4 July 2022

Auckland Air Quality Report

Monthly update

Research and Evaluation Unit | RIMU

Auckland Council
Te Kaunihera o Tāmaki Makaurau

Introduction

Auckland Council continuously collects air quality data to assess compliance with national standards and provide information to aid policy development and evaluation. The data the council collects enables us to quantify ambient air quality in the region and note spatial and temporal variations. This report presents a monthly update on air quality in Auckland. It has three sections: sections A and B present tables and graphics illustrating air quality status in the Auckland region based on the data collected from continuous monitoring sites across the region. For this edition, section C focuses on one monitoring site – Customs Street. The monthly update is prepared using validated data which is generally available one month after raw data is collected. This update covers data to 31 May 2022.

Summary

- No breach of national air quality standards has occurred this year (1 Jan to 31 May 2022).
- All monitoring sites recorded particulate matter (PM_{10}) concentrations higher than the previous year.
- All monitoring sites, except Patumahoe and Henderson, registered lower average nitrogen dioxide (NO_2) concentrations compared to the previous year.
- The highest concentrations of air contaminants were measured at Auckland city centre monitoring sites.

Glossary of terms

Term	Meaning
Aerodynamic diameter	Used to describe the behaviour of a particle as it moves around in the air; it compares the behaviour with that of a spherical particle of unit density.
Air pollutant/contaminant	Any substance in the air that could harm humans, animals, vegetation, or other parts of the environment when present in high enough concentrations.
Air pollution	The presence of one or more air pollutants in high enough concentrations to cause harm.
Air quality	Is the degree to which air is suitable or clean enough for humans, animals, or plants to remain healthy.
Air quality index (AQI)	Score out of 100, based on dividing a pollutant concentration by a relevant standard. It can be used to approximate relative impact of different pollutants.
Ambient air	The external air environment (does not include the air environment inside buildings or structures)
Black carbon (BC)	Is an air pollutant made up of tiny soot-like particles discharged into the atmosphere from combustion processes.
CO	Carbon monoxide, a type of air pollutant.
Exceedance	An exceedance defines a period of time during which the concentration of a pollutant is greater than the appropriate air quality criteria.
Ground-level ozone (O_3)	At ground level, ozone is considered an air pollutant that can seriously affect the human respiratory system. It is a major component of photochemical smog.
Monitoring site	A facility for measuring the concentration of one or more pollutants in the ambient air; also referred to as 'monitoring station'
NESAQ	National Environmental Standard for Air Quality.
NO_2	Nitrogen dioxide, a type of air pollutant
PM	Particulate matter is made up of a mixture of various sizes of solid and liquid particles suspended in air.
PM_{10}	Particulate matter with an aerodynamic diameter of 10 micrometres or less; a type of air pollutant.
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of 2.5 micrometres or less; a type of air pollutant.
SO_2	Sulphur dioxide, a type of air pollutant
$\mu g/m^3$	Microgram of pollutant (1 millionth of a gram) per cubic metre of air, referenced to temperature of 0°C (273.15 K) and absolute pressure of 101.325 kilopascals (kPa)
n/a	Not applicable

Data can be viewed on the environmental data portal , LAWA or requested from environmentaldata@aucklandcouncil.govt.nz. Full state and trends analyses and reports are prepared every few years (last report; Trends in Auckland's air quality 2006-2018).

See the frequently asked questions about the Auckland air quality monitoring programme.

Section A – Data tables

Table 1. Summary information about Auckland air quality monitoring programme 1 January 2022 to 31 May 2022

Number of Continuous Monitoring Sites	10	
Location of Monitoring Sites	Queen Street, Customs Street, Khyber Pass Road, Penrose, Henderson, Takapuna, Glen Eden, Pakuranga, Papatoetoe, and Patumahoe	
Standard Contaminants Monitored	PM_{10}, CO, NO_2, O_3, and SO_2	
Other Key Contaminants Monitored	$PM_{2.5}$, and Black Carbon	
Number of Exceedances Of NESAQ In 2022	0	
Number of Exceedances of Auckland Ambient Air Quality Targets In 2022	0	
Maximum PM_{10} 24-Hours Mean (Jan - May 2022)	37.0 µg/m³ (74.0% of NESAQ)	*Recorded at Queen Street on 25 March 2022*
Maximum $PM_{2.5}$ 24-Hours Mean (Jan - May 2022)	13.8 µg/m³ (55.2% of Auckland target)	*Recorded at Queen Street on 25 March 2022*
Maximum NO_2 1-Hour Mean (Jan - May 2022)	119.0 µg/m³ (59.5% of NESAQ)	*Recorded at Customs Street on 20 January 2022*
Maximum SO_2 1-Hour Mean (Jan - May 2022)	24.0 µg/m³ (6.9% of NESAQ)	*Recorded at Penrose on 12 May 2022*
Maximum O_3 1-Hour Mean (Jan - May 2022)	60.0 µg/m³ (40.0% of NESAQ)	*Recorded at Patumahoe on 29 May 2022*
Maximum CO Running 8-Hour Mean (Jan - May 2022)	2.05 mg/m³ (20.5% of NESAQ)	*Recorded at Khyber Pass Rd on 13 May 2022*
Written Reports Framework	Monthly Updates, Annual Report, Trends Report, and State of the Environment Report	

Table 2. General changes in concentration of key contaminants monitored for the last 16, 28 and 40 months.

