REPORT

Tonkin+Taylor

Downtown Carpark Site Development

Coastal hazard and risk assessment

Prepared for
Precinct Properties Holdings Limited

Prepared by
Tonkin & Taylor Ltd

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1 Introduction

Precinct Properties NZ Ltd (Precinct), engaged Tonkin & Taylor Ltd (T+T) to complete natural hazard assessment studies and to assist Precinct in the substantive consent application process for the Downtown Car Park Site Development project ("Project").

The purpose of this report is to present coastal hazard information and a coastal hazard risk assessment to support the substantive application. Flood hazard assessments from rainfall flooding are reported separately.

All levels presented in this document are in New Zealand Vertical Datum 2016 (NZVD2016) referred to as reduced level (RL). An offset value of 320 mm has been applied to flood levels previously reported in Auckland vertical datum 1946 (AVD46), in line with the offset applied to the architectural drawing set of the substantive consent application.

2 Coastal hazard

2.1 Background information

The site is in Downtown Auckland CBD on the corner of Lower Hobson Street and Customs Street West. The site is located 90 m away from the coastal edge at the Downtown Ferry Basin. Street level surrounding the site varies between 3 – 4 mRL.

The coastal edge is historically reclaimed and is protected from coastal erosion hazards by engineered structures. The site is therefore not exposed to coastal erosion hazards at present day or with climate change. The site is outside of current tsunami hazard zones mapped by the Auckland Council Hazard viewer[1]. Therefore, the only coastal hazard to consider is coastal inundation.

The Auckland Unitary plan layers for natural hazards identify that the site could be exposed to coastal inundation from sea level rise. The 1% annual exceedance probability (AEP) coastal inundation overlays are presented in Figure 2.1. This shows exposure of the current site to coastal inundation based on ground level (not building platform) changes with relative sea level rise (RSLR):

- **1% AEP + 0 m RSLR**: site and surrounding streets **not exposed** to coastal inundation.
- **1% AEP +0.5 m RSLR**: site and surrounding streets **not exposed** to coastal inundation.
- **1% AEP +1.0 m RSLR**: **site not exposed** to coastal inundation, but some areas of Quay Street could be inundated by sea water.
- **1% AEP +1.5 m RSLR**: The existing site, Quay Street, and Lower Hobson Street are **exposed** to coastal inundation. Customs Street West is **not exposed** to inundation.
- **1% AEP +2.0 m RSLR**: Much of the existing site, Quay Street, and Lower Hobson Street are **exposed** to coastal inundation. Some parts of Customs Street West are exposed to inundation but not all.

[1] https://aucklandcouncil.maps.arcgis.com/apps/MapSeries/index.html?appid=81aa3de13b114be9b529018ee3c649c8

