PART C: DESCRIPTION OF THE ENVIRONMENT

6. Description of the environment

Overview

The Project mainly traverses through rural land. However, the southern end of the Project area lies in the vicinity of the residential suburbs of Whitby, Waitangirua, Cannons Creek, Ranui Heights, Linden and Tawa. Whitby is one of the region's most affluent suburbs, while Waitangirua and Cannons Creek are two of the poorest suburbs.

The Project area is highly modified and consists almost entirely of pasture. Within this, however, there are pockets of both native and exotic (mainly forestry) vegetation. The highly modified nature of the area means that is holds little ecological value in terms of providing habitat for terrestrial species. The Project traverses nine hydrological catchments which are part of three different watersheds. The ecological value of the streams in these catchments varies from high to low but all streams are in highly modified catchments. Five of the catchments (approximately 65% of the length of the Project area) drain into the Pauatahanui Inlet. This inlet is of significant ecological value, supporting a wetland and marine ecosystem.

A range of network utilities are present throughout the Project area, the most significant being the 110kV electricity transmission line (from which the Project takes its name).

Within the Project area there are relatively few archaeological, historical or cultural features of note.

6.1 Introduction

This chapter contains a description of the existing environment. It is based on information from a number of sources, but principally the design and technical reports contained in Volume 3. These reports should be consulted for more detailed information about specific aspects of the existing environment.

Four terms are used throughout this chapter in reference to particular areas[53]:

- the 'Main Alignment corridor' refers generally to the corridor adjacent to the proposed Main Alignment centreline;

53. These four terms refer to general geographical areas of relevance. As such, they include, but are not limited to the extent of the proposed designation.

- the 'Kenepuru Link Road area' refers generally to the area in the vicinity of the proposed Kenepuru Link Road;
- the 'Porirua Link Roads area' refers generally to the area in the vicinity of the proposed Porirua Link Roads; and
- the 'Project area' refers to wider areas of relevance to the Project and varies between topic areas (i.e. traffic, ecology etc.).

Section 6.2 contains a description of the topography and land use of the Main Alignment corridor, the Kenepuru Link Road area and the Porirua Link Roads area. In the rest of the chapter, the following environmental aspects of the Project area are described:

- geology (Section 6.3);
- natural hazards (Section 6.4);
- climate (Section 6.5);
- hydrology (Section 6.6);
- terrestrial ecology (Section 6.7);
- freshwater ecology (Section 6.8);
- marine ecology (Section 6.9);
- air quality (Section 6.10);
- noise (Section 6.11);
- transport networks (Section 6.12);
- network utilities (Section 6.13);
- the social environment (Section 6.14); and
- archaeology, cultural and heritage (Section 6.15).

More detailed information about the environment is provided in the relevant chapters on the assessment of environmental effects in Part G. This also contains further information about particular receiving environments in relation to the discharge of contaminants.

6.2 Land use and topography

This section contains a description of the land use and topography of the following three key areas:

- the Main Alignment corridor;
- the Kenepuru Link Road area; and
- the Porirua Link Roads area.

The general land cover is shown in plan **GA06**, while plans **GA03**, **GA04** and **GA05** show the landform, slope and geomorphology across the Project area, respectively. Plan **GA08** shows the parcel sizes.

6.2.1 Main Alignment corridor

The Main Alignment corridor consists of nine sections as detailed in Table 6.1. Section divisions were broadly determined by changes in topography and proposed connections with the existing road network.

Table 6.1: Sections of the Main Alignment corridor

Section number	Section name	Station value (m)	Length (km)	District
1	MacKays Crossing	0 – 3,500	3.5	Kapiti Coast
2	Wainui Saddle	3,500 – 6,500	3.0	Kapiti Coast, Upper Hutt City, Porirua City
3	Horokiri Stream	6,500 – 9,500	3.0	Porirua City
4	Battle Hill	9,500 – 12,500	3.0	Porirua City
5	Golf Course	12,500 – 15,500	3.0	Porirua City
6	State Highway 58	15,500 – 18,500	3.0	Porirua City
7	James Cook	18,500 – 21,500	3.0	Porirua City
8	Cannons Creek	21,500 – 24,900	3.4	Porirua City, Wellington City
9	Linden	24900 – 27700	2.8	Porirua City, Wellington City

The Main Alignment corridor begins at MacKays Crossing at SH1 and ascends through the Te Puka Stream valley towards the Wainui Saddle. After cresting the saddle the corridor descends to the south, following the Horokiri Stream valley, and on through Battle Hill Farm Forest Park (BHFFP). The corridor then descends through rolling farmland before crossing SH58 approximately 500m to the east of Pauatahanui Roundabout. After crossing Pauatahanui Stream, the corridor climbs again through farmland and an area of exotic forest behind Whitby. It then climbs behind and to the south of Porirua East. From there it continues southwards, crossing the headwaters of Duck Creek and Cannons Creek Valley. The corridor then turns west and descends through plantation forest behind Ranui Heights to finish at SH1 at Linden. Overall, the Main Alignment corridor is approximately 27km long.

Figure 6.1 shows the general location of the nine sections of the Main Alignment corridor, the Porirua Link Roads area and the Kenepuru Link Road area which are described generally in the remainder of the section. The land use maps of each Project section are intended to provide a general overview of the predominant land use and are based on the same data used for Project-wide plan **GA06**.

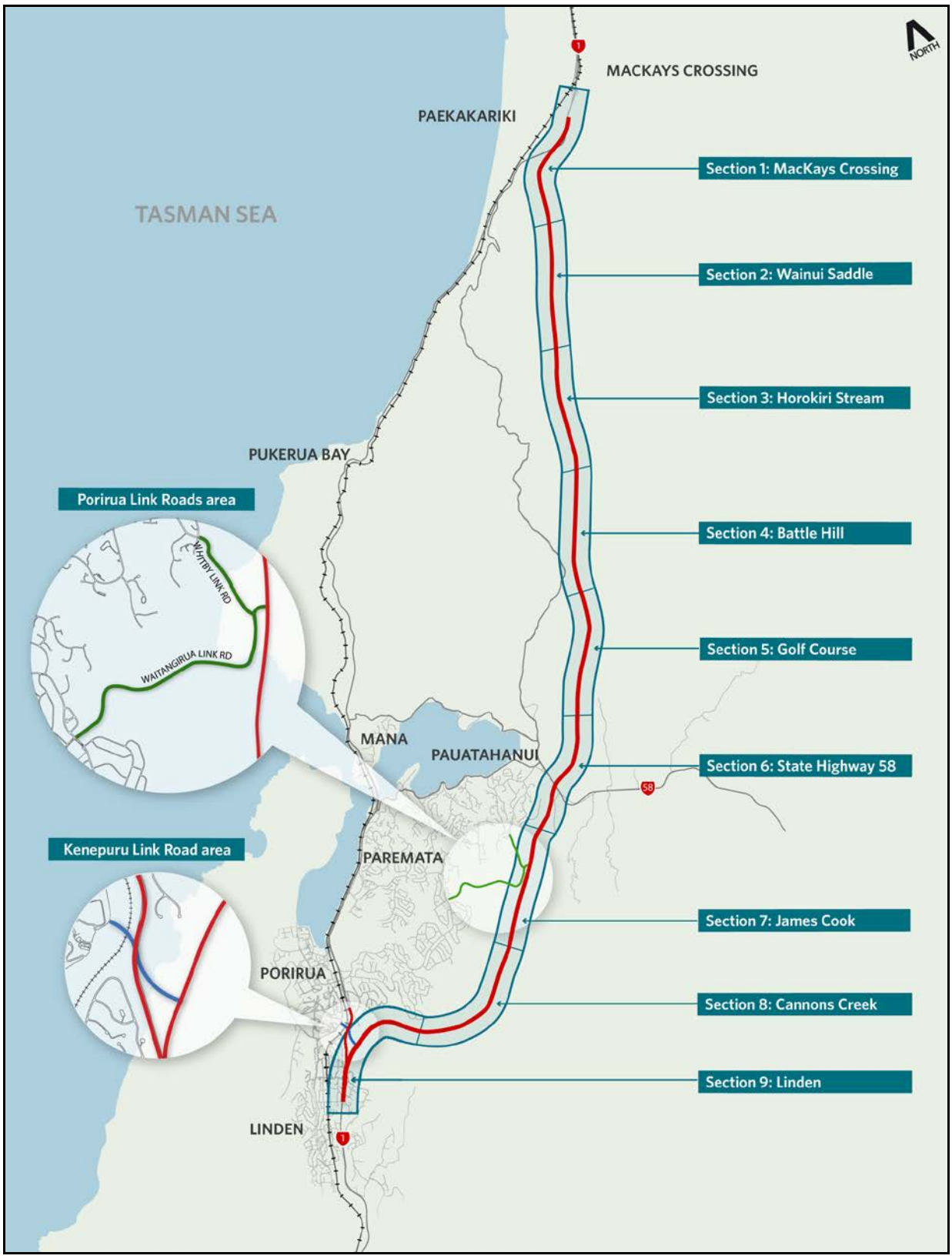

Figure 6.1: The Project area, including the Main Alignment corridor, Kenepuru Link Road area and Porirua Link Roads area

6.2.1.1 Section 1: MacKays Crossing

Section 1 extends from MacKays Crossing (including existing SH1) to the lower part of the Te Puka Stream valley. The topography consists of low-lying flat plains comprising peat lands, dune depressions and low dunes, with the highest dunes rising to about 15m above the surrounding flats. The township of Paekakariki is elevated on dune landforms where the coastal plains meet the Paekakariki Hills.

The landscape features of note are the surrounding hills, which are characterised by steep slopes, large plantation forest on hills east of Te Puka Stream, and extensive pastoral land use on hills west of Te Puka Stream. There is a particularly prominent terrace southeast of MacKays Crossing, the edge of which is a former sea cliff. The terrace has been modified by construction works for the existing SH1. In the vicinity of MacKays Crossing the existing SH1 follows a northeast-southwest alignment along the edge of the coastal plain at the toe of the Ohariu Fault escarpment.

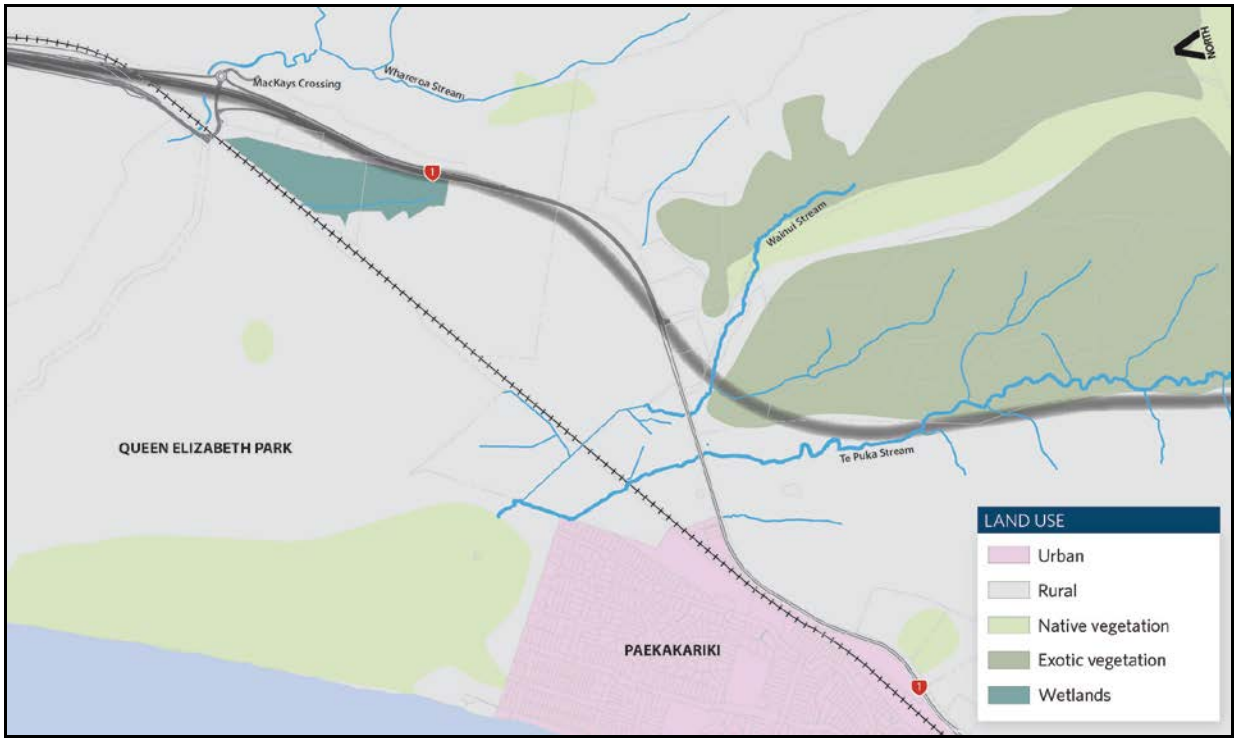

Figure 6.2: Land use in Section 1: MacKays Crossing

As shown in Figure 6.2, land use within the section is predominantly horticultural and pastoral, with some rural residencies. The majority of the land within this section is zoned rural.

6.2.1.2 Section 2: Wainui Saddle

Section 2 extends from approximately half-way up the Te Puka Stream valley, to the south side of the Wainui Saddle. At approximately 262m above sea level, the Wainui Saddle is the highest point of the Main Alignment corridor. The section is characterised by the linear valley of the northward flowing Te Puka Stream, north of Wainui Saddle. The steep greywacke side slopes are forested on the eastern flank and in pasture and regenerating bush on the western slopes. There are a number of alluvial fan deposits

at the mouths of main tributary streams. The steep valley generally follows the Ohariu Fault along this section.

