisation may occur at dredging contract negotiation stage.

The widening and deepening of the channel will be achieved via dredging. Soft clays within the channel will be dredged via a Trailer Suction Hopper Dredge (TSHD). Soft clay dredge material will be transported to a shore based Dredge Material Placement Area (DMPA) via a constructed pipeline.

Stiff clays will be placed at Port North's Tingira Street property which has been progressively reclaimed (**Figures 2.1 and 2.2**).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.

Figure 2.1 Location of Tingira Street DMPA

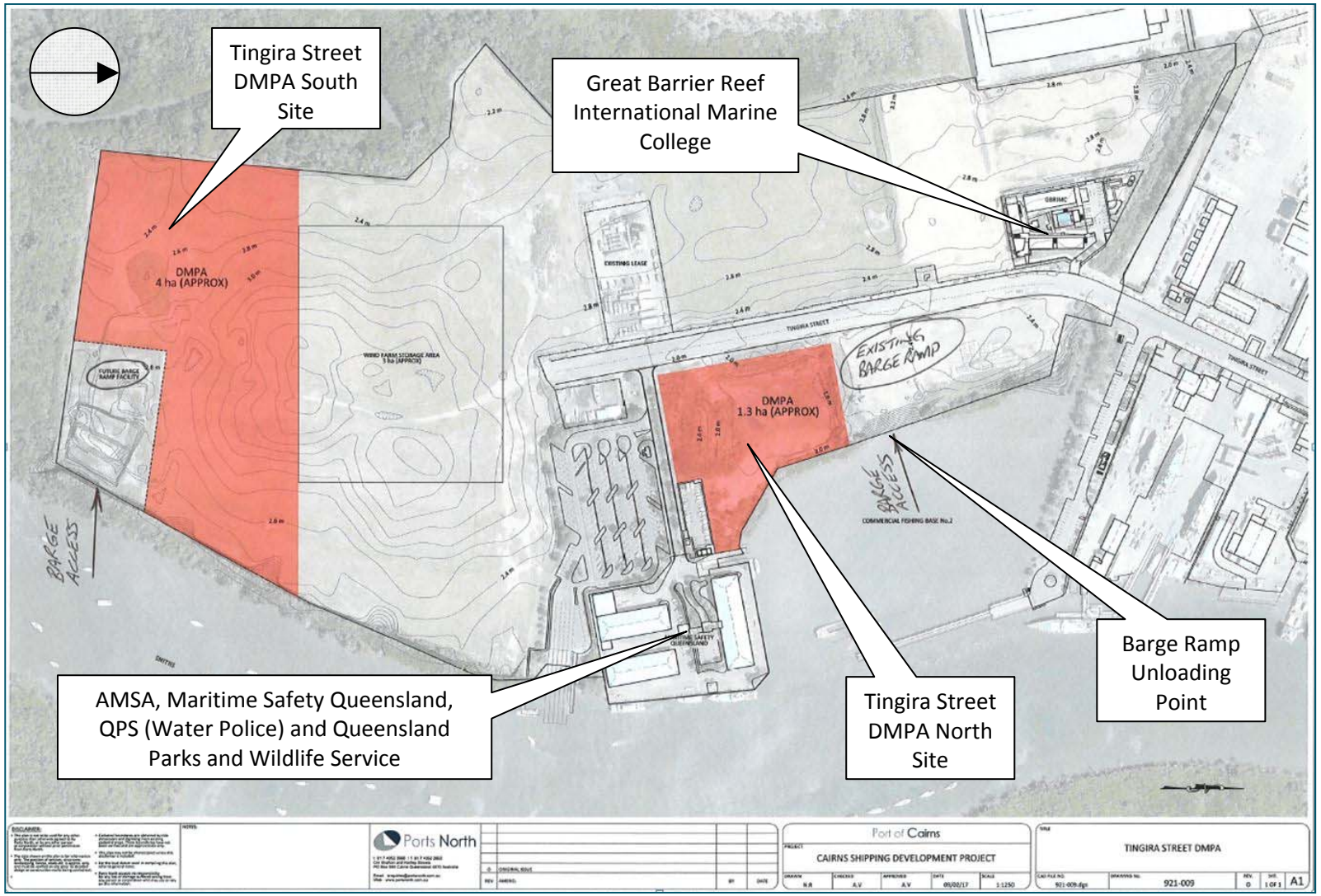

Figure 2.2 Plan of Tingira Street DMPA Locations and Nearest Buildings

2.2 Details of Stiff Clay Dredging Activities

2.2.1 Overview

The Tingira Street DMPA (TS 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 4 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 C1 Construction EMP including the Site Preparation and Post Placement Management.
- 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. Low perimeter bunding is proposed to be formed from existing site material. 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 (i.e. 24/7 operation).

2.2.2 DMPA Off-shore Equipment

The stiff and potentially the firm clays in the inner port will be dredged using a Back Hoe Dredger (BHD). Also, in addition to the firm and stiff clays, a BHD will be more efficient to dredge berth pockets, swing basins and other complex dredging areas. Therefore, a dredging fleet comprising BHD, barges and tug boats is also proposed for some areas of the inner port.

