Clevedon Quarry: Air Quality Assessment

- Prepared for

Stevenson Aggregates Limited

- 27 October 2026

PATTLE DELAMORE PARTNERS LTD
Level 2, 109 Fanshawe Street,
Auckland Central 1010
PO Box 9528, Auckland 1149, New Zealand

Tel +64 9 523 6900
Web www.pdp.co.nz

solutions for your environment

Quality Control Sheet

TITLE	Clevedon Quarry: Air Quality Assessment
CLIENT	Stevenson Aggregates Limited
ISSUE DATE	27 October 2026
JOB REFERENCE	A030910003

Revision History

REV	Date	Status/Purpose	Prepared By	Reviewed by	Approved
A	03/12/2025	First draft for client review	Amy Burney	Paul Crimmins	Jeff Bluett
B	06/03/2026	Updated staging plans	Amy Burney	Paul Crimmins	Andrew Curtis
C	09/07/2026	Updated wind analysis and staging figures	Paul Crimmins	Paul Crimmins	Jeff Bluett
D	27/10/2026	Post-legal review	Paul Crimmins	Paul Crimmins	Jeff Bluett

DOCUMENT CONTRIBUTORS

Prepared by

SIGNATURE

Paul Crimmins

Reviewed and approved by

SIGNATURE

Jeff Bluett

Limitations:

This report has been prepared by Pattle Delamore Partners Limited (PDP) on the basis of information provided by Stevenson Aggregates 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 Stevenson Aggregates 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.

The author of this report acknowledges that this report will be relied on by a Panel appointed under the Fast Track Approvals Act 2024 and these disclaimers do not prevent that reliance.

© 2026 Pattle Delamore Partners Limited

Executive Summary

Stevenson Aggregates Limited (SAL) is seeking resource consents to extend the current footprint for mineral extraction at its Clevedon Quarry, 546 McNicol Road, Clevedon (the Site). The proposed quarry extension will be staged with remediation of quarried areas being undertaken as the quarry stages progress.

SAL has engaged Pattle Delamore Partners Limited (PDP) to assess the air quality effects (outlined in this Air Quality Assessment) of the quarry expansion to support an Assessment of Environmental Effects (AEE) and Fast-track consent application.

The proposed quarry expansion will not increase the maximum rate of aggregate extraction or processing currently authorised under air discharge consent DIS60302443. Instead, the key changes relevant to air discharges are the extended duration of quarrying activities and the expansion of the areas where extraction will occur, including changes to the location and extent of the internal haul roads.

PDP has assessed the potential amenity, human health and ecological effects of the proposed quarry extension. PDP concludes that there is a low risk of dust effects from the proposed expanded Clevedon Quarrying operation. Overall, the adverse effects from the potential discharges of dust from the expanded quarry are considered negligible. This conclusion is based on the following findings:

- SAL utilises and proposes to continue to utilise dust mitigation and management measures that, if continued to be effectively implemented, will minimise dust emissions and limit impacts to within 50 to 100 m of the sources.
- The Site's key dust mitigation measure is the application of water to potentially dusty surfaces. PDP considers that SAL has sufficient water available on site to ensure that effective dust suppression can continue to be undertaken at Clevedon Quarry.
- The majority of sensitive receptors are located at distances greater than 300 m from dust sources and therefore will not be notably affected by dust from the proposed quarrying activities when the proposed dust mitigation measures are implemented.
- Based on the meteorological data for the area, the nearest high sensitivity receptors, located to the north and west of the quarry, are not frequently exposed to high-risk wind conditions blowing from the quarry.
- The current quarrying activity has not been the subject of any dust complaints.

- The continuation of the current quarrying activity at the same rate of extraction and processing across an expanded footprint is not likely to change the existing low levels of dust nuisance effects.
- Based on the silica concentration within the aggregate materials and the monitoring data from comparable quarries, PDP does not consider that there is any material risk for people currently living near the expanded Clevedon Quarry to be exposed to elevated concentrations of respirable crystalline silica.
- The concentrations of PM_{10} in areas surrounding the Clevedon Quarry will remain well below the relevant Ambient Air Quality Standard of the NESAQ and WHO Air Quality Guidelines.
- Based on the dust management measures proposed and on-site observations, PDP considers that ecologically sensitive vegetation and streams in the surrounding environment are not likely to be materially impacted by dust deposition from the expanded Clevedon Quarry.

Table of Contents

SECTION		PAGE
Executive Summary		ii
1.0	Introduction	1
2.0	Project Background	1
2.1	Existing Quarry	1
2.2	Proposed Phased Quarry Expansion	3
3.0	Location and Receiving Environment	4
3.1	Site Location	4
3.2	Human Sensitivity of the Receiving Environment	5
3.3	Ecological Sensitivity of the Receiving Environment	8
3.4	Meteorology	9
3.5	Existing Air Quality	13
4.0	Project Description: Dust Generating Activities	13
4.1	Removal of Overburden	13
4.2	Removal of Rock from Quarry Face	14
4.3	Processing of Quarried Rock	14
4.4	Stockpiling of Topsoil, Quarried Rock and Quarry Products	15
4.5	Loading Topsoil, Quarried Rock and Quarry Products onto Trucks	15
4.6	Transportation of Rock and Quarry Products	16
5.0	Types of Air Contaminants Discharged	16
5.1	Particulate Matter	16
5.2	Respirable Crystalline Silica	18
5.3	Machine and Vehicle Emissions	18
6.0	Particulate Dispersion	19
6.1	Wind Speed Thresholds for Dust Generation	19
6.2	Particle Transport Considerations	20
7.0	Risks Posed by Air Contaminants Discharged	22
7.1	Nuisance Dust	22
7.2	Health Effects Dust and RCS	23
7.3	Ecology Effects	24
8.0	Air Quality Assessment Criteria	24
8.1	Nuisance Dust	24
8.2	Buffer Distances	25
8.3	TSP and PM_{10}	25
8.4	Respirable Crystalline Silica	27

8.5	Ecological Effects	27
9.0	Mitigation Measures	28
9.1	Existing Dust Mitigation and Dust Management Plan	28
9.2	Dust Mitigation - Water Dust Suppression	29
9.3	Recommended Further Dust Mitigation Procedures	30
10.0	Assessment Methodology	32
10.1	Amenity Effects	32
10.2	Human Health effects	33
10.3	Ecological Effects	33
11.0	Assessment of Environmental Effects	33
11.1	Amenity Effects	33
11.2	Human Health Effects	36
11.3	Ecological Effects	40
12.0	Conclusion	41

Table of Figures

Figure 1: Clevedon Quarry Location 2

Figure 2: Indicative Quarry Expansion Stages 3

Figure 3: Stage 5 Quarry Pit Extent and AUP Zoning 5

Figure 4: Sensitive Receptors in Relation to Stage 5 quarry extent, including 500 m and 1 km buffer distances 6

Figure 5: Waterways in close proximity to the proposed quarry boundary 8

Figure 6: Wind Rose for Clevedon AWS, November 2022 to May 2026 10

Figure 7: Ardmore Aerodrome average daily precipitation (2000-2016) 12

Figure 8: Ardmore Aerodrome average days per month with more than 0.2 mm of rainfall (2000-2016) 12

Figure 9: Existing Front of House Quarry layout 15

Figure 10: Particle size of different dust types (GPG:Dust) 17

Figure 11: Variation of hourly PM_{10} concentrations with windspeed (Watson, 2000) 20

Figure 12: Difference in Particle Travel with Wind Speed (Stoke's Law) 22

Table of Tables

Table 1: Proposed Quarry Expansion Timeline 4

Table 2: Approximate location of receptors near to the proposed Clevedon Quarry expansion 7

Table 3: Clevedon AWS wind frequency data (2022- 2026) 11

Table 4: GPG:Dust trigger levels for TSP monitoring 26

Table 5: Windspeed trigger levels for on-site dust management 31

Appendices

Appendix A: Seasonal Wind Roses – Clevedon Quarry November 2022 to May 2026

Appendix B: Ardmore Aerodrome Wind data July 2016 to October 2024

Appendix C: Existing Clevedon Quarry Dust Management Plan

1.0 Introduction

Stevenson Aggregates Limited (SAL) is seeking resource consents to extend the current footprint and duration for mineral extraction at the Clevedon Quarry, located at 546 McNicol Road, Clevedon (the Site).

The quarry is currently consented to extract 3 million tonnes per year (MT/year) with this maximum rate to remain unchanged as the quarry footprint expands. The current consented quarry footprint is 29 hectares (ha). SAL proposes to expand the quarry footprint to approximately 74 ha over five indicative stages, over an approximate 50-year period. The expansion will ensure access to approximately 150 MT of aggregate at an annual extraction limit of 3 MT per year.

The proposed expansion in quarry operations follows Plan Change 89 to the Auckland Unitary Plan (AUP), which rezoned adjoining land to Special Purpose – Quarry Zone (SPQZ). The rezoned land is outside (to the south) of the consented quarry footprint[1].

Pattle Delamore Partners Limited (PDP) has been engaged by SAL to assess the air quality aspects of the Clevedon Quarry expansion, in particular the dust effects of this proposal. PDP has undertaken observations of the current operations at Clevedon Quarry and prepared a FIDOL (Frequency, Intensity, Duration, Offensiveness and Location) dust assessment for the proposed expansion. The FIDOL assessment is based on these observations, the meteorology of the site, and PDP's extensive observations and experiences at other similar quarrying sites.

This Air Quality Assessment is written to support a resource consent application from SAL for the proposed Clevedon Quarry expansion under the Fast-Track Approvals Act 2024.

2.0 Project Background

2.1 Existing Quarry

Clevedon Quarry has been in operation since the 1970s and is located 5.5 km to the south-east of Clevedon, with the SAL land bordering the Hunua Ranges Regional Park on the eastern side. The location of the quarry can be seen in Figure 1.

[1] NZEnvC 96. (2018); which includes air discharge consent DIS60302443.

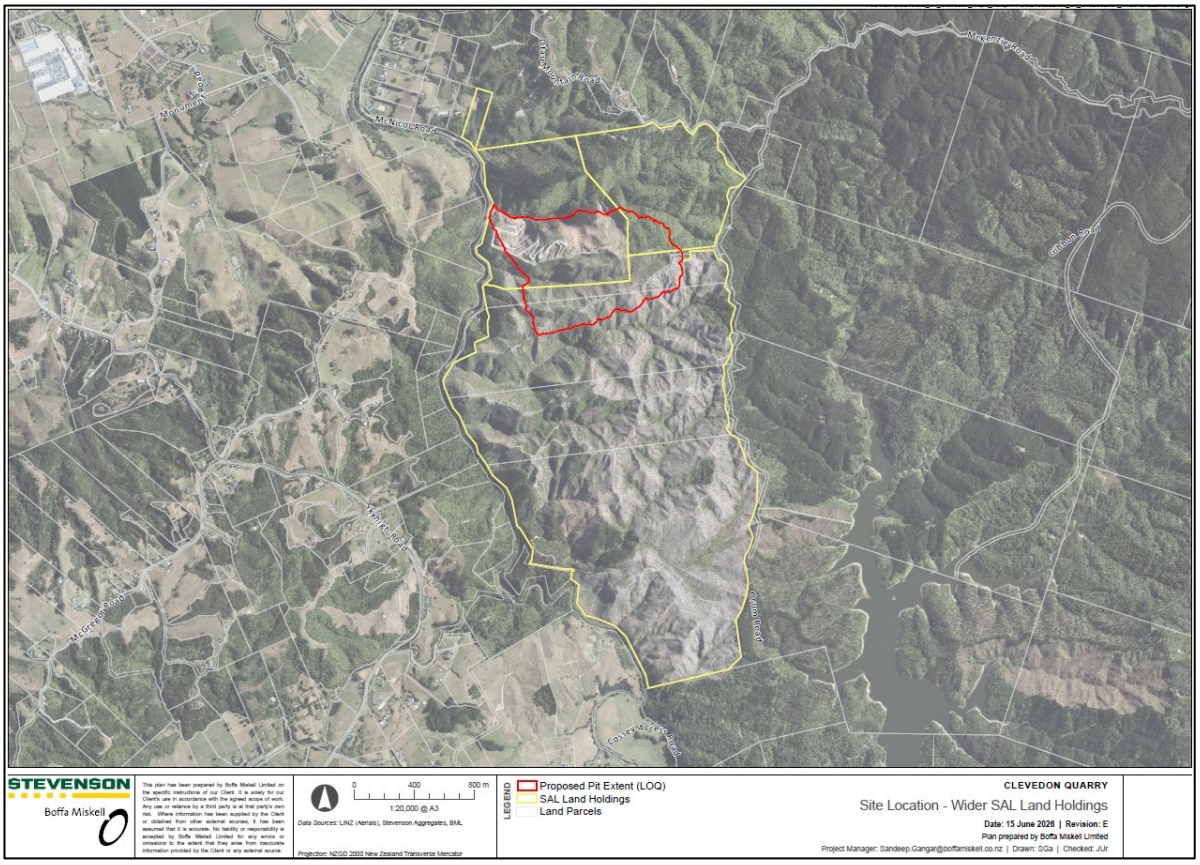


Figure 1: Clevedon Quarry Location

The currently consented quarry pit is approximately 29 ha in size, with the proposed pit size to reach a maximum area of 74 ha over the next 50 years.

The zoning of the proposed quarry extent comprises approximately 59 ha (around 80%) within the SPQZ, with the remaining approximately 16 ha (around 20%) within the Rural Production Zone (RPZ). The SAL landholding also consists of a number of lots neighbouring the quarry with a total extent of approximately 544.3 ha as shown by the white outlines on Figure 1.

Resource Consents were most recently granted for the operation of Clevedon Quarry by the Environment Court in 2018 (Consent bundle BUN60302442).[2] These consents include air discharge consent DIS60302243, granted under Chapter 14 of the AUP and which expires in 2053. Consent compliance was reviewed by Auckland Council in August 2025, which included a review of the site's 2024-2025 Dust Management Plan (DMP).

[2] NZEnvC 96. (2018).

Current extraction volumes at Clevedon Quarry are in the order of up to 200,000 – 300,000 tonnes per year. The quarry currently operates with fixed and mobile crushers and screens to process extracted rock for off-site use as construction aggregate materials.

PDP understands that there have not been any air quality-related complaints made to SAL or Auckland Council as a result of activities from the Clevedon Quarry for the 2018-2026 period.

2.2 Proposed Phased Quarry Expansion

The surrounding SAL landholding (yellow parcels) as well as the proposed staged expansion of the quarry footprint are shown in Figure 2 with the indicative timeframe for expansion outlined in Table 1.

