PATTLE DELAMORE PARTNERS LTD

Peach Island Quarry – Assessment of Air Quality Effects

CJ Industries Limited

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Prepared for

CJ Industries Limited

July 2022

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Quality Control Sheet

TITLE	Peach Island Quarry – Assessment of Air Quality Effects
CLIENT	CJ Industries Limited
VERSION	Final
ISSUE DATE	14 July 2022
JOB REFERENCE	C04627800
SOURCE FILE(S)	C04627800R001_Final.docx

DOCUMENT CONTRIBUTORS

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Limitations:

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Executive Summary

Pattle Delamore Partners Limited (PDP) was engaged by CJ Industries Limited (CJ Industries) to prepare an Air Quality Impact Assessment regarding a resource consent application to Tasman District Council (TDC) for a proposed gravel quarry located at 134 Peach Island in Motueka.

The aim of this report is to determine the potential air quality effects beyond the site boundary as a result of discharges to air at the proposed gravel quarry, namely dust-generating activities. The following proposed activities at the site have the potential to generate dust emissions:

- Site preparation and restoration (including cleanfilling);
- Gravel extraction (including soil and overburden);
- Materials handling and temporary storage (including soil, overburden and aggregate); and,
- Vehicle movements on unsealed site roads and surfaces.

The area of land to be actively quarried will be limited to 1,600 m^2 at any one time (slightly smaller than two Olympic sized swimming pools). There will be no aggregate crushing or screening on site. The extracted material will be stockpiled and transported off site for process. The combination of 1,600 m^2 quarry and no aggregate processing will result only small amounts of dust being discharged from the site.

A qualitative risk assessment for dust was undertaken in accordance with FIDOL and IAQM guidelines assessment methods (described in Sections 7.1 and 7.2). This method determined the potential dust risk and magnitude of effects in the surrounding community and facilitated the identification of the mitigation and monitoring measures that will be required. The focus of the dust impact assessment in this report is on the larger particles, usually termed dust or total suspended particulate (TSP), which tend to settle out of the air quickly, and their potential to cause offsite dust nuisance effects.

A number of best practice mitigation measures have been recommended in this report to control dust emissions at the project site. Providing that the mitigation measures recommended in this report in conjunction with the implementation of the Dust Management and Monitoring Report (DMMP) are effectively implemented by CJ Industries, dust emissions will be minimal.

The dust assessment concludes that the dust discharged from the proposed quarry will have a less than minor adverse effect on amenity values, horticultural activity and human health. The key factors which determined this result is the small scale of activities and the effectiveness of the proposed mitigation and monitoring measures.

It is also anticipated that there will be no exceedances of the National Environmental Standards for Air Quality or Ambient Air Quality Guidelines for PM_{10} beyond the boundary of the project site, as a result of particulate emissions and there will be no adverse public health risks from respirable crystalline silica discharged from the proposed quarry, providing that the mitigation measures are implemented at all times. Any potential health effects caused by the emission of PM_{10} from the proposed site is considered to be less than minor.

The DMMP (Appendix B) describes mitigation measures which will ensure a negligible risk is maintained to all sensitive receptors, and monitoring will ensure dust particulate matter concentrations are measured and maintained well below AAQG limits.

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1.0 Introduction

1.1 Purpose of the Assessment of Environmental Effects

CJ Industries Limited (CJ Industries) proposed to establish a new gravel quarry at 134 Peach Island in Motueka. CJ Industries have applied for resource consents Tasman District Council (TDC) to authorise the extraction of gravel, stockpiling of topsoil, and reinstatement of quarried land, with associated amenity planting, signage, and access formation. The consent applications are being processed via the public notification pathway with a number of submissions having been made and a hearing scheduled for August 2022.

The purpose of this report is to provide an air quality assessment prepared in accordance with the Ministry for the Environments Good Practice Guides for the Assessment and Management and Dust to support CJ Industries' application and the TDC hearing process.

1.2 Site Location and Discharge of Contaminants

CJ Industries propose to develop and operate a gravel quarry at 134 Peach Island in Motueka (Lot 2 DP 2357 and Lot 2 DP 432236), the area of which is shown Figure 1 below.

Figure 1: Location and boundary of the proposed gravel extraction site

The site is approximately 4 km from the township of Motueka and is surrounded by the Motueka River to the east, apple orchards to the north and northwest as well as bushland forest and agricultural land to the west and south.

The extraction and handling of gravel, including truck movements to and from the site, has potential for discharges of fugitive dust

2.0 Activities and Site Layout

2.1 Background

C J Industries currently holds consents RM150901 and RM150896 to extract gravel from the banks of the Motueka River at 83 Douglas Road. CJ Industries has been undertaking gravel extraction in this location since 2002 (under NN020167). CJ Industries are familiar with the operation of gravel extraction including site development staging extraction, and site rehabilitation. They are well versed in monitoring and mitigating the impacts of dust therefore enabling them to undertake this type of activity without causing any significant dust impacts.

Gravel is in high demand and has a high value because of regional growth and limited supply throughout the Tasman region, however, the majority of the available gravel material from Douglas Road is near to being exhausted (Planscapes (NZ) Limited, 2021). Therefore, CJ Industries has applied for further resource consents in order to extract gravel material for high end use such as concrete, seal chip and roading projects in the Tasman region. The application site is considered to be a desirable location for gravel extraction, despite not being within the gravel extraction zone, because of the high-quality aggregate that is available and the relatively close carting distances.

The property contains a house and sheds, but not within the area proposed to be excavated (see Figure 3 for location of the house) and is accessed from Peach Island Road through the use of a Right of Way (ROPW). The property is flat positioned within quaternary river gravels and is currently in pasture for grazing dry stock.

2.2 Site Development and Remediation

Removal of topsoil and overburden will be undertaken incrementally, and these materials will be stockpiled for rehabilitation in piles which are aligned parallel to the flow of flood water. The topsoil will be removed by a motor-scraper or bulldozer. The topsoil will be stockpiled by a front-end loader.

Backfilling will be undertaken at every possible opportunity even when no new excavation is occurring. No excavated piece of ground will remain open for longer than 12 months on completion of excavation from any individual hole

No excavation will occur within 20m of stop banks, on the Motueka River side of the stop bank within Lot 2 DP 2357, nor within the land surrounding the dwelling and sheds. Any excavation which approaches property boundaries will have a 1:1 batter of material which will remain unexcavated. Furthermore, Gravel will be extracted progressively in an upstream direction starting at the downstream end

of the property, and all excavation will occur in strips (20 m wide x 80 m long) which are aligned parallel to the general direction of flood flow. The area of land to be actively quarried will be limited to 1,600 m^2 at any one time (slightly smaller than two Olympic sized swimming pools).

2.3 Proposed Gravel Extraction and Transport

CJ Industries proposes to undertake gravel extraction in three stages (Figure 2), over a period of 15 years.

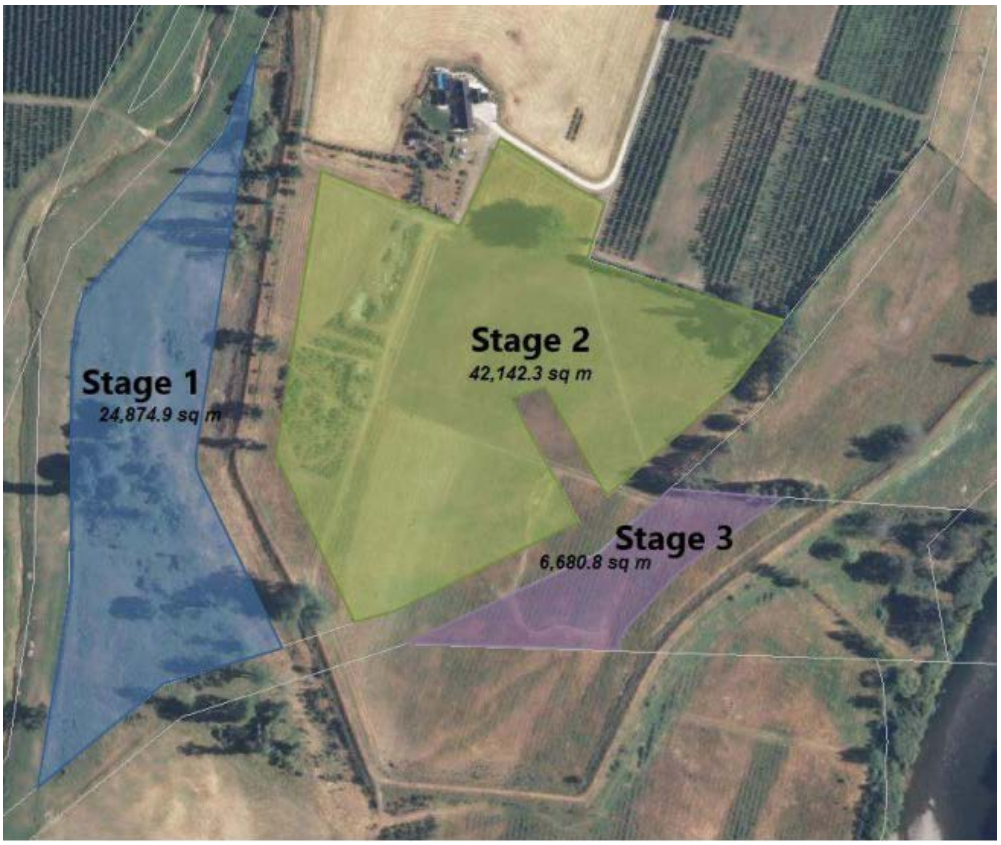


Figure 2: Staging plans for the extraction of gravel at Peach Island Quarry

There is an apple orchard that is located on the northern eastern boundary of the Stage 2 area. Quarrying within 100 m of this orchard boundary is proposed to only occur over the months of May to October (the wet less windy time of the year). CJ Industries will move between stages 2 and 3 to suit the time of the year. Extraction is expected only to be undertaken for approximately one week of each month, however this may increase during periods of high demand so CJ Industries do not want to be limited to this duration.

Gravel will be extracted and stockpiled onsite through use of excavators, dozers and dump trucks within the site and truck and trailer units will be used to transport gravel offsite and return with cleanfill material. Machinery types and sizes are shown in Figure 3 below.

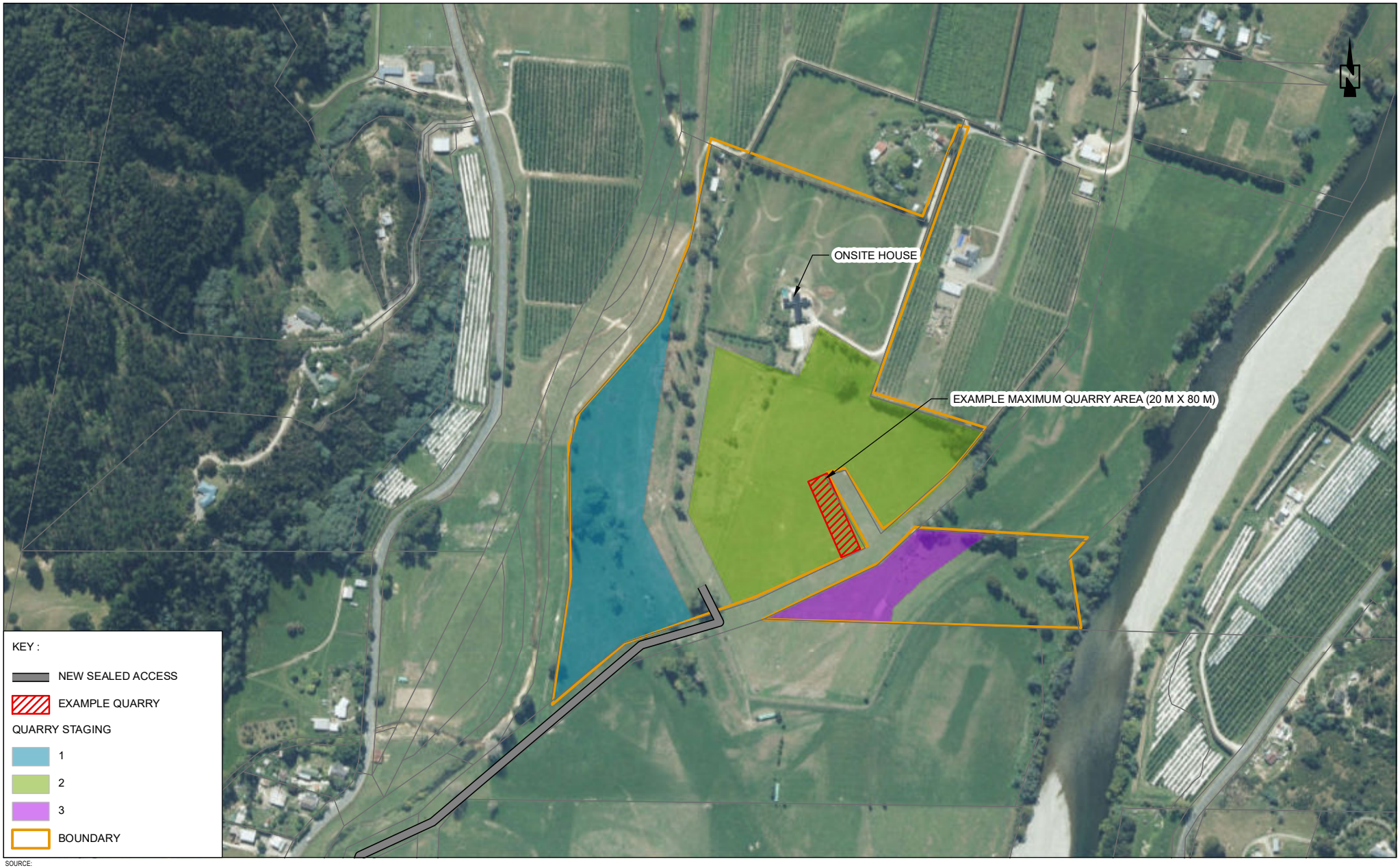
Machine	Purpose	Machine	Purpose
30 Ton Moxy Dump Trucks 	Transport aggregates from the excavation site to the stockpile.	30 Ton Excavator with GPS depth control & recording ability. 	To remove topsoil and create berm, to extract aggregates from pit and load dump truck.
Loader 	To load trucks from the stockpile.	Dozer D65 	To reinstate the excavation; push in back fill and topsoil.
36 & 38 Tonne Truck & Trailers 	To cart aggregate from stockpile to Hau Road for screening and crushing.		

Figure 3: Types of machinery proposed for use for gravel extraction onsite

A 30 tonne excavator, up to three Moxy dump trucks and a loader will be operating while extraction activities are taking place, this will be for approximately one week in four. The material may either be stockpiled or loaded directly on to the trucks once excavated. All excavation will occur in strips (20 m wide x 80 m long at a time) and will be undertaken by the 30-tonne excavator and loader which will load material into various transport machinery, dozers will be used to push material around and smooth and compact filling material, and dump trucks will be used for internal transportation.

There will be up to 15 truck and trailers come to the site for clean fill import and aggregate export for each day. There is the potential for this operation to happen every working day of the month.

CJ INDUSTRIES - PEACH ISLAND QUARRY



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2. HORTICULTURE TYPES SUPPLIED BY CJ INDUSTRIES

FIGURE 4 : PEACH ISLAND QUARRY - ADDITIONAL SITE DETAILS

SCALE : 1:5,000 (A4)

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METRES

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No processing, crushing or screening of materials will occur on the site. Hours of operation will be limited to 7.30 am to 5 pm Monday to Friday, with no work during weekends or on public holidays.

Up to 15 truck and trailer units will enter/exit the site each day. Trucks or truck-and-trailer units will carry up to 38 tonnes of material each, with a maximum of 570 tonnes of gravel transported each day. Trucks will return with back fill material as often as possible, in order to minimis traffic movements. The existing paper road (Figure 5) is currently in pasture and will be formed into a sealed road.

Figure 5: Proposed new sealed access road (left) and route to processing site (right)

It is proposed that trucks will travel south along the Peach Island paper road, then via a section of river reserve land before entering Motueka River West Bank Road via the established ROW which services 493 Motueka River West Bank Road where they will continue south. Trucks will cross the Motueka River at the closest bridge on the Alexander Bluff Road.

Between Motueka River West Bank Road and the quarrying site a sealed haul road will be formed and maintained for the duration of the activity. This means that the only unsealed roads with potential for dust generation are the haul roads to each of stages 1, 2 and 3 and to and from any stockpiles.

2.4 Monitoring and Mitigation

In parallel to gravel extraction, CJ Industries propose to undertake mitigation and monitoring to ensure there are no offensive or objectionable dust effects will occur beyond the boundary of the property and any effects from dust are less than minor.

The activity will be undertaken in accordance with a Dust Management and Monitoring Plan (DMMP) which details the mitigation measures and monitoring procedures undertaken onsite. A copy of this plan will be made available onsite to all personnel who will also be trained to undertake gravel extraction activities in accordance with the DMMP (Appendix B).