A BHD is a mechanical dredger, similar to an excavator which is mounted on a barge. A BHD is a stationary dredger anchored by three spud piles. It works by dredging the seabed using the bucket at the end of the excavator arm and placing the dredged material into a hopper barge which is moored alongside for disposal at the preferred dredge material placement area.

Material dredged by the BHD will be placed at the Tingira Street Dredge Material Placement Area (TS DMPA).

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. 92,312 m^3 of stiff clay is to be removed (83,796 by backhoe and 8,516 by drag bar). The drag bar is to work 170 hours (17 days 10 hours per day) and the backhoe 313 hours (16 days 20 hours per day). The total working days are to be 22.5 days but this may extend to 30 days (i.e. 3 to 5 weeks). A typical program with two barges is 4 hours of loading, one hour of towing and five hours of unloading.

2.2.3 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. 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 2.2**. According to the College website, the facility includes:

- Full Mission Bridge Simulator (Kongsberg Polaris)
- Tug-optimised bridge
- Desktop simulators
- Multi-purpose Emergency Response Training Simulator (MERTS)
- Engineering workshops
- Immersion pool
- Training vessel

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 noise control measures.

4. Acoustic Criteria

4.1 Overview

The objective of this report is to assess noise emissions from the Tingira Street DMPA. This section presents relevant acoustic criteria.

4.2 Terms of Reference

The Terms of Reference (ToR) for the Project refers to the following documents:

- Environmental Protection (Noise) Policy 2008 (EPP (Noise))
- Noise Measurement Manual (formerly Environment Protection Agency, now Department of Heritage and Environmental Protection)
- Guideline: Planning for Noise Control (formerly Environment Protection Agency, now Department of Heritage and Environmental Protection).

Noise monitoring undertaken for the CSD Project was undertaken in accordance with the EHP Noise Measurement Manual.

4.3 Construction Noise

4.3.1 Environmental Protection Act

In Queensland, the environment is protected under the Environmental Protection Act 1994. The object of the Act is to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development).

This legislation refers to noise as including *"vibration of any frequency, whether emitted through air or another medium"* and thus includes underwater noise.

The Act states a person must not carry out any activity that causes, or is likely to cause, environmental harm unless the person takes all reasonable and practicable measures to prevent or minimise the harm. This is termed the 'general environmental duty'. Environmental harm is defined as any adverse effect, or potential adverse effect (whether temporary or permanent and of whatever magnitude, duration or frequency) on an environmental value, and includes environmental nuisance. Environmental nuisance is unreasonable interference or likely interference with an environmental value caused by noise or vibration.

The following noise sources are excluded from the Act – audible traffic signals, warning signals for railway crossings, safety signals from reversing vehicle, operating a ship, aircraft, public and state controlled roads, busway, light rail, rail, and non-domestic animals.

This Act refers to the Environmental Protection Policies as being subordinate legislation to the Act.

The Act describes a number of offences relating to noise standards, including building work, regulated devices (e.g. power tools), pumps, air-conditioning equipment, refrigeration equipment, indoor venues, outdoor events, amplifier devices other than at indoor venue or open-air event, power boat sports in waterway, operating power boat engine at premises, blasting, and outdoor shooting ranges. The relevant standard for building work is presented below.

440R Building Work

(1) A person must not carry out building work in a way that makes an audible noise—

(a) on a business day or Saturday, before 6.30a.m. or after 6.30p.m; or

(b) on any other day, at any time.

(2) The reference in subsection (1) to a person carrying out building work—

(a) includes a person carrying out building work under an owner-builder permit; and

(b) otherwise does not include a person carrying out building work at premises used by the person only for residential purposes.

4.3.2 Discussion of the Environmental Protection Act

As discussed in **Section 4.3.1**, legislative requirements with respect to construction noise impacts in Queensland only relate to the restriction of the hours of work for construction sites which produce audible noise at a noise sensitive receptor.

For a major project such as CSD Project, work during the restricted hours may be necessary for reasons of public safety or to minimise disruption to essential services.

Dredging is proposed to occur 24 hours per day, while piling is proposed to be restricted to the standard hours wherever possible.

Accordingly, it is important to adopt a procedure for managing noise impacts from construction of CSDP both during standard construction hours and outside standard hours, since it is not feasible to undertake dredging activities entirely during standard hours.

In the absence of State noise criteria, the NSW Interim Construction Noise Guideline (ICNG) (NSW DECC, 2009) has been adopted as noise level targets however they are not considered prescriptive.

4.3.3 NSW Interim Construction Noise Guideline (ICNG)

The noise level targets adopted for the assessment of noise impacts from construction have been taken from the NSW Interim Construction Noise Guideline (ICNG) (NSW DECC, 2009). These noise level targets were adopted as legislative requirements in Queensland and are based on limiting hours of construction rather than nominating discrete noise limits.

The ICNG provides recommended noise levels for airborne construction noise at sensitive land uses. The guideline provides construction managers with noise levels above which all feasible and reasonable work practices should be applied to minimise the construction noise impact.