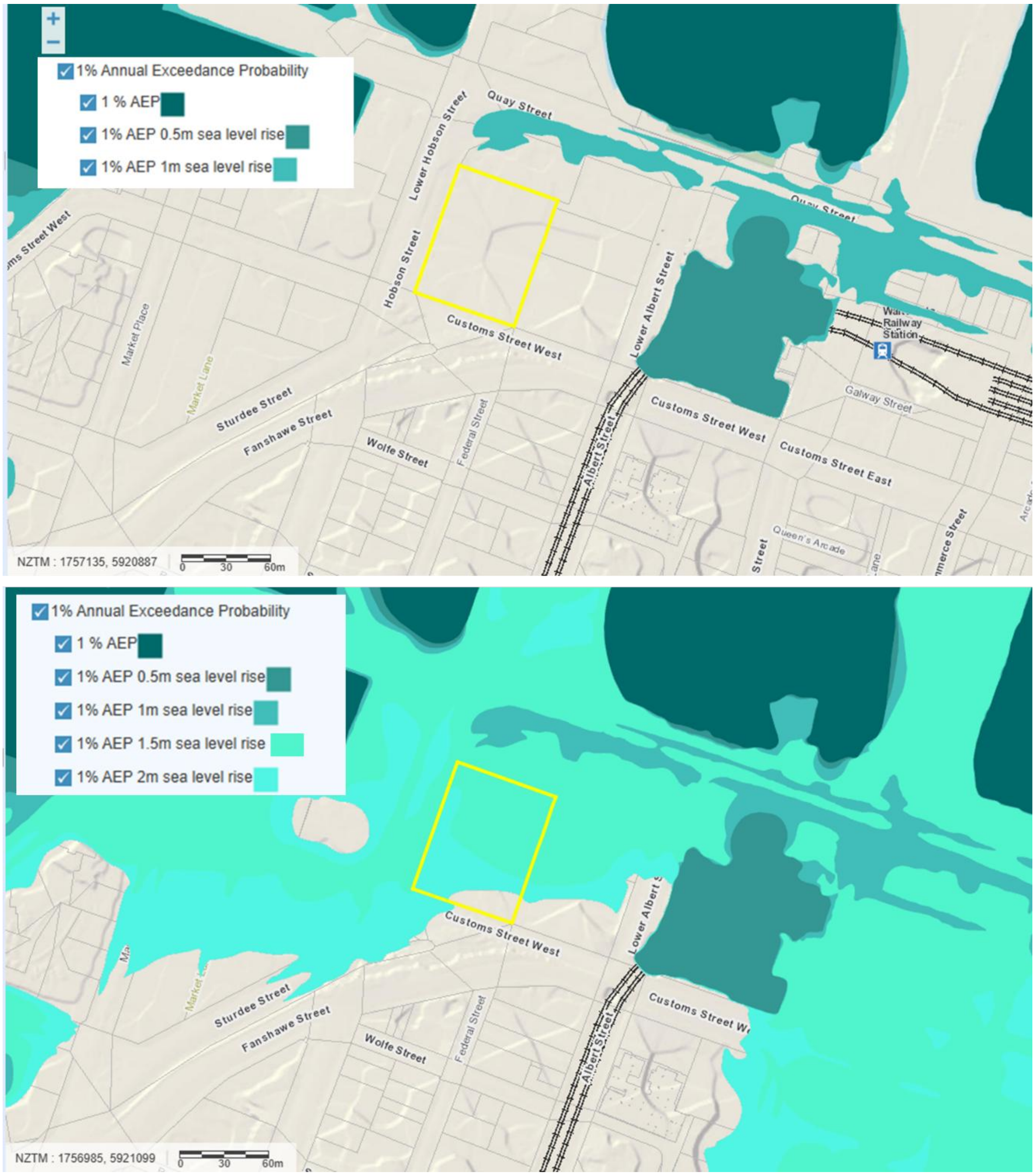

Figure 2.1: Coastal inundation overlays for the 1% AEP event with different relative sea level rise magnitudes (source: Auckland Council GeoMaps).

2.2 Assessment criteria

Auckland Unitary Plan's (AUP) Chapter E36 'Natural Hazards and Flooding' requires the completion of natural 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. Plan Change 120 which was notified on 3 November includes a draft revision of E36 which has been considered in this assessment.

This coastal inundation assessment is consistent with Auckland Council (2022) guidance for undertaking hazard assessments in the Auckland region (GD2021/10)[2] and gives effect to the New Zealand Coastal Policy Statement (2010) and considers the guidance provided by the Ministry for the Environment's 'Coastal Hazards and Climate Change Guidance for Local Government' (MfE, 2024)[3].

Auckland Council GD13[4] on Freeboard (December 2024) and notified revision to AUP E36 for the Plan Change 120 (PC120, sourced 8 October 2025) have also been considered.

The revision to AUP E36 associated with PC120 has some important updates that are material for assessing development in the context of potential future coastal hazards with climate change. This includes a change from the existing E36 that adopted a single sea level rise test for whether a site may be subject to coastal inundation (the 1% AEP storm tide plus 1 m RSLR) towards a more risk-based approach that considers a range of potential RSLR scenarios and the sensitivity of different activities. The revisions of E36 with PC120 align with recent information on climate change for the 100 year timeframe that is required by The New Zealand Coastal Policy Statement (NZCSP, 2010) and MfE (2024) guidance. This is particularly relevant for areas such as Downtown Auckland where recent climate change projections indicate greater than 1 m RSLR in the next 100 years. Therefore, the notified PC120 revisions to E36 provide a useful framework to evaluate risk of development on land potentially exposed to future coastal inundation with sea level rise.

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 average return interval (ARI) 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[5] 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 or sensitive and less-sensitive).
- 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.
- The draft AUP E36 for PC120 states that safe egress is provided for during a 1% AEP inundation event, taking into account 1.5 m relative sea level rise.

The revised AUP E36 for notified PC120 also defines new natural hazard areas, with rules according to the sensitivity of development. Based on the PC120 hazard area definitions, the proposed development is in **Coastal Hazard Area 3** (1.0 – 1.5 m RSLR). According to Table E36.3.1B.1 development in Coastal Hazard Area 3 within existing urban areas is *potentially tolerable* for sensitive activities and *acceptable* for less-sensitive activities such as parking and loading.

