# Ngapuna Industrial Area Dust Survey 2010

Prepared by Shane Iremonger, Environmental Scientist

Bay of Plenty Regional Council
Environmental Publication 2010/17

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NEW ZEALAND

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Bay of Plenty REGIONAL COUNCIL

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Cover Photo: Ngāpuna subdivision, 28 October 2009.

# Acknowledgements

Nick Miller for his accurate and timely assessments of the selected businesses in the Ngāpuna subdivision.

Dr Bruce Graham[1] for his peer review.

Maria Glen for her document management skills.

[1] Principal author of the *Good practice guide for assessing and managing environmental effects of dust emissions*, Ministry for the Environment, ME40-8, Wellington, New Zealand, p58.

# Executive summary

The purpose of this report is to summarise the findings of the Ngāpuna industrial site survey. This survey was conducted following the recording of on going exceedances of the NES-AQ $PM_{10}$ at the Bay of Plenty Regional Council monitoring caravan located at the north eastern boundary of the Ngāpuna subdivision.

The survey consisted of a questionnaire and accompanying site photographs, some specific aerial photography and the collection of grab samples.

A total of 29 sites were included in the survey. These sites were chosen due to the type of activity undertaken. Several sites were currently for sale and hence had no occupants. Several sites declined to be included. A small number of office based businesses are present in the area but these were not included in the survey.

The recent site dust survey has shown that most occupants of the subdivision are aware of this issue and are impacted in a variety of ways. The survey shows that a reasonable proportion of the sites are trying to address the issue already in a range of ways.

The survey has shown that a number of sites have a management plan of some description in place, although only a limited number address the issue of dust management. This shortcoming would be a suitable starting point to try and address this issue.

A management plan approach would be best achieved on a site by site basis as there are a variety of activities being undertaken on a variety of land covers and therefore site specific plans would be most beneficial. For each site a dust management plan could be developed in conjunction with the occupant and implemented as outlined in the plan.

This site specific approach should firstly be targeted at the consented sites and those which expressed interest during the survey in receiving advice from the regional council. Those that requested advice should be ranked for attention in relation to the following parameters collected during the survey and subsequent analysis:

- stockpiles
- unsealed yards
- yards with high traffic volumes

As part of this program a future follow up subdivision wide dust survey should be programmed along with the continuation of the regional councils air quality monitoring site as a quantitative measure.

Discussion should also occur with the Rotorua District Council regarding more frequent road sweeping for the Ngāpuna subdivision.

# Contents

# Part 1: Introduction

The purpose of this report is to summarise the findings of the Ngāpuna industrial site survey. This survey was conducted following the recording of on going exceedances (see Part 3) of the NES-AQ $PM_{10}$ at the Bay of Plenty Regional Council monitoring caravan located at the north eastern boundary of the Ngāpuna subdivision.

This report also builds on point source information collated and the findings of the earlier investigation of $PM_{10}$ sources[2] and AUSPLUME modelling[3] of the three major industrial activities in the Ngāpuna subdivision. The key findings of these earlier two investigations are summarised in Part 2.

[2] Iremonger, S.D., 2009, *Ngapuna Air Quality Monitoring Report 2008*, Environment Bay of Plenty Environmental Publication 2009/02, p.42.
[3] Iremonger, S.D. & Graham, B. W., *Industrial Emissions in the Rotorua LAMA*, Environment Bay of Plenty internal memorandum, 0240 02I01, p.8.

# Part 2: Background

The environmental impacts of dust emissions can cause widespread public concern about environmental degradation and/or a decline in amenity. The nature and extent of the problem and significance of the effects usually depend on the nature of the source, sensitivity of the receiving environment and on individual perceptions. For example, the level of tolerance to dust deposition can vary enormously between individuals. However, individual responses can also be affected by the perceived value of the activity producing the dust. For example, people living in rural areas may have a high level of tolerance for the dust produced by activities such as ploughing or top-dressing, but a much lower tolerance level for dust from unsealed roads[4].

## 2.1 Dust characteristics

Dust particle size is an important factor in determining the way in which the dust moves through the air. It is also relevant for the possible environmental impacts, especially health effects. Particle sizes are normally measured in microns, and the size range of airborne particles is typically from less than 0.1 microns up to about 500 microns, or half a millimetre. This size distribution is shown in Figure 2.1. A micron is one thousandth of a millimetre and therefore invisible to the naked eye.

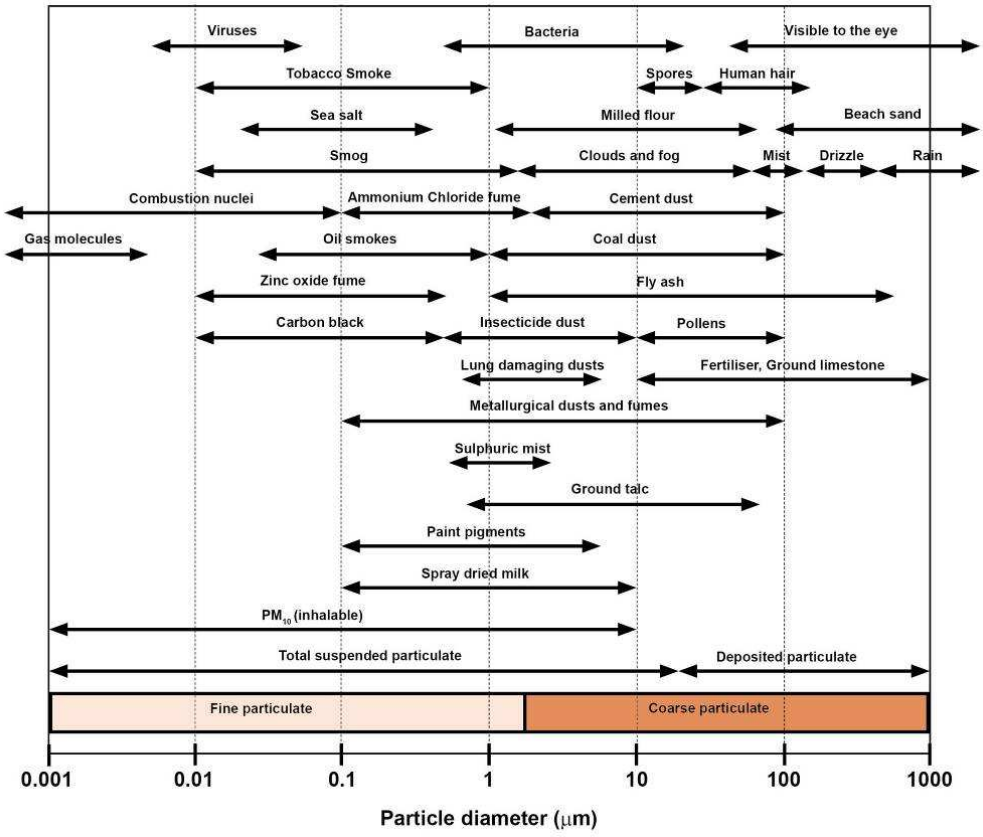



*Figure 2.1 Approximate particle size distribution.*

[4] MfE, 2001, *Good practice guide for assessing and managing environmental effects of dust emissions*, Ministry for the Environment, ME40-8, Wellington, New Zealand, p58.

Particles deposited on a surface will only become individually visible at about 50 microns. For the purposes of comparison, a single sheet of paper is about 100 microns thick, and the diameter of human hair varies from about 30–200 microns.

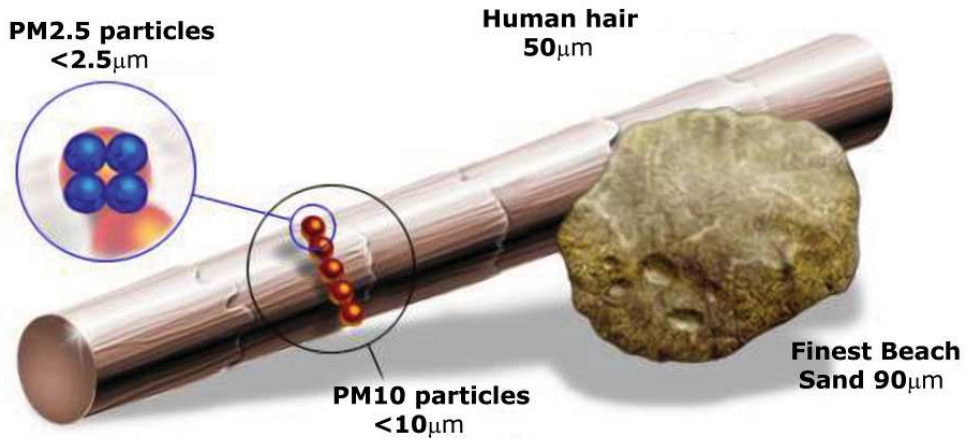



*Figure 2.2 Particle size comparison.*

When dust particles are released into the air they tend to fall back to ground at a rate proportional to their size. This is called the settling velocity. For a particle 10 microns in diameter, the settling velocity is about 0.5 cm/sec, while for a particle 100 microns in diameter it is about 45 cm/sec, in still air[5]. To put this into a practical context, consider the generation of a dust cloud at a height of one metre above the ground. Any particles 100 microns in size will take just over two seconds to fall to the ground, while those 10 microns in size will take more than 200 seconds. In a 20 kph wind, the 100 micron particles would only be blown about 10 metres away from the source while the 10 micron particles have the potential to travel about a kilometre. Fine particles can therefore be widely dispersed, while the larger particles simply settle out in the immediate vicinity of the source. Bearing in mind that if suitable conditions prevail (such as strong winds, vehicle activity) then this deposited material can get re-suspended and move in the direction of the prevailing wind to a new location, hence particles can travel much greater distances than given in the simplistic example stated above.

It is the larger dust particles that are generally responsible for nuisance effects. This is mainly because they are more visible to the naked eye, and therefore more obvious as deposits on clean surfaces. These are also the particles that will settle most readily onto exposed surfaces. For this reason, measurement methods for nuisance dust are generally directed at dust particles of about 20 microns in size and above.

## 2.2 Health effects

The potential health effects of dust are closely related to particle size. Human health effects of airborne dust are mainly associated with particles less than about 10 microns in size ($PM_{10}$) (Figure 2.2), which are small enough to be inhaled (Figure 2.3). Nuisance effects can be caused by particles of any size, but are most commonly associated with those larger than 20 microns.

[5] Bagnold, R.A., 1971, *The Physics of Blown Sand and Desert Dunes*, Published by Chapman and Hall, 265p.

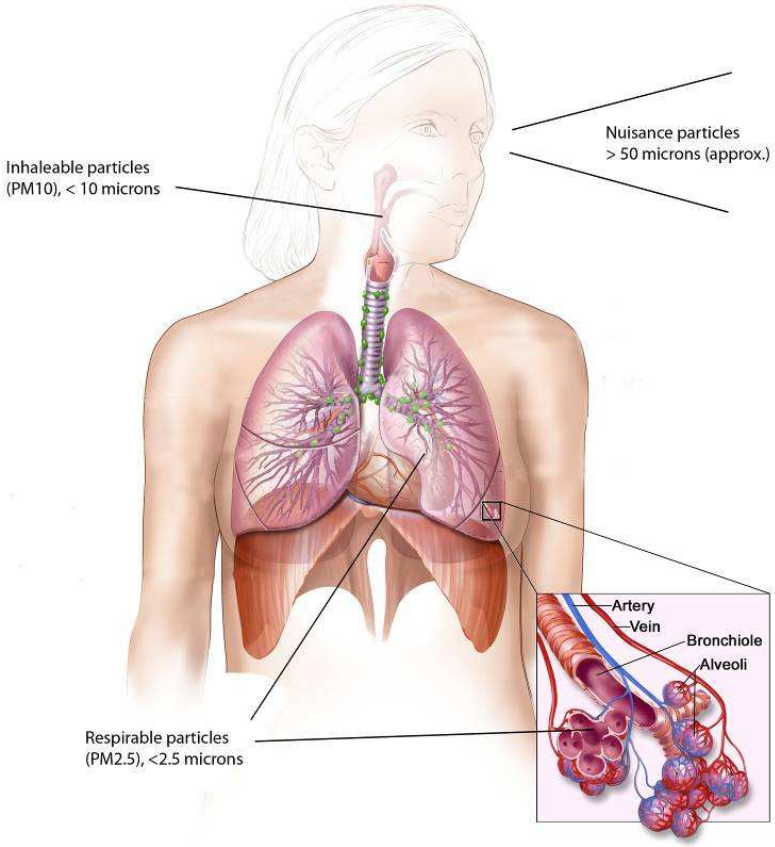



*Figure 2.3 Particle effect zones for the human body.*

Many forms of nuisance dust are considered to be biologically inert, and hence the primary effects on people relate to our sense of aesthetics. There can also be minor health effects, such as eye irritation, when the dust is airborne. Indirect stress-related health effects could also arise, especially if dust problems are allowed to persist for an unreasonable length of time.

Some nuisance dust may have the potential to cause other types of health effects because of the presence of specific biologically active materials. For instance, some mineral dusts contain quantities of quartz, which can cause the lung disease known as silicosis when persistent at high concentrations. Other dusts may contain significant amounts of toxic metals such as mercury or lead.

The potential health effects of fine particles (less than 10 microns) are specifically covered under the National Environmental Standards for Air Quality[6] (Table 2.1).

[6] Resource Management (National Environmental Standards Relating to Certain Air Pollutants, Dioxins, and Other Toxics) Regulations 2004 SR 2004/309 (2004/433 and 2005/214).