Dust mitigation and monitoring methods and how the impact of these will ensure the effects from fugitive dust are less than minor are described further in Section 11.0 and 13.0 respectively.

3.0 Particulate Matter Discharges

3.1 Introduction

The key contaminants relevant to this application are:

- Coarse particulate matter (PM) > µm (dust); and
- Inhalable PM comprising particles with a diameter less than 10 µm (PM_{10})

3.2 Types of Particulate Matter

PM is generally categorised by particle size (defined by the aerodynamic diameter of particles) as follows:

- Deposited dust – PM of generally greater than 30 µm in diameter. This coarse size fraction falls out of suspension in the air relatively rapidly and deposits on exposed surfaces, generally within 100 m of the source. The bulk of dust emissions from handling and storage of gravel will be comprised of this fraction.
- Total suspended particulates (TSP) – PM of generally less than 30 µm in diameter. PM of this size fraction remains suspended in the air for a longer time and therefore has the potential to travel further than larger fractions. TSP (particularly the coarse fractions larger than 10 µm) have the potential to affect visibility.
- Fine inhalable or respirable fractions of TSP such as PM_{10} can penetrate the nose or mouth under normal breathing conditions. PM_{10} is currently the preferred indicator of the potential for health effects of PM in New Zealand.

3.3 Dispersion of Particulate Matter

Dust emissions at the Site will be predominantly fugitive in nature (i.e. from area sources as opposed to point sources) and can vary substantially from day-to-day, depending on the level of activity, the number of truck movements and the weather conditions. The scale (or magnitude) of potential dust impacts also depends on dust suppression and other mitigation measures applied by

CJ Industries to control dust emissions on site. Five primary factors influence the potential for dust impacts:

- Wind speed across the surface. Dust emissions from exposed surfaces generally increase with increasing wind speed. However, dust pick up by winds is only significant at wind speeds above 5 m/s (11 knots or a Beaufort scale number of 3). Above wind speeds of 10 m/s (20 knots) dust pick up increases rapidly;
- Moisture content of the material. Moisture binds particles together, preventing them from being disturbed by winds or vehicle movements;
- The area of exposed surface. The larger the area of exposed surfaces the more potential there is for dust emission. Vegetated surfaces are less prone to wind erosion than bare surfaces;
- The percentage of fine particles in the exposed surface material. The smaller the particle size the more easily the particles are able to be picked up and entrained in the wind; and
- Disturbances such as traffic and loading and unloading of materials. Vehicles travelling over exposed surfaces tend to pulverise any surface particles. Particles are displaced from rolling wheels and the surface. Dust is also sucked into the turbulent wake created behind moving vehicles.

3.4 Sources of Particulate Matter

A description of the Site's key dust sources of particulate matter, the type of dust discharged, and the relative size of the dust source are detailed in Table 1.

Table 1: Sources and characteristics of dust

Source	Description	Dust type	Relative size of dust source
Development of site	Removal and stockpiling of overburden	Soil dust Mainly deposited dust or TSP with a small component of PM_{10}.	Medium
Excavation of gravel	Disturbance of material being extracted from the ground will generate dust.	Grey gravel dust. Mainly deposited dust or TSP with a small component of PM_{10}.	Medium
Site access road and other unsealed surfaces.	Dust generated by vehicles traversing Site access road and moving over other unsealed surfaces.	Gray road dust. Mainly deposited dust or TSP with a small component of PM_{10}.	Large

Table 1: Sources and characteristics of dust			
Source	**Description**	**Dust type**	**Relative size of dust source**
	On an average working day, there will be approximately 15 vehicle movements on site.		
Disturbing stockpiles	The deposit and removal of materials from stockpiles will generate dust.	Grey gravel dust. Mainly deposited dust or TSP with a small component of PM_{10}.	Medium
Stockpiles	Higher speed winds passing over stockpiles can generate dust.	Grey gravel dust. Mainly deposited dust or TSP with a small component of PM_{10}.	Small

4.0 Potential Impacts of Particulate Matter Discharges

Particulate emissions have the potential to cause nuisance beyond the site boundary. Dust nuisance is caused where dust has impacts on amenity values. Annoyance to neighbours may occur from soiling of property such as windows, houses, cars, and washing hung out to dry. The degree of amenity effects tends to increase with darker colors of dust. For example, coal dust is considered more offensive than grey aggregate dust. For most people, the major effect of nuisance dust is the increased requirement for cleaning.

Dusty conditions can adversely affect people's ability to enjoy an outdoor environment. Airborne dust can cause effects on visibility and are largely considered a matter of aesthetics. Visibility effects are usually only a concern in the immediate vicinity of the source. Extreme loss of visibility can also be a safety concern for road traffic and aircraft. Section 11.0 of this report provides an assessment of the amenity impact of dust on the nearest sensitive receptors to the site.

High dust loadings can have a significant effect on plant life including:

- Reduced photosynthesis leading to reduced growth and plant vigour;
- Increased incidence of pests and disease;
- Reduced effectiveness of pesticide sprays; and
- Crop blemishing potentially leading to the downgrading of produce.

With particular regard to the surrounding apple and kiwifruit orchards, nuisance dust settlement around the orchard may impact the quality of apple growth or quality of fruit produced by the orchard.

Human health effects can occur from exposure to PM_{10} and smaller size fractions of particulate matter. Section 11.0 of this report provides an assessment of the potential human health impacts of dust on the nearest sensitive receptors to the site.

The gavels extracted from the site may contain trace amounts of crystalline quartz silica, which has been classified by IARC as (Group I) carcinogenic to humans when inhaled. Prolonged or repeated inhalation of respirable crystalline silica (RCS) can also cause a lung disorder, silicosis. While the gravels will contain crystalline quartz silica, most of the material is bound into larger particle of rock which cannot be inhaled. RCS is sometimes considered in detail for large scale quarries when they are crushing and screening large volumes of gravel which is not the case for Peach Island Quarry.

The potential health impacts of RCS can occur from high short-term or lower long-term exposures. The people most likely to be exposed to concentrations of concern are the quarry employees. CJ Industries Health, Safety and Environment management staff have advised PDP that CJ Industries staff use Personal Protection Equipment where necessary to ensure compliance with the Workplace Exposure Standards and that health impacts have not been observed in CJ Industries Quarry workers.

Any exposures off site will be much lower and less frequent than quarry workers. Section 12.0 of this report provides an assessment of the health impact of quarry dust and RCS on the nearest sensitive receptors.

5.0 Receiving Environment

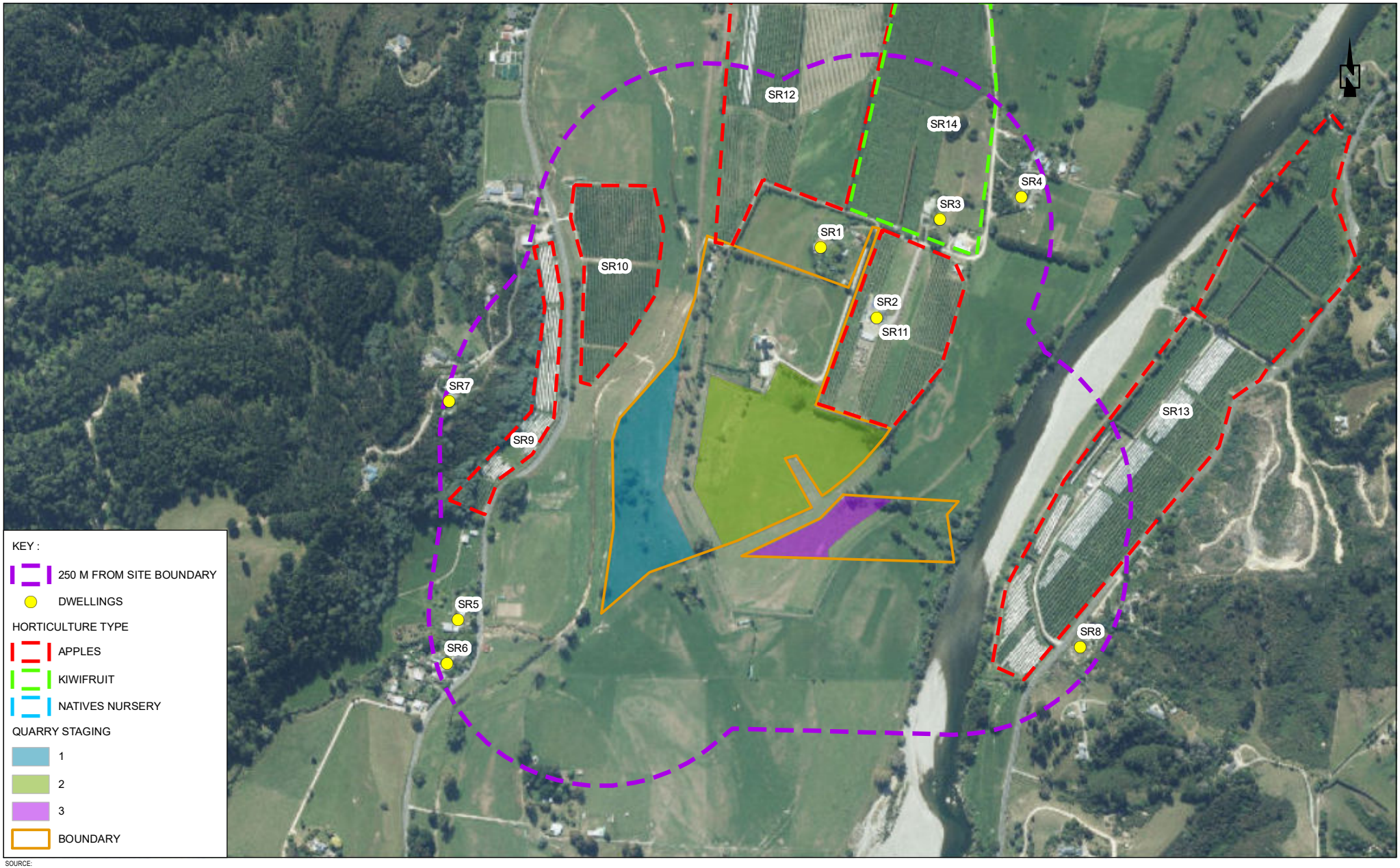
5.1 Sensitivity of Receiving Environment

The Site is located on Rural 1 zoned land (Tasman District Council, 2022) in Ngatimoti, Motueka. The site is currently agricultural pasture.

The site is approximately 4 km from the township of Motueka and is currently surrounded by the Motueka River to the east, apple and kiwifruit orchards (both highly sensitive) to the north and northwest as well as bushland forest and agricultural land to the west and south (both low to moderate sensitivity).

Figure 6 shows the locations of each of these receptors as well as the areas used for growing kiwifruit and apples.

CJ INDUSTRIES - PEACH ISLAND QUARRY



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2. HORTICULTURE TYPES SUPPLIED BY CJ INDUSTRIES

FIGURE 6 : PEACH ISLAND QUARRY - EXISTING ENVIRONMENT

SCALE : 1:7,500 (A4)

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Residential, ecological receptors and rivers are considered to have a high sensitivity to dust impacts, and the presence of wāhi tapu is listed as a cultural matter that may require consideration in the Ministry for the Environment's (MfE) Good Practice Guide to Assessing and Managing the Impacts of Dust (MfE, 2016). Therefore, these 8 identified sensitive receptor dwellings and 6 horticultural areas have been considered within the assessment of dust impacts in Section 11.0.

The proposed site and location of each of the sensitive receptors is shown in Figure 6. The details of each of the building with 250 m of the quarry are shown in Table 2. The details of each of the orchards are shown in Table 3.

The MfE Dust GPG recommends that a dust assessment consider the impacts on specific locations with high sensitivity to the impacts of dust. Experience in New Zealand is that there are limited amenity effects of dust discharges on receptors beyond 250 m.

Table 2: Potential Sensitive Receptors – Buildings within 250 m of the Quarry

Type	Identifier	Location	Shortest Distance to Quarry Boundary	Distance to Nearest Active Pit	Downwind Direction of Quarry
Dwelling / sheds	SR1	132 Peach Island Road	35 m	180 m	S
Dwelling / sheds	SR2	131 Peach Island Road	30 m	125 m	SWS
Dwelling / sheds	SR3	130 Peach Island Road	95 m	300 m	SWS
Dwelling / sheds	SR4	121 Peach Island Road	205 m	395 m	SW
Dwelling / sheds	SR5	458 Motueka River West Bank Road	200 m	210 m	NE
Dwelling / sheds	SR6	470 Motueka River West Bank Road	240 m	230 m	NE
Dwelling	SR7	396 Motueka River West Bank Road	250 m	250 m	E
Dwelling	SR8	85B Motueka Valley Highway	220 m	350 m	NW

Notes:

1. *Downwind direction considered for entire site boundary due to uncertainty about specific sensitive area within the site.*
2. *Dwellings and buildings have been identified through desktop study using google maps.*

In addition to dwellings and buildings identified the following horticultural industries have been identified as sensitive businesses where fruit growing or plant nurturing may be adversely effected as a result of dust deposition on plants.

Table 3: Orchards/Plant Nurseries within 250 m of the Proposed Quarry

Type	Identifier	Location	Shortest Distance to Quarry Boundary	Distance to Nearest Active Pit	Downwind Direction of Quarry
Apples	SR9	Motueka River West Bank Road (west side)	95 m	95 m	E, SE
Apples	SR10	Motueka River West Bank Road (east side)	60 m	60 m	SE, S
Apples	SR11	Peach Island Road (south side – closest to quarry)	0 m	0 m	SE, S
Apples	SR12	Peach Island Road (north side)	0 m	190 m	S
Apples	SR13	Motueka Valley Highway (west side)	90 m	210 m	SW, W
Kiwifruit	SR14	Peach Island Road	10 m	250 m	SE, S

Notes:

1. *Downwind direction considered for entire site boundary due to uncertainty about specific sensitive area within the site.*
2. *Horticulture types have been identified through google maps desktop study and communications with CJ Industries.*

In addition, the Motueka River flows past the site directly to the east of the nearest site boundary (120 m from the closest Stage 3 excavation) and needs to be considered in terms of sensitivity in conjunction with horticulture and dwellings identified above.

5.2 Local Meteorology

5.2.1 Local Wind Conditions

Meteorological data has been obtained from the Motueka, Riwaka Weather Station (EWS) (12429) for the years 2018 to 2021. This station is situated 3.5 km northeast of the proposed quarry site and will provide data that is representative

to the wind conditions experienced at the site. Average annual wind from 2018 to 2021 is shown as a windrose in Figure 7.

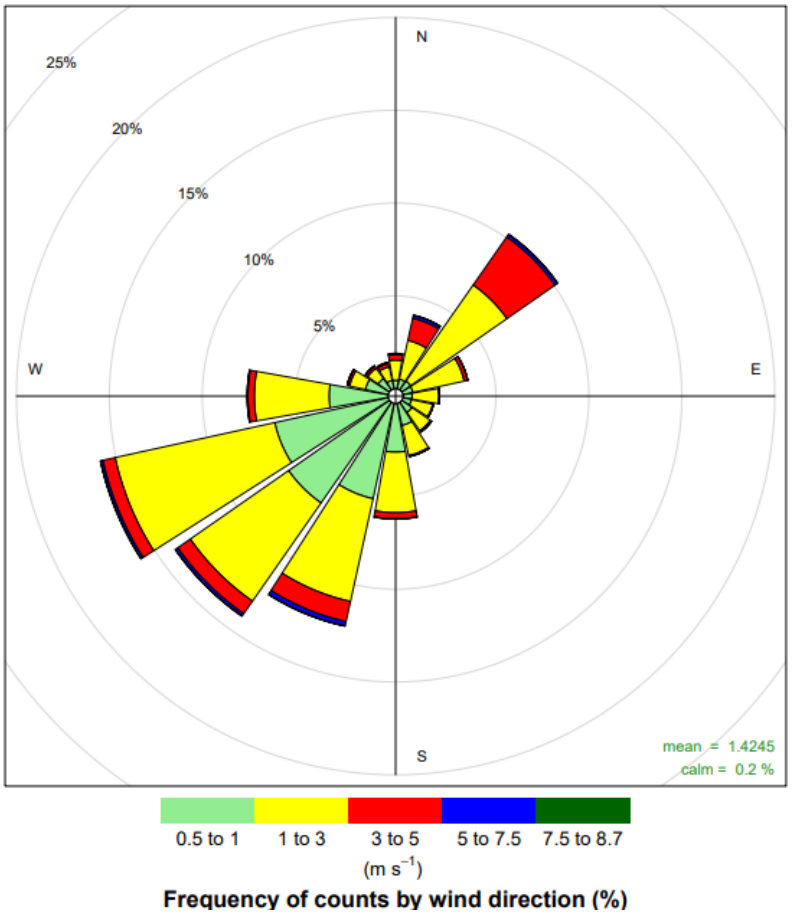

Figure 7: Motueka, Riwaka Weather Station (EWS) (12429) 2018 to 2021

The windrose shows winds from the south-westerly direction are predominant, with winds from the north-easterly direction occurring relatively frequently compared to other wind directions. Additional windroses, further breaking down the data by year and month, are included in Appendix A. These windroses show consistency in the meteorology between various years. Lower wind speeds are more common in the winter months.