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

[3] https://environment.govt.nz/assets/publications/Coastal-hazards-and-climate-change-guidance-2024-ME-1805.pdf

[4] https://www.aucklanddesignmanual.co.nz/content/dam/adm/adm-website/developing-infrastructure/infrastructure-technical-guides/gd13-freeboard/FINAL_Freeboard_GD13v1_December_2024.pdf

[5] Shared Socioeconomic Pathway

Table 2.1: PC120 AUP E36 Coastal Hazard area definitions

Hazard Area	Coastal inundation definition
Coastal Hazard Area 1	Coastal inundation hazard areas taking into account a relative sea level rise of up to 0.5 m.
Coastal Hazard Area 2	Coastal inundation hazard areas taking into account a relative sea level rise of between 0.5 m and 1 m.
Coastal Hazard Area 3	Coastal inundation hazard areas taking into account a relative sea level rise of between 1 m and 1.5 m.

2.3 Coastal water levels

Relevant tide and storm tide[6] levels are presented in Table 2.2 for present day (adjusted to mean sea level in 2020). Tide levels were sourced form LINZ (2025)[7] and storm tide levels were from point ID#4 in Table 3.3 of Auckland Council Technical Report 2020/024[8], adjusted by +0.04 m to be relative to a mean sea level baseline in 2020, based on MSL values in LINZ (2025).

Table 2.2: Present day water levels

Name	Level (m, Chart Datum)	Level (m, AVD-46)	Level (mRL, NZVD-16)
Lowest Astronomical Tide (LAT)	0.08	-1.66	-1.98
Mean low water spring (MLWS)	0.52	-1.22	-1.54
Mean sea level (MSL)	1.93	0.19	-0.13
Mean high water spring (MHWS)	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

To inform a coastal inundation risk assessment for the proposed development, various relative sea level rise (RSLR) pathways were sourced from NZ Sea Rise[9] based on different future emission projections. RSLR considers vertical land movement (VLM), which in areas of land subsidence can compound with increasing ocean level to cause a higher rate of relative sea level increase.

RSLR values for the site were sourced from the closest NZ Sea Rise point (ID 1233) associated with a vertical land movement of -0.9 ± 1.5 mm/yr (i.e. subsidence). Relative sea level rise and the change in the 1% AEP water level are presented in

[6] Storm tide is storm surge on top of the astronomic tide. Storm surge is caused by low atmospheric pressure and on shore wind.
[7] https://www.linz.govt.nz/sites/default/files/doc/hydro_202425-almanac_full-nautical-almanac_pdf.pdf
[8] https://www.aucklandcouncil.govt.nz/environment/what-we-do-to-help-environment/Documents/coastal-inundation-in-auckland.pdf
[9] https://searise.takiwa.co/map/6245144372b819001837b900/embed

Table 2.3. The site is in a sheltered harbour environment with no surf zone. Therefore, wave setup is not relevant to the coastal inundation level. Some consideration for freeboard is recommended as the site could be exposed to vessel wake, small wind waves, or car wake during an inundation event.

Table 2.3: RSLR and the 1% AEP water level for different relative sea level rise pathways

Year	SSP2-4.5 p50		SSP3-7.0 p50		SSP5-8.5 p50		SSP5-8.5 p83	
	RSLR (m)	1% AEP (mRL)	RSLR (m)	1% AEP (mRL)	RSLR (m)	1% AEP (mRL)	RSLR (m)	1% AEP (mRL)
2020	0.00	2.08	0.00	2.08	0.00	2.08	0.00	2.08
2030	0.06	2.14	0.06	2.14	0.07	2.15	0.08	2.16
2040	0.12	2.20	0.12	2.20	0.14	2.22	0.18	2.26
2050	0.19	2.27	0.20	2.28	0.22	2.30	0.28	2.36
2060	0.26	2.34	0.29	2.37	0.32	2.40	0.41	2.49
2070	0.34	2.42	0.38	2.46	0.43	2.51	0.57	2.65
2080	0.41	2.49	0.49	2.57	0.56	2.64	0.73	2.81
2090	0.50	2.58	0.61	2.69	0.70	2.78	0.92	3.00
2100	0.58	2.66	0.74	2.82	0.84	2.92	1.11	3.19
2110	0.68	2.76	0.85	2.93	0.98	3.06	1.33	3.41
2120	0.77	2.85	0.99	3.07	1.14	3.22	1.55	3.63
2130	0.87	2.95	1.13	3.21	1.30	3.38	1.78	3.86
2140	0.97	3.05	1.28	3.36	1.47	3.55	2.02	4.10
2150	1.07	3.15	1.43	3.51	1.64	3.72	2.26	4.34

2.4 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 residential 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. Freeboard of 0.15 may be considered for less sensitive activities away from the coastal edge that are exposed to coastal inundation.