*Table 2.1 National Environmental Standards for ambient air.*

| Pollutant | Standard | Time average | Allowable exceedances per year |
|---|---|---|---|
| **Fine particles ($PM_{10}$)** | **50µg/m$^3$** | **24-hours** | **1** |
| Carbon monoxide (CO) | 10mg/m$^3$ | 8-hours (running mean) | 1 |
| Nitrogen dioxide ($NO_2$) | 200µg/m$^3$ | 1-hour | 9 |
| Ozone ($O_3$) | 150µg/m$^3$ | 1-hour | 0 |
| Sulphur dioxide ($SO_2$) | 350µg/m$^3$<br>570µg/m$^3$ | 1-hour<br>1-hour | 9<br>0 |

## 2.3 Ngāpuna $PM_{10}$ sources report summary.

This section and the following (s2.4) summarise the main findings from two earlier investigations into air quality in the Ngāpuna subdivision.

Air quality monitoring data recorded during the last two summer periods (2007/08 and 2008/09) at the monitoring caravan located in the Ngāpuna subdivision has shown exceedances of the NES-AQ for $PM_{10}$. Designation of the Air Quality Management Area for Rotorua was based on the wintertime exceedances recorded within several residential areas of the city. The Ngāpuna exceedances are a summer time phenomenon and council requires a better understanding of the contributing emissions and frequency.

This report summarised $PM_{10}$ data collected within the Ngāpuna subdivision and investigated the cause of the recorded $PM_{10}$ exceedances at the councils Ngāpuna air quality monitoring site.

Historical monitoring data (1999-2002) shows the Ngāpuna subdivision to be a “dustier” environment when compared to values recorded for the same period at the Pererika Street residential/traffic air quality monitoring site located in central Rotorua.

The full $PM_{10}$ dataset is unlike the three other monitoring locations within Rotorua City, with no winter peak present. A more even annual pattern highlights the fact that domestic emission influences are not dominant at this particular location, rather the pattern is for sporadic elevated levels to typically occur during the spring and summer months.

The high resolution dataset (10 minute values) shows an increase in base levels of $PM_{10}$ in the quadrant from 220° to 280°. Peak values are also prevalent within this quadrant. This direction represents an air mass that has moved through the Ngāpuna subdivision. Interestingly elevated levels also occur outside this quadrant and occur during the winter periods and therefore could originate not only from traffic on Te Ngae Road (SH30) but from the domestic sources in the Lynmore residential subdivision area to the east and the south-western ends of the Owhata subdivisions.

Several temporal patterns exist within the $PM_{10}$ dataset. Noticeably the highest daily results occur during the working week with concentrations diminishing in the weekends. This pattern would be associated with the typical Monday to Friday trading hours of a business operation. It should be noted that the boilers associated with the wood processing industries within the Ngāpuna subdivision are normally 24 hour a day, seven day a week operations.

The performance of the two main industries (currently operating) in regard to particulate emission control has been variable. Stack test results show that both sites have had issues with compliance against particulate emission limits.

Investigation of video surveillance footage during October 2008 elevated particulate levels showed the emissions from the Tachikawa boiler stack to be 'normal'. There was however evidence in the footage of plumes/clouds of dust passing through the field of view of the camera. Because of the limited view of the camera it was not possible to determine the source but it is suggested that the primary source of particulate during these elevated periods of data was not the nearby boiler stack.

The elemental composition of particles identified on the collected samples indicates a general urban dust profile with contributions from soil and road sources. No dominant potassium signature was evident on any of the investigated particles, which would indicate wood material that has been exposed to a combustion process.

The investigation showed that there is no one single contributor to the exceedances recorded to date, more so a combination of a number of sources. Table 2.2 attempts to list emissions in order of level of contribution to the summer time NES-AQ exceedances impacting on the Ngāpuna subdivision, and this is expected to give direction to action plan strategies for obtaining compliance with the NES-AQ.

*Table 2.2 Emissions contributing to elevated $PM_{10}$ in the Ngāpuna subdivision.*

| ← LOW Level of contribution to summertime $PM_{10}$ exceedances HIGH → | **Source** | **Comment** |
|---|---|---|
| | Re-suspended yard/process dust | Difficult to quantify. Appears to be the significant contributor to recorded summertime exceedances to date. Requires a field mapping exercise to more accurately validate information available from high resolution photography to determine the extent of areas and activities within these areas. Possibly the $IP^3$ programme could be undertaken in this small well confined industrial subdivision to improve knowledge and assess activity levels and non best practice activities. |
| | Traffic emissions (including road dust) | This source can be broken into two groups: i) traffic activity on SH30, the SEM analysis showed evidence of combustion particles. A less common E/SE wind would be required for material to be carried through the Ngāpuna subdivision from this source; ii) traffic activity within the Ngāpuna subdivision, this could be a significant contributor of both combustion particles and dust particles from tyre and road wear and also material coming from loads. Anecdotal evidence suggests that there is much heavy traffic activity servicing and receiving services from business within the Ngāpuna subdivision. This activity needs to be more accurately quantified. |
| | Consented industrial emissions | Annual stack test results provide limited understanding of overall performance of such operations. Their contribution to the exceedances is not definitive, but theoretically they could be contributing at least 30%. |
| | Natural sources | These had been estimated (5-7µg/$m^3$) based on data collected from the long term Pongakawa monitoring site. This value may be higher due to the nature of the soils in the area and the large exposed areas of sediments (pumiceous sands, reworked tephras, hydrothermally altered mud and lake sediments exposed in the Puarenga Stream delta, Sulphur Bay (1km to the west of the monitor). |
| | Domestic heating | Predominantly wintertime emissions although domestic heating survey shows some households heat all year round. Contribution is well understood and timing of these emissions is not aligned with peak concentrations during recorded summertime exceedances. Already part of action plan strategies. |

## 2.4 AUSPLUME® modelling findings

Dispersion modelling (using AUSPLUME®) has been carried out for the four timber mills and one of the abrasive blasters. The modelling was undertaken with the emission rate set at the consent limit and with other discharge parameters (stack dimensions, temperature, and velocity) taken from the available test reports on each of the sources. The activities were assumed to operate for 24 hours a day. Allowance was also made for building downwash effects, with the dimensions of nearby buildings being estimated from aerial photographs of the sites.

Only a limited amount of source information was available for the abrasive blasting booth so the modelling was based on some worst-case assumptions, including an emission rate of 0.05 kg/hr, a zero (vertical) discharge velocity, and stack gases at ambient temperature.

For this exercise the Tachikawa and McAlpines mills have been combined in output because the two sources are close enough to each other for their plumes to overlap.

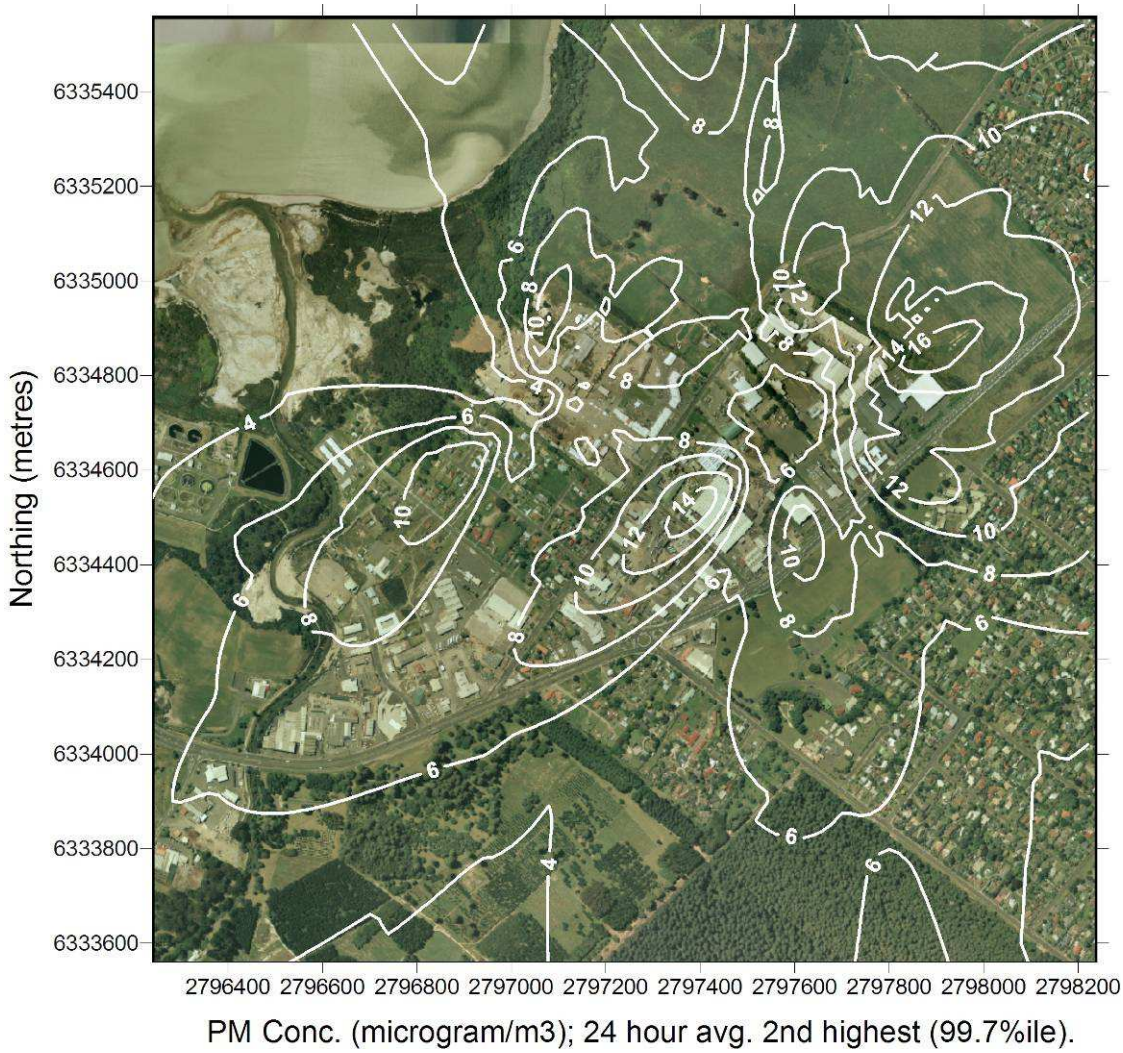



*Figure 2.5 Ground level concentrations of particulate matter from AUSPLUME® for Tachikawa and McAlpine's boiler emissions.*

This higher resolution modelling output was then used to determine that the maximum combined impact from all sources occurs within about two hundred metres either side of Te Ngae Road (SH30), and the relative source contributions were (very approximately) as follows:

- domestic heating, up to 40 µg/m$^3$
- motor vehicles, up to 20 µg/m$^3$
- industry, up to 16 µg/m$^3$ (based on the second highest (99.7%) result for Tachikawa plus McAlpines)
- background contribution, 5 µg/m$^3$
- Total impact, 81µg/m$^3$.

It should be noted that this earlier analysis is based on winter levels for domestic heating, but all others would be year round. With that in mind, using the above values, the maximum prediction for summer is only 41 µg/m$^3$, therefore one or more of the sources must be contributing more than their 'share'. The most obvious source is background, but also fugitive industry sources, which were not included in the assessment.

As a general comparison the results from the earlier Rotorua Airshed Modelling Investigation[7] using a CALPUFF® model showed that the industrial source contributions were only significant in the area around Ngāpuna (Figure 2.5).

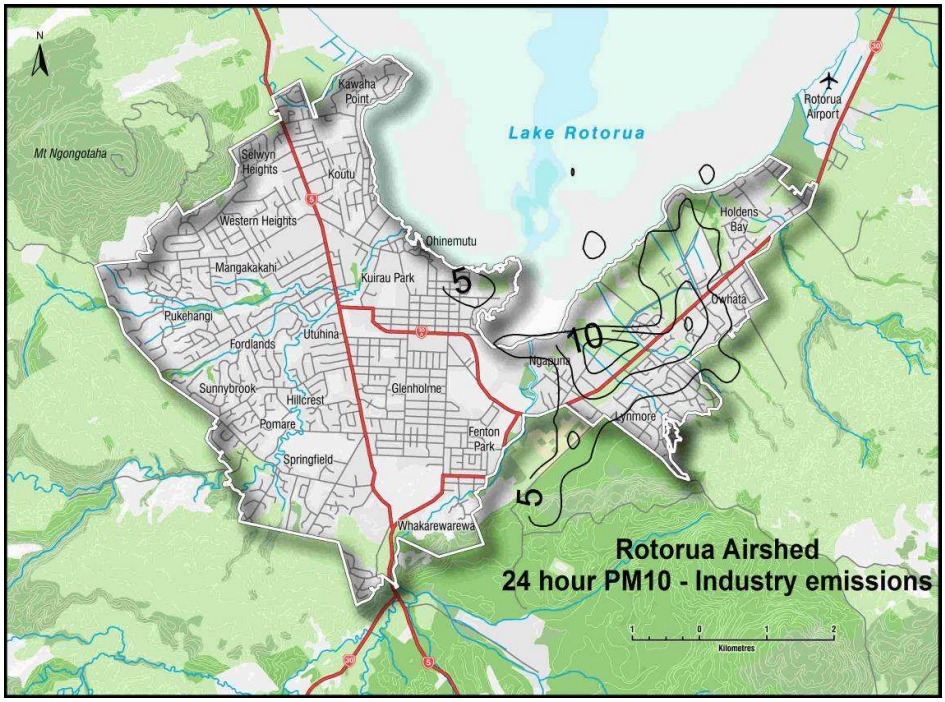



*Figure 2.5 Industry emissions from the Rotorua Airshed Modelling Investigation[7].*

[7] Fisher, G.et.al., 2007, *Rotorua Airshed Modelling Investigation*, report prepared for Environment Bay of Plenty, Endpoint Ltd, p.54.

# Part 3: Latest monitoring data

The regional council's air quality monitoring caravan is now in its fourth year of monitoring $PM_{10}$, CO and meteorological conditions in the north eastern corner of the Ngāpuna subdivision. Results to date show 18 recorded exceedances of the $PM_{10}$ standard (Table 3.1).

*Table 3.1 Exceedances recorded to date (August 2010) at the Ngāpuna site.*

| ***Recorded NES-AQ Exceedances*** | | | |
|---|---|---|---|
| **2007** | | **2008** | |
| **Date** | **$PM_{10}$ (µg/m$^3$)** | **Date** | **$PM_{10}$ (µg/m$^3$)** |
| 30 August | 54 | 22 April | 66 |
| 27 November | 53 | 24 September | 72 |
| | | 29 October | 51 |
| **2009** | | **2010** | |
| **Date** | **$PM_{10}$ (µg/m$^3$)** | **Date** | **$PM_{10}$ (µg/m$^3$)** |
| 27 January | 52 | 11 March | 70 |
| 28 August | 54 | 12 March | 51 |
| 25 September[8] | 61 | | |
| 2 October | 63 | | |
| 8 October | 53 | | |
| 12 October | 54 | | |
| 13 October | 58 | | |
| 2 November | 71 | | |
| 11 November | 71 | | |
| 13 November | 103 | | |
| 16 November | 60 | | |

The timing of increased concentrations of particulate matter associated with these exceedances shows a dominant daytime pattern as opposed to the nocturnal elevated levels seen at sites with nearby domestic heating sources. This pattern is shown in Figure 3.1 where diurnal time series are plotted for each exceedance event. A late morning increase in levels is shown, with peaks occurring during the mid to late afternoon, and concentrations beginning to subside around 16:00 hours. This pattern closely resembles the surface wind speed data which also has a strong diurnal trend of highest speeds recorded from midday to late afternoon.

[8] Australian dust storm, http://en.wikipedia.org/wiki/2009_Australian_dust_storm, was recorded as an exceedance of the $PM_{10}$ standard at all particulate monitoring stations in the region.

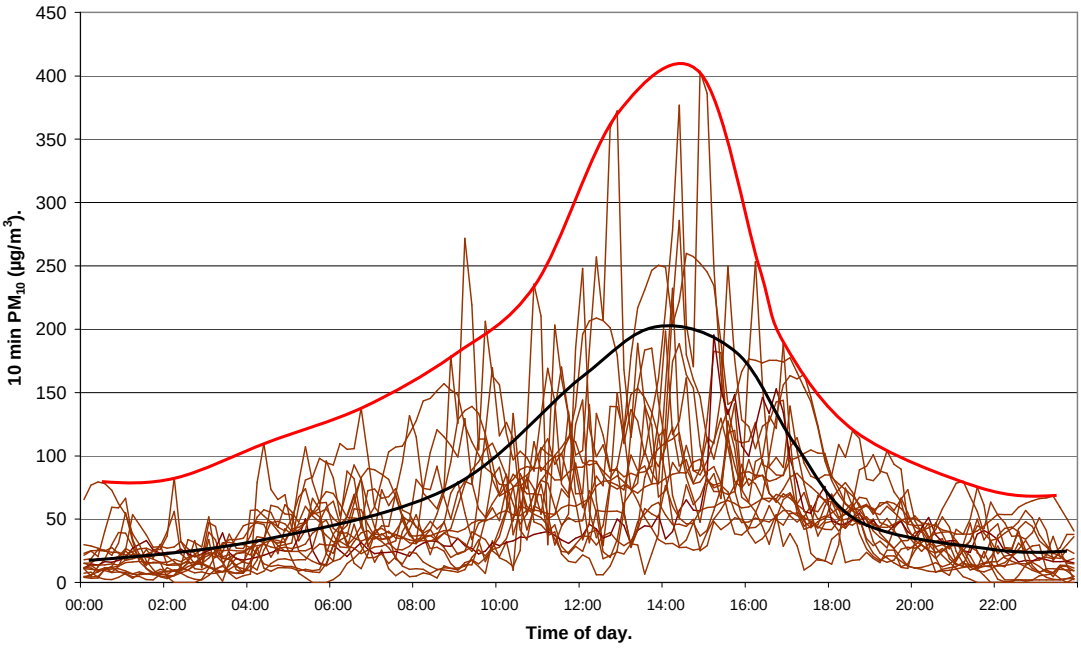



*Figure 3.1 Diurnal particulate concentrations from recorded exceedances with trend lines showing smoothed peaks and midpoints.*

Wind direction is also a key factor. Analysis of the directions recorded during the exceedances showed a strong pattern of wind moving through the industrial area under west and south-westerly conditions, wind speeds were most commonly in the 5 to 15 kph band.

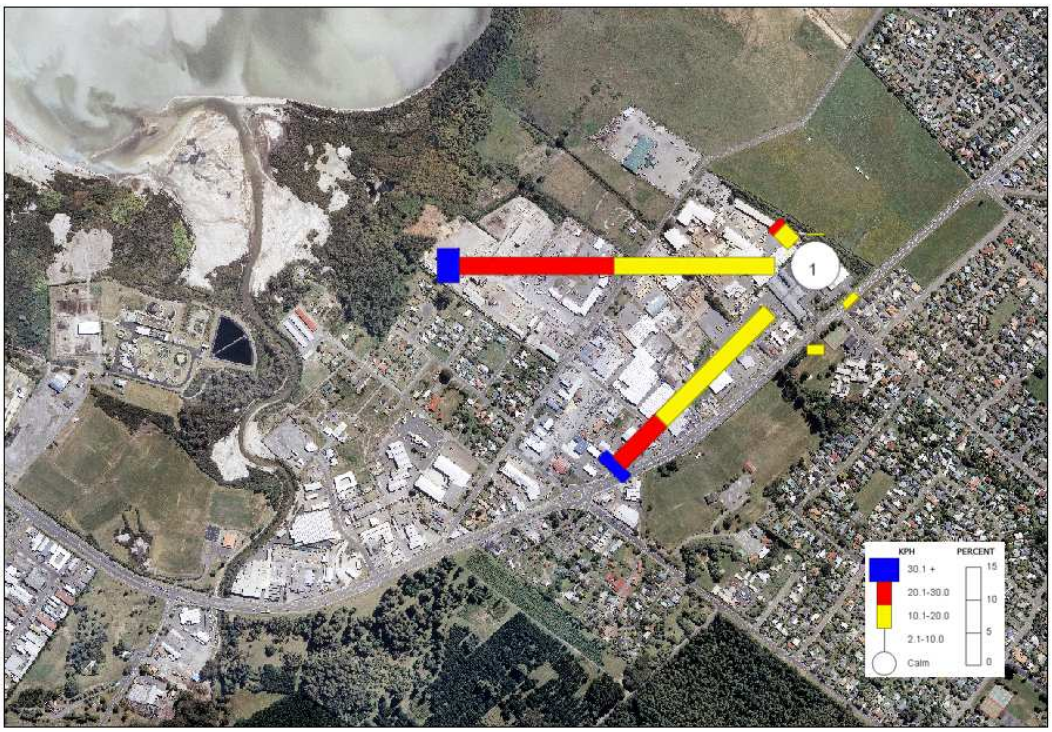



*Figure 3.2 Wind patterns[9] during recorded $PM_{10}$ exceedances.*

[9] Meteorological data was recorded from the Bay of Plenty Regional Council site in the north eastern corner of the Ngāpuna Industrial Area.

This wind direction influence was discussed in the earlier report[2] and can be represented with the updated plot showing potential upwind sources in Figure 3.3.

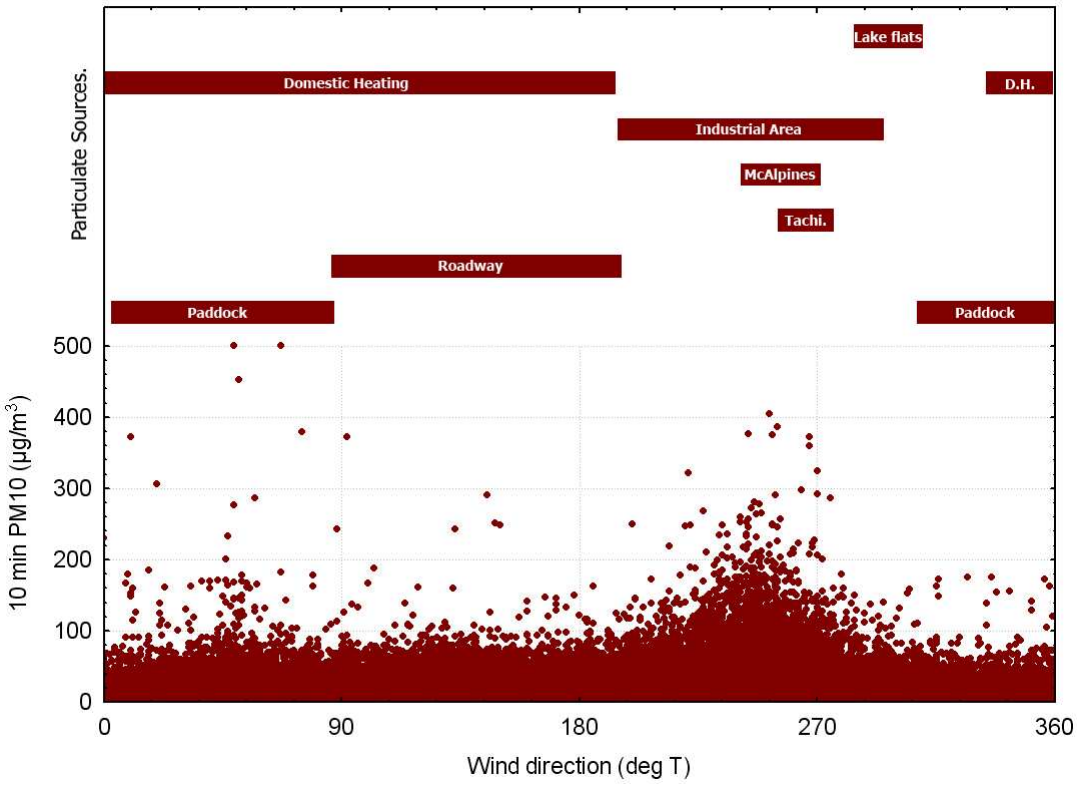



*Figure 3.3 Wind direction and $PM_{10}$ relationship for August 2007 to July 2010.*

The earlier two reports[2,3] began by looking at the traditional sources of particulate matter for airshed management (point sources). However various forms of monitoring showed that these traditional sources, although contributing to the overall particulate profile, may not be the primary contributor to the recorded exceedances of the $PM_{10}$ standard.

Yard dust and resuspended material was indentified as a potential contributor and thus a detailed site survey was undertaken of businesses operating in the Ngāpuna subdivision. The following sections of this report present the results of this survey along with other useful ancillary information.

# Part 4: Survey methodology

The survey consisted of a questionnaire and accompanying site photographs, some specific aerial photography and the collection of grab samples, each of these components is outlined in detail in the flowing sections.

A total of 29 sites were included in the survey. These sites were chosen due to the type of activity undertaken[10]. Several sites were currently for sale and hence had no occupants. Several sites declined to be included. A small number of office based businesses are present in the area but these were not included in the survey.


*Figure 4.1 Surveyed businesses.*

[10] RDC waste database list generated for businesses in the Ngapuna area.

## 4.1 Survey questionnaire

The survey questionnaire has a primary focus on site dust. Secondary questions regarding air quality in general have also been included as these will add value to the direction of the Action Plan[11] strategies for this particular area.

The survey program had a multi stage approach with advance notification given[12], contact with the business was then made by Nick Miller, Analytical & Environmental Consultants Ltd, to arrange a suitable interview time. The interview was then typically undertaken with the business owner or site manager.

Survey questions were grouped into three sections, (i) general information and conditions during the survey, (ii) a discussion section which involved asking the site representative a number of questions about their operation in relation to nuisance dust, and dust issues in the area and (iii) an observation section where Nick collected information from a site walk around.

A copy of the full dust inspection survey form can be found in Appendix 1.

The surveys were undertaken during the period 15 December 2009 to 11 March 2010.

At each site a collection of photographs[13] were taken showing key areas of the yard and operation.

## 4.2 Aerial photography

To assist with recording the results of the individual site assessments a new suite of aerial photography was collected just prior to the survey field programme.

This dataset was collected on 28 October 2009 from the Action Aviation Ltd Cessna 172M. The onboard GIS specialist was Tim Wilson using a Canon EOS 5D Mark II camera with a 50mm lens. Collected images were processed and imported into an Arc®GIS 9 environment for geo-referencing and further spatial analysis. Analysis of the land type was undertaken using these photography layers.

## 4.3 Collected grab samples

During the survey field programme samples of dust were collected at many of the sites. These samples consisted of sweeping material from the yard surface at the survey site. Several samples of stockpiled material were also collected for microscopy analysis.

[11] Bay of Plenty Regional Council, Action Plan for the Rotorua Airshed, 2010.
[12] Advance notification given by Shane Iremonger or Karen Parcell several weeks prior to initiation of survey.
[13] Bay of Plenty Regional Council, electronic file reference fA194969.

# Part 5: Survey results

A summary of each survey question[14] response is given below. The survey form was setup in three sections: (1) base information, which contained general information about the site, (2) a discussion section which contained a number of questions about local air quality with a focus on nuisance dust, (3) an observation section which required the interviewer to make a visual assessment of the site as well as various parts of the site operation/activity.

## 5.1 Base information

### 5.1.1 Weather conditions

Most of the surveys were undertaken during periods of fine weather, as this gave the best opportunity to detect any dust transportation, onsite or offsite, during the site survey. Rainfall was recorded during the surveying period and infrequently on days when the surveys were undertaken (Figure 5.1).

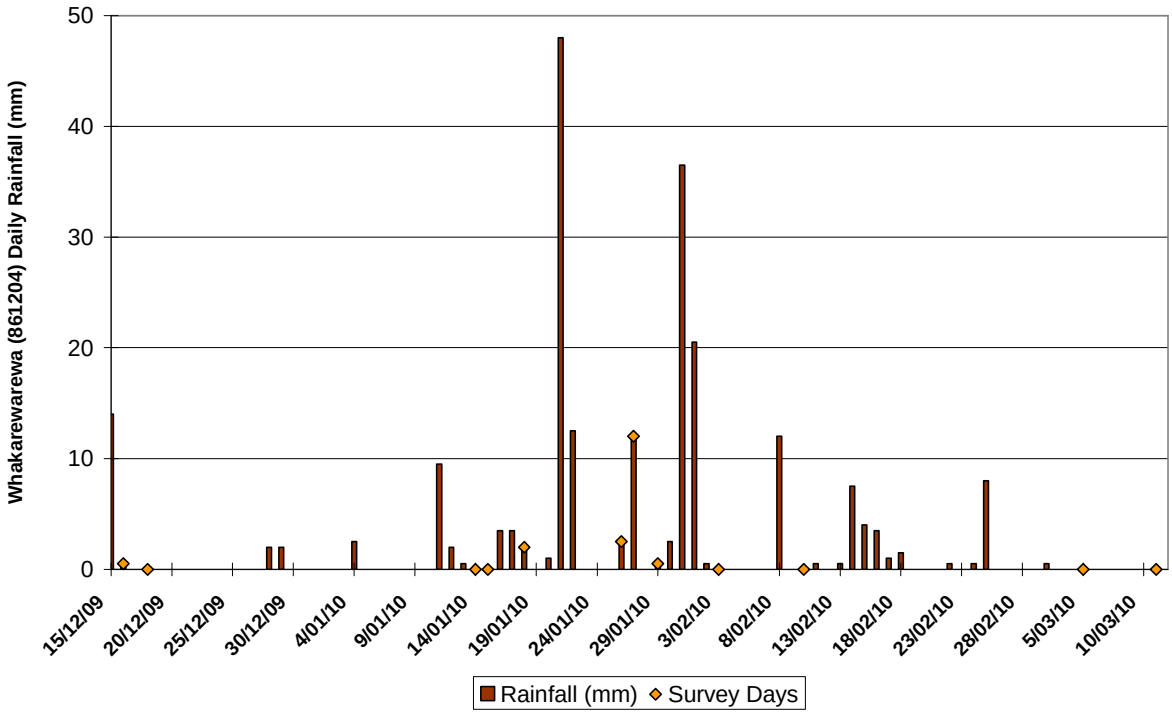



*Figure 5.1 Daily rainfall during the survey period.*

Monthly rainfall for January 2010 was above the long term average for the nearby Whakarewarewa rain gauge, December 2009 and February 2010 were drier than average and March 2010 was extremely dry (fifth driest March in 111 years of record) (Table 5.1).

[14] See Appendix 1 for the full survey form.

*Table 5.1 Monthly rainfall summary with data for survey period included.*

| Whakarewarewa Rainfall Summary (1899-2010) (mm). | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Min. | 1 | 2 | 7 | 13 | 0 | 29 | 15 | 17 | 23 | 25 | 15 | 12 |
| Mean | 103 | 102 | 104 | 117 | 132 | 136 | 133 | 128 | 116 | 126 | 103 | 120 |
| Max. | 352 | 313 | 400 | 487 | 464 | 324 | 369 | 305 | 308 | 336 | 267 | 351 |
| Survey period. | 139 | 61 | 21 | | | | | | | | | 80 |

Wind conditions are important to consider when discussing dust potential (see Section 1). For the survey period wind conditions were typical (Figure 5.2) when compared with the long term summertime wind rose[15]. The west/southwest quadrant influence is present, along with a sea breeze influence which isn't unusual for this time of the year. Winds from the east/southeast quadrant are uncommon.

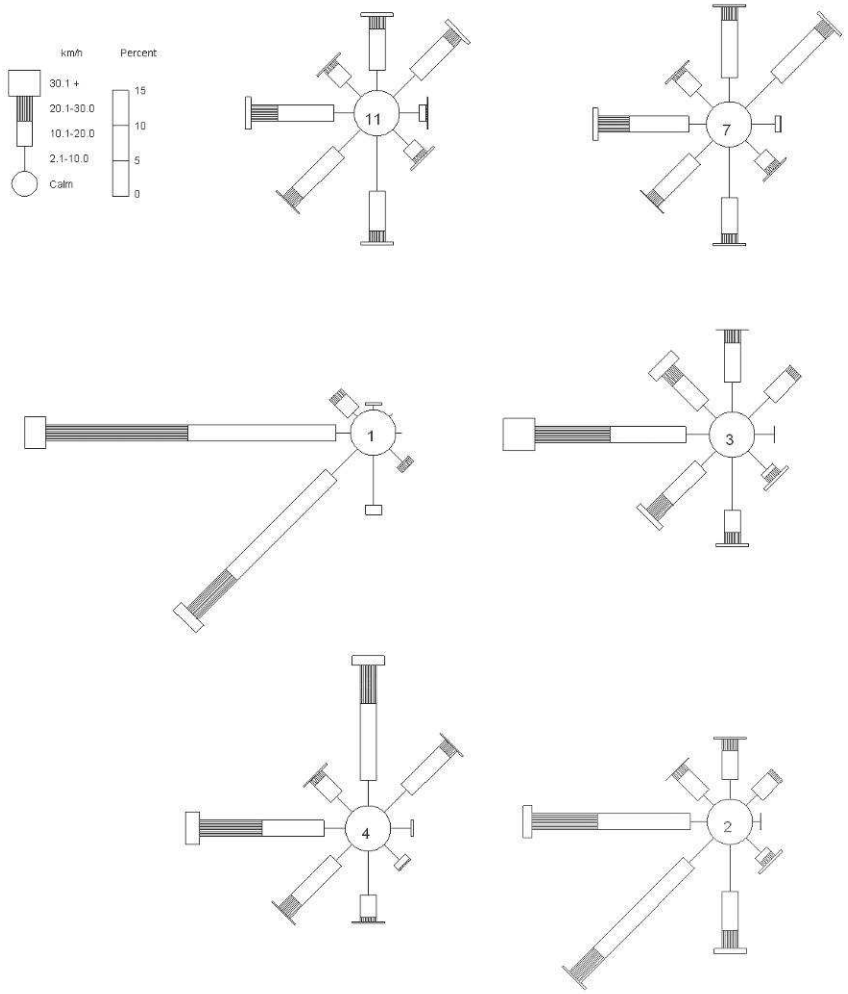



*Figure 5.2 Windroses (clockwise from top left) – full period (1981-2010), survey period (Dec, Jan, Feb, Mar 2010), Oct/Nov 2007, Oct/Nov 2009, Oct/Nov 2008, wind during recorded exceedances[16].*

[15] Data from the Rotorua Airport AWS
[16] Meteorological data for the Australian dust storm exceedance was not included in this windrose.

### 5.1.2 Years of employment

The majority of those interviewed had more than five years of employment in the Ngāpuna subdivision (Figure 5.3). This longevity should provide for a useful contribution in relation to not only current dust issues but its patterns over time as business type and intensity within the area has changed.

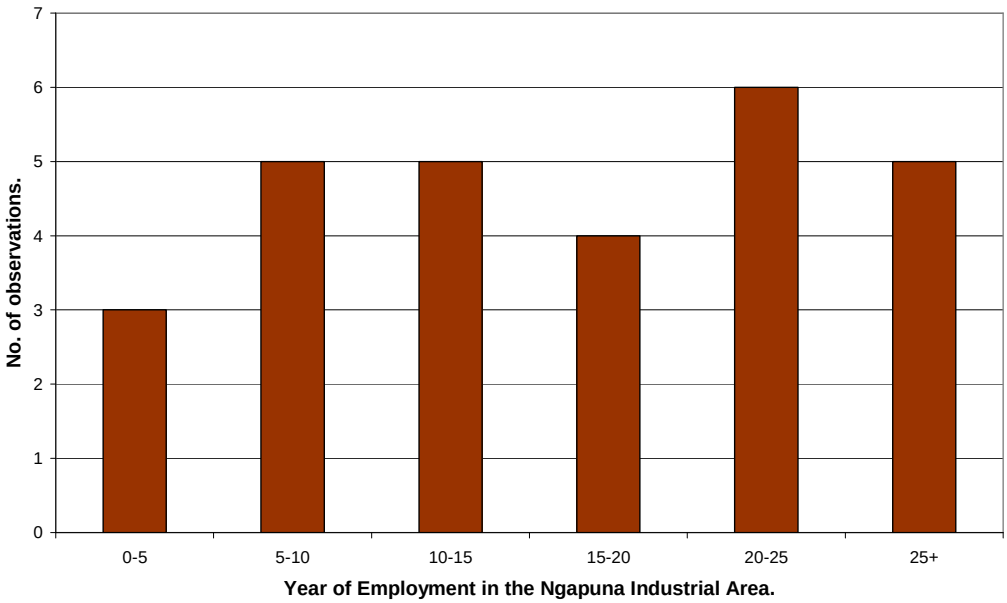



*Figure 5.3 Length of employment in the Ngāpuna subdivision for interviewees n=28, one respondent was unable to provide a length of time.*

### 5.1.3 Dust samples

At 13 of the sites “dust” samples were collected. One sample was also collected from the kerbside channelling. These will form a time stamped reference dataset. Microscopy analysis of these samples is outlined in more detail in Section 5.5.

## 5.2 Discussion section

### 5.2.1 Surveyed site activity description

As expected a wide range of light to heavy industrial activities are undertaken within the area (Figure 5.4). Many are centred around or linked to the timber processing industry which occupies large areas throughout the subdivision. A number of retail outlets are also present, the larger being the Toyota dealership on Allen Mills Road, Placemakers at the southern boundary and Telfer Marine Ltd the recreational boating business, all of which have sizable sales yards.

Several specialised activities are undertaken which require clean areas as part of their workflow.

As mentioned earlier, several office based activities are also present in the subdivision, but these have not been surveyed at this time. Two businesses also declined to be surveyed.

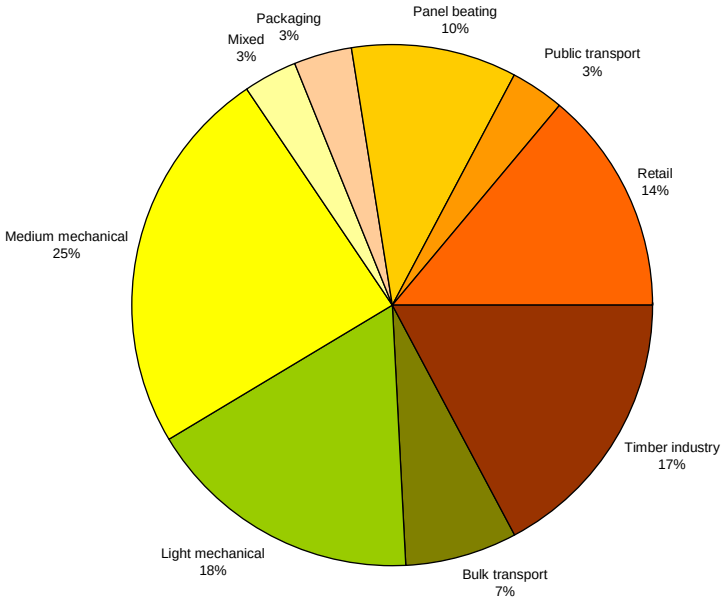



*Figure 5.4 Surveyed activity type in the Ngāpuna subdivision.*

### 5.2.2 Hours of operation

Hours of operation depended on the type of business. 58% of the businesses reported operating for more than the traditional eight hour working day (Figure 5.5). Days of operation also varied, just over 40% of the businesses operated for 5 days a week, 32% of the businesses worked the Saturday morning as well and 22% worked six or seven days a week.

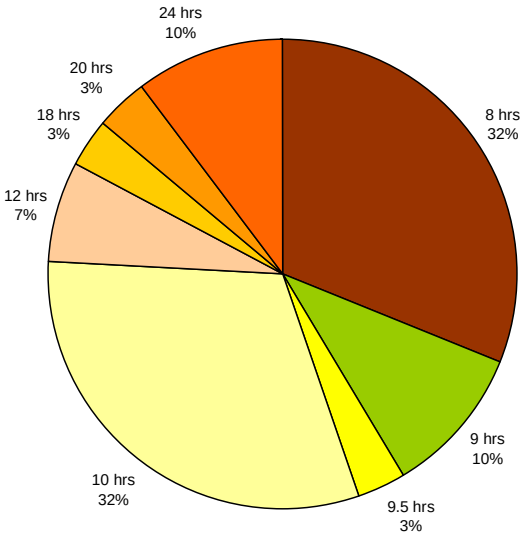



*Figure 5.5 Hours of operation for surveyed businesses in the Ngāpuna subdivision.*

### 5.2.3 Site management plan

Site management plans are useful in defining site activities and processes within these activities and how they will be managed. Site management plans are generally recognised as forming part of best practice for environmental monitoring. Some medium to large businesses now have such plans, however they do require maintaining and making staff aware of their existence and contents. Of the surveyed businesses 79% said they had a management plan or similar documents with 28% of them saying they had reference to dust management (Figure 5.6).

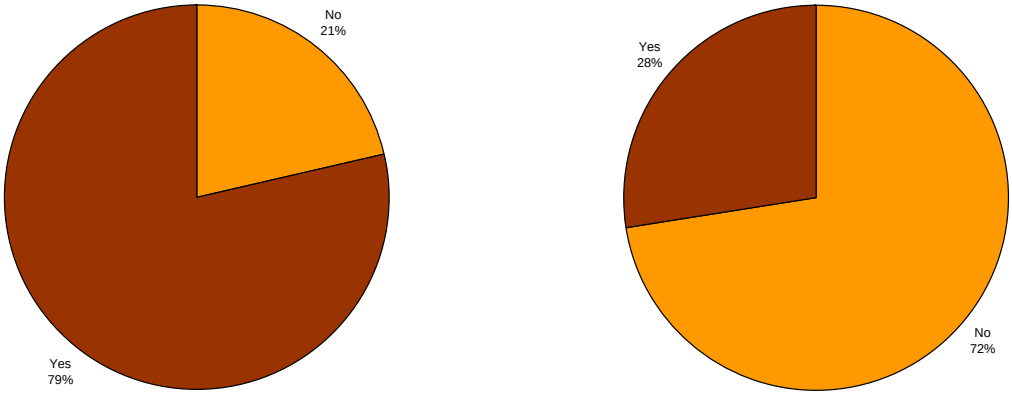



*Figure 5.6 Does the surveyed business have site a management plan (left), if yes does it have a "dust section"? (right).*

### 5.2.4 Resource consents

At the time of this report, six current air discharge consents for the Ngāpuna subdivision exist (Table 5.2). Three are for spray painting activities and three are for discharge to air from boiler operations. Of these boiler operations, one is fired from woodwaste, one is on a mixture of coal and woodwaste and the third is a mixture of woodwaste and natural gas fired.

*Table 5.2 Current air discharge permits issued by the Regional Council.*

| Consent Number | Name |
|---|---|
| 61044 | JR Autospray & Panel Ltd |
| 61106 | Spraypainters & Autobody Repairs Ltd |
| 61497 | McAlpines (Rotorua) Ltd |
| 61836 | Hume Pine (NZ) Limited |
| 62197 | TBS Farnsworth Limited |
| 62444 | Tachikawa Forest Products (NZ) Limited |

Each of these consents also has conditions around minimising nuisance effects beyond the boundary. An example of such conditions is listed below from Consent 62444:

*"c. 5.8 Discharge of particulate matter from the site yard shall be controlled by the permit holder by water suppression or such other means so that a dust nuisance does not occur beyond the boundary of the site."*

### 5.2.5 Dust issues

Twenty four of the 29 people interviewed stated that they thought there was a dust issue in the area. 17 went further and said that they were affected in some way by this dust issue. The majority of those interviewed said that the dust was generated offsite, with 13% or 4 people recognising that they are a source of dust (Figure 5.7).

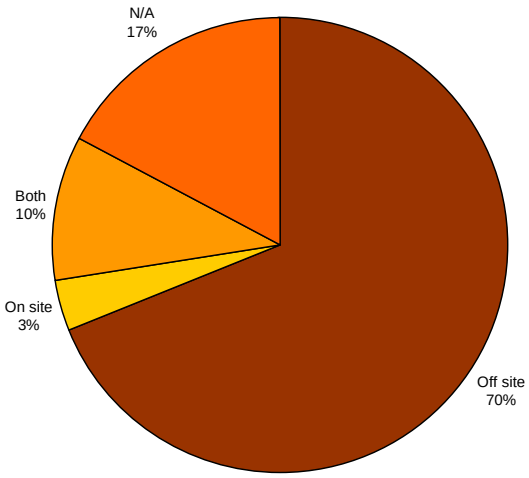



*Figure 5.7 General location of dust source.*

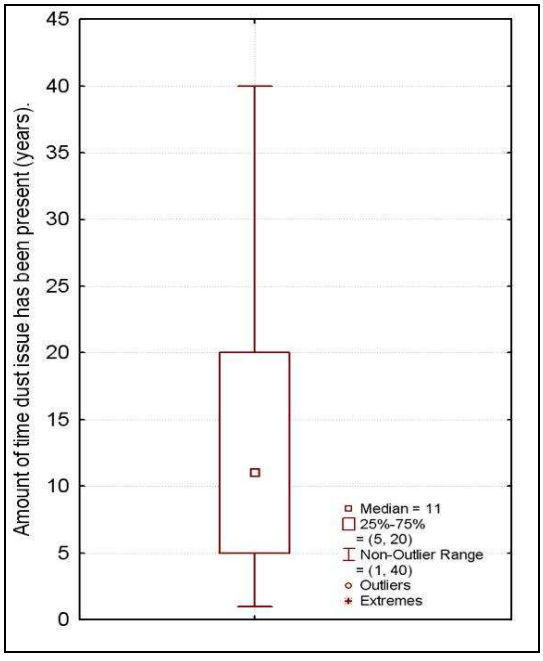



*Figure 5.8 How long has the dust issue been present?*

When questioned about the origin of the dust the responses were wide ranging and included the soil type and characteristics, dust from the roadways (mainly Vaughan Road) and associated vehicles, unsealed yards, the sawmills and other industries.

When questioned how long this dust issue had been present there were 21 responses ranging from 1 to 40 years with an average of 15 years and a mode of 10 years (Figure 5.8).

When asked if the situation was better or worse than in the past 35% of the respondents were not sure. Some stated it was better and gave reasons such as “sealed roads” and “sealed yards are more common thus providing improvements” (Figure 5.9).

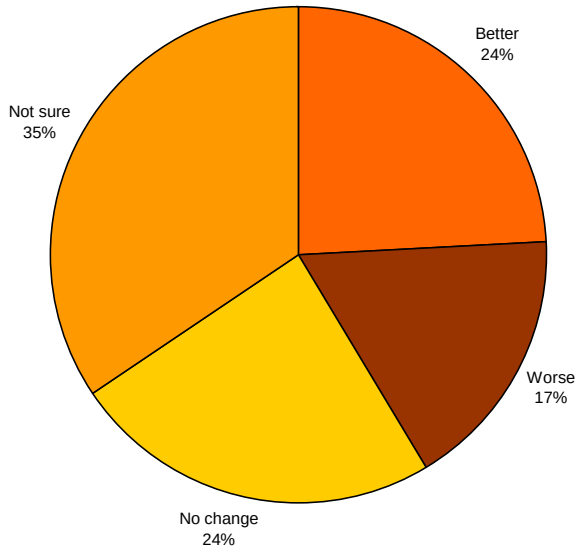



*Figure 5.9 Is the dust issue changing?*

When asked about the typical weather conditions when the problem existed the unanimous answer was along the lines of – “normally a summer time occurrence during dry conditions”. Most commented on a specific wind direction and depending on the site location this varied, sites in the northern area commented it was when wind was from the southwest, sites in the southern sector of the area commented it was when the wind was from the northern quadrant. This commentary aligns very well with the data collected by the regional council from the particle and meteorological monitoring equipment which is located near the north eastern boundary of the industrial area.

When asked about whether this dust affects the business operation or soils clean surfaces. The responses on how they were affected were broadly grouped into two categories; (1) dust on product or work surfaces and (2) health effects. 14 responded positively to the former, six sites to the later. 20 of the sites reported visual soiling of clean surfaces.

Only three sites identified a negative cost (from a small amount of staff time for cleaning to several thousand dollars due to soiling on product) associated with the presence of dust on their site.

Fourteen of the respondents answered “Yes” when questioned whether this dust was offensive or objectionable.

The final questions relate to complaints. Only one site mentioned that they had received a complaint (unofficial) from outside of their operations. Many sites (12) had occasions where staff had complained about the situation (dust from external source). Six sites had taken the further step and had raised the issue with the regional council at some time.

Other air quality concerns noted were to do with odour from both natural $H_2S$ and odour from the RDC WWTP. Industrial fumes were also noted but not elaborated on.

### 5.2.6 Vehicle movements

Traffic flow in and around the Ngāpuna subdivision is going to be important in relation to bringing dust into the area, but also in re-suspending the existing dust and promoting further distribution. Average daily traffic counts for SH30 which borders the eastern boundary of the area are in the order of 37,000 vehicles with a heavy vehicle contribution of 6%[17]. Average daily counts for Vaughan Road are ~2700 with a heavy vehicle contribution of ~12%[18].

Due to the range of activity undertaken in the area a number of different vehicle types were registered as part of on-site activities during the survey. These include motorbikes, cars, trucks (small through to large), forklifts, buses and a variety of loaders in differing configurations. Cars and truck were dominant with the forklifts and loaders being restricted to site use.

In total an estimated 950 daily vehicle movements were recorded to occur within the surveyed sites, this can be categorised into, ~300 car, ~200 car and truck mix, and the remainder trucks (this differs from the figure given above (~12%), but not all heavy vehicles will use Vaughan Road). One site reported continual use of several loaders and a fleet of forklifts.

Most sites reported vehicles speeds were kept below 10kph and 18 of the sites had some form of speed control requirement (e.g. signage, judder bars).

In relation to load coverage those sites dealing with secondary products[19] required loads to be covered. Primary products such as logs are not covered. One site reported that loads such as chip and sawdust which are prone to loss during cartage are strictly controlled in relation to covering.

Twenty of the respondents stated that vehicle washing takes place onsite, normally in a designated wash down area, only one site operated a wheel wash.

Each interviewee was also asked if they had seen road sweepers working. Thirteen (45%) stated that they had. Typically this sweeping is undertaken outside of busy traffic times so may go unnoticed most of the time. One respondent mentioned it happened regularly on Saturday mornings. Rotorua District Council stated that the industrial area roadways get swept on a fortnightly schedule by a subcontractor, no special attention is given to the Vaughan Road carriageway[18].

[17] New Zealand Transport Agency, 2010, *State Highway Traffic Data Booklet 2005 – 2009*, p.101.
[18] Pers. Comms. with Rotorua District Council Roading Engineer, July 2010.
[19] Produced as a result of some form of process on-site e.g. wood shavings as a result of milling.

### 5.2.7 Dust control measures

For this section, interviewees were asked about emission control equipment and whether it was present or not. This question is targeted to a certain group of activities as not all will require such equipment or technology, however it should be recognised that dust control is part of best practice when managing yard areas[4].

Ten of the respondents mention some form of emission control equipment was present ranging from filter systems for paint and dust to cyclones for particulate control. Several mentioned watering down surfaces and sweeping and this was expanded on in several follow-up questions.

Only five sites (17%) didn't undertake some form of sweeping. The sweeping ranged from hand sweeping with a broom to various levels of mechanical sweeping. Twelve sites mentioned they washed their yards with varying frequency ranging from daily (2) to only following a spill. Eight sites wet their yard when necessary and several sites have fixed sprinkler systems in place.

Only three sites reported having stockpiles of uncovered material. One was for road metal and due to it size characteristic would not be an immediate source of dust although finer material may be attached and dislodged during handling. Another site has a sprinkler system associated with the stockpile.

Most sites have no dedicated screening. One site has limited screening around a storage area while another three sites were using boundary vegetation as a form of screening. Few additional measures of control were mentioned, however one site re-metalled its rear yard annually.

## 5.3 Observation section

This section of the survey required the interviewer to peruse the site and identify and record practices or issues relating to nuisance dust, or the potential for nuisance dust to occur.

During the survey 11 sites were indentified where there was onsite dust visible or leaving the site. Of these an obvious source was only able to be determined at six of the sites. Five of these were areas of unsealed yard and the remainder was where woodchips were deposited as part of a loading/unloading operation. Quantities of this recorded material were mostly described as small, two were "significant" and one was "quite a lot". Apart from the woody material the appearance of this dust was fine with a pale brown coloration. When discussed with site personnel it was explained that this material was generated due to vehicle activity on the unsealed parts of the yard and in the case of the wood material it was a result of a backlog which required temporary onsite storage.

### 5.3.1 Yard composition

The dominant surface composition of each site was also assessed, 13 were sealed (asphalt, concrete), eight sites had a mixture of sealed areas and gravel, three yards were recorded as being solely gravel, four were regarded as not applicable and one recorded no response. The percentage of land surface type is investigated and discussed in more detail in Section 5.4.

While inspecting the site surface, evidence of vehicle tracking was also checked, and at 10 of the sites there were signs of this occurring. At 8 of these 10 sites, this tracking was deemed to be minor. Three interviewees stated that their operation occasionally involved the transporting of dusty material. Loaders were the

mechanism for unloading this material and for one of the sites this was identified by the site personnel as the main source of the on-site dust.

Conveyors were used at three sites and these were all adequately covered.

While investigating the yard, the boundary fencing was also noted (Figure 5.10), as this could provide some containment of small localised dust events.

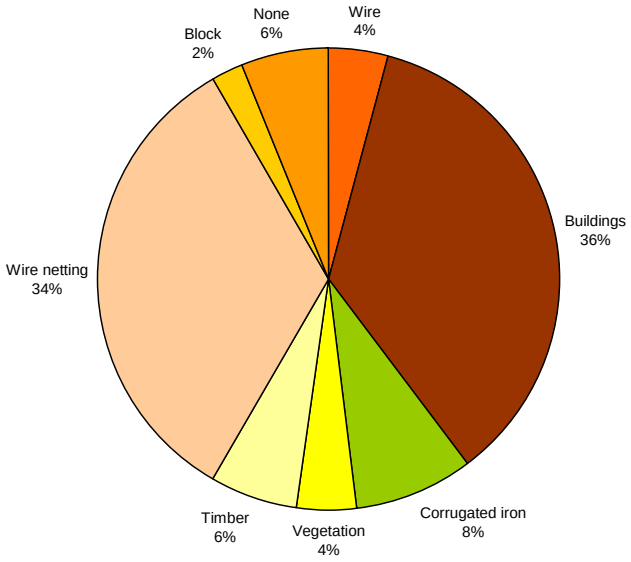



*Figure 5.10 Boundary fencing type for surveyed sites.*

### 5.3.2 Waste material

A wide range of waste was listed due to the varying activities in the area. The more commonly mentioned are shown in Table 5.3.

*Table 5.3 Commonly mentioned waste material at surveyed sites.*

| **Common types of waste material.** | |
|---|---|
| General office waste | Wood shavings |
| Paper | Solvents |
| Paint | Pallets |
| Tins | Oil |
| Scrap metal | Wood waste |
| Plastic | Cardboard |

The majority (82%) of this material is disposed of in a satisfactory manner. Open back yard burning is a practice that should be discouraged and is to be made prohibited as one of the strategies in the current Action Plan[11] for the Rotorua Airshed[20].

[20] New Zealand Gazette, 2005, *Bay of Plenty Regional Airshed Notice,* New Zealand Gazette, No. 141, 25 August 2005.

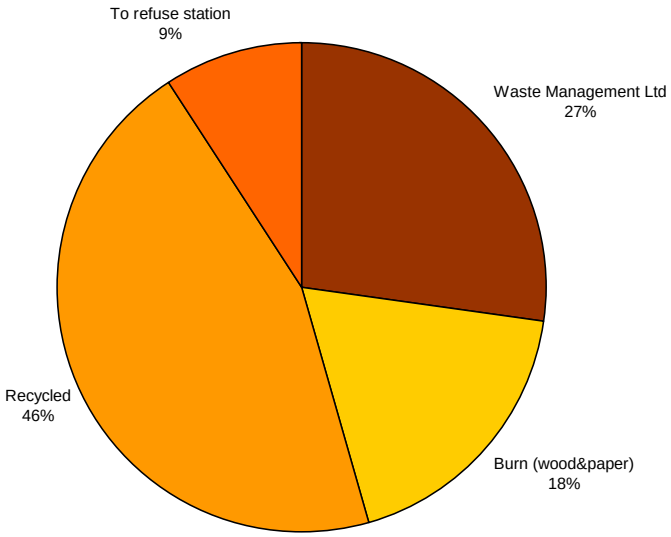



*Figure 5.11 Types of disposal for waste material.*

Where applicable the storage bins were assessed and these were deemed adequate.

### 5.3.3 Advice from the regional council

The final question was whether the site business would be interested in receiving assistance or advice from the regional council in relation to nuisance dust. Twenty of the businesses highlighted that they would interested in this service.

## 5.4 Aerial photography

An assessment using high resolution aerial photography and field notes collected during the site surveys were analysed in a GIS to determine percentage of land cover type. 15 classes (Table 5.4) were used to describe this parameter.

*Table 5.4 Land cover classes indentified in the Ngāpuna subdivision and surrounds.*

| Class Description | |
|---|---|
| Uncovered stockpiles | Sealed yard |
| Non sealed yard bare | Building |
| Lake flats | Grass |
| Bare land | Residential property |
| Accessway - unsealed | Scrub |
| Accessway - sealed | Cemetery |
| Roadway | Pond |
| Non sealed yard gravel | |

Spatially (Figure 5.12) represented these classes show a pattern in relation to anticipated dust potential and the location of the regional councils monitoring caravan.

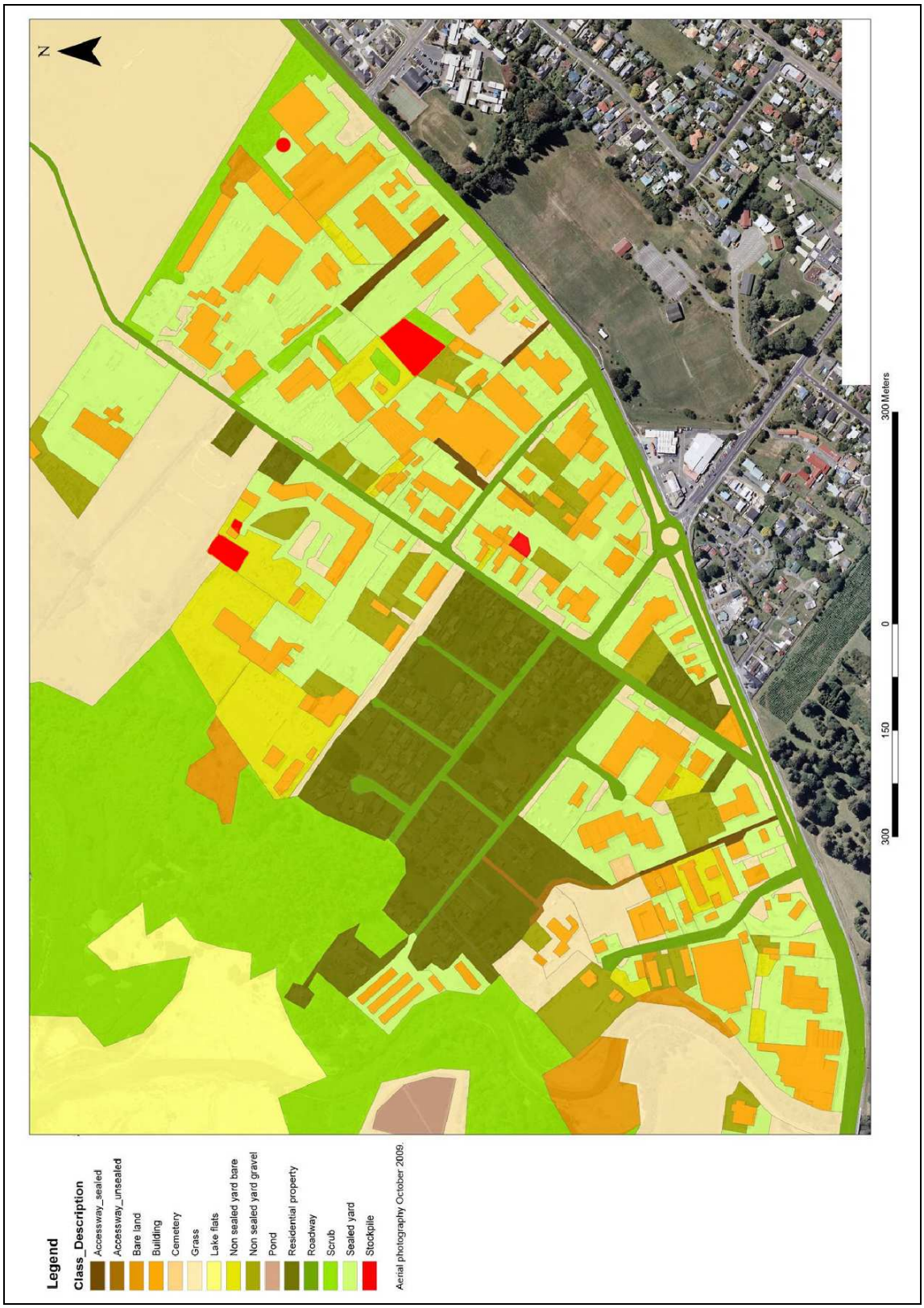



*Figure 5.12 Land cover type for Ngāpuna subdivision (red dot – air quality monitoring site).*

Approximate area coverage ($m^2$) of the different land cover and their respective percentages are shown in Figure 5.13. Dust generating potential is common from most classes although some have greater potential than others.

A significant proportion (33%) of the subdivision is covered in buildings and occupied by residential properties[21]. Other grassed areas including roadside verges comprises of 7%. Roadways and access ways account for approximately 11%. Non sealed yards (both bare and gravelled) equate to ~13%. The single largest cover type is sealed yards (32%). Uncovered stockpiles are identified at three sites (~2000 $m^2$ in total), composition of the stored material varies and includes sawdust, wood waste, gravel, soil and bark.

Areas adjacent to the Ngāpuna subdivision were also investigated spatially. Some of these areas were also raised in the survey responses. Approximately 203,000$m^2$ is the area of exposed lake flats to the west of the Ngāpuna subdivision. Bare areas also to the west of the subdivision include some geothermal zones and the BMX track, total 71,000$m^2$.

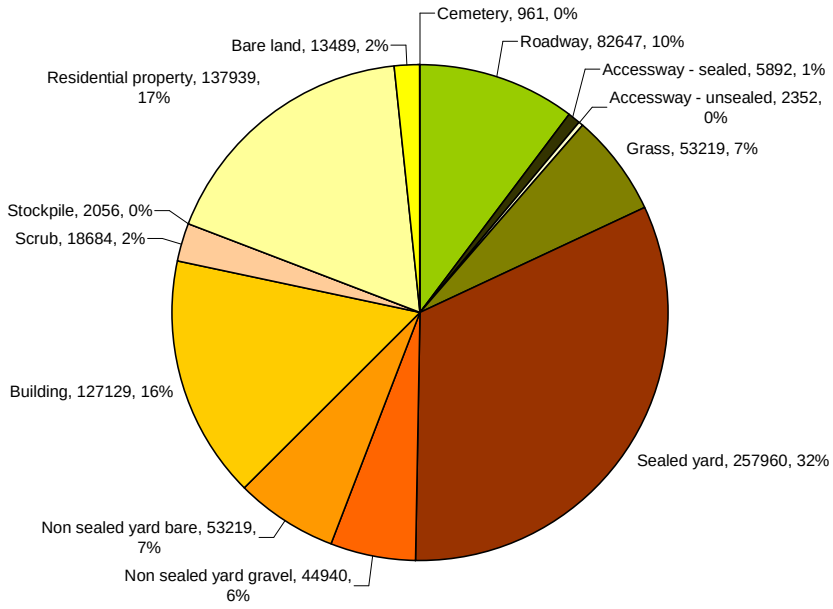



*Figure 5.13 Land cover classes for the Ngāpuna subdivision, with area ($m^2$) and % of total cover for the subdivision area.*

## 5.5 Grab samples

Grab samples of material from the ground surface were collected at 14 sites. There was a common underlying particle profile for all of the samples. This characteristic gave each sample a universal light grey appearance to the naked eye. Particle sizes varied from several millimetres to less than 10 μm which is the approximate detection limit for individual particles for the optical microscope[22] used.

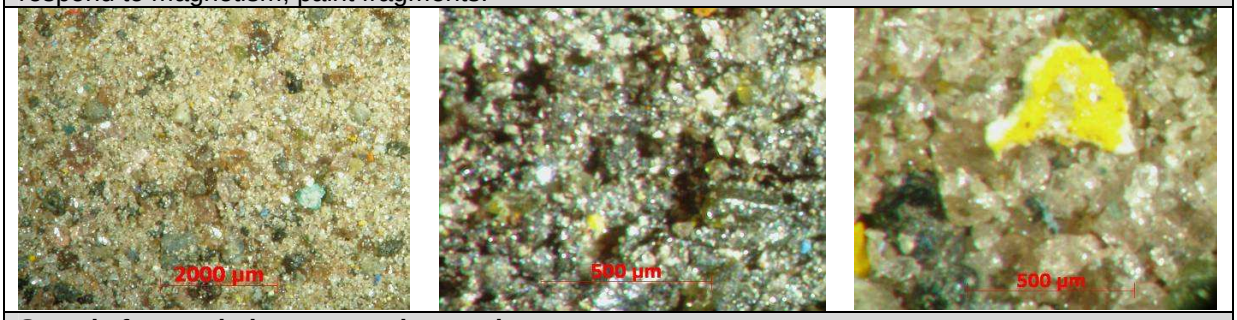
[21] Residential class includes dwellings and grassed areas.
[22] Zeiss Stemi V2 optical microscope. Maximum magnification of 66x.

Under the microscope individual minerals of volcanic origin could be identified. Accompanying these larger minerals is a finer fraction (<20µm) of pumiceous material (Figure 5.14).


*Figure 5.14 Sample from Godfrey Haulage Ltd. 10x mag.*

In addition to this background profile some sites has additional components associated with their activity. The spray painting/sandblasting sites had paint fragments and particles which responded to magnetism. The timber processing and handling sites had wood fragments present in the sample.

**Sample from a spray painting/sandblasting operation**
L to R: Sample showing underlying particle profile along with sandblasting medium, particles that respond to magnetism, paint fragments.




**Sample from a timber processing yard.**
Sample clearly showing wood fragments and the common underlying mineral content.

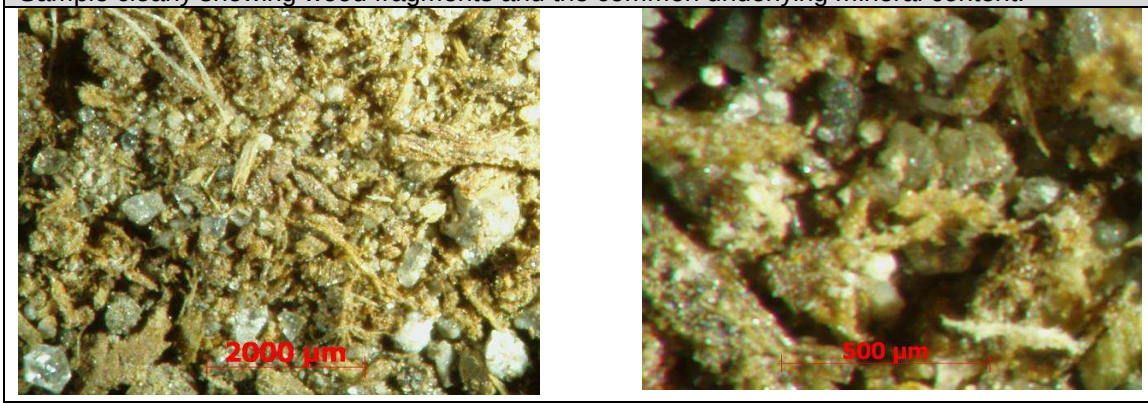



*Figure 5.15 Photomicrography examples of the grab samples collected from two sites in the Ngāpuna subdivision.*

Re-examination of earlier photomicrography and scanning electron microscope analysis of filters from the regional council particulate monitor[2] show some common patterns and similarities with particles that have been collected as part of this latest site survey.

# Part 6: Discussion

## 6.1 Survey results

### 6.1.1 Base information

The base information collected provided useful data about the conditions during which the survey was undertaken. The conditions early in the survey period were typical for the time of year; however as the survey period progressed, conditions in the later part could be described as atypical in relation to rainfall. Recorded wind speeds during the survey period were typical for the time of year, and compared well with the long term dataset.

The years of employment data showed that the majority of respondents had spent reasonable periods of time (average employment of ~18 years) working in the Ngāpuna subdivision.

Grab samples were collected from the surface of many of the yards and show a strong underlying volcanic soil signature. In some of the samples this is supplemented by material from the on site activities (eg. wood and paint fragments).

### 6.1.2 Discussion section

A wide range of activities are present in the Ngāpuna subdivision and many of these are associated directly or indirectly with the larger timber processing operations within the subdivision. These activities all have a dustiness potential with certain businesses being greater than others.

A smaller number of retail businesses are also present. Some of the small retail outlets were omitted from the survey due to scale whereas the larger businesses such as Placemakers Ltd. were examined more closely. The hours of operation of these businesses varied, however, all covered at least the traditional eight hour window which is when elevated concentrations have been measured (Figure 6.1).

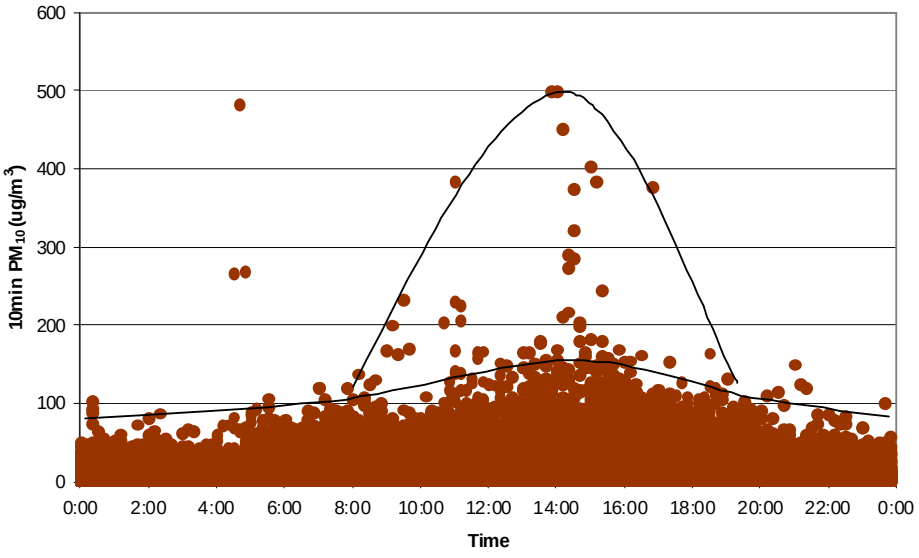



*Figure 6.1 Diurnal patterns in $PM_{10}$ recorded at the monitoring caravan.*

When looking at the day of operation, 78% worked 5.5 days or less. This pattern aligns well with the weekly data assessment of the $PM_{10}$ data (Figure 6.2) which shows a build-up in concentrations during the week and lesser values in the weekends. This pattern also shows that some of the surrounding natural sources of dust may not be as dominant as some of the interviewees suggested, as this would result in a much more even pattern throughout the week.

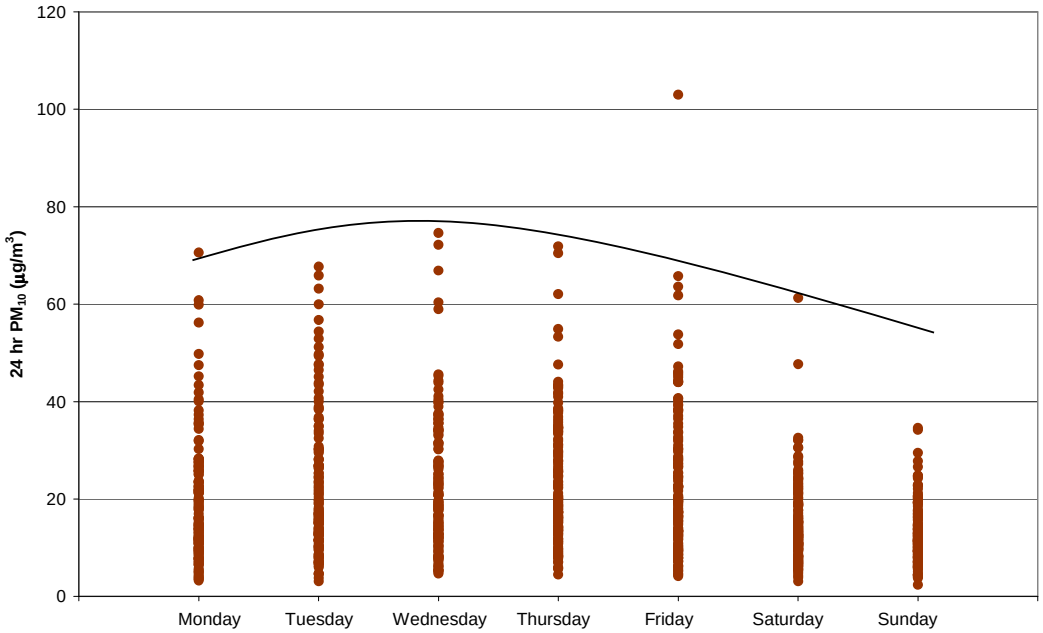



*Figure 6.2 Weekly pattern in $PM_{10}$ recorded at the monitoring caravan.*

Site management plans do exist at many of the sites, however of these, less than a third contain reference to dust management. This would be a good starting point for the regional council to engage with businesses on. The existing plans could be reviewed and modified if necessary and plans could be initiated with businesses were they are currently absent.

Several of the larger operations, along with a handful of spray painting operations are required by the Air Plan[23] to have air discharge consents. All of these current consents held by the businesses in the subdivision require that their operation doesn't create a dust nuisance beyond their boundary. Compliance should be followed up closely and would be part of the refinement or development process mentioned above in relation to their respective site management plan.

The next section of the survey related specifically to dust issues and it was widely recognised by the interviewees (83%) that there was a nuisance dust issue within the subdivision. Few respondents considered that this issue was generated onsite. This is another area where the council could work with individual businesses and discuss the sources and how better yard management can alleviate localised and ultimately subdivision wide nuisance dust occurrences.

The respondents identified that the nuisance dust had been an issue for many years but there was no strong pattern in the responses when questioned on whether the issue was getting better or worse, even though greater areas are now sealed or covered by more expansive buildings.

[23] Bay of Plenty Regional Council, 2003, *Bay of Plenty Regional Council Air Plan*, updated with amendments and adopted by council on 31 August 2006.

This section of the survey also highlighted that the issue was widespread throughout the subdivision and that it was generally regarded as being objectionable or offensive, with effects ranging from soiling of surfaces through to possible adverse health effects.

Vehicle movements were also investigated as this is widely recognised in the literature as generating or exacerbating the existing issue. Once again this could be covered off in a management plan. Most sites already have a speed restriction "policy" as a health and safety requirement. The typical traffic flow paths onsite could be examined further to ensure these areas receive additional and suitable maintenance (ranging from ensuring suitable surface type is present to cleaning methods and frequency).

Load covering (where applicable) was discussed as largely being addressed during the survey responses (Figure 6.3), but signage or the like may be necessary as a reminder. This should be addressed and reinforced in a site specific management plan.


*Figure 6.3 Uncovered truck, Vaughan Road, looking south, 9 October 2009.*

Road sweeping frequency by the Rotorua City Council may need to be readdressed (and may require the entire road width rather than the traditional kerbside), fortnightly seems too infrequent when considering the level and type of activities (Figure 6.4) within the subdivision. Tauranga City Council for example has daily and twice weekly road sweeping schedules for areas around Mt Maunganui and the Port of Tauranga. The option of including private business within the schedule could also be investigated.


*Figure 6.4 Vaughan Road, looking south, 9 October 2009.*

Dust control measures appear to be in place for many of the sites ranging from sweeping and washing to specific technologies to capture process dust (although these are focussed on point not area sources). This would be an area that would benefit from a site management plan where site specific solutions could be discussed and implemented.

### 6.1.3 Observation section

At 11 of the 29 sites the interviewer noticed that there was visible onsite dust or dust that was leaving the site. At half of these sites an obvious source could be identified, these sources involved unsealed yards and product that had been left on the ground following a loading/unloading operation. The latter is a case of poor process management and the former possibly just poor yard management. However in both instances a management plan and ensuring the outlined action(s) in the plan are followed would be a typical approach to address both of these issues.

During the survey the yard composition was also documented and this information along with site photographs and high resolution aerial photographs provided adequate data to determine land cover types and spatial coverage of each type.

The results show (Figure 5.13) that about 16% of the area is unsealed. By percentage, stockpiles are less than 1% but equate to approximately 2000 $m^2$. Management of these stockpiles and the unsealed areas should be a primary focus through a site specific management plan. Re-suspended material is also a contributor. This can be from many surfaces, not just bare or unsealed surfaces, and needs to be managed through suitable cleaning and or suppressing techniques and managed traffic activity.

Dusty material coming into the subdivision can occur in many ways from both nearby natural and anthropogenic sources. Management of these, particularly the natural sources would be difficult so dealing with it once it is in the subdivision would be the more effective method.

## 6.2 Importance of meteorology

The wind and rainfall effect is important in understanding this issue. Figure 5.2 shows the wind patterns for the last three October/November periods (when many of the exceedances are recorded). Stronger and more persistent winds from the southwest quadrant have resulted in more exceedances of the standard (Table 3.1). This is further reinforced when just the wind conditions around the exceedances are examined (Figure 5.2), once again the dominant southwest quadrant pattern is evident.

Rainfall plays an important role in suppressing and removing surface dust and thus inhibiting aeolian suspension or re-suspension, it also is responsible for scavenging dust from the boundary layer.

The amount of rainfall recorded prior to an exceedance is shown in Figure 6.5, it shows that an absence of rainfall is required if an exceedance is to result (bearing in mind other meteorological factors are also required). The rainfall data prior to exceedance shows that these exceedances can occur when - little or no rain is recorded on the day and 1 day prior, a few mm two days prior, 10 mm+ three days prior, and up to 50mm+ four days prior, but still an exceedance - thus 1-2 days dry weather is the critical condition and whatever happens prior to that is largely irrelevant.

However with the soil type present (see next section) and suitable drying conditions, it is probable that up to 10mm could be measured 1 day prior and an exceedance would still result if other factors are favourable.

A full investigation of the both the rainfall and wind datasets for all occasions is beyond the scope of this report but could be beneficial for assessing those situations where the meteorological conditions exist but no exceedance is recorded, this would then require the factor of “level of activity” to be included.

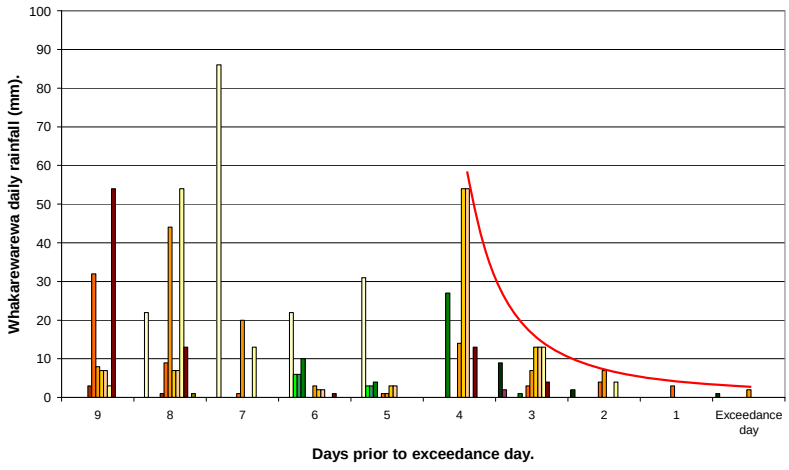



*Figure 6.5 Recorded rainfall days prior to recorded exceedances of the $PM_{10}$ standard.*

## 6.3 Soil type

Soil characteristics are an important factor and need to be managed accordingly.

Topography is generally flat throughout the Ngāpuna subdivision, with a slight fall of 8 m over 800 m from SH30 (290m ASL) to the western margin (282 m ASL). Soil type is varied, with the area south of Allen Mills Road being the well drained Tikitere Sand (parent material - hydrothermal altered tephras). North of Allen Mills Road and east of Vaughan Road is the well drained Whakarewarewa sandy loam, and to the west of Vaughan Road is the imperfectly drained Waiowhiro sand (parent material – pumice derived from lake sediments and colluvium).

All three soils are light in structure and very susceptible to aeolian transport if vegetative or any cover is removed. In situations where gravel is applied to the surface as a stabilising medium the dust suppression effects may not be as pronounced as those where heavier soils are present.

## 6.4 Aerial map analysis

Bare areas outside the subdivision particularly to the west are a potential dust source. However levels of activity on these areas is nil to low and thus there would be a sole reliance on re-suspension being caused by wind at the ground surface (where a sharp decrease in horizontal wind is exhibited[24]). The MfE dust guide[4] discusses that dust pick-up by wind is usually only significant at wind speeds above five metres per second (10 knots), but vehicle re-entrainment can occur under any conditions. Areas within the subdivision do have a reasonable level of traffic activity and thus significantly aid in re-suspending material which would then allow for wind transportation a distance based on the particle size of the dust.

## 6.5 Analysis of the exceedance/wind speed/wind direction dataset

For most situations were exceedances have been recorded a set of meteorological conditions have existed and preceded the exceedance period. To qualify this further a flow chart (Figure 6.6) has been devised to forecast when exceedances will occur and thus provide a management tool for site managers to determine if preventative action should be undertaken.

It is currently setup to make a decision for the current day, but a spreadsheet exercise could be used to examine a larger set of historical meteorological data. It has been currently refined on the collected exceedance dataset to date. It makes no assessment of site activity levels or type other than using a weekday/weekend differentiation based on information assessed in the earlier Ngāpuna report[2] (see Figure 9).

An intermediate result – *potential for localised nuisance dust issues* - has also been included to account for occasions where several factors are negative towards the later part of the model.

This model could be used alongside actual monitoring to confirm if Action Plan strategies are effective.

[24] Oke, T.R., 1992, *Boundary Layer Climates*, 2nd Edition, University Press, Cambridge, 435p.

This model or a variation of it could be included in the development of any site specific dust management plan.

## 6.6 Areas affected

The information presented suggests that exceedances would most likely be occurring if $PM_{10}$ monitoring was undertaken in the southern area as well, maybe not as many as the current monitoring location, as the strongest and prevailing winds for summer are still from the SW quadrant. However earlier monitoring[2] showed exceedances of the 50 μg/m$^3$ $PM_{10}$ limit but these were with TSP[25] instruments. During this TSP monitoring program values of up to 75 μg/m$^3$ were measured. Additional monitoring would be necessary to confirm this southern area exceedance hypothesis.

[25] TSP – total suspended particulate (particles typically less than 100μm in diameter).

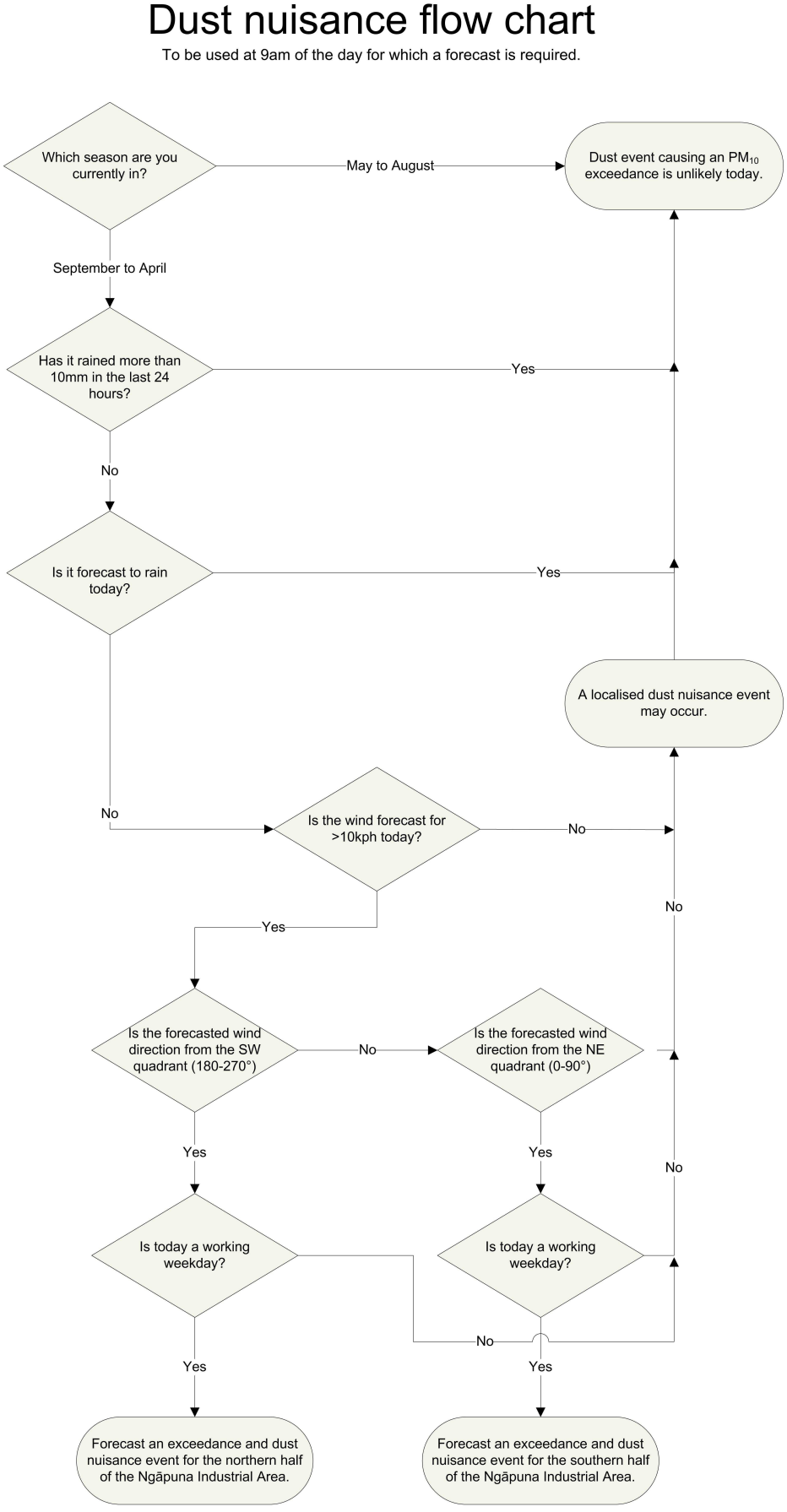



*Figure 6.6 Flow chart for determining occurrence of dust event or $PM_{10}$ exceedance.*

# Part 7: Conclusion

Land use and cover have changed significantly in and around the Ngāpuna subdivision over the last 65 years and continues to do so (Appendix 2) with the residential development just beyond the northern boundary being a recent example.

Nuisance dust is currently causing problems for occupants in the Ngāpuna subdivision, whether as a worker in a local business or as a resident of the housing area in the middle of the subdivision.

Recent monitoring has shown that a portion of this dust has a size fraction that is below 10μm and on a number of occasions has caused exceedances of the health based particulate matter ($PM_{10}$) standard[26].

Earlier investigations have shown that these recorded non-winter exceedances are not caused by emissions from the industrial combustion sources but from dust events in the subdivision.

The recent site dust survey (the basis of this report) has shown that most occupants of the subdivision are aware of this issue and are impacted in a variety of ways. The survey shows that a reasonable proportion of the sites are trying to address the issue already in a range of ways.

The survey has shown that a number of sites have a management plan of some description in place, although only a limited number address the issue of dust management. This shortcoming would be a suitable starting point to try and address this issue.

A management plan approach would be best achieved on a site by site basis as there are a variety of activities being undertaken on a variety of land covers and therefore site specific plans would be most beneficial. For each site a dust management plan could be developed in conjunction with the occupant and implemented as outlined in the plan.

This site specific approach should firstly be targeted at the consented sites and those which expressed interest during the survey in receiving advice from the regional council. Those that requested advice should be ranked for attention in relation to the following parameters collected during the survey and subsequent analysis:

- stockpiles
- unsealed yards
- yards with high traffic volumes

As part of this program a future follow up subdivision wide dust survey should be programmed along with the continuation of the regional councils air quality monitoring site as a quantitative measure.

Discussion should also occur with the Rotorua District Council regarding more frequent road sweeping for the Ngāpuna subdivision.

[26] http://www.envbop.govt.nz/Environment/Air-Quality-Results.aspx

# Appendices

# Appendix 1 – Dust inspection survey form

| | |
|---|---|
| Site number:1 | |
| Business name: | |
| Date: | Start time: Finish time |
| Weather conditions - | fine/fine periods/overcast/showers/raining/wind/other |
| Site contact person: | How long have they worked in the area |
| Photos taken: | Video taken: Dust sample(s) collected |
| Site owner | |

| **2** | **Discussion section** |
|---|---|
| | Describe site activities |
| | Hours/Days of operation per week plus note any seasonal variations |
| | Size and composition of work force – (no. of managers, admin, factory workers, drivers, etc |
| | Do you have an Environmental Management System/Plan? Dust management section |

| 2.1 | **Dust issues** |
|---|---|
| | Do you think there is a dust issue in the area? Are you affected by nuisance dust? |
| | Is this dust generated by your operation or offsite sources? |
| | Offsite/onsite (Circle) |
| | Where do you think the dust comes from? |
| | How long has it been like this? Is it better or worse than in the past? |
| | Frequency, intensity and duration: |
| | General conditions when affected (wind direction, strength etc) |
| | Is it objectionable and/or offensive? |
| | How are you affected? – Possible answers; eye/skin irritation, breathing, health generally, curtailment of outdoor activities, need to close doors and windows when we'd rather have them open, frequency of cleaning, clogging of air intakes, etc |
| | Do you have problems with visual soiling of clean surfaces? |
| | Is there a cost associated with this nuisance dust? |
| | Has anybody complained to them about dust? |
| | Have you ever raised this issue with RDC or Bay of Plenty Regional Council? |
| | Do you have other air quality concerns? |
| | If so what are your concerns (Odours, spray painting drift, fertiliser drift, vehicle emissions, smoke) |

| **2.2** | **Vehicles** |
|---|---|
| | Vehicle activity on site |
| | Type of vehicles |
| | Number of movements per day specify time (ie. 100 vpd spread over 8 hours is significantly different from 100 vpd over 24 hours.) |
| | Typical vehicle speed: Speed controls present and enforced |
| | Types of loads and which ones are covered? |
| | Vehicles washed down and/or wheel wash present |
| Do you see council road sweeping trucks working in this area | |

| Other information |
|---|

| 2.3 | Dust control measures |
|---|---|
| | Emission control equipment present? specify sources controlled and what monitoring/maintenance/performance testing, if any |
| | Sweeping of yard eg. sweeping parts of site by hand, or with small mobile vacuum sweepers, or a vacuum/sweeper truck. If so how often? |
| | Washing yard? |
| hand | Wetting yard eg. water truck, sprinklers or simply wetting down dusty areas with a held hose? |
| | Covering stockpiles/height restrictions/sprinklers? |
| | Screening erected? permanent or temporary |
| | Any other dust mitigation/control measures? |

| 3.0 | Observation section - Site characteristics and activities |
|---|---|
| | Onsite dust visible or leaving site (if yes take samples)? Is a local source obvious |
| | Describe quantities |
| | Briefly describe appearance |
| or | Discuss with site personnel (where has it come from, always there or periodic, better worse than usual): |
| | Yard surface compositions |
| | Percentage cover of various types (annotate high res. site map sheet) |
| | Type of boundary fencing/hedging/screens plus estimate extent of coverage (eg. 80% fenced, 20% open): |
| | Evidence of vehicle tracking on and offsite: Generating dust activities |
| | Transporting dusty material |
| control | Loading/unloading dusty material – methods used; potential for spillages or dust; measures |
| to | Conveyors covered, including transfer points. Also note drop heights (if applicable) on stockpiles: |
| discharges: | Stacks/vents present (combustion, dust extraction) - any visible discharges/continuous or intermittent, or visible residues around vents that suggest past |
| | What waste is generated on site? |
| occasionally | How is it disposed of and does this include on-site burning (even if only very |
| | Stockpiles of potentially dusty material plus management/control methods (if any, including limitations on stockpile heights, covering): |
| | Condition of storage bins/silos/hoppers (in relation to spilled material or general dust releases): |

| 4.0 | Final comment |
|---|---|
| to | Would you be interested in receiving assistance and/or advice from EBOP in relation dust management, or other environmental matters? |

| Other information |
|---|
| |

# Appendix 2 – Early and latest photography

Changes in land use and cover over the last 65 years are demonstrated in the following aerial photographs.

September 1945

1996

October 2009.