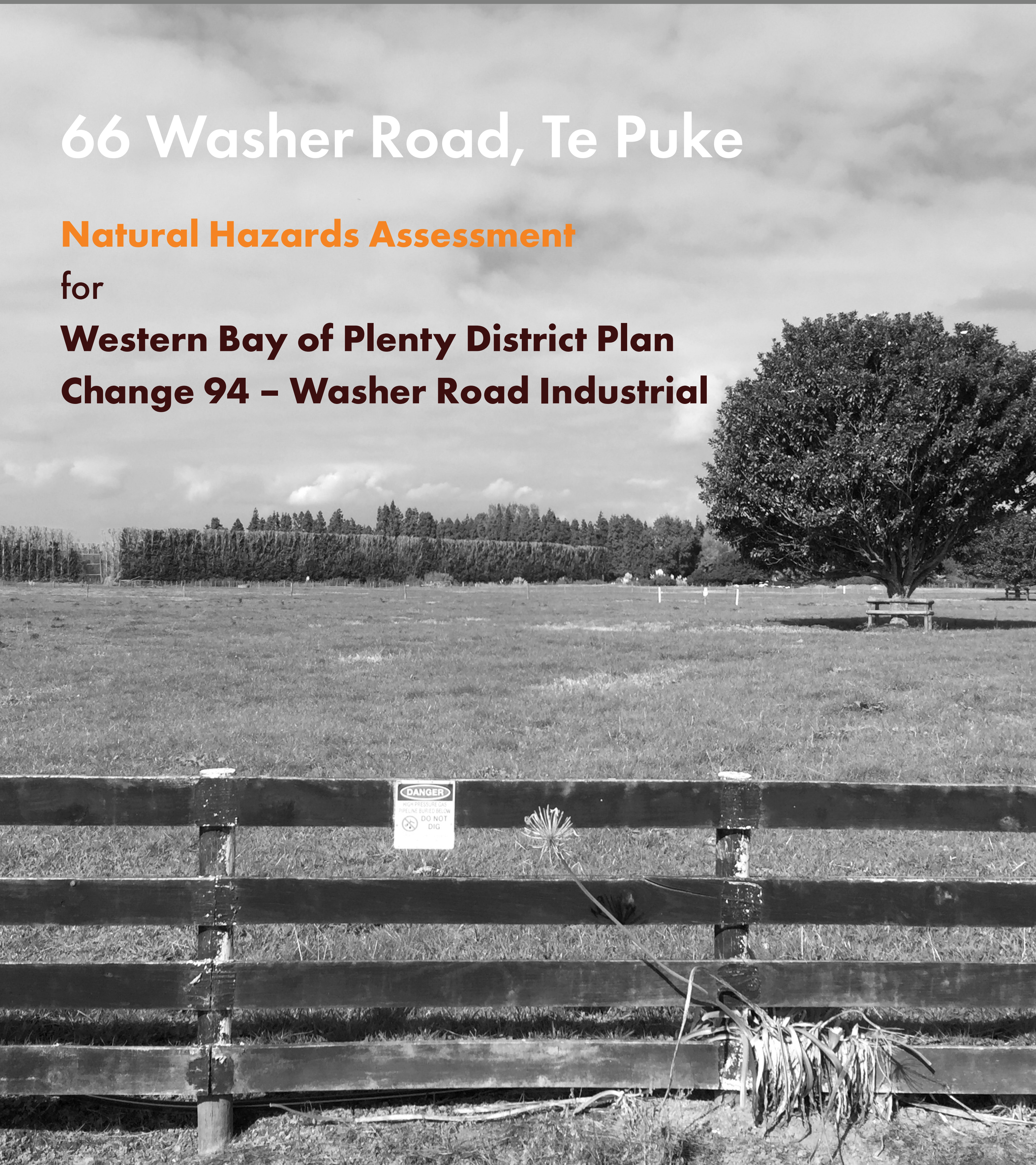
66 Washer Road, Te Puke

Natural Hazards Assessment

for

Western Bay of Plenty District Plan Change 94 – Washer Road Industrial



30 May 2022

MOMENTUM
PLANNING AND DESIGN

Report Information
Title: Natural Hazards Assessment for WBOPDC Plan Change 94
Version: 1
Date: 27 May 2022