2.5 Inundation levels

A summary of coastal inundation levels and freeboard scenarios used to inform coastal hazard exposure of the development are in Table 2.4 below.

Table 2.4: Coastal inundation and freeboard scenarios and levels

Activity	AEP	Timeframe	Climate Scenario	Water level (mRL)	Freeboard (m)	Total (mRL)
Floor level for non-habitable or less-sensitive activities	1% AEP	2130	SSP5p50+VLM	3.38	0.15	3.55
Floor level for non-habitable or potentially sensitive activities	1% AEP	2130	SSP5p50+VLM	3.38	0.3	3.7
Floor level for habitable or sensitive activities	1% AEP	2130	SSP5p50+VLM	3.38	0.5	3.9
Safe egress: PC 120 E36.3 (5K)	1% AEP	n/a	1.5 m RSLR	3.58	n/a	3.6
MfE (2024) Stress Test	1% AEP	2130	SSP5p83+VLM	3.86	n/a	3.9

3 Proposed development

The proposed development is outlined in detail in the architectural plans. The drawings in "20251003_WAM_DTW_FTA_Doc-A_Architectural-Drawings_Revision-A.pdf" dated 3 October 2025 was referred to for informing this assessment.

Key elements of the development that are potentially at risk to coastal inundation hazards include:

Basement levels and access:

- Vehicle access to the basement is via a 'Service Lane' that connects Quay Street and Customs Street West. The lane goes north to south between the site and the HSBC/AON buildings. Ground level at the Quay Street entrance to the Service Lane is 3.11 mRL on the ground plan, which slopes down to the basement carpark entrance (2.78 mRL). Ground level at the Customs Street West entrance to the Service Lane is 5.22 mRL.
- The development has four basement levels with varying use:
  - 'Basement 01' includes the building power plant and 'back of house' facilities for building staff. This level would be considered '*sensitive'* to flooding from coastal inundation as it hosts critical infrastructure for the building.
  - The lower three levels ('Basement 04 to 02') are for primarily for carparking which is considered a '*less-sensitive*' activity in the PC120 version of E36.
  - The lowest level (B4) has a fuel storage area with bulk diesel tanks that are corrosion resistant and double skinned with vents. Fuel tanks would be considered *sensitive* to flooding from coastal inundation as they are classified as a hazardous facility.
- Flood barriers and/or land contouring are proposed at both the Quay Street and Customs Street West entrance to prevent water ingress to the Service Lane during flood conditions. The locations of these flood barriers are show in drawing FTA-10-100 of the architectural plans noted above. Design of these flood barriers are yet to be finalised, but their design intent is to prevent water ingress to the Service Lane and basements. Further discussion on the design options under consideration is provided in the T+T Flood Hazard and Risk Assessment report.
  - Potential flow pathways for coastal inundation to enter the basement could also occur even with the flood barrier.

Ground level:

- The development is on a raised platform with finished ground and floor levels of 'Level 00' set to 4.18 mRL (NZVD-16). Level 00 includes a variety of retail, hospitality and lobby areas. This level would be '*potentially sensitive*' to flooding from coastal inundation as it is not critical infrastructure or habitable but is used commercially and for access to upper floors.
- The minimum required elevation of Level 00 is 3.7 mRL based on a 1% AEP water level in 2130 with the SSP5-8.5p50 scenario with VLM and 0.3 m freeboard. The proposed level provides greater resilience from less frequent events and higher levels of sea level rise.

Safe access and egress:

- Access in and out of the building is available via Customs Street West (street level of 5.22 mRL) and via a lobby at Lower Hobson Street (~3.2 mRL).
- The finished floor of Level 00 is elevated to a suitable level for safe refuge during an event that could allow people to shelter in place until the tide drops. The minimum required level for safe egress in PC120's E36 is the 1% AEP coastal inundation with 1.5 m RSLR, which is a level of 3.6 mRL at this site. This means that evacuation from the building during a significant event with this amount of RSLR would need to be via Customs Street West.

First floor and above:

- The development has seven levels that span the site before extending into two towers up to 44 stories (Tower 2) and 53 stories (Tower 1). These levels are not exposed to coastal inundation hazards.

