# ENVIRONMENTAL NOISE IMPACT ASSESSMENT OF RIO TINTO'S PROPOSED DESALINATION PLANT IN DAMPIER

## RIO TINTO

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# EXECUTIVE SUMMARY

## Background

Hamersley Iron (part of the Rio Tinto Group) is proposing to construct and operate a Sea Water Reverse Osmosis (SWRO) Desalination plant at Parker Point in Dampier. The proposal will be developed in stages up to a maximum capacity of 8 GL/a (gigalitres per annum). Key features of the proposal include the desalination facilities at the plant site, a seawater intake lagoon and a booster pump station. This document provides an environmental noise impact assessment for construction and operation of the plant based on the maximum 8 GL/a capacity.

Noise impacts from the project have the potential to affect noise sensitive receptors within the town of Dampier which are already exposed to noise emissions from Rio Tinto's existing port operations at Parker Point and East Intercourse Island.

## Noise Objectives

Rio Tinto's noise objectives for the desalination plant are:

1. to ensure that noise emissions from the desalination plan do not contribute to exceedances of the Assigned Levels prescribed by the *Environmental Protection (Noise) Regulations 1997*; and

2. to ensure that cumulative emissions from the desalination plant and existing iron ore operations at Rio Tinto's port facilities do not result in an increase in noise impacts to the community at noise sensitive premises in the town of Dampier.

## Methodology

A noise model has been developed and used to investigate noise emissions from the proposed desalination plant during normal operations. The model has also been used to investigate noise emissions from significant construction activities which could potentially affect noise sensitive residential premises.

Three locations have been selected for assessing noise impacts from the proposed desalination plant:

- A location on Patterson Crescent which is representative of the nearest noise sensitive residential receivers to the proposed plant and which is strongly affected by noise emissions from Rio Tinto's existing port operations at Parker Point;

- A location representative of noise sensitive premises on Hampton Drive which is strongly affected by noise emissions from Rio Tinto's existing port operations at East Intercourse Island; and

- A location on Hill Road which is close to the proposed booster pump station.

The locations on Patterson Crescent and Hampton drive are the same locations used by Rio Tinto to monitor noise emissions from their existing port operations.

**Noise from Operation of the Desalination Plant**

An initial model representing normal plant operations was used to identify the noise sources which most significantly contribute to received levels at noise sensitive receivers and to determine the noise reductions required to achieve the Project's noise objectives at these receivers.

A subsequent modelling scenario was developed incorporating noise controls to the major noise emitting sources to demonstrate how the Project's noise objectives may be achieved.

Worst-case predicted noise levels at all selected receptors are below the most-stringent, night-time Assigned Levels for the baseline operating scenario. However, the predicted level at R1 is within 5 dB of the Assigned Level and could, therefore, be considered to contribute to an exceedance when considering cumulative noise impacts, taking into account existing ambient levels from Rio Tinto's port operations (see section 1.1).

Predicted noise levels are considerably lower than existing ambient noise levels in the town of Dampier and consequently any intrusive noise characteristics such as tonality, impulsiveness or modulation are unlikely to be evident at any noise sensitive residential location.

Without noise mitigation, the contribution of the desalination plant would result in an increase in received levels of less than 0.2 dB(A) at the most affected receiver.

By applying noise controls to seawater intake pumps and relocating some externally located pumps within the plant site, the contribution of the desalination plant to can be significantly reduced at the most affected receiver. The predicted contribution of the plant in this case is less than 25 dB(A) and the resultant increase in noise compared to existing ambient levels would be less than 0.01 dB.

**Noise from Construction Activities**

Noise is likely to be generated during construction activities associated with ground preparation, excavation of trenches and installation of piles. It is assumed that construction activities will be restricted to daytime hours.

Three construction scenarios have been modelled which are considered to represent worst-case noise impacts:

- Construction at the intake lagoon including installation of piles;
- Ground improvement and installation of stone columns, and excavation of trenches for services at the plant site;
- Ground preparation at the location of the pump station.

Predicted noise levels for construction activities at the intake lagoon and the plant site are below the daytime Assigned Levels. Therefore, no remediation or management measures are required provided that construction is restricted to 0900 and 1900 on Sundays and public holidays and 0700 and 1900 hours on any other day.

Noise from ground preparation activities at the booster pump station is likely to exceed the assigned levels at the nearest residential buildings, so the provisions in Regulation 13 will apply, specifically:

- The work should be carried out in accordance with section 6 of AS2436 "Guide to Noise Control on Construction Maintenance and Demolition Sites; and
- The equipment used should be the quietest reasonably available.

This activity is expected to be short-lived and will only have a localised impact over a small area. It is unlikely, therefore, that a noise management plan will be required.

**Conclusion**

The proposed desalination plant can comply with the *Environmental Protection (Noise) Regulations 1997* and can be operated without any discernible increase in received noise levels.

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# 1 INTRODUCTION

This report presents an environmental noise impact assessment of Hamersley Iron's (part of the Rio Tinto Group) proposed Sea Water Reverse Osmosis (SWRO) Desalination plant at Parker Point in Dampier.

The desalination plant will be constructed on a disturbed area of reclaimed land south of the Parker Point jetty. The seawater intake will be located on an existing, redundant power station cooling water intake lagoon to the south-west of the plant.

The proposal will be developed in stages up to a maximum capacity of 8 GL/a (gigalitres per annum). This assessment is based on the maximum 8 GL/a capacity.

The proposal comprises the following areas:

- Seawater intake site – located within an existing intake lagoon;
- Plant site - within an existing disturbed area;
- Ocean brine outfall – located along the Parker Point Jetty;
- Water transfer pipelines – connecting the plant with the existing potable water networks;
- A pumping station – located on the south eastern outskirts of the Dampier town site.

The project location is shown in Figure 1-1.

Noise emissions associated with the project are likely to originate from equipment operating at the plant site, the pumping station, and at the intake lagoon. The majority of equipment at the plant site is enclosed within buildings, with some externally located pumps as shown in Figure 1-2. The most significant items of equipment at the intake lagoon are the seawater intake pumps – see Figure 1-3.

Noise is also likely to be generated during construction activities associated with ground preparation, excavation of trenches and installation of piles. It is anticipated that construction activities will be restricted to daytime hours.

