Technical Report 14

Assessment of Construction Air Quality Effects

NZ TRANSPORT AGENCY
WAKA KOTAHI

MacKays to Peka Peka Expressway

Revision History

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on behalf of	Beca Infrastructure Ltd		

Table of Contents

Appendices

Executive summary

The NZ Transport Agency ('the NZTA') is lodging a Notice of Requirement (NOR) and resource consent applications (RCA's) to construct, operate and maintain an Expressway between MacKays Crossing and Peka Peka ('the Project') on the Kāpiti Coast.

This report considers the effects of discharges to air associated with the construction of the Project. Technical Report 13, Volume 3 considers the effects of the operation of the proposed Expressway on air quality.

The scope and purpose of this report is to provide:

- an overview of the Project itself and of the receiving environment;
- a description of the types and sources of discharges to air from construction activities (including dust, odour and hazardous air pollutants);
- an assessment of the effects of dust discharges; and
- an outline of a range of mitigation measures that will be employed as required.

Due to the close proximity of sensitive receptors (mainly residential premises) to large parts of the proposed construction footprint for the Project, a high standard of emissions control and management will be employed to adequately avoid or mitigate the effects of discharges of construction dust.

A monitoring programme is proposed, utilising regular visual monitoring of dust discharge in all areas, continuous monitoring of total suspended particulate matter (TSP) at a number of locations, continuous meteorological monitoring at one or more locations and prompt responses to complaints from the public and regulatory authorities. The aim of this monitoring programme is to assist the control and management of discharges of construction dust from the Project.

In parallel with this assessment, the Construction Air Quality Management Plan (CAQMP) (CEMP Appendix G, Volume 4) has been prepared, which is designed to form the basis of a full CAQMP, to be prepared once the conditions of any Expressway Designation and consents are known. This CAQMP will detail methods to be used to mitigate discharges of contaminants into air from the construction of the Project.

This assessment concludes that, through the use of appropriate emissions control and good on-site management, adverse effects that may otherwise be caused by discharges of contaminants into air from the construction of the Project will be adequately avoided or mitigated.

1 Introduction

1.1 Background

The NZ Transport Agency ('the NZTA') is lodging a Notice of Requirement (NOR) and resource consent applications (RCA's) to construct, operate and maintain an Expressway between MacKays Crossing and Peka Peka ('the Project') on the Kāpiti Coast.

The MacKays to Peka Peka Expressway route has been identified as one of eight sections within the Wellington Northern Corridor (SH1 from Levin to the Wellington Airport) which is an identified "Road of National Significance" (RoNS) in terms of the 2009 Government Policy Statement.

1.1.1 Outline of report

In addition to assessing the effects of vehicle exhaust emissions from roading projects ("operational effects"), the Draft NZTA Standard for Producing Air Quality Assessments for State highway Projects (NZTA, 2010) (Draft NZTA Standard) requires an assessment to be made of the air quality impacts of construction activities associated with such projects, primarily focussed on the effects of dust. The Draft NZTA Standard specifically refers to the Ministry for the Environment (MfE) Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Emissions (MfE, 2001) (MfE Dust GPG). The requirements of these documents are addressed in the following sections of this report, as follows:

- Section 2 provides an overview of the receiving environment and relevant land use zoning.
- An overview of the Project is given in Section 3.
- Section 5 outlines the approach taken to the assessment of effects of discharges to air from the construction of the Project, including an overview of the relevant statutory provisions and of the types and sources of discharges to air.
- Section 5 summarises the location and type of specific dust generating activities in relation to the receiving environment.
- Section 6 outlines the monitoring that has been recommended.
- Sections 7 and 8 summarise the potential effects of discharges of odour and of vehicle exhaust emissions from construction traffic.

Technical Report 13, Volume 3 considers the effects of the operation of the proposed Expressway on air quality.

2 Existing environment

2.1 Land use

The Project is broken down into the following four sectors from South to North (refer Figure 2 Section 3.2):

2.1.1 Sector 1

All land within 200m of both SH1 and the proposed Expressway in Sector 1 is currently either zoned Rural or Open Space under the Operative Kāpiti Coast District Plan (KCDP). Land in the vicinity of the proposed Expressway in Sector 2 between Poplar Avenue and

Raumati Road is largely zoned either Rural or Residential under the KCDP, with the exception of land to the east of SH1, which is zoned Open Space.

South of Poplar Avenue, there are no sensitive receptors within 100m of any part of the construction footprint, although there are a number of residential properties within 100m of the access road between the Poplar Avenue construction yard and the proposed Expressway Alignment, while the Te Ra Waldorf School is within 100m of the yard itself.

Likewise, there are a number of residential properties within 100m of the proposed Expressway construction Designation between Poplar Avenue and Raumati Road. Although many of these are likely to be over 100m from the actual construction footprint, some, particularly near the eastern end of Leinster Avenue and on Raumati Road, are immediately adjacent to construction areas.

2.1.2 Sector 2

Land in the vicinity of the proposed Expressway in Sector 2 between Raumati Road and Ihakara Street is largely zoned either Rural or Residential under the KCDP. Between Ihakara Street and Kāpiti Road, land to the east of the proposed Expressway Alignment is zoned Town Centre (i.e. for the future expansion of Kāpiti town centre), while land immediately to the west is zoned either Residential or Rural, with Airport zoning beyond that (over 200m from the proposed Expressway Alignment).

In the immediate vicinity of the Kāpiti Road intersection, land to the east of the proposed Expressway Alignment is zoned Residential, while land to the west is zoned Industrial.

Between Kāpiti Road and Mazengarb Road, land to the east of the proposed Expressway Alignment is zoned Residential. To the west of the proposed Expressway Alignment, land is zoned industrial between Kāpiti Road and the end of Te Roto Drive, while most of the remaining land between there and Mazengarb Road is zoned Residential.

There are a considerable number of residential properties within 100m of the construction footprint between Raumati Road and Kāpiti Road, largely along Rata Road, the northern end of Kiwi Road, and properties in the modern residential subdivision including Quadrant Heights, Observation Place and Milne Drive. Properties on the eastern side of Quadrant Heights and Milne Drive are immediately adjacent to the proposed Expressway construction Designation boundary.

Similarly, there are a significant number of residential properties immediately adjoining the construction footprint to the east of the proposed Expressway Alignment (Spackman Crescent, Makarini Street, Palmer Court, St James Court) between Kāpiti Road and Mazengarb Road, as are with a number units on the west side of the proposed Expressway Alignment in the Metlifecare Kāpiti retirement village (off Guildford Drive).

2.1.3 Sector 3

North of Mazengarb Road to the Waikanae River, almost all the land within 200m of the proposed Expressway Alignment is zoned Rural, as is land to the east of the proposed Expressway Alignment from the Waikanae River to beyond Te Moana Road, with isolated houses within 100m of the construction footprint. Land to the west of the proposed Expressway Alignment from the Waikanae River to beyond Te Moana Road is zoned either Rural or Residential, with a significant number of residential dwellings within 100m of the footprint.

Immediately to the east of the proposed Expressway Alignment, approximately 300m northeast of Mazengarb Road, is the Paraparaumu wastewater treatment plant, while a composting plant is located just to the south of the former Otaihanga Road landfill site.

2.1.4 Sector 4

Land within Sector 4 is almost all zoned either Rural, Open Space or Ngarara[1], with the exception of the relatively new subdivision on Ferndale Road, which is zoned Residential. The closest parts of this subdivision are approximately 100m to the west of the proposed Expressway, while there are a small number of individual houses within 100m of the proposed Expressway Alignment, particularly on Peka Peka Road.

2.2 Sensitive receptors

2.2.1 What is a sensitive receptor?

Areas that are regarded as sensitive to dust discharges typically have significant residential development, whereas a sparsely populated rural area may be relatively insensitive to some discharges. Schools, preschools, healthcare facilities and certain types of commercial activities, such as office and retail premises, may also be regarded as sensitive receptors.

Rural areas are not generally regarded as being particularly sensitive to the effects of dust discharges. Although the productivity of horticultural crops close to unsealed roads can be adversely affected by high dust loadings (in excess of 7 g/m2), the effects on pastoral grassland are minimal (McCrea, 1984). There is limited data and no known published limits for managing the impact of dust discharges on wildlife or natural ecosystems.

2.2.2 Selection of sensitive receptors

Due to the nature of dust discharges that are likely to occur from road construction activities, only premises within about 100m of the construction footprint of the proposed Expressway are at significant risk of being adversely affected by discharges of construction dust (refer section 4.6.1 of this report).

There are no schools, preschools or residential healthcare facilities within that area.

There are a significant number of residential premises within 100m of the construction footprint of the proposed Expressway, largely in the following areas:

- Poplar Avenue to Mazengarb Road
- Waikanae River to Te Moana Road
- In the vicinity of Peka Peka Road.

[1] The KCDP states: "*Ngarara is a special part of the Kāpiti Coast providing for a variety of residential development clusters, integrated into its rural, coastal, conservation and forest setting. The fundamental design approach underpinning Ngarara has been driven by the objective of retaining the distinctive character of the site by the careful integration of built form with its rural coastal setting.*"

The Project team[2] is not aware of any significant horticultural activities in the immediate vicinity of the construction footprint of the Project.

Further description of these areas and maps showing the sensitivity of the receiving environment are included in section 5 of this report.

2.3 Meteorology

Prevailing winds on the Kāpiti Coast are from the north to northeast and, to a lesser extent, the southwest. These prevailing winds vary with season, with northerly winds dominant during the summer and northeasterly in the winter. The highest wind speeds tend to occur when the wind is from a northwesterly direction, especially during spring and summer. In consequence, properties to the south and/or southwest of the construction footprint have a higher risk of exposure to dust emissions than those to the northwest.

Figure 1 presents a summary of hourly average wind speed and direction for the period 2008 to 2010 for Paraparaumu Airport, which is located 1.2km northwest of the proposed Kāpiti Road intersection. Wind roses for each of these years, together with summary wind roses for spring, summer, autumn and winter, are presented in Appendix A of this report.

[2] This Technical Report refers to the Project team as carrying out works on behalf of and as contracted by the NZTA. The NZTA is the requiring authority and the consent holder.

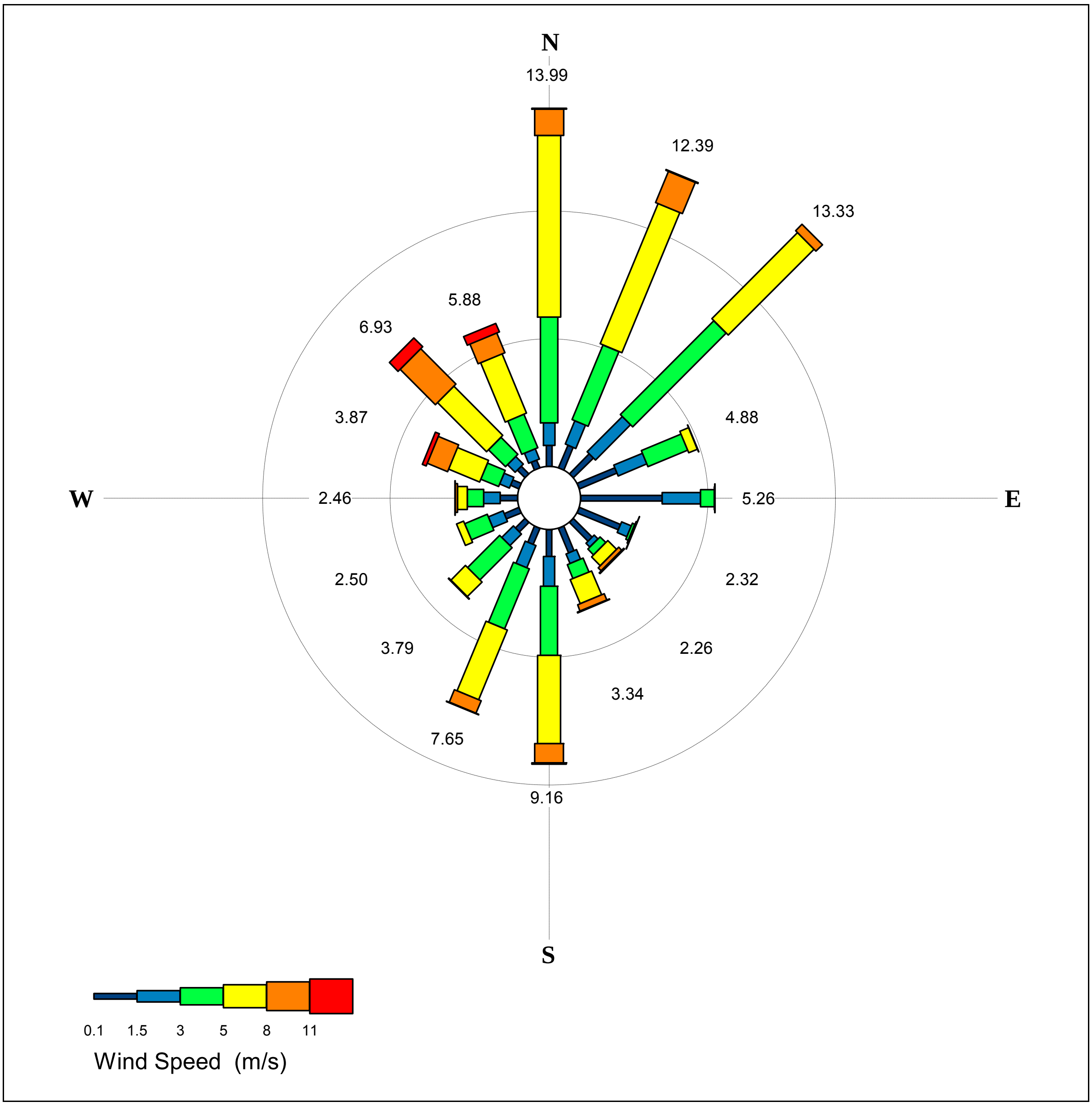


Figure 1 – Summary Wind Rose, Paraparaumu Airport, 2008-2010

3 Project description

3.1 Overview of Project

The proposed Designation for the Project is proposed to generally follow the existing Western Link Road (WLR) designation, and span a length of approximately 16km from just south of Poplar Ave (chainage 1,900m) to just north of Peka Peka Road (chainage 18,050m).

The MacKays to Peka Peka Expressway ('the Expressway') will provide for two lanes of traffic in each direction, connections with local roads at four interchanges, construction of new local roads and access roads to maintain local connectivity and an additional crossing of the Waikanae River.

Once completed, the proposed Expressway will become part of State Highway 1 (SH1). The existing section of SH1 between MacKays Crossing and Peka Peka is likely to become a local arterial road.

The Project will be designed to the RoNS Design Standards and Guidelines and will include the following principal design features:

- A four lane median divided Expressway (two traffic lanes in each direction);
- Partial interchange at Poplar Avenue;
- Full interchange at Kāpiti Road;
- Four lane bridge over the Waikanae River;
- Full interchange at Te Moana Road;
- Partial interchange at Peka Peka Road;
- Grade separated overbridges and underbridges to cross local roads, watercourses and the Expressway.

The general locations of operational elements of the Project are described by chainages. A chainage refers to the distance (measured in metres) along the proposed Expressway Alignment, with chainage 0m being the starting point of the Project at the southern end and chainage 18050m being the approximate end point of the Project at the northern end.

For a comprehensive description of the Project, refer to the full Project description in Part D, Chapters 7 and 8, Volume 2 of the AEE.

3.2 Overview of sectors

The proposed Expressway Alignment has been divided into four geographic sectors. Each of the sectors covers a geographic area that is described in Table 1 and illustrated in Figure 2 below.