4 Coastal hazard risk assessment

4.1 Approach

Our coastal hazard assessment considers potential risks relating to coastal inundation, based on a '*risk-based approach'*. This approach provides a structured way of making decisions that starts with a formal risk assessment—identifying, analysing and evaluating risks—focused on how exposure and vulnerability change over time with climate-driven hazards. An overview of the risk assessment methodology is provided in Appendix A. This section tests elements of the development against future relative sea level rise for a 100 year timeframe and stress-tests residual risk of adaptation options, consistent with ISO adaptation and risk management standards (ISO 14091:2021).

Based on the development plans and coastal hazards outlined above, five potential 'risk elements' have been identified (refer):

1. Basement parking.
2. Basement infrastructure services.
3. Basement fuel storage.
4. Level 00 (ground floor of development).
5. Provision for safe egress and refuge.

The timing of when these elements could be exposed to coastal inundation is outlined in Table 4.1, based on the different SSP pathways, assuming a situation where there is no flood barrier active across the Service Lane.

Table 4.1: Element exposure to inundation

Element	Asset level (mRL)	Year first exposed to 1% AEP coastal inundation			
		SSP2-4.5 p50	SSP3-7.0 p50	SSP5-8.5 p50	SSP5-8.5 p83
1 Basement carpark 2 Basement services 3 Basement fuel storage	3.105 [A]	2140	2130	2120	2100
4 Level 00	4.18	>>2150	>>2150	>>2150	2150
5 Safe egress	5.22	>>2150	>>2150	>>2150	>2150

[A] based on surveyed height of Service Lane at Quay Street as shown on plan and not including flood barrier.

4.2 Developed ground floor (level 00)

Level 00 is designed to have a minimum ground and finished floor level of 4.18 mRL. This is above the coastal inundation level with freeboard (3.9 mRL) for 2130 and above the 1% AEP level with 1.5 m RSLR scenario. This designed ground level also allows 0.32 m freeboard above the MfE (2024) stress test scenario based on the SSP5-8.5 p83 pathway with VLM.

The risk of coastal inundation to level 00 over the next 100 years is ***insignificant*** because exposure to the hazard has been avoided in designing the building platform to be above the inundation level.

4.3 Safe refuge and egress

Access to and from the building via Customs Street West will not be disrupted by coastal inundation for the 1% AEP + 1.5 m RSLR test. The elevation of Customs Street West is sufficient to allow emergency access during a coastal inundation event for pedestrians and vehicles.

The risk of coastal inundation to emergency egress over the next 100 years is ***insignificant*** because access to Customs Street West will still be safe with the 1% AEP event +2.0 m RSLR. Safe refuge is also an option for this development as lobby space on Level 00 will be above the coastal inundation level.

4.4 Basement elements

4.4.1 Onset of basement flooding

Onset of flooding to the basement is not predicted until sea level exceeds the ground level at the Quay Street entrance to the Service Lane which is 3.105 mRL (assuming no operating flood barrier).

Based on the range of climate change pathways, the earliest that the 3.105 mRL threshold is predicted to be exceeded by the 1% AEP water level is between 2090 and 2100 for the stress test climate pathway of SSP5-8.5p83+VLM (Table 4.1). The associated 50 percentile pathway of SSP5-8.5p50+VLM indicates the onset of inundation to be 2120 (Table 4.1). Therefore, this is not a present-day or short-to medium term risk but a possible long term risk to be monitored and mitigated as needed in the future.

The development design has included a flood barrier at both Service Lane entrances to mitigate the risk of flooding entering the basement. By 2130 the flood barrier on the Quay Street side of the Service Lane should have a crest level that is around 1 m above ground level. This would allow some freeboard above the SSP5-8.5p50+VLM scenario and accommodates the SSP5-8.5p83+VLM scenario.

The risk of coastal inundation to basement carparking, infrastructure and fuel storage over the next 50 to 80 years is ***insignificant*** because the coastal inundation level is below the Service Lane entrance level. The risk of coastal inundation over the next 100 years may require mitigation. This is based on the 1% AEP inundation level being predicted to overtop the Service Lane around 2100, depending on the climate change pathway realised.

4.4.2 Basement Carparking with flood barrier

This assessment considers carparks as *less sensitive* to inundation. With the current **mitigation** plan of a **flood barrier**, and assuming no significant seawater inflow through the HSBC building or ingress through catchpit drains, the risk to the basement carparks can be classed as ***insignificant*** as water would not enter the basement, assuming the barrier is suitably designed, maintained, and deployed during any event.

4.4.3 Basement infrastructure services with flood barrier

The infrastructure assets are primarily on B1 with some on B2 and are considered more sensitive to water flow than the basement parking levels, and the consequence of damage to these assets could be damage and disruption to building power and communications infrastructure.