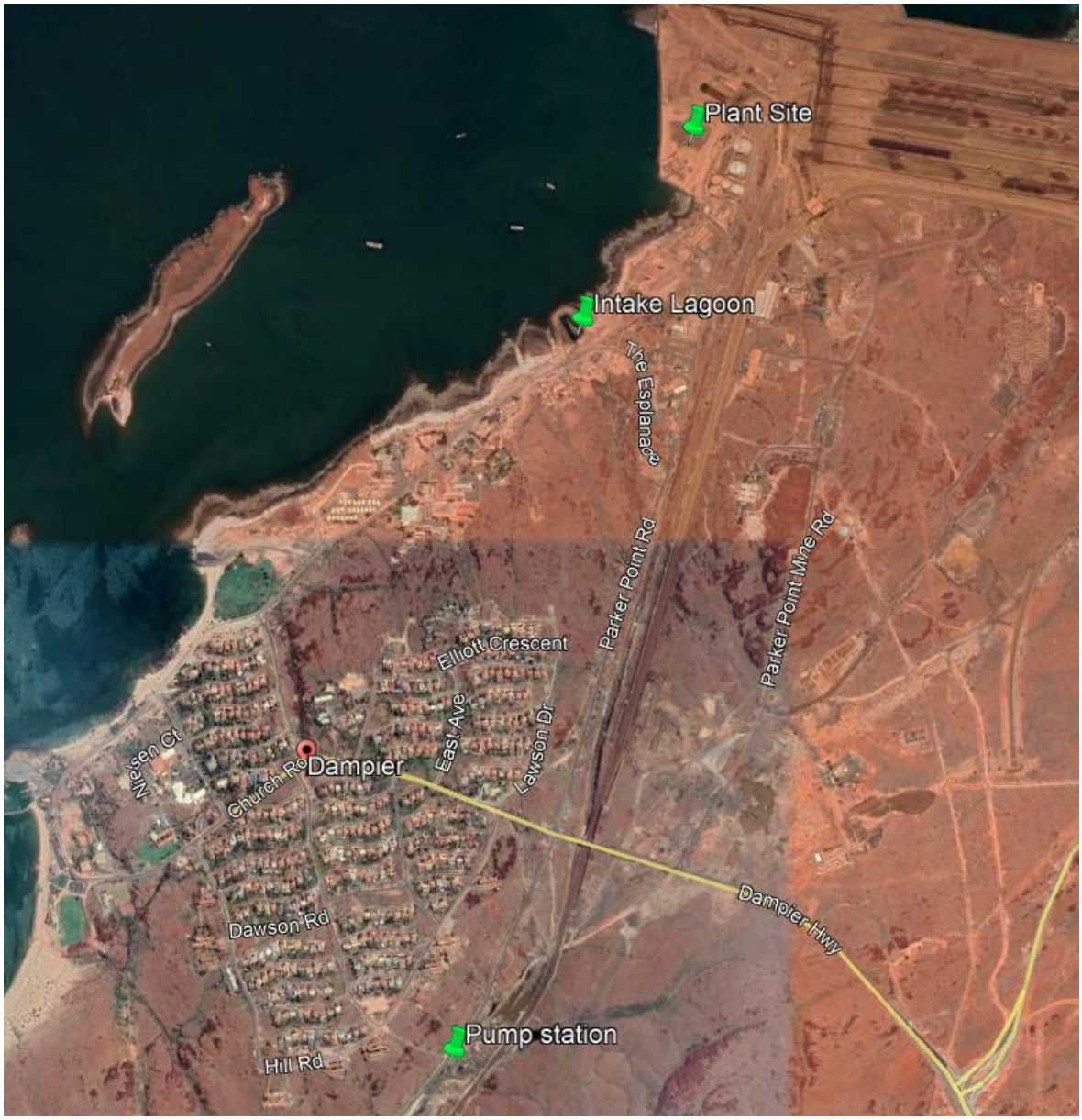


**Figure 1-1 : Project Location**

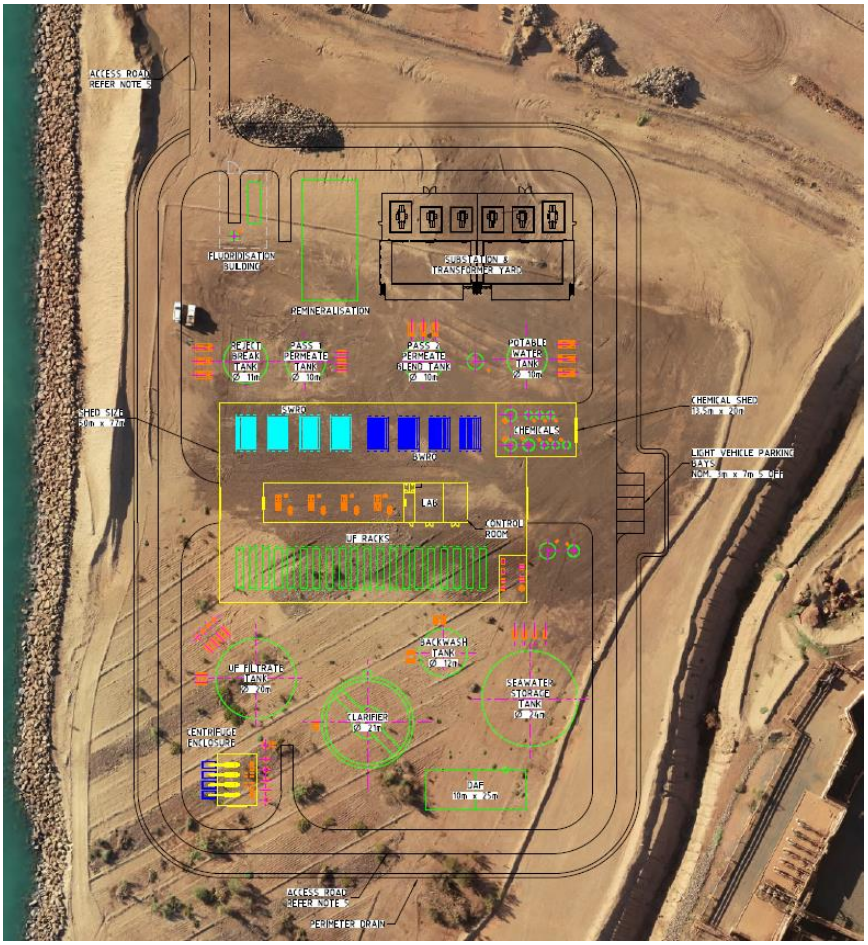


**Figure 1-2 : Plant Site**

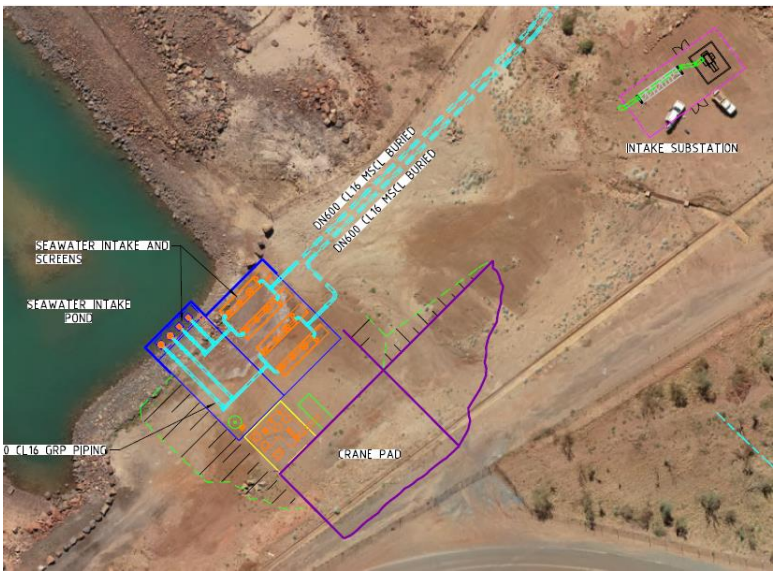


**Figure 1-3 : Intake Lagoon**

## 1.1 Affected Premises and Existing Noise Climate

Noise impacts from the project have the potential to affect noise sensitive receptors within the town of Dampier.

The town of Dampier is exposed to noise emissions from Rio Tinto's existing port operations at Parker Point and East Intercourse Island. These emissions currently exceed the prescribed standard (Assigned Levels) defined in the *Environmental Protection (Noise) Regulations 1997* (the Regulations), and Rio Tinto has applied for approval to vary the applicable noise limits via the process outlined in Regulation 17.

Three locations have been selected for assessing noise impacts from the proposed desalination plant:

- R1 – a location representative of noise sensitive premises on Patterson Crescent which is strongly affected by noise emissions from Rio Tinto's existing port operations at Parker Point;
- R12 – a location representative of noise sensitive premises on Hampton Drive which is strongly affected by noise emissions from Rio Tinto's existing port operations at East Intercourse Island; and
- PS1 – a location on Hill Road which is close to the proposed pump station.

These locations are shown in Figure 1-4.