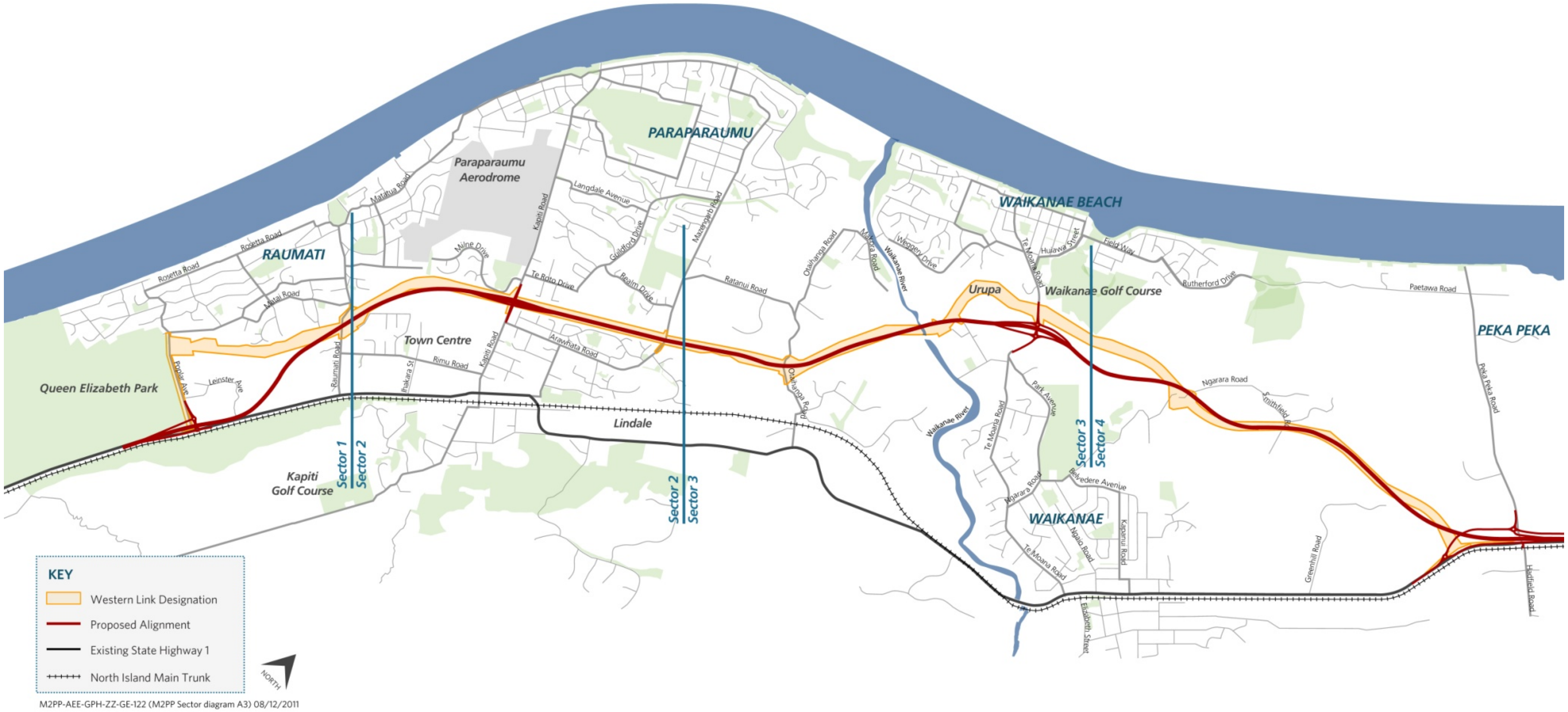


Figure 2 – Sector Illustration

Table 1 – Sector Description

Sector number	Sector Name	Description	Chainage (m)	Length (km)
1	Raumati South	From just south of Poplar Ave to just north of Raumati Road	1900– 4500	2.6
2	Raumati/Paraparaumu	From north of Raumati Road to north of Mazengarb Road	4500 – 8300	3.8
3	Otaihanga/Waikanae	From north of Mazengarb Road to north of Te Moana Road	8300 – 12400	4.1
4	Waikanae North	From north of Te Moana Road to Peka Peka	12400 – 18050	5.7

4 Methodology

4.1 Approach to the assessment of effects

The principal air quality issue in relation to road construction is the discharge of dust and the potential impacts of this discharge on human health and amenity values. Although certain activities may cause discharges of odour, and construction vehicles will discharge exhaust emissions, these are relatively minor issues by comparison to the potential effects of dust. This, therefore, focuses on the assessment, management, mitigation and monitoring of dust discharges from road construction.

Where this dust arises from contaminated sites (as identified in the Assessment of Land and Groundwater Contamination Effects (Technical Report 23, Volume 3), there is also a risk that any airborne dust may also be contaminated with hazardous substances. Measures to control discharges of contaminants from such sites are discussed in the sector by sector assessment of dust discharges (section 5 of this report) and in Technical Report 23, Volume 3.

Discharges of odour and vehicle related emissions are discussed briefly in sections 7 and 8 of this report.

In general, the effects of airborne dust discharges on the natural environment are insignificant compared to the effects of surface water run-off, which are addressed in the Erosion and Sediment Control Plan (CEMP Appendix H, Volume 4).

No attempt has been made to undertake a quantitative assessment of dust discharges from construction activities. The MfE Dust GPG (MfE, 2001) recognises that there are severe limitations on the accuracy of dispersion modelling for fugitive sources such as road construction (due to uncertainties in emissions factors and to poor characterisation of localised wind turbulence and flow disturbances due to trees, buildings, or other obstructions). At best, dispersion modelling can be used to highlight the most significant sources on a site, or to identify those receptors most likely to be affected by dust discharges.

In consequence, the MfE Dust GPG states:

> *The key point to recognise with most fugitive dust sources is that nuisance effects will almost certainly occur if the sources are not adequately controlled. Rather than spending time and money on extensive (and expensive) theoretical predictions of the possible effects, it is likely to be more appropriate to put the effort into the design and development of effective dust control procedures.*

This approach has been followed in this assessment. In parallel with this assessment, recommended mitigation and monitoring measures have been detailed in the Construction Air Quality Management Plan (CEMP Appendix G, Volume 4), which are contained with the Construction Environmental Management Plan (CEMP, Volume 4) for the Project.

4.2 Air quality assessment criteria

4.2.1 Introduction

Air quality standards and guidelines are used to assess the potential for air pollutants to give rise to adverse health or nuisance effects. The MfE Transport GPG recommends the following order of precedence when selecting suitable assessment criteria:

- New Zealand National Environmental Standards (AQNES)
- New Zealand Ambient Air Quality Guidelines (NZAAQG)
- Regional Air Quality Targets
- Recognised international assessment criteria including World Health Organisation Air Quality Guidelines, United States Environmental Protection Agency Reference concentrations and California Office of Environmental Health Hazard Assessment Reference Exposure Levels.

Where no New Zealand standards or guidelines are available, the MfE Transport GPG allows the use of assessment criteria based on New Zealand Workplace Exposure Standards (8-hour time weighted averages) (WES-TWA), divided by 50 for low and moderately toxic hazardous pollutants or divided by 100 for highly toxic, bioaccumulative or carcinogenic hazardous pollutants. In addition, assessment criteria derived from other sources may be used if there is appropriate technical justification to support their use.

4.3 Dust and Odour

There are no specific assessment criteria for dust or odour. A number of ‘trigger levels’ are contained in the MfE Dust GPG (MfE, 2001), and the “Good Practice Guide for Assessing and Managing Odour in New Zealand” (MfE, 2003) (MfE Odour GPG) which are summarised in Table 2 and Table 3.

Table 2 presents three different trigger levels for total suspended particulate (TSP), depending on the sensitivity of the receiving environment.

Table 2 – Recommended Trigger Levels for Deposited and Suspended Particulate (MfE, 2001)

Pollutant	Trigger Level	Averaging period	Applicability
Deposited dust	4 g/m^2	30 days	All Areas
Total Suspended Particulate	80 $\mu g/m^3$ 100 $\mu g/m^3$ 120 $\mu g/m^3$	24-hour 24-hour 24-hour	Highly sensitive areas Moderately sensitive areas Insensitive areas

The MfE Dust GPG does not offer any clear definition of sensitivity, although it does provide the following commentary:

> *"A sensitive area typically has significant residential development, whereas a sparsely populated rural area may be relatively insensitive to some discharges. Clearly the judgement of sensitivity will be somewhat subjective, depending on the specific circumstances in each case."*

The trigger levels presented in Table 2 have not been used as assessment criteria in this document as no dust dispersion modelling has been carried out. As discussed in Section 5.4.1 of this report, the trigger values for TSP are appropriate for managing the effects of dust once construction of the Project has commenced.

At high dust loadings, dust deposits may potentially have significant effects on plant life, although there are no national air quality assessment criteria with which to quantify the level of this effect.

Table 3 – Recommended Odour- Modelling Guideline Values (1- Hour Average) (MfE, 2003)

Sensitivity of the Receiving Environment	Concentration	Percentile *
High (e.g. residential)	1-2 OU/m^3	0.1% and 0.5%
Moderate (e.g. light industrial)	5 OU/m^3	0.1% and 0.5%
Low (e.g. rural)	5-10 OU/m^3	0.1% and 0.5%
Note: * the percentile allows for a small level of exceedence of the predictions, to account for worst-case meteorological conditions, at which objectionable odours are unlikely because the conditions occur infrequently		

Again, the guideline values presented in Table 3 have not been used as assessment criteria in this document, as no odour dispersion modelling has been carried out. The principal reasons for this relate to the difficulty in quantifying odour emissions from the possible odour sources associated with the Project (extraction and removal of peat and diverted discharges of landfill gas due to use of the former landfill as the main construction yard) and the good separation distance between the construction yard and sensitive receptors.

The Greater Wellington Regional Air Quality Management Plan (RAQMP) contains the following descriptive assessment criterion of discharges of dust or odour from road construction activities and activities on closed landfills.

> *"The person(s) responsible for the activity shall ensure that … there is no discharge of particulate matter, smoke, odour, gas, aerosols or vapours from the process, which is noxious, dangerous, offensive or objectionable at or beyond the boundary of the property."*

This is the fundamental criterion, designed to avoid construction activities giving rise to adverse effects beyond the site boundaries. The dust and odour concentration criteria in Table 2 and Table 3 and all management tools described elsewhere in this assessment are intended to achieve compliance with this criterion.

4.4 Hazardous air pollutants

There are three locations on the proposed Expressway Alignment that have been identified as contaminated sites – 55 Rata Road, Kāpiti Road Intersection and 124-154 Te Moana Road (refer Technical Report 23, Volume 3). Assessment criteria for the relevant contaminants at each site are presented in Table 4.

Table 4 – Assessment Criteria for Hazardous Air Pollutants

Site	Key Contaminant	Assessment Criterion	Averaging period	Source
55 Rata Road	Benzo(a)pyrene	3 ng/m^3	Annual	NZAAQG
Kāpiti Road Intersection	Arsenic	0.0055 $\mu g/m^3$	Annual	NZAAQG
124-154 Te Moana Road	Zinc	50 $\mu g/m^3$	24-hour	*

Note: * There are no recognised air quality criteria for zinc. The WES-TWA for zinc dust is the same as that for particulate matter as inhalable dust (10 $\mu g/m^3$), and over three times higher than that for respirable dust (3 $\mu g/m^3$); Therefore, to be conservative, the assessment criterion has been based on the AQNES threshold concentration for PM_{10} particulates.

4.5 Assessment matters

A complete description of the statutory framework can be found in Part B, Volume 2 of the AEE.

The following sections of this report outline the key statutory and non-statutory documents that must be considered in relation to the assessment of effects of discharges into air. The key statutory documents are:

- Resource Management Act 1991
- Land Transport Management Act 2003
- Greater Wellington Regional Policy Statement
- Greater Wellington Regional Air Quality Management Plan
- Kāpiti Coast District Plan
- The NZTA [Transit] Environmental Plan.

4.5.1 Resource Management Act 1991

The purpose and principles of the Resource Management Act 1991 (RMA) are set out in Sections 5 to 8 of that Act. Of particular relevance to the assessment of effects of discharges into air from land transport activities are Sections 5(1) and 5(2)(c), which state:

> *"(1) The purpose of this Act is to promote the sustainable management of natural and physical resources*
>
> *(2) In this Act, sustainable management means managing the use, development and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic and cultural wellbeing and for their health and safety while – …*
>
> *(c) Avoiding, remedying or mitigating any adverse effects of activities on the environment."*

Air is one such natural resource. Section 7 of the RMA requires consent authorities to give particular regard to those matters listed in the section. In the case of discharges into air from this particular Project, the following matters are considered relevant: maintenance and enhancement of amenity values (Section 7(c)) and maintenance and enhancement of the quality of the environment (Section 7(f)).

In the context of this assessment, amenity values may be affected by discharges of construction dust or odour, while the quality of the environment is described in the context of effects on human health. Effects on the environment that are not associated with the direct effects of vehicle exhaust emissions on human health or with discharges of dust or odour are considered to be outside the scope of this report. Amenity values are addressed in Sections 5 and 7 of this report, while other effects on human health are considered in Section 8.

Discharges of contaminants into air are specifically addressed in section 15 of the RMA. Sections 15(2) and (2A) state:

> *(2) No person may discharge a contaminant into the air, or into or onto land, from a place or any other source, whether moveable or not, in a manner that contravenes a national environmental standard unless the discharge—*
>
> *(a) is expressly allowed by other regulations; or*
>
> *(b) is expressly allowed by a resource consent; or*
>
> *(c) is an activity allowed by section 20A.*
>
> *(2A) No person may discharge a contaminant into the air, or into or onto land, from a place or any other source, whether moveable or not, in a manner that contravenes a regional rule unless the discharge—*
>
> *(a) is expressly allowed by a national environmental standard or other regulations; or*
>
> *(b) is expressly allowed by a resource consent; or*
>
> *(c) is an activity allowed by section 20A.*

The relevant regional plan requirements as they relate to air discharges are described in more detail below.

4.5.2 Land Transport Management Act 2003

The LTMA sets out requirements for the operation, development and funding of the land transport system. Section 94 of the LTMA states that the objective of the NZTA is to "undertake its functions in a way that contributes to an affordable, integrated, safe, responsive, and sustainable land transport system." The functions of the NZTA in the context of this proposal are set out in Section 95(1) of the LTMA, while Section 96 sets out the operating principles of the NZTA. The specific principle that applies to this assessment is set out in Section 96(1)(a)(i), as follows:

"(1) In meeting its objective and undertaking its functions, the [NZTA] must—

(a) exhibit a sense of social and environmental responsibility, which includes—

> *(i) avoiding, to the extent reasonable in the circumstances, adverse effects on the environment; and ..."*

4.5.3 Greater Wellington Regional Policy Statement

The operative Greater Wellington Regional Policy Statement 1995 (RPS) sets out the framework for the management of air quality in the region. Objectives 1 and 3 are that:

> *High quality air in the Region is maintained and protected, degraded air is enhanced, and there is no significant deterioration in ambient air quality in any part of the Region.*
>
> *The adverse effects of the discharge of contaminants into air on human health, local or global environmental systems and public amenity are avoided, remedied or mitigated.*

These objectives are carried through into the RAQMP (below).

In 2009, the GWRC notified a revised Regional Policy Statement. Decisions on submissions on this Proposed Regional Policy Statement (PRPS) were notified in May 2010. The PRPS identifies the effects of dust from earthworks on amenity values as a regionally significant issue.

4.5.4 Greater Wellington Regional Air Quality Management Plan

The RAQMP contains objectives, policies and rules that address air quality impacts from a range of sources, including road construction. Objectives 4.1.1 and 4.1.2 set out the overall aims of the RAQMP, as follows:

4.1.1 High quality air in the Region is maintained and protected, degraded air is enhanced, and there is no significant deterioration in ambient air quality in any part of the Region.

4.1.2 Discharges to air in the Region are managed in a way, or at a rate which enables people and communities to provide for their social, economic, and cultural wellbeing and for their health and safety while ensuring that adverse effects, including any adverse effects on:

- *local ambient air quality;*
- *human health;*
- *amenity values;*
- *resources or values of significance to tangata whenua;*
- *the quality of ecosystems, water, and soil; and*
- *the global atmosphere;*

are avoided, remedied or mitigated.

The only policy that is directly relevant to discharges of dust or odour is Policy 4.4.27, which aims:

> *To avoid, remedy or mitigate the adverse effects of the discharge of contaminants to air on amenity values.*

This policy is reflected in the conditions attached to Rules 20 and 22, which identify discharges to air from closed landfills and road construction and paving as Permitted Activities. These rules state:

20 *The discharge of contaminants into air in connection with any:*

> *(1) landfilling and composting;*
>
> *(2) sites which have been used in the past for landfilling (closed landfills);*
>
> *is a Permitted Activity, provided it complies with the conditions below, and excluding any discharges or contaminants to air arising from:*
>
> *(a) sites where waste materials are accepted from sources other than the property on which the landfilling or composting takes place; and/or*
>
> *(b) waste transfer stations.*
>
> ***Conditions***
>
> *The person(s) responsible for the activity shall ensure that:*
>
> *(i) there is no dust, gas (including carbon dioxide and methane gases), or odour from the process which is offensive, objectionable, noxious, or dangerous at or beyond the boundary of the premises or property.*

22 *Notwithstanding any provisions in Rules 1-21, the discharge of contaminants into air in connection with any industrial or trade processes associated with: …*

> *(7) Road construction and paving activities (including reconstruction), other than the manufacture of hot-mix asphalt paving mixes, including moveable asphalt plants, and the remediation of asphalt surfaces ("tar burning"); and/or …*
>
> *is a Permitted Activity, provided it complies with the conditions below.*
>
> ***Conditions***
>
> *The person(s) responsible for the activity shall ensure that:*
>
> *(i) there is no discharge of particulate matter, smoke, odour, gas, aerosols or vapours from the process, which is noxious, dangerous, offensive or objectionable at or beyond the boundary of the property.*

There are no rules in the RAQMP that relate to discharges to air from motor vehicles (including construction vehicles). The “User Guide to the Regional Rules” (Section 5.1 of the RAQMP) specifically states:

> *These rules do not apply to discharges from mobile transport sources, whether or not the mobile transport source is on industrial or trade premises, and no resource consents are required for such discharges.*

All activities to be undertaken on the Alignment of the proposed Expressway are directly related to the proposed road construction. Such activities are specifically identified as Permitted Activities under the RAQMP. As noted above, discharges to air from industrial or trade processes associated with road construction are specifically permitted under the RAQMP, provided that "*there is no discharge of particulate matter, smoke, odour, gas, aerosols or vapours from the process, which is noxious, dangerous, offensive or objectionable at or beyond the boundary of the property.*" The aim of the control measures outlined in this report and in the associated Construction Air Quality Management Plan (CEMP Appendix G, Volume 4) is to achieve compliance with this condition.

