19 May 2026
Job No: 1093341.0000

Devonport Property Management Ltd
Level 3, 6 Viaduct Harbour Avenue
Auckland 1010

Attention: Nick Turley

Dear Nick

Devonport Mixed Use Development
Coastal Inundation and finished floor level

1 Introduction

1.1 Assessment scope

Devonport Property Management Ltd commissioned Tonkin + Taylor Ltd (T+T) to provide advice on a range of development considerations for Devonport Mixed Use Development. The site is located in Devonport town centre, Auckland, and assessments include geotechnical, flooding and coastal inundation to support a Fast Track project referral application.

This report focuses on coastal inundation hazards and presents inundation levels and freeboard scenarios to inform finished floor levels to reduce risk of inundation hazards with climate change over the next 100 years. The assessment is suitable for the Fast Track Referral stage. Additional work in the form of a natural hazard risk assessment may be required to support the substantial application.

1.2 Assessment criteria

Auckland Unitary Plan's (AUP) Chapter E36 'Natural Hazards and Flooding' requires the completion of Hazard Risk Assessments when a subdivision, use or development requiring resource consent is proposed to be undertaken on land which may be subject to natural hazards considering the effects of climate change over at least a 100-year timeframe (rounded up here to 2130). This includes land in the coastal erosion hazard area and the coastal storm inundation area identified in Auckland Council's GIS viewer. The general site of this development in Devonport town centre is within AUP overlays for coastal inundation from a 1% AEP event with 1m of sea level rise.

This coastal inundation assessment is consistent with Auckland Council (2022) guidance for undertaking hazard assessments in the Auckland region (GD2021/10)[1] and gives effect to the New Zealand Coastal Policy Statement (2010) and considers the guidance provided by the Ministry for the

[1] https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/Documents/coastal-hazard-assessment-guidance-2022.pdf

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Environment's ''Coastal Hazards and Climate Change Guidance for Local Government' (2024)[2]. Auckland Council GD13[3] on Freeboard (December 2024) and draft edits to AUP E36 for the proposed PC120 (Notified November 2025) have also been considered.

Assessment criteria for evaluating coastal inundation and finished floor levels include:

- The New Zealand Coastal Policy Statement (NZCSP) and Auckland Council guidance documents (e.g. GD2021/10 and GD13) and E36.2 require a timeframe of at least 100 years including impacts of climate change (here taken to be 2130).
- The Auckland Unitary Plan and AC guidance documents require the use of a 1 in 100 year return period event (1% Annual Exceedance Probability) for assessing inundation levels and informing floor levels, but there is also a consideration in PC120 E36 of the residual risk (i.e. lower frequency events such as a 0.5% AEP or 200 yr ARI).
- Auckland council GD13 recommends the use of climate change pathway[4] SSP5-8.5p50 (50 percentile) plus consideration of vertical land movement (VLM) and additional freeboard which can vary depending on exposure and site use (e.g. habitable or non-habitable).
- MfE (2024) guidance on climate change hazards recommends a stress test scenario for SSP5-8.5p83 plus consideration of VLM for testing land use related to intensification.

[2] https://environment.govt.nz/assets/publications/Coastal-hazards-and-climate-change-guidance-2024-ME-1805.pdf
[3] https://www.aucklanddesignmanual.co.nz/content/dam/adm/adm-website/developing-infrastructure/infrastructure-technical-guides/gd13-freeboard/FINAL_Freeboard_GD13v1_December_2024.pdf
[4] Shared Socioeconomic Pathway

2 Location and proposed development

The site is in the Devonport town centre a considers a range of parcels on Wynyard Street and Victoria Road as outlined in red in Figure 2.1.

Figure 2.1: Site Location. Site boundary shown in red.

2.1 Proposed development

The proposal is for a comprehensive mixed-use urban town centre development located in Devonport, Auckland, within the block bounded by Victoria Road, Clarence Street, and Wynyard Street. The site comprises 14 existing titles and approximately 6,126 m² of brownfield land and includes five Auckland Unitary Plan Category B listed heritage buildings and one Category A listed heritage building.

The development comprises five buildings arranged across three site areas, with building heights ranging from four to eight storeys, and includes up to two basement levels. Buildings 1–3 are located between Victoria Road and Wynyard Street and include a hotel and mixed-use buildings with a two-level basement accessed from Wynyard Street. Building 4 is mixed-use building located at the corner of Victoria Road and Clarence Street and includes one basement level. Building 5 is a mixed-use building located to the south-west of the site on Wynyard Street with on-grade carparking access.

The proposal includes a commercially activated ground plane comprising a network of laneways and a central courtyard, providing pedestrian connections between Victoria Road and Wynyard Street and supporting active ground-floor uses.

The development includes the adaptive reuse of the Victoria Road heritage buildings, which are integrated into the commercial ground plane.

The development delivers approximately 21,125 m² of total gross floor area and 1,770 m^2 of commercial ground plane. This encompasses 12,516 m² of residential floor area, 2,382m² of commercial space, and 3,004 m² of ground floor retail including commercial outdoor ground plane area. The proposal incorporates 2,319 m² of adaptively reused heritage and a new 2,095 m² hotel, with the balance comprising building circulation. The proposal provides options for 2,952 m^2 – 6,736 m^2 of basement.

Associated works include carparking and loading facilities potentially ranging between 80 and 200 carparks and loading spaces; earthworks and excavation potentially ranging between 2,000 m^2 and 6,735 m² and 9,380 m^3 and 25,000 m^3; and all required associated infrastructure including water supply, stormwater (including any required flood mitigation measures), and wastewater services.

The site is located immediately north of the Devonport Ferry Terminal and associated public transport services.

Figure 2.3: Proposed ground floor layout from PB&A architectural drawings (05/05/2026 reference 1089-A-FTR-212).