With the current **mitigation** plan of a **flood barrier** the risk to infrastructure on B1 from coastal inundation over 100 years can be classed as ***low***.

4.4.4 B4 fuel storage with flood barrier

The fuel storage on B4 are considered more sensitive to water flow than the basement parking levels, and the consequence of damage to these assets is greater due to potential contamination.

With the current **mitigation** plan of a **flood barrier** the risk to fuel storage on B4 from coastal inundation over 100 years can be classed as ***low***.

4.4.5 Residual risks

Residual risk is defined as the level of risk to people, property, and the environment that remains after all reasonable and practicable mitigation measures to avoid or reduce the impacts of natural hazards have been implemented.

This section considers the potential risk of both events that exceed the design parameters (i.e. an over design event) as well as potential risk resulting in failure of the flood mitigations that are part of the design.

Other inflow pathways

It is not possible to rule out potential water inflow to the Service Lane from seawater flowing through the HSBC building. While there are several doors and walls that would block and slow water, this flow path may be possible from around 2100 (Table 4.1)[10]. The likelihood of this occurring is unknown, and the potential volume is also unknown, allowing about 75 years to upgrade flood resistance of the HSBC building if this need is triggered to protect assets inside that building.

An overdesign event

Storm surge for a 0.5% AEP (1 in 200 year event) is only 5 cm higher than the 1% AEP event (refer Table 2.2) and this increase is adequately addressed in the freeboard allowances. Potential for higher rates of sea level rise for the ground floor are managed through consideration of the SSP5-8.5H+ stress test and Table 2.4 shows inundation is unlikely to occur prior to 2150.

Flood barrier failure

[10] Assuming floor level is on grade with ground level inflow to the Service Lane

The potential for coastal inundation to the basement and Service Lane up to 2130 is managed through the provision of a flood barrier. There is a residual risk from around 2100 if this element should fail with the high emission sea level rise scenarios.

If the flood barrier fails, the potential flood depth inside the basement could exceed 1.2 m in 2130 for a 1% AEP event which is the depth threshold for very high exposure (Appendix A). This would likely occur on the lowest of the four basement levels (B4) but could wet elements on B1 - B3 as seawater moves down to B4.

In the case of a barrier failure, the risk to the **basement carparking** in 2130 is classed as ***medium*** as damage would be limited to assets such as cars that can be managed removing assets before the event and the structural components could be designed to be saltwater resilient.

In the case of a barrier failure, the risk to the **infrastructure services on B1 and B2** in 2130 is ***very high*** as critical plant infrastructure could be affected by sea water inundation, causing disruption to the building operation.

In the case of a barrier failure, the risk to the **fuel storage on B4** in 2130 is ***very high*** due both to the hazardous substance as well as the potential for leaks and contamination that could occur if the basement is inundated by seawater.

Secondary mitigation options may need to be considered after 50 - 75 years (e.g. by 2080 to 2100) to manage residual risk of coastal inundation to the basement in the case of a flood barrier failure. These options could include:

- Raising the ground level approaching the Service Lane above 3.7 mRL to prevent sea water flowing into the basement access.
- Designing the basement to convey any inflow towards a sump at the lowest level, with a flood management scheme and pumps designed to reduce risks to any assets and services in that area.
- Placing essential services on the B1 level on a suitable plinth above the floor to reduce exposure to inundation that could pond on this level.
- Having essential services in rooms with flood proof doors and walls.

4.5 Effects on neighbours

The building design and flood barrier mitigation will not adversely affect neighbours’ exposure to coastal inundation hazards. This is because coastal inundation from the sea is time and level limited but is not volume limited and is therefore not mass-balanced like catchment flows. For example, neighbouring areas that would be exposed to the same hazard will have the same exposure after the development is complete. Likewise, neighbouring areas that are not exposed will remain unexposed after this development is complete.

4.6 Risk summary

The proposed development is situated in a coastal inundation hazard area subject to future coastal inundation exposure with sea level rise of between 1.0 and 1.5 m. The proposed design mitigates significant coastal inundation risk through the design elements of floor level elevation for the ground floor and a flood barrier to the Service Lane and basement car parking area, with the resultant risks being low to negligible for at least the next 100 years.

Residual risks have been identified and quantified. There are possible adaptation options to manage residual risk to the basement areas that could be considered in the present design, or accommodated in future works, closer to the time where adaptation responses are needed.

The proposal enables both safe egress and safe refuge during significant events and the proposal avoids creating or exacerbating coastal inundation risk on other properties, infrastructure and the environment.