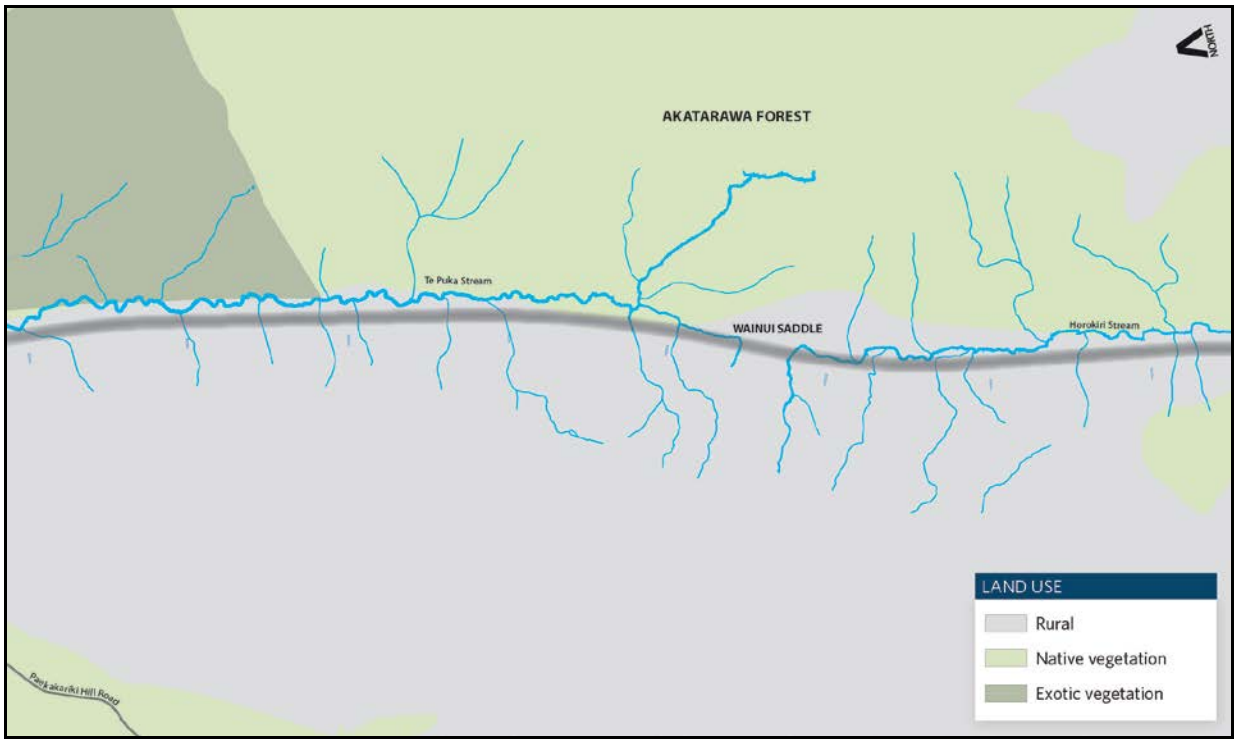

Figure 6.3: Land use in Section 2: Wainui Saddle

As shown in Figure 6.3, Section 2 contains predominantly undeveloped rural land, comprised of exotic and native forest and areas of pastoral land. A significant proportion of this land is particularly steep-sided.

6.2.1.3 Section 3: Horokiri Stream

This section is approximately 3km long and extends from the southern end of the Wainui Saddle to the northern end of BHFFP. It is characterised by the southward flowing Horokiri Stream, south of Wainui Saddle. The steep bedrock slopes are forested on the eastern flank and covered by rough pasture on the western slopes and valley floor. The mouths of steep-sided tributary streams contain alluvial fan deposits. The steep escarpment on the valley's west side has short, steep tributary streams and scree slopes. Rough pasture with extensive areas of regenerating scrub and pockets of remnant indigenous forest are present. On the valley's eastern side, there are larger catchments with tributary streams incised in deep valleys with inter-leaved spurs. Some areas of indigenous and second growth bush are located on the valley side, backed by expansive plantation forest. The stream itself is characterised by a gravel bottom meander with limited riparian vegetation.

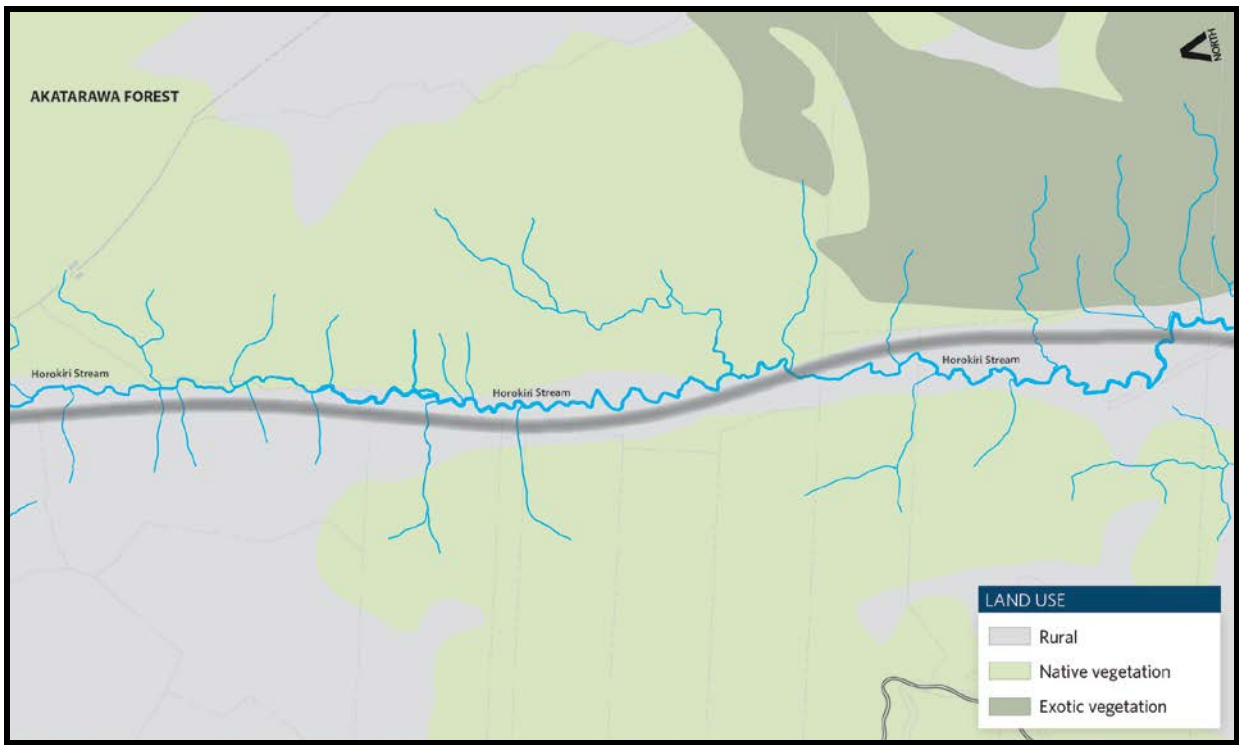

Figure 6.4: Land use in Section 3: Horokiri

As shown in Figure 6.4, land use in this section is predominantly forest and pastoral, however the steep sided valley limits access. Consequently, little development has taken place in the area. There are no residences in this section.

6.2.1.4 Section 4: Battle Hill

This section extends from the northern boundary of the BHFFP to the Pauatahanui Golf Course. It is characterised by the wide, sloping alluvial basin of the Horokiri Stream, with steep sided slopes planted in pine forest on the eastern flank (Akatarawa Forest), and pasture on the valley floor and western hills. The valley is influenced by a straight splinter fault on the north-south alignment, but the Horokiri Stream meanders across the flood plain.

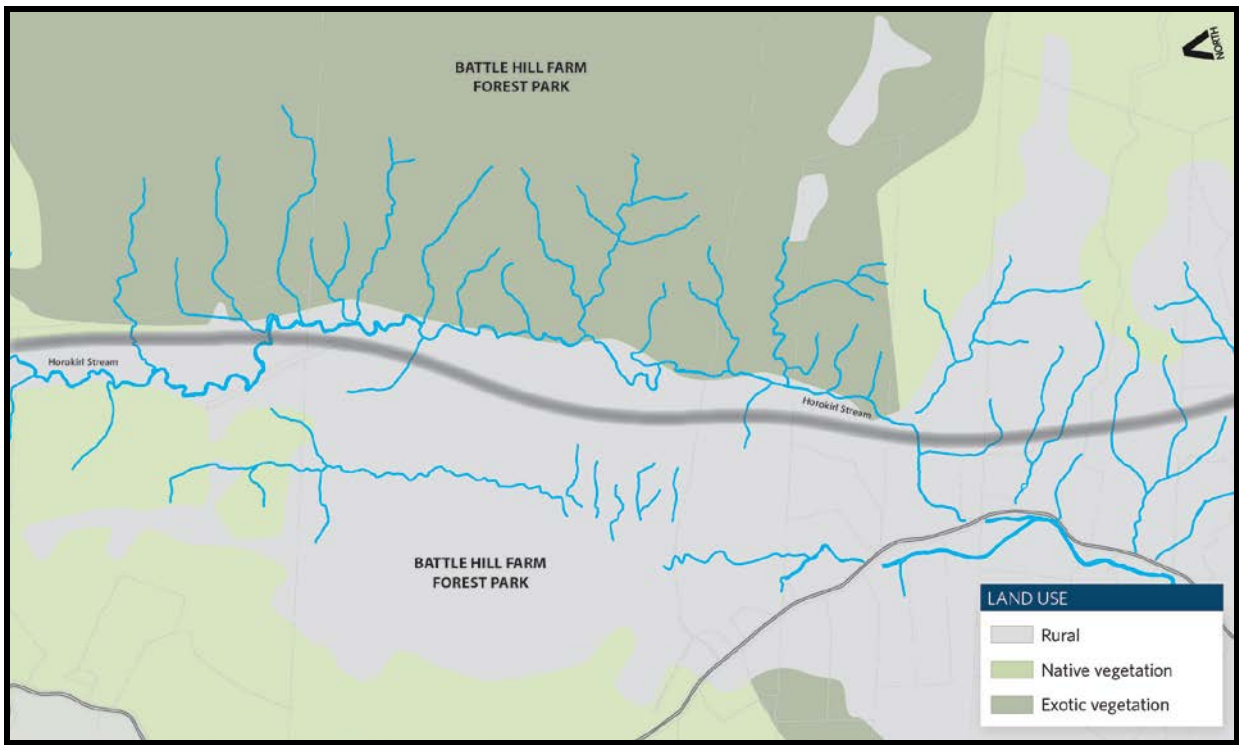

Figure 6.5: Land use in Section 4: Battle Hill

As shown in Figure 6.5, the area through BHFFP is relatively undeveloped and provides for a range of recreational activities, including access to the Akatarawa Ranges. While there is no development within the BHFFP, there are a limited number of rural residential subdivisions and small orchards and farming activities located off Paekakariki Hill Road.

6.2.1.5 Section 5: Golf Course

Section 5 extends from north to south through rural land adjacent to the Pauatahanui Golf Course and Flightys Road. It is characterised by undulating river terraces, gullies and gentle hilltops in pasture and plantation pines, lying between Horokiri Stream and SH58 (in the vicinity of the Pauatahanui Golf Course). The higher hills to the east are characterised by plantation forest and areas of pasture. To the west of the Main Alignment corridor is the Pauatahanui Inlet. To the east of the Main Alignment corridor is Ration Stream bush and Flightys Road. The Main Alignment corridor crosses a number of small tributaries along this section.

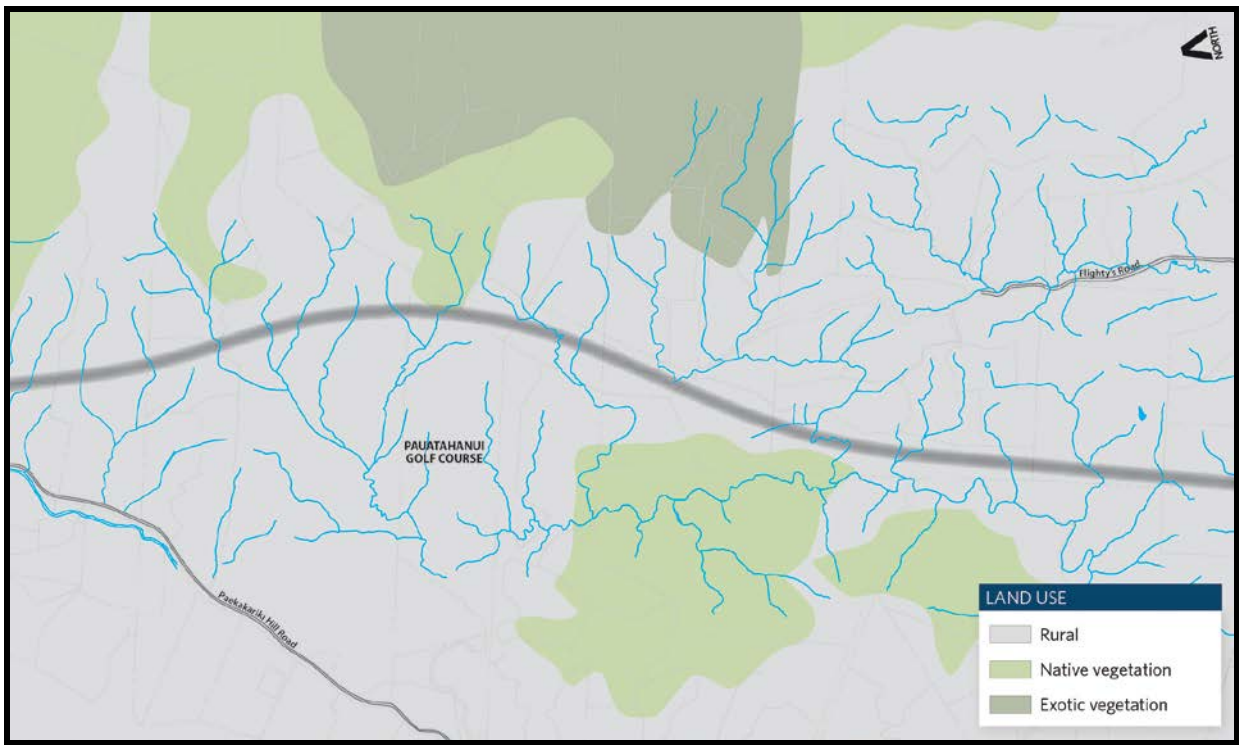

Figure 6.6: Land use in Section 5: Golf Course

As shown in Figure 6.6, land use within this section is a mix of rural activity and rural residential development. Residential dwellings are located on both sides of the Main Alignment and accessed from Paekakariki Hill Road on the western side, and from Flightys Road on the eastern side. There are large areas of forestry either side of the Horokiri Stream.