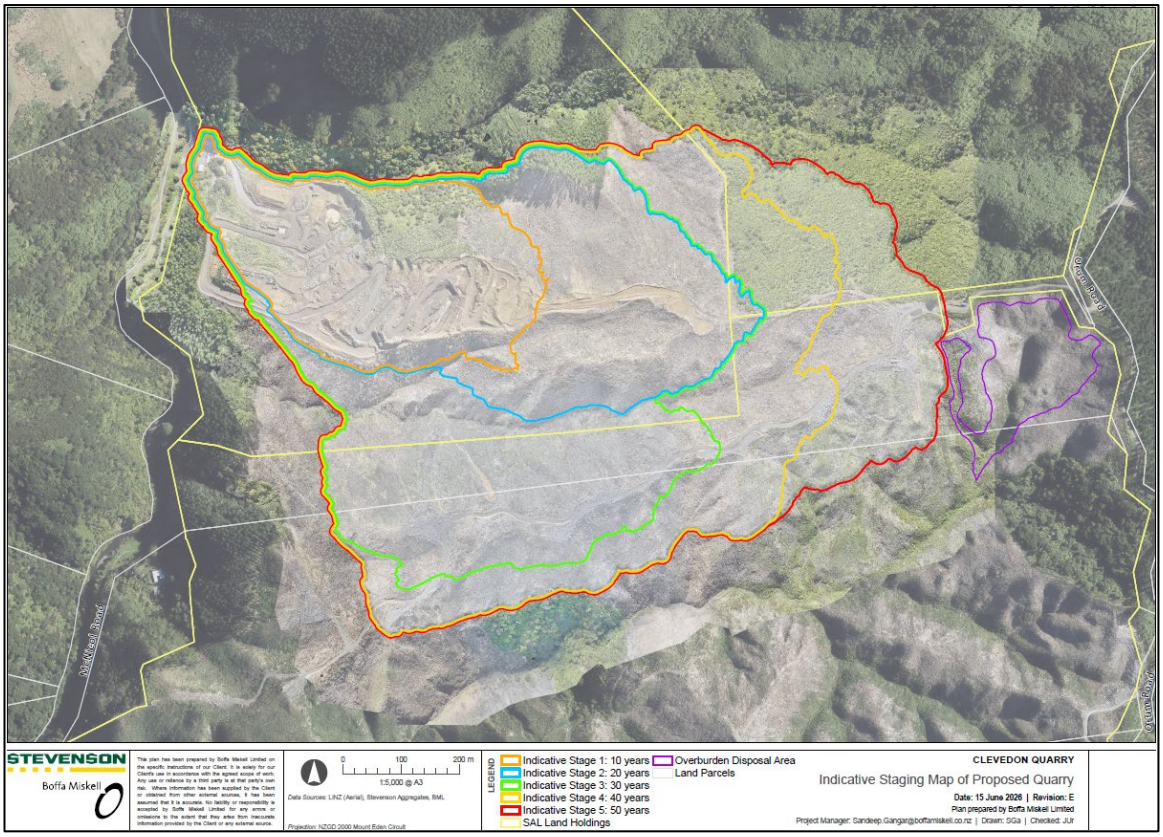


Figure 2: Indicative Quarry Expansion Stages

Table 1: Proposed Quarry Expansion Timeline		
Stage	**Map Colour**	**Indicative Timeframe**
Stage 1	Orange	10 years
Stage 2	Blue	20 years
Stage 3	Green	30 years
Stage 4	Yellow	40 years
Stage 5	Red	50 years
Overburden Disposal Area (OBDA)	Purple	10 years

3.0 Location and Receiving Environment

3.1 Site Location

Clevedon Quarry is located 5.5 km to the south-east of the town of Clevedon, within the Hunua Ranges. Figure 1 shows the location of the quarry and SAL land in relation to the south-eastern Auckland region.

The majority of the quarry and proposed expanded quarry is zoned by the AUP as SPQ Zone. Adjoining this SPQ Zone is land zoned by the AUP as Rural – Rural Production. Figure 3 shows the proposed quarry footprint and SAL land-holdings in relation to the AUP zoning.

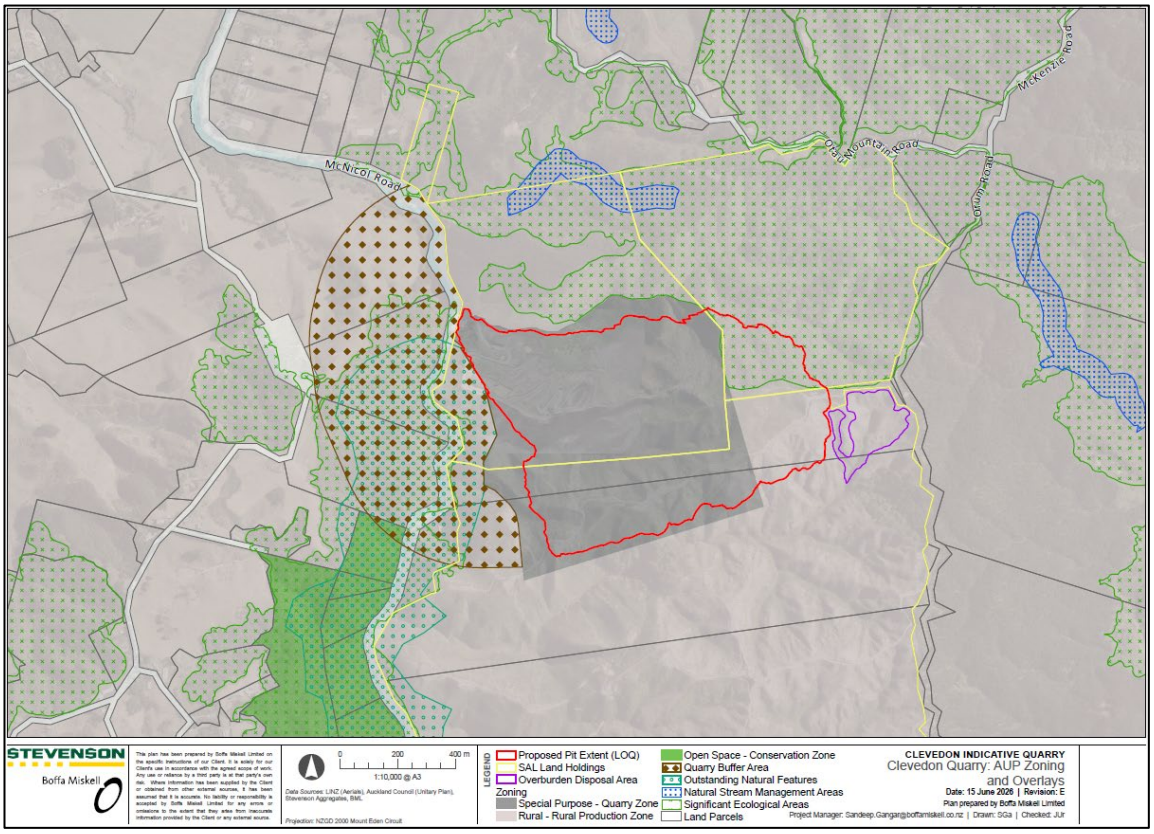


Figure 3: Stage 5 Quarry Pit Extent and AUP Zoning

3.2 Human Sensitivity of the Receiving Environment

In the context of this air quality assessment, the term 'sensitive receptors' is defined as a location where people or surroundings may be particularly sensitive to the effects of air pollution, in accordance with the definition provided by the AUP. This type of receptor includes:

- residential dwellings;
- hospitals;
- schools;
- libraries; and
- public outdoor locations (e.g. parks, reserves, beaches, sports fields).

A site investigation was undertaken to identify nearby discrete receptors deemed sensitive to changes in air quality as a result of potential dust discharges from the expanded Clevedon Quarry operations.

Sensitive receptors, including residential properties on the SAL owned land within 1 km of the largest proposed site boundary (i.e. the 50 year 'Life of Quarry' footprint extent) have been marked in Figure 4 and listed in , with the majority located to the north, north-east and north-west of the site. Note, although residential properties on SAL land are owned by SAL (R3 and R5), the occupants are tenants and as such they have been included as sensitive receptors in this assessment. Figure 4 also shows a 500 m line from the boundary of the Life of Quarry footprint which is the distance beyond which it is highly unlikely to experience any effects on amenity values and is the trigger buffer distance to require an assessment of quarrying activities under the Environmental Protection Agency Victoria's planning guidelines.[3] The 1 km marking is included to delineate all representative sensitive receptors considered in this assessment.

The estimated separation distances are measured to the nearest point of the Life of Quarry footprint (the maximum area of the proposed quarry extension). However, these minimum separation distances are not likely to occur until at least 40 years into the future. The expansion of the site from the 2018 consented footprint to the Stage 5 footprint causes three additional sensitive receptors to fall within 1 km of the site (129 Highridge Road, 498 McNicol Road and 494 Otau Mountain Road).

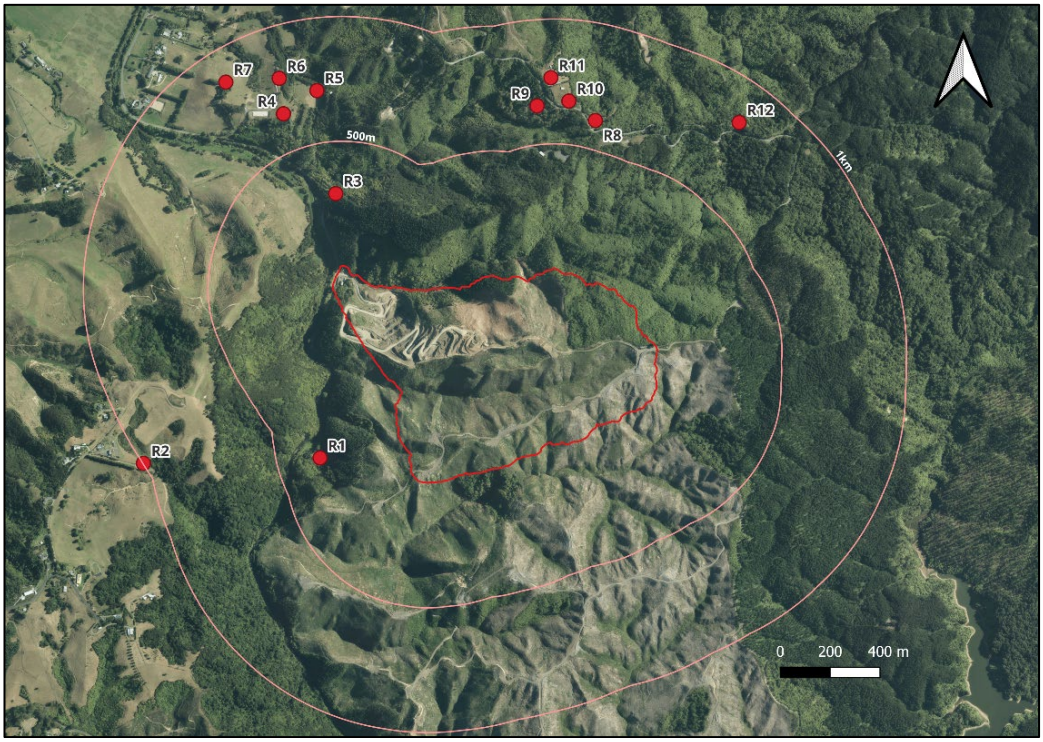


Figure 4: Sensitive Receptors in Relation to Stage 5 quarry extent, including 500 m and 1 km buffer distances

[3] Environmental Protection Agency Victoria. (2024). *Separation distance guidelines. Publication 1949*.

Table 2: Approximate location of receptors near to the proposed Clevedon Quarry expansion			
Receptor Name	Address	Approx. Minimum Distance to Final Stage 5 Quarry Footprint (m)	Closest Direction Relative to the Quarry
R1	600 McNicol Road	340	West
R2	129 Highridge Road	1000	West
R3	546 McNicol Road (SAL Owned)	420	North-west
R4	520 McNicol Road	780	North-west
R5	530 McNicol Road (SAL Owned)	820	North-west
R6	510 McNicol Road	910	North-west
R7	498 McNicol Road	990	North-west
R8	460 Otau Mountain Road	590	North
R9	373 Otau Mountain Road	640	North
R10	426 Otau Mountain Road	640	North
R11	422 Otau Mountain Road	740	North
R12	494 Otau Mountain Road	880	North-east

Chapter E14 of the AUP[4] defines the sensitivity of zones to dust and odour. The SPQ Zone is defined by Chapter E14 as 'Low air quality – dust and odour area (Quarry)', to denote its low sensitivity to dust discharges. The neighbouring Rural – Rural Production Zone is defined as 'Medium air quality – dust and odour rural area (Rural)'.

[4] Auckland Unitary Plan Section E14 Air Quality: https://unitaryplan.aucklandcouncil.govt.nz/index.html

3.3 Ecological Sensitivity of the Receiving Environment

The area around the quarry site is primarily commercial forestry (pine). To the north-east of the current quarry lies an area which the AUP has identified as a Significant Ecological Area (SEA_T_5588) due to the indigenous vegetation growing there.

The Wairoa River Gorge located to the west of the site is identified in the AUP as an Outstanding Natural Feature (ONF) ID 237. A number of tributaries of the Wairoa River are located across the proposed pit extent.

The quarry expansion is not proposed to encroach into the Wairoa River Gorge ONF. However, the final two stages of the expansion will encroach into the SEA _T_5588 area, which will require the removal of vegetation within the proposed quarry footprint.

Figure 3 shows the AUP zoning and overlays relevant to the land within and surrounding the proposed Life of Quarry footprint (red polygon). Figure 5 shows the waterways located near this Life of Quarry footprint.

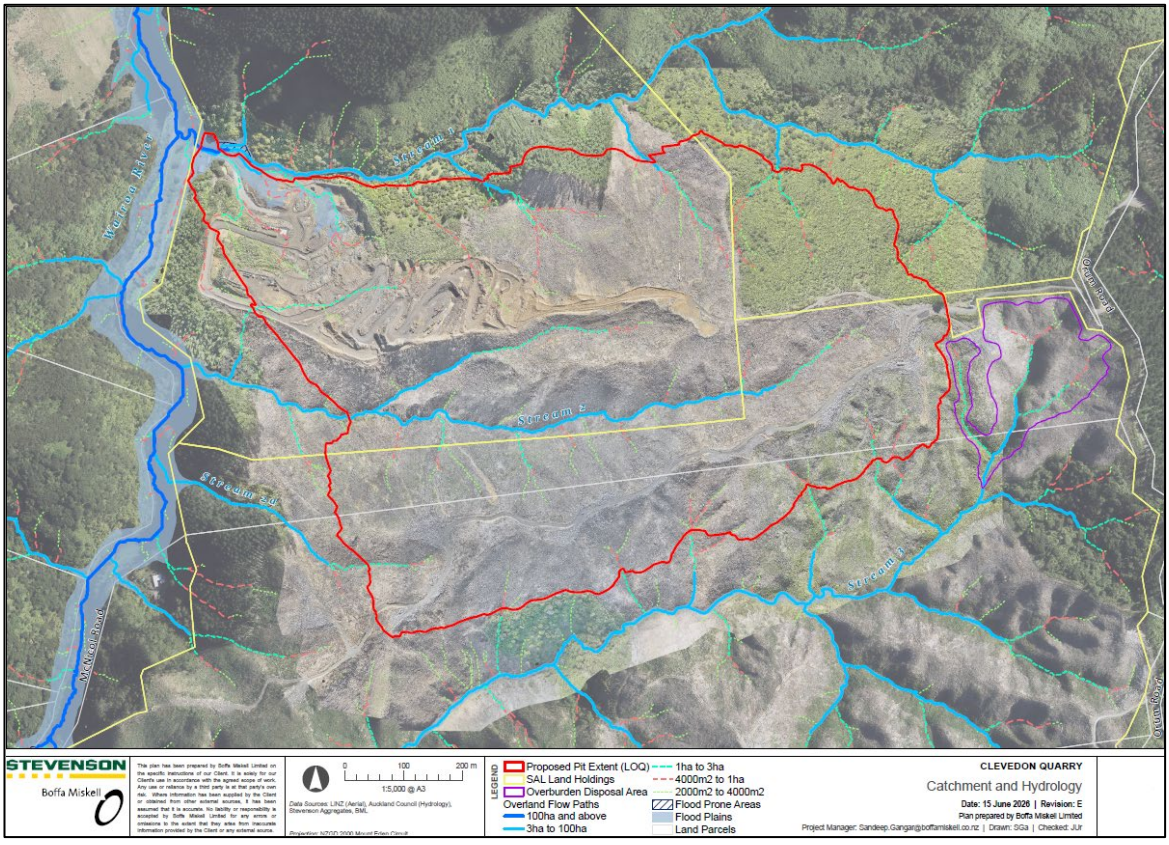


Figure 5: Waterways in close proximity to the proposed quarry boundary

Figure 3 and Figure 5 show the ecological receptor areas which could potentially be impacted from the dust discharged from the proposed quarry extension. The ecological receptors include:

- Rural production land located on the south and south-east boundaries;
- Forested land to the north and north-east boundaries;
- Natural steam management area on the west boundary; and
- Streams on the western, southern and northern boundaries.