In some circumstances wind speeds are not properly recorded if a weather station is sheltered by trees, buildings or hilly topography. It is unknown whether the Riwaka weather station is impacted by any of these factors or whether the area nearby the hills does experience significantly lower wind speeds.

It is possible the Riwaka site is influenced by surrounding shelter belt trees in terms of wind speeds, and potentially to some extent direction, although exact location through desktop study is currently unknown. PDP are aware that there are limitations with the data. To ensure a conservative assessment is undertaken for the purposes of this dust assessment, it is assumed that the Nelson Airport wind conditions are applicable to this site.

5.2.2 High risk dust conditions

Dust mobilising conditions occur when windspeeds are over 5 m/s. High-risk conditions occur when windspeeds are over 7.5 m/s.

At the Nelson Airport site, windspeeds over 5 m/s occur 25% of the time, and 9% of winds are over 7.5 m/s. These winds are primarily from the south-west direction.

When excluding hours that include rainfall greater than 1 mm/hour when hourly evapotranspiration is removed (as this would largely mitigate dust risks), windspeeds over 5 m/s occur 1.2% of the time, and 0.7% of winds are over 7.5 m/s. In general, wet days (rainfall minus evapotranspiration greater than 1 mm/hour) occur for 3% of the year.

This is based on data collected from Nelson Airport weather station between June 2017 – June 2022.

5.3 Existing Air Quality

Existing air quality is expected to be good, with no significant sources of dust nearby except the existing riverbed which will contribute some natural particulate. Agricultural activities in the area also have potential to cause small quantities of dust.

Due to a lack of other sources and distance from any urban areas, the concentrations of air pollutants that have the potential to adversely affect human health is expected to be low (i.e., excellent air quality).

6.0 Dust Assessment Criteria

This section presents the dust assessment criteria relevant to the contaminants being discharged from CJ Industries proposed quarry.

6.1 Amenity Effects

The relevant criterion for amenity dust effects is set out in the *Good Practice Guide for Assessing and Managing Dust* (MfE, 2016):

> *There shall be no discharge of particulate matter that is objectionable to the extent that it causes an adverse effect at or beyond the boundary of the subject property.*

While wording may vary from council-to-council the assessment criteria is widely accepted for use across New Zealand. While this is a qualitative assessment criterion, the Dust GPG provides recommendations on how undertake an objective and robust assessment against this qualitative assessment criteria.

6.2 Buffer Distance

The potential amenity impact of any dust source is highly dependent on the distance between the source and receptor. A receptor that is 250 m or greater from any dust source is highly unlikely to experience a detrimental effect on amenity values. The recommended buffer distance for a quarry without blasting is 250 m (EPA Victoria, 2013). A receptor between 250 m and 100 m from a dust source employing good practice dust suppression measures is unlikely to experience a detrimental effect on amenity values. Any receptor that is less than 100 m from a dust emitting site could potentially experience a detrimental effect on amenity values. However, this risk can be mitigated by proactively using best practice dust mitigation and monitoring methods.

6.3 Health Effects

The relevant guidelines for assessing the off-site health effects of PM_{10} are defined in the NESAQ (Ministry for the Environment, 2004) and ambient air quality guidelines AAQG (Ministry for the Environment, 2002) as follows:

- 50 µg/m³ PM_{10} as a 24-hour average, allowing one exceedance in a 12-month period (NESAQ); and
- 20 µg/m³ PM_{10} as an annual average (AAQG).

7.0 Dust Assessment Method

This section presents the dust assessment methods used to assess the impacts of dust being discharged from CJ Industries proposed quarry.

7.1 Qualitative Method for Assessment of Dust Impacts (FIDOL)

The nuisance effects of dust emissions are influenced by the nature of the source, sensitivity of the receiving environmental and on individual perception. For example, the level of tolerance to dust deposition can vary significantly between individuals. Individual responses can also be affected by the perceived value of the activity producing the dust.

The Ministry for the Environment's (MfE) Good Practice Guide to Assessing and Managing the Impacts of Dust (Ministry for the Environment, 2016) recommends that the nuisance effect of dust emissions may be assessed by using FIDOL factors to take into account the nature of the source in the context of receiving environment. These factors are described in Table 4.

Table 4: Description of the FIDOL Factors	
Frequency	How often an individual is exposed to the dust
Intensity	The concentration of the dust
Duration	The length of exposure
Offensiveness/character	The type of dust
Location	The type of land use and nature of human activities in the vicinity of the dust source

Different combinations of these factors can result in adverse effects. Location is particularly important as this relates to sensitivity of the receiving environment.

Depending on the severity of the dust event, one single occurrence may be sufficient to consider that a significant adverse effect has occurred. In other situations, however, the event may be short enough, and the impact on neighbours sufficiently minor, that the events would need to be happening more frequently for an adverse effect to be deemed to have occurred.

Other factors that may determine whether an offensive or objectionable effect from dust emissions is likely to occur are the presence of background sources of dust. Cultural matters such as the presence of marae, mahinga kai, wāhi tapu, churches, mosques, theatres, art galleries and sporting or recreational areas and venues may also need consideration.

The FIDOL assessment method considers each of these factors in a qualitative manner.

7.2 Source, Pathway, Receptor Model

The Institute of Air Quality Management (IAQM) based in the UK produced a document providing '*Guidance on the Assessment of Mineral Dust Impacts for Planning'* (IAQM, 2016). This describes a source-pathway-receptor (S-P-R) model for the assessment of mineral dust impacts. The S-P-R concept presents the hypothetical relationship between the source(s) of the dust, the pathway (P) by which exposure might occur and the receptor (R) that could be adversely affected. The IAQM S-P-R approach provides a series of assessment matrices which are used to estimate the dust impact risk, the pathway effectiveness and the likely magnitude of amenity effects (e.g. loss of amenity due to dust deposition or visible dust plumes, including nuisance, annoyance or dust complaints) at each sensitive receptor location.

The S-P-R method presented by IAQM has been integrated with the FIDOL assessment method from the MfE Good Practice Guide to provide a comprehensive qualitative assessment of likely dust impacts from activity of quarry activities at Peach Island.

8.0 Dust Mitigation

This section describes the mitigation measures proposed to minimise the amount of dust discharged from the CJ Industries Site.

8.1 Best Practice

Best practice dust mitigation is proposed for the quarrying activities in accordance with Table 4 'Good practice Mitigation – Design Measures' of the IAQM guidelines.

Table 5: Good Practice Mitigation – Design Measures Taken

Mitigation and Design	Description
Phasing of extraction activities	As far as practicable, dust-generating activities have been located away from highly sensitive receptors and activities have been kept at small scales (20 m x 80 m burrows at maximum). Minimisation of dust through site design is addressed through extraction of gravel in 3 stages, minimising unconsolidated areas.
Design and location of dust-generating activities	Stockpiles, haul roads, and exposed areas have located a reasonable distance away from sensitive receptors. Dust generating potential from each of these areas will be minimised.
Provision for dust mitigation measures	The site has a landscape planting plan and recommendation for bund acoustic design which will provide adequate protection at the boundary. Planning and design of the scheme has made provision for water supply to meet the site demand for mitigation and damping.
Equipment and vehicles	The site has been designed to minimise haul route distances and to locate haul routes away from receptors. CJ Industries intend to seal the access road and will minimise haul road distances where possible for each staged area. A long-paved road after the wheel or vehicle washer before joining the public roads, where feasible, reduces the track out off-site.
Planting	Existing trees along site boundaries will be retained where possible.
Management	A DMMP has been produced and will be adhered to. Effective site management practices are critical to demonstrate the willingness of the operator to control dust emissions and provides a mechanism for auditing of site operations. Such management procedures are outlined within the DMMP. This

Table 5: Good Practice Mitigation – Design Measures Taken	
Mitigation and Design	**Description**
	includes recording of all dust and air quality complaints, identification of cause(s), appropriate measures taken to reduce emissions in a timely manner, and record of the measures taken.
Training	CJ Industries provide training to the site personnel on dust mitigation. Training will also cover 'emergency preparedness plans' to react quickly in case of any failure of the planned dust mitigation.
Monitoring	An appropriate monitoring scheme will be implemented. This includes a range from visual inspections, wind monitoring and only in the event of successive complaints, installation of real-time PM_{10} continuous monitoring locations. CJ Industries will undertake daily on-site and offsite inspections, audit the monitoring programme: carry out regular site inspections to monitor compliance with the DMMP and adjust the frequency of site inspections according to dust risk (higher frequency in dry and windy conditions)
Communication	CJ Industries aim to maintain good communication to help alleviate anxieties between the operators and the surrounding communities.
Planning of activities	Some activities should ideally be planned only during favourable weather conditions. Where possible, particularly dusty activities should be avoided during extended periods of dry and windy conditions. As outlined in the DMMP, excavation of gravel will cease if winds are greater than 7.5 m/s.
Vehicle movements	Site traffic is often the greatest source of dust on sites. Standard good practices for site haulage include: ⁘ avoiding abrupt changes in direction ⁘ regular clearing, grading and maintenance of haul routes, CJ Industries find it effective to lay down a bed of pea metal (<6mm stone), which keeps the truck tyres out of contact with fine dust ⁘ setting a site-specific and enforceable speed limit of 15 km/hour ⁘ evenly loading vehicles to avoid spillages

Table 5: Good Practice Mitigation – Design Measures Taken	
Mitigation and Design	**Description**
	⁘ regular application of water in dry conditions ⁘ if other measures aren't successful, clean heavy-duty vehicles used to transport gravels before they leave the site using a wheel-wash system.
Soil and overburden handling	Site stripping and reinstatement operations, and overburden handling activities should be avoided during dry and windy conditions. Soils handling is generally a short-lived activity in a discrete area and there is considerable flexibility as to its timing. Overburden can usually be worked at higher moisture contents than soils which can reduce the risk of unacceptable dust emissions. Use of soil scrapers is effective in minimising soil handling. For all gravel handling it is appropriate to minimise handling and reduce drop heights.

8.2 Site Specific

Table 6 summarises the Site's dust sources and proposed mitigation measures.

Table 6: Sources and mitigation of dust		
Source	**Mitigation**	**Relative impact of mitigated dust source**
On site vehicle movements	Gravel the internal haul roads.	Medium
Unsealed surfaces.	Trafficked and working unsealed surfaces will be watered on a regular basis using a water cart, water cannon or sprinkler system. A speed limit of 15 km/hr is enforced around the gravel pit.	Medium
Gravel extraction in active area.	Excavation and loading will cease if winds above 7.5 m/s occur. Dust suppression will be undertaken through water application on dry days where winds are above 5 m/s. Limit the area of activity to a maximum of 3,000 m². 3m high bund backed by mature trees on the northern boundary of Stage 2.	Medium
Disturbing materials	Good practice machine operation will be implemented including minimizing drop heights and wetting dusty materials when needed. The loading on to, or removal of, material from stockpiles will only be undertaken during low dust risk wind conditions.	Small
Stockpiles	The size and location and surface condition of stockpiles is constructed and maintained in such a way as to minimise any dust emissions. Stockpiles will be located away from sensitive receptors.	Small
Gravel Processing	No gravel crushing or screening will be undertaken on site.	Small
Gravel transportation	Deep sided trucks filled to the appropriate level are used.	Small
Tracking dust onto sealed road	Sweeping or road washing.	Medium to small.

A total of 7.37 ha is proposed to be used for gravel extraction with staging of extraction to minimise dust potential. The total area of unconsolidated surfaces on the Site will not exceed 3,000 m^2 at any time (including active extraction areas, stockpiles and unsealed haul roads). Assuming 100% of this unconsolidated area is regularly trafficked or worked at any one-time, regular watering for dust suppression during periods of high dust risk will be required for the 3,000 m^2 area.

Any excavation which approaches property boundaries will have a 1:1 batter of material which will remain unexcavated to create a buffer from offsite receptors. Furthermore, Gravel will be extracted progressively in an upstream direction starting at the downstream end of the property, and all excavation will occur in strips (up to 20m wide x 80m long). At any one time no more than a 1,600 m^2 strip will be exposed, resulting in each excavation strip yielding up to 8,000 m^3 of gravel matrix.

Quarrying in Stage 2 within 100 m of the apple orchard boundary is proposed to only occur over the months of May to October (the wet less windy time of the year). This seasonal extraction of Stage 2 will add an additional mitigation measure to ensure impacts on the nearby orchard are mitigated. CJ Industries will move between stages 2 and 3 to suit the time of the year. In addition to the seasonal quarrying activity the neighbouring apple orchard will be protected by a 3 m high bund backed by mature trees. These two physical barriers will provide an effective screen between the quarry and the orchard.

8.3 Dust suppression Water Availability

As a benchmark for dust suppression the Ministry for the Environment Good practice guide on assessing and managing dust recommends a water application rate 1 mm/hour (or 1 litre/m2) per hour. Using 1 mm per hour over 3,000 m^2 requires 3 m^3 of water per hour. Over a 10-hour working day the total volume of water required could be 30 m^3. However, it is unlikely that dust suppression would be required over a full day.

These water application volumes are possibly conservative estimates because:

- The application rate of 1 mm/hr is conservative for some areas in NZ
- Depending on dust management strategies:
  - The entire active area may not need watering
  - Every hour in the working day may not need watering
- No impact of meteorological conditions has been considered:
  - Rainfall will reduce water demand
  - Some months/seasons may have lower windspeeds

CJ Industries will ensure that 16 m^3 of water is available daily for potential dust suppression purposes. The main dust suppression measures onsite include sprinkler systems and a water cannon which will be moved around with each staged area that is excavated. There will be a dust suppression cart on site which can provide water for dust suppression only if a suitable sprinkler system which targets the unconsolidated area is not available. Use of a cart rather than fixed sprinkler lines allows dust suppression target areas to move around with staging of gravel extraction. The site's water is supplied by water permit RM171337 which allows CJ Industries to take up to 2,625 m^3 a week for irrigation, and is currently being varied to include use for dust suppression at the quarry.

Should the need be identified by visual dust monitoring, fixed sprinklers, mobile k-line sprinkler system, water truck with cannon may also be opted for instalment along haul roads and active quarry areas in addition to the water cart.

In summary, the site provides access to ample water for typical and for high demand dust suppression. All mitigation installed will be designed to ensure 1 mm water per hour over 3,000 m^2 can be achieved by the quarry operations on dry days at any stage. Details on how mitigation will be installed and managed on site are provided in the Dust management and monitoring plan (DMMP, Appendix B).

9.0 Dust and Meteorological Monitoring

9.1 Meteorological Monitoring

A meteorological station that will measure wind direction, wind speed, temperature and relative humidity will be set up on site. The location of the equipment and location of the meteorological station location will, as far as practical, be consistent with the AS/NZS 3580.1.1:2016.

The meteorological station will provide real time data to the site staff. This information will be used to assist with the dust management of the site. The meteorological system will be set up to send email and SMS text alerts to site staff. An alert will be sent when 1-hour average windspeeds exceed 5 m/s that will be used to prompt site staff to carefully monitor dust sources and implement additional mitigation measures if required. An alert will be sent when 1-hour average windspeeds exceed 7.5 m/s that will be used to prompt site staff to stop work on dust generating activities. DMMP details the monitoring station to be installed and the response procedures to wind trigger alarms

The meteorological data will be archived and be available for reviewing and responding to any dust and odour complaints received by the site staff.

9.2 Dust Monitoring

Given the relatively small size and low risk generated by the site's dust sources, it is considered appropriate and cost effective to monitor any off-site impacts of dust using both scheduled and reactive visual monitoring.

The CJ Industries will implement the following visual dust monitoring programme:

- Undertake daily onsite and offsite visual inspections to monitor deposited dust and visible dust plumes, record inspection results, and make the log available to TDC when requested;
- Carry out regular site inspections to monitor compliance with the DMMP and resource consent conditions, record inspection results, and make an inspection log available to TDC when asked;
- Increase the frequency of site inspections by the person accountable for air quality and dust issues onsite when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions (e.g. spring and summer); and,
- The site's visual monitoring procedure will be detailed in the site's Dust Management and Monitoring Plan (Section 10).

Consideration and implementation of undertaking dust deposition monitoring or continuous real-time monitoring around the site (as a dust management tool), will be made in the unlikely event of dust nuisance complaints or visible dust plumes are seen beyond the site boundary.

10.0 Dust Management and Monitoring Plan

MfE's good practice guide on assessing and managing the impacts of dust (Ministry for the Environment, 2016) specify the content of dust management and monitoring plans (DMMP) and such a plan has been developed for the site. The purpose of the DMMP is to provide a framework for the landfill operations and site personnel, in particular to:

- Facilitate the avoidance, remediation, and mitigation of any adverse effects of discharges of dust generated from the operation of the quarry;
- Promote proactive solutions to the control of dust discharges from the site; and
- Ensure the effective and targeted use of available mitigation measures so that adverse effects of dust and discharges do not breach the dust limits set by the consent.