↑ indicates an increase ↓ indicates a decrease ↗ Increase but not significant ↘ Decrease but not significant

	PM_{10}			$PM_{2.5}$			NO_2			Black carbon			Ozone			CO			SO_2			Air Quality Index(AQI)			
Site	*Last 16 months*	*Last 28 months*	*Last 40 months*	*Last 16 months*	*Last 28 months*	*Last 40 months*	*Last 16 months*	*Last 28 months*	*Last 40 months*	*Last 16 months*	*Last 28 months*	*Last 40 months*	*Last 16 months*	*Last 28 months*	*Last 40 months*	*Last 16 months*	*Last 28 months*	*Last 40 months*	*Last 16 months*	*Last 28 months*	*Last 40 months*	*Last 16 months*	*Last 28 months*	*Last 40 months*	Site
Customs Street*	n/a	n/a	n/a	↑	↓	n/a	↓	↓	n/a	↘	↘	n/a	n/a	n/a	n/a	n/a	n/a	n/a	↗	↘	n/a	n/a	n/a	n/a	Customs Street*
Glen Eden*	↗	↘	↓	↑	↗	↘	↘	↗	↘	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	↗	↘	↓	Glen Eden*
Henderson	↗	↗	↓	n/a	n/a	n/a	↗	↗	↘	↗	↘	↘	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	↗	↘	↓	Henderson
Khyber Pass Road	↑	↗	↗	n/a	n/a	n/a	↓	↘	↓	n/a	n/a	n/a	n/a	n/a	n/a	↘	↘	↘	n/a	n/a	n/a	n/a	n/a	n/a	Khyber Pass Road
Pakuranga*	↗	↗	↘	↑	↗	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Pakuranga*
Papatoetoe	↘	↗	↘	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Papatoetoe
Patumahoe	↗	↘	↘	↗	↗	↘	↗	↗	↗	n/a	n/a	n/a	↗	↘	↘	n/a	n/a	n/a	n/a	n/a	n/a	↗	↘	↓	Patumahoe
Penrose	↗	↗	↘	↘	↘	↓	↗	↘	↘	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	↑	↑	↗	↑	↗	↓	Penrose
Takapuna	↗	↗	↘	↗	↗	↘	↗	↘	↘	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	↗	↗	↓	Takapuna
Queen Street	↗	↑	↑	↗	↑	↑	↓	↓	↓	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	↘	↗	↗	Queen Street
	PM_{10}			$PM_{2.5}$			NO_2			Black carbon			Ozone			CO			SO_2			Air Quality Index(AQI)			

Notes

Effective dates: 16 months (1 Jan 2021 to 31 May 2022), 28 months (1 Jan 2020 to 31 May 2022), and 40 months (1 Jan 2019 to 31 May 2022)

PM_{10} is monitored at Glen Eden, Henderson, Khyber Pass Rd, Pakuranga, Papatoetoe, Patumahoe, Penrose, Takapuna, and Queen St.

$PM_{2.5}$ is monitored at Customs St, Glen Eden, Pakuranga, Patumahoe, Penrose, Takapuna, and Queen St.

NO_2 is monitored at Customs St, Glen Eden, Henderson, Khyber Pass Rd, Patumahoe, Penrose, Takapuna, and Queen St.

Black carbon is monitored at Customs St, and Henderson.

CO is monitored at Khyber Pass Rd.

Ozone is monitored at Patumahoe.

SO_2 is monitored at Customs St, and Penrose.

*$PM_{2.5}$ data coverage for Glen Eden, Customs Street and Pakuranga is less than 75% due to instrument failure between Sep 2021 and Jan 2022. Weather changes significantly affect concentrations of air contaminants (see this report)

