IN THE MATTER OF	the Fast-track Approvals Act 2024 ("FTAA")
AND	
IN THE MATTER OF	an application for approvals by **NZ Transport Agency Waka Kotahi** to construct, operate and maintain the State Highway 1 Wellington Improvements project

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STATE HIGHWAY 1 WELLINGTON IMPROVEMENTS PROJECT
TECHNICAL REPORT #18 - AIR QUALITY ASSESSMENT

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1 INTRODUCTION

1. This report has been prepared by Andrew Curtis, a Technical Director at Pattle Delamore Partners Limited (PDP). I am the primary author of this report. I have been assisted by:

   i. Tara Potts who is a Senior Air Quality Scientist at PDP and was responsible for undertaking the dispersion modelling and assisted with drafting the operational effects assessment proportion of this report

   ii. Owen West who is an Air Quality Service Leader at PDP and was responsible for undertaking the construction effects assessment and assisted with drafting of the construction effects assessment proportion of this report

   iii. Shanon Lim who is an Air Quality Service Leader at PDP and was responsible for undertaking the initial stages of the dispersion modelling and assisted with drafting the operational effects assessment proportion of this report

2. In undertaking my assessment, I have relied upon the following experts and reports:

   i. SH1 Wellington Improvements Constructability Report, prepared by HoffCon.Pro

   ii. Technical Report #16, Contaminated Land Assessment prepared by Kevin Tearney

   iii. Tunnel design and construction information provided by the design team

Qualifications and experience

3. I have the following qualifications and experience relevant to this assessment:

   i. Bachelor's Degree in Chemical and Material Engineering from the University of Auckland

   ii. Post Graduate Diploma in Toxicology with Distinction from RMIT University, Melbourne

   iii. Post Graduate Certificate in Sustainable Management from the Open Polytechnic

   iv. Some recent or current projects where I have provided air quality advice include:

      - Primary author of the air quality assessment for the Ōtaki to North of Levin Highway project, and preparation of evidence for the Environment Court
      - Primary author of the air quality assessment for the Peka Peka to Ōtaki expressway, and preparation of evidence for the Board of Inquiry
      - Primary author of the air quality assessment associated with an assessment of options for an alternate crossing of the Waitemata Harbour
      - Primary Air Quality specialist for the construction of Puke Ahu / National War Memorial and Arras Tunnel
      - Primary Author of the Construction Air Quality Management Plan for Te Ara Nui o Te Rangihaeata / Transmission Gully
      - Co-author on the Clean Air Society of Australia and New Zealand ("CASANZ") "Good Practice Guide for the Assessment and Management of Air Pollution from Road Transport" (2021)

4. I am familiar with the site, having visited Wellington City many times over my professional career. I have also been assisted in my observations by site visits carried out by my Wellington based colleague Owen West.

Code of conduct

5. I confirm that I have read the code of conduct for expert witnesses contained in the Environment Court Practice Note 2023. This assessment has been prepared in compliance with that code, as if it were evidence being given in Environment Court proceedings. Unless I

state otherwise, this assessment is within my area of expertise, and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

Project description

6. The SH1 Wellington Improvements project (the Project) has been broken up into five sections. The sections are:

   i. Section 1 – Terrace Tunnel Duplication

   Terrace Tunnel duplication including widening of SH1 north and south of the tunnel, and realigned, longer Ghuznee Street overbridge

   ii. Section 2 – Te Aro Improvements

   Reconfiguration of Vivian Street and the Arthur Street / Cuba Street intersection to increase capacity of the SH1 route

   iii. Section 3 – Basin Reserve Improvements

   Reconstruction of the Basin Reserve roading network to achieve grade separation between SH1 traffic and north-south local road traffic. SH1 (Buckle Street) will pass over an extended Sussex Street that ties into Cambridge Terrace south of Barker Street

   iv. Section 4 – Mount Victoria Duplication

   Duplication of the Mount Victoria Tunnel to provide two southbound lanes on the north side of the existing tunnel

   v. Section 5 – Eastern Connections

   Widening of Wellington Road, and Ruahine Street, east of the Mount Victoria Tunnel to Evans Bay Parade

7. The complete details of the Project are described in full in the Proposal Description in the AEE, so are not repeated here.

Scope of assessment

8. My assessment addresses the following matters:

   i. The methodology I have used to assess the effects of the Project

   ii. The existing environment

   iii. Effects of the Project during operation

   iv. Effects of the Project during construction

   v. Benefits of the Project

   vi. Recommended measures to avoid, remedy or mitigate adverse effects

Assumptions and exclusions in this assessment

9. This assessment does not address any air quality effects that may be associated with asbestos or contaminated soils uncovered during the proposed works (in respect of which there are other legal requirements for safe working and disposal).

10. This assessment has included some arterial routes. The arterial routes chosen are predicted to have a decrease or increase in vehicle movements as part of the Project. However, not all arterial routes have been included.

11. This assessment takes into account predicted increases in the use of cleaner vehicles and the corresponding decrease in predicted air contaminant concentrations in 2053 when compared to 2033.

2 EXECUTIVE SUMMARY

Existing environment

12. The areas for the Project are located along the existing SH1, traversing land that is zoned city centre, high density residential, medium density residential, special purpose and open space zone in the Wellington District Plan. There are a significant number of sensitive receptors within close proximity to the Project.

13. The predominant wind directions recorded at Wellington Airport are from the north and the south. The varied terrain over the length of the proposed Project route will result in localised differences in wind speed and direction but will generally exhibit a similar pattern.

14. Existing air quality is below the relevant assessment criteria for relevant contaminants for most of the time, largely due to emissions from motor vehicles (e.g. PM_{10}, $PM_{2.5}$, and nitrogen dioxide (NO_2)).

Potential benefits of the Project

15. There will be a minor improvement in air quality effects along the southern portion of the Basin Reserve, but this change is not significant. It should be noted that all anticipated air quality changes are negligible and below the relevant guideline concentrations.

16. A reduction in concentrations from Mount Victoria Tunnel at some sensitive receptors is expected as a result of the decommissioning of the existing tunnel stacks, which currently discharge vehicle exhaust to the outside air.

17. The provision of a cycling and pedestrian facility through the new Mount Victoria Tunnel may result in fewer people using motor vehicles and fewer tailpipe emissions and improved air quality for the cyclists and pedestrians through the tunnel, but these are not matters this assessment considers.

18. My assessment also does not take into account the improvements in traffic flow, noting improvements in traffic flow will reduce tailpipe emissions, however this level of improvement has not been quantified.

Potential adverse effects without mitigation

19. I have assessed that the potential adverse effects of the Project include:

    i. An increase in road emissions along the northern proportion of the Basin Reserve as a result of the proposed traffic movement changes

    ii. An increase in concentration at some of the sensitive receptors due to the increase in portal emissions as a result of decommissioning the Mount Victoria Tunnel stacks

    iii. Nuisance dust impacts for sensitive receptors up to 200 metres from the working areas during construction

Proposed mitigation measures

20. The recommended measures to avoid, remedy or mitigate potential adverse air quality effects are summarised for the operation and construction of the Project.

Operation

21. The Project is not expected to result in any significant degradation of air quality, and therefore mitigation of the operational effects is not required.

Construction

22. Mitigation is recommended to manage construction phase air quality effects, in particular dust. The primary mitigation measure in relation to the construction of this project is through the implementation of a Construction Air Quality Management Plan (CAQMP), which is recommended as part of the proposed consent conditions. A summary of the mitigation measures are:

    i. The use of water tankers, sprinklers or fog cannons to dampen surfaces that have the potential to create dust
    ii. Limiting open areas of earthworks during drier months and windy conditions
    iii. Having a dedicated team to monitor environmental effects including air quality effects
    iv. Monitoring environmental conditions (e.g. weather and dust)

23. Subject to the mitigation measures contained in this report being implemented, the air quality effects of the Project are expected to be reduced so that they are not considered offensive or objectionable and below the relevant guidelines.

3 ASSESSMENT FRAMEWORK

NZTA technical publications or guidance documents

24. This air quality assessment has been undertaken in accordance with the following NZTA publication:

    i. Guide to assessing Air Quality Impacts from State Highway Project v3 ("NZTA Guide") (NZTA, 2025b)

Industry best practice or management guidance

25. The following industry best practice guidance has been consulted in preparing this assessment:

    i. Ministry for the Environment ("MfE") Good practice Guide for Assessing and Managing Dust ("MfE GPG Dust") (MfE, 2016)

    ii. MfE Good Practice Guide for Assessing Discharges to Air from Land Transport ("MfE GPG LT") (MfE, 2008)

    iii. MfE Good Practice Guide for Atmospheric Dispersion Modelling ("MfE GPG ADM") (MfE, 2004)

    iv. CASANZ, Good Practice Guide for the Assessment and Management of Air Pollution from Road Transport Projects ("CASANZ GPG") (CASANZ, 2023)

Relevant consents

26. I am not aware of any air quality consents relevant to the Project.

4 ASSESSMENT METHODOLOGY

Introduction

27. This air quality assessment has been undertaken in general accordance with the publications noted in section 3. Where the methodology used varies from the accepted best practice, this has been highlighted.

28. The assessment methodology primarily entails a desktop based assessment, although a site visit along the full length of the proposed roading development was completed.

29. The Air Quality Assessment is broken down into two sections. These are:

    i. The operational effects of the Project

    ii. The construction effects of the Project

Guidance and scope

30. The NZTA Environmental Plan (NZTA, 2008) sets formal objectives regarding air quality and the state highway network including:

    i. A1 – understand the contribution of vehicle traffic to air quality

    ii. A2 – ensure new state highway projects do not directly cause national environmental standards for ambient air quality to be exceeded

    iii. A3 – contribute to reducing emissions where a state highway network is a significant source of exceedances of the national air quality standards

31. This air quality assessment has been generally undertaken in accordance with accepted New Zealand best practice as set out in the guidance documents listed in section 3.

Approach to assessing effects – operational effects

32. The operational effects of the Project have been assessed using a methodology based on that set out in the NZTA Guide. This document set out an approach to determine the appropriate level of assessment required, when assessing the environmental effects from a specific roading project.

33. The NZTA Guide sets out a staged assessment as follows:

    i. Stage 1 – Environmental Screen. The environmental screen is an interactive online document that consists of a checklist of questions that is carried out for all projects during the indicative business case

    ii. Stage 2 – Preliminary technical assessment. The purpose of this assessment is to establish whether the Project (relative air quality impact) or cumulative air quality impact is likely to result in relevant air quality criteria being exceeded

    iii. Stage 3 – Technical Assessment. This level of assessment is based on detailed atmospheric dispersion modelling techniques and reliance on site-specific input data. This stage is designed to evaluate in detail the likely effects of air quality risks or opportunities arising from a project and feed this information back into the detailed design process. The assessment also aims to provide information on how potential effects can be mitigated

34. The Project's operational assessment uses a Stage 3 assessment. A Stage 3 assessment is required due to the Project being located in an urban area.

Operational Assessment – Criteria Pollutants

35. The following vehicle-related air pollutants have been identified in the NZTA Guide as having the potential to cause adverse health effects:

i. Gases – such as NO_2, carbon monoxide (CO) and volatile organic compounds (VOCs) such as benzene

ii. Particulate matter in different size fractions - e.g. PM_{10} and $PM_{2.5}$

36. From these pollutants the majority of ambient air quality health effects results from fine particulate matter (PM_{10} and $PM_{2.5}$) and NO_2. As a result, these pollutants have been assessed in this assessment.

Assessment scenarios

37. The NZTA Guide recommends the potential effects of the Project on the surrounding environment are predicted for three scenarios – the current situation (base year, 2018), the opening year (2033) and 20 years after opening (2053). Future scenarios are referred to as either “Without Project” / “Do Minimum”, or “With Project”.

38. The scenarios reflect the effect the Project will have on air quality, taking into consideration improvements in vehicle emissions over time and changes to the composition of the vehicle fleet. These scenarios also allow a ‘With’ and ‘Without Project’ / ‘Do Minimum’ comparison of air quality.

Sensitive Receptors

39. A ‘sensitive area’ or receptor is defined by the Greater Wellington Natural Resources Plan (NRP) as an area which includes (but is not limited to) dwelling houses, or marae, educational facilities, public places, public roads, surface water bodies and associated riparian vegetation. A ‘sensitive activity’ as defined in the NRP includes any residential activity, any early childhood education centre, and any hotel or other accommodation activity. It may also include hospitals and respite care facilities.

40. The Project area includes a large number of sensitive areas, including a number of residences in close proximity to SH1 which are potentially affected by changes in traffic patterns. A number of discrete receptors along the SH1 route were selected to provide a representation of the air quality effects of the various scenarios modelled and include residences, accommodation, parks and schools. These locations particularly focus on where the proposed alignment differs from the current SH1 alignment. The location and type of the selected receptors are provided in Table 1 and shown in aerial images in Figure 1 to Figure 3.

Table 1: List of Receptors

Receptor ID	Address	Receptor Type
R1	202 The Terrace	Accommodation
R2	Kelburn Park	Public Place
R3	140 Ghuznee Street	Accommodation
R4	Capital City Preschool, 3 MacDonald Crescent	School
R5	222 Willis Street	Accommodation
R6	2 Oak Park Avenue	Residential
R7	Cobblestone Park	Public Place
R8	25 Vivian Street	Accommodation
R9	War Memorial Park	Public Place
R10	Mount Cook Primary School	School
R11	Millie’s House, 79 Kent Terrace	School
R12	Basin Reserve	Public Place
R13	St Mark’s School	School
R14	66 Ellice Street	Residential
R15	Wellington East Girls’ College	School
R16	Hataitai Village	Public Place

Receptor ID	Address	Receptor Type
R17	Hataitai Park	Public Place
R18	Kilbirnie School	School
R19	140 Moxham Avenue	Church
R20	172A Moxham Avenue	Residential
R21	14 Henry Street	Residential
R22	Kilbirnie Park	Public Place
R23	32 Wellington Road	Residential
R24	St Patrick's College	School

Figure 1 – Selected Sensitive Receptors in Terrace Tunnel Project Area

Figure 2 – Selected Sensitive Receptors in Central Wellington Project Area

Figure 3 – Selected Sensitive Receptors in Mount Victoria/ Hataitai Project Area

Air Dispersion Modelling Methodology

41. A traffic emission and pollution dispersion model was set up and used to predict the concentration of the indicator pollutants at specific locations along the current SH1, key arterial routes and locations associated with the Project. The results of modelling were then used to assist in the assessment of air quality effects when the Project is operational.

42. The two atmospheric dispersion models used in this assessment were:

   i. CALPUFF (Version 7)

   ii. CAL3QHCR module of the CALROADS model

43. CALPUFF is extensively used in New Zealand and Australia and is a recommended model in the MfE GPG ADM, particularly for sites surrounded by complex terrain and/or in complex settings. This model has been used for assessing the tunnel emissions as per section 7.3.2.2 of the NZTA Guide; the tunnel emissions have been assessed through the use of a portal discharge jet.

44. For the roadway dispersion model, there are three commonly used dispersion models in Australia and New Zealand CAL3QHCR / AERMOD, CALPUFF and GRAL as per the CASANZ GPG. This assessment has used the CAL3QHCR model, while this is being phased out by the US EPA and replaced with AERMOD for some applications, I consider that this choice of model is still fit for purpose. CAL3QHCR has been used in the past for the surrounding area and has been specifically designed for modelling operational roading air quality effects. This model has been used for assessing the emissions from the operation of the road.

45. It is considered that the chosen models are appropriate for the Project.

46. To run the dispersion models, I used a three-year meteorological dataset (CALMET) running from 1 January 2017 to 31 December 2019 developed by Greater Wellington Regional Council (GWRC) for use in CALPUFF.

47. Meteorological data from the CALMET dataset was extracted for a single location for input CAL3QHCR. For simplicity the same meteorological data was used for the CAL3QHCR model, even though there will be slight differences due to terrain features, particularly along the eastern corridor. However, this approach is considered appropriate for the purposes of demonstrating the changes in air quality.

Traffic Assumptions

48. The following assumptions on roadway traffic have been made as part of the modelling assessment.

   i. Hourly traffic flows have been calculated based on daily traffic data vehicle count percentages provided in Table 3 which are taken from the Wellington Transport Strategy Model (WTSM)[1,2]

   ii. The vehicle fleet profile has been calculated as a ratio of the default NZTA Vehicle Emission Prediction Model ("VEPM") version 7.2

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[1] A constant HCV rate has been used for each road link with no hourly fluctuation assumed.

[2] Wellington Transport Strategy Model – this model is owned by the Wellington Transport Analytics Unit and used for all transport analysis across the Wellington Region

iii. Fleet compositions are based on the % Heavy Commercial Vehicles ("HCV") data sourced from the WTSM[3,4]

iv. Vehicle speeds have been sourced from the WTSM[5]

49. Vehicle speeds have been based on the average for the modelled section of road, rounded to the nearest whole number. No account has been made for variability encountered during peak traffic flow period.

Approach to assessing effects – Construction Effects

50. This assessment has qualitatively determined the air quality effects associated with the construction of the Project in accordance with the recommendations detailed in the MfE GPG Dust and the NZTA Guide. The primary pollutant of concern will be dust although some odour may be associated with the placement of asphalt or during disturbance of contaminated soils.

51. This assessment involved reviewing the activities that will be undertaken at a particular location and determining the potential for these activities to generate nuisance dust that might affect sensitive receptors. In determining whether there is the potential for nuisance to occur, consideration has been made of:

i. The nature of the activity being undertaken

ii. How long the activities are likely to occur

iii. The volume and nature of the soils or other material being cut or placed

iv. Mitigation measures implemented to control the potential for effects (e.g. use of water carts, covering stockpiles etc)

v. How close receptors are to the work areas

vi. The nature of the receptors and their sensitivity to dust

vii. The prevailing meteorological conditions

viii. The effectiveness of mitigation measures

[3] A constant HCV rate has been used for each road link with no hourly fluctuation assumed.

[4] Wellington Transport Strategy Model – this model is owned by the Wellington Transport Analytics Unit and used for all transport analysis across the Wellington Region

[5] Wellington Transport Strategy Model – this model is owned by the Wellington Transport Analytics Unit and used for all transport analysis across the Wellington Region

5 TRAFFIC AND EMISSION MODELLING

52. The number, age and type of vehicles have a critical impact on the type and volume of contaminants from the vehicle fleet. This section details the approach taken and data used to model the vehicle fleet's emissions.

Road links inputted into the model

53. For the operational air dispersion model, the current SH1 and SH1 Project changes have been included. Local or arterial roads have been included where there is likely to be a change in traffic volumes as a result of the Project.

54. The road link data was provided as a spreadsheet downloaded from the WTSM for different locations along SH1. The roads have been separated as per Table 2.

55. The road links inputted into the model are presented in Annexure A.

Table 2: Road Link Segments

Street Name	Between
Basin Reserve	Mount Victoria Tunnel and Karo Drive
Buckle Street	Before Cambridge Terrace
Cable Street	Jervois Quay and Oriental Parade
Cambridge Terrace	Wakefield Street and Vivian Street
Ghuznee Street	The Terrace and Victoria Street
Jervois Quay	Hunter Street and Cable Street
Karo Drive	Basin Reserve and Terrace Tunnel
Kent Terrace	Wakefield Street and Basin Reserve
Moxham Ave	Wellington Road and Waitoa Road
Mount Victoria Tunnel	Basin Reserve and Ruahine St
Oriental Parade	Cable Street and Grass Street
Ruahine Street	Mount Victoria Tunnel and Wellington Road
Terrace Tunnel	Aurora Terrace Overbridge and Vivian Street
The Terrace	Abel Smith Street and SH1 offramp
Wellington Road	Ruahine St and Cobham Drive
Willis Street	Ghuznee Street and Karo Drive
Vivian Street	Terrace Tunnel and Kent Terrace

Traffic Flow

56. The road traffic data was provided from the WTSM for 2018 (base year), 2033, and 2053 as a five day average (weekend traffic excluded).

57. The daily traffic count for each direction and a daily percentage of heavy vehicles for each section of the road was also provided from the WTSM. The 2033 and 2053 data was provided from the WTSM for three scenarios, 'Without Project'/ 'Do Minimum', 'With Project' and 'With Project and Tolling".

58. A summary of the traffic data used in this assessment is presented in ANNEXURE B Traffic Data.

59. Hourly Traffic data has been calculated using the AM and PM peak flows. A high-level analysis of the 2033 traffic modelling data showed that the Terrace Tunnel and Mount Victoria Tunnel had slightly different hourly flows with the northbound and southbound traffic showing different peak volumes. As a result, I have incorporated four hourly scenarios, depending on road direction and location in this assessment. The same hourly breakdown has been used for

the “With Project” and “Do Minimum” / “Without Project” scenarios as the high-level analysis of the data showed minimal changes between these scenarios. The hourly breakdown used is as follows (with the data provided in Table 3):

i. Terrace Tunnel and north of Wellington northbound

ii. Terrace tunnel and north of Wellington southbound

iii. All other roads northbound

iv. All other roads southbound

Table 3: Hourly Traffic Breakdown (as a percentage of daily traffic)

Hour	Terrace (Northbound)	Terrace (Southbound)	All Other Roads (Northbound)	All Other Roads (Southbound)
0	1.7%	1.5%	1.7%	1.6%
1	1.7%	1.5%	1.7%	1.6%
2	1.7%	1.5%	1.7%	1.7%
3	1.7%	1.5%	1.7%	1.7%
4	1.7%	1.5%	1.7%	1.7%
5	1.7%	1.5%	1.7%	1.7%
6	5.0%	7.2%	6.2%	5.9%
7	5.0%	7.2%	6.2%	5.9%
8	5.0%	7.2%	6.2%	5.9%
9	5.8%	5.8%	5.7%	5.7%
10	5.8%	5.8%	5.8%	5.7%
11	5.8%	5.8%	5.8%	5.7%
12	5.8%	5.8%	5.8%	5.7%
13	5.8%	5.8%	5.8%	5.7%
14	5.8%	5.8%	5.8%	5.7%
15	8.2%	7.0%	7.1%	7.7%
16	8.2%	7.0%	7.1%	7.7%
17	8.2%	7.0%	7.1%	7.7%
18	4.3%	3.8%	4.2%	4.2%
19	4.3%	3.8%	4.2%	4.2%
20	1.7%	1.5%	1.7%	1.7%
21	1.7%	1.5%	1.7%	1.7%
22	1.7%	1.5%	1.7%	1.6%
23	1.7%	1.5%	1.7%	1.6%

60. Weekend traffic volumes have not been provided for the Project. To assess the potential changes in the traffic volumes, I have used data from the Wellington Transport Analytics Unit[6] to provide a qualitative assessment.

