# Appendix 14: Green Island Resource Recovery Precinct Assessment of Acoustic Effects

# Green Island Resource Recovery Park Precinct

## Assessment of Acoustic Effects

Dunedin City Council (DCC)

27 February 2024

→ **The Power of Commitment**

| Project name | | Green Island Landfill Consenting to Closure and RRPP Consenting | | | | | |
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# Glossary of Terms

| Abbreviation | Definition |
|---|---|
| Ambient noise | The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far. |
| Background Noise | The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the $L_{A90}$ descriptor. |
| dB | Decibel is the logarithmic unit used for expressing the sound pressure level (SPL) or power level (SWL) in acoustics. |
| dBA | Frequency weighting filter used to measure 'A-weighted' sound pressure levels, which conforms approximately to the human ear response, as our hearing is less sensitive at very low and very high frequencies. |
| Ground-borne noise | A separate issue to airborne noise, ground-borne noise is generated by vibration transmitted through the ground into a structure. The vibration of structures causes noise to be radiated into a room. |
| Impulse vibration | A source of vibration (continuous or intermittent) which has a rapid build up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on frequency and damping). |
| Intermittent vibration | Interrupted periods of continuous (for example, a drill) or repeated periods of impulsive vibration (for example, a pile driver), or continuous vibration that varies significantly in magnitude. |
| $L_{eq}$ | The continuous sound level having the same total energy as the time varying sound being measured. |
| $L_{A90}$ | The A-weighted sound pressure level, which in any particular time period is exceeded 90 per cent of the time by the actual fluctuating sound pressure level. In the absence of the noise source under consideration, the $L_{A90}$ is commonly utilised as a measure of the background or average minimum ambient sound pressure level. |
| $L_{Amax}$ | The maximum sound level recorded during the measurement period. |
| Mitigation | Reduction in severity |
| Short-term and long-term vibration | As defined in DIN 4150: Part 3:2016 Vibrations in Buildings – Effects on Structures. |
| Sound pressure level (Lp) | The level of the RMS sound pressure level in decibels given by $Lp = 10\log_{10}(p/p_o)2$ (where p is the RMS sound pressure in Pascals. The reference sound pressure $p_o$ is 20 µPa). |
| Sound power level (Lw) for the noise source | An absolute that does not vary with distance or differing acoustic environments. It is 10 times the common logarithm of the ratio of the sound power of the source to a reference sound power (usually 1 pW). |
| Sound transmission Loss | The amount in decibels by which a random sound is reduced as it passes through a sound barrier. |
| Tonality | Noise containing a prominent frequency or frequencies characterised by definite pitch. |
| Transient vibration | Vibration in which the oscillatory displacement of the ground or structure reaches a peak and then decays rapidly towards zero. |
| Vibration | Vibration of the ground or of structures and buildings; that is, the oscillatory displacement of the ground or of structures and buildings. |

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# 1. Introduction

## 1.1 Waste futures programme

As part of Dunedin's wider commitment to reducing carbon emissions and reducing waste going to landfill, the Dunedin City Council (DCC) has embarked on the Waste Futures Programme to develop an improved comprehensive waste management and diverted material system for Ōtepoti Dunedin. The programme aligns with DCC's responsibility under the Waste Minimisation Act 2008 to *'promote effective and efficient waste management and minimisation within its district'.*

Improving Dunedin's whole waste system includes enhancing collection services for reuse and recycling, and safe disposal of residual waste to landfill.

The Waste Futures Programme includes provision of an enhanced kerbside recycling and waste collection service for Dunedin from July 2024. The new kerbside collection service will include collection of food and green (organic) waste.

To support the implementation of the new kerbside collection service, the DCC is planning to make changes to the use of Green Island landfill site (Figure 1.1) in coming years including:

– Developing an improved Resource Recovery Park Precinct (RRPP) for food and green waste and to process recycling
– Providing new waste transfer facilities to enable the safe disposal of any residual waste to landfill.

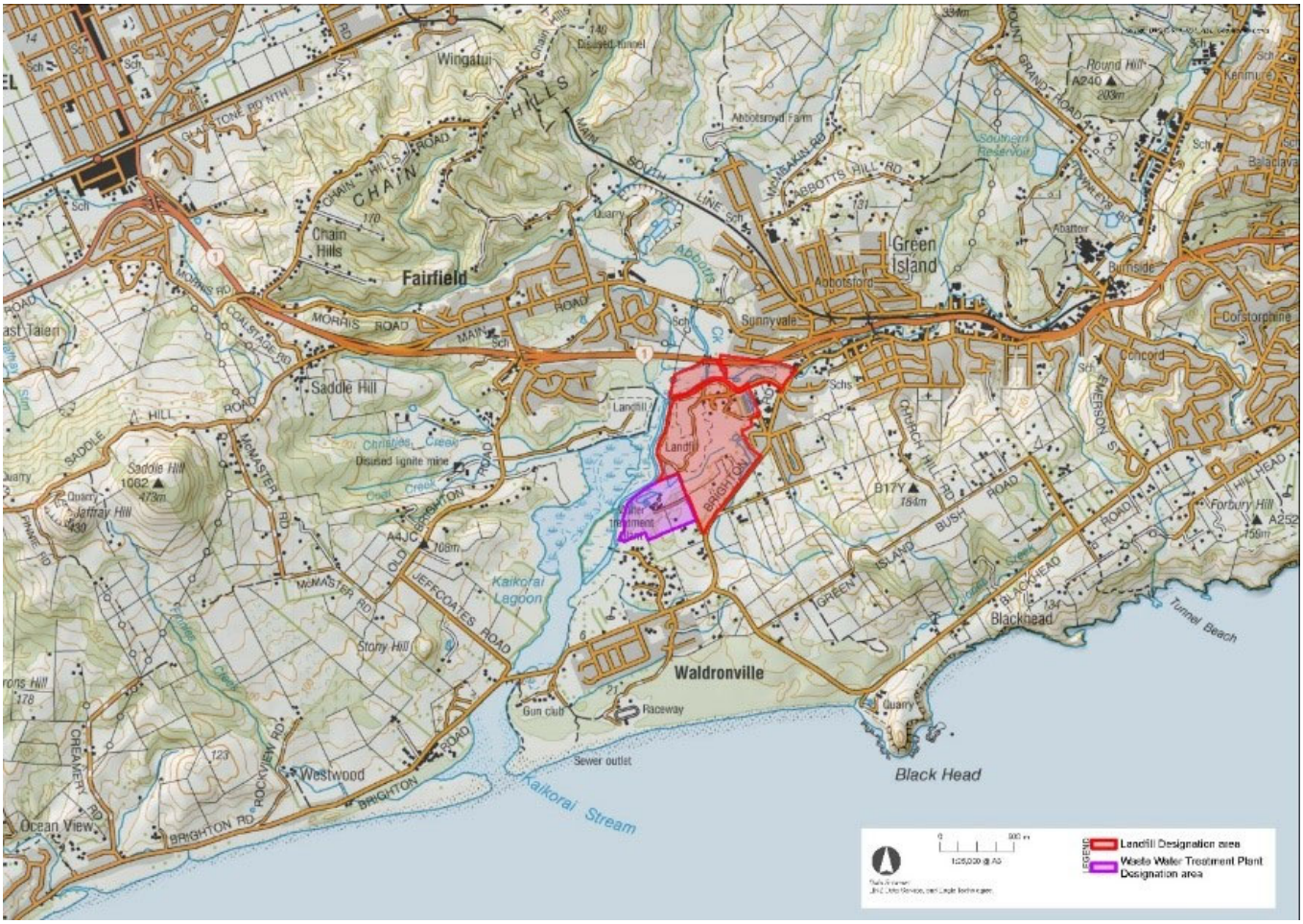


*Figure 1.1 Green Island Landfill and Resource Recovery Park Precinct Site (Designation D658).*

In addition, the DCC is planning for the ongoing operation and closure of the Green Island landfill, which is coming to the end of its operational life. The existing Otago Regional Council (ORC) resource consents, required to

operate a landfill at Green Island, expired in October 2023. In March 2023, DCC applied to ORC for replacement resource consents to continue to use the landfill until it closes completely, and waste disposal can be transferred to a new landfill facility. These consent applications are in the process of being considered by ORC.

## 1.2 Green Island Resource Recovery Park Precinct (RRPP)

To meet the requirements of the new kerbside collection service the DCC is investing in improvements and expansion to the existing resource recovery area at Green Island landfill site. Proposed new facilities are shown on Figure 1.2 and include:

– organic receivals building (ORB) and processing facilities to support the organic waste kerbside collection
– materials recovery facility (MRF) to sort and bale items collected from kerbside mixed recycling bins
– bulk waste transfer station (BWTS) to facilitate the compaction and trucking of waste to landfill

Additional facilities also include new glass bunkers, staff offices, parking, and breakrooms and associated access roads and truck parking areas. Several existing facilities are to be retained including the Rummage shop, public drop-off areas and the education centre.

The resource consents for the development and operation of the new facilities relate to ground disturbance, and discharges to land and air. The Green Island landfill site is subject to an operative designation (D658) in the Proposed Second-Generation Dunedin City District Plan (2GP) for the purpose of Landfilling and Associated Refuse Processing Operations and Activities.

The RRPP will be run by EnviroNZ on behalf of DCC and will start operating in July 2024 following construction of the ORB, which is currently underway. Resource consent to operate the ORB was granted by ORC in September 2023 under the existing landfill consents.

The other new RRPP facilities are planned to start operating from mid to late 2025.

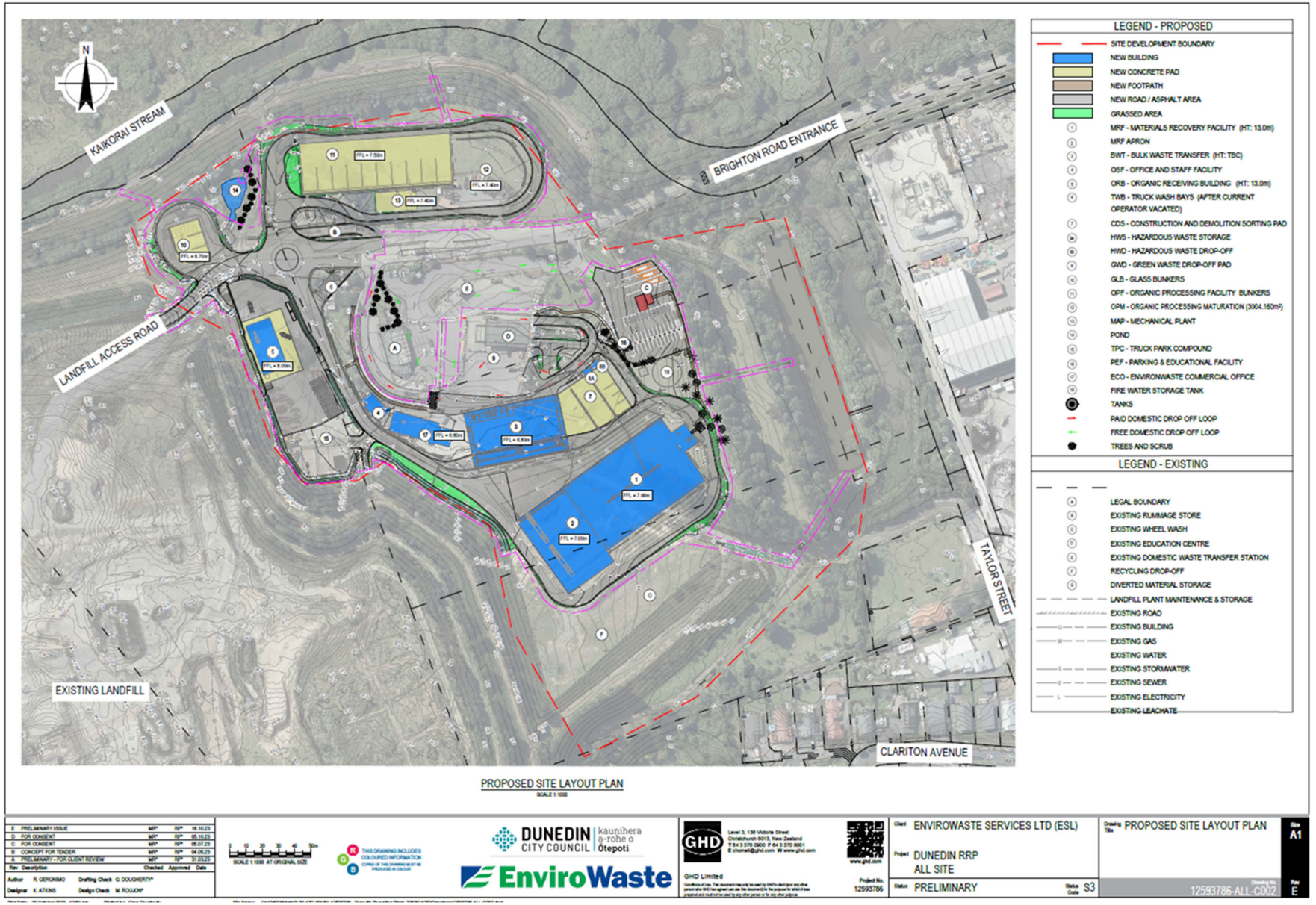


*Figure 1.2 Green Island Resource Recovery Park Development Area Proposed Layout*

Figure 1.2 shows the proposed site development and the new facilities are listed in Table 1.1. These facilities are the subjects of this report. Whilst the Organics Receiver Building (ORB) is the subject of separate applications to ORC and DCC, noise emissions resulting from this proposed facility have been included within the scope of this acoustics assessment. The facilities are described in detail in Section 3 of GHD's Green Island Full Site Design and Operations Report (2024A).

Figure 1.3 also shows the access roads that will be upgraded or developed. The roads designed for the RRPP will feature new asphalt surfaces. The design of the roads will prioritize factors such as durability, load-bearing capacity, and efficient traffic flow within the plant premises.