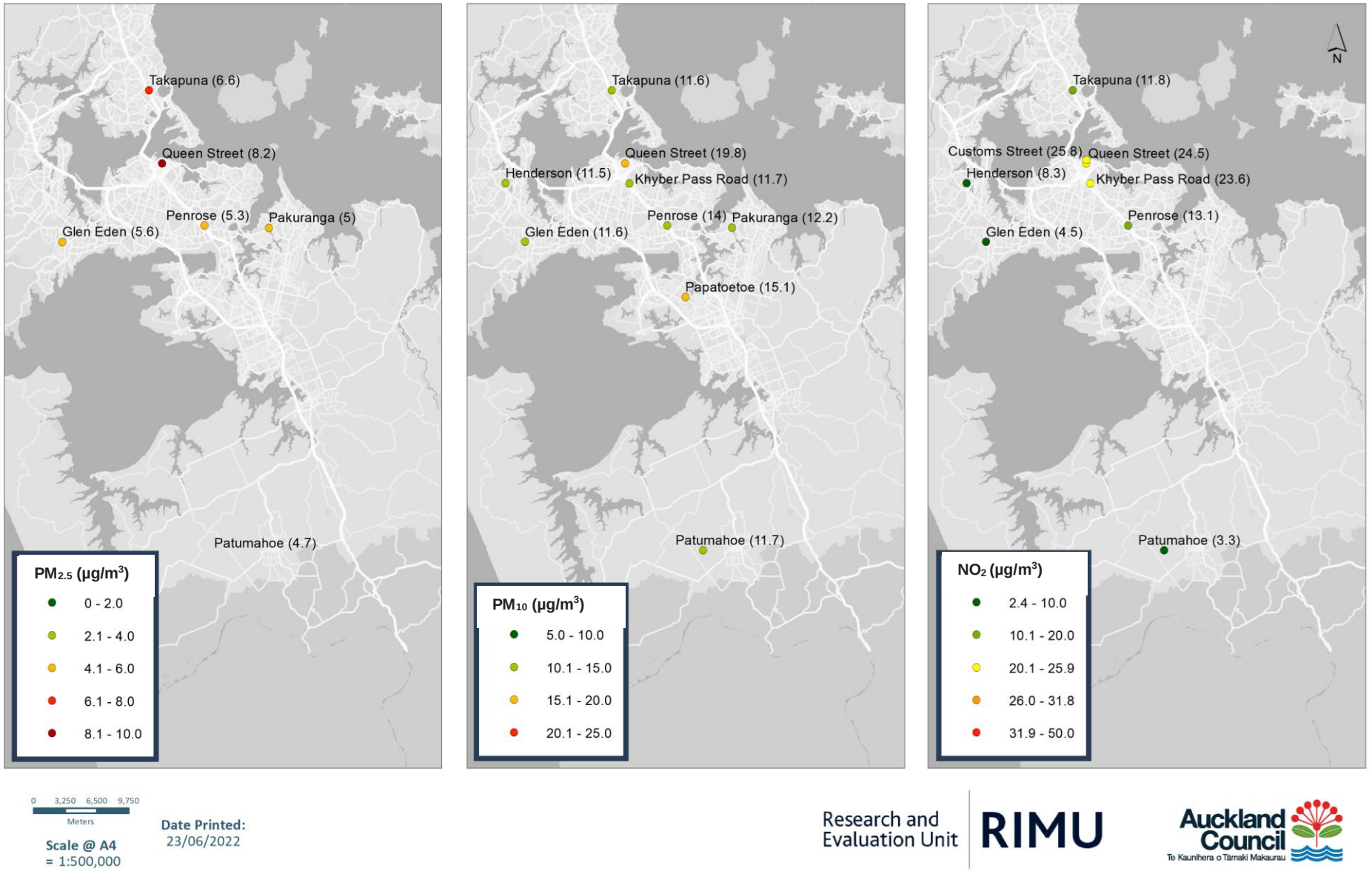

Figure 1. Maps a, b and c show the air quality monitoring sites and their last 12- months (1 June 2021 to 31 May 2022) average PM and NO_2 concentrations in brackets. Auckland city centre monitoring sites recorded the highest PM and NO_2 concentrations.

Section B. Key air contaminants across the 10 air quality monitoring sites (1 January 2022 to 31 May 2022)