**Figure 1-4 : Representative Noise Sensitive Receiver Locations**

The locations on Patterson Crescent and Hampton Drive are the same locations used by Rio Tinto to monitor port noise emissions and are the locations proposed for approval of varied noise limits via the Regulation 17 application.[1] Statistical analysis of noise monitoring data presented in recent annual noise monitoring reports has estimated Rio Tinto's contribution to received noise levels to be approximately 48 dB(A) and 46 dB(A) at Patterson Crescent and Hampton Drive respectively under worst-case conditions.

[1] Their location references (R1 and R12) have been selected for consistency with previous noise studies.

The town of Dampier is also exposed to noise from rail operations as trains approach and depart the port. Noise from rail operations can dominate the noise environment, particularly at locations close to the rail tracks (e.g. Patterson Crescent). The Regulations do not apply to these emissions.

## 1.2 Project Noise Objectives

Rio Tinto's noise objectives for The Project are:

1) to ensure that noise emissions from the desalination plan do not contribute to exceedances of the Assigned Levels prescribed by the *Environmental Protection (Noise) Regulations 1997*; and

2) to ensure that cumulative emissions from the desalination plant and existing iron ore operations at Rio Tinto's port facilities do not result in an increase in noise impacts to the community at noise sensitive premises in the town of Dampier.

## 1.3 Objectives and Scope of this Assessment

### 1.3.1 Assessment Objectives

The objectives of this assessment are:

- to quantify the predicted noise impacts associated with the desalination plant at nearby noise sensitive premises and to determine the extent of the area affected by noise emissions from the plant;
- to assess predicted noise levels against the Assigned Levels specified by the *Environmental Protection (Noise) Regulations 1997*;
- to determine the likely change in received noise levels compared to current noise emissions associated with iron ore operations at the port; and
- where appropriate, to identify noise control measures to achieve compliance with the Project noise objectives.

Measurement of current ambient noise levels is excluded from this scope, however ambient noise is considered in relation to routine noise monitoring undertaken by Rio Tinto as a requirement of ministerial statement MS770. (See section 1.1).

### 1.3.2 Scope of Assessment

This assessment is based on the maximum 8 GL/a capacity design option which represents a worst-case for noise emissions. Noise impacts in the town of Dampier from normal plant operations and construction activities are considered.

The assessment considers airborne noise impacts only. Assessment of underwater noise impacts on marine fauna is excluded.

## 1.4 Applicable Documents

- Environmental Protection Act 1986;
- Environmental Protection (Noise) Regulations 1997 ;
- Draft Guideline on Environmental Noise for Prescribed Premises, May 2016, DWER2015/001319, Department of Water and Environment Regulation;
- Ministerial statement MS770;
- Rio Tinto Dampier Annual Noise Monitoring Report.

# 2 ASSESSMENT METHODOLOGY

A noise model has been developed which includes Project related equipment only. This model has been used to determine the Project's contribution to received noise levels at noise sensitive receptors. The model excludes noise sources associated with existing port operations.

An initial model representing normal plant operations was used to identify the contributing noise sources at key receivers and to determine the noise reductions required to achieve the Project's noise objectives at these receivers.

A subsequent modelling scenario was developed incorporating noise controls to the major noise emitting sources to demonstrate how the Project's noise objectives may be achieved.

The noise model was also used to investigate high-risk construction scenarios in order to determine what, if any, noise management measures may be required to mitigate construction noise impacts.

All noise level predictions represent worst-case, night-time conditions for sound propagation as defined in the *Draft Guideline on Environmental Noise for Prescribed Premises*[2].

[2] Draft Guideline on Environmental Noise for Prescribed Premises, May 2016, DWER2015/001319, Department of Water and Environment Regulation

# 3 SUMMARY OF RELEVANT LEGISLATION

Noise management in Western Australia is implemented through the *Environmental Protection (Noise) Regulations 1997* (the Regulations) which operate under the *Environmental Protection Act 1986*. The Regulations specify the prescribed standard for noise emissions in terms of Assigned Levels which are the highest noise levels that can be received at noise-sensitive premises, commercial and industrial premises. Table 3-1 presents the Assigned Levels. Noise emitted from a premises must not cause, or significantly contribute[3] to, a level of noise which exceeds the Assigned Levels.

Assigned Levels have been set differently for noise sensitive premises, commercial premises, and industrial premises. For noise sensitive premises, e.g. residences, an "influencing factor" is incorporated into the assigned noise levels. The influencing factor depends on land use zonings within circles of 100 m and 450 m radius from the noise receiver, including:

- the proportion of industrial land use zonings;
- the proportion of commercial zonings; and
- the presence of major or secondary roads.

For noise sensitive residences, the time of day also affects the assigned levels.

The regulations define three types of Assigned Level:

- $L_{Amax}$ Assigned Level means a noise level which is not to be exceeded at any time;
- $L_{A1}$ Assigned Level which is not to be exceeded for more than 1% of the time; and
- $L_{A10}$ Assigned Level which is not to be exceeded for more than 10% of the time.

The $L_{A10}$ Assigned Level is the most significant for this study since this is representative of continuous noise emissions from the proposed desalination plant.

[3] A noise emission is taken to significantly contribute to a level of noise if the noise emission exceeds a value which is 5 dB below the Assigned Level.

**Table 3-1 : Assigned Levels**

| Type of premises receiving noise | Time of Day | Assigned Level (dB) | | |
|---|---|---|---|---|
| | | $L_{A10}$ | $L_{A1}$ | $L_{Amax}$ |
| Noise sensitive premises: highly sensitive area | 0700 to 1900 hours Monday to Saturday | 45 + Influencing factor | 55 + Influencing factor | 65 + Influencing factor |
| | 0900 to 1900 hours Sunday and public holidays | 40 + Influencing factor | 50 + Influencing factor | 65 + Influencing factor |
| | 1900 to 2200 hours all days | 40 + Influencing factor | 50 + Influencing factor | 55 + Influencing factor |
| | 2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays | 35 + Influencing factor | 45 + Influencing factor | 55 + Influencing factor |
| Noise sensitive premises: any area other than highly sensitive area | All hours | 60 | 75 | 80 |
| Commercial premises | All hours | 60 | 75 | 80 |
| Industrial premises | All hours | 65 | 80 | 90 |

## 3.1 Assigned Levels for Selected Receptors

The three selected locations (R1, R12 and PS1) for noise level predictions are representative of highly sensitive areas within noise sensitive premises.

Receptors R1 (Patterson Crescent) and PS1 (Hill Road) have influencing factors of 3 dB because of their proximity to industrially zoned land. No influencing factor applies for receptor R12 (Hampton Drive).

Table 3-2 presents the $L_{A10}$ Assigned Levels, at the selected receptors.

**Table 3-2 : $L_{A10}$ Assigned Levels at Selected Receptors**

| Time of Day | Assigned Level – $L_{A10}$ dB(A) | | |
|---|---|---|---|
| | R1 (Patterson Crescent) | R12 (Hampton Drive) | PS1 (Hill Road) |
| 0700 to 1900 hours Monday to Saturday | 48 | 45 | 48 |
| 0900 to 1900 hours Sunday and public holidays | 43 | 40 | 43 |
| 1900 to 2200 hours all days | 43 | 40 | 43 |
| 2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays | 38 | 35 | 38 |

## 3.2 Adjustments for Intrusive Characteristics

Received noise levels associated from proposed desalination plant must be adjusted if the noise exhibits intrusive or dominant characteristics which cannot be reasonably or practicably removed, i.e. if the noise is impulsive (e.g. banging), tonal (e.g. whining noise having a defined pitch) or modulating (e.g. noise which varies cyclically in either pitch or amplitude). Table 3-3 presents the adjustments required when intrusive or dominant characteristics cannot be reasonably and practicably removed. The adjusted noise levels must now comply with the Assigned Levels. Regulation 9 sets out objective tests to assess whether the noise is taken to be free of these characteristics.