The ICNG sets out management levels for noise at sensitive receptors, and how they are to be applied. Management levels are based on the existing background noise levels in the absence of construction activity (represented by the Rating Background Level (RBL) parameter).

The management levels from the ICNG for residences are presented in **Table 4.1**.

For out-of-hours work, the ICNG nominates a noise level 5 dB above the rating background level (RBL) as the noise affected level to represent a threshold where the proponent should negotiate with the community.

It is important to note that the ICNG targets are not noise limits as such, but screening criteria for assessing whether construction noise is likely to have adverse impacts and hence whether “feasible and reasonable” work practices should be implemented during the construction process in order to reduce noise levels.

Table 4.1 ICNG Management Level for Airborne Construction Noise at Residences

Time of Day	Management Level L_{eq}(15 minute) dBA	How to Apply
Recommended standard hours: Monday to Saturday 6:30 am to 6:30 pm No work on Sundays or Public Holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured L_{Aeq} (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noise activities can occur, taking into account: Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences). If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5 dB	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community.

The nearest uses to the proposed TS DMPA sites are a college and office buildings. For these uses, as compared to residential uses, the protection of outdoor amenity is considered less important. Similarly, the protection of the evening and night noise environment is also considered less important as these uses are generally little used outside of day hours, or at least, are no more sensitive in the evening and night than the daytime.

The ICNG includes noise targets for educational and commercial facilities, as follows:

- Classrooms at education facilities (e.g. Marine College): Internal noise level - 45 dBA L_{eq}(15minute)
- Commercial facilities (e.g. offices): External noise level - 70 dBA L_{eq}(15minute)

Based on typical modern educational building construction with closed windows, a minimum facade noise reduction of 20 dBA would be expected, and thus an internal design level of 45 dBA L_{eq} corresponds to an external (outdoor) target level of 65 dBA L_{eq}.

5. Existing Noise Environment

5.1 Noise Monitoring Locations

Noise measurements have been undertaken to determine the existing noise environment at and around areas that could be affected by project activities. The measurements have consisted of short-term attended noise measurements.

The locations used for noise monitoring are presented in **Figure 5.1** and described in **Table 5.1**. The locations used for noise monitoring were selected based on the presence of sensitive or non-sensitive receptors and consideration of likely actions and potential impacts resulting from the Tingira Street DMPA component of the CSD Project.