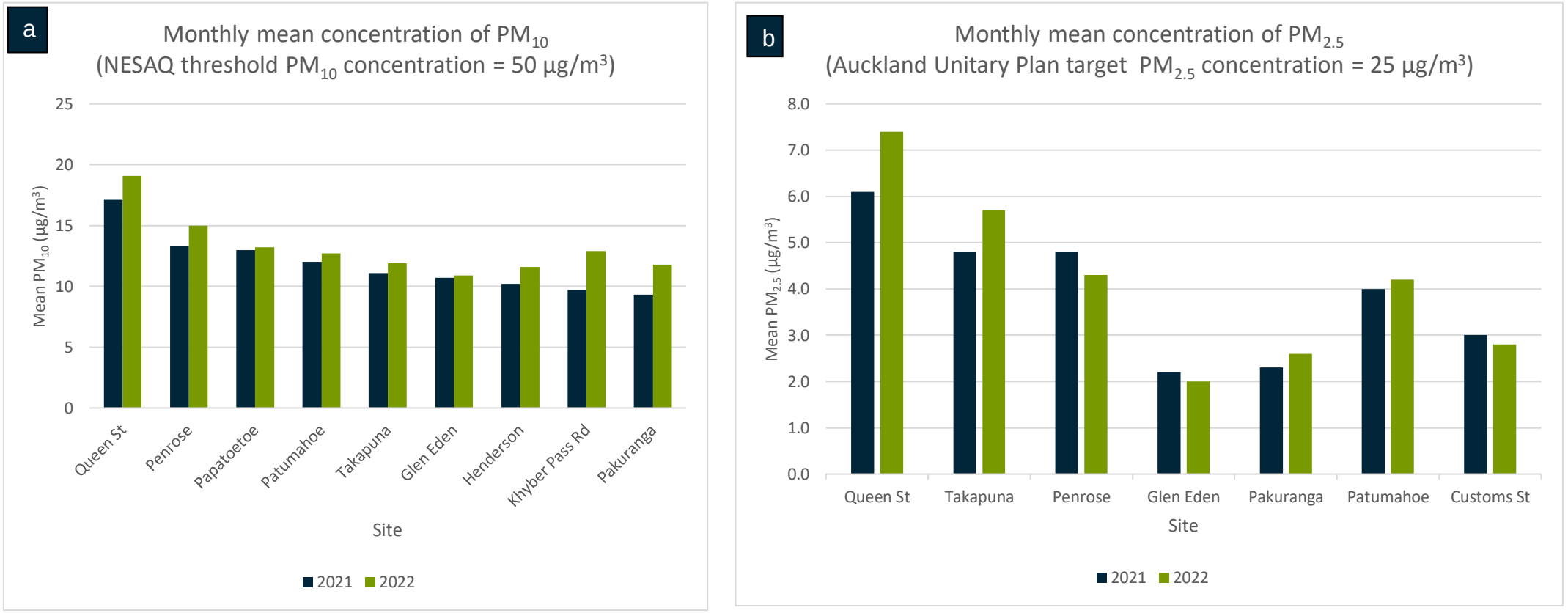

Figure 2. Monthly mean concentration of particulate matter. As in the previous year, the highest concentrations of both PM_{10} and $PM_{2.5}$ were recorded at Queen St. Plots a and b represent PM_{10} and $PM_{2.5}$, respectively. The average PM_{10} concentration in all the monitoring sites is higher than the same period of the previous year. PM_{10} and $PM_{2.5}$ have multiple sources including motor vehicles, sea salt, marine diesel, and soils (windblown soil, road dust, and dust generated by earthworks, construction, and road works).

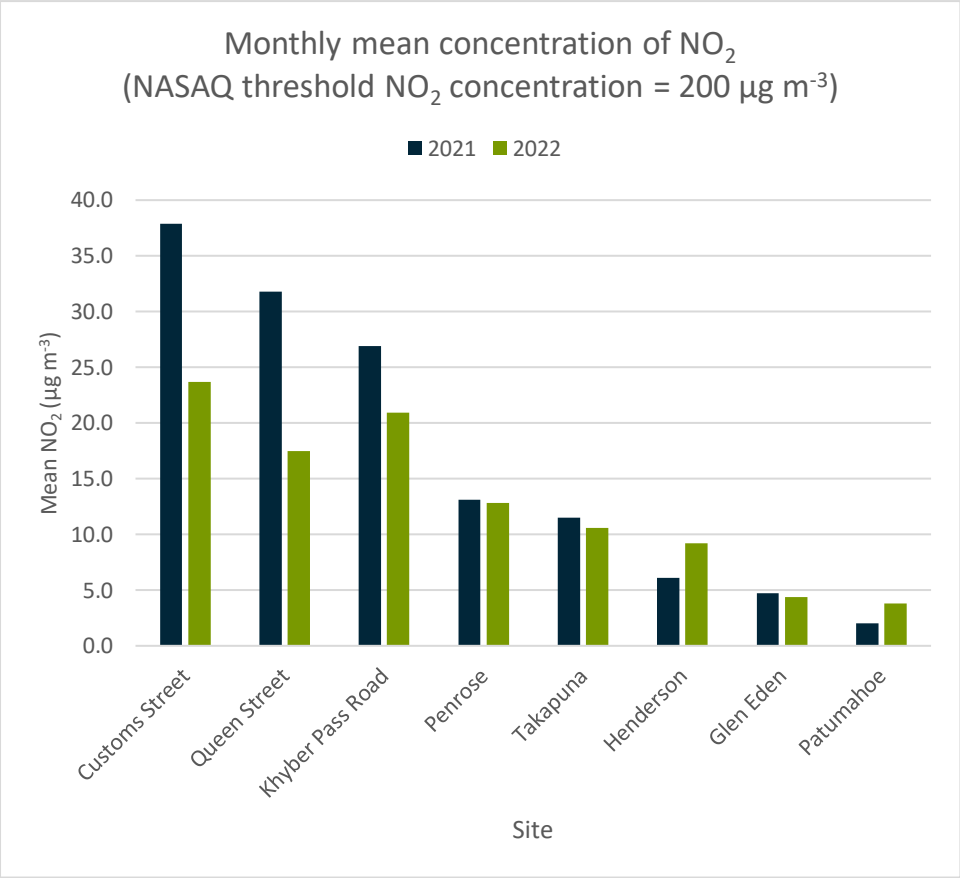

Figure 3. Monthly mean concentration of NO_2 across monitoring sites. Auckland city centre monitoring sites recorded the highest concentrations. All monitoring sites, except Henderson and Patumahoe, recorded lower average NO_2 concentrations compared to 2021. The main source of NO_2 is motor vehicles.