2.2 Coastal setting

The coast around the site is a harbour environment that is sheltered from open coast wave energy but is exposed to some wind wave activity from the easterly quarter and westerly quarter. Typical wind waves would be in the order of <0.3 m and short period (<3 s). Vessel wake is present at the

coast, created by the ferry service the runs to and past Devonport, and vessels passing Devonport for a range of commercial and recreational activities.

The waterfront is mostly characterised by coastal protection structures. A sloped masonry seawall with concrete crown is located along the south facing coastal edge from the Navy Base to Devonport Wharf. A breakwater and groyne are located east of the wharf before a semi-artificial beach is located seaward of Windsor Reserve. A seawall is located along King Edward Parade to the east of Windsor Reserve (Figure 2.4).

Figure 2.4: Site location in Devonport town centre, Auckland North Shore.

Terrain levels to inform coastal inundation were sourced from a 2024 regional LiDAR survey relative to NZVD-16 (RL). The coastal edge crest of the south facing waterfront is approximately 2.7 mRL and the terrain then undulates between 2.3 and 2.7 mRL until the bottom of Victoria Road, where the grade gradually increases to approximately 4.0 mRL in the intersection of Victoria Road and Clarance Street (Figure 2.5).

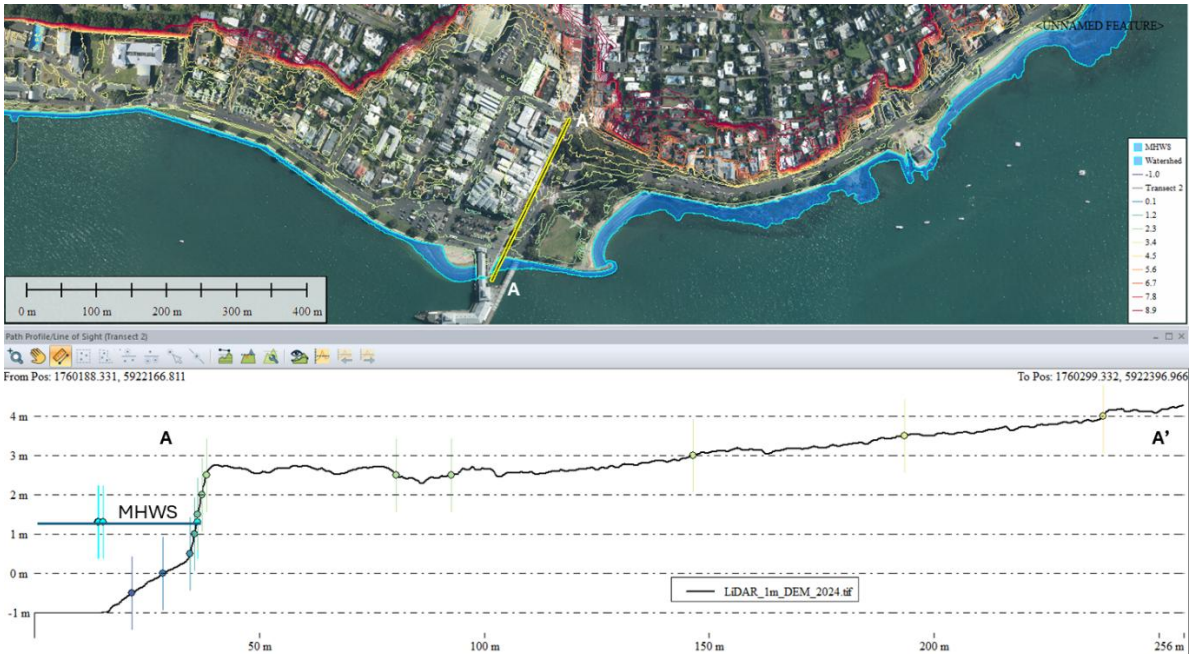

Figure 2.5: Cross section from south facing coast up Victoria Road.

The lowest terrain pathway between the sea and the site is from beach to the east and across Windsor Reserve. Crest level at Windsor Reserve is approximately 2.3 mRL and the grassed area dips to 2.0 mRL before rising onto Victoria Street (Figure 2.6). This would be the initial area flooded by storm tide with sea level rise before water reaches the developed areas.

Figure 2.6: Cross section from Windser Reserve beach to the east.

3 Coastal inundation

3.1 Coastal hazard screening

The coastal edge around Devonport is armoured with coastal protection structures and the development is setback from the coastal edge. The site is not subject to coastal erosion hazards in the Auckland Council Geomaps information and therefore coastal erosion hazards are not applicable to the proposed development.

Two of the proposed development outline sites are potentially exposed to tsunami hazards at present day sea level, according to the Auckland council hazard viewer (Figure 3.1)[5]. The yellow land threat zone reaches a level of approximately 3.6 mRL on Victoria Road. Tsunami are low likelihood events and are assessed for emergency management purposes. Tsunami hazards are not required under AUP E36 to inform development. However, the new National Policy Statement on Natural Hazards (NPS-NH, 2025) does include tsunami as a hazard that should be assessed in the context of new developments. Tsunami likelihood is not expected to change with sea level rise, but the level of inundation may increase proportional to the amount of sea level increase.

The site is exposed to coastal inundation with sea level rise, which is the primary hazard addressed in this report.