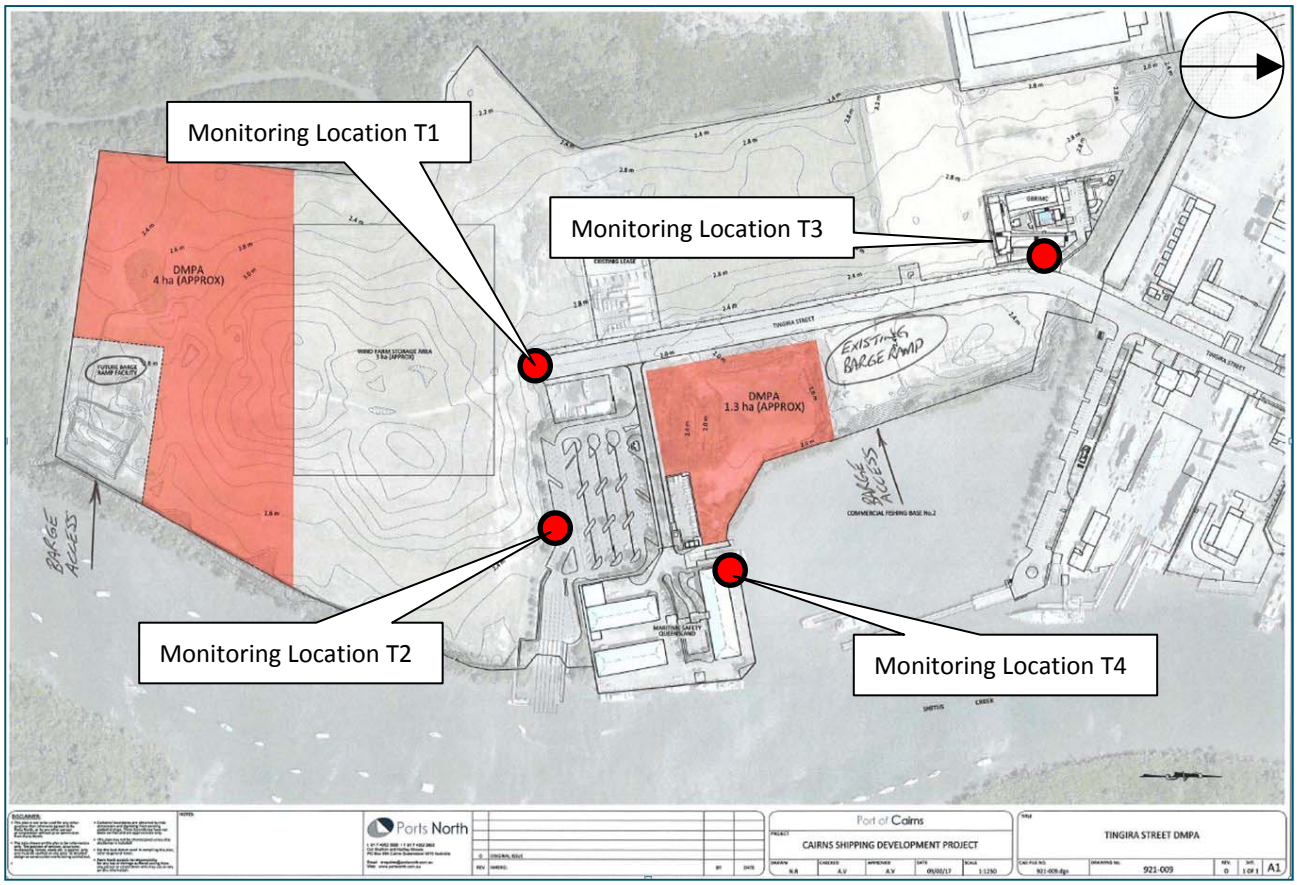

Figure 5.1 Tingira Street Monitoring Locations T1 to T4

Table 5.1 Attended Tingira Street Noise Monitoring Locations

Location	Description
T1	Attended monitoring was undertaken at the southern end of Tingira Street. The site is within a commercial and industrial area near the proposed Tingira Street Dredge Material Placement Area. GPS coordinates were -16.952701°N, 145.770985°E.
T2	Attended monitoring was undertaken at the southern end of Tingira Street next to the public boat ramp. The site is within a commercial and industrial area near the proposed Tingira Street Dredge Material Placement Area. GPS coordinates were -16.952683°N, 145.772212°E.
T3	Attended monitoring was undertaken at the southern end of Tingira Street in front of the Great Barrier Reef International Marine College. The site is within a commercial and industrial area near the Tingira Street Dredge Material Placement Area. GPS coordinates were -16.949232°N, 145.770205°E.
T4	Attended monitoring was undertaken at the southern end of Tingira Street behind the Queensland Marine Services and Queensland Park and Wildlife Services offices. The site is within a commercial and industrial area near the proposed Tingira Street Dredge Material Placement Area. GPS coordinates were -16.951392°N, 145.772328°E.

5.2 Measurement Results

Attended noise measurements were undertaken using a field and laboratory calibrated Norsonic NOR 140 sound level meter. The microphone height was approximately 1.3 metres above ground level in the free field. Weather during attended monitoring was generally fine.

The measured noise levels are summarised in **Table 5.2**. The parameters noted in **Table 5.2** are described in the glossary in **Appendix A**.

Table 5.2 Attended Noise Measurement Results

Location	Date & Time	Period (Minutes)	Results & Notes
T1	5:18pm 09/05/2017	15	Statistical noise levels: L_{10} 44 dBA, L_{eq} 43 dBA, L_{90} 34 dBA Very distant Industry noise audible coming from the north Bird song 39 to 41 dBA (46),(55) loud bird screech Car travelling on Tingira Street 47 dBA Loader moving in laydown yard to the north 40 to 42 dBA Loader grading rocks in laydown yard to the north 46 to 48 dBA
T2	8:05am 10/05/2017	15	Statistical noise levels: L_{10} 45 dBA, L_{eq} 42 dBA, L_{90} 37 dBA Car doors closing in car park 41, 44, 46 dBA Reverse beeper in car park 53 dBA Bird song 37 to 44 dBA Car engine start in carpark 43 to 47 dBA Car pulling boat through car park 56 dBA Small boat travelling along river 43 to 44 dBA
T3	9:00am 10/05/2017	15	Statistical noise levels: L_{10} 61 dBA, L_{eq} 61 dBA, L_{90} 49 dBA Distant industry noise 48 to 49 dBA Trucks/Loaders/Cranes moving in laydown yard directly opposite 54 to 58 dBA Traffic on Tingira Street 61 to 67 dBA Trucks on Tingira Street 72, 78, 82 dBA Forklift on Tingira Street 63, 66 dBA Truck idling in laydown yard directly opposite 50 dBA

Location	Date & Time	Period (Minutes)	Results & Notes
T4	9:51am 10/05/2017	15	Statistical noise levels: L_{10} 55 dBA, L_{eq} 53 dBA, L_{90} 45 dBA Distant noise from laydown yard on Tingira Street 50 to 56 dBA Cars moving through carpark 54 to 64 dBA Plane overhead 60 dBA Boat travelling along river 55 dBA Distant industry noise 45 to 46 dBA Mechanical plant for offices 43 to 44 dBA
T2	11:44am 10/05/2017	15	Statistical noise levels: L_{10} 46 dBA, L_{eq} 45 dBA, L_{90} 37 dBA Wind through trees and grass 38 to 39 dBA Bird song 40 to 42 dBA Cars moving in car park 44 to 55 dBA Car door slams 58, 60, 44, 55, 44 dBA Small boat travelling along river 42 to 50 dBA
T3	12:23pm 10/05/2017	15	Statistical noise levels: L_{10} 66 dBA, L_{eq} 64 dBA, L_{90} 50 dBA Cars on Tingira Street 62 to 75 dBA Trucks on Tingira Street 84, 80, 74, 80 dBA Industry noise 51 to 54 dBA Noise from laydown yard directly opposite 55 to 57 dBA Distant traffic and industry noise 47 to 48 dBA