A number of the existing resource recovery facilities will be retained including (see Figure 1.2 and Table 1.2):

***Table 1.1 New RRPP Facilities***

| Plan Reference Number | Proposed Facility | Facility Activity |
|---|---|---|
| 1 | MRF Building and site | Plant transforming comingled recyclable waste into sorted bales |
| 2 | MRF Apron | Storage of MRF bales ready for loading and off take |
| 3 | BWTS | Drop off of general waste by public and commercial customers – and loading of off take trucks. Timing of construction of the BWTS is dependent on closure of Green Island landfill and the need to transport waste to another facility. |
| 4 | Workers Facilities | Staff amenities: change rooms, lunchrooms, toilets and showers |
| 5 | ORB | Drop off and shredding of organic waste (food waste and green waste), (subject of a separate resource consent application). |
| 6 | Truck Wash Bays | 2 wash bays with steam cleaner |
| 7 | Construction and Demolition (C&D) Sorting Pad | Drop off and sorting of construction and demolition waste. Note access for commercial vehicles to offload within BWTS (3 above) is across this pad. |
| 8A | Hazardous Drop Off (Public) | Drop off of hazardous waste by public |
| 8B | Hazardous Waste Storage | Sorting and storage of hazardous waste |
| 10 | Glass Bunkers | Storage of glass waste |
| 11 | Organic Processing Facility (OPF) Bunkers | Aerated static pile bunkers for composting of organic waste |
| 12 | OPF Maturation | Windrowing of composted material after the bunkers for curing/maturation |
| 13 | Mechanical Plant | Ventilation of the OPF bunkers |
| 15 | Transport Compound Area | Parking of truck fleet |
| 16 | Office Parking | Staff and visitor parking |
| 17 | EnviroNZ Services Limited (ESL) Office | Office |
| 18 | Possible Bunkers Extension | Future compositing bunkers if the #11 are at capacity |

*Table 1.2 Existing Facilities To Be Retained*

| Plan Reference Number | Existing Facility | Facility Activity |
|---|---|---|
| A | Rummage Store & Domestic Recycling Drop-off | Public access for drop off or purchase of pre-loved goods |
| B | Wheel Wash | For trucks leaving Green Island landfill and any other trucks requiring wheel cleaning |
| C | Education Centre | An existing small classroom facility for undertaking education activities such as school visits and other community groups |
| D & 9 | Domestic Waste Transfer Station. Re-purposed as green waste Drop-off. | The existing domestic waste transfer station will continue to operate until the construction of the BWTS. Domestic waste drop offs will then be incorporated into the new BWTS.<br><br>The current building will be re-purposed to allow domestic drop-off of green waste. Commercial green waste will be dropped off at the ORB directly. |
| E | Recycling Drop-off | The existing recycling drop-off will continue to operate, being areas where public can drop off recyclables such as plastics, cardboard, steel, whiteware etc. |
| F | Diverted Material Storage | Storage of tyres, plaster board, while ware, gas bottles, electronic waste etc. that are then collected by commercial vehicles to be taken away for recycling. |
| G | Landfill plant maintenance and associated storage. | Maintenance shed / shelter for plant maintenance as well as storage of items that are essential to the landfill management, environmental monitoring equipment, pumps, gas well materials. |

Note :- Items F and G are currently undertaken in the proposed locations of the ORB Building (5 above) and the Transport Compound Area (15 above).

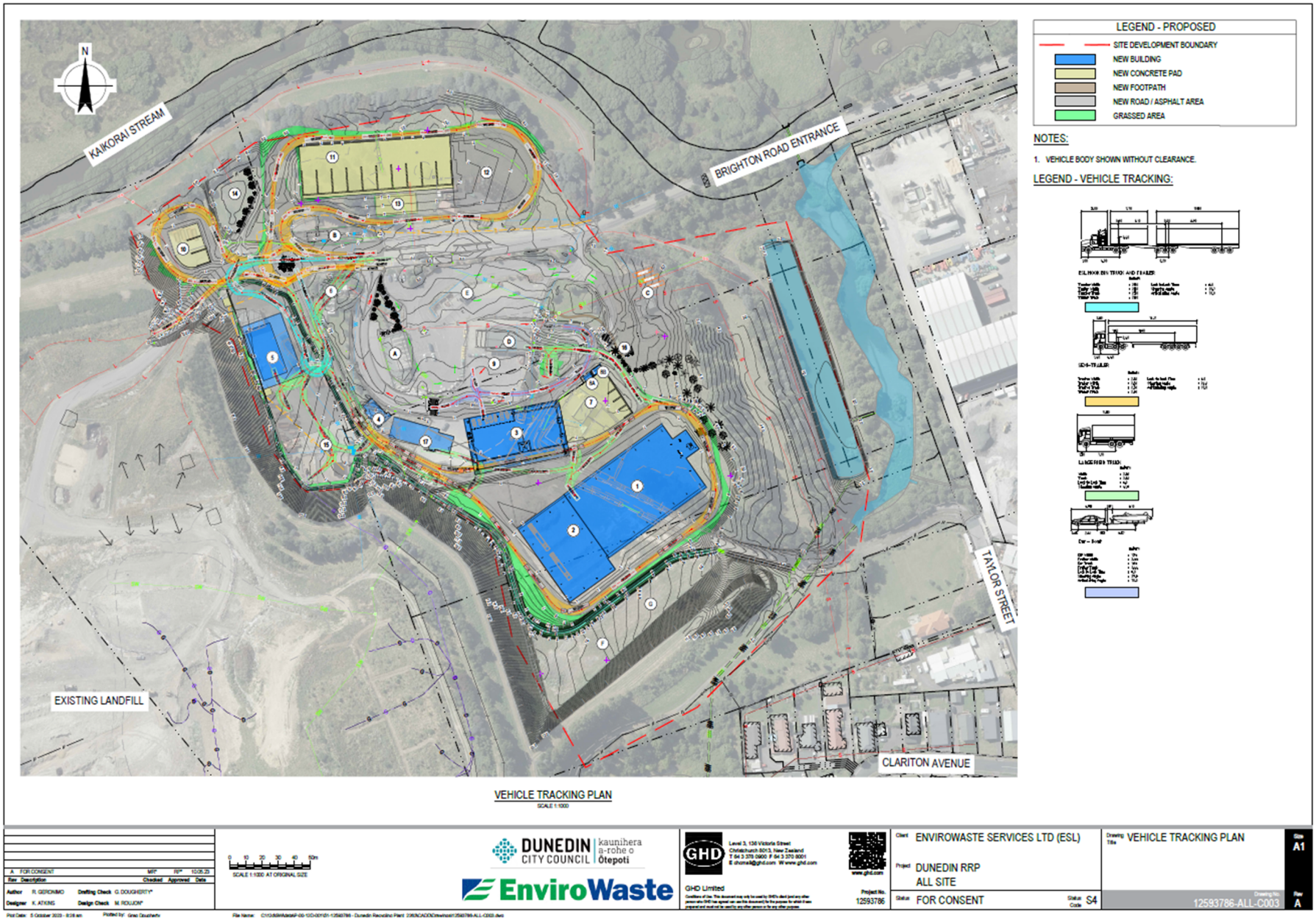


*Figure 1.3 Green Island Resource Recovery Park Precinct Development Area Proposed Tracking Plan.*

## 1.3 Purpose of this report

This report is prepared as supporting documentation to the ORC and DCC Resource Consent (RC) Applications and DCC's Outline Plan of Works (OPW) with the purpose of assessing the potential noise effects of the construction and operation of the proposed design and operations of the RRPP development at Green Island, Dunedin.

## 1.4 Scope of works and material documents

This report assesses the:

a) proposed operational activities of the RRPP development against the noise requirements of the Designation Condition;

b) off-site road traffic noise effects arising from the operation of the proposed RRPP development;

c) potential construction noise emissions against the requirements of the Designation Condition.

This assessment and the details provided in this report have been developed with reference to the following drawings and reports produced for the project:

- BS EN ISO 12354-4:2017 Building acoustics – estimation of acoustic performance of buildings from the performance of elements. Transmission of indoor sound to the outside
- ESL, 2023 – Site Environmental Management Plan
- GHD, 2024A – Waste Futures – Green Island – Resource Recovery Park Precinct – Design and Operations Report
- GHD, 2024B – Waste Futures – Green Island – Resource Recovery Park Precinct – Integrated Transportation Assessment
- MRF Building, Drawing No. BIM-Dunedin-RRP-MRF-000ARC-Building
- BWTS Building, Drawing No. BIM-Dunedin-RRP-BWTS-000ARC-Building
- ORB Building, Drawing No. BIM-Dunedin-RRP-ORB-000ARC-Building

# 2. Site description

The site is located in the suburb of Green Island, approximately 8 km southwest of Dunedin city centre. The landfill is positioned within a semi-rural setting, surrounded by agricultural land and some industrial and residential areas. The site is accessible via an off-ramp from State Highway 1 (SH1), facilitating the transport of waste to and from the landfill.

The landfill site comprises a total area of 75.6 ha, which is designated in the DCC Second Generation District Plan (2GP) for landfilling related activities as shown outlined in Figure 1.1. Primary access to the site is via Brighton Road on a sealed access road.

Designation D658 is currently zoned as Industrial, Rural and Recreation. The RRPP development largely falls under Industrial zoned land. Surrounding land uses include heavy and light industry, farmland, environmental conservation land, and residential land. Surrounding land uses are as follows:

– The existing Dunedin Southern Motorway runs in an east-west direction to the north of the site;
– Residential receivers are located to the north of the site on the opposite side of the motorway on Watson Street as well as Awa Toru Drive;
– The Brighton Road industrial area is located east of the site;
– Residential land adjoins the eastern boundary of the site. The closest residence to new operational footprint is southeast of the site at 21 Clariton Avenue; and
– Land to the west of the site is zoned as Coastal Rural as well as General Residential 1. Residential receivers are located to the west of the site on Blanc Avenue.

The existing acoustic environment is dominated by road traffic noise in proximity to SH1. Further away from SH1, to the south, the acoustic environment comprises of industrial sources of noise, bird and insect noise and wind through vegetation e.g. long grass.

# 3. Criteria

## 3.1 Designation condition

Current activities on the Green Island site are designated under Designation D658 until October 2023 with only one condition, which is noise related:

1. Noise generated by any activity on the site shall comply with the following standards at the boundary of this site: 55Dt/40Nt dBA (NB These levels are subject to an adjustment of minus 5 dBA for noise emissions having special audible characteristics).

It is important to note:

– Special audible characteristics such as tonality, low frequency noise, impulsive or intermittent noise events, have the potential to make the sound more annoying than another sound of the same decibel level. This is referred to as a Special Audible Characteristic (SAC) adjustment.
– The nomenclature under the condition does not define the metric for the noise levels shown. GHD Acoustics considers it reasonable to adopt $L_{Aeq(15min)}$.
– Daytime is assumed to be from 7:00 am – 10:00 pm and Night-time is assumed to be 10:00 pm – 7:00 am based on the EIA 1992.
– No distinction is made under the designation condition between operational noise and construction noise, therefore limits are applicable to both activities.
– No reference is made in terms of noise associated with bird management practices

## 3.2 s.16 Resource Management Act

The overarching requirement for the control of noise is to comply with a reasonable level of noise in accordance with Section 16 (1) of the Resource Management Act 1991 (RMA).

> *Section 16 (1)*
>
> *Every occupier of land (including any premises and any costal marine area), and every person carrying out an activity in, on, or under a water body or the costal marine area, shall adopt the best practicable option to ensure that the emission of noise from that land or water does not exceed a reasonable level.*

Section 2 of the RMA defines noise as “includes vibration” and defines the best practicable option (BPO) as:

> *Best practicable option, in relation to a discharge of a contaminant or an emission of noise, means the best method for preventing or minimising the adverse effects on the environment having regard, among other things, to—*
>
> *a) the nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and*
>
> *b) the financial implications, and the effects on the environment, of that option when compared with other options; and*
>
> *c) the current state of technical knowledge and the likelihood that the option can be successfully applied.*

# 4. Sensitive receivers

Whilst Condition 1 states that noise limits are to be complied with at the boundary of the Designation, there is the potential for noise emissions to be higher at or within the boundary of nearby noise sensitive receivers due to the topography of the land. Therefore, in general accordance with s.16 of the RMA, nearby noise sensitive receivers to the RRPP development have been identified. These essentially comprise residential properties to the south along Clariton Avenue, and to the north (on the opposite side of the motorway) on Watson Street and Awa Toru Drive, as well as Blanc St to the west. The sensitive receivers modelled in the assessment are listed in Table 4.1 and shown in Figure 4.1

*Table 4.1 Identified noise sensitive receivers*

| Receiver ID | Receiver address | Receiver type |
|---|---|---|
| Boundary – East_1 | - | Site Boundary |
| Boundary – East_2 | - | Site Boundary |
| Boundary – North East | - | Site Boundary |
| Boundary – North West | - | Site Boundary |
| Boundary – South | - | Site Boundary |
| Boundary – South East | - | Site Boundary |
| Boundary – West | - | Site Boundary |
| R001 | 49 Awa Toru Drive | Residential |
| R002 | 47 Awa Toru Drive | Residential |
| R003 | 39 Awa Toru Drive | Residential |
| R004 | 37 Awa Toru Drive | Residential |
| R005 | 35 Awa Toru Drive | Residential |
| R006 | 43 Awa Toru Drive | Residential |
| R007 | 33 Awa Toru Drive | Residential |
| R008 | 31 Awa Toru Drive | Residential |
| R009 | 21 Awa Toru Drive | Residential |
| R010 | 19 Awa Toru Drive | Residential |
| R011 | 17 Awa Toru Drive | Residential |
| R012 | 10 Watson Street | Residential |
| R013 | 12 Watson Street | Residential |
| R014 | 14 Watson Street | Residential |
| R015 | 16 Watson Street | Residential |
| R016 | 18 Watson Street | Residential |
| R017 | 20 Watson Street | Residential |
| R018 | 22 Watson Street | Residential |
| R019 | 26 Watson Street | Residential |
| R020 | 24 Watson Street | Residential |
| R021 | 33 Blanc Avenue | Residential |
| R022 | 34 Blanc Avenue | Residential |
| R023 | 36 Blanc Avenue | Residential |
| R024 | 10 Taylor Street | Residential |

| Receiver ID | Receiver address | Receiver type |
|---|---|---|
| R025 | 4 Taylor Street | Residential |
| R026 | 3 Clariton Avenue | Residential |
| R027 | 5 Clariton Avenue | Residential |
| R028 | 7 Clariton Avenue | Residential |
| R029 | 11 Clariton Avenue | Residential |
| R030 | 13 Clariton Avenue | Residential |
| R031 | 15 Clariton Avenue | Residential |
| R032 | 17 Clariton Avenue | Residential |
| R033 | 19 Clariton Avenue | Residential |
| R034 | 21 Clariton Avenue | Residential |
| R035 | 23 Clariton Avenue | Residential |
| R036 | 25 Clariton Avenue | Residential |
| R037 | 27 Clariton Avenue | Residential |
| R038 | 2 Clariton Avenue | Residential |
| R039 | 4 Clariton Avenue | Residential |
| R040 | 6 Clariton Avenue | Residential |
| R041 | 8 Clariton Avenue | Residential |
| R042 | 10 Clariton Avenue | Residential |
| R043 | 12 Clariton Avenue | Residential |
| R044 | 14 Clariton Avenue | Residential |
| R045 | 16 Clariton Avenue | Residential |
| R046 | 18 Clariton Avenue | Residential |
| R047 | 20 Clariton Avenue | Residential |