6.2.1.6 Section 6: State Highway 58

This section extends through rolling rural and rural residential land north of SH58, crosses SH58 and a low-lying marine plain (Lanes Flat) associated with the Pauatahanui Inlet, then climbs the moderately steep terrain to the south.

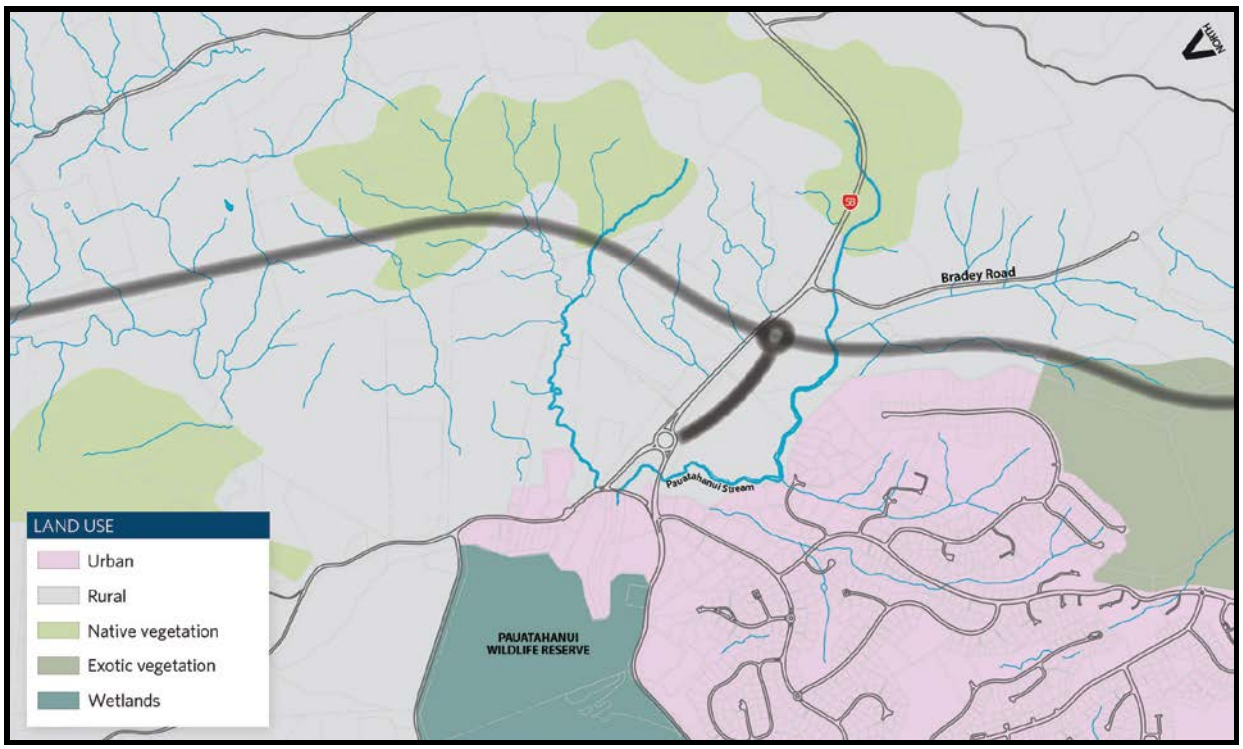

Figure 6.7: Land use in Section 6: State Highway 58

As shown in Figure 6.7, the land north of SH58 is rural. South of SH58, a number of land uses are present. The Lanes Flat area, the land east of Bradey Road and a strip of land west of Bradey Road are all used for rural land use. The Judgeford Hills covers an area of land south of Bradey Road. A number of areas to the south of SH58 have been, or are in the process of being, developed for residential use, including the Silverwood Forest subdivision site and land on either side of Bradey Road.

6.2.1.7 Section 7: James Cook

This section starts just south of SH58, and is approximately 1.8km long. The section flanks a significant tributary of Pauatahanui Stream adjacent to Bradey Road, rises to a saddle in the Duck Creek valley, and then follows the recently deforested east side of the Duck Creek valley, crossing a number of steeply incised tributary streams. The Moonshine fault line is located in Duck Creek valley, to the east of the Main Alignment corridor.

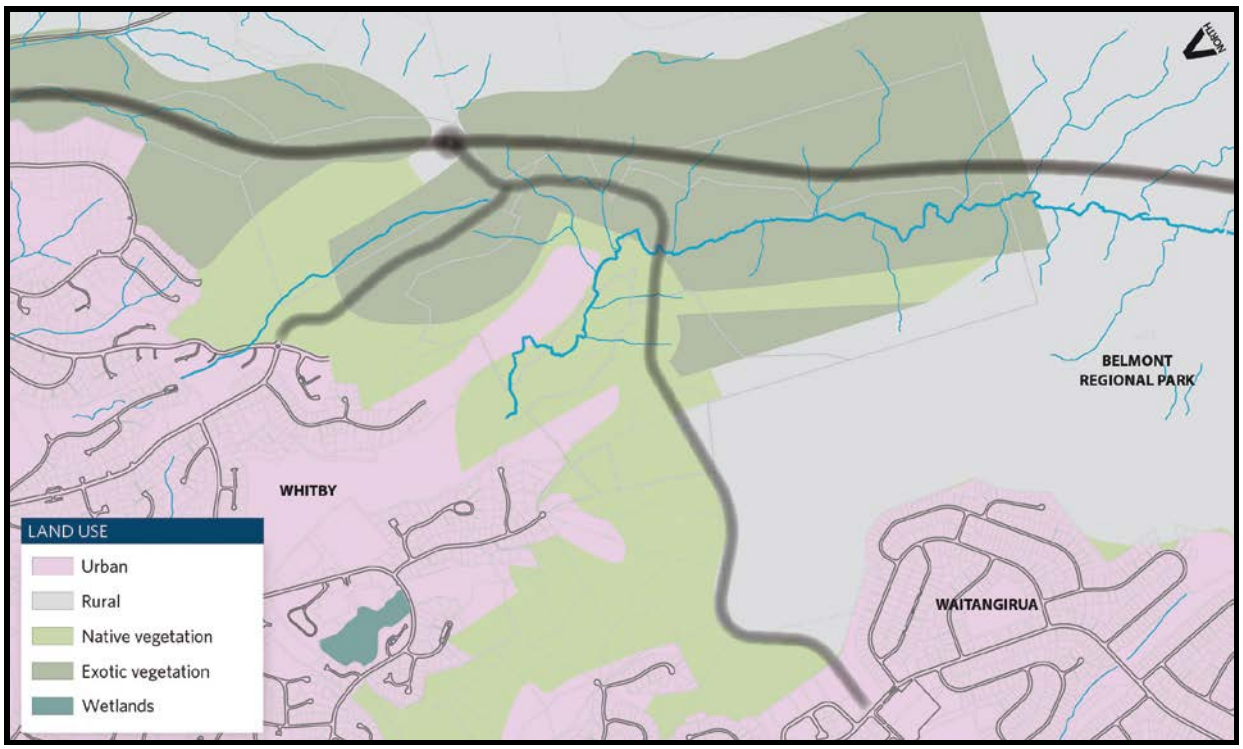

Figure 6.8: Land use in Section 7: James Cook

As shown in Figure 6.8, the land in this section is mostly undeveloped, except for some rural residential subdivisions, and forestry and pastoral farming on the eastern side of the Main Alignment corridor. These are accessed off Bradey Road. There is also a mixture of suburban and rural residential subdivision in the Silverwood Forest Estate, on the western side of the Main Alignment corridor. The residential suburbs of Whitby and Waitangirua are located west of the Main Alignment corridor.

6.2.1.8 Section 8: Cannons Creek

This section is approximately 3.4km long, and stretches from the eastern side of Duck Creek valley, and across an undulating plateau between Duck Creek and Cannons Creeks. It is characterised by the steep-sided Duck Creek Valley (Belmont Hill Country), which is along the Moonshine Fault, and the Cannons Creek area (Porirua East basin).

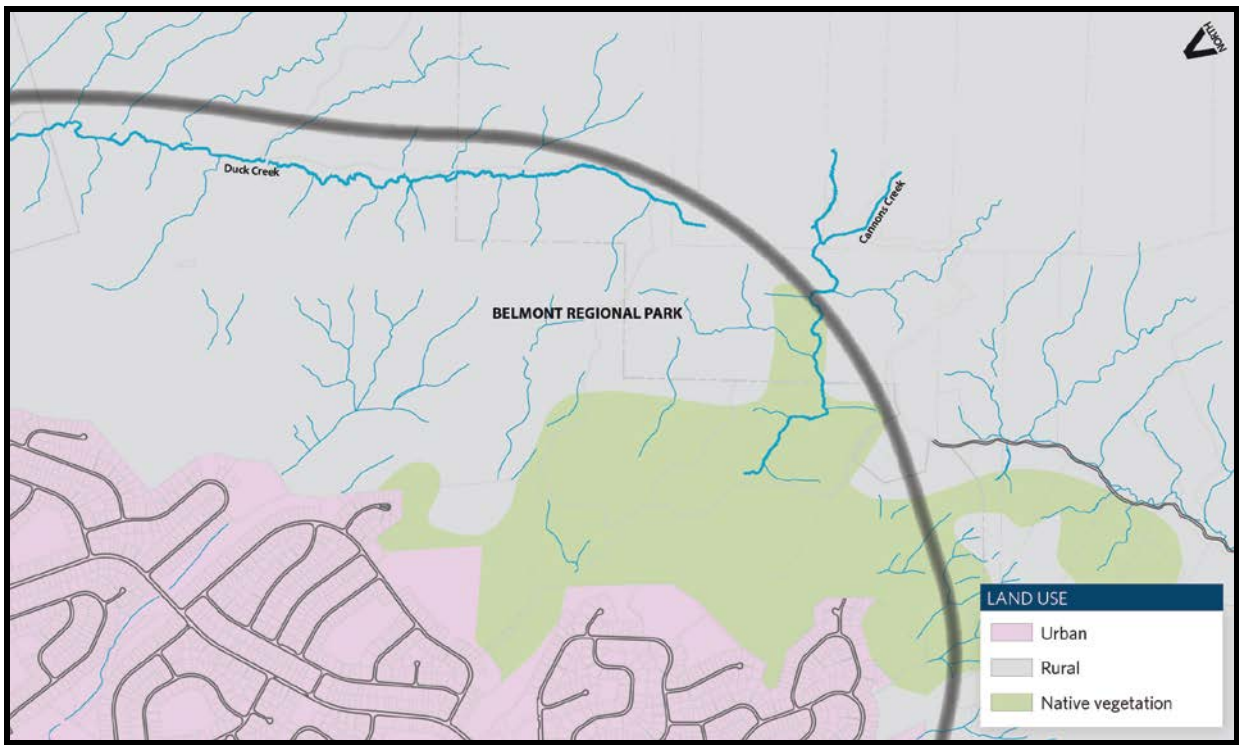

Figure 6.9: Land use in Section 8: Cannons Creek

As shown in Figure 6.9, land use in this section is predominantly rural and includes pasture and a few remnants of native vegetation, some restoration planting and some areas of regenerating scrub. The rolling to steep hills provide a backdrop to the suburbs of Cannons Creek and Waitangirua.

6.2.1.9 Section 9: Linden

This southernmost section is approximately 2.8km long and crosses a number of deep gullies in rough pasture and scrub, to plantation pine at the southern end. This section culminates in the gentle slopes of the Porirua Stream valley at SH1 Linden. Section 9 is characterised as the southern perimeter of the Porirua East basin, with rolling to steep hills, remnant native bush (Gillies Bush Reserve), regenerating gorse and pines, and the existing SH1 motorway corridor and NIMT corridor, at the southern end.