Quality Assurance
The assessment contained herein and this report has been completed by the following:
Prepared by: Richard Coles, MNZPI Director, MPAD
Reviewed by: Vincent Murphy, Senior Planner, MPAD
Issued for Approval by: Richard Coles, MNZPI Director, MPAD

Momentum Planning & Design

136 Willow Street
Tauranga, 3110

07 220 9812

richard@mpad.co.nz

www.mpad.co.nz

MOMENTUM
PLANNING AND DESIGN

Table of Contents

1.0 Bay of Plenty Regional Policy Statement

The Bay of Plenty Regional Policy Statement (RPS) is a higher order planning document that District Plans need to be consistent with. The RPS at Appendix L sets out a methodology to be followed for the assessment and consideration of natural hazards.

Policy NH 4B requires greenfield development areas to achieve a low natural hazard risk after completion of the development, without increasing natural hazard risk to other land.

Policy NH 9B requires an assessment of natural hazard risk at the time of land use change and subsequent subdivision of that land. This plan change application triggers the need for that assessment, particularly as land encompassing the plan change has an area greater than 5 hectares. For the purpose of this policy, we have assumed that this relates to the developable land area as the policy relates to an urban site. The plan change area is 7.0ha of which approximately 6.1ha is classified as future developable land.

Policy NH 8A requires the assessment of the natural hazard risk to be completed at the time of plan development, and it is appropriate to consider those risks as part of this plan change process.

2.0 Context of Proposed Plan Change and Proposed Land Use Change

The application site is located within the township of Te Puke within the Western Bay of Plenty District. The site is accessed via Washer Road, a local road that connects to Jellicoe Street via Station Road and Cameron Road. Station Road has a one-way bridge. The site is located on the northern side of the town beyond the East Coast Main Trunk Railway Line and is located opposite East Pac packhouse and cool stores.

The site is encumbered with a drainage reserve and an easement for the gas line that runs through the site. These parts of the site will be protected for their underlying purpose.

The land is flat and adjoins the Ohineangaanga Stream on the eastern side of the site. The stream is protected by a stop bank. The current use is grazing land, which is proposed to be changed to industrial activities by way of a formal plan change to Industrial zoning.

3.0 Identification of hazards potentially affecting the land

Appendix L of the RPS prescribes a methodology for assessing the risk of natural hazards and quantifying the risk and likelihood of the natural hazard occurring. This is through a primary and secondary risk analysis. The primary risk assessment is an initial assessment of all hazard risks. The secondary assessment relates to assessing the consequences of the risk sufficient to determine an overall risk classification low, medium or high.

Table 20 identifies the types of natural hazards and also prescribes the likelihood of the AEP event occurring[1].

Table 20[11] Likelihoods for risk assessment

Hazard	Column A: Likelihood for initial analysis* AEP (%)#	Column B: Likelihood for secondary analysis* AEP (%)#
Volcanic hazards (including geothermal)	0.1	0.2 0.005
Earthquake (Liquefaction)	0.1	0.2 0.033
Earthquakes (Fault rupture)	0.017	0.2 0.005
Tsunami	0.1	0.2 0.04
Coastal erosion	1	2 0.2
Landslip (Rainfall related)	1	2 0.2
Landslip (Seismic related)	0.1	0.2 0.033
Flooding (including coastal inundation)	1	2 0.2

Further commentary on the presence and risk profile of the above hazards is detailed below.

3.1 Volcanic Hazards

The nearest active volcanos include Putauaki (Mount Edgecumbe) and Tuhua (Mayor Island). Both of these volcanos are over 20km away and therefore there will be very low risk of volcanic or geothermal hazards affecting the site. There may well be ash fall which would be dependent on

[1] We understand that BOPRC is conjunction with TA's within its region are reviewing the return period events for natural hazards assessments.

wind direction. As the predominant wind direction is southwest there is also a low likelihood that sha fall would affect the plan change site.