**Legend**

- Sensitive Receivers
- Cadastre

Paper Size ISO A4

0 50 100 150 200

Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

GHD

**DUNEDIN CITY COUNCIL**
**GREEN ISLAND RESOURCE RECOVERY PARK PRECINCT (RRPP)**

Project No. **12613622**
Revision No. **B**
Date **26/02/2024**

# IDENTIFIED SENSITIVE RECEPTORS

# FIGURE 4.1

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Print date: 26 Feb 2024 - 16:25

Data source: Sensitive Receptors - GHD - 20240226, Parcel - GHD - 20240226 NZ Hybrid Reference (Vector): Eagle Technology, LINZ, StatsNZ, NIWA, Natural Earth, © OpenStreetMap contributors.
NZ Imagery: Eagle Technology, LINZ. Created by: schen4

# 5. Operational noise assessment

## 5.1 Overview

Section 3 of GHD's Green Island Full Site Design and Operations Report (GHD 2024A) provides a full description of the operational buildings and activities. Alternatively, Table 1.1 of this report provides a brief description of the activities that can typically be expected within each facility.

The following operational impacts are assessed within this section:

– Operational activity including both stationary sources of sound and on-site vehicle reticulation.
– Off-site operational road-traffic noise effects.

The publicly accessible areas of the RRPP, including the public-drop off areas, will be open between 8.00 am – 5.30 pm Monday – Saturday and 9.00 am – 5.30 pm Sunday.

The non-publicly accessible (operational) areas of the RRPP will be open 8.00 am – 5.30 pm Monday – Friday and at the weekends as required by the operator. The gates at the Brighton Road access will be locked after hours.

All areas of the RRPP will be closed Easter Friday, Christmas Day, and ANZAC day until 1pm.

Some parts of the RRPP will be in operation 24/7. This will include the mechanical aeration plant of the OPF bunkers and general traffic/other activities as required by operational needs for the MRF and BWTS.

All operations will comply with the noise limits established for the site through the site designation in the DCC Second Generation District Plan (2GP). Acoustic assessment has been completed to assess both likely day time and nighttime operations to confirm compliance with the designation noise condition is achievable.

## 5.2 Operational noise modelling

### 5.2.1 Noise modelling methodology

The ISO 9613-2:1996 prediction methodology is used within SoundPLAN 3D modelling (Version 8.2) to predict noise emissions from the operation of the site. The noise model inputs and assumptions for this assessment are provided in Table 5.1.

***Table 5.1 Noise modelling parameters***

| Modelling component | Assumption |
|---|---|
| Software | SoundPLAN version 8.2 |
| Prediction algorithm | *ISO 9613 – 2 Acoustics – Attenuation of sound during propagation outdoors* |
| **Model Inputs** | |
| Meteorology | ISO 9613 considers the presence of a well-developed moderate ground-based temperature inversion, such as commonly occurs on clear, calm nights or 'downwind' conditions which are favourable to sound propagation |
| Topography | – Site topography based on drawings prepared by GHD project team.<br>– Surrounding topography based on terrain data from LINZ with a resolution of 2 metres. |
| Buildings | – Site building locations, height and construction materials based on GHD project team drawings and 3D models.<br>– Surrounding buildings based on building shapes sourced from LINZ data service. |

| Modelling component | Assumption |
|---|---|
| Modelling period | – Typical worst-case 15-minute period of operation where each item of equipment is running at full power |
| Receiver location | – Project boundary – boundary receivers<br>– 1.0 m from the building façade – residential receivers |
| Receiver heights | – 1.5 m above building ground level (ground floor) |
| Ground absorption coefficient | G = 0.5 |
| Atmospheric absorption | Based on an average temperature of 10°C and an average humidity of 70% |
| Vehicles movements on site | All heavy vehicle movements on site will be travelling at approximately 20 km/hr |
| Roller doors | All buildings with roller doors are modelled with all doors open. (Noting that this is conservative, as for odour and pest control (seagulls) buildings will operate with doors closed if practicable. |
| Mobile plant | All mobile plant modelled as operating continuously during operating hours. |
| Indoor noise levels | All indoor noise levels modelled as operating continuously during operating hours. |
| Bunkers | Bunkers modelled as 3 metre high noise barriers. |
| Landfill | Modelling assumes the landfill is still operating at the same time as the resource recovery park to determine cumulative, worst-case operational noise levels at nearby sensitive receivers. Landfill operations assume a dozer, compactor and heavy vehicles are working at the tip face. |

Equipment that has been included within the noise model are shown in Table 5.2 and are presented graphically in Figure 5.1.

### 5.2.2 Internal noise modelling methodology

It has been assumed that the incident sound fields for the walls and the ceiling of each building are a 'diffuse field' as the 'direct sound' levels from the internal noise sources on the walls and ceiling are expected to be lower than the spatially averaged diffuse levels. This 'diffusivity factor' on each external building component (walls, ceiling, door etc.) influences the portion of sound that will transmit out of the building structure.

'Diffusivity factor Cd' is defined in BS EN ISO 12354-4: 2017 '*Building acoustics - estimation of acoustic performance of buildings from the performance of elements. Transmission of indoor sound to the outside'* and states that Cd to be the difference between the sound pressure level at 1 to 2 m from the inside face of the relevant building element and the intensity level of the incident sound perpendicular to that element.

The standard notes that for an industrial building with few dominant and directed emitting sources in front of reflective surfaces (as appropriate with this building), the diffusivity factor Cd is -3 dB and that for other situations it can have a value between 0 and -6 dB depending on the proximity of noise sources to the relevant building elements. A diffusivity factor of -3 dB for all internal building elements has been used in the noise model.

The calculated average internal reverberation time (RT60) with all roller doors open for each building (excluding the MRF, see note below) is presented below:

- ORB building – 3.5 seconds
- BWTS building – 7.8 seconds
- MRF apron – 5.0 seconds

The calculated internal noise level of the ORB, BWTS and MRF apron buildings with operations running inside are presented in Table 5.3.

The internal noise level of the MRF building has not been calculated, as sound measurements at a similar facility located at Sunshine Avenue, Hamilton have been used within the noise model.

## 5.2.3 Internal plant

### 5.2.3.1 ORB building

The ORB is proposed to house an Impaktor 250 shredder. Overall sound power levels for the shredder were provided to GHD. A noise level spectrum for a 200kW diesel wood shredder was sourced from SCHALL Emmissionsdatenkatalog, November 2006 and adjusted to match the overall Lw provided to GHD by manufacturer. The overall sound power level and one-third octave spectrum of the shredder is presented in Table 5.2.

In this context, the Sound Power Level (SWL) represents the total noise output from a piece of equipment. This is a constant that does not change wherever the equipment is located, similar to the power of an electric fire is described kilowatts. Sound Pressure Levels (SPLs) reduce with distance from the equipment, similar to how an electric fire will feel much hotter if one is stood 1 metre away compared to 10 metres away.

Octaves bands are a way splitting the audible spectrum of a sound into smaller segments called octaves. This allows different levels of sound to be identified across frequency bands e.g. low through to high frequencies. Octave bands in human hearing are developed by dividing the range of human hearing (20 Hz – 20 kHz) into eleven octave bands, each having double the frequency span of the previous band. These are called the single (1/1) octave bands. To replicate more closely how the human ear distinguishes loudness across the audible spectrum each 1/1 octave band is split into three bands. These are call the one-third (1/3) octave bands.

### 5.2.3.2 BWTS building

Front-end loaders, a materials handler and trucks will operate inside the BWTS building. The noise model includes noise emissions for movements of these vehicles. The overall sound power level and one-third octave spectrum of the plant is also presented in Table 5.2.

### 5.2.3.3 MRF building

The MRF building will house equipment used in material recovery process. Internal noise levels measured at the Sunshine Ave Hamilton MRF building have been used within the Green Island noise model as well as the use of a front-end loader. Calculated internal noise levels within the MRF (and other facilities) are shown in Table 5.3.

## 5.2.4 Building façade construction details

The construction details of buildings on site have been taken from Developed Design drawings prepared by GHD.

The proposed building envelope constructions are as follows:

- 0.6 mm thick steel (ORB building only)
- 600 mm thick Interloc concrete blocks (ORB building only)
- 0.8 mm thick steel
- 200 mm thick concrete panels
- 1.1 mm thick Lexan polycarbonate (for windows on MRF and BWTS buildings).

The sound insulation performance assumed for each building element are shown in Table 5.4. Noise modelling has assumed that all roller doors are open during operation of the site.

## 5.2.5 Existing operations

The existing operations at Green Island include the landfill and an existing small scale resource recovery centre. The noise emissions from the existing resource recovery centre are minimal. The landfill will continue to operate concurrently with the proposed RRPP for some time, until the landfill is eventually closed. GHD measured sound levels of equipment operating at the Green Island site to inform the operational noise modelling.

*Table 5.2 Equipment sound power levels, dBA*

| Noise source | 1/3 Octave centre frequency (Hz) dBA | | | | | | | | | | | | | | | | | | | | Lw dBA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 50 | 63 | 80 | 100 | 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1k | 1.25k | 1.6k | 2k | 2.5k | 3.15k | 4k | 5k | |
| Impaktor 250 [1] | 67 | 67 | 67 | 77 | 77 | 77 | 84 | 84 | 84 | 90 | 90 | 90 | 93 | 93 | 93 | 94 | 94 | 94 | 94 | 94 | 94 | 105 |
| Front End Loader – Volvo L90 [3] | 66 | 80 | 67 | 65 | 70 | 72 | 74 | 74 | 72 | 76 | 81 | 81 | 80 | 82 | 81 | 79 | 78 | 75 | 74 | 70 | 67 | 90 |
| Materials Handler in BWTS | 50 | 59 | 54 | 61 | 67 | 71 | 68 | 70 | 70 | 74 | 75 | 75 | 77 | 77 | 76 | 77 | 74 | 73 | 72 | 71 | 69 | 86 |
| Blower [3] | 65 | 68 | 72 | 76 | 80 | 84 | 88 | 84 | 83 | 87 | 81 | 86 | 89 | 88 | 89 | 88 | 86 | 85 | 84 | 81 | 77 | 98 |
| Compactor [3] | 56 | 65 | 68 | 79 | 73 | 77 | 77 | 77 | 79 | 83 | 84 | 83 | 91 | 82 | 86 | 83 | 81 | 82 | 79 | 77 | 72 | 95 |
| Dozer [3] | 55 | 63 | 65 | 81 | 73 | 79 | 79 | 77 | 81 | 81 | 83 | 84 | 87 | 85 | 88 | 84 | 82 | 85 | 83 | 81 | 78 | 96 |
| Semi – trailer [4] | - | 80 | - | - | 86 | - | - | 88 | - | - | 90 | - | - | 91 | - | - | 97 | - | - | 97 | - | 108 |

Notes:

1. Spectrum sourced from SCHALL Emmissionsdatenkatalog, November 2006 for 200kW diesel wood shredder. Adjusted to match overall Lw provided to GHD by manufacturer.
2. Shredder modelled at 2 metre height.
3. Spectrum sourced from noise measurements undertaken by GHD at Hampton Downs facility.
4. Semi-trailers modelled with a 1/1 octave spectrum.