**Table 3-3 : Adjustments for Intrusive or Dominant Noise Characteristics**

| Adjustment where noise emission is not music<br>these adjustments are cumulative to a maximum of 15 dB | | |
|---|---|---|
| Where tonality is present | Where modulation is present | Where impulsiveness is present |
| +5 dB | +5 dB | +10 dB |

## 3.3 Construction Noise

Regulation 13 of The *Environmental Protection (Noise) Regulations 1997* addresses noise from constructions sites and states that for construction work carried out between 7am and 7pm on

any day, which is not a Sunday or public holiday the assigned noise levels do not apply provided that:

- The construction work is carried out in accordance with control of noise practices set out in Section 6 of Australian Standard 2436-1981 "Guide to Noise Control on Construction, Maintenance and Demolition Sites"; and
- The equipment used for the construction is the quietest reasonably available.

The Chief Executive Officer (CEO) may request that a noise management plan be submitted for the construction work at any time.

For construction work done outside daytime hours or on Sundays and public holidays, if noise emissions are likely to exceed the Assigned Levels then:

- The contractor must advise all nearby occupants or other sensitive receptors who are likely to receive noise levels which fail to comply with the standard under Regulation 7, of the work to be done at least 24 hours before it commences;
- The contractor must show that it was reasonably necessary for the work to be done out of hours; and
- The contractor must submit to the CEO a Noise Management Plan at least seven days before the work starts, and the plan must be approved by the CEO. The plan must include details of:
    - Need for the work to be done out of hours;
    - Types of activities which could be noisy;
    - Predictions of the noise levels;
    - Control measures for noise and vibration;
    - Procedures to be adopted for monitoring noise emissions; and
    - Complaint response procedures to be adopted.

# 4 NOISE MODELLING METHODOLOGY

## 4.1 Noise Model Program

A computer noise model has been developed for the proposed desalination plant and related construction activities using SoundPlan noise modelling software which has been previously accepted by WA Department of Water and Environmental Regulation (DWER) as appropriate for environmental noise prediction.

The inputs required in SoundPlan are noise source data, barriers/screens, ground topographical and absorption type data, assessed meteorological conditions and receiver point locations.

The model has been used to generate predicted noise contours for the town of Dampier and to predict noise levels at the selected noise sensitive receptors.

The model does not include noise emissions from any sources other than those associated with desalination project. Noise emissions from existing port operations, other neighbouring industrial sources, road traffic, aircraft, animals, domestic sources, etc. are excluded from the modelling.

## 4.2 Noise Model Algorithm

SoundPlan provides a range of published noise propagation prediction algorithms that can be selected by the user. The CONCAWE[4,5] prediction algorithms were selected for consistency with previous modelling undertaken for Rio Tinto's port operations.

The CONCAWE algorithms are also recommended by the WA Department of Water and Environment Regulation (DWER) Draft Guideline[6].

## 4.3 Selection of Meteorological Conditions

SoundPlan calculates predicted noise levels for defined meteorological conditions. In particular, the following variables are included in the prediction algorithms and will affect the predicted

[4] CONCAWE (Conservation of Clean Air and Water in Europe) was established in 1963 by a group of oil companies to carry out research on environmental issues relevant to the oil industry.

[5] *The propagation of noise from petroleum and petrochemical complexes to neighbouring communities,* CONCAWE Report 4/81, 1981

[6] *Draft Guideline on Environmental Noise for Prescribed Premises*, May 2016, DWER2015/001319, Department of Water and Environment Regulation

noise level: temperature; Pasquill stability (temperature inversion); relative humidity; wind speed; and wind direction.

The "default meteorological conditions" as suggested by the WA DWER Draft Guideline have been used to determine the worst-case overall predicted noise levels at each selected noise sensitive receiving location (see Table 4-1).

**Table 4-1 : Noise Model Meteorological Inputs for Worst-Case Conditions**

| Period | Temperature | Pasquill Stability | Wind speed | Wind Direction | Relative Humidity |
|---|---|---|---|---|---|
| **Day** | 20 C | Pasquill Stability E | 4 m/s | Worst-case (source to receiver) | 50% |
| **Night** | 15 C | Pasquill Stability F | 3 m/s | Worst-case (source to receiver) | 50% |

## 4.4 Ground Topography, Buildings and Barriers

Topographical information for the acoustic model (in the form of 1 m topographical contours) have been provided by Rio Tinto in dxf file format. The ground contours were directly imported into the acoustic model. A figure showing the topography is provided in APPENDIX A.

Where relevant, the acoustic barrier effects and reflections due to existing structures (e.g. large tanks and buildings) have been included in the model because of their potential influence on the modelled noise levels. The buildings and tanks associated with the desalination plant have also been incorporated in the model for operation scenarios, but are excluded from modelling scenarios representing construction activities. A figure showing the relevant structures is provided in APPENDIX A.

A moderately absorptive ground (ground factor 0.6) is assumed in the acoustic model for sound propagation over land. A highly reflective ground (ground factor 0) is assumed for sound propagation over water.

## 4.5 Noise Sources

Details of the noise sources and assumptions are provided in the following sections of this report. APPENDIX B summarises the sound power levels assumed for the noise sources in the model.

Potential noise sources have been identified from plot plans, the preliminary engineering mechanical equipment list[7], and in meetings and correspondence with the project's design engineers. Table B-10 in APPENDIX B lists the coordinates of the noise sources[8].

Since the design of the project is yet to be finalised, sound power levels for new equipment associated with the proposed desalination plant are based on Wood's experience with similar equipment. It is also assumed that equipment will be selected as far as practicable to meet occupational noise requirements with sound pressure levels typically no greater than 85 dB(A) at 1m. Table 4-2 provides a list of the assumptions used as a guide to estimate equipment sound power levels based on the rated power (kW) of the equipment.

**Table 4-2 : Sound Power Level Assumptions**

| Rated Power of Equipment | Assumed Sound Pressure Level at 1m (dBA) | Assumed Radiating Surface Area ($m^2$) | Corresponding Area at 1m from Source ($m^2$) | Sound Power Level (dBA) |
|---|---|---|---|---|
| > 500 kW | 85 | 9 | 31 | 100 |
| 100 – 500 kW | 82 | 3 | 20 | 95 |
| 50 – 100 kW | 80 | 2 | 16 | 92 |
| 10 – 50 kW | 80 | < 1 | 8 | 89 |
| 1 – 10 kW | 78 | <1 | 6.3 | 86 |
| < 1kW | 75 | <1 | 6.3 | 83 |

### 4.5.1 Seawater Intake

The most significant noise sources at the seawater intake lagoon are the seawater intake pumps. There are 4 pumps of which only 2 operate at any given time. The operational pumps are represented by two point noise sources in the noise model.

### 4.5.2 Desalination Plant Main Building

Significant noise sources within the main building include:

- High pressure (HP) pumps;

[7]Document Number CWSS-LST-M-0XX

[8] Coordinates indicating the centre point of buildings are provided for sources located within buildings.

- Air compressor and blowers; and
- CIP and dosing pumps.

These sources are contained in separate rooms with each room modelled as a point source within the main building. The effective sound power level of each room has been estimated accounting for the following factors:

- The assumed sound power level of each individual operational item, which has been estimated based on the installed power;
- The number of operational items[9];
- The acoustic properties of the room in which the equipment is operated[10];
- The sound transmission loss of the room walls and ceilings[11].