3.2 Liquefaction and landslip hazards

The CMW Geoscience (CMW) geotechnical report has identified that the site has been filled in places in the past. They summaries the soils as: *Holocene aged alluvium comprising interbedded sandy silts, clayey silts and organic soils inferred to be very soft to stiff were presence in all CPT tests to depths of up to approximately 10 metres below existing ground level. A distinct bed of sandy dominant soils inferred to be pumiceous sands was observed within the alluvium between 5.0m and 8.0m below existing ground level, at up to 5m thick." (pg 3, CMW report).*

CMW have identified that the ground conditions include soft alluvial soils within the upper 10m of the site. Preloading the site is recommended to prepare the ground for future industrial use and minimise the risk of liquefaction, lateral spread and consolidation following future buildings being established on the land.

CMW have concluded that for SLS Index settlement will be less than 10mm and liquefaction effects are considered to be negligible. For the ULS Index Settlement of between 130mm and 370mm, with differential settlements in the order of 65mm to 250mm. These settlements are in excess of the Building Code and therefore need specific design.

CMW has concluded "*Significant liquefaction settlement magnitudes of 130mm to 370mm are predicted during the ULS seismic event. In all cases however, a thick (minimum 4.7m) non-liquefiable soil crust is present that should suppress any ground surface effects. It is expected that large span portal frame industrial buildings can be designed to accommodate the magnitude of predicted ULS settlements without collapse."*

CMW have concluded that buildings can be designed to withstand the ULS at time of building consent or ground condition improvements at time of subdivision should that occur. The extent of preloading on the site will depend on the ultimate floor loading of future buildings. Table 8 of the CMW report addresses the necessary preload heights.

There is a very low risk of land slip, either seismic or rainfall related due to the flat contour of the ground (See CMW report Section 7). The static stability of the land adjacent to the stream edge on the eastern side of the Plan Change site has been considered.   They conclude that beyond 10m from the stream invert that the factors of safety would be met (See 7.3.2). As there is a maintenance track, stop bank and proposed landscaping strip between the stream and the industrial land able to be developed there is a buffer zone in excess of 15m, which exceeds the CMW recommendation by 50%.

CMW has assessed seismic slope stability (See Section 7.3.3 CMW Report) and displacements during the ULS event are in the order of 10mm. They have concluded that the risk of lateral spread is therefore low.

Overall, the site is suitable for Industrial use in respect of natural hazard risk of liquefaction and landslips subject to the recommendations of the CMW report being adopted and ground improvements being completed at time of development and/or subdivision.

3.3 Tsunami and Coastal Erosion

The site is located 6km from the coast and the modelled Tsunamai run up and evacuation area is located 3.6km away from the site.

3.4 Fault Rupture

The nearest fault is the Otamarakau fault which is 20km away from the application site and unlikely to be a risk to buildings or infrastructure on the plan change site.

3.5 Flooding

The Bay of Plenty Regional Council (BOPRC) has commissioned a flood model for the catchment that identifies the 1% AEP floodable area climate adjusted to 2130 and sea level rise of 1.25m. This identifies that part of the site will be inundated to a minor extent. This is from the DHI model updated by Phil Wallace from RiverEdge. As can be seen from **Figure 1** below the flood depth is up to 0.1m deep. This area of the site is proposed to be filled so will no longer be subject to the flood hazard.

Figure 1- DHI model as updated by Phil Wallace from RiverEdge (2022) supplied by BOPRC

The Western Bay of Plenty planning maps also identify a floodable area that affects a larger area of the site (see **Figure 2** below). Council has acknowledged that the flooding map overlays were based on a mix of actual recorded flood depths and anecdotal evidence, some of which has proven to be less accurate.