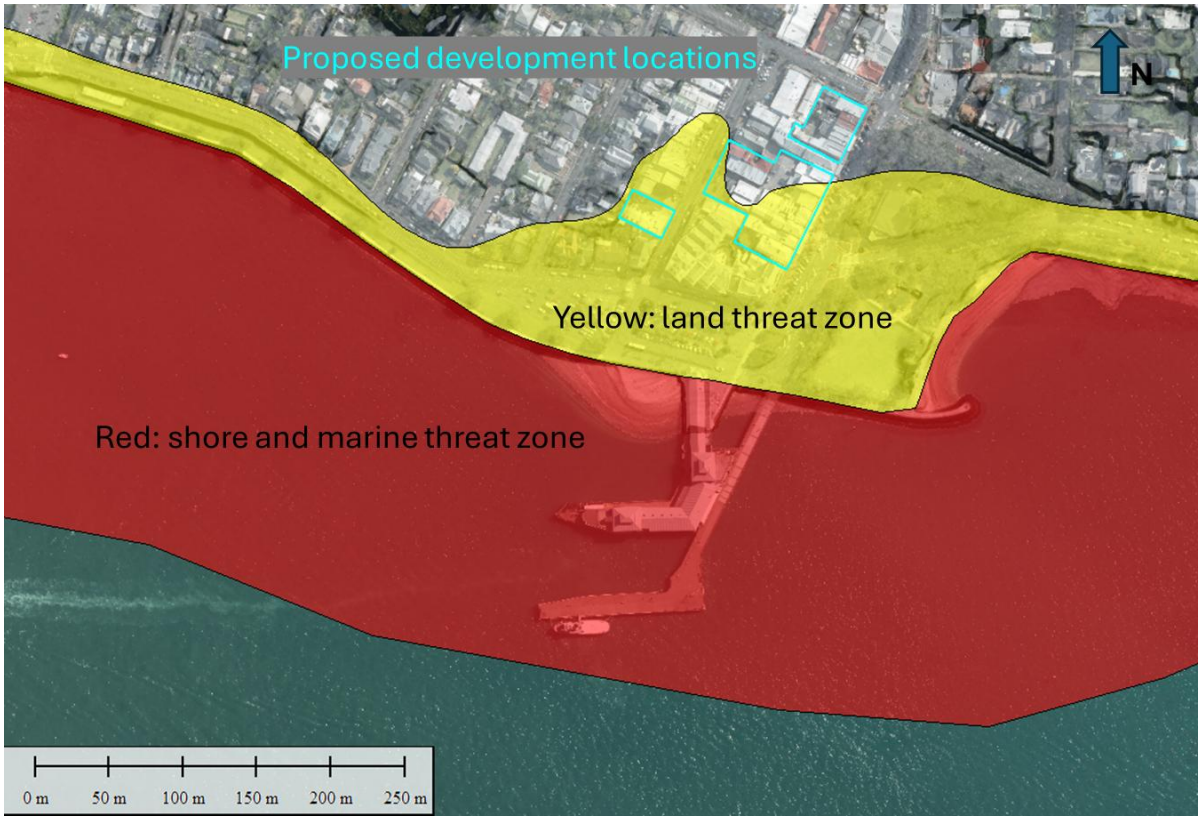

Figure 3.1: Tsunami hazard zones form Auckland Council.

3.2 Coastal inundation levels

The water level at any time is determined by the combination of several components including both deterministic and stochastic components.

[5] https://www.aucklandemergencymanagement.govt.nz/hazards/tsunami/

Key components that determine water level are presented in Figure 3.2 and include:

- Astronomical tides (e.g. mean sea level, mean high water spring).
- Barometric and wind effects, generally referred to as storm surge.
- Medium term fluctuations in mean sea level over seasons and years due to climate patterns.
- Long-term changes in relative sea level due to climatic or geological changes.
- Nearshore wave effects including wave set-up and wave run-up.

Details on astronomical tide, storm surge, storm tide, wave setup, and relative sea level rise (RSLR) for Devonport are presented in Appendix A and were used to inform calculations of coastal inundation levels and freeboard.

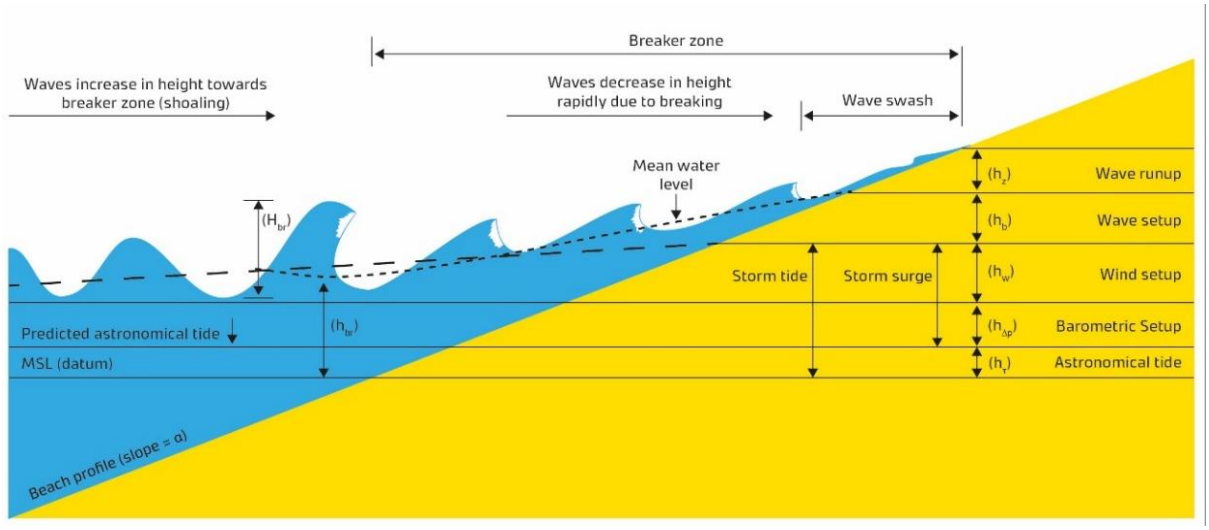

Figure 3.2: Key components that determine water level.

