

**BEFORE INDEPENDENT HEARING COMMISSIONERS
AT WHANGAREI**

IN THE MATTER of the *Resource
Management Act 1991*

AND

IN THE MATTER of an application for land
use consent to place
2.4 million cubic metres of
overburden from Otaika
Quarry onto adjoining land
zoned countryside
environment.

BETWEEN Whangarei District Council

AND GBC Winstone

STATEMENT OF EVIDENCE OF VIRGINIA MCLAUGHLIN

6 April 2018

TABLE OF CONTENTS

1. QUALIFICATIONS AND EXPERIENCE.....	2
2. SCOPE OF EVIDENCE.....	4
3. SUMMARY OF EVIDENCE.....	4
4. BACKGROUND.....	4
5. WHANGAREI DISTRICT PLAN.....	7
6. HEALTH EFFECTS.....	7
7. YALDHURST QUARRIES OPERATION.....	11
8. CONCLUSION.....	13
9. REFERENCES.....	15

1. QUALIFICATIONS AND EXPERIENCE

- 1.1 My full name is Virginia Anne McLaughlin.
- 1.2 I am a medical doctor. I hold a Bachelor of Medicine, Bachelor of Surgery from the University of Otago and a Master of Applied Epidemiology from the Australian National University. I was first registered by the Medical Council of New Zealand in 1992 and have maintained good standing and annual registration since that time. I specialised in public health medicine and am vocationally registered as a public health medicine specialist. I am also Medical Officer of Health for the Northland District Health Board (NDHB), based in Whangarei. I have been in this role since November 2015. Prior to this, I worked for the Department of Health, Western Australia in regional and metropolitan settings as well as in other jurisdictions in Australia. I have also worked for the World Health Organisation and as a Resident Medical Officer at Whangarei Hospital. I seek to improve the health and wellbeing of individuals, and society as a whole by addressing the social determinacies of health and the wider risk factors that increase the likelihood that an individual will experience harm. I also have experience and expertise in analysing local and international research relating to public health issues.
- 1.3 I have worked as Principal Medical Consultant, Environmental Health Directorate, Department of Health, Western Australia and have provided public health advice in relation to environmental health issues including contaminated sites (in particular lead contamination), drinking water, waste water and air quality.
- 1.4 I was contacted by a member of the public asking if I was aware of GBC Winstone's application on 27 July 2017. I was not. The resource consent application, granted by Northland Regional Council (NRC) on 27 April 2017 had not been formally notified as NRC had determined that it did not need to be publicly notified. At this point, I organised an internal meeting to scan the application and seek expert review of both noise and air quality aspects. This review indicated that from a public health perspective, air quality aspects were not adequately reviewed. I also met with several concerned residents at Acacia Drive on 4 August 2017

to listen to their concerns and view the proposed overburden site and surrounds.

1.5 I attended a pre-Hearing meeting with the applicant on 28 September to discuss the proposal in general terms. Also present were Mr Ian Wallace (GBC, Winstone), Mr Andrew Curtis (Air Quality Expert at the request of the applicant), Mr Gavin de Klerk (NDHB) and Ms Louise Wickham (Air Quality Expert at my request) attending by teleconference. These parties were also present when I visited the existing quarry at Quarry Road, Raumanga, and the proposed site for the overburden referred to as the 'Pegram Block', by invitation from Ian Wallace on 30 October 2017.

1.6 I have read the Code of Conduct for Expert Witnesses contained in the Environment Court's Practice Note 2014 and have complied with it in preparing this evidence. I confirm that the issues addressed in this evidence are within my area of expertise, unless otherwise stated, and I have not omitted material facts known to me that might alter or detract from my evidence. Although I am employed by the NDHB, I am advocating for public health, not for the NDHB. It is in this role, as an independent expert witness, that I am providing my expertise in public health to the commissioners, so that they can make an informed decision under the *Resource Management Act 1991*.

1.7 The key documents that I have referred to in preparing my evidence include:

- (a) Boffa Miskell Limited 2017. *Otaika Quarry - Proposed Overburden Disposal Area: Application for Land Use Consent and Assessment of Environmental Effects*. Report prepared by Boffa Miskell Limited for GBC Winstone.
- (b) Whangarei District Council. *Whangarei District Plan*. May 2007.
- (c) Ministry for the Environment. 2016 *Good Practice Guide for Assessing and Managing Dust* and the Environmental Protection Agency Victoria. 2013 *Guideline for recommended separation distances for industrial residual air emissions*.
- (d) Additional documents referred to in my brief are contained in a complete reference list at page 15.