5 Applicability

This report has been prepared for the exclusive use of our client Precinct Properties Holdings Limited, 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 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. We understand and agree that this report will be used by the Expert Panel in undertaking its regulatory functions.

Compliance with the Environment Court Practice Note 2023

We confirm that, in our capacity as authors of this report, we have read and abided by the Environment Court of New Zealand's Code of Conduct for Expert Witnesses contained in the Practice Note 2023

Dr Eddie Beetham: I am a Senior Coastal Geomorphologist at Tonkin & Taylor Ltd (T+T). I specialise in coastal hazards. I have worked at T+T since 2019. Prior to joining T+T, I was a Research Fellow at The University of Auckland. I have 12 years' experience in coastal processes and hazards. I am a member of the New Zealand Coastal Society management committee. I hold the following qualifications – PhD, MSc, BSc [Hons].

Richard Reinen-Hamill: I am a Technical Director: Coastal Engineering at Tonkin & Taylor Ltd (T+T). I specialise in coastal hazard risk assessments. I have worked at T+T since 1994. I have more than 35 years' experience in coastal engineering. I am a Member of Engineering New Zealand (Fellow). I hold the following qualifications – BE (hons), ME.

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Appendix A Risk assessment methodology

Risk assessment approach

Risk is a combination of the likelihood of a hazard causing damage / disruption and consequence of that damage / disruption. The general model for risk is presented in Figure Appendix A.1:, based on the following variable descriptions:

- **Exposure**: How much of the asset (e.g. percent asset area or length of shoreline) is exposed to the hazard and to what level or magnitude for different probabilities (e.g. flooded to a depth of 1 m in a 1% AEP event).
- **Sensitivity**: How resilient or sensitive is the asset to the hazard once exposed. For example, cladding on the interior of a building can be significantly damaged if submerged in seawater. However, a paved surface has low sensitivity to static inundation as operational function would return with minimal clean up once the water recedes.
- **Adaptive capacity**: How easily / efficiently an at-risk element can adapt or be adapted when exposed to the hazard.
- **Vulnerability**: The combination of **sensitivity** and **adaptive capacity.**
- **Likelihood:** The combination of **vulnerability** and **exposure**.
- **Consequence:** The magnitude of impact that result from an element being damaged or disrupted by the hazard, directly and indirectly.
- **Risk**: The combination of **likelihood** and **consequence**.

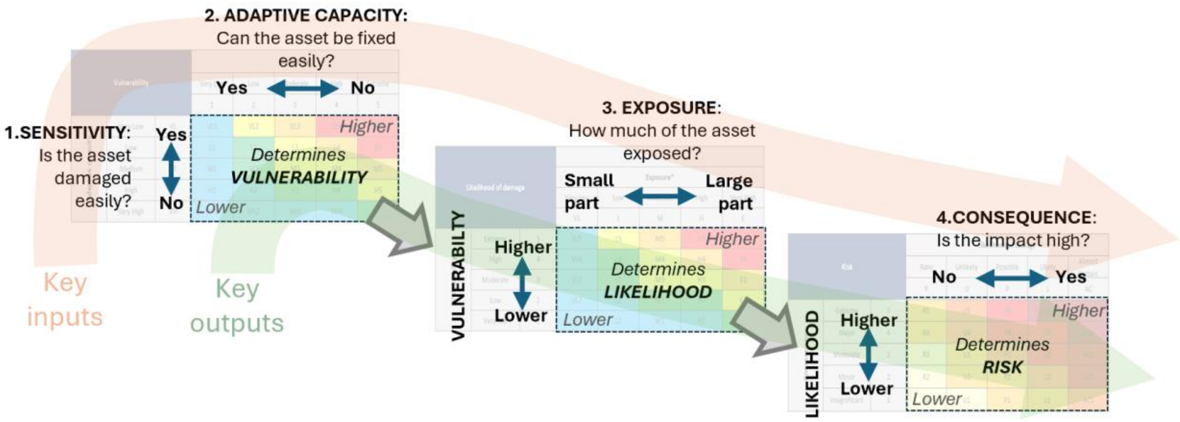

Figure Appendix A.1: Adopted risk assessment model.

Rating definitions

A summary of the rating definitions used for the risk assessment are presented in the tables below.