*Table 5.3 Calculated internal noise levels, dBA*

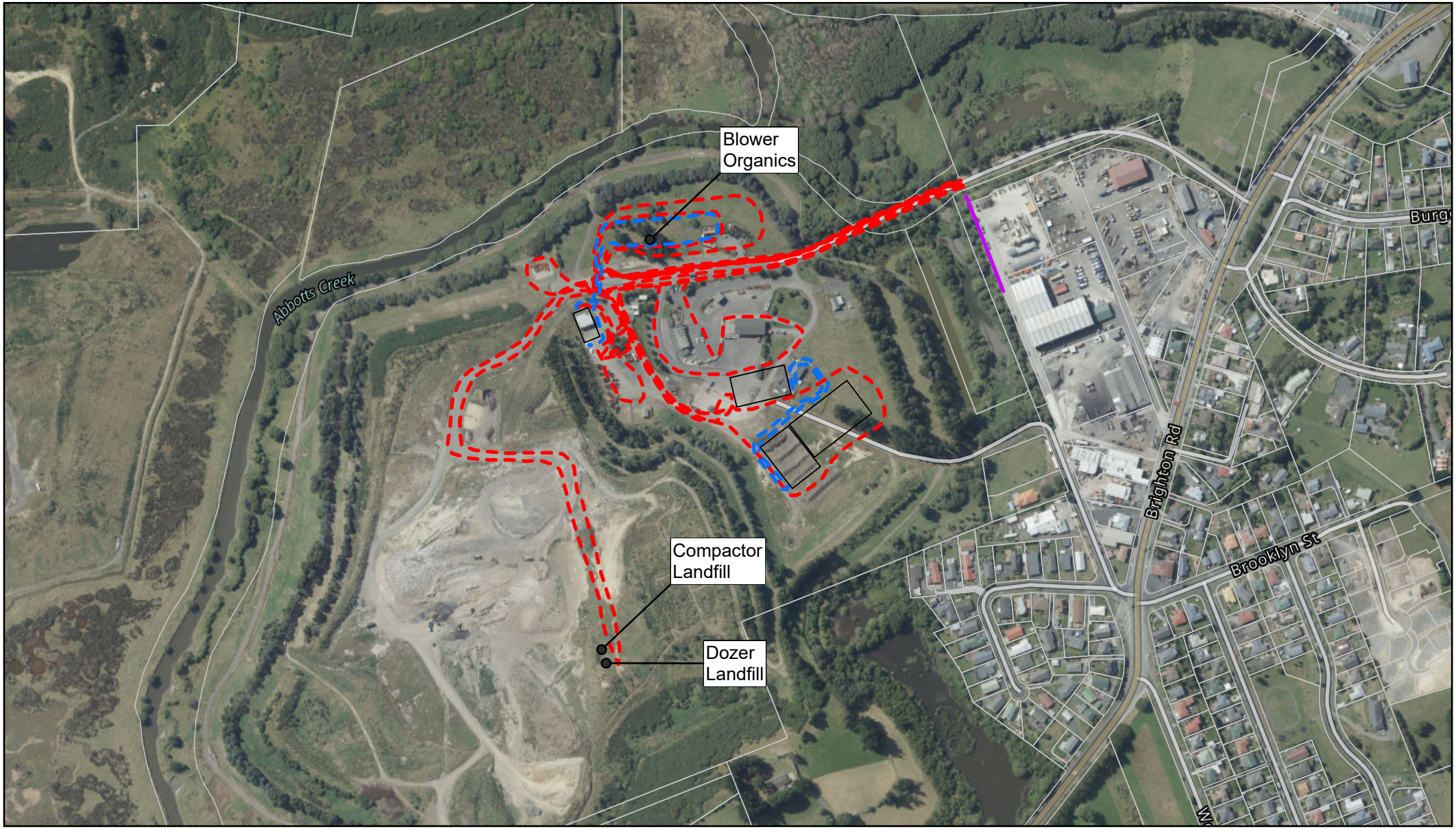
| Noise source | 1/3 Octave centre frequency (Hz) dBA | | | | | | | | | | | | | | | | | | | | Li dBA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 50 | 63 | 80 | 100 | 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1k | 1.25k | 1.6k | 2k | 2.5k | 3.15k | 4k | 5k | |
| ORB | 72 | 69 | 67 | 74 | 72 | 70 | 76 | 74 | 73 | 77 | 76 | 75 | 76 | 76 | 75 | 76 | 75 | 75 | 75 | 74 | 74 | 88 |
| BWTS | 45 | 56 | 41 | 37 | 43 | 40 | 41 | 42 | 36 | 39 | 44 | 42 | 39 | 43 | 40 | 37 | 41 | 32 | 30 | 38 | 21 | 58 |
| MRF Apron | 49 | 59 | 45 | 40 | 42 | 43 | 44 | 42 | 38 | 42 | 45 | 44 | 41 | 44 | 42 | 39 | 37 | 35 | 33 | 28 | 25 | 61 |
| MRF | 44 | 48 | 53 | 55 | 59 | 64 | 66 | 67 | 69 | 73 | 75 | 75 | 77 | 76 | 78 | 78 | 78 | 78 | 78 | 77 | 75 | 88 |

*Table 5.4 Material sound insulation performance*

| Building element [1] | 1/3 Octave Band (Hz) Material sound insulation performance dB[1] | | | | | | | | | | | | | | | | | | | | Rw |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 50 | 63 | 80 | 100 | 125 | 160 | 200 | 250 | 315 | 400 | 500 | 630 | 800 | 1k | 1.25k | 1.6k | 2k | 2.5k | 3.15k | 4k | 5k | |
| 600 mm thick Interbloc concrete blocks | 49 | 51 | 54 | 56 | 59 | 61 | 64 | 66 | 69 | 71 | 73 | 75 | 76 | 78 | 79 | 81 | 83 | 84 | 86 | 87 | 89 | 76 |
| 200 mm thick concrete panels | 44 | 44 | 45 | 46 | 45 | 43 | 45 | 47 | 50 | 52 | 55 | 57 | 60 | 62 | 63 | 65 | 67 | 68 | 70 | 71 | 73 | 59 |
| 0.8 mm thick steel | 10 | 10 | 11 | 12 | 13 | 15 | 16 | 17 | 19 | 20 | 22 | 24 | 25 | 26 | 26 | 22 | 21 | 22 | 22 | 23 | 24 | 23 |
| 0.6 mm thick steel | 8 | 8 | 9 | 10 | 11 | 12 | 14 | 15 | 17 | 18 | 20 | 21 | 23 | 24 | 24 | 21 | 20 | 20 | 20 | 21 | 22 | 21 |
| 1.1 mm thick Lexan (polycarbonate) | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 5 | 6 | 7 | 9 | 10 | 12 | 13 | 15 | 17 | 18 | 20 | 22 | 24 | 26 | 13 |
| Openings (roller doors) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Notes:

1. All material sound insulation performance data presented in Table 5.4 has been sourced from Insul (version 9.0)




**Legend**

- Equipment
- Site Layout
- Front End Loader
- Semi Trailer
- Cadastre
- Noise protection wall

Paper Size ISO A4

0 50 100 150 200

Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

**DUNEDIN CITY COUNCIL**
**GREEN ISLAND RESOURCE RECOVERY PARK PRECINCT (RRPP)**

# MODELLED NOISE GENERATING EQUIPMENT

Project No. **12613624**
Revision No. **B**
Date **04/10/2023**

# FIGURE 5.1

\\ghdnet\ghd\NZ\Christchurch\Projects\51\12613624\GIS\Maps\Deliverables\12613624_Green_Island_RRPP\12613624_Green_Island_RRPP.aprx - 12613624_Fig7_1_Modelled_Noise_Generating_Equipment
Print date: 04 Oct 2023 - 18:36

### 5.2.6 Vehicle reticulation

The predicted traffic volumes for operation of the site are detailed in the Traffic Impact Assessment Report (GHD 2024B). Each waste stream has been modelled as a line source within the Green Island operational noise model as per the indicative vehicle circulation shown in Figure 5.2.

*Table 5.5 Estimated future traffic generation (trips per year)*

| | Recycling and Waste | | | | | Non Waste | | | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| | A - Recycling | B - General Waste | C - Green Waste | D - Hazardous Waste | E - Inert Waste | F - ESL Compound | G - Site offices, staff facilities and other | H - Rummage store and recycling drop off | |
| Total Inbound Trips | 6,037 | 55,346 | 16,509 | 2,929 | 7,657 | 0 | 5,792 | 110,048 | 204,318 |
| Total Trips | 12,074 | 110,692 | 33,018 | 5,858 | 15,314 | | 11,584 | 220,096 | 408,636 |
| Total tonnes | 13,33 | 48,338 | 3,531 | 10,091 | 52,677 | | 0 | Unknown | 115,970 |
| | | | | | | | | | |
| % Total trips | 3% | 27% | 8% | 1% | 4% | 0% | 3% | 54% | 100% |
| % Total tonnes | 1% | 42% | 3% | 9% | 45% | | 0% | | 100% |

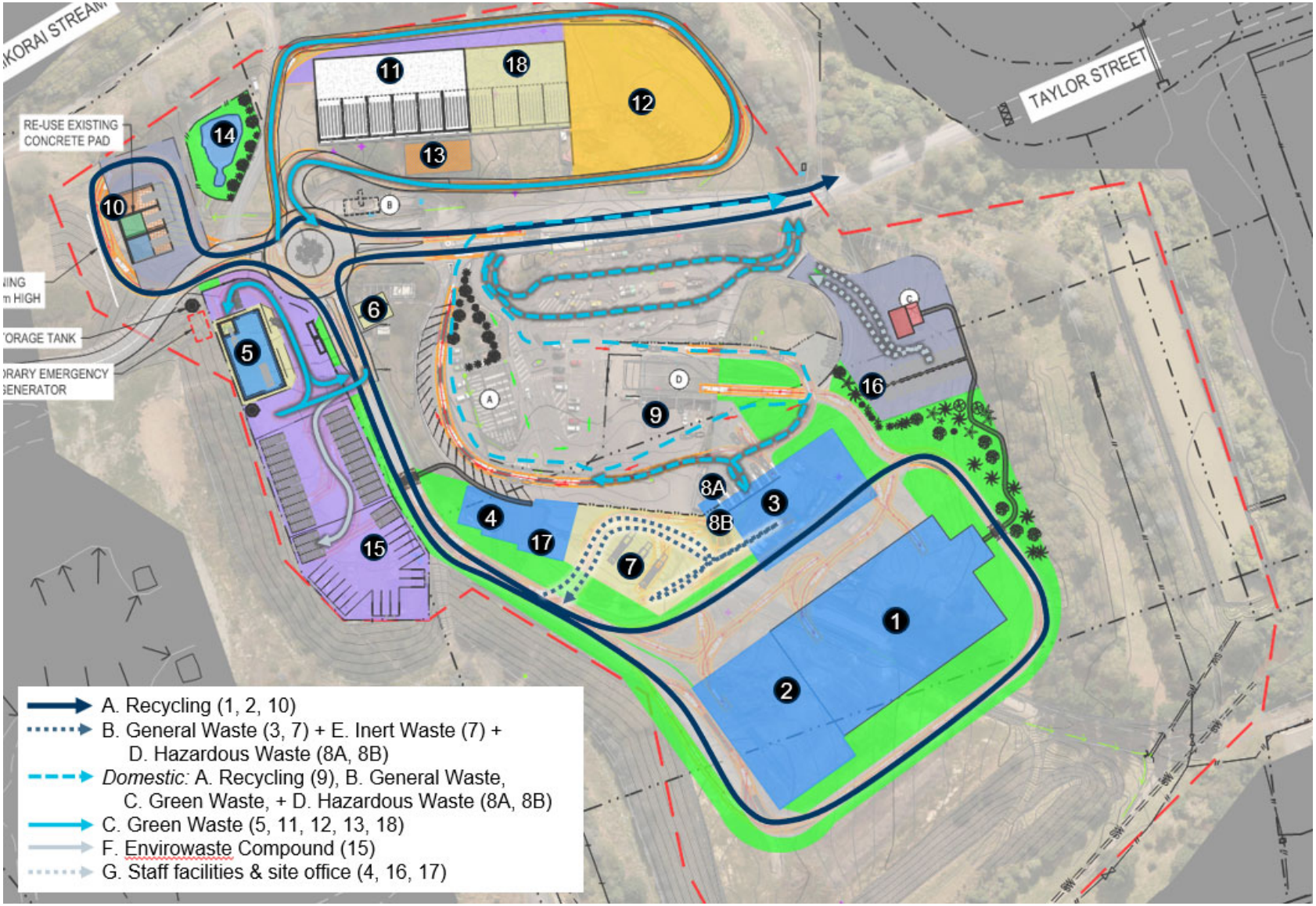



*Figure 5.2* ***Indicative vehicle circulation***

## 5.3 Operational noise modelling results

### 5.3.1 Daytime operations

The predicted $L_{Aeq(15min)}$ noise levels associated with the operation of the site at nearby sensitive receivers are presented in Table 5.6 and include a +5 dBA correction to account for special audible characteristics.

The noise modelling also includes noise from landfill operations to determine worst-case operational noise levels at nearby sensitive receivers. The landfill operations have been modelled on the southeastern side of the landfill area, at the top of the tip face with minimal shielding between the mobile plant and the nearest sensitive receivers on Clariton Avenue. The modelling assumes that a waste compactor and dozer are working simultaneously, and trucks are delivering waste to the work area. The location of the modelled equipment is presented graphically in Figure 5.1.

It is important to note that the results from the noise model are considered conservative due to the assumption that all modelled equipment is operating at one time and the inclusion of noise enhancing meteorological conditions. The predicted noise levels should therefore be considered as the worst-case i.e. the highest noise level emissions that can be expected from the proposed use of the site within any given 15-minute period during the daytime hours between 7:00 am and 10:00 pm.

The predicted results show compliance with the noise criteria is achieved at all sensitive receiver locations during the daytime period except for one exceedance predicted on the eastern boundary shared with an industrial premises, shown by the highlighted cell in Table 5.6.

A 2-metre-high noise barrier has been modelled along a section of the shared eastern boundary to reduce noise levels in order to comply with the Designation Condition. The results show that with the construction of the noise barrier, the predicted noise level is sufficiently reduced to comply with the daytime noise criterion of $L_{Aeq}$ 55 dB at all locations. Operational noise contours are presented in Appendix B. The recommended location and extent of a 2 metre high fence is shown in Appendix B under Figure B2.