Although ecological receptors are identified in close proximity to the quarry, the nature of these receptors is such that their sensitivity to the impacts of dust is generally low. The ecological impact from fugitive dust emissions is expected to be minimal.

3.4 Meteorology

Wind can have a significant effect on dust generation and transportation. Clevedon Quarry has its own Automatic Weather Station (AWS) located between the processing area and entrance gate of the quarry (refer to Figure 9). This was installed in November 2023, logging weather conditions continuously at one-minute resolution, and is inspected and calibrated on a quarterly basis. PDP has reviewed the data collected by the Clevedon Quarry AWS between 1 November 2023 and 31 May 2026.

A reference grade meteorological station is also located at the Ardmore Aerodrome 9.3 km to the west of the site. PDP has reviewed the data collected from this station between 24 July 2016 and 20 October 2024 to compare the representativeness of the Clevedon data.

Figure 6 shows the wind rose for the Clevedon Quarry AWS and Table 3 shows the frequency distribution of wind at this site. The data shows mostly low windspeeds with predominant southerly and north-westerly winds at this location. Seasonal windroses for the Clevedon Quarry AWS can be found in Appendix A.

These wind directions are seasonal in nature with southerly winds dominating in the winter months. This wind data appears to be influenced by the mast height of the monitor and the topography of the site. Due to the hilly topography of the site the Clevedon Quarry AWS data may not be representative of the entire quarry extent.

Data from Ardmore Aerodrome is presented in Appendix B. The Ardmore weather station is in a more exposed location that can be assumed to be representative of the flatter area to the west of the quarry. This data shows generally faster windspeeds than the Clevedon Quarry AWS with prevailing south-westerly winds in summer and east to north-east in winter, which is the

typical wind pattern across the Auckland region. The lower wind speeds measured from the Clevedon Quarry AWS may in part be due to the lower height of the station and sheltering from the topography.

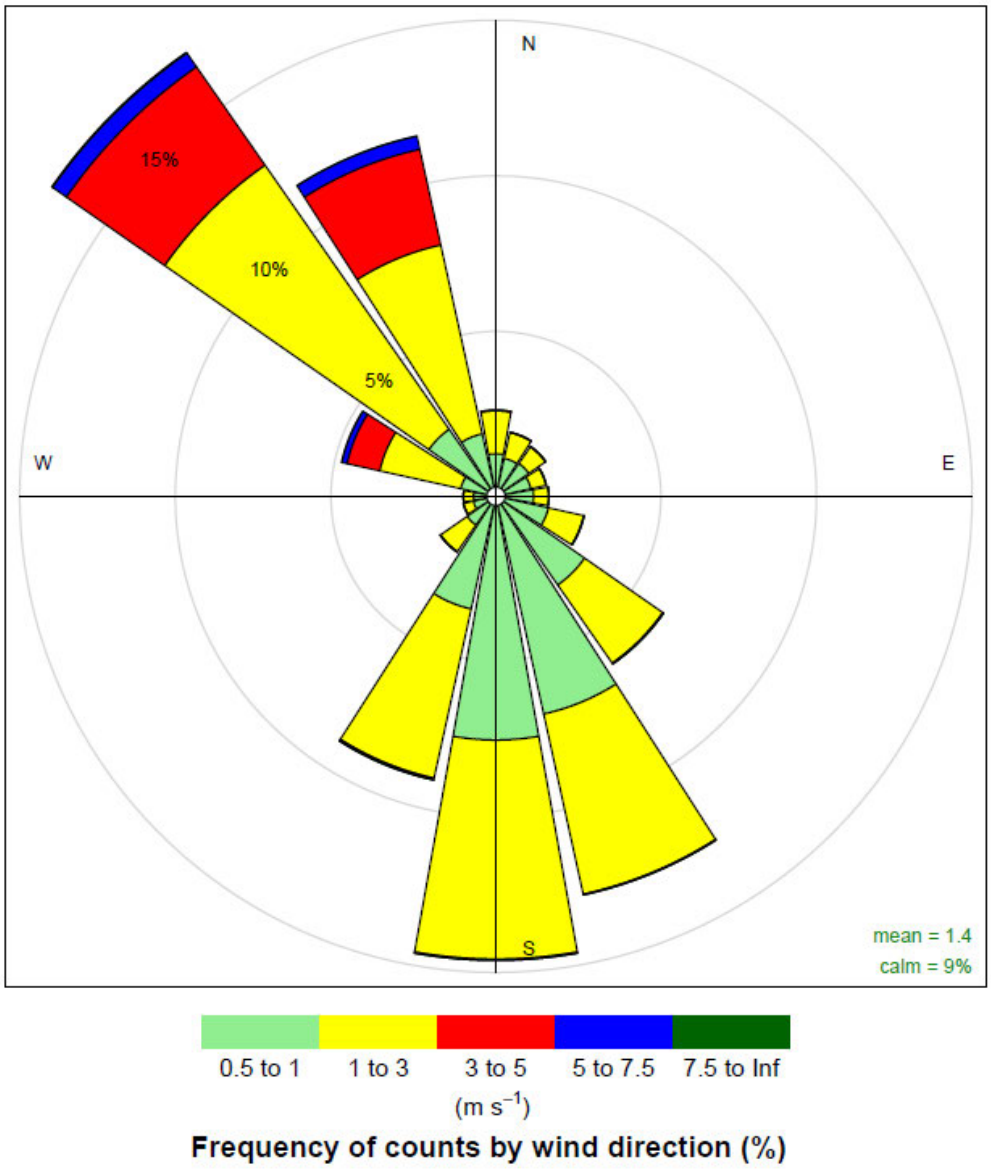


Figure 6: Wind Rose for Clevedon AWS, November 2022 to May 2026

Table 3: Clevedon AWS wind frequency data (2022- 2026)						
Wind Direction	Wind Speed (m/s)					
	0.5 - 1.0	1.0 - 3.0	3.0 - 5.0	5.0 - 7.5	>7.5	Total (%)
North	1.1	1.4	0	0	0	2.5
North northeast	0.9	0.9	0	0	0	1.8
Northeast	1	0.7	0	0	0	1.7
East northeast	0.8	0.5	0	0	0	1.3
East	0.9	0.5	0	0	0	1.4
East southeast	1.4	1.2	0	0	0	2.6
Southeast	3.2	3.1	0	0	0	6.3
South southeast	6.9	6	0	0	0	12.9
South	7.5	7.1	0	0	0	14.6
South southwest	3.4	5.6	0.1	0	0	9.1
Southwest	0.8	1	0	0	0	1.8
West southwest	0.4	0.3	0	0	0	0.7
West	0.4	0.3	0	0	0	0.7
West northwest	0.9	2.7	1.1	0.2	0	4.9
Northwest	2.3	10.4	3.9	0.5	0	17.1
North northwest	1.8	6.2	3.2	0.4	0	11.6
Sub-total	**33.7**	**47.9**	**8.3**	**1.1**	**0**	**91**
Calms (<0.5 m/s)						9
Total						**100.0**

Rainfall acts as a natural dust suppressant and therefore reduces the potential for dust generation. The average daily precipitation for the years 2000 to 2016 for the nearest automated weather station which measures rainfall (Ardmore Aerodrome) are shown in Figure 7. Over the data period available, 53% of days had less than 0.2 mm of rain in a 24-hour period. The driest months of the year are January to April (refer Figure 8), therefore greater consideration and management should be given to dust control during these drier months.

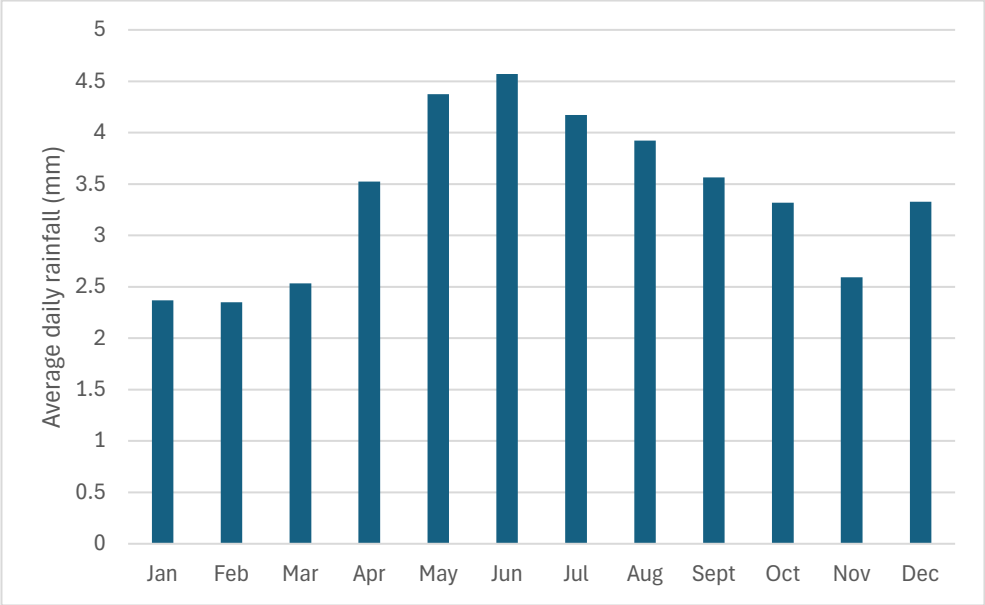


Figure 7: Ardmore Aerodrome average daily precipitation (2000-2016)

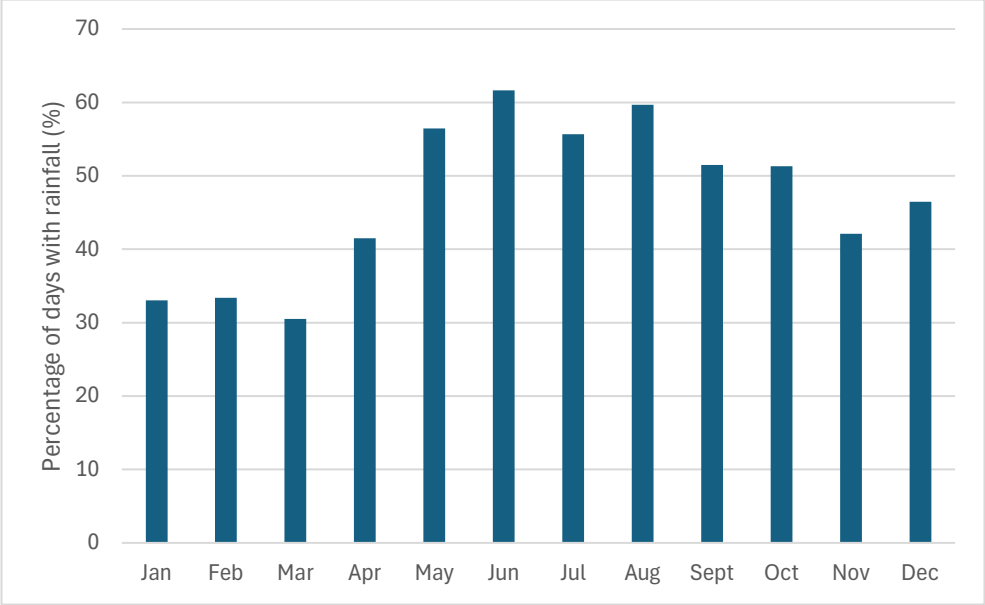


Figure 8: Ardmore Aerodrome average days per month with more than 0.2 mm of rainfall (2000-2016)

3.5 Existing Air Quality

In the area around the Clevedon Quarry there are few other significant dust emission sources due to the remote nature of the site. No other industrial activities are known to exist in the nearby vicinity. To the north and west there are a number of rural residences in a rural production zone. Some farming, residential wood burning and transport emissions are expected from this area.

To the east and south of the SAL land is a forested area (Hunua Ranges); minimal anthropogenic emissions are expected to originate from this area.

Logging and other forestry works are occurring across the SAL land area, which may at times result in bare land, and which may be a source of airborne dust.

The nearest available ambient air quality data to the site provided by Auckland Council, is to the west of Patumahoe, which is not considered to be representative of the site. As such PM_{10} and $PM_{2.5}$ background concentrations (24-hour and annual), are best estimated from the default background air quality values by census area unit (CAU)[5], produced by Waka Kotahi (NZTA). The site lies within the Clevedon CAU, which has the background levels stated as follows:

- PM_{10} 24hr average – 18.7 µg/m^3; and
- PM_{10} annual average – 7.1 µg/m^3.

4.0 Project Description: Dust Generating Activities

The Clevedon Quarry currently undertakes the following activities which are potential dust sources. As the current operational conditions of the quarry are not proposed to change during the proposed quarry expansion, these dust sources are expected to remain representative of the proposed expansion in quarry footprint.

4.1 Removal of Overburden

As new areas of quarry footprint are opened up for mineral extraction, existing vegetation and overburden is removed.

Site stripping and reinstatement operations, along with overburden handling activities can be a significant source of dust. Ideally this activity should be avoided during dry and windy conditions. Soil handling is generally a short-lived activity in a discrete area of the site, and there is considerable flexibility as to its timing, which also assists in minimising dust effects. Overburden can usually be worked at higher moisture contents than soils, which can reduce the risk of

[5] NZTA. (2022). *Background PM Concentrations by CAU.* https://www.nzta.govt.nz/roads-and-rail/highways-information-portal/technical-disciplines/environment-and-sustainability-in-our-operations/environmental-technical-areas/air-quality/background-air-quality

unacceptable dust emissions. The removal of overburden includes topsoil, clay and brown-rock, with this predominantly undertaken by excavators.

Overburden material will be loaded into dump trucks for placement within the quarry site. An area at the eastern edge of the Stage 5 footprint has been identified as suitable for overburden placement during the Stage 1 expansion (see Figure 2 for OBDA location). Following the first 10 years overburden will be either stored or taken off-site.

4.2 Removal of Rock from Quarry Face

Removal of rock from the quarry working face requires blasting, which will be undertaken as required, usually on average of twice per fortnight. Blasting at Clevedon Quarry is currently completed between the hours of 9 am and 5 pm Monday to Saturday. The subsequent extraction of rock at the quarry face will be undertaken predominantly with excavators, material is then loaded into dump trucks for transportation to the on-site processing plant.

4.3 Processing of Quarried Rock

Quarried rock will be processed into saleable product through crushers and screens within the quarry footprint. For all five proposed quarry stages this processing is likely to occur at or near to its current 'Front of House' location so that the processing activities are unlikely to be closer to the boundary than the existing (refer to Figure 9). Processed aggregate product will continue to be stockpiled within the current area on-site for export from the site.