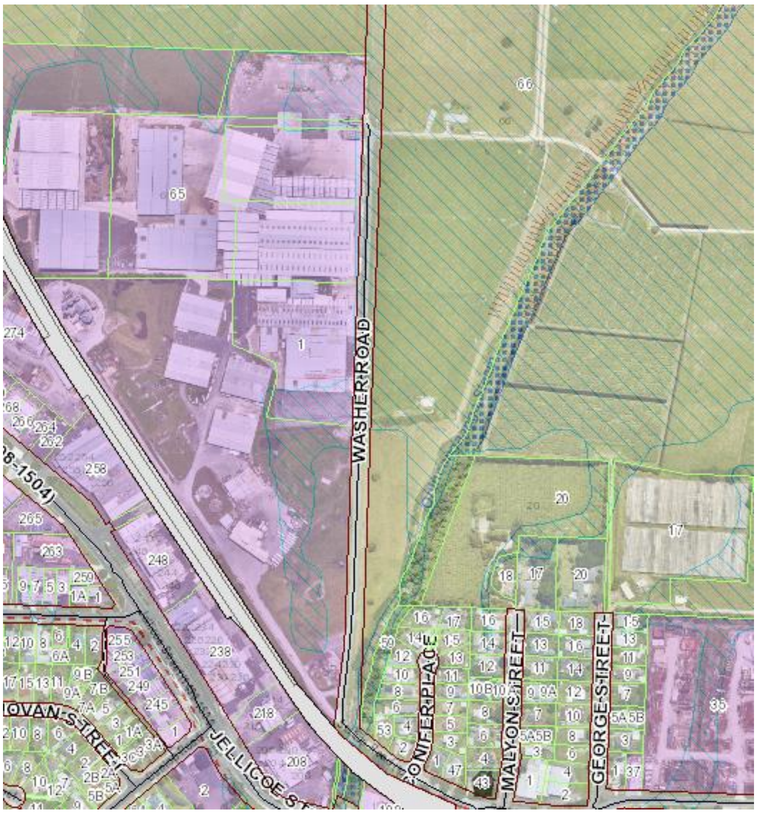


Figure 2- District Plan Flood Map

3.6 Summary of Primary Analysis

In summary, the following natural hazards may affect the Plan Change site:

Volcanic – Volcanic risk is low due to the distance between active volcanoes and the site.

Earthquake (Liquefaction) –Liquefaction results show a non-liquefiable crust of 4.7m to 9.7m (average 7.0m) during a ULS earthquake event, which suggests that the potential for any surface manifestation of liquefaction across the site is low.

Earthquake (Fault Rupture) – The nearest faults are >20km from the site and therefore highly unlikely to affect the site. The hazard risks for fault rupture is considered dot be low.

Earthquake (Lateral Spread) – The risk of lateral spread has been measured to be low (estimated at 10mm) and is not anticipated to cause buildings to functionally be compromised.

Tsuanami – The site is located far outside the modelled Tsunami hazard risk area for the 0.1% AEP event. The risk of Tsunamai is low.

Coastal Erosion – Due to the proximity of the site to the coast, coastal erosion is not anticipated to affect the site for the 1% AEP event. The risk of coastal erosion is low.

Landslip – Due to the contour of the ground being flat no land slip hazards are considered to affect the site. The risk of landslip is considered to be low.

Flooding – for defined areas of the site in the 1%AEP event climate adjusted to 2130 with sea level rise affects the site to a shallow depth of approximately 100mm. As ground improvements are proposed including preload it is possible to raise the portion of the site above the 1% AEP flood plain. The flooding effects are considered to be low and able to be fully mitigated through earthworks to raise the site to a minor extent.

Given the above natural hazards including flooding, liquefaction and lateral spread are anticipated to affect the site to a minor extent and are able to be mitigated by ground improvement works and foundation design.

4.0 Determining Potential Consequences

The primary risk assessment methodology requires an assessment of the consequences of the natural hazard occurring (See Table 21).

Of the three natural hazards that may potentially affect the site as concluded above, the following assessment has been completed to confirm the consequences. This draws on the geochemical report by CMW and also hazard modelling that has been completed for flooding by BOPRC.