6. Determination of Construction Noise Limits

Construction noise limits for the project have been taken from the NSW Interim Construction Noise Guideline (ICNG) (NSW DECC, 2009) as discussed in **Section 4.3**. The noise limits for construction are based on the ambient background noise level plus an allowance of 10 dB for activity during Monday to Saturday from 6:30 am to 6:30 pm (recommended standard hours), or an allowance of 5 dB (as a guide) for activity outside standard hours.

Construction noise screening criteria have been determined based on the attended noise measurements at Location T3 (College) and Location T4 (Office Facilities) and are included in **Table 6.1**.

Table 6.1 Construction Noise Screening Criteria (Daytime)

Receptor	Background Noise Level L_{90} dBA	ICNG Noise Affected Level L_{eq} (15minute) dBA
Marine College (Near Location T3)	49 & 50	65
Office Facilities (Near Location T4)	45	70

It is important to note that the Noise Affected Levels are not noise limits as such, but screening criteria for assessing whether construction noise is likely to have adverse impacts and hence whether "feasible and reasonable" work practices should be implemented during the construction process in order to reduce noise levels. Where noise levels exceed the "Proposed Screening Criteria" some community reaction to construction noise may be expected and the project should implement mitigation measures to reduce noise impacts.

7. Construction Noise Assessment

7.1 Prediction Methodology

Environmental noise calculations have been conducted for this assessment of noise impacts from construction work associated with the development.

The construction contractors for CSD Project have not been selected at the time of this assessment, and therefore the assessment has been undertaking on the basis of an assumed construction methodology. It is expected that the assumed methodology considered in this assessment is representative of the method which will be utilised, however it is also likely that some refinements will be made.

The sound power levels (Lw) applied in this assessment have been chosen based on information provided regarding the anticipated type and specifications (brand, model, size, etc) for mobile and fixed plant provided to ASK. The sound power levels applied in the assessment for this plant have been obtained from ASK's extensive noise source database, which includes data obtained from ASK noise measurements as well as review of published literature.

It should be noted that the plant items detailed in this study are at this stage indicative of the plant required to complete the construction of the Project. The accuracy of the calculations would be affected should plant be modified, moved (substantially) or replaced.

The successful contractor, in preparing noise control measures for their Environmental Management Plan (EMP) will need to confirm noise levels of the actual equipment to be used.

7.2 Assumptions and Technical Limitations

As with most proposed developments, and as indicated in the Draft EIS, the impact assessment process is based on defining representative scenarios reflecting typical conditions likely to be experienced during construction and operation of the project.

Prediction of noise impacts from any construction project involves unknown source characteristics in that the particular construction equipment to be used on site is not confirmed until detailed planning for the construction process is conducted.

The adopted methodology is based on the NSW ICNG is a “screening criterion” approach – i.e. the assessment identifies which construction activities have higher risks of resulting in noise or vibration impacts and therefore which activities require noise mitigation measures to be incorporated into planning the activity.

During the detailed planning of the construction sequence these activities should be planned and managed to minimise noise impacts, e.g. by including mitigation measures as discussed in this EIS chapter.

The prediction of acoustic impacts based on representative sources, means that there is the possibility that the actual source construction or operational noise levels may be higher (or lower) than predicted in this EIS chapter (e.g. a particularly noisy construction activity). If this occurs in practice, additional mitigation measures will be implemented as documented in a Noise Management Plan to be prepared for the project. Actual residual impacts will, however, be determined by the acoustic impacts after appropriate mitigation is applied.

7.3 Construction Noise Sources

The typical construction sound power levels for construction vehicles are presented in **Table 7.1**.

Table 7.1 Typical Sound Power Levels for Construction Activities and Equipment

Vehicle Type	# Required	Sound Power Level, $L_{w,eq}$ dBA
Backhoe Style Dredger	1	106
Tug	2	109
Excavator (40 tonne)	1	110
Articulated dump truck (Volvo A35F, A40F)	3	112
Dozer Cat D6T Track-Type Tractor	1	111
Grader (Cat 12M3)	1	107
Water cart	1	111

Reference sound power levels presented in **Table 7.1** have been obtained from multiple sources including:

- AS2436-2010 - Guide to noise and vibration control on construction, demolition and maintenance sites.
- Department of Environment, Food and Rural Affairs - Update of Noise Database for Prediction of Noise on Construction and Open Sites, 2005.
- "Port of Eden Dredging maintenance works" Noise Assessment, Jacobs 8 February 2017
- Cat M Series 3 Motor Grader Specification
- Cat D6T Track-Type Tractor Specification
- Volvo A35F, A40F Articulated Haulers Specification
- Information held in ASK libraries.