The processed aggregate products are used for the manufacture of concrete, asphalt, sealing chip and roading aggregates.



Figure 9: Existing Front of House Quarry layout

4.4 Stockpiling of Topsoil, Quarried Rock and Quarry Products

Topsoil, quarried rock and quarry products will be stored in stockpiles. The process of building and dismantling stockpiles involves disturbing bulk materials which and result in the discharge of dust especially when the bulk material contains a large fraction of fine materials.

Once formed, the fine material on the surface of the stockpile can be prone to wind erosion. Stockpile dust can be mitigated by maintaining adequate buffer distance (250 m) to sensitive receptors, shaping the stockpile so the surfaces are not steep, building the stockpiles to a maximum height of 30 m, dampening the surface and establishing vegetative cover on long-term soil stockpile surfaces where necessary.

4.5 Loading Topsoil, Quarried Rock and Quarry Products onto Trucks

The process of loading bulk materials on to trucks results in the discharge of dust especially when the bulk material contains a large fraction of fine materials. Good operator practice can minimise the discharge of dust from this source and includes minimising drop heights from excavator and dump truck, maintaining adequate buffer distance (250 m) to sensitive receptors, and dampening the surface of the bulk material if needed.

4.6 Transportation of Rock and Quarry Products

A sealed gateway to the quarry contains a high-pressure wheel wash facility and weighbridge. Trucks exit the site from the weighbridge to the sealed McNicol Road, minimising dust emissions. To further minimise the discharge of dust from the materials being transported of site, the truck and trailer loads of fine materials are covered or dampened where covers are not available.

Truck movements into and out of the quarry are restricted by the existing 2018 consent conditions[6]. No increase to the currently authorised truck movement volumes are proposed. Traffic associated with the proposed quarry expansion will remain subject to the same restrictions and controls as currently apply to the existing operation required under the 2018 consent[7]. Specifically, quarry truck movements to and from Clevedon Quarry Expansion will not exceed an hourly maximum of 90 truck movements (Monday to Saturday), or exceed an average of 900 truck movements per day (Monday to Saturday) measured on a 12-month rolling basis.

The internal hauling and site access road surfaces will be unsealed but engineered, built and maintained to provide a strong stable surface for heavy vehicles and machines, and compacted surface that minimise the amount of fine material which could be suspended as dust by vehicle induced turbulence or high windspeeds.

5.0 Types of Air Contaminants Discharged

The potential for air quality effects associated with the operation of the Clevedon Quarry relates almost exclusively to the potential for there to be dust emissions. While there will be diesel-powered vehicles and machinery operating on the site, based on PDP's experience with similar quarrying activities, these combustion emissions are considered to be insignificant, and are unlikely to result in any noticeable off-site changes in ambient air quality.

5.1 Particulate Matter

Dust is a generic term that describes airborne particles dispersed into the air via a variety of both natural and anthropogenic means. Often the term "dust" is used interchangeably with "particulate matter". Dust particles vary greatly in diameters, from approximately 100 µm to less than 10 µm, thus ranging from particles large enough to be visible to the human eye, to particles small enough to be inhaled into human lungs.

[6] Auckland Council ref. BUN60302442; [2018] NZEnvC 96

[7] Refer to conditions 20 -28 of [2018] NZEnvC 96 consent.

Figure 10, sourced from the Ministry for the Environment's *Good Practice Guide for Assessing and Managing Dust*[8] (GPG:Dust), shows the particle size of different types of dust. This report focuses on the particles captured within the soil and road dust envelope shown at the top right of Figure 10, as these are generated by the abrasion (mechanical crushing/grinding) of soil and rock.

The nature of dust generation at quarries means that most of the particles are in the coarse size fraction, greater than 2.5 µm.[9] Therefore, $PM_{2.5}$ air pollutants typically associated with combustion processes, such as vehicle exhaust emissions, are not considered in this report.

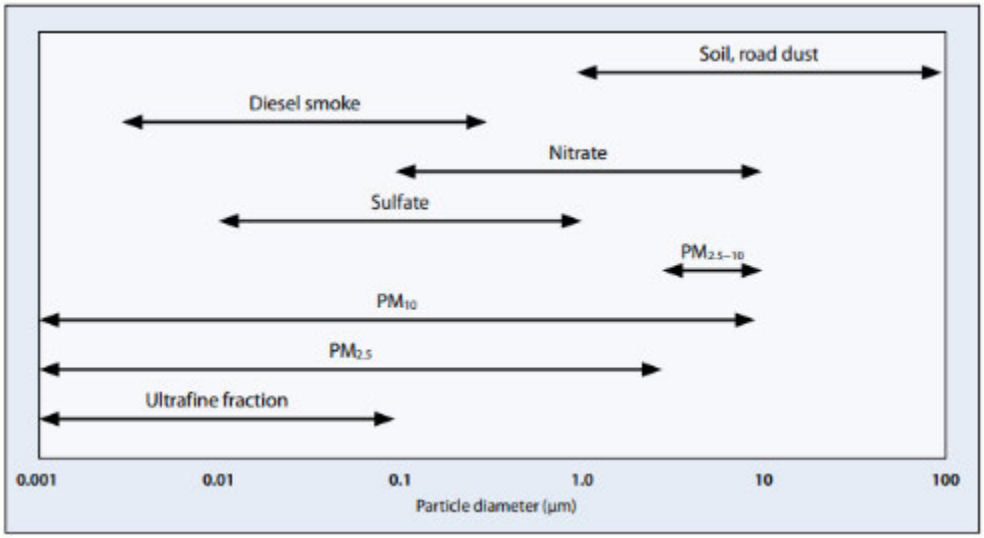


Figure 10: Particle size of different dust types (GPG:Dust)

For the purposes of this report the particulates potentially discharged from the quarry will be referred to using the generic term "dust" and considered as:

- Deposited dust – particulate matter of generally between 30 µm and 100 µm in diameter. This 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 the earthworks, extraction and handling of rock will be comprised of this fraction.[10]
- Total suspended particulates (TSP) – dust of generally less than 30 µm in diameter. Particles of this size fraction remains suspended in the air for a longer time and therefore have the potential to travel further

[8] Ministry for the Environment. (2016). *Good Practice Guide for Assessing and Managing Dust*.
[9] Watson, Chow & Pace. (2000). Fugitive dust emissions. In *Air Pollution Engineering Manual*, the Association of Air & Waste Management.
[10] Institute of Air Quality Management. (2016). *Guidance on the Assessment of Mineral Dust Impacts for Planning.*

than larger fractions. TSP (particularly the coarse fractions larger than 10 µm) have the potential to affect visibility.

- Inhalable PM comprising particles with a diameter less than 10 µm (PM_{10}) – fine fractions of TSP, such as PM_{10}, can penetrate the nose or mouth under normal breathing conditions. PM_{10} is currently the size fraction that is monitored and managed under the *Resource Management (National Environmental Standards for Air Quality) Regulations 2004* (NESAQ) to manage the health effects of particulates in New Zealand.

In relation to deposited and visible dust, the colour of dust will vary with the material being excavated and processed:

- Overburden – brown; and
- Quarry rock – grey.

5.2 Respirable Crystalline Silica

Respirable crystalline silica (RCS) can also be present as a minor component of the dust generated by concrete crushing and some quarry operations, depending on the rock types excavated. RCS is respirable (typically defined as less than 4 µm in diameter) particles of free silica crystals. RCS is commonly formed by the abrasion of quartz, such as occurs when grinding concrete and exposure is largely a workplace health and safety issue.

5.3 Machine and Vehicle Emissions

In addition to the dust sources described above, air emissions will be generated from combustion sources associated with the use and refuelling of heavy machinery and use of vehicles used to transport materials to and from the site. The main emissions from heavy machinery burning diesel are oxides of nitrogen (NO_x) and fine particulate matter ($PM_{2.5}$ and PM_{10}) fractions. Based on PDP's experience with assessing the impacts of vehicle emissions associated with roadway developments, the relative level of emissions from operations at the Clevedon Quarry is very low, and the potential effects on air quality relative to the air quality standards and guidelines (NESAQ & Ambient Air Quality Guidelines (AAQG) (MfE, 2002)) is considered as *de minimis*. Combustion source emissions are accordingly not considered any further in this assessment. As a good practice measure, vehicles and other diesel machinery used on site should follow a regular maintenance schedule to ensure that they are well maintained.

The main emissions to air from refuelling of fuel storage tanks are volatile organic compounds (VOCs). These discharges are anticipated to be infrequent and short in duration. Following good practice measures, including maintaining a separation distance of at least 100 m between the storage tanks and the site boundary, will ensure that potential effects on air quality at the site boundary relative to the AAQG (MfE, 2002) will be *de minimis*.

6.0 Particulate Dispersion

6.1 Wind Speed Thresholds for Dust Generation

As described at Section 5.1, some of the dust particles generated by the abrasion of rock will be of a size fraction less than 10 µm (PM_{10}). The key sources of PM_{10} at the quarry are the rock processing (crushing and screening) and vehicle movements along unsealed haul roads. Further PM_{10} emissions are likely to arise from the excavation and handling of overburden material.

Figure 11 shows the relationship between PM_{10} concentrations downwind of a dust source and windspeed as measured in an open area.[11] Figure 11 shows that dust pick up begins to occur once wind speeds exceed the threshold velocity at the ground surface (typically between 8 and 11 m/s when measured at 10 m). The relationship between wind speed and dust concentrations shown in Figure 11 is consistent with the measurements made by the US EPA[12] and the recommendation of the GPG:Dust, which suggests that high-risk conditions occur when windspeeds are over 5 m/s.

For the purposes of this assessment, noting the separation distances, it is considered that high risk dust conditions occur when windspeeds are over 7.5 m/s.

[11] Watson, Chow & Pace. (2000). *Fugitive dust emissions*. In Air & Waste Manual, the Association of Air & Waste Management.
[12] US EPA. (2006). *AP42, Section 13.2.2 Unpaved Roads*.

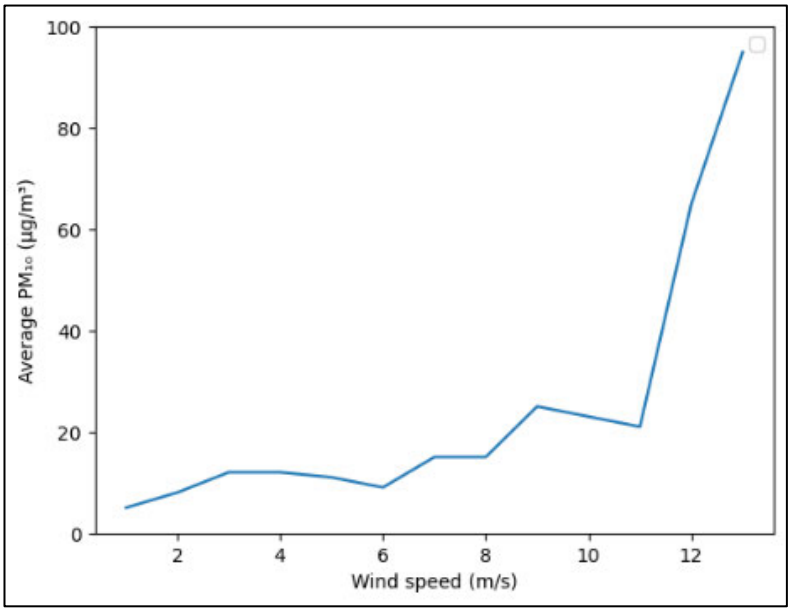


Figure 11: Variation of hourly PM_{10} concentrations with windspeed (Watson, 2000)

6.2 Particle Transport Considerations

There are six main factors that are important to understand when determining how particles may be transported from the generation source and whether any nuisance is caused by these dust emissions. These are:

- Particle size;
- Particle density;
- Wind speed;
- Wind direction;
- Topography; and
- Distance between the source of the dust and sensitive receivers.

These factors are all interrelated, and it is how they combine that determines the potential for an effect to occur. In general, however, it is possible to make the following statements:

- Heavier and larger particles require more wind speed to become airborne;
- Large particles will deposit faster than small particles (of a similar density);
- More dense particles will deposit more rapidly than less dense particles (of a similar size);

- Elevated topographical features and/or structures will cause dust particles to deposit faster than flat land; and
- Particles will travel further before depositing with a strong wind blowing than with a light wind blowing.

Considering this range of variables, there are a number of recognised guidance documents that state that dust nuisance effects are generally only experienced within 200 m and 300 m of unmitigated dust sources at quarries[13]. As discussed in Section 9.0 of this report, SAL will employ various forms of mitigation to control dust discharges from the quarry operations associated with the expanded quarry footprint, and therefore these nuisance dust effects are likely to be further contained within 200 m of the sources.

PDP considers that the materials that have the most potential to generate dust emissions from the quarry operations are topsoil and clay from the overburden handling processes.

Dust from the quarried rock material is typically denser than soil and consequently does not travel as far. Figure 12 depicts the distance potentially travelled by dry material from the quarry for a range of wind speeds based on a particle diameter of 50 to 100 µm, based on Stoke's Law of particle motion.[14] This is a reasonable assumption based on PDP's experience with dust nuisance. The release height of three metres in Figure 12 is also typical of the height that dust is released from for a range of quarrying activities i.e. material being loaded into a truck.

Given that the quarried rock would generally be damp, these figures will overestimate the potential for effect from the rock extraction source. The wind direction has an obvious impact on the potential for a source to be affected, especially those downwind in a predominant wind direction.

[13] Institute of Air Quality Management. (2016). *Guidance on the Assessment of Mineral Dust Impacts for Planning*.
[14] Dey, S., et al. (2019). *Terminal fall velocity: the legacy of Stokes from the perspective of fluvial hydraulics*. Royal Society: https://doi.org/10.1098/rspa.2019.0277

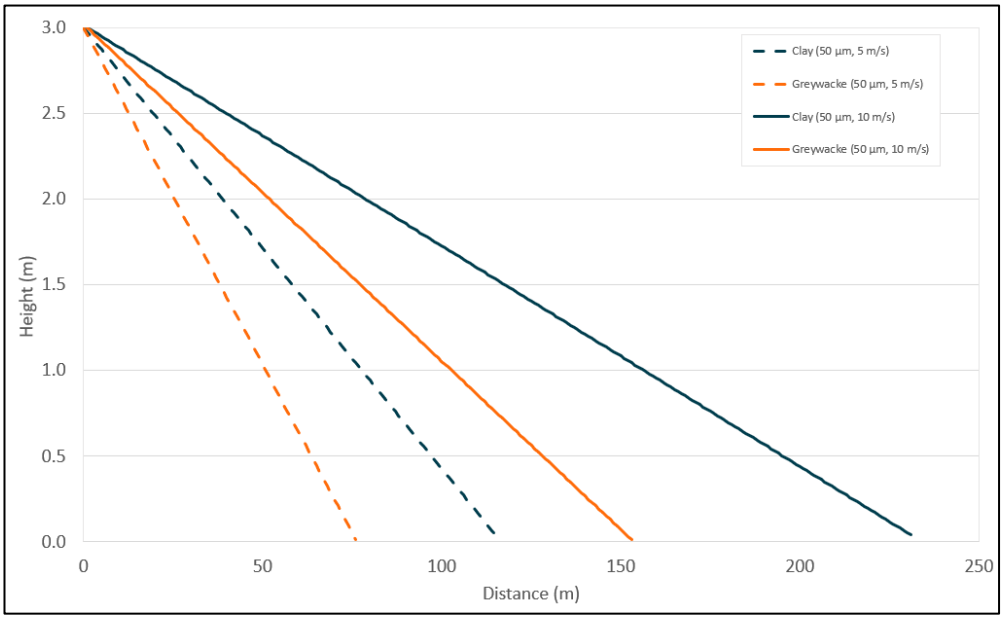


Figure 12: Difference in Particle Travel with Wind Speed (Stoke's Law)

Based on the above, when activities are undertaken at some elevated exposed locations, effects could be experienced at extended distances if no form of mitigation is used. The processing of rock poses further dust risk, depending on the mitigation measures employed and proximity of these processing activities to the quarry boundaries.

