City Pacific Limited

# Townsville Ocean Terminal Noise and Vibration Assessment

Friday, 12 October 2007Report no: pr\_Y05401JM\_rev4/96238



# Townsville Ocean Terminal Noise and Vibration Assessment

Author: J. McDonagh

Checker: D. Dang

Approver: J. McDonagh

Report no: pr\_Y05401JM\_rev4

Mags	
098	
Mags	
Date:	Friday, 12 October 2007

This report has been prepared for City Pacific Limited in accordance with the terms and conditions of appointment for Noise and Vibration Assessment dated . Hyder Consulting Pty Ltd—Incorporating Weathered Howe (ABN 76 104 485 289) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

Hyder Consulting Pty Ltd Incorporating Weathered Howe ABN 76 104 485 289 45 Nerang Street, Southport QLD 4215, Australia Tel: +61 7 5532 3933 Fax: +61 7 5591 4778 www.hyderconsulting.com





# Contents

1	1 Executive Summary			1
2	Intro	duction.		7
	2.1	Purpose	e	7
	2.2	Project	Description	7
3	Dese	cription c	of Existing Environment	10
	3.1	Sensitiv	e Receptors	10
		3.1.1	Existing Sensitive Receptors	10
		3.1.2	Future Sensitive Receptors	11
	3.2	Noise a	nd Vibration Sources	11
		3.2.1	The Existing CBD	11
		3.2.2	Jupiter's Casino and Townsville Entertainment Centre	12
		3.2.3	Existing Port Operations	12
		3.2.4	Future Port Operations	16
		3.2.5	TOT Project Noise Sources	17
	3.3	Ambien	t Noise Environment	17
		3.3.1	Noise Monitoring	17
		3.3.2	Meteorological Conditions	19
		3.3.3	Equipment Calibration	19
		3.3.4	Environmental Noise Descriptors	19
		3.3.5	Ambient Noise Monitoring Results	20
		3.3.6	Cruise Terminal Noise Monitoring Results	23
	3.4	Relevar	nt Legislation and Standards	23
		3.4.1	Local Laws	23
		3.4.2	Queensland State Law	
		3.4.3	Australian Standards	
4	Pote	ential Imp	acts and Mitigation Measures	31
	4.1	Noise a	nd Vibration Criteria	31
		4.1.1	Vibration Emissions Assessment Guidelines	31
		4.1.2	Construction Noise Emissions Criteria	
		4.1.3	Operational Noise Emissions Criteria	35
	4.2	Potentia	al Impacts	41
		4.2.1	Vibration Impacts	41
		4.2.2	Construction Impacts	42
		4.2.3	TOT Operational Impacts	56
		4.2.4	Noise Impacts from Existing Port Operations	60
		4.2.5	Potential Noise Impacts from Future Port Operations	



	4.2.6	Marine Fauna Impacts	69
4.3	Mitigatior	n Measures	72
	4.3.1	Mitigation of Construction Phase Noise and Vibration	72
	4.3.2	Mitigation of TOT Precinct Operational Noise	73
	4.3.3	Mitigation of Port Operational Noise	74
	4.3.4	Mitigation of Noise Impacts on Marine Fauna	75
Conc	lusion		78

APPENDIX 1 Ambient Measurement Results

5

- APPENDIX 2 Predicted TOT Operational Noise Contours
- APPENDIX 3 Veitch Lister Consulting Traffic Forecast
- APPENDIX 4 Predicted Construction Noise Contours
- APPENDIX 5 Noise Barrier Location & Description
- APPENDIX 6 Spatial Relationship Between Breakwater Cove, TOT and the Port

Page ii



# 1.1 Purpose

This Noise and Vibration Assessment has been undertaken by Hyder Consulting Pty Ltd to provide supporting information to address Sections 2.2 and 4.10 of the Terms of Reference (ToR) for preparation of an Environmental Impact Statement (EIS) for the proposed Townsville Ocean Terminal (TOT) Project.

# 1.2 Project Description

The site proposed for development of the TOT Project is located adjacent to the Townsville Hotel and Casino Complex and the Townsville Entertainment Centre as identified in the Breakwater Island Casino Agreement Act (BICA) as the "Future Development Area". The TOT project is the reclamation of land to the north of Sir Leslie Thiess Drive for development of two precincts –

(1) The TOT Precinct: will be developed for construction of a dedicated ocean terminal and ancillary facilities for use by cruise ships and naval vessels. Naval vessels currently utilise the existing Townsville Port facilities.

(2) The Breakwater Cove Precinct: a residential area providing for a range of uses including apartments, attached dwellings, detached dwellings, commercial and retail facilities services, landscaping and public utilities. The Breakwater Cove Precinct will be constructed on reclaimed land to the west of the Townsville Ocean Terminal and will provide waterfront residential properties including attached and detached dwellings and apartment buildings.

# 1.3 Existing Receptors

The TOT Project has the potential to impact on the following receivers:

- Existing residences to the south and south west 0.8km to 1.2km from the project site;
- Existing residences along proposed construction haul routes;
- The Port of Townsville;
- The Townsville CBD;
- The Jupiter's Casino precinct; and
- Marine Fauna in Cleveland Bay.



# 1.4 Existing Port Operations

In addition, the TOT Project is located in the range of approximately 500m to 1500m from the Port of Townsville. Noise from the Port operations has the potential to impact on the proposed residential housing in the Breakwater Cove Precinct.

## 1.5 Port Noise Sources

Potential sources of noise from Port operations are:

- Port vehicles.
- Railway activities.
- Berth activities.

Port noise sources of significance generally relate to the following activities which were experienced and monitored during the two week data logging programme. Noise generating activities within the Port include:

- Loading cargo such as minerals, ores and scrap metal into ships.
- Banging of containers.
- Loaders and excavators.
- Rail and vehicular noise.

# 1.6 Noise Data Logging

Two weeks of noise data logging was recorded at a variety of receptor locations. The most relevant to the Breakwater Cove residential precinct was the noise logger external to the Jupiter's Casino. Over the period of the logging, ship traffic was higher than average and marginally below the highest density for the year according to the Port's shipping records.

The purpose of the noise logging was to ascertain and describe the existing noise environment at locations considered representative of the proposed development.

To this end, measured noise levels immediately external to the Jupiter's Casino have been used to represent (with some adjustments) those at the Breakwater Cove residences.



## 1.7 Noise Assessment: Impact from the Port

#### 1.7.1 Existing Port Noise Compliance

The Port Users operate under a variety of approvals and licences which require compliance with EPA noise guidelines in accordance with their specific activities (ERAs).

#### 1.7.2 Noise Complaints

An analysis of noise complaints over the last 8 years provided by the Port reveals the following:

- 87 complaints were received.
- 26 of these related to noise.
- 22 originated from South Townsville.
- 3 originated from the Strand and from the Casino.

South Townsville is designated a Z3 zone. This would mean that lower background noise levels in this area would make the planning noise levels on average 5dBA lower than for the Breakwater Cove (see Table 6 page 32). Noise measured at South Townsville (Table 2 L6 page 20) indicates that measured noise is generally 5dBA higher than the planning noise level. This means that South Townsville is more vulnerable to noise from the Port. This appears to be borne out by the high proportion (even though low in number) of complaints from this area.

#### 1.7.3 Predicted Port Noise Impact on Breakwater Cove

The Port is a complex site with multiple stationary and moving sources and a range of heights and locations. Each one of these numerous sources will affect the proposed Breakwater Cove development to a lesser or greater extent than existing surrounding residential receivers.

Therefore, given that the Port is currently operating lawfully, a relative assessment of predicted Port noise impact on the Breakwater Cove in comparison to that at the Existing Casino accommodation has been considered the appropriate basis for assessment.

Preliminary assessment based on relative distances between selected Port users, and both the worst affected Breakwater Cove Development, and existing Casino, indicates that Port noise is likely to be up to 3.5 dB(A) higher at the worst affected Breakwater Cove dwellings from some sources than at the existing Casino accommodation.

However, this applies to a small number of Port users with the majority being located further from the Breakwater Cove development than the Casino with significantly less impact predicted on the Breakwater Cove



Precinct than the existing Casino. Therefore the overall noise impact from the Port is likely to be less than this. Background noise monitoring carried out by Max Winders & Associates for the existing Port, at a number of different locations in June 2006 appears to substantiate this, and in fact indicates that existing Port noise impact is likely to be less than or equal to that experienced by the existing Casino accommodation at the worst affected Breakwater Cove dwellings. Further, the 3.5 dB(A) increase applies only to the dwellings closest to the Port with the impact diminishing with distance and shielding from other Breakwater Cove dwellings. Again, the Max Winders report bears this out.

It therefore follows that as long as the Port is currently operating lawfully and proposed mitigation measures at Breakwater Cove provide at least 3.5 dB(A) of additional attenuation to port noise impacting on the Breakwater Cove dwellings, that it will continue to do so.

This does however, assume that background noise levels at Breakwater Cove will be similar to those at the existing Casino. Whilst a reasonable assumption, this is not able to be confirmed at this stage as there is no existing land at this location where noise logging can be carried out.

It is also not possible to determine the actual attenuation which will be provided by the barrier generally, as this will vary considerably with source location, height, distance from the precinct and receiver height and location.

#### 1.7.4 Recommendations for Further Investigation

We understand that it is a clear objective for this project, that noise from the existing and future operations of the Port are properly mitigated at Breakwater Cove, to ensure amenity for the residents of Breakwater Cove is preserved, and to prevent future noise impact problems from arising.

Computer noise modelling of the existing and future port operations is likely to confirm the effectiveness of the current proposed mitigation measures and identify any areas where control of port activity noise impact may require further mitigation. This will also verify the comparison of noise impact between Breakwater Cove and the existing Casino. This modelling has not been carried out to date in the absence of pertinent noise data for current Port operations.

It is therefore a recommendation of this report that Port source noise measurements and noise modelling be carried out for a selection of nominated worst case Port sources. We have been instructed to carry out these measurements and noise contour modelling, and a supplementary report will be added to the EIS as soon as it is available. This will be used to predict absolute rather than relative impact and will clearly demonstrate the extent of predicted attenuation provided by the barrier. This will then enable the Breakwater Cove precinct to be zoned according to noise impact levels with minimum building treatments nominated for each zone to

Noise and Vibration Assessment Townsville Ocean Terminal Hyder Consulting Pty Ltd Incorporating Weathered Howe ABN 76 104 485 289 12/10/07 3:58 24



ensure that internal levels meet the requirement of current Australian Standards.

- 1.7.5 Spatial Relationship Between the Port and Breakwater Cove A long section showing this relationship is attached in Appendix 6 for clarification.
- 1.8 Noise Impact from the TOT Project

#### 1.8.1 Construction Site Noise Impacts

Noise impacts are possible during the following construction phases:

- Bulk earthwork phase;
- TOT construction work phase;
- Civil work phase;
- Loading activity at the Riverside Marine site; and
- Combined construction activities

As the existing residences to the south and south-west are reasonably distant from the construction sites, construction noise and vibration impacts from the proposal are unlikely to be significant.

The highest construction noise impact would be at residences near the Riverside Marine site (west of Ross River) primarily because these activities would extend outside the daytime period. However, this will only be significant if the temporary bridge haul route option is not adopted, a this option is expected to significantly reduce loading activities at the Riverside Marine Site.

For daytime noise impact, the Casino accommodation is likely to be the most affected. There is no quantitative criteria for construction noise impact between the hours of 6.30am and 6pm in Queensland. Therefore the best practice mitigation measures detailed in this report are recommended to mitigate construction noise impact on the nearby receivers.

If the Riverside Marine haul route is adopted, the noise control measures proposed could provide a noise reduction of up to 10dB(A) at the Ross River residences, resulting in external construction noise levels of 40-45dB(A). With windows open adequate for ventilation, the difference between the external and internal noise levels is typically 10dB(A). Hence, construction noise levels inside the residences' bedrooms would be in the order of 30-35dB(A) and are within the internal noise levels recommended by Australian Standard AS2107:2000.



## 1.8.2 Construction Traffic Noise Impacts

The predicted increases in road traffic noise levels as a result of construction traffic are within 2dB(A), except for residences along Archer Street, Ross Street, Oxley Street and The Strand. For residences along these streets, the increases in road traffic noise levels are within 3-4dB(A).

Subjectively, an increase in 2dB(A) is generally considered just noticeable and an increase of 3-5dB(A) is clearly noticeable. Haulage Contractors will be requested to maintain delivery vehicles properly and operate efficiently to minimise noise impact from construction traffic.

Impact on receiver located near to the temporary bridge haul route have been assessed as part of a supplementary report, appended to the EIS. This assessment has determined that the predicted noise levels from construction traffic associated with the temporary bridge over Ross Creek comply with the noise assessment objective of 60dB(A)  $L_{A10,18hr}$  at the nearest residential buildings located at the end of The Strand and Sir Leslie Thiess Drive.

#### 1.8.3 Ocean Terminal Operational Noise Impacts

Noise emissions from the TOT ship operations have the potential to exceed the recommended levels at the future residential development within the Breakwater Cove Precinct.

Maximum noise levels from ship horns are expected to exceed the assessment guideline at Jupiter's Casino and residential development within the Breakwater Cove Precinct. In order to control these emissions, an Operational Noise Management Plan should be implemented and ship horn operations should be limited during night-time.

Proposed measures to be implemented by the Port Protection Codes should be appropriate to achieve acceptable levels within the Breakwater Cove residences.

In addition to the Port Protection Codes, design mitigation measures could include property boundary fences, minimum building envelope constructions, or glazing for exposed windows and doors and appropriate window/ door orientations.

Page 6

Noise and Vibration Assessment Townsville Ocean Terminal



# 2 Introduction

# 2.1 Purpose

Hyder Consulting Pty Ltd (Hyder) was commissioned by City Pacific Limited to prepare an Acoustic and Vibration Assessment for the proposed construction and operation of the Townsville Ocean Terminal (TOT) Project.

This report provides a summary of the construction and operational noise and vibration assessment for incorporation into an Environmental Impact Statement (EIS). The report is preliminary and investigative for the purpose of the EIS. More detailed investigation will be required during the design development phase.

The noise and vibration assessment has been based on:

- Review of conceptual site layout;
- Site inspections to identify nearby noise sensitive receptors;
- Measurements of existing ambient noise levels;
- Establishment of relevant noise and vibration assessment guidelines; and
- Prediction and assessment of noise and vibration from the proposed development.

The noise and vibration assessment has been prepared for the particular investigation described above and should not be used in any other context.

# 2.2 Project Description

The site proposed for development of the TOT Project is located adjacent to the Townsville Hotel and Casino Complex and the Townsville Entertainment Centre as identified in the Breakwater Island Casino Agreement Act (BICA) as the "Future Development Area". This area is identified in the context of the surrounding area on Drawing K200–QL00704-01 in the construction methodology report and is bounded by the Port Western Breakwater, the existing Offshore Breakwater and the Townsville Hotel and Casino Complex and the Townsville Entertainment Centre Peninsula. The TOT project is the reclamation of land to the north of Sir Leslie Thiess Drive for development of two precincts –

(1) The TOT Precinct: will be developed for construction of a dedicated ocean terminal and ancillary facilities for use by cruise ships and naval vessels. Naval vessels currently utilise the existing Townsville Port facilities. The design of the Townsville Ocean Terminal will also cater for additional visits to Townsville by naval vessels through the provision of dedicated berthing facilities.



(2) The Breakwater Cove Precinct: a residential area providing for a range of uses including apartments, attached dwellings, detached dwellings, commercial and retail facilities services, landscaping and public utilities. The Breakwater Cove Precinct will be constructed on reclaimed land to the west of the Townsville Ocean Terminal and will provide waterfront residential properties including attached and detached dwellings and apartment buildings.

The project site is located within the State waters of Cleveland Bay, which supports species, communities and habitats of conservation significance under State and Commonwealth legislation. The site is within the Great Barrier Reef World Heritage Area but is excluded from the Great Barrier Reef Marine Park as it is located within Port of Townsville limits.

Figure 1 and

Noise and Vibration Assessment Townsville Ocean Terminal Hyder Consulting Pty Ltd Incorporating Weathered Howe ABN 76 104 485 289 12/10/07 3:58 24

Page 8



Figure 2 show the site location and conceptual site layout for the proposed development.



Figure 1: Site Location

Noise and Vibration Assessment Townsville Ocean Terminal Hyder Consulting Pty Ltd Incorporating Weathered Howe ABN 76 104 485 289 12/10/07 3:58 24

Page 9



#### Figure 2: Conceptual Site Layout



Noise and Vibration Assessment Townsville Ocean Terminal Hyder Consulting Pty Ltd Incorporating Weathered Howe ABN 76 104 485 289 12/10/07 3:58 24

Page 10



# 3 Description of Existing Environment

## 3.1 Sensitive Receptors

#### 3.1.1 Existing Sensitive Receptors

The TOT and Breakwater Cove Precincts have the potential to impact on the following existing sensitive receptors:

- existing residences to the south and south-west of the Townsville Ocean Terminal (e.g. Mariners Peninsula)
- existing residences along the material delivery haul routes
- The existing Port of Townsville
- The existing Townsville CBD
- Holiday accommodation at the Casino Precinct.
- Existing marine fauna within Cleveland Bay.

#### Adjacent Residences

The nearest existing residences are approximately 1,200m to the south and 800m to the south-west of the proposed development. The nearest existing residences from the Riverside Marina site are approximately 200m to the west of the mouth of Ross River. The nearest residences along the haul routes would be in the order of 10m to the roads.

## Existing Port of Townsville

The existing Port is not likely to experience any significant noise impacts from the TOT project given the commercial and industrial nature of land usage in the Port precinct, the distance between the Port and the TOT project site (approximately 500-1500m) and expected high existing background noise levels. Therefore, noise impact from the TOT project on the existing Port has not been considered as part of this assessment.