*Table 5.6 Predicted $L_{Aeq(15min)}$ noise levels at sensitive receivers, dBA – Daytime*

| Receiver ID | Address | Predicted noise level, $L_{Aeq(15min)}$ dB[3] | Compliance with daytime noise criterion of $L_{Aeq}$ 55 dB? |
|---|---|---|---|
| Boundary - East_1 | - | 58 | No |
| Boundary - East_2 | - | 48 | Yes |
| Boundary - North East | - | 48 | Yes |
| Boundary - North West | - | 48 | Yes |
| Boundary - South | - | 45 | Yes |
| Boundary - South East | - | 51 | Yes |
| Boundary - West | - | 37 | Yes |
| R001 | 49 Awa Toru Drive | 46 | Yes |
| R002 | 47 Awa Toru Drive | 43 | Yes |
| R003 | 39 Awa Toru Drive | 36 | Yes |
| R004 | 37 Awa Toru Drive | 41 | Yes |
| R005 | 35 Awa Toru Drive | 42 | Yes |
| R006 | 43 Awa Toru Drive | 44 | Yes |
| R007 | 33 Awa Toru Drive | 44 | Yes |
| R008 | 31 Awa Toru Drive | 43 | Yes |
| R009 | 21 Awa Toru Drive | 40 | Yes |
| R010 | 19 Awa Toru Drive | 42 | Yes |

| Receiver ID | Address | Predicted noise level, $L_{Aeq(15min)}$ dB[3] | Compliance with daytime noise criterion of $L_{Aeq}$ 55 dB? |
|---|---|---|---|
| R011 | 17 Awa Toru Drive | 40 | Yes |
| R012 | 10 Watson Street | 50 | Yes |
| R013 | 12 Watson Street | 50 | Yes |
| R014 | 14 Watson Street | 50 | Yes |
| R015 | 16 Watson Street | 50 | Yes |
| R016 | 18 Watson Street | 50 | Yes |
| R017 | 20 Watson Street | 51 | Yes |
| R018 | 22 Watson Street | 50 | Yes |
| R019 | 26 Watson Street | 51 | Yes |
| R020 | 24 Watson Street | 50 | Yes |
| R021 | 33 Blanc Avenue | 41 | Yes |
| R022 | 34 Blanc Avenue | 39 | Yes |
| R023 | 36 Blanc Avenue | 39 | Yes |
| R024 | 10 Taylor Street | 51 | Yes |
| R025 | 4 Taylor Street | 46 | Yes |
| R026 | 3 Clariton Avenue | 44 | Yes |
| R027 | 5 Clariton Avenue | 47 | Yes |
| R028 | 7 Clariton Avenue | 49 | Yes |
| R029 | 11 Clariton Avenue | 49 | Yes |
| R030 | 13 Clariton Avenue | 46 | Yes |
| R031 | 15 Clariton Avenue | 48 | Yes |
| R032 | 17 Clariton Avenue | 49 | Yes |
| R033 | 19 Clariton Avenue | 48 | Yes |
| R034 | 21 Clariton Avenue | 48 | Yes |
| R035 | 23 Clariton Avenue | 48 | Yes |
| R036 | 25 Clariton Avenue | 48 | Yes |
| R037 | 27 Clariton Avenue | 43 | Yes |
| R038 | 2 Clariton Avenue | 43 | Yes |
| R039 | 4 Clariton Avenue | 46 | Yes |
| R040 | 6 Clariton Avenue | 46 | Yes |
| R041 | 8 Clariton Avenue | 46 | Yes |
| R042 | 10 Clariton Avenue | 47 | Yes |
| R043 | 12 Clariton Avenue | 46 | Yes |
| R044 | 14 Clariton Avenue | 47 | Yes |
| R045 | 16 Clariton Avenue | 45 | Yes |
| R046 | 18 Clariton Avenue | 46 | Yes |
| R047 | 20 Clariton Avenue | 45 | Yes |

Notes:

1. Noise levels at boundary receptors are free-field.
2. Noise levels at receivers are predicted at 1 metre from the façade and 1.5 metres above ground floor level. Predicted noise levels include façade reflections.

3. Predicted results include a +5 dBA special audible characteristics correction for direct comparison with the 55 dBA noise limit.

### 5.3.2 Night operations

A night-time operational scenario has been modelled to determine if night operations between the hours of 10:00 pm to 7:00 am is possible without adversely impacting surrounding sensitive receivers.

The scenario modelled is as follows:

**Scenario**

1. No landfill activities.
2. Organics blower operating.
3. BWTS operating (Materials handler and loader inside and doors closed).
4. A single trips BWTS offtake vehicle (heavy truck) departing in the clockwise loop around the MRF building.

Results from the modelled scenario predict compliance can be achieved at all nearby noise sensitive receivers. The predicted $L_{Aeq(15min)}$ noise levels associated with the scenario are presented in Table 5.7 and include a +5 dBA correction to account for special audible characteristics.

Note the presented scenario does not necessarily represent the actual activities that will be undertaken at night (although the organics blowers will be operational). It has been used to demonstrate that noise compliance can be achieved with limited nighttime activities.

*Table 5.7 Predicted $L_{Aeq(15min)}$ noise levels at sensitive receivers, dBA – Night*

| Receiver ID | Address | Predicted noise level, $L_{Aeq(15min)}$ dB[3] | Compliance with daytime noise criterion of $L_{Aeq}$ 40 dB? |
|---|---|---|---|
| Boundary - East_1 | - | 38 | Yes |
| Boundary - East_2 | - | 37 | Yes |
| Boundary - North East | - | 38 | Yes |
| Boundary - North West | - | 39 | Yes |
| Boundary - South | - | 27 | Yes |
| Boundary - South East | - | 37 | Yes |
| Boundary - West | - | 27 | Yes |
| R001 | 49 Awa Toru Drive | 38 | Yes |
| R002 | 47 Awa Toru Drive | 35 | Yes |
| R003 | 39 Awa Toru Drive | 28 | Yes |
| R004 | 37 Awa Toru Drive | 32 | Yes |
| R005 | 35 Awa Toru Drive | 34 | Yes |
| R006 | 43 Awa Toru Drive | 35 | Yes |
| R007 | 33 Awa Toru Drive | 34 | Yes |
| R008 | 31 Awa Toru Drive | 33 | Yes |
| R009 | 21 Awa Toru Drive | 33 | Yes |
| R010 | 19 Awa Toru Drive | 32 | Yes |
| R011 | 17 Awa Toru Drive | 30 | Yes |
| R012 | 10 Watson Street | 39 | Yes |
| R013 | 12 Watson Street | 39 | Yes |
| R014 | 14 Watson Street | 39 | Yes |
| R015 | 16 Watson Street | 39 | Yes |
| R016 | 18 Watson Street | 39 | Yes |
| R017 | 20 Watson Street | 40 | Yes |
| R018 | 22 Watson Street | 40 | Yes |
| R019 | 26 Watson Street | 40 | Yes |
| R020 | 24 Watson Street | 40 | Yes |
| R021 | 33 Blanc Avenue | 30 | Yes |
| R022 | 34 Blanc Avenue | 29 | Yes |
| R023 | 36 Blanc Avenue | 30 | Yes |
| R024 | 10 Taylor Street | 39 | Yes |
| R025 | 4 Taylor Street | 33 | Yes |
| R026 | 3 Clariton Avenue | 32 | Yes |
| R027 | 5 Clariton Avenue | 35 | Yes |
| R028 | 7 Clariton Avenue | 37 | Yes |
| R029 | 11 Clariton Avenue | 36 | Yes |
| R030 | 13 Clariton Avenue | 32 | Yes |
| R031 | 15 Clariton Avenue | 35 | Yes |
| R032 | 17 Clariton Avenue | 35 | Yes |

| Receiver ID | Address | Predicted noise level, $L_{Aeq(15min)}$ dB[3] | Compliance with daytime noise criterion of $L_{Aeq}$ 40 dB? |
|---|---|---|---|
| R033 | 19 Clariton Avenue | 33 | Yes |
| R034 | 21 Clariton Avenue | 31 | Yes |
| R035 | 23 Clariton Avenue | 33 | Yes |
| R036 | 25 Clariton Avenue | 35 | Yes |
| R037 | 27 Clariton Avenue | 28 | Yes |
| R038 | 2 Clariton Avenue | 33 | Yes |
| R039 | 4 Clariton Avenue | 35 | Yes |
| R040 | 6 Clariton Avenue | 35 | Yes |
| R041 | 8 Clariton Avenue | 35 | Yes |
| R042 | 10 Clariton Avenue | 36 | Yes |
| R043 | 12 Clariton Avenue | 36 | Yes |
| R044 | 14 Clariton Avenue | 36 | Yes |
| R045 | 16 Clariton Avenue | 31 | Yes |
| R046 | 18 Clariton Avenue | 33 | Yes |
| R047 | 20 Clariton Avenue | 33 | Yes |

Notes:

1. Noise levels at boundary receptors are free-field.
2. Noise levels at receivers are predicted at 1 metre from the façade and 1.5 metres above ground floor level. Predicted noise levels include façade reflections.
3. Predicted results include a +5 dBA special audible characteristics correction for direct comparison with the 40 dBA noise limit.

## 5.4 Off-site operational road-traffic noise effects

The predicted traffic volumes for operation of the site are detailed in the associated Traffic Impact Assessment Report (GHD 2024B). Existing road-traffic flow is approximately 8,825 vehicles per day on Brighton Road with heavy vehicles making up 3% of that volume. When fully operational the RRPP is forecast to increase road-traffic flow to 9,204 vehicles per day with heavy vehicles accounting for 4% of that volume. Existing and forecast landfill traffic flows during typical weekday peak periods are summarised in Table 5.8.

*Table 5.8 Existing and forecast total traffic trips*

| Time | Existing (trips) | Forecast (trips) | Forecast Increase (trips) | Existing Brighton Road Traffic | Forecast Brighton Road Traffic | % traffic increase on Brighton Road |
|---|---|---|---|---|---|---|
| | Trips | Trips | Trips | Trips | Total Trips | Trips |
| Median Weekday AM Peak – 8:00 am to 9:00 am | 82 | 101 | 19 | 900 | 919 | 2% |
| Median Weekday PM Peak – 5:00 pm to 6:00 pm | 48 | 93 | 45 | 900 | 945 | 5% |
| Average Weekday Traffic | 1,310 | 1,689 | 379 | 8,825 | 9,204 | 4.3% |

The increase in road-traffic noise is predicted to be less than 1 dBA. This level of increase is typically perceived to be negligible when considered in terms of an increase in loudness.

# 6. Construction noise

It is important to note that no distinction is made under the Designation Condition between operational noise and construction noise, therefore the noise limits are applicable to both activities.

## 6.1.1 Construction period

From mid-2024 kerbside food scraps and garden waste collection will commence in Dunedin. This requires the construction of the ORB at Green Island to receive and process the collected organics materials from late 2023.

The balance of the RRPP facilities (with the exception of the BWTS) will be constructed by mid-2025, including the Organics Processing Facility (OPF) bunkers and maturation area, to allow processing of organics on site.

The timing of the BWTS building construction will depend on the closure of Green Island landfill and the need to transport waste to a distant landfill site .

## 6.1.2 Construction methodology

### 6.1.2.1 Construction staging

The construction methodology has been reviewed to identify the construction scenarios to assess the potential for noise emissions. These scenarios are outlined in Table 6.1. It is important to note that the construction scenarios envisaged should only be treated as indicative, as the final construction methodology is subject to change. Nonetheless, the noise emissions predicted are useful for establishing the potential emissions to the surrounding environment and informing the potential extent of the effects envelope and practicality of achieving compliance; as opposed to providing a definitive set of noise levels at any one receiver.

*Table 6.1 Construction Scenarios*

| Scenario ID | Description |
|---|---|
| CS01 | Construction of Organics Receival Building (ORB) |
| CS02 | Construction of Material Recovery Facility (MRF) Building |
| CS03 | Construction of Bulk Waste Transfer Station (BWTS) Building |
| CS04 | Construction of Offices |
| CS05 | Construction of Bunkers |

Whilst the proposed construction hours are unknown at the time of writing, this assessment assumes that the hours will typically fall between Monday to Saturday 7:30 am – 6:00 pm.

### 6.1.2.2 Equipment sound levels

The proposed equipment that is expected to generate the highest noise levels during each works phase and their associated scenario sound power levels are provided in Table 6.2. Reference noise levels for equipment have been obtained from BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise* (‘BS5228-1‘).

Construction scenarios have been created based on the equipment likely to be operating simultaneously at any given time, based upon the location creating the highest received noise levels, to provide a conservative approach. The modelling assumes the worst-case scenario to identify where noise levels could be of concern and may require mitigation.

Whilst other equipment may be used it is anticipated that they would produce similar net noise emissions compared with the equipment listed in Table 6.2. The scenario sound power levels are based on the two loudest items of equipment operating simultaneously.

The scenario sound power levels assume that equipment will operate at full power for the full duration of the assessment period, e.g., 15 minutes to 1 hour. In reality, the equipment is more likely to move around the construction footprint which will change the level of noise emissions as construction progresses.

*Table 6.2 Construction equipment and scenario sound power levels*

| Equipment | Sound power level, dBA | Construction scenario | | | | |
|---|---|---|---|---|---|---|
| | | CS01 | CS02 | CS03 | CS04 | CS05 |
| **Scenario sound power level** | | **109** | **109** | **109** | **109** | **109** |
| Excavator | 107 | X | X | X | X | X |
| Franna crane | 95 | X | X | X | X | X |
| Front end loader | 103.5 | X | X | X | X | X |

## 6.1.3 Construction noise modelling

The ISO 9613-2:1996 prediction methodology was utilised within SoundPLAN 3D modelling (Version 8.2), to predict noise emissions from the construction of the project. Scenarios were modelled as a maximum point at extents of the project area.

The noise model inputs for this assessment are detailed under Table 5.1. The following noise modelling assumptions were also made:

– modelled scenarios consider the shielding effect from surrounding buildings and structures on and adjacent to the site.
– noise modelling assesses the noise source at multiple locations and takes the highest $L_{Aeq}$ noise level at the receiver.

## 6.1.4 Predicted construction noise levels

Predicted noise levels, for all modelled scenarios, at the noise sensitive receivers identified are provided in Table 6.3 and presented graphically in Appendix A.

The predicted levels are based on construction works occurring at the worst-case location relative to each receiver. The actual noise levels received at sensitive receivers during construction will generally be lower as construction works progress around the site and the highest noise level emissions will only be experienced for limited periods where equipment is operating at maximum capacity. For most of the time, construction equipment would produce lower noise levels than those considered in this assessment.

The following is to be noted when comparing the noise levels reported under Table 6.3 with the daytime noise criterion of 55 dBA under the Designation Condition. The predicted noise levels:

a) do not include a 5 dBA penalty for special audible characteristics as it is inappropriate to apply a SAC adjustment to construction noise. The best way to address potentially 'annoying' sources of noise is through the Construction Noise and Vibration Management Plan (CNVMP) that will set out the Best Practicable Option approach to noise management of tonal reversing alarms and plant e.g. squeal of dozer tracks.

b) do include a reduction of 1.5 dBA to allow for averaging of the energy from the construction time-period of 7:30 am to 6:00 pm, to the Designation daytime period of 7:00 am to 10:00 pm.

The highest noise levels are predicted during the construction of the MRF building (CS02). Construction noise levels up to 54 dBA at 1 metre from the façade of No.10 Taylor Street and 55 dBA at the South-East Site Boundary location are predicted when the works are located closest to the nearest receivers. On this basis, the construction noise levels comply with the day-time Designation Condition criterion at the site boundary as well as all other noise sensitive receivers.