An additional source representing ambient noise from piping and filters in the main building has also been included. The sound power level of the source was set assuming that the corresponding reverberant sound pressure level[12] in the building would be less than 75 dB(A). A flat spectral distribution was assumed with equal energy in each frequency band.

The main building itself is modelled as an industrial building containing the sources described above and constructed from corrugated steel with an acoustic lining to the underside of the roof.

### 4.5.3 Other Buildings and Enclosed Noise Sources at the Plant Site

The following buildings and enclosures housing noise generating equipment have been identified from the design documentation:

- Centrifuges enclosure;
- Remineralisation building;

[9] Only operating items are included in the noise model. For example, where the mechanical equipment list identifies groups of pumps which operate on a duty/standby rationale, only those on duty are included.

[10] An acoustically lined ceiling has been assumed as this will be required to minimise occupational noise exposure.

[11] Internal walls and ceilings are assumed to be plasterboard stud partitions or equivalent.

[12] The reverberant sound pressure level is affected by the volume of the building and the acoustic absorption characteristics of the internal building facades.

- Fluoridation building; and
- Dissolved air filtration (DAF) building.

Each of these are modelled as industrial buildings containing noise sources representing the operational equipment. The buildings are assumed to be constructed from corrugated steel with an acoustic lining to the underside of the roof.

### 4.5.4 Externally Located Pumps at the Plant Site

The following pumps are located externally at the plant site and a represented by point sources in the noise model with sound power levels estimated based on installed power:

- Ultrafiltration (UF) backwash pumps;
- Low pressure (LP) pumps;
- Clarifier underflow pumps;
- Clarifier feed pumps;
- Backwash recirculation pumps;
- UF feed pumps;
- Reject discharge pumps;
- Brackish water reverse osmosis (BWRO) feed pumps;
- Clean in place (CIP) waste water pump; and
- Potable water pumps.

### 4.5.5 Transformer Yard

The noise model includes five point sources representing the operating transformers at the plant site. The sound power levels have been estimated based on Wood's experience of similar equipment and include noise emissions from the body of the transformers as well as cooling fans.

### 4.5.6 Pump Station

The pump station close to Hill Road in Dampier comprises a brick building housing two booster pumps in a duty/standby arrangement. This has been modelled as an industrial building containing a point noise source representing the operating pump. The building is assumed to be constructed from brick with a corrugated steel roof. Acoustic lining is assumed to be installed

to the underside of the roof. It is assumed that noise levels outside the building will be no greater than 50 dB(A) at 1m from the building facades.

## 4.6 Noise Modelling Scenarios

Two operating scenarios have been modelled:

- A base-line scenario assuming no noise controls other than those required to minimise occupational noise exposure; and
- An ALARP[13] scenario in which noise controls are assumed for the key noise emitters identified from the results of the base-line scenario.

The noise controls assumed for the ALARP scenario are described in section 5.2 and have been selected to meet the projects noise control objectives.

The model has also been used to investigate noise emissions from construction activities. The construction modelling scenarios and results are presented in section 6.

[13] As Low As Reasonably Practicable

# 5 NOISE MODELLING RESULTS

Noise level predictions at specific receptors are presented in the following sections for baseline and ALARP plant operating scenarios. The predictions assume worst-case meteorological conditions for sound propagation. Noise contours for each scenario are presented in APPENDIX C.

## 5.1 Baseline Plant Operating Scenario

Table 5-1 presents the predicted noise levels for the baseline plant operating scenario which assumes no noise controls other than those required to minimise occupational noise exposure. Noise contours are presented in APPENDIX C.

**Table 5-1 : Noise Level Predictions for Baseline Operating Scenario**

| Receptor | Receptor Location | Predicted Noise Level dB(A) |
|---|---|---|
| R1 | Patterson Crescent | 32.8 |
| R12 | Hampton Drive | 21.3 |
| PS1 | Hill Road | 24.5 |

The most affected receptor is location R1 and the dominant noise emitters are the seawater intake pumps and some of the larger, externally located pumps at the plant site.

## 5.2 ALARP Plant Operating Scenario

The following noise controls are required in order to minimise noise impacts at location R1:

- Fully enclosing the seawater intake pumps in a building or within close-fitting acoustic enclosures capable of reducing noise levels to 50 dB(A) at 1m from the building / enclosure façades.
- Relocation of the following externally located pumps to take advantage of shielding provided by tanks and buildings within the plant site[14]:

[14] This noise controls relies on eliminating the line of sight between the noise source and noise sensitive receptors within the town of Dampier. The design of the desalination plant is still at an early stage and, therefore, the specific pumps identified my change as the design progresses. However, the principle of eliminating line of sight must be maintained in order to achieve ALARP noise impacts.

- LP pumps;
- UF backwash pumps; and
- Reject discharge pumps.

Table 5-1 presents the predicted noise levels for the ALARP plant operating scenario described above. Noise contours are presented in APPENDIX C.

**Table 5-2 : Noise Level Predictions for ALARP Operating Scenario**

| Receptor | Receptor Location | Predicted Noise Level dB(A) |
|---|---|---|
| R1 | Patterson Crescent | 20.6 |
| R12 | Hampton Drive | 14.5 |
| PS1 | Hill Road | 22.1 |

## 5.3 Discussion of Modelling Results

Worst-case predicted noise levels at all selected receptors are below the most-stringent, night-time Assigned Levels for the baseline operating scenario. However, the predicted level at R1 is within 5 dB of the Assigned Level and could, therefore, be considered to contribute to an exceedance when accounting for existing ambient levels from Rio Tinto's port operations (see section 1.1).

Predicted noise levels are considerably lower than existing ambient noise levels in the town of Dampier and consequently any intrusive noise characteristics such as tonality, impulsiveness or modulation are unlikely to be evident at any noise sensitive residential location.

Without noise mitigation, the contribution of the desalination plant would result in an increase in received levels of less than 0.2 dB(A) at location R1.

Predicted noise levels at R1 for the ALARP operating scenario are 17 dB below the Assigned Level and 27 dB below the worst-case ambient levels from existing port operations. The resultant increase in noise associated with the desalination plant would be less than 0.01 dB for this scenario.

# 6 REVIEW OF IMPACTS FROM CONSTRUCTION NOISE

Noise is likely to be generated during construction activities associated with ground preparation, excavation of trenches and installation of piles. It is anticipated that construction activities will be restricted to daytime hours.

Three construction scenarios have been modelled which are considered to represent worst-case noise impacts:

- Construction at the intake lagoon including installation of piles;
- Ground improvement and installation of stone columns, and digging of trenches for services at the plant site;
- Ground preparation at the location of the pump station.

The noise sources assumed for each of these scenarios are described below. Sound power levels are provided in APPENDIX B.

## 6.1 Description of Construction Noise Scenarios

### 6.1.1 Construction at Intake Lagoon

The following equipment is assumed to be operating simultaneously to represent a worst-case for noise impacts from construction activities at the intake lagoon:

- 1 x rotary drilling rig (piling);
- 1 x excavator;
- 1 x front end loader; and
- 1 x truck.

Sound power levels assumed for the drilling rig were estimated based on sound pressure level data provided by Rio Tinto's design engineers for a Bauer BG 28 H rotary drilling rig. Sound power levels assumed for mobile equipment are based on measurements recorded by Wood for similar equipment.

### 6.1.2 Construction at Plant Site

The following equipment is assumed to be operating simultaneously to represent a worst-case for noise impacts from construction activities at the plant site.

- 1 x vibro rig for construction of stone columns;
- 1 x compactor;
- 1 x excavator;
- 1 x dozer;
- 1 x front end loader; and
- 1 x truck.