61. Holiday traffic patterns have not been included in this assessment. It is likely that the vehicle numbers will fluctuate over holiday periods, therefore, using weekday traffic provides a more conservative assessment and best represents daily traffic volumes.

Vehicle Speed

62. Network vehicle speed data was provided from the WTSM. This data has been rounded to the nearest whole number.

[6] https://wellingtontransportanalytics.co.nz/state-highway-traffic-volumes-dashboard

63. The predicted vehicle speeds were provided for 2018, 2033 (“With Project”, “Do Minimum” and “With Tolling”), and 2053 (“With Project”, “Do Minimum” and “With Tolling”).

Vehicle Fleet Profile

64. HCV data for the base year of 2018 and the Project HCV data for 2033 and 2053 was provided by the WTSM. Detailed fleet composition was not available for this assessment and is required in VEPM. Therefore, the default fleet profile in VEPM was used to obtain the proportion of vehicles within each category including cars, LCV, HCV, and buses against the overall percentage of HCV provided by the WTSM.

Road Gradients

65. As this assessment focused on the change in air quality between the different scenarios, the current and proposed changes to the road gradient have not been taken into account. It is likely that this will increase and decrease vehicle emissions in some areas, however this is likely to occur for all scenarios, meaning that the change in air quality is unlikely to significantly change with the inclusion of road gradients.

Emission Modelling Methodology

66. The VEPM vehicle emission model was used in conjunction with the traffic data provided from the WTSM to determine emission rates for NO_2, PM_{10}, $PM_{2.5}$ for the scenarios modelled.

67. VEPM was selected in accordance with current industry best practice. VEPM provides emission factors for various pollutants for a range of vehicle fleet categories including passenger cars, LCV and HCV. VEPM uses these emission factors in combination with a fleet profile to obtain a fleet average emission factor.

68. The default fleet profile provided by VEPM for 2018, 2033 and 2053 takes into account changes to the vehicle fleet composition. For example, the percentage of electric vehicles greatly increases between 2018 and 2053. This is a primary driver of the reduction in emission rates.

69. The emission factors consider a number of variables including:

    i. Assessment year
    ii. Road gradient
    iii. Heavy vehicle load
    iv. Impact of cold engine operation
    v. Impact of road degradation
    vi. Average trip length
    vii. Ambient temperature
    viii. Average vehicle speeds
    ix. Fleet profile

70. The following VEPM values have been used as inputs into the model (all inputs are VEPM default values except for the average trip length):

    i. Average trip length (car and LCV) = 8 km
    ii. Average trip length (bus and HCV) = 44 km
    iii. Heavy vehicle: load = 50%

iv. Ambient temperature = 13.1°C[7]

v. Consider cold start = yes

vi. Consider degradation = yes

71. Short distance journeys create more emissions on a per kilometre basis due to the engine running when cold, therefore reducing the average trip length is deemed to be conservative.

72. The VEPM emission factors and vehicle flow numbers are presented in Tunnel Portal Modelling

73. The tunnel emissions have been modelled using the CALPUFF dispersion model software, which is an approved model in New Zealand. In order to model the portal emissions these have been calculated using the approach developed by Ginzburg and Schattanek (1997). This approach models a portal plume, with the distribution of contaminants based on the tunnel configuration, and is a method stated in the NZTA Guide for modelling tunnel emissions.

74. The existing stacks on the Mount Victoria Tunnel have been modelled in the CALPUFF model for the existing scenario.

75. Road tunnels restrict the dispersion of pollutants emitted by traffic travelling through the tunnels and results in an increased concentration of the contaminants, which in unventilated tunnels are emitted from the tunnel portals.

76. The concentration of the contaminants in the tunnel discharges is proportional to tunnel length, and can result in much higher ground level concentrations of contaminants in the vicinity of the portals compared to those seen on open portions of a road.

77. As the air flow through the tunnels is largely independent of traffic volumes, I have run three scenarios. These are:

i. Mount Victoria Tunnel – Current Set-up (Portal and Stack emissions)[8]

ii. Mount Victoria Tunnel – Proposed Set-up (Portal emissions)

iii. Terrace Tunnel – Current and Proposed Set-up (Portal emissions)

78. Changes in air quality will be determined by the vehicle emission rates calculated using VEPM, with 2018 having the highest emission rate and 2053 having the lowest.

79. The tunnel emissions have been provided as hourly emissions rates by WSP for NOx and PM_{10}.

i. The NO_2 emission rate was derived using the NOx:NO_2 ratio from VEPM (0.566:0.129 for 2018 and 0.343:0.085 for 2033)

ii. The $PM_{2.5}$ emission rate was derived using the PM_{10}:$PM_{2.5}$ ratio from VEPM (0.043:0.050 for 2018 and 0.041:0.028 for 2033).

80. Ginzburg and Schattanek provide guidance on how to estimate the distribution of portal emissions as they exit the tunnel. The following assumptions were used:

i. Average traffic speed of 46 km/h, with an average wind speed of 4 m/s. This equates to a jet length of 105 m

ii. The volume source was separated into three 35 m volume line sources. With the volume source width equal to the width of the tunnel

[7] The average temperature in Wellington between 1 January 2020 and 31 December 2024 is 14.3°C.

[8] As stated above, the Project involves the decommissioning of the Mount Victoria Tunnel Stacks, which is why it is not assessed in the Proposed Set-up scenario.

iii. The emissions decrease as the jet moves further away from the tunnel portal. The breakdown is as follows:

- Source 1: 57% of the emissions
- Source 2: 31% of the emissions
- Source 3: 12% of the emissions

81. The stack emissions were modelled using the stack parameter data provided by WSP. This is:

i. Assumed stack height of 2 m above ground level

ii. Assumed exit temperature of 25°C

iii. Exit velocity of 7.7 m/s. This is based on the air flow rate provided by the traffic engineers

iv. Stack diameter of 2.5 m

82. I have not assessed the contaminant concentrations that could be experienced within the tunnels.

6 AIR QUALITY ASSESSMENT CRITERIA

83. To determine the adverse effects of the contaminants discharged for the Project's construction and operational scenarios, the predicted pollutant impacts and concentrations are compared against the relevant amenity and health effect assessment criteria.

Operational Air Quality Guidelines

84. As per the NZTA Guide, the air quality assessment criteria set out in Table 4 and Table 5 has been used in this assessment. The NZTA Guide notes that the World Health Organisation (WHO) guidelines (updated in 2021) have not been formally adopted in New Zealand and are not recommended to be used as assessment criteria. The NZTA Guide criteria are set out in Table 4.

85. The NZTA's recommended assessment method assumes that if the levels for the indicator pollutants are below those shown in Table 4, then levels of other pollutants are also likely to meet acceptable criteria.

86. NZTA has also developed some significance criteria which are set out in the NZTA Guide and provided in Table 5. These criteria are used to determine the risk of an adverse air quality impact associated with the Project.

Table 4: Key ambient air quality criteria for road-transport related air pollutants

Pollutant	Concentration ($\mu g/m^3$)	Averaging Period	Protection	Standard/Guideline
PM_{10}	50[9]	24-hour	General population	NES-AQ
	20	Annual	General population	NZAAQG
$PM_{2.5}$	25	24-hour	General population	NZAAQG
NO_2	200[10]	1-hour	General population	NES-AQ
	100	24-hour	General population	NZAAQG
	40	Annual	General population	2005 WHO AQG

Table 5: NZTA Air Quality Significance Criteria

Pollutant	Limit ($\mu g/m^3$)	Averaging Period	Project contribution[11]	Cumulative contribution[12]
PM_{10}	50	24-hour	10%	90%
NO_2	40	Annual	10%	90%

MfE Significance Criteria for Incremental Analysis

87. MfE has recommended a set of criteria to determine whether the predicted concentrations of road traffic pollutants are likely to be 'significant' (MfE GPG LT). MfE states that these are absolute criteria, not related to existing air quality, and are to be used for incremental analysis only. The significance criteria relevant to this assessment are presented in Table 6.

[9] One exceedance allowed in a 12-month period.

[10] Nine exceedances allowed in a 12-month period.

[11] The project contribution is the concentration predicted for only the road/link under consideration as a percentage of the relevant guideline.

[12] The cumulative contribution is the concentration predicted for the project plus the estimated background air quality at that location as a percentage of the guideline.

Table 6: MfE Ambient Air Quality Significance Criteria

Pollutant	Significant Criteria Concentration (μg/m³)	Averaging Period
PM_{10}	2.5	24-hour
	1.0	Annual
$PM_{2.5}$	1.3	24-hour
NO_2	20	1-hour
	5	24-hour

Construction Air Quality Guidelines

88. The following assessment criteria have been identified in the MfE GPG Dust as being relevant to the construction assessment:

    i. Resource Management (National Environmental Standards for Air Quality) Regulations 2004 (NES-AQ)

    ii. New Zealand Ambient Air Quality Guidelines (NZAAQG) (MfE, 2002)

    iii. Objectives and policies in some regional plans

National Environmental Standards and Ambient Air Quality Guidelines

89. The NES-AQ and NZAAQG set out ambient concentration limits for PM_{10}. As this assessment is a qualitative assessment, these standards do not apply.

Regional Guidelines

90. The Natural Resources Plan for the Wellington Region (NRP) sets out the following objectives that relate to the construction dust assessment criteria.

"Objective O39

Ambient air quality is maintained or improved to the acceptable category or better in Schedule L1 (ambient air).[13]

Objective O41

The adverse effects of odour, smoke and dust on amenity values and people's well-being are minimised".

MfE GPG Dust

91. The MfE GPG Dust sets out suggested mitigation trigger levels for total suspended particulates (TSP) and PM_{10} and these have been outlined in Table 7 and Table 8 respectively.

92. These trigger levels are regularly adopted throughout the country for construction, roading and quarry projects.

[13] Schedule L of the NRP sets regional ambient air quality targets, with 'acceptable' values for environmental performance indicator categories (at between 33% and 66% of the NAAQG value) and for a range of specific pollutants.

Table 7: Suggested mitigation trigger levels for total suspended particulate (TSP)

Trigger	Averaging Period	Sensitivity of receiving environment		
		High	Moderate	Low
Short term	5 min	250 µg/m^3	n/a	n/a
Short term	1 hour	200 µg/m^3	250 µg/m^3	n/a
Daily	24 hours (rolling average)	60 µg/m^3	80 µg/m^3	100 µg/m^3
Wind warning	1 minute	10 m/s (during two consecutive 10-minute periods)		
Rain warning	12 hours	There has been no rain the previous 12 hours		
Visible Dust	Instantaneous	Visible dust crossing the boundary		

Table 8: Suggested mitigation trigger levels for PM_{10}

Trigger	Averaging Period	Sensitivity of receiving environment		
		High	Moderate	Low
Short term	1-hour	150 µg/m^3	n/a	n/a

7 EXISTING ENVIRONMENT

Introduction

93. The following sections provide a description of the surrounding land use and topography and provides an overview of the meteorological and air quality environment in the area in which the Project is proposed.

Land use and Topography

94. The Project areas are located on the existing SH1 through land that is zoned city centre, high density residential, medium density residential, special purpose and open space zone in the Wellington District Plan (depending on the section of road).

95. Figures showing the land use of the area along the Project route are presented in the Project drawings. The topography is relatively flat with height increasing to the north and east of the Project.

Meteorology

96. The Meteorological Service of New Zealand (MetService) operates the electronic weather station (EWS) located at Wellington International Airport. The data has been reviewed from the MetService Site (January 2020 to December 2024) located at Universal Transverse Mercator (UTM) 316,234 m E and 5,421,676 m S, Zone 60S. This station is located approximately 2 km southeast of Mount Victoria Tunnel.

97. The windrose for the MetService weather station is presented in Figure 4 for the 5-year period between January 2020 and December 2024.

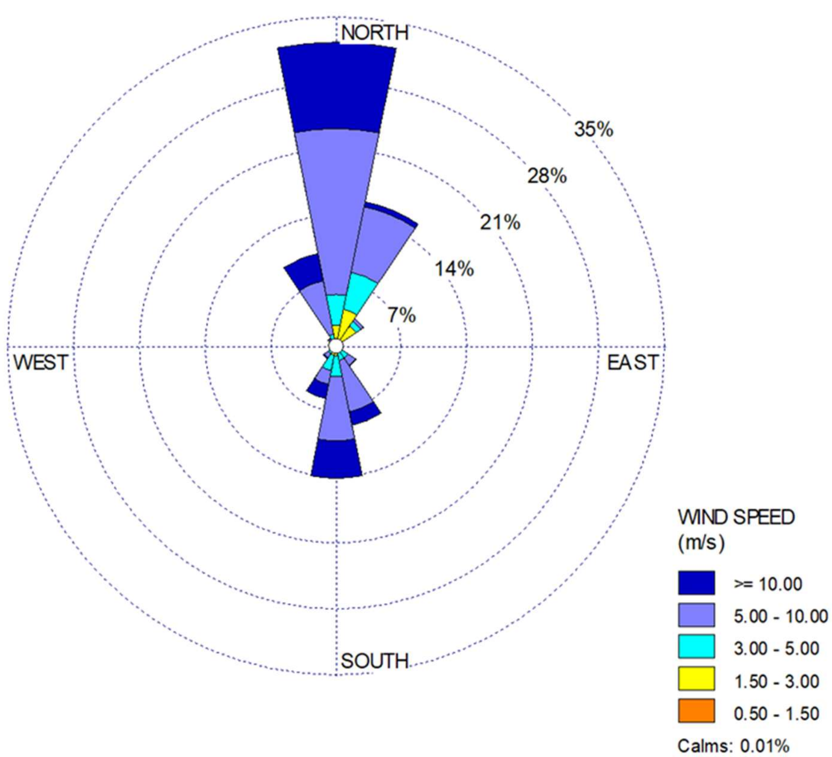

Figure 4 – Wellington Airport Metservice Windrose January 2020 to December 2024

98. The windrose indicates that the predominant wind directions at the airport are from the north and south. The winds from the northerly directions (northwest to northeast) occur approximately 63% of the time and the winds from the southerly directions (southeast to southwest) occur approximately 33% of the time. The average wind speed recorded was 6.9 m/s, while calms occurred 0.01% of the time.

99. For comparison, Auckland Airport has an average wind speed of 4.6 m/s (2021 to 2025 data), with calm winds being observed 3.1% of the time.

100. The greater percentage of strong winds and lower calms means that there is greater atmospheric mixing in Wellington which improves the dispersion of any compounds discharged to air.

101. Terrain changes will have a localised effect on the wind speed and direction within the Project area. The Project area to the west of Mount Victoria will likely have lower wind speeds and slightly different wind directions. However, I am not aware of any permanent weather stations currently located in this area. As a result, our assessment has used synthetic weather data to estimate the likely meteorological conditions in this area. This data was derived from a CALMET dataset developed by GWRC for use by the air quality community as inputs to the commonly-used dispersion model, CALPUFF.

Existing Air Quality

102. As outlined in the section 4, the three key pollutants associated with vehicle emissions are NO_2, PM_{10} and $PM_{2.5}$. The following section presents an analysis of the data used to estimate the background concentrations for the criteria pollutants within the Project area.

103. Background data has then been used in this assessment to assess cumulative concentrations, i.e. road contribution plus background contributions, from all other activities. The monitoring data takes into account the current emissions from vehicles within the Project area and as a result the cumulative concentrations are likely to be overpredicting the actual concentrations.

104. The predicted air quality impacts from a road project are combined with the background air quality to determine whether the air quality criteria are likely to be exceeded. If the air quality criteria is exceeded, further analysis of the background data will be undertaken to determine the proportion of emissions that are vehicle related so these can be excluded and not double counted.

105. There are a number of sources that can be used to determine the background air quality along the proposed alignment. These are:

i. GWRC monitoring data

ii. NZTA passive NO_2 monitoring

iii. NZTA background air quality dataset[14]

GWRC Monitoring Data

106. GWRC has undertaken air quality monitoring of the Wellington Airshed at the intersection of Vivian and Willis Street since 2015. This monitoring data will be heavily influenced by traffic emissions, alongside home heating and sea spray. A summary of the criteria pollutant monitoring data is presented in Table 9.

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[14] https://www.nzta.govt.nz/roads-and-rail/highways-information-portal/technical-disciplines/environment-and-sustainability-in-our-operations/environmental-technical-areas/air-quality/background-air-quality/

Table 9: GWRC Monitoring Station Data (Vivian and Willis Street intersection)

Contaminant	Averaging Period	2020	2021	2022	2023	2024	2025
		(µg/m³)					
PM_{10}	Maximum 24-hour	33.5	37.0	31.1	37.7	36.4	30.2
	2nd highest 24-hour	30.3	33.2	28.3	32.3	30.1	29.7
	75th percentile 24-hour	15.0	14.8	14.9	15.8	15.8	15.7
	Annual	12.6	12.7	12.3	12.9	13.1	13.1
$PM_{2.5}$	Maximum 24-hour	18.5	14.9	11.3	14.9	13.7	12.0
	2nd highest 24-hour	15.9	14.3	11.2	11.9	13.6	11.9
	75th percentile 24-hour	6.7	6.6	6.4	6.3	6.4	6.1
	Annual	5.5	5.5	5.3	5.3	5.5	5.1
NO_2[15]	Maximum 1-hour	63.3	67.4	66.1	55.9	59.7	59.7
	2nd highest 1-hour	62.6	64.1	64.0	55.1	57.2	59.5
	75th percentile 1-hour	15.9	14.9	14.9	14.1	14.1	13.8
	Maximum 24-hour	35.7	37.7	32.0	28.8	33.8	32.9
	2nd highest 24-hour	32.7	35.3	31.9	28.1	31.6	30.8
	75th percentile 24-hour	15.5	14.4	14.5	13.9	13.5	13.6
	Annual	11.6	11.0	10.9	10.4	10.6	10.3

Airsheds

107. In 2005 the regional councils and unitary authorities identified a number of areas throughout New Zealand where ambient concentrations of air pollutants could reach levels higher than the MfE promulgated NES-AQ. These areas have been called airsheds. Airsheds serve as a management tool for regional councils to assist with controlling levels of pollutants within that area. Regional councils have the responsibility to monitor concentrations of air pollutants within these airsheds, and must implement rules and regulations to ensure that air quality is maintained at levels below the relevant NES-AQ standard.

108. The Project areas are located within the gazetted Wellington Airshed. This area is not considered to be a polluted airshed by GWRC.

NO_2 Passive Sampling

109. NZTA has set up a network of passive NO_2 monitoring sites at various locations across New Zealand (NZTA, 2025c). Passive NO_2 samplers are low-cost and provide an indicative long term (monthly) concentration of NO_2 concentration. NZTA has three samplers within the Project area, and a summary of the data is provided in Table 10.

110. The highest NO_2 concentrations are located on Rugby and Sussex Street, next to the Basin Reserve, with the highest monthly concentration of 41 µg/m³. Annually there is a slight decrease in emissions, which reflect technology upgrades to the vehicle fleet.

Table 10: NO_2 Passive Monitoring Data

Location	Averaging Period	2020	2021	2022	2023	2024
		(µg/m³)				
Rugby and Sussex Street (WEL008)	Maximum Monthly	39.3	37.4	35.2	41.0	35.4
	Annual	29.8	29.2	26.5	27.3	26.5
Kilbirnie Cresent and Wellington Road (WEL050)	Maximum Monthly	20.9	26.5	22.0	29.9	23.9
	Annual	15.8	19.8	17.0	18.6	17.7
	Maximum Monthly	23.4	23.3	21.3	24.2	21.9

[15] The NO_2 monitoring station was offline from 12 November 2024 until 9 April 2025.

Location	Averaging Period	2020	2021	2022	2023	2024
		($\mu g/m^3$)				
Vivian and Willis Street (WEL073)	Annual	15.4	16.0	16.3	15.9	15.0

NZTA Background Ambient Air Quality

111. NZTA developed an estimate of default background air quality levels across New Zealand. The background air quality levels are provided on a census area unit (CAU) basis. The Project transverses across six CAU units, with the data provided in Table 11.

112. The highest background air quality concentration for each criteria pollutant is:

i. Annual NO_2 = 16.0 $\mu g/m^3$ (Lambton)

ii. 24-hour PM_{10} = 33.9 $\mu g/m^3$ (Kilbirnie West – Hataitai South)

iii. Annual PM_{10} = 12.9 $\mu g/m^3$ (Kilbirnie West – Hataitai South)

iv. 24-hour $PM_{2.5}$ = 16.3 $\mu g/m^3$ (Kilbirnie West – Hataitai South)

v. Annual $PM_{2.5}$ = 5.7 $\mu g/m^3$ (Kilbirnie West – Hataitai South)

113. In comparison the background concentrations for the Newton (Auckland City) motorway intersections are between 10% and 33% higher than those observed in Wellington. This indicates that Wellington has relatively "good" air quality for a city centre. This is likely due to the lower vehicle numbers and the well-ventilated nature of the city (i.e. it is windier).

Table 11: NZTA Background Concentrations

Census Area Unit	Criteria Pollutant	Averaging Period	Background Concentration ($\mu g/m^3$)
Lambton	PM_{10}	24-hour	32.5
		Annual	12.4
	$PM_{2.5}$	24-hour	15.6
		Annual	5.5
	NO_2	Annual	16.0
Willis Street – Cambridge Terrace	PM_{10}	24-hour	24.4
		Annual	12.5
	$PM_{2.5}$	24-hour	12.0
		Annual	5.5
	NO_2	Annual	15.3
Mount Cook – Wallace Street	PM_{10}	24-hour	31.3
		Annual	11.9
	$PM_{2.5}$	24-hour	15.0
		Annual	5.3
	NO_2	Annual	10.1
Mount Victoria West	PM_{10}	24-hour	32.9
		Annual	12.5
	$PM_{2.5}$	24-hour	15.8
		Annual	5.5
	NO_2	Annual	7.9
Hataitai North	PM_{10}	24-hour	33.5
		Annual	12.8
	$PM_{2.5}$	24-hour	16.1
		Annual	5.6
	NO_2	Annual	6.0
Kilbirnie West-Hataitai South	PM_{10}	24-hour	33.9
		Annual	12.9

Census Area Unit	Criteria Pollutant	Averaging Period	Background Concentration (µg/m^3)
	$PM_{2.5}$	24-hour	16.3
		Annual	5.7
	NO_2	Annual	9.7

Background concentrations used in this assessment

114. Using the data provided in paragraphs 102 to 112, I have derived background concentrations for the Project area which are provided in Table 12.