3.3 Exposure to coastal inundation

Storm tide levels (not including wave setup) were calculated and mapped to understand the onset of inundation impacting the lower Devonport town centre at different timeframes for the SSP5-8.5p50+VLM projection (See Appendix A2 for details). The storm tide level for this primary assessment scenario is 3.34 mRL for 2130 (Figure 3.3). The stress test scenario from MfE (2024) planning category A or B (subdivisions or upzoning / intensification) is SSP5-p83+VLM-2130 and has a water level of 3.82 mRL (not mapped).

The following describes the changing exposure to coastal inundation for the SSP5-8.5p50+VLM scenario in Devonport town centre:

- **Present day**: Water level of 2.04 mRL. Developed areas of the Devonport town centre are not exposed to coastal inundation from storm surge today, but some wave overtopping may occur at the immediate coastal edge. Some low-lying reserve areas and road space are below the 1% AEP storm tide level at present day, but the coastal edge is higher so flooding would only occur if seawater flowed from sea through the storm water network to land.
- **2050 (30 years)**: Sea water inundation to 2.26 mRL is connected Windsor Reserve but not across Victoria Road on Queens Parade (Figure 3.3).
- **2080 (50 years)**: Water level of 2.60 mRL allows flow path from Windsor Reserve to cross Victoria Road and the ferry carpark, potentially flooding property on the corner of Queens Parade and Victoria Road (Figure 3.3). No flooding to the proposed developments.

- **2100 (70 years):** Sea level of 2.88 mRL exceeds the coastal edge level on south facing waterfront causing additional flooding around lower Victoria Road and Queens Parade (Figure 3.3). Potential for some minor exposure to the proposed developments.
- **2130 (100 years):** Coastal inundation of 3.34 mRL exposes a larger area between Clarence Street, Victoria Road and Anne Street (Figure 3.3). Existing ground level of the developments becomes exposed to coastal inundation.

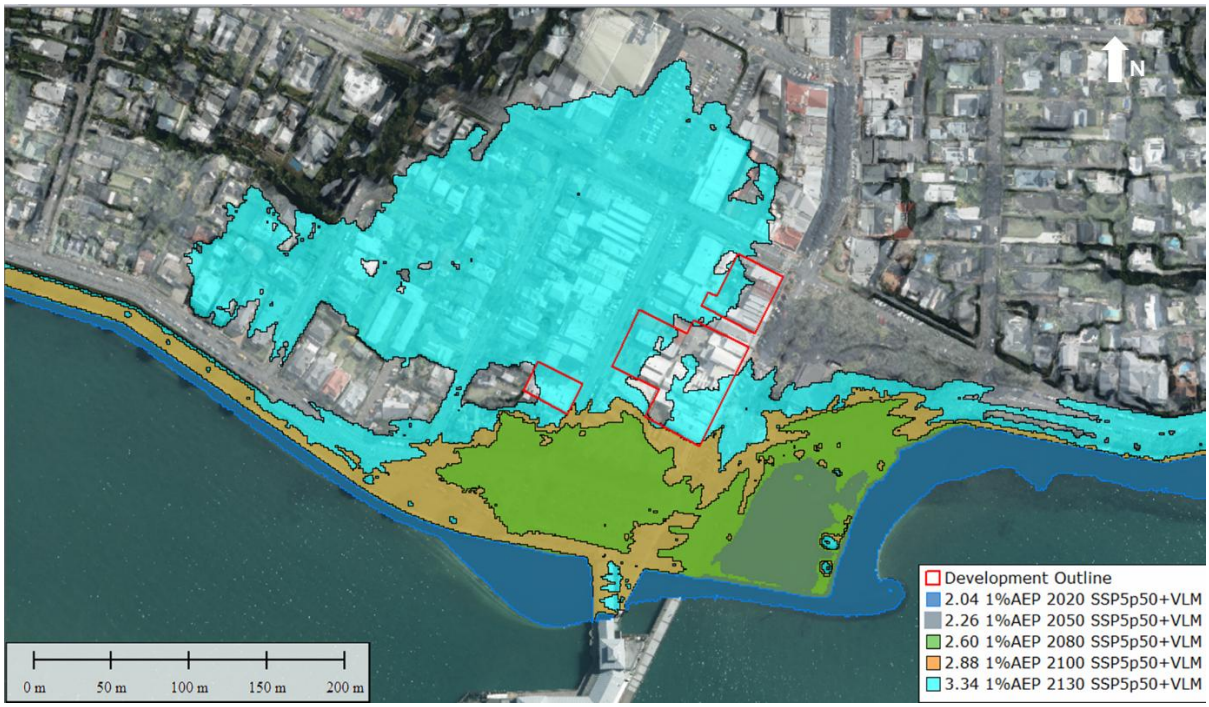

Figure 3.3: Coastal inundation extents connected to the sea (not showing disconnected bath-tub) for different decades based on SSP5-p50+VLM. Not including wave setup.

3.4 Freeboard

Freeboard is the height between the inundation level and the ground or building floor level being assessed or designed. Guidance on freeboard from GD13 (December 2024) indicates that freeboard can vary depending on the locations exposure to flooding and based on the sensitivity of the activity. A general interpretation is that habitable floor levels should be informed by a freeboard of 0.5 m above the 1% AEP inundation level. For non-habitable commercial or retail a freeboard of 0.3 m above the 1% AEP inundation level could be considered. A freeboard of 0.15 m may be suitable for some floor levels that are set away from the coastal edge and not exposed to wave action.

4 Finished floor level

Finished floor levels for Devonport were informed by the sum of the following variables:

- Relative sea level rise (RSLR) for the 100-year timeframe based on SSP5-8.5p50 in 2130.
- The 1% AEP storm tide level.
- Wave setup, which super elevates coastal water level due to wave breaking and forming surf zone.
- Freeboard to account for uncertainty, local wave action, and wave effects.

Finished floor level scenarios are presented in Table 4.1 below, considering the variables presented above.