CMW has confirmed that the effects of earthquake (liquefaction, lateral spread and structural integrity of buildings) are able to withstand a ULS earthquake. It is anticipated that large span portal frame industrial buildings can be designed to withstand the predicted ULS settlements without collapse.

With respect to the wastewater disposal system CMW have recommended ground improvements to reduce the effects settlement with precautionary measures include ensuring the services are designed to have appropriate service design gradients (See CMW 8.8.2).

Taking into account Table 21 of Appendix L RPS the following conclusions are reached.

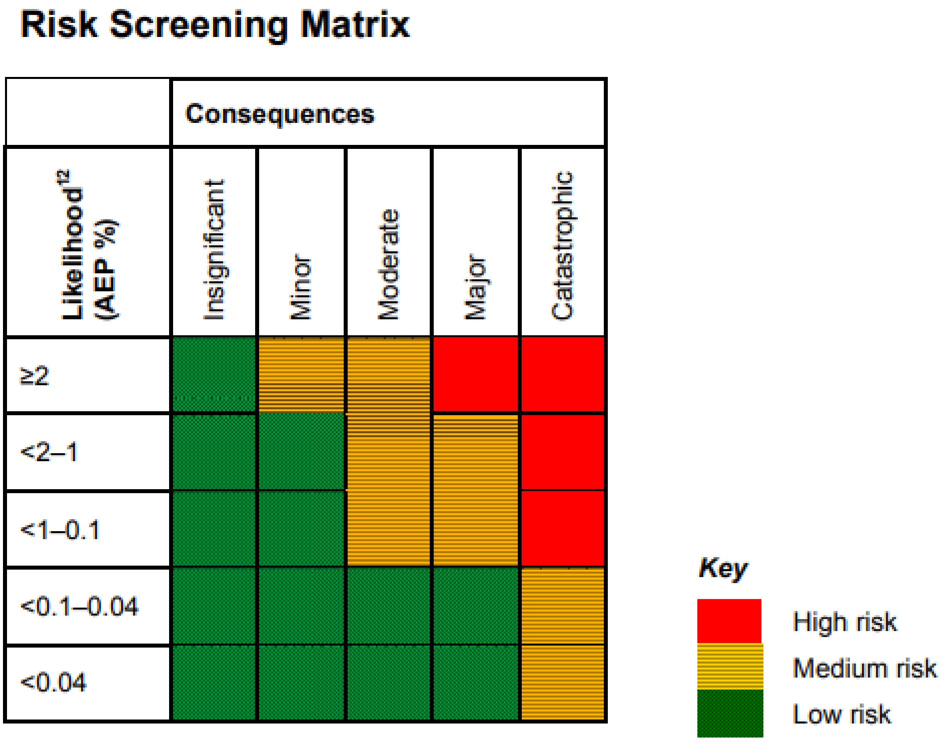
Structure Type	Comment	Consequence Level/Health & Safety
Buildings	Using appropriate foundation and building design the buildings are anticipated to stand up during a ULS earthquake event.	Assessed as minor based on the technical reports supporting the plan change application.
Lifeline Utilities	Following the recommendation of the geotechnical experts the water and wastewater system is likely to be able to withstand an earthquake and have minor damage. The road network is existing and designed to appropriate standards. Alternate routes are available to Jellicoe Street should there	Assessed as minor based on the technical reports supporting the plan change application.

	be a structural failure to a bridge.	

Note there are no critical buildings, or social or cultural buildings proposed in conjunction with this Plan Change.

5.0 Determine the Risk Level

Taking into account the likelihood of risk and the consequences of the hazard the overall risk analysis has been completed using the Risk Screening Matrix in the RPS Appendix L.



Applying the assessed likelihood of an event occurring and analysing the consequences taking into account the recommended mitigation measures (all being minor), the overall hazard risk is calculated as low risk based on the risk screening matrix.

5.0 Iterate Risk Assessment and Calculation of annual individual fatality risk (AIFR)

Using the Appendix L Table 20 column B likelihood for secondary analysis AEP rates we make the following comments in respect to each hazard risk, recognising there are no critical buildings or social/cultural buildings proposed as defined in Table 21. In the absence of any modelled events for these scenarios, we have made qualitative assessments of natural hazard risk.