The main construction yard is to be located on part of the former Otaihanga Road Landfill Site. As noted above, discharges to air from closed landfills are specifically permitted under the RAQMP, provided that "*there is no dust, gas (including carbon dioxide and methane gases), or odour from the process which is offensive, objectionable, noxious, or dangerous at or beyond the boundary of the premises or property.*" Given the separation distance between any part of the construction yard and sensitive receptors, it is unlikely that this condition would be breached.

4.5.5 Kāpiti Coast District Plan

Policy 1 of the Operative Kāpiti Coast District Plan (KCDP) addresses effects on amenity values in residential environments, as follows:

> *Activities locating and/or operating in the district's residential environments shall … be at a density … which does not cause a decline in the amenity values of these environments through the: …*
>
> - *generation of excessive levels of … dust or odour associated with the activities themselves;*
> - *generation of additional traffic movements resulting in excessive … dust or odour …*

Although this policy is not specifically related to road construction, the particular aims of the policy are relevant to the effects of such activities and have informed this assessment of effects.

4.5.6 The NZTA Statement of Intent

The NZ Transport Agency Statement of Intent 2011–2014 (NZTA SoI) sets out the NZTA's strategy for achieving the government's goals for the land transport sector. This includes a policy on environmental and social responsibility that, among other things, aims to:

> *continuously improve performance in the management of environmental and social impacts.*

The NZTA SoI identifies the NZTA Environmental Plan as setting out in more detail how this will be achieved. Section 2.2 of the Environmental Plan addresses air quality issues; although this section does not set out any objectives in relation to the construction of state highways, it does identify the following methods:

Assessment of Effects	*Assess the effects on local air quality of new or improved sections of State highways in accordance with appropriate New Zealand and overseas guidance*
Construction Dust and Air Pollution	*Ensure Construction Management Plans, or equivalent, include an air quality management component. These should detail consultant and contractor obligations during the construction phase in relation to:* • *monitoring and reporting requirements including results of risk assessments and any air pollution measurements, for example in relation to dust and/or odour;* • *identifying appropriate dust and air pollution mitigation measures to be implemented; and* • *procedures for maintaining contact with stakeholders and managing dust and air pollution complaints.*

4.6 Discharges to air from road construction

4.6.1 Dust from earthworks and road construction

The construction of the Project will entail large scale earthworks over a considerable area. The overall Project is expected to take approximately five years to complete, although some parts may be completed more quickly, or will be started later.

Exposed earthworks can be a significant source of dust. Dust can affect human health and plant life along the edge of the earthworks area, can be a nuisance to the surrounding public, and can contribute to sediment loads by depositing in areas without sediment control measures. Sediments deposited on sealed public roads can also result in a dust nuisance. Rainfall, water evaporation, and wind speed, are meteorological conditions having the greatest effect on dust mobilisation.

Dust discharges from earthworks typically fall into the larger particle sizes, generally referred to as “deposited particulates”, although there may also be a significant component in the smaller size ranges. Deposited particulates are particulates having an aerodynamic size range greater than about 20 microns. As a class of material, such particulates have minimal physical health impact (particles have only limited penetration into the respiratory tract), but may cause nuisance in sensitive areas due to soiling. Soiling includes excessive dust deposits on houses, cars, and household washing and excessive dust within houses.

At sufficient loadings, dust may also have adverse effects on some plants. Research by the Agricultural Engineering Institute, focussed on high value horticultural crops grown alongside unsealed roads, concluded that significant crop productivity losses occurred within 200m of the source (McCrea, 1984).

Construction work associated with the Project will not be the only source of dust in the area. For example, other construction activities not associated with the Project may also be occurring at the same time, while wind-blown sand and re-entrainment of road dust on existing roads (i.e. dust being picked up from surfaces by the wind) will also contribute to overall dust levels.

a. Sources of dust during construction

Potential sources of dust and other air contaminant discharges are:

- Dust from roads and access areas generated by trucks and other mobile machinery movements during dry and windy conditions
- Excavation and disturbance of dry material
- Loading and unloading of dusty materials to and from trucks
- Smoke and odour from diesel-engine machinery and truck exhausts
- Stockpiling of materials including material placement and removal
- Concrete grinding undertaken as part of the manufacture of pre-cast concrete bridge components.

These sources are liable to cause nuisance beyond the site boundary during adverse conditions if adequate controls and mitigation measures are not adopted.

Dust may be generated from dry undisturbed surfaces at wind speeds greater than 5 - 10 m/s (10 – 20 knots), although vehicle re-entrainment of dust can occur under any conditions (MfE, 2001). Wind can transport dust mobilised from dry surfaces by machinery or truck movements or mechanical disturbance. Transportation of dust is dependent on dust particle size and wind speed. Rainfall, rate of water evaporation, and wind speed, are conditions having the greatest effect on dust mobilisation.

Dust generation by truck and machinery movements in dry conditions is a function of vehicle speed, number of wheels and vehicle size. Judder bars or humps to reduce vehicle speed are not recommended as they can cause spillage of load and may damage loaded vehicles.

Unpaved roads and yards areas can be very dusty during dry weather. This can be aggravated if surfaces are allowed to get muddy during wet weather which eventually dries out and then becomes ground-up by vehicle movements.

Carrying out extensive earthworks during dry conditions exposes large areas to effects of wind while being disturbed by machinery. Excavated areas left exposed during dry windy conditions can be significant dust sources. Stockpiling of topsoil and subsoil, and in particular dry dusty materials, may also be major dust sources during stockpile formation and when exposed to strong winds.

b. Factors influencing dust generation from earthworks

There are five primary factors which influence the potential for dust to be generated from the site (MfE, 2001). These are:

- Wind speed across the exposed surfaces;
- The percentage of fine particles in exposed surface material;
- Moisture content of that material;
- The area of exposed surface; and
- Mechanical disturbance of material including excavation and filling, loading and unloading of materials and vehicle movements.

In addition to consideration of dust sources and factors that may influence dust generation, any assessment of the effects of dust must consider the distance that any dust may travel from the sources. In general, although construction activities can generate dust with a wide range of particle sizes, it is the larger dust particles that tend to be associated with 'dust nuisance' from construction activities. However, the larger the particle size, the less distance it will travel in light to moderate winds. The MfE Dust GPG states:

> *"When dust particles are released into the air they tend to fall back to ground at a rate proportional to their size. This is called the settling velocity. For a particle 10 microns in diameter, the settling velocity is about 0.5 cm/sec, while for a particle 100 microns in diameter it is about 45 cm/sec, in still air. To put this into a practical context, consider the generation of a dust cloud at a height of one metre above the ground. Any particles 100 microns in size will take just over two seconds to fall to the ground, while those 10 microns in size will take more than 200 seconds. In a 10-knot wind (5 m/sec), the 100-micron particles would only be blown about 10 metres away from the source while the 10-micron particles have the potential to travel about a kilometre. Fine particles can therefore be widely dispersed, while the larger particles simply settle out in the immediate vicinity of the source."* (MfE, 2001)

Dust particles generated by construction activities generally fall into the larger size fractions, with an aerodynamic diameter of 100 µm or greater. In steady wind conditions, with average wind speeds of less than 10 m/s (typical of the Kāpiti Coast), without vehicle movements, such particles would travel only a few tens of metres from the source. However, this theoretical calculation takes no account of re-entrainment of dust or of the effects of turbulent airflow. There have been a number of studies undertaken using field measurements of suspended particulate at different distances from road sources (e.g. Cowherd C. J., 2003, Cowherd C. J., 2006, Etymezian, 2004). Overall, the conclusions from these studies appear to be that dust travels much further under unstable atmospheric conditions than in stable conditions. These conclusions emphasise the need for effective mitigation measures to be applied, especially during hot, dry weather as well as during windy conditions.

Based on the discussion regarding particle size in the MfE Dust GPG and the results of research into dust entrainment, only premises within approximately 100m of significant dust sources have been considered as potentially sensitive receptors for assessing the effects of construction dust. The purpose of the controls outlined in the following sections will be to prevent (if possible) or otherwise minimise the effects of dust emissions on those premises.

c. Dust mitigation and management - earthworks

Before considering the effects of dust from those specific activities that will be undertaken as part of the construction of the Project, it is appropriate to outline the dust control and mitigation measures that may be applied. The management approach which is applied in all cases is based on the avoidance of adverse effects through the control of potential dust discharges.

This section of the report presents a range of control and mitigation measures designed to prevent or minimise adverse dust effects on the environment and local community beyond the boundary of the construction site. The following section (section 5) considers, on a sector by sector basis, the specific activities that may generate fugitive dust emissions, the sensitive neighbours that may be affected by such emissions and the control and monitoring methods that should be applied to each of those activities to avoid dust nuisance. As noted in section 4.1, a separate CAQMP includes more detailed recommendations on dust control measures that will be required in specific areas.

Systems for controlling dust emissions should include:

- methods that modify the condition of the materials so that it has a lesser tendency to lift with the wind or through disturbances such as vehicle movements; and
- methods that reduce the velocity of the wind at the surface.

Wet suppression

- Watering of exposed surfaces and materials that may be disturbed is an important method of control. The MfE Dust GPG recommends that, as a general guide, the typical water requirements for dust control in most parts of New Zealand are up to 1 litre per square metre per hour. The dust prevention methods detailed below are methods typically found to be effective. They can be used alone or in combination depending on the circumstances. This list is not exhaustive and other methods may be found to be effective.
- Dust discharges from activities can be significantly reduced by using water sprinkler systems during dry conditions. Adequate dust suppression is necessary to provide reasonable working conditions as well as minimising impacts upon sensitive receptors beyond the boundary of the site. Water should be applied to haul roads via water trucks and sprinklers in sufficient quantity to suppress dust but to avoid generating muddy conditions or sediment runoff.

Roads, other accessways, and parking areas

- Semi-permanent working areas and construction site access roads should be constructed with an appropriate base, kept metalled, and kept damp using watering trucks or fixed sprinkler systems.
- Roads, accessways, and parking areas used by vehicles and mobile machinery that are not hard paved should be kept well metalled.
- All roads, accessways, and parking areas that are liable to dry out and generate excessive dust should be regularly watered by a watering truck or by equivalent means during periods of low rainfall.
- Significant spills of materials that may cause dust when dry should be collected, swept, scraped up or hosed down as soon as practicable.

Site exits

- Vehicles leaving site from unsealed surfaces can be washed down to remove dust and/or coagulated material where necessary. This would occur at selected site exits either manually or automatically via the use of high pressure water hoses, jets or water assisted brushing. Stabilised entranceways would be established at site access points, with wheel washes if required. Detergents or hydrocarbon based liquids should not be used for vehicle cleaning or dust suppression.

Earthworks

- The extent of earthworks carried out during dry conditions should be limited as far as practicable to a manageable surface area to minimise dust generation while being disturbed by machinery.
- Excavated areas left exposed during dry windy conditions and liable to be dusty should be watered as necessary, or preferably stabilised e.g. through metalling, grassing or mulching.

- Cleared areas not required for construction, access or for parking, if liable to cause excessive dust during windy conditions, should be stabilised e.g. through metalling, grassing, mulching or the establishment of vegetative cover.
- Site laydowns should be metalled to minimise mud during wet conditions and dust during dry and windy conditions.

Stockpiles and spoil heaps

- Stockpiles of topsoil, sand, and other materials liable to dry out and generate significant dust during windy conditions, should be monitored and options such as dampening, allowing piles crust over, or covering, will be considered as appropriate.
  - Even when dry, peat is unlikely to generate dust, so stockpiles of peat should not require covering.
- Stockpile margins should be defined to minimise spread onto access areas.
- Drop heights should be minimised to the extent practicable during stockpiling activities to minimise dust generation.
- In areas with ongoing dust issues or in close proximity to sensitive receptors, water sprays and/or sprinklers should be considered to suppress and control dust generated from stockpiles and spoil heaps.
- Water spraying of stockpiles and spoil heaps requires uniform application rates consistent with evaporation rates. Spraying can result in over-watering. Excessive use of water during building-up of stockpiles can saturate their bulk, but the surface will still dry out and become dusty. Excessive wetting (especially during building-up of stockpiles) may cause flow slides and cause slips. Typically, the loss of approximately 5% of moisture from the surface of an aggregate may make the material sufficiently dry to result in dust generation during mechanical disturbance, and dust from an undisturbed surface under strong wind conditions. Water application rates, and therefore the capacity of the water spray system, should be carefully evaluated during the design phase.

Wind fencing

- Wind break fencing (e.g. shade cloth) of suitable length, height and porosity reduces prevailing wind speed and therefore the impact of dust on surrounding areas. Effectiveness is greatest where fencing is perpendicular to the prevailing wind direction with a porosity of about 50%.
  - In some areas of the Project, wind break fencing may have only limited effectiveness, e.g. where the wind direction is nearly parallel to the proposed Expressway Alignment.
  - Wind break fencing will be used as a last resort. The preference is to use dust suppression and stabilisation of surfaces to prevent dust generation.

Vehicles, machinery and generators

- Vehicles accessing construction sites that are used on public roads should be checked to ensure that tailgates are secure and all loads are covered. Material tracked out from the site onto public roads, if significant, should be removed by suction sweeper.
- The imposition of vehicle speed limits is a practical measure to minimise dust emissions caused by construction traffic. This can be done through speed restrictions on site and training of drivers regarding the sensitivity of the local environment. Normal signage will inform drivers of the maximum speed limit. If the control of vehicle speed on site becomes an issue, the implementation of electronic selective

speed signs should be considered. The maximum speed limit on site should be 10 km/h or less.

- Loading and unloading of trucks should be conducted in a manner which minimises the discharge of dust. This includes the minimisation of drop heights during the loading of vehicles to minimise dust generation.

4.6.2 Dust from pre-cast concrete manufacture

Construction of the Project will also require the manufacture of a large number of pre-cast concrete components (about 500) for the bridge structures. In order to facilitate this, a pre-cast concrete manufacturing facility will be installed at the main contractor' yard on Otaihanga Road.

Wet concrete will be brought in by truckmixer from a nearby cement batching plant – bulk cement itself will not be stored or used anywhere in the actual Project area. Concrete will be poured directly from the truckmixers into moulds or forms that have been pre-lined with a release agent. Once set, the pre-cast components will be lifted out of the moulds to finish curing. Hand-held grinders may be used as required to remove surface flaws, while a limited number of bridge beams may require water-blasting to get a suitable finish at the ends.

Concrete grinding has the potential to generate dust emissions. It is understood that emissions from concrete grinding will be negligible to minor through carrying out grinding of freshly cast concrete wherever possible, since this has a relatively high moisture content, and by the use of diamond-toothed hand grinders, since these tend to generate minimal dust emissions.

4.6.3 Odour

Road construction activities in themselves are not usually regarded as a source of odour, however, where the construction involves disturbance of land contaminated with organic wastes (such as closed landfills) or waterlogged soils that may be anaerobic, such as peat, discharges of odour may occur.

Sector 3 of the proposed proposed Expressway Alignment of the Project runs close to the former landfill site on Otaihanga Road, which will itself be used as the main construction yard for the Project. However works in this area are not anticipated to release any odours.

Soils underlying the Alignment of the proposed Expressway are generally either sand dunes (which should be relatively free of odour) or varying depths of peat.

4.6.4 Vehicle exhaust emissions

There will be discharges of engine exhaust emissions from construction traffic associated with the construction of the Project. These will include fine particles (PM_{10} and $PM_{2.5}$), oxides of nitrogen (NO_x), carbon monoxide (CO) and organics such as benzene. Most construction vehicles are diesel powered, and are therefore likely to emit larger quantities of PM_{10}, $PM_{2.5}$, NO_x and organics than the general vehicle fleet (which is mostly petrol driven). As noted in section 4.5.4 of this report, vehicle exhaust emissions (including those from construction traffic) are specifically exempted from control under the RAQMP.

5 Sector by sector assessment of dust discharges

The construction methodology for the Project is described in detail in the Construction Methodology Report (Technical Report 4, Volume 3), while the main dust sources associated with construction of the proposed Expressway in all Sectors are described in section 4.6 of this report. The following sections provide an overview of the construction methodology, sensitive receptors and potential for adverse effects on air quality in each Sector of the Project.

The main issues relating to discharges of dust include the visual soiling of clean surfaces, such as cars, window ledges, and household washing; dust deposits on flowers, fruit or vegetables; and the potential for contamination of roof-collected water supplies. Excessive discharges of dust may also impact on visibility on roads in the immediate vicinity of the Project.

Dust particles generated from most construction activities are generally regarded as relatively inert; thus effects on human health are unlikely.

Figure 3 indicates the periods when a significant potential for dust discharges exists in each Sector, taking into account the activities being undertaken and the soil type in that area. Figure 3 itself is based on the anticipated water take requirements for earthworks[3].

[3] Data supplied by Andrew Goldie of Fletcher Construction Ltd on behalf of the Project team.