The proposed hopper barge landing point (refer **Figure 2.2**) is estimated at approximately 160 metres from the college and offices. Other distances are taken from the middle of the respective DMPA areas, or from the middle of haulage routes for the trucks.

The calculated noise levels are as follows:

- **Table 7.2:** Northern Tingira Street DMPA to Offices
- **Table 7.3:** Northern Tingira Street DMPA to College
- **Table 7.4:** Southern Tingira Street DMPA to Offices
- **Table 7.5:** Southern Tingira Street DMPA to College

Table 7.2 Noise Level from Construction Activities in Northern Tingira Street DMPA at Offices

Vehicle Type	#	Sound Power Level, $L_{w,eq}$ dBA	Average Distance (metres)	Duration (Within 15 minute period)	Noise Level at Receptor L_{eq}(15min) dBA
Tug	2	109	50	Passby 3 minutes	60
Excavator (40 tonne)	1	110	160	15 minutes	58

Vehicle Type	#	Sound Power Level, $L_{w,eq}$ dBA	Average Distance (metres)	Duration (Within 15 minute period)	Noise Level at Receptor L_{eq}(15min) dBA
Articulated dump truck (Volvo A35F, A40F)	3	112	100	15 minutes. Assume 1 of 3 trucks active/driving at any one time.	64
Dozer Cat D6T Track-Type Tractor	1	111	100	50% active/moving, i.e. 7.5 minutes	60
Grader (Cat 12M3)	1	107	100	50% active/moving, i.e. 7.5 minutes	56
Water cart	1	111	100	50% active/moving, i.e. 7.5 minutes	60
TOTAL					68

Table 7.3 Noise Level from Construction Activities in Northern Tingira Street DMPA at College

Vehicle Type	#	Sound Power Level, $L_{w,eq}$ dBA	Average Distance (metres)	Duration (Within 15 minute period)	Noise Level at Receptor L_{eq}(15min) dBA
Tug	2	109	200	Passby 3 minutes	48
Excavator (40 tonne)	1	110	160	15 minutes	58
Articulated dump truck (Volvo A35F, A40F)	3	112	230	15 minutes. Assume 1 of 3 trucks active/driving at any one time.	57
Dozer Cat D6T Track-Type Tractor	1	111	230	50% active/moving, i.e. 7.5 minutes	53
Grader (Cat 12M3)	1	107	230	50% active/moving, i.e. 7.5 minutes	49
Water cart	1	111	230	50% active/moving, i.e. 7.5 minutes	53
TOTAL					62

Table 7.4 Noise Level from Construction Activities in Southern Tingira Street DMPA at Offices

Vehicle Type	#	Sound Power Level, $L_{w,eq}$ dBA	Average Distance (metres)	Duration (Within 15 minute period)	Noise Level at Receptor L_{eq}(15min) dBA
Tug	2	109	50	Passby 3 minutes	60
Excavator (40 tonne)	1	110	160	15 minutes	58
Articulated dump truck (Volvo A35F, A40F)	3	112	200	15 minutes. Assume 1 of 3 trucks active/driving at any one time.	58
Dozer Cat D6T Track-Type Tractor	1	111	350	50% active/moving, i.e. 7.5 minutes	49
Grader (Cat 12M3)	1	107	350	50% active/moving, i.e. 7.5 minutes	45

Vehicle Type	#	Sound Power Level, $L_{w,eq}$ dBA	Average Distance (metres)	Duration (Within 15 minute period)	Noise Level at Receptor L_{eq}(15min) dBA
Water cart	1	111	250	50% active/moving, i.e. 7.5 minutes	52
TOTAL					64

Table 7.5 Noise Level from Construction Activities in Southern Tingira Street DMPA at College

Vehicle Type	#	Sound Power Level, $L_{w,eq}$ dBA	Average Distance (metres)	Duration (Within 15 minute period)	Noise Level at Receptor L_{eq}(15min) dBA
Tug	2	109	200	Passby 3 minutes	48
Excavator (40 tonne)	1	110	160	15 minutes	58
Articulated dump truck (Volvo A35F, A40F)	3	112	550	15 minutes. Assume 1 of 3 trucks active/driving at any one time.	49
Dozer Cat D6T Track-Type Tractor	1	111	550	50% active/moving, i.e. 7.5 minutes	45
Grader (Cat 12M3)	1	107	550	50% active/moving, i.e. 7.5 minutes	41
Water cart	1	111	300	50% active/moving, i.e. 7.5 minutes	50
TOTAL					60

From **Tables 7.2** to **7.5** the predicted construction noise levels are summarised as follows:

- Northern Tingira Street DMPA to Office Facilities 68 dBA L_{eq}(15min)
- Northern Tingira Street DMPA to Marine College 62 dBA L_{eq}(15min)
- Southern Tingira Street DMPA to Office Facilities 64 dBA L_{eq}(15min)
- Southern Tingira Street DMPA to Marine College 60 dBA L_{eq}(15min)

From **Table 6.1** the ICNG noise affected levels are 65 dBA L_{eq}(15minute) for the college and 70 dBA L_{eq}(15minute) for the offices. The predicted noise levels in **Tables 7.2** to **7.5** for typical construction scenarios are therefore compliant with a 2 to 3 dBA margin.