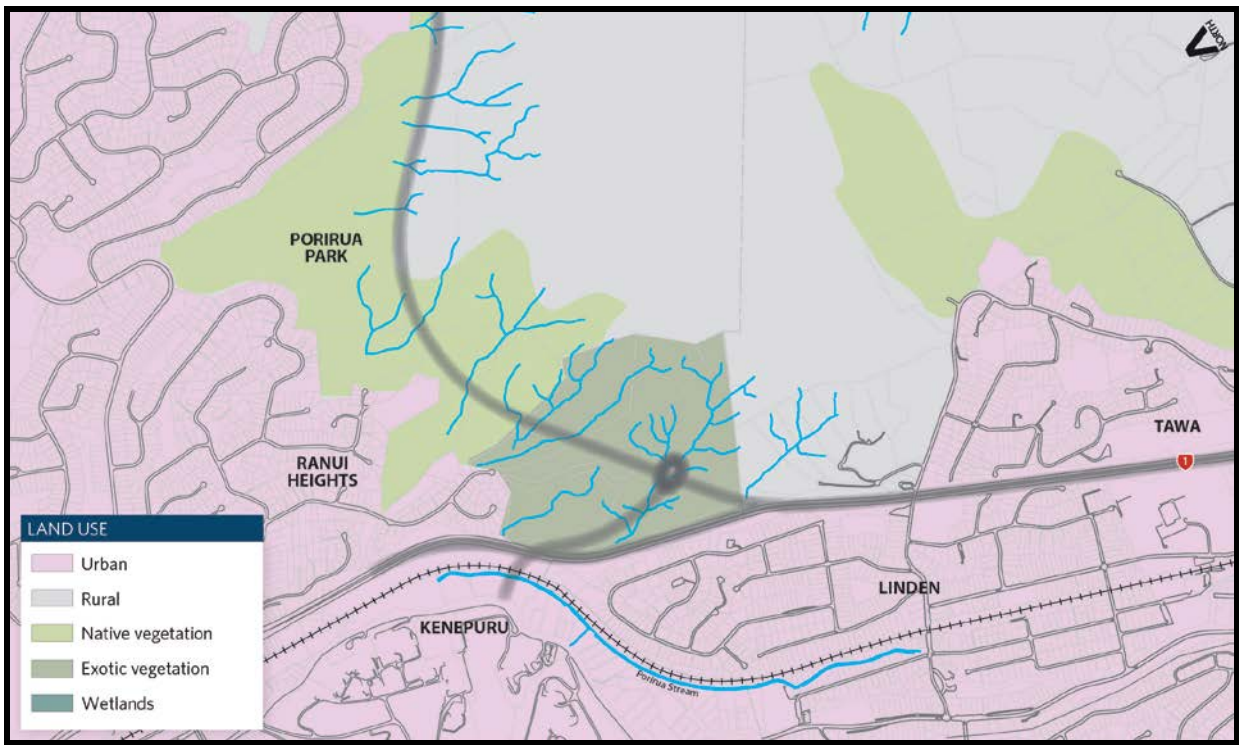

Figure 6.10: Land use in Section 9: Linden

As shown in Figure 6.10, this section is bounded by the residential areas of Cannons Creek and Ranui Heights to the north, with forestry and rural land uses to the south and east.

6.2.2 Kenepuru Link Road area

The Kenepuru Link Road area is similar to Section 9 of the Main Alignment corridor (shown in Figure 6.10) but extends further west. The area consists of a valley from Ranui Heights to the east, through to Kenepuru to the west. Two key transport corridors run through this valley presently, namely existing SH1 and the NIMT rail line. The Porirua Stream also runs through the bottom of the valley. To the west of the area is Kenepuru Drive which is dominated by a number of light industrial sites. Kenepuru Hospital is immediately north of the area.

6.2.3 Porirua Link Roads area

The Porirua Link Roads area is relatively undeveloped with most of the area consisting of pastoral land to the east and lifestyle properties to the northeast (as shown in Figure 6.8). To the west there are a number of rural residential subdivisions and a combination of suburban and rural residential subdivision in the Silverwood Forest Estate. The western edge of the area also borders the eastern Porirua suburbs of Waitangirua and Whitby. There are five waterways in the Porirua Link Roads area, with the most significant being Duck Creek.

At the existing intersection of Niagara Street and Warspite Avenue, there is the Maraeroa Marae, the Tokelau Christian Church, and the carpark of the Waitangirua Mall. The remainder of the Waitangirua area is medium density residential development. The existing intersection of James Cook and Navigation Drive is a roundabout with the surrounding area being relatively low density residential development.

Much of the Porirua Link Roads area is owned by either Silverwood Forest Estate or Whitby Coastal Estates and future subdivision and residential development is planned for this area.

6.3 Geology

The entire length of the Main Alignment corridor is predominantly underlain by greywacke bedrock. However, there are other geological features of note within the Project area. From MacKays Crossing (Section 1), the land is dominated by sand dunes, comprising fine to medium unconsolidated sand.

From Te Puka Terrace, the land is comprised of sandstone and mudstone (greywacke) and underlain with alluvial deposits of sand, gravel, silt and clay, (particularly at its northern end) and steep alluvial and bedrock slopes, which is exposed in the lower walls of the Te Puka Stream valley. The Te Puka Terrace has large amounts of colluvium identified by the truncated spurs faces on the east side of the Te Puka Stream.

The slopes on either side of the Horokiri Valley south of Wainui Saddle (Sections 3 and 4) consist of greywacke, which is typically closely orientated and moderately to highly weathered at the surface. Sections 5 and 6 include alluvial and marine deposits. This alluvium has been cut by streams and is covered by loess. Section 7 is underlain by generally highly weathered, weak greywacke. Completely weathered, very weak rock is exposed along many of the ridge crests with slightly to moderately weathered, strong greywacke exposed in the bed of Duck Creek. In Sections 8 and 9, bedrock exposed in cuttings on the hill slopes is generally moderately to highly weathered. Slightly to moderately weathered, strong greywacke bedrock is exposed in the beds of incised streams.

The geology of the Project area is described further in **Technical Report 3**.

6.4 Natural hazards

Two main types of potential natural hazards have been identified in the Project area:

- earthquakes; and
- storms.

These are also discussed in greater detail in **Technical Report 3**.

6.4.1 Earthquakes

The Wellington region is tectonically active and is prone to earthquakes. The Ohariu Fault and its associated active splinter fault south of the Wainui Saddle and the inactive Moonshine Fault are all within the Project Area, as shown in Figure 6.11.

Within the Project area there are a number of hazards associated with earthquakes, namely:

- ground shaking;
- fault rupture;

- earthquake induced landslides and/or slope instability;
- earthquake induced liquefaction; and
- tsunami.

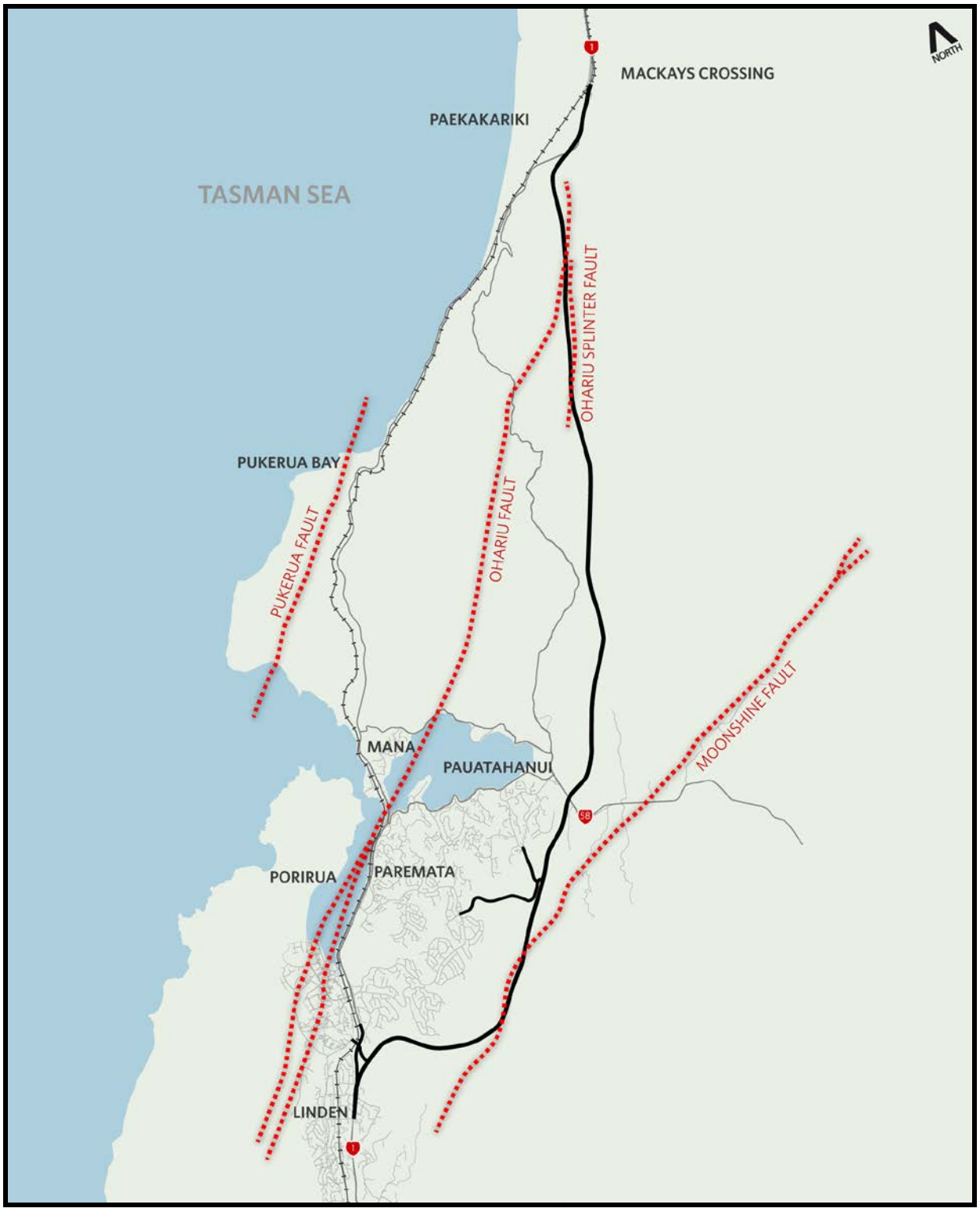

Figure 6.11: Faultlines in the Project area

6.4.1.1 Ground shaking

The Project area and wider Wellington region is an area of high seismicity, and significant levels of ground shaking can be expected to occur.

The regional ground shaking hazard maps[54] indicate a ground shaking along the Main Alignment corridor of Modified Mercalli Intensity (MMI)[55] of MM VIII (Destructive) to IX (Violent) with expected peak ground accelerations of 0.3g to 0.6g in a Wellington Fault (Wellington to Hutt Valley) segment event. The predicted level of ground shaking is not uniform along the Main Alignment corridor with higher levels predicted towards the southern end of the corridor, due to its proximity (6 to 8km), to the Wellington Fault.

6.4.1.2 Fault rupture

The Main Alignment corridor crosses two main faultlines, the Ohariu Fault and the Moonshine Fault. An active splinter fault, considered to be associated with the Ohariu Fault, was discovered as part of the Project's geotechnical investigations, and runs along the western side of Horokiri Stream to the south of Wainui Saddle. Expected recurrence intervals along these faults are outlined in Table 6.2.

Table 6.2: Faults within the Project area

Active fault	Recurrence interval	Fault rupture hazard
Ohariu Fault	1,500 – 2,200 years	The Main Alignment corridor crosses the fault between SH1 at Paekakariki and in the Wainui Saddle area.
Active Splinter of the Ohariu Fault (south of Wainui Saddle)	Estimated 2,000 years	This newly discovered fault also poses a fault rupture hazard where it straddles the Main Alignment corridor, south of Wainui Saddle.
Moonshine Fault	> 11,000 years (inactive)	Investigations indicate that this fault is represented by a wide fault zone in the southern part of the Duck Creek area (in the vicinity of Section 8 of the Main Alignment corridor).

6.4.1.3 Earthquake induced landslides and/or slope instability

Earthquake induced landslide potential in the surrounding area is discussed in detail in Technical Report 3. In general terms, there are several parts of the Main Alignment corridor where the expected effects during strong earthquake shaking (MM VIII – MM X) are rated as moderate, i.e. slides in the order of 1,000 to 10,000 cubic metres.

54. Wellington Regional Council, 1992.

55. The MMI scale relates to how an earthquake is felt by people, ranging from I (Instrumental) to XII (Cataclysmic)

The natural slopes along the Main Alignment corridor are typically 25° to 40°, with few locations where there is evidence of major slope instability.

The main areas of slope instability are:

- a large (approximately 50,000m^2) prehistoric landslide at the north-eastern end of the Te Puka terrace, immediately south of existing SH1 at Paekakariki. This landslide is considered to be inactive, and is thought to have been triggered by a movement on the Ohariu Fault;
- a large landslide (approximately 50,000m^2) on the eastern flank of Te Puka Stream valley, north of Wainui Saddle;
- suspected rock slides on fault facets on the west side of Te Puka Stream; and
- small landslides in Pre-Holocene alluvium are present in the areas of Battle Hill, the Pauatahanui Golf Course and SH58, and numerous shallow instabilities in the areas of SH58, Duck Creek and Cannons Creek.

6.4.1.4 Earthquake induced liquefaction

Liquefaction can lead to subsidence and lateral spreading. The area of highest risk from liquefaction and lateral spreading (and consequent ground damage) is between Porirua and Plimmerton, as shown in Figure 6.11. A large portion of this liquefaction hazard area is reclaimed land.

6.4.1.5 Tsunami

The tsunami hazard for the Project area is very low, with little potential for damage. Seiching (small wave generation as a result of an earthquake) in the Pauatahanui Inlet could result in localised flooding of the existing SH58 at Pauatahanui.

The risks to the coastal sections of existing SH1 between Linden and MacKays Crossing are considerably higher.

6.4.2 Storms

Storms are high rainfall events and have the potential to create a number of hazards within the Project area, namely:

- storm induced slope instability;
- debris flows; and
- flooding.

6.4.2.1 Storm induced slope instability

Storms have the potential to cause slopes to become unstable or trigger landslides where there are weak soils along the route, which can be weakened further when saturated or eroded by precipitation.

The areas vulnerable to storm induced slope instability are generally the same as those vulnerable to earthquake induced slope instability.

6.4.2.2 Debris flows

Debris flows have previously affected the existing SH1 near Paekakariki during major storm events. The most recent event was in October 2003, which also caused debris flows in a number of tributary gullies on the western flank of Te Puka Stream valley. Debris flows remain a risk, particularly where there are colluvium deposits in the Te Puka and Horokiri Stream valleys.

6.4.2.3 Flooding

Flood events with potential to cause damage to properties have been known to occur in the following flood plains:

- Te Puka Stream and Wainui Stream;
- Horokiri Stream;
- Pauatahanui Stream and Lanes Flat; and
- Kenepuru Stream.