## Existing Townsville CBD

The Townsville CBD is located approximately 700m southwest of the TOT project site. Existing commercial and retail businesses operate within the CBD as well as dining and night club precincts. It is not expected that noise emissions from the TOT project site would result in significant noise impacts due to its distance from the CBD and mitigation measures implemented at the TOT project to control noise impacting on the nearby residential receptors. There are no current EPP noise criteria for noise from industrial or commercial sources impacting on commercial receptors.



Therefore noise impacts from the TOT project on the existing CBD have not been considered as part of this assessment.

#### Jupiter's Casino and Townsville Entertainment Centre

The Jupiter's Casino accommodation and the Townsville Entertainment Centre are the closest noise sensitive receptors to the TOT project site. However, given the distances involved, the only likely noise impact on these receptors is likely to be from ship horns from the TOT Precinct, which will not occur frequently.

#### Marine Fauna

Other noise sensitive receptors include marine fauna species potentially affected by cruise ship and naval traffic and construction sites at the TOT and Breakwater Cove Precincts. Potential noise impacts on the marine environment are outlined in Section 4.2.6 of this report.

#### 3.1.2 Future Sensitive Receptors

Future noise sensitive receptors within the TOT project site are the future residential dwellings within the Breakwater Cove Precinct. The TOT Precinct itself is not considered to be a noise sensitive receptor.

Future residential dwellings within the Breakwater Cove Precinct will be approximately 100m to 800m from the TOT Precinct. Potential impacts from TOT operations on the Breakwater Cove Precinct have been considered as part of this assessment.

The residential dwellings within the Breakwater Cove Precinct would not be affected by construction noise and vibration as it is expected that occupation of these residences will occur after the construction of the Breakwater Cove Precinct and TOT Precincts.

Future residential development within the Breakwater Cove Precinct is approximately 500m to 1,500m from the existing Port of Townsville Facilities and will be approximately 1,200m to 1,800m from Port of Townsville future expansion.

## 3.2 Noise and Vibration Sources

#### 3.2.1 The Existing CBD

The Townsville CBD is located some 700m southwest of the TOT project site. Existing commercial and retail businesses operate within the CBD as well as dining and night club precincts.

Noise and Vibration Assessment Townsville Ocean Terminal



It is not expected that noise emissions from this source would cause impacts on future residences of Breakwater Cove due to the distance from the CBD.

However, the long term continuous noise logging that was undertaken as part of this acoustic study includes monitoring of noise from the CBD. The recommended EPP project noise level objective criteria (refer Section 4.1.3) has taken into account ambient noise levels from all existing noise-generating sources.

#### 3.2.2 Jupiter's Casino and Townsville Entertainment Centre

The Jupiters Casino Complex and the Townsville Entertainment Centre are the closest noise-generating source to the TOT project site. The majority of site operations within this complex are contained within existing buildings and are not expected to have significant impacts on future residences within the Breakwater Cove precinct.

Other potential noise sources from this precinct, identified in this assessment are external plant and equipment servicing the complex.

Noise monitoring was conducted within the Casino complex to account for existing noise levels from operation of plant and services. The recommended EPP project noise level objective criteria (refer Section 4.1.3) for the project site has taken Casino ambient noise levels into account.

#### 3.2.3 Existing Port Operations

Existing Port of Townsville operations may impact on the future residences within Breakwater Cove by emission of noise from operational activities. The Port of Townsville operations that are nearest to the TOT project site are Berths 1 to 4, and 7 to 10. Operations at these berths include loading and unloading of:

- bulk cement, scrap metal, minerals and ores;
- general cargo and containers;
- motor vehicles and live cattle;
- frozen beef, raw sugar, molasses and fertiliser;
- passengers and luggage; and
- discharge of bulk liquids and fuel oil bunkering.

A range of vessels are received at these berths including bulk carriers, tankers, cargo vessels, livestock carriers, vehicle carriers and cruise and naval vessels. Goods are loaded and unloaded from these vessels by use of mobile handling equipment including hoppers and conveyors, forklifts, tractors, cranes and front-end loaders.



Other nearby Port operations include Patrick Stevedores, Australian Molasses Trading, Origin Energy, Queensland Nickel, Xstrata and the NSS Container Terminal.

### Port Users, Activities and Existing Approvals

Storage, processing and workshop operations within the Port precinct are located at greater distance from the project site than berth operations. However, these operations may impact on future residences by emission of noise. Existing Port users conduct the following Environmentally Relevant Activities (ERAs) under existing approvals and licences issued by the Environmental Protection Agency (EPA) that require noise control and monitoring measures to be undertaken in accordance with the conditions of approval.

- Queensland Terminals Pty Ltd operates under Development Authority No. ENDC00473406 for chemical storage and stockpiling, loading or unloading. Condition 32 of this authority relates to noise control and requires that noise emissions comply with requirements of the Noise Abatement Act. Since then the Environmental Planning Policy (Noise) 1997 has superseded this legislation.
- Southern Cross Fertilizers Pty Ltd operates under Development Authority No. ENCD00514006 for stockpiling, loading or unloading and crude oil or petroleum storage. Conditions F1 to F3 relate to noise complaints and require the holder of the authority to take necessary actions to resolve any complaint by appropriate dispute resolution or implement noise abatement measures to achieve required noise limit levels.
- Shell Company of Australia and Australian Petroleum Pty Ltd conducts stockpiling, loading or unloading and crude oil or petroleum storage under Development Approval No. ENDC00250105B11. This authority does not prescribe conditions for noise.
- The Shell Company of Australia Limited conducts stockpiling, loading or unloading and crude oil or petroleum storage under Integrated Authority No. NR0448. Conditions D1 to D3 prescribe noise limits that must not be exceeded and requires noise monitoring be undertaken on receipt of a complaint.
- Queensland Cement Limited operates under Environmental Authority No. ENDC00250105B11 to undertake chemical manufacturing, processing or mixing and stockpiling, loading or unloading of bulk goods. Conditions E1 and E2 require the authority holder to prevent or minimise noise emissions and to not cause unreasonable noise beyond the site boundaries.
- Queensland Nickel Pty Ltd operates under Licence No. NR0091 for storage of crude oil or petroleum products and Environmental Authority No. 5020000183 for stockpiling, loading or unloading which are issued by the EPA. These approvals require the operator to



prevent or minimise environmental nuisance and ensure that noise emissions comply with prescribed noise limits.

- MIM Holdings Pty Ltd operates under Licence No. NR0054 to conduct screening, stockpiling, loading or unloading and operation of a motor vehicle workshop.
- SIMS Metal Limited conducts metal recovery and regulated waste storage activities under Integrated Authority No. SR1420. This authority requires noise monitoring to be conducted in the event of a complaint and prescribed noise limits to be achieved at noise sensitive places and commercial places.
- Australian Marshall Services undertakes sawmilling or woodchipping activities under Approval No. ENRE00246705. The conditions of approval require that noise from these activities must not cause environmental nuisance at any noise sensitive place or commercial place.
- Townsville Port Authority holds an Environmental Authority (Licence No. NR238) to conduct sewerage treatment, marina or seaplane mooring and regulated waste storage. The conditions of this authority require that any necessary actions be taken to resolve a complaint by appropriate dispute resolution or implement noise abatement measures to achieve required noise limit levels.
- Patrick Logistics conduct storage of chemical and regulated waste under Development Approval No. ENRE00265205. There are no conditions relating to noise under this approval.
- BP Australia Limited operates under Development Approval No. IPCE00404506C11 for storage of crude oil or petroleum. This approval requires that any necessary actions be taken to resolve a complaint by appropriate dispute resolution or implement noise abatement measures to achieve required noise limits.
- Stockpiling, loading or unloading bulk goods are undertaken at Berth 7 within the Port of Townsville under Development Approval No. ENCD00454205. This approval requires that any necessary actions be taken to resolve a complaint by appropriate dispute resolution or that noise abatement measures are implemented to achieve specified noise limits.
- Incitec Fertilisers Limited conducts chemical manufacturing, processing or mixing under Licence No. NR0512. This licence requires recording and investigation of complaints of noise nuisance be undertaken.
- BHP Minerals operates under Environmental Authority No. NR162 for stockpiling, loading or unloading of bulk goods. This authority requires noise monitoring to be conducted in the event of a complaint and prescribed noise limits to be achieved at noise sensitive places and commercial places.
- S Colborne Pty Ltd operates a motor vehicle workshop under Licence No. NR0428. This licence requires management of environmental



impacts in accordance with the conditions of a previous development approval for the site (conditions not provided).

- Northern Port Services Pty Ltd operates under NR0495 to conduct boilermaking or engineering activities and for operation of a motor vehicle workshop (conditions not provided).
- Northern Shipping and Stevedoring Pty Ltd operates under Licence No. NR268 for stockpiling, loading or unloading bulk goods. The licensee is required to take reasonable and practical measures to minimise noise emissions.
- Patrick Stevedores Operations Pty Ltd conducts stockpiling, loading or unloading of bulk goods under Environmental Authority No. NR233. The holder of the authority is required to achieve specified noise limits in the event of a complaint.
- Caltex Australia Petroleum Pty Ltd conducts crude oil or petroleum storage and stockpiling, loading or unloading of bulk goods under Environmental Authority No. NR361. The holder of the authority is required to take any necessary actions to resolve a complaint by appropriate dispute resolution or implement noise abatement measures to achieve specified noise limits.
- Queensland Sugar Limited operates under Licences No. NR0390, NR0517 and NR0391 for stockpiling, loading or unloading bulk goods. These licences require that specified noise limits are to be achieved in the event of a complaint.
- Licensed activities and conditions of approval for other operations within the Port precinct including Xstrata, Australian Molasses Trading, Chemtrans, Origin Energy, NSS Container Terminal, Pentarch Forests and Powerplay Catamarans were unknown at the time of writing this report.

## Port Shipping Traffic

A review of the shipping log issued by the Port of Townville indicates the following ship movements for the last 12 months:

Average weekly ship movements	28
No of Ship movements during logging period (1 week)	35
Minimum number of weekly ship movements in the last 12 months	14
Maximum number of weekly ship movements in the last 12 months	38

The above indicates that the shipping movements occurring during the noise logging period were indicative of the worst case scenario of weekly shipping movements. Analysis indicates that the maximum for the last 12



month period was 3 more ship movements than used the Port during the noise logging period. This is equivalent to an absolute worst case increase in dB over the logger period of 0.4 dB, which is considered marginal.

#### 3.2.4 Future Port Operations

#### Future Port Expansion

At the time of preparation of this report Hyder understands that the proposed expansion of the Port of Townsville to 2030 includes future layout of additional infrastructure and demolition or relocation of existing infrastructure. Future works within the existing Port precinct include:

- demolition of Berth 7;
- upgrade of Berth 4;
- extension of the pier at the end of Berth 8;
- demolition of the Xstrata site; and
- relocation of Origin Energy.
- Extension of Berth 10 to allow for a potential doubling in ship traffic & associated activities.

The majority of expansion of the Port precinct will proceed on reclaimed land to the east of the existing Port operations and will include the following:

- construction of 7 additional berths;
- construction of bulk storage sheds; and
- construction of cargo storage areas.
- Proposed changes to road and rail access to move road and rail corridors further from residential areas.

The proposed expansion as provided by the Port of Townsville indicates that the majority of the expansion and the additional berths will generally be located further away from the Breakwater Cove and TOT precincts to the north east.

Hyder understands the key requirements to be:

- One or two additional berths are likely be required by 2015.
- Between 1 and 3 new bulk berths will be required by 2030
- Two of the three new berth above may be required to service Chalco.



#### Future Port Activities

#### Future Shipping Requirements

Hyder understands that given a high growth scenario (worst case), ships are likely to typically increase from 4.4 vessels per day to 8,5 vessels per day.

#### Future Road & Rail Requirements

Hyder understands the key future requirements to be:

- Road and rail transport are expected to increase nearly three-fold over the 25 year period given the high growth (worst case) scenario.
- All cargo imports and exports for Chalco are likely to be transported in and out the port by conveyor and pipeline.
- The eastern access corridor will become increasingly important for inland transportation because of impacts of present port access routes on residential areas.

## Future Shipping Requirements

Hyder understands that the predicted additional land required for the development of cargo storage / transfer areas (lease areas) by 2030 is between 10 and 42 Ha depending on the level of growth.

## 3.2.5 TOT Project Noise Sources

TOT project operational noise sources will include cruise ship and naval vessel operations and increase in road traffic on public roads as a result of the project. The potential impacts associated with TOT operational noise sources are assessed in Section 4.2.3.

Construction noise and vibration sources will include equipment and plant used for the construction of the Townsville Ocean Terminal, Breakwater Cove Precinct and construction traffic. The potential impacts associated with construction noise sources are assessed in Section 4.2.2.

## 3.3 Ambient Noise Environment

#### 3.3.1 Noise Monitoring

Environmental noise data loggers were installed at six (6) representative locations from Thursday 19 October to Thursday 2 November, 2006 to measure existing ambient noise levels.

Noise and Vibration Assessment Townsville Ocean Terminal



The noise loggers were checked before and after the measurements with a sound level calibrator and drift in calibration remained within  $\pm 0.5$ dB(A).

The purpose of the noise logging is to ascertain and describe the existing ambient noise environment at receptors considered representative of the existing and future residential development.

It is noted that as the Breakwater Cove Precinct has not been constructed, measured noise levels at the Jupiters Casino are used to represent those at the Breakwater Cove Precinct.

Table 1 provides a description of the monitoring locations and noisesourcesobservedduringthesiteinspections.



Figure 3 shows the monitoring locations. The measured noise levels at locations L5 and L6 are for information only as these locations would not be affected by operational noise from the proposed development.

Observations from the site inspections confirmed that the existing noise environment is due to port activities, road traffic, freight trains, aircraft from the commercial and military airports and natural environment such as waves, wind in trees and bats.

Table 1:

Noise Monitoring Locations

	Monitoring Location	Observed Noise Sources
L1	The Beach House Motel, The Strand	Road traffic, waves, bats
L2	21 Cleveland Terrace	Road, rail and air traffic, mechanical plant from neighbouring buildings, local commerce (hotel outdoor entertainment)
L3	Enterprise House	Local road traffic, sugar loading facility
L4	Jupiters Casino	Train shunting, port activities, mechanical plant
L5	Townsville Port Terminal	Port activities
L6	Cannan Street	Road and rail traffic, nearby industries



#### Figure 3: Noise Monitoring Locations



#### 3.3.2 Meteorological Conditions

During the assessment the meteorological condition were noted as:

Conditions: Mostly Fine, Brief light shower, Tuesday 24.

Temperature: 17 – 31°C

Wind: SE to NE direction 22-33 km/h

Humidity: 30-70%

#### 3.3.3 Equipment Calibration

Calibration carried out before and after the measurements, of the measuring equipment was noted to vary by less than +/-  $0.5 \, dB(A)$  during the course of the monitoring.

#### 3.3.4 Environmental Noise Descriptors

As environmental noise varies with time, A-weighted statistical levels are used to describe ambient noise levels. The common parameters used to

Noise and Vibration Assessment Townsville Ocean Terminal



describe environmental noise the  $L_{Amax}$ ,  $L_{A1}$ ,  $L_{A10}$ ,  $L_{A90}$  and  $L_{Aeq}$  levels measured over 15-minute intervals.

The statistical measurements are described a follows:

- L<sub>Amax</sub>: is the A-weighted maximum noise level measured during the measurement period.
- L<sub>A1</sub>: is the A-weighted noise level exceeded for 1% of the measurement period, referred to as the adjusted maximum sound pressure level.
- L<sub>A10</sub>: is the noise A-weighted level exceeded for 10% of the measurement period, generally referred to as the average maximum sound pressure level.
- L<sub>A90</sub>: is the A-weighted noise level exceeded for 90% of the measurement period, generally referred to as the average minimum sound pressure level or background noise level (refer AS 1055.1 – 1997).
- L<sub>Aeq</sub>: is the equivalent continuous noise level over the measurement period, generally referred to as the average sound pressure level over the measurement period.

A-weighting refers to a filter that is applied to compensate for the sensitivity of the human ear (refer Table 4; AS 1259:1990). Environmental noise impacts are usually expressed as A-weighted noise levels in terms of dB(A).

#### 3.3.5 Ambient Noise Monitoring Results

Appendix 1 presents a graphical summary of the measured  $L_{Amax}$ ,  $L_{A1}$ ,  $L_{A10}$ ,  $L_{A90}$  and  $L_{Aeq}$  noise levels at 15-minute intervals.

Table 2 presents a summary of the day/evening/night assessment background  $L_{A90}$  level (ABL) and rating background  $L_{A90}$  level (RBL), established in accordance with Appendix B of the QLD Environmental Protection Agency Planning for Noise Control Guideline.

The ABL is the lowest tenth-percentile value of the hourly  $L_{A90}$  noise levels for the relevant day/evening/night periods for each day. The RBL is the median value of the relevant day/evening/night period during the monitoring period.

The hourly  $L_{A90}$  and  $L_{Aeq}$  noise levels were obtained by arithmetically and logarithmically averaging the levels measured over the 15-minute intervals during the relevant hours respectively.

In accordance with the EPA Planning for Noise Control Guideline (refer Section 4.1.3 of this report), daytime is the period from 7:00am - 6:00pm; evening is the time period from 6:00pm - 10:00pm and night-time is the



period from 10:00pm - 7:00am. For Sundays and public holidays, daytime is the period from 9:00am - 6:00pm.

