Ministry for the Environment
Manatū Mō Te Taiao

OFFICE USE ONLY
Application no:
Date received:
Date accepted:

Resource Management (National Environmental Standards for Air Quality) Regulations 2004 – Regulation 16A Exceptional Circumstances

APPLICATION FORM

Before completing this form please read section 3.8 of the 2011 User's Guide to the revised National Environmental Standards for Air Quality.

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1 Applicant details

Name of regional council	Bay of Plenty Regional Council
Contact person	Mark Hamilton/Shane Iremonger
Position	Policy Analyst/Science Team Leader
Email address	mark.hamilton@boprc.govt.nz, shane.iremonger@boprc.govt.nz
Telephone number	0800 884 880
Mobile number	n/a
Postal address	Bay of Plenty Regional Council, PO Box 364, Whakatāne 3158

2 Details of exceedance event

Containment	PM_{10} (24-hour average)
Date of exceedance (*application must be received within 3 months from date of the exceedance*)	21 April 2022
Relevant airshed	Mount Maunganui Airshed

Monitoring station and technical specifications of monitor	Rata Street. Location: 50m south of Rata Street, Mount Maunganui Instrument specifications: Thermo model 5014i Beta Attenuation Monitor (BAM) with PM10 size selective inlet. Additional analysis of the BAM tape using Scanning Electron Microscope techniques. Hitachi Regulus SU8230 FE SEM (imagery) with Oxford Instruments EDS (spectral analysis).	
Summary of monitoring reading showing exceedance event	PM10 53 µg/m^3 – 21 April 2022	
Analysis of baseline data	Refer to supporting documentation.	
Source speciation or other analysis	Refer to supporting documentation.	
Explanation of any previous exceedance event/s from this monitoring station in the past 5 years	Due to anthropogenic activities within the Mount Maunganui Airshed, elevated PM10 levels are common. Consequently, values above the NES PM10 standard value have been recorded at the Rata Street site within the past 3 years. However, a strong influence can be seen in the monitoring record from the nearby marine environment when sea state conditions are conducive. Sea spray (sea salt) particles related to a weather pattern are considered to have been the cause of exceedances recorded on 9 and 10 June 2021 at this monitoring station. In November 2021, the Minister approved the Bay of Plenty Regional Council's exceptional circumstances application for these exceedances.	
Monitoring readings covering exceedance event	☒ Attached	☐ Not attached

3 Details of exceptional circumstances

Exceptional circumstances leading to exceedance	☐ Localised impact on a monitor	☐ Anthropogenic extreme event	☒ Natural disaster or natural extreme event	☐ Other
Explanation of circumstances leading to exceedance event	An increased presence of sea spray particles originating from an elevated sea state and onshore winds is considered to have been the cause of the exceedances occurring on 21 April 2022 at the Rata Street air quality monitoring station within the Mount Maunganui Airshed in the Bay of Plenty region.			

Reasons why these circumstances were beyond the reasonable control of the regional council	Meteorological conditions conducive to elevated wave heights, and the transport and inland deposition of sea spray particles were responsible for the recorded exceedance. These conditions are well beyond the reasonable control of the Bay of Plenty Regional Council. Page 43 of the "2011 Users' Guide to the revised National Environmental Standards for Air Quality 2011: Updated 2014 guide" (the Users' Guide) states: *"Generally, unforeseeable emergencies and natural disasters cannot be prevented or controlled and are likely to satisfy this criterion."* All evidence that we have examined points to sea spray particles being the source of the PM10 exceedances on 21 April 2022. In reference to the requirements of page 44 of the Users' Guide, these exceedances can credibly be considered an unplanned circumstance that could not reasonably be predicted or planned. Analysis of the samples collected during this event by SEM analysis at the University of Waikato has shown that there is a significant signature of sea spray (NaCl particles) during the 21 April 2022 and the preceding several days. The events causing the exceedances of the PM10 air standard on 21 April can be considered exceptional due to their nature as a weather event responsible for the exceedance. The events created a situation where salt spray particles were formed in abundance and then transported under suitable wind patterns, so a conducive weather event that directly led to the exceedance. Page 45 of the Users' Guide states that: *"The majority of exceptional circumstances are likely to be related to a natural disaster or extreme weather event… ".* These exceedances are considered to have been caused by sea salt from unusually high waves being transported by winds as part of a weather event. Weather events are cited in the Users' Guide as an example of exceptional events. The RMA framework is based on the principle of sustainable management when making resource management decisions. There is no evidence that this event is related to poor resource management of air as a resource. It is considered that the source of the PM10 exceedances on 21 April 2022 is an increased ratio of sea salt particles within the local profile. This was generated by the elevated sea state and wind patterns associated with firstly a weak complex depression system located to the northwest of the Bay of Plenty, and then the presence of a sizable anticyclone system centred over New Zealand, both of which pushed a north-easterly wind flow into the western area of the Bay of Plenty. This connected series of meteorological events provided a means of particle generation and transportation. It is unreasonable to expect the Bay of Plenty Regional Council to control this emission when it originates from a specific weather pattern. The recent HAPINZ 3.0 report indicates that sea spray is a source of particulate matter within New Zealand. In the Mount Maunganui Airshed, sea spray has been identified as a source through a variety of monitoring programmes and has been a key contributor to two weather-related PM10 exceedances in June 2021, both of which were considered exceptional circumstances by the Minister in November 2021. For the reasons outlined above we are requesting the exceedance be considered an exceptional event because the exceedance was not foreseeable, not likely to reoccur, beyond the reasonable control of the council and not within the intent of the RMA framework.	
Supporting evidence **(eg, *meteorological report*)**	☒ Attached	☐ Not attached

20 July 2022

Date

Signed

Supporting documentation

Background

The Rata Street monitoring station is an integral part of the wider ambient air quality monitoring network within the Mount Maunganui Airshed. Like all the sites within this network, it is operated by WaterCare Ltd under contract for the Regional Council. Quality assessed and controlled data is provided from WaterCare on a following month basis. The data used in this supporting document is part of that monthly delivery QA/QC data batch.

Located at the northern-most position within the network (Figure 1) means that the Rata Street site is fully exposed to a wide range of anthropogenic and natural sources.

Figure 1. Ambient air quality monitoring sites within the Mount Maunganui Airshed.

Previous exceedances recorded at the Rata Street site (Table 1) have been the result of activities to the south of the site associated with human activity, or sea spray events. A successful exceptional circumstances application for PM10 exceedance, also stemming from an increased ratio of sea salt particles on 9/10 June 2021 was made for this site. An earlier, exceptional circumstances application was also approved for an exceedance related to Australian bushfire and dust events, recorded on 6 December 2019.

Table 1. Rata Street PM10 exceedances.