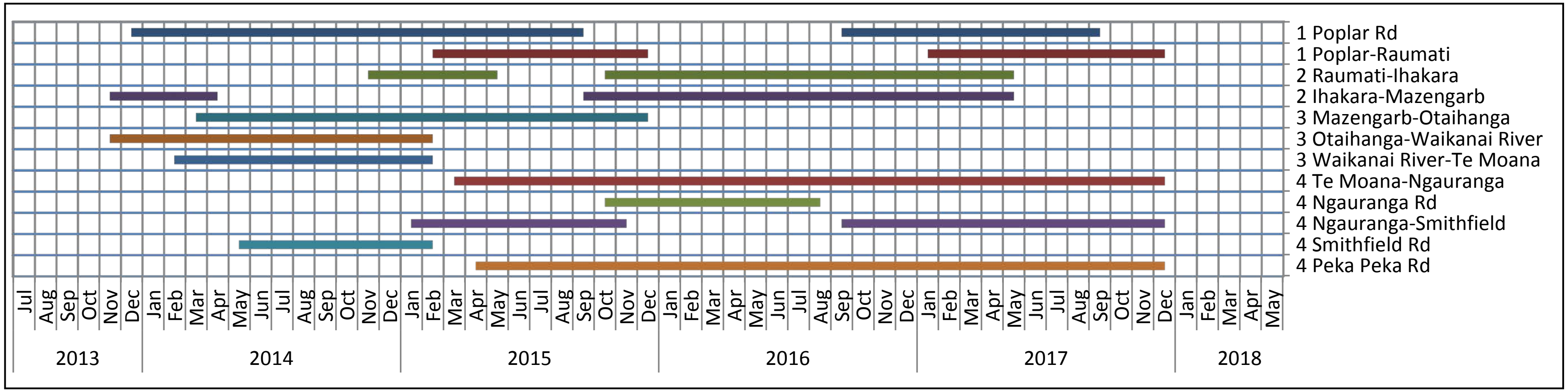


Figure 3 – Anticipated Periods of Water Usage for Dust Control

5.1 Sector 1

5.1.1 Dust generating activities

- **Earthworks and construction:** Pre-loading between MacKays Crossing and Chainage 4000 (south of Raumati Road); bridge construction at Poplar Avenue and Raumati Road; construction of sediment control ponds around Chainage 3800.
- **Construction yards:** Intersection construction yard, located at Poplar Avenue, operating for almost all the duration of the Project. Vehicle access to and from the proposed Expressway via a dedicated haul road immediately north of Poplar Avenue. Bridge construction yard adjacent to the Raumati Road Bridge construction site, operating for about eight months.
- **Vehicle movements:** vehicles accessing the road and bridge construction and construction yards, either directly from SH1, from Poplar Avenue and Raumati Road (for bridge construction only) or via a haul road along the proposed Expressway Alignment from the north.

5.1.2 Contaminated Sites

- **None**.

5.1.3 Sensitive receptors:

- **Residential:** residential properties at the eastern end of Poplar Avenue, Leinster Avenue and Fincham Road, on Conifer Court and on Raumati Road (refer Figure 4 and Figure 5).

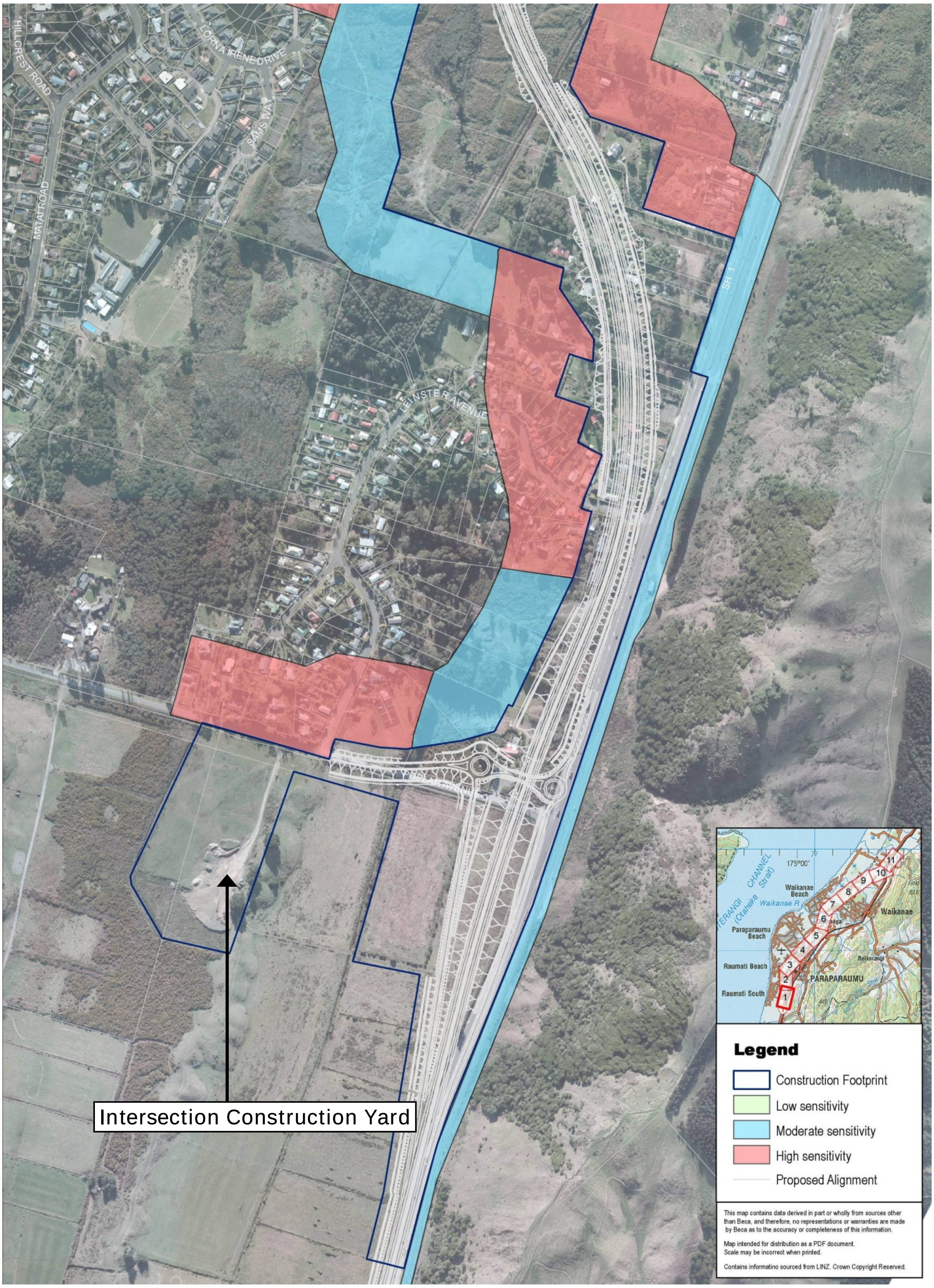


Figure 4 – Sensitive and Moderately Sensitive Areas – Sector 1 North of Poplar Avenue

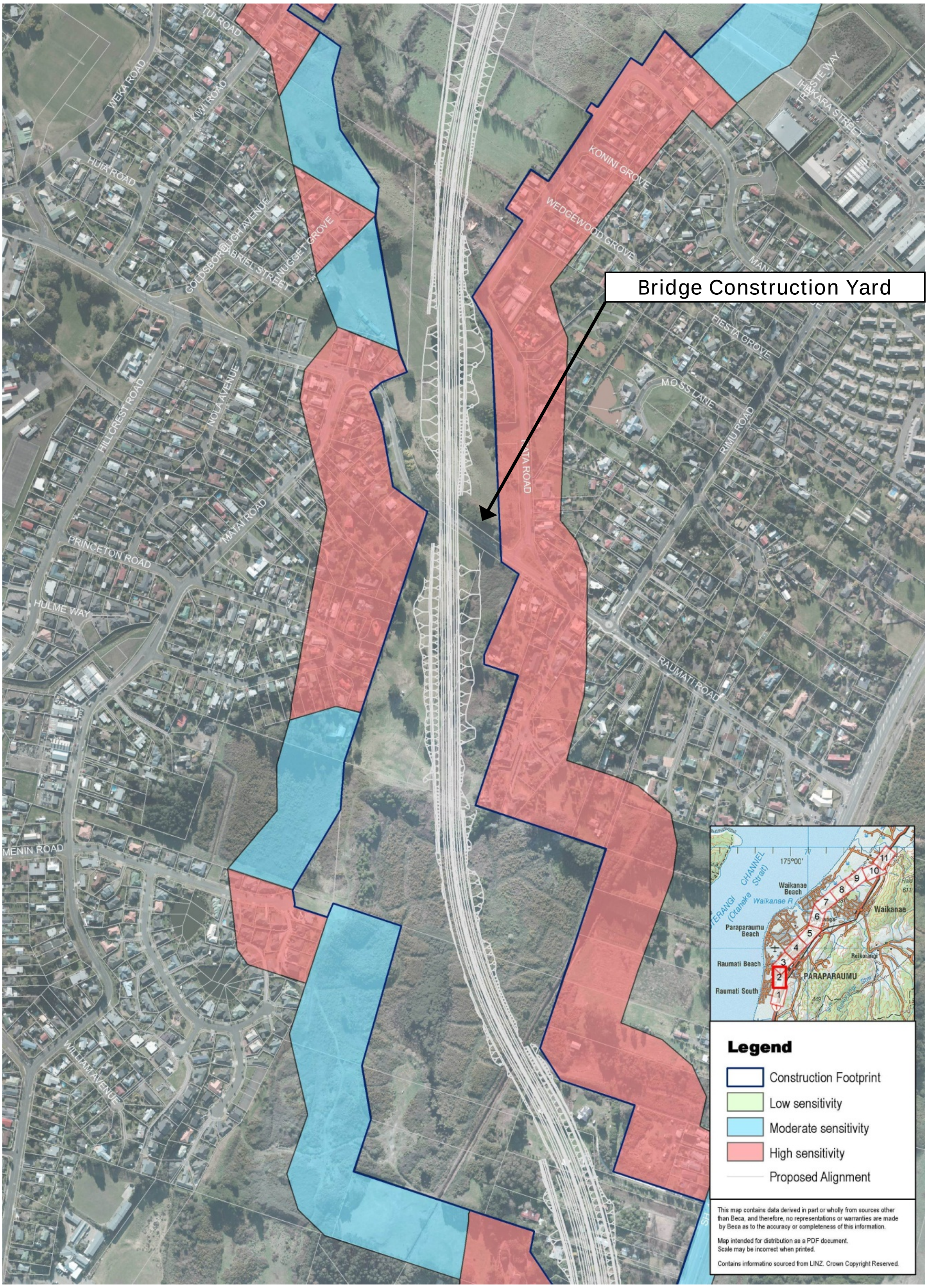


Figure 5 – Sensitive and Moderately Sensitive Areas – Sector 1 Raumati Road

5.1.4 Potential for Adverse Effects:

- Earthworks and other activities involving a significant potential for dust emissions are likely to occur as follows:
  - **Poplar Avenue** – Early 2014 for about two years and from September 2016 for about a year
  - **Poplar Avenue to Raumati Road** - Early 2015 for about a year and from early 2017 for about a year.
- The greatest potential for adverse effects due to dust emissions in Sector 1 will probably occur at the eastern end of Leinster Avenue, given the proximity of houses in this area to the main construction footprint and the ongoing use of the proposed Expressway Alignment as a haul road for most of the duration of the Project, and from vehicle movements on the access road to the Poplar Avenue construction yard. Beyond the new access road off Leinster Avenue, much of the proposed Expressway construction Designation is required for stormwater control ponds, and will not be used for ongoing construction activities once those ponds are established.
- Effective dust control measures, as described in section 4.6.1 of this report will be essential in this Sector, especially in the vicinity of Poplar Avenue, Leinster Avenue and Raumati Road.
- The aim of these control measures will be to minimise and, if practicable, avoid adverse effects in surrounding areas by keeping dust discharges within the construction footprint. Assuming such measures are in place, although it is unlikely that adverse effects can be avoided altogether, adverse effects from the construction of the proposed Expressway will be adequately avoided or mitigated.

5.2 Sector 2

5.2.1 Dust generating activities

- **Earthworks and construction**: Bridge construction at Wharemauku Stream, Kāpiti Road and Mazengarb Road; widening of Kāpiti Road itself; vertical realignment of Mazengarb Road; construction of sediment control ponds either side of the proposed Expressway south of Wharemauku Stream, south-east of Kāpiti Road and south-west of Mazengarb Road.
- **Construction yards**: Intersection construction yard, located at 108 Kāpiti Road, operating for almost the whole duration of the Project. Bridge construction yard adjacent to the Mazengarb Road Bridge construction site, operating for about 16 months.
- **Vehicle movements**: vehicles accessing the road and bridge construction from Ihakara Road, Kāpiti Road and Mazengarb Road (for bridge construction only) or via a haul road along the proposed Expressway Alignment from the north.

5.2.2 Contaminated Sites (refer Figure 6)

- **55 Rata Road** – surface soils comprise fill to a depth of about 3m, contaminated with benzo(a)pyrene, naphthalene and long-chain (C7 to C14) petroleum hydrocarbons. Although construction of the proposed Expressway in this area involves pre-loading with fill, rather than excavation, a stormwater retention pond may be constructed immediately to the east of the proposed Expressway Alignment, partly within the contaminated site. This will involve excavation of much of the site, with contaminated fill being removed for disposal to an appropriate landfill off-site, and is likely to take less than a month to complete.

- **Kāpiti Road Intersection** - surface soils contaminated with arsenic. As part of the road formation, some of this contaminated soil may be removed for use as fill material in nearby parts of the Project area.
- **Asbestos** – a small amount of suspected asbestos-containing material (cement bonded asbestos) has also been identified in soil samples from both sites.

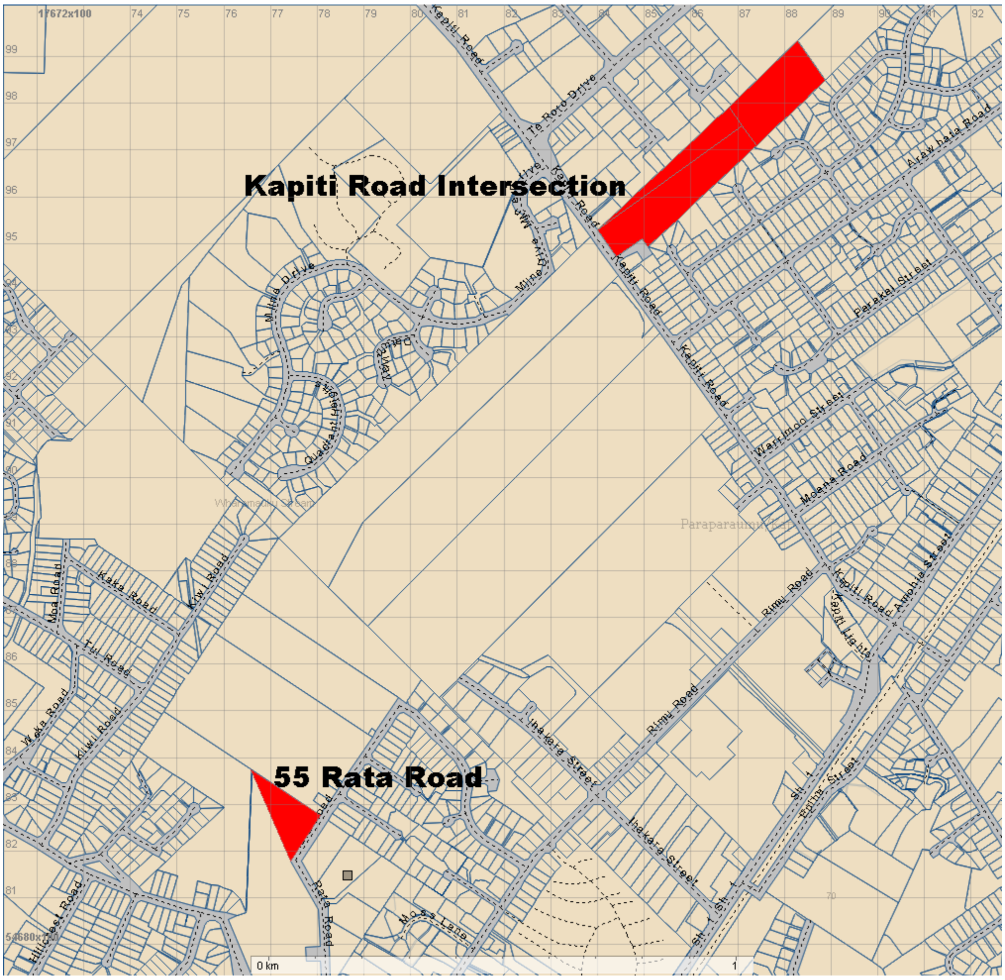


Figure 6 – Contaminated Sites – Sector 2

1.1.1 Sensitive receptors:

- **Residential**: residential properties on Raumati Road and Rata Road, at the northern end of Kiwi Road, on the western side of Quadrant Heights and Datum Way, on Milne Drive, and on both sides of the proposed Expressway Alignment between Kāpiti Road and Mazengarb Road (refer Figure 7 and Figure 8).
- **Non- residential**: certain commercial and retail activities in the vicinity of Kāpiti Road.

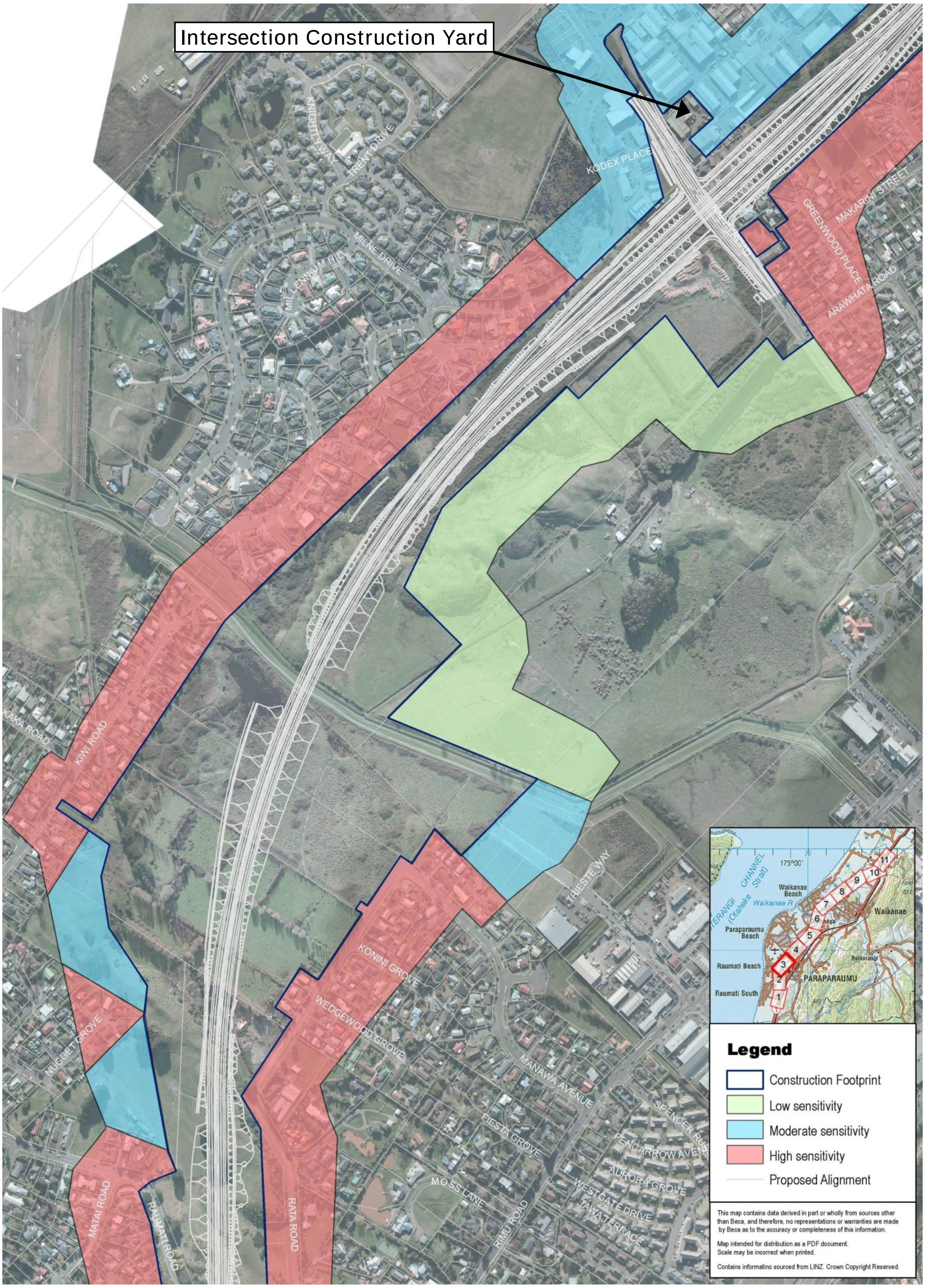


Figure 7 – Sensitive and Moderately Sensitive Areas – Sector 2, Rata Road to Kāpiti Road

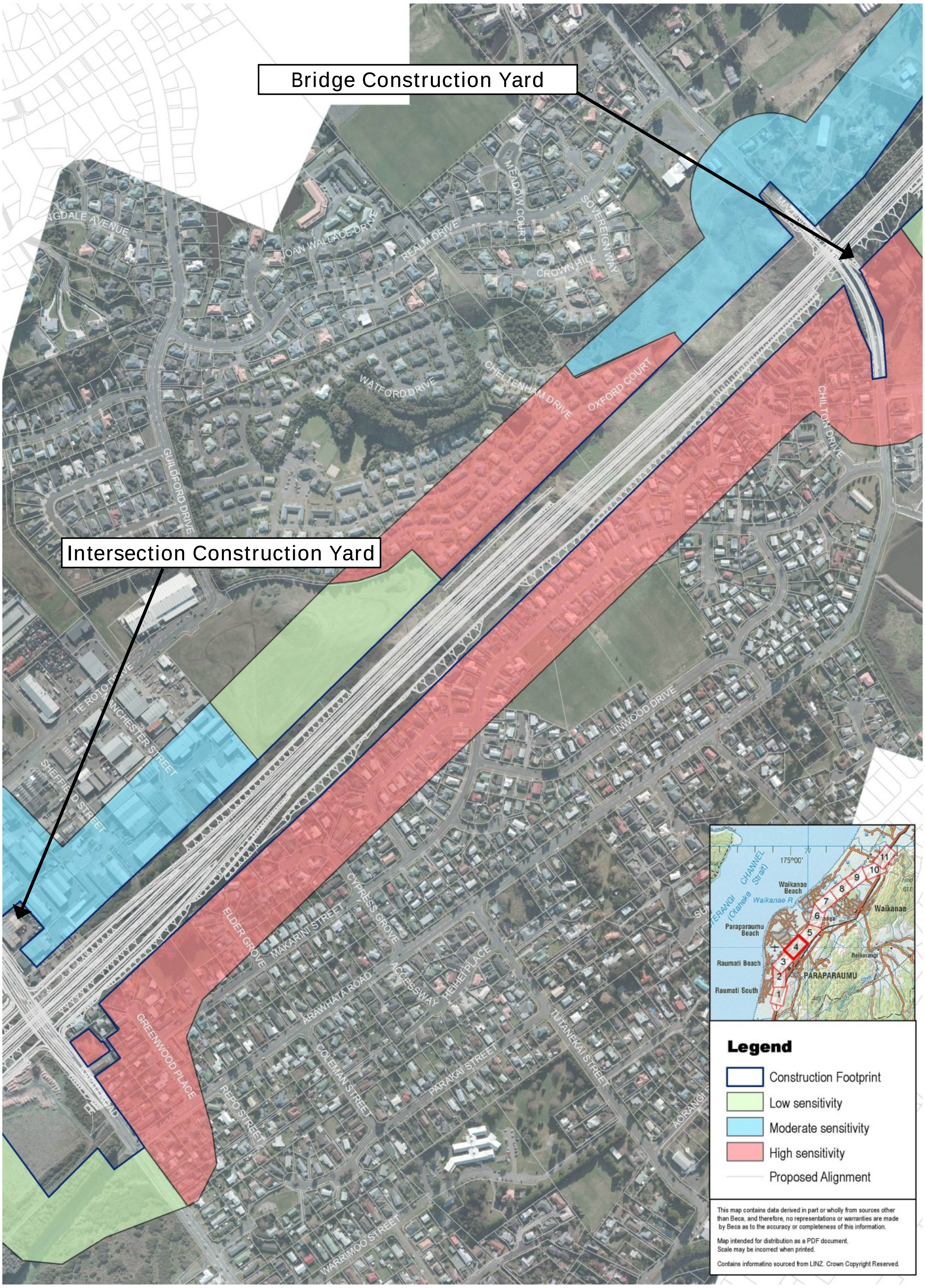


Figure 8 – Sensitive and Moderately Sensitive Areas – Sector 2, Kāpiti Road to Mazengarb Road

5.2.3 Potential for adverse effects:

- Earthworks and other activities involving a significant potential for dust emissions are likely to occur as follows:
  - **Raumati Road to Ihakara Road –** Late 2014 for approximately seven months and late 2015 for about 20 months
  - **Ihakara Road to Mazengarb Road (including the Kāpiti Road interchange) –** Late 2013 for about six months and from about September 2015 for about 20 months.
- The greatest potential for adverse effects due to dust emissions in Sector 2 will probably relate to properties that are immediately adjacent to the proposed Expressway Alignment, particularly because of the ongoing use of the proposed Expressway Alignment as a haul road most of the duration of the Project. It is likely that the haul road will be hard surfaced within this sector, to minimise the effects of dust discharges on neighbouring residential premises.
- The area of the construction footprint to the east of the proposed Expressway Alignment between Raumati Road and Kāpiti Road is required for stormwater control ponds, and will not be used for ongoing construction activities once those ponds are established.
- Contaminated sites
  - **55 Rata Road** – surface soils contaminated with benzo(a)pyrene to a maximum measured concentration of 380 mg/kg. Discharges of contaminated dust from this site have the potential to pose a significant risk to human health – for example, assuming that heavily contaminated airborne dust concentrations were discharged at 80 µg/m^3 as a 24-hour average, 24-hour average benzo(a)pyrene concentrations could be as high as 30 ng/m^3, compared to the (annual average) NZAAQG of 0.3 ng/m^3. In practice, actual concentrations of benzo(a)pyrene are likely to be substantially lower than this theoretical maximum – the average soil concentration across all samples was <14.5 mg/kg.
  - Given this potential risk, the excavation of contaminated fill from this site will be carefully managed to minimise actual discharges of dust. With effective mitigation in place, coupled with the relatively short timeframe for this activity, significant adverse effects on human health are unlikely.
  - **Kāpiti Road Intersection** - surface soils contaminated with arsenic to a maximum measured concentration of 70 mg/kg. Assuming that contaminated airborne dust concentrations are maintained below 80 µg/m^3 as a 24-hour average, maximum 24-hour average arsenic concentrations would be approximately 0.0056 µg/m^3 Given that the NZAAGQ for arsenic is 0.0055 µg/m^3 as an <u>annual</u> average, it is unlikely that discharges of contaminated dust from this site would cause adverse effects on human health.
  - **Asbestos** – any asbestos found during excavation works at either site will require removal by specialist contractors. Guidelines for the Management and Removal of Asbestos (revised 1999) for the Department of Labour, and the Health & Safety in Employment (Asbestos) Regulations (1998) will be followed. Potential effects on air quality arising from the removal of such material is beyond the scope of this assessment.
- Effective dust control and monitoring measures, as respectively described in sections 4.6 and 6 of this report, will be essential in this sector to minimise the discharge of dust beyond the Project boundaries.

- The aim of these control measures will be to minimise and, if practicable, avoid adverse effects in surrounding areas by keeping dust discharges within the construction footprint. Assuming such measures are in place, although it is unlikely that adverse effects can be avoided altogether, adverse effects from the construction of the proposed Expressway will be adequately avoided or mitigated.

5.3 Sector 3

5.3.1 Dust generating activities

- **Earthworks and construction**: Pre-loading between Chainage 4000 and Otaihanga Road (south of Raumati Road); bridge construction at Otaihanga Road, Waikanae River and Te Moana Road; construction of new access links to Otaihanga Landscaping and El Rancho; construction of sediment control ponds south of Te Moana Road.
- **Construction yards**: Project yard at the former Otaihanga Road landfill site, operating for the entire duration of the Project; activities including the operation of a pre-cast concrete plant (although all concrete for the Project is to be brought in from off-site suppliers). Bridge construction yard, located on Te Moana Road, operating for about two years.
- **Vehicle movements**: vehicles accessing the bridge construction from Te Moana Road; vehicles accessing all parts of the Project via the construction yard and a haul road along the proposed Expressway Alignment in both directions.

5.3.2 Contaminated Sites

- Otaihanga Road landfill site (closed) – possibility of the diversion of discharges of landfill gas (including methane) where temporary buildings are located on site.
- 124-154 Te Moana Road – surface soils contaminated with zinc. As part of the road formation, some of this contaminated soil may be removed for use as fill material in nearby parts of the Project area.

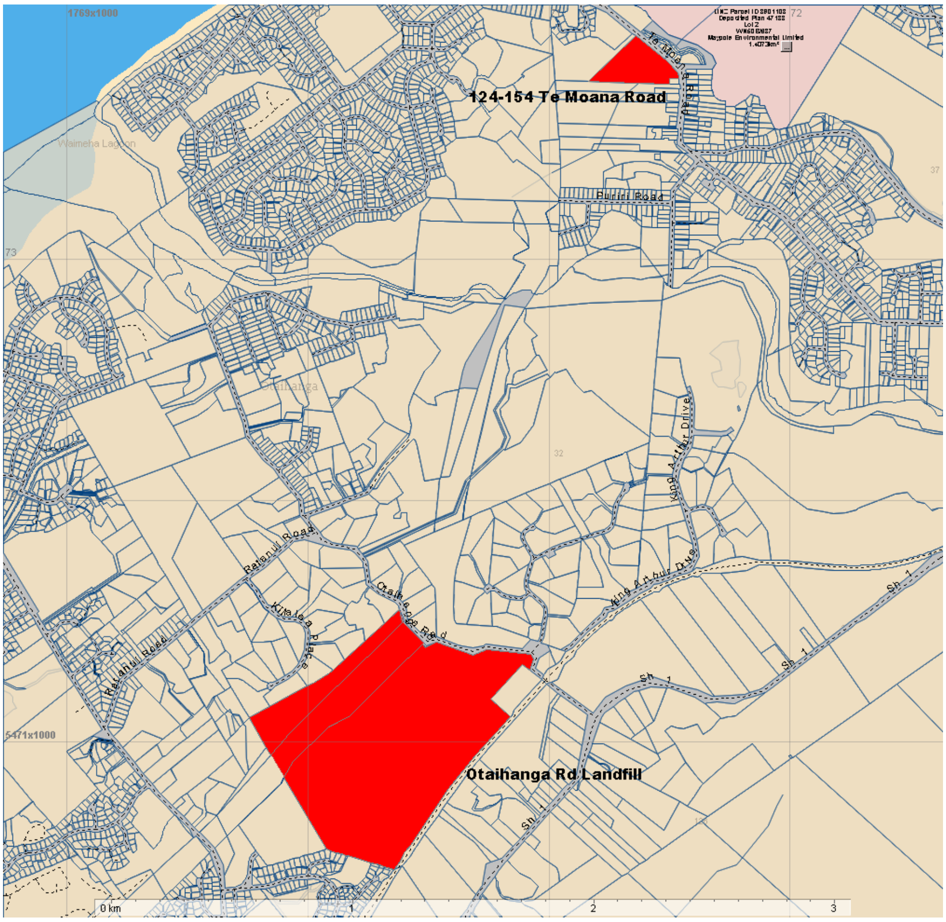


Figure 9 – Contaminated Sites – Sector 3

5.3.3 Sensitive receptors:

- **Residential**: residential properties on Kauri Road, Puriri Road and on Te Moana road in the vicinity of the intersection; there are almost no sensitive receptors within 100m of the construction footprint in this Sector south of the Waikanae River (refer Figure 10 to Figure 12).
- **Non- residential**: Parts of El Rancho (an educational camp) lie within 100m of the construction footprint north of the Waikanae River.
- There are no sensitive receptors within 250m of any part of the main construction yard on the former Otaihanga road landfill site.

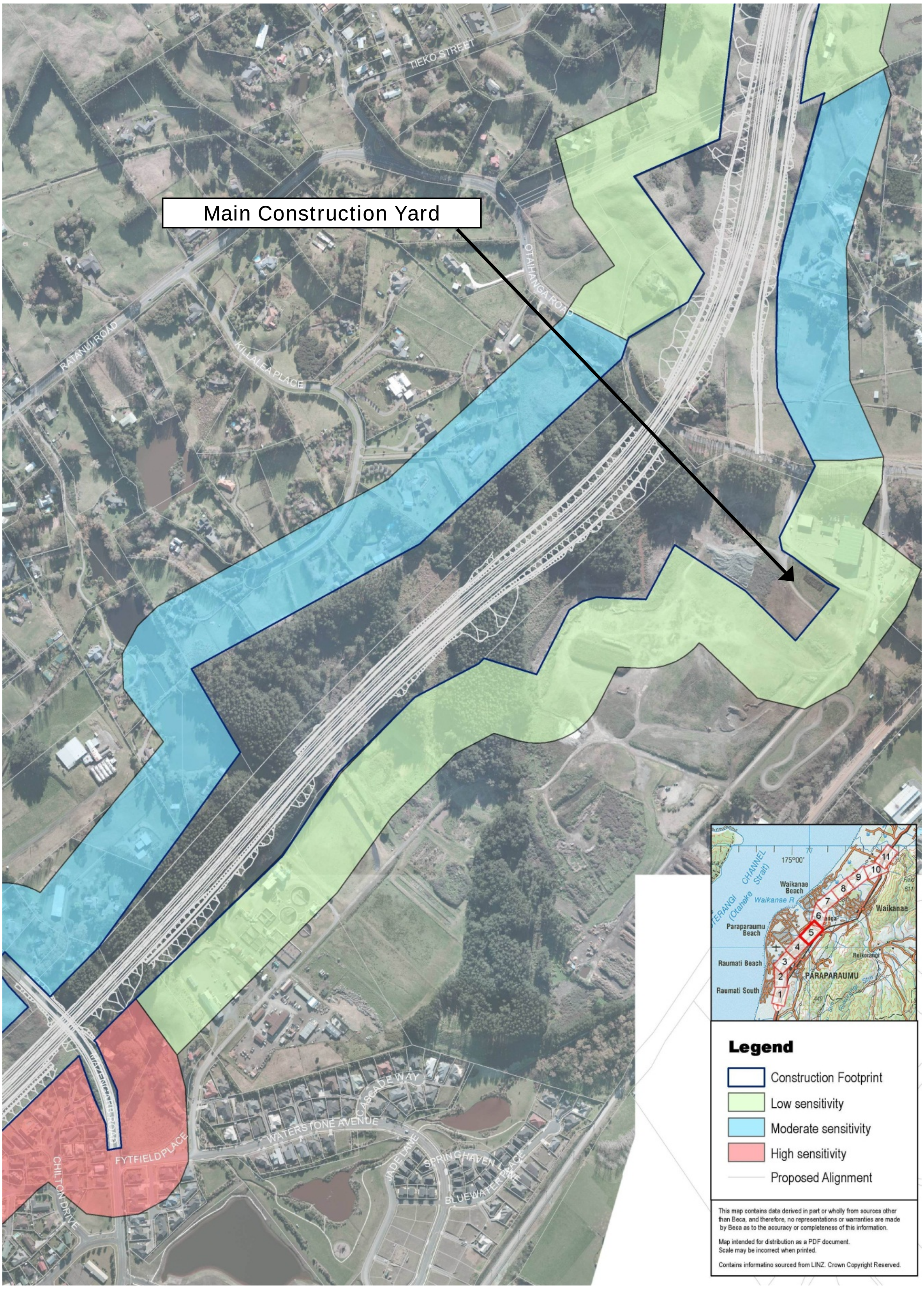


Figure 10 – Sensitive and Moderately Sensitive Areas – Sector 3, Mazengarb Road to Otaihanga Road

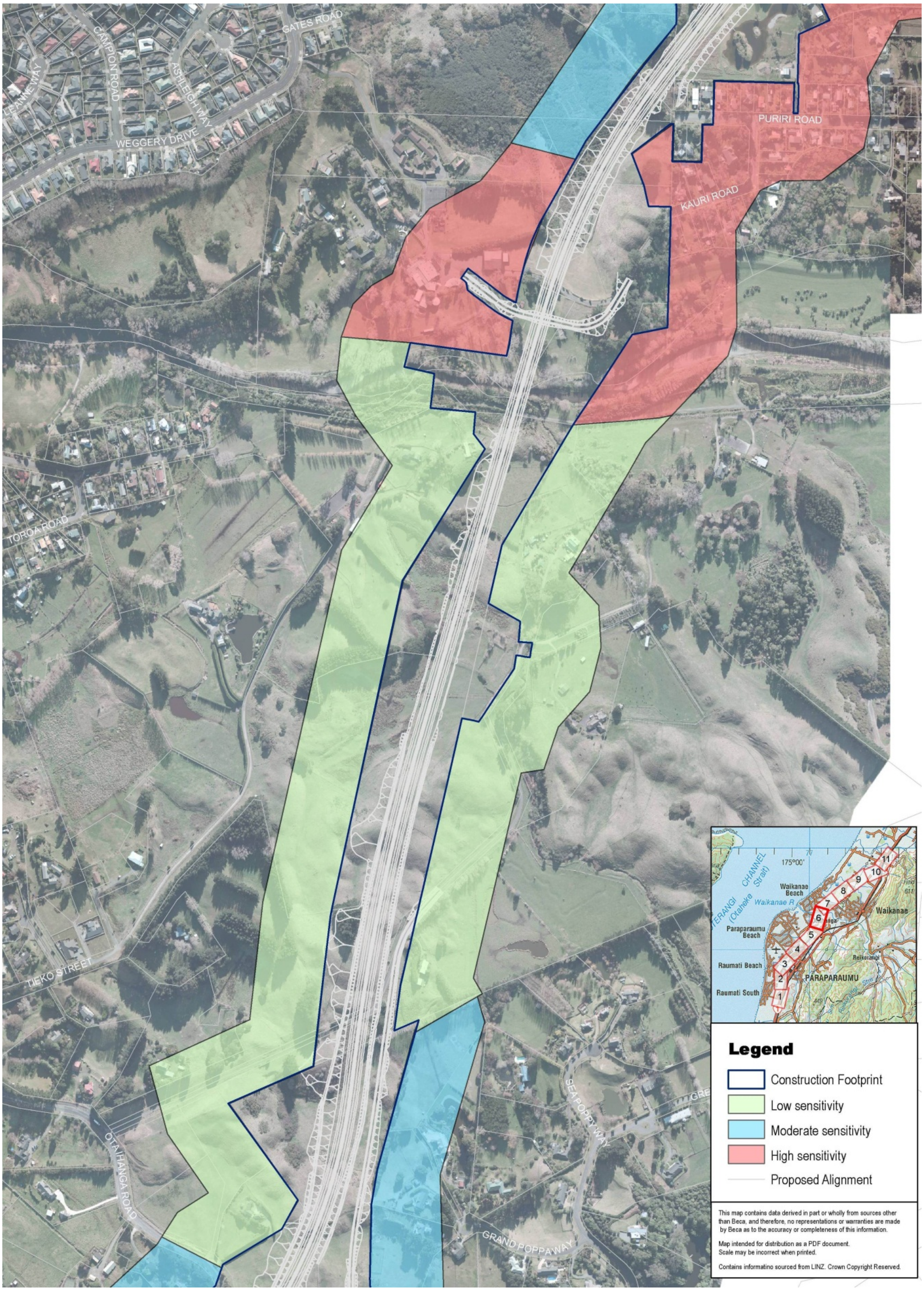


Figure 11 – Sensitive and Moderately Sensitive Areas – Sector 3, Otaihanga Road to Waikanae River

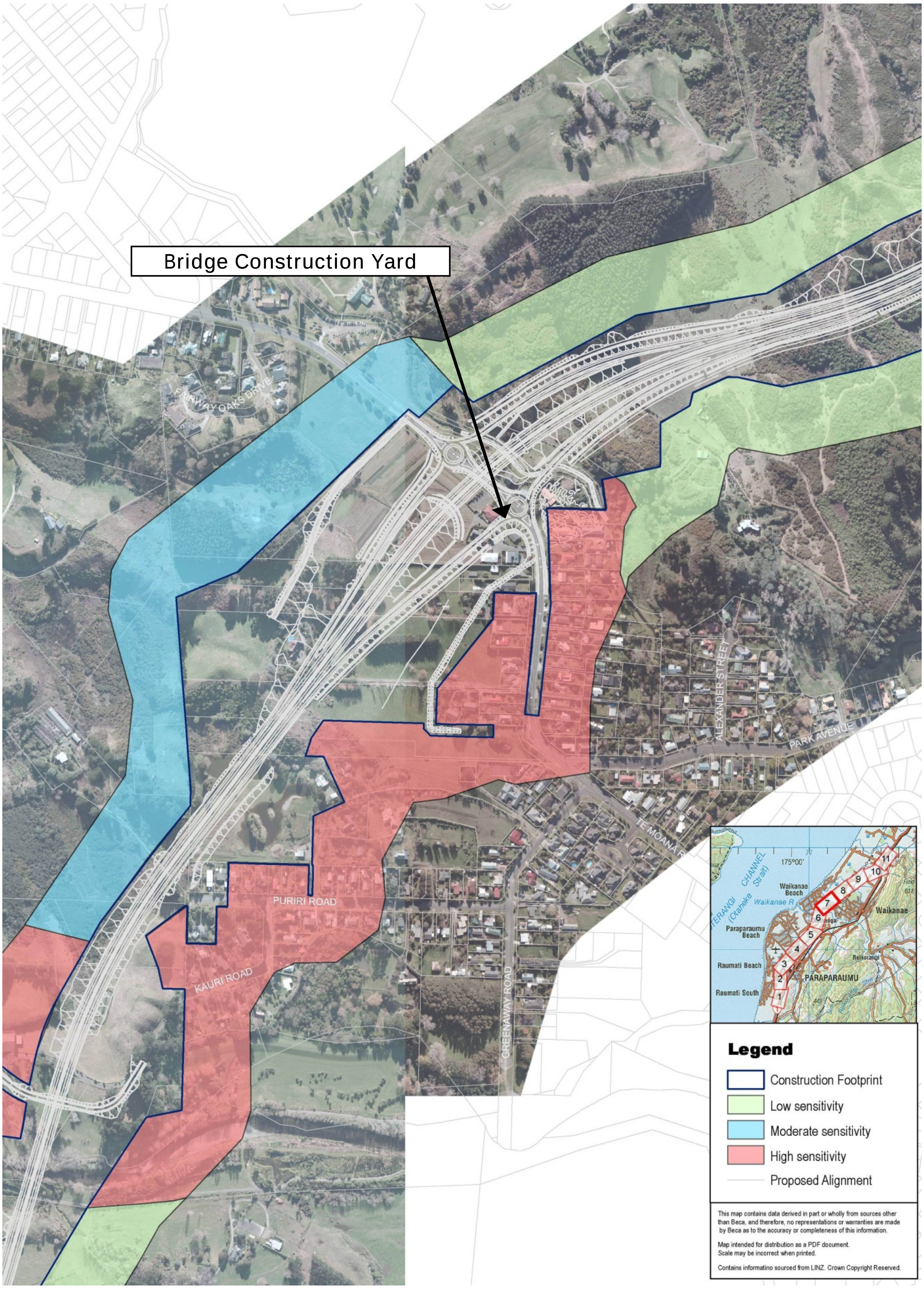


Figure 12 – Sensitive and Moderately Sensitive Areas – Sector 3, Waikanae River to Te Moana Road

5.3.4 Potential for adverse effects:

- Earthworks and other activities involving a significant potential for dust emissions are likely to occur as follows:
  - **Mazengarb Road to Otaihanga Road** – March 2014 for approximately 22 months
  - **Otaihanga Road to the Waikanae River Crossing** – Late 2014 for about 16 months
  - **Waikanae River Crossing to Te Moana Road (including the Te Moana Road Interchange)** – Early 2014 for approximately 13 months
  - **Otaihanga Yard – Occasional abrasive blasting of bridge beams** – estimated to be less than 10 occurrences over the duration of the Project.
- The greatest potential for adverse effects due to dust emissions in Sector 3 will relate to properties between the Waikanae River and Te Moana Road, partly due to the ongoing use of the proposed Expressway Alignment as a haul road for most of the duration of the Project. Overall, the risk of adverse effects in this sector is likely to be lower than in either Sector 1 or Sector 2, due to the greater separation between residential properties and the main construction footprint.
- Areas of pasture or agricultural land within 200m of the construction footprint may potentially be impacted by dust deposition from an unsealed haul road. Appropriate measures should be put into place to minimise these potential impacts – e.g. sealing the road and wet suppression (water carts).
- Contaminated sites
  - **Otaihanga Road landfill** – The report into the 2009-2010 landfill monitoring programme for KCDC notes: "*It is possible that landfill gas occurs within the fill but significant horizontal migration is unlikely as a result of rapid vertical dispersion from the sandy soils around the site.*" (MWH, 2010) Given the separation distance between the construction yard on the former Otaihanga Road landfill site, adverse effects due to the diversion and discharge of landfill gas caused by the construction or operation of this yard are unlikely.
  - **124- 154 Te Moana Road** – surface soils are contaminated with zinc to a maximum measured concentration of 510 mg/kg. While the aim of the dust management controls for the Project is to avoid adverse effects such as soiling due to dust deposition, these controls will also be sufficient to avoid adverse effects on human health from discharges of zinc-contaminated dust in this area. Assuming that airborne dust concentrations are maintained below 80 $\mu g/m^3$ as 24-hour averages, zinc concentrations will be lower than 0.05 $\mu g/m^3$ (1000 times lower than the relevant assessment criterion).
- Although the overall potential for adverse effects due to dust emissions in this sector is relatively low, this does assume that appropriate dust control measures (as described in section 4.6.1 of this report) are put in place, especially in the area between Waikanae River and Te Moana Road.
- The aim of these control measures will be to minimise and, if practicable, avoid adverse effects in surrounding areas by keeping dust discharges within the construction footprint. Assuming such measures are in place, although it is unlikely that adverse effects can be avoided altogether, adverse effects from the construction of the proposed Expressway will be adequately avoided or mitigated.

5.4 Sector 4

5.4.1 Dust generating activities

- **Earthworks and construction:** cut-to-fill from 600m north of Te Moana Road to Ngarara Road; preload between Chainage 15,700 and Peka Peka Road; road realignment and bridge construction at Ngarara, Smithfield and Peka Peka Roads; construction of stormwater ponds and wetlands between Ngarara Road and Smithfield Road and 300m south of Peka Peka Road.
- **Construction yards**: Intersection construction yard, located on Peka Peka Road, operating for about four years. Bridge construction yard on Ngarara Road for the Ngarara Road and Smithfield Road bridges, operating for about 18 months.
- **Vehicle movements**: vehicles accessing bridge construction at Ngarara, Smithfield and Peka Peka Roads and bringing pre-load in to the Sector; off-road dump trucks taking fill material to other sectors via haul route along the proposed Expressway Alignment.

5.4.2 Contaminated Sites

- **None**.

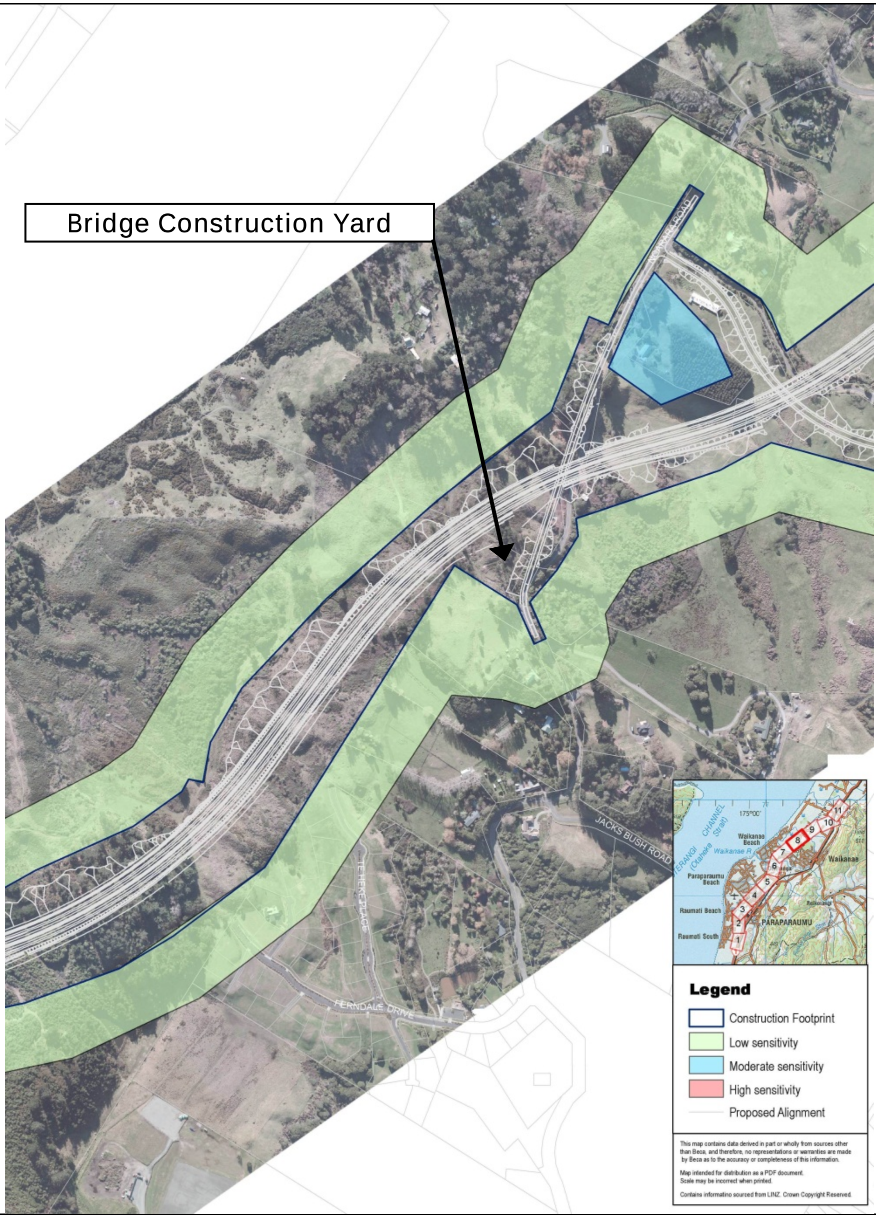
5.4.3 Sensitive receptors:

- **Residential**: aside from one or two isolated residential properties, there are no sensitive receptors within 100m of the construction footprint in Sector 4. Figure 13 and Figure 14 show the areas in Sector 4 that are moderately or highly sensitive to discharges of airborne dust.