6.5 Climate

The Wellington region's climate is relatively temperate and does not typically experience extremes of temperature.

Table 6.3 provides a summary of some of the main climatic conditions for the Wellington region[56].

Table 6.3: Climate of the Wellington region

Climatic aspect	Value
Average annual rainfall	1,249 mm
Average annual sunshine	2065 hours
Average temperature	12.8°C
Average wind speed	22km/hr

The region's average rainfall and number of sunshine hours are fairly typical when compared to the rest of the country. The region typically experiences ground frosts on average of 10 days per year, which is low compared to most of the rest of the country. Of particular note is the wind experienced in the region. The average speed of 22km/hr is the highest in the country (with the exception of the Chatham Islands at 25km/hr). Also of note is that the region has an average of 22 days per year where wind

56. Sourced from NIWA climate data 1971 – 2000.

speed is classed as gale force (greater than 63km/hr), which is the second highest average in the country. The prevailing wind direction is from the north to northeast.

Long term rainfall data indicates that there is considerable variability in extreme rainfall events across the Project area. While a particular catchment can experience heavy rainfall, a neighbouring catchment may be receiving a much lower intensity of rainfall. Lower intensity rainfall events are more uniform across the Project area.

6.6 Hydrology

The Project traverses nine hydrological catchments in four separate watersheds.

Within the Whareroa watershed:

- the Whareroa Stream catchment.

Within the Wainui watershed:

- the Wainui Stream catchment (including the Te Puka sub-catchment).

Within the Pauatahanui Inlet watershed:

- the Horokiri Stream catchment;
- the Ration Stream catchment;
- the Collins Stream catchment;
- the Pauatahanui Stream catchment; and
- the Duck Creek catchment.

Within the Onepoto Arm watershed:

- the Kenepuru Stream catchment; and
- the Porirua Stream catchment.

These catchments and watersheds are shown in Figure 6.12.

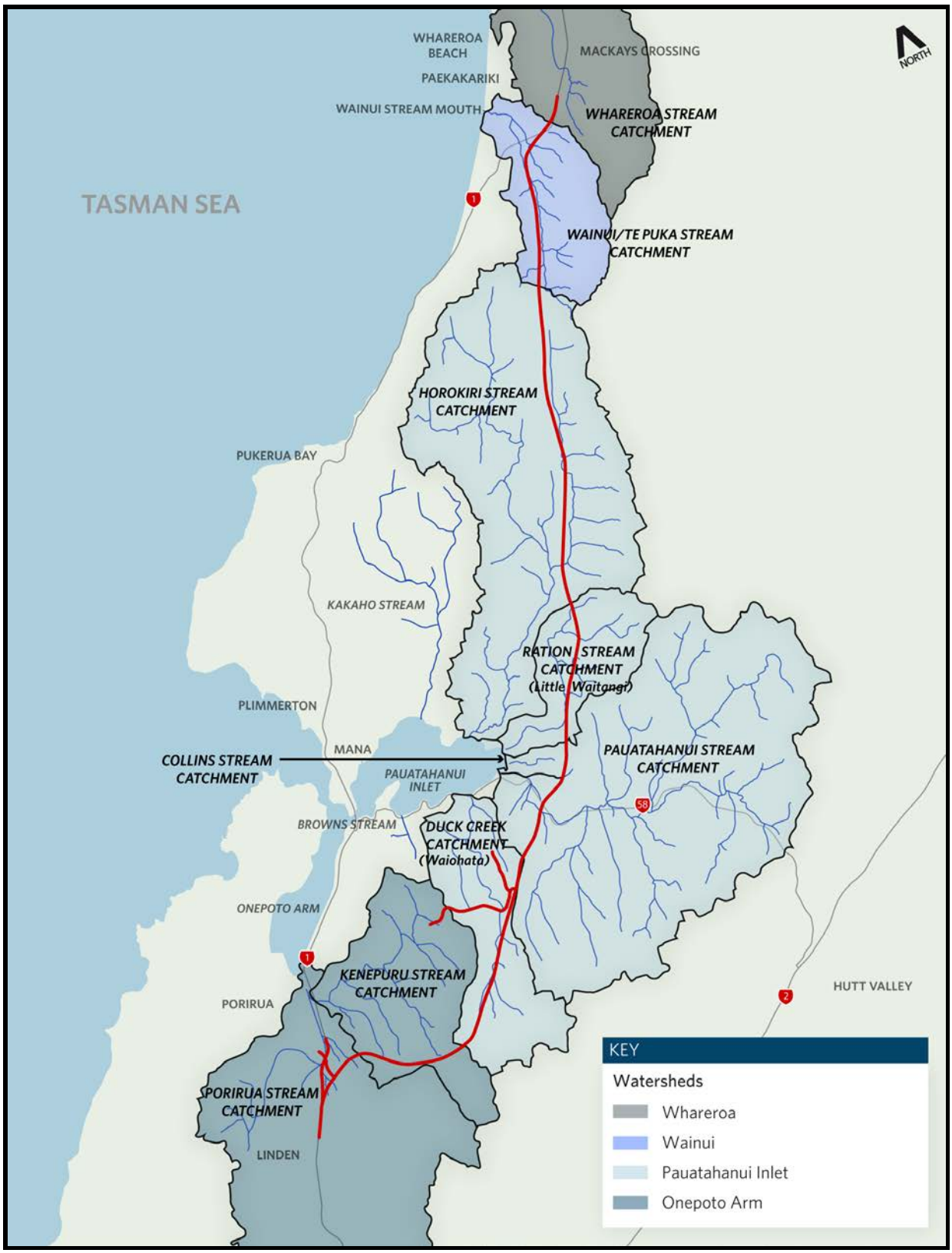

Figure 6.12: Hydrological catchments and watersheds within the Project area

The Whareroa and Wainui catchments both discharge at Whareroa Beach into the Tasman Sea, just north of Paekakariki. The catchments from Horokiri south to Duck Creek all discharge into the Pauatahanui

Inlet, while the Kenepuru and Porirua catchments discharge into the Onepoto Arm of the Porirua Harbour.

This section described the land use in each catchment (as this influences the water quality and hydrology of the catchment), as well as the general water quality parameters found in each catchment. Water quality is discussed in relation to ANZECC[57] water quality guidelines which contain trigger levels for specific contaminants.

The hydrological characteristics of the Project area are described in further detail in **Technical Report 14**, and water quality is described further in **Technical Report 15**.

6.6.1 Whareroa Stream catchment

The Whareroa Stream is the northern most catchment in the Project area, and is 1572ha in size. The stream is primarily influenced by the pastoral and scrub covered hills which it passes through, before crossing the proposed Main Alignment and traversing through QE Park out to the coast.

Water quality within the stream is generally good, although elevated levels of nutrients were recorded. All measured PAHs[58] and metals were below relevant guidelines.

6.6.2 Wainui Stream catchment and Te Puka sub- catchment

The Wainui and Te Puka Streams are small catchments to the north of the Project area, with a combined catchment area of 83ha. Both streams cross the proposed Main Alignment corridor and converge downstream from the Main Alignment and flow into the township of Paekakariki.

The topography traversed by these streams is typical of the Kapiti Coast district. Land use is a mixture of pasture, plantation pine and native bush. The steep upper catchment drops down onto an undulating dune environment. This change in grade between the hills and the coastal zone, combined with the restrictions as the streams runs through the dunes, has resulted in historical flooding problems for the developed land surrounding the streams.

Water quality within the Wainui and Te Puka Streams is generally good although the lower reaches had elevated nutrient levels. All measured PAHs and metals were below relevant guidelines.

6.6.3 Horokiri Stream catchment

The Horokiri Stream catchment is one of the largest catchments within the Project area (at approximately 3,30ha). The catchment drains into the eastern side of the Pauatahanui Inlet. The stream has two main tributaries, one of which crosses the Main Alignment corridor. Land use within this catchment is mostly pastoral with scrub and planted forest evident.

57. Australian and New Zealand Environment and Conservation Council, 1992.

58. PAH refers to polycyclic aromatic hydrocarbons, which are a by-product of the burning of fuel.

The main channel begins at the Wainui Saddle. In the upper catchment the steep sided valleys on the western catchment boundary are predominantly forested, whereas, on the eastern boundary the land use is predominantly pasture. As the lower catchment opens up onto the Horokiri Stream floodplain the major land use is rural pasture with pockets of residential dwellings.

The water quality within the catchment is generally good, although elevated nutrient levels were recorded at all locations, except for in the uppermost reaches. All measured PAHs and metals were below relevant guidelines.

6.6.4 Ration Stream catchment

The Ration Stream catchment comprises 680ha and is one of the smaller catchments in the Project area. The Stream has two tributaries, both of which cross the proposed Main Alignment. Land use within the catchment is mostly high quality pastoral, scrub and planted forest, with an area of coastal wetlands at the stream mouth. The catchment also passes through the Pauatahanui Golf Course.

Overall, water quality within this catchment is generally good (when compared with relevant guidelines) although quality does deteriorate downstream. Nutrients were consistently higher than guideline values throughout the stream. Some metals were also elevated above guideline levels in the lower reaches. All measured PAHs were below relevant guidelines.

6.6.5 Collins Stream catchment

The Collins Stream catchment is small (0.64ha) and is almost entirely in pasture. Unlike most of the other catchments in the Project area it has relatively low grade slopes.

Water quality was not assessed in this catchment due to its relatively small size.

6.6.6 Pauatahanui Stream catchment

The Pauatahanui Stream drains a large catchment of approximately 4,200ha on the eastern side of the Pauatahanui Inlet. The upper Pauatahanui catchment has numerous steep sided valleys which converge and drain northwest out onto the Pauatahanui floodplain. The upper catchment is predominately a mixture of rural pasture land and forestry.

As the lower catchment opens up, the land use becomes a mixture of rural pasture, residential and commercial. The residential suburb of Whitby lies on the western catchment boundary and at the northern catchment boundary is Pauatahanui Village. In the upper extent of the catchment, the stream channel is located in a narrow steep sided gorge. The Stream is constrained as it runs adjacent to SH58 until the topography levels out downstream of the Bradey Road Bridge. Downstream of Bradey Road the grade of the stream flattens out as it skirts the western perimeter of the floodplain before passing beneath SH58 at Paremata Road and the Paremata Road bridge adjacent to Pauatahanui Village, and finally into the Pauatahanui Inlet.

Water quality within the catchment is variable. Dissolved oxygen is low throughout the stream, while lower reaches of the streams recorded elevated levels of metals and turbidity.

6.6.7 Duck Creek catchment

The Duck Creek catchment is 1,030ha and has a mixture of land uses. In the upper reaches of the catchment land use is primarily pastoral. Further downstream the catchment is mostly urbanised with patches of scrub. The Creek has three tributaries which cross the proposed Main Alignment, these converge downstream of the Project area and also pass the proposed Whitby Link Road.

Upstream of the proposed Main Alignment corridor, the Creek is located in pastoral farmland, where stock has regular access to the Creek. The channel is generally small, at approximately 1m wide. Downstream of the proposed Main Alignment and the proposed Link Road to Whitby, land use is mostly prime pastoral and planted forest, with some indigenous forest. The site is wider and flatter than further upstream, with the channel varying between 2m and 3m in width.

At the mouth of the Creek into the Pauatahanui Inlet, the Creek is downstream of residential urban land use in the suburb of Whitby. Upstream of the urban area there is indigenous and planted forest, scrub and high quality pastoral land. At approximately 7m wide the channel here is wider and flatter than upstream locations. It is surrounded by wetlands and scrub which are part of DOC land.

Water quality within the catchment is variable. Nutrient levels are elevated throughout the stream. Elevated levels of metals, in excess of relevant guidelines, were also recorded in the lower reaches of the stream. All measured PAHs were below relevant guidelines.

6.6.8 Kenepuru Stream catchment

The Kenepuru Stream catchment is located adjacent to the Duck Creek and Porirua Stream catchments. The Stream has several tributaries, one of which crosses the proposed Main Alignment. At the lower end of the Kenepuru Stream it flows into the Porirua Stream. The catchment is mostly urbanised; flowing through the Waitangirua and Cannons Creek residential areas (refer Figure 6.9). Above the Waitangirua residential area in the upper reaches of the catchment the stream flows through high quality pastoral and scrub areas.

Water quality in this catchment is generally good, although it does deteriorate noticeably downstream with elevated turbidity and levels of metals in the lower reaches. All measured PAHs were below relevant guidelines.

Figure 6.13: Like many of the waterways in the Kenepuru Stream catchment, parts of Cannons Creek have been significantly modified

6.6.9 Porirua Stream catchment

The Porirua Stream catchment is of comparable size to the Pauatahanui catchment at around 4,100ha in area. A large proportion of the area surrounding the channel in this catchment is urban. Upstream areas are mostly pastoral and scrub. There are several tributaries to the main channel, which drain the surrounding hill catchments.

Water quality in this catchment is poor, with elevated nutrient, turbidity and metal levels in excess of relevant guidelines. This is likely to be reflective of the highly modified and urbanised nature of many parts of this catchment. However, all measured PAHs were below relevant guidelines.

6.6.10 Groundwater

Within the slopes above the main valleys, groundwater levels are typically about 10m to 20m below ground level, but depths of 35m, or greater, have been found during testing on some, but not all, of the higher slopes of Sections 3 and 4 of the Main Alignment corridor. Springs are evident along the Ohariu Fault and its active splinter on the western flank of Horokiri Stream, south of the Wainui Saddle, in Section 4.

Artesian pressures were noted in Section 7 (adjacent to the Pauatahanui Stream), with a head of at least 2m above ground level encountered in a borehole at a depth of 22m below ground level. Artesian pressures were also noted in Section 1 at a depth of 7m below ground level, adjacent to the Te Puka stream. KCDC extracts potable water from a bore located adjacent to the Wainui Stream and in close proximity to the Main Alignment corridor.