Volcanic Risk – Due to the distance from the nearest volcano is over 15 km, the risk relates to ash fall and is unlikely to result in death unless the volcanic activity was over a long period of time. Air quality will likely be affected for a short period and will be dependent on the prevailing wind direction. Given this is southwest it is unlikely that volcanic ash will reach the plan change area in quantities that could affect human life. Assuming the consequences are moderate the overall hazard risk remains low risk.

Earthquake - Liquefaction –CMW have assessed the liquefaction potential as low due to the non-liquifiable crust of 4.7mdepth during ULS event.

Earthquake - Lateral Spread – The risk of lateral spread has been assessed by CMW to be low (approximately 10mm) for the 1% AEP event. This would increase because of a 3000-year event. However, the damage anticipated during a ULS event are low.

Earthquake - Fault Rupture - The nearest faults are >20kmfrom the site, Otumaraku being the closest, and therefore remains highly unlikely to affect the site. Using the risk matrix, the overall risk remains low.

Tsuanami – The site is located 3.6km south of the modelled Tsunami hazard risk area for the 0.1% AEP event (1000 year event). The run up of the Tsunami for the 0.1% AEP event reaches only land at or about the 2m RL contour. It is anticipated that the developed industrial land will have a finished contour of RL 6.5m or above and therefore Tsunami wave run up is highly unlikely to affect the plan change area.

Coastal Erosion – Due to the plan change site being located over 5 km from the coast, coastal erosion is not anticipated to affect the site for the 0.2% AEP event (500 year).

Landslip – There is no land slip risk due to the plat contour of the land. Using the risk screening matrix the overall risk remains low.

Flooding – for defined areas of the site in the 0.2%AEP event climate adjusted to 2130 with sea level rise the site may be affected by temporary inundation. It is likely the road corridors may be affected within the Plan change site. These corridors, as secondary overland flow paths, will contain a substantial amount of flood waters but if the flood elevation height is above this then there may also be flooding on some of the future industrial sites.

<u>Comment</u>

In the above qualitative assessment, we have drawn on the technical reports, modelling and mapping of natural hazards as well as considered factual information such as land contours and distance from the source of natural hazards to reach conclusions. Static subsidence is the biggest risk and this will be mitigated by preloading the site as recommended by CMW as well as ensuring that building designs meet the building code for intended point loads. These will be purpose built and engineered buildings.

Using the AIFR formula the hazard risk remains low as there are no deaths anticipated as no buildings are anticipated to collapse and there will be an extremely low risk of inundation from flooding.

6.0 Conclusion and Mitigation

This assessment has been undertaken drawing on the already modelled hazard risks for flooding and tsunami. Earthquake hazard risks have been assessed by CMW Geoscience in accordance with the primary and secondary analysis return periods as prescribed in the RPS Appendix L methodology. Qualitative assessment has been completed with respect to fault rupture risks and volcanic hazards, both of which have been mapped by BOPRC and are considered to be low risk due to the distance between the site and the nearest faults and active volcanoes. Coastal hazard risk is also considered to be extremely low risk given the site is located 6.0km inland. Overall, the risk from natural hazards is considered low and the land is suitable for use as an industrial park.

The following recommendations are drawn from the CMW report.

- That the ground be preloaded to reduce static settlement.

The earthworks and associated ground improvements will be subject to future consents to the regional council. Future development and subdivision in the plan change area will be subject to design approval through WBOPDC.

The plan change is therefore consistent with Policy NH 4B of the RPS for Greenfield urban development that will create zoning appropriate for the establishment of an industrial park.

Bibliography

Regional Policy Statement Appendix L *Methodology for Risk Assessment* P369-378.

CMW Geoscience *Geotechncial Report Washer Road* 2022

Western Bay of Plenty District Council Mapi – *Significant Fault Lines*

Western Bay of Plenty District Council Mapi – *Tsunami Flood Modelling 1000 year event*

DHI Flood model 2020, updated Phillip Wallace of RiverEdge 2022.