A draft DMMP is provided in Appendix B. The Table of Contents of the DMMP is as follows:

11.0 Assessment of Amenity Effects from Dust

This section presents the assessment of effects from the dust discharged from the proposed operation. The assessment considers the impacts of the dust sources listed in Section 3.4 using the assessment methods detailed in Section 7.0. The assessment is focused on the sensitive receptors detailed in Section 5.1.

The assessment results for each of the five FIDOL factors are detailed in the following sections. These are then drawn together in a summary assessment which considers the combined influence of all the FIDOL Factors.

11.1 Frequency

11.1.1 Site operations

The traffic assessment indicates anticipated maximum vehicle traffic of 15 daily vehicles to and from site (30 movements total) resulting in 150 vehicle movements per week (300 total movements on the road back and forth). It is understood the site will be operational over a 5-day working week, with Monday-Friday operating during 7.30am to 5pm and no work during weekends. Vehicle movements are spread throughout the operational time and will be subject to peak and lower use periods. The quarry will be active for up to 9.5 hours each weekday all year round, which means the activity occurs frequently.

The annual maximum of 150 vehicles per week consists of truck and trailer units only and it is noted that excavation machinery, onsite haulage in dump trucks and some staff vehicles will also occur on site. To demonstrate that there is some flexibility for addition staff vehicles and machinery, calculations have been based on 4 return trips (8 movements) per hour. This allows for peak hours and additional staff movements.

11.1.2 Impact of meteorological conditions

The description of the meteorology of the area provided in Section 5.2 details the frequency and strength of wind directions and the monthly frequency of wet days. To better understand the winds that are likely to have an impact on dust emissions, the wind data was cross-referenced with the rainfall and evapotranspiration data for the period of 2017 – 2022. Figure 8 shows there is little difference in predominant wind conditions for dry days to the overall windrose for dry and wet days shown in Figure 8.

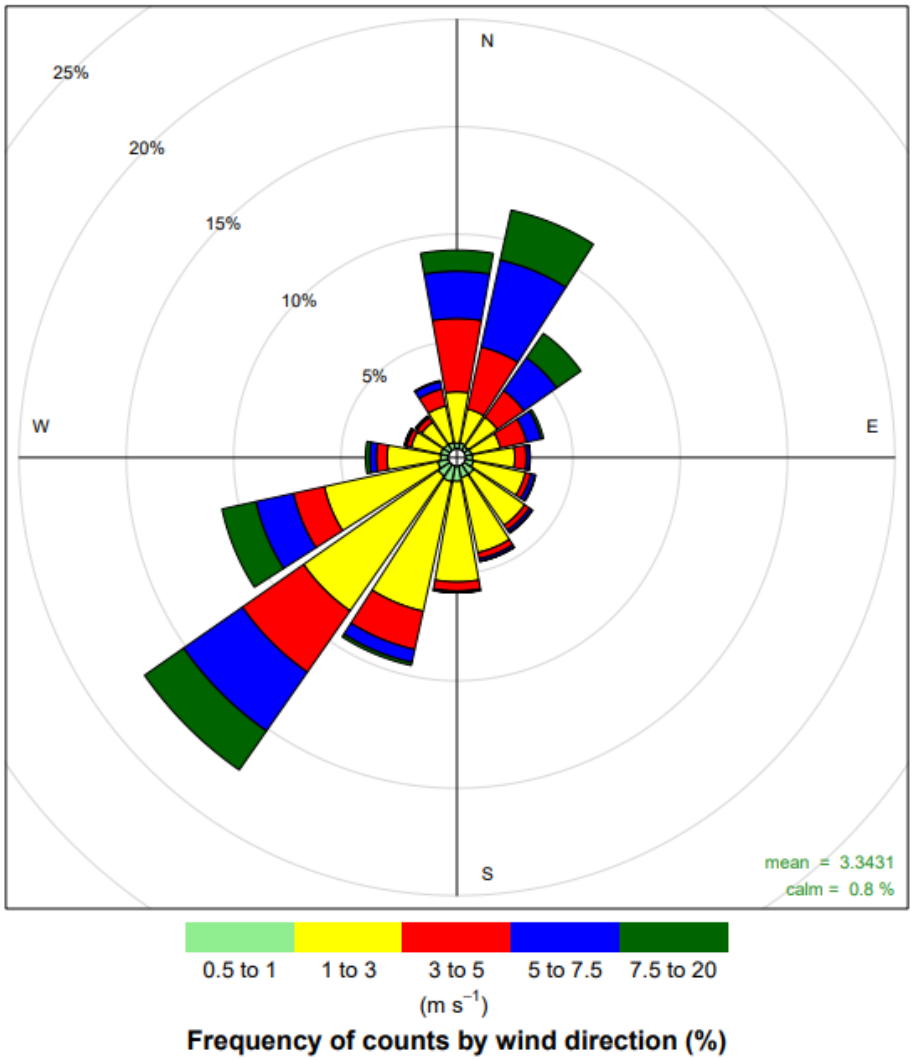

Figure 8: Nelson Airport Windrose for Dry Days Only, 2017 - 2022

The monthly breakdown in Figure 9 shows that most of the time the site will be operating in dry conditions where evapotranspiration is greater than rainfall, with some wet days occurring at low frequencies from all wind directions.

The impact of soil moisture and gravel moisture is one of the factors used in common models used to estimate the relative discharge rate of dust particles from stockpiles, ground disturbance activities and unsealed roads as discussed in Section 3.0. The lowest frequency of wet days occurs during the months of October to April where average monthly evapotranspiration is generally greater than rainfall, as shown in Figure 9. These months will have the highest risk for fugitive road dust emissions based upon the anticipated moisture content of the unconsolidated quarry surfaces. The months of May through to September have higher average rainfall then evapotranspiration potential but on and are the wettest months annually. These months will be associated with a lower risk for

dust emissions based upon surface moisture content, however will still require dust suppression on dry days.

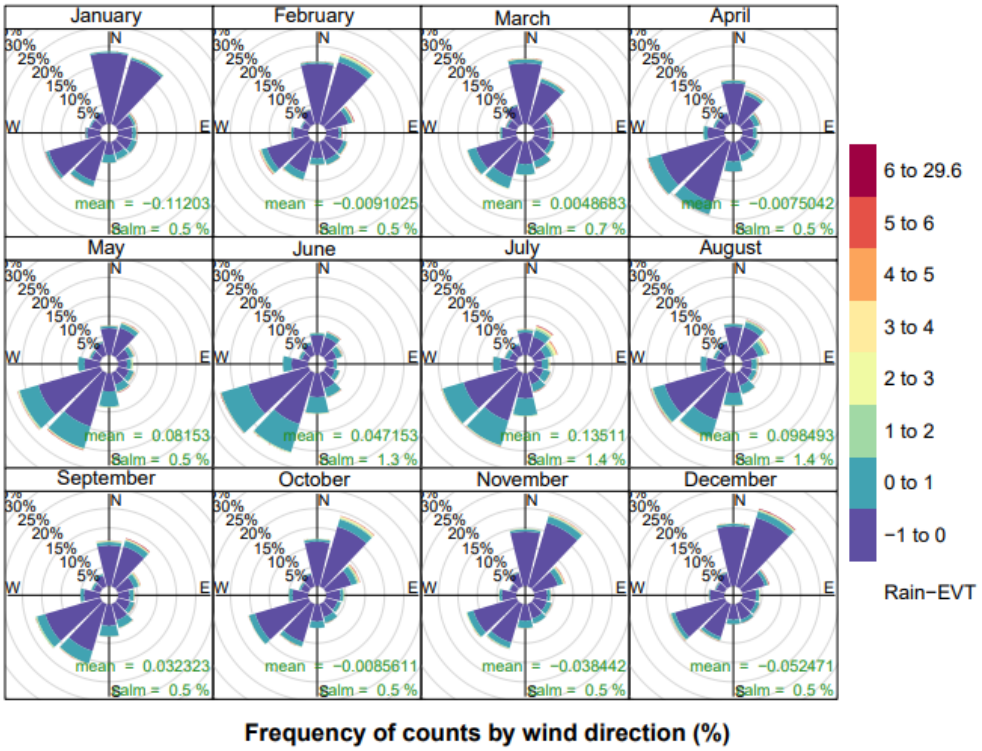

Figure 9: Nelson Airport Monthly Frequency of Dry and Wet days (Rainfall minus Evapotranspiration (EVT) in mm/hour) with Wind Direction 2017 - 2022

In order to assess the frequency of winds according to the IAQM guidelines, wind conditions have been cross-referenced with rainfall to report the frequency of wind towards each identified sensitive receptor on dry days and when winds are above 5 m/s. This assessment reports the frequency of high-risk meteorological conditions for dust events. The period of data for this assessment was from June 2017 to June 2022. The results are shown in Table 7.

Table 7: Frequency that sensitive receptors are downwind from source

Sensitive Receptor	Frequency that sensitive receptor is downwind (%)			Time downwind with wind speeds above 5 m/s on dry days		
	%	estimated number of hours/year	estimated number of days/year	%	estimated number of hours/year	estimated number of days/year
SR1	13%	1177	49	0.3%	27	1
SR2	21%	1842	77	2.5%	218	9
SR3	21%	1842	77	2.5%	218	9
SR4	26%	2289	95	7.4%	651	27
SR5	12%	1056	44	5.3%	465	19
SR6	12%	1056	44	5.3%	465	19
SR7	7%	641	27	0.5%	48	2
SR8	4%	339	14	0.3%	22	1
SR9	14%	1242	52	0.9%	77	3
SR10	20%	1778	74	0.6%	56	2
SR11	20%	1778	74	0.6%	56	2
SR12	13%	1177	49	0.3%	27	1
SR13	36%	3135	131	8.9%	784	33
SR14	20%	1778	74	0.6%	56	2

Table 7 shows that all of the 14 identified sensitive receptors (dwellings and horticulture) with the exception of 4 sensitive receptors, SR4, SR5, SR6, and SR13, will be downwind from the dust source (as determined by the impact arc) on dry days with winds above 5 m/s for less than 5% of the time. This is associated with the 'Infrequent' category (less than 5%) in the IAQM guidelines (IAQM, 2016). The 4 sensitive receptors identified above will be downwind from the dust source on dry days with winds above 5 m/s between 5.3% to 8.9% of the time. This is associated with the 'Moderately Frequent' category (between 5% and 12%) in the IAQM guidelines.

11.1.3 Frequency of high-risk dust events

SR4, SR5, SR6, and SR13 are all located in areas where winds above 5 m/s on dry days will be moderately frequent. All other sensitive receptors are in areas where winds above 5 m/s on dry days will be low frequency. The most conservative estimation of vehicle movements is 4 return trips (8 movements) per hour with additional excavation machinery movement within the quarry pits.

Due to the low to moderate frequency of high-risk meteorological conditions and the reasonably low peak traffic volume, the combined frequency of high-risk conditions for dust events is anticipated to be low for sensitive receptors. For this reason, the overall frequency for these receptors has been considered as equivalent to the IAQM 'Infrequent' category for further assessment purposes.

Due to the possibility of moderate frequencies of winds blowing towards some potential dwellings, CJ Industries will proactively implement measures for mitigation of road dust emissions. This approach is detailed in Section 8.0.

11.2 Intensity

The nearby dwellings identified in the vicinity of Peach Island Quarry are recognised as 'human receptors' in the IAQM guidelines and are classified as 'highly sensitive' due to their use as residential dwellings. The horticultural orchards in this instance have been considered as an 'ecological receptors' as this categorisation includes the direct impacts on vegetation and this is classified as 'highly sensitive' due to the value of the ecological assets (fruit).

11.2.1 Pathway effectiveness

The IAQM guidelines state that the distance between the dust source and the sensitive receptor is the primary factor influencing the pathway, with adjustments made depending upon the orientation of the receptor with respect to the prevailing wind and the topography, terrain and physical features of the site. At this site there is no significant terrain that will influence the pathway between the road and the sensitive receptors. However, there are small clusters of trees located throughout the area as well as the Motueka River as shown in Figure 6.

The guidelines advise that adverse dust impacts from sand and gravel sites are uncommon beyond 250 m measured from the nearest dust generating activity. They also state that whereby receptors are located between 250 m and 1 km of operations (for soft rock) it would normally be assumed that a detailed amenity dust impact assessment is not required. In PDP's experience the guideline advice applies to dust discharged from the gravel quarry.

PDP considers that the most common type of material that has the potential to generate dust emissions from the site is soil. Figure 10 depicts the typical distances travelled by soil dust for a range of wind speeds. Travel distances have been calculated using Stokes' Law with the following assumptions:

- The density of stone is approximately 2.6 g/cm^3;
- The average particle diameter is 50 µm (typically, nuisance dust has a diameter of between 20 µm and 100 µm); and
- A release height of 3 metres (conservative as most sources will be close to ground).

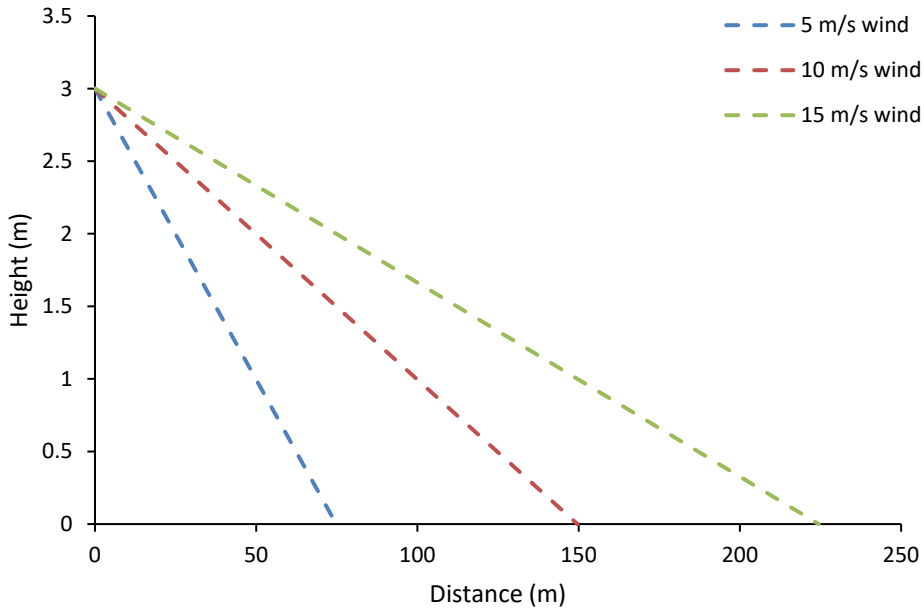

Figure 10: Particle travel distance with wind-speed

Dust intensity decreases with distance from the source as particles settle out of suspension. Dust deposition rates calculated using Stokes' law estimate that particles of size 50 µm would be unlikely to travel 250 metres. PDP's dust transport modelling aligns with EPA Victoria's recommendation on recommended separation distances for industrial residual air emissions for quarries without blasting. Table 8 shows the determination of the receptor distance as defined in the IAQM guidelines.

Table 8: Categorisation of Receptor Distance from Source

Category	Criteria
Distant	Receptor is between 200 m and 400 m from the dust source
Intermediate	Receptor is between 100 m and 200 m from the dust source
Close	Receptor is less than 100 m from the dust source

While it is likely the dust source is the quarry pit from each of stage 1, 2 or 3 at different stages of time, the dust source as conservatively been classified as the quarry boundary for the purposes of categorisation of receptor distance from source below.

Referring to the closest distance between the sensitive receptor and the dust source (active pit) as shown in Section 5.1, SR1, SR2, SR3 (dwellings) as well as SR9, SR10, SR11, SR12, SR13 and SR14 (apple and kiwifruit orchards) are categorised as 'Close'. No sensitive receptors are categorised as 'Intermediate'

receptors, whilst all the remaining receptors are categorised as 'Distant' receptors.

The pathway effectiveness can then be defined by combining the frequency of potentially dusty winds with the receptor distance classification as shown in Table 9. This results in a categorisation of 'Ineffective' for all of the sensitive receptors considered, except SR13, as noted in the green text in Table 9.

Table 9: Pathway Effectiveness

Receptor Distance		Frequency of Potentially Dusty Winds			
		Infrequent	Moderately Frequent	Frequent	Very Frequent
	Close	Ineffective	Moderately Effective	Highly Effective	Highly Effective
	Intermediate	Ineffective	Moderately Effective	Moderately Effective	Highly Effective
	Distant	Ineffective	Ineffective	Moderately Effective	Moderately Effective

SR13 is the only sensitive receptor which has both a moderate frequency as close categorisation to the dust source, therefore this would be categorised as 'Moderately Effective', as noted in the blue text in Table 9. However, this is a conservative categorisation based on dust source distance, based off a site boundary distance of 90 m. It is noted that the active stage 3 quarry pit area is proposed to be 210 m away from SR13, which is the more realistic source of dust than the pastural area near the boundary and Motueka River which will not be excavated. If considering distance from potential of dust unconsolidated ground (active quarry pit area), then SR13 would also be categorised as 'Distant' with 'Ineffective' pathway effectiveness. See Figure 6 for context of SR13 with relation to the boundary and active pit area.