6.7 Terrestrial ecology

6.7.1 Flora

The area traversed by the Main Alignment corridor has mostly been cleared and converted to exotic vegetation, including pasture and pine plantation. Areas of extensive grazing land are located on the steeper hill country in Te Puka Stream and Horokiri Stream and the Duck Creek catchment south of SH58. Exotic vegetation can also be seen in the lower lying valley occupied by BHFFP.

There are occasional remnant pockets of indigenous vegetation, including areas in Te Puka Stream and Duck Creek tributaries. There are areas of regenerating second growth bush, notably in the Cannons Creek catchment. There are also extensive areas of former pasture that are reverting to natural vegetation, largely characterised by gorse, tauhinu and other small leafed species such as twiggy coprosma, manuka and kanuka. The other notable indigenous vegetation is the wetland area (wildlife refuge) at the head of Pauatahanui Inlet, adjacent to the Pauatahanui township. There are extensive areas of commercial pine plantation on the hills east of Horokiri Stream (Akatarawa Forest), and smaller areas scattered through the remainder of the route.

Within the BHFFP there are still significant remnants of native vegetation which provide good representations of the types of indigenous flora which would have once been typical of the region. Vegetation includes a small coastal forest remnant (35ha) which can be found in the front (closest to Paekakariki Hill road) of the park, as well as areas of low producing grassland and indigenous forest within the plantation forest at the back of the park. The bush is dominated by tawa and titoki, while the upper slopes are almost pure kohekohe. The bush is valuable, especially considering its proximity to a larger block of bush of similar composition located adjacent to the park. In swampy lower areas, kahikatea, pukatea and swamp maire are present. Within this remnant, is the last remaining self-sustaining population of the plant *Rhabdothamnus solandri* in the region.

The middle part of the Main Alignment corridor (Sections 3 – 7) has a more gently rolling topography and is characterised by a closer pattern settlement; a patchwork pattern of boundary shelter planting and differing land management; a wide variety of vegetation including exotic shelter trees, small plantations, amenity trees, and areas of native re-vegetation.

The area between Linden and Cannons Creek (including the Kenepuru Link Road and Porirua Link Roads areas) comprises rural fringe land. The hills form the backdrop to the Porirua East urban area, and comprise a mosaic of former pasture that has reverted to gorse and mahoe shrubland; rough pasture on the ridgelines; small pine plantations; areas of remnant or regenerating indigenous forest; and peri-urban activities.

Terrestrial vegetation and habitats are described in further detail in **Technical Report 6**.

6.7.2 Herpetofauna and terrestrial macro- invertebrates

The Project area provides potential habitat for herpetofauna and terrestrial macro-invertebrates. Herpetofauna are amphibians and reptiles, whereas terrestrial macro-invertebrates are species without a backbone that are visible with the naked eye. This covers all land-based species (i.e. not fish or amphibians) with the exception of reptiles, birds and mammals. As part of the ecological investigations,

an assessment of the prevalence of herpetofauna and terrestrial macro-invertebrates within the Project area was undertaken. This utilised existing information gathered from previous studies, as well as field surveys.

In addition to the following summaries, herpetofauna and terrestrial macro-invertebrates are described in further detail in **Technical Report 7**.

6.7.2.1 Herpetofauna

Most of the Project area is in grazed pasture which provides relatively poor habitat for indigenous herpetofauna, due to the lack of potential refugia and the presence of introduced predators such as rodents, mustelids and cats. The exception to this is the larger scree slopes and stone fields towards the north of the Project area which does provide good potential habitat.

Three herpetofauna species were detected during the field surveys; common geckos, common skinks and common copper skinks. These species were detected in relatively low numbers and are among the most common lizards found throughout the North Island. These species are classified as not threatened. The range and count of species found is considered to be representative of inland pasture throughout the region.

6.7.2.2 Terrestrial macroinvertebrates

Terrestrial macroinvertebrates represent a diverse group of species. Within the Project area, habitats for terrestrial macroinvertebrates were dominated by grazed pasture, with smaller areas of native forest and scrublands and scree rock slopes. A wide range of terrestrial macroinvertebrates were detected including bees and wasps, butterflies and moths, spiders, snails and slugs, centipedes and millipedes, peripatus, beetles, wetas, cockroaches, silverfish, cicadas, hoppers, dragonflies, midges, earwigs, ants, worms and slaters. These species are all relatively common and are as expected for this type of environment. None of the species are considered to be threatened or at risk.

The most notable species found was *Peripatus novaezealandiae* (see Figure 6.14) which is one of five peripatus species found in New Zealand.

Figure 6.14: *Peripatus novaezealandiae*

The northern part of the Project area seems to be something of a stronghold for this species. They were commonly found in moist conditions with sufficient shade, such as under rotting logs and rocks.

6.7.3 Birds and bats

The Project area provides habitat for avifauna (birds) and bats. As part of the ecological investigations, an assessment of the prevalence of birds and bats within the Project area was undertaken. This utilised existing information based on previous studies, as well as field surveys.

In addition to the following summaries, avifauna and bats are described in further detail in **Technical Report 8**.

6.7.3.1 Birds

The prevalence of birds was determined from existing data for the Project area from the Ornithological Society of New Zealand's (OSNZ) data atlas, as well as from field surveys using point counts, incidental observations and nocturnal surveys. Information from the Guardians of the Pauatahanui Inlet (GOPI) was also assessed specifically in relation to bird species located around the Pauatahanui Inlet.

The field surveys recorded the presence of approximately half (48%) of the bird species listed in the OSNZ data atlas for the Project area. This is likely to be a function of the narrower sample area of the field survey and the time of year the survey was undertaken (January – March). Nonetheless, the 37 species observed during the survey are considered to provide an accurate representation of bird species in the area, with the addition of a few more species which were not observed but which are known to be present in the area at various times of the year. Of the 37 species recorded, 20 are native and 17 are introduced. Although introduced species make up less than half of the number of species, approximately two-thirds (69%) of the point counts were introduced species, indicating their relative presence in greater numbers than native species within the area.

In terms of the conservation status of the native species, 16 are classified as not threatened, two as threatened (the bush falcon and the pied shag) and two are considered to be at risk (the black shag and the New Zealand pipit). Of the four threatened or at risk species, all were only recorded in low numbers and only the black shag and New Zealand pipit were observed using the area for basking and/or feeding. The bush falcon and pied shag were only observed traversing the area. Based on known information about the habitat requirements of these four species, the only species likely to be a resident in the immediate Project area (i.e. along the Main Alignment corridor) would be the New Zealand pipit. Bush falcons may also be resident in the wider area but it is considered unlikely that black and pied shags are resident in the area.

6.7.3.2 Bats

There are three native bat species in New Zealand. The only part of the Project area where bats could potentially be present is around the Wainui Saddle and northwards down the Te Puka valley. Field surveys were undertaken during January 2010 around this area. The survey failed to positively identify any bat activity, with the one possible record unable to be positively identified by DoC staff.

As such, it is considered that any bats in the Project area are only present in very low numbers, if at all. Further field surveys will be undertaken during this coming spring (i.e. 2011) to attempt to confirm the presence or absence of bats around the Wainui Saddle.

6.8 Freshwater ecology

The Duck, Horokiri and Te Puka systems provide valuable aquatic fauna and physical habitat, although it is noted that they appear to be deteriorating in the lower reaches, potentially due to current land use practices. In particular, the Horokiri Stream (Figure 6.15) supports a number of threatened native fish and a small wetland area. Nationally threatened native fish (including tuna (long fin eel), red fin bully, inanga, kokopu and occasionally the rare kakahi (freshwater mussel)) have also been found in the Horokiri Stream catchment.

Figure 6.15: The Horokiri Stream provides significant freshwater habitat on the western coast of the Wellington region

Despite their modifications, the lower reaches of the Ration, Cannon Creek (a tributary of the Kenepuru Stream) and Pauatahanui Stream catchments are also considered to be of moderate value as they still retain important fauna species. The Kenepuru and Porirua Stream systems are of lower value, although they still support an array of values, notably components of macro-invertebrate fauna.

Freshwater ecology is described in further detail in **Technical Report 9**.

6.9 Marine ecology

As noted, the Project involves works in four watersheds that drain into the following four marine environments:

- the Whareroa Stream mouth;
- the Wainui Stream mouth;
- the two arms of the Porirua Harbour, being:
    - the Pauatahanui Inlet; and
    - the Onepoto Arm.

In addition to the following summaries, marine ecology is described in further detail in **Technical Report 10**.

6.9.1 Whareroa Stream mouth

The tidal river mouth estuary of the Whareroa Stream is a modified ecosystem that discharges through a sandy beach to the high energy marine environment. The stream mouth is occasionally blocked and as such the mouth is artificially managed and there is a significant amount of drift wood present on the beach and within the lower reaches of the stream. It provides habitat for a number of marine and freshwater fish and birds.

6.9.2 Wainui Stream mouth

The Wainui Stream discharges at Paekakariki to the Tasman Sea. This coastal environment is a sandy, high energy and exposed beach. The abundance and diversity of organisms is low in this marine environment. Like the Whareroa Stream mouth, it provides habitat for a number of marine and freshwater fish and birds.

6.9.3 Porirua Harbour

Porirua Harbour is a natural inlet. The Harbour has an entrance only a few hundred metres in width, close to the suburb of Plimmerton. It opens up into two arms. The arm to the south, Onepoto Arm, has an area of 283 hectares (35% of the Harbour), of which around 80% is subtidal. The eastern arm (the Pauatahanui Inlet) is 524 hectares (65%), of around which 60% is subtidal. The Harbour has been affected by the impacts of both rural and urban development, as approximately 100,000 people reside in the 175km^2 catchment.

6.9.3.1 Pauatahanui Inlet

The Pauatahanui Inlet (Figure 6.16) is a dynamic natural system which is in a constant state of change. While the Inlet is part of the Porirua Harbour, and is flushed with daily tidal flows, it is also influenced by

the surrounding catchments which drain into it. The convergence of the sea and freshwater streams provide for fresh water and salt water mixing, and natural sedimentation.

Pauatahanui Inlet is a significant wildlife site, providing habitat for indigenous waterfowl and migratory wading birds. It is also a regionally significant wetland, retaining the only large area of saltmarsh and sea grass in the Wellington region[59]. The Inlet contains many habitats, including intertidal sand flats, salt marsh, rush lands and manuka shrub land.

Figure 6.16: Looking northwest over the Pauatahanui Inlet with the Pauatahanui wetland in the foreground and the suburb of Whitby to the left of the Inlet

The Inlet and catchment streams provide habitat for indigenous freshwater species. All of these freshwater fish species spend part of their lifecycle in the sea, migrating the length of the streams to the estuary. They require streams and rivers that are relatively unmodified from the mouth to the headwaters. Three of the plant species growing (as shore vegetation at the Inlet) are rare or endangered. The Inlet is also nationally important as providing habitat for the threatened/rare crustacean *Parastenhelia*.

In addition to its importance as a wildlife and plant sanctuary, the Inlet and its biota provide for a range of functions vital for the continuing health of the ecosystems and associated communities. The saltmarsh vegetation acts as a natural trap for the sediment arriving in the Inlet. As ground builds up behind the rushes and shrubs of the high marsh, there is a degree of regulation over the amount of sediment that enters into the waters of the estuary.

6.9.3.2 Onepoto Arm

The Onepoto Arm is the southern arm of the Porirua Harbour and contains large areas of mud flats, shell beds, populations of coastal fish and small areas of salt marsh. Part of the Onepoto Arm was reclaimed for a causeway for the NIMT Railway. The construction of this causeway created three shallow lagoons from the Harbour. When SH1 was re-aligned in the 1970s along the railway, these lagoons were partially filled in and Aotea Lagoon was developed into a recreational area. The modification of a significant

59. It is identified in the Regional Coastal Plan for the Wellington Region as an area of significant conservation value (ASCV) due to its natural, conservation, geological and scientific values.

portion of the coast means that the Onepoto Arm has lower biological diversity, as compared to the Pauatahanui Inlet.

6.10 Air quality

The Project area is within the Porirua and Kapiti Coast airsheds, as defined by GWRC. In terms of air quality within the Project area, vehicle emissions and domestic solid heating from the residential areas are the biggest contributors to air contaminants, namely particulate matter (PM_{10}), nitrogen dioxide (NO_2), oxides of nitrogen (NO_x), carbon monoxide (CO) and benzene. Vehicle emissions in this area predominantly arise from SH1, SH58, Kenepuru Drive and suburban streets and contribute to background levels of PM_{10},NO_2, NO_x, CO and benzene. Contaminants arising from solid fuel heating at Paekakariki, Cannons Creek and other residential areas are also contributors of background levels of PM_{10} and CO within the environment. Estimated worst-case contaminant levels for urban settings are shown in Table 6.4.

Table 6.4: Estimated worst- case background contaminant levels for air quality in urban settings in the Project area

Contaminant	Averaging period	Background concentration	NES AQ / AAQG threshold[60]
PM_{10}	24-hour	39 µg/m³	50 µg/m³
	Annual	16 µg/m³	20 µg/m³
NO_2	1-hour	45 µg/m³	200 µg/m³
	24-hour	29 µg/m³	100 µg/m³
NO_x	1-hour	425 µg/m³	-
	24-hour	213 µg/m³	-
CO	1-hour	3.4 mg/m³	30 mg/m³
	8-hour	3.1 mg/m³	10 mg/m³
Benzene	Annual	1.0 µg/m³	3.6 µg/m³

The estimated background concentration levels in urban settings are all below the relevant thresholds, indicating a good overall level of existing air quality. Air quality in rural settings (i.e. throughout most of the Project area) is likely to be considerably better than the worst-case levels estimated for the urban settings, as shown by the estimated levels shown in Table 6.5.