Based on the anticipated construction time of up to 5 weeks and the compliance with the ICNG levels, it is considered that noise levels will not significantly impact the college and offices.

It is understood that construction activities will also occur in the evening and night periods. It is understood there are no sensitive receptors in the vicinity to be exposed to the noise in these periods, and thus they have not been assessed.

No specific mitigation measures are proposed but general mitigation methods to reduce noise impacts onto receptors are discussed in **Section 8**.

8. Mitigation Measures

All general activities relating to the construction works should carried out in accordance with best practice measures to reduce the potential for noise impacts, including the following:

- Modern and well-maintained equipment should be used to undertake the works.
- Noisy or vibration generating plant, equipment and activities should be substituted with lower impact options where possible.
- Arrange work flow to minimise the use of reversing alarms on vehicles and plant. Use equipment with broadband (squashed duck) alarms where possible.
- Locate noisy plant, site vehicle entrances and off-site truck parking areas away from sensitive receptors where possible.
- Plant known to emit noise strongly in one direction should, where possible, be orientated so that the noise is directed away from the closest noise-sensitive areas.
- Where machines are fitted with mufflers, these should be kept in good condition and replaced if degradation has lead to noticeably increased noise emissions.
- There should be continuous training of operators, labourers, subcontractors and supervisors through induction training and ongoing meetings on the need to minimise noise impacts on surrounding local residents.
- Where machines are fitted with engine covers, these should be kept closed when the machine is in use.
- The drivers of machinery should be provided with appropriate communication equipment, to ensure that signalling by other means (e.g. horns) is kept to a minimum.
- Noise sensitive receptors should be informed of any nearby construction works, or significant changes to nearby construction works, in advance (preferably at least one weeks' notice, except for emergency works) of works occurring.
- Provide advanced notice, where possible, to stakeholders when loud construction or demolition activity is proposed to be undertaken.
- Open communication should occur with stakeholders located in the vicinity of construction areas who could potentially be impacted by activities resulting in noise and vibration emissions. A construction engagement program should be developed and implemented to create a dialogue with stakeholders during the construction phase.
- A designated communication channel, i.e. email and phone number, should be established, to facilitate communication with stakeholders. This communication method should be actively managed to ensure complaints and issues can be addressed as soon as practically possible.

A Construction Noise and Vibration Management Plan should be developed for the Project, including these mitigation strategies.

9. Risk Assessment

Based on the results of the noise assessment and the identified mitigation measures, a risk assessment has been undertaken for noise impacts associated with the construction and operation of the Tingira Street component of the CSD Project.

The risk assessment has applied the significance criteria outlined in **Table 9.1**, which refers to the duration criteria in **Table 9.2**, and the likelihood of impact criteria (**Table 9.3**) to determine the overall risk of impact for individual project activities based on the risk matrix presented in **Table 9.4**. The risk rating legend is included in **Table 9.5**.

The derived risk rating for each of the project activities is then summarised in **Table 9.6**. No additional mitigation measures are proposed beyond the standard mitigation measures discussed in **Section 8**.

It is noted that human response to noise is subjective, and varies between individuals. The risk assessment provides a summarised review of the potential for impact, but may not accurately represent all individuals.

Table 9.1 Significance Criteria

Impact Significance/Consequence	**Description of Significance** (refer to Table 9.2 for duration criteria)
Very High	The management of the impact is critical to decision-making, including the selected methodology for delivering the Project and the development of management measures. Noise emissions will: • significantly exceeds noise limits at receptors occur over a medium or long-term duration • moderately exceed noise limits for permanent duration
High	Addressing the impact is very important to decision-making, including the selected methodology for delivering the Project and the development of management measures. Noise emissions will: • significantly exceeds noise limits for a temporary to short term activity, or, moderately exceed the noise limits for a medium to long-term duration activity, or, result in a minor exceedance of noise limits for a permanent activity • not be consistent with the existing noise environment.
Moderate	The effects of the impact are important to decision-making including the selected methodology for delivering the Project and the development of management measures. Noise emissions will: • significantly exceeds the derived noise limit for a temporary to short term activity, or, result in minor or moderate exceedance of noise limits for a medium to long-term duration activity, or, result in a minor exceedance of noise limits for a permanent activity • be consistent with the existing noise environment.

Impact Significance/Consequence	Description of Significance (refer to Table 9.2 for duration criteria)
Minor	Impacts are recognisable/detectable but acceptable and are unlikely to influence decision making. Noise emissions will: • significantly exceeds the derived construction noise limit, but not the 'highly affected noise limit, for a temporary activity. • comply with noise limits at all receptors, but occur outside of standard construction hours or during noise sensitive periods (i.e. night) and therefore may impact people more sensitive to noise.
Negligible	Negligible impacts are anticipated. Noise emissions will: • be compliant at all receptors • will not occur outside of standard construction hours (6:30am - 6:30pm, Monday to Saturday) in the vicinity of sensitive receptors.
Beneficial	Amenity of the area in respect to noise is improved.