115. The background NO_2 concentration used in this assessment already incorporates the effects of NO to NO_2 conversion from existing road traffic emissions. Additional NO_2 formation resulting from ozone conversion of NO emitted by the proposed activity has not been included, as any incremental increase is expected to be negligible given that ambient ozone is likely to be largely depleted through reactions with existing NO sources in the area.

116. The NZTA background NO_2 concentration has been used as the background concentration because it is similar to the annual passive monitoring data at two of the monitoring locations. When compared to the ambient monitoring results, the NZTA background concentration is considered conservative as the maximum annual NO_2 concentration measured by GWRC is 11.6 µg/m³, Therefore, I consider it appropriate to use the NZTA background concentration for annual NO_2.

Table 12: Background Concentrations used in this assessment

Criteria Pollutant	Averaging Period	Background Concentration (µg/m^3)	Source
PM_{10}	24-hour	30.8	Average 2nd highest 24-hour concentrations at Vivian and Willis Street intersection
	Annual	12.7	Average annual concentrations at Vivian and Willis Street intersection
$PM_{2.5}$	24-hour	13.4	Average 2nd highest 24-hour concentrations at Vivian and Willis Street intersection
	Annual	5.4	Average annual concentrations at Vivian and Willis Street intersection
NO_2	1-hour	60.6	Average 2nd highest 1-hour concentrations at Vivian and Willis Street intersection
	24-hour	31.9	Average 2nd highest 24-hour concentrations at Vivian and Willis Street intersection
	Annual	16.0	NZTA background data - Lambton

8 BENEFITS OF THE PROJECT (POSITIVE EFFECTS)

117. The air quality assessment has not identified any material positive air quality effects as a result of the Project. For clarity, a positive effect might occur when a project results in an improvement in air quality. This assessment has not identified any significant improvement in air quality as a result of the Project. All air quality changes are negligible and below the relevant guideline concentrations.

118. A minor improvement is observed along the southern edge of the Basin Reserve; however this decrease in concentration is not considered significant.

119. There may be reduction in concentrations from Mount Victoria Tunnel at some sensitive receptors as a result of the decommissioning of the tunnel stacks (which currently discharge vehicle exhaust to the outside air).

120. With the decommissioning of the tunnel stacks, Receptor 15 observes a reduction in concentrations, with the cumulative 99.9%ile 1-hour NO_2 concentration decreasing from 53% of the guideline to 48%, the 24-hour NO_2 concentration decreasing from 41% to 40% of the guideline. The annual NO_2 concentration increases slightly from 42% to 43% of the guideline. The 24-hour PM_{10}, $PM_{2.5}$ and annual PM_{10} concentrations are also predicted to change by a similar percentage.

9 ASSESSMENT OF OPERATIONAL EFFECTS

121. The NZTA Guide recommends that a staged assessment approach is undertaken. This is as follows:

    i. Environmental screen

    ii. Preliminary technical assessment

    iii. Technical assessment

122. Due to the location of the Project, a full technical assessment has been requested. As a result, I have not undertaken an environmental screen or preliminary technical assessment.

123. For the operational effects, the air quality assessment has been split into two types of emissions:

    i. Emissions from vehicles using the road

    ii. Portal and stack emissions from the tunnels

Assessment of Operational Roading Emissions

124. This section of the report presents the results of the road traffic pollution dispersion modelling assessment for the Project. The modelling scenarios 2018 (Base year), 2033 ('Without Project'/'Do Minimum' and 'With Project') and 2053 ('Without Project'/'Do Minimum' and 'With Project') were run to determine the concentrations of air pollutants for the Project. The 'With Project and Tolling' scenario has been assessed separately in section 9.2.

125. NO_2, PM_{10} and $PM_{2.5}$ concentrations were predicted for all areas along the Project.

126. The 1-hour NO_2, 24-hour NO_2, annual NO_2, 24-hour PM_{10}, annual PM_{10}, and 24-hour $PM_{2.5}$ concentrations at each of the sensitive receptors, the percentage of the guideline value, and the significance of predicted change based on the MfE significance of change criteria is provided in ANNEXURE D Roading Assessment Predicted Concentration for the road assessment and ANNEXURE E Tunnel Assessment Predicted Concentrations for the tunnel emissions.

127. To determine the potential cumulative air quality effects at a receptor from road and tunnel emissions, I have added the peak concentrations from each model output. This is likely to overestimate the actual effects at the receptor as it is unlikely that the peak concentrations from the road and tunnel will occur on the same day, under the same meteorological conditions. However, in the first instance I consider this to be an appropriate screening method to determine whether an exceedance of the relevant guideline is predicted to occur.

128. As I have noted in Section 5, the road emissions are primarily driven by the emission rates calculated using VEPM. This tool takes into account the predicted uptake of electric vehicles resulting in lower emission rates in 2053, when compared with 2033 and 2018. However, if the overall number of vehicles using the road greatly increases this could outweigh the benefits.

129. In addition to this, I have modelled the road emissions as free-flowing traffic. A sensitivity analysis has been provided in Paragraphs 165 to 170 to quantify the air quality changes that could be observed with the Project improving traffic movement.

130. A limit of the roading air dispersion model is that it can only assess one contaminant and one year at a time. To reduce the number of modelling runs undertaken, I modelled the 2018 NO_2 emissions rates for three meteorological years (2017-2019), to determine which year resulted in the highest concentrations at the sensitive receptors. This was the 2017 meteorological

dataset. As a result, the following subsections only show the results for the 2017 modelling year.

131. The following analysis provides a summary of the key results from the air dispersion modelling assessment for each of the Project sections.

132. As the 1-hour NO_2 concentrations result in the highest roading emissions I have only presented figures for these concentrations. Other contaminants and averaging periods not shown will have a similar trend.

Terrace Tunnel (Section 1)

133. The closest receptors to the Terrace Tunnel are receptors 1-6 (see Figure 5). These receptors experience the highest concentrations in 2018 (except for R1 which experiences the highest concentration in 2033 "With Project").

134. The concentrations for the "With Project" scenario are slightly higher than the "Without Project" Scenario for all contaminants, however this change in concentration is not significant using the criteria in Table 6.

135. The maximum concentration in 2033 "With Project" at a receptor is provided in Table 13. The emissions from the Terrace Tunnel portal contribute the highest percentage of off-site concentrations for the short-term effects, however on an annual basis, the road and tunnel emission contributions are similar.

136. Table 13 shows that Receptor 3 is largely impacted by the emissions from the Terrace Tunnel with these emissions alone resulting in close to 50% of the 99.9%ile NO_2 guideline concentration. However, the cumulative effects show that Receptor 3 is below the relevant guideline concentration for all contaminants assessed.

137. The Terrace Tunnel emissions are not predicted to change as a result of the Project due to the air flow through the tunnel being similar, and the Project is not predicted to significantly increase the air quality effects at the receptors.

Table 13: Section 1 – Maximum Concentration at a Sensitive Receptor (R3) – 2033 With Project

Criteria Pollutant	Averaging Period	Road	Terrace Tunnel	Background Concentration	Cumulative Concentration	Guideline
		($\mu g/m^3$)				
PM_{10}	24-hour	1.3	5.1	30.8	37.2 (74%)	50
	Annual	0.4	0.5	12.7	13.6 (68%)	20
$PM_{2.5}$	24-hour	0.8	3.5	13.4	17.7 (71%)	25
NO_2	99.9%ile 1-hour	8.7	95.3	60.6	164.6 (82.3%)	200
	24-hour	3.1	22.5	31.9	57.5 (58%)	100
	Annual	1.1	2.0	16.0	19.1 (48%)	40

138. Figure 5 presents the 99.9%ile 1-hour NO_2 2033 "With Project" concentrations from road emissions. The background concentrations and tunnel concentrations are not shown.

139. Figure 5 shows that the highest concentrations are observed at the Terrace Tunnel.

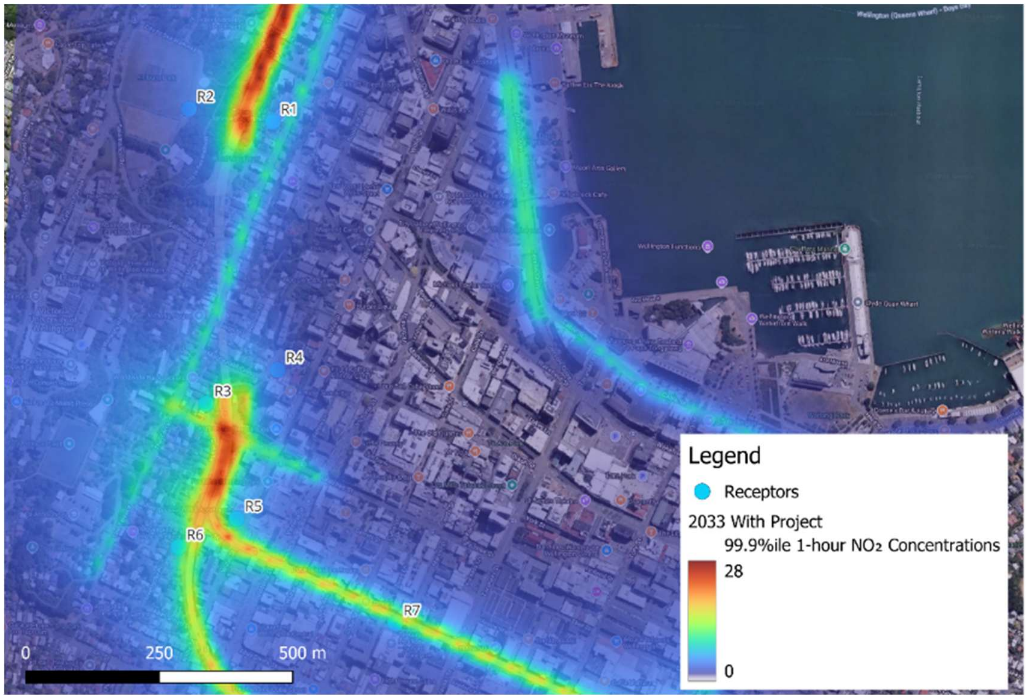

Figure 5 – 99.9%ile 1-hour NO_2 Concentration from the Terrace Tunnel (µg/m³) for 2033 With Project

140. A comparison of the 99%ile 1-hour NO_2 concentrations for the 2033 (“Without Project / Do Minimum” and “With Project”) is provided in Figure 6, with red indicating an increase in concentrations and dark blue indicating a decrease in concentrations with the Project in place (although no decreases are shown in the Figure).

141. Overall, due to the increase in vehicle numbers an increase in concentrations is observed with the Project. However, this change is unlikely to result in air quality effects.

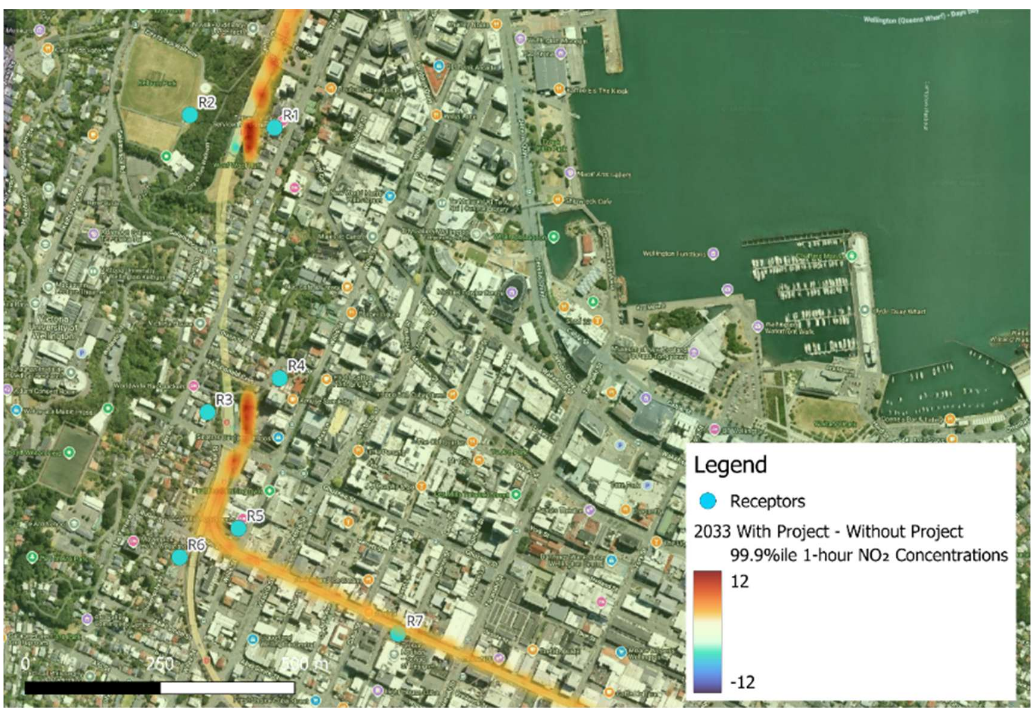

Figure 6 – 99.9%ile 1-hour NO_2 Change in Concentration from the Terrace Tunnel (µg/m³)

Te Aro and Basin Reserve (Section 2 and 3)

142. Te Aro goes southbound along The Terrace and northbound along Karo Drive. As with the Terrace Tunnel, the highest concentrations are in 2018, with the concentrations decreasing in 2033 and 2053. The concentrations for the "With Project" scenario are slightly higher than the "Without Project / Do Minimum" for all contaminants, however this change in concentration is not significant using the criteria in Table 6.

143. The Basin Reserve sees the highest change in concentrations, when comparing the 1-hour "With Project" and "Without Project" scenarios with the northern section of the Basin seeing an increasing in concentrations and the southern proportion of the Basin seeing a decrease in concentrations (Receptor 12).

144. The maximum concentration in 2033 "With Project" at a receptor is provided in Table 14 for sections 2 and 3.

145. Table 14 shows that the cumulative concentration is less than the relevant guideline concentration for all contaminants assessed.

Table 14: Section 2 and 3 – Maximum Concentration at a Sensitive Receptor (R13) – 2033 With Project

Criteria Pollutant	Averaging Period	Road	Background Concentration	Cumulative Concentration	Guideline
		($\mu g/m^3$)			
PM_{10}	24-hour	2.0	30.8	32.8 (66%)	50
	Annual	0.7	12.7	13.4 (67%)	20
$PM_{2.5}$	24-hour	1.3	13.4	14.7 (59%)	25
NO_2	99.9%ile 1-hour	14.3	60.6	74.9 (37%)	200
	24-hour	4.7	31.9	36.6 (37%)	100
	Annual	1.6	16.0	17.6 (44%)	40

146. The Willis Street ambient monitoring station is located within this section, with the concentrations at this site being similar to those predicted at R5. For 2018, the 99.9%ile 1-hour NO_2 concentration at R5 is predicted to be 51.1 $\mu g/m^3$ and the 24-hour PM_{10} concentration is 2.6 $\mu g/m^3$. While the NO_2 concentration is similar to the values recorded at the monitoring station, the PM_{10} concentration is significantly less. This is not unexpected as the predominant source of PM_{10} emissions in the surrounding area is likely to be marine aerosols (e.g. sea salt).

147. Figure 7 presents the 99.9%ile 1-hour NO_2 2033 concentrations for the Project with the road emissions from Section 2 and 3 shown. The background concentrations are not shown.

148. Figure 7 shows the highest concentration is observed between the Terrace Tunnel and Vivian Street and along the northern part of the Basin Reserve.

Figure 7 – 99.9%ile 1-hour NO_2 Concentration from Te Aro and Basin Reserve (µg/m³)

149. A comparison of the 99.9%ile 1-hour NO_2 concentrations for the 2033 ("Without Project / Do Minimum" and "With Project") is provided in Figure 8, with red indicating an increase in concentration and dark blue indicating a decrease.

150. Overall, due to an increase in vehicle movements along the northern section of the Basin Reserve an increase in concentration is observed with the Project. There is a decrease in concentrations along the southern section of the Basin Reserve with the rerouting of traffic.

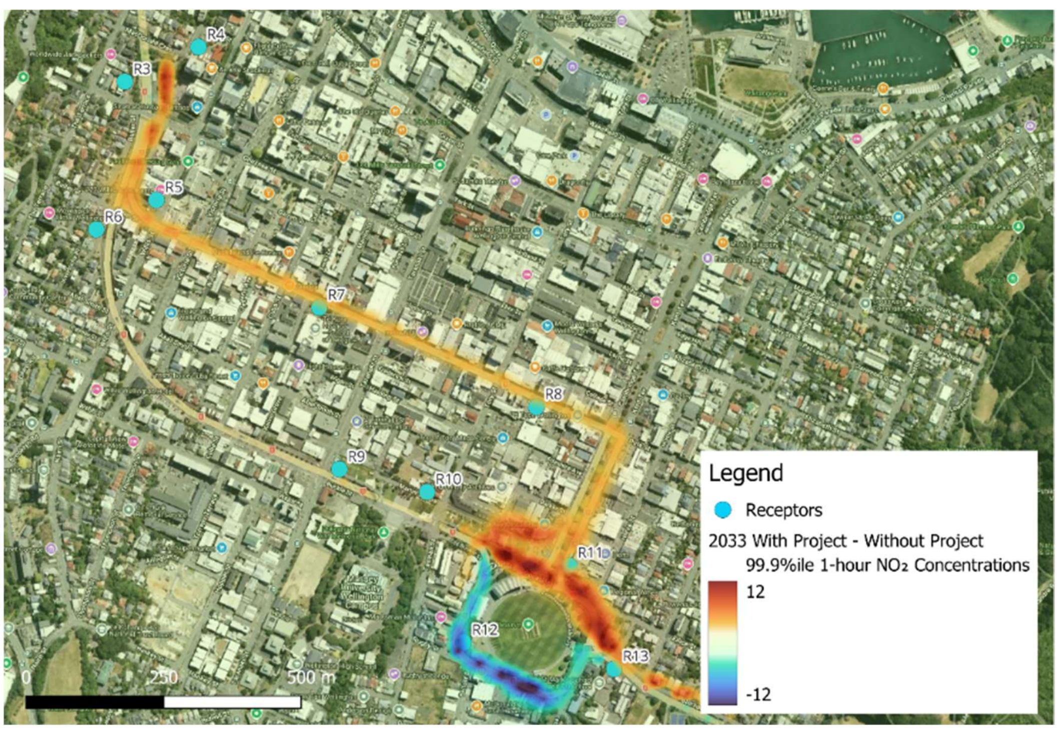

Figure 8 – 99.9%ile 1-hour NO_2 Change in Concentration from Te Aro and Basin Reserve (µg/m³)

Mount Victoria Tunnel (Section 4)

151. The closest receptors to the Mount Victoria Tunnel are receptors 7-17. These receptors experience the highest concentrations in 2018 and 2033 ("With Project"), with the concentrations decreasing in 2033 ("Without Project / Do Minimum") and 2053 (both scenarios). The concentrations for the "With Project" scenario are slightly higher than the "Without Project" Scenario for all contaminants, however this change in concentration is not significant using the criteria in Table 6.

152. The Project involves the decommissioning of the ventilation stacks on the Mount Victoria Tunnel, this results in a change in the dispersion of tunnel emissions. Receptor 14 sees an increase in concentration with the removal of the ventilation stacks, whereas Receptor 15 sees a decrease in concentrations. This is due to the increased portal emissions and no stack emissions altering the location where air quality effects are observed from the Mount Victoria Tunnel. The concentrations observed at Receptor 15 are provided in Table 15.

153. Table 15 shows that the cumulative concentrations are less than the relevant guideline concentration for all contaminants assessed.

Table 15: Section 4 – Maximum Concentration at a Sensitive Receptor (R15) – 2033 With Project

Criteria Pollutant	Averaging Period	Road	Mount Victoria Tunnel	Background Concentration	Cumulative Concentration	Guideline
		(µg/m^3)				
PM_{10}	24-hour	0.8	1.9	30.8	33.5 (67%)	50
	Annual	0.1	0.4	12.7	13.2 (66%)	20
$PM_{2.5}$	24-hour	0.4	1.3	13.4	15.1 (60%)	25
NO_2	99.9%ile 1-hour	6.0	29.5	60.6	96.1 (48%)	200
	24-hour	1.9	5.9	31.9	39.7 (40%)	100
	Annual	0.3	1.0	16.0	17.3 (43%)	40

154. Figure 9 presents the 99.9%ile 1-hour NO_2 2033 concentrations "With Project" with the road concentrations emissions from Section 4 shown. The background concentrations and tunnel concentrations are not shown.

155. Figure 9 shows the highest concentrations occur along SH1.

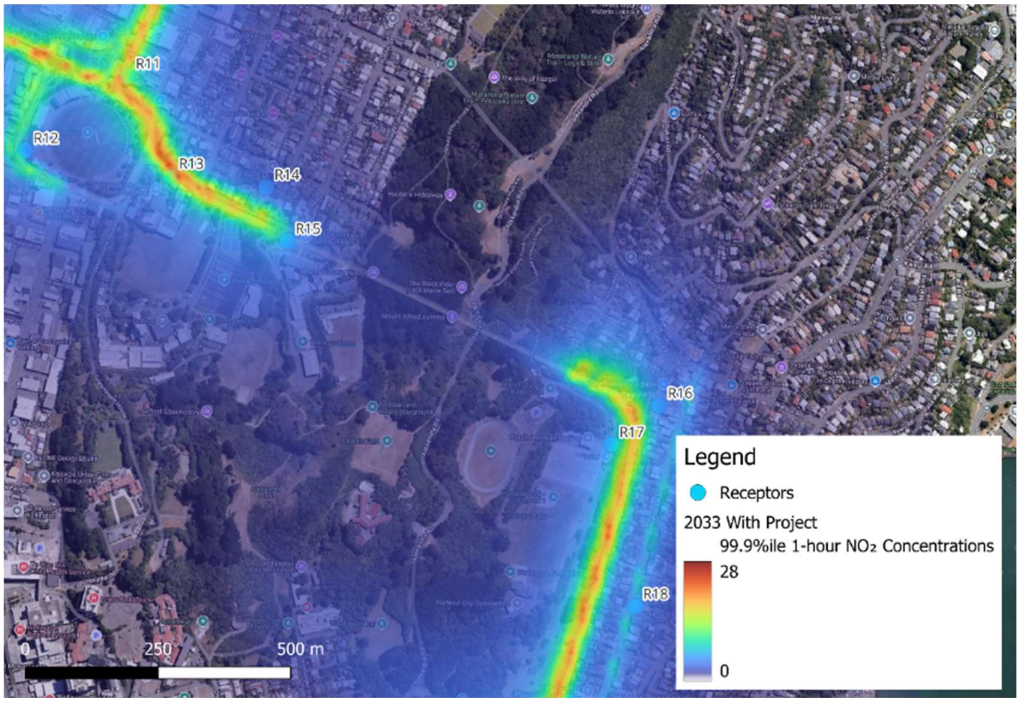

Figure 9 – 99.9%ile 1-hour NO_2 Concentration from the Mount Victoria Tunnel (µg/m³)

156. A comparison of the 99%ile 1-hour NO_2 concentrations for the 2033 ("Without Project / Do Minimum" and "With Project") is provided in Figure 10, with red indicating an increase in concentration.