Sound power levels assumed for the vibro rig were assumed to be similar to those for the rotary drilling rig employed for installation piles at the intake lagoon (described in the previous section). This assumption was based on a sound pressure level estimate of 60 dB(A) at 50m provided by Rio Tinto's design engineers for a Keller vibro rig. Sound power levels assumed for mobile equipment are based on measurements recorded by Wood for similar equipment.

### 6.1.3 Construction at Pump Station

A single excavator has been assumed to be operating during ground preparation for the pump station. Sound power levels assumed for the excavator are based on measurements recorded by Wood for similar equipment.

## 6.2 Construction Noise Modelling Results

Table 6-1 presents the predicted noise levels for the construction scenarios described above. The 45 dB(A) noise contours[15] for these scenarios are presented in APPENDIX C.

**Table 6-1 : Noise Level Predictions for Construction Scenarios**

| Location of Construction Activities | Predicted Noise Level dB(A) | | |
|---|---|---|---|
| | R1 Patterson Crescent | R12 Hampton Drive | PS1 Hill Road |
| Intake lagoon | 36.7 | 28.4 | 25.0 |
| Plant site | 39.2 | 29.7 | 29.8 |
| Pump station | 29.5 | 22.6 | 52.0 |

[15] The 45 dB(A) contour has been selected because it represents the most stringent day-time Assigned Level within Dampier.

## 6.3 Discussion of Construction Noise Modelling Results

Predicted noise levels for construction activities at the intake lagoon and the plant site are below the daytime Assigned Levels. Therefore, no remediation or management measures are required provided that construction is restricted to 0900 and 1900 on Sundays and public holidays and 0700 and 1900 hours on any other day.

Noise from ground preparation activities at the pump station is likely to exceed the assigned levels at the nearest residential buildings, so the provisions in Regulation 13 will apply, specifically:

- The work should be carried out in accordance with section 6 of AS2436 "Guide to Noise Control on Construction Maintenance and Demolition Sites
- The equipment used should be the quietest reasonably available.
- It is unlikely (although possible) that a noise management plan will be required since this activity is expected to be short-lived and will only have a localised impact over a small area (refer APPENDIX C).

# 7 CONCLUSIONS

Predicted noise emissions from Rio Tinto's proposed desalination plant are below the Assigned Levels at the nearest noise sensitive residential locations in the town of Dampier.

Predicted noise levels are also considerably lower than existing ambient noise levels and consequently any intrusive noise characteristics such as tonality, impulsiveness or modulation are unlikely to be evident at any noise sensitive residential location.

Without noise mitigation, noise emissions from the desalination plant are likely to contribute to noise exceeding the Assigned Levels at the nearest noise sensitive residences on Patterson Crescent which are currently exposed to noise from Rio Tinto's Parker Point port operation. The contribution of the desalination plant and associated infrastructure would result in an increase in received levels of less than 0.2 dB(A).

Implementation of the following noise controls will reduce the noise impact of the desalination plant to a level which would result in an increase in noise levels of less than 0.01 dB:

- Enclosure of seawater intake pumps in a building or close-fitting acoustic enclosures capable of reducing noise levels to 50 dB(A) at 1m from the building / enclosure façades.
- Relocation of the some externally located pumps to take advantage of shielding provided by tanks and buildings within the plant site[16]:
    - LP pumps;
    - UF backwash pumps; and
    - Reject discharge pumps.

With the exception of ground preparation activities at the pump station near Hill Road, predicted noise levels from construction activities are below the daytime Assigned Levels and no remediation or management measures are required provided that construction is restricted to 0900 and 1900 on Sundays and public holidays and 0700 and 1900 hours on any other day.

Noise from ground preparation activities at the pump station is likely to exceed the Assigned Levels at the nearest residential buildings, so the provisions in Regulation 13 will apply, specifically:

[16] This noise controls relies on eliminating the line of sight between the noise source and noise sensitive receptors within the town of Dampier. The design of the desalination plant is still at an early stage and, therefore, the specific pumps identified my change as the design progresses. However, the principle of eliminating line of sight must be maintained in order to achieve ALARP noise impacts.

- The work should be carried out in accordance with section 6 of AS2436 "Guide to Noise Control on Construction Maintenance and Demolition Sites; and
- The equipment used should be the quietest reasonably available.
- It is unlikely that a noise management plan will be required since this activity is expected to be short-lived and will only have a localised impact over a small area.