*Table 6.3 Predicted construction noise levels, dB $L_{Aeq}$ dBA*

| Receiver ID | Address | CS01 | CS02 | CS03 | CS04 | CS05 |
|---|---|---|---|---|---|---|
| Boundary - East_1 | Site Boundary | 40 | 52 | 50 | 42 | 48 |
| Boundary - East_2 | Site Boundary | 40 | 52 | 49 | 41 | 44 |
| Boundary - North East | Site Boundary | 40 | 41 | 41 | 39 | 46 |
| Boundary - North West | Site Boundary | 46 | 37 | 38 | 40 | 49 |
| Boundary - South | Site Boundary | 37 | 45 | 41 | 40 | 38 |
| Boundary - South East | Site Boundary | 41 | 55 | 48 | 43 | 44 |
| Boundary - West | Site Boundary | 30 | 25 | 25 | 26 | 36 |
| R001 | 49 Awa Toru Drive | 41 | 38 | 39 | 41 | 44 |
| R002 | 47 Awa Toru Drive | 40 | 36 | 37 | 38 | 41 |
| R003 | 39 Awa Toru Drive | 31 | 29 | 30 | 30 | 33 |
| R004 | 37 Awa Toru Drive | 37 | 34 | 35 | 35 | 38 |
| R005 | 35 Awa Toru Drive | 37 | 35 | 36 | 36 | 39 |
| R006 | 43 Awa Toru Drive | 41 | 38 | 38 | 39 | 42 |
| R007 | 33 Awa Toru Drive | 41 | 37 | 38 | 39 | 42 |
| R008 | 31 Awa Toru Drive | 40 | 37 | 38 | 38 | 41 |
| R009 | 21 Awa Toru Drive | 36 | 34 | 36 | 34 | 39 |
| R010 | 19 Awa Toru Drive | 38 | 36 | 36 | 37 | 39 |
| R011 | 17 Awa Toru Drive | 35 | 34 | 34 | 34 | 36 |
| R012 | 10 Watson Street | 42 | 44 | 44 | 39 | 47 |
| R013 | 12 Watson Street | 43 | 42 | 44 | 40 | 47 |
| R014 | 14 Watson Street | 43 | 43 | 44 | 40 | 47 |
| R015 | 16 Watson Street | 41 | 44 | 44 | 41 | 48 |
| R016 | 18 Watson Street | 42 | 44 | 43 | 39 | 48 |
| R017 | 20 Watson Street | 44 | 44 | 44 | 41 | 48 |
| R018 | 22 Watson Street | 44 | 44 | 44 | 41 | 48 |
| R019 | 26 Watson Street | 44 | 42 | 44 | 42 | 49 |
| R020 | 24 Watson Street | 44 | 44 | 44 | 41 | 48 |
| R021 | 33 Blanc Avenue | 33 | 31 | 31 | 32 | 37 |
| R022 | 34 Blanc Avenue | 33 | 32 | 32 | 31 | 34 |
| R023 | 36 Blanc Avenue | 33 | 32 | 32 | 31 | 35 |
| R024 | 10 Taylor Street | 42 | 54 | 49 | 44 | 44 |
| R025 | 4 Taylor Street | 40 | 48 | 45 | 41 | 42 |
| R026 | 3 Clariton Avenue | 39 | 45 | 42 | 40 | 38 |
| R027 | 5 Clariton Avenue | 41 | 51 | 48 | 43 | 41 |
| R028 | 7 Clariton Avenue | 42 | 53 | 50 | 44 | 43 |
| R029 | 11 Clariton Avenue | 42 | 53 | 49 | 44 | 43 |
| R030 | 13 Clariton Avenue | 37 | 53 | 48 | 37 | 42 |
| R031 | 15 Clariton Avenue | 42 | 53 | 48 | 43 | 43 |
| R032 | 17 Clariton Avenue | 44 | 50 | 47 | 45 | 42 |
| R033 | 19 Clariton Avenue | 43 | 48 | 46 | 44 | 42 |

| Receiver ID | Address | CS01 | CS02 | CS03 | CS04 | CS05 |
|---|---|---|---|---|---|---|
| R034 | 21 Clariton Avenue | 43 | 48 | 45 | 44 | 41 |
| R035 | 23 Clariton Avenue | 40 | 49 | 46 | 44 | 42 |
| R036 | 25 Clariton Avenue | 43 | 49 | 46 | 44 | 41 |
| R037 | 27 Clariton Avenue | 39 | 42 | 38 | 38 | 36 |
| R038 | 2 Clariton Avenue | 41 | 44 | 42 | 41 | 39 |
| R039 | 4 Clariton Avenue | 40 | 46 | 43 | 43 | 41 |
| R040 | 6 Clariton Avenue | 40 | 46 | 44 | 42 | 41 |
| R041 | 8 Clariton Avenue | 41 | 47 | 46 | 42 | 42 |
| R042 | 10 Clariton Avenue | 41 | 47 | 44 | 43 | 40 |
| R043 | 12 Clariton Avenue | 41 | 47 | 45 | 43 | 41 |
| R044 | 14 Clariton Avenue | 42 | 48 | 46 | 43 | 41 |
| R045 | 16 Clariton Avenue | 42 | 47 | 43 | 44 | 39 |
| R046 | 18 Clariton Avenue | 41 | 45 | 43 | 42 | 41 |
| R047 | 20 Clariton Avenue | 41 | 44 | 42 | 42 | 40 |

Notes:

1. Noise levels at boundary receptors are free-field.
2. Noise levels at receivers are predicted at 1 metre from the façade and 1.5 metres above ground floor level. Predicted noise levels include façade reflections.

# 7. Management Plans

## 7.1 Construction noise

Whilst unmitigated noise and vibration levels are predicted to comply with the day-time criterion, implementation of the Best Practicable Option (BPO) mitigation measures referenced within NZS 6803:1999 Acoustics – Construction Noise (NZS 6803) are still generally recommended to minimise construction noise emissions and effects.

The most effective way to enable the BPO mitigation measures to be implemented and help ensure noise emissions are minimised is by advising the contractor(s) how to manage levels and the effects upon neighbouring properties. This is best achieved under the framework of a Construction Noise and Vibration Management Plan (CNVMP). As a minimum, it is recommended the CNVMP must address the relevant measures in Annex E of NZS 6803.

At this stage of development, it is commonplace for the end construction methodology to not yet be fully identified. The following general noise mitigation measures in Table 7.1 are recommended throughout all phases of construction work to achieve good construction noise management practice:

*Table 7.1 Construction noise mitigation and management measures*

| Recommended measures |
|---|
| – Community engagement programme including complaints handling procedure. |
| – Noise training as part of site induction requirements and at toolbox meetings. |
| – Schedule the noisiest works between the hours of 7:30 am to 6:00 pm Monday to Saturday if practicable. |
| – Onsite fabrication works should be avoided where practicable. Where required onsite fabrication should consider noise mitigation measures to acoustically screen residential receivers from noise emissions such as location, and/or use of acoustic shielding (e.g. 2 metres high temporary barrier), and/or enclosures, to be used if higher noise levels are predicted. |
| – All mobile equipment used on site should be fitted with broad-band reversing sirens in place of standard reversing sirens. |
| – Review available fixed and mobile equipment fleet and prefer more recent and silenced equipment whenever possible. All equipment used on site should be in good condition and good working order. |
| – All combustion engine plant, such as generators, compressors and welders should be checked to ensure they produce minimal noise with particular attention to residential grade exhaust silencers. |
| – Where practical, machines should be operated at low speed or power and should be switched off when not being used rather than left idling for prolonged periods. |
| – Equipment should be fitted with appropriate silencers and be in good working order. Machines found to produce excessive noise compared to normal industry expectations should be removed from the site or stood down until repairs or modifications can be made. |
| – Where possible, the quietest machinery and methods available and practicable should be used e.g. minimisation of the number of items of equipment required on site and the idling of that equipment by planning and scheduling of works. . |

The construction methodology will evolve, and detailed information developed as the project progresses. The contractor is to determine and implement the BPO mitigation, incorporating the applicable measures detailed immediately above, prior to and throughout construction. The CNVMP should as a minimum include:

a. The construction noise criteria;
b. Description of the works, equipment/processes and their scheduled durations;
c. Machinery and equipment to be used;
d. Hours of operation, including times and days of week when construction activities causing noise will occur;
e. Identification of noise sensitive receivers where management and mitigation will be required;
f. Management and mitigation measures to achieve compliance with the applicable noise criteria;
g. Training of site personnel;

h. Method for communicating and consulting with affected parties, and for responding to complaints; and

i. Method for monitoring and reporting on construction noise; including if full compliance cannot be achieved, or in response to complaints.

## 7.2 Operational noise

To facilitate ongoing compliance with the Designation Condition noise criteria the mitigation and management measures in Table 7.2 are recommended to minimise noise emissions from operational activity on the site:

*Table 7.2 Operational noise mitigation and management measures*

| Recommended measures |
|---|
| – The MRF (No.1 and 2), the BWTS (No.3) and the ORB (No.5) building envelope constructions should be constructed of the materials as detailed under Section 5.2.4 with a nominal sound insulation performance that can be expected to be equal to or greater than that shown under Table 5.4 |
| – Smooth and well-maintained roadways and vehicle access points. |
| – Build a 2-metre high noise barrier (e.g. fence) along the site boundary to the east (as shown in Figure B2 under Appendix B). An acoustically effective fence typically comprises approximately 20mm thick timber with a surface mass of 10kg/$m^2$ with no gaps or holes between panels or where the fence meets the ground. |
| – Equipment is to be selected, maintained and operated to minimise noise emissions and prevent noise sources that could potentially lead to annoyance e.g. squealing dozer tracks. |
| – Mobile plant involved with the operation of the site that typically stays on site for longer period(s) of time are to be fitted with broad-band reversing alarms. Note: this provision does not strictly apply to equipment that arrives and departs site on a daily basis (e.g. delivery vehicles), although installation of broad-band reversing sirens on such visiting equipment is to be encouraged whenever practical as good acoustic practice. |
| – Methods of bird management that avoid noise-based bird dispersal methods are preferred whenever practicable e.g. roller doors to buildings to operate with doors closed when practicable, anti-roosting strips to prevent birds landing and roosting on structures. |
| – Noise training is to form part of the site-induction program and include procedures for managing noise e.g. prevention of tailgates banging. |
| – An incident management procedure to include site contact details and name of person responsible for responding to and resolving complaints. |
| – A record of all noise monitoring results and complaints received (including actions taken to resolve any matters) is to be submitted to Dunedin City Council annually with a copy available on-site. |
| – A program of community liaison to provide information on noise (and wider environmental) aspects of the operational activities, monitoring and future plans with an avenue for community feedback. |
| – Procedure for amendments to the noise section of the management plan, including updating DCC. |

# 8. Conclusion

This noise and vibration assessment was prepared to identify the potential impacts of noise from proposed activities associated with the construction and operation of the proposed RRPP and to provide recommendations regarding noise management strategies and mitigation measures, where necessary, with the aim of achieving the Designation Condition noise criteria.

3D noise modelling has been completed to predict operational noise levels at sensitive receivers arising from the proposed development and the results assessed against the noise limits under the Designation Condition. The noise modelling is based on worst-case operating conditions with all equipment at the RRPP (and Landfill) operating simultaneously, noise propagation enhancing meteorological conditions, doors of buildings open and the application of a 5 dBA adjustment for special audible characteristics. The results show it is practicable for compliance to be achieved at all sensitive receiver locations during daytime hours, with one exceedance predicted along the eastern boundary shared with a nearby industrial premise. A 2-metre-high noise barrier has been modelled along a section of the shared eastern boundary to reduce noise levels in order to comply with the noise limit. With the barrier in place, noise levels are sufficiently reduced to comply with the daytime noise criterion. The recommended location and extent of the 2-metre-high noise barrier is shown in Appendix B.

A night-time operational scenario has also been modelled to determine if night operations between the hours of 10:00 pm to 7:00 am is possible without adversely impacting surrounding sensitive receivers. Compliance with the night-time criterion is achieved with the presented scenario that allows for the organics blower to operate, the BWTS (with the Materials Handler and Loader operating inside with the doors closed), and a single trip from the BWTS offtake vehicle (heavy truck) departing in a clockwise loop around the MRF building. The results of this assessment indicate that while compliance with the nighttime noise limits is possible any activity will need to be carefully managed to enable compliance to be achieved with the night-time noise criterion.

Off-site operational road-traffic noise effects have also been considered. Additional vehicle numbers (both light and heavy) arising from the development have been established based upon the Traffic Impact Assessment (GHD 2024B). Based on these numbers the increase in road-traffic noise is predicted to be less than 1 dBA. This level of increase is typically perceived to be negligible when considered in terms of an increase in loudness.

It is important to note that no distinction is made under the Designation Condition between operational noise and construction noise, therefore the noise limits are applicable to both activities.

The construction scenarios assessed should only be treated as indicative, as the final construction methodology is subject to change. Nonetheless, the noise emissions predicted are useful for establishing the potential emissions to the surrounding environment and informing the potential extent of the effects envelope and practicality of achieving compliance; as opposed to providing a definitive set of noise levels at any one receiver.

The assessment assumes that the hours of noisy construction will typically fall between Monday to Saturday 7:30 am – 6:00 pm. The highest noise levels are predicted during the construction of the MRF building (CS02). Construction noise levels up to 54 dBA at 1 metre from the façade of No.10 Taylor Street and 55 dBA at the South-East Site Boundary location are predicted when the works are located closest to the nearest receivers. On this basis, the construction noise levels comply with the day-time Designation Condition criterion at the site boundary as well as all other noise sensitive receivers.

To facilitate compliance with the Designation Condition noise criteria the mitigation and management of noise emissions from both the construction and operation of the RRPP are proposed under the recommended management plans. The measures recommended under Table 7.1 and Table 7.2 are to be incorporated into the CNVMP and the Land Fill Management Plan as appropriate.

The assessment of acoustic effects summarised in this report is based on the current engineering design of the project. As the detailed engineering design progresses, DCC and ESL will have a more advanced understanding of noise emissions resulting from the project. DCC and ESL is committed to further assessment of potential noise impacts from the project where future design of the facility indicates emission conditions may not be consistent with those presented or assumed within this report. Further assessment will be completed as required prior to the operation of any plant generating noise on the project site.