5.4.4 Potential for Adverse Effects:

- Earthworks and other activities involving a significant potential for dust emissions are likely to occur as follows:
  - **Te Moana Road to Ngarara Road** – March 2015 for approximately 34 months
  - **Ngarara Road** – October 2015 for about 11 months
  - **Ngarara Road to Smithfield Road** – Early 2015 for approximately 11 months and from about September 2016 for approximately 16 months
  - **Smithfield Road** – From about May 2014 for approximately 10 months
  - **Smithfield Road to Peka Peka Road (including the Peka Peka Road Interchange)** – From about April 2015 for approximately 33 months.
- The greatest potential for adverse effects due to dust emissions in Sector 4 will relate the ongoing use of the proposed Expressway Alignment as a haul road for most of the duration of the Project.
- Given the limited number of properties within 100m of the construction footprint in Sector 4, the overall potential for adverse effects due to dust emissions is lowest in this sector.
- Areas of pasture or agricultural land within 200m of the construction footprint may potentially be impacted by dust deposition from an unsealed haul road. Appropriate measures should be put into place to minimise these potential impacts – e.g. sealing the road and wet suppression (water carts)
- Although the overall potential for adverse effects due to dust emissions in this sector is relatively low, this does assume that appropriate dust control measures (as described in section 4.6.1 of this report) are put in place, especially in the vicinity of residential premises.

- The aim of these control measures will be to minimise and, if practicable, avoid adverse effects in surrounding areas by keeping dust discharges within the construction footprint. Assuming such measures are in place, adverse effects from dust discharges in this Sector are unlikely.



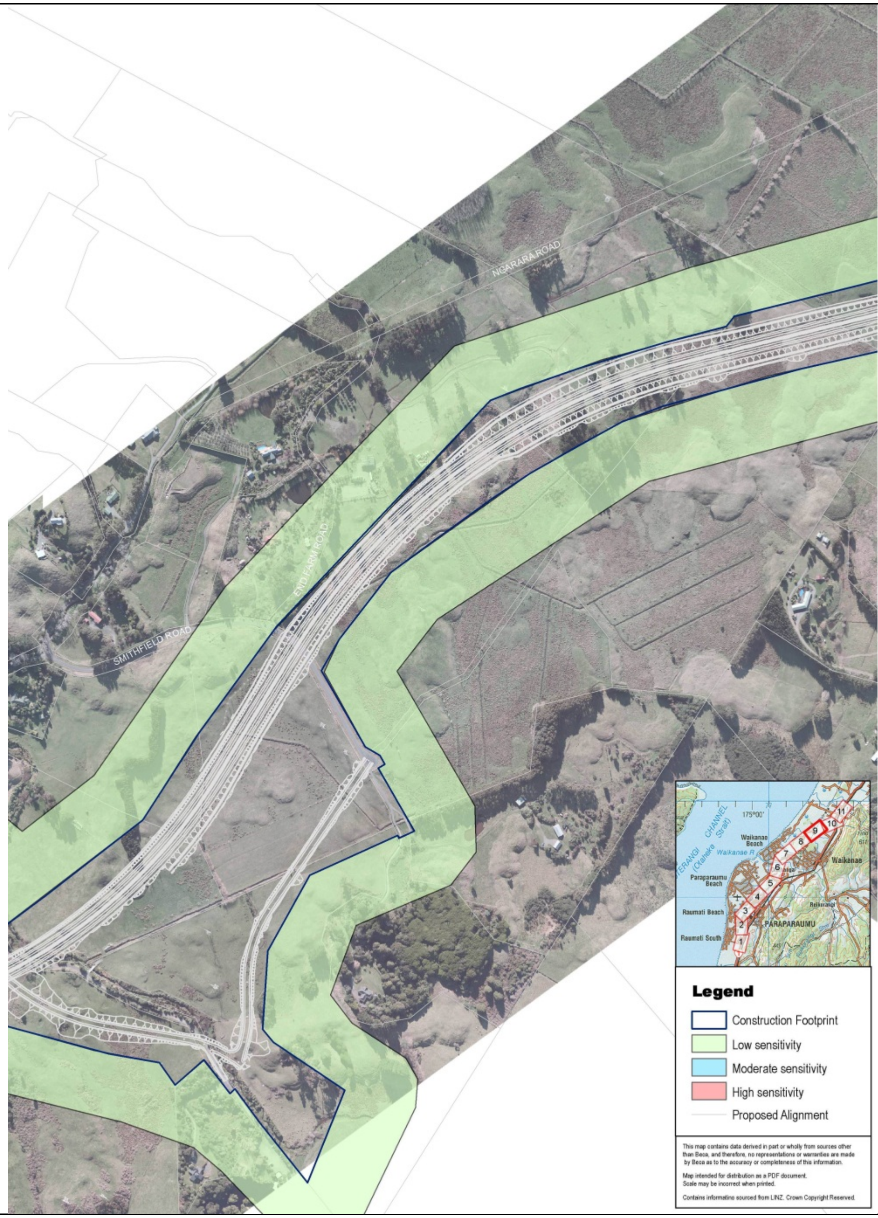


Figure 13 – Sensitive and Moderately Sensitive Areas – Sector 4, Ngarara Road and Smithfield Road

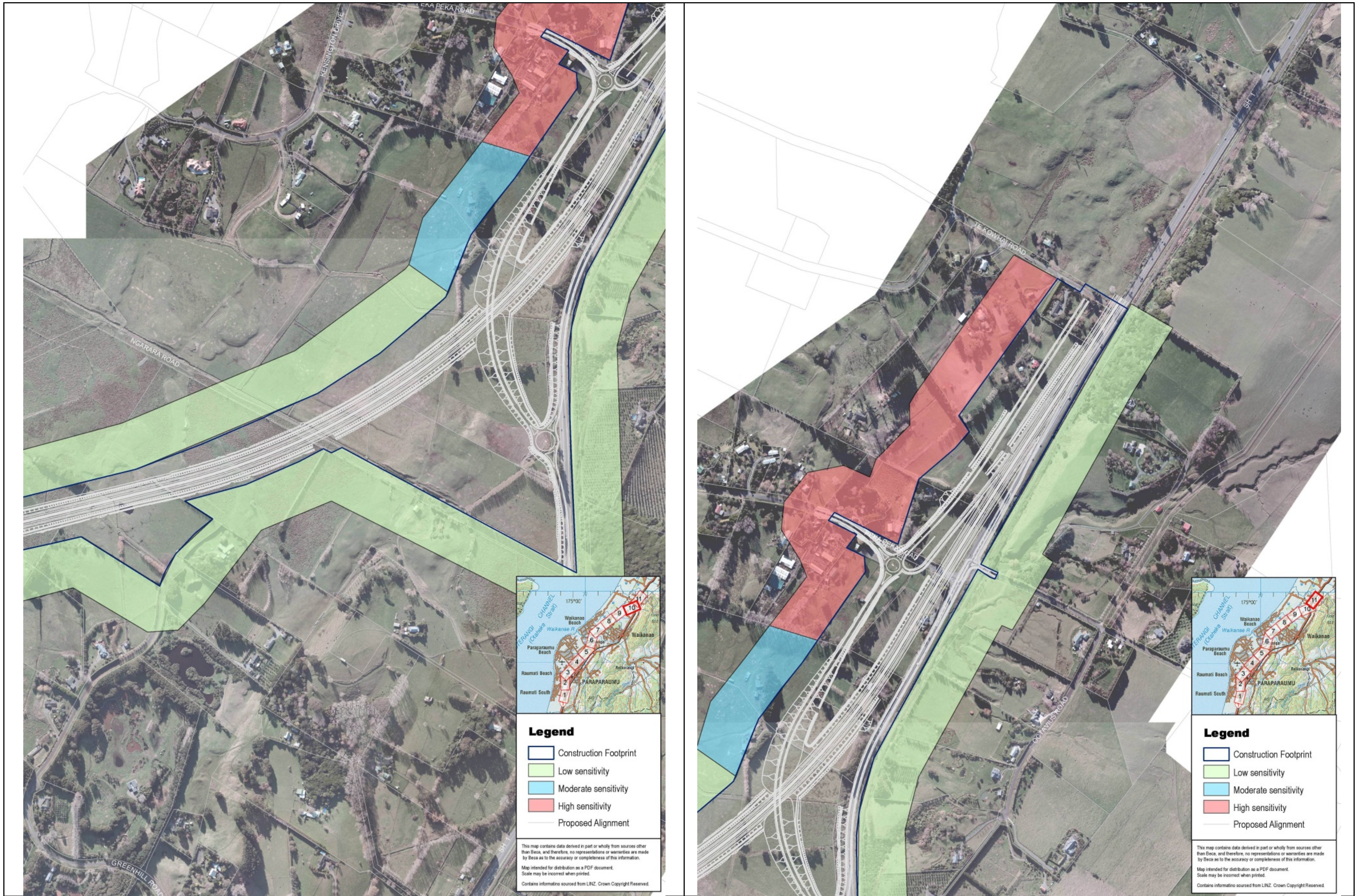


Figure 14 – Sensitive and Moderately Sensitive Areas – Sector 4, Peka Peka

6 Monitoring

6.1 Introduction

A dust monitoring programme will be implemented during the construction and earthworks phases of the development. The objective of this programme would be to identify conditions where dust nuisance may occur and to assess whether the mitigation and control measures implemented through the CAQMP are effective in minimising dust emissions.

The two key methods for monitoring dust discharges are visual and instrumental. Visual methods are cheap and simple to implement – wherever construction is taking place, there are staff who could observe and report dust discharges. However, visual observation is subjective – what one person considers a nuisance may be thought quote reasonable by another. Instrumental monitoring is more expensive to set up and operate, but can provide an objective, continuous indication of dust emissions, so warning of an issue before it generates complaints.

Visual and instrumental monitoring alone will not be sufficient to effectively and adequately mitigate the effects of dust discharges from the construction sites; rather, they should be seen as part of a package, along with good management practices. Visual and instrumental monitoring are tools to inform the management of dust emissions from the construction sites, with site management practices both reacting to observations of increased discharges and being proactively updated to prevent such discharges in the future.

Routine monitoring for discharges of hazardous air pollutants from contaminated sites is not proposed, although provision will be made in the instrumental TSP monitoring programme for dust filter samples to be collected that may be analysed at a later date if required. There are no practicable methods for the sampling and analysis of airborne particulate matter contaminated with benzo(a)pyrene or arsenic that would assist with the management of emissions of these contaminants – currently available methods are based on collection of particulate matter samples for laboratory analysis (e.g 3 – 5 days later).

6.2 Instrumental monitoring

The recommended method for monitoring deposited dust is the use of bucket deposition gauges, while TSP can be monitored by gravimetric samplers or continuous analysers. Although a trigger level for deposited dust is included in the MfE Dust GPG (MfE, 2001), monitoring for compliance with this value has little practical benefit. As any measurements are averaged over 30 days, it is difficult to distinguish the contribution of various sources over the long sampling period (ARC, 2002). Rather than using deposition gauges (and in addition to regular visual monitoring of potentially dusty activities), it is proposed that dust discharges from construction are monitored using one or more continuous particulate monitors (i.e. particulate monitors fitted with a TSP inlet, coupled with continuous wind speed, wind direction and temperature monitors).

The locations of the monitoring sites will depend on the scale of the construction activity in the area, the expected duration of the activity, the sensitivity of the surrounding areas and the availability of suitable monitoring sites. However, given the overall scale and duration of the Project and the proximity of parts of the Project to sensitive receptors, continuous TSP monitoring will probably be needed at one or possibly more than one locations (although it is envisaged that the monitors may be moved as construction progresses).

In those areas where the construction activity has a high potential to generate dust and where sensitive locations are nearby, the proposed monitoring locations are as follows:

- Leinster Avenue (while pre-loading is being laid down and during carriageway construction)
- 55 Rata Road while excavation of contaminated fill is undertaken
- Between Kāpiti Road and Mazengarb Road (throughout the Project).

Given that the prevailing winds in the area are from the north during summer months (when the greatest risk of dust discharges occurs, continuous monitors should preferably be located on the southern side of the construction footprint, as close to the boundary of the proposed Expressway construction Designation as practicable.

A real-time TSP monitor should be located in each of the above (approximate) locations. A meteorological station which measures wind direction, wind speed and temperature should be located alongside at least one of the real time TSP monitors.

The locations selected for the TSP and meteorological monitoring sites should be selected as far as is practicable to comply with the requirements of:

- AS/NZ 3580.1.1:2007 Method for Sampling and Analysis of Ambient Air – Guide to Siting Air Monitoring Equipment; and
- AS 2923:1987 Ambient Air – Guide for the Measurement of Horizontal Wind for Air Quality Applications.

The specific monitoring systems have not yet been selected. However, specifications for the TSP monitoring systems will include:

- Near continuous measurement and recording of TSP concentrations with outputs as 1 hour and 24 hour average concentrations.
- The ability to collect filters for subsequent analysis for hazardous air pollutants, where monitoring is carried out in the vicinity of identified contaminated sites (55 Rata Road and the Kāpiti Road intersection in Sector 2). This is included as a precautionary measure – e.g. if subsequent analysis identifies significantly higher contaminant loads in soils than previously measured.
- The outputs from the TSP monitors and the meteorological stations must be able to be monitored remotely, and be set to produce an alarm when trigger values are approached. Alarms should activate a pager or cell phone.

The purpose of this instrumental monitoring is to provide a management tool to assist in avoiding dust discharges that cause adverse effects beyond the Project boundaries, rather than as a compliance measure. Therefore, actual monitoring locations may vary in response to both the operational requirements of the Project and public concerns regarding dust emissions. Monitoring instruments will need to be sufficiently portable that they can be easily relocated as required for this purpose.

6.3 Visual monitoring

Full details of proposed monitoring methods and frequencies are given in the CAQMP. In addition to the instrumental monitoring referred to above, this will include: visual inspection of operational sites and surrounding areas for evidence of dust discharges; regular inspection of operational areas for dampness and amount of exposed surface area and regular inspection of stockpiles; maintenance and inspection of water spray systems and windbreak fences (if used). In addition to these, procedures will be in place for responding to complaints.

7 Discharges of odour

The occupation of the former landfill site as a construction yard may result in landfill gas (containing methane and odour) being diverted and concentrated, and consequently giving rise to odour impacts beyond the boundary of the site. However, such discharges are unlikely to give rise to significant adverse effects. The nearest sensitive receptors are about 250m to the northwest of the construction yard and over 400-500m from the yard in all other directions. In addition, there are a number of odorous or potentially odorous activities in the vicinity of the yard, including the Paraparaumu wastewater treatment plant, a composting facility and the Otaihanga Resource Recovery Facility.

8 Vehicle exhaust emissions

8.1 Construction traffic

Excessive smoke and odour from diesel-fuelled trucks, generators and other machinery is primarily caused by poor engine maintenance. Failure to maintain air filters, fuel filters, and fuel injectors to manufacturer’s specifications may cause excessive black smoke and objectionable odour.

Excessive smoke and odour discharges from trucks, earth moving machinery and generators, while unlikely, could affect neighbours under adverse meteorological conditions if vehicles and machinery are not well maintained. Therefore trucks and machinery used on-site, including those of subcontractors, should be kept appropriately maintained. Although it may be desirable to only use machinery that meets specific emissions standards (e.g. Euro 3 or Euro 4), in practice this is likely to be unrealistic given the average age of the existing construction vehicle fleet in NZ.

Construction of the Project will temporarily increase truck numbers in the Project vicinity; however the selection of haulage routes includes consideration of air quality and other amenity effects (e.g. noise). Where possible, trucks accessing all parts of the Project will do so directly from SH1 or via Kāpiti Road, Te Moana Road, Otaihanga Road and the main construction yard, and will then use a haul road running the length of the Project. The exceptions will be vehicles accessing the various bridge construction sites until those bridges are complete.

Table 5 summarises the planned daily truck movements on local roads associated with the construction of the Project. Column 2 of Table 5 shows the maximum daily average truck movements, while column 3 shows the number of months that truck access will be required via the particular road.

Table 5 – Summary of daily truck movements on local roads[4]

Road	Existing Two- Way Daily Traffic[1.]	Expected Max. Truck Movements Per Day
Poplar Ave	3,900	120
Raumati Rd	11,500	80
Ihakara Rd	4,800	75
Kāpiti Rd	20,600	120
Mazengarb Rd	7,800	140
Otaihanga Rd	6,300	535
Te Moana Rd	9,200	310
Ngarara Rd	900	120
Peka Peka Rd	1,100	125

The highest increase in movements of HCVs due to the construction of the proposed Expressway is 535 movements per day on Otaihanga Road (between the main construction yard and SH1). Such increases will result in an insignificant increase in ground level concentrations of air pollutants (e.g. an increase of less than 0.6 µg/m^3 in the maximum 24-hour average concentration of PM_{10} particulate matter) and are not predicted to cause any health-based air quality standard or guideline to be exceeded (refer Technical Report 13, Volume 3).