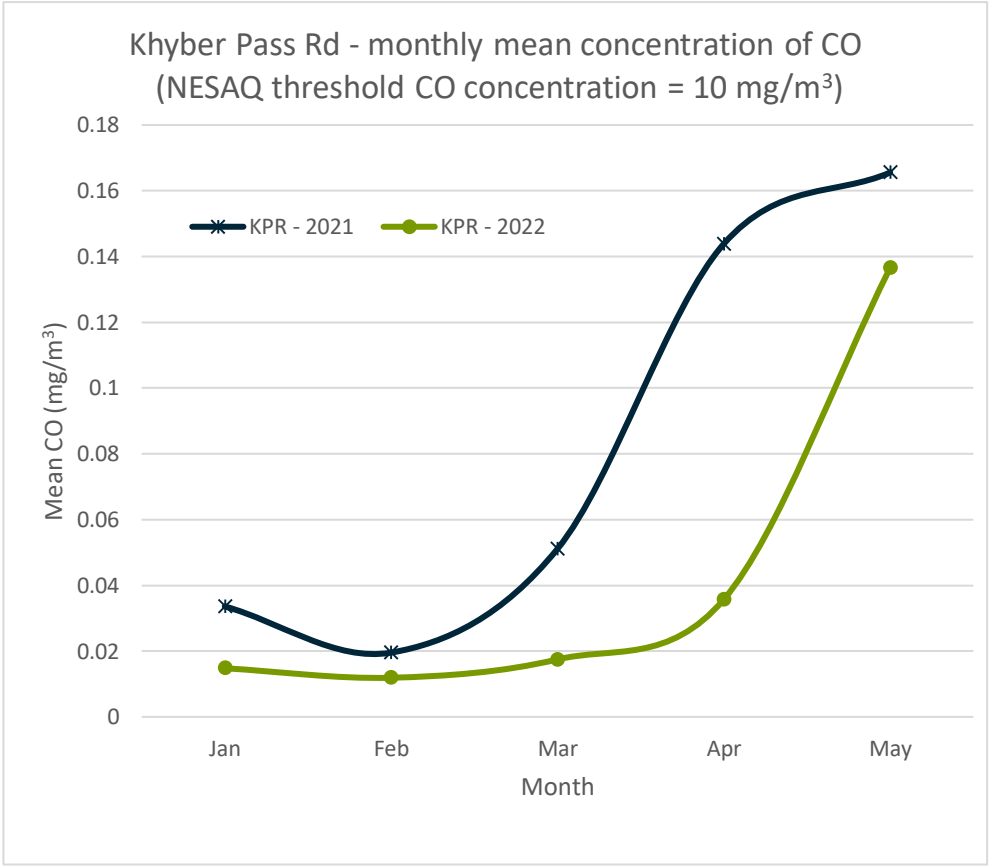

Figure 4. Monthly mean concentration of CO. The mean CO concentration for each month is less than the previous year. The main source of CO is motor vehicles. Note: currently, CO is only monitored at Khyber Pass Road.

Section C. Focus on a monitoring site: **Customs Street**

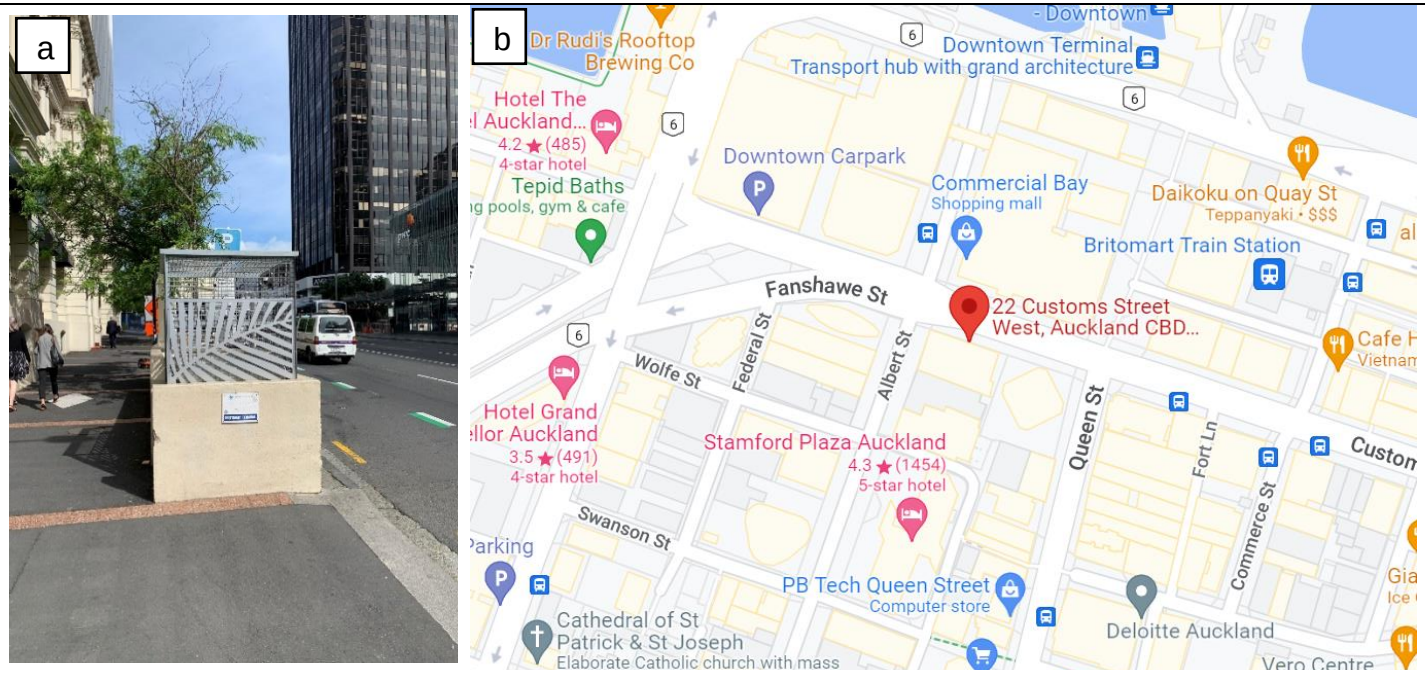

Figure 5. The Customs Street air quality monitoring site is located at 22 Customs Street West. Image a shows the air quality monitoring shed. Image b is an aerial view of the monitoring site and surroundings taken in July 2022 (Source: Google Maps). Air quality monitoring at this site commenced on January 2020. $PM_{2.5}$, NO_2, SO_2, and black carbon are monitored at this site. The main sources of air contaminants are motor vehicles, shipping emissions, and soils.