The dust mitigation procedures and measures undertaken by SAL for the quarrying (rock extraction) and processing activities are outlined in Section 9.0 of this report. These mitigation techniques reduce and control the potential for dust emissions, and therefore the amount of nuisance dust which could be transported from these operations will reduce significantly across all five expansion stages. Based on the types of activities that will be undertaken and guidance provided in US EPA technical documents,[15] with mitigation in place it is likely that dust effects will only occur within 50 m of sources that are located at ground level.

7.0 Risks Posed by Air Contaminants Discharged

7.1 Nuisance Dust

The most significant potential effect from the current and expanded quarrying activities on-site is nuisance associated with dust deposition. The activities that could cause this dust are discussed in Section 4.0.

[15] US EPA. (2006). *AP42, Section 13.2.4 - Aggregate Handling and Storage Piles.*

Dust nuisance is caused where dust impacts on amenity values. Dust nuisance impacts include soiling of property such as windows, houses, cars, and washing hung out to dry. The degree of amenity effects tends to increase with darker colours of dust. For example, coal dust is typically considered more offensive than grey aggregate dust.

Dusty conditions can adversely affect people's ability to enjoy an outdoor environment[16]. Airborne dust can cause effects on visibility, which is largely considered a matter of aesthetics. Visibility effects are usually only a concern in the immediate vicinity of the source.

7.2 Health Effects Dust and RCS

Human health effects can occur from exposure to smaller size fractions of particulate matter, PM_{10}[17]. Some compounds within PM_{10} particles also pose different levels of toxicity, such as RCS. Section 11.2 of this report provides an assessment of the potential human health impacts of dust on the nearest sensitive receptors to the site.

Short-term and long-term exposure to PM_{10} is associated with a wide range of health impacts. Mild impacts include shortness of breath or coughing. More severe impacts include premature death from cardiovascular and respiratory problems and an increased risk of lung cancer. Exposure to PM_{10} can also worsen asthma symptoms.

The aggregate 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, with prolonged or repeated inhalation of RCS, potentially causing silicosis and chronic obstructive pulmonary disease.

While the aggregate will contain some quartz, most of this material is bound into larger particles of rock which cannot be inhaled.

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. Personal exposure monitoring at the site was undertaken at Clevedon Quarry in 2023 and found low risk to health from RCS for workers on site[18].

[16] Ministry for the Environment. (2016). *Good Practice Guide for Assessing and Managing Dust*.
[17] World Health Organisation. (2021). *Air Quality Guidelines*.
[18] Fulton Hogan Limited. (June 2023). *Personal Dust/Chemical Exposure Report.*

7.3 Ecology Effects

The GPG:Dust indicates that at high dust loadings there is potential for dust deposition to have effects on plant life. These effects can include:

- Reduced photosynthesis due to reduced light penetration to the leaves. This can cause reduced growth rates and plant vigour. It can be especially important for horticultural crops, through reductions in fruit setting, fruit size and sugar levels;
- Increased incidence of plant pests and diseases. Dust deposits can act as a medium for the growth of fungal diseases. In addition, it appears that sucking and chewing insects are not affected by dust deposits to any great extent, whereas their natural predators are affected;
- Reduced effectiveness of pesticide sprays due to reduced penetration; and
- Rejection and downgrading of produce due to crop blemishing. Once again, this is a particular issue for horticultural crops.

The impacts of dust on plants are variable and largely dependent on the chemical composition of the dust and plant type. It is difficult to determine a universal effects assessment criteria for the ecological effects of deposited dust. However, it is apparent that for most plant species, significant coating of dust would be required to diminish photosynthesis, with the toxicological responses to certain chemical species within the particles of greater importance. The relatively inert nature of the soil and rock at Clevedon Quarry is not expected to pose any toxicological risks to flora.

8.0 Air Quality Assessment Criteria

This section presents the dust assessment criteria relevant to the contaminants that will be discharged from the expanded Clevedon Quarry footprint.

8.1 Nuisance Dust

The relevant criterion for nuisance dust effects is set out in the GPG:Dust:

> *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 varies from council-to-council, this wording is widely accepted for use across New Zealand as a limit condition or standard. While this is a qualitative assessment criterion, the GPG:Dust provides recommendations on how to undertake an objective and robust assessment against this criterion.

8.2 Buffer Distances

The potential amenity impact of any dust source is highly dependent on the distance between the source and receptor. A receptor that is 500 m or greater from any dust source is highly unlikely to experience any effects on amenity values; this is the trigger buffer distance to require an assessment of quarrying activities under the Environmental Protection Agency Victoria's planning guidelines.[19]

Guidance prepared by the Institute of Air Quality Management (IAQM)[20] for the assessment of dust from the minerals industry categorises receptors further than 200 m from a dust source as 'Distant' and those further than 100 m as 'Intermediate'.

Vegetation and topography also impact the level of dust experienced by off-site receptors. Elevated topography increases the effective separation distance and can cause dust to deposit faster than flat terrain. The containment of key dust sources within relatively deep quarry pits at the final Stage 5 expansion will benefit from this topography. Vegetation has a more nuanced impact on dust transport, with the types, density, and height of trees all factors for any increase in dust containment and/or deposition. PDP's experience is that vegetation typically has a more visual benefit than for the physical containment and/or deposition of dust.

PDP's experience with these activities demonstrates that a receptor more than 100 m from a dust source employing good practice dust suppression measures, is unlikely to experience significant dust effects. Any receptor that is less than 100 m from a dust emissions source could potentially experience a detrimental effect on amenity values and higher PM_{10} exposure. However, this risk can be mitigated by proactively using best practice dust mitigation and monitoring methods.

8.3 TSP and PM_{10}

The *Good Practice Guide for Assessing Discharges to Industry* (GPG:Industry)[21] recommends that ambient air quality assessment criteria for the assessment of health risks are selected in accordance with a hierarchy:

[19] Environmental Protection Agency Victoria. (2024). *Separation distance guidelines. Publication 1949*.
[20] Institute of Air Quality Management. (2016). *Guidance on the Assessment of Mineral Dust Impacts for Planning*.
[21] Ministry for the Environment. (2016). *Good Practice Guide for Assessing Discharges into Air from Industry*.

1. National Environmental Standards for Air Quality Ambient Air Quality Standards (NES-AQ);[22]
2. NZ Ambient Air Quality Guidelines (NZ AAQGs);[23]
3. World Health Organisation Air Quality Guidelines 2005 (WHO AQG);[24]
4. California Office of Environmental Health Hazard Assessment Reference Exposure Levels (OEHHA REL)[25] and/or US Environmental Protection Agency Reference Concentrations (US EPA RfC);[26] then,
5. The Texas Commission on Environmental Quality Effects Screening Levels (TCEQ ESL)[27] and/or other international guidelines.

This hierarchy has been accounted for in selecting the relevant ambient air quality assessment criteria for this assessment. The relevant guidelines for assessing the off-site health effects of PM_{10} are defined in the NESAQ and NZ AAQG 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).

TSP is often used as a proxy measurement of PM_{10} at quarries so that both the nuisance and health effects of dust emissions can be effectively monitored and managed. The GPG:Dust's trigger alert levels for TSP at 'high and low sensitivity receiving environments' are detailed in Table 4. PDP notes that these 'high sensitivity receiving environment' trigger values would only apply at sensitive receptors such as dwellings. Immediately at the boundary, the sensitivity to dust is considered to better fit the 'low sensitivity environment' descriptor of the GPG:Dust.

Table 4: GPG:Dust trigger levels for TSP monitoring

Averaging period	High sensitivity receiving environment trigger level for TSP (µg/m³)	Low sensitivity receiving environment trigger level for TSP (µg/m³)
5-min	250	N/A
1-hour	200	N/A
24-hour	60	100

[22] Resource Management (National Environmental Standards for Air Quality) Regulations 2004.
[23] Ministry for the Environment. (2002). *Ambient Air Quality Guidelines.*
[24] World Health Organisation. (2005). *Global Air Quality Guidelines.*
[25] California Office of Environmental Health Hazard Assessment. (2020). *Reference Exposure Levels.*
[26] US Environmental Protection Agency. (2023). *Integrated Risk Information System.*
[27] Texas Commission on Environmental Quality. (2017). *Effects Screening Levels.*

The WHO AQG referenced by the MfE GPG Industry hierarchy were updated in 2021,[28] with lower guidelines recommended for most air contaminants and averaging periods. The WHO AQG also include four 'interim targets' recommended for countries to transition toward achieving the lowest AQGs. These revised 2021 WHO AQG or interim targets have not yet been adopted by any regulatory or non-statutory guidance document for assessing the effects of industrial air discharges in a New Zealand context. It is notable that the 2021 WHO AQG are population health targets, to assist with the aspirational goal for governments to reduce population level exposure to air contaminants.[29] The non-statutory 2021 WHO AQG for PM_{10} are 45 µg/m³ as a 24-hour average and 10 µg/m³ as an annual average. These 2021 WHO AQG are considered in the below assessment of effects as additional non-statutory guidelines.

8.4 Respirable Crystalline Silica

There are no specific standards or guidelines for RCS in ambient air in New Zealand. The GPG: Industry recommends that applicable air quality assessment criteria are selected using a hierarchy. Based on this hierarchy, the most relevant international assessment criteria for RCS is:

- 3 µg/m³ RCS as an annual average, adopted from the California Office of Environmental Health Hazard Assessment Reference Exposure Level (OEHHA REL).[30]

PDP has also reviewed the literature to identify an appropriate short-term health assessment criteria for RCS. This review found a Texas[31] (USA) 24-hour average health assessment criteria of 24 µg/m³.

8.5 Ecological Effects

Dust deposits can pose risks to plant life, though mainly at high dust loadings[32].

The impacts of dust on plants are variable and largely dependent on the chemical composition of the dust and plant type. It is difficult to determine a universal effects assessment criteria for the ecological effects of deposited dust. Despite the lack of a specific ecological assessment criteria, on-site observations of plant health suggest that dust is not currently posing any toxicological risks to flora.

[28] World Health Organisation. (2021). *Global Air Quality Guidelines*.
[29] Velasco, R. of World Health Organisation (2022). *Update of the WHO global air quality guidelines: Systematic reviews – An introduction*: Environment International, 170: https://doi.org/10.1016/j.envint.2022.107556
[30] California Office of Environmental Health Hazard Assessment. (2005). *Adoption of Chronic Reference Exposure Levels for Silica (Crystalline, Respirable).*
[31] Texas Commission on Environmental Quality, (December 2020). *24-hour ReV for Silica, Crystalline Forms*.
[32] Ministry for the Environment. (2016). *Good Practice Guide for Assessing and Managing Dust*.

9.0 Mitigation Measures

This section outlines the mitigation measures that are implemented on site at the Clevedon Quarry to control the effects of discharges to air from current quarry operations, along with recommendations as to further measures that could be employed to achieve good practice and minimise dust emissions from the proposed quarry expansion.

9.1 Existing Dust Mitigation and Dust Management Plan

The Clevedon Quarry Dust Management Plan (DMP)[33], required by Condition 137 of air discharge consent DIS60302443, presents a comprehensive dust management and monitoring strategy. The DMP has been reviewed and certified by Auckland Council with an updated DMP provided to Council on an annual basis as required by the consent conditions. The current DMP is contained Appendix C. Implementation of the DMP on-site has proved to have been successful in minimising complaints received by SAL or Auckland Council in relation to dust discharges from quarry operations.

PDP considers that continued adherence to the dust mitigation measures outlined by this DMP are suitable for the expanded quarry with some additions (refer to section 9.3).

The conditions of the air discharge consent set out some generic dust mitigation measures. These requirements are woven into and achieved by the specifics detailed in the DMP. The mitigation measures set out in the consent are:

- All stockpiles are constructed and positioned to minimise the potential for dust emissions;
- All ponds are maintained at such capacity that application of water as a dust control measure is not limited;
- Ensure techniques are used for excavating rock, blasting and drilling which minimise dust emissions;
- Dust emissions from all crushing, screening and transfer operations shall be kept to a practicable minimum; and
- Dust suppression equipment shall be maintained in good condition.

The specific dust mitigation measures included in the DMP are:

- Minimising exposed surface areas of earthworks;
- Minimise dusty activities on days with dry and windy conditions;
- A maximum speed limit of 20 km/hr within the quarry and 30 km/hr on unsealed sections of McNicol Road (to the south of the quarry exit);

[33] SAL. (03/07/2025). *Dust Management Plan: 2024-2025 (Clevedon Quarry)*; certified by Auckland Council under Condition 140 of Consent DIS60302443 on 29/08/2025.

- Water cart used when applicable to supress dust from moving plant and exposed surfaces;
- Regular maintenance of haul roads;
- Covering or dampening of vehicle loads containing dusty materials;
- Minimise drop heights when loading and unloading vehicles and hoppers;
- Pre watering dusty materials being transferred to/from vehicles;
- Undertake loading/ unloading on leeward side of stockpiles where practicable;
- Suitably revegetate exposed soil as soon as possible;
- Minimise heights of stockpiles;
- Remove loose material prior to rock blasting; and
- Keep paved roads and yard areas clean using water cart.

9.2 Dust Mitigation - Water Dust Suppression

The Site's key dust mitigation measure is the application of water to dry surfaces that contain fine material which may be lifted and blown away as dust by strong winds. Water is applied by way of water carts spraying dusty surfaces, along with a wheel wash for heavy vehicles exiting the site and water sprays within the aggregate crushers.

To provide effective dust suppression the GPG:Dust recommends a water application rate of 1 mm/per hour, or 1 litre/m^2/hour. This water application is most critical during dry and windy periods when the quarry is operating with frequent heavy vehicle movements on site.

From information provided by SAL, PDP understands that Clevedon Quarry's water supply and storage provide ample water for this dust suppression purpose across all expansion stages. A bore and on-site sediment retention ponds can be utilised by water trucks to re-fill from in all seasons. PDP understands that water supply for dust suppression has not run short at the site and the use of this water for dust suppression has been generally effective, as demonstrated by the absence of complaints. Overall, PDP considers that effective dust suppression can continue to be undertaken at the expanded Clevedon Quarry.

9.3 Recommended Further Dust Mitigation Procedures

As part of the proposed quarry expansion, PDP has reviewed the DMP and identified further dust mitigation strategies that should be employed for Clevedon Quarry to achieve good practice and adequately minimise dust emissions for the expanded quarry. The supplementary dust mitigation measures are primarily associated with the maintenance of measures already in place and are:

- Site entrance inspected daily to ensure clear of debris;
- Water cart is inspected weekly to ensure it is operating correctly;
- The crusher water sprayers are checked daily; and
- Wheel wash is checked daily to ensure satisfactory operation.

Continuous instrumental dust monitoring is recommended by the GPG:Dust to aid on-site management and enable adaptive management to instances of dust before off-site effects arise. The GPG:Dust recommends specific trigger response levels for TSP concentrations to avoid off-site nuisance amenity effects and PM_{10} health effects. Importantly, the GPG:Dust notes:

> *These triggers are intended to be used for the proactive management of dust on site. They are not intended to be used for enforcement because exceedance of trigger levels does not necessarily infer an adverse effect offsite.*

Instrumental dust monitoring is not currently required at the Clevedon Quarry as there have been no significant adverse dust effect on neighbouring properties reported. However, SAL does operate a meteorological monitor at the Clevedon Quarry Site. PDP recommends that the meteorological monitor is configured to send alerts to the SAL management team when it records wind speeds of above 5 m/s and 7.5 m/s as a ten-minute average. This will allow management to make operational decisions around where work is undertaken and/or the use of specific mitigation measures, particularly if the windspeed alert coincides with dry conditions.

On receipt of any windspeed trigger response level alert, additional visual dust monitoring will be employed, and supplementary dust suppression considered including the use of additional water carts for haul roads and water sprays for any localised dust sources. These trigger levels and the associated visual monitoring and dust contingency measures are detailed in Table 5. The wind trigger limits and responses should be detailed in an updated DMP.

Table 5: Windspeed trigger levels for on-site dust management			
Trigger Level	**Wind speed trigger**	**Indicator**	**Contingency Response Measure**
TL-Acute	7.5 m/s 10-minute average	A potential short-term spike in windspeed has been recorded that may cause complaint of visible emissions, or adverse effects if not addressed promptly.	Check for local dust sources where the plume could pass over the boundary Direct water suppression to any noted dust source.
TL-1	5 m/s as a 1-hour average	A dust nuisance may occur off-site if action is not taken to implement mitigation measures.	Visually assess all quarry dust sources where the plume could pass over the boundary. Deploy additional water carts and other dust mitigation measures to any visibly dusty activities.
TL-2	7.5 m/s as a 1-hour average	A dust nuisance may occur off-site if action is not taken to implement mitigation measures. Off-site concentrations of PM_{10} may approach the relevant 24-hour average Ambient Air Quality Standard if action is not taken.	Visually assess all quarry dust sources where the plume could pass over the boundary. If dust plumes are witnessed, cease dust-generating activities (including crushing) until additional dust mitigation is implemented and 1-hour average windspeeds are below TL-1.

Given the lower sensitivity of the receiving environment, proposed dust mitigation measures and the buffer distances to sensitive receptors, PDP does not consider that real-time dust monitoring is necessary. However, instrumental dust monitoring could be deployed in response to any validated dust complaints received to compliment the wind speed trigger alert system. To give effect to this back up plan, PDP recommend real-time dust monitoring is included as a contingency measure in the DMP.

10.0 Assessment Methodology

This assessment of the actual and potential dust effects arising from the expansion of Clevedon Quarry has been undertaken in accordance with the GPG:Dust[34].

The GPG:Dust recommends that dust effects from proposed dust-generating activities such as quarries, be assessed by a range of qualitative assessment methods. This assessment has involved a review of the activities that are being undertaken and then determining the likely potential for these activities to discharge dust which could affect the surrounding environment. In determining whether there is the potential for a dust effect to occur, the following matters have been considered:

- The nature of the activities being undertaken;
- How long the activities are likely to occur;
- Whether mitigation measures can be implemented to control the potential for effects (e.g. use of water carts);
- How close receptors are to the activities;
- The nature of the receptors and their sensitivity to dust; and
- The prevailing meteorological conditions.

10.1 Amenity Effects

PDP has undertaken a qualitative assessment to predict the dust effects from the Clevedon Quarry using the FIDOL assessment tool recommended by the GPG:Dust.

The FIDOL factors are explained in greater detail below:

- Frequency relates to how often an individual is exposed to dust. Factors determining this include the frequency that the source releases dust (including its source type, characteristics and the rate of emission of the compound or compounds), prevailing meteorological conditions and topography.
- Intensity is the concentration of dust at the receptor location.
- Duration is the amount of time that a receptor is exposed to dust. Combined with frequency and intensity, this indicates the exposure to dust. The duration of dust emissions, like its frequency, is related to the source type and discharge characteristics, meteorology and location. The longer the dust detection persists in an individual location, the greater the level of complaints that may be expected.

[34] Ministry for the Environment. (2016). *Good Practice Guide for Assessing and Managing Dust*.

- Offensiveness is a subjective rating of the unpleasantness of the dust. Offensiveness is related to the character of dust particles, with sticky or abrasive dust more of a nuisance than inert particles that can be easily washed away.
- Location is the type of land use and the nature of human activities in the vicinity of a dust source and their sensitivity to dust. In some locations certain higher dust concentrations may be more acceptable than in others.

10.2 Human Health effects

PDP has extensive experience with dust monitoring and assessments for other comparative quarries. This data is useful to determine the likely scale of dust generation and the off-site concentrations of PM_{10} and RCS, and resulting health effects.

10.3 Ecological Effects

Because there are no widely accepted quantitative dust impact guidelines for ecological effects, the qualitative FIDOL assessment method as detailed in Section 10.1 will be used to assess the potential ecological impacts of the dust discharged from the proposed extension to the Clevedon Quarry.

11.0 Assessment of Environmental Effects

This section provides an assessment of the potential dust emissions resulting from the proposed quarrying activities across all five stages of the proposed Clevedon Quarry expansion.

11.1 Amenity Effects

PDP has undertaken a FIDOL assessment, as described in Section 10.1, to assess the potential for off-site dust nuisance effects to occur. This assessment is presented in the following sections.

11.1.1 Frequency

Frequency relates to how often dust discharges have the potential to cause an effect on sensitive receptors. This is influenced by the frequency with which dust discharges occur and when suitable meteorological conditions exist. To determine the frequency, three parameters need to be established: the direction of sensitive receptors relative to quarrying activities, the frequency at which the wind blows in this direction with sufficient strength that dust can be carried and the frequency of dust discharges.

Based on the information contained in Section 6.0, PDP considers that winds above 7.5 m/s have the greatest potential to cause dust nuisance effects to the nearest sensitive receptors (those within 500 m of a dust source). PDP consider

windspeeds between 5 m/s and 7.5 m/s have a low to moderate risk of dust nuisance effects for near-field receptors and windspeeds below 5 m/s as have a negligible risk of causing nuisance dust impacts. PDP note that if the mitigation measures listed in Section 9.0 are effectively implemented the dust risk of each windspeed category is lowered.

Based on the wind speed frequency distribution presented in Section 3.4, winds above 7.5 m/s have been infrequently recorded by the on-site monitor, occurring <0.1% of the time from any direction. Windspeeds of between 5 m/s and 7.5 m/s occur for a total of 1.1 % of the time. Combined, high and moderate wind conditions occur for <1.2% of the time (or on average a total 105 hours per year). All of these elevated risk winds were measured from the northwest quadrant.

Any dust carried by these higher speed winds would impact the forested areas to the east and south of the site.

The on-site wind monitoring data shows the frequency of high-risk winds blowing toward the residential properties located to the west (R1) to the north-nor-west (R2 to R6) and to the north-nor-east (R8 to R11) are negligible.

For dust nuisance to occur, dust producing activities would need to coincide with the receptor affecting winds and during dry conditions. As these events must occur at the same time, the chances of dust nuisance occurring are smaller than predicted wind frequencies and therefore less likely to occur.

Based on guidance prepared by the IAQM,[35] the percentage of winds which could blow towards receptors is classified as Infrequent. This in combination with the proposed mitigation and monitoring, means that the frequency of any effects associated with the proposed quarrying operations will be infrequent based on the IAQM guidance.

11.1.2 Intensity

Intensity relates to the concentration of dust that is likely to be experienced at any potential receptor. The key factor that determines the intensity of any dust impact is the size of the dust source and distance between source and receptor. For Clevedon Quarry, when the dust mitigation measures are factored in, PDP considers that the size of the dust source will be small to moderate.

From PDP's analysis of New Zealand and international quarry monitoring data and our review of the relevant regulator and industry guidelines we consider that unmitigated quarry dust is unlikely to be transported more than 250 m from a source. The impact of dust on any receptor greater than 250 m from a dust source will be minimal.

[35] Institute of Air Quality Management. (2016). *Guidance on the Assessment of Mineral Dust Impacts for Planning*.

Figure 4 shows the maximum proposed footprint of the extended Clevedon Quarry and two buffer zones, 500 m and 1,000 m from the proposed site boundary. Figure 4 shows sensitive receptors R1 and R3 are within the 500 m buffer but are further than 250 m away from the proposed site boundary. Sensitive receptors R2 and R4 to R11 are greater than 500 m from the proposed site boundary. It is important to note that the dust sources within the quarry will be further from the sensitive receptors than these distances between the sensitive receptors and the quarry footprint boundary. It is further noted that sensitive receptors R3 and R5 are located on SAL owned land.

Given the small to moderate size of the dust sources at Clevedon Quarry and the separation distance between the source and receptors, PDP concludes that the intensity of any dust impact at the sensitive receptors will be negligible.

11.1.3 Duration

Duration relates to the length of time that dust discharges are likely to occur and the length of time that wind conditions direct wind toward any one sensitive receptor location.

PDP considers based on the recommended monitoring and contingency response programme presented in Section 9.3 that if an event was to occur, at worst the duration would be limited to a period of no more than 1 hour at any one time, being the time to recognise that dust emissions are occurring and to implement any additional mitigation that might be required.

The very low frequency of high-risk wind conditions suggests that any high-risk wind events (windspeeds > 7.5 m/s) are likely to be no more than an hour in duration, perhaps two hours in a worse case infrequent scenario.

Combining the low duration emission factor with the low duration wind factor leads PDP to conclude that the duration of any dust event will be low and most likely one hour or less.

11.1.4 Offensiveness

The character of dust generated by quarrying and materials processing activities is inert soil and rock particles similar to other earthwork activities and natural sources (wind abrasion of soil and rock). Any deposited dust particles from these natural soil and rock sources are easily removed with washing so that they are not considered to be of an unpleasant character, such as sticky or etching.

PDP consider the potential offensiveness of the dust discharged from the Clevedon Quarry as low to moderate.

11.1.5 Location

The location of the proposed extended quarry and surrounding land uses are shown in Figure 3. In regard to the assessment of amenity effects, the land use in the area that surrounds the proposed quarry extension are predominantly:

- Rural production land; and
- Forested land.

Both of these land uses are of low sensitivity to the amenity impacts of dust discharged from the proposed quarry extension. The nearest sensitive receptor to the boundary of the site is over 300 m away and unlikely to experience any significant amenity impacts.

The AUP zoning of the surrounding land is Special Purpose Quarry Zone and Rural – Rural Production Zone. These zones are scheduled by AUP section E14.4.1 as 'low air quality (dust and odour) area' and 'medium air quality (dust and odour) area (rural)', with respect to their reduced sensitivities to dust amenity impacts.

PDP concludes that the sensitivity of the land surrounding the quarry is low and therefore location of the quarry in regard to amenity dust impacts is appropriate.

11.1.6 FIDOL Conclusion

Having assessed the quarrying activities that have the potential to cause dust discharges against the five FIDOL factors, PDP considers that any amenity impacts caused by the discharge of dust from the proposed Clevedon Quarry expansion will be negligible. This FIDOL conclusion is also supported by the absence of recent dust complaints for the existing quarry.

11.2 Human Health Effects

11.2.1 PM_{10}

The potential human health impacts are driven primarily by the smaller size fraction of particulate (PM_{10} and smaller).

To help understand the potential level of PM_{10} concentrations from quarrying activities, PDP has reviewed various guidance documents to understand the likely proportion of PM_{10} found in dust from quarrying activities. The United States Environmental Protection Agency (US EPA)[36] estimates that PM_{10} from handling overburden material is 35% of the TSP concentration. Australian guidance for air pollutant inventories[37] includes a number of PM_{10} emissions factors for quarrying

[36] US Environmental Protection Agency. (2006). *AP42 Compilation of air pollutant emissions factors, Chapter 13.2.4: Aggregate handling and storage piles*.
[37] Australian Department of Climate Change, Energy, the Environment and Water. (2014). *National Pollutant Inventory Emission Estimate Technique Manual for Mining and Processing of Non-Metallic Minerals*.

activities. This document provides a range of PM_{10}/TSP ratios from 25% for activities such as topsoil removal through to rock screening and crushing with a ratio of 33%.

Based on the review of these documents PDP considers that the proportion of PM_{10} from quarrying activities would be between 25 and 35% of the TSP discharged depending on the specific activity and type of material generating the dust.

SAL undertook a comprehensive ambient air quality monitoring programme at their Waingaro Quarry. The Waingaro Quarry contains similar types of rock processing activities to the Clevedon Quarry; PDP considers this data useful and fit for purpose of undertaking a high-level comparative assessment of PM_{10} impacts between the Waingaro and Clevedon Quarries.

Based on the TSP data collected at the comparative Waingaro Quarry's aggregate processing area (maximum measured 24-hour average TSP concentration of 22.9 µg/m³, with k-factor correction), and the TSP/PM_{10} ratios discussed above, it is estimated that the cumulative average 24-hour PM_{10} concentrations in the vicinity of Clevedon Quarry would be in the order of 8 µg/m³, or less than a fifth of the NESAQ Ambient Air Quality Standard (50 µg/m³).

These TSP concentrations also account for the cumulative TSP already within the air from other sources outside of the quarry, including natural sources. This compliance with the relevant statutory and non-statutory air quality criteria for PM_{10} is considered to demonstrate that there are negligible health risks posed by the rock processing activities proposed at Clevedon Quarry.

The Waingaro Quarry TSP monitoring was undertaken in a 'worst-case' location, immediately downwind and within 50 m of the aggregate processing yard. The TSP monitor was erected within the Waingaro Quarry site immediately adjacent to a large stockpile of processed aggregate. Therefore, this TSP monitoring data is considered to provide a conservative assessment of potential cumulative PM_{10} exposure at locations where people may be exposed to dust from Clevedon Quarry's well-separated rock processing activities.

To further support this assessment of potential PM_{10} concentrations for the expanded Clevedon Quarry, PDP has reviewed the Yaldhurst quarry area monitoring[38] commissioned by Environment Canterbury between 22 December 2017 and 21 April 2018. In this study, monitoring for PM_{10} was undertaken at 10 locations at a variety of different distances around the large- scale Yaldhurst quarries. The Yaldhurst study measured PM_{10} and RCS concentrations to assess the dust nuisance and the potential risk to public health. Yaldhurst represents a large relatively flat area (230 ha) containing

[38] Mote Limited. (19 June 2018). *Yaldhurst Air Quality Monitoring – Summary Report: 22 December – 21 April 2018.*

multiple quarries and a range of aggregate processing activities, compared to the expansion of Clevedon Quarry (approx. 70 ha). The Yaldhurst study is further considered a worst-case comparison given that the rock type excavated and processed is gravel with high concentrations of moraine (glacial till) which generates high volumes of very fine material that is not be present at Clevedon.

A summary of the results from the Yaldhurst study applicable to this assessment is as follows:

- There were no exceedances of the NESAQ for PM10 as measured by the reference instruments (50 µg/m³ as a 24-hour average);
- The average 24-hour average PM10 concentrations for all of the sites were between 21 and 27 µg/m³; and
- There were 17 exceedances of the MfE PM10 nuisance dust trigger level (150 µg/m³ as a 1-hour average). However, the majority of these exceedances occurred within 100 m of the quarries.