8.2 Temporary traffic re- routing

Construction of bridges where the proposed Expressway crosses local roads and at the intersections with the existing SH1 will involve temporary lane and or road closures. Section 5.1 of the Assessment of Temporary Traffic Effects (Technical Report 33, Volume 3) states:

- *The short term temporary lane realignments and shoulder closures and long term remarked lane arrangements are not expected to impact the capacity of the existing intersection or roads. Short term activities will occur outside peak hour traffic flows to minimise disruption to road users.*
- *The full closure of roads and associated detours during bridge beam placement will significantly increase the time and distance that road users have to travel. The closure will occur overnight, during low traffic flow to minimise the impact on road users.*

Given the scheduling of short-term lane and road closures outside peak traffic periods, vehicle exhaust emissions associated with temporary traffic re-routing are likely to cause an insignificant increase in ground level concentrations of air pollutants and are not predicted to cause any health-based air quality standard or guideline to be exceeded (refer Technical Report 13, Volume 3).

[4] Data supplied by Andrew Goldie of Fletcher Construction Ltd on behalf of the Project team.

9 Summary and conclusions

Due to the close proximity of sensitive receptors (mainly residential premises) to large parts of the proposed construction footprint for the Project, a high standard of emissions control and management will be employed to adequately avoid or mitigate the effects of discharges of construction dust. The management approach which will be applied is based on the avoidance of adverse effects through the control of potential dust discharges before they arise.

A separate Construction Air Quality Management Plan (CAQMP) (CEMP Appendix G, Volume 4) has been prepared, which is designed to form the basis of a full CAQMP, which will be prepared once the conditions of any Expressway Designation and consents are known. Once finalised, this CAQMP will detail methods to be used to mitigate discharges of contaminants into air from the construction of the Project.

A dust monitoring programme is proposed, utilising regular visual monitoring in all areas, continuous monitoring of TSP at a number of locations, continuous meteorological monitoring at one or more locations and prompt responses to complaints from the public and regulatory authorities. The aim of this monitoring programme is to assist the control and management of discharges of construction dust from the Project.

Although there may be discharges of odour associated with the occupation of the former Otaihanga Landfill as the main contractor’s yard, adverse effects are likely to be negligible due to the distance from sensitive receptors.

Haulage routes for construction traffic have, where possible, been selected so as to minimise impacts on the surrounding community. For the most impacted road (Kāpiti Road east of Rimu Road) effects arising from construction traffic are predicted to comply with New Zealand ambient air quality standards.

Through the use of appropriate emissions control and good on-site management, adverse effects that may otherwise be caused by discharges of contaminants into air from the construction of the Project will be adequately avoided or mitigated so as to be contained within the Project site boundaries and thus be acceptable.

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Appendix 14.A

Wind Speed and Direction

Wind Speed and Direction – Paraparaumu Airport, 2008- 2010

Figures A1 to A7 present a summary of hourly average wind speeds and directions recorded at Paraparaumu Airport between 2008 and 2010, as follows:

- Figures A1-A3 – Annual wind roses for 2008, 2009 and 2010
- Figures A1-A3 – Seasonal wind roses for spring (A4), summer (A5) autumn (A6) and winter (A7) for the period 2008-2010.

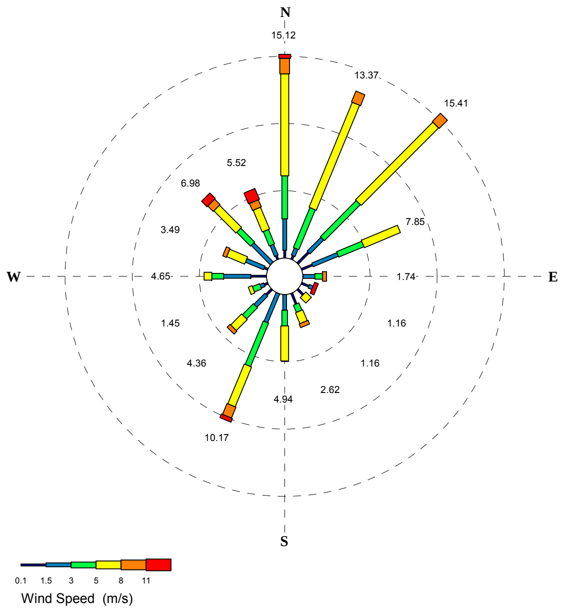

Figure A1 – Annual Wind Rose for 2008 Paraparaumu Airport

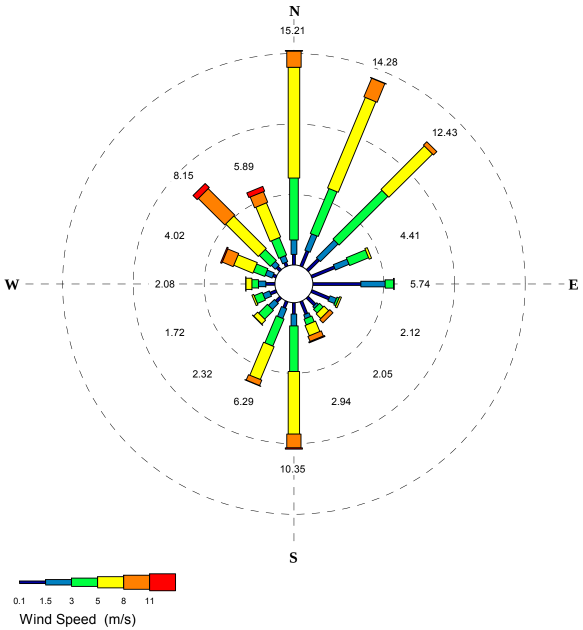

Figure A2 – Annual Wind Rose for 2009 Paraparaumu Airport

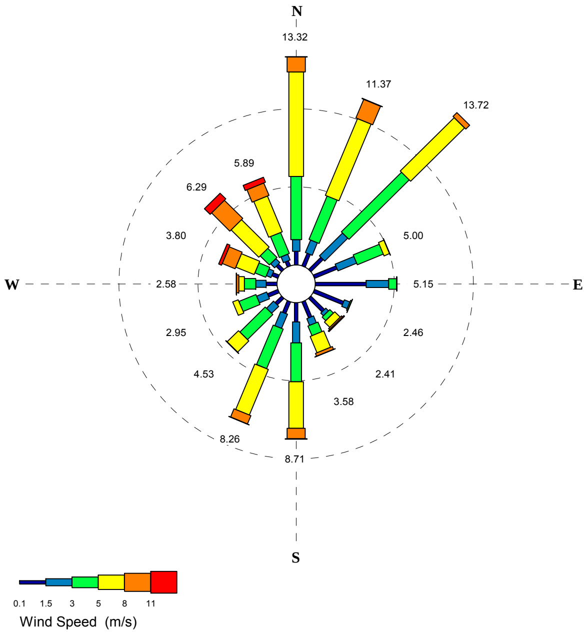

Figure A3 – Annual Wind Rose for 2010 Paraparaumu Airport

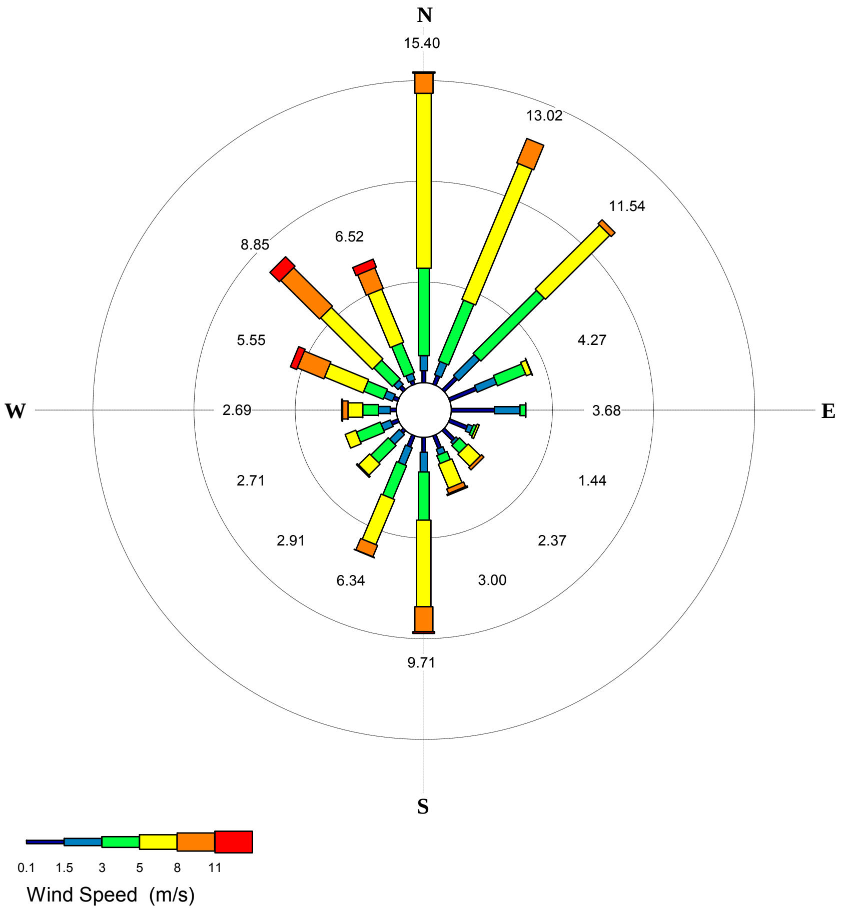

Figure A4 – Seasonal Wind Rose – Spring
Paraparaumu Airport

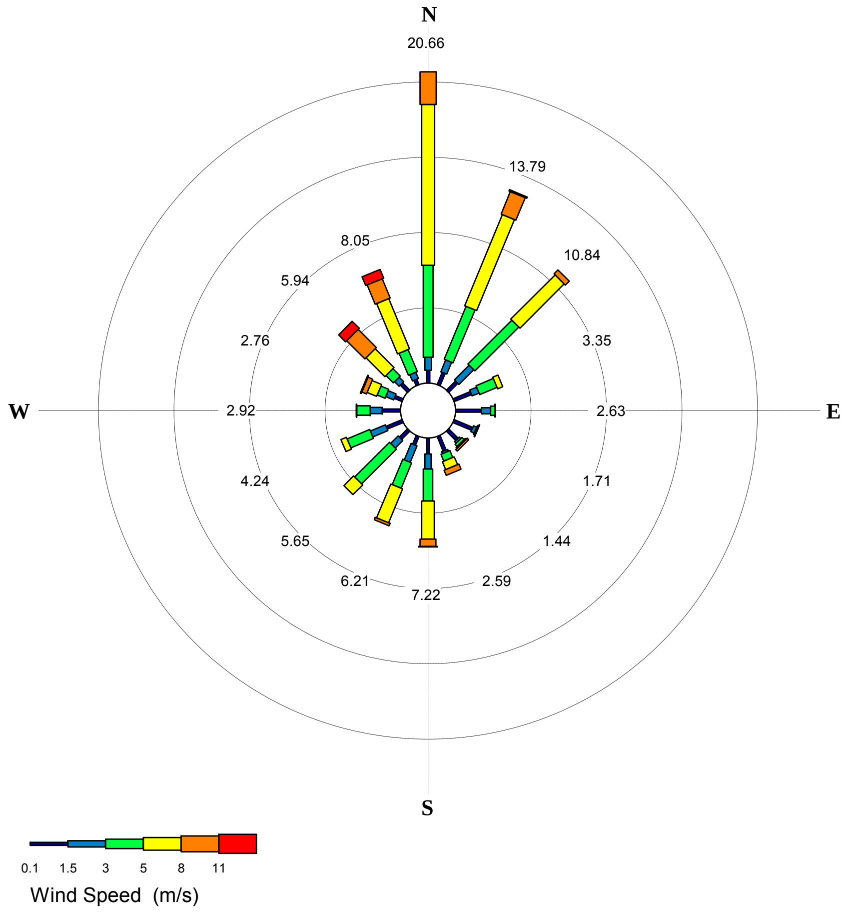

Figure A5 – Seasonal Wind Rose – Summer
Paraparaumu Airport

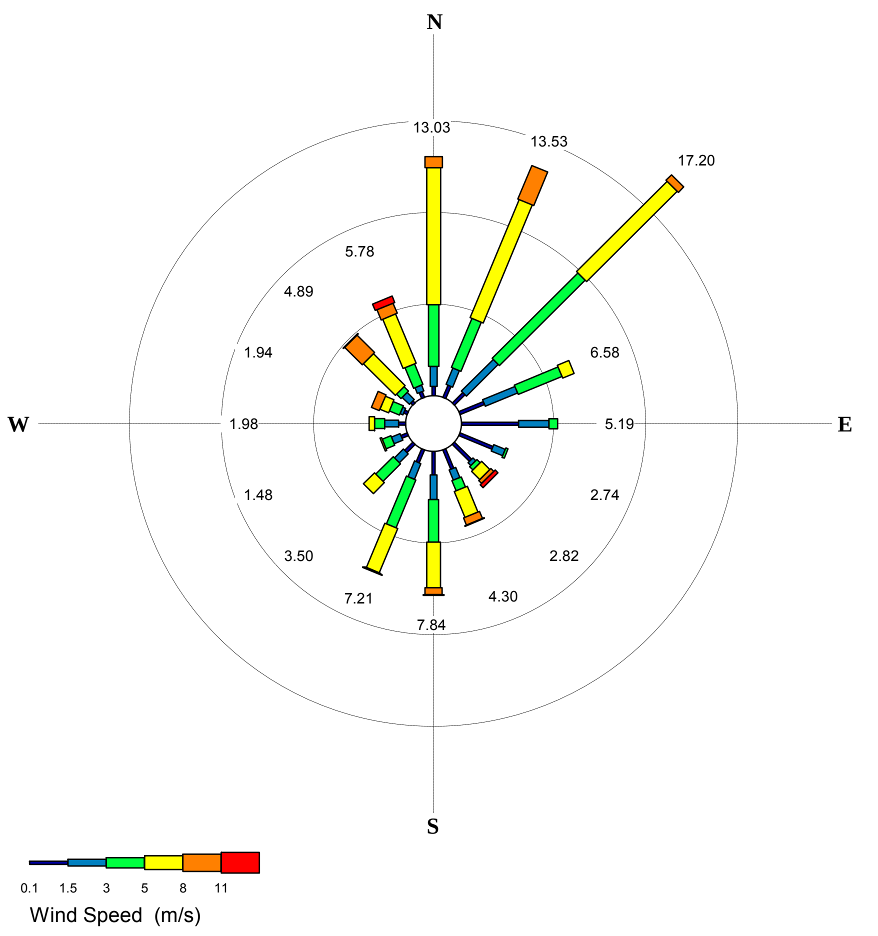

Figure A6 – Seasonal Wind Rose – Autumn Paraparaumu Airport

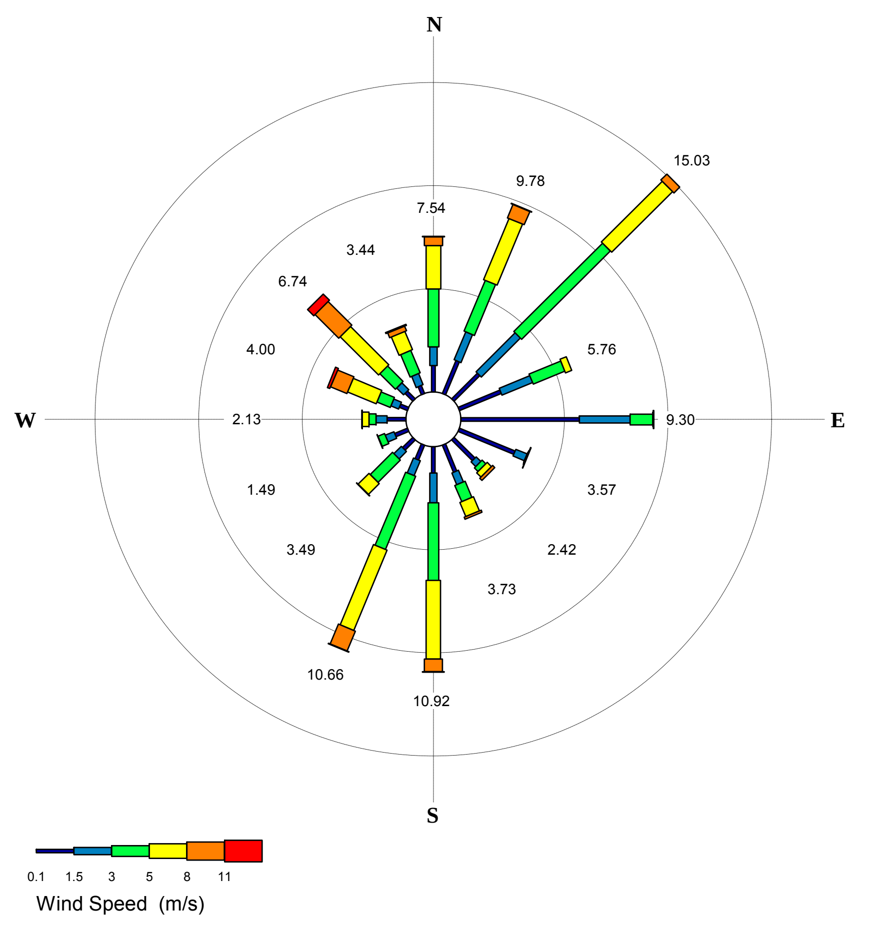

Figure A7 – Seasonal Wind Rose – Winter Paraparaumu Airport