



# Evans Bay Intermediate School

## Coastal Inundation Adaptive Pathway Report

# Adaptive Pathway: Evans Bay Intermediate School

This adaptive pathway has been prepared for the Ministry of Education by WSP NZ Ltd. and is intended to advise possible adaptation pathways and give an indicative timeframe of these pathways in current and future climates.

This adaptive pathway document is required to be read with the "Guidance Document: Adaptive Pathway to Coastal Inundation" (WSP, 2023).

## Site Overview

School Name	Evans Bay Intermediate School
School ID	2837
MoE Region	Central South
Number of buildings on school site	7

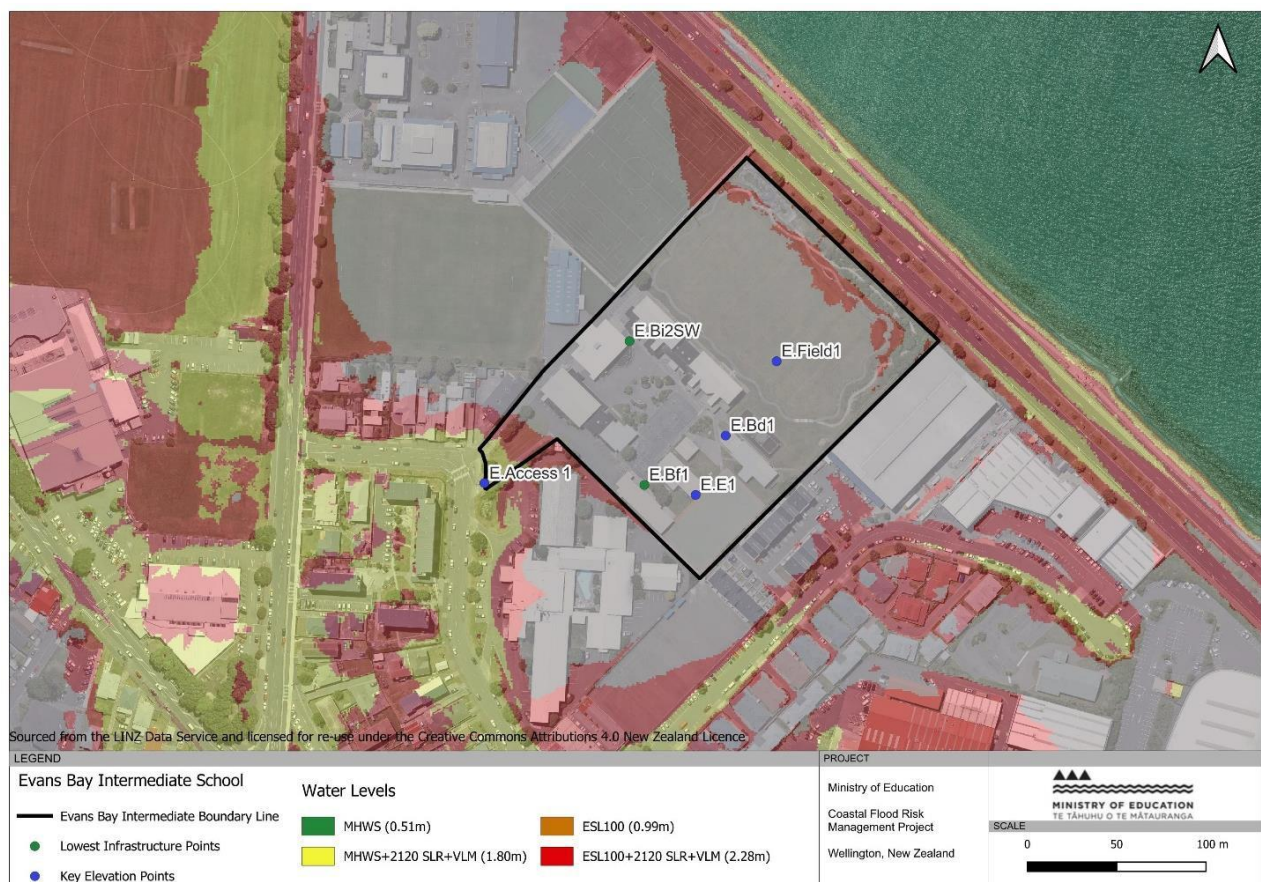


Figure 1 - Map of Evans Bay Intermediate School with the indicative inundation zones based on land elevation from LiDAR.

Latitude	-41.315375
Longitude	174.797044
Community Setting	School grounds are at same elevation as the community, therefore likely to have similar flooding from the coast. The surrounding water body is the Wellington Harbour / Te Whanganui-a-Tara Harbour.
Community Emergency Hub	No – Evans Bay Intermediate is not a community Emergency Hub
General Subsidence/Tectonics information	The Evans Bay / Kilbirnie area is subsiding at a rate of -2.85 mm per year (Site 2506) (NZSeaRise Takiwa Programme, 2022).

## Key Elevation Points

Note: Points are in NZVD 2016.

Access / Egress Points	Vehicle and Pedestrian Access (Access 1) – 1.61 m	
Lowest Finished Floor Levels	Block D North (E.Bd1) – 3.03 m	Block E South Entrance (E.E1) – 3.08 m
Lowest Infrastructure levels	Block F Stormwater Sump (E.Ff1) – 2.64 m	Block I Stormwater Sump (E.Bi2SW) – 3.05 m
Coastal Defences	Cobham Drive (Based on LiDAR) – 2.12 m	Suburb of Kilbirnie (Based on LiDAR) – 4.0 m

## Water levels (current and future)

Note: Points are in NZVD 2016.