While this data is from a different location, it is a high quality and comprehensive data set collected from a quarrying area (with multiple quarries across an area of 230 ha) that is larger than the proposed expanded Clevedon Quarry. This data set provides robust information to inform a conservative (worst case) health impact assessment for the expansion of Clevedon Quarry.

Given the sources and type of dust that will be discharged from the Clevedon Quarry, PDP considers that the potential for there to be any impacts on human health from the discharge of dust from the expanded site operations is negligible because:

- PM_{10} is only a component of the dust generated from quarrying and aggregate processing activities. Most dust emitted from these activities is not in the inhalable PM_{10} fraction;[39]
- Given low background PM_{10} concentrations in the surrounding environment, with the small contribution to PM_{10} from the site's activities, total cumulative concentrations of PM_{10} will be maintained well below the NESAQ criteria of 50 µg/m³ as a 24-hour average, the AAQG criteria of 20 µg/m³ as an annual average, as well as the non-statutory 2021 WHO AQGs; and
- Suppression of dust also suppresses PM_{10}.

Overall PDP considers that PM_{10} concentrations as a result of the expanded quarry operations will be at a level that will result in less than minor adverse health effects at nearby sensitive locations.

[39] IAQM. (2016).

11.2.2 Respirable Crystalline Silica

While there is no ambient monitoring of RCS undertaken at Clevedon Quarry, SAL has undertaken quartz analysis of processed material for the similar Drury Quarry, which indicates a quartz content of between 0.5 and 13%. Assuming this worst-case quartz content of 13% for the quartz content of rock quarried at Clevedon, PDP has undertaken some conservative screening calculations to assess whether there is any potential for RCS to result in a health effect.

The United States Environmental Protection Agency (US EPA)[40] has also carried out an extensive review of all the available RCS monitoring and epidemiology in the United States and overseas. This review included monitoring undertaken in communities located around quarries and assesses the potential cumulative health risk to the community based on a lifetime RCS exposure over 70 years.

PDP has conservatively assumed that the annual average TSP concentration associated with quarrying is the same as the 3-month average TSP concentration measured at Waingaro Quarry's on-site monitor of 3.8 µg/m³ and that 13 percent of this TSP is RCS. This results in an estimated annual average RCS concentration of 0.5 µg/m³, within the site boundaries immediately near to the aggregate processing activity. This worst-case estimate of RCS is much lower than the Californian[41] (USA) annual average RCS health guideline of 3 µg/m³ and will be lower again at off-site receptor locations. Further, these low RCS concentrations are significantly lower than the threshold for health responses identified by the US EPA. Based on this conservative screening assessment, PDP considers that RCS will not cause any human health risk.

This estimate is very conservative because as already discussed PM_{10} is expected to be between 25 and 35 percent of TSP and the respirable component (PM_4), which is the fraction of concern for RCS, would be even less again.

As outlined in section 7.2, Texas has published a short-term health assessment criterion for RCS (24 µg/m³ as a 24-hour average). Again, analysing the Waingaro Quarry on-site TSP data and assuming a quartz content of 13 percent, the 24-hour average RCS concentrations are expected to be between 0.1 - 1.3 µg/m³, or less than 5% of the Texas guideline.

In the study that was undertaken at Yaldhurst, out of 20 samples collected for RCS only two samples detected RCS at a level above the laboratory limit of detection (within 50 m of a quarry), and these were well below the recommended guidelines.

[40] United States Environmental Protection Agency. (1996). *Ambient Levels and Noncancer Health Effects of Inhaled Crystalline and Amorphous Silica*: EPA/600/R-95/115.
[41] (California) Office of Environmental Health Hazard Assessment, (2005). *Adopted Chronic Reference Exposure Levels for Silica (Crystalline Respirable)*.

The Texas Commission on Environmental Quality (TCEQ)[42] published a comprehensive analysis of RCS monitoring around quarries and concluded that:

> *These data indicate that the contribution of RCS from these facilities to ambient levels of particulate matter and RCS is negligible or minimal and that the levels generally are below the health-based air monitoring comparison values for RCS developed by the TCEQ.*

Based on the above, PDP concludes that the health risks associated with RCS exposure from the expanded Clevedon Quarry will be negligible.

11.3 Ecological Effects

The type and location of ecological receptors are detailed in Section 3.3 and identifies the areas of:

- Rural production land located on the south and western boundaries;
- Forested land to the north and eastern boundaries;
- Natural stream management area on the west boundary; and
- Streams on the south and northern boundaries.

It is important to remember that while these ecological receptors are on the boundary of the site, they are for the most part, likely to be in excess of 250 m from the dust sources within the site boundary. On this basis, the assessment outcomes for the FIDOL factors detailed in Section 11.1 have been used to inform the assessment of ecological effects. The ecological receptors which are within 100 m of the key dust sources have been assessed as potentially having a:

- Low frequency of exposure to the dust emissions;
- Low intensity of dust loading;
- Low duration of dust exposure; and
- Moderate sensitivity to the impacts of dust.

PDP consider the conclusion based on the FIDOL assessment demonstrates the impact of dust discharged from the proposed activities will likely be:

- Low on the small area of plants and streams located within 100 m of the site's key dust sources;
- Very low on the plants and streams located 100 m -250 m of the key dust sources; and
- Negligible on the plant and streams located more than 250 m of the key dust sources.

[42] Texas Commission on Environmental Quality. (December 2020). *Ambient Air Monitoring and Evaluation of Community Health Impacts near Aggregate Production Operations*.

Observations of plant dust loading made by PDP staff during the site visit suggest that soil and rock dust are not currently posing any dust loading risks to ecological receptors.

PDP considers the measures proposed to mitigate and monitor the dust effects, which are detailed in Section 9.0 of this assessment, will ensure the dust emissions are reduced to effectively minimise the deposition of dust to plants and streams within the quarry site.

12.0 Conclusion

PDP concludes there is a low risk of dust effects from the proposed expanded Clevedon Quarrying operation. Overall, the adverse effects from the potential discharges of dust from the expanded quarry are considered negligible. This is based on the following:

- SAL utilises and proposes to continue to utilise dust mitigation and management measures that, if continued to be effectively implemented, will minimise dust emissions and limit impacts to within 50 to 100 m of the sources.
- The Site's key dust mitigation measure is the application of water to potentially dusty surfaces. PDP considers that SAL has sufficient water available on site to ensure that effective dust suppression can continue to be undertaken at Clevedon Quarry.
- The majority of sensitive receptors are located at distances greater than 300 m from dust sources and therefore will not be notably affected by dust from the proposed quarrying activities when the proposed dust mitigation measures are implemented.
- Based on the meteorological data for the area, the nearest high sensitivity receptors, located to the north and west of the quarry, are not frequently exposed to high-risk wind conditions blowing from the quarry.
- The current quarrying activity has not been the subject of any dust complaints.
- The continuation of the current quarrying activity at the same rate of extraction and processing across an expanded footprint is not likely to change the existing low levels of dust nuisance effects.
- Based on the silica concentration within the aggregate materials and the monitoring data from comparable quarries, PDP does not consider that there is any material risk for people currently living near the expanded Clevedon Quarry to be exposed to elevated concentrations of respirable crystalline silica.

- The concentrations of PM_{10} in areas surrounding the Clevedon Quarry will remain well below the relevant Ambient Air Quality Standard of the NESAQ and the WHO Air Quality Guidelines.
- Based on the dust management measures proposed and on-site observations, PDP considers that ecologically sensitive vegetation and streams in the surrounding environment are not likely to be materially impacted by dust deposition from the expanded Clevedon Quarry.

Appendix A: Seasonal Wind Roses – Clevedon Quarry November 2022 to May 2026

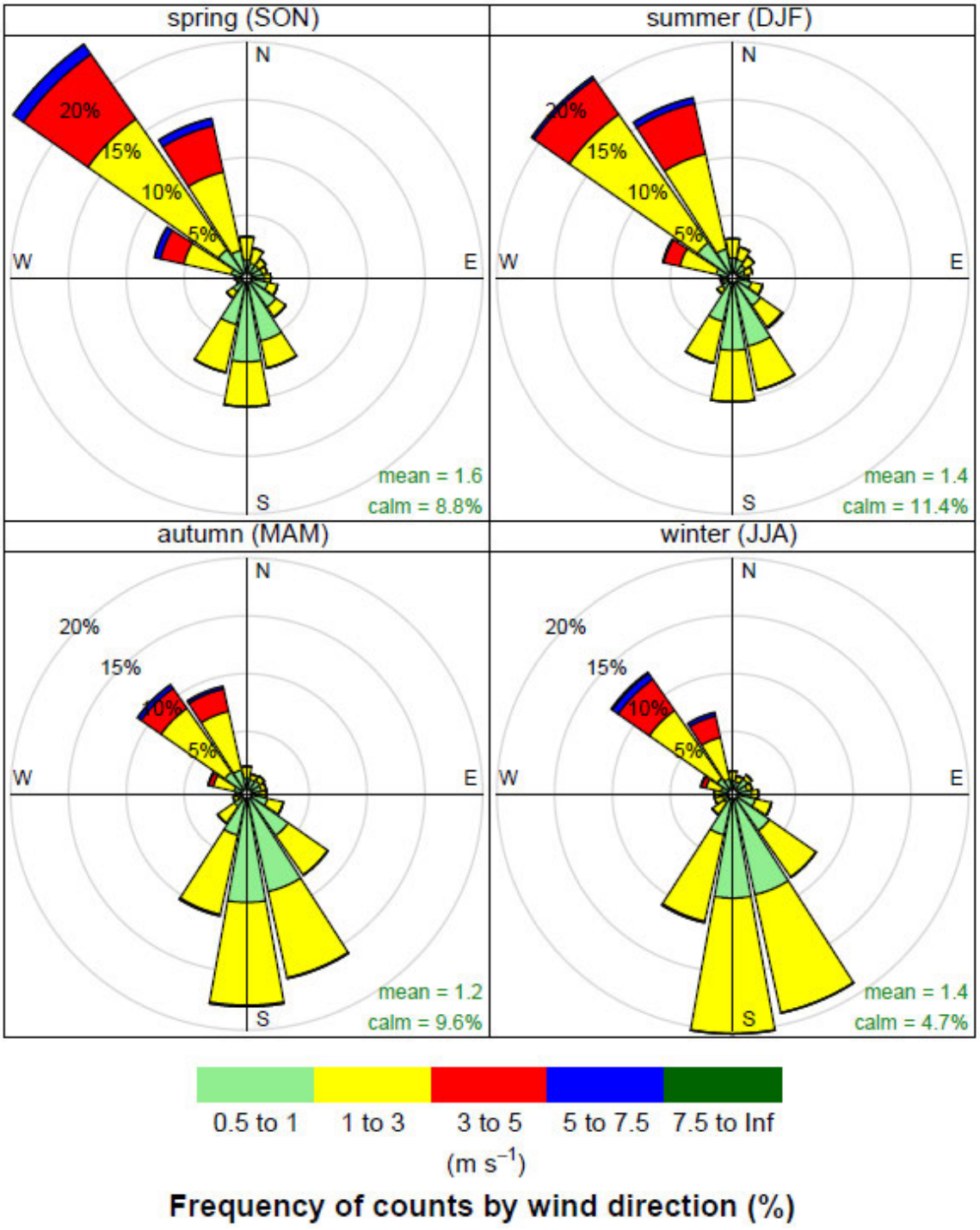


Figure A1: Seasonal Wind Roses for Clevedon AWS, November 2022 to May 2026

Appendix B: Ardmore Aerodrome Wind data July 2016 to October 2024

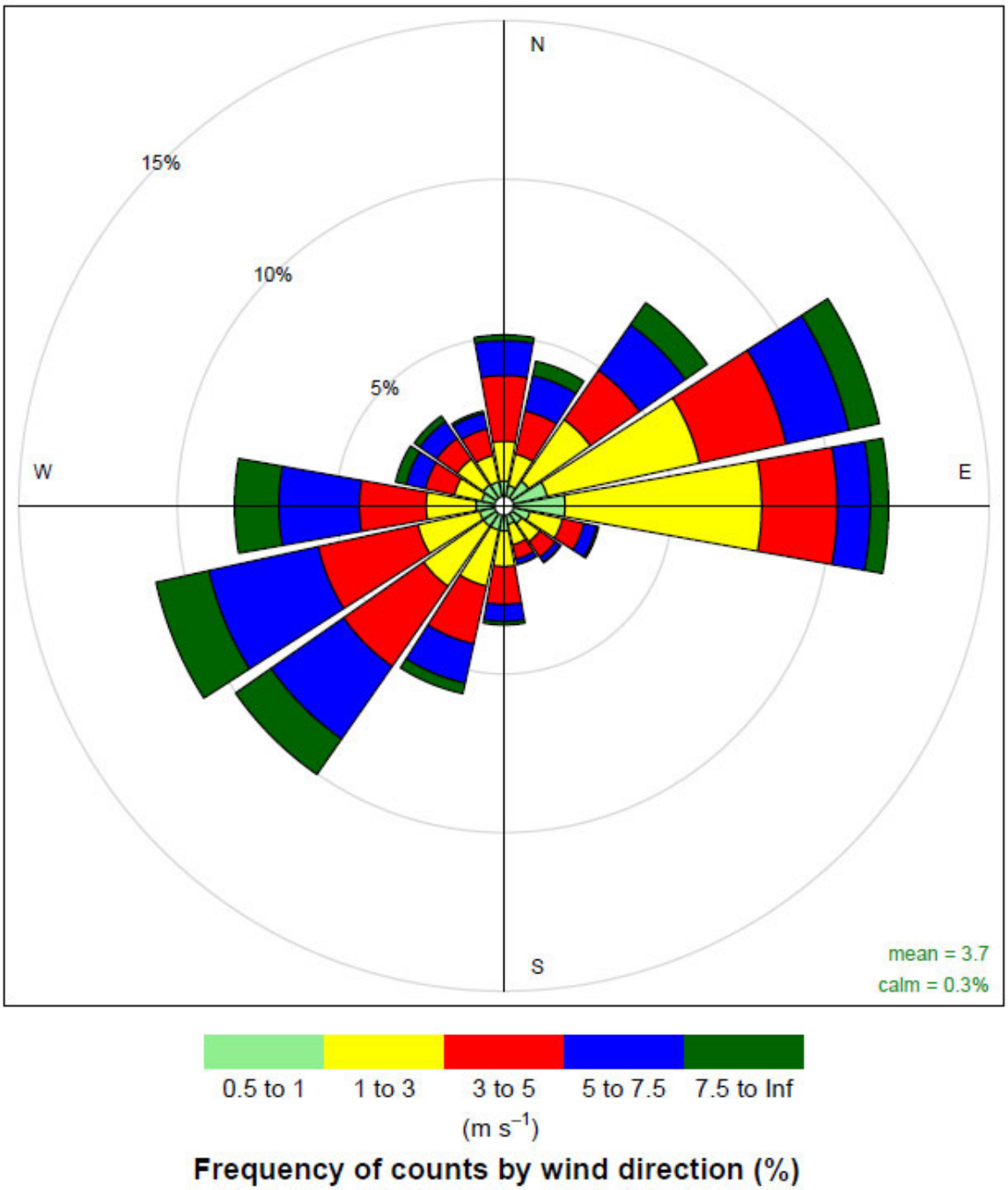


Figure B1: Wind Rose for Ardmore Aerodrome AWS, July 2016 to November 2024

Table B1: Ardmore Aerodrome wind frequency data (2016- 2024)						
Wind Direction	Wind Speed (m/s)					
	0.5 - 1.0	1.0 - 3.0	3.0 - 5.0	5.0 - 7.5	7.5-25.0	Total (%)
North	0.4	1.7	2.1	1.1	0.2	5.5
North northeast	0.4	1.4	1.4	1.1	0.5	4.8
Northeast	0.4	3	1.9	1.8	0.9	8
East northeast	0.6	5.9	2.8	2	1	12.3
East	0.6	7.7	2.4	1.1	0.6	12.4
East southeast	0.3	1.5	0.7	0.4	0.1	3
Southeast	0.3	1	0.6	0.2	0	2.1
South southeast	0.2	0.9	0.5	0.2	0	1.8
South	0.4	1.5	1.2	0.6	0.1	3.8
South southwest	0.3	2.2	1.9	1.3	0.3	6
Southwest	0.3	2.7	3.1	2.8	1.4	10.3
West southwest	0.3	2.4	3.2	3.5	1.7	11.1
West	0.4	2.1	2.1	2.6	1.4	8.6
West northwest	0.3	1.3	0.9	0.6	0.3	3.4
Northwest	0.3	1.5	0.8	0.6	0.2	3.4
North northwest	0.3	1.3	0.9	0.5	0.1	3.1
Sub-total	**5.8**	**38.1**	**26.5**	**20.4**	**8.8**	**99.6**
Calms (<0.5 m/s)						0.4
Total						**100.0**