Date	Location	PM10 24-hour average
6/12/2019	Rata Street	53µg/m³
31/01/2020	Rata Street	68 µg/m³
17/03/2020	Rata Street	87 µg/m³
9/06/2021	Rata Street	58µg/m³
10/06/2021	Rata Street	53µg/m³
14/07/2021	Rata Street	62µg/m³
21/4/2022	Rata Street	53µg/m³

The PM10 exceedances can be seen in the full daily timeseries plot (Figure 2).

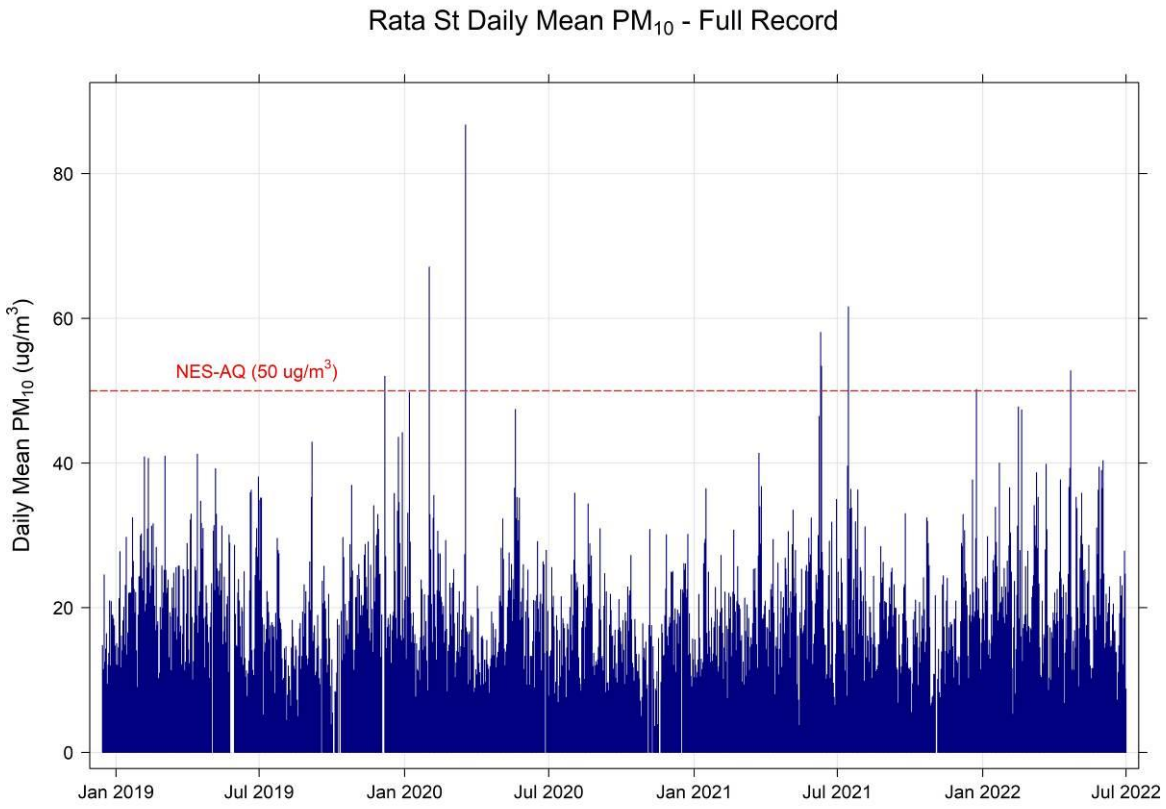

Figure 2. Rata Street PM10 24-hour timeseries, full record.

The Rata Street site has an elevated annual mean PM10 value when compared with all sites within the Council's monitoring network (Table 2). The short record of data collected to date also demonstrates that the PM10 levels at this site are at, or just below, the current NZAAQG annual value of 20 µg/m³.

Table 2. Annual PM10 statistics for the Bay of Plenty Region.

	Annual mean PM10 (µg/m3)		
Site	**2019**	**2020**	**2021**
Otumoetai	11	10	10
Kopeopeo	12	13	12
Sulphur Point	14	13	14
Edmund Rd	14	12	11
Moses Rd	14	15	16
Marina	16	14	15
Whareroa Marae	17	14	11
De Havilland Way	20	18	19
Rata St	20	18	19
Totara St	25	21	21
Rail Yard South	31	24	24

Like all ambient air quality monitoring sites located within urban areas, the full timeseries (Figure 3) from the Mount Maunganui Airshed exhibits much variability. The only real difference from other urban areas is the absence of a dominant wintertime domestic heating signature, such as that shown at the Council monitoring site in Rotorua. Analysis shows that the opposite is often the case with the Mount Maunganui sites, where an elevated summer pattern can be statistically defined, which is a result of climatic/meteorological drivers, coupled with anthropogenic activity.

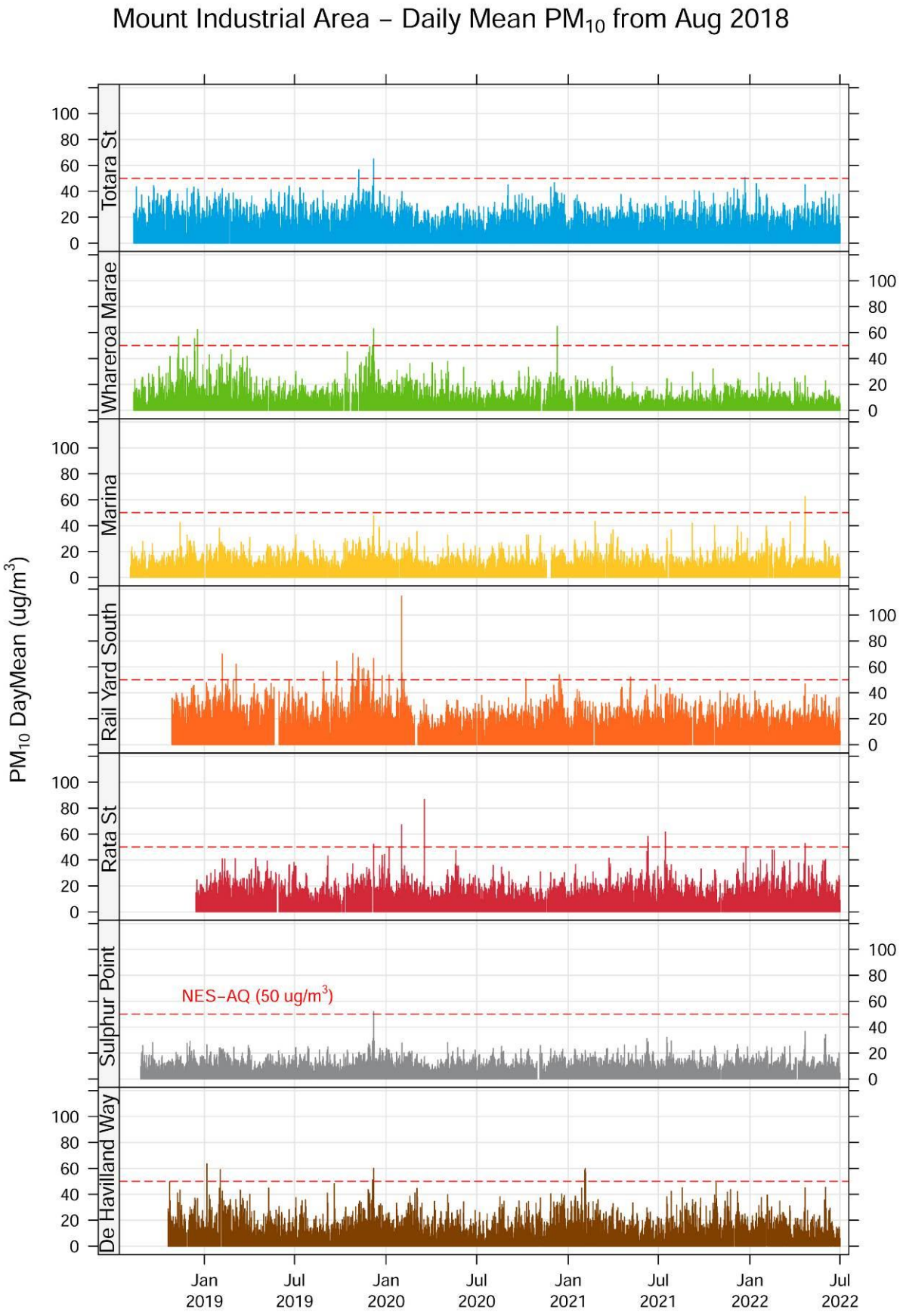

Figure 3. Full PM10 data for all sites within the Mount Maunganui Airshed.

Polar plots for the mean and maximum statistics for the full record of data at Rata Street (Figure 4) show a dominant pattern whereby higher concentrations are experienced at the site when winds are from the southern quadrant, and typically when wind speeds are higher; this latter point aligns well with general particle transport theory. Other sectors of the compass do show occasions of elevated values, but winds from the coastal sector typically have low particle concentration loads in comparison.

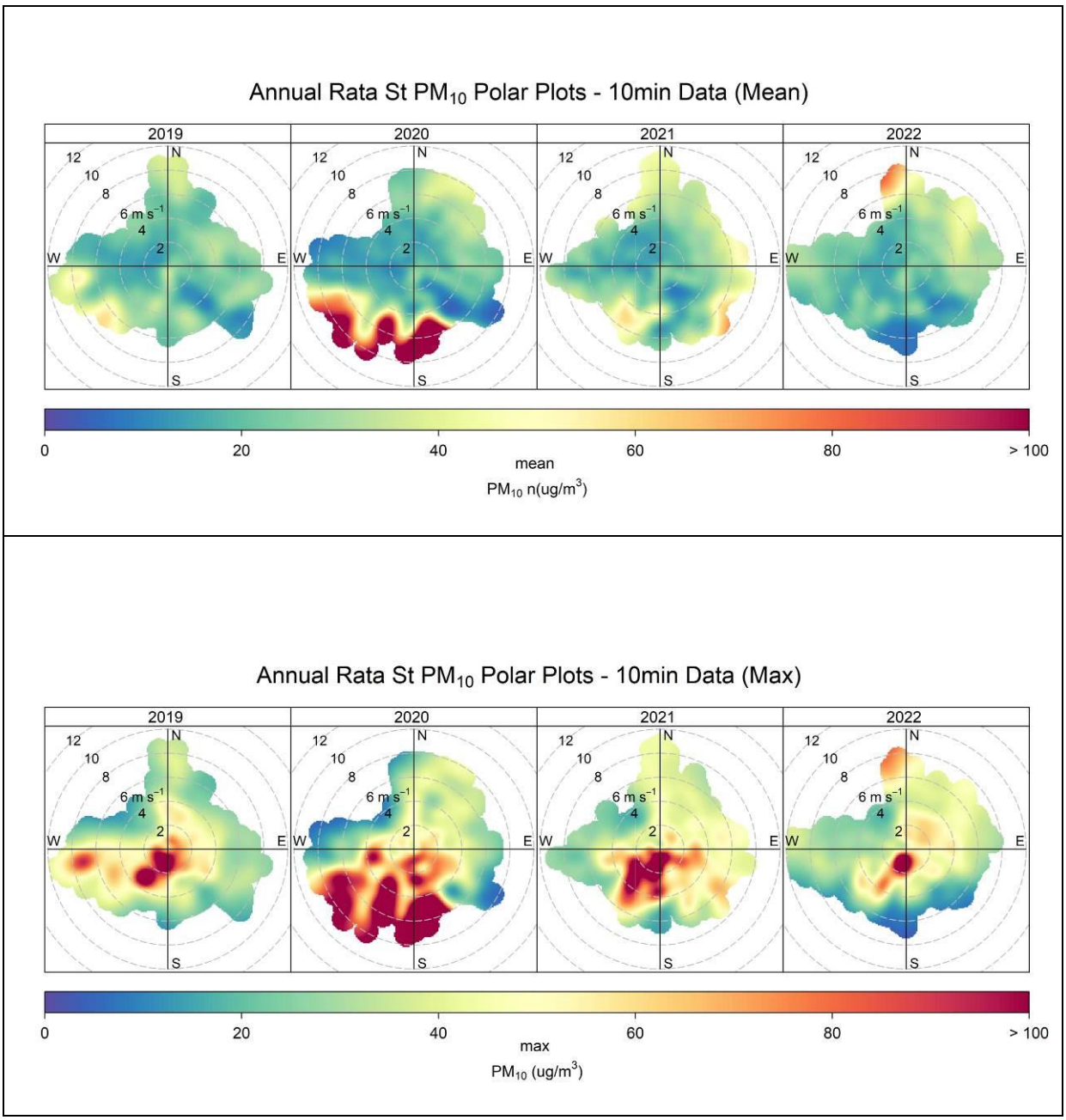

Figure 4. Annual polar plots for both the mean and maximum statistics for Rata Street.

The spatial aspect can be seen in Figure 5 when the 2020 polar plot (from Figure 4) is overlaid on a recent aerial image which also shows the boundary of the Mount Maunganui Airshed. Major anthropogenic particle sources are to the south/south-west and coastal sources are in an arc from the north through to the east.

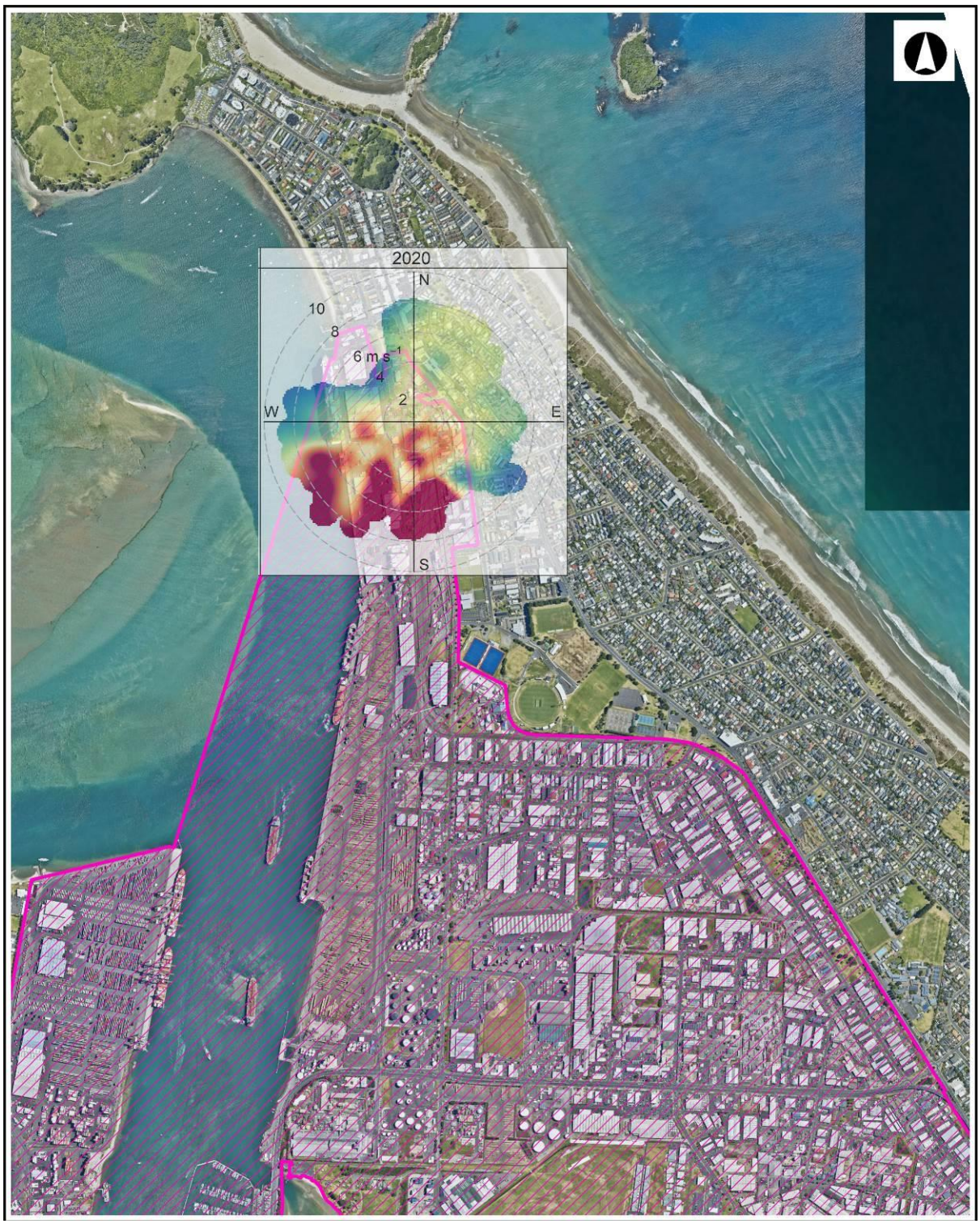

Figure 5. The Rata Street 2020 polar plot overlaid on aerial imagery to show source locations.

21 April 2022 PM10 exceedance events

The following information builds on the background information in the previous section and is more specific to the PM10 exceedance event recorded at Rata Street monitoring station on 21 April 2022.

Wind direction for the two days was investigated and shown to be within the north-east quadrant (Figure 6). This is a band that is away from the industrial sources of PM10, and potential upwind sources are traffic roadways, residential areas, and the Bay of Plenty coastal environment.

Figure 6. Windrose for 21 April 2022.

The wind flow over the Bay of Plenty is shown in the following synoptic maps (Figure 7). They show several important features and drivers related to the exceedance event. Firstly, the presence of a depression located to the north of the Bay of Plenty for several days, and a substantial anticyclone to the south. The resulting wind flow over the Bay of Plenty is a north-easterly one with a substantial fetch which creates a sea state which will be discussed further in this section. The depression weakened after several days but the anticyclone's continued presence to the south saw a persistent north-east/easterly wind flow.

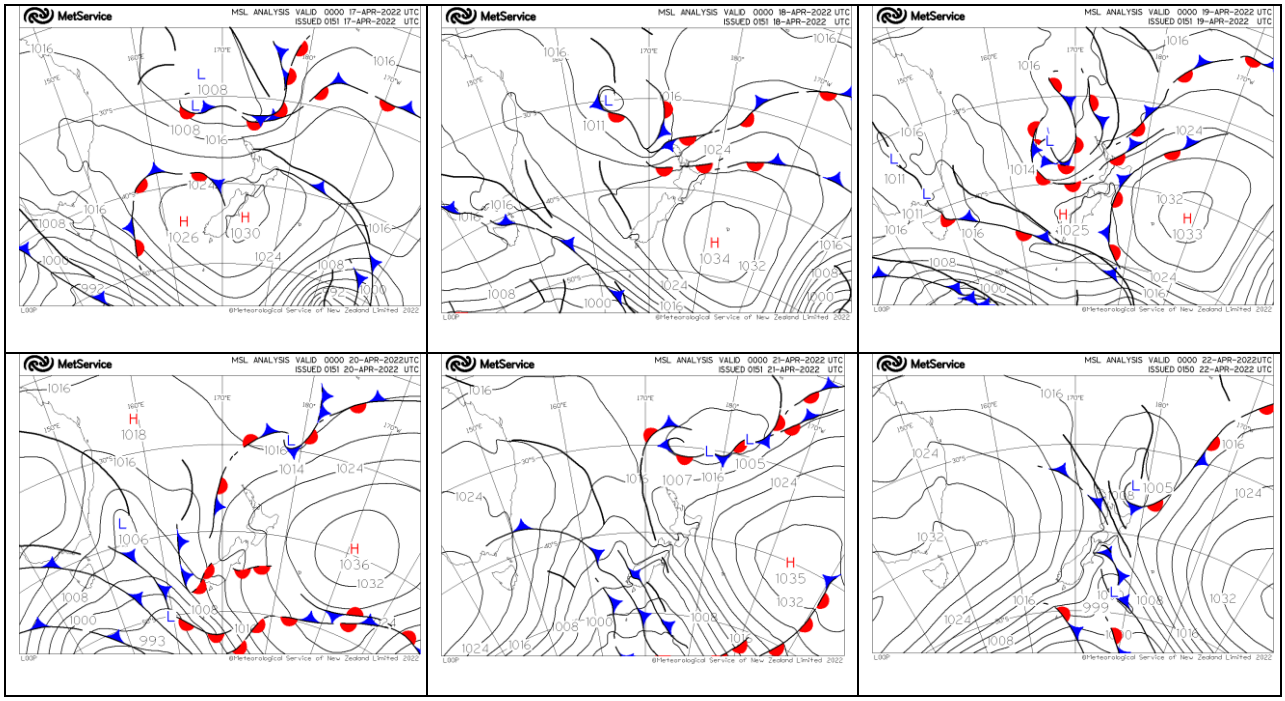

Figure 7. Synoptic maps for the period of interest.

PM10 24-hour datasets from the Mount Maunganui Airshed sites (Figure 8) show an increase in PM10 concentration over a period leading up to and including the date of the exceedance. It should be noted that individual site locations are not equidistant from the coastline (as shown in Figure 1) and this situation, in relation to measured concentrations, is discussed later in this section. The Marina dataset also shows an exceedance; further discussion with Ballance Agri-Nutrients Ltd (which operates a fertiliser manufacturing and storage facility adjacent to the monitor) and SEM analysis is currently being untaken in relation to the recorded elevated PM10 values for this site.

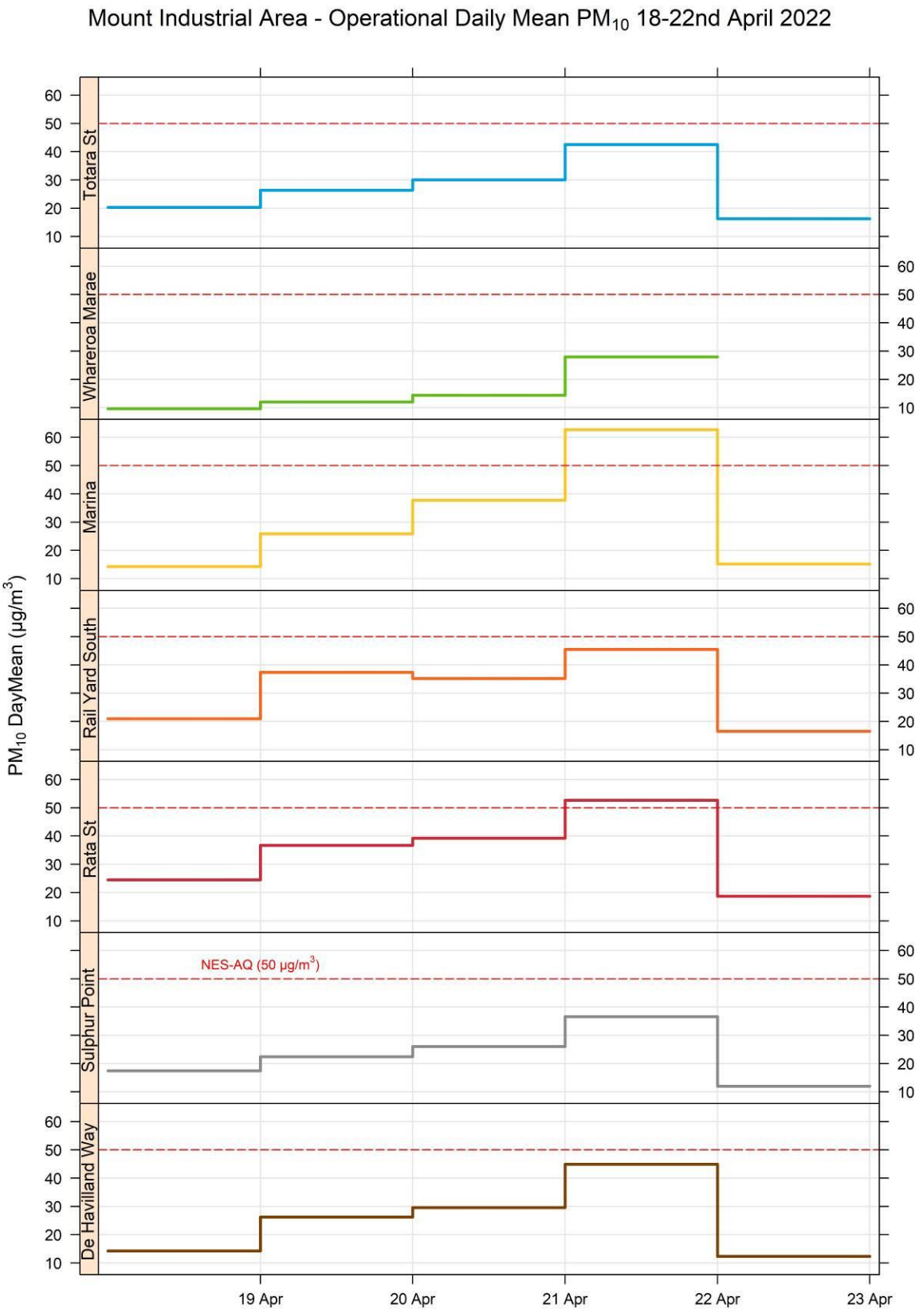

Figure 8. Daily PM10 plots for the Airshed sites.

Rata Street's timeseries for the event is shown in Figure 9. The first plot shows an initial peak and then a sustained elevation of PM10 concentrations for the several days. The north-easterly wind direction relates well with the location of the coastal environment. This north-easterly/increasing concentration relation is further demonstrated with the polar plots in Figure 10, with high values recorded when the north-easterly wind flow is present.

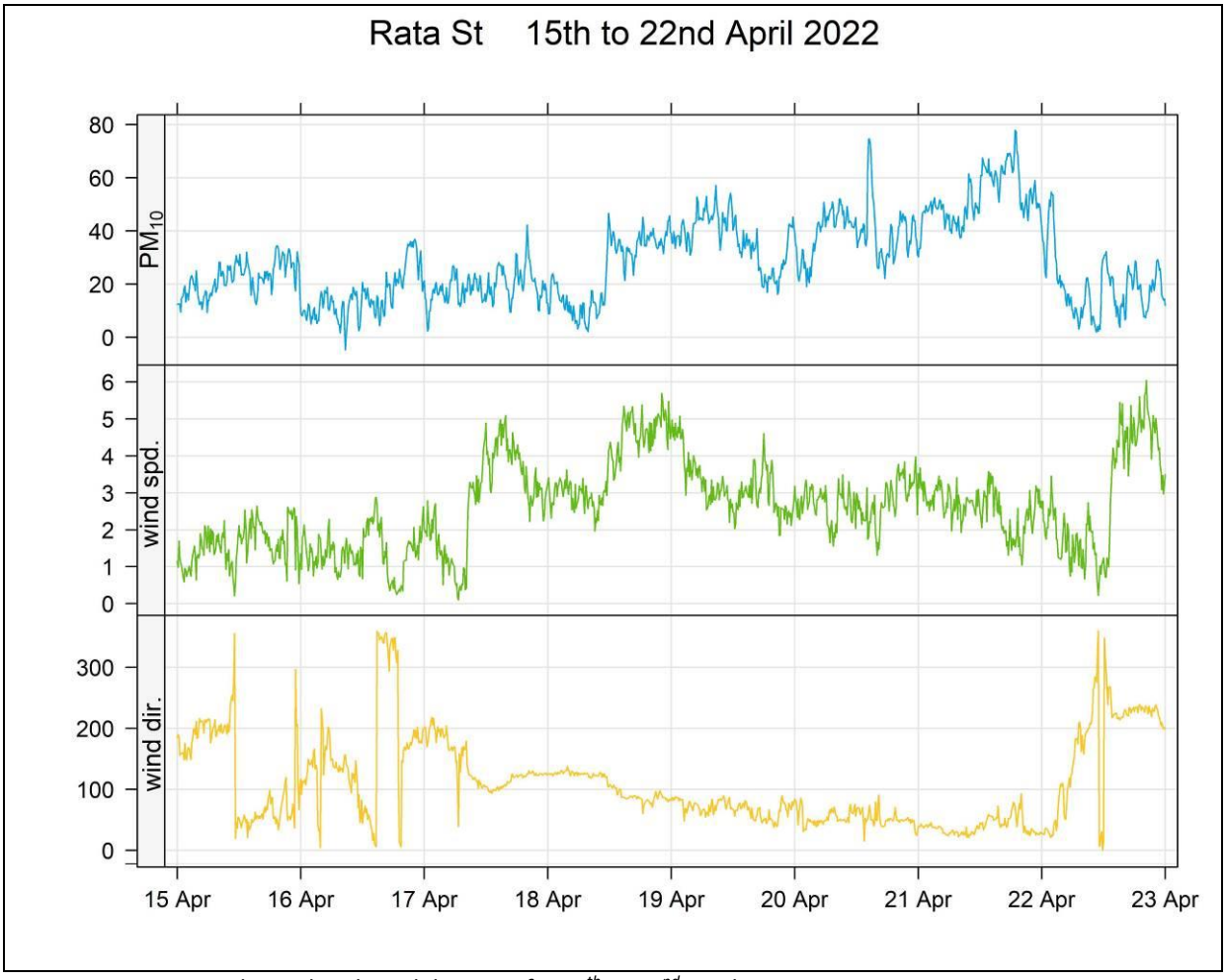

Figure 9. PM10, wind speed and wind direction for 15th to 22nd April 2022.

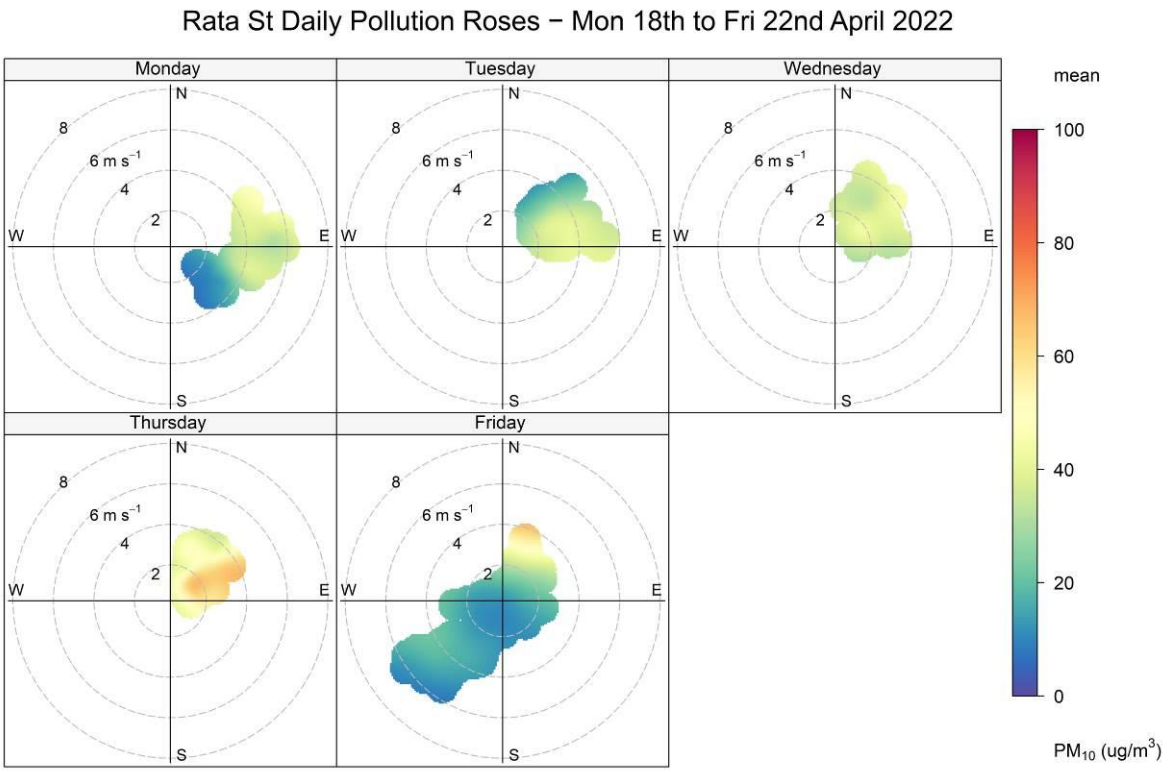

Figure 10. Polar plots for 21 April 2022 event and preceding days.

In addition to traditional air quality datasets, several other parameters have been checked as part of this investigation. Firstly, precipitation, which is recorded by acoustic techniques at each of the sites within the Airshed. Rainfall was recorded on the 22 April but not on the date that the exceedances were recorded. Secondly, wave parameters from a wave buoy located within the Bay of Plenty, approximately 10km off the coastline. As can be seen in Figure 11, during the time of the PM10 exceedance, an elevated sea state event was present within the Bay of Plenty. This was notable/strong enough to result in areas of significant coastal shoreline erosion within the western Bay of Plenty. Wave heights were in a range of 3 to 5 metres for a period of more than three days. It is this elevated sea state that generated a source of natural sea spray particles that persisted and accumulated over several days leading into and during the day of the exceedance.

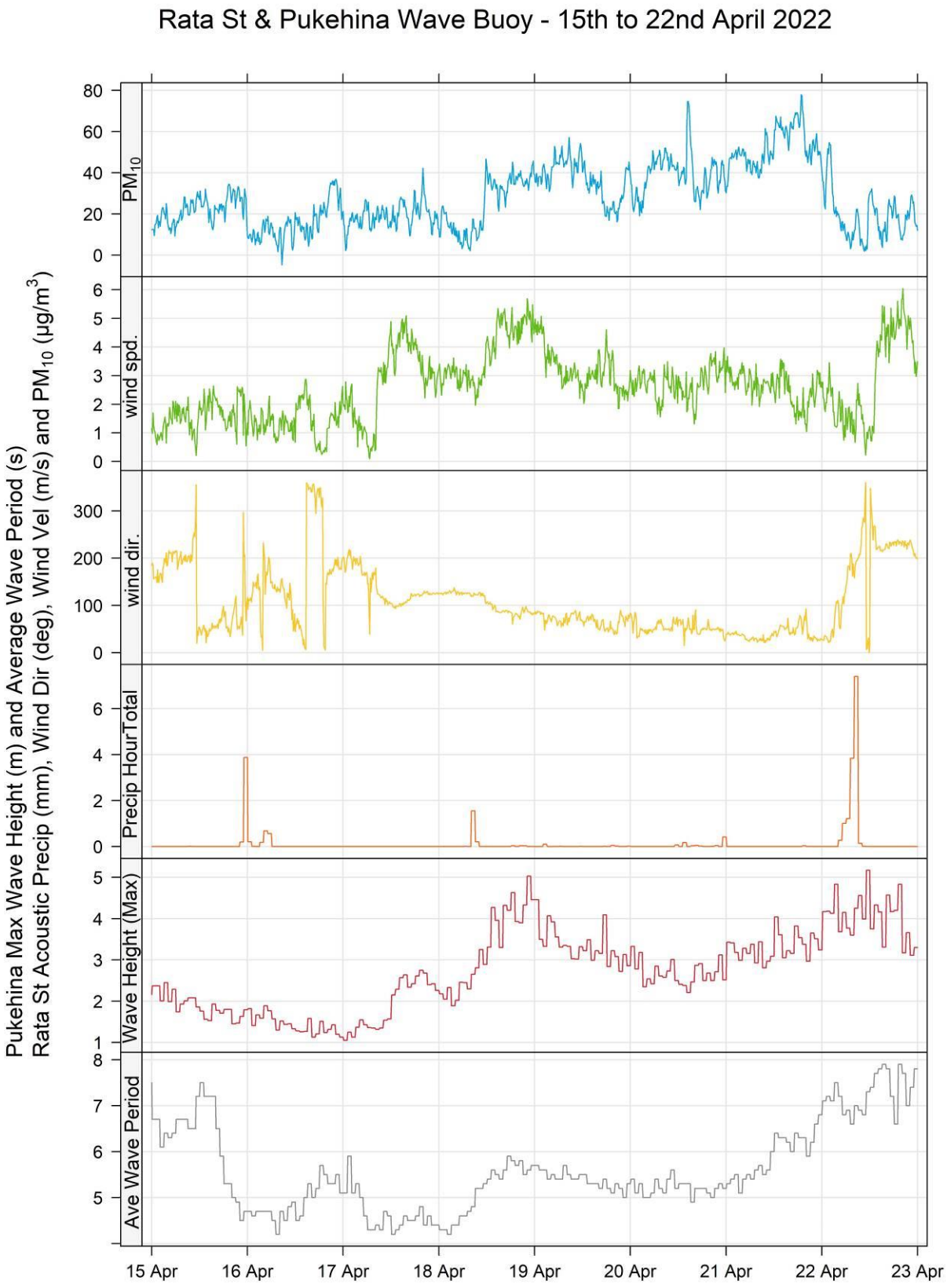

Figure 11. Air quality, precipitation, and wave data for the event.

Further Council Officer observations were made shortly after the events in the neighbourhood to the east of the site (Figure 12). These were focussed on any potential particulate source activities that could have given rise to a period of several days of elevated PM10 readings. No activities were identified and, furthermore, the Council's Pollution Hotline recorded no calls that could be related to such activities either. A building site, on the corner of Rata Street and Maunganui Road, was identified to the northeast, in close proximity of the monitoring location. The site, although appearing unsealed in Figure 12, had no exposed land or dust-generating construction activity and was subsequently discounted as a source for this event.

Figure 12. General area of Council officer observations.

Scanning Electron Microscope (SEM) data

Filter tapes (Figure 13) from the Rata Street PM10 recording instrument for the 21 April exceedance event were sent to the University of Waikato Scanning Electron Microscope laboratory for further qualitative analysis. This technique allows for visual identification of individual particles along with elemental composition of said particles. The results (Figure 14) and subsequent discussion with Helen Turner (Advanced Technical Officer, SEM Facility) highlighted an increase in the presence of NaCl based particles from the 18th - 21st April, and then an absence as the wind direction changed to the southwest on 22 April and precipitation occurred.

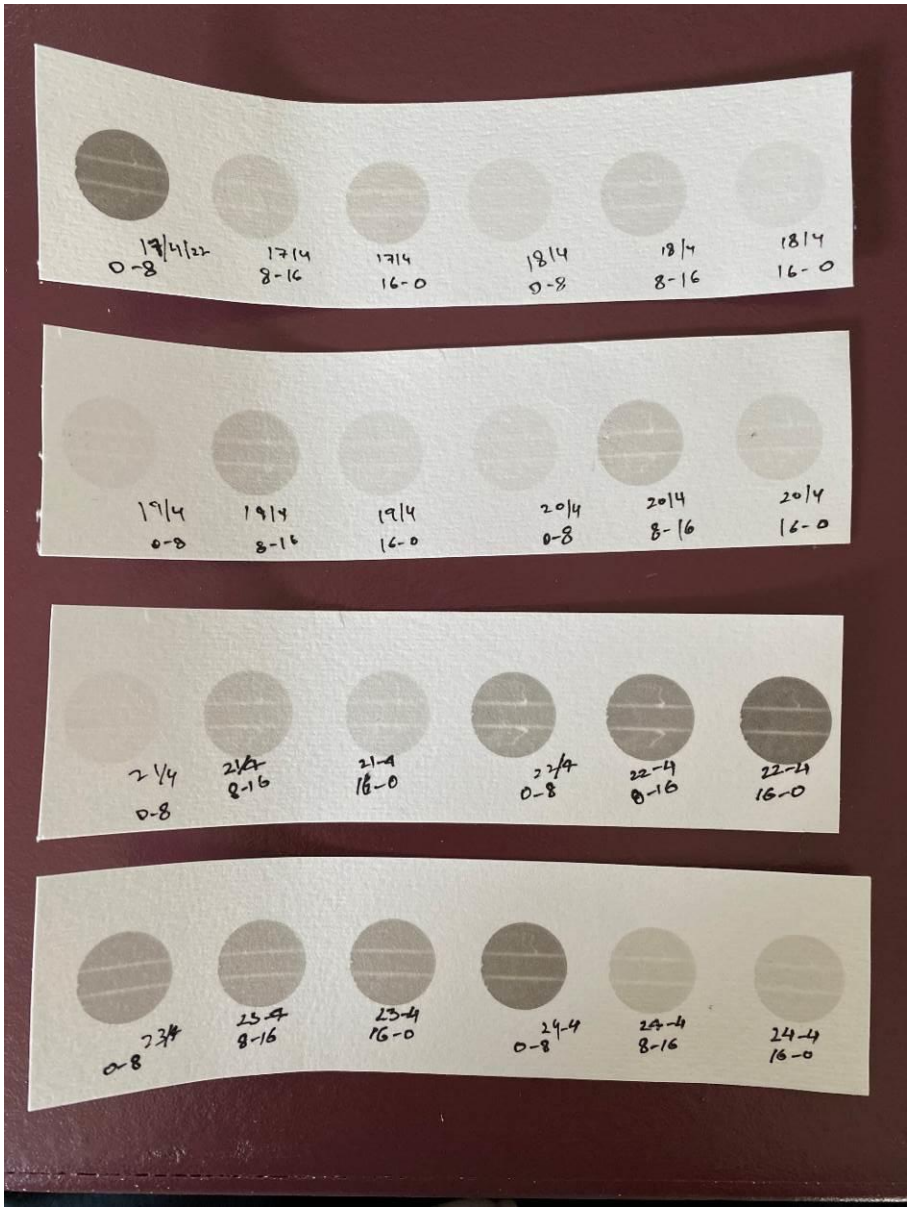

Figure 13. BAM filter tapes for the PM10 event and preceeding days.

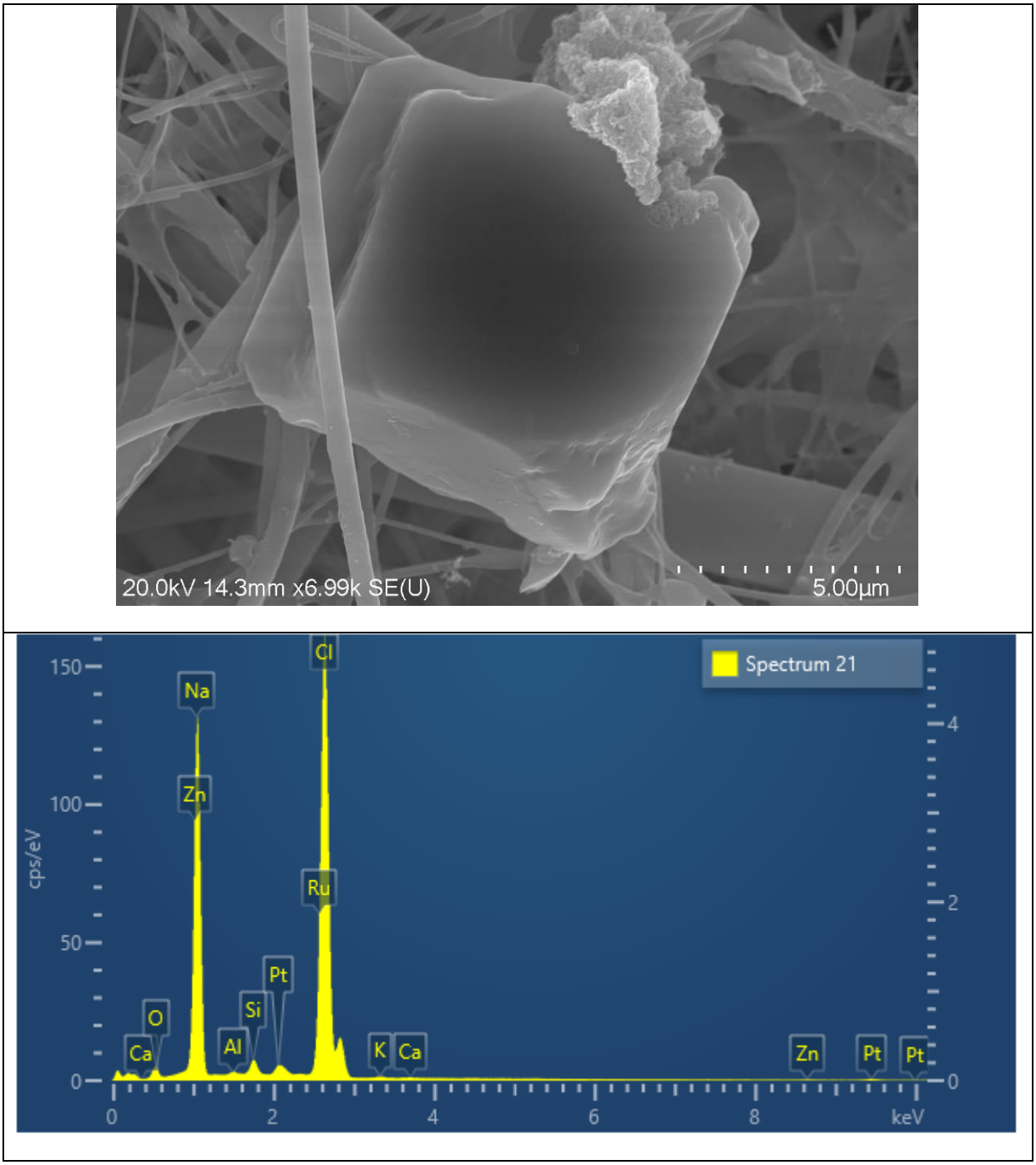

Figure 14. Example of results from SEM analysis showing NaCl particle and spectra which were common in the tapes for the period 18th to 21st April 2022.

Conclusion

The information presented within this supporting document demonstrates a pattern of recorded ambient air quality, meteorological data, and Council Officer observations for 21 April 2022 (and preceding days) that is in line with the influencing factor of a natural coastal environment source (sea spray-derived particles). This presence of natural particles resulted in concentrations of PM10 recorded at the Rata Street monitoring site that exceeded the 24-hour standard of 50µg/m3 on 21 April 2022 and an increase in PM10 concentrations in the preceding days, with the entire PM10 "event" being the result of an elevated sea state. This phenomenon appears to be not uncommon as our datasets (and analysis) continue to grow and develop as the Council commits significant resources to managing the air quality within the Mount Maunganui airshed.