# 9. Limitations

*This report: has been prepared by GHD for Dunedin City Council and may only be used and relied on by Dunedin City Council for the purpose agreed between GHD and Dunedin City Council as set out in section 1.3 of this report.*

*GHD otherwise disclaims responsibility to any person other than Dunedin City Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.*

*The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.*

*The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.*

*The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 5 and 6 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.*

*The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.*

*Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.*

*GHD has prepared the SoundPLAN Noise Model ("Model") for, and for the benefit and sole use of, Dunedin City Council to support the determination of construction and operational noise impacts and must not be used for any other purpose or by any other person.*

*The Model is a representation only and does not reflect reality in every aspect. The Model contains simplified assumptions to derive a modelled outcome. The actual variables will inevitably be different to those used to prepare the Model. Accordingly, the outputs of the Model cannot be relied upon to represent actual conditions without due consideration of the inherent and expected inaccuracies. Such considerations are beyond GHD's scope.*

*The information, data and assumptions ("Inputs") used as inputs into the Model are from publicly available sources or provided by or on behalf of the Dunedin City Council, (including possibly through stakeholder engagements). GHD has not independently verified or checked Inputs beyond its agreed scope of work. GHD's scope of work does not include review or update of the Model as further Inputs becomes available.*

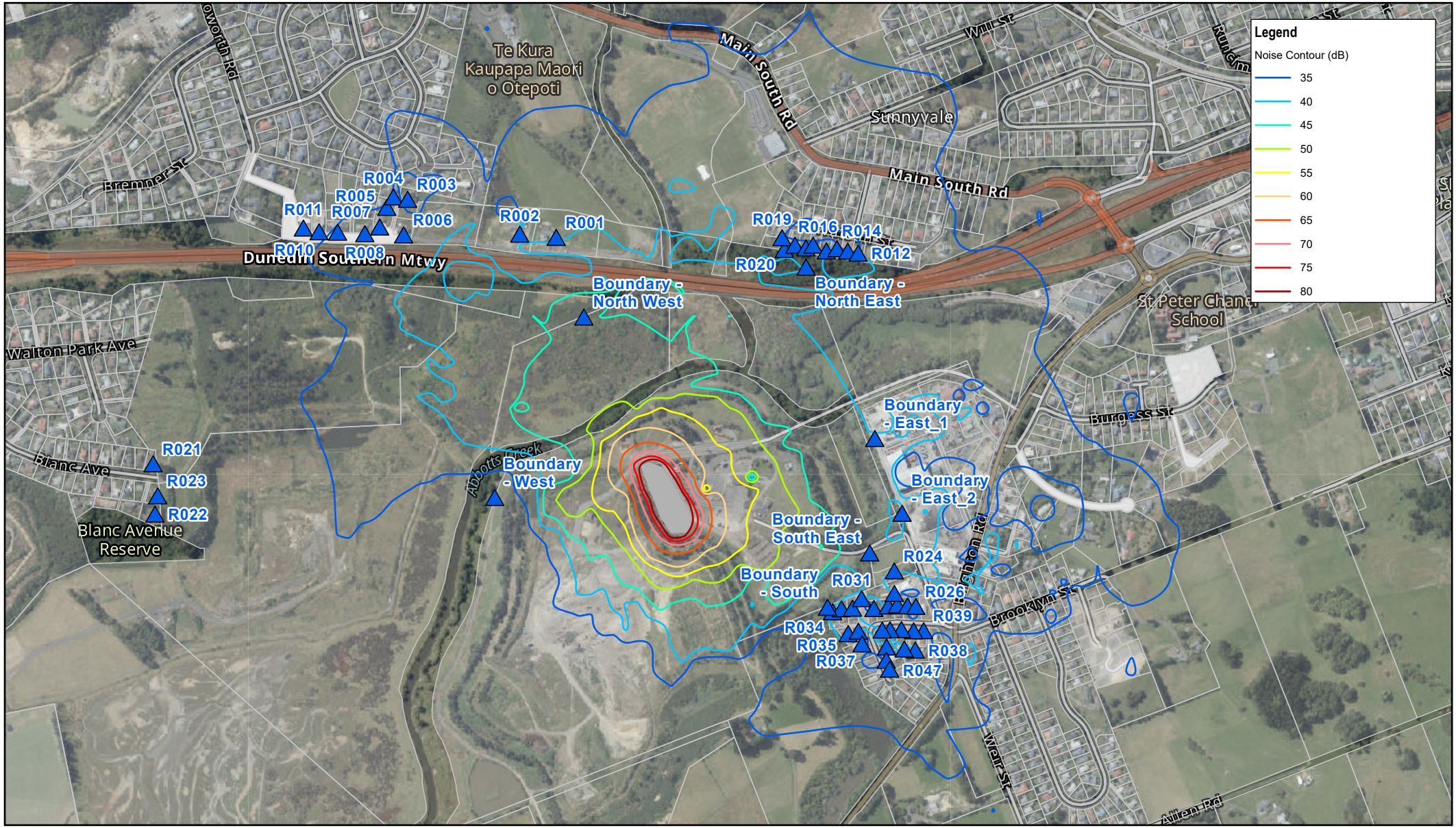
*The Model is limited by the mathematical rules and assumptions that are set out in the Report or included in the Model and by the software environment in which the Model is developed.*

*The Model is a customised model and not intended to be amended in any form or extracted to other software for amending. Any change made to the Model, other than by GHD, is undertaken on the express understanding that GHD is not responsible, and has no liability, for the changed Model including any outputs.*

# Appendices

# Appendix A

## Construction noise contours




**Legend**

- Sensitive Receivers
- Construction Area
- Cadastre

Paper Size ISO A4

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

GHD

**DUNEDIN CITY COUNCIL**
**GREEN ISLAND RESOURCE RECOVERY PARK PRECINCT (RRPP)**

## CS01
## ORGANICS RECEIVAL BUILDING (ORB)
## DAYTIME - 1.5m HEIGHT

Project No. **12613624**
Revision No. **B**
Date **04/10/2023**

# FIGURE A.1

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**Legend**

- Sensitive Receivers
- Construction Area
- Cadastre

Paper Size ISO A4

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

GHD

**DUNEDIN CITY COUNCIL**
**GREEN ISLAND RESOURCE RECOVERY PARK PRECINCT (RRPP)**

# CS02 - MATERIAL RECOVERY FACILITY (MRF) BUILDING 1.5m HEIGHT

Project No. **12613624**
Revision No. **B**
Date **04/10/2023**

# FIGURE A.2

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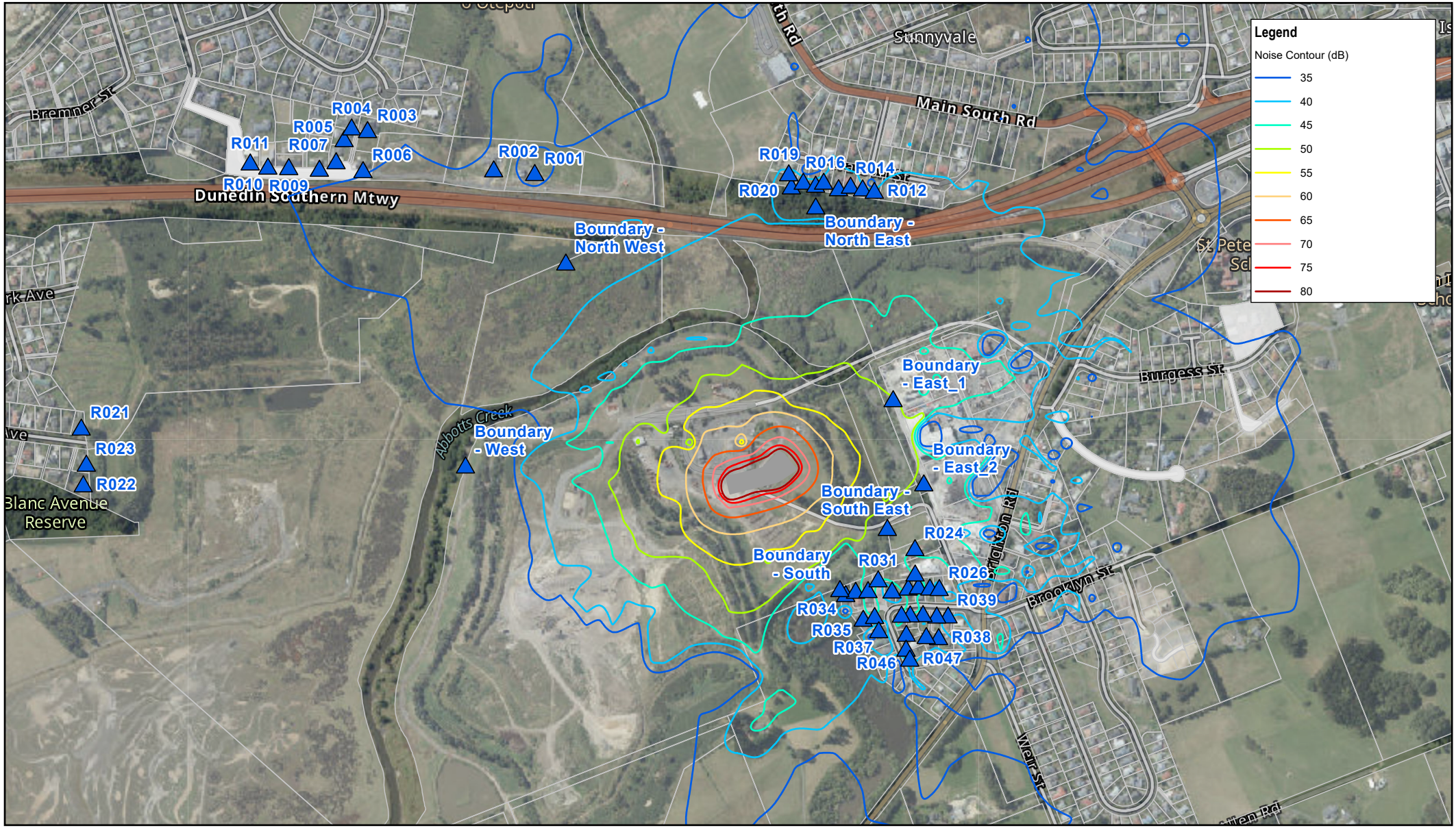


**Legend**

- Sensitive Receivers
- Construction Area
- Cadastre

Paper Size ISO A4

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Meters

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

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GHD

**DUNEDIN CITY COUNCIL**
**GREEN ISLAND RESOURCE RECOVERY PARK PRECINCT (RRPP)**

# CS03 - BULK WASTE TRANSFER STATION (BWTS) BUILDING 1.5m HEIGHT

Project No. **12613624**
Revision No. **B**
Date **04/10/2023**

# FIGURE A.3

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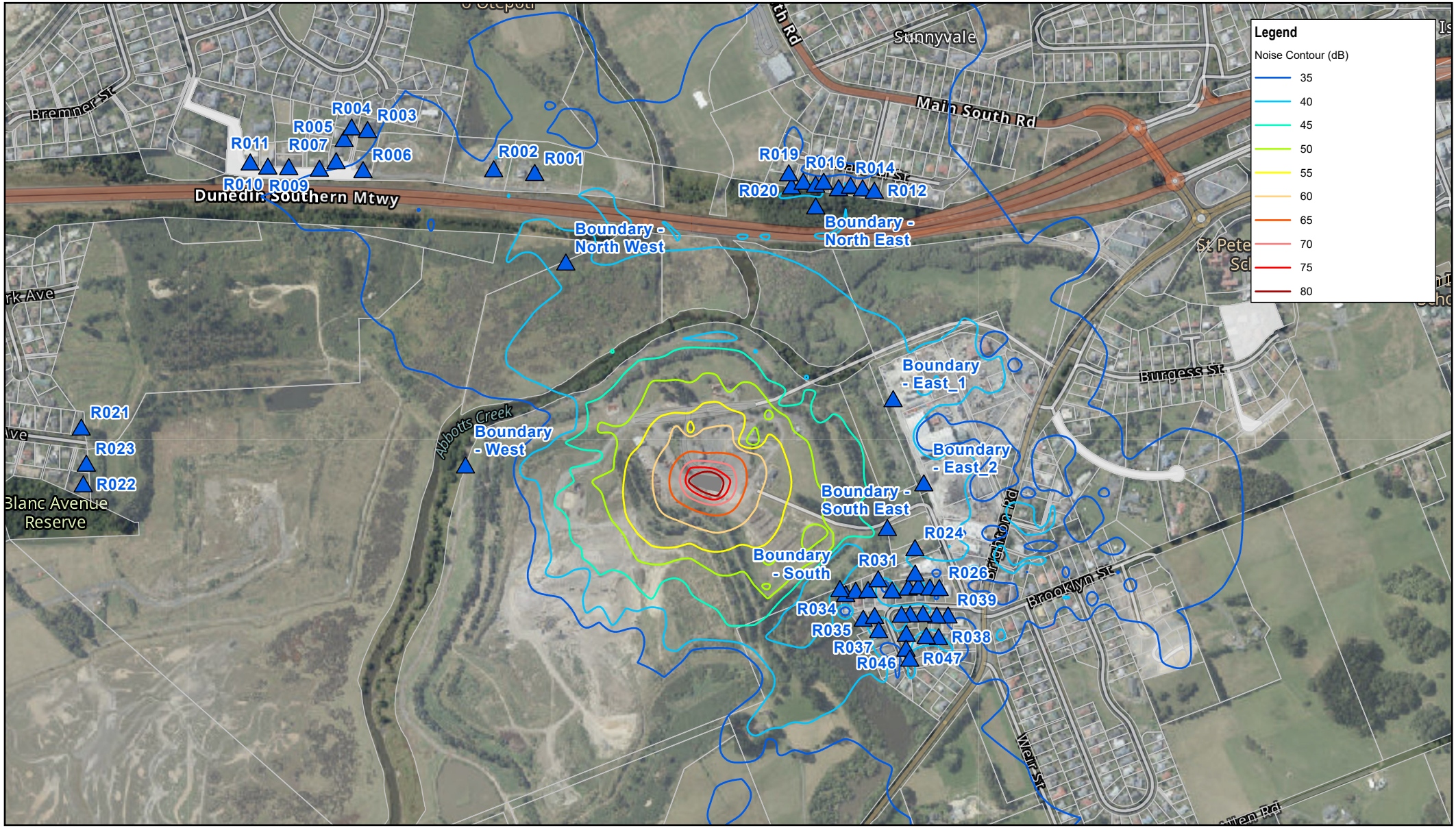