# APPENDIX A GROUND TOPOGRAPHY, BUILDINGS AND SCREENING STRUCTURES

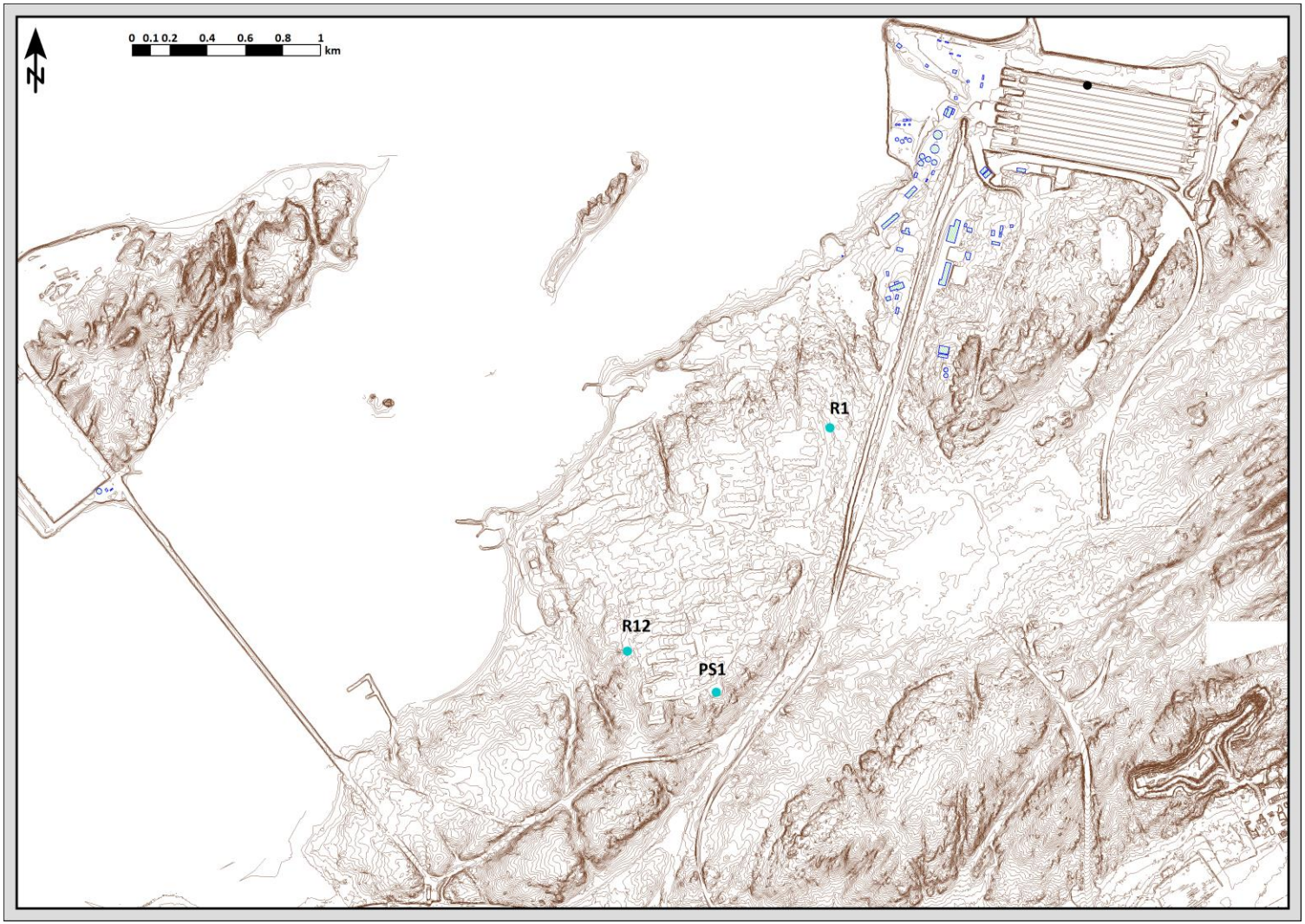


**Figure A1 : Ground Topography**


**Figure A2 : Buildings and Screening Structures**

# APPENDIX B EQUIPMENT SOUND POWER LEVELS AND COORDINATES

**Table B-1 : Desalination Plant Main Building Equipment Sound Power Levels**

| Equipment | No. in Duty | Installed Power kW | Octave Band Sound Power Levels – dB(lin) | | | | | | | | Overall dB(A) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 63Hz | 125Hz | 250Hz | 500Hz | 1kHz | 2kHz | 4kHz | 8kHz | |
| HP pumps | 4 | 800 | 96 | 101 | 99 | 97 | 95 | 91 | 87 | 85 | 100 |
| ERD booster pumps | 4 | 90 | 91 | 96 | 94 | 92 | 90 | 86 | 82 | 80 | 95 |
| CIP pumps | 3 | 11 | 85 | 90 | 88 | 86 | 84 | 80 | 76 | 74 | 89 |
| Dosing pumps | 7 | < 1 | 79 | 84 | 82 | 80 | 78 | 74 | 70 | 68 | 83 |
| UF Air Blowers | 3 | 22 | 93 | 95 | 93 | 91 | 93 | 85 | 77 | 69 | 95 |
| Air compressor | 1 | 11 | 84 | 84 | 83 | 86 | 89 | 89 | 87 | 84 | 95 |
| Ambient noise | 1 | n/a | 93 | 93 | 93 | 93 | 93 | 93 | 93 | 93 | 100 |

**Table B-2 : Desalination Plant Centrifuge Enclosure Equipment Sound Power Levels**

| Equipment | No. in Duty | Installed Power kW | Octave Band Sound Power Levels – dB(lin) | | | | | | | | Overall dB(A) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 63Hz | 125Hz | 250Hz | 500Hz | 1kHz | 2kHz | 4kHz | 8kHz | |
| Centrifuge | 4 | 7.5 | 91 | 90 | 89 | 91 | 85 | 85 | 85 | 93 | 95 |
| Dosing / metering / mixing pumps | 7 | <= 3 | 79 | 84 | 82 | 80 | 78 | 74 | 70 | 68 | 83 |

## Table B-3 : Desalination Plant Remineralisation Room Equipment Sound Power Levels

| Equipment | No. in Duty | Installed Power kW | Octave Band Sound Power Levels – dB(lin) | | | | | | | | Overall dB(A) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 63Hz | 125Hz | 250Hz | 500Hz | 1kHz | 2kHz | 4kHz | 8kHz | |
| Centrifuge | 3 | 10 - 50 | 85 | 90 | 88 | 86 | 84 | 80 | 76 | 74 | 89 |
| Dosing / metering / mixing pumps | 5 | 1 - 11 | 82 | 87 | 85 | 83 | 81 | 77 | 73 | 71 | 86 |

## Table B-4 : Desalination DAF Building Equipment Sound Power Levels

| Equipment | No. in Duty | Installed Power kW | Octave Band Sound Power Levels – dB(lin) | | | | | | | | Overall dB(A) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 63Hz | 125Hz | 250Hz | 500Hz | 1kHz | 2kHz | 4kHz | 8kHz | |
| Air Compressors | 2 | 3 | 84 | 84 | 83 | 86 | 89 | 89 | 87 | 84 | 95 |
| DAF Effluent pumps | 2 | 90 | 88 | 93 | 91 | 89 | 87 | 83 | 79 | 77 | 92 |
| Dosing, recycle, sludge pumps and tank agitators | 13 | <=10 | 82 | 87 | 85 | 83 | 81 | 77 | 73 | 71 | 86 |

## Table B-5 : Desalination Plant Fluoridation Building Equipment Sound Power Levels

| Equipment | No. in Duty | Installed Power kW | Octave Band Sound Power Levels – dB(lin) | | | | | | | | Overall dB(A) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 63Hz | 125Hz | 250Hz | 500Hz | 1kHz | 2kHz | 4kHz | 8kHz | |
| Dosing pumps | 4 | <=10 | 79 | 84 | 82 | 80 | 78 | 74 | 70 | 68 | 83 |

## Table B-6 : Desalination Plant Externally Located Equipment Sound Power Levels

| Equipment | No. in Duty | Installed Power kW | Octave Band Sound Power Levels – dB(lin) | | | | | | | | Overall dB(A) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 63Hz | 125Hz | 250Hz | 500Hz | 1kHz | 2kHz | 4kHz | 8kHz | |
| UF Backwash pumps | 2 | 45 | 85 | 90 | 88 | 86 | 84 | 80 | 76 | 74 | 89 |
| LP pumps | 4 | 220 | 91 | 96 | 94 | 92 | 90 | 86 | 82 | 80 | 95 |
| Clarifier underflow pumps | 1 | 7.5 | 82 | 87 | 85 | 83 | 81 | 77 | 73 | 71 | 86 |
| Clarifier feed pumps | 1 | 11 | 85 | 90 | 88 | 86 | 84 | 80 | 76 | 74 | 89 |
| Backwash recirculation pumps | 1 | 11 | 85 | 90 | 88 | 86 | 84 | 80 | 76 | 74 | 89 |
| UF feed pumps | 2 | 280 | 91 | 96 | 94 | 92 | 90 | 86 | 82 | 80 | 95 |
| Reject discharge pumps | 2 | 55 | 88 | 93 | 91 | 89 | 87 | 83 | 79 | 77 | 92 |
| BWRO feed pumps | 4 | 55 | 88 | 93 | 91 | 89 | 87 | 83 | 79 | 77 | 92 |
| CIP waste water pump | 1 | 18.5 | 85 | 90 | 88 | 86 | 84 | 80 | 76 | 74 | 89 |
| Potable water pumps | 2 | 160 | 91 | 96 | 94 | 92 | 90 | 86 | 82 | 80 | 95 |

## Table B-7 : Desalination Plant Transformer Station Equipment Sound Power Levels

| Equipment | No. in Duty | Installed Power kW | Octave Band Sound Power Levels – dB(lin) | | | | | | | | Overall dB(A) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 63Hz | 125Hz | 250Hz | 500Hz | 1kHz | 2kHz | 4kHz | 8kHz | |
| Transformers (including cooling fans) | 5 | TBA | 85 | 91 | 90 | 90 | 87 | 86 | 81 | 71 | 93 |

## Table B-8 : Pump Station Equipment Sound Power Levels

| Equipment | No. in Duty | Installed Power kW | Octave Band Sound Power Levels – dB(lin) | | | | | | | | Overall dB(A) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 63Hz | 125Hz | 250Hz | 500Hz | 1kHz | 2kHz | 4kHz | 8kHz | |
| Booster Pumps | 1 | TBA | 88 | 93 | 91 | 89 | 87 | 83 | 79 | 77 | 92 |