Bay Hazards – Bay of Plenty Natural Hazards Viewer May 2022

Appendix 1 – Map of Fault Lines BOPRC

Figure 3- Otumarakau Fault Line - Source BOP Natural Hazard Viewer May 2022

Appendix 2 – Map of Tsunami Evacuation Zones BOPRC

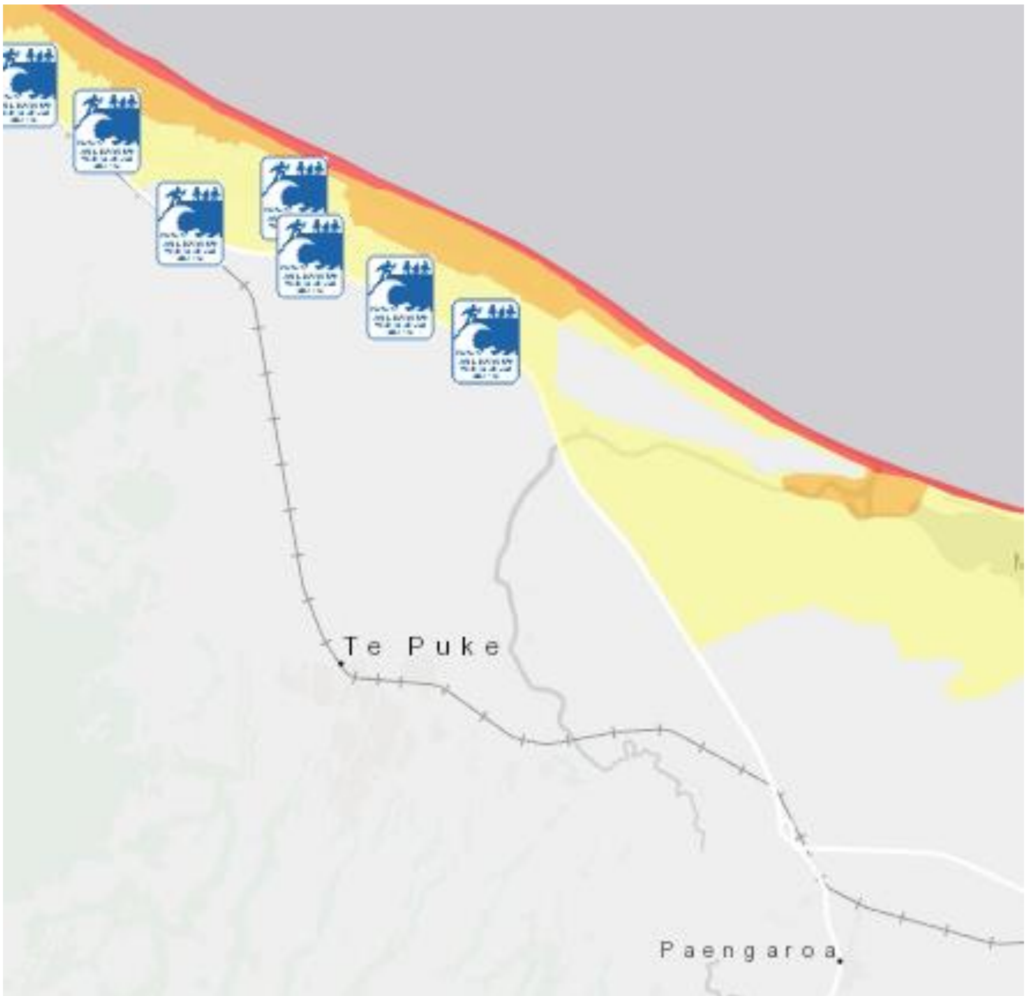


Figure 4- Extent of Tsunami Risk; note reaches Tauranga Eastern Link: Source BOP Natural Hazard Viewer May 2022