Date	A Back	ssessmei (ground L	nt .evel	Energy	Average Level	L <sub>Aeq,1hr</sub>
	Day	Evening	Night	Day	Evening	Night
L1. The Beach House Motel, The	e Strand					
Friday 20 October 2006		50.0	42.0		62.7	60.8
Saturday 21 October 2006	47.5	47.8	41.5	63.1	62.5	60.0
Sunday 22 October 2006	49.5	50.5	43.0	64.7	63.6	58.9
Monday 23 October 2006	48.5	51.8	42.0	64.9	62.7	58.4
Tuesday 24 October 2006	47.5	50.0	41.0	64.9	62.7	56.7
Wednesday 25 October 2006	47.2	50.0	42.0	62.9	62.3	58.1
Thursday 26 October 2006	46.5	48.5	41.0		63.2	58.5
Rating Background Level (RBL)	48	50	42			
Energy Average Level				64	63	59
L2. 21 Cleveland Terrace						
Thursday 19 October 2006		42.3	39.5		50.0	52.0
Friday 20 October 2006	47.2	43.2	40.6	57.2	50.0	50.6
Saturday 21 October 2006	44.7	42.8	41.4	55.3	48.3	49.1
Sunday 22 October 2006	43.7	44.4	40.9	59.0	49.6	49.4
Monday 23 October 2006	46.3	46.2	40.3	56.3	51.5	49.2
Tuesday 24 October 2006	47.0	44.1	40.1	59.0	49.9	48.0
Wednesday 25 October 2006	46.9	43.7	40.9	57.8	48.7	49.2
Thursday 26 October 2006	44.3	43.6	40.9	57.2	48.6	49.8
Rating Background Level (RBL)	46	44	41			
Energy Average Level				57	50	50

 Table 2:
 Existing Ambient Noise Levels, dB(A)

Table 2: Existing Ambient Noise Levels, dB(A) (contd.)



Date	Assessment Background Level		Energy	Energy Average L <sub>Aeq,1</sub> Level		
	Day	Evening	Night	Day	Evening	Night
L3. The Enterprise House						
Friday 20 October 2006		47.7	44.2		56.2	53.8
Saturday 21 October 2006	48.1	44.6	44.5	56.1	55.0	54.7
Sunday 22 October 2006	48.3	48.1	43.3	57.1	55.1	53.8
Monday 23 October 2006	51.2	49.9	42.5	58.6	55.9	52.7
Tuesday 24 October 2006	48.7	47.1	42.7	59.0	55.5	53.4
Wednesday 25 October 2006	49.4	47.5	43.2	58.6	54.4	53.0
Thursday 26 October 2006	50.2	46.4	43.9	59.1	54.5	53.4
Rating Background Level (RBL)	49	48	43			
Energy Average Level				58	55	54
L4. Jupiters Casino						
Friday 20 October 2006		45.9	45.1		48.9	49.4
Saturday 21 October 2006	46.9	45.9	46.0	53.1	52.3	49.9
Sunday 22 October 2006	48.2	47.7	46.3	55.0	53.6	51.6
Monday 23 October 2006	48.3	50.0	45.1	56.7	57.0	51.7
Tuesday 24 October 2006	47.4	47.0	45.4	58.0	52.3	49.1
Wednesday 25 October 2006	46.9	46.9	44.9	55.6	51.4	48.9
Thursday 26 October 2006	47.5	45.6	45.7	58.1	49.3	49.5
Rating Background Level (RBL)	47	47	45			
Energy Average Level				56	53	50
L5. Existing Port Terminal						
Friday 20 October 2006		50.0	47.2		61.6	56.9
Saturday 21 October 2006	46.6	49.4	56.2	56.8	53.2	61.7
Sunday 22 October 2006	59.3	59.4	58.6	74.3	65.2	66.3
Monday 23 October 2006	59.5	58.2	56.1	67.6	63.2	59.4
Tuesday 24 October 2006	50.2	47.6	45.1	64.0	51.3	56.8
Wednesday 25 October 2006	59.4	58.6	53.3	67.7	65.0	73.0
Thursday 26 October 2006	54.5	55.9	53.1	74.9	69.2	72.0
Rating Background Level (RBL)	57	56	53			
Energy Average Level				71	64	68
L6. Cannan Street						
Friday 27 October 2006		37.2	35.5		51.0	48.5
Saturday 28 October 2006	41.0	34.1	34.7	57.8	44.2	48.8
Sunday 29 October 2006	37.4	36.8	35.5	59.4	44.0	50.3
Monday 30 October 2006	46.2	35.5	35.9	55.2	46.8	49.6
Tuesday 31 October 2006	45.5	37.4	36.8	55.1	46.4	50.6
Wednesday 1 November 2006	46.9	39.1	35.4	55.8	47.5	49.4
Thursday 2 November 2006	47.0			57.7		
Rating Background Level (RBL)	46	37	36			
Energy Average Level				56	47	50

Noise and Vibration Assessment Townsville Ocean Terminal Page 24 Hyder Consulting Pty Ltd Incorporating Weathered Howe ABN 76 104 485 289 12/10/07 3:58 24



## 3.3.6 Cruise Terminal Noise Monitoring Results

Noise levels from commercial ship operations at the Brisbane Cruise Terminal were measured on 14 November 2006 to ascertain reference noise levels for the purpose of modelling operational noise levels from the TOT Precinct.

Table 3 presents a summary of the typical noise levels associated with passenger cruise ship operations.

Noise Source	Measured L <sub>Aeq</sub> Noise Level, dB(A)									
Noise Source	31.5	63	125	250	500	1000	2000	4000	8000	dB(A)
Ship idling at 10m	72.0	75.2	68.4	62.4	59.0	54.4	48.8	42.0	32.1	66
Ship winching gang plank up at 10m	72.1	75.8	68.1	63.4	70.5	64.0	59.5	48.0	44.5	73
Ship PA system at 10m	72.2	75.5	68.8	67.7	75.7	67.6	66.9	61.1	51.1	78
Ship horn at 30m <sup>1</sup>	73.9	77.1	94.5	85.7	94.8	88.7	83.6	78.6	68.9	97
Ship pulling away at 25m	68.1	75.8	73.2	67.0	62.3	58.7	51.9	45.8	39.7	70
Forklift at 2m	81.5	80.0	75.3	72.8	73.2	73.6	67.8	57.5	50.4	79

 Table 3:
 Noise Levels Associated with Passenger Cruise Ship

Note 1 L<sub>Amax</sub> noise level.

Noise levels from naval vessels are not available as permission was not granted to undertake noise measurements. However, it is expected that noise from naval ships would be lower as would be required for military operations.

# 3.4 Relevant Legislation and Standards

## 3.4.1 Local Laws

## Existing Port Protection Code Requirements

Section 51 of the *Breakwater Island Casino Agreement Act 2006* (BICA Act) defines the Surplus Casino Land (SCL) Port Protection Code. The purpose of the Code is to minimise impacts on the existing and future operations of the Port of Townsville from future development of the SCL.

Future development within the SCL will be required to comply with the probable solutions (self-assessable development) or specific outcomes (assessable development) of the Code in order to prevent conflict of incompatible land uses that may arise as a result of impacts such as emission of noise, dust, odour, and from light and visual intrusion.

Noise and Vibration Assessment Townsville Ocean Terminal



The Port Protection Code identifies Specific Outcomes (SO) that relate to noise impacts. Probable Solutions are specified in the Code detailing appropriate design measures to achieve the SOs and to minimise impacts on future residences within the Breakwater Cove precinct from noise emissions from existing and future port operations.

Specific Outcomes	Probable Solutions
SO1 - Openings in the buildings are located, designed and constructed to maximise residential comfort and safety and assist in the reduction of adverse noise impacts as a result of Port operations.	PS1.1 All external doors excluding garage doors are to be provided with seals and timber doors are solid core 40mm thick. AND
	PS1.2 The aggregate area of windows and glass doorways on each building façade with direct sight lines to the operations of the Port of Townsville does not exceed 40% of the total area of that façade unless PS3.1 is complied with. AND
	PS1.3 If the aggregate area of windows and glass doorways on a building façade with direct sight lines to the operations of the Port of Townsville exceeds 40% of the total area of that façade, all windows and glass doors of that façade shall be of acoustic quality. AND
	PS1.4 Notwithstanding PS1.2, all bedroom windows on each building facade with direct sight lines to the operations of the Port of Townsville shall be of acoustic quality. AND
	PS1.5 Ventilation openings located on exposed walls and eaves facing the Port of Townsville that leads directly into living areas are to be acoustically treated.
	Note for the purposes of PS1.1 to PS1.5 where noise sensitive issues as defined in the EPP Noise are proposed, architectural treatments of building elements are required to meet indoor design level noise criteria to achieve:
	a) average Lmax (10pm to 6am) not greater than 50dB(A); and
	b) 35LAeq.
SO2 - Appropriate construction materials for buildings assist in the mitigation of	PS2.1 All development incorporates the following minimum standards of construction:



adverse noise intrusion.	<ul> <li>Cavity masonry or concrete construction for external walls of buildings; or</li> </ul>
	<ul> <li>Fibre insulation such as fibreglass or polyester bats are inserted in external walls. AND</li> </ul>
	PS2.2
	<ul> <li>Fibre insulation such as fibreglass or polyester bats are inserted in all roof cavities.</li> </ul>
	Note for the purposes of PS2.1 to PS2.2 where noise sensitive issues as defined in the EPP Noise are proposed, architectural treatments of building elements are required to meet indoor design level noise criteria to achieve:
	<ul> <li>average Lmax (10pm to 6am) not greater than 50dB(A); and</li> </ul>
	d) 35LAeq.
SO3 - Air conditioning units are provided for all habitable buildings and workplaces, other than ancillary or minor development or construction sites so as to maximise	PS3.1 Air conditioning units are provided for all habitable buildings and workplaces, other than ancillary or minor developments or construction sites. AND
comfort and mitigate any adverse noise, dust or odours from the Port operations.	PS3.2 All air conditioning units are reverse cycle systems and comply with any relevant Australian Standard with respect to fresh air under the Building Code of Australia.
SO7 – Above ground outdoor areas are not subject to unacceptable levels of noise, light, dust or odour from Port of Townsville operations.	PS7.1 Balconies larger than 3 square metres are located only on the marina frontage.
SO8 – Ground level outdoor areas are not subject to unacceptable levels of noise, light or air pollution	PS8.1 All development must have a screen between its northern boundary and the adjacent car parking area and between its eastern boundary and Sir Leslie Thiess Drive meeting the following:
	A fence constructed of solid materials such as overlapped timber palings, brick or blockwork with a height of 1.8 metres. Fences exceeding 10 metres in length will include articulation every 3 metres or detailing for visual interest, or

Noise and Vibration Assessment Townsville Ocean Terminal



		A landscaped strip of at least 2m in width. Minimum planting density is one plant per square metre with a ratio of one large shrub/small tree to eight understorey shrubs. Trees are to have a mature height of 4 metres.
--	--	---

We believe that the current Port Protection Code covers the proposed Breakwater Cove & TOT precincts, but will be updated to incorporate the findings of this EIS.

## Townsville City Plan

The Townsville City Plan contains a number of codes relevant to this development which describe specific outcomes and probable solutions.

## Accommodation Building Code (6.2)

(4) Amenity Impacts

Specific Outcomes	Probable Solutions
SO16 The amenity of adjoining premises is	PS16.6 Air conditioning units are insulated so that
not unreasonably adversely affected	adjoining properties are not affected by the noise
having regard to privacy, visual impact,	source, and the unit is installed on the roof or at the
noise, odour and lighting	rear of the building.

#### (6) Road and Rail Noise Attenuation

Specific Outcomes	Probable Solutions
SO17 The premises are not subjected to unacceptably high levels of noise	PS17.1 The site is not located within 100m of a railway or within 25m of any sub-arterial road as described in Schedule 2A
	AND
	PS17.2 Noise levels at habitable floor areas of buildings on land adjoining a State-controlled road are no greater than:
	$60dB(A) L_{10}$ (18 hour) or less, where existing levels measured at the buildings' setback distance from the road are greater than 40dB(A) L <sub>90</sub> (8 hour) between 10pm and 6am; or
	57dB(A) L <sub>10</sub> (18 hour) or less, where existing levels measured at the buildings' setback distance from the road are less than or equal to 40dB(A) L <sub>90</sub> (8



hour) between 10pm and 6am; or
Where the above cannot be achieved, internal maximum design criterion levels specified in Table 1 AS2107-1987.
AND
PS17.3 Noise levels on balconies and external open space (both private and communal) on land adjoining a State-controlled road are no greater than:
$60dB(A) L_{10}$ (18 hour) or less, where existing levels measured at the buildings' setback from the road are greater than $45dB(A) L_{90}$ (18 hour); or
57dB(A) L <sub>10</sub> (18 hour) or less, where existing levels measured at the buildings' setback from the road are less than or equal to $45$ dB(A) L <sub>90</sub> (18 hour).
AND
PS17.4 Where the premises is located near a high level noise source such as major roads, railway line or noise generating activities and industries:
Any private open space or balcony is located away from the noise source or incorporates design elements to buffer noise;
Doors incorporate an enclosed porch;
Non-habitable rooms are located between the noise source and bedrooms;
Exhaust vent outlets are insulated or vented into the ceiling space away from the noise source: AND
Facades facing the noise source adopt construction techniques and materials, which buffer the dwelling from the noise source.

## Works Code (6.26)

#### (1) Management of Site Works

Specific Outcomes	Probable Solutions
SO1 During construction measures are taken to protect nearby residences from noise nuisance. (compliance with EP Act	No construction activities are carried out during the following hours:



EP Regulation and EPP Noise)	7pm and 7am Monday to Saturday; AND
	Anytime on a Sunday or public holiday

#### (2) Earthworks and Rock-Breaking

Specific Outcomes	Probable Solutions
SO5 Noise impacts associated with rock breaking activities are appropriately managed. (Council will require preparation of a noise management programme)	No probable solution provided.

## Dual Occupancy Code (6.7)

#### (2) Building Siting and Design

Specific Outcomes	Probable Solutions
SO11 The amenity of adjoining premises is not unreasonably adversely affected by noise.	PS11.1 Air conditioning units are insulated so as adjoining properties are not affected by the noise source, and the unit is installed on the roof or at the rear of the building.

#### (4) Road and Rail Noise Attenuation

Specific Outcomes	Probable Solutions
SO14 The premises are not subjected to unacceptably high levels of noise	As provided for PS17.1 to PS17.4 under Accommodation Building Code

## Multiple Dwelling Code (6.9)

#### (2) Site Layout and Building Design

Specific Outcomes	Probable Solutions
SO14 The amenity of adjoining premises is not unreasonably and adversely affected by noise.	PS14.1 Air conditioning units are insulated so as adjoining properties are not affected by the noise source, and the unit is installed on the roof or at the rear of the building.

#### (5) Road and Rail Noise Attenuation

Noise and Vibration Assessment Townsville Ocean Terminal



Specific Outcomes	Probable Solutions
SO14 The premises are not subjected to unacceptably high levels of noise	As provided for PS17.1 to PS17.4 under Accommodation Building Code

## Desired Environmental Outcomes (DEOs)

The Townsville City Plan specifies Desired Environmental Outcomes (DEOs) for Health and Safety and Environmental Management. Strategies for achieving these DEOs include:

- ensure development incorporates appropriate air, water, noise and light pollution control measures;
- ensure sensitive uses such as dwellings and child care centres are located in areas of high air quality and are adequately protected from noise intrusion; and
- recognise the impacts from existing point sources and air polluting activities and minimise their effect on surrounding areas.
- 3.4.2 Queensland State Law

#### **EPA** Regulations

#### Industrial Premises

The QLD Environmental Protection Agency Planning for Noise Control provides guidelines for the assessment of noise from industrial premises, commercial premises and mining operations. These guidelines fall under the Queensland EPA EcoAccess Planning for Noise Control Guideline. The objectives of the guideline are to:

- control and prevent degradation of background noise from steady noise sources;
- contain noise levels to acceptable levels above the background levels from variable and short-term noise sources; and
- set noise levels to avoid sleep disturbance from night-time transient activities.

The guideline provides a procedure to identify planning noise level objectives for the area surrounding a development, comparing these to measured, existing noise levels, then adjusting the allowable noise component from the new development so that it's contribution does not raise the overall noise level above the noise level objective for that area.

Noise and Vibration Assessment Townsville Ocean Terminal



#### Road Traffic Noise

The relevant road traffic noise criteria is contained in the Environmental Protection Policy EPP (Noise) 1997 and is applicable to this development. The EPP (Noise) provides the following planning levels for public roads assessed 1 metre in front of the mot exposed façade of an affected noise sensitive receptor:

- 68 dB(A) assessed as a L<sub>A10, 18hr</sub> noise level for a State controlled road.
- 63 dB(A) assessed as a L<sub>A10, 18hr</sub> noise level for any other public road.
- 60 dB(A) assessed as the highest 1-hour equivalent continuous Aweighted sound pressure level measured between 10pm and 6am.
- 80 dB(A) assessed as a single event maximum sound pressure level

#### 3.4.3 Australian Standards

Australian Standards that apply to the assessment of noise and vibration associated with this development are a follows:

- AS/NZS:2107:2000 "Acoustics Recommended deign sound levels and reverberation times for building interiors."
- AS 3671:1989 "Acoustics Road Traffic Noise Intrusion Building Siting and construction"
- AS 2021:2000 "Acoustics Aircraft noise intrusion Building Siting and construction"
- AS 1055:1997 "Acoustics Description & Measurement of Environmental Noise"
- AS 1259:1990 Acoustics Sound Level Meters Integrating & Non Integrating – Averaging.
- Australian Standard AS2670.2:1990 "Evaluation of Human Exposure to Whole-body Vibration";
- British Standard BS7385.2:1993 "Evaluation and Measurement for Vibration in Buildings – Guide to Damage Levels from Groundborne Vibration"; and
- German Standard DIN4150:1999 Part 3 "Structural Vibration in Buildings – Effects on Structures".


# 4 Potential Impacts and Mitigation Measures

# 4.1 Noise and Vibration Criteria

### 4.1.1 Vibration Emissions Assessment Guidelines

The QLD Environmental Protection (Noise) Policy 1997, Environmental Protection Act 1994 and Environmental Protection Regulation 1998 do not provide guidelines for the assessment of vibration from construction sites.

For the purpose of this assessment, recommendations in the following standards are adopted:

- Australian Standard AS2670.2:1990 "Evaluation of Human Exposure to Whole-body Vibration";
- British Standard BS7385.2:1993 "Evaluation and Measurement for Vibration in Buildings – Guide to Damage Levels from Groundborne Vibration"; and
- German Standard DIN4150:1999 Part 3 "Structural Vibration in Buildings – Effects on Structures".

The vibration assessment guidelines are in terms of the potential to cause annoyance to building occupants and damage to building contents and structures.

### Annoyance

Figure 4 provides a summary of the recommended vibration levels in terms of velocity for continuous exposure to vibration, as recommended in AS2670.2:1990 for the assessment of potential disturbance from vibration experienced by occupants of buildings.

Page 33

Noise and Vibration Assessment Townsville Ocean Terminal Hyder Consulting Pty Ltd Incorporating Weathered Howe ABN 76 104 485 289 12/10/07 3:58 24



#### Figure 4: Vibration Assessment Objectives for Residential Buildings



For intermittent or impulsive vibrations, which would typically arise from construction activities, the allowable limits are in the order of 10-15 times higher than the levels for continuous exposure (Figure X). Figure 5 presents indicative human response to transient vibration levels.

Figure 5: Human Response to Transient Vibration Levels



Noise and Vibration Assessment Townsville Ocean Terminal Page 34 Hyder Consulting Pty Ltd Incorporating Weathered Howe ABN 76 104 485 289 12/10/07 3:58 24



## **Building Contents**

The thresholds for visible movement of susceptible building contents (eg. plants, hanging pictures, etc.) and audible rattling of loose objects (eg. crockery) as recommended in AS2670.2:1990, are approximately 0.5mm/s and 0.9mm/s respectively.

### **Building Structures**

The effects of building structures to ground-borne vibration depend on the type of foundation, ground condition, building construction and state of repair of the building.

The British Standard BS7385.2 and German Standard DIN4150.3 provide guidelines for evaluating the effects of vibration on structures. The values recommended in the Standards are frequency dependent and are the maximum vibration levels measured in any direction at the building foundation.

Table 4 and Table 5 present a summary of vibration levels recommended by BS7385.2 and DIN4150.3. Figure 6 presents a graphical summary of the vibration levels recommended by BS7385 and DIN4150.3.

It is noted that the recommendations in BS7385 and DIN4150.3 apply to buildings in normal conditions. For buildings with particular sensitivity to vibration, existing damage or in poor conditions, lower limits may apply and will need to be considered on a case-by-case basis.

Table 4	Safety Limits for Structural D	)amage - BS7385-2
Table 4.	Salety Linits for Structural L	amaye - D37303.2

Type of Structure	Peak Component Particle Velocity at Foundation			
Type of Structure	4Hz to 15Hz	> 15Hz		
Reinforced or framed structures, industrial and heavy commercial buildings	50mm/s			
Un-reinforced or lightly framed structures and residential or light commercial type buildings	15mm/s at 4Hz increasing to 20mm/s at 15Hz	20mm/s at 15Hz increasing to 50mm/s at 40Hz and above		

#### Table 5: Safety Limits for Structural Damage – DIN4159.3

Tupo of Structuro	Peak Component Particle Velocity at Foundation				
Type of Structure	< 10Hz	10Hz to 50Hz	50Hz to 100Hz		
Commercial/industrial buildings or buildings with similar design	20mm/s	20-40mm/s	40-50 mm/s		
Dwellings and buildings of similar design and/or use	5mm/s	5-15mm/s	15-20mm/s		
Structures that do not correspond to those above and are of great intrinsic value because of their	3mm/s	3-8mm/s	8-10mm/s		

Noise and Vibration Assessment Townsville Ocean Terminal Hyder Consulting Pty Ltd Incorporating Weathered Howe ABN 76 104 485 289 12/10/07 3:58 24

Page 35



[	particular sensitivity to vibration		



#### Figure 6: Safety Limits for Structural Damage

#### 4.1.2 Construction Noise Emissions Criteria

The QLD Environmental Protection (Noise) Policy 1997, Environmental Protection Act 1994 and Environmental Protection Regulation 1998 do not provide assessment guidelines construction noise impacts in terms of the actual noise limits at present. The Environmental Protection Amendment Regulation (No. 2) 1999 recommends that where construction noise is audible, building works must not be undertaken:

- before 6:30am and after 6:30pm from Monday to Saturday; and
- anytime on Sundays or public holidays.

Although there are guidelines in NSW for construction noise assessment objectives which are based on the existing background noise levels and construction duration, the NSW Department of Environment and Conservation recognises that compliance with construction noise objectives is not often practical. Where predicted construction noise levels exceed the assessment objectives, management measures are generally implemented to minimise the impacts.

The approach adopted for the noise assessment is to predict the noise impact and identify areas where construction noise may be high. Mitigation measures in terms of management plan are recommended to minimise the impacts.



## 4.1.3 Operational Noise Emissions Criteria

In Queensland, if no local laws for the quantitative assessment of noise impact exist, the State legislation is used to assess noise impact. Therefore, the Queensland EPA EcoAccess Planning for Noise Control Guideline has been used to determine noise criteria for operations at the TOT precinct impacting on nearby residential receptors.

The EPA Guideline requires that Specific Noise Level Objectives (no more than 3dB(A) over existing background noise levels) and recommended Planning Noise Level Objectives (according to the noise area category) are to be considered when establishing Project Noise Level Objectives.

The Project Noise Level Objectives for the TOT Project are therefore set at the lower of these two recommended objectives in order to determine the relevant project noise level objective in accordance with the EPA Guideline.

### Specific Noise Level Objective

The specific noise level objectives will depend on the nature of the noise sources (ie. steady, variable or short-term) and the existing background  $L_{A90}$  noise levels.

Noise emissions from the proposed Townsville Ocean Terminal would be variable. Accordingly, the specific noise assessment objective from the noise source is that the  $L_{Aeq,1hr}$  is not to exceed the background  $L_{A90,1hr}$  by more than 3dB(A).

Table 6 presents a summary of the specific noise assessment objectives, established from the measurement results presented in Table 2.

- Table 6:
- Specific Noise Assessment Objective, dB(A)

Recentor Location	L <sub>Aeq,1hr</sub> Noise Assessment Objective			
	Day	Evening	Night	
South-west of Townsville Ocean Terminal	52	51	46	
South of Townsville Ocean Terminal	49	47	44	
Jupiters Casino (hotel accommodation)	50	50	48	
Breakwater Cove Precinct	50	50	48	

## Planning Noise Level Objective

Table 7 presents summary of the planning  $L_{Aeq}$  noise levels recommended by the QLD EPA Planning for Noise Control Guideline for different noise area categories.

Noise and Vibration Assessment Townsville Ocean Terminal



Noise Area		Maxin	num L <sub>Aeq,1h</sub>	<sub>n</sub> PNL
Category	ategory Description of Neighbourhood		Evening	Night
Z1	Very rural, purely residential, less than 40 vehicles per hours	40	35	30
Z2	Negligible transportation, less than 80 vehicles per hour	50	45	40
Z3	Low density transportation, less than 200 vehicles per hour	55	50	45
Z4	Medium density transportation (less than 600 vehicles per hour) or some commerce or industry	60	65	50
Z5	Dense transportation (less than 1400 vehicles per hour) or some commerce or industry	65	60	55
Z6	Very dense transportation (less than 3000 vehicles per hour) or in commerce or bordering industrial districts	70	65	60
Z7	Extremely dense transportation (3000 or more vehicles per hour) or within predominantly industrial districts	75	70	65

#### Table 7: Maximum Planning Noise Level (PNL)

Residential receptors to the south-west of the proposed Townsville Ocean Terminal, Jupiters Casino (hotel accommodation) and Breakwater Cove Precinct residential development are either exposed to medium density transportation or some commercial or industrial activities. Accordingly, the appropriate noise area category would be classified as zone "Z4".

The day/evening/night  $L_{Aeq,1hr}$  noise levels of 56/53/50dB(A) established at the Breakwater Cove Precinct, based on measured levels at the Jupiters Casino, are within the recommended maximum planning noise levels.

It is noted that adopting the measured  $L_{Aeq,1hr}$  noise levels at the Jupiters Casino for the assessment of the Breakwater Cove Precinct (as the Breakwater Cove Precinct has not been constructed) is conservative as the measured noise levels at the Jupiters Casino would have included noise from the existing entertainment facilities. As the Breakwater Cove Precinct is further from the entertainment facilities, the actual  $L_{Aeq,1hr}$  noise levels would be lower. In any case, the measurement results show that the Breakwater Cove Precinct is suitable for future residential development.

Residential receptors to the south of the proposed Townsville Ocean Terminal and west of Ross River are exposed to low density transportation



and some commercial or industrial activities. For the purpose of the noise assessment, these areas are classified as zone "Z3".

Where existing  $L_{Aeq,1hr}$  noise levels (ie. without noise contribution from the new sources) are high or already exceed the recommended levels in Table 8 for the relevant noise area category, correction factors are applied to ensure that noise levels from the new sources do not further degrade the existing noise environment. The correction factors depend on the existing noise levels and are summarised in Table 8 below.

Total Existing L <sub>Aeq,1hr</sub> Noise Level dB(A)	ting L <sub>Aeq,1hr</sub> Maximum L <sub>Aeq,1hr</sub> Planning Noise Level from New Noi evel dB(A) Sources alone, dB(A)				
	= Planning Noise Level – 10	If existing noise levels decrease in future			
≥ Planning Noise Level + 2	= Existing Noise Level – 10	If existing noise level is unlike to decrease in future and no significant land use changes			
= Planning Noise Level + 1	= Planning Noise Level – 9				
= Planning Noise Level	= Planning Noise Level – 8				
= Planning Noise Level – 1	= Planning Noise Level – 6				
= Planning Noise Level – 2	= Planning Noise Level – 4				
= Planning Noise Level – 3	= Planning Noise Level – 3				
= Planning Noise Level – 4	= Planning Noise Level – 2				
= Planning Noise Level – 5	= Planning Noise Level – 2				
= Planning Noise Level – 6	= Planning Noise Level – 1				
< Planning Noise Level	= Planning Noise Level				

Table 8:

Correction Factors to account for Existing Noise Environment

Table 9 presents a summary of the recommended  $L_{Aeq,1hr}$  planning noise levels from the proposed Townsville Ocean Terminal, taking account of the relevant noise area categories (Table 7) and correction factors (Table 8).

Table 0.	Decommonded	1hr Dlanning Noi	a Loual from Tou	unavilla Oaaan T	Forminal	
	Recommended LAeu	, 1111 Flathing NUL			i ei i i iii iai, u	JD(A)

Receptor Location	Maximum L <sub>Aeq,1hr</sub> Planning Noise Level from Townsville Ocean Terminal			
	Day	Evening	Night	
South-west of Townsville Ocean Terminal	54	53	49	
South of Townsville Ocean Terminal	47	42	40	
Jupiters Casino (hotel accommodation)	58	43	42	
Breakwater Cove Precinct	58	43	42	

Noise and Vibration Assessment Townsville Ocean Terminal



# Project Noise Level Objective

The previous sections recommend specific and planning noise level objectives. To satisfy the QLD EPA Planning for Noise Control Guideline, the requirements of both the specific and planning noise level objectives should be achieved.

Table 10 presents a summary of the project noise level objectives, which are the lower of the specific and planning noise level objectives. That is, noise emissions from the proposed development will comply with both the specific and planning noise level objectives, provided that the project noise level objectives are achieved.

#### Table 10: Project Noise Level Objective

Becontex Logation	Project Noise Level Objective			
Receptor Location	Day	Evening	Night	
South-west of Townsville Ocean Terminal	51	53	45	
South of Townsville Ocean Terminal	47	42	40	
Jupiters Casino (hotel accommodation)	50	43	42	
Breakwater Cove Precinct	50	43	42	

### Sleep Disturbance

The assessment of noise impacts included general consideration of health effects of environmental noise, with respect to current Queensland legislation. Given the predicted noise levels for the project, it is considered that sleep disturbance is likely to be the only significant health effect experienced at noise sensitive receptors.

Research has shown that sleep arousal is related to the ambient noise environment and maximum ( $L_{Amax}$ ) noise levels from the sources. Table 12 presents a summary of the external  $L_{Amax}$  noise levels that could cause awakenings to various extent.

Table 11: I	External L <sub>Amax</sub>	Noise Level	corresponding	g to Probability	y of Awakening,	dB(A)
					,	

	External L <sub>Amax</sub> Noise Level, dB(A)					
Window Condition	0% Awakening	5% Awakening	10% Awakening	20% Awakening		
Wide open	37	42	47	52		
Partially open	42	47	52	57		
Fully closed (single glazed)	52	57	62	67		
Fully closed (double glazed)	57	62	67	72		

Noise and Vibration Assessment Townsville Ocean Terminal Page 40



For planning purposes, the QLD EPA Planning for Noise Control Guideline recommends that for good sleep the indoor sound pressure levels should not exceed 45dB(A)  $L_{Amax}$  more than 10-15 times per night. With external windows partially open and taking account of façade correction, this corresponds to an external  $L_{Amax}$  noise level of 52dB(A).

The number of allowable short-term or transient noise events during night-time will depend on the  $L_{Amax}$  levels and are summarised in Table 12 below.

Table 12: Number of Allowable Night-time Transient Noise Events (windows closed, 10% probability of awakening)

External L <sub>Amax</sub> Noise Level, dB(A)	Allowable Number of Events
47	32
52	10
57	3
62	1

It is noted that at present the relationship between noise levels and sleep disturbance is not well defined. For example, the above recommendations do not address the impact of transient events from new noise sources where existing  $L_{Amax}$  noise levels already exceed the levels presented in Table 2.

### **Breakwater Cove Precinct**

Part 6.2 "Accommodation Building Code" and Part 6.9 "Multiple Dwelling Code" of the Townville City Plan 2005 provide guidelines for residential development located near a high level noise source such as major roads, railway line or noise generating activities and industries.

For habitable areas of buildings on land adjoining state controlled roads, the codes recommend that where the external noise level objectives cannot be achieved, internal maximum design noise levels should be designed to achieve the recommendations in the Australian Standard AS2107:1987. It is noted that AS2107:1987 has been superseded by AS2107:2000.

Although the codes do not specify internal noise objectives for development potentially affected by commercial or industrial noise sources, it is considered that the recommendations in AS2107:2000 should be adopted for the Breakwater Cove Precinct potentially affected by the proposal and existing and future Townsville Port Facilities.

As a guide, internal  $L_{Aeq}$  noise levels of typically 40dB(A) and 35dB(A) should be adopted for sleeping areas during daytime and night-time



respectively. For other habitable areas such as lounge/living rooms and kitchens, design noise levels of 5dB(A) higher should be considered.

The codes of the Townsville City Plan 2005 recommend that possible noise reduction measures could include:

- Any private opening space or balcony be located away from the noise source of incorporates design elements to buffer noise;
- Doors incorporating an enclosed porch;
- Non-habitable room be located between the noise source and bedrooms;
- Exhaust vents to be insulated or vented into the ceiling space away from the noise source; and
- Facades facing the noise source adopt construction techniques and materials, which buffer the dwelling from the noise source.

Additionally, where development within the Breakwater Cove Precinct facilitates multi-story residential buildings, acoustic privacy will need to satisfy the requirements of the Building Code of Australia (BCA). Appropriate construction materials and methods will need to be determined by the developer at the design phase of the development.

### Road Traffic Noise

The proposed development would not result in modification or upgrade of public roads. However, additional road traffic noise generated by the development has the potential to impact on residences along public roads.

The QLD Department of Main Roads "*Road Traffic Noise Management: Code of Practice*" provides guidelines for assessment of road traffic noise for:

- noise sensitive development affected by state controlled roads;
- new state controlled road development;
- upgrading of existing state controlled roads; and
- existing state controlled roads with high traffic noise.

The Townsville City Plan 2005 provides guidelines for assessment of road traffic noise for noise sensitive development affected by state controlled roads. The Townsville City Plan 2005 guidelines are similar to those from the EPP (Noise) 1997.

At present, neither the EPP (noise) 1997 nor the Townsville City Plan 2005 provides guidelines for the assessment of increase in road traffic noise levels on public roads as a result of a commercial or industrial development.

The QLD Department of Main Roads considers an increase in road traffic noise levels of 3dB(A) or more (above the existing levels) to be significant.



As discussed above, although the guidelines do not strictly apply to additional road traffic noise generated by commercial or industrial development, Hyder have adopted this as relevant criteria for this assessment.

It should be noted that an increase of 3dB(A) is just noticeable subjectively. In general, in order for road traffic noise from an adjacent road, impacting on nearby receptors, to increase by 3dB(A), road traffic on that road would need to double in volume.

We understand that there will be some modification of Sir Leslie Theiss Drive a part of this development. However, there were no details of this modification available at the time of preparation of this report. Therefore this will be the subject of a separate assessment.

# 4.2 Potential Impacts

Noise and vibration impacts associated with the TOT project will be due to the following:

- Operational and construction phases impacting on nearby existing receptors; and
- Nearby existing sources impacting on the TOT and Breakwater Cove development.