The 'Ineffective' pathway effectiveness classification can be combined with the Residual Source Emission (RSE) type to estimate the Dust Impact Risk as detailed in Section 11.2.2

11.2.2 Residual Source Emission (RSE) determination

Various dust generating activities are outlined for assessment of residual source emission (RSE) magnitude in Appendix 4 of the IAQM guidelines. The proposed quarry with its various stages, sealed access road, total working area of unconsolidated surface of 3,000 m², and low extraction rate, low vehicles movements of 4 trucks per hour with some excavation machinery in the pit is defined as having 'Small' RSE under IAQM Appendix 4.

Combining the 'Ineffective' and 'Moderately Effective' pathway and 'Small' RSE values using Table 10 gives an overall Dust Impact Risk of 'Negligible Risk' (as noted in green text) for the proposed operation of Peach Island Quarry on all sensitive receptors considered.

Table 10: Estimation of Dust Impact Risk

Pathway Effectiveness		Residual Source Emissions		
		Small	Medium	Large
	Highly Effective Pathway	Low Risk	Medium Risk	High Risk
	Moderately Effective Pathway	Negligible Risk	Low Risk	Medium Risk
	Ineffective Pathway	Negligible Risk	Negligible Risk	Low Risk

11.3 Duration

The quarry and clean fill operating hours will be 7.30 am to 5 pm Monday to Friday. The duration of an individual vehicle movement will be short, but due to the sensitivity of surrounding dwellings and horticulture consideration has been given to observed wind patterns and the duration of high-risk wind events towards each of the sensitive receptors.

This assessment is conservative in that an operational duration of 5 days a week every week is assumed. However, extraction is expected only to be required for approximately one week of each month with the occasional increase during periods of high demand.

Figure 11 shows the diurnal variation of average wind speed for the data from the Nelson weather station. The average wind speed is highest in the afternoon with average speeds above 5 m/s occurring between approximately 12 pm and 6 pm. This time period is within the weekday operating hours of the quarry and managed fill.

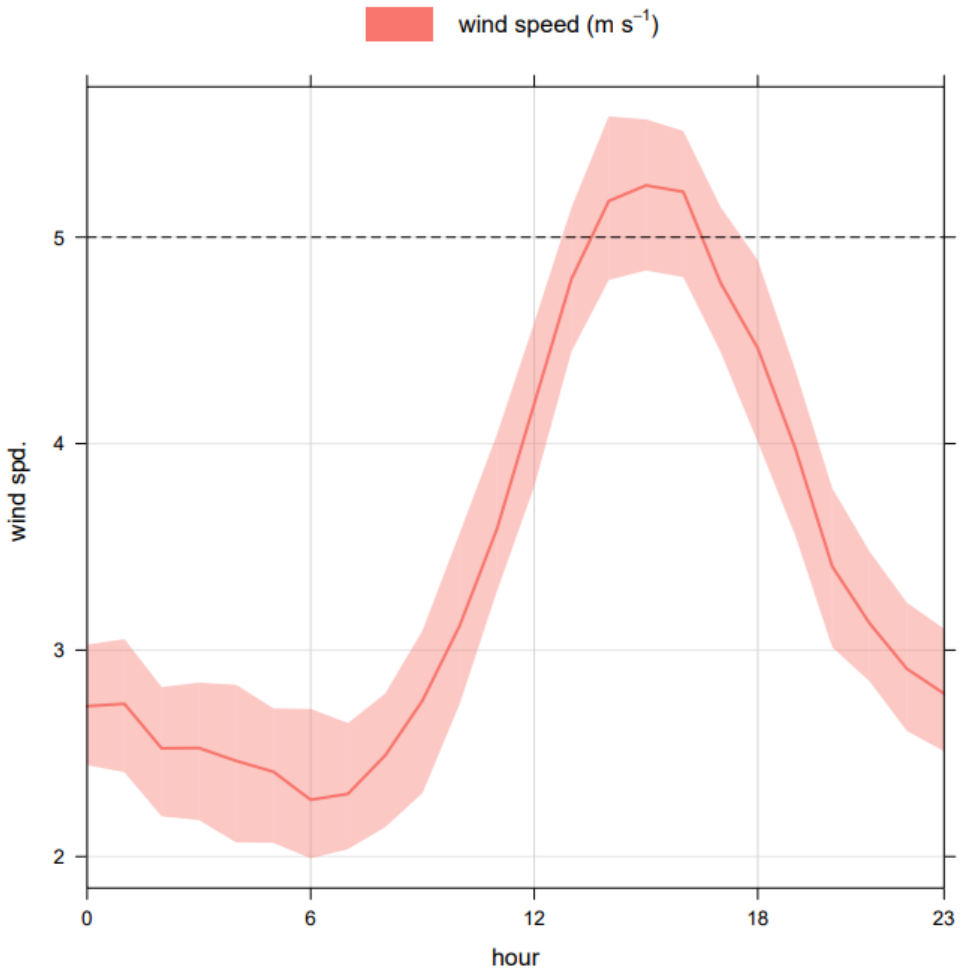

Figure 11: Diurnal pattern of average daily wind speed variation in m/s (December to February)

Given the duration of the high-risk wind events, and the duration of the dust generating events, the average duration of any dust impact on sensitive receptors is expected to be low and limited to a maximum of four hours late in the afternoon during summer.

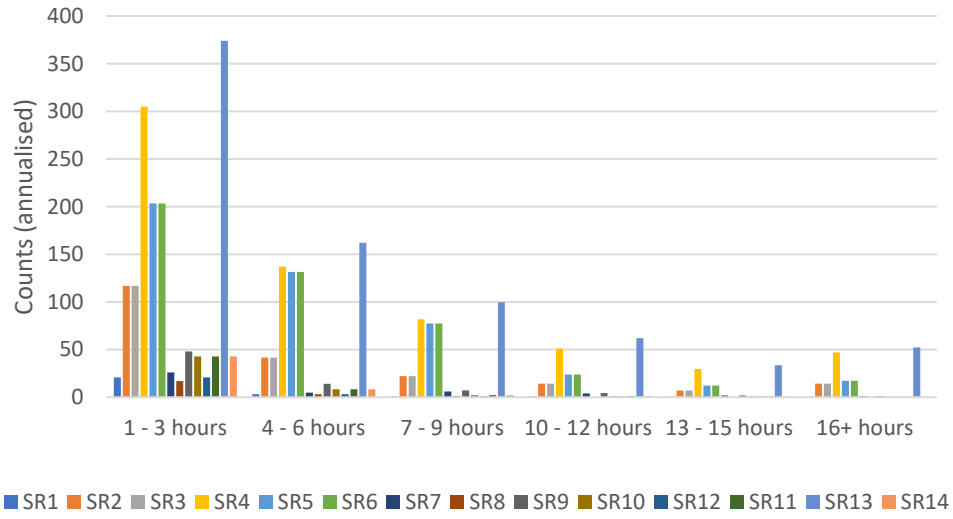

Figure 12: Frequency and duration of dry wind events ≥5m/s towards sensitive receptors (annualised)

Theoretical exposure, as shown in Figure 12, to an event greater than 12 hours in duration is predicted to occur less than once per year for SR1, SR7, SR8, SR9, SR10, SR11 and SR12. SR2, SR3, SR4, SR5, SR6, and SR13 are predicted to be exposed to wind events greater than 12 hours in duration frequently throughout the year. Notably site operation and disturbance of material does not exceed 9.5 hours and is on weekdays only so maximum duration is more likely to be 9.5 hours. Given the duration of the high-risk wind events and the duration of the dust generating events the duration of any dust impact on sensitive receptors is expected to be most frequently low, but for some receptors on limited days the duration of may be medium. The conclusions drawn on the duration of exposure are likely to be very conservative because for most months of the year the quarry will actually only operate one week in four.

11.4 Offensiveness

Dust emissions occurring as a result of quarry activities are expected to be in the particle size range of 1 µm – 100 µm. Smaller particles will be present as a result of erosion of the surfacing material as well as some haul road basecourse material over time.

The dust will be grey to light brown in colour. The offensiveness of dust of this size, composition and colour deposited from the unsealed road on surfaces is likely to be moderate to low.

11.5 Location

The locations of the sensitive receptors with respect to the dust source are detailed in Section 5.1 and shown in Figure 6. The area around the site is all zoned 'Rural 1' land (Tasman District Council, 2022). Rural zones typically have low sensitivity to the effects from the discharge of dust.

Some of the land directly adjacent to Peach Island Quarry is currently used for agriculture so is considered to have relatively low sensitivity to dust. There is also a native plant nursery 450 m from the site boundary, however this is also considered to be low sensitivity due to the nature of native plants and distance from the site. However, some land is used for horticultural crops with have a higher sensitivity to dust than agricultural pastureland use. Potential impacts on horticultural crops and likelihood of this occurring are discussed further below for this reason.

11.6 Overall Finding of Dust Assessment

The dwellings considered as sensitive receptors in this assessment are recognised as 'human receptors', and orchards also recognised as 'ecological receptors', in the IAQM guidelines and are classified as 'highly sensitive' due to their use as residential dwellings or use to produce fruit.

Table 11 can be used to combine the 'Negligible Risk' Dust Impact Risk value with the 'High' receptor sensitivity classification to assess the Magnitude of Dust Effects. This gives an overall result of 'Negligible Effect' for the proposed operation of Peach Island Quarry on the sensitive receptors considered. PDP consider the conclusion based on the IAQM assessment method is equivalent to concluding the impact of dust is likely to be a less than minor adverse effect. The measures proposed to mitigate and monitor the dust impact are detailed in Section 8.0.

Table 11: Descriptors for Magnitude of Dust Effects				
		Receptor Sensitivity		
		Low	Medium	High
Dust Impact Risk	High Risk	Slight Adverse Effect	Moderate Adverse Effect	Substantial Adverse Effect
	Medium Risk	Negligible Effect	Slight Adverse Effect	Moderate Adverse Effect
	Low Risk	Negligible Effect	Negligible Effect	Slight Adverse Effect
	Negligible Risk	Negligible Effect	Negligible Effect	**Negligible Effect**

11.7 Complaints

CJ Industries have had complaints about dust from their existing quarry and vehicles travelling to or from the site. These are as follows:

- The Douglas Road Quarry operated by CJ Industries also extracting alluvial gravels has had some complaints, usually after a high rainfall event. The identified source when these complaints were investigated was mud is tracked out onto the road. This source of dust can be mitigated through use of laying pea metal for the trucks to drive over, as well as heavy chip which has no fines and keeps the truck tyres away from contact with mud. CJ Industries has worked on measures to prevent this from happening again through increased staff training and awareness to improve diligence in this area. CJ Industries also now complete road sweeping when required, but not less than monthly. Following these actions CJ Industries consider there has been an improvement in complaints and they have not received a dust complaint due to mud on the road in some time.
- Last summer there was a complaint of dust coming from the site onto neighbours' houses during high winds from Douglas Road Quarry. In this circumstance the dust could have been mitigated by use of water trucks and pea metal or shutting down operations during high wind conditions. Again, CJ Industries has addressed this through increased staff training and awareness in dust management and when to implement mitigation measures as well as cease works.
- Finally, a historic dust complaint from another quarry operated by CJ Industries on 44 Takaka Hill Highway CJ Industries have now sealed the access road and make use of pea metal and sweeping as required. CJ Industries have had no complaints about the operation of this quarry for years following these improvements.

CJ Industries notes these historic dust complaints and has incorporated the learnings from each of these complaints to improve operation and strengthen mitigation measures at their quarries.

To comply with the requirements of the dust management plan a complaints register will be kept onsite and will be reported to TDC annually should any complaints be received. The complaints register will be filled out and investigation into the source of the dust actions to mitigate it taken shall be documented. The complaints register is included in the DMMP attached in Appendix B.

11.8 Cumulative Effects

As discussed in section 5.3 there are no significant sources of dust in the nearby area except for natural riverbed and minor agricultural sources. Normal farming practice can involve the machine cultivation of soils which creates dust, as does the biannual spreading of fertiliser. These are minor sources of dust at low frequencies. As such the addition of a small-scale quarry in the area is not considered to be a significant risk on cumulative effects.

12.0 Assessment of Health impacts

The dust discharged from excavation of gravels vehicles travelling over unsealed haul roads from unconsolidated surfaces contains a small amount of PM_{10}, which can penetrate into human lungs and cause adverse health effects. The NESAQ for PM_{10} (50 µg/m³ as a 24-hour average) has been set to protect the general population from adverse health effects (MfE, 2004). Given the site's processes, the sources of dust and proposed dust mitigation measures, the amount of PM_{10} discharged from the site is expected to be small and not to cause a large increase in ground level concentrations of PM_{10} at or beyond the site boundary.

Given the uncertainty in estimating dust emission and dispersion rates, it is a difficult task to quantify the potential increase in ground level concentrations of PM_{10} at or beyond the site boundary for CJ Industries proposed operation. The most useful approach is to consider PM_{10} monitoring data collected at a similar site, or one that is conservatively representative of the proposed site.

Mote reported on an air quality monitoring campaign undertaken at locations in and around the Yaldhurst Quarry area for four months from 22 December 2018 (Mote, 2018). The purpose of this monitoring was to characterise the nature of particulate by measuring short-term (hourly) and long-term (24-hour and three-month) particulate levels and measuring different size fractions of particulate at multiple locations.

The size of the Yaldhurst quarries is a significantly larger source of PM_{10} than that proposed by CJ Industries (230 ha compared to 3,000 m² at a time). The scale of the Yaldhurst quarries operation is also more process intensive with at least 4 screening and crushing plants operating at any one time. Therefore, the

concentrations of contaminants measured adjacent to the Yaldhurst quarries will be significantly higher than those experienced in close proximity to CJ Industries quarry.

The Mote Yaldhurst report is relevant (albeit conservative) and informative for the purposes of considering any health impacts from the discharge of PM_{10}, from CJ Industries proposal.

The key conclusion that can be drawn from the Yaldhurst monitoring data is that PM_{10} concentrations measured at a distance of greater than 160 m from the quarry boundary show very little impact from the quarry compared to data collected at a background site. Given that the Yaldhurst quarry is significantly larger and PM_{10} emissions magnitudes higher than the CJ Industries quarry is concluded that any potential health impact of PM_{10} at the sensitive receptors will be less than minor.

In addition, RCS was not found in air at concentrations of concern for human health in the vicinity of the Yaldhurst quarries. The vast majority of RCS measurements taken were below the limit of detection of the chemical analysis. We expect that this will also be the case for the Peach Island Quarry given the considerably smaller scale of the operations compared to Yaldhurst. CJ Industries quarry Occupational safety and health (OSH) air testing showed workers on site were exposed to very low levels of RCS.

In summary, PDP concludes that based on the nature of the quarry dust, the separation distance to the nearest off-site dwelling and the implementation of the proposed management measures any adverse health impacts from RCS discharged from the proposed Quarry will be negligible and certainly less than minor.

13.0 Impacts on Horticulture Production

There are a number of characteristics of dust which can impact vegetation. Dust can have both a physical and a chemical impact (Farmer, 1991). These are described below:

- Physical: Dust falling onto plants may physically smother the leaves, therefore controlling the absolute level of deposition is important. This is affected by dust emission rates, meteorology and conditions on the leaf surface. Dust can also physically block stomata. Krajickova & Mejstrik (1984) noted that the stomata diameter was 8-12 µm for a range of crops. Thus, particle size is important if dust is to act in this way on stomata functions.
- Chemical: Dusts of diverse origin have very different chemistries. The chemical effect of dust, either on soil or directly on the plant surface, may be more important than any physical effects.

Before describing effects of dust itself on horticultural crops such as apples, kiwifruit and the native plant nursery nearby, it is necessary to consider the characteristics of gravel dust.

Dust from excavated river gravel and inert cleanfill is expected to be relatively low in chemical properties and reactivity which may impact plant leaves or fruit growth and ripening. It is noted however that deposition of some river gravel dust may vary pH characteristics. However most likely to effect fruit production or hinder plant growth is significant deposition causing a physical impact.

The most significant physical effects of road dust on agricultural and horticultural production appear to be (Crea, 1990):

- Reduced photosynthesis leading to loss of plant yield.
- Increased pest and disease incidence causing yield losses and reduced quality of horticultural produce.
- Dust contamination reducing fruit and vegetable attractiveness.
- Dust hindering the pollination of small seeded fruits causing abortion and deformed fruit.

Therefore, dust deposition may impact apple and kiwifruit growth at all stages in pollination, and growth and into maturity.

Apples are typically harvested at maturity in New Zealand between January and May (McGrath Industries, 2022). Kiwifruit are harvested from March until May (Zespri Kiwifruit, 2022). During these times dust has the biggest potential to reduce fruit attractiveness, and prior to these harvesting periods may hinder formation and growth.