157. Overall, due to the increase in vehicle numbers an increase in concentrations is observed with the Project. However, this change is unlikely to result in any air quality effects with all predicted concentrations below the criteria set out in Table 5 .

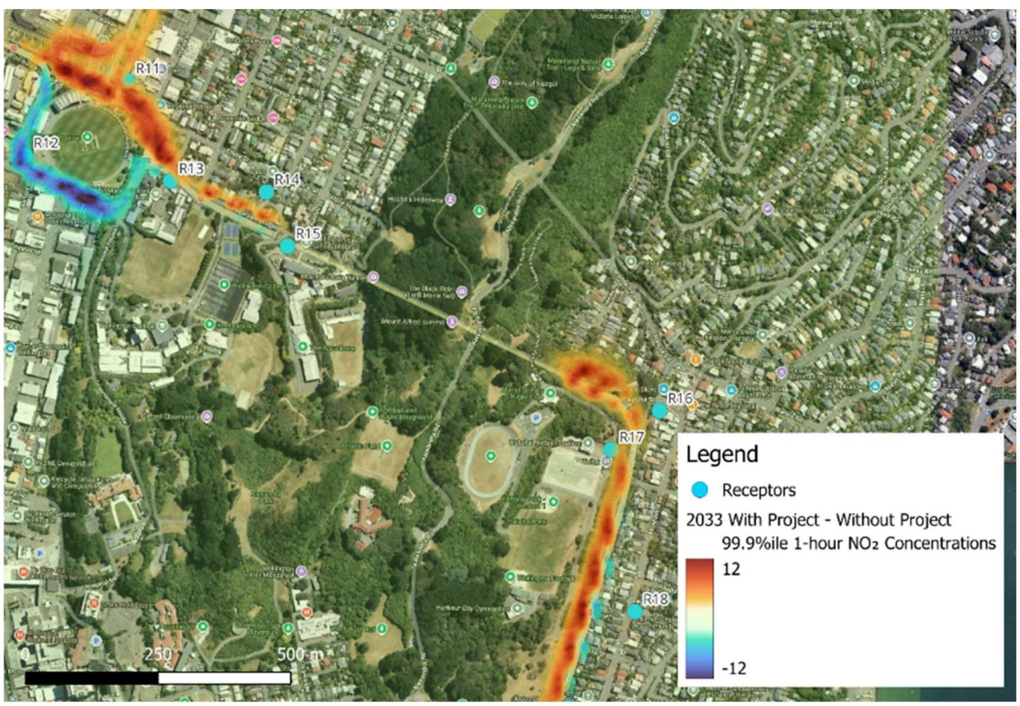

Figure 10 – 99.9%ile 1-hour NO_2 Change in Concentration from the Mount Victoria Tunnel (µg/m³)

Eastern Connections (Section 5)

158. The Eastern Connections section is from the end of section 4 towards the airport from Mount Victoria Tunnel. As with other sections, the highest concentrations occur in 2018, with the concentrations decreasing in 2033 and 2053. The concentrations for the "With Project" scenario are slightly higher than the "Without Project / Do Minimum" for all contaminant, however this change in concentration is not significant.

159. The maximum concentrations predicted in 2033 "With Project" at a receptor (receptor R24) are provided in Table 16.

160. Table 16 shows that the cumulative concentration is less than the relevant guideline concentration for all contaminants assessed.

Table 16: Section 5 – Maximum Concentration at a Sensitive Receptor (R24) – 2033 With Project

Criteria Pollutant	Averaging Period	Road	Background Concentration	Cumulative Concentration	Guideline
		(µg/m³)			
PM_{10}	24-hour	1.9	30.8	32.7 (65%)	50
	Annual	0.6	12.7	13.3 (67%)	20
$PM_{2.5}$	24-hour	1.2	13.4	14.6 (58%)	25
NO_2	99.9%ile 1-hour	13.7	60.6	74.3 (37%)	200
	24-hour	4.5	31.9	36.4 (36%)	100
	Annual	1.3	16.0	17.3 (43%)	40

161. Figure 11 presents the 99.9%ile 1-hour NO_2 2033 "With Project" concentrations for the road concentrations from Section 5. The background concentrations are not shown.

162. Figure 11 shows the highest concentration is observed along SH1.

Figure 11 – 99.9%ile 1-hour NO_2 Concentration from the Eastern Connections (µg/m³)

163. A comparison of the maximum 1-hour NO_2 concentrations for the 2033 ("Without Project / Do Minimum" and "With Project") scenario is provided in Figure 12, with red indicating an increase in concentration and dark blue indicating a decrease.

164. Overall, due to the increase in vehicle numbers an increase in concentrations is observed with the Project. However, this change is unlikely to result in air quality effects, with all predicted concentrations remaining below the criteria set out in Table 5.

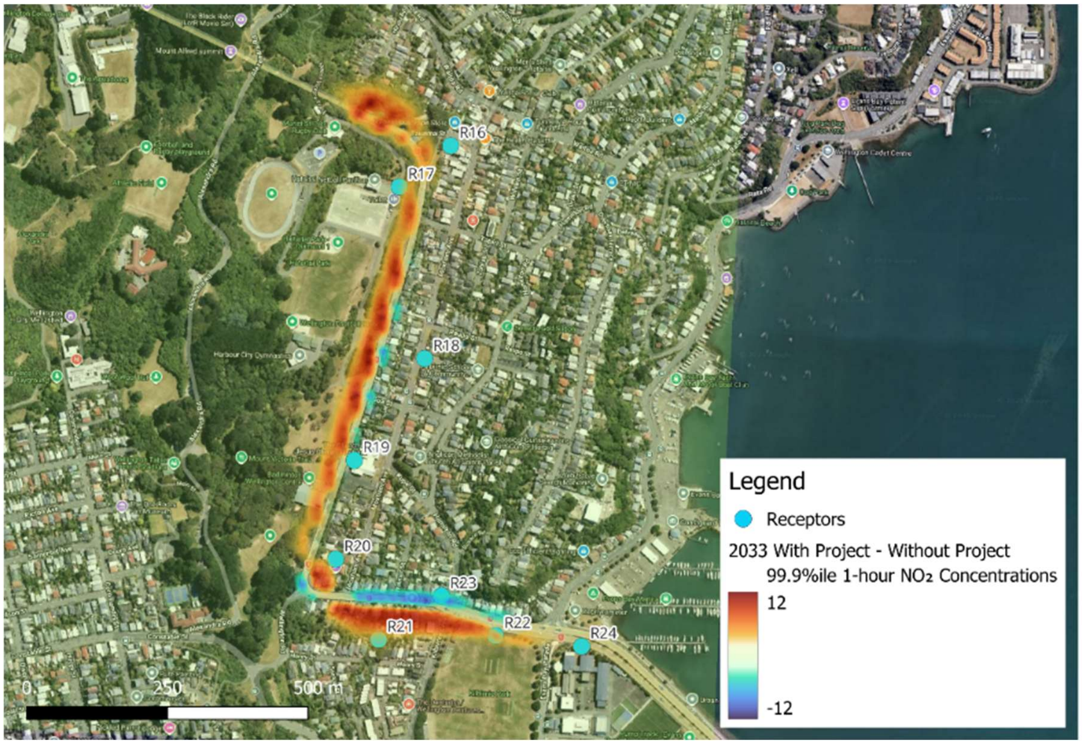

Figure 12 – 99.9%ile 1-hour NO_2 Change in concentration from the Eastern Connections

Vehicle Speed Sensitivity

165. As mentioned earlier, I have not assessed the changes in air quality as a result of improved traffic flow. In order to semi-qualitatively assess the benefits of increasing the vehicle speed, i.e increasing traffic flow, I have assessed the changes in vehicle emission rates with changes in vehicle speeds.

166. Figure 13, Figure 14, and Figure 15 present the changes in vehicle emission rates with changes in vehicle speed for NO_2, PM_{10} and $PM_{2.5}$ respectively. All three figures show that emission rates increase significantly when vehicle speeds are less than 40 km/hr, and increase again when speeds are greater than 80 km/hr.

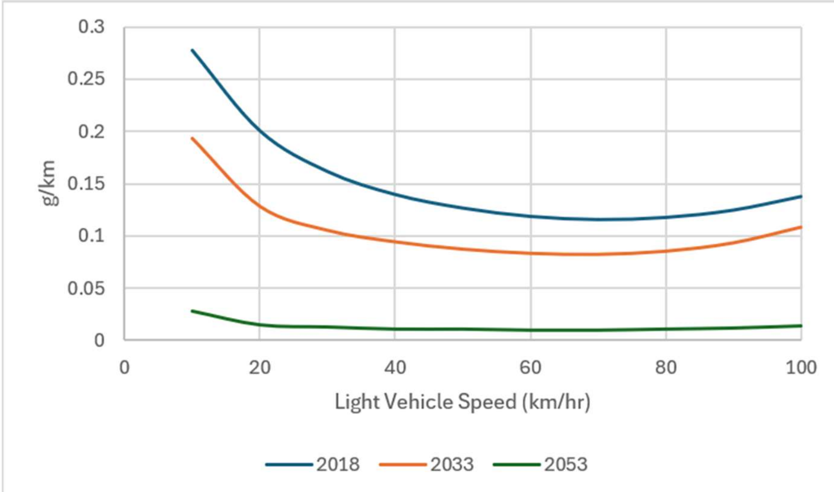

Figure 13 – NO_2 Emission Rate Changes with Speed (Default Vehicle Fleet)

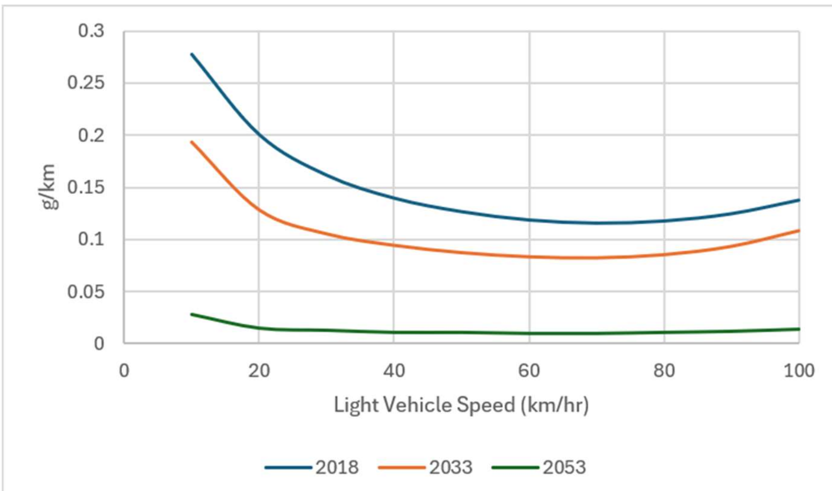

Figure 14 – PM_{10} Emission Rate Changes with Speed (Default Vehicle Fleet)

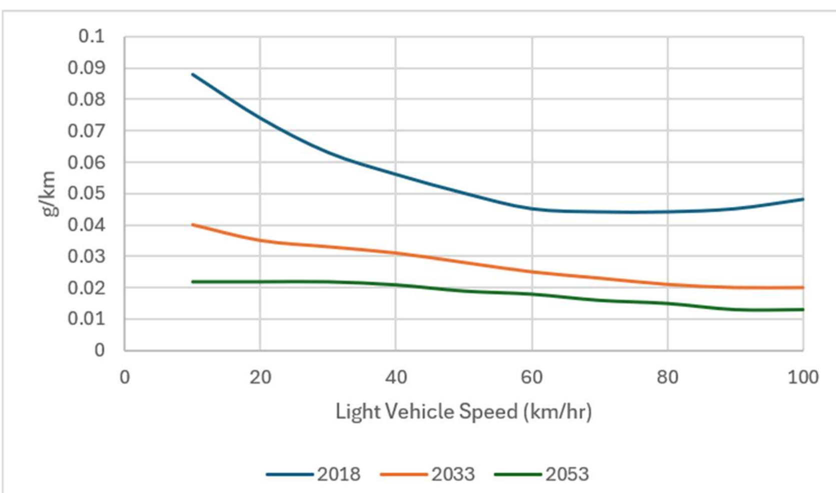

Figure 15 – $PM_{2.5}$ Emission Rate Changes with Speed (Default Vehicle Fleet)

167. As the Project is designed to improve traffic flow, one of the key operational benefits in terms of air quality is the reduction in vehicle emissions. Therefore, instead of modelling the off-site emissions for lower vehicle speeds, I have provided an example in Table 17 for Receptor 9, of how the concentrations might change based on the ratio of emission values for different speeds. R9 has been chosen for simplicity as this is located on a one-way road and as a result the changes in vehicle speed are easier to quantify.

168. As this assessment is to determine the benefit in increased traffic flow the 2033 Without Project (stopped traffic (10 km/hr)) off-site concentration has been calculated by pro-rating the emission factor used in Annexure D to the 10 km/hr VEPM factor – note that the 10 km/hr VEPM factor uses the default HV percentage.

169. Overall, Table 17 shows that the NO_2 off-site concentration increases by 122%, PM_{10} increases by 8% and $PM_{2.5}$ increased by 36% from reducing the vehicle speed to 10 km/hr.

170. The improved flow predicted as part of this project will have the greatest impact of reducing the NO_2 concentrations.

Table 17: R7 – 2033 With Project vs 2023 Without Project Vehicle Speed Sensitivity

Criteria Pollutant	Averaging Period	2033 With Project Road (46 km/hr)	2033 Without Project (46 km/hr)	2033 Without Project (10 km/hr)	% Change (2033 Without 46 km/hr vs 10 km/hr)
		(µg/m^3)`			
PM_{10}	24-hour	1.2	0.8	0.9	8%
	Annual	0.4	0.3	0.3	8%
$PM_{2.5}$	24-hour	0.7	0.5	0.7	46%
NO_2	99.9%ile 1-hour	8.5	5.8	12.9	122%
	24-hour	2.7	1.8	4.0	122%
	Annual	0.9	0.6	1.3	122%

Weekend Traffic

171. Wellington Transport Analytics Unit (WTAU) has two monitoring stations within the Project boundary that record the daily traffic numbers. These monitors have been used to assess the potential differences in weekday and weekend traffic. These monitors are located on Cobham Drive and Vivian Street.

172. I have compared the average daily traffic count (**ADTC**) for the WTAU 2019 monitoring data to the baseline 2018 project data (Annexure B). A comparison of the data is provided in Table 18.

Table 18: Weekday and Weekend Traffic Comparison

Location	2018 ADTC Used in the Assessment (Weekday average)	2019 WTAU Weekday DTC	2019 WTAU Weekend DTC	% difference for Weekday DTC	% difference for WTAU Weekday vs Weekend DTC
Cobham Drive	38,900	37,065	33,668	-5%	-9%
Vivian Street	16,500	22,519	20,955	36%	-7%

173. Overall, the ADTC used for Cobham Drive is comparable with the data provided by the traffic engineers, with the weekend traffic being lower and therefore the overall air quality effects from the road will decrease.

174. The weekday and weekend ADTC data for Vivian Street measured by WTAU is significantly higher than the data provided by WTSM, this means that the concentrations provided in the above sections underpredicts the potential effects. As a result of this, I have further analysed the potential effects from the increased vehicle numbers along Vivian Street.

175. Table 19 presents the modelled receptor (R7) concentration using the traffic data provided by WTSM, and Table 20 presents the predicted change in concentration and weekend concentration using the WTAU traffic data.

176. Overall, the updated traffic data predicts the off-site concentration at R7 to be less than the relative guidelines for both weekday and weekend traffic volumes.

Table 19: Maximum Concentration at a Sensitive Receptor (R7) – 2018 Baseline

Criteria Pollutant	Averaging Period	Road	Background Concentration	Cumulative Concentration	Guideline
		(μg/m³)			
PM_{10}	24-hour	0.7	30.8	31.5 (63%)	50
	Annual	0.3	12.7	13.0 (65%)	20
$PM_{2.5}$	24-hour	0.8	13.4	14.2 (56%)	25
NO_2	99.9%ile 1-hour	6.4	60.6	67.0 (34%)	200
	24-hour	2.0	31.9	33.9 (34%)	100
	Annual	0.7	16.0	16.7 (42%)	40

Table 20: WTAU R7 Updated Concentrations with Background

Criteria Pollutant	Averaging Period	WTAU Weekday Concentration	WTAU Weekend Concentration	Guideline
		(μg/m³)		
PM_{10}	24-hour	31.8 (64%)	31.7 (63%)	50
	Annual	13.1 (66%)	13.1 (65%)	20
$PM_{2.5}$	24-hour	14.5 (58%)	14.4 (58%)	25
NO_2	99.9%ile 1-hour	69.3 (35%)	68.7 (34%)	200
	24-hour	34.6 (35%)	34.4 (34%)	100
	Annual	17.0 (42%)	16.9 (42%)	40

Effect of Tolling

177. In addition to predicting the change in air quality with the Project, I have assessed the changes that might occur if tolling was to be implemented.

178. Based on information provided by the WTSM, it is predicted that tolling will increase the volume of cars moving along the other arterial routes. As a result, I have presented the effects of tolling as a change in concentration figure, between the Project with and without tolling.

179. For simplicity as all of the contaminants will follow a similar trend, I have only provided the results for the 1-hour NO_2 concentrations.

180. Figure 16 to Figure 19 show the change in 1-hour NO_2 concentrations if tolling was implemented with red indicating an increase in concentrations with tolling and dark blue indicating a decrease in concentrations with tolling.

181. Overall, based on the predicted increase in vehicle numbers along the arterial roads (Jervois Quay, Cable Street and Oriental Parade) there is an increase in ambient 1 hour NO_2 concentrations. Even though I have not modelled the emissions along Evans Bay Parade these concentrations will also increase by a similar percentage.

182. A very minor increase in concentrations is also observed along The Terrace and Ghuznee Street however this is not significant. However overall, even with tolling in place, predicted concentrations along the arterial roads (as well as SH1) remain well below the criteria set out in Table 5.

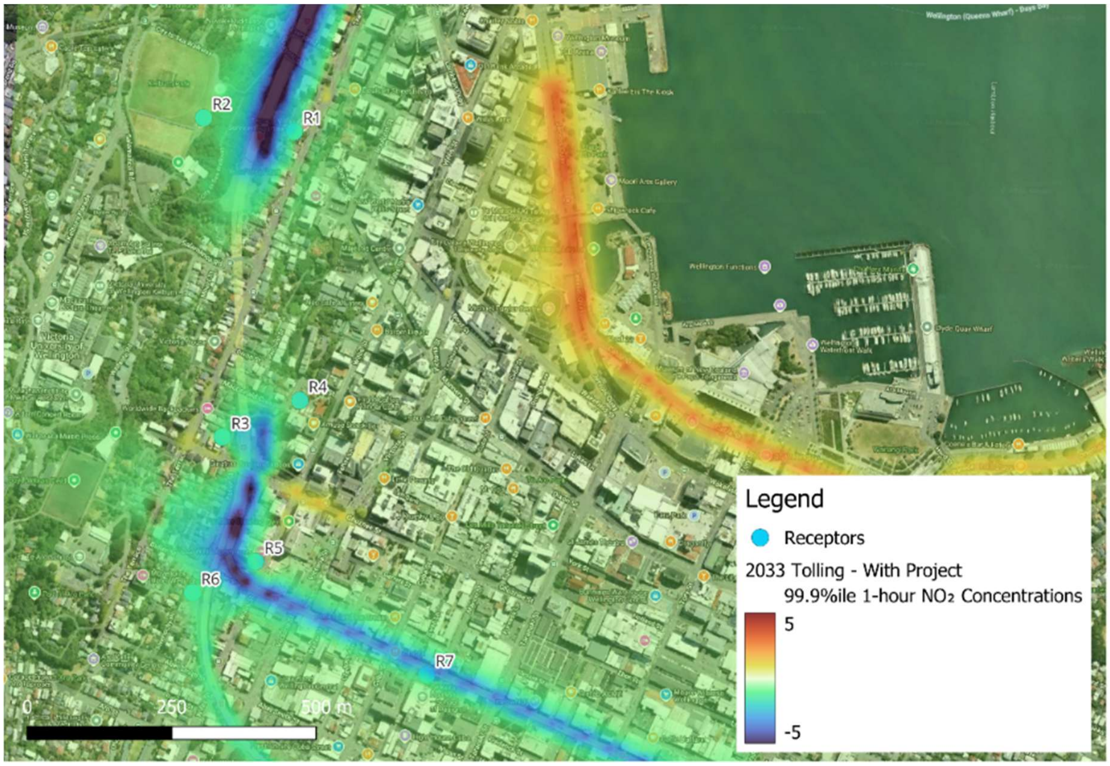

Figure 16 – 99.9%ile 1-hour NO_2 Change in concentration from the Terrace Tunnel with Tolling implemented