Table 9.2 Duration Criteria

Classification	Duration	Applicable Project Noise Sources
Temporary	1 - 2 Weeks	-
Short Term	Up to 1 Month	-
Medium Term	Up to 3 Months (~12 Weeks)	Tingira DMPA
Long Term	Up to 12 Months	-
Permanent	In excess of 12 Months	-

Table 9.3 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 9.4 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 9.5 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.
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 9.6 Impact Assessment Table

Project Area	Construction Activity / Noise Source	Initial Assessment with Standard Mitigation Measures			Residual Assessment with Additional Mitigation in Place		
		Significance	Likelihood	Risk Rating	Significance	Likelihood	Risk Rating
Construction							
Tingira Street DMPA	Various	Negligible	Possible	Negligible	Negligible	Possible	Negligible

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10. Conclusion

ASK Consulting Engineers Pty Ltd (ASK) was commissioned by Flanagan Consulting Group to provide acoustic consultancy services to assess the Tingira Street component of the Cairns Shipping Development Project (CSD Project). The results of this assessment are as follows:

- Noise emissions from Tingira Street DMPA will not significantly impact sensitive receptors.
- A construction Noise and Vibration Management Plan should be developed. The management plan should include the standard mitigation measures nominated in **Section 8** of the report.
- The risks associated with noise and vibration emissions are considered negligible.

Appendix A Glossary

Parameter or Term	Description
CSD Project	Cairns Shipping Development Project
dB	The decibel (dB) is the unit measure of sound. Most noises occur in a range of 20 dB (quiet rural area at night) to 120 dB (nightclub dance floor or concert).
dBA	Noise levels are most commonly expressed in terms of the 'A' weighted decibel scale, dBA. This scale closely approximates the response of the human ear, thus providing a measure of the subjective loudness of noise and enabling the intensity of noises with different frequency characteristics (e.g. pitch and tone) to be compared.
Octave band	Ranges of frequencies where the highest frequency of the band is double the lowest frequency of the band. The band is usually specified by the centre frequency, i.e., 31.5, 63, 125, 250, 500 Hz, etc.
Low frequency noise	Noise that occurs in the 10 Hz to 200 Hz frequency range, as defined in the Queensland Department of Environment and Heritage Protection (DEHP) EcoAccess "Assessment of Low Frequency Noise" draft guideline document.
Day	The period between 7am and 6pm.
Evening	The period between 6pm and 10pm.
Night	The period between 10pm and 7am.
Free-field	The description of a noise receiver or source location which is away from any significantly reflective objects (e.g. buildings, walls).
Reverberant field	The description of a noise receiver or source location which is in a room or near significant reflective objects (e.g. surrounded by walls).
Noise sensitive receiver OR Noise sensitive receptor	The definition can vary depending on the project type or location, but generally defines a building or land area which is sensitive to noise. Generally it includes residential dwellings (e.g. houses, units, caravans, marina), medical buildings (e.g. hospitals, health clinics, medical centres), educational facilities (e.g. schools, universities, colleges),
L_1	The noise level exceeded for 1% of the measurement period.
L_{10}	The noise level exceeded for 10% of the measurement period. It is sometimes referred to as the average maximum noise level.
$L_{10,adj,T}$	As for L_{10} except the measurement interval is defined as duration of 'T' and the level is adjusted for tonality or impulsiveness, if required.
$L_{10,15min}$	As for L_{10} except the measurement intervals are defined as 15 minute duration.
L_{90}	The noise level exceeded for 90% of the measurement period. This is commonly referred to as the background noise level.
$L_{90,adj,T}$	As for L_{90} except the measurement interval is defined as duration of 'T' and the level is adjusted for tonality or impulsiveness, if required.
minL_{90} and/or Rating Background Level	The background noise levels calculated using the 'lowest 10th percentile' of the L_{90} levels in each period of the day. This 'lowest 10th percentile' method is defined in the Queensland Department of Environment and Heritage Protection (DEHP) guidelines.
min$L_{90,1hour}$	As for minL_{90} except the measurement interval is defined as 1 hour duration.
L_{eq}	The equivalent continuous sound level, which is the constant sound level over a given time period, which is equivalent in total sound energy to the time-varying sound level, measured over the same time period.
$L_{eq,1hour}$	As for L_{eq} except the measurement interval is defined as 1 hour duration.
$L_{eq,T}$	As for L_{eq} except the measurement interval is defined as duration of 'T'.
$L_{eq,adj,T}$	As for L_{eq} except the measurement interval is defined as duration of 'T' and the level is adjusted for tonality or impulsiveness, if required.
L_{max} OR maxL_{pA}	Maximum sound pressure level.

Parameter or Term	Description
L_w	The sound power level of a noise source is its inherent noise, which does not vary with distance from the noise source. It is not directly measured with a sound level meter, but rather is calculated from the measured noise level and the distance at which the measurement was undertaken.
L_{weq}	The sound power level expressed as the equivalent sound level.