The findings of the assessment on frequency and duration in Sections 11.1 and 11.3 respectively, undertaken in accordance with IAQM guidelines estimated dust impact to these orchard areas as 'Negligible risk' due to receptor distance, pathway effectiveness and small residual source emissions. Because of this, is not considered that dust deposition on nearby fruit orchards is likely to be of any significance that could cause the physical or chemical impacts described above.

In addition, CJ Industries has the mitigation measures and quarry design in place as described in Section 8.0 to ensure effective dust suppression and no objectionable or offensive dust leaves the quarry boundaries.

14.0 Assessment Summary and Conclusions

The aim of this report is to determine the potential air quality effects beyond the site boundary as a result of discharges to air at the proposed gravel quarry, namely dust-generating activities. The following proposed activities at the site have the potential to generate dust emissions:

- Site preparation and restoration (including cleanfilling);

- Gravel extraction (including soil and overburden);
- Materials handling and temporary storage (including soil, overburden and aggregate); and,
- Vehicle movements on unsealed site roads and surfaces.

The area of land to be actively quarried will be limited to 1,600 m^2 at any one time (slightly smaller than two Olympic sized swimming pools). There will be no aggregate crushing or screening on site. The extracted material will be stockpiled and transported off site for process. The combination of 1,600 m^2 quarry and no aggregate processing will result only small amounts of dust being discharged from the site.

A qualitative risk assessment for dust was undertaken in accordance with FIDOL and IAQM guidelines assessment methods (described in Sections 7.1 and 7.2). This method determined the potential dust risk and magnitude of effects in the surrounding community and facilitated the identification of the mitigation and monitoring measures that will be required. The focus of the dust impact assessment in this report is on the larger particles, usually termed dust or total suspended particulate (TSP), which tend to settle out of the air quickly, and their potential to cause offsite dust nuisance effects.

A number of best practice mitigation measures have been recommended in this report to control dust emissions at the project site. Providing that the mitigation measures recommended in this report in conjunction with the implementation of the Dust Management and Monitoring Report (DMMP) are effectively implemented by CJ Industries, dust emissions will be minimal.

The dust assessment concludes that the dust discharged from the proposed quarry will have a less than minor adverse effect on amenity values, horticultural activity and human health. The key factors which determined this result is the small scale of activities and the effectiveness of the proposed mitigation and monitoring measures.

It is also anticipated that there will be no exceedances of the National Environmental Standards for Air Quality or Ambient Air Quality Guidelines for PM_{10} beyond the boundary of the project site, as a result of particulate emissions and there will be no adverse public health risks from respirable crystalline silica discharged from the proposed quarry, providing that the mitigation measures are implemented at all times. Any potential health effects caused by the emission of PM_{10} from the proposed site is considered to be less than minor.

The DMMP (Appendix B) describes mitigation measures which will ensure a negligible risk is maintained to all sensitive receptors, and monitoring will ensure dust particulate matter concentrations are measured and maintained well below AAQG limits.

15.0 References

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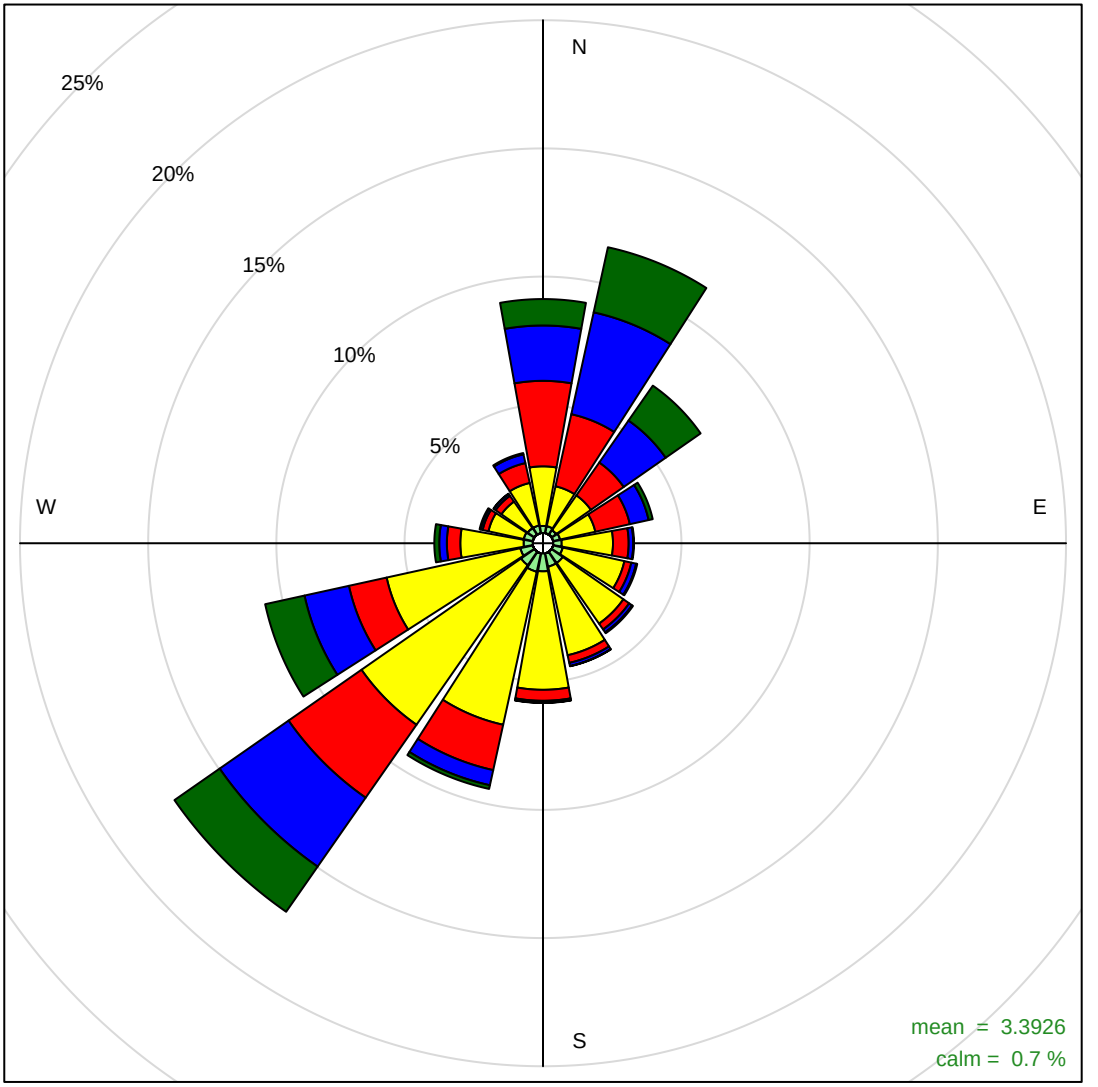
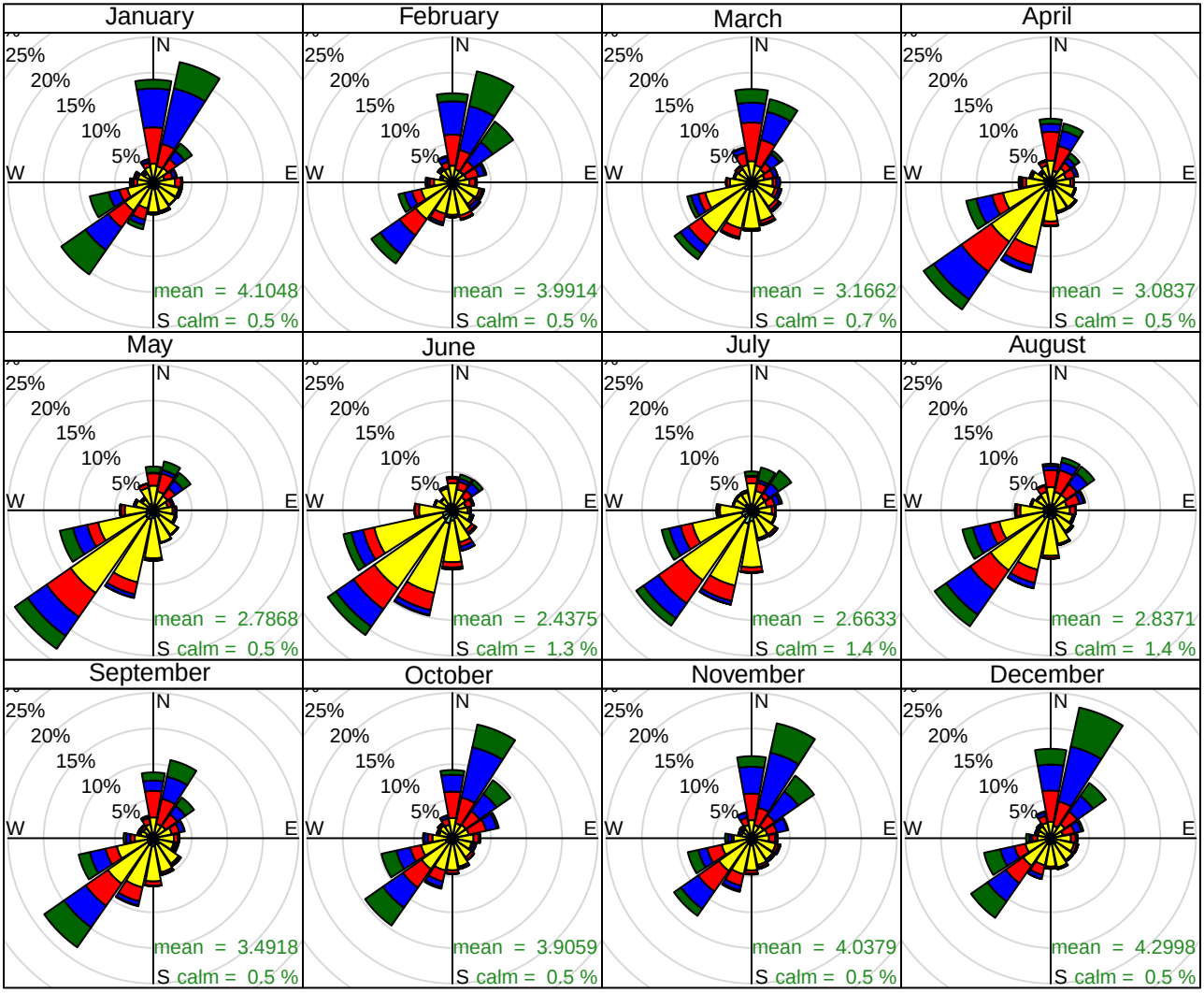
Appendix A: Windroses

Nelson Airport 2017 – 2022



Frequency of counts by wind direction (%)

Nelson Airport Monthly WindRoses



Frequency of counts by wind direction (%)

Appendix B: Dust Management and Monitoring Plan

PATTLE DELAMORE PARTNERS LTD

Dust Management and Monitoring Plan – Peach Island Quarry

CJ Industries Limited

Dust Management and Monitoring Plan – Peach Island Quarry

Prepared for

CJ Industries Limited

July 2022

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Quality Control Sheet

TITLE	Dust Management and Monitoring Plan – Peach Island Quarry
CLIENT	CJ Industries Limited
VERSION	Final
ISSUE DATE	14 July 2022
JOB REFERENCE	C04627800
SOURCE FILE(S)	C04627800R002_DMMP_Final.docx

DOCUMENT CONTRIBUTORS

Prepared by

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Jeff Bluett

Limitations:

This report has been prepared by Pattle Delamore Partners Limited (PDP) on the basis of information provided by CJ Industries Limited. PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the report. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

This report has been prepared by PDP on the specific instructions of CJ Industries Limited for the limited purposes described in the report. PDP accepts no liability if the report is used for a different purpose or if it is used or relied on by any other person. Any such use or reliance will be solely at their own risk.

Document Control

Table 1: Amendment Register – Dust Management and Monitoring Plan

Date	Version	Description	Prepared by:	Reviewed/ Authorised by:
14 July 2022	1	Original Document	AV	JB

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1.0 Introduction

This Dust Management and Monitoring Plan - Peach Island Quarry (DMMP) has been prepared by Pattle Delamore Partners Ltd (PDP) on behalf of CJ Industries Limited (CJ Industries).

1.1 Purpose

The purpose of the DMMP is to provide a framework for the quarry and restoration operations and site personnel, in particular to:

- facilitate the avoidance, remediation, and mitigation of any adverse effects of discharges of dust generated from the operation of the Peach Island Quarry; and
- promote proactive solutions to the control of dust discharges from the site.

1.2 Background Information

CJ Industries intend to undertake the extraction of gravel, stockpiling of topsoil, and reinstatement of quarried land in three stages at Peach Island Road.

An assessment of the sensitivity of the receiving environment and identification of the location of highly sensitive receptors is provided in Air Quality Assessment of Environmental Effects (AEE), dated July 2022. The location of the quarry and the location of the sensitive receptors within 500 m of the boundary of the site are shown in are in Figure A-1.

A key focus of the management plan is to avoid adverse effects at the nearest neighbouring residential dwellings and apple and kiwifruit orchards.

1.3 Description of Activity and Dust Sources

CJ Industries propose to operate a gravel quarry at 134 Peach Island in Motueka (Lot 2 DP 2357 and Lot 2 DP 432236), the area of which is shown Figure 1 below.

Figure 1: Location and boundary of the proposed gravel extraction site

Hours of operation will be limited to **7.30 am to 5 pm Monday to Friday**, with no work during weekends or on public holidays.

The extraction and handling of gravel, including truck movements to and from the site, has potential for discharges of fugitive dust and odour.

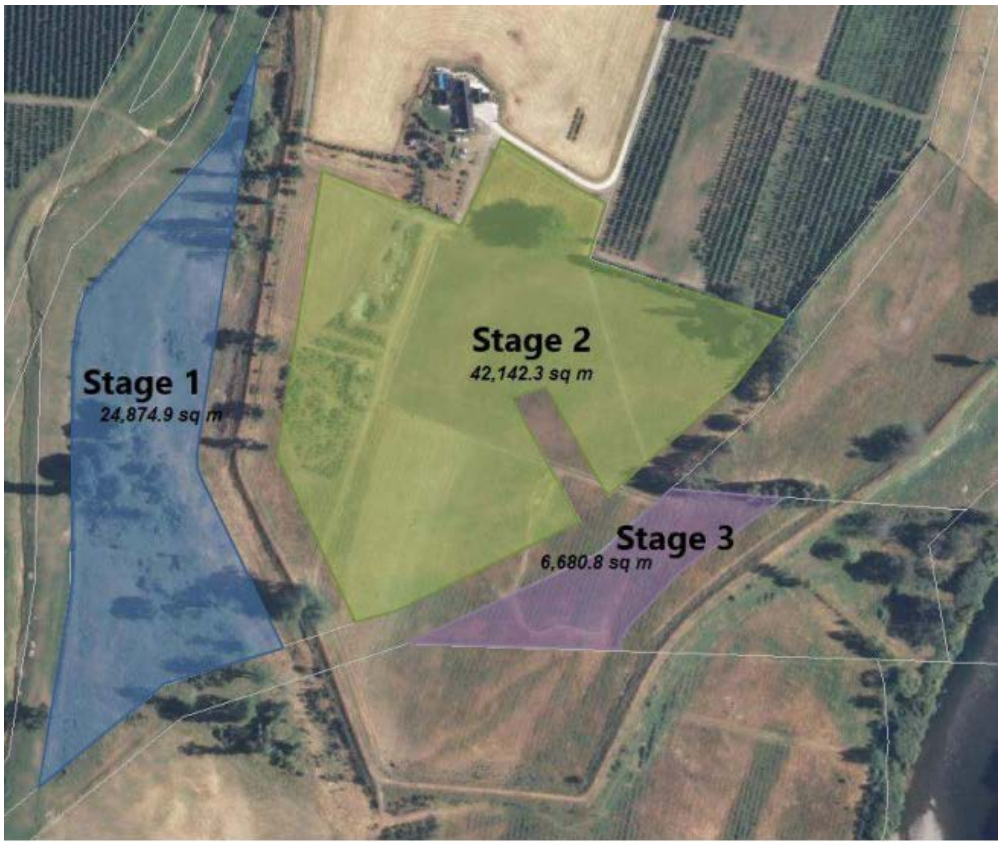


Figure 2: Staging plans for the extraction of gravel at Peach Island Quarry

No processing, crushing or screening of materials will occur on the application site.

Up to 15 truck and trailer units will enter/exit the site each day for the import of clean fill and the export of aggregate. Trucks or truck-and-trailer units will carry up to 38 tonnes of material each, with a maximum of 570 tonnes of gravel transported each day. Trucks will return with back fill material as often as possible, in order to keep traffic down. The existing paper road and area of marginal strip that is proposed to be used as a haul road is currently in pasture and will be formed into a sealed road. An existing ROW will also be utilised to access the marginal strip and paper road. This too will be upgraded to a sealed surface. The access will be adequately maintained by CJ Industries. This means that the only unsealed roads with potential for dust generation are the internal haul roads within each of stages 1, 2 and 3.