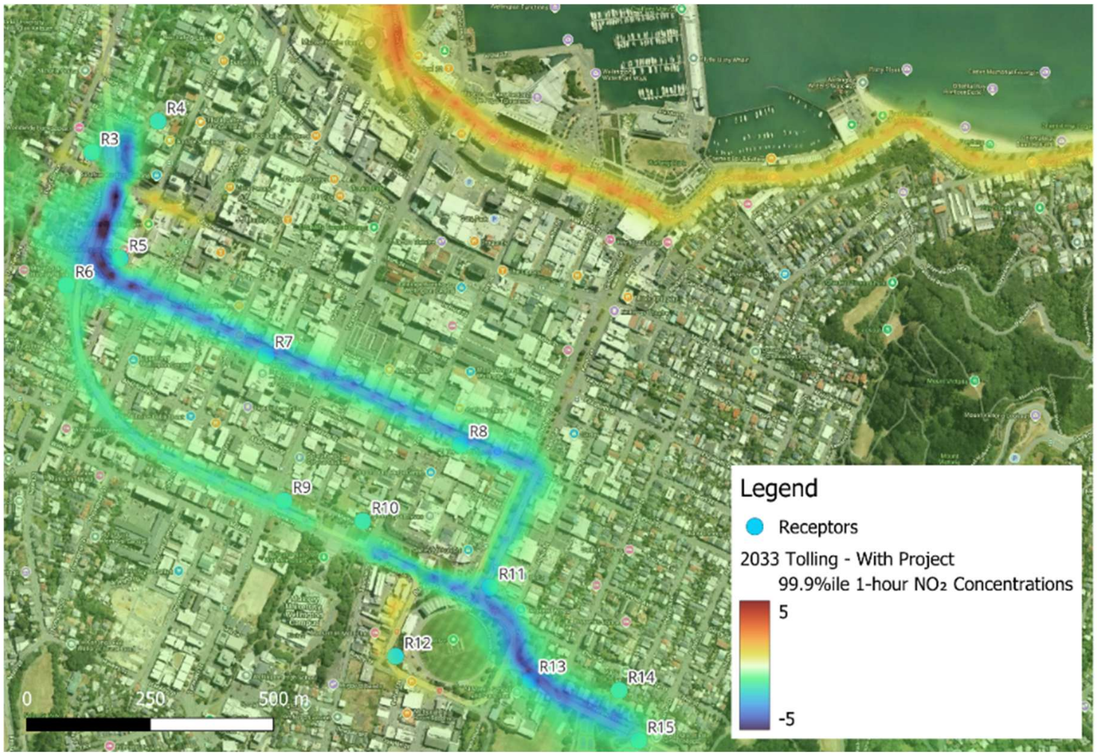

Figure 17 – 99.9%ile 1-hour NO_2 Change in concentration from Te Aro and Basin Reserve with Tolling implemented

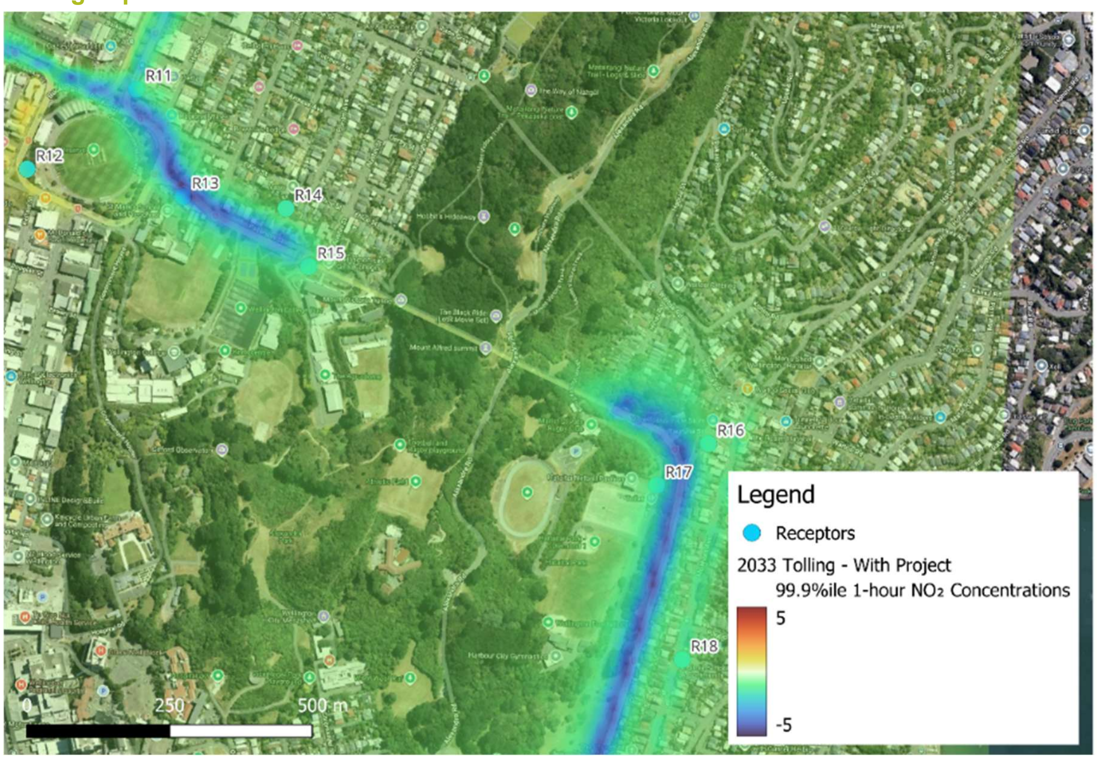

Figure 18 – 99.9%ile 1-hour NO_2 Change in concentration from the Mount Victoria Tunnel with Tolling implemented

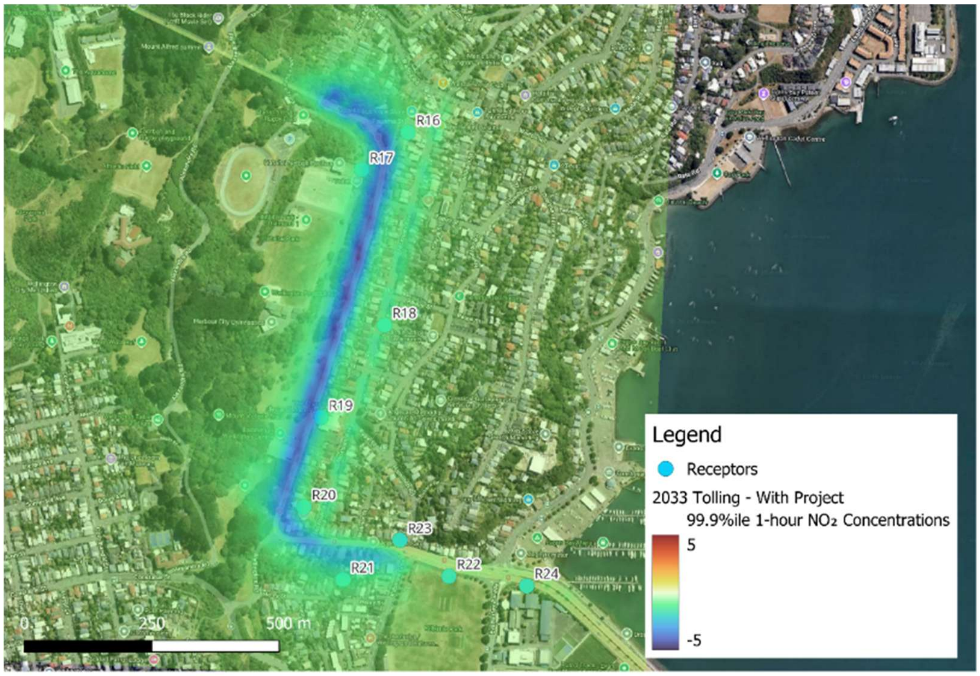

Figure 19 – 99.9%ile 1-hour NO_2 Change in concentration from the Eastern Connections with Tolling implemented

10 ASSESSMENT OF CONSTRUCTION EFFECTS

Dust Generating Activities

183. During the construction phase of the Project there is the potential for nuisance dust from construction activities, and combustion emissions from construction vehicles and machinery, to affect properties that are in close proximity to the construction areas.

184. In my experience dust nuisance effects are often experienced up to 250 m from a source, where good practice dust management measures are not used. Where dust management measures are implemented in accordance with good practice guidelines, this distance reduces to 50 m. Wellington's high frequency of elevated wind speeds increases the risk of dust events, particularly during the drier summer months.

185. Construction activities that have the potential to generate dust if not adequately controlled or mitigated include:

   i. Stripping and stockpiling of topsoil
   ii. Excavation of cut material
   iii. Drilling and blasting of exposed rock
   iv. Placement of fill
   v. Stockpiling of soil / cut material
   vi. Traffic movements over unsealed surfaces
   vii. Demolition of buildings and hard landscaping
   viii. Rehabilitation of completed areas

186. Spoil disposal sites are not within the scope of this assessment as it will be considered separately. It will either be disposed at an existing consented site, where dust potential has already been considered, or it will be disposed of at a new site where the effects will be considered in the consenting of that site.

187. The estimated volume of cut and fill for the Project are approximately 426,000 m^3 and 87,500 m^3 respectively. Although a small amount of excavated material may be able to be used as fill for parts of the wider Project, it has been assumed that all cut material will be disposed of off-site. The cut material is planned to be hauled off-site via public roads to one or more clean-fill sites at locations not yet determined. The need to haul cut material off-site has been incorporated into this assessment.

188. The application of water is an important component of dust control. My assessment has been completed on the basis that there will be sufficient water available for dust control. Water application becomes particularly important as wind speeds increase, drying out the exposed surfaces. Fine material stored in stockpiles can be subject to entrainment when winds exceed 5 m/s.

189. Asbestos containing materials (ACM) may be present in the buildings being demolished. This assessment does not address specific measures that may be required. Likewise, this assessment does not provide specific measures for any contaminated soil dust. ACM and contaminated soil are addressed in the Contaminated Land Assessment report (Technical Report #16).

Sensitivity of the Receiving Environment

190. Using the assessment method and criteria detailed in the NZTA Guide, the potential for air quality risk associated with the construction of the Project is largely dependent on the number of Highly Sensitive Receivers (HSR) within 200 m of the Project boundary. The MfE GPG Dust recommends two risk-based assessment tools for assessing dust which are the Dust Risk Index (DRI) and the Institute of Air Quality Management (IAQM, 2024) assessment of risk. The IAQM method was chosen due to the uncertainty remaining for some construction details at this stage in the Project. For completeness, the Dust Risk Index was calculated using the methodology specified in b B of the NZTA Guide. Overall, the dust risk for the Project is High.

191. The MfE GPG Dust also recommends explicit consideration of all FIDOL factors for any qualitative dust assessment. These factors are as follows:

i. Frequency –how often a receptor is exposed to dust. Factors determining this include the frequency of the source releasing dust; prevailing meteorological conditions; and topography

ii. Intensity – the concentration of dust at the receptor location

iii. Duration – the amount of time that a receptor is exposed to dust. The duration of dust emissions, like its frequency, is related to the source type and discharge characteristics, meteorology, and location. The longer dust detection persists in an individual location, the greater the level of complaints that may be expected

iv. Offensiveness – a subjective rating of the unpleasantness of the effects of nuisance dust. Offensiveness is related to the sensitivity of the receptors to the dust emissions. For example, industrial premises may be more tolerant to dust concentrations than residential properties

v. Location – the type of land use and the nature of human activities in the vicinity of a dust source. The same process in a different location may produce more or less dust depending on local meteorological conditions. It is also important to note that some locations may be more accepting of higher concentrations of dust than others

192. Table 21 defines the sensitivity of the area for people and property to dust nuisance effects based on the number of receptors and the separation distance as defined by IAQM, which I have adapted to match the NZTA guidance of considering properties within 200 m. These factors are relevant, as the more receptors you have, and the closer they are to the construction footprint, the more likely receptors are to be affected by dust

193. The receptor sensitivity of the people and property in the Project area is classed as high due to proximity of the residential properties to the works with more than 100 receptors within 50 m of the construction footprint.

Table 21: Sensitivity of the area to dust nuisance effects

Receptor Sensitivity	Number of receptors	Distance from the Project boundary (m)			
		0<20	21<50	51<100	101<200
High	>100	High	High	Medium	Low
	11-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low

Assessment of Dust Effects

194. The following section assesses the potential dust effects of the Project's construction on the areas adjacent to the Project boundary. I have conducted a detailed assessment of the sensitive receptors which are located within 200 m of the Project boundary. For the purposes of this assessment, the Project areas have been split into five zones moving from north to

south, aligning with the Project Description. The five zones and the sensitive areas are shown in Figure 1 to Figure 3.

195. This assessment methodology is highly conservative as it uses the Project boundary as the location of the construction footprint and assumes worst case activities are occurring adjacent to it.

196. I have not considered the potential effects on land within the Project boundary that will be permanently acquired by the Crown on the basis that any sensitive receptors will no longer be present, and therefore any potential effects on the land does not need to be considered. Additionally, effects on parcels of land which have no residence present (empty lots) were not considered in this assessment.

197. Overall, there are hundreds of sensitive receptors within 200 m of the Project boundary and therefore, a high sensitivity rating has been assigned for the high-level assessment. An individual sensitivity rating for each zone has not been provided. I consider that the mitigation measures, set out later in this report, will ensure that the potential nuisance effects are minimised as far as practicable. However, as stated in the FIDOL assessment below, even with mitigation, there will still be a risk of dust effects on the properties located within 50 m of construction activities.

Construction Dust Assessment for Sensitive Receptors

198. When considering the FIDOL factors, the intensity, duration, offensiveness, and location will likely be relatively consistent between all the zones. This is based on the following:

i. Intensity – The intensity that nuisance dust is experienced is likely to be at the same level for all sensitive receptors within 50 m of the Project boundary and at a lower intensity for the sensitive receptors within 50 to 200 m from the Project boundary

- For receptors located within 50 m of the source, the unmitigated dust effects are likely to be offensive or objectionable. These effects will be minimised through mitigation measures outlined below. However, even with mitigation measures in place there remains some risk of dust nuisance effects
- For the receptors located more than 50 m from the source, the dust nuisance effects can be mitigated so that the risk of dust nuisance effects that are offensive or objectionable is low

ii. Duration – Due to the size and location of the works, the time over which these are undertaken within each zone will likely be over a year. Furthermore, receptors located near haul roads will likely have an increased duration due to ongoing vehicle movements during construction

iii. Offensiveness – As the same materials are being moved throughout the Project areas, the type of dust and the offensiveness of that dust will be constant between the zones

iv. Location - The majority of the sensitive receptors are residential properties, commercial properties or public open spaces and therefore have a high sensitivity to nuisance dust

199. The frequency of dust generating activities is likely to present the greatest risk at north portal of the Terrace Tunnel and the western portal of the Mount Victoria Tunnel. The 24/7 frequency of operations at these two locations means the risk will be higher than for other sections of the Project.

200. Where the assessment identifies the need for mitigation measures, these will be developed and implemented to avoid as far as practicable, nuisance effects. Where this is not possible, dust nuisance effects will be minimised such that they are not offensive or objectionable.

201. Effective mitigation procedures are presented in section 11 of this report. These measures are recommended to mitigate any adverse effects of dust generated during the construction of the Project.

202. The sensitive areas located within 50 m of the Project boundary have the potential to be exposed to dust nuisance effects if the specific dust mitigation measures described in section 11 are not implemented. If the dust mitigation measures are effectively implemented the dust risk on these sensitive receptors will be significantly reduced. The following sections provide a more detailed assessment for construction activities specific to each zone and its sensitive receptors.

Terrace Tunnel (Section 1)

Northern End

203. The proposed tunnelling direction is from the north to south, meaning that excavated material will primarily be brought out from the northern end. Figure 20 shows the northern end of the tunnel and a 50 m buffer, setback from the Project boundary.

204. The Northern Portal Yard (TT-SC001, Hoffcon.Pro Construction Methodology) will be used to manage the spoil before it is transported via SH1 to an off-site fill location. This approach means that the dust risk will be greatest at the northern end of the proposed tunnel. A haul route will be established from the tunnel entrance back to the yard area, presenting a risk of dust emissions along that route. Tunnel spoil is often damp, so dust is most likely to present a risk where it is tracked by tyres along the route.

205. The predominant wind directions where wind speeds are greater than 5 m/s are the north-west, north, south and south south-west. Winds from these directions are most likely to lead to dust generation and transportation due to the frequency of elevated wind speeds. This is true for both the northern and southern ends of the new Terrace Tunnel.

206. At the northern end of the new tunnel, receptors along The Terrace (to the east, e.g. R1 in Figure 20) are likely to be affected by dust. These receptors are located to the south-east of the tunnel area and will be downwind of the prevailing wind. Receptors further to the north, such as those on Onslow Terrace and Everton Terrace, are less likely to be affected by construction dust due to their elevation above the working face and yard, and the presence of vegetation that provides some screening. The construction works will occur within the existing incision in the landscape, meaning that there will be some shelter from stronger winds. Without mitigation, the dust effects in this location are expected to be high.

207. The Shell Gully Overbridge modifications will also occur in this area. These modifications primarily involve a realignment of the existing barriers and lanes. The construction dust effects of this work are considered to be low risk and can be managed through the application of the good practices that generally apply to road maintenance.

Figure 20 – Terrace Tunnel northern buffer adjacent to Project boundary

Southern End

208. At the southern end of the new tunnel, there are apartment buildings within 100 m of the new entrance. These buildings sit to the south-east and east of the new tunnel entrance and present the greatest risk from construction dust at this location. Even with mitigation in place, there is still potential that some dust effects will be experienced by the residents of these buildings. Without mitigation, dust risk is considered to be high.

209. The Southern Portal and Ghuznee Street Yard (TT-SC003) will also occupy land adjacent to these buildings and present some dust risk due to the nature of the activities occurring there. There are also receptors further to the south and south-east of the site that include a church, commercial offices and a residential dwelling. Residential properties to the west of the new entrance, on Ghuznee Street and The Terrace, are also within 100 m of the proposed works. While there will be some dust risk for these properties, easterly winds occur infrequently and the properties are elevated above the proposed works area, reducing the likelihood of adverse dust effects for these properties to moderate.

210. The closest of the residential properties to the north of the proposed southern entrance, on MacDonald Crescent, will be approximately 30 m from the tunnel portal. It is considered that the dust risk for these properties is high, especially during elevated winds from the south and south-east.

Figure 21 – Te Aro and Terrace Tunnel southern buffer adjacent to Project boundary

Ghuznee Street Bridge

211. Replacement of the Ghuznee Street Bridge will require works that occur less than 50 m from sensitive receptors at the northern end of Ghuznee Street. Most of the dust risk associated with this work is expected to occur during the demolition of the existing bridge. The buffer shown in Figure 21 indicates that dust effects are likely to occur in a similar area to that impacted by the Terrace Tunnel construction.

Te Aro (Section 2)

212. Works involved in this portion of the Project will primarily involve activities similar to those commonly performed on the roadway, such as road widening, upgrades to services and resurfacing. These activities are not expected to contribute to significant air quality issues provided the routine good practice measures are followed. Although the buffer in Figure 21 indicates that nuisance could impact receptors within 50 m of the road corridor, our experience is that routine roading maintenance activities typically only impact those receptors adjoining the carriageway.

213. This section also involves the reconstruction of verandas where they extend into the new road corridor. Some dust may occur during the removal and reinstatement of these verandas. These works will largely be completed with hand tools that can be fitted with vacuum systems. Dust risk from this section of work is considered to be moderate without mitigation, but low once mitigation measures are taken into account.

Basin Reserve (Section 3)

214. Elevated winds (>5 m/s) around the Basin Reserve generally occur from the north-west through north, and from the south and south south-east. Sensitive receptors in this area

include residential buildings, commercial buildings, public open space and schools (e.g. St Mark's School and Preschool to the south-east of the Basin).

215. There will be a number of buildings demolished in this works section, particularly to the west, east and north of the Basin Reserve. Dust from these demolitions will need to be managed to mitigate dust nuisance effects for adjacent residential and commercial properties.

216. To the north of the Basin Reserve, earthworks will be required for the realignment of Sussex Street, including construction of the trench. It is estimated across the Basin Reserve section of works that approximately 30,000 m^3 will be cut to waste, while approximately 7,000 m^3 of fill will be imported from off-site. Without mitigation, the dust effects in this location are expected to be high.

217. The sensitive receptors that are likely to be particularly affected by these earthworks are the residential buildings on Tasman Street and on the corner of Kent Terrace and Buckle Street (R11 in Figure 22). The Basin Reserve itself is also used as a transit point for active commuters (cyclists and walkers). Although effects on those users will be of a short duration, they can be frequent users of the area.

218. Construction works in this area will include resurfacing of the carriageway and laying of new asphalt. This activity has the potential to give rise to odour. Any odour effects will be of short duration, consistent with typical road maintenance activities. Where the Project differs is the intensity, however, as the works will cover a large area.

Figure 22 – Basin Reserve and western Mount Victoria tunnel buffer adjacent to Project boundary

Mount Victoria Tunnel (Section 4)

219. The main sources of dust at this location will be from the significant volume of earthworks required for the new Mount Victoria Tunnel and approach. Approximately 130,000 m^3 will be

cut to waste, while 2,000 m^3 will be imported fill from offsite. The construction methodology assumes that the new tunnel will advance from the western portal towards the east. This approach means that large volumes of material will be extracted via the new tunnel's western portal. Although the tunnel spoil itself is likely to be damp, the haul roads and storage areas will present a dust risk.

220. The construction methodology indicates that blasting may be required to advance through hard rock in the new tunnel. Ventilation of blasting fumes and dust from the tunnel portal would be required and will present a high dust risk if unmitigated. Blasting fumes may also include carbon monoxide and nitrogen oxides.

221. The predominant directions for elevated wind (>5 m/s) are from the north to north-west and south to south south-east. Sensitive receptors to the north (residential) and south (colleges) of the new tunnel portal mean that this area is high risk for dust nuisance. Saint Joseph's Church and Saint Mark's School and Preschool (R13) to the west are also at risk of a moderate level of dust nuisance. The specific mitigation measures noted in Section 110 should be put in place to reduce dust emissions from the physical works, blasting and transportation of cut and fill material in this area.

Figure 23 – Eastern end of Mount Victoria Tunnel buffer adjacent to Project boundary

Eastern Connections (Section 5)

222. The main sources of dust at this location, as shown in Figure 24,will be from the earthworks required for the widening of Ruahine Street and Wellington Road. Approximately 54,000 m^3 will be cut to waste, while 14,500 m^3 will be imported fill from offsite. Without mitigation, the risk of dust effects in this location is considered to be high.

223. The predominant directions for elevated wind (>5 m/s) are from the north and south, similar to that observed at Wellington Airport. The elevated topography to the west of this area means

that the works will be sheltered from the north-westerly winds prominent elsewhere in the city. Residential sensitive receptors to the east and south of the works will be most affected by dust nuisance.

Figure 24 – Hataitai buffer adjacent to Project boundary

Combustion Emissions from Construction Vehicles and Machinery

224. The construction of the proposed roading improvements will require a number of vehicles and machinery to operate along the length of the Project route. The use of construction vehicles and machinery is an expected activity in the Project area and city more generally, but we have included a brief assessment on the impact these could have on the air quality environment.