Appendix 3 – Map of Active Volcanos

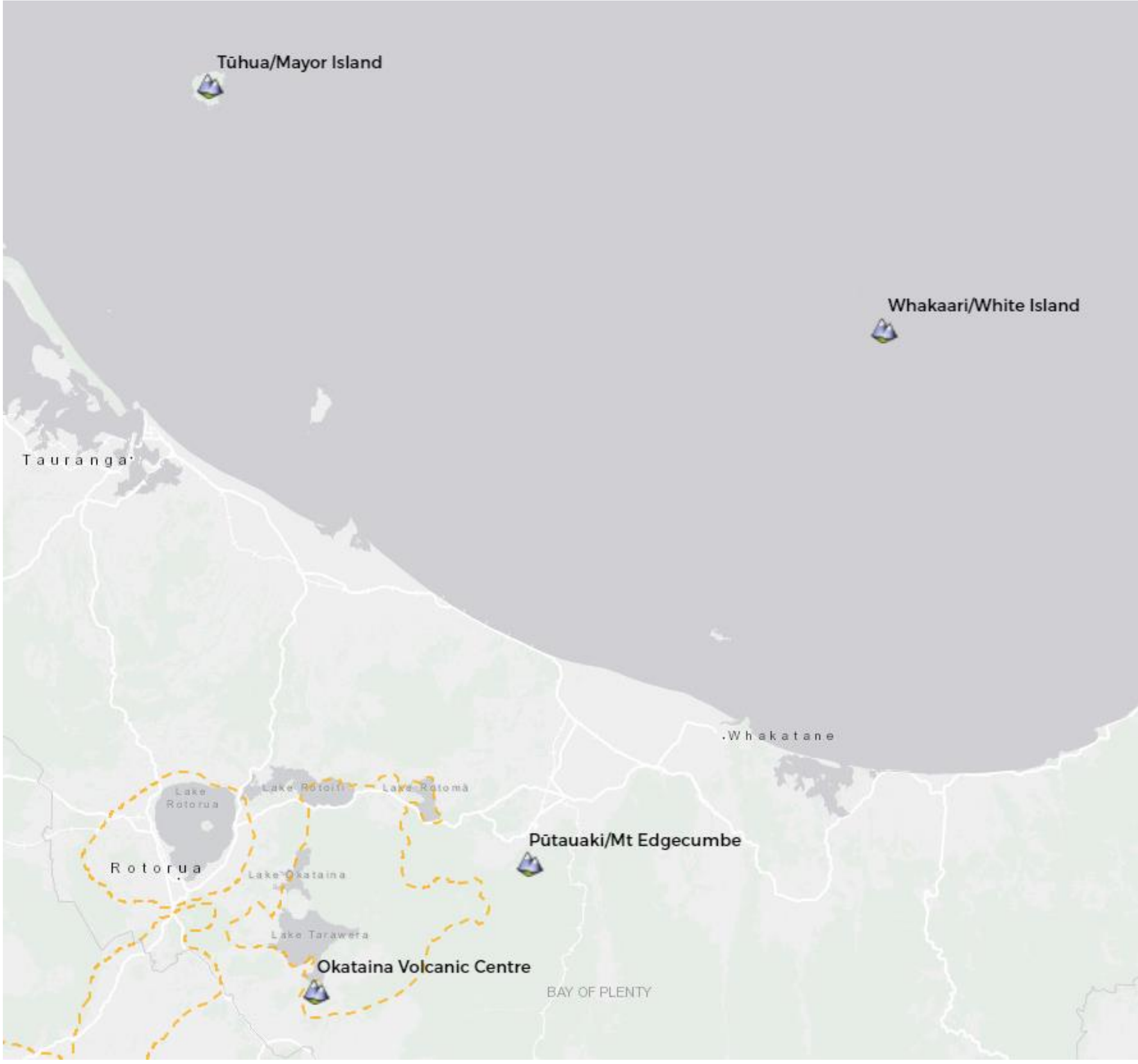


Figure 5- Active Volcanos: Source BOP Natural Hazard Viewer May 2022

Appendix 4 – Geotechnical Report