2. SCOPE OF EVIDENCE

2.1 My evidence will address the following matters:

- (a) The magnitude of the proposal (in general terms. 2.4 million cubic metres of overburden being placed within close proximity of current residences)
- (b) Health effects of particulate matter (especially inhalable fraction and silica) and psychological issues
- (c) Health concerns being raised currently by residents near Yaldhurst Quarry, Christchurch – a quarry which contains a similar material (greywacke which in turn contains silica), and the corresponding interagency response.

3. SUMMARY OF EVIDENCE

3.1 The proposal by GBC Winstone will mean that quarrying activities will now take place in a designated buffer zone in the Whangarei District Plan.

3.2 Substantiated health effects have arisen from dust related to quarry activities in Yaldhurst (which mine a similar material to that contained at the Otaika Quarry).

3.3 The proposed activity does not have an adequate separation distance (buffer) to ensure the health and amenity of residents.

4. BACKGROUND

4.1 The proposal by GBC Winstone is to place overburden (consisting of topsoil, clay, greensand, limestone and highly weathered greywacke. Note that both greensand and greywacke contain silica) from the Otaika Quarry onto an adjoining property known as the 'Pegram Block' legally described as Lot 2 DP 53728 and Lot 2 DP 363982. The activity will involve the placement of 2.4 million m³ of overburden over a series of campaigns, with 300,000m³ of overburden being placed on site over a period of 6-8 months every 3-5 years, over a 35 year consent period. This makes this one of the largest quarry works in New Zealand. Enabling works are proposed to be carried out in October – April (ie including the drier and hotter months of summer). Works will occur

between the hours of 7.30am – 6pm Monday to Friday, and from 7.30am – 2pm on Saturday. The minimum separation distance for the current operation (as calculated using Google maps) from active area to residence is 211m (western end of Acacia Avenue) with the next closest property 290m (at the southern end of Acacia Avenue), refer Figure 1. The proposal for the overburden will mean works occurring less than 40 m from residential boundaries, with general works occurring less than 200m. In addition, The Otaika Sports park, is situated on the south side of Quarry Road and will be less than about 500m from the proposed general works¹.

- 4.2** The application by GBC Winstone states that GBC Winstone purchased the Pegram Block in 2006. As I understand (and was confirmed by Mr Ian Wallace), GBC Winstone originally owned the block, sold it and then reacquired the land in 2006. In addition, there is no indication in the application if other options for management of the overburden have been considered by GBC Winstone and what the pros and cons may have been for comparison.
- 4.3** Health and Safety requirements for workers at Open cast mines, alluvial mines and quarries is well documented by Worksafe¹ and exposure to silica is a well-recognised risk to workers in the mining, quarrying and sandblasting industries. A review of the Extractive Industry (ie essentially coal mining, gold mining and quarrying) by the former Occupational Safety and Health Service in 1999/2000 revealed that 11% dust samples from the work sites identified as “Quarries” had levels of respirable silica in excess of the current New Zealand workplace exposure limit (ie for respirable quartz dust $0.2\text{mg}/\text{m}^3$)². This indicates that on-site issues have been identified in relation to respirable silica in the New Zealand setting and consequently there is also potential for off-site issues.
- 4.4** Workers in New Zealand should not be compared with the general population as they are protected by the relevant Occupational Health and Safety legislation. Although there is a wealth of international literature available regarding the health effects on quarry workers, there is limited information regarding health effects from particulate matter (PM) arising

¹ Using scale on Otaika Quarry – Proposed Overburden Disposal Area. Concept Plan – Final form. Prepared for GBC Winstone by Boffa Miskell Limited. 13 March 2017.

from quarries on the general public in developed countries. A study in Puerto Rico in 2009 compared two communities, one exposed to PM from quarries and diesel and one with no such exposure. Although the study was limited, there was a higher prevalence of general and respiratory symptoms (ie bronchitis, nasal allergies, nasal congestion, nausea and vomiting) in the exposed community.³ Given the paucity of available literature, learnings from the Yaldhurst Quarry situation will be very important to inform future practice and policy.

- 4.5** Road dust generated from the deposition of the overburden also needs to be considered. A recent Canadian study found that road dust (both coarse and fine fraction particles) had an adverse health effect on communities affected by road dust.⁴
- 4.6** Reverse sensitivity (incompatible land uses) occurs when sensitive activities, such as residential properties, are allowed to locate where they may be adversely affected by industrial or noxious activities. Allowing sensitive activities to establish in close proximity to industry can have adverse effects on health, safety and/or amenity values of people, as well as potentially adversely affect the economic and safe operations of activities.^{iv} However, in the Otaika Quarry situation, it is a more unusual scenario, where an identified potentially hazardous to health activity would be knowingly allowed to expand towards a sensitive population.
- 4.7** Separation distances (buffers) are intended to be used to manage reverse sensitivity effects (they are not intended as an alternative to source control).⁵ The Ministry for Environment document *Good Practice for Assessing and Managing Dust* 2016 states that at the time of writing, EPA Victoria has the most up-to-date guidance considered appropriate for New Zealand. The Environmental Protection Authority, Western Australia provides guidance on separation distances. For quarrying activities it ranges from 300 – 1000m depending on activity.⁶ The EPA, Victoria recommended separation distance for Quarries ranges from 250m (without blasting) to 500m (with either blasting or respirable silica).⁷ This would suggest that the planned placement of the overburden is just too close to the current (and potential future) sensitive population.

5. WHANGAREI DISTRICT PLAN

5.1 The Whangarei District Plan sets out rules, policies and objectives for sustainably managing natural and physical resources in the Whangarei District (as required by *the Resource Management Act 1991*), and was made operative on 3 May 2007. The 'Pegram Block' is currently located in several different zonings with an overlay known as the Mineral Extraction Area (MEA). The southwestern two-thirds of the 'Pegram Block' is zoned Countryside Living (also abuts the residential dwellings in Acacia Park), while the balance is zoned Living 3 (to the north). The Mineral Extraction overlay (MEA3) – buffer area currently abuts the residential dwellings in Acacia Park. Otaika Sports ground is currently zoned Countryside Living, Open Space and Living 1.

5.2 In my view, the WDC is to be commended for including this buffer area (or separation distance) in their District Plan as it recognises the potential impact that the quarrying activity can have on the surrounding population. The buffer area provides a distance of more than 200m from Mineral Extraction Active area to location of current dwellings.

6. HEALTH EFFECTS

6.1 The 'Pegram Block' and surrounding area is located in the Whangarei suburb of Raumanga West. Data from the 2013 Census, indicate that at that time there was a population of 2,817 people resident, with a median age of 29.3 years (28% are aged <15 years, and 4% are aged 60 years and above). 46% identify as of Maori ethnicity and the median personal income is \$20,700. Raumaunga West is classified as having a NZ Deprivation Index score of 10 (ie highly deprived). This indicates that the suburb has a more susceptible population by virtue of its youth, Maori ethnicity and deprivation score. It is not anticipated that these demographic statistics would have changed markedly from the 2018 census (data awaited), however, Whangarei itself has made it on to the Government's *National Policy Statement on Urban Development Capacity (NPS-UDC)* list as a High Growth City.⁸ This means that we can expect future population growth in Whangarei – the area is not going into population decline.

6.2 The Otaika Sports Park is currently under development, which will result in construction of two new sports fields with sand carpet (giving a total of

four), and is anticipated to be ready in April 2019. This will attract a considerable number of people (mainly young) to the area from around Whangarei, both after school and in the weekend. The sports fields are used for soccer and rugby league and host dog shows, and there is a community building which caters for clubs and community groups⁹.

6.3 Particulate Matter (PM) or particle pollution is the term for a mixture of solid particles and liquid droplets found in the air. Some particles, such as dust, dirt, soot, or smoke, are large enough to be seen with the naked eye. Others are so small they can only be detected using an electron microscope. They can be classified as PM₁₀ (ie inhalable particles of 10 micron in size, that can enter your lungs) and PM_{2.5} (ie fine inhalable particles of 2.5 micron in size that can go deep into your lungs and some may even enter your blood stream). These particles can come from a source (eg a construction site, unpaved road, field tillings, fires) or from complex chemical reactions in the atmosphere (eg from power plants, industries and cars).

6.4 Exposure to particulate matter can affect both your lungs and your heart and this is now well recognised. There is now global scientific consensus that exposure to particulate pollution causes predominantly respiratory and cardiovascular effects, ranging from subclinical functional changes (e.g. reduced lung function) to symptoms (eye or skin irritation, increased cough, difficulty breathing, exacerbated asthma) and impaired activities (e.g. school or work absenteeism) through to doctors' or emergency room visits, hospital admissions and death¹⁰. The effects, in terms of escalating severity, are described as increased visits to doctors for many individuals, hospital admission for some individuals and death for a few individuals¹⁰. People with heart or lung diseases, children and older adults are most likely to be affected by PM.

6.5 In 2013, the World Health Organisation International Agency for Research on Cancer (IARC) classified particulate matter as carcinogenic based on an increased risk of lung cancer¹¹. Importantly, IARC noted that whilst the composition of air pollution and levels of exposure can vary dramatically between locations, the conclusions of carcinogenicity apply to all regions of the world. This is consistent with the World Health Organisation global guidelines for particulate matter, which are based on

all airborne particles having the same potential to cause adverse health effects, regardless of chemical composition or physical characteristics¹⁰.

- 6.6** New research further indicates particulate matter is associated with atherosclerosis, adverse birth outcomes, childhood respiratory disease as well as Alzheimer's disease and other neurological endpoints, cognitive impairment, diabetes, systemic inflammation and aging^{12,13}.
- 6.7** Respirable crystalline silica (RCS) (measured as < 4 micron particle size) in the form of quartz or cristobalite dust is rated as carcinogenic to humans (Group 1, IARC, 2012), with sufficient evidence in humans to show that it causes cancer of the lung.¹⁴ Silica is contained in both greensand and greywacke and the quarrying processes can generate RSC (for example, through the repetitive crushing and grinding of rock under vehicles). The fine fractions of silica can cause scarring of the lungs (known as silicosis) and mostly affects workers exposed to silica dust.
- 6.8** Wind dispersion of both coarse and fine fractions of particulate matter is best discussed by Air Quality Experts as this is their area of expertise, however, available wind speed and wind direction monitoring provided from monitors at Whangarei Airport and Portland Cement for 2008-2012 (1 hour average) indicate that there is the potential for dust to be blown from the proposed overburden site to both the residential area and Sports Park¹⁵.
- 6.9** Psychological stress has emerged as an important consideration in managing environmental health risks, although there is limited literature available that is transferable to the current setting^{16,17}. Community stress may add to psychological stress at the individual level, which can add to negative physical health consequences for residents. Five main elements for stressors have been described: (1) uncertainty (ie related worries about the health effects of the exposure); (2) housing and job security (eg possible loss of property value); (3) social rejection (eg social stigma due to coming from a "toxic" community); (4) media siege (eg how information is transmitted about the community, how debate is shaped); (5) cultural pressure (eg conflicting public pressures and implicit social messages about how to behave, what information to believe and

what can be expected now and in the future).¹⁷ Consequently, it would be anticipated that the current process will be having an impact on current residents, and may also impact on future residents and users of the redeveloped Sports Park (who will come from many different suburbs and potentially out of town), if significant works are undertaken on 'Pegram block'.

6.10 Nuisanceⁱⁱ and amenityⁱⁱⁱ must also be taken into consideration. This includes the impact of larger dust particles, from placement of overburden and vehicular transport, on the surrounding area potentially coating windows, cars and gardens. Apart from impacting on health, dusty conditions can affect people's ability to enjoy their outdoor areas and increase the requirement for cleaning. This can also result in a financial cost due to increased use of cleaning materials, and possibly paid labour.^{iv} It is also noted, that for some residents, sweeping views across countryside to Whangarei Harbour will now be obscured by a tree buffer and a significant hill form over an existing gully area.

6.11 Although, outside the scope of this consent, there are additional public health considerations in terms of urban planning and design in relation to this area. The Otaika, Raumanga, and ToeToe Structure Plan¹⁸ was adopted by Whangarei District Council in 2003 after community consultation regarding an Urban Growth Strategy for the area. This area was identified as requiring structure planning to plan for, and manage, growth (as well as other urban fringe suburbs of Maunu, Kamo, Tikipunga, Onerahi and 10 Coastal areas). There is no mention of consultation about potential quarry expansion in this document. Water pipelines and sewer pipelines are currently located in the residential areas surrounding the 'Pegram Block'. From a public health perspective, good urban design includes safe drinking water supplies and wastewater systems that don't pose a risk to public health. Well maintained and operated Territorial Authority (or private entities with water/wastewater as their key responsibility) schemes (where available) are the best way to fulfil this requirement. The placement of infrastructure pipework may contribute a considerable cost to subdivision development and it is

ⁱⁱ Nuisance as defined by the *Health Act 1956* (s29)...(l) where any trade, business, manufacture, or other undertaking is so carried on as to be unnecessarily offensive or likely to be injurious to health:....(o) where any street, road, right of way, passage, yard, premises, or land is in such a state as to be offensive or likely to be injurious to health...

ⁱⁱⁱ Amenity values as defined by the *Resource Management Act 1991* (s2) "...means those natural or physical qualities and characteristics of an area that contribute to people's appreciation of its pleasantness, aesthetic coherence, and cultural and recreational attributes"

important that existing pipework is well utilised in terms of planning for potential increased urban density in this area. As Whangarei grows, urban fringe development will become more critical.

7. YALDHURST QUARRIES OPERATION

7.1 Yaldhurst Quarry is located near Christchurch, on an old Waimakariri River Channel. I understand that the site is comprised of five quarries in close proximity to some residences. I am not familiar with the site and have not undertaken a site visit, consequently, the following information has been provided to me by others working in the area.

7.2 Discussion with Medical Officer of Health colleagues in Canterbury indicate that there are ongoing health and nuisance issues arising from the Yaldhurst Quarries (which also mine greywacke, containing crystalline silica). Residents have complained of respiratory symptoms (eg conjunctivitis, "burning" sore throats and nose bleeds) in relation to dust exposure which has been described by medical specialists, who have seen the patients, as consistent with mined silica exposure. The specialists have attributed these symptoms to larger particles of silica, and not the respirable crystalline silica which potentially can lead to silicosis of the lung. I understand that in this situation some residents are living 20-30 metres from the quarry boundaries. There also appear to be issues in the Yaldhurst community relating to psychological stressors that appear similar to what has been outlined in my paragraph 6.7 above.¹⁹

7.3 In the absence of a separation distance, the management of dust from Winstone's Yaldhurst quarry relies on a resource consent condition (CRC971466) –

4. The discharge shall not cause the deposition of particulate matter, which is determined to be objectionable or offensive by an enforcement officer of the Canterbury Regional Council, beyond the property boundary of the consent holder.

(This is similar to the condition signed off in the Resource Consent by Northland Regional Council on 27 April 2017 (File: 39161) ie The Consent Holder shall provide an Erosion and Sediment Control Plan...as a minimum... shall include the following:

.....

(j) Measures to ensure dust discharge from the earthworks activity does not create a nuisance on neighbouring properties;
.....)

7.4 The application of this consent condition relies on a very subjective measure of nuisance (“objectionable or offensive”). Enforcement has not been effective to date with the Yaldhurst community disagreeing with the enforcement officers’ assessment of the situation.

7.5 I understand that Community and Public Health, a division of Canterbury District Health Board, is now recommending a separation distance of 500m from the boundary of residential properties in relation to quarry activities^{iv}.

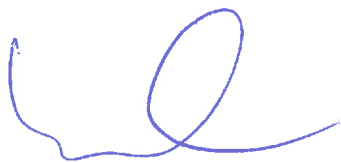
7.6 The subsequent joint agency response to the Yaldhurst (ie Local Council, Regional Council and District Health Board) is resource intense (in terms of staff time, monitoring requirements, and communications management). Environment Canterbury has a dedicated information internet site relating to “Working together to resolve quarry dust issues”, and are working with Christchurch City Council and the Canterbury District Health Board ²⁰. A monitoring program is also being undertaken. Levels of microparticulate silica (<4µg) are currently being measured in an air quality research programme which could cost the Canterbury Regional Council over \$300,000 for 3 months monitoring data.

7.7 I would not like a repeat of the Yaldhurst situation - here in Northland. We should be learning from this experience, and implementing appropriate preventive measures ie separation distances, to reduce the risk to public health (or in the case of the Whangarei Plan – upholding the current buffer area rather than reducing it).

^{iv} Personal Communication with Dr Alistair Humphrey, Medical Officer of Health (Canterbury).

8. CONCLUSION

- 8.1** We have an obligation to protect the health of residents, especially in light of issues currently arising from Yaldhurst, where substantiated health issues are being reported by specialists at Canterbury District Health Board.
- 8.2** I do not believe that the current application has an adequate separation distance (buffer) to ensure the health and amenity of residents. The WDC District Plan acknowledges this requirement in terms of the yellow striped buffer area in Figure 1 for the current quarry activity (rather than the proposed activity) and should be viewed as good practice land planning.
- 8.3** For these reasons, I recommend that the land use consent application be declined.

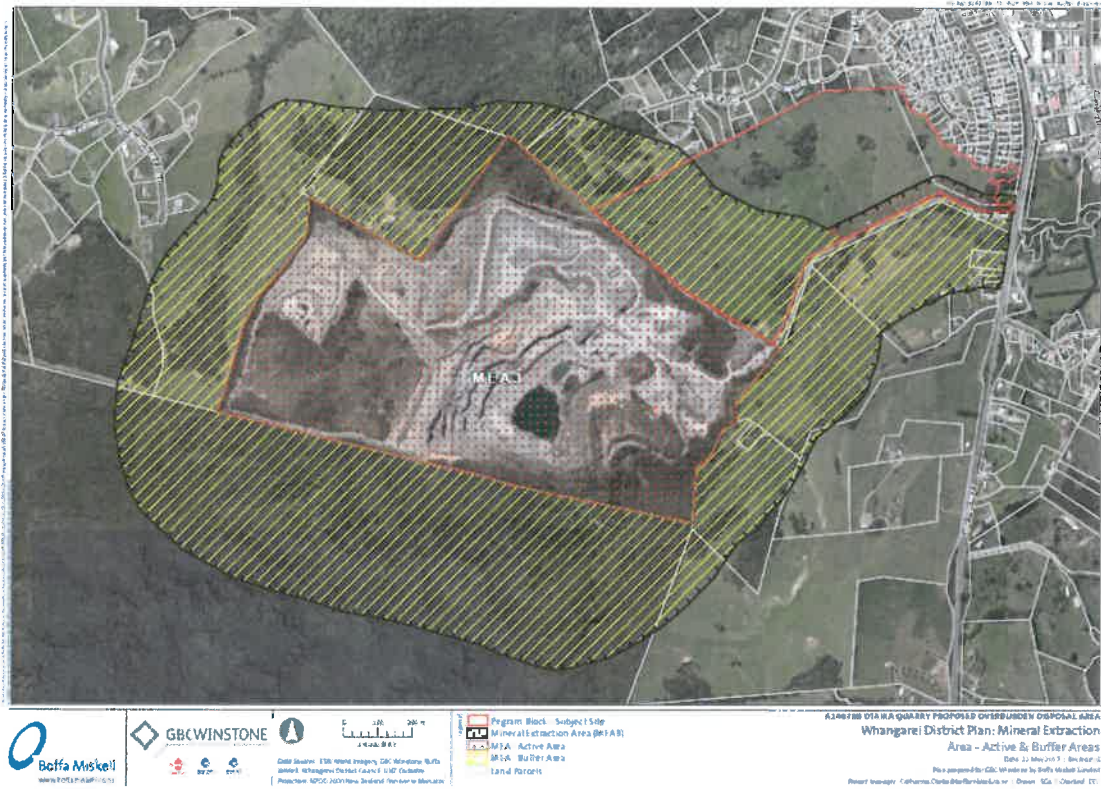


Virginia McLaughlin

6 April 2018

Attachment 1

Figure 1. Mineral Extraction Area 3 (Otaika Quarry) showing active (red dots) and buffer (yellow stripes) areas. Pegram block outlined in red.



References

- ¹ WorkSafe New Zealand. Health and Safety at Opencast Mines, Alluvial Mines and Quarries. Good Practice Guidelines. November 2015. Retrieved from: <https://worksafe.govt.nz/topic-and-industry/extractives/guidance-position-statements/health-and-safety-at-opencast-mines-alluvial-mines-and-quarries/>
- ² Respiratory Health and Silica Dust Levels in the Extractive Industry. Occupational Health Report Series. Number 9. 2003. Occupational Safety and Health (now WorkSafe). Retrieved from: <https://worksafe.govt.nz/topic-and-industry/extractives/guidance-position-statements/respiratory-health-and-silica-dust-levels-in-the-extractive-industry/>
- ³ Clinical Conditions Associated with Environmental Exposures: an Epidemiologic Study in Two Communities in Juana Diaz, Puerto Rico. *PR Health Sci J.* 2009 Jun; 28(2):126-134. Retrieved from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3885176/>
- ⁴ Seasonal ambient particulate matter and population health outcomes among communities impacted by road dust in British Columbia, Canada. Hong KY et al. *J Air Waste Management Assoc* 2017. Retrieved from: <http://doi.org/10.1080/10962247.2017.1315348>
- ⁵ Ministry for the Environment. 2016. Good Practice Guide for Assessing and Managing Dust. Wellington. Ministry for the Environment.
- ⁶ Environmental Protection Authority. Western Australia. Guidance for the Assessment of Environmental Factors. Separation Distances between Industrial and Sensitive Land Uses. No 3. June 2005. Retrieved from: <http://www.epa.wa.gov.au/policies-guidance/separation-distances-between-industrial-and-sensitive-land-uses-gs-3>
- ⁷ EPA Victoria. Recommended separation distances for industrial residual air emissions. No 1518. March 2013. Retrieved from: <http://www.epa.vic.gov.au/our-work/publications/publication/2013/march/1518>
- ⁸ Whangarei District Council. Long Term Plan 2018-28 Consultation Document. February 2018.
- ⁹ Retrieved from: <http://www.wdc.govt.nz/FacilitiesandRecreation/Sportsgrounds/Pages/SportsgroundFacilities.aspx>
- ¹⁰ World Health Organisation, (2006). Air Quality Guidelines Global Update 2005. Copenhagen. Denmark.
- ¹¹ World Health Organisation: International Agency for Research on Cancer, (2013). Press Release No. 221, 17 October 2013.
- ¹² World Health Organisation, (2016). Available evidence for the future update of the WHO Global Air Quality Guidelines. Meeting report Bonn, Germany 29 September – 1 October 2015. Copenhagen. Denmark.
- ¹³ World Health Organisation, (2013). Review of evidence on health aspects of air pollution – REVIHAAP Project. Technical Report. Regional Office for Europe. Copenhagen. Denmark.
- ¹⁴ World Health Organisation: International Agency for Research on Cancer. (2012). Arsenic, Metals, Fibres, and Dusts: A Review of Human Carcinogens. IARC Monographs on the

Evaluation of Carcinogenic Risks to Humans, 100C, 355-405. Retrieved from: <http://monographs.iarc.fr/ENG/Monographs/vol100C/mono100C-1.pdf>.

¹⁵ Primary Statement of evidence of Mr Curtis dated March 2018 at Figure 6 and Figure 15

¹⁶ Downey L, Willegen M. Environmental Stressors: The mental health impacts of living near industrial activity. *J Health Soc Behav*. 2005. September;46(3):289-305

¹⁷ Couch S, Coles C. Community stress, psychosocial hazards, and EPA decision-making in communities impacted by chronic technological disasters. *Am J Pub Health*. 2011;101S140-148

¹⁸ WDC. Otaika, Raumanga and Toe Toe Structure Plan. February 2009. Retrieved from: <http://www.wdc.govt.nz/PlansPoliciesandBylaws/Plans/UrbanPlanning/StructurePlans/Documents/Otaika-Raumanga-Toe-Toe-Structure-Plan-2009.pdf>

¹⁹ The Press Media article " Yaldhurst residents feel 'ground down' by costly quarry court action. Nov 8 2017. Retrieved on 2/4/2018: <https://www.stuff.co.nz/the-press/news/98684363/Yaldhurst-residents-feel-ground-down-by-costly-quarry-court-action>

²⁰ Retrieved from: <https://www.ecan.govt.nz/get-involved/news-and-events/2017/working-together-to-resolve-quarry-dust-issues/>