225. The construction methodology provides an indication of the construction vehicles the Project is estimated to generate. A maximum of 504 light vehicle movements and 10 heavy truck movements are expected per shift. Each shift will be 8 hours long, indicating a potential maximum of 1,542 vehicle movements per day. Given that the base year traffic volumes along SH1 are in the order of 25,000 Annual Average Daily Traffic (AADT), the increase in construction vehicles, while resulting in a small increase in the level of combustion emissions in areas adjacent to where the works are occurring, is extremely unlikely to give rise to any significant change in ambient concentrations of pollutants that result in an exceedance of the NES-AQ.

226. Notwithstanding the small scale of combustion emissions from construction vehicles and machines, the implementation of mitigation measures as described in section 11 of this report will assist in minimising the effect of these emissions.

Potential effects of construction dust

227. The primary air quality effects resulting from construction will be those of dust nuisance and could include excessive dust depositing on residential and commercial buildings, cars and laundry. Excessive dust may also deposit within buildings such as on furniture, curtains and floor coverings. Excessive dust deposition can cause stress related conditions for some residents. Dust can also have effects on visibility, although this is typically near the source and does not pose a wider effect. While the visibility of dust is more of an aesthetic concern, much of the public perception of air quality directly relates to visibility.

228. PM_{10} will also be generated by the construction activities including earthworks, vehicle movements, blasting and spoil handling. Short-term exposure to PM_{10} concentrations is associated with respiratory irritation, exacerbation of asthma and other pre-existing pulmonary conditions. The construction emissions of PM_{10} are expected to be intermittent and localised and without effective controls could result in short-term exceedances of the NES-AQ standard in public spaces or at nearby residences. However, with the implementation of the proposed dust management measures, the risk of adverse health effects form PM_{10} exposure is expected to be low and largely limited to short durations close to the works sites.

Summary of Construction Air Quality Effects

229. Overall, construction of the Project has been assessed as having the potential to cause nuisance dust emissions in distinct areas due to the scale of earthworks required and its proximity to sensitive receptors. Where construction zones are within 50 m of high sensitivity areas (mainly residential, public space and childcare centres), without mitigation, the potential for dust nuisance effects to be experienced by people and property from the Project is high.

230. I consider the potential for construction dust to have nuisance effects on sensitive receivers in areas located more than 50 m from the construction activities to be low. I consider that it is unlikely that the Project will result in any other air quality effects, such as effects arising from an increase in vehicle emissions from construction.

231. Overall, even with mitigation measures embedded in a Construction Air Quality Management Plan (CAQMP), residual dust has the potential to affect sensitive receptors located within 50 m of the Project boundary. However, based on the FIDOL assessment in Section 10, the effects are unlikely to be considered offensive or objectionable. Table 22 summarises the residual dust effects after mitigation measures have been applied.

Table 22: Summary of overall actual and potential dust effects resulting from the Project.

Effect	Location Details	Magnitude of effect (unmitigated)	Proposed effects management (avoid, remedy, minimise)	Overall level of effect (mitigated)
Dust from construction activities	Section 1 – Terrace Tunnel	High	Embedding the mitigation measures outlined in Section 11 into a Construction Air Quality Management Plan (CAQMP)	Moderate
	Section 2 – Te Aro	Moderate		Low
	Section 3 – Basin Reserve	High		Moderate
	Section 4 – Mount Victoria Tunnel	High		Moderate

Effect	Location Details	Magnitude of effect (unmitigated)	Proposed effects management (avoid, remedy, minimise)	Overall level of effect (mitigated)
	Section 5 – Eastern Connections	High		Moderate

11 MEASURES TO AVOID, REMEDY OR MITIGATE ACTUAL OR POTENTIAL ADVERSE EFFECTS

Measures to avoid, remedy or mitigate effects during operation

232. When the Project is operational, it is predicted that concentrations of contaminants will be below the applicable assessment criteria. The Project is not expected to result in any significant degradation of air quality, and therefore mitigation of the operational effects is not required.

Measures to avoid, remedy or mitigate effects during construction

233. This section of the report presents the recommended mitigation measures that, when implemented, reduce the impacts of construction dust at nearby sensitive receptors and will also control the potential effects of discharges of dust, odour, and hazardous air pollutants during the construction of the Project.

234. The mitigation measures that are contained in the following sections are consistent with the MfE GPG Dust and NZTA Guide. Ultimately, I recommend that the mitigation measures below form the basis of a CAQMP. A CAQMP should be developed in accordance with any recommended conditions and incorporate the mitigation measures below.

General Measures

235. The general measures that are recommended to assist in the mitigation of air discharge effects are:

   i. where practical, defining an area around construction activities where there is the potential to create dust effects and putting in place appropriate mitigation, such as operating water trucks along haul roads and timely stabilisation of open areas to minimise dust effects

   ii. limiting open earthworks areas in drier months and areas that are distant from water sources

   iii. developing location specific speed limits (e.g. 15 km/h) on haul roads to minimise dust emissions when within 100 m of sensitive locations

   iv. identifying activities that have the potential to generate airborne dust and cease works if there are sensitive activities downwind until such time that it is suitable to start again if wind conditions render dust control impracticable

   v. having a community liaison person available to consult with landowners prior to construction and promptly address concerns or complaints

   vi. having a comprehensive complaints procedure (as set out below)

   vii. having a team dedicated to monitor environmental effects including air quality effects

   viii. ensuring that construction vehicles and machinery engines are checked, serviced and maintained to manufacturers' standards

   ix. ensuring all Project staff are trained and inducted on air quality management issues and mitigation requirements of the conditions and the CAQMP

   x. on-going community engagement as part of the broader Project

   xi. identifying all potential sensitive areas and listing them in the CAQMP

Complaints Analysis

236. If complaints are received the following steps are recommended:

   i. The site manager responsible for control of environmental effects is to log the following:

      - The date and time
      - Nature of the complaint
      - The name, telephone number and address or approximate location of the complainant

- Weather information (wind speed and direction based on meteorological information)
- Details of key sources of dust or likely sources of dust at the time of the complaint

237. If the complaint is investigated and works associated with the Project are identified as being the source, then appropriate additional mitigation measures will be implemented. The primary focus should be to mitigate the effect at the source. If source mitigation has failed to prevent adverse impacts, measures such as cleaning dust off properties or temporary relocation of residents could be implemented on a case-by-case basis if required to deal with nuisance effects at specific locations.

Odour

238. The following measures are recommended to be in place in the CAQMP to deal with odour events:

i. Include guidelines to assess the level of odour during excavation, should odorous material be found in areas close to sensitive receptors
ii. Altering the specification of the tar seal/asphalt to lower the temperature during placement and minimising the time taken to apply the surface
iii. Transporting odorous material from the site to an appropriate facility for disposal as soon as practicable
iv. Minimising open areas of excavations where odorous material is excavated as much as practicable at all times, including ensuring that odorous sources are covered or temporarily backfilled when not excavating
v. Consider wind direction and downwind receptors when deciding on when to excavate potentially odorous materials
vi. Using an odour masking agent or deodoriser, on the surface of odorous material as it is encountered

Earthworks

239. There will be significant quantities of material cut and transported off-site as part of this Project. There will also be some areas where fill is required. The following measures are recommended to minimise dust effects from earthworks:

i. Limiting or stopping the removal and stockpiling of topsoil during dry windy conditions in areas close to sensitive receptors
ii. Using weather forecasts (such as dry and windy days) that could lead to dust generation to ensure sufficient mitigation equipment are available on site (e.g. water carts, fog cannons) and/or change works to employ low dust generating activities on such days
iii. Developing procedures for the operation of construction vehicles in areas within 100 m of sensitive receptors
iv. Developing procedures for the removal of potentially dusty cut or placement of fill material, such as sand and silts at locations close to sensitive receptors
v. All finished cut batters should be vegetated or covered with hydroseed or mulch as soon as practicable
vi. Minimising material drop heights
vii. As appropriate, dust suppression chemicals may be applied to haul roads or open areas using watercarts

Tunnelling

240. The Project involves tunnelling works, including portal excavation, underground excavation, blasting, spoil handling and ancillary activities such as ventilation and services installation. There is potential for dust emissions at the tunnel portal from spoil handling, blasting and from ventilation exhausts. The following measures are recommended to minimise dust effects from tunnelling activities:

viii. using water spray or misting systems at the tunnel face and portal areas to suppress dust during dry conditions

ix. using water spray or misting systems during and immediately following blasting

x. shielding the tunnel portals where practicable to limit the escape of dust

xi. ensuring that tunnel construction ventilation systems are designed to include filtration or other dust control measures

xii. locating ventilation exhausts in a manner that maximises the distance from sensitive receptors

Stockpiled Materials

241. As the Project is completed, there will be quantities of material excavated and placed as fill. Stockpiling of construction materials such as fill, sand and aggregate may also be required. The following management measures are recommended to be used to minimise dust emissions from stockpiles:

i. developing procedures to manage the movement of stockpiled materials during windy conditions at locations close to sensitive receptors

ii. keeping the size and height of stockpiles to a minimum

iii. using water as required to control dust such that it does not result in nuisance beyond the Project boundary

iv. installing wind breaks around large stockpiles

v. locating stockpiles as far as practical from sensitive receptors

Construction Yards

242. The proposed works will require a number of separate construction yards across the Project area. The exact number of yards will depend on factors such as the staging of the Project, which is yet to be determined. These yards will be used as staging points for materials and personnel, and will either have sealed or metalled surfaces. Depending on the activities undertaken at these yards, there may be a need for dust suppression. Water carts or sprinklers are most likely to be appropriate in these instances.

Haul Roads

243. Vehicles travelling along haul roads are often a significant dust source on roadway construction projects. The construction methodology indicates that haul roads will be located within the proposed Project boundary, particularly at each portal of the new tunnels. The northern portal of the Terrace Tunnel, through the Clifton car park, and the western portal of the Mount Victoria Tunnel will be the primary areas requiring mitigation. Tracking of dust on to sealed public roadway surfaces from the construction will also need to be monitored. Mitigation measures along these haul roads that are recommended include:

i. wet suppression of unpaved areas using water carts or fixed sprinklers during dry conditions

ii. metalling or chemical stabilisation of roadway surfaces

iii. revegetation of exposed surfaces once construction works have been completed

iv. wash down vehicles after travelling through haul roads to minimise tracking on public roadway surfaces

v. ensuring vehicles are not overloaded

vi. speed controls on vehicle movements which are appropriate and dependent of proximity to sensitive receptors

Construction Monitoring

244. Monitoring of the proposed construction mitigation measures is required to ensure that they are being effectively implemented. This section outlines the monitoring that is recommended for

inclusion in the CAQMP. It is recommended that the wind and dust monitoring measures are discussed at the daily toolbox meeting, along with key dust mitigation measures.

Real-time Monitoring

245. The NZTA Guide suggests the use of real-time PM10 monitoring for projects with a high air quality risk. I consider it important that real-time dust monitoring be installed in the following three locations due to the proximity of the works to a large number of sensitive receptors:

   i. Adjacent to the northern portal of the Terrace Tunnel

   ii. Adjacent to the western portal of the Mount Victoria Tunnel

   iii. Adjacent to R19 (church) on Moxham Ave

246. Real-time monitoring at each location should include a weather station and a PM_{10} monitor. The weather stations should be configured to collect data automatically and display it on a website for access by all construction personnel. The stations will be used to monitor when wind speeds at a height of 5-10 m exceed specific mitigation trigger values that can result in increased dust generation (e.g. average wind speeds >5 m/s or wind gusts >10 m/s). This information should be provided via text or email to key personnel such as the Construction Manager or Environmental Manager so that they can implement appropriate mitigation measures. Likewise, the PM_{10} monitors should also provide alerts to site staff when trigger levels are reached. These alerts will be used to prompt investigation and or/additional mitigation measures.

Visual Dust Monitoring

247. Table 23 outlines the visual dust monitoring programme that is to be implemented during the construction process. The frequency of the visual monitoring is defined but it should also occur in the event that wind speeds are greater than 10 m/s, discharges of dust cross the site boundary or when a complaint is received. Wind speeds greater than 10 m/s significantly increase the risk of adverse dust events, so a heightened level of caution is required when wind speeds exceed this trigger.

Table 23: Dust Monitoring Programme

Monitoring Activities	Frequency
Check weather forecasts for strong winds and rainfall to plan appropriate dust management response.	Daily
Inspect land adjacent to the site, construction exits and adjoining roads for the presence of dust deposits.	Daily
Site Walkover with observations detailed in a log sheet	Daily (in the afternoon)
Observe weather conditions, wind via observations and data outputs from weather stations and presence of rain.	Daily and as conditions change
Inspect all unsealed surfaces for dampness and to ensure that surface exposure is minimised.	Daily and as conditions change
Inspect stockpiles to ensure enclosure, covering, stabilisation or dampness. Ensure stockpile height is less than 5 m or appropriately stabilised.	Weekly and at times of expected high winds
Inspect dust generating activities to ensure dust emissions are effectively controlled.	Daily and as new activities are commenced
Inspect watering systems (sprays and water carts) to ensure equipment is maintained and functioning to effectively dampen exposed areas.	Weekly
Additional visual monitoring of dust generating activities and water application rate.	In winds over 5 m/s (11 knots or a Beaufort scale number of 3)
Inspect site access and egress points to ensure effective operation of wheelwash / truckwash systems and/or judder bars (if installed).	Weekly
Ensure site windbreak fences, if used, are intact.	Weekly

12 ENGAGEMENT SUMMARY

248. I have reviewed NZTA's summary of feedback received during the community engagement period in late 2025, and feedback from adjacent property owners and occupiers notified of the Project in November 2025. A review copy of this assessment was also provided to GWRC and WCC, and I have reviewed and considered their comments. The key matters raised in the feedback that are relevant to this assessment, and my response to each, are set out below.

GWRC Questions

Table 24: GWRC Feedback Table

Topic	Discussion / Response
Consideration of weekend traffic patterns	Weekend traffic assessment has been undertaken in paragraphs 171 to 176
Intersection and start/stop emissions	Rather than modelling start/stop traffic emissions, I have undertaken a sensitivity analysis of vehicle emissions at slower speeds, as discussed in paragraphs 165 to 170 and agreed with GWRC's air quality advisor. In my view this assessment methodology is an appropriate substitution for modelling in this situation.
Tunnel portal emissions and use of GRAL	It was confirmed with GWRC's air quality advisor that use of the GRAL model was not required for this assessment. The CALPUFF model has been reviewed and confirmed to have been applied in accordance with good practice.
Annual NO_2 background concentrations	Additional information has been provided at paragraph 116.
NO to NO_2 atmospheric conversion	Additional information has been provided at paragraph 115
Methodology for combining model outputs	Additional information has been provided at paragraph 127.
Construction duration uncertainty	Specific duration information is not available at this stage. Works may take a shorter time and involve more intensive activity or take a longer period and involve less intensive activity. My assessment has considered both scenarios. In order to ensure sufficient mitigation measures are in place, the management plan will need to consider construction duration in due course.
Deposited dust monitoring	As real-time ambient monitoring is being proposed, any reference to deposition dust monitoring has been removed from this report. Dust deposition monitoring does not support real-time adaptive management, so ambient PM_{10} monitoring is recommended instead.
Construction air quality monitoring plan	It was agreed during the pre-lodgement meeting with GWRC, that a draft construction air quality monitoring plan was not required at lodgement.

Adjacent Property Engagement

Property location	Summary of comments on air quality	Specialist response
Hamilton Road, Hataitai	Feedback sought air pollution monitors e.g. along Moxham Avenue, Kupe Street and Wellington Road to monitor changes in pollutants from increase in traffic	As part of this Air Quality Assessment a PM_{10} monitoring station is proposed to be installed on Moxham Avenue near the church. This will monitor potential construction impacts for the Project. Post-construction: no ongoing monitoring is proposed, as the GWRC monitors pollutant concentrations at Willis Street. This monitor will represent the likely peak air pollutant concentrations for the central Wellington region.
Abel Smith Street, Te Aro	Concern raised with removal of trees leading to less mitigation of pollution	In terms of air pollution mitigation, the difference resulting from removal of these trees is expected to be negligible.
Henry Street, Kilbirnie	Concern with increased car exhaust and carbon emissions	The operational air quality assessment shows that pollutant concentrations at the modelled sensitive receptors are below the relevant air quality guidelines. In 2033 and 2053, an increase in vehicles numbers is predicted along the Project, however the air quality effects do not significantly change due to the predicted electric car / hybrid uptake. The Integrated Transport Assessment includes a summary of the operational emissions as predicted by the transport modelling undertaken for the Project. This shows a small (approximately 1%) increase in CO_2 emissions.

Property location	Summary of comments on air quality	Specialist response
Moxham Avenue, Hataitai	Notes lack of information on expected additional pollutants and potential impact on health and wellbeing	Detailed information was not available during the public consultation undertaken in late 2025. The pollutants now assessed in this report cover those most likely to result in health effects, as per NZTA guidance. This assessment shows that the concentrations at the modelled sensitive receptors are below the relevant air quality guideline for all contaminants assessed.
Tapiri Street, Hataitai	Concern with dust pollution along Moxham Avenue	As part of this assessment a PM_{10} monitoring station is proposed to be installed on Moxham Avenue near the church. This will monitor potential construction impacts and pollution increases as a result of vehicle movement during this phase. Dust effects will also be managed and mitigated in a Construction Air Quality Management Plan (CAQMP).
Clifton Terrace Model School	Concern with impact of dust and debris on the school	Dust effects will be managed and mitigated in a CAQMP, with spoil handling to occur in an enclosed area. This will reduce the potential for dust impacts as far as practicable.
Dual Apartments	Concern with increased pollution from vehicles on quality of life	Overall, the change in concentration as a result of this Project is not considered to be significant. This is due to the increase in vehicles being off-set by the reduction in emissions (due to the hybrid and electric vehicle predicted uptake). My assessment shows that the concentrations at the sensitive receptors are below the relevant air quality guideline for all contaminants assessed. Any change in concentration is unlikely to be observed or noticeable by the public, therefore it is unlikely to affect people's quality of life.
Park Mews	Seeks comprehensive modelling and mitigation for pollution on surrounding areas and each side of Mount Victoria Tunnel Notes insufficient detail regarding local pollution levels, including on Park Mews Seeks for existing vegetative buffer between Park Mews and Ruahine Street to be retained to mitigate dust and road-related pollution	The air dispersion model as part of my assessment covers the tunnel portal emissions. I report on a number of representative sensitive receptors, along the Project. The sensitive receptors that are likely to experience similar concentrations to Park Mews are R19 (140 Moxham Ave) and R17 (Hataitai Park). These receptors experience concentrations below the relevant guideline concentrations and therefore the concentration at Park Mews is also expected to be below the relevant guidelines. While maintaining vegetation may reduce the visual impacts, there is little benefit from an air quality perspective.
Sunset West	Concern with increased pollution within local area	My assessment shows that the concentrations at the sensitive receptors are below the relevant air quality guideline for all contaminants assessed. Any change in concentration is unlikely to be observed or noticeable by the public therefore it is unlikely to affect people's quality of life.
Trinity Apartments	Concern with increased pollution from three lanes near dwelling	My assessment shows that the concentrations at the sensitive receptors are below the relevant air quality guideline for all contaminants assessed. Any change in concentration is unlikely to be observed or noticeable by the public therefore it is unlikely to affect people's quality of life. The increase in the road width has been included in the assessment.

13 CONCLUSION AND RECOMMENDATIONS

249. Potential adverse air quality effects of the Project during construction and operation have been assessed using best practice methods and adopting the recommendations of relevant good practice guides.

Operational effects

250. The assessment of potential adverse air quality effects during the operation of the Project has predicted ambient concentrations of NO_2, PM_{10} and $PM_{2.5}$ from vehicle emissions from the Project for the opening year (2033) and 20 years after opening (2053).

251. The assessment shows that the predicted concentrations of all pollutants are less than the relevant health impact assessment guidelines and the NES-AQ limits at the identified sensitive receptors.

252. The highest concentrations for all contaminants occurred in 2018, with the concentrations decreasing for 2033 and 2053. The concentrations for the “With Project” scenario are slightly higher than the “Without Project / Do Minimum” for all contaminants, however this change in concentration is not significant when compared to MfE’s significance of change criteria.

253. The decommissioning of the Mount Victoria Tunnel stacks as a result of this Project, decreases the off-site air quality concentrations at some receptor locations (R12 and R15) but increases the concentration at other receptors (R11, R13-R14, R16 – R17). However, all changes are not considered significant.

254. If tolling was implemented, there would be a decrease in concentrations along SH1 and an increase in concentration along some arterial routes. However, all of these concentrations are below the relevant guidelines concentrations.

255. Overall, it is considered that the operational effects of the Project are unlikely to result in an adverse health effect and any change in concentration is unlikely to be experienced at any sensitive receptor location, due to the change being less than the MfE’s significance of change criteria.

Construction effects

256. The primary air discharge from the construction of the Project will be dust. Overall, this Project has been assessed as having the potential to cause nuisance dust emissions, particularly where earthworks are required. Sensitive receptors located within 50 m of construction activities could experience dust nuisance effects.

257. In order to reduce the potential for these nuisance effects so that they are not considered offensive or objectionable, a number of well tested mitigation measures have been recommended. It is recommended these measures be required through the consent conditions and detailed in the recommended CAQMP.