For habitable areas a minimum floor level of 3.9 mRL is recommended, which includes a 0.5 m freeboard above the 1% AEP inundation level based on SSP5-8.5p50+VLM+setup for 2130. This elevation sits above the stress test inundation level of 3.82 mRL based on SSP5-8.5p83+VLM (2130) and is therefore aligned with MfE (2024) guidance on reducing risk with sea level rise by avoiding exposure.

For non-habitable areas a minimum floor level of 3.7 mRL may be suitable, which includes a 0.3 m freeboard above the 1% AEP inundation level based on SSP5-8.5-p50+VLM+setup (2130). This sits below the stress test inundation level of 3.82 mRL based on SSP5-8.5p83+VLM (2130) and therefore has some exposure to inundation at 2130, to a depth of 0.12 m. This depth is within the H1 category of the ARR Combined Floor Hazard Curve[6], which is considered 'generally safe people and buildings'.

[6] ARR Book 6 - Flood Hydraulics (figure 6.7.9)

Table 4.1: Finished floor level components and levels

Variable	Value	Units	Description
Vertical datum	NZVD2016	mRL	0.313 m below AVD-46
Site location	Sheltered	n/a	Site > 100 m landward of coastal edge. Harbour wind waves and wake present. Shoreline armoured with limited high tide surf zone.
Present day sea levels			
Mean sea level baseline	2020		Most recent IPCC AR6 year to zero off
MSL	-0.13	mRL	LINZ 2025 Almanac Port of Auckland
MHWS	1.30	mRL	LINZ 2025 Almanac Port of Auckland
2% AEP storm tide	1.99	mRL	Technical Report 2020/024 adjusted to 2020
1% AEP storm tide	2.04	mRL	Technical Report 2020/024 adjusted to 2020
Future sea level rise			
Assessment scenario	SSP5p50+VLM 2130		Recommended by AC GD13; GD2021/10
SLR	1.185	m	NZ Sea Rise site 1124
VLM	0.115	m	NZ Sea Rise site 1124 (-0.9 ± 1.5 mm/yr)
RSLR	1.30	m	NZ Sea Rise site 1124
1% AEP storm tide 2130	3.34	mRL	1.3 m (2130 RSLR) + 2.04 mRL (1% AEP storm tide)
Overdesign event inundation level	3.39	mRL	1.3 m (2130 RSLR) + 2.09 mRL (0.5% AEP storm tide)
Stress test inundation level from MfE (2024)	3.82	mRL	1% AEP with SSP5-p83-2130+VLM: 1.78 m (RSLR) + 2.04 mRL (storm tide)
Wave effects			
Setup	0.06	m	Based on waves breaking on Windsor Reserve beach
Runup	0.2	m	Consider incorporated in freeboard allowance. Development setback >100 m from coast
Freeboard			
Non-habitable floor	0.3	m	AC GD13 considering uncertainty in levels, wake and waves
Habitable floor	0.5	m	AC GD13 considering uncertainty in levels, wake and waves
Minimum floor level			
Non-habitable floor	3.70	mRL	Freeboard of 0.3 m above 1% AEP 2130 • Some exposure to MfE (2024) stress test inundation level • Freeboard reduces to 0.25 m for overdesign 0.05% AEP
Habitable floor	3.90	mRL	Freeboard of 0.5 m above 1% AEP 2130 • No exposure to MfE (2024) stress test inundation level • Freeboard reduces to 0.45 m for overdesign 0.05% AEP

5 Development considerations

The notified Plan change 120 (PC120) revisions to the AUP E36 on natural hazards require a risk assessment for developments potentially exposed to hazards with climate change over the next 100 years. This section presents an initial risk screening based on different development elements based on sensitivity to coastal inundation.

PC120 categorises development activities into less sensitive, potentially sensitive, and sensitive (Table 5.1) with development being either acceptable, potentially tolerable or of significant risk depending on the level of hazard exposure and the sensitivity (Table 5.2). For coastal inundation, development of sensitive and potentially sensitive activities is associated with significant risk if exposure occurs for a 1% AEP event with 0.5 m RSLR.

The development locations are **not exposed** to coastal inundation for a 1% AEP event with 0.5 m RSLR, but there is some minor exposure for the 1% AEP event with 1.0 m RSLR.

Therefore, potentially sensitive activities such as retail and food/beverage are potentially tolerable and less sensitive activities are acceptable. However, the development needs to consider mitigation measures such as finished floor levels with suitable freeboard above the inundation level over the design life, or adaptation options that trigger future upgrades.

Table 5.1: Examples of activity sensitivity

Sensitivity	Examples
Less sensitive	Parks, reserves, carparking
Potentially sensitive	Offices, retail, day schools
Sensitive	Retirement village, habitable dwellings, medical centres

Table 5.2: Risk tolerance to different sensitivities and inundation exposures

Coastal inundation	Sensitive	Potentially sensitive	Less sensitive
1% AEP + 0.5 m RSLR	Significant	Significant	Acceptable
1% AEP + 0.5 to 1 m RSLR	Potentially tolerable	Potentially tolerable	Acceptable
1% AEP + 1 to 1.5 m RSLR	Potentially tolerable	Potentially tolerable	Acceptable

The NPS-NH and PC120 E36 require a natural hazard risk assessment as part of the substantial application the elements potentially at risk include:

1 **Ground floor building use**: Based on the available development plans the ground floor will be for food and beverage, retail, wellness, and lobby space for hotel and apartment areas and include laneway type atrium spaces. These activities would be considered *potentially sensitive* and should consider freeboard of 0.3 m above the coastal inundation level of 3.34 mRL, resulting in a finished floor level of 3.7 mRL. If a finished floor level of 3.7 mRL is built into the development today, then risk of inundation will be low over the next 100 years. Alternatively, exposure to inundation may not occur for another 30 – 70 years, allowing time to raise floor levels in the future as part of a dynamic adaptation pathways plan that is implemented with clear triggers.

2 **Critical building utilities**: Utilities such as electoral units that power buildings and elevators are considered *sensitive* and should consider a freeboard of 0.5 mRL to prevent exposure to coastal inundation over 100 years, also considering a stress test scenario. If services are elevated above 3.9 mRL the risk of inundation is low over the 100-year climate change timeframe.

3 **Habitable floors:** Habitable floors for residential or hotel accommodation are considered *sensitive* and should consider a freeboard of 0.5 mRL to prevent exposure to coastal inundation over 100 years, also considering a stress test scenario. We understand that habitable floors are on the first floor and above and will therefore be above the 3.9 mRL minimum floor level, which is low risk.

4 **Safe refuge/refuge:** PC120 requires specific consideration of emergency egress or refuge for new developments that could be exposed to the 1% AEP coastal inundation event with 1.5 m RSLR (3.55 mRL). Road levels adjacent building B1, B3 and B5 are around 3.0 mRL, which is a depth of 0.55 m that is generally considered unsafe for emergency egress (depth below 0.3 is generally safe for pedestrians and vehicles). These buildings should consider having areas for safe refuge so occupants can comfortably shelter during an inundation event which may be a 2 – 4 hours until the tide turns and water drains to a suitable level. Building B2 has some access to dry or shallow inundation locations for egress at the north edge of the boundary. Building B4 has access to 4.0 mRL ground level on the corner of Victoria Road and Clarence Street.

5 **Basement flooding**: Coastal inundation flow into any basement areas could become a significant risk to any assets or people in the basement area with future sea level. A berm or raised entrance at a level of at least 3.7 mRL includes 0.3 m freeboard above the 1% AEP inundation level for 2130 would prevent inflow and reduce risk to low over the assessment timeframe. This also allows some freeboard above the 1% AEP with 1.5 m RSLR egress scenario in PC120.

6 Summary and recommendations

The development site is not exposed to coastal erosion but is exposed to tsunami hazards at present day, and coastal inundation from a 1% AEP event with future sea level rise over the next 70 to 100 years.

The proposed development can be low risk from coastal inundation by mitigating exposure over the next 100 years by establishing a minimum floor level of 3.7 mRL for potentially sensitive activities, and 3.9 mRL for sensitive activities. Floor levels on the existing site are mostly on grade with the street. Upgrading the existing site to have buildings that avoid inundation exposure for the next 100 years will improve the overall resilience of Downtown Devonport to natural hazards.

We recommended that the findings of this coastal inundation assessment are used to build mitigation into the development design. A natural hazard risk assessment is recommended to support the substantive application based on the requirements in PC120 AUP E36 and NPS-NH.

7 Applicability

This report has been prepared for the exclusive use of our client Devonport Property Management Ltd, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that our client will submit this report as part of an application for referral under the Fast-track Approvals Act 2024 and that an Expert Panel as the consenting authority will use this report for the purpose of assessing that application.

Tonkin & Taylor Ltd

Report prepared by:

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Authorised for Tonkin & Taylor Ltd by:

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Mark Thomas
Project Director

Technical Review by Richard Reinen-Hamill, Technical Director: Coastal Engineering

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Appendix A Coastal Inundation Variables

A1 Tide and storm surge

Tide is the regular rise and fall of the sea level due to astronomic forces. Tide levels were sourced from the 2025 LINZ Nautical Almanac for the Port of Auckland to inform this assessment (Table Appendix A.1). Tide levels converted to Auckland Vertical datum 1946 are consistent with the MHWS-10 reported (NIWA 2023)[7].

Storm tide is the super elevation of sea level caused by storm surge, where onshore wind and low atmospheric pressure increase the increase the sea level at the coast. Tide values were sourced from the 2025 LINZ nautical almanac for Auckland Port. Storm tide level is calculated using extreme value analysis for different average torrent intervals (ARIs) or annual exceedance probabilities (AEPs). Storm tide values were sourced form Site 20 of Table 3.3 in Auckland Council Technical Report 2020/24 on Coasatl Inundation. Levels were adjusted to mean sea level baseline in 2020 based on the LINZ Nautical Almanac which is +0.04 m relative to levels reported in TR2020/24[8] (Table Appendix A.1). The storm tide analysis accounts for the coincidence of medium-term fluctuations, onshore wind and low atmospheric pressure.

The 1% AEP storm tide level for Devonport is 2.08 mRL for the baseline year of 2020, indicating a storm surge component that is 0.74 m above MHWS.

Table Appendix A.1: Present day water levels for the Port of Auckland relative to 2020 baseline

Name	Level (m, CD)	Level (m, AVD-46)	Level (mRL, NZVD-16)
Lowest Astronomical Tide (LAT)	0.08	-1.66	-1.98
Mean low water spring (MLWSn)	0.52	-1.22	-1.54
Mean sea level (MSL)	1.93	0.19	-0.13
Mean high water spring (MHWSn)	3.36	1.62	1.30
Highest astronomical tide (HAT)	3.74	2.00	1.68
39% AEP (2yr ARI)	3.82	2.08	1.76
10% AEP (10yr ARI)	3.96	2.22	1.90
2% AEP (50yr ARI)	4.09	2.35	2.03
1% AEP (100yr ARI)	4.14	2.40	2.08
0.5% AEP (200yr ARI)	4.19	2.45	2.13

n refers to nautical

A2 Sea level rise and relative sea level rise

Sea level rise (SLR) is the increase in water level in the ocean caused by global climate change. There is uncertainty in the rate and magnitude of SLR, which is influenced by possible climate change emission scenarios and unknown ice sheet feedback. This uncertainty is managed by projecting a range of Shared Societies Pathways (SSPs) that represent different plausible climate futures and

[7] NIWA (2023) Coastal Inundation from sea level rise in the Auckland Region, prepared for Auckland Council. November 2023.