Key findings:

- Overall, Customs Street's average $PM_{2.5}$ concentration is 17.2 % lower than Auckland's average and 3.6 % lower than Patumahoe (a rural site).
- The average SO_2 concentration is 71.8 % higher than Penrose's average.
- In general, Customs Street's average NO_2 concentration is 70 % higher than Auckland's average and 13-fold higher than Patumahoe.
- The average black carbon concentration is 72.7 % higher than Henderson's average.
- Deseasonalised trend analysis result shows there is an upward trend in SO_2 average concentrations.
- Conversely, deseasonalised trend analysis results show there is a downward trend in NO_2 and $PM_{2.5}$ average concentrations.
- There is no clear trend is black carbon concentrations at the Customs Street site.

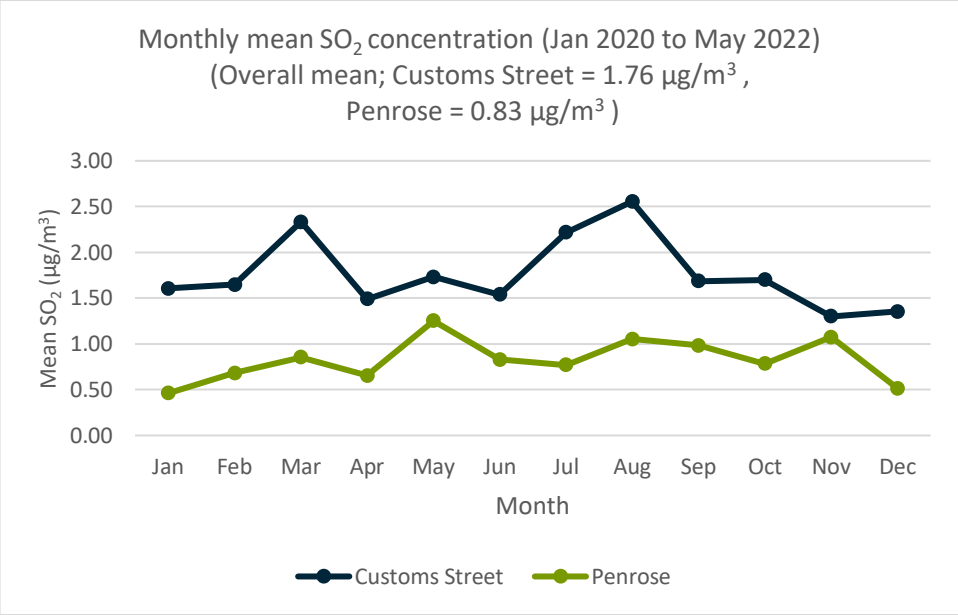

Figure 6. Temporal variation in monthly SO_2 concentrations – Customs Street compared to Penrose site. Overall, Customs Street average SO_2 concentration is 71.8 % more than Penrose average.

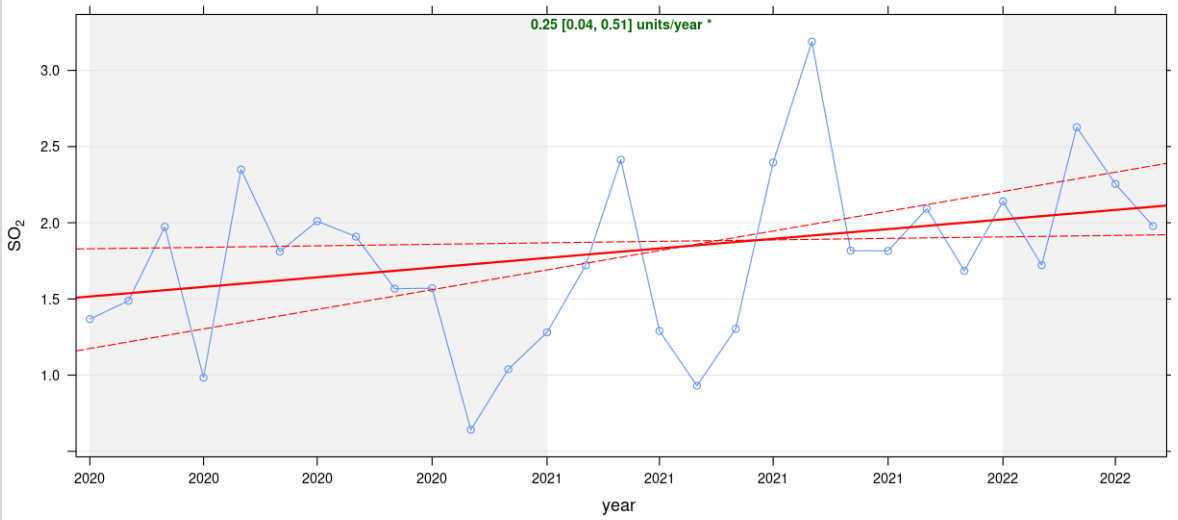

Figure 7. Trends in SO_2 at Customs Street. The plot shows the deseasonalised monthly mean concentrations of SO_2. The solid red line shows the trend estimate and the dashed red lines show the 95% confidence intervals for the trend based on resampling methods. The overall trend is shown at the top-left as 0.25 (µg/m³) per year and the 95% confidence intervals in the slope from 0.04 – 0.51 µg/m³/year. The '*' show that the trend is significant to the 0.05 level.

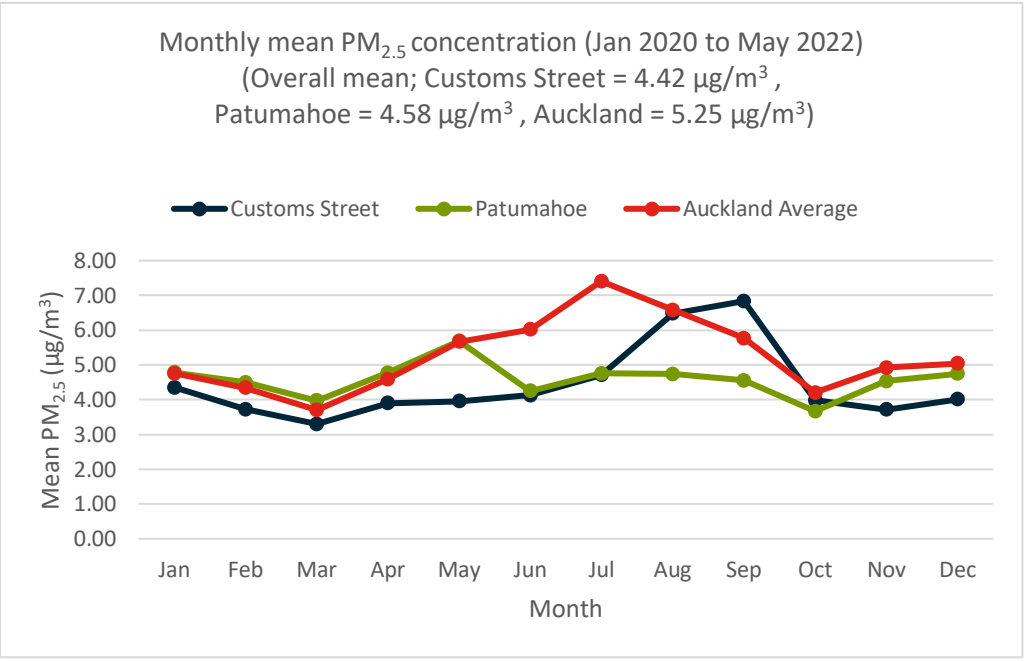

Figure 8. Temporal variation in monthly $PM_{2.5}$ concentrations – Customs Street compared to Patumahoe (rural site) and Auckland average. Overall, Customs Street average $PM_{2.5}$ concentration is 17.2 % less than Auckland's average and 3.6 % less than Patumahoe (a rural site).

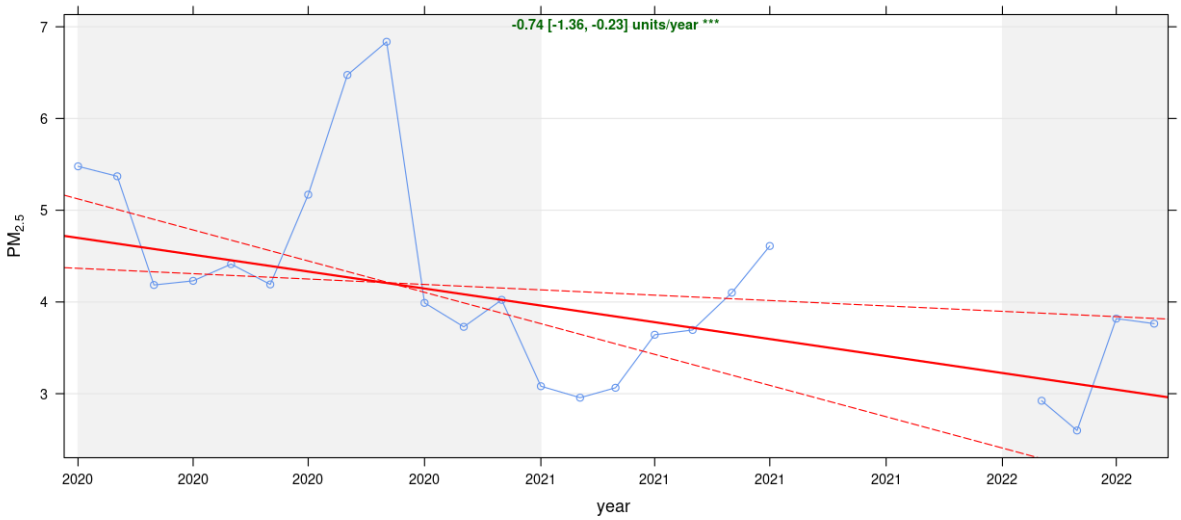

Figure 9. Trends in $PM_{2.5}$ at Customs Street. The plot shows the deseasonalised monthly mean concentrations of $PM_{2.5}$. The solid red line shows the trend estimate and the dashed red lines show the 95% confidence intervals for the trend based on resampling methods. The overall trend is shown at the top-left as -0.74 (µg/m^3) per year and the 95% confidence intervals in the slope from -1.36 – (-0.23) µg/m^3/year. The '***' shows that the trend is significant to the 0.001 level.

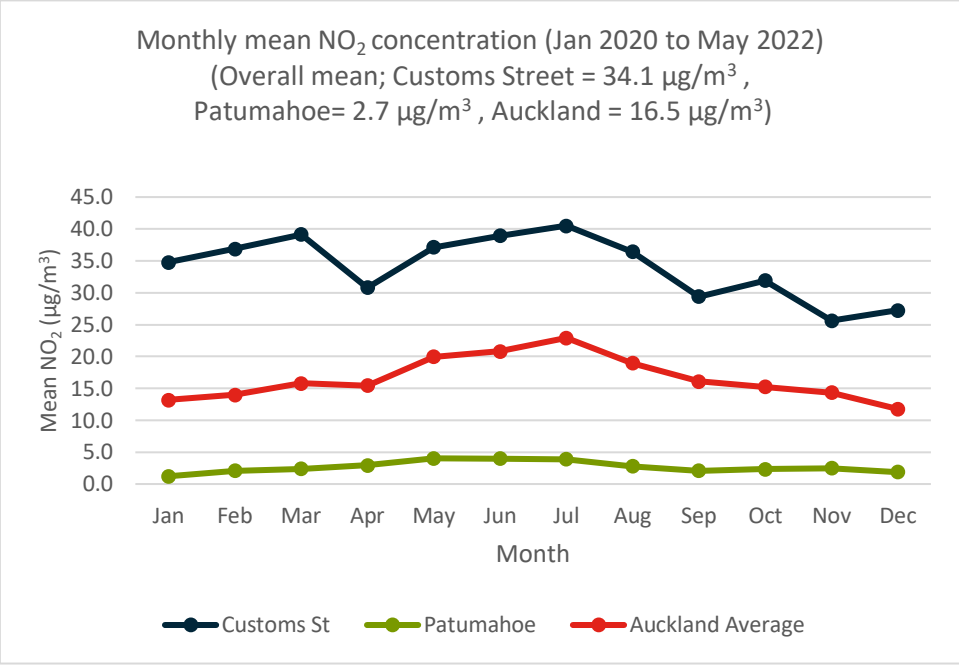

Figure 10. Temporal variation in monthly NO_2 concentrations – Customs Street compared to Patumahoe (rural site) and Auckland average. Overall, Customs Street average NO_2 concentration is 70 % more than Auckland's average and 13-fold more than Patumahoe (a rural site).

Figure 11. Trends in NO_2 at Customs Street. The plot shows the deseasonalised monthly mean concentrations of NO_2. The solid red line shows the trend estimate and the dashed red lines show the 95% confidence intervals for the trend based on resampling methods. The overall trend is shown at the top-left as - 12.6 (µg/m^3) per year and the 95% confidence intervals in the slope from -15.25 – (- 8.03) µg/m^3/year. The '***' show that the trend is significant to the 0.001 level.

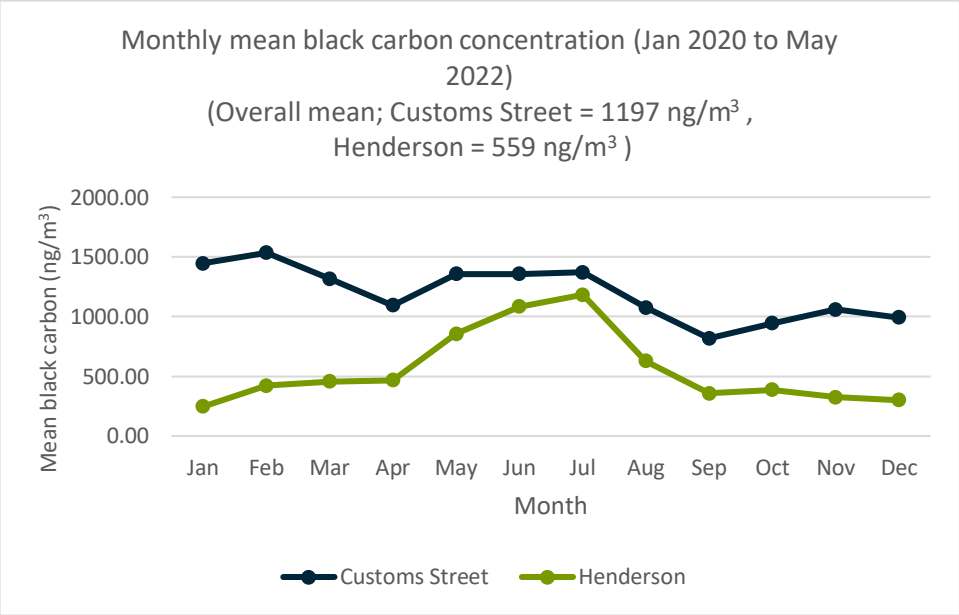

Figure 12. Temporal variation in monthly black carbon concentrations – Customs Street compared to Henderson site. Overall, Customs Street average black carbon concentration is 72.7 % more than Henderson average.

Figure 13. Trends in black carbon at Customs Street. The plot shows the deseasonalised monthly mean concentrations of black carbon. The solid red line shows the trend estimate and the dashed red lines show the 95% confidence intervals for the trend based on resampling methods. The overall trend is shown at the top-left as - 3.71 (ng/m^3) per year and the 95% confidence intervals in the slope from -5.59 – (- 2.07) ng/m^3/year. There is no clear trend in black carbon concentrations.

Find out more: EnvironmentAuckland.org.nz

Research and Evaluation Unit RIMU

Auckland Council
Te Kaunihera o Tāmaki Makaurau