There are three existing primary noise sources that may potentially impact on the Breakwater Cove and TOT precincts. These are summarised as the following:

- The existing and future operations from the Townsville Port;
- The existing Townsville CBD; and
- The adjacent Casino Precinct.

These are discussed in more detail below:

### 4.2.1 Vibration Impacts

Vibration levels generated from construction activities would mainly be due to piling activities, earthworks and soil compaction at the Townsville Ocean Terminal and Breakwater Cove Precinct using piling machines, excavators, compactors and rollers.

Vibration levels from construction equipment will vary widely depending on a number of factors including the geology and ground conditions. Table 13 presents a summary of the estimated vibration levels at various distances due to construction equipment for typical conditions.

 Table 13:
 Estimated Vibration Levels from Construction Equipment

Noise and Vibration Assessment Townsville Ocean Terminal



E	Peak Particle Velocity (mm/s)					
Equipment	10m	20m	50m	100m		
Pile driver	12 – 30	7 – 15	2 – 5	0.8 – 2		
Vibratory roller	5 – 8	1.5 – 4	0.5 – 1	< 0.2		
Compactor	5 – 7	1.5 – 3.5	0.4 – 1	< 0.2		
Dozer	2.5 – 4	0.6 – 2	0.2 – 0.7	Negligible		
Excavator	1 – 3	0.3 – 1	0.1 – 0.4	Negligible		

Given construction activities at the proposed Townsville Ocean Terminal and Breakwater Cove Precinct are in the order of 1000m from the existing residences to the south and south-west, it is unlikely that construction vibration levels would be felt at these residences.

Residences near the Riverside Marine site (west of Ross River) are approximately 200m from the loading point. However, loading rock materials onto barges using an excavator or a front end loader is considered to generate low vibration levels and hence unlikely to cause significant impact at the residences.

Existing commercial properties such as Jupiters Casino and Convention Centre are nearer to the construction site and would be exposed to higher vibration levels. However, the levels are unlikely to exceed the safety limit of 15-20mm/s for commercial/industrial buildings when equipment operates further than 20-30m from the buildings.

It is proposed that dilapidation surveys be undertaken for these buildings prior to construction activities.

Additionally, it is recommended that monitoring of construction vibration at these buildings be undertaken during critical stages (eg. nearby pile driving and ground compaction). Where required, alternative and/or alteration to the construction methods should be investigated to ensure the guidelines are achieved.

### 4.2.2 Construction Impacts

### Construction Methodology

Figure 7 shows a predicted construction plan for the proposal. It is noted that the construction methodology discussed in this Section is general and for the purpose of an overview and assessment of construction noise and vibration impacts only. For a detailed description of the proposed construction refer the Construction Methodology Report for this project. Additionally, the following assessment is predicted based on the current

Noise and Vibration Assessment Townsville Ocean Terminal



information available. It will need to be updated should the construction program, methodology and equipment change during detailed design and construction phase of the project.

It is envisaged that the construction would last approximately three (3) years.

Noise and Vibration Assessment Townsville Ocean Terminal Hyder Consulting Pty Ltd Incorporating Weathered Howe ABN 76 104 485 289 12/10/07 3:58 24

Page 45





### Figure 7: Conceptual Construction Plan

CONSTRUCTION DWG, SAMONWW202-QL00704-01-KEY CONSTRUCTION DWG, 500(200711.0025 AM 1.2

Noise and Vibration Assessment Townsville Ocean Terminal Page 46 Hyder Consulting Pty Ltd Incorporating Weathered Howe ABN 76 104 485 289 12/10/07 3:58 24



Generally, the construction methodology is as follows:

- Construction of an access road by creating a rock bund adjacent to the existing Port Western breakwater and Northern breakwater. Quarry rock materials will be required and delivered to the site by trucks and trailers via Saunders Street/Dean Street/Oxley Street route and Bundock Street/Warburton Street/Eyre Street/Oxley Street route and directly tipped into place or placed by excavators from storage piles;
- Delivery of rock materials by B-Doubles via Boundary Street to the stockpiles at Riverside Marine site at Eight Avenue, Railway Estate. Rock materials will loaded by excavators or front end loaders onto barges and barged to the sites 24-hours a day via Ross River for the construction of the Strand breakwater, Northern breakwater extension and Northern breakwater remediation. Final material placement will be carried out by excavators and front end loaders located on the breakwaters of mounted on barges;
- To encapsulate the site for dewatering, construction of rock bunds will be required:
- from the termination of the site haul road (north-west corner of the site) to the Strand breakwater;
- from the existing Casino finger to the Strand breakwater; and
- between the Strand breakwater and the Northern breakwater.
- Construction of an additional rock bund to aid with concurrent construction of the TOT berth. Once the rock bund is created, the TOT Precinct can be constructed independent of the rest of the site;
- Sheet piling the remaining areas in the north-west corner of the site to close off the parkland area. Placement of rocks across the northwest finger of the northern breakwater to create a spill pond and water treatment area;
- Dewatering of the site;
- Following dewatering of the site, geo-textile fabric (500mm layer of sand) will be laid above the existing ooze within the parkland areas. Removal of ooze within from the canal down to stiff clay layer using excavators and trucked to disposal within the parkland areas by dump trucks. The area will then be placed with geo-textile fabric and capped with engineering fill;
- The Breakwater Cove Precinct will be excavated, filled and backfilled until completion of the land reclamation areas to the required RL;
- Construct and progressively locate temporary bunds within the Breakwater Cove Precinct to create working cells for the excavation of ooze and stiff clay. Ooze will be disposed within canal trenches, stripped and temporarily stored within excavated disposal ponds for later disposal. Land will be created by controlled clay compaction to the required RL. A pre-cast revetment wall system will be placed complete with drainage membrane, engineered backfilled, soil



anchors and placement of rock armour protection at the revetment toes. Land areas within the Breakwater Cove Precinct will receive engineered backfill to bring the area to the final RL;

- The TOT berth pocket clay within the existing breakwater will be dredged using cutter suction dredge and the clay will be placed within the excavated disposal ponds. Wharf piling will be undertaken using piling rigs mounted on barges. Once the embankment is created, armour rocks will be placed using clamshell excavators. Wharf precast headstocks and decking will be placed using land based cranes. The old breakwater will be removed by clamshell and conventional excavators and rocks will be barged to Mariners Peninsular for final placement;
- Clay below the old breakwater will be removed using cutter suction dredges and disposed within the existing port dumping grounds;
- Dredging of future access basin and channel to the development site using cutter suction dredges. Dredged materials will be deposited at future port reclamation areas;
- Piling to construct bridges within the site. Rock scour protection to the base of the piles will be placed by excavators. Placement of headstocks, decking and installation of handrails;
- Temporary stored ooze within the storage bunds will be suction dredged to the final disposal areas;
- Removal of temporary rock bunds using clamshell excavators mounted on barges. The removed rocks will be deposited adjacent to Strand and Northern breakwaters; and
- Piling driving using a piling rig mounted on barge for the construction of the Strand breakwater bridge access. Headstocks and decking will be lifted into place using a crane mounted on barge.

Refer to the construction methodology report for further details.

Page 48

Hyder Consulting Pty Ltd Incorporating Weathered Howe ABN 76 104 485 289 12/10/07 3:58 24



# **Construction Equipment**

The construction activities could be classified into three (3) main activities, namely bulk earthworks, TOT construction works and civil works.

Table 14 presents a summary of envisaged construction plant and typical equipment sound power levels based on previous projects and published data.

### Table 14: Construction Equipment and Typical Sound Power Level, dB(A)

	Equip	ment Qua	Typical Sound	
Equipment Type	Year 1	Year 2	Year 3	Power Level
B	ulk Earthworl	ks		
Sheet Piling	1	0	0	112
Driven Pile	1	1	1	125
Barge (SLV500)	2	2	2	106
Dewatering Pump	1	1	1	100
Pile Breaker	1	2	1	115
100t Digger	0	2	2	115
55	-			-

Noise and Vibration Assessment Townsville Ocean Terminal



### Table 14 continued

-	Equip	ment Qua	Typical Sound	
Equipment Type	Year 1	Year 2	Year 3	Power Level
12G Grader	4	1	1	111
16G Grader	0	2	2	111
30t Excavator	0	1	1	108
40t Excavator	10	5	2	110
65t Excavator	2	3	3	110
825C 4-Wheel Compactor	0	2	2	114
988 Wheel Loader	2	2	1	114
Cat740 40t Articulated Truck	8	7	9	106
D6 Dozer	3	1	1	114
D6 LGP Swamp Dozer	0	5	7	116
HD465 Ridgid Dump Truck	0	7	9	110
Self Propelled Roller	0	1	1	109
Tandem Water Truck	3	2	3	106
40t Crane	0	0	1	110
Franna Crane	0	1	1	110
Total	38	48	51	
TOT Termi	nal Construc	tion Works		
Sheet Piling	1	0	0	112
Driven Pile	1	1	1	125
Barge (SLV500)	2	2	2	106
Dewatering Pump	1	1	1	100
Pile Breaker	1	2	1	115
Excavator	0	1	0	108
Backhoe	0	1	0	103
BobCat	0	0	1	103
Clamshell Digger/Dragline	0	1	0	114
Franna Crane	0	1	1	110
40t Crane	0	1	1	110
Scissor Lift	0	1	1	100
Total	6	12	9	



	Equip	ment Qua	Typical Sound				
Equipment Type	Year 1	Year 2	Year 3	Power Level			
Civil Works							
Sheet Piling	1	0	0	112			
Driven Pile	1	1	1	125			
Barge (SLV500)	2	2	2	106			
Dewatering Pump	1	1	1	100			
Pile Breaker	1	2	1	115			
Excavator	0	0	2	108			
Backhoe	0	0	1	103			
Ditch Witch Trencher	0	0	1	109			
Dozer	0	0	2	114			
Grader	0	0	2	111			
Kerb Machine	0	0	1	111			
Water Truck	0	0	2	106			
Sheep Foot Roller	0	0	2	109			
Steel Drum Roller	0	0	2	109			
Ridged Dump Truck	0	0	3	110			
A.C Placing Plant	0	0	1	106			
Moxy Truck	0	0	3	110			
Franna Crane	0	0	1	110			
Total	6	6	28				

 Table 14:
 Construction Equipment and Typical Sound Power Level, dB(A) (contd.)

### **Construction Traffic**

Rock, sand and engineering fill materials used for the construction of the Breakwater Cove and TOT Precincts will be delivered to the site by road trucks from local Quarries, refer the Construction Methodology Report for details.

Table 15 presents a description of the construction traffic haul routes. The preferred haul route is the "*Temporary Bridge Haul Route*" option as delivery vehicles will bypass the town. However, this option will require construction of a temporary bridge connecting Ross Street with Sir Leslie Thiess Drive. Other options include "*The Strand Haul Route*", "*Riverside Marine Haul Route*" and "*Bundock Street/Warburton Street Haul Route*".

Table 16 presents a summary of estimated construction traffic generated by the proposed development.



Table 15.	Construction Traffic Haul Route Ontions

Construction Traffic Haul Route	Description					
	Delivery from Roseneath Quarry					
Temporary Bridge Haul Route	Trucks will use Flinders Highway, Bruce Highway, Abbot Street, Railway Avenue, Boundary Street, Archer Street, Ross Street and over the temporary bridge then turn right onto Sir Leslie Thiess Drive and continue to the project site.					
The Strand Haul Route	Trucks will use Flinders Highway, Bruce Highway, Abbot Street, Railway Avenue/Saunders Street/Dean Street, Oxley Street, The Strand, Sir Leslie Thiess Drive and then continue to the project site.					
Warburton Street/Bundock Street Haul Route	Trucks will use Flinders Highway, Bruce Highway, Abbot Street, Railway Avenue, Boundary Street/Woolcock Street, Hugh Street/Percy Street/Bundock Street, Warburton Street/Eyre Street, Oxley Street, The Strand, Sir Leslie Thiess Drive and then continue to the project site.					
Riverside Marine Haul Route	Trucks will use Flinders Highway, Bruce Highway, Abbot Street, Railway Avenue, Boundary Road and then continue to the Riverside Marine barge landing site.					
	Delivery from Pinnacle Quarry					
Temporary Bridge Haul Route	Trucks will use Harvey Range Road, Ross River Road, Bruce Highway, Woolcock Street, Boundary Street, Archer Street, Ross Street and over the temporary bridge then turn right onto Sir Leslie Thiess Drive and continue to the project site.					
Riverside Marine Haul Route	Trucks will use Harvey Range Road, Ross River Road, Bruce Highway, Woolcock Street, Boundary Street and then continue to the Riverside Marine barge landing site.					
	Delivery from Marathon Quarry					
Temporary Bridge Haul Route	Same as the Temporary Bridge Haul Route option for delivery from Roseneath Quarry					
Riverside Marine Haul Route	Same as the Riverside Marine Haul Route option for delivery from Roseneath Quarry					



Construction Stage	Haul Route	Duration	Delivery Vehicles/Hour
	Option	1 (Preferred)	
Stage 1	Temporary Bridge Haul Route	12 Months, 6 days/ week, 10 hours/day	5-6
Stage 2	Temporary Bridge Haul Route	12 Months, 6 days/ week, 10 hours/day	6-7
Stage 3	Temporary Bridge Haul Route	12 Months, 6 days/ week, 10 hours/day	4-5
	C	)ption 2	
Stage 1	The Strand Haul Route	12 Months, 6 days/ week, 6 hours/day	10-11
Stage 2	Riverside Marine Haul Route	12 Months, 6 days/ week, 10 hours/day	6-7
Stage 3	Riverside Marine Haul Route	12 Months, 6 days/ week, 10 hours/day	4-5
	C	)ption 3	
Stage 1	Bundock Street/Warburton Street Haul Route	12 Months, 6 days/ week, 6 hours/day	10-11
Stage 2	Riverside Marine Haul Route	12 Months, 6 days/ week, 10 hours/day	6-7
Stage 3	Riverside Marine Haul Route	12 Months, 6 days/ week, 10 hours/day	4-5

#### Table 16: Estimated Construction Traffic Generation

### **Construction Hours**

It is envisaged construction hours are as follows:

- Material deliveries via The Strand and Bundock Street/Warbuton Street haul routes would be between 9:00am and 3:00pm, Monday to Saturday;
- Material deliveries via the *Temporary Bridge* and *Riverside Marine* haul routes would be between 6:00am and 6:00pm, Monday to Saturday;
- Materials from the Riverside Marine site would be barged to the construction site via Ross River 16-hours per day. However, depending on the timing and progress, materials could be barged from the Riverside Marine site to the construction site 24-hours per day. However, adoption of the temporary bridge haul route is likely to



result in these activities being carried out during the daytime hours only; and

• Construction hours for the bulk earthworks, TOT construction works and civil works between 6:00am and 6:00pm, Monday to Saturday.

### Predicted Construction Noise Level

Table 17 presents the summary of the predicted construction noise levels during the noisiest period (Year 3 for bulk earthwork and civil work and Year 2 to TOT construction work) for the:

- Bulk earthwork phase;
- TOT construction work phase;
- Civil work phase;
- Loading activity at the Riverside Marine site; and
- Combined construction activities

Appendix 4 presents a predicted noise contours from construction activities.

#### Table 17: Predicted Construction Noise Level

Decenter	Predicted Construction Noise Level					
Location	Bulk Earthworks	TOT Construction Works	Civil Works	Riverside Marine Loading Site	All Activities	
South-west of TOT (Mariners Peninsula)	60-65	40-45	55-65	_	55-65	
South of TOT	50-60	45-55	40-55	_	50-60	
Jupiters Casino (hotel accommodation)	60-65	55-65	55-65	_	65-70	
West of Ross River	_	_	_	50-55	50-55	

It is noted that the predicted noise levels are conservative as the calculations assumed that all equipment would be operating at the same time and generate maximum noise levels simultaneously, which would not the case in practice.

Based on previous projects, it is not unusual for the measured noise levels from construction sites to be in the order of 5-10dB(A) lower than the predicted levels for most of the time due to the following reasons:

Not all equipment is required to operate at the same time;



- Equipment does not generally generate maximum noise levels simultaneously;
- Shielding effect provided by buildings/structures such as construction compounds; and
- Shielding effect provided by the surrounding when equipment is located in excavated areas and trenches, etc.,

At present there are no noise assessment objectives in Queensland for construction activities taking place during daytime (6:30am - 6:30pm), Monday to Saturday. The predicted maximum noise levels are presented for information only. For the majority of the time, the actual construction noise levels are expected to be considerable lower that the predicted levels.

Residences to the west of the Riverside Marine loading site would experience noise from material loading and barging at the loading site, if the Riverside Marine haul route option were adopted, as the envisaged construction hours at this site extend outside the daytime period. However, this is unlikely as the preferred route is the temporary bridge haul route option. However, Section 4.3.1 provides recommendations to reduce construction noise impacts at residences to the west of the Riverside Marine loading site.

### Predicted Road Traffic Noise Increase during Construction

Existing Hourly Traffic Volume and Composition

Table 18 presents a summary of the existing hourly traffic volumes and compositions during AM peak, PM peak and outside peak hours on public roads along the haul routes. For the purpose of the calculation and assessment, the "outside peak hour" is the average hourly traffic data excluding those during the peak hours.

	Existing Hourly Traffic Volume and Composition						
Street Name	AM Peak		PM F	Peak	Outside Peak Hour <sup>1</sup>		
	Volume	%HV <sup>2</sup>	Volume	%HV	Volume	%HV	
Flinders Highway	742	4.8%	756	3.7%	275	3.8%	
Bruce Highway	3,523	72.6%	1,057	3.7%	383	7.0%	
Abbot Street	1,229	5.1%	1,173	4.2%	493	6.9%	
Railway Avenue	1,629	4.8%	1,701	3.7%	670	6.3%	
Boundary Street	519	26.9%	517	23.8%	216	37.1%	
Woolcock Street	1,647	3.4%	1,666	2.5%	683	4.2%	
Hugh Street	1,781	1.8%	1,787	1.4%	757	2.2%	
Percy Street	1,525	1.1%	1,522	0.9%	670	1.3%	
Archer Street	47	64.4%	45	60.0%	23	76.1%	

Table 18:

Page 55



Ross Street	126	41.6%	118	39.5%	53	57.3%
Saunders Street	1,702	3.2%	1,780	2.4%	696	4.1%
Dean Street	1,151	5.3%	1,193	4.2%	511	6.2%
Oxley Street	740	3.9%	721	4.0%	371	4.1%
The Strand	281	3.6%	324	2.6%	157	3.4%
Bundock Street	1,962	2.2%	1,987	1.7%	866	2.5%

	Existing Hourly Traffic Volume and Composition						
Street Name	AM Peak		PM Peak		Outside Peak Hour <sup>1</sup>		
	Volume		Volume	%HV	Volume	%HV	
Warbuton Street	1,277	2.9%	1,296	2.3%	535	3.5%	
Eyre Street	894	4.2%	860	3.5%	373	5.4%	
Hervey Range Road	898	2.1%	949	1.5%	302	3.0%	
Ross River Road	1,914	1.0%	1,917	0.9%	694	1.6%	

Notes 1. outside peak hour is average hourly traffic data excluding AM and PM peak hours. 2. %HV denotes percentage of heavy vehicles.

The noise prediction took account of existing traffic conditions, anticipated construction traffic generation (Table 18) and the following assumptions:

- construction traffic would be evenly distributed throughout the delivery hours. Where the number truck deliveries during each hour varies significantly, the predicted road traffic noise increase would be higher;
- existing traffic conditions (Table 18) provided by Veitch Lister Consulting Pty Ltd are based on Year 2005 data. The assessment (based on predicted road traffic noise increase relative to Year 2005 traffic data) would be slightly conservative;
- the data provided by Veitch Lister Consulting Pty Ltd includes heavy vehicles. As vehicles over three (3) tonnes are classified as heavy vehicles and haul trucks being much larger, the noise prediction assumed that the proportions of heavy vehicles on existing roads (without construction traffic from the proposal) are half of those presented in Table 18.

The noise predictions were performed for the "AM peak hours", "PM peak hours", "outside peak hours" and the results are presented in Table 19.

	Predicted Increase in Road Traffic Noise during Construction				
Street Name	AM Peak	PM Peak	Outside Peak Hour <sup>1</sup>		
Flinders Highway	0.6	0.6	1.4		
Bruce Highway	0.4	0.5	1.0		

 Table 19:
 Predicted Road Traffic Noise Increase during Construction, dB(A)

Noise and Vibration Assessment Townsville Ocean Terminal



Abbot Street	0.4	0.4	0.9
Railway Avenue	0.3	0.3	0.7
Boundary Street	0.5	0.5	0.9
Woolcock Street	0.8	0.4	1.5

Table 19Predicted Road Traffic Noise Increase during Construction, dB(A)(contd.)

	Predicted Increase in Road Traffic Noise during Construction					
Street Name	AM Peak	PM Peak	Outside Peak Hour <sup>1</sup>			
Hugh Street	0.6	0.8	1.2			
Percy Street	0.5	0.6	1.0			
Archer Street	2.6	2.8	3.9			
Ross Street	1.5	1.7	2.5			
Saunders Street	0.6	0.6	1.2			
Dean Street	0.9	0.9	1.7			
Oxley Street	1.3	1.4	2.3			
The Strand	2.4	2.3	3.7			
Bundock Street	0.5	0.5	1.0			
Warbuton Street	0.6	0.7	1.3			
Eyre Street	0.8	0.8	1.6			
Hervey Range Road	0.5	0.5	1.4			
Ross River Road	0.5	0.5	1.0			

It can be seen from Table 19 that the increases in road traffic noise levels as a result of construction traffic are within 2dB(A), except for residences along Archer Street, Ross Street, Oxley Street and The Strand. For residences along these streets, the increases in road traffic noise levels are within 3-4dB(A).

Subjectively, an increase in 2dB(A) is generally considered just noticeable and an increase of 3-5dB(A) is clearly noticeable.

At present, there are no guidelines in Queensland for the assessment of construction traffic noise. Albeit, it is recommended that the contractor(s) be requested to maintain delivery vehicles properly and operate efficiently to minimise noise impact from construction traffic.



# 4.2.3 TOT Operational Impacts

### **TOT Operations**

It is expected that operation of the TOT Precinct will attract around 20 to 30 additional vessels to the Port of Townsville each year. It is expected that visiting naval vessels will increase to around 40 to 50 a year from the existing 30 vessels a year. Currently, 7 to 8 cruise vessels visit the Port each year. This is expected to increase to around 20 vessels a year. It is estimated that approximately 600 to 700 vessels currently use the Port each year. Additional shipping traffic as a result of TOT operation represents an increase in existing Port traffic of approximately 3.8%.

The TOT facility will only operate during visits by cruise and naval vessels. Hours of operation of the facility on these days are expected to be between daylight hours. Vessels will arrive at the TOT berth in the early morning and will depart during late afternoon.

### Noise Modelling

Computer modelling software Soundplan 6.3 has been used to generate predicted noise levels impacting on the surrounding residential receptor from the predicted TOT operations. The current masterplan has been included which assumes that the residential developments between the TOT and the Casino will be 5 to 6 storey buildings whilst the other Breakwater Cove residential developments will be 2 storey standalone dwellings.

### Noise Sources

The following noise sources and associated noise levels were used as the basis of this assessment:

 Table 20:
 TOT Operational Noise Sources

Noise Source	Location	Sound Power Level, dB(A) re 1 <i>p</i> W
Cruise Ship Idling at berth with generators and ventilation running	Located in Berth	114
Ships Horn	Located at top of ship at an estimated height of 58 metres	134
Forklift Truck	Located on the berth at a height of 1 metre	83
Gang plank being raised & stowed	Located on the Berth side of the ship at a height of 15 metres	130

Hyder Consulting Pty Ltd Incorporating Weathered Howe ABN 76 104 485 289 12/10/07 3:58 24



PA System	Loudspeaker located at ocean facing edge of TOT Building at 3 metres above	108
	ground	

# Topography

The topography of the proposed TOT and Breakwater Cove site is predominantly flat with the exception of the proposed acoustic barrier located as shown in Appendix 5. The natural topography of the surrounding land and the proposed 6 metre high combination earth berm and acoustic fence have been included in the modelling.

The site is surrounded by water, which provides no ground absorption and this has been allowed for in the modelling.

### Predicted Noise Levels from TOT Ship Operations

Table 21 and Table 22 present the predicted noise levels from: -

- Ship loading operations (ship idling, 2 forklifts and gang plank raising)
- Ship engine idling;
- TOT PA System & Ship Idling;
- Ship horn

Appendix 2 presents predicted noise level contours from ship loading operation, engine idling and horns.

Table 21:	Predicted LAeq Noise Levels from Ship Operations

	Night-time L <sub>Aeq,1hr</sub>	Predicted L <sub>Aeq</sub> Noise Level		Compliance	
Receptor Location	Noise Assessment Objective	Loading Operation	Cruise Ship Idling	Loading Operation	Cruise Ship Idling
South-west of TOT (Mariner's Peninsula)	45	≤ 30	≤ 30	$\checkmark$	$\checkmark$
South of TOT	40	≤ 30	≤ 30	$\checkmark$	$\checkmark$
Jupiters Casino (hotel accommodation)	42	35 – 45	35 – 45	Marginal	Marginal
Breakwater Cove Precinct (nearest multi-level apartments)	42	40 - 50	40-50	Marginal	Marginal
Breakwater Cove Precinct (furthest)		35 – 40	35-40	$\checkmark$	$\checkmark$



#### Notes: √indicates compliance X indicates non-compliance

Receptor Location	L <sub>Amax</sub> Noise Assessment	Predicted I Le	- <sub>Amax</sub> Noise evel	Compliance	
	Objective	Ship Horn	PA System	Ship Horn	PA System
South-west of TOT (Mariners Peninsula)		50-60	≤ 30	Marginal	$\checkmark$
South of TOT		55-65	≤ 30	Marginal	$\checkmark$
Jupiters Casino (hotel accommodation)	52	60-70	40-45	х	$\checkmark$
Breakwater Cove Precinct (nearest)		75-80	47-50	Х	$\checkmark$
Breakwater Cove Precinct (furthest)		60-65	≤ 30	х	$\checkmark$

#### Table 22: Predicted LAmax Noise Levels from Ship Horn & PA System

Notes:  $\sqrt{indicates compliance}$ 

X indicates non-compliance

The results of the noise predictions show that:

- Predicted noise levels from ship loading operations and engine idling comply with the L<sub>Aeq,1hr</sub> noise assessment objectives at receptor locations to the south and south-west of the Townsville Ocean Terminal;
- Noise exceedance at the Jupiters Casino (hotel accommodation) is marginal. However, it is likely that the Jupiters Casino (hotel accommodation) would have incorporated architectural mitigation measures within the development to control noise from entertainment facilities. These measures are also likely to control noise from ship operations;
- Predictions indicate that noise levels from ship loading operations and engine idling are likely to comply or marginally comply with the L<sub>Aeq,1hr</sub> noise assessment objectives at the nearest locations within the Breakwater Cove Precinct, with the exception of the nearest two proposed multilevel apartment buildings. This is largely because the noise barrier/berm construction does not provide a screening effect at the upper levels of these buildings.
- For ship horn noise, the exceedance of criteria is predicted to be around 8 to 28 dB(A) above the external design objective at the nearest Breakwater Cove developments. Therefore architectural controls will be required to be imposed on these dwellings for internal noise levels to comply with AS 2021. Using compliance with the internal noise levels recommended in Australian Standard AS 2107



for living and sleeping areas for ship horn noise is considered overly stringent as the noise will be largely short term and intermittent and not occur during night-time periods. Assessment against AS 2021 is likely to be more appropriate for intermittent or transient noise sources. The appropriate internal noise criteria for living and sleeping areas from AS 2021 is 50 dB(A) for both spaces. To further mitigate ship horn noise it I recommended that ships horn operation is limited to outside night-time hours.

- To control noise to acceptable internal noise levels, a minimum external noise reduction, calculated as per Australian Standard AS 3671 will be required. Note that AS 3671 refers to traffic noise intrusion but may be used as an appropriate method to determine minimum building envelope construction for the cruise ship noise also. Refer Section 4.3.2 for recommended mitigation measures.
- With shielding effect from buildings/structures, the predicted L<sub>Amax</sub> noise levels from ship horn would be expected to comply with or marginally exceed the assessment objective at receptor locations to the south and south-west of the Townsville Ocean Terminal.
- Predictions indicate that noise from the PA system is likely to comply with L<sub>Amax</sub> criteria at all the nearby noise sensitive receptors detailed in Table 21.

Section 4.3.2 provides recommendations to reduce the predicted noise impact from ship operations.

### Operational Road Traffic Noise

Increases in operational road noise from the proposed TOT and Breakwater Cover development has not been assessed in absolute terms against the EPP (Noise) 1997 criteria because the detailed road traffic flow information required for this type of assessment was not available at the time of preparation of this report. However, based on the information available, a relative assessment has been carried out to determine potential noise impact.

*Appendix 3* provides existing and preliminary predicted future traffic volumes within Townsville CBD, forecast by Veitch Lister Consulting Pty Ltd. The forecast shows significant traffic growth in the surrounding areas due to natural traffic growth and future development which are unrelated to the proposed Townville Ocean Terminal and Breakwater Cove Project.

In terms of the proposed Townsville Ocean Terminal and Breakwater Cove Project, the majority of traffic generation will be due to future residential development within the Breakwater Cove Precinct.

Based on traffic forecast provided by Veitch Lister Consulting Pty Ltd, it is expected that the proposed development would generate additional traffic volume in the order of 2,000 vehicle movements per day and are expected to be distributed on the major routes within the Townsville CBD. Figure 8 provides a graphical representation of major traffic routes.



It can be seen from *Appendix 3* that, depending on the roads, future traffic volumes on the Townsville CBD road network vary between 3,000 and 18,000 vehicles per day.

The predictions show that road traffic noise generated by the proposed development could increase the existing levels by up to 2dB(A) on Gregory Street. However, once the traffic is distributed on major roads such as Warburton Street, Bundock Street, Eyre Street, Dean Street, Saunders Street and Sturt Street, the increase in road traffic noise levels would typically be less than 1dB(A).

Subjectively, an increase in road traffic noise levels of 1-2dB(A) is generally considered be barely to just noticeable.



#### Figure 8: Major Traffic Routes within Townsville CBD

### 4.2.4 Noise Impacts from Existing Port Operations

### Shipping Noise

Continuous noise logging was carried out at a number of sites around the proposed Breakwater Cove development site between 19 October and 2

Noise and Vibration Assessment Townsville Ocean Terminal Hyder Consulting Pty Ltd Incorporating Weathered Howe ABN 76 104 485 289 12/10/07 3:58 24

Page 62



November 2007 to identify the current existing noise ambient environment. During this time it was noted that 35 cargo ships entered or left the Port. This is 7 ships more than the average weekly movement of 28. This information was provided by the Townsville Port Authority Shipping schedule for 2006 & 2007. The activities carried out during the monitoring period are detailed below.

During the first week of noise monitoring, 16 vessels were moved in and out of the Port and moved between berths within the Port, resulting in a total of 35 vessel movements within the Port. Activities at the Port during this period included discharging of LPG and fuel oil, unloading nickel ore, unloading and loading containers, unloading bulk cement, unloading fertiliser, unloading motor vehicles, loading concentrates and visits by cruise vessels. These vessel types, vessel sizes, vessel movements and Port activities are summarised in Table 23.

Vessel	Length	Berth	Activity
Glorious Halo	185.7	A, 2	unloading nickel ore
Lizzie Kosan	99.9	1	discharging LPG
Palmerston	179	1	discharging fuel oil
Luminous Halo	190	2	unloading nickel ore
Cape Moreton	161	3	loading containers
Zao Express	179.8	1	discharging fuel oil
Alcem Calaca	134.5	4	unloading bulk cement
Annou GO	190	A, 2	unloading nickel ore
General Delgado	174.8	8	unloading fertiliser
HMAS Manoora	159.2	10	unloading motor vehicles
Hume Highway	199.8	9	unloading motor vehicles
Coral Princess II	37.27	8	Cruise vessel visit
Helix	182.9	1	discharging fuel oil
Cattleya Ace	198.6	9	unloading motor vehicles
Mathawee Naree	170	A, 7	loading concentrates
Chekiang	157.9	3	unloading and loading containers

Table 23: Port of Townsville Shipping Movement Summary 19 October 2007 to 25 October 2007

During the second week of monitoring, 14 vessels were moved in and out of the Port and moved between berths within the Port, resulting in a total of 35 vessel movements. Activities at the Port during this period included unloading and loading containers, loading general cargo, unloading bulk cement, unloading nickel ore, unloading motor vehicles, loading molasses, taking on bunkers, loading sugar and visits by cruise and naval vessels. These vessel types, vessel sizes, vessel movements and Port activities are summarised in Table 24.

Noise and Vibration Assessment Townsville Ocean Terminal



Vessel	Length	Berth	Activity
Niugini Coast	104.7	10	loading containers
T <sub>Pacific</sub> Condor	117.7	9	unloading containers and tyres, loading containers and general cargo
<sup>n</sup> Alcem Calaca	134.5	4	unloading bulk cement
e Topflight	190	11, 7, 3	loading concentrates and zinc ingots
m <sub>Annou GO</sub>	190	2	unloading nickel ore
<sup>a</sup> Avedon Calypso	170	A, 2	unloading nickel ore
<sup>x</sup> Bougainville Coast	88.6	10, A, 10	unloading containers
Felicity Ace	199.9	8	unloading motor vehicles
Sepik Coast	77.5	10, 7, 8	unloading and loading containers
Georgiy Kononovich	160	8	loading molasses
Coral Princess	34.9	9	Cruise vessel visit
ТОВ	179	4	take on bunkers
hHMAS Tarakan	44.5	1	naval vessel visit
eAtlantic Star	169.3	9	loading sugar

Table 24: Port of Townsville Shipping Movement Summary 26 October 2007 to 2 November 2007

maximum weekly ship movements assessed over the last 12 month was found to be 38. Therefore the monitoring undertaken for this assessment is considered indicative of a typical, (almost worst case scenario) 1 week period of Port operations. Using simple logarithmic analysis, on the basis of the above maximum weekly ship movements this indicate that noise from ship movements could increase by 0.4 dB(A) above what was measured given the maximum number of ship movements for a weekly period in the last 12 months.

This is not considered a significant increase. Therefore, measured noise levels have not been adjusted for this assessment.

### **Industrial Noise**

At the time of preparation of this EIS detailed noise source information for all of the port users activities was not available. However, it was noted that there are already existing residential developments, namely Jupiters Casino Accommodation and the Mariners Peninsula (MP) Development located at similar distances from the existing Port operations. Therefore a relative port user by port user noise comparison study has been conducted to compare potential noise impacts on the proposed Breakwater Cove development with those on the existing Casino and MP receptors.