[8] https://www.aucklandcouncil.govt.nz/environment/what-we-do-to-help-environment/Documents/coastal-inundation-in-auckland.pdf

uncertainties. SLR for the 100 year timeframe to 2130 is 1.19 m above 2020 levels for SSP5p50 or 1.59 m for SSP5-p83 ((Table Appendix A.1).

Another variable is vertical land movement (VLM), where areas of land subsidence can experience relative sea level rise (RSLR) even if the sea level remains stable. Data for VLM and RSLR was sourced from NZ SeaRise point 1124 for this assessment (located near the naval base) which indicates subside at a rate of -0.9 ± 1.5 mm/yr (Figure Appendix A 4). Over the 100-yr timeframe to 2130, VLM is projected to lower the land by 0.11 m for the 50-percentile projection (p50) or by 0.19 m for the 83-percentile projection (p83). Including VLM creates a RSLR of 1.3 m by 2130 for the SSP5-p50 projection or RSLR of 1.78 m for the SSP5-p83 projection (Table Appendix A.2).

The 1% AEP storm tide with different RSLR projections is presented in Table Appendix A.3.

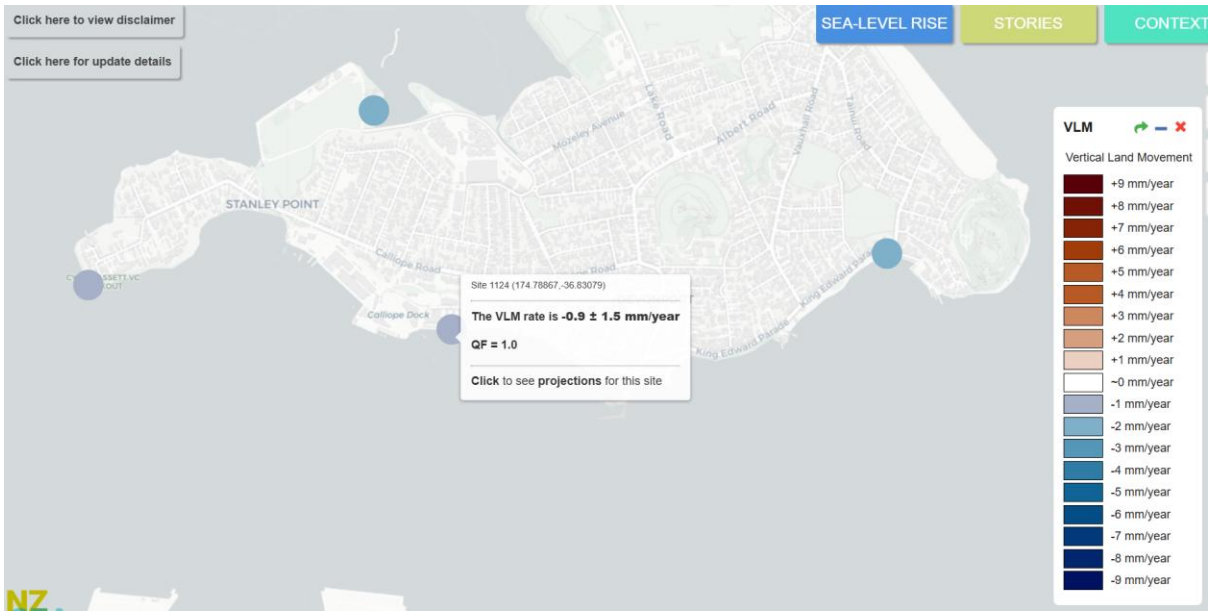

Figure Appendix A 4: NZ Sea Rise values for VLM at Site 1124.

Table Appendix A.2: Sea level rise from NZ Sea Rise Point 1124 (Queens Parade)

Year	SSP2-4.5 p50 (mRL)		SSP3-7.0 p50 (mRL)		SSP5-8.5 p50 (mRL)		SSP5-8.5 p83 (mRL)	
	No VLM	VLM	No VLM	VLM	No VLM	VLM	No VLM	VLM
2020	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2030	0.05	0.06	0.04	0.06	0.05	0.06	0.06	0.08
2040	0.10	0.12	0.10	0.12	0.12	0.14	0.13	0.18
2050	0.15	0.19	0.16	0.20	0.19	0.22	0.22	0.29
2060	0.22	0.26	0.24	0.29	0.28	0.32	0.34	0.42
2070	0.28	0.34	0.32	0.38	0.38	0.43	0.46	0.57
2080	0.35	0.41	0.42	0.49	0.49	0.56	0.61	0.74
2090	0.42	0.50	0.53	0.61	0.62	0.69	0.79	0.92
2100	0.50	0.58	0.65	0.74	0.76	0.84	0.97	1.12
2110	0.58	0.68	0.75	0.85	0.89	0.98	1.17	1.34
2120	0.67	0.77	0.88	0.99	1.03	1.14	1.38	1.55
2130	**0.75**	**0.87**	**1.01**	**1.13**	**1.19**	**1.30**	**1.59**	**1.78**
2140	0.84	0.97	1.16	1.28	1.34	1.47	1.82	2.02
2150	0.94	1.07	1.30	1.43	1.50	1.64	2.04	2.27

Table Appendix A.3: 1% AEP water level for different RSLR pathways (m, NZVD-16)