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ANNEXURE A Road Links

Figure A1 – Road Links Inputted into the Air Disperion Model with and without project (1)

Figure A2 – Road Links Inputted into the Air Disperion Model with Project (2)

Figure A3 – Road Links Inputted into the Air Disperion Model without Project (2)

Figure A4 – Road Links Inputted into the Air Disperion Model with and without Project (3)

ANNEXURE B Traffic Data

Table B1: Traffic Data inputted into the Air Dispersion Model

Traffic Link	AADT (Vehicles / day)					
	2018	2033			2053	
	Base Year	Without Project	With Project	Tolling	Without Project	With Project
1	24,700	25,200	34,900	24,200	25,300	35,200
2	20,600	22,050	30,400	22,250	22,400	30,950
3	16,500	18,900	25,900	20,300	19,500	26,700
4	26,100	27,700	31,000	28,500	29,000	32,500
5	24,700	25,200	34,900	24,200	25,300	35,200
6	29,600	31,100	33,700	26,100	31,500	34,200
7	16,500	18,900	25,900	20,300	19,400	26,700
8	27,400	27,100	35,800	31,500	28,700	38,100
9	18,100	18,600	22,600	17,700	19,500	24,800
10	-	-	24,900	20,000	-	27,000
11	26,100	27,700	-	-	29,000	-
12	26,100	27,700	31,000	28,500	29,000	32,500
13	18,100	18,600	22,600	17,700	19,500	24,800
14	18,100	18,600	22,600	17,700	19,500	24,800
15	16,400	17,400	22,600	17,700	18,500	24,800
16	19,200	19,700	21,100	19,900	21,800	22,800
17	19,200	19,700	21,100	19,900	21,800	22,800
18	19,700	20,200	23,300	22,900	22,300	25,300
19	19,700	20,200	23,300	22,900	22,300	25,300
20	19,500	20,800	26,600	24,200	21,600	28,800
21	18,800	19,800	24,900	20,000	20,700	27,000
22	18,800	19,800	24,900	20,000	20,700	27,000
23	18,800 / 34,000	19,800 / 35,800	-	-	20,700 / 37,100	-
24	5,500	6,000	-	-	5,800	-
25	-	-	9,100	9,100	-	9,300
26	-	-	12,400	14,100	-	12,700
27	3,000	2,700	2,300	2,600	3,000	2,500

Traffic Link	AADT (Vehicles / day)					
	2018	2033			2053	
	Base Year	Without Project	With Project	Tolling	Without Project	With Project
28	5,000	4,500	8,800	6,700	5,000	8,900
29	5,200	4,700	4,500	7,100	5,300	5,200
30	5,100	9,600	9,800	11,100	10,700	10,800
31	3,200	3,700	3,600	3,700	4,200	4,200
32	11,900	13,900	12,600	14,900	14,600	13,500
33	4,700	5,500	5,500	7,100	5,900	6,000
34	16,400	14,700	12,500	16,500	15,500	13,100
35	4,600	4,000	2,600	5,000	4,600	2,800
36	3,800	2,600	1,900	2,900	3,400	2,000
37	13,400	14,000	14,400	16,600	14,900	15,200
38	14,100	13,900	10,900	16,300	14,900	11,600
39	4,200	5,900	6,600	6,500	5,800	6,900
40	8,800	7,500	7,800	8,400	7,800	8,400
41	-	-	6,100	8,500	-	5,500
42	-	-	3,800	3,600	-	4,000
43	-	-	5,900	5,200	-	6,400
44	-	-	9,100	9,100	-	9,300

ANNEXURE C VEPM Emission Factors

Table C1: Base Year 2018 Link Information and Emission Factors

Traffic Link	AADT	Vehicle Type	Vehicle Speed	Emission Factor (g/km)		
		(%HV)	(km/h)	NO_2	PM_{10}	$PM_{2.5}$
1	24,700	3.8%	75	0.105	0.029	0.039
2	20,600	3.7%	40	0.120	0.045	0.049
3	16,500	3.5%	40	0.119	0.045	0.049
4	26,100	4.4%	46	0.117	0.043	0.047
5	24,700	3.8%	75	0.105	0.029	0.039
6	29,600	3.9%	72	0.105	0.030	0.039
7	16,500	3.5%	40	0.119	0.045	0.049
8	27,400	4.9%	40	0.127	0.046	0.052
9	18,100	1.0%	48	0.099	0.038	0.040
10	-	-	-	-	-	-
11	26,100	4.4%	46	0.117	0.043	0.047
12	26,100	4.4%	46	0.117	0.043	0.047
13	18,100	1.0%	48	0.099	0.038	0.040
14	18,100	1.0%	48	0.099	0.038	0.040
15	16,400	0.9%	48	0.099	0.038	0.040
16	19,200	4.0%	48	0.113	0.041	0.046
17	19,200	4.0%	48	0.113	0.041	0.046
18	19,700	3.7%	48	0.112	0.041	0.045
19	19,700	3.7%	48	0.112	0.041	0.045
20	19,500	3.6%	48	0.112	0.041	0.045
21	18,800	3.8%	48	0.112	0.041	0.046
22	18,800	3.8%	48	0.112	0.041	0.046
23	18,800 / 34,000	3.8% / 4.9%	48	0.112 / 0.118	0.041 / 0.042	0.046 / 0.047
24	5,500	4.2%	48	0.114	0.041	0.046
25	-	-	-	-	-	-
26	-	-	-	-	-	-
27	3,000	1.0%	46	0.100	0.039	0.041
28	5,000	2.6%	46	0.108	0.041	0.044
29	5,200	7.3%	46	0.130	0.045	0.053
30	5,100	4.0%	46	0.115	0.042	0.047
31	3,200	6.0%	46	0.125	0.044	0.050
32	11,900	2.7%	46	0.109	0.041	0.044
33	4,700	5.1%	46	0.120	0.043	0.049
34	16,400	6.2%	46	0.125	0.044	0.051
35	4,600	1.2%	40	0.107	0.042	0.045
36	3,800	1.6%	40	0.109	0.043	0.045
37	13,400	7.7%	46	0.132	0.046	0.053
38	14,100	7.8%	46	0.132	0.046	0.053
39	4,200	4.2%	48	0.114	0.041	0.046
40	8,800	8.0%	48	0.130	0.045	0.053
41	-	-	-	-	-	-
42	-	-	-	-	-	-
43	-	-	-	-	-	-
44	-	-	-	-	-	-

Table C2: 2033 Without Project Link Information and Emission Factors

Traffic Link	AADT	Vehicle Type	Vehicle Speed	Emission Factor (g/km)		
		(%HV)	(km/h)	NO_2	PM_{10}	$PM_{2.5}$
1	25,200	4.2%	75	0.081	0.028	0.020
2	22,050	4.2%	40	0.087	0.043	0.027
3	18,900	4.2%	40	0.087	0.043	0.027
4	27,700	4.6%	46	0.084	0.041	0.026
5	25,200	4.2%	75	0.081	0.028	0.020
6	31,100	4.4%	72	0.081	0.029	0.020
7	18,900	4.2%	40	0.087	0.043	0.027
8	27,100	5.3%	40	0.089	0.044	0.028
9	18,600	0.7%	48	0.079	0.036	0.022
10	-	-	-	-	-	-
11	27,700	4.6%	46	0.084	0.041	0.026
12	27,700	4.6%	46	0.084	0.041	0.026
13	18,600	0.7%	48	0.079	0.036	0.022
14	18,600	0.7%	48	0.079	0.036	0.022
15	17,400	0.6%	48	0.078	0.036	0.022
16	19,700	4.3%	48	0.083	0.039	0.026
17	19,700	4.3%	48	0.083	0.039	0.026
18	20,200	3.8%	48	0.083	0.039	0.025
19	20,200	3.8%	48	0.083	0.039	0.025
20	20,800	4.3%	48	0.083	0.039	0.026
21	19,800	4.4%	48	0.083	0.040	0.026
22	19,800	4.4%	48	0.083	0.040	0.026
23	19,800 / 35,800	4.4% / 5.0%	48	0.083 / 0.084	0.040	0.026
24	6,000	4.8%	48	0.083	0.040	0.026
25	-	-	-	-	-	-
26	-	-	-	-	-	-
27	2,700	1.2%	46	0.080	0.037	0.023
28	4,500	2.3%	46	0.081	0.038	0.024
29	4,700	7.1%	46	0.087	0.043	0.029
30	9,600	5.3%	46	0.085	0.041	0.027
31	3,700	6.9%	46	0.087	0.043	0.029
32	13,900	4.5%	46	0.084	0.041	0.026
33	5,500	4.8%	46	0.084	0.041	0.026
34	14,700	7.0%	46	0.087	0.043	0.029
35	4,000	1.5%	40	0.083	0.040	0.024
36	2,600	2.6%	40	0.085	0.041	0.026
37	14,000	8.8%	46	0.089	0.045	0.031
38	13,900	8.4%	46	0.089	0.044	0.030
39	5,900	4.6%	48	0.083	0.040	0.026
40	7,500	8.5%	48	0.088	0.043	0.030
41	-	-	-	-	-	-
42	-	-	-	-	-	-
43	-	-	-	-	-	-
44	-	-	-	-	-	-

Table C3: 2033 With Project Link Information and Emission Factors

Traffic Link	AADT	Vehicle Type	Vehicle Speed	Emission Factor (g/km)		
		(%HV)	(km/h)	NO_2	PM_{10}	$PM_{2.5}$
1	34,900	4.1%	75	0.081	0.028	0.031
2	30,400	4.0%	40	0.087	0.043	0.044
3	25,900	3.8%	40	0.087	0.042	0.043
4	31,000	3.7%	46	0.083	0.040	0.025
5	34,900	4.1%	75	0.081	0.028	0.020
6	33,700	4.0%	72	0.080	0.029	0.020
7	25,900	3.8%	40	0.087	0.042	0.027
8	35,800	4.2%	40	0.087	0.043	0.027
9	22,600	3.8%	48	0.083	0.039	0.025
10	24,900	3.3%	48	0.082	0.038	0.025
11	-	-	-	-	-	-
12	31,000	3.7%	46	0.083	0.040	0.025
13	22,600	3.8%	48	0.083	0.039	0.025
14	22,600	3.8%	48	0.083	0.039	0.025
15	22,600	3.8%	48	0.083	0.039	0.025
16	21,100	3.8%	48	0.083	0.039	0.025
17	21,100	3.8%	48	0.083	0.039	0.025
18	23,300	3.4%	48	0.082	0.038	0.025
19	23,300	3.4%	48	0.082	0.038	0.025
20	26,600	3.0%	48	0.081	0.038	0.024
21	24,900	3.3%	48	0.082	0.038	0.025
22	24,900	3.3%	48	0.082	0.038	0.025
23	-	-	-	-	-	-
24	-	-	-	-	-	-
25	9,100	3.8%	46	0.083	0.040	0.025
26	12,400	5.0%	46	0.085	0.041	0.027
27	2,300	1.30%	46	0.080	0.037	0.023
28	8,800	4.00%	46	0.083	0.040	0.026
29	4,500	6.20%	46	0.086	0.042	0.028
30	9,800	5.30%	46	0.085	0.041	0.027
31	3,600	6.90%	46	0.087	0.043	0.029
32	12,600	4.60%	46	0.084	0.041	0.026
33	5,500	5.70%	46	0.085	0.042	0.027
34	12,500	7.10%	46	0.087	0.043	0.029
35	2,600	2.00%	40	0.084	0.041	0.025
36	1,900	3.10%	40	0.085	0.042	0.026
37	14,400	8.60%	46	0.089	0.044	0.030
38	10,900	8.50%	46	0.089	0.044	0.030
39	6,600	5.20%	48	0.084	0.040	0.026
40	7,800	6.80%	48	0.086	0.042	0.028
41	6,100	0.4%	48	0.078	0.036	0.022
42	3,800	1.30%	40	0.083	0.040	0.024
43	5,900	5.40%	48	0.084	0.040	0.027
44	9,100	3.80%	40	0.087	0.042	0.027

Table C4: 2033 With Project Link Information + Tolling and Emission Factors

Traffic Link	AADT	Vehicle Type	Vehicle Speed	Emission Factor (g/km)		
		(%HV)	(km/h)	NO_2	PM_{10}	$PM_{2.5}$
1	24,200	5.00%	75	0.082	0.029	0.020
2	22,250	4.80%	40	0.087	0.033	0.023
3	20,300	4.50%	40	0.087	0.043	0.028
4	28,500	3.90%	46	0.083	0.040	0.026
5	24,200	5.00%	75	0.082	0.029	0.020
6	26,100	4.90%	72	0.081	0.030	0.021
7	20,300	4.50%	40	0.087	0.043	0.028
8	31,500	4.40%	40	0.087	0.043	0.028
9	17,700	4.50%	48	0.083	0.040	0.026
10	20,000	3.90%	48	0.083	0.039	0.025
11	-	-	-	-	-	-
12	28,500	3.90%	46	0.083	0.040	0.026
13	17,700	4.50%	48	0.083	0.040	0.026
14	17,700	4.50%	48	0.083	0.040	0.026
15	17,700	4.50%	48	0.083	0.040	0.026
16	19,900	3.90%	48	0.083	0.039	0.025
17	19,900	3.90%	48	0.083	0.039	0.025
18	22,900	3.40%	48	0.082	0.038	0.025
19	22,900	3.40%	48	0.082	0.038	0.025
20	24,200	3.20%	48	0.082	0.038	0.024
21	20,000	3.90%	48	0.083	0.039	0.025
22	20,000	3.90%	48	0.083	0.039	0.025
23	-	-	-	-	-	-
24	-	-	-	-	-	-
25	9,100	3.80%	46	0.083	0.040	0.025
26	14,100	4.60%	46	0.084	0.041	0.026
27	2,600	1.40%	46	0.080	0.037	0.023
28	6,700	5.50%	46	0.086	0.042	0.027
29	7,100	4.50%	46	0.084	0.041	0.026
30	11,100	4.90%	46	0.084	0.041	0.027
31	3,700	7.00%	46	0.087	0.043	0.029
32	14,900	4.00%	46	0.083	0.040	0.026
33	7,100	4.60%	46	0.084	0.041	0.026
34	16,500	5.50%	46	0.086	0.042	0.027
35	5,000	1.30%	40	0.083	0.040	0.024
36	2,900	2.50%	40	0.085	0.041	0.026
37	16,600	7.90%	46	0.089	0.044	0.030
38	16,300	6.50%	46	0.087	0.042	0.028
39	6,500	4.40%	48	0.083	0.040	0.026
40	8,400	6.00%	48	0.085	0.041	0.027
41	8,500	3.90%	48	0.083	0.039	0.025
42	3,600	1.20%	40	0.082	0.040	0.024
43	5,200	5.00%	48	0.084	0.040	0.026
44	9,100	3.80%	40	0.087	0.042	0.027

Table C5: 2053 Without Project Link Information and Emission Factors

Traffic Link	AADT	Vehicle Type	Vehicle Speed	Emission Factor (g/km)		
		(%HV)	(km/h)	NO_2	PM_{10}	$PM_{2.5}$
1	25,300	5.1%	75	0.010	0.026	0.015
2	22,400	5.0%	40	0.011	0.037	0.020
3	19,500	4.9%	40	0.011	0.037	0.020
4	29,000	5.4%	46	0.010	0.036	0.020
5	25,300	5.1%	75	0.010	0.026	0.015
6	31,500	5.3%	72	0.010	0.027	0.015
7	19,500	4.9%	40	0.011	0.037	0.020
8	28,700	5.9%	40	0.011	0.038	0.021
9	19,500	1.9%	48	0.010	0.032	0.017
10	-	-	-	-	-	-
11	29,000	5.4%	46	0.010	0.036	0.020
12	29,000	5.4%	46	0.010	0.036	0.020
13	19,500	1.9%	48	0.010	0.032	0.017
14	19,500	1.9%	48	0.010	0.032	0.017
15	18,500	1.5%	48	0.010	0.031	0.017
16	21,800	4.4%	48	0.010	0.034	0.019
17	21,800	4.4%	48	0.010	0.034	0.019
18	22,300	4.2%	48	0.010	0.034	0.019
19	22,300	4.2%	48	0.010	0.034	0.019
20	21,600	4.9%	48	0.010	0.035	0.019
21	20,700	5.1%	48	0.010	0.035	0.019
22	20,700	5.1%	48	0.010	0.035	0.019
23	20,700 / 37,100	5.1% / 5.8%	48	0.010	0.035	0.019 / 0.020
24	5,800	5.6%	48	0.010	0.035	0.019
25	-	-	-	-	-	-
26	-	-	-	-	-	-
27	3,000	1.40%	46	0.010	0.032	0.017
28	5,000	3.50%	46	0.010	0.034	0.019
29	5,300	7.80%	46	0.011	0.038	0.021
30	10,700	5.90%	46	0.010	0.036	0.020
31	4,200	7.20%	46	0.011	0.038	0.021
32	14,600	5.20%	46	0.010	0.036	0.020
33	5,900	5.50%	46	0.010	0.036	0.020
34	15,500	7.80%	46	0.011	0.038	0.021
35	4,600	1.80%	40	0.010	0.034	0.018
36	3,400	2.60%	40	0.010	0.035	0.019
37	14,900	9.60%	46	0.011	0.040	0.022
38	14,900	9.40%	46	0.011	0.040	0.022
39	5,800	5.20%	48	0.010	0.035	0.019
40	7,800	9.40%	48	0.011	0.039	0.022
41	-	-	-	-	-	-
42	-	-	-	-	-	-
43	-	-	-	-	-	-
44	-	-	-	-	-	-

Table C6: 2053 With Project Link Information and Emission Factors

Traffic Link	AADT	Vehicle Type	Vehicle Speed	Emission Factor (g/km)		
		(%HV)	(km/h)	NO_2	PM_{10}	$PM_{2.5}$
1	35,200	4.9%	75	0.010	0.026	0.024
2	30,950	4.8%	40	0.011	0.037	0.020
3	26,700	4.6%	40	0.011	0.037	0.020
4	32,500	4.3%	46	0.010	0.035	0.019
5	35,200	4.9%	75	0.010	0.026	0.015
6	34,200	4.9%	72	0.010	0.027	0.015
7	26,700	4.6%	40	0.011	0.037	0.020
8	38,100	4.8%	40	0.011	0.037	0.020
9	24,800	4.2%	48	0.010	0.034	0.019
10	27,000	3.7%	48	0.010	0.033	0.018
11	-	-	-	-	-	-
12	32,500	4.3%	46	0.010	0.035	0.016
13	24,800	4.2%	48	0.010	0.034	0.016
14	24,800	4.2%	48	0.010	0.034	0.019
15	24,800	4.2%	48	0.010	0.034	0.019
16	22,800	4.1%	48	0.010	0.034	0.019
17	22,800	4.1%	48	0.010	0.034	0.019
18	25,300	3.8%	48	0.010	0.034	0.018
19	25,300	3.8%	48	0.010	0.034	0.018
20	28,800	3.4%	48	0.010	0.033	0.018
21	27,000	3.7%	48	0.010	0.033	0.018
22	27,000	3.7%	48	0.010	0.033	0.018
23	-	-	-	-	-	-
24	-	-	-	-	-	-
25	9,300	4.4%	46	0.010	0.035	0.019
26	12,700	5.9%	46	0.010	0.036	0.020
27	2,500	1.5%	46	0.010	0.032	0.017
28	8,900	4.9%	46	0.010	0.035	0.015
29	5,200	6.4%	46	0.011	0.037	0.020
30	10,800	5.9%	46	0.010	0.036	0.020
31	4,200	7.1%	46	0.011	0.037	0.021
32	13,500	5.1%	46	0.010	0.036	0.020
33	6,000	6.4%	46	0.011	0.037	0.020
34	13,100	8.0%	46	0.011	0.038	0.021
35	2,800	2.4%	40	0.010	0.035	0.019
36	2,000	3.8%	40	0.010	0.036	0.020
37	15,200	9.4%	46	0.011	0.040	0.022
38	11,600	9.6%	46	0.011	0.040	0.022
39	6,900	5.8%	48	0.010	0.035	0.020
40	8,400	7.4%	48	0.011	0.037	0.021
41	5,500	0.6%	48	0.010	0.031	0.017
42	4,000	1.5%	40	0.010	0.034	0.018
43	6,400	5.8%	48	0.010	0.035	0.020
44	9,300	4.4%	40	0.011	0.037	0.020

ANNEXURE D Roading Assessment Predicted Concentration

Table D1: Predicted 99.9%ile 1-hour NO_2 (Excluding Background) Concentrations (% of guideline provided in brackets)

Receptor	Base Year ($\mu g/m^3$)	Without Project ($\mu g/m^3$)		With Project ($\mu g/m^3$)		Significance of Change (+ve, NC, -ve)[1]	
		2033	2053	2033	2053	2033	2053
R1	5.0 (3%)	4.4 (2%)	0.5 (0%)	5.9 (3%)	0.7 (0%)	NC	NC
R2	4.0 (2%)	3.6 (2%)	0.5 (0%)	4.0 (2%)	0.5 (0%)	NC	NC
R3	9.1 (5%)	7.9 (4%)	1.0 (1%)	8.7 (4%)	1.1 (1%)	NC	NC
R4	3.5 (2%)	3.0 (2%)	0.4 (0%)	3.8 (2%)	0.5 (0%)	NC	NC
R5	7.1 (4%)	5.8 (3%)	0.7 (0%)	7.2 (4%)	0.9 (0%)	NC	NC
R6	8.0 (4%)	7.0 (3%)	0.9 (0%)	8.3 (4%)	1.0 (1%)	NC	NC
R7	6.4 (3%)	5.8 (3%)	0.7 (0%)	8.5 (4%)	1.1 (1%)	NC	NC
R8	5.5 (3%)	4.9 (2%)	0.6 (0%)	7.1 (4%)	0.9 (0%)	NC	NC
R9	8.6 (4%)	7.2 (4%)	0.9 (0%)	8.1 (4%)	1.0 (1%)	NC	NC
R10	4.1 (2%)	3.5 (2%)	0.4 (0%)	5.4 (3%)	0.7 (0%)	NC	NC
R11	15.3 (8%)	11.5 (6%)	1.5 (1%)	13.6 (7%)	1.8 (1%)	NC	NC
R12	14.9 (7%)	12.3 (6%)	1.6 (1%)	5.0 (2%)	0.6 (0%)	NC	NC
R13	14.5 (7%)	12.8 (6%)	1.6 (1%)	14.3 (7%)	1.9 (1%)	NC	NC
R14	3.1 (2%)	2.7(1%)	0.3 (0%)	3.8 (2%)	0.5 (0%)	NC	NC
R15	6.2 (3%)	5.3 (3%)	0.7 (0%)	6.0 (3%)	0.8 (0%)	NC	NC
R16	4.2 (2%)	3.6 (2%)	0.5 (0%)	4.8 (2%)	0.6 (0%)	NC	NC
R17	5.0 (3%)	4.3 (2%)	0.6 (0%)	6.6 (3%)	0.9 (0%)	NC	NC
R18	5.4 (3%)	4.4 (2%)	0.6 (0%)	6.2 (3%)	0.8 (0%)	NC	NC
R19	8.2 (4%)	7.1 (4%)	0.9 (0%)	7.5 (4%)	1.0 (0%)	NC	NC
R20	5.4 (3%)	4.6 (2%)	0.6 (0%)	5.7 (3%)	0.7 (0%)	NC	NC
R21	4.5 (2%)	3.9 (2%)	0.5 (0%)	7.0 (4%)	0.9 (0%)	NC	NC
R22	8.2 (4%)	6.7 (3%)	0.9 (0%)	12.3 (6%)	1.6 (1%)	NC	NC
R23	10.9 (5%)	8.9 (4%)	1.2 (1%)	6.1 (3%)	0.8 (0%)	NC	NC
R24	14.6 (7%)	12.1 (6%)	1.6 (1%)	13.7 (7%)	1.8 (1%)	NC	NC
Guideline	200					-	-