Figure 9: – Aerial Photo of Potential Port Sources & Nearby Receptors shows an aerial photograph of the Port used to identify potential noise sources and to determine the comparative distances to the Breakwater Cove Precinct and other existing noise sensitive receptors:

Noise and Vibration Assessment Townsville Ocean Terminal



#### Figure 9: - Aerial Photo of Potential Port Sources & Nearby Receptors



Noise and Vibration Assessment Townsville Ocean Terminal Page 65 Hyder Consulting Pty Ltd Incorporating Weathered Howe ABN 76 104 485 289 12/10/07 3:58 24



An analysis of the port layout and the proximity of the nearby receptors to each existing source indicates that following:

The nearest noise sensitive receptor is the existing Jupiters Casino accommodation which is considered residential for the purposes of noise impact on bedroom and living areas and has the same internal design noise criteria for these spaces as recommended in AS 2107.

Of the 44 sources (note that 5 & 6 are missing) shown in Figure 9, 40 have the potential to impact Breakwater Cove (43-46 have been deemed too far away from either the exiting receptor or Breakwater Cove to have significant impact).

Of those 40 sources the 16 of those sources are located closer, and thus with more exposure to noise impact to the Casino Accommodation.

The difference in dB(A) likely to be experienced at the Breakwater Cove from the Casino as a result of the remaining 24 sources, based on the difference in proximity to the port users have been summarised below in Table 25.

Table 25: Differences in Predicted Existing Port Noise Levels Experienced between Breakwater Cove & the Existing Casino Accommodation

Predicted Increase in dB(A)					
0-2 dB(A) (marginal) 2-3 dB(A) >3dB(A) (just discernable) (clearly discernable)					
13 sources 10 sources 1 source					

The sources relating to the above predicted noise level differences are:

Sources where the existing noise levels from the Port are predicted to be marginally  $(0-2 \ dB(A))$  higher than those experienced by the existing Casino accommodation are:

Table 26: Port Users Where Predicted Noise Impact is Marginally Higher than the Existing Casino Based on Distance Alone

Figure 9 Reference	Port User
7	Berth 7 (Bulk Minerals
	Loader)
19	Port Control Tower
22	Australian Molasses Trading
23	Chemtrans
24	Origin Energy
26	Northern Port Services
27	Queensland Nickel
28	BHP Biliton
30	S.Colbourne
31	Incitec Pivot

Noise and Vibration Assessment Townsville Ocean Terminal



32	Cement Australia
33	Shell Company of Australia
34	Patrick Logistics

Sources where the existing noise levels from the Port are predicted to be barely or just discernable (2-3 dB(A)) from those experienced by the existing Casino accommodation are:

Table 27: Port Users Where Predicted Noise Impact is Just Discernibly Higher than the Existing Casino Based on Distance Alone

Figure 9 Reference	Port User
2	Berth 2
3	Berth 3
4	Berth 4
8	Berth 8
9	Berth 9 (Bulk Sugar Loader)
10	Berth 10
11	Berth 11 (Bulk Minerals
	Loader)
20	Svitzer Tugs
25	NSS Container Terminal
29	Queensland Terminals

Sources where the existing noise levels from the Port are predicted to be clearly discernable (2-3 dB(A)) from those experienced by the existing Casino accommodation are:

Table 28: Port Users Where Predicted Noise Impact is Marginally Higher than the Existing Casino Based on Distance Alone

Figure 9 Reference	Port User
1	*Berth 1 (Bulk Liquids)
* the predicted increase is $2 E dD(\Lambda)$	

\* the predicted increase is 3.5 dB(A).

It should be noted that the above predicted noise levels have not taken into account the 6 metre proposed acoustic berm/barrier structure to the north west of the TOT which is likely to provide at least 5-10 dB(A) noise reduction to the 2 storey dwellings.

Noise monitoring results indicate the following:

Noise levels emanating from port users 12 to 18, 21 and 35 to 42 are likely to be lower than those experienced by the existing Casino Accommodation.

Of the remaining 24 port users predicted noise levels likely to be experienced at the Breakwater Cove precinct from existing Port operations range between 0 to 3.5 dB(A) higher than those likely to be experienced at the existing Casino Accommodation.

Noise and Vibration Assessment Townsville Ocean Terminal



Of those 24 port users 11 are predicted to produce noise levels 2 to 3.5 dB(A) higher than those experienced by the existing Casino. The remainder are predicted to be marginal exceedances of less than 2 dB(A).

Of those predicted to exceed current noise exposure at the Casino, generally, an additional reduction of 5-10 dB(A) may be expected for any port noise sources where the proposed TOT acoustic barrier cuts off line of sight between the source and the dwellings on the other side of the barrier. This may apply for Berths 1 to 9 & 11 and port users 20 and 22-34.

Based on the above discussion, the following port users therefore, have the potential to produce noise which may exceed the levels experienced at the existing closest noise sensitive location (the Casino Accommodation):

- Port Control Tower (by 1.2 dB(A))
- Berth 10 (by 2.6 dB(A) to the Breakwater Cove apartments and 1.1 dB(A) to the Breakwater Cove 2 storey dwellings)
- Berth 11 (by 2.3 dB(A) to the Breakwater Cove apartments and 2.7 dB(A) to the Breakwater Cove 2 storey dwellings)
- Activities that are not shielded by the proposed acoustic barrier at Berths 2-9 & 11 and port users 20 and 22-34. (by up to 2.7 dB(A) to the Breakwater Cove apartments and 2.9 dB(A) to the Breakwater Cove 2 storey dwellings).
- Berth 1 (by 3.2 dB(A) to the Breakwater Cove apartments and 3.5 dB(A) to the Breakwater Cove 2 storey dwellings). However we would expect at least minimal shielding to occur at these locations, where at least partial loss of line of sight is likely.
- All of the above predicted exceedances, with the exception of Berth 1 which is likely to experience at least some shielding, are less than 3 dB(A) higher than what is likely to be experienced by the closest existing noise sensitive receptor and are therefore likely to either indiscernible or slightly discernable from that experienced at the existing Casino accommodation.

The above predictions are worst case scenarios for the proposed dwellings on the Breakwater Cove site located closest to the indicated noise source. Dwellings located further from the source are likely to experience a lower noise level and experience the benefit of shielding from other closer buildings.

The above analysis indicates noise levels likely to be experienced by the Breakwater Cove precinct are not likely to be significantly higher than those experienced by the existing Casino accommodation.

### Maintenance Dredging

Currently the Port of Townville waterways are dredged on a regular basis to keep the shipping channels clear. We understand that this is likely to occur


for an approximate 24 hour period once annually at locations nearest to the proposed TOT precinct. Noise measurements were carried out for similar dredgers under full load as part of construction noise assessment, and measurements identified that the sound power level for the maintenance dredge is likely to be around 106 dB(A). Based on a closest estimated distance between the dredging activities and the Breakwater Cove precinct, this indicates a predicted noise level of 49 dB(A) likely to be incident on the Breakwater Cove dwellings as a result of dredging noise. The specific project planning noise level for night time at Breakwater Cove is 42 dB(A) (refer table 8). Therefore with no mitigation, noise levels from dredging are likely to exceed project noise criteria by up to 7 dB(A).

However, the proposed 6 metre acoustic barrier located between the TOT and the Breakwater Cove Dwellings is likely to provide between 5 and 10 dB(A) of shielding which indicates that dredging noise is likely to either comply or only marginally exceed the planning noise criteria. Given the above and the low occurrences of this activity occurring (once per year for 24 hours) this is not likely to provide significant noise impact on the Breakwater Cove precinct.

#### Road, Rail and Tugboat Noise

Over the period of noise logging undertaken during this assessment, one of the more discernable Port noise sources was noted to be railway carriage shunting and coupling. It should be noted that these noise emissions are usually of a short duration and are more discernable during the evenings. It is also noted that 1 to 2 tugboats are in use during movements of vessels in and out of the Port and between berths within the Port. Observations at the Casino monitoring location during placement and retrieval of the logger and general inspection did not note any of these sources as clearly discernible from the overall noise emanating from the Port.

An individual assessment of Port rail, road and tugboat noise has not been carried out for this assessment as existing noise sensitive receptors such as the Casino are located closer to these sources than the Breakwater Cove development, with less shielding and, as such, are expected to be subjected to lower levels of noise.

However, these events were captured within the reported results and contributed to the overall background noise level used to determine the design noise criteria for the Breakwater Cove precinct described in *Table X* of this report.

### Previous Noise Complaints

A record of amenity complaints received by the existing Port in the last 8 years has been analysed to assist in summarising the extent of existing noise impact associated with the existing Port operations on existing

Noise and Vibration Assessment Townsville Ocean Terminal



receptors near to the proposed Breakwater Cove development. The following Table summarises these previously received complaints

Complaints	2000	2001	2002	2003	2004	2005	2006	2007	Total
dust		1		4	4	10	6	1	26
noise		1	1	10	4	7	3		26
rubbish	1			2	7	6	2	1	19
heavy vehicles	2						1		3
flood/drainage				1	1		1		3
trees		1	1						2
sprinklers/water use					1	1			2
lighting					1	1			2
odour								2	2
signage					1				1
business park works							1		1
Totals	3	3	2	17	19	25	14	4	87

Table 29: Amenity Complaints Received by the Port of Townsville 2000 to 2007

Of the above 87 complaints received by the Port of Townsville since 2000, only 26 of these were related to noise and of those 22 originated from South Townsville, with 3 of the noise complaints originating from the receptors on the Strand and 1 from the Casino. This is considered to be a relatively low level of complaint over an 8 year period with all of the noise complaints associated with Port activities impacting on areas other than South Townsville, being lodged in 2004 or earlier. The overall list of complaints suggests that the noise impact in the last three years has decreased subjectively.

## 4.2.5 Potential Noise Impacts from Future Port Operations

At the time of preparation of this report Hyder understands that the proposed expansion of the Port of Townsville to 2030 includes future layout of additional infrastructure and demolition or relocation of existing infrastructure as detailed in Section 3.2.4

The proposed expansion as detailed in the Port of Townsville Masterplan indicates that the majority of the expansion and the additional berths will generally be located further away from the Breakwater Cove and TOT precincts to the north east and are therefore likely to have a lower impact on the development than existing operations. The exception to this will be the extension to Berth 10 which is located close to the proposed TOT & Breakwater Cove precincts. However whilst a potential increase in 3 dB(A) could be expected from a doubling in ship activities at Berth 10, the impact on the Breakwater Cove precinct is likely to be significantly less than that on the existing Casino accommodation because of the proposed 6 metre high acoustic barrier proposed to the west of the TOT. Therefore if noise from Berth 10 complies with statutory noise criteria at the existing Casino

Page 70

C:\Projects\Y054 TOT as of 140907\docs\pr\_Y05401JM\_rev4.doc



accommodation, it will be likely to comply with the same criteria at the proposed Breakwater Cove precinct, providing the recommendations in the report are adhered to.

The removal of berth 7 is also likely to reduce incident noise levels on both the existing Casino accommodation and the Breakwater Cove precinct.

Based of the close proximity of existing noise sensitive receptors such as the Casino, Mariner's Peninsula and approved future residential development along Sir Leslie Theiss drive, this assessment indicates that if the existing and future port operations are achieving acceptable noise levels, at the existing adjacent noise sensitive receptors then they are likely to be similarly acceptable at the Breakwater Cove precinct and the TOT, provided the recommendations in this report are adhered to.

It is noted that the Port of Townsville Master Plan – 2030 (Conceptual Layout Plan) shows that future expansion of the port facilities is to the north east of the existing facilities. Based on this and the analysis carried out in this report, it is unlikely that there would be significant increase in noise levels from port operations at the Breakwater Cove Precinct. Further to this, should future noise from the Port increase significantly, noise would increase similarly at other existing noise sensitive receptors, and thus, contravene the existing ERAs under which many of the Port users operate.

#### Ship Traffic

The masterplan indicates three levels of predicted growth for increases in ship traffic. The worst case scenario indicates that the number of cargo vessels could increase by up to 82% whilst naval ships visiting the port may increase by 76%. This equates to overall increases in long terms ship noise levels of 2.6 dB(A) and 2.5 dB(A) respectively using simple logarithmic analysis and assuming that more berths will be used simultaneously to accommodate that additional ships.

Further to this the Port propose to construct 7 additional berths to the north east of the current port operations located at a greater distance from the Breakwater Cove precinct and Casino further indicating that noise from ship movements is not likely to significantly increase at these noise sensitive locations.

### 4.2.6 Marine Fauna Impacts

This section presents a summary of qualitative research and recommends conceptual methods for consideration as part of an Environmental Management Plan for the construction and operation of the Townsville Ocean Terminal development project.

The findings from the research should not be considered definitive as there is currently limited knowledge of the full impact of noise pollution on cetaceans, particularly the long term impact and the levels of noise



exposure that cause the impacts. Present research studies appear to rely on mammals stranded or caught to analyse the ears and internal organs to assess the impacts. Studies on physiological impacts, as a result of exposure to noise pollution, are almost impossible to be carried out.

#### Bird Environment

Construction noise may have the potential to cause initial disturbance to bird species such as temporary displacement, abandonment of nests and breeding areas. It is considered unlikely that construction noise would cause long-term impact on bird species. Albeit, monitoring of bird visitation/behaviour during construction and operation as recommended in the ecological study would help to determine short-term and long-term noise impact on bird environment.

Additionally, mitigation measures including prevention, monitoring and remediation recommended in the ecological study would help to minimise the noise impact on bird environment.

#### Marine Environment

Dugong and many cetaceans live in an environment where vision is not the primary sense as light does not penetrate far beneath the surface of the ocean. These animals inhabit underwater environments that restrict visibility further, such as turbid rivers and estuaries or plankton rich oceanic waters.

Marine animals use sound for echolocation to determine their surroundings, navigation, communication and preying. Research shows that noise from military sonars, seismic surveys, shipping and boat traffic, oceanographic experiments has the potential to impact on marine animals. Table 30 presents a description of possible impacts on cetaceans due to noise pollution.

Table 30:	Possible Impacts of Noise on Cetaceans
-----------	--

Types of Impact		Description				
Dhusiaal	Non-auditory	Damage to body tissues, induction of bends				
Physical	Auditory	Damage to ears, temporary and permanent threshold shift				
Perceptual		Masking of communication and other biologically important noises, interference with ability to acoustically interpret environment, adaptive shifting of vocalisations				
Behavioural		Interruption of behaviour, behaviour modified, temporary and permanent displacement from area				
Chronic/Stress		Decreased viability of individual, increase vulnerability to decease, increased potential for impacts from negative cumulative effects, sensitisation to noise, habituation to noise				



Decompression sickness	Harm to complex sinuses in the heads of cetaceans and other organs			
Indirect effects	Reduced availability of prey, increased vulnerability to predation or other hazards, stranding			

Source WDCS Science Report "Oceans of Noise 2004"

#### Noise Sources

Noise sources with the potential to impact on bird and marine environment include land based and underwater noise sources.

Land based noise sources that could impact on birds are mainly equipment used during construction.

Underwater noise sources associated with the proposed development that could impact on marine animals include:

- dredging activities associated with construction of the Breakwater Cove Precinct;
- piling activities associated with construction of the Townsville Ocean Terminal;
- increase in commercial and private watercraft due to the Breakwater Cove Precinct development;
- increase in operation and berthing of cruise and military vessels at the Townsville Port Terminal; and
- increase sea traffic movements

Noise from ships dominates the marine waters and is mainly due to propellers, machinery, hull interaction with water and the use of sonar and depth sounders.

Most shipping emanates noise at frequencies below 1,000Hz which is in the frequency range used by baleen whales for communication and other biological activities.

Small leisure craft generate noise from 1,000Hz – 50,000Hz which have the potential to impact toothed whales. Propellers on these vessels may also cause cavitation which generates noise at higher frequencies and could impact smaller cetaceans.

Naval vessels use active sonar (which emits short pulses of high sound levels) on exercises and during routine activities. Noise generated by naval activities ranges from 100Hz - 200,000Hz. As military information is usually classified, military sonar systems used may generate frequencies outside this range.

Piling activities generate underwater noise at frequencies from 45Hz - 7000Hz. There are studies on the effects of underwater noise on cetaceans due to piling and dredging operations. For example, whales were displaced from the areas where piling and dredging operations



occurred for a number of years after the operations. Piling and dredging operations may also affect feeding, vocalisations, surfacing, respiration and diving patterns of whales.

The noise sources identified above have the potential to cause severe impacts on cetaceans. Section 4.3.4 presents a number of measures that could be considered to minimise the impacts from the proposed development.

## 4.3 Mitigation Measures

### 4.3.1 Mitigation of Construction Phase Noise and Vibration

As the existing residences to the south and south-west are reasonably distant from the construction sites, construction noise and vibration impacts from the proposal are unlikely to be significant.

The highest construction noise impact would be at residences near the Riverside Marine site (west of Ross River), but only if the Riverside Marine haul route option is selected. The preferred option is the temporary bridge haul route option, which will result in significantly lower levels of activity at this site and limit activities to within daytime operations. For either option, it is recommended that where feasible and practical, the following engineering noise controls be considered:

- provision of engineering controls for stationary noise sources such as acoustic enclosures for barges' diesel engines and silencers for engine exhausts;
- construction/maintenance of barriers and/or stockpiles during material deliveries to act as acoustic screening between the noise sensitive residences and the Riverside Marina loading point;
- fitting warning lights instead of audible reverse alarms on mobile equipment (excavator/front end loader) during night-time operation, where safety measures are not compromised;
- maintenance and operation of equipment in proper and efficient condition/manner; and
- turning equipment off when not in use rather than leaving them on idle.

The above measures can provide a noise reduction of typically up to 10dB(A), resulting in external construction noise levels of 40-45dB(A) at the Ross River residences to the west of the Riverside Marine site. With windows open adequate for ventilation, the difference between the external and internal noise levels is typically 10dB(A). Hence, construction noise levels inside the residences' bedrooms would be in the order of 30-35dB(A) and are within the internal noise levels recommended by Australian Standard AS2107:2000. Although construction noise is expected to be



audible at times, adverse comments from the residents would not be expected.