Year	SSP2-4.5 p50 (mRL)		SSP3-7.0 p50 (mRL)		SSP5-8.5 p50 (mRL)		SSP5-8.5 p83 (mRL)	
	No VLM	VLM	No VLM	VLM	No VLM	VLM	No VLM	VLM
2020	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04
2030	2.09	2.10	2.08	2.10	2.09	2.10	2.10	2.12
2040	2.14	2.16	2.14	2.16	2.16	2.18	2.17	2.22
2050	2.19	2.23	2.20	2.24	2.23	2.26	2.26	2.33
2060	2.26	2.30	2.28	2.33	2.32	2.36	2.38	2.46
2070	2.32	2.38	2.36	2.42	2.42	2.47	2.50	2.61
2080	2.39	2.45	2.46	2.53	2.53	2.60	2.65	2.78
2090	2.46	2.54	2.57	2.65	2.66	2.73	2.83	2.96
2100	2.54	2.62	2.69	2.78	2.80	2.88	3.01	3.16
2110	2.62	2.72	2.79	2.89	2.93	3.02	3.21	3.38
2120	2.71	2.81	2.92	3.03	3.07	3.18	3.42	3.59
2130	**2.79**	**2.91**	**3.05**	**3.17**	**3.23**	**3.34**	**3.63**	**3.82**
2140	2.88	3.01	3.20	3.32	3.38	3.51	3.86	4.06
2150	2.98	3.11	3.34	3.47	3.54	3.68	4.08	4.31

A3 Wave effects

Wave setup was not included in the Auckland Council mapping of coastal inundation layers for the Waitemata Harbour area (including the Devonport waterfront) as reported in GD2021/10. However, a review of possible extreme wave conditions in the Tamaki Straite and Waitemata indicates that

moderate size waves could approach from the east during extreme easterly or northeasterly wind events. The wind wave field from a NE event could potentially wrap around from the Rangitoto Channel into the harbour or being generated within the Tamaki Strait from the east. Wave setup would not be expected on the armoured sections of coast, as there would be minimal surf zone during a storm tide or spring high tide. However, wave setup is plausible from waves breaking on the beach near Windsor Reserve and may could influence static inundation levels during some events.

A previous wind wave generation model developed by T+T for the Hauraki Gulf and Waitemata Harbour was based on sustained 25 m/s (~50 knots) wind speeds for a 100 year ARI design event and produced waves offshore of Windsor Reserve of 0.85 m with a period of 3.3 s (Figure Appendix A 5). Empirical formula for wave setup associated with short period waves on beaches with a shallow foreshore, variable beach slope and a likely submerged beach crest are not readily available. Therefore, the Stockdon (2006)[9] formula with a composite foreshore slope of 0.05 was used, resulting in wave setup of 0.06 m. This is included in the coastal inundation level, added to sea level rise and storm tide.

Wave runup was also calculated from Stockdon (2006) to be 0.2 m above the storm tide water level. Wave runup effects are only considered relevant within an approximate 30 m distance from the coastal edge and are therefore not included in the 1% AEP water level for assessing inundation. Freeboard is recommended to partially account for wave effects and is discussed later.

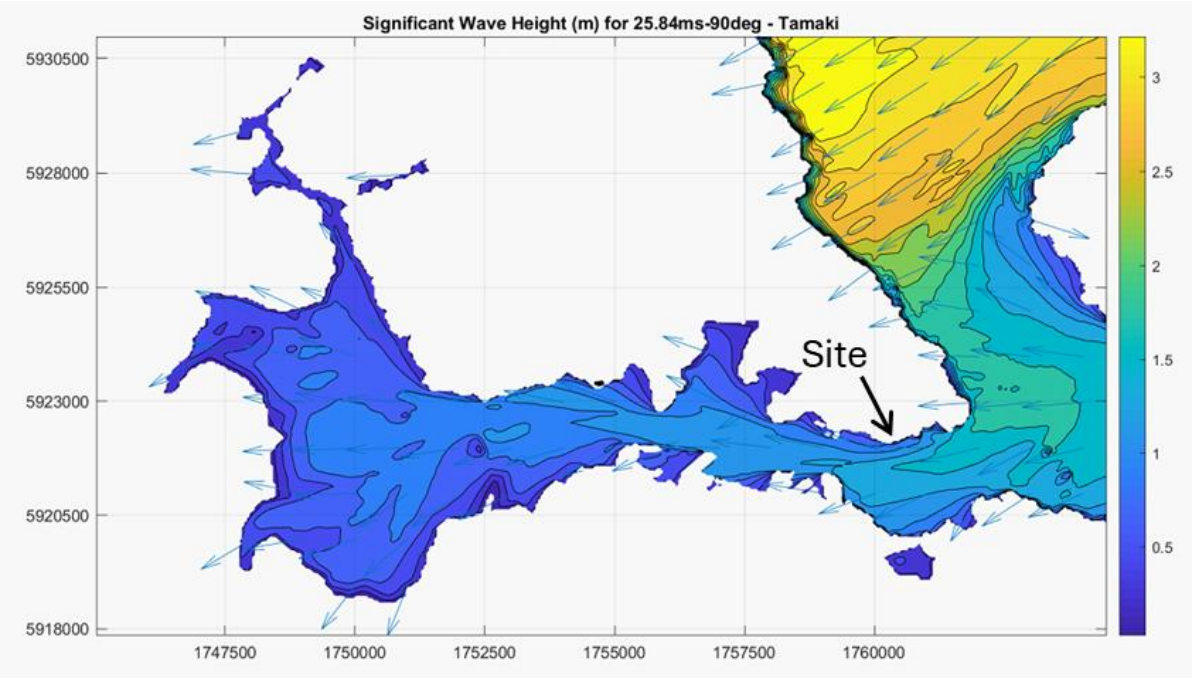

Figure Appendix A 5: SWAN model output for significant wave height (Hs, m) for design wave conditions from an easterly wind. This domain is nested into a Haruaki Gulf model.

[9] Stockdon, H. F., Holman, R. A., Howd, P. A., & Sallenger Jr, A. H. (2006). Empirical parameterization of setup, swash, and runup. *Coastal engineering*, *53*(7), 573-588.