Table 6.5: Estimated worst- case background contaminant levels for air quality in rural settings within the Project area

Contaminant	Averaging period	Background concentration	NES AQ threshold
PM10	24-hour	15 µg/m³	50 µg/m³
NO2	1-hour	15 µg/m³	200 µg/m³
CO	8-hour	0 mg/m³	10 mg/m³

60. NES AQ refers to the National Environmental Standards for Air Quality, while AAQR refers to the Ambient Air Quality Guidelines issued by MfE in 2002.

Existing air quality is discussed in further detail in **Technical Report 13**.

6.11 Noise

The Project area is characterised by a number of different land uses, which provide differing noise environments. These land uses are predominantly suburban and rural.

The Main Alignment corridor passes through areas of small rural holdings, such as the Paekakariki Hill Road area and in the Horokiri Valley. In these areas the noise environment is of an isolated rural area with larger holdings and forest plantations, where natural noises (such as cicadas, birds and wind in trees) are the dominant noises. Where these rural areas are located near SH1, for example towards Paekakariki, the noise environment becomes consistent with its proximity to a State highway, with traffic noise from the significant daily traffic flows as the dominant noise.

The suburban areas in the vicinity of the Main Alignment corridor, such as Cannons Creek and Waitangirua, also have a natural noise environment (such as birds, cicadas and wind in trees), but these environments also commonly feature people-oriented noise, such as music, machinery and household noises, including pets. Where vehicles are present, traffic noise tends to dominate. Some of the suburban areas in the Project area are within existing State highway noise environments, including Linden and Ranui Heights, which are close to SH1. The Pauatahanui Village has a noise environment consistent with its location near the intersection of a local road and SH58, with significant daily traffic flows.

Existing noise is discussed in further detail in **Technical Report 12**.

6.12 Transport networks

There are a number of existing transport networks within the Project area, including:

- the State highway network;
- the local road network;
- the rail network;
- the bus network; and
- walkways, cycleways and bridleways.

In addition to the following descriptions, the existing transport networks are also discussed in further detail in **Technical Report 4**.

6.12.1 State highway network

There are two key State highways that provide connections from Wellington northwards:

- SH1, which connects Wellington to the Kapiti Coast and further northwards to the central North Island; and

- SH2, which provides a local link between Wellington and the Hutt Valley, and continuing to the Wairarapa and Hawkes Bay.

SH1 is the main road lifeline for Wellington, providing a strategic connection for freight movement to and from the north, as well as catering for other traffic. The two state highways intersect at Ngauranga Interchange on the northern outskirts of Wellington. A cross-connection between SH1 in Porirua and SH2 in the Hutt Valley is provided by SH58.

In the Wellington region SH1, and part of SH2, are 'national strategic' State highways[61], signifying their high importance in terms of strategic connections for freight traffic and other vehicles to Wellington City, CentrePort, the Interislander ferry, and Wellington International Airport.

6.12.2 Local road network

There are a number of important local road connections within the Project area. At Paekakariki, Beach Road is the main vehicular access point to Paekakariki, which joins to the existing SH1 south of MacKays Crossing.

Despite being a steep, narrow, and winding rural road, the Paekakariki Hill Road is used by a significant number of vehicles as a route between SH1 at Paekakariki and SH58 at Pauatahanui. This route also provides access to a number of rural residential properties located to the west of the Main Alignment.

Flightys Road heads north from SH58 and provides access to a number of rural residential properties. An existing ROW off the end of Flightys Road will be crossed by the Main Alignment corridor.

Grays Road is another route used by traffic between SH1 (at Plimmerton) and SH58 (at Pauatahanui). Tight bends on the western part of this route preclude its desirability for use by larger trucks.

The Whitby and eastern Porirua areas are serviced by a network of local roads which intersect with either SH58 (Joseph Banks Drive, James Cook Drive, Spinnaker Drive and Postgate Drive) or SH1 (Whitford Brown Avenue, Mungavin Avenue). Traffic distribution internal to this area is principally provided by Discovery Drive, Omapere Street, and Warspite Avenue.

To the west of SH1, the principal local routes are Titahi Bay Road and Kenepuru Drive, providing access to the Porirua CBD, retail and commercial areas and the Kenepuru Hospital.

6.12.3 Rail network

The North Island Main Trunk (NIMT) railway line generally follows the alignment of existing SH1 between Wellington City and the Kapiti Coast. As such, it is only adjacent to the Main Alignment corridor at the northern (MacKays Crossing) and southern (Tawa) ends of the corridor. The NIMT also runs directly through the Kenepuru Link Road area.

61. NZTA, State highway classification, June 2011.

The NIMT transports both passengers and freight. It carries approximately ten freight trains daily in each direction, while commuter trains operate between Wellington and Waikanae every 20 minutes during peak times, in addition to a small number of longer distance services.

6.12.4 Bus network

Bus services are currently precluded from operating in the corridor where these would compete with the subsidised rail service. Accordingly, the extensive network of local bus services across the corridor area is primarily orientated towards providing connectivity between residential areas and the rail network.

6.12.5 Walkways, cycleways and bridleways

There are a number of key tracks used by walkers, cyclists and horse riders in the Project area; including QE Park, Paekakariki, and Pauatahanui Inlet, BHFFP and Belmont Regional Park.

There are three entrances to QE Park; at Paekakariki, MacKays Crossing off SH1, and an entrance at Raumati. Pedestrian links between Paekakariki and the Park are currently provided along residential roads, namely The Parade and Wellington Road.

BHFFP is an important destination for pedestrians, cyclists and horse riders, with a number of walking and multi-use (walking, mountain biking and horse riding) tracks provided. It is accessed from Paekakariki Hill Road and provides entry to the Akatarawa's for trampers. Belmont Regional Park is also used widely by walkers and mountain bikers. Most users gain access from the eastern (Hutt Valley) side, although access from the west (Cannon Creek) is also available.

The Kapiti Coast cycle route generally follows the coastline from Paekakariki to Peka Peka. In Paekakariki, the route is accessed from Ames Street and The Parade. The route then enters QE Park, where it follows off-road paths and re-joins the street network at The Esplanade in Raumati South. Both SH1 and the Kapiti Coast Cycle Route are part of the regional cycling network. Although there are currently no formal cycle lanes along SH1, a parallel cycle path is available between Paekakariki and Paremata, part of which is Ara Harakeke, a joint cycle / walking facility between Pukerua Bay and Paremata. SH58 is part of the regional cycling network, however there are currently no formal cycle lanes or paths along SH58 and cyclists share the carriageway with vehicles or use the road shoulders.

Kenepuru Drive is also part of the regional cycling network. There are no formal cycle lanes or paths along Kenepuru Drive and cyclists share the carriageway with vehicles or use the road shoulders. As cyclists are not permitted along SH1 south of Porirua[62], cyclists heading towards Linden, Tawa and Wellington are compelled to use Kenepuru Drive.

6.13 Network utilities

There are a number of existing network utilities within the Project area, namely:

- electricity transmission infrastructure;

62. As this section of State Highway has been declared motorway.

- electricity distribution infrastructure;
- gas transmission infrastructure;
- gas distribution infrastructure;
- water supply infrastructure; and
- telecommunications infrastructure.

6.13.1 Electricity transmission infrastructure

The Transmission Gully Project is named as such because the Main Alignment corridor generally follows Transpower's existing 110kV electricity transmission line between Paekakariki and Takapu Road (PKK-TKR-A). This 110kV double circuit line is carried on steel lattice towers. It runs most of the length of the Main Alignment corridor, from MacKays Crossing to the Takapu Road Substation, which is located at approximately 24,000m. The line also passes through the Pauatahanui Substation which is located on SH58 along the Main Alignment corridor at approximately 17,500m.

In addition to the PKK-TKR-A line there are a number of other electricity transmission lines within the Project area. There are three other 110kV transmission lines which start or terminate at the Takapu Road Substation, namely:

- the Takapu to Wilton A line (TKR-WIL A) from the south;
- the Khandallah to Takapu A line (KHD-TKR A) from the south; and
- the Haywards to Takapu A line (HAY-TKR A) from the east.

The 220kV Bunnythorpe to Wilton A line (BPE-WIL A) also runs in a general north-south direction on the eastern side of the Main Alignment corridor, only coming close to the alignment in the vicinity of the Takapu Road Substation. All of these transmission lines are operated by Transpower.

Figure 6.17: The existing PKK- TKR- A line looking southwards down the Horokiri Stream valley

6.13.2 Electricity distribution infrastructure

Throughout most of the Project area, electricity distribution assets are owned and operated by Vector (Wellington Electricity). The only exception to this is in the Kapiti Coast District where assets are owned and operated by Electra.

There are five locations (listed in Chapter 15) within the Project area where Wellington Electricity's assets will be affected by the Project.

Within the Project area Electra's sole assets are their overhead 33kV lines running along SH1 at MacKays Crossing.

6.13.3 Gas transmission infrastructure

High pressure gas transmission pipelines run most of the length of the Main Alignment corridor, from MacKays Crossing to approximately 24,000m. These pipelines are part of the North Island natural gas transmission network, owned and operated by Vector Gas Limited.

6.13.4 Gas distribution infrastructure

There are four locations (listed in Chapter 15) within the Project area where local gas distribution assets are situated in the vicinity of the Main Alignment corridor. These assets are owned and operated by Powerco (Gas).

6.13.5 Water supply infrastructure

There are four locations (listed in Chapter 15) where GWRC water supply assets cross the Main Alignment corridor.

At the northern end of the Main Alignment corridor (at approximately 2,100m) there are two groundwater abstraction bores operated by KCDC. The water from these bores supplies potable water to the Paekakariki township.

6.13.6 Telecommunications infrastructure

There are six locations (listed in Chapter 15) within the Project area where Chorus has underground copper and/or fibre lines.

Telstra Clear also has two underground single fibre cables within the Project area. One runs along SH58, providing a connection between the Hutt Valley and the Kapiti Coast and the other runs along Kenepuru Drive.

Vodafone NZ also has a cell tower located in State highway road reserve on the Main Alignment corridor at approximately 27,000m.

6.14 Social environment

This section contains a description of two key aspects of the social environment of the Project area:

- the main communities; and
- the open space areas.

It is recognised that there are a number of other aspects which contribute to the social environment of the Project area and these aspects are described elsewhere in this chapter.

6.14.1 Main communities

For the purposes of the social impact assessment (**Technical Report 17**), the route has been divided into six 'Community Areas', which represent broadly identifiable communities within the wider environs of the Project area:

- Community Area 1 – Paekakariki: includes MacKays Crossing Interchange on SH1 and the coastal community of Paekakariki;

- Community Area 2 - Rural communities: includes Maungakotukutuku and Paekakariki Hill, which is predominantly rural land, with several rural residential dwellings;
- Community Area 3 - Pauatahanui and Whitby: extends through rolling rural and rural residential land north of SH58, crosses SH58 and a low-lying marine plain associated with the Pauatahanui Inlet, then climbs the moderately steep terrain to the south, into Whitby;
- Community Area 4 - Eastern Porirua: includes the communities of Ascot Park, Waitangirua, Cannons Creek and Ranui Heights;
- Community Area 5 - Linden and Tawa: traverses a number of steep gullies, and ends in the gentle slopes of the Porirua Stream Valley at Linden. It includes the communities of Linden, Tawa, Greenacres, and Porirua Central; and
- Community Area 6 - Coastal communities: Pukerua Bay, Plimmerton, Mana-Camborne, Paremata, and Papakowhai. These communities fall within the wider study area, but are not directly adjacent to the Project route. Existing SH1 severs a number of these coastal communities.

These six Community Areas have been identified for the purposes of profiling the existing environment and for assessing local social impacts associated with the Project. It is also noted that the Community Areas are made up of Census Area Units (CAU), which are developed and used for statistical analysis purposes.

These Community Areas are described in more detail within the SIA. The following provides a summary of the key features of the existing social environment for each of the six community areas.

6.14.1.1 Community Area 1: Paekakariki

Community Area 1 includes the MacKays Crossing Interchange on SH1 (the northern Project tie-in) and, the surrounding area, which is predominantly horticultural and pastoral. There are also several rural residential properties in this area.

The wider study area for this Community Area also includes Paekakariki which lies within the Kapiti Coast District. Paekakariki Village is to the south of the Project area and is separated from it by the NIMT railway line. Paekakariki is accessed directly off SH1, although SH1 does not travel through the townshipe proper. The majority of people in the Community Area 1 catchment reside in Paekakariki.

Paekakariki is a well-established coastal residential community, which includes a small retail centre that serves the surrounding area, a school (Paekakariki School) and two early childhood centres (Te Kohanga Reo o Paekakariki, and Paekakariki Playcentre). Residents within the area generally work within the Kapiti Coast District or in Wellington City.

6.14.1.2 Community Area 2: Rural communities

Community Area 2 encompasses predominantly rural land, comprised of forest and areas of steep pastoral land. There are several rural residential dwellings within this Community Area, the majority of which are located in the vicinity of Paekakariki Hill Road; however, there is limited community

infrastructure and resources. There are no educational facilities, nor places of religious assembly. Residents travel to the surrounding areas (north to the Kapiti Coast or south to Pauatahanui, Whitby, and Paremata, or into Porirua Central) for retail areas, places of religious assembly and schools. Paekakariki Hill Road is a popular alternative road into/out of Pauatahanui, and is also used by recreational horse riders.

Pauatahanui Golf Course, located on Paekakariki Hill Road is a significant feature of Community Area 2. The Club is directly affected by the Project. The 500 hectare BHFFP is also located within Community Area 2, and is used for walking, horse riding, mountain biking, camping and picnicking.

6.14.1.3 Community Area 3: Pauatahanui and Whitby

Community Area 3 extends through rolling rural and rural residential land north of SH58, crosses SH58 and a low-lying marine plain associated with the Pauatahanui Inlet, then climbs the moderately-steep terrain to the south. The wider study area includes the communities of Pauatahanui and Whitby, both of which are within the Porirua District. Pauatahanui and Whitby are located to the west of the Main Alignment. Whitby will also be joined to the Main Alignment by the Whitby Link Road, which will feed into the James Cook Drive/ Navigation Drive Intersection.

The Pauatahanui Village includes a cluster of shops on Paekakariki Hill Road that serves both the wider local community and visitors to the Inlet. Pauatahanui School is located within the Pauatahanui Village, and is a state primary school with a roll of 232 students (in 2010). Its students come from the local area. The Pauatahanui Preschool is also located on Paekakariki Hill Road.

St Joseph's Catholic Church, which is located on SH58, is the oldest Catholic Church building still in use in Wellington and was the first Catholic Church building in the Porirua basin. Adjacent to the church is a graveyard where a number of early settlers to the Pauatahanui area are buried. It is registered by the New Zealand Historic Places Trust as a Category One Historic Place.

The Whitby Village Mall also includes a number of retail shops, as well as community and health care facilities. The PCC Development Framework (2009) identifies the area surrounding the Whitby shops as being suitable for further comprehensive development.

6.14.1.4 Community Area 4: Eastern Porirua

The residential suburbs that make up Community Area 4 are Ascot Park, Waitangirua, Cannons Creek and Ranui Heights, which are situated to the west of the Main Alignment, sitting within the wider study area.

The Waitangirua neighbourhood centre includes a shopping mall which is predominantly vacant, except for a number of small retail units along the eastern façade. A number of community facilities are located around the neighbourhood centre; including the Maraeroa Marae and associated health centre and the Tokelauan Church. A Mana Coach Services bus depot is situated north-east of the neighbourhood centre within a cluster of small-scale industrial activities. There are a large number of early childhood centres and primary schools in Waitangirua. Waitangirua will also be joined to the Main Alignment by the

Waitangirua Link Road, which will feed into the Warspite Avenue/ Niagara Street Intersection. The Cannons Creek neighbourhood centre is located on Warspite Avenue, and includes retail stores, and a number of community facilities. There are a significant number of HNZC owned properties within eastern Porirua.

Figure 6.18: Recently upgraded Waitangirua park

There are active residents' associations in Waitangirua, including the Maraeroa Marae Executive. PCC, in association with the Eastern Porirua Residents Association, Cannons Creek Opportunity Centre, and the Maraeroa Marae, have developed Village Plans for Cannons Creek, Ranui Heights and Waitangirua, after periods of consultation with the local communities. In Waitangirua, the Village Plan was predominantly focused around the development of a new community park, which is now situated opposite Maraeroa Marae. The park includes exercise and playground equipment and landscaping and other features, and has been developed in close collaboration with the community, incorporating Pacifica and Maori cultural influences.

Ascot Park and Ranui Heights are smaller neighbourhood centres within Community Area 4, both of which contain a number of community facilities, including schools and neighbourhood parks and reserves.

6.14.1.5 Community Area 5: Linden and Tawa

West of the Main Alignment, in the vicinity of the Kenepuru Link Road, is the suburb of Linden, which is predominantly residential with associated uses such as schools. Some limited commercial activity takes place within the suburb. For example; there is a number of small retail shops located on Collins Avenue. For a larger selection of general interest shops, local residents generally travel to Tawa or into Porirua City.

Linden Primary School adjoins the existing SH1 and proposed Main Alignment. Tawa Intermediate and Tawa College also adjoin SH1 further south. Northwest of Linden is a commercial and light industrial area, located between Kenepuru Drive and the NIMT. East of the Main Alignment and south of Collins Avenue is the residential area of Greenacres.

The existing SH1 motorway and NIMT corridor are features of the surrounding community (as demonstrated in Figure 6.19 below), following a north-south alignment along Porirua Stream valley. The Tawa and Linden suburban areas are aligned along the valley.

Figure 6.19: Existing SH1 at Linden

6.14.1.6 Community Area 6: Coastal communities

Community Area 6 includes the coastal communities that fall within the wider study area, but are not directly adjacent to the Transmission Gully route; namely, Pukerua Bay, Plimmerton, Mana-Camborne, Paremata, and Papakowhai[63]. Residential activity is the predominant land use within these areas. The existing SH1 severs a number of these coastal communities.

63. Titahi Bay was not considered within these coastal communities, due to its distance from SH1 and the Project area.

6.14.2 Open space areas

There are a number of open space areas within the vicinity of the Project, including several regional parks, as shown in Figure 6.20.

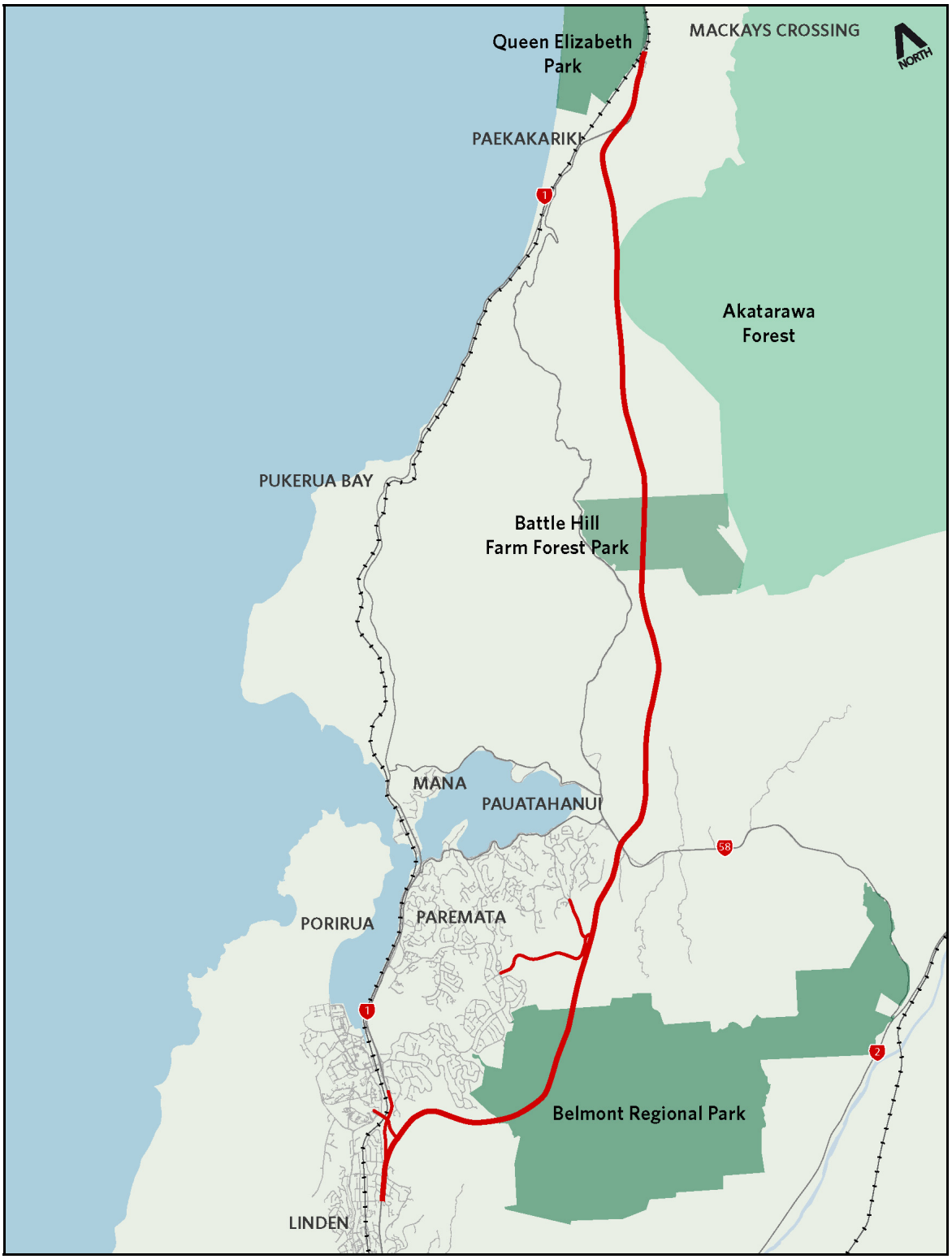

Figure 6.20: Regional parks in the Project area

To the north west of MacKays Crossing are three significant areas; Whareroa Farm Reserve, QE Park and the MacKays Crossing Wildlife Reserve and Wetlands. Whareroa Farm Reserve is a recreational and nature reserve that is open to the public. QE Park is a Wellington Regional Park of 650ha. It is zoned Open Space in the KCDP. QE Park provides for a number of recreation facilities, including the Wellington Tramway Museum, picnic areas and large areas of open space. MacKays Crossing Wildlife Reserve and Wetlands (west of SH1 and south of the rail crossing) is considered regionally significant and is protected as a wildlife management reserve[64].

Figure 6.21: Queen Elizabeth Park

BHFFP and Belmont Regional Park are also significant open space areas. BHFFP, which is generally accessed from Paekakariki Hill Road (approximately 6km north of SH58 and Pauatahanui), provides for a range of recreational activities, including access to the Akatarawa Ranges. School groups frequently visit, especially to the Ken Gray Education Centre, which is an educational centre within a working wool shed, located at the Park. Belmont Regional Park provides recreational activity opportunities, including walking, mountain biking and horseback riding tracks. Waitangirua Farm is a 1200ha working farm (with sheep and cattle) and is a key central component of the Belmont Regional Park.

64. Under section 14A of the Wildlife Act 1953.

Figure 6.22: Belmont Regional Park

Figure 6.23: Battle Hill Farm Forest Park

The Pauatahanui Golf Course, accessed off Paekakariki Hill Road, occupies a large area and has significant recreation value for Pauatahanui and the wider environment, as its members predominantly travel from Johnsonville, Tawa, the Hutt Valley and Porirua. The nine-hole golf course has more than 200 members.

Also located in Pauatahanui is the Pauatahanui Wildlife Reserve, a 50-hectare reserve that lies at the head of the Pauatahanui Inlet. This reserve is an important community recreational feature, incorporating regionally significant flora and fauna. The reserve features a plant nursery and visitor centre and tracks, boardwalks and hides for observing birdlife. There is also a 13km track provided around the edge of the Inlet – the Te Ara Piko (Meandering Path) Pauatahanui Inlet Walkway. There are active community groups that promote and protect the ecological, recreational and cultural values of the Harbour and its catchment area.

Other areas of open space offer recreational opportunities, such as Porirua Park, Gillies Place, and Cardiff Park, which are close to the Main Alignment corridor. Porirua Park has a 1,900 seat covered grandstand with four senior playing fields and a softball diamond, and is home to the Northern United Rugby Clubrooms, while Cardiff Park offers one rugby practice field. The gully between existing SH1 and Kenepuru Drive contains Kenepuru Drive Reverse which is a local purpose reserve for drainage purposes.

6.15 Archaeology, culture and heritage

There are a number of archaeological and heritage sites in the wider environs of the Project area, which remain from Maori occupation and subsistence and also past military presence in the area. These sites include Maori storage pits, midden, pa and urupa and evidence of the World War II military camps (Camps Russell and MacKay[65]).

Further evidence of military presence exists in the area, including the historic battle fought at Battle Hill. The BHFFP was the site of the last battle in the region between Ngati Toa Rangatira and the Crown in 1846. There are two groups of archaeological sites in the BHFFP; the location of the military camp below the battle site, and the site of the battle on the hill behind. The grave sites and site of the battle itself on the ridge leading up to Battle Hill summit are regarded as waahi tapu by Ngati Toa Rangatira.

Early European settlement is also evident in the area surrounding Pauatahanui. St Joseph's Church is located on SH58, opposite Bradey Road, and St Albans Church, is also located on SH58. These Churches are both listed on the PCC Heritage Register, and are also registered by the New Zealand Historic Places Trust as Category 1 (St Josephs) and Category 2 (St Albans) Historic Places.

In the vicinity of MacKays Crossing there is a World War II splinter proof blast containment structure (referred to as 'brick fuel storage tank'). The structure is listed in the KCDP as a significant site and it is identified within the Assessment of Built Heritage Values as a heritage feature. No other heritage assessment or a conservation plan is known to have been written about the structure and it is not registered under the HPA. This brick fuel tank is shown in Figure 6.24.

65. The Project does not encroach on either of these camps.

Figure 6.24: Brick fuel tank at the bottom of the Te Puka Valley, near MacKays Crossing

This area is also recognised as an environment that was rich in resources for early Maori. As a result there are numerous midden sites and pits located around the edge of the Pauatahanui Inlet, reflecting the richness of the sea-based resources. Traditionally the Inlet sustained an abundance of fish and shellfish which was highly valued by Ngati Toa Rangatira for customary fishing. It is still regarded as a mahinga mataitai[66] by Ngati Toa Rangatira who believe it has the capacity to regenerate if it is protected and nurtured into the future.

Several of the streams in the area (including Te Puka Stream, Horokiri Stream, Pauatahanui Stream and Duck Creek) were highly valued historically by Ngati Toa Rangatira as important mahinga kai or food resources and many continue to provide an important habitat for native fish species, including tuna (long and short finned eel), bully, inanga, kokopu and occasionally the rare kakahi (freshwater mussel). These species continue to be highly prized by Ngati Toa Rangatira who still exercise their customary fishing rights throughout the catchment.

QE Park is located within a historic Ngati Toa Rangatira reserve (extending from Paremata to Wainui) that was set aside by the Crown as part of the purchase of Porirua in 1847. It includes areas of early Ngati Toa Rangatira settlement and contains a number of important waahi tapu, including urupa, and pa sites.

66. Mahinga mataitai is a traditional seafood gathering place.

Two significant streams also pass through the park, the Wainui and Whareroa Streams, which were traditionally used for fishing and still retain important cultural associations. Whareroa Farm (which takes its name from the historical site of Whareroa Pa, on a high dune close to the mouth of the Whareroa Stream) is also located within the vicinity of the wider Project area, within an early area of Ngati Toa Rangatira settlement. Whareroa Farm also contains a number of waahi tapu, including urupa.