Appendix C: Existing Clevedon Quarry Dust Management Plan

03/07/2025

Dust Management Plan

2024 – 2025



STEVENSON

Contents

1. Introduction 3
2. Purpose 3
3. Objectives 3
4. Site Description 3
5. Description of Proposed works for 2025-2026 4
6. Dust Sources and Generation 4
   Potential Dust Sources 4
   Factors Influencing Dust Generation 4
   6.1Dust Mitigation Measures and Procedures 5
   6.1.1. Earthworks 5
   6.1.2. Roads – External and within the quarry 5
   6.1.3. Loading and unloading 5
   6.1.4. Exposed surfaces 5
   6.1.5. Crushing and screening 5
   6.1.6. Blasting 5
   6.1.7. Use of Wheel Wash. 5
   6.1.8. Sediment Retention Ponds 5
7. Dust monitoring methodology 6
8. Meteorological Monitoring Station 7
9. Sediment Retention Pond 8
10. Responsibilities 8
   Key personnel onsite 8
   8.1 Contingency plan 9
11. Complaints for 2024-2025 9
12. Annual Review 2024-2025 dust management onsite. 9
13. Revision History 10

1. Introduction

This Dust Management Plan covers the period 30th April 2024 to 1st May 2025for Clevedon Quarry, 546, McNicol Road, Clevedon.

This Dust Management Plan (DMP) sets out details of the dust suppression undertaken, and a record of any air quality complaints received in the previous 12-month period for the Clevedon Quarry.
As required by resource consent ENV-2018-AKL-000046 (Part E DIS60302443 Air Discharge – condition 140) granted by Auckland Council.

The DMP is used as a working document and as such, information included is regularly reviewed and revised as quarry activities develop.

2. Purpose

Along with providing details of actions taken over the previous 12 month period the secondary purpose of this Dust Management Plan (DMP) is to facilitate the avoidance, remediation and mitigation of any adverse effects of dust discharges generated from the quarrying activities at Clevedon Quarry going forward.
To promote proactive solutions to the control of dust discharges from the site.
The DMP identifies the following:

- The various sources of dust that may be created at Clevedon Quarry
- Dust mitigation and prevention measures
- Monitoring methods
- Mechanisms for remediation of adverse effects (should this be required)
- Methods for managing complaints regarding dust and keeping records related to compliance
- Key personnel responsible for implementing the DMP.

3. Objectives

The objectives of this management plan are:

- To operate in full compliance with the resource consent requirements and demonstrate this through reporting procedures
- To liaise with the local community as required, regarding dust management
- To provide the methods that may be employed to avoid, remedy or mitigate adverse effects on the environment due to quarrying activities
- To provide a safe working environment for people on the site.

4. Site Description

The site is located towards the southern end of McNicol Road, on the north-western edge of the Hunua Ranges, approximately 5km to the southeast of the township of Clevedon. The land is owned by Stevenson Aggregates Ltd and covers an area of 80.51 hectares.
The pine plantation on the Southern part of the site has now been harvested and is being replanted in August 2025. Bat monitoring was conducted during the harvesting as per the consent requirements.
Vehicular access to the site is gained via McNicol Road and site traffic approaches and leaves the quarry from the north on McNicol Road. McNicol Road to the north of the site is sealed, and in 2025 the quarry paved the entrance way. The recent pavement has helped to reduce tracking and dust generation.

5. Description of Proposed works for 2025-2026

The current operation at the Clevedon Quarry consists of the following typical mineral extraction activities and operations:

- Removal of overburden
- Blasting rock
- Extraction of rock from the face
- Transportation of the rock from the quarry face to a crushing and screening plant
- Crushing and screening of rock
- Stockpiling and loading out.

Twomey's is our main contractor and undertake all the earthworks on site.

Rayonier have completed felling the quarry zone and the surrounding area. Bat monitoring was conducted during the felling process as per our consent requirements.

In conjunction to these normal work activities, we would like to continue with the works prepared by Eltirus. Eltirus have developed a staged quarry design plan. This is carried out using GPS guidance on machinery to align to the plan developed. This is focused on safe access up to RL200 and access to resources at differing levels.
The proposed work comprises:

- Bulldozer and excavators extracting material using GPS (aligned to design plans).
- Loading dump trucks to cart products to designated stockpiles.
- Loaders to load trucks to exit the site.

6. Dust Sources and Generation

Potential Dust Sources

The activities that can take place at McNicol Road Quarry that have the potential to generate dust include the following:

- Removal of overburden
- Blasting rock
- Extraction of rock from the face
- Transportation of the rock from the quarry face to a crushing and screening plant
- Crushing and screening of rock
- Stockpiling
- Transportation of finished products off site.

Factors Influencing Dust Generation

Five major factors influence the potential for dust to be generated from the site.
These are:

- Wind speed across the surface
- The percentage of fine particles in the material on the surface
- Moisture content of the material
- The area of exposed surface
- Disturbances such as traffic, excavation, loading and unloading of materials, blasting.

Dust emissions from exposed surfaces generally increase with increasing wind speed. However, dust pick up by wind is only significant at wind speeds above 5 m/s. The smaller the particle size of the material on an exposed surface, the more easily the particles are able to be picked up and entrained in the wind. Moisture binds particles together preventing them from being disturbed by winds or vehicle movements. Similarly, vegetated surfaces are less prone to wind erosion than bare surfaces. The larger the areas of exposed surfaces the more potential there will be for dust emissions.

The dust prevention methods detailed below are the methods that are typically found to be effective. They have been used alone or in combination depending on the circumstances.

6.1Dust Mitigation Measures and Procedures

The following measures and procedures have been implemented onsite as necessary.

6.1.1. Earthworks

- Keep exposed surface areas to a minimum.
- Avoid undertaking potentially dusty activities (such as the stripping and spreading of topsoil) on days when conditions are dry, and winds are strong and blowing towards sensitive receptors.
- Use water as a dust suppressant to keep potentially dusty surfaces such as haul roads damp when required.

6.1.2. Roads – External and within the quarry

- Vehicles travelling within the quarry do not exceed 20 km/h, to minimise the risk of generating dust.
- Speed of trucks leading into quarry on unsealed section of McNicol Road do not exceed the Temporary Speed Limit of 30 km/hr.
- Minimise haul distances as far as practical.
- Keep roads and construction surfaces damp with water carts when required.
- Regularly maintain haul roads by grading and laying of fresh rock/gravel.
- Regularly maintain the site access roads by grading and the laying of coarse gravel
- Regularly maintain the weighbridge and entrance with water via sprinkler and/or hose system.
- Require vehicles entering and leaving the site that are carrying dusty materials to have their loads covered when applicable.
- Keep paved roads and yard areas clean using onsite water cart.

6.1.3. Loading and unloading

- Minimise drop heights when loading and unloading vehicles.
- Pre-water transferred materials when required.
- Undertake loading and unloading operations on the leeward side of stockpiles where practicable.

6.1.4. Exposed surfaces

- Revegetate exposed soil with appropriate vegetation as soon as practical.
- Minimise the area of surfaces covered with fine materials.
- Minimise undertaking potentially dusty activities (such as the stripping and spreading of topsoil) on days when conditions are dry, and winds are strong and blowing towards sensitive receptors.
- Minimise the height of stockpiles as far as practicable.
- Keep exposed surfaces damp with water carts and/or fixed sprinklers when required.

6.1.5. Crushing and screening

- Minimise drop heights from the loading of raw materials into the feed hopper and from stacking of stockpiles.

6.1.6. Blasting

- Remove topsoil and loose material covering rock prior to blasting.

6.1.7. Use of Wheel Wash.

- Use of wheel wash in the management of dust within the quarry. This is supplemented by sprinklers along the road following the wheel wash.

6.1.8. Sediment Retention Ponds

- SRPs on site supply water for dust mitigation measures such as the wheel washIf SRPs reach 20% capacity, they are cleaned out.

- If required, flocculant is used to separate the sediment from the water.
- Bore levels are monitored, and water take regulations are followed.
- SRPs are checked weekly, and any maintenance that occurs is logged.

7. Dust monitoring methodology

The following table outlines the dust monitoring methodology that are currently implemented at the quarry. The frequency of monitoring is defined but in the instance of strong winds, observations of dust moving off-site or a complaint received, the monitoring program requires being undertaken more regularly.

Monitoring Activities	Frequency	Person responsible
Check weather forecasts for strong winds and rainfall	Daily	Quarry Manager/ Quarry supervisor
Observe weather conditions, wind via observations (Beaufort scale).	Daily and as conditions change	Quarry Manager/ Quarry supervisor
Inspect dust generating activities to ensure dust emissions are effectively controlled	Daily and as new activities are commenced	Quarry Manager/ Quarry supervisor

As per consent conditions should it be required by Auckland Council, instrumental monitoring of dust concentrations beyond the site boundary would be implemented. The methodology, including the design of the monitoring system, the monitoring methods used, location of monitoring points, alert thresholds and reporting systems will be determined in consultation with Auckland Council, prior to monitoring taking place.
Instrumental monitoring beyond the site boundary is currently not required as there has been no significant adverse dust effect on the neighbouring properties.

8. Meteorological Monitoring Station

A Meteorological Monitoring Station measuring rainfall is located on site, this was upgraded in 2019 to include measuring of wind speed, wind direction and temperature. This was destroyed during Cyclone Gabrielle. A new Meteorological monitoring station was installed on the 1st of November 2023 (pictured below). Meteorological data from the station will be continuously logged and will be available to site staff and Auckland Council on request. The data is monitored regularly and notifications are set up for significant rainfall. Wind and rain can impact the spread of dust so monitoring the weather conditions helps us to determine if the water cart or sweeper is needed. This station is inspected and calibrated on a quarterly basis.



Figure 1: Meteorological station



Figure 2: Location of meteorological monitoring station shown in blue.

9. Sediment Retention Pond

We have an active Sediment Retention Pond on site. Water from the quarry is directed to the holding pond where it is treated via a floc box and able to settle before being transferred to the main ponds forebay where it continues the settling process before discharging to the north stream. Water from the wheel wash is treated via the floc box before entering the holding pond. The ponds are inspected on a weekly basis for water and sediment levels and receive maintenance when needed. The sediment retention pond supplies water to the water cart and the wheel wash.



Figure 3: Sediment Retention Pond and holding pond.

10. Responsibilities

Stevenson Aggregates is the holder of the consent for Clevedon Quarry and has the ultimate responsibility to ensure that all statutory requirements and conditions of consent are complied with and quarry activities are carried out in accordance with the DMP.

Key personnel onsite

Name	Role	Contact details
Janus Lombard	Quarry Manager	[redacted]
Roel Van Es	Quarry Supervisor	
Tara Edwards-Tusa	Quarry Engineer/ Environmental compliance Manager	
Ella Kelso	Quarry Environmental Engineer / Advisor	

The Quarry Manager will have overall responsibility for the implementation of the DMP and will have the following attributes and experience;

- Be experienced in the management of hard rock quarries
- Be experienced in the control of dust from quarries
- Have a thorough knowledge and understanding of the requirements to manage the quarry in a manner that minimizes any adverse effects on the environment and the nearby residents
- Have a thorough knowledge and understanding of the requirements to comply with the conditions of resource consents and the implications of non-compliance
- Be experienced in the training of personnel in the methods used to control dust from a quarry.

The Quarry Manager and Quarry Supervisor will also have the following associated responsibilities:

- To ensure that all contractors and staff are properly trained and understand the requirements of the DMP
- To ensure that the dust control and mitigation measures and procedures outlined in the DMP are implemented effectively
- To ensure that the conditions of the resource consent for discharges to air are complied with at all times
- To ensure that the dust-monitoring programme is carried out as required
- To ensure that complaints are received and investigated as outlined in the DMP
- To ensure that dust emissions are avoided and mitigated as far as is practicable
- To ensure there are adequate personnel and equipment on site at all times to enable the dust control and mitigation measures outlined in the DMP to be implemented effectively, including in extreme weather events
- To ensure that in the Quarry Supervisor's absence an appropriately qualified deputy is available
- To ensure the DMP is current and reviewed at least annually.
- All contractors and staff working on site are to ensure that their activities comply with the requirements of the DMP.

8.1 Contingency plan

Should areas of the site become sources of excessive dust, work in those areas will be stopped until the areas have been stabilised or other measures have been successful in mitigating the dust. The dust monitoring methodology outlined in 7.0 will be followed.

11. Complaints for 2024-2025

No air or dust related complaints were received for Clevedon Quarry over the 2024-2025 period.
In the instance a complaint is received it will be logged in the CAMS system as per company procedures and protocol and presented at the quarterly CLG meeting.

12. Annual Review 2024-2025 dust management onsite.

- No complaints were received over the previous 12-month period.
- Blasting has slightly increased in the 2024-2025 period. The appropriate measures were taken to ensure that blasting caused minimum disruption including staying within the consent requirements and notifying nearby residents. We expect blasting to decrease in frequency over the next year.
- The site entranceway/ exit has been paved in the 2024-2025 period, reducing the presence of dust and tracking.
- Our internal haul roads and entrance/exit continues to be maintained in a good condition. The water cart and sweeper are kept on site and used as needed.
- Minimal truck movements from quarry activities occurred over previous 12-month period.

- Continued work onsite focusing on construction of internal haul roads and transport of resulting stripping/overburden offsite.

13. Revision History

Date	Author	Brief Description of change
22/05/2024	E Kelso Environmental Engineer	Updated report 2023-2024
19/02/2025	E Kelso Environmental Engineer	Updated report following Auckland Council's comments.
24/03/2025	J Lombard Quarry Manager	Reviewed and Approved 2023-2024 report.
03/07/2025	E Kelso Environmental Engineer	Updated report for 2024-2025
08/08/2025		Reviewed and Approved 2024-2025 report