**Legend**

- Sensitive Receivers
- Construction Area
- Cadastre

Paper Size ISO A4

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

GHD

**DUNEDIN CITY COUNCIL**
**GREEN ISLAND RESOURCE RECOVERY PARK PRECINCY (RRPP)**

**CS04**
**OFFICES**
**1.5m HEIGHT**

Project No. **12613624**
Revision No. **A**
Date **04/10/2023**

# FIGURE A.4

\\ghdnet\ghd\NZ\Christchurch\Projects\51\12613624\GIS\Maps\Deliverables\12613624_Green_Island_RRPP\12613624_Green_Island_RRPP.aprx - 12613624_FigC_4_Offices
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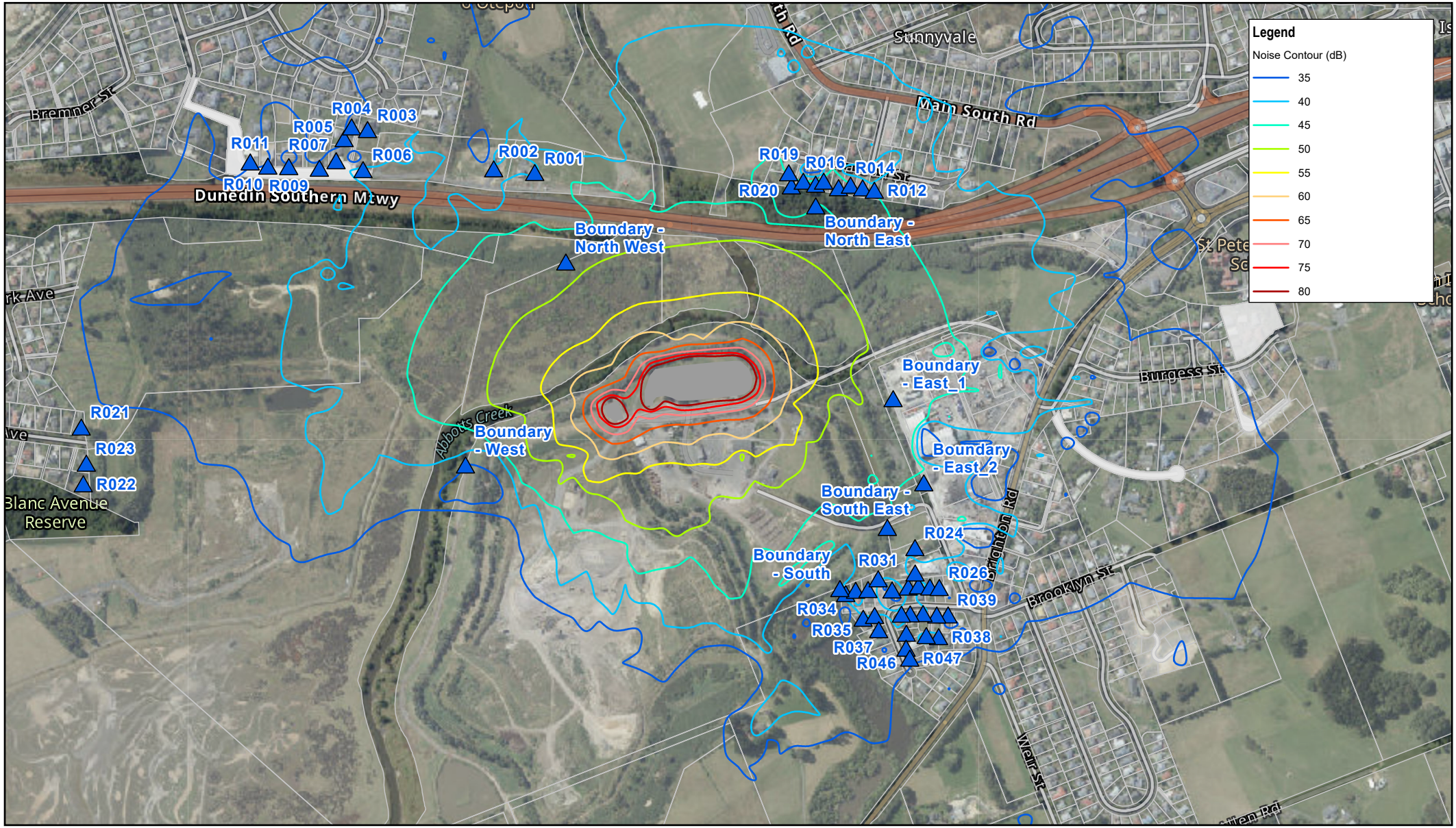


**Legend**

- Sensitive Receivers
- Construction Area
- Cadastre

Paper Size ISO A4

0 50 100 150 200

Meters

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

GHD

**DUNEDIN CITY COUNCIL**
**GREEN ISLAND RESOURCE RECOVERY PARK PRECINCT (RRPP)**

## CS05 BUNKERS 1.5m HEIGHT

Project No. **12613624**
Revision No. **B**
Date **04/10/2023**

# FIGURE A.5

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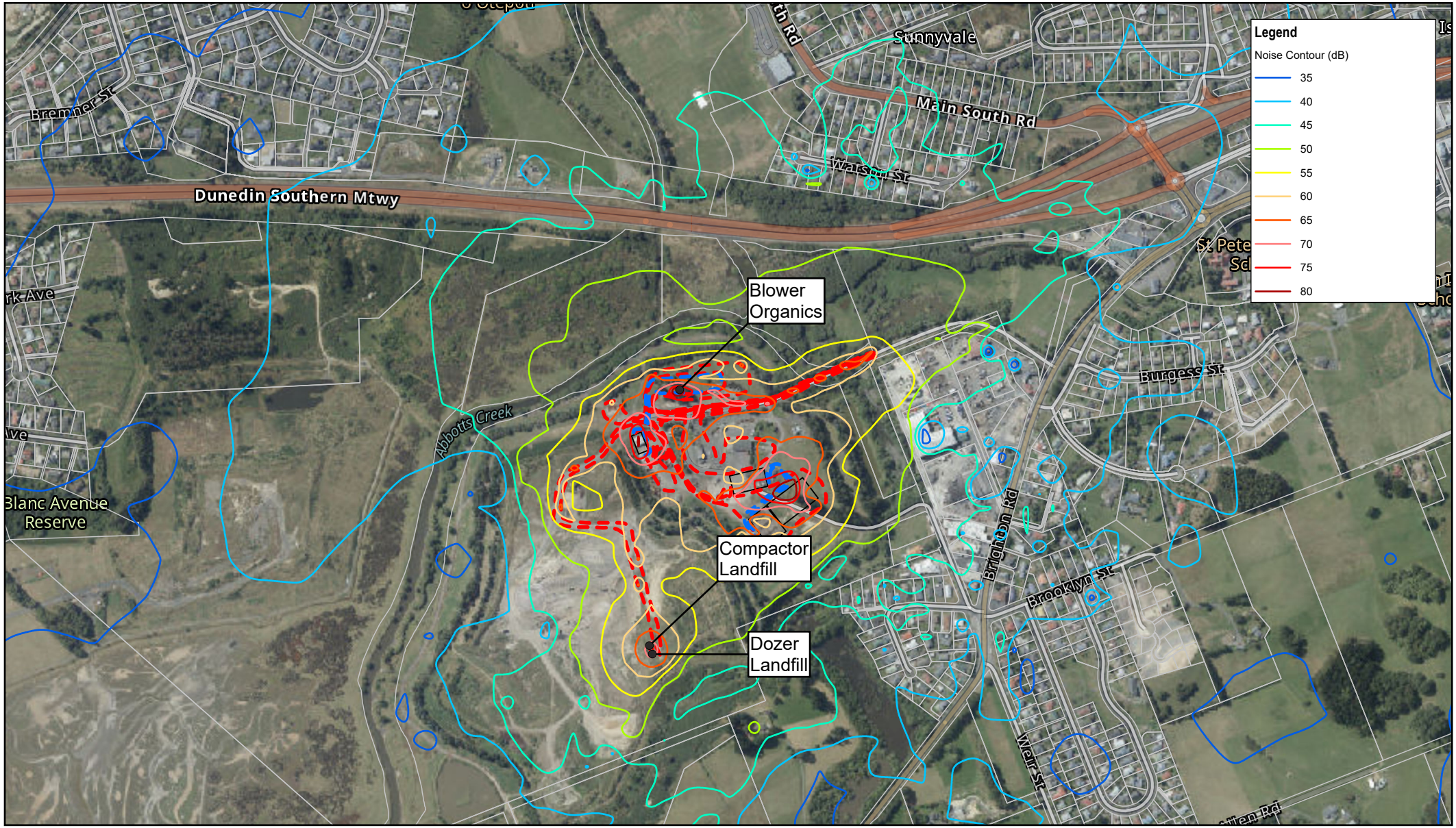
# Appendix B

## Operational noise contours




**Legend**

- Equipment
- Front End Loader
- Semi Trailer
- Site Layout
- Cadastre

Paper Size ISO A4

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

GHD

**DUNEDIN CITY COUNCIL**
**GREEN ISLAND RESOURCE RECOVERY PARK PRECINCT (RRPP)**

# LANDFILL AND RRPP DAYTIME - 1.5m HEIGHT - 5 dBA SPECIAL AUDIBLE CHARACTERISTIC CORRECTION

Project No. **12613624**
Revision No. **B**
Date **04/10/2023**

# FIGURE B.1

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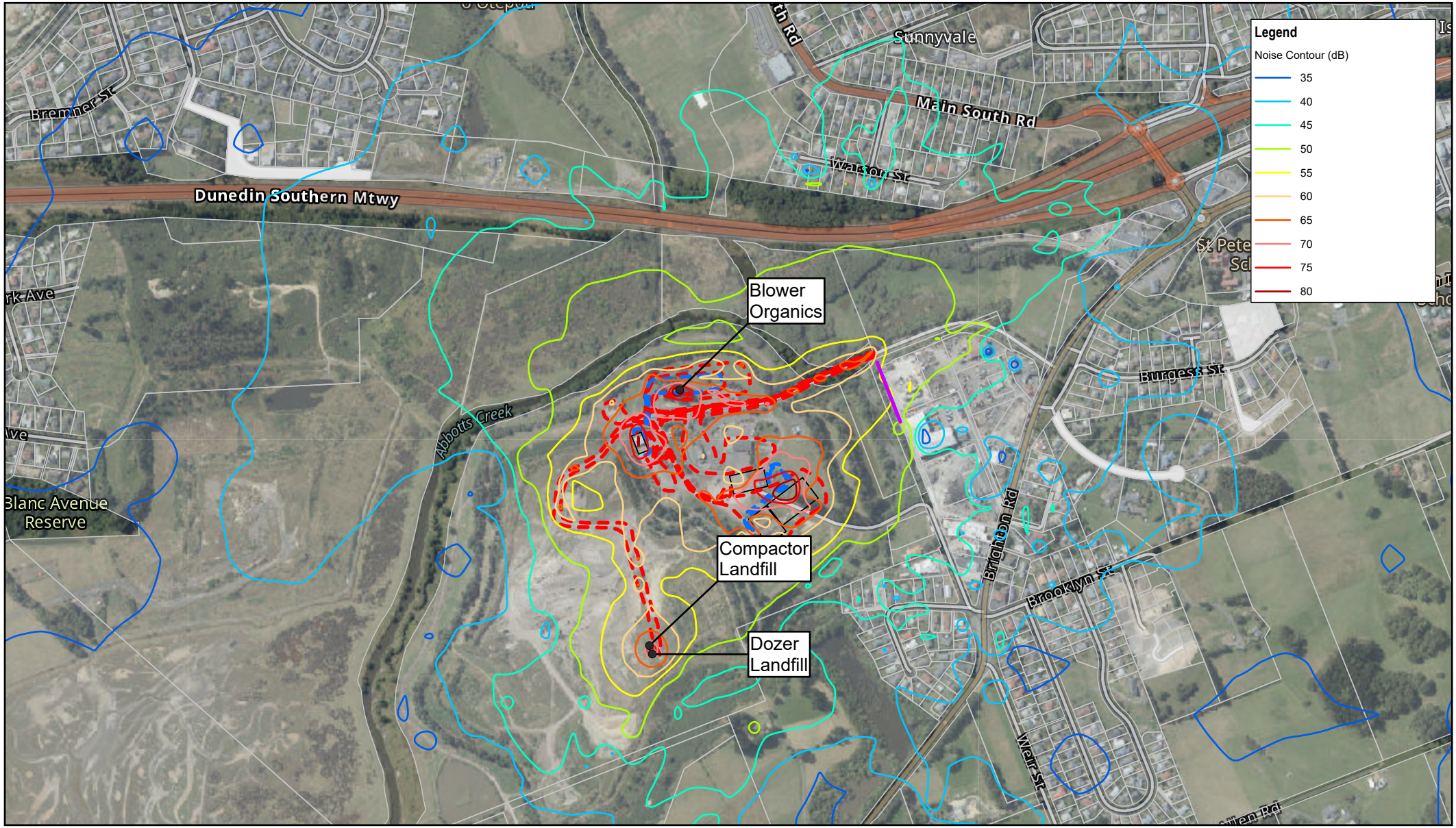


**Legend**

- Equipment
- Front End Loader
- Semi Trailer
- Site Layout
- Cadastre
- Noise protection wall

Paper Size ISO A4

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

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GHD

**DUNEDIN CITY COUNCIL**
**GREEN ISLAND RESOURCE RECOVERY PARK PRECINCT (RRPP)**

**OPERATION - LANDFILL AND RRPP 2m NOISE BARRIER**
**DAYTIME - 1.5m HEIGHT - 5 dBA SPECIAL AUDIBLE CHARACTERISTIC CORRECTION**

Project No. **12613624**
Revision No. **B**
Date **04/10/2023**

# FIGURE B.2

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