Exposure rating	Inundation categories
Very high	Depth >1.2 m
High	Depth 0.5 to 1.2 m
Moderate	Depth 0.3 to 0.5 m
Low	Depth 0.15-0.3 m
Very Low	Depth <0.15

Sensitivity rating	Definition
Extreme	Extremely likely to be adversely affected, because the element or asset is extremely sensitive to a given hazard.
High	Highly likely to be adversely affected, because the element or asset is highly sensitive to a given hazard.
Moderate	Moderately likely to be adversely affected, because the element is moderately sensitive to a given hazard.
Low	Low likelihood of being adversely affected, because the element has low sensitivity to a given hazard.
Very Low	Very low likelihood of being adversely affected, because the element has low sensitivity to a given hazard.

Adaptive capacity rating	Definition
Very low	The organisation, element or asset has a very low capacity to adapt. Major capital works required to continue operating or achieve compliance, requiring international expertise.
Low	The organisation, element or asset has a low capacity to adapt. Significant capital works required to continue operating or achieve compliance, requiring national expertise.
Medium	The organisation, element or asset has a moderate capacity to adapt. Some down time in operation, requiring specialist repairs to return to safe operation.
High	The organisation, element or asset has a high capacity to adapt. Local repairs or maintenance with minimal disruption.
Very High	The organisation, element or asset has a very high capacity to adapt. No repairs required and operation returns after the tide turns.

Consequence rating	Definition
Extreme	Significant damage or loss of infrastructure and service Total disruption to residents
Major	Extensive infrastructure damage Severe disruption to residents
Moderate	Limited infrastructure damage and loss of service Frequent disruptions to residents
Minor	Localised infrastructure serviced disruption short-term disruption to residents
Insignificant	No damage, little change in service No disruption

Appendix B Risk assessment table

Key Questions	*The level of exposure of the risk element to the climate hazard?*	*How sensitive is the risk element to the hazard?*	*Assuming low adaptive capacity*		How does the impact of this risk affect the operation?

Climate Hazard / Driver	Risk element	Risk Statement	Exposure			Exposure rating justification	Sensitivity	Sensitivity rating justification / comments	Vulnerability	Combined likelihood (Exp x Vuln)			Consequence	Risk (Exposure x Sensitivity x Adaptive Capacity x Consequence)		
			2080 SSP5p50	2130 SSP5p50	2130 SSP5p83					2080 SSP5p50	2130 SSP5p50	2130 SSP5p83		2080 SSP5p50	2130 SSP5p50	2130 SSP5p83
Inundation	Level 00	Water damage and disruption to services	Very low	Very low	Very low	Design level of 00 is above coastal inundation levels	Moderate	Non-habitible	Moderate	Rare	Rare	Rare	Moderate	Insignificant	Insignificant	Insignificant
Inundation	Access and egress	Restriction on lifeline access to the building.	Very low	Very low	Very low	Level of Custom St West is above coastal inundation levels	High	AUP requirement for safe egress	High	Rare	Rare	Rare	Major	Low	Low	Low
Inundation	Basement services B1-B2: With Flood Barrier	Damage to electrics/services. Unsafe for people.	Very low	Very low	Very low	2130 flood barrier active and required to prevent inflow.	Extreme	Power plant and working areas	Extreme	Rare	Rare	Rare	Extreme	Low	Low	Low
Inundation	Basement carparks B2-B4: With Flood Barrier	Damage to vehicles	Very low	Very low	Very low	2130 flood barrier active and required to prevent inflow.	Low	Parking level	Low	Rare	Rare	Rare	Moderate	Insignificant	Insignificant	Insignificant
Inundation	Basement fuel storage B4: With Flood Barrier	Contamination	Very low	Very low	Very low	2130 flood barrier active and required to prevent inflow.	High	Fuel tanks inundated	High	Rare	Rare	Rare	Extreme	Low	Low	Low
Inundation: residual risk	Basement services B1-B2: No Flood Barrier	Damage to electrics/services. Unsafe for people	Very low	Moderate	High	Seawater enters basement in 2130 for p50 and p83	Extreme	Power plant and working areas	Extreme	Rare	Likely	Almost Certain	Extreme	Low	Very High	Very High
Inundation: residual risk	Basement carparks B2-B4: No Flood Barrier	Damage to vehicles	Very low	Very High	Very High	Seawater enters basement in 2130 for p50 and p83	Low	Parking level	Low	Rare	Possible	Possible	Moderate	Insignificant	Medium	Medium
Inundation: residual risk	Basement fuel storage B4: No Flood Barrier	Contamination	Very low	Very High	Very High	Seawater enters basement in 2130 for p50 and p83	High	Fuel tanks inundated	High	Rare	Almost Certain	Almost Certain	Extreme	Low	Very High	Very High

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