Table D2: Predicted Maximum 24-hour NO_2 (Excluding Background) Concentrations (% of guideline provided in brackets)

Receptor	Base Year ($\mu g/m^3$)	Without Project ($\mu g/m^3$)		With Project ($\mu g/m^3$)		Significance of Change (+ve, NC, -ve)[2]	
		2033	2053	2033	2053	2033	2053
R1	1.6 (2%)	1.4 (1%)	0.2 (0%)	1.9 (2%)	0.2 (0%)	NC	NC
R2	0.9 (1%)	0.8 (1%)	0.1 (0%)	1.0 (1%)	0.1 (0%)	NC	NC
R3	3.2 (3%)	2.8 (3%)	0.4 (0%)	3.1 (3%)	0.4 (0%)	NC	NC
R4	1.2 (1%)	1.1 (1%)	0.1 (0%)	1.4 (1%)	0.2 (0%)	NC	NC
R5	2.5 (2%)	2.1 (2%)	0.3 (0%)	2.6 (3%)	0.3 (0%)	NC	NC
R6	2.2 (2%)	2.0 (2%)	0.3 (0%)	2.3 (2%)	0.3 (0%)	NC	NC
R7	2.0 (2%)	1.8 (2%)	0.2 (0%)	2.7 (3%)	0.3 (0%)	NC	NC
R8	1.7 (2%)	1.5 (2%)	0.2 (0%)	2.2 (2%)	0.3 (0%)	NC	NC
R9	3.2 (3%)	2.6 (3%)	0.3 (0%)	2.7 (3%)	0.3 (0%)	NC	NC
R10	1.0 (1%)	0.8 (1%)	0.1 (0%)	1.1 (1%)	0.1 (0%)	NC	NC

[1] The 'significance of change' criteria is explained in the Assessment Criteria

[2] The 'significance of change' criteria is explained in the Assessment Criteria

Receptor	Base Year (µg/m³)	Without Project (µg/m³)		With Project (µg/m³)		Significance of Change (+ve, NC, -ve)[2]	
		2033	2053	2033	2053	2033	2053
R11	5.2 (5%)	3.9 (4%)	0.5 (0%)	4.8 (5%)	0.6 (1%)	NC	NC
R12	5.1 (5%)	4.2 (4%)	0.5 (1%)	1.8 (2%)	0.2 (0%)	NC	NC
R13	4.7 (5%)	4.1 (4%)	0.5 (1%)	4.7 (5%)	0.6 (1%)	NC	NC
R14	1.0 (1%)	0.9 (1%)	0.1 (0%)	1.2 (1%)	0.2 (0%)	NC	NC
R15	1.7 (2%)	1.5 (1%)	0.2 (0%)	1.9 (2%)	0.3 (0%)	NC	NC
R16	1.3 (1%)	1.1 (1%)	0.1 (0%)	1.5 (2%)	0.2 (0%)	NC	NC
R17	1.7 (2%)	1.5 (1%)	0.2 (0%)	2.2 (2%)	0.3 (0%)	NC	NC
R18	1.9 (2%)	1.5 (2%)	0.2 (0%)	2.1 (2%)	0.3 (0%)	NC	NC
R19	2.8 (3%)	2.4 (2%)	0.3 (0%)	2.6 (3%)	0.3 (0%)	NC	NC
R20	1.6 (2%)	1.4 (1%)	0.2 (0%)	2.0 (2%)	0.3 (0%)	NC	NC
R21	1.6 (2%)	1.4 (1%)	0.2 (0%)	2.6 (3%)	0.3 (0%)	NC	NC
R22	2.8 (3%)	2.3 (2%)	0.3 (0%)	3.9 (4%)	0.5 (1%)	NC	NC
R23	2.7 (3%)	2.3 (2%)	0.3 (0%)	2.0 (2%)	0.3 (0%)	NC	NC
R24	4.7 (5%)	3.9 (4%)	0.5 (1%)	4.5 (4%)	0.6 (1%)	NC	NC
Guideline	100					-	-

Table D3: Predicted Annual NO_2 (Excluding Background) Concentrations (% of guideline provided in brackets)

Receptor	Base Year (µg/m³)	Without Project (µg/m³)		With Project (µg/m³)	
		2033	2053	2033	2053
R1	0.7 (2%)	0.7 (2%)	0.1 (0%)	0.8 (2%)	0.1 (0%)
R2	0.3 (1%)	0.2 (1%)	0.0 (0%)	0.3 (1%)	0.0 (0%)
R3	1.0 (3%)	1.0 (2%)	0.1 (0%)	1.1 (3%)	0.1 (0%)
R4	0.3 (1%)	0.3 (1%)	0.0 (0%)	0.4 (1%)	0.0 (0%)
R5	1.2 (3%)	1.0 (3%)	0.1 (0%)	1.3 (3%)	0.2 (0%)
R6	0.8 (2%)	0.7 (2%)	0.1 (0%)	0.8 (2%)	0.1 (0%)
R7	0.7 (2%)	0.6 (2%)	0.1 (0%)	0.9 (2%)	0.1 (0%)
R8	0.7 (2%)	0.6 (2%)	0.1 (0%)	0.9 (2%)	0.1 (0%)
R9	1.2 (3%)	1.0 (3%)	0.1 (0%)	1.1 (3%)	0.1 (0%)
R10	0.4 (1%)	0.4 (1%)	0.0 (0%)	0.4 (1%)	0.1 (0%)
R11	1.9 (5%)	1.5 (4%)	0.2 (0%)	2.0 (5%)	0.3 (1%)
R12	2.4 (6%)	2.0 (5%)	0.3 (1%)	0.8 (2%)	0.1 (0%)
R13	1.6 (4%)	1.4 (4%)	0.2 (0%)	1.6 (4%)	0.2 (1%)
R14	0.3 (1%)	0.2 (1%)	0.0 (0%)	0.4 (1/%)	0.1 (0%)
R15	0.2 (1%)	0.2 (0%)	0.0 (0%)	0.3 (1%)	0.0 (0%)
R16	0.3 (1%)	0.2 (1%)	0.0 (0%)	0.3 (1%)	0.0 (0%)
R17	0.6 (2%)	0.5 (1%)	0.1 (0%)	0.9 (2%)	0.1 (0%)
R18	0.6 (2%)	0.5 (1%)	0.1 (0%)	0.7 (2%)	0.1 (0%)
R19	1.0 (3%)	0.9 (2%)	0.1 (0%)	1.0 (2%)	0.1 (0%)
R20	0.8 (2%)	0.7 (2%)	0.1 (0%)	1.0 (2%)	0.1 (0%)
R21	0.4 (1%)	0.3 (1%)	0.0 (0%)	0.6 (2%)	0.1 (0%)
R22	0.7 (2%)	0.6 (2%)	0.1 (0%)	1.1 (3%)	0.1 (0%)
R23	1.0 (3%)	0.9 (2%)	0.1 (0%)	0.8 (2%)	0.1 (0%)
R24	1.3 (3%)	1.1 (3%)	0.1 (0%)	1.3 (3%)	0.2 (0%)
Guideline	40				

Table D4: Predicted 24-hour PM_{10} (Excluding Background) Concentrations (% of guideline provided in brackets)

Receptor	Base Year (µg/m³)	Without Project (µg/m³)		With Project (µg/m³)		Significance of Change (+ve, NC, -ve)[3]	
		2033	2053	2033	2053	2033	2053
R1	0.4 (1%)	0.5 (1%)	0.5 (1%)	0.6 (1%)	0.6 (1%)	NC	NC
R2	0.3 (1%)	0.3 (1%)	0.3 (1%)	0.3 (1%)	0.3 (1%)	NC	NC
R3	1.1 (2%)	1.2 (2%)	1.1 (2%)	1.3 (3%)	1.2 (2%)	NC	NC
R4	0.4 (1%)	0.4 (1%)	0.4 (1%)	0.5 (1%)	0.5 (1%)	NC	NC
R5	0.8 (2%)	0.8 (2%)	0.8 (2%)	1.0 (2%)	0.9 (2%)	NC	NC
R6	0.8 (2%)	0.8 (2%)	0.8 (2%)	1.0 (2%)	0.9 (2%)	NC	NC
R7	0.7 (1%)	0.8 (2%)	0.7 (1%)	1.2 (2%)	1.1 (2%)	NC	NC
R8	0.6 (1%)	0.7 (1%)	0.6 (1%)	1.0 (2%)	0.9 (2%)	NC	NC
R9	1.2 (2%)	1.2 (2%)	1.1 (2%)	1.2 (2%)	1.1 (2%)	NC	NC
R10	0.4 (1%)	0.4 (1%)	0.3 (1%)	0.5 (1%)	0.5 (1%)	NC	NC
R11	1.9 (4%)	1.8 (4%)	1.6 (3%)	2.1 (4%)	2.0 (4%)	NC	NC
R12	1.8 (4%)	1.8 (4%)	1.7 (3%)	0.8 (2%)	0.7 (1%)	NC	NC
R13	1.8 (4%)	1.8 (4%)	1.6 (3%)	2.0 (4%)	1.9 (4%)	NC	NC
R14	0.4 (1%)	0.4 (1%)	0.3 (1%)	0.5 (1%)	0.5 (1%)	NC	NC
R15	0.6 (1%)	0.6 (1%)	0.6 (1%)	0.8 (2%)	0.8 (2%)	NC	NC
R16	0.5 (1%)	0.5 (1%)	0.4 (1%)	0.7 (2%)	0.6 (1%)	NC	NC
R17	0.6 (1%)	0.6 (1%)	0.6 (1%)	1.0 (2%)	0.9 (2%)	NC	NC
R18	0.7 (1%)	0.6 (1%)	0.6 (1%)	0.9 (2%)	0.8 (2%)	NC	NC
R19	1.0 (2%)	1.0 (2%)	1.0 (2%)	1.1 (2%)	1.1 (2%)	NC	NC
R20	0.6 (1%)	0.6 (1%)	0.5 (1%)	0.9 (2%)	0.8 (2%)	NC	NC
R21	0.6 (1%)	0.6 (1%)	0.6 (1%)	1.1 (2%)	1.1 (2%)	NC	NC
R22	1.0 (2%)	1.0 (2%)	1.0 (2%)	1.7 (3%)	1.6 (3%)	NC	NC
R23	1.0 (2%)	1.0 (2%)	0.9 (2%)	0.8 (2%)	0.8 (2%)	NC	NC
R24	1.7 (3%)	1.7 (3%)	1.6 (3%)	1.9 (4%)	1.8 (4%)	NC	NC
Guideline	50					-	-

Table D5: Predicted Annual PM_{10} (Excluding Background) Concentrations (% of guideline provided in brackets)

Receptor	Base Year (µg/m³)	Without Project (µg/m³)		With Project (µg/m³)		Significance of Change (+ve, NC, -ve)[4]	
		2033	2053	2033	2053	2033	2053
R1	0.2 (1%)	0.3 (1%)	0.2 (1%)	0.3 (1%)	0.3 (1%)	NC	NC
R2	0.1 (0%)	0.1 (0%)	0.1 (0%)	0.1 (0%)	0.1 (0%)	NC	NC
R3	0.4 (2%)	0.4 (2%)	0.4 (2%)	0.4 (2%)	0.4 (2%)	NC	NC
R4	0.1 (1%)	0.1 (1%)	0.1 (1%)	0.1 (1%)	0.1 (1%)	NC	NC
R5	0.4 (2%)	0.4 (2%)	0.4 (2%)	0.5 (3%)	0.5 (2%)	NC	NC
R6	0.3 (1%)	0.3 (2%)	0.3 (1%)	0.4 (2%)	0.3 (2%)	NC	NC
R7	0.3 (1%)	0.3 (1%)	0.3 (1%)	0.4 (2%)	0.4 (2%)	NC	NC
R8	0.3 (1%)	0.3 (1%)	0.2 (1%)	0.4 (2%)	0.4 (2%)	NC	NC
R9	0.4 (2%)	0.4 (2%)	0.4 (2%)	0.5 (2%)	0.4 (2%)	NC	NC
R10	0.2 (1%)	0.2 (1%)	0.1 (1%)	0.2 (1%)	0.2 (1%)	NC	NC
R11	0.7 (4%)	0.7 (3%)	0.6 (3%)	0.9 (4%)	0.8 (4%)	NC	NC
R12	0.9 (4%)	0.9 (4%)	0.8 (4%)	0.4 (2%)	0.3 (2%)	NC	NC

[3] The 'significance of change' criteria is explained in the Assessment Criteria

[4] The 'significance of change' criteria is explained in the Assessment Criteria

Receptor	Base Year (µg/m³)	Without Project (µg/m³)		With Project (µg/m³)		Significance of Change (+ve, NC, -ve)[4]	
		2033	2053	2033	2053	2033	2053
R13	0.6 (3%)	0.6 (3%)	0.6 (3%)	0.7 (3%)	0.6 (3%)	NC	NC
R14	0.1 (1%)	0.1 (1%)	0.1 (1%)	0.2 (1%)	0.2 (1%)	NC	NC
R15	0.1 (0%)	0.1 (0%)	0.1 (0%)	0.1 (1%)	0.1 (1%)	NC	NC
R16	0.1 (1%)	0.1 (1%)	0.1 (0%)	0.2 (1%)	0.1 (1%)	NC	NC
R17	0.2 (1%)	0.2 (1%)	0.2 (1%)	0.4 (2%)	0.3 (1%)	NC	NC
R18	0.2 (1%)	0.2 (1%)	0.2 (1%)	0.3 (2%)	0.3 (1%)	NC	NC
R19	0.4 (2%)	0.4 (2%)	0.4 (2%)	0.4 (2%)	0.4 (2%)	NC	NC
R20	0.3 (1%)	0.3 (1%)	0.3 (1%)	0.4 (2%)	0.4 (2%)	NC	NC
R21	0.1 (1%)	0.1 (1%)	0.1 (1%)	0.3 (1%)	0.2 (1%)	NC	NC
R22	0.3 (1%)	0.3 (1%)	0.2 (1%)	0.5 (2%)	0.4 (2%)	NC	NC
R23	0.4 (2%)	0.4 (2%)	0.3 (2%)	0.3 (2%)	0.3 (2%)	NC	NC
R24	0.5 (2%)	0.5 (2%)	0.5 (2%)	0.6 (3%)	0.5 (3%)	NC	NC
Guideline	20					-	-

Table D6: Predicted 24-hour $PM_{2.5}$ (Excluding Background) Concentrations (% of guideline provided in brackets)

Receptor	Base Year (µg/m³)	Without Project (µg/m³)		With Project (µg/m³)		Significance of Change (+ve, NC, -ve)[5]	
		2033	2053	2033	2053	2033	2053
R1	0.6 (2%)	0.3 (1%)	0.3 (1%)	0.4 (2%)	0.3 (1%)	NC	NC
R2	0.4 (1%)	0.2 (1%)	0.2 (1%)	0.2 (1%)	0.2 (1%)	NC	NC
R3	1.3 (5%)	0.8 (3%)	0.6 (2%)	0.8 (3%)	0.7 (3%)	NC	NC
R4	0.5 (2%)	0.3 (1%)	0.2 (1%)	0.4 (1%)	0.3 (1%)	NC	NC
R5	1.0 (4%)	0.6 (2%)	0.4 (2%)	0.7 (3%)	0.5 (2%)	NC	NC
R6	0.9 (4%)	0.5 (2%)	0.4 (2%)	0.6 (2%)	0.5 (2%)	NC	NC
R7	0.8 (3%)	0.5 (2%)	0.4 (2%)	0.7 (3%)	0.6 (2%)	NC	NC
R8	0.7 (3%)	0.4 (2%)	0.3 (1%)	0.6 (3%)	0.5 (2%)	NC	NC
R9	1.3 (5%)	0.7 (3%)	0.6 (2%)	0.8 (3%)	0.6 (2%)	NC	NC
R10	0.4 (2%)	0.2 (1%)	0.2 (1%)	0.3 (1%)	0.3 (1%)	NC	NC
R11	2.1 (8%)	1.2 (5%)	0.9 (4%)	1.4 (5%)	1.1 (4%)	NC	NC
R12	2.0 (8%)	1.2 (5%)	0.9 (4%)	0.5 (2%)	0.4 (2%)	NC	NC
R13	1.9 (8%)	1.1 (4%)	0.9 (4%)	1.3 (5%)	1.1 (4%)	NC	NC
R14	0.4 (2%)	0.2 (1%)	0.2 (1%)	0.3 (1%)	0.2 (1%)	NC	NC
R15	0.7 (3%)	0.4 (2%)	0.2 (1%)	0.5 (2%)	0.4 (2%)	NC	NC
R16	0.5 (2%)	0.3 (1%)	0.3 (1%)	0.4 (2%)	0.3 (1%)	NC	NC
R17	0.7 (3%)	0.4 (2%)	0.2 (1%)	0.6 (2%)	0.5 (2%)	NC	NC
R18	0.8 (3%)	0.4 (2%)	0.2 (1%)	0.6 (2%)	0.5 (2%)	NC	NC
R19	1.1 (5%)	0.6 (3%)	0.4 (2%)	0.7 (3%)	0.6 (2%)	NC	NC
R20	0.6 (3%)	0.4 (1%)	0.2 (1%)	0.6 (2%)	0.5 (2%)	NC	NC
R21	0.7 (3%)	0.4 (2%)	0.2 (1%)	0.7 (3%)	0.6 (2%)	NC	NC
R22	1.1 (5%)	0.6 (3%)	0.4 (2%)	1.1 (4%)	0.9 (3%)	NC	NC
R23	1.1 (5%)	0.6 (3%)	0.4 (2%)	0.5 (2%)	0.4 (2%)	NC	NC
R24	1.9 (8%)	1.1 (4%)	0.7 (3%)	1.2 (5%)	1.0 (4%)	NC	NC
Guideline	25					-	-

[5] The 'significance of change' criteria is explained in the Assessment Criteria

ANNEXURE E Tunnel Assessment Predicted Concentrations

Terrace Tunnel – 2033 Project Emission Rates

Table E1: Predicted 2033 Terrace Tunnel (Excluding Background) Concentrations

Receptor	99.9%ile 1-hour NO_2 (µg/m^3)	Maximum 24-hour NO_2 (µg/m^3)	Annual NO_2 (µg/m^3)	Maximum 24-hour PM_{10} (µg/m^3)	Annual PM_{10} (µg/m^3)	Maximum 24-hour $PM_{2.5}$ (µg/m^3)
R1	14.8	3.8	0.4	2.1	0.2	1.4
R2	12.7	2.4	0.1	1.3	0.1	0.9
R3	95.3	22.5	2.0	5.1	0.5	3.5
R4	45.6	5.7	0.4	1.3	0.1	0.9
R5	44.0	7.7	0.8	1.8	0.2	1.2
R6	28.5	6.2	0.3	1.4	0.1	1.0
Guideline	**200**	**100**	**40**	**50**	**20**	**25**

Mount Victoria Tunnel

Table E2: Predicted 99.9%ile 1-hour NO_2 (Excluding Background) Concentrations

Receptor	Current Set-up (With Stack) (µg/m^3)	Project Set-up (No stacks) (µg/m^3)	Significance of Change (+ve, NC, -ve)[6]
R11	1.5	2.7	NC
R12	0.8	2.1	NC
R13	2.7	3.4	NC
R14	16.1	24.2	NC
R15	38.7	29.5	NC
R16	1.7	2.2	NC
R17	3.4	2.9	NC
Guideline	**200**		**-**

Table E3: Predicted Maximum 24-hour NO_2 (Excluding Background) Concentrations

Receptor	Current Set-up (With Stack) (µg/m^3)	Project Set-up (No stacks) (µg/m^3)	Significance of Change (+ve, NC, -ve)[7]
R11	0.4	0.5	NC
R12	0.2	0.4	NC
R13	0.6	0.9	NC
R14	3.6	6.6	NC
R15	7.2	5.9	NC
R16	0.3	0.5	NC
R17	0.6	0.7	NC
Guideline	**100**		**-**

Table E4: Predicted Annual NO_2 (Excluding Background) Concentrations

Receptor	Current Set-up (With Stack) (µg/m^3)	Project Set-up (No stacks) (µg/m^3)
R11	0.02	0.04
R12	0.01	0.01
R13	0.03	0.05
R14	0.3	0.9
R15	0.4	1.0
R16	0.01	0.03
R17	0.1	0.2
Guideline	**40**	

[6] The ‘significance of change’ criteria is explained in the Assessment Criteria

[7] The ‘significance of change’ criteria is explained in the Assessment Criteria

Table E5: Predicted 24-hour PM_{10} (Excluding Background) Concentrations

Receptor	Current Set-up (With Stack) (µg/m³)	Project Set-up (No stacks) (µg/m³)	Significance of Change (+ve, NC, -ve)[8]
R11	0.2	0.2	NC
R12	0.1	0.1	NC
R13	0.3	0.3	NC
R14	1.5	2.2	NC
R15	3.0	1.9	NC
R16	0.1	0.3	NC
R17	0.2	0.4	NC
Guideline	**50**		**-**

Table E6: Predicted Annual PM_{10} (Excluding Background) Concentrations

Receptor	Current Set-up (With Stack) (µg/m³)	Project Set-up (No stacks) (µg/m³)	Significance of Change (+ve, NC, -ve)[9]
R11	0.01	0.01	NC
R12	2.8×10^{-3}	4.7×10^{-3}	NC
R13	0.01	0.02	NC
R14	0.1	0.3	NC
R15	0.2	0.4	NC
R16	4.6×10^{-3}	0.02	NC
R17	0.03	0.1	NC
Guideline	**20**		**-**

Table E7: Predicted 24-hour $PM_{2.5}$ (Excluding Background) Concentrations

Receptor	Current Set-up (With Stack) (µg/m³)	Project Set-up (No stacks) (µg/m³)	Significance of Change (+ve, NC, -ve)[10]
R11	0.2	0.1	NC
R12	0.1	0.1	NC
R13	0.3	0.2	NC
R14	1.7	1.5	NC
R15	3.5	1.3	NC
R16	0.1	0.2	NC
R17	0.2	0.3	NC
Guideline	**25**		**-**

[8] The 'significance of change' criteria is explained in the Assessment Criteria

[9] The 'significance of change' criteria is explained in the Assessment Criteria

[10] The 'significance of change' criteria is explained in the Assessment Criteria