There is an apple orchard that is located on the northern eastern boundary of the Stage 2 area. Quarrying within 100 m of this orchard boundary only occurs over the months of May to October (the wet less windy time of the year). CJ Industries moves between stages 2 and 3 to suit the time of the year.

1.4 Objectives

The objectives of the DMMP are to inform the quarry operations and site personnel of management and mitigation measures for quarry activities to minimise the adverse impacts of potential dust discharges on the receiving environment.

The DMMP methods are designed to be practical for CJ Industries to implement, while the document is intended to be continuously improved to adapt mitigation where needed to ensure the required outcomes.

2.0 Consent Compliance and Key Performance Indicator

The environmental objective of the DMMP is to ensure that the site will be managed to comply with consent conditions related to the discharge of dust to air. The relevant performance indicator is to ensure that the site activities will not result in dust that is objectionable to the extent that it causes an adverse effect beyond the boundary of the site.

3.0 Sources of Dust

The Site's key dust sources are as follows:

- Development and remediation of the site;
- Excavation of gravel;
- Site access road and other unsealed surfaces;
- Disturbing stockpiles; and
- Stockpiling.

4.0 Management and Mitigation Measures

4.1 Water Suppression

As a benchmark for dust suppression the Ministry for the Environment Good practice guide on assessing and managing dust recommends a water application rate 1 mm/hour (or 1 litre/m^2) per hour. Using 1 mm per hour over 3,000 m^2 requires 3 m^3 of water per hour. Over a 10-hour working day the total volume of water required could be 30 m^3. However, it is unlikely that dust suppression would be required over a full day.

CJ Industries will ensure that 30 m^3 of water is available daily for potential dust suppression purposes. Water is sourced from water permit RM171337 which has a current application to vary this consent to allow use for dust suppression. This consent provides for 8.33 L/s and 2625 cubic metres per week from an on-site bore. Restrictions can be implemented by Council during times of low river levels, in this circumstance water will be trucked in from an external provider. In circumstances where the sprinkler system cannot be extended to all appropriate areas, there will be one 15 m^3 dust suppression cart on site which can provide water for dust suppression. Both systems can be refilled from the site's water supply, the site provides access to ample water for typical and for high demand dust suppression.

Fixed sprinklers, mobile k-line sprinkler system, water truck with cannon may also be opted for instalment along haul roads and active quarry areas in addition to a water cart, which would only be bought onto site if sprinklers and cannons were not able to service the unconsolidated surface areas. All mitigation installed will be designed to ensure 1 mm water per hour over 3,000 m^2 can be achieved by the quarry operations on dry days at any stage.

4.2 Tiered Mitigation Measures

Dust prevention on site uses a two-tiered approach. Tier 1 controls are employed routinely, and Tier 2 controls are implemented additionally in the unlikely situation that the Tier 1 controls do not prove to be fully effective. These control measures are summarised in Table 2.

Application of water for dust suppression as described in the Tier 1 and Tier 2 controls should be prioritised as shown in Table 2.

Table 2: Sources of Dust and Tiered Controls to be Employed		
Source of Dust	**Tier 1 Controls (Routine)**	**Tier 2 Controls (Additional, as needed)**
Unpaved surfaces such as site access roads	⁘ Limit the area of exposed surfaces as much as practical. ⁘ Cover surfaces with coarse materials where practicable. ⁘ Compact all unconsolidated surfaces where practicable. ⁘ Trafficked unsealed surfaces will be watered on a regular basis using a k-line sprinkler, water cannon or water cart system. ⁘ An onsite speed limit of 15 km/hr will be enforced.	⁘ Increase water application rate to ensure that in-use unpaved roads are kept damp. ⁘ Use polymer additives or chemical stabilisation to assist in forming a surface crust on site access roads only in rare occasion all other options are insufficient.
Vehicles	⁘ Limit load sizes and ensure even loading to avoid spillages. ⁘ As far as practical minimise travel distances and/or maximise buffer distances between site access roads and site boundary through appropriate site layout and design. ⁘ Deep sided trucks (dump trucks) are used for transport within the site to reduce spill ⁘ As above, an onsite speed limit of 15 km/hr will be enforced. ⁘ The main haul road into the site is sealed to prevent dust. ⁘ Sweeping of the sealed road is undertaken weekly as needed in Summer. ⁘ Any spills of soil from vehicles are swept up and washed down on the same day as the spill.	⁘ Limit vehicle speeds on unsealed surfaces to 10 km/hr when traveling within 250 m of the site boundary or when vehicle generated dust plumes approach the boundary of the site. ⁘ A wheel wash can be installed if sweeping is not effective to prevent tracking of material offsite. ⁘ Dry soil material in trucks will be covered or wetted.

Table 2: Sources of Dust and Tiered Controls to be Employed		
Source of Dust	**Tier 1 Controls (Routine)**	**Tier 2 Controls (Additional, as needed)**
Disturbing materials	⁘ The loading on to or removal of material from stockpiles will be only undertaken during low dust risk wind conditions (one hour average windspeed < 7.5 m/s). ⁘ Good practice machine operation will be implemented including minimizing drop heights and wetting dusty materials when needed (wind speeds above 5 m/s). ⁘ No materials will be disturbed when wind speeds are above 7.5 m/s. ⁘ Quarrying in Stage 2 within 100 m of the apple orchard boundary only occurs over the months of May to October. ⁘ A 3 m high bund backed by mature trees to provide a dust scree between the quarry and the orchard located on the northern boundary of Stage 2.	⁘ Adequate water suppression systems must be available at the site to dampen areas that are to be worked prior to any earthwork commencing and shall be used on the site until further earthworks in that area are not required.
Stockpiles (including placement and removal)	⁘ Locate stockpiles as far away as practicable from identified sensitive receptors. ⁘ Orientate stockpiles to maximise wind sheltering as much as possible. ⁘ Maintain the height of gravel stockpiles to a practical minimum of 4 m. ⁘ Maintain the height of unvegetated topsoil stockpiles to a practical minimum of 3 m. ⁘ Load and remove stockpiled material from site as soon as practical.	⁘ Use polymer additives or chemical stabilisation to assist in forming a surface crust on stockpiles only in rare occasion all other options are insufficient. ⁘ Further limit the height and slope of stockpiles to reduce wind entrainment. ⁘ Vegetation of long-term stockpiles. ⁘ Dampen stockpiles if they are producing visible dust emissions.

Table 2: Sources of Dust and Tiered Controls to be Employed		
Source of Dust	**Tier 1 Controls (Routine)**	**Tier 2 Controls (Additional, as needed)**
	⁘ Stockpiles in the Stage 2 area within 100 m of the apple orchard boundary are removed over the drier months of November to April.	
Soil removal and replacement	⁘ Areas are incrementally backfilled at regular intervals and re-grassed with suitable grass species as soon as practicable to limit potential for dust generation from exposed surfaces.	⁘ Use polymer additives or chemical stabilisation to assist in forming a surface crust on soil surfaces if delays in vegetation. ⁘ Addition of nutrients (fertiliser) to increase fertility and promote and maintain even revegetation. ⁘ Soil moisture management via irrigation (if available) to promote and maintain even revegetation.
Miscellaneous	⁘ Plan site layout so that mobile machinery and dust causing activities are located away from receptors as far as is practicable. ⁘ Ensure sufficient water is available on site. ⁘ Take account of daily forecast wind speed, wind direction and soil conditions before commencing an operation that has a high dust potential. ⁘ All site machinery should be regularly maintained to ensure optimal operation. ⁘ Targeted watering on areas within 250 m of sensitive receptors during high dust risk conditions (see Table 3).	⁘ Targeted watering on areas identified as high-risk for dust discharge as a result of visual inspections.

5.0 Roles and Responsibilities

5.1 Site Manager and Staff

The Site Manager has the day-to-day responsibility for implementing the DMMP. The Site Manager has the responsibility to ensure that:

- the conditions of all relevant resource consents are complied with at all times;
- the dust control and mitigation measures and procedures outlined in the DMMP are implemented effectively;
- there are adequate personnel and equipment on site at all times to implement the dust control;
- the meteorological and dust monitoring programmes are carried out as required, including recording of daily observations;
- any complaints received are investigated and resolved as far as practicable; and
- all records are kept and are available to the relevant regulatory authorities.

All personnel working on the Project have responsibility for following the requirements of the air discharge consent conditions and the DMMP and reporting to the Site Manager on these issues.

5.2 Staff Training

Successful dust management depends on appropriate actions by site personnel in day-to-day operations of the site. Environmental training for all staff will be undertaken as part of the site induction programme. The environmental induction will include the following information specific to this DMMP:

- Information about the activities that may cause dust discharges within the site with the potential to impact neighbouring areas;
- Consent requirements;
- Dust mitigation procedures;
- Description of dust and meteorological monitoring for the site; and
- Complaints management procedures.

Staff training records will be maintained on site. The records will include:

- Who was trained;
- When the person was trained; and

- General description of training content and whether follow up/refresher courses are required at a later date.

6.0 Implementation and Operation of DMMP

The Site Manager is responsible for implementing the DMMP including to:

- Identify key staff responsible for dust management and assign roles;
- Undertake staff training focusing on the objectives, responsibilities and actions defined by the DMMP;
- Establish daily processes and scheduling activities;
- Implement a daily briefing meeting; and
- Undertake regular debriefs and reviews of the DMMP.

The Site Manager is responsible for reviewing the effectiveness of the DMMP and if necessary, revising it to improve management and mitigation measures to reduce any dust impacts.

7.0 Environmental Monitoring Programme

7.1 Dust Monitoring

Visual monitoring of dust will be undertaken to assess the level of dust emissions on the site and beyond its boundary. The visual monitoring will:

- Identity source(s) of dust (e.g. from heavy machinery, stockpiles, earthworks, etc.);
- Identify any areas of deposited dust from the site on surrounding roads and properties;
- Assess the extent and direction of any dust plumes (e.g. within boundary, cross-boundary, or covering a large extent);
- Identify receptors potentially impacted by the plume (e.g. properties downwind to the northeast);
- Assess offensiveness as high, medium, or low; and
- Assess overall impact as high, medium, or low.

All staff are required to continuously visually monitor activities to identify dust events. The Site Manager or delegate undertakes a site walkover and visual dust monitoring at least once per day, in the early afternoon, to assess the overall effectiveness of the DMMP and assess compliance with the requirements of the resource consent conditions.

Site observations are recorded in a daily log form, an example of which is provided as Appendix B. The daily log forms will be kept for at least 5 years.

Recording relevant inspection results, as well as the conditions of external and internal factors on the log forms, will be used to help assess if control measures are effective and to define appropriate corrective or preventative actions in the event that adverse effects occur.

Should CJ Industries receive four validated dust complaints from surrounding neighbours or council (validated meaning the quarry activities are the confirmed source of dust) within any 12-month period, this DMMP will be revised to incorporate real time dust monitoring. Specific issues to be considered in the updated DMMP include:

- Type of monitor;
- Location of monitor;
- Dust mitigation trigger alerts;
- Responses to dust trigger mitigation alerts; and
- Reporting of dust monitoring data.

7.2 Meteorological Monitoring

Monitoring of weather forecasts will be undertaken daily and used to inform the potential need for additional mitigation measures (e.g. in the event that strong winds are forecast).

Before the daily briefing meeting, the Site Manager will obtain the weather forecast for the day and identify whether high dust risk conditions (see Table 3) may occur. If high dust risk conditions are forecast, the Site Manager will highlight this to other on-site staff and instruct whether any additional dust mitigation is to be implemented for that day.

The forecast occurrence of high dust risk conditions shall be noted in the daily log along with any outcomes from the daily briefing meeting.

A meteorological station that will measure wind direction, wind speed, temperature and relative humidity will be set up on site. The location of the equipment and location of the meteorological station location will be, as far as practical, be consistent with the AS/NZS 3580.1.1:2016.

The meteorological station will provide real time data to the site staff. This information will be used to assist with the dust management of the site. The meteorological system will be set up to send email and SMS text alerts to site staff. An alert will be sent when 1-hour average windspeeds exceed 5 m/s which will prompt site staff to carefully monitor dust sources and implement additional mitigation measures if required. An alert will be sent when 1-hour average windspeeds exceed 7.5 m/s, which will prompt site staff to stop work on dust generating activities.

The meteorological data will be archived and be available for reviewing and responding to any dust and odour complaints received by the site staff.

Table 3 shows a summary of the meteorological conditions contributing to different dust risk levels, the associated notifications, and required responses.

Table 3: Dust Risk Levels, Meteorological Conditions and Responses

Dust Risk Level	Wind Speed	Wind Direction (blowing from)	Notification	Response
Low	< 5 m/s	All directions	-	-
Medium	5 – 7.5 m/s		Text & email	Prepare for mitigation actions, visual inspection of dust discharges and implement water application for dust suppression if required
High	≥ 7.5 m/s		Text & email	Operators to visually identify potentially sensitive receptors in downwind direction and to use Tier 1 & Tier 2 dust mitigation measures as appropriate.

Through use of real-time meteorological data to target dust suppression, combined with the two-tier approach to dust prevention detailed in Section 4.2, dust suppression water application will be carefully targeted. This approach will ensure that the objective of mitigating adverse effects of dust discharges without exceedance of the water take limit can be achieved.

Meteorological data will be logged and archived and will be used in the complaints response procedure (see Section 9.2).

7.3 Frequency of Monitoring

Table 4 outlines the frequency of the activities undertaken as part of the monitoring programme.

Table 4: Monitoring Programme Activities and Frequency

Monitoring Activities	Frequency
Check weather forecasts for strong winds and rainfall to plan appropriate activities and dust management response (7-day forecasts also available on www.metvuw.com and www.metservice.com).	Daily and as conditions change
Visual dust monitoring early afternoon site walkover.	Daily
Inspect site access and egress points to ensure dust is being contained to within the site.	Daily
Daily log form for visual monitoring of dust.	Daily
Inspect watering systems (water cannon, sprinklers, water carts and any other spray system) to ensure equipment is maintained and functioning to effectively dampen exposed areas.	Weekly
Inspect dust generating activities (as listed in Section 1.3) to ensure dust emissions are effectively controlled.	Ongoing
Monitor dust generating activities and water application rate.	In winds over 5 m/s blowing all directions.

7.4 Reporting of Monitoring Programme

The following information will be recorded in a daily log or equivalent system (an example of the type of detail that may comprise the daily log is provided in Appendix B of this DMMP):

- Results of the daily site inspections of visible dust emissions;
- Likely source(s) of any observed dust;
- General weather conditions during the day (i.e., windy, calm, warm, rain etc.);
- The frequency of use of the sprinkler system, water cannon and any water carts (if needed);
- Dust control equipment malfunctions and any remedial action(s) taken;

- Any unusual on-site activities; and
- Records of any complaints or other community feedback regarding the waste transfer and processing activities.

The log forms will be collated and stored on site and will be made available to TDC staff upon request.

8.0 DMMP Review

The DMMP will be reviewed and updated, with the necessary approval, throughout the course of the quarrying activity timeline to reflect changes in dust management techniques, staging of excavation and fill areas, or changes to the receiving environment. Approval from the TDC will be required for any relevant revisions of a material nature for the DMMP. The review will take into consideration:

- Any significant changes to dust management activities or methods;
- Key changes to roles and responsibilities;
- Changes in industry best practice standards or recommended dust or odour controls;
- Results of inspection and maintenance programmes, logs of incidents, corrective actions, internal or external assessments; and
- The outcome of investigations into discharges of dust/odour/air pollutants.

Reasons for making changes to the DMMP will be documented and version tracking will be recorded in the 'Document Control' register at the start of this report. A copy of the original DMMP document and subsequent versions will be kept for the project records and marked as obsolete. Each new/updated version of the DMMP documentation will be issued with a version number and date.

9.0 Complaints

9.1 Receipt Procedure

CJ industries acknowledges the importance of ensuring that any complaints are recorded and promptly investigated to identify and resolve the cause of the complaint. Requirements and procedures for complaints are detailed below.

The Site Manager is responsible for response to and follow up all complaints regarding dust or any other air quality matters, and to ensure that suitable trained personnel are available to respond to complaints at all times.

Following the receipt of a complaint the Site Manager will, as soon as is possible, respond as follows:

- Undertake a site inspection. Note all dust-producing activities taking place and the mitigation methods being used, take photographs for reference as appropriate. If the complaint was related to an event in the recent past, where possible, note any dust-producing activities taking place at that time and review on site weather records and daily log;
- Initiate any remedial action necessary, which may include a stop work period;
- Note the time and date of the complaint/s and (unless the complainant refuses to provide them) the identity and contact details of the complainant. Ask the complainant to describe the discharge:
  - Is it constant or intermittent?
  - How long has it been going on for?
  - Is it worse at any time of day?
  - Does it come from an identifiable source?
- Review meteorological data from the on-site station;
- Note if the complaint has been referred to the TDC;
- As soon as possible (within 1 hour, where practicable), visit the area from where the complaint originated to ascertain if dust is still a problem;
- If it becomes apparent that there may be a source of dust other than the quarry activities causing the complaint, it is important to verify this, for example, photograph the source and emissions and/or make notes;
- As soon as possible after initial investigations have been completed, contact the complainant to explain any problems found and remedial actions taken; and
- If necessary, update any relevant procedures to prevent any recurrence of problems and record any remedial action taken.