It is recommended that a Construction Noise and Vibration Management Sub-plan (as part of the overall Environmental Management Plan) be implemented to minimise the impacts. Specific issues would be determined following approval being granted, construction contractors being engaged and construction program and method being finalised. However, issues that should be considered include:

- ensure dilapidation surveys for the commercial buildings such as Jupiters Casino and Convention Centre are undertaken prior to construction of the TOT project;
- undertake vibration measurements during critical stages and where required, alternative construction (and/or alteration) methods should be investigated to ensure the guidelines are achieved;
- undertake construction activities between the hours of 6:30am and 6:30pm, Monday to Saturday;
- ensure staff and contractors are aware of potential noise impacts and undertake work as quietly as possible;
- specify and select construction equipment based on acoustic performance;
- maintain and operate construction equipment including trucks in a proper and efficient condition/manner;
- warm up plant as far as possible from noise sensitive receptors prior to moving them to work sites and turn plant off when not in use instead of leaving them on idle;
- plan and schedule noisy activities not to occur at the same time;
- locate fixed plant equipment such as de-watering pumps and concrete batching plant behind shielding structures, as far as possible from noise sensitive receptors and provide hoarding or enclosures where feasible and practical;
- where feasible and practical, locate equipment behind construction site offices, sheds and structures so that it is shielded as much as possible from the noise sensitive receptors;
- establish a complaint hotline, register the number of complaints and the nature of complaints (if any) and investigate options to minimise the impacts.

### 4.3.2 Mitigation of TOT Project Operational Noise

The prediction shows that noise emission levels from the TOT ship operations have the potential to exceed the recommended levels at the future residential development within the Breakwater Cove Precinct.

Noise and Vibration Assessment Townsville Ocean Terminal



Additionally, maximum ( $L_{Amax}$ ) noise levels from transient events from ship horns are expected to exceed the assessment guideline at the Jupiters Casino (hotel accommodation) and residential development within the Breakwater Cove Precinct. Although these events would very few during night-time, it is recommended that an Operational Noise Management Plan be implemented and limit ship horn operations during night-time where safety is not compromised.

Where predicted noise levels still exceed the design objectives, it would be more practical and economical to incorporate control measures into the future residential development to achieve the required internal noise levels. This is due to the fact that noise sources from cruise ships are high above the ground and the residential development consists of multi-level buildings. Construction of acoustic barriers to mitigate such elevated noise sources and receptors could create secondary impacts such as visual character.

It is recommended that to ensure that noise impacts are taken into consideration and minimised, acoustic design considerations should include appropriate building design, orientation and location of buildings/structures and noisy activities/venues to provide screening between the major noise sources and sensitive receptors.

### 4.3.3 Mitigation of Port Operational Noise

It is understood that future residential development within the Breakwater Cove Precinct will be required to comply with Port Protection Codes to incorporate mitigation measures (where required) to control external noise intrusion into the buildings to control noise from the TOT Precinct, the Port and other external sources.

Based on predicted external noise levels from the Port at Breakwater Cove of up to 3.5 dB(A) higher than those at the existing Casino, the Codes should be appropriate to achieve acceptable levels within the residences. It is considered that the Surplus Casino Land Port Protection Codes provide a reasonable base for such mitigation. This is applicable to houses only. Further modelling of Port sources is required to determine predicted impact on the medium density unit development which will be required to develop mitigation measures, primarily in the form of building treatments as part of the development application for these dwellings.

In addition to the Port Protection Codes, the types of mitigation measures could include property boundary fences, minimum building envelope constructions, or glazing for exposed windows and doors and appropriate window/ door orientations.

Acoustic privacy between sole-occupancy units should be designed to achieve the requirements of the Building Code of Australia (BCA2007).

Noise and Vibration Assessment Townsville Ocean Terminal



## **Existing Port Protection Measures**

There are currently several agreements which dovetail together to provide for the protection of the continuation of Port operations.

These include Breakwater Island Casino Agreement Act 1984 (as amended) (BICA), Port Protection Agreement, Harbour Agreement, SCL Scheme, FDA Scheme, Port Protection codes and Community Management Schemes.

The Agreements require the adoption of several measures to protect the existing operation of the Port as follows:

- Disclosure to buyers of the Port operations.
- Flagging the Port operations and the Port Protection Measures (PPM) to subsequent buyers.
- Controls that regulate development deign to mitigate Port impacts
- Regulate the building deign to mitigate any nuisance impacts

## 4.3.4 Mitigation of Noise Impacts on Marine Fauna

## Long-Term Mitigation Measures

As ship noise dominates the underwater noise pollution in marine waters, the control, reduction and management measures will require worldwide initiatives, obligations and commitments.

The WDCS Science Report "Oceans of Noise 2004" recommends the actions that could be investigated to address potential threat to marine life due to underwater noise pollution include:

- determining international law to regulate marine noise pollution;
- establishing an independent body consisting of relevant international scientists to initiate, promote, monitor and fund marine noise research and continually review effective mitigation measures;
- major development in the marine environment be subject to public environmental assessment;
- commitment from major development to develop alternative technologies and investigate mitigation measures to address underwater noise pollution;
- navies of the world seek to effectively mitigate noise generating activities and avoid deployment of powerful sonars and develop a treaty to limit or prevent the use of powerful sonars;
- establishment of national and international ocean conservation plans; and
- greater efforts made to collect and share information relating to reactions of marine life to underwater noise pollution.



The above initiatives and actions will require international commitment and obligations. Any meaningful outcomes could only be expected in the long term and relevant to the noise reductions from vessel traffic at seas.

### Project Specific Measures

In terms of practical safeguards or solutions for the proposed development, the following initiatives and conceptual measures could be considered as part of the overall Environmental Management Plan (EMP).

#### Awareness/Education

Many operators in the marine environment are unaware of the effect of underwater noise pollution on marine life and hence give little thought to alleviating the concerns. A willingness of operators to implement effective mitigation measures for the protection of cetaceans is likely to be looked on more favourably by the community if the community is aware of the problem. Hence, awareness raising is an important priority in mitigating underwater noise pollution.

#### Safety Zones

Cetacean safety zones could be established prior to construction as part of Environmental Management Plan (EMP) for the proposal. There is research which suggests that safety radius from the noise sources could be in the order of 500m to 3000m. Research also suggests a more flexible safety zones based on sound pressure levels at the receptors (cetaceans), however there are insufficient data currently to accurately determine sound exposure guidelines for marine mammals. Surveys and sampling of marine mammals as recommended in the ecological study would also help to determine safety zones.

### **Operational Management**

Where certain areas in the vicinity of the Townsville Port Terminal including the Townsville Ocean Terminal and Breakwater Cove Precinct are considered as biological important, management of vessel movements and restricting vessel speeds could be considered to protect marine life.

#### Site Observation

Observations could be undertaken prior to work commencement and during work activities. Where cetaceans are detected within the specified safety zones, noisy activities should be managed or stopped until the area is clear of cetaceans.

Noise and Vibration Assessment Townsville Ocean Terminal



### Ramp-up

Research suggests ramp-up or "soft-start" of noise generating activities could alert marine mammals with sufficient time so that they move away from the noise sources. However, there are also suggestions that animals may become habituated to persistent noise and remain in the area when repeated exposure could cause damage. While in the absence of other methods, ramp-up may be considered. Its effectiveness would need to be monitored and analysed.

## Bubble Screening

Bubble screening has been shown to reduce sound levels at the source. This could be considered to reduce underwater noise pollution during major construction activities. However, its effectiveness is unpredictable and varies from case to case. Further investigations would be needed to assess the effectiveness of bubble screen as a mitigation measure.

## Acoustic Detection System

There have been suggestions of the use of vessel-mounted acoustic detection systems to warn vessels the presence of marine mammals or warn the mammals to keep them away. However, issues with habituation, displacement and attraction have been considered as negative impacts from the use of such devices. Therefore, more research is needed and environmental assessments should be made before such devices are used.

### Monitoring

It is understood that an ecological monitoring program will be prepared as part of proposed development. The findings from the ecological monitoring program would assist in identification and devising mitigation and management plan to minimise the noise impacts.

Page 79

Hyder Consulting Pty Ltd Incorporating Weathered Howe

ABN 76 104 485 289



## 5 Conclusion

The TOT Project will involve development of an ocean terminal facility and a residential precinct (Breakwater Cove) to be constructed on reclaimed land to the north of the Jupiter's Casino and Townsville Entertainment Centre and to the west of the Port of Townsville.

An assessment has been undertaken to determine the potential impacts on:

- a) existing sensitive receptors from noise and vibration as a result of construction and operation of the TOT Project; and
- b) future sensitive receptors within the Breakwater Cove precinct as a result of the Port of Townsville operational activities.

Noise monitoring was conducted at various noise sensitive locations in the vicinity of the project site to determine existing ambient noise levels and noise modelling was undertaken to identify potential future noise impacts at the project site. This assessment has concluded that:

- Potential noise impacts on existing sensitive receptors from construction of the TOT Project are likely to be effectively mitigated by implementation of noise control measures contained in the Project EMP. Predicted noise levels at noise sensitive receptors during construction are likely to be within recommended limits.
- Noise emissions from operation of the proposed ocean terminal have the potential to exceed recommended limits at the Breakwater Cove residences. However, these impacts are likely to be effectively mitigated by restricting ocean terminal activities at night and by construction of an acoustic barrier within the ocean terminal precinct.
- The noise impact from existing Port operations at the worst affected dwellings within the Breakwater Cove precinct is predicted to be up to 3.5 dB(A) higher than that measured at the existing Casino accommodation. However, this is a predicted worst case scenario and does not take account of the proposed acoustic barrier within the TOT precinct. Further investigations are recommended as detailed in section 1.7.3 of this report.
- The proposed acoustic barrier is likely to result in reductions of noise levels of up to 10 dB(A) at the some of the worst affected Breakwater Cove receivers where line of sight is removed between the Port sources and those receivers.
- Modelling of discrete worst case port noise sources (sources to be confirmed by discussion with the Port) is recommended. This will allow the Breakwater Cove Precinct to be zoned in terms of experienced noise level from the Port, to develop minimum building envelope acoustic ratings for each zone. This will be used to ensure that internal noise levels within these dwellings as a result of Port noise impact, are controlled to levels recommended in current



Australian Standards, to protect the amenity of the Breakwater Cove Residents.

Page 81

C:\Projects\Y054 TOT as of 140907\docs\pr\_Y05401JM\_rev4.doc



# References

- Australian Standard AS2107:2000 "Acoustics Recommended Design Sound Levels and Reverberation Times for Building Interiors"
- AS 3671:1989 "Acoustics Road Traffic Noise Intrusion Building Siting and construction"
- AS 2021:2000 "Acoustics Aircraft noise intrusion Building Siting and construction"
- AS 1055:1997 "Acoustics Description & Measurement of Environmental Noise"
- AS 1259:1990 Acoustics Sound Level Meters Integrating & Non Integrating Averaging.
- Australian Standard AS2670.2:1990 "Evaluation of Human Exposure to Wholebody Vibration"
- British Standard BS7385.2:1993 "Evaluation and Measurement for Vibration in Buildings – Guide to Damage Levels from Groundborne Vibration"
- Building Code of Australia (2005)
- German Standard DIN4150:1999 Part 3 "Structural Vibration in Buildings Effects on Structures"
- Port of Townsville Port Notices, November 2006
- QLD Department of Main Roads "Road Traffic Noise Management Code of Practice Version 2, January 2000"
- QLD Environmental Protection (Noise) Policy 1997
- QLD Environmental Protection Amendment Regulation (No. 2) 1999
- QLD Environmental Protection Regulation 1998
- QLD Environmental Protection Act 1994
- QLD Environment Protection Agency EcoAccess Guideline Planning for Noise Control
- Townsville City Plan 2005
- Townsville Ocean Terminal Draft Terms of Reference for an Environmental Impact Statement
- Wales and Dolphins Conservation Society (WDCS) Science Report "Oceans of Noise"
- Townsville Port Protection Agreement



- Breakwater Island Casino Agreement Act 1984 (as amended BICA)
- Townsville Port Authority Shipping Logs
- Port of Townsville Masterplan Report R5, 20 August 2007
- Townsville Port Protection Codes
- Townsville Port Authority Background Noise Survey, June 2006 issued by Max Winders & Associates.

Page 83

C:\Projects\Y054 TOT as of 140907\docs\pr\_Y05401JM\_rev4.doc



Appendix 1

#### AMBIENT NOISE MEASUREMENT RESULTS

Noise and Vibration Assessment Townsville Ocean Terminal Page 84 Hyder Consulting Pty Ltd Incorporating Weathered Howe ABN 76 104 485 289 12/10/07 3:58 24

C:\Projects\Y054 TOT as of 140907\docs\pr\_Y05401JM\_rev4.doc







abulated LA01 and LA10 are arithmetically averaged.
Tabulated LA90 are the lowest 10-percentile levels













Tabulated LA01 and LA10 are arithmetically averaged
Tabulated LA90 are the lowest 10-percentile levels





Tabulated LA01 and LA10 are arithmetically averaged
Tabulated LA90 are the lowest 10-percentile levels





2. Tabulated LA01 and LA10 are arithmetically averaged

















Tabulated LAeq are logarithically averaged
Tabulated LA01 and LA10 are arithmetically averaged
Tabulated LA90 are the lowest 10-percentile levels





Tabulated LA01 and LA10 are arithmetically averaged
Tabulated LA90 are the lowest 10-percentile levels













2. Tabulated LA01 and LA10 are arithmetically averaged





2. Tabulated LA01 and LA10 are arithmetically averaged













2. Tabulated LA01 and LA10 are arithmetically averaged





2. Tabulated LA01 and LA10 are arithmetically averaged








































interfection1. Tabulated LAeq are logarithically averaged2. Tabulated LA01 and LA10 are arithmetically averaged3. Tabulated LA90 are the lowest 10-percentile levels

















Tabulated LA01 and LA10 are arithmetically averaged
Tabulated LA90 are the lowest 10-percentile levels





























abulated LA01 and LA10 are arithmetically averaged.
Tabulated LA90 are the lowest 10-percentile levels





Tabulated LA01 and LA10 are arithmetically averages
Tabulated LA90 are the lowest 10-percentile levels





Tabulated LA01 and LA10 are arithmetically averaged
Tabulated LA90 are the lowest 10-percentile levels













Tabulated LA01 and LA10 are arithmetically averaged
Tabulated LA90 are the lowest 10-percentile levels













Appendix 2

## PREDICTED OPERATION NOISE CONTOURS

Noise and Vibration Assessment Townsville Ocean Terminal Page 85 Hyder Consulting Pty Ltd Incorporating Weathered Howe ABN 76 104 485 289 12/10/07 3:58 24

C:\Projects\Y054 TOT as of 140907\docs\pr\_Y05401JM\_rev4.doc





Project: Townsville Ocean Terminal Enviromental Noise Impact

Job File:Y054 Elevations based on Topographical map supplied by SUNMAP Department of Natural Resources

Grid Noise Map: 1.5 metres above ground elevation level.

SCENARIO Loading Activities - Cruise Ship

Noise Sources

1\* Gang plank being raised 1\* Forklift

HYDER CONSULTING PTY LTD 161 Breakfast Creek Road, PO Box, 3028, Newstead QLD 4006 Phone: +61 7 3337 0000 Fax: +61 7 3337 0050









Appendix 3

VEITCH LISTER CONSULTING'S TRAFFIC FORECAST

Noise and Vibration Assessment Townsville Ocean Terminal Page 86 Hyder Consulting Pty Ltd Incorporating Weathered Howe ABN 76 104 485 289 12/10/07 3:58 24

C:\Projects\Y054 TOT as of 140907\docs\pr\_Y05401JM\_rev4.doc




















Appendix 4

PREDICTED CONSTRUCTION NOISE CONTOURS

Noise and Vibration Assessment Townsville Ocean Terminal Page 87 Hyder Consulting Pty Ltd Incorporating Weathered Howe ABN 76 104 485 289 12/10/07 3:58 24

C:\Projects\Y054 TOT as of 140907\docs\pr\_Y05401JM\_rev4.doc













Appendix 5

## **NOISE BARRIER LOCATION & DESCRIPTION**

Noise and Vibration Assessment Townsville Ocean Terminal Page 88 Hyder Consulting Pty Ltd Incorporating Weathered Howe ABN 76 104 485 289 12/10/07 3:58 24

C:\Projects\Y054 TOT as of 140907\docs\pr\_Y05401JM\_rev4.doc



nah, "Mg/@wheve.com.gu FISCEAVE Co Jan 1923, Nevatread, Did Co Jantralia. dephrae: I-4171 3337 0056 ani I-4171 3337 0056 mail: "Mitrif @wheve.com.gu	OLD COMST D Box 1653, Sputhpart, Old Sighang, 1-6171 S533 3933		<u> </u>					
NOV 2005 QL00017-SK-02 C	TOWNSVILLE OCEAN TERMINAL - MASTER PLAN PLAN VIEW	NOTE: SUBJECT TO EIS ASSESSMENT AND FINAL DESIGN	<u>RE LINE OF</u> <u>TYPUS CHANNEL</u> "	BREAK WATER	3m HIGH LANDSCAPED EARTH BERM	3m HIGH ACOUSTIC ATTENUATION SCREEN		





Appendix 6

## SPATIAL RELATIONSHIP BETWEEN BREAKWATER COVE, TOT & TOWNSVILLE PORT

Noise and Vibration Assessment Townsville Ocean Terminal Hyder Consulting Pty Ltd Incorporating Weathered Howe ABN 76 104 485 289 12/10/07 3:58 24

Page 89

C:\Projects\Y054 TOT as of 140907\docs\pr\_Y05401JM\_rev4.doc