## Table B-9 : Construction Equipment Sound Power Levels

| Equipment | No. in Duty | Installed Power kW | Octave Band Sound Power Levels – dB(lin) | | | | | | | | Overall dB(A) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 63Hz | 125Hz | 250Hz | 500Hz | 1kHz | 2kHz | 4kHz | 8kHz | |
| Excavator | 1 | N/A | 108 | 113 | 104 | 99 | 104 | 104 | 94 | 81 | 109 |
| Loader High Idle | 1 | N/A | 102 | 112 | 107 | 106 | 105 | 102 | 96 | 87 | 110 |
| Dozer High idle | 1 | N/A | 101 | 115 | 113 | 109 | 105 | 102 | 98 | 91 | 111 |
| Truck | 1 | N/A | 105 | 110 | 101 | 102 | 99 | 95 | 99 | 82 | 105 |
| Compactor | 1 | N/A | 103 | 120 | 111 | 109 | 106 | 105 | 97 | 91 | 112 |
| Rotary Drill Rig & Vibrator for Stone Columns | 1 | N/A | 103 | 108 | 99 | 94 | 99 | 99 | 89 | 76 | 103 |

**Table B-10 : Noise Source Coordinates**

| Sources | X m | Y m |
|---|---|---|
| Backwash Recirculation Pump 1 | 471118 | 7717215 |
| BWRO Feed Pump 1 - 4 | 471093 | 7717278 |
| Centrifuge Enclosure industrial building | 471068 | 7717179 |
| Clarifier Feed Pump 1 | 471110 | 7717207 |
| Clarifier Underflow Pump 1 | 471087 | 7717190 |
| DAF industrial building | 471125 | 7717176 |
| Desalination industrial building | 471102 | 7717244 |
| Fluoridation industrial building | 471071 | 7717316 |
| LP Pump 1 | 471061 | 7717208 |
| LP Pump 2 | 471062 | 7717209 |
| LP Pump 3 | 471063 | 7717211 |
| LP Pump 4 | 471065 | 7717212 |
| Permeate Transfer Pump 1 | 471110 | 7717286 |
| Permeate Transfer Pump 2 | 471113 | 7717286 |
| Potable Water Pump 1 | 471147 | 7717275 |
| Potable Water Pump 2 | 471148 | 7717278 |
| Pump St Building industrial building | 470350 | 7714235 |
| Reject Discharge Pump 1 | 471059 | 7717274 |

| Sources | X m | Y m |
|---|---|---|
| Reject Discharge Pump 3 | 471059 | 7717281 |
| Remineralisation industrial building | 471090 | 7717307 |
| Remineralisation Product water pump | 471090 | 7717289 |
| Seawater intake pump 1 | 470769 | 7716598 |
| Seawater intake pump 3 | 470767 | 7716595 |
| Transformer 1 | 471114 | 7717313 |
| Transformer 2 | 471122 | 7717313 |
| Transformer 3 | 471129 | 7717313 |
| Transformer 4 | 471137 | 7717313 |
| Transformer 5 | 471144 | 7717313 |
| UF Backwash Pump 11 | 471059 | 7717203 |
| UF Backwash Pump 13 | 471059 | 7717199 |
| UF Backwash Pump 14 | 471059 | 7717197 |
| UF Feed Pump 11 | 471135 | 7717211 |
| UF Feed Pump 21 | 471140 | 7717211 |

# APPENDIX C NOISE CONTOURS

- Figure C1 : Baseline Desalination Plant Noise Contours
- Figure C2 : ALARP Desalination Plant Noise Contours
- Figure C3 : Construction 45 dB(A) Noise Contour - Intake Lagoon
- Figure C4 : Construction 45 dB(A) Noise Contour - Plant Site
- Figure C5 : Construction 45 dB(A) Noise Contour - Pump Station

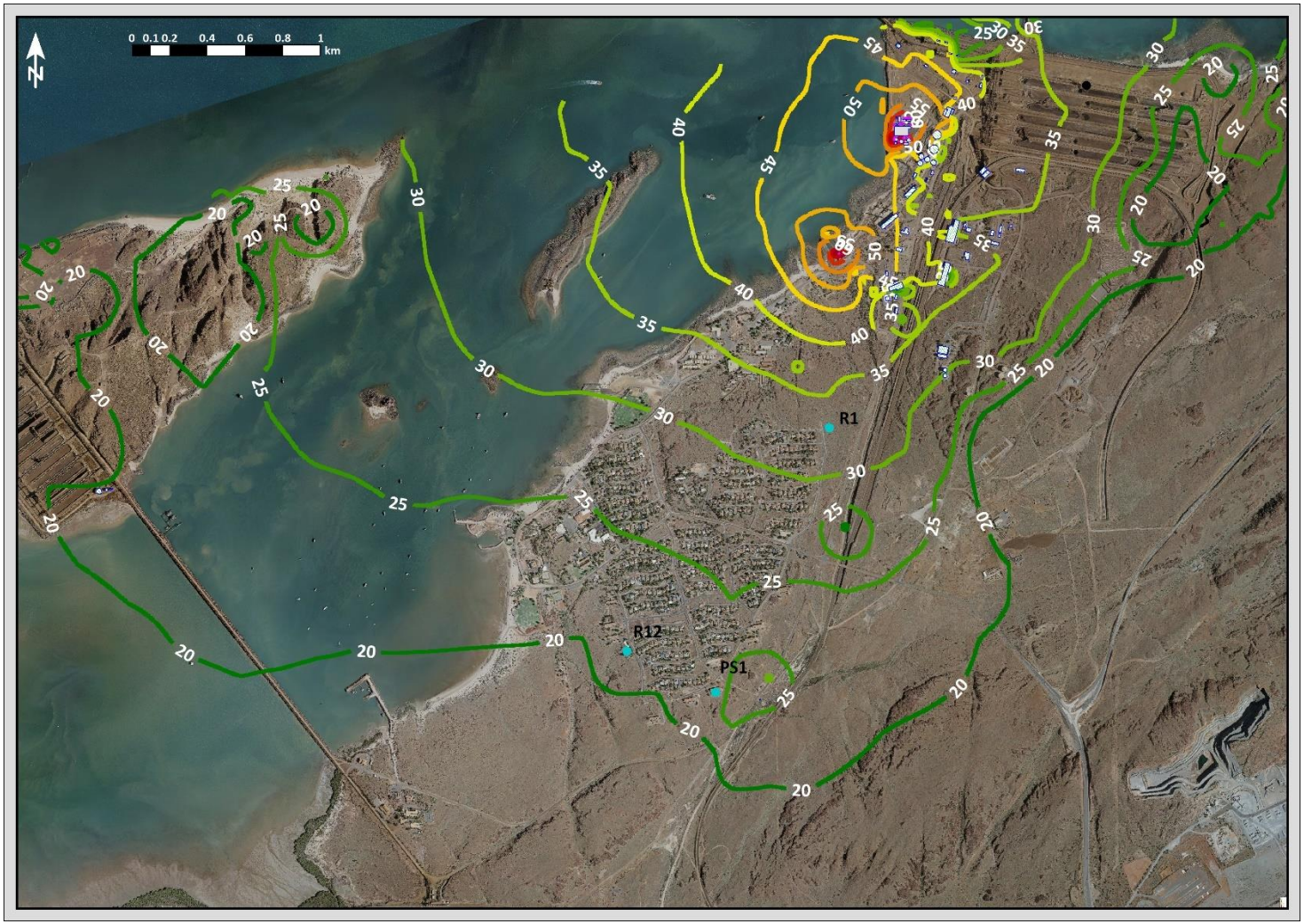


**Figure C1 : Baseline Desalination Plant Noise Contours**


**Figure C2 : ALARP Desalination Plant Noise Contours**


**Figure C3 : Construction 45 dB(A) Noise Contour - Intake Lagoon**


**Figure C4 : Construction 45 dB(A) Noise Contour - Plant Site**


**Figure C5 : Construction 45 dB(A) Noise Contour - Pump Station**