9.2 Response Procedure

Following the receipt of the complaint, the following actions will be undertaken:

- Fill out the appropriate complaint form, attached as Appendix C to this DMMP;
- Advise site personnel as soon as is practicable that a complaint has been received, what the findings of the investigation were, and any remedial action taken; and

- Call or visit the complainant to update them on the actions taken and to check that the issue has been resolved.

10.0 Emergency Contacts

Internal contacts for the site in the event of an emergency of other problems are provided in Table 5 and Table 6 below.

Table 5: Internal Environmental Emergency Contact Details

Role	Name	Organisation	Phone
Site Manager	TBC	CJ Industries	TBC
Environmental and Consents Officer	TBC	CJ Industries	TBC
After Hours Contact	TBC	TBC	TBC

Table 6: External Environmental Emergency Contact Details

Role	Name	Organisation	Phone	Email
Consents Compliance Team	TBC	Tasman District Council	TBC	TBC

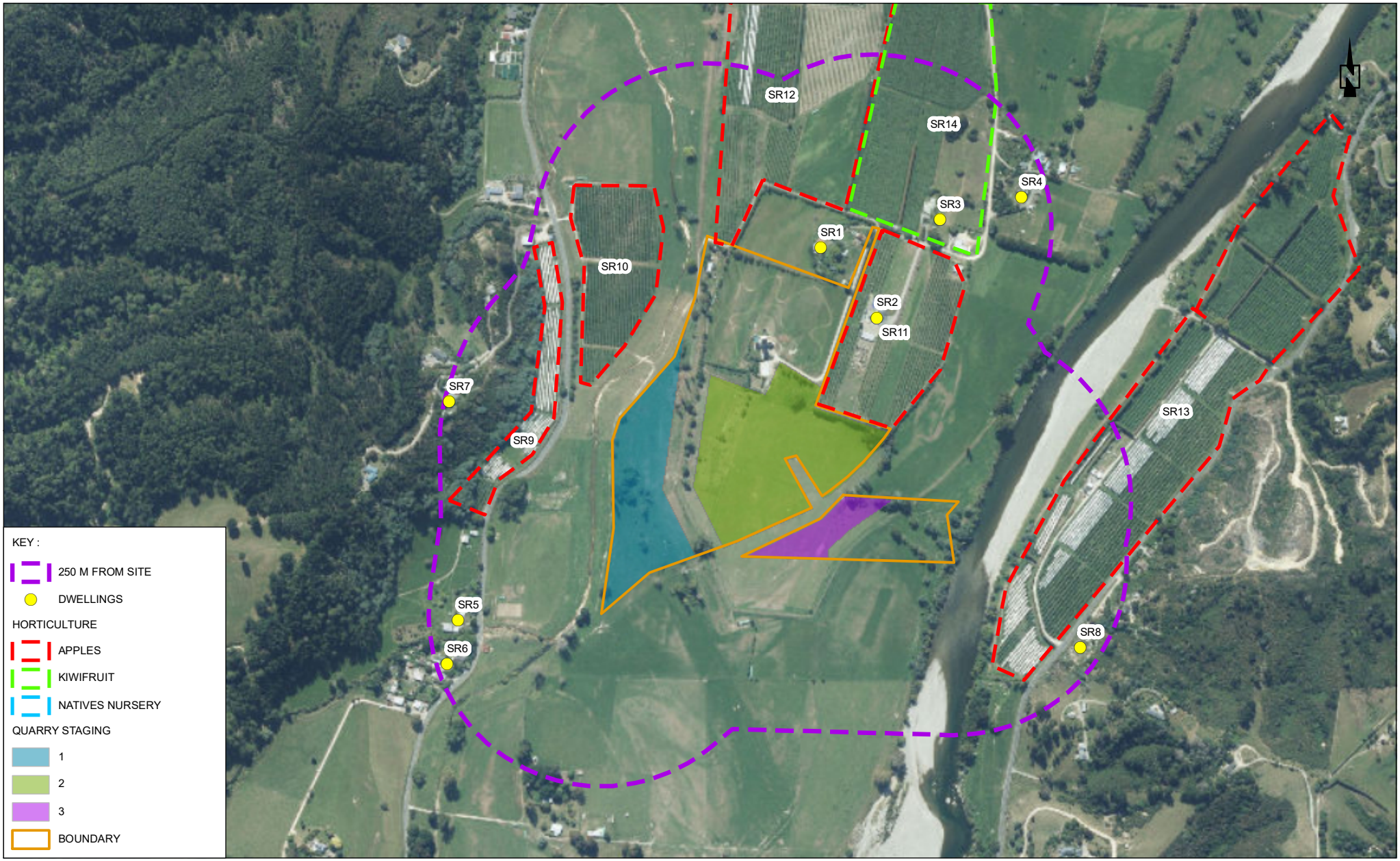
11.0 Annual Report

CJ Industries prepare an annual monitoring report for the period of 1 July to 30 June and provide to the TDC on request. The annual monitoring report shall include but not be limited to:

1. A record of any maintenance of the meteorological monitoring system undertaken over the proceeding 12-month period.
2. The annual complaints record and any investigation, remediation or additional monitoring undertaken as a result of the complaint.

Appendix A: Figure

CJ INDUSTRIES - PEACH ISLAND QUARRY



SOURCE:
1. AERIAL IMAGERY SOURCED FROM THE LINZ DATA SERVICE AND LICENSED BY TASMAN DISTRICT COUNCIL FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
2. HORTICULTURE TYPES SUPPLIED BY CJ INDUSTRIES

FIGURE A-1 : PEACH ISLAND QUARRY - EXISTING ENVIRONMENT

SCALE : 1:7,500 (A4)

0 50 100 200 300

METRES

PATTLE DELAMORE PARTNERS LTD

C04627800Z001-AV2.mxd 30/06/2022 ISSUE 1

Appendix B: Daily Log Form

Daily Dust Inspection Log

Date: _____ Time: _____

Inspection by: _____

Current weather conditions (e.g. sunny, cloudy, rainy): _____

Wind speed and direction (e.g. light, moderate, strong): _____

Weather forecast for next 24 hours (e.g. rainy, windy): _____

Area(s) inspected: _____

Scope of Inspection	Circle Relevant Item	Comments
Is there visible dust from site work activities, stockpiles, earthworks areas or site access roads?	Y N N/A	
Are unsealed surfaces dry and need spraying with water?	Y N N/A	
Are any exposed earthworks visibly dry and need water spray?	Y N N/A	
Stockpiles covered/stabilised where needed?	Y N N/A	
Are there any signs of dust going off site as a result of site activities? [Inspect land adjacent to the site exits and adjoining roads for the presence of dust deposits.]	Y N N/A	
If wind speeds are strong or forecast to be strong (over 5 m/s) are additional inspection and mitigation measures being put in place? (e.g. increase water application, restrictions on dusty activities)	Y N N/A	
Are watering systems (e.g. sprinklers, water carts, wheel wash) operating effectively to minimise dust?	Y N N/A	
Are trucks carrying loose (uncovered) material entering or leaving the site?	Y N N/A	
How frequently has water sprinkling/spraying been used today (i.e. number of sprinklers, cannons, time, area watered)		

Scope of Inspection	Circle Relevant Item	Comments
Note and dust control equipment malfunctions (and remedial actions taken as appropriate)		
Any unusual on-site activities today?		
Complaints received / community feedback		

Appendix C: Complaints Records

DUST COMPLAINT & ASSESSMENT FORM

PART A: Complaint Details

Date: Time:

Complaint Received By:

Name:

Address:

Contact phone numbers:

Possible source:

Anonymous: Y/N

Is dust occurring now?

Complaint details (include impacts/effects experienced by complainant:

PART B: Complainant Location Assessment

Date: Time:

Assessors Name:

Person spoken to at complaint location:

Reason for investigation: COMPLAINT/PROACTIVE

Complaint details (include impacts/effects experienced by complainant:

INITIAL IMPRESSIONS:

Type of dust

Time of the intial impression:

Any visible dust deposits: Y/N

Plume width (if known):

VISIBLE DUST DEPOSITS

Describe approximate quantites and extent

When was surface last cleaned?

Frequency of cleaning:

Describe the appearance of the deposits:

Colour		Any odour	
Shape		Water soluble	
Size		Other	
Crystalline or powdery			
Hard, soft			

Weather Data (see over)

Wind direction:
Wind velocity:
Cloud cover:
Temperature:
Rainfall in past 24 hrs:

Photos Taken: Y/N Samples taken Y/N

Diagram/description of where photos were taken.

Diagram/description of where samples were taken:

Sample collection: Use a small paintbrush (clean) to sweep samples of the dust onto a sheet of paper and then into a clean plastic bag. At least half a teaspoonful will be required for analysis. Lesser amounts may be colected on strips of clear cellotape, which should then be stuck onto sheets of clear plastic to preserve the samples. Label all samples and record date, time, location, etc on a separate sheet of paper if required.

Based on your assessment on this occasion, which of the following applies:

- [ ] I did not find any dust
- [ ] I did find dust and consider it would not be objectionable at any location for any duration or frequency
- [ ] I did find dust and consider it would be objectionable if it became continuous
- [ ] I did find dust and consider it would be objectionable if it occurred on a regular or frequent basis
- [ ] I did detect dust and consider it to be objectionable even in periods of short duration.

FINAL CHECKLIST

- [ ] Upwind assessment completed. Record details below. If not, detail reason: _____
- [ ] Aerial photo/sketch showing location of assessment and upwind assessment attached
- [ ] Are there potential witness statements to obtain YES/NO

REMARKS

PART C: Off-site dust and 360° assessment

Assess the dust upwind of the suspected source and if possible conduct a 360° sweep around the source assessing the odour at different points

OTHER POTENTIAL SOURCES **Time:** _____

Check for road works, ploughing, construction activities, burn-offs, unsealed roads, unsealed sites

Site 1:

Wind direction: Wind strength: Wind stability: GPS Loc:

Visible dust: Desciption of dust

Comment:

Site 2:

Wind direction: Wind strength: Wind stability: GPS Loc:

Visible dust: Desciption of dust:

Comment:

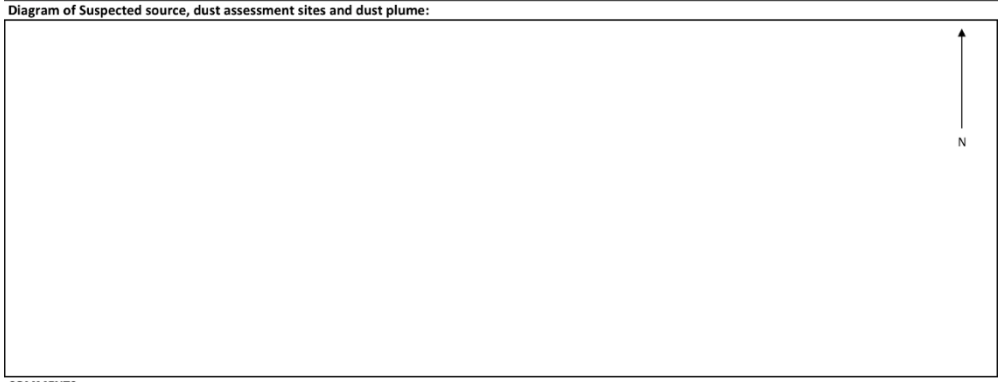
Site 3:

Wind direction: Wind strength: Wind stability: GPS Loc:

Visible dust: Description of dust:

Comment:

Diagram of Suspected source, dust assessment sites and dust plume:



COMMENTS

PART D: Source On-site Investigation

If source of dust identified, visit site, identify yourself and show warrant. Explain the findings of your investigation to staff.

Date: Time: Source Identified:

Staff spoken to:: Position:

Staff contact phone number:

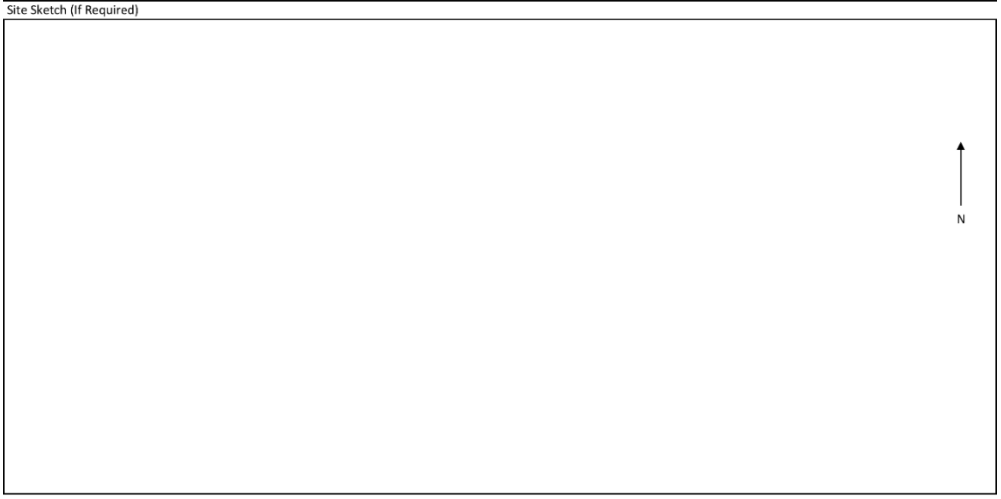
Current site operations:

Reason/explanation given for dust

Other Comments

Monitoring results/samples/other records

Site Sketch (If Required)



SIGNED BY ASSESSOR _____ DATE: _____

PART E: Dust Reference Sheet

Definitions

Objectionable The term objectionable is the term used in consent conditions and is an ingredient of any subsequent enforcement action. It is a subjective term and is open to interpretation. There is guidance from case law which defines objectionable as: unpleasant or offensive or repugnant; open to objection or undesirable or disapproved of; noxious or dangerous. A test will be applied by the court that the term objectionable will be as it applies to "the minds of a significant cross section of reasonable people in the community". The assessor must bear this test in mind when completing their assessment.

Frequency How often an individual is exposed to dust nuisance events

Intensity As indicated by dust quantity/concentration and the degree of nuisance

Duration The length of the particular dust event

Character How objectionable the dust is, having regard to the nature of the dust

Land Beaufort Wind Scale

B. No.	Description	How to Recognise
0	Calm	Smoke rises straight up
1	Light Air	Smoke drifts
2	Light Breeze	Wind felt on face; leaves rustle
3	Gentle Breeze	Flags flap; twigs move all the time
4	Moderate Breeze	Papers blow; small branches move
5	Fresh Breeze	Small trees sway
6	Strong Breeze	Large branches move, wind whistles
7	Near Gale	Whole trees sway

Measuring Temperature

Use descriptions below or obtain local meterological data, especially temperature from websites such as www.metservice.govt.nz

Cold
Cool
Mild
Warm
Hot

Measuring Cloud Cover

Okta No.	Description
0	Clear Sky
1	Sunny
2	Mostly sunny
3	
4	Half the sky is covered in cloud
5	
6	Mostly cloudy
7	Considerable cloudiness
8	Overcast
F	Fog / Mist

During the day the sun is always shining, so the amount of sunshine reaching the ground depends on the amount and duration of any cloud cover. The amount of cloud cover is usually given in units called oktas. Each okta represents one eighth of the sky covered by cloud.

Appendix D: Beaufort Wind Scale

Table D-1: Beaufort Wind Scale			
Beaufort Scale	**Wind Speed (m/s)**	**Description**	**Observations**
0	0-0.2	Calm	Calm. Smoke rises vertically.
1	0.3-1.5	Light Air	Wind motion visible in smoke.
2	1.6-3.3	Light Breeze	Wind felt on exposed skin. Leaves rustle.
3	3.4-5.4	Gentle Breeze	Leaves and smaller twigs in constant motion.
4	5.5-7.9	Moderate Breeze	Dust and loose paper raised. Small branches begin to move.
5	8-10.7	Fresh Breeze	Branches of a moderate size move. Small trees begin to sway.
6	10.8-13.8	Strong Breeze	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
7	13.9-17.1	Near Gale	Whole trees in motion. Effort needed to walk against the wind. Swaying of skyscrapers may be felt, especially on upper floors.
8	17.2-20.7	Gale	Twigs broken from trees. Cars veer on road.
9	20.8-24.4	Severe Gale	Larger branches break off trees, some small trees blow over. Demolition/temporary signs and barricades blow over. Damage to circus tents and canopies.
10	24.5-28.4	Storm	Trees broken off or uprooted, saplings bent and deformed, poorly attached asphalt shingles or shingles in poor condition peel off roofs.
11	28.5-32.6	Violent Storm	Widespread vegetation damage. More damages to most roofing surfaces, asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	32.7-36.9	Hurricane	Considerable and widespread damage to vegetation, a few windows broken, structural damage to mobile homes and poorly constructed sheds and barns. Debris may be hurled about.