MHWS	0.51 m	ESL100 + 2050 SLR (+VLM) <sup>1</sup>	1.36 m
MHWS + 2120 SLR (+VLM) <sup>2</sup>	1.80 m	ESL100 + 2070 SLR (+VLM) <sup>3</sup>	1.58 m
ESL100	0.99 m	ESL100 + 2120 SLR (+VLM) <sup>4</sup>	2.28 m

<sup>1</sup> This reference level is the ESL100 (0.99 m) with the 2050 (+VLM) SLR scenario (0.37 m) added to it.

<sup>2</sup> This reference level is the MHWS (0.51 m) with the 2120 (+VLM) SLR scenario (1.29 m) added to it.

<sup>3</sup> This reference level is the ESL100 (0.99 m) with the 2070 (+VLM) SLR scenario (0.59 m) added to it.

<sup>4</sup> This reference level is the ESL100 (0.99 m) with the 2120 (+VLM) SLR scenario (1.29 m) added to it.

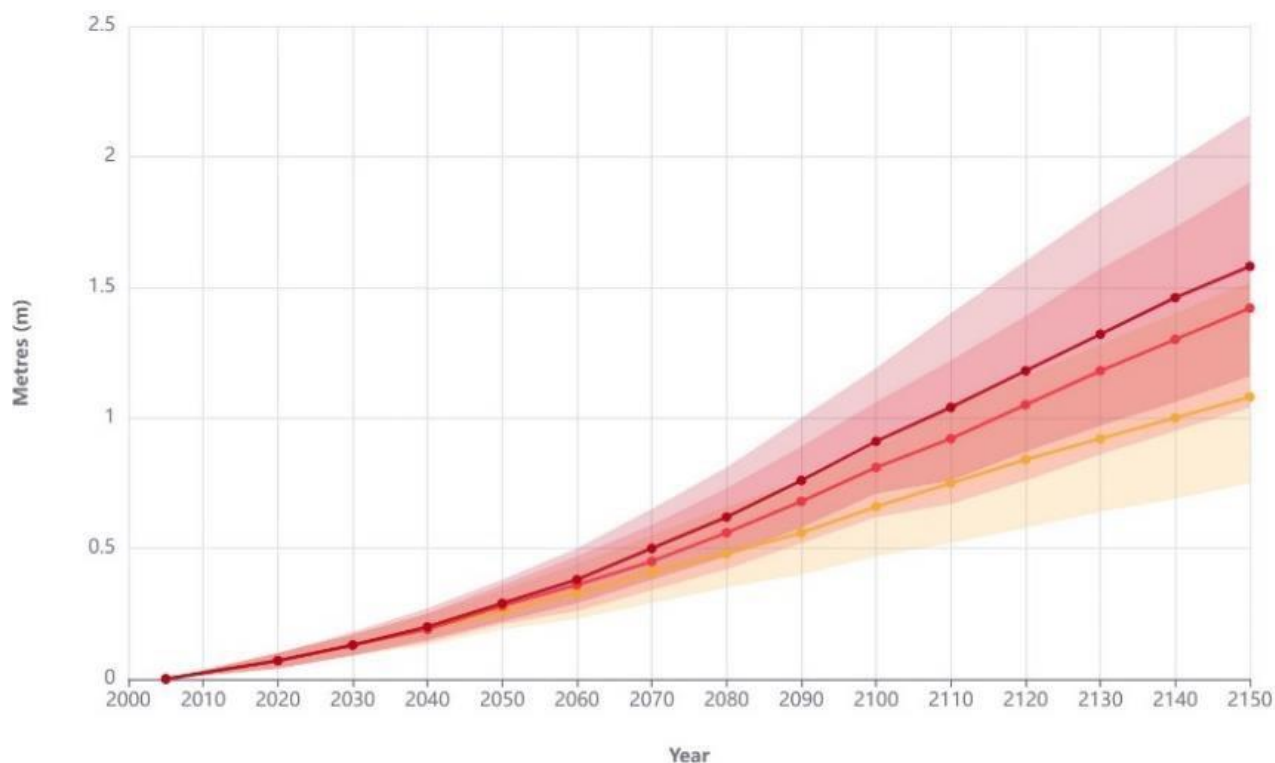


Figure 2 - Sea level rise (SLR) increments<sup>5</sup> with vertical land movement under potential climate change scenarios (SSP2-4.5+VLM in orange, SSP3-7.0+VLM in red and SSP5-8.5 in deep red) and likely confidence intervals (faded colour blocks) (NZSeaRise Takiwa Programme, 2022). MfE (2022) recommends that the median (p50) SSP3-7.0+VLM is used.

## Background / Summary of Coastal Inundation Risk

### Local, district regional adaptation and infrastructure plans

The readily available relevant local, district and regional plans that provide guidance to understand and adapt to climate risks applicable to Evans Bay Intermediate School are listed in the Appendix C of this document and summarised below.

Greater Wellington Regional Council and Wellington City Council are in the process of undertaking risk assessments and establishing adaptation plans for the area to ensure community resilience to climate change in the future. Multiple reports have been commissioned from the city council to understand the level of exposure and the level of risk of the area to coastal hazards into the future. Waka Kotahi, who are responsible for the State Highway located between Evans Bay Intermediate and the inner Wellington Harbour, outline specific adaptation strategies they will build into their long-term planning of their assets. However, there is no specific evidence (as of yet) in these plans if they may include works to the inner harbour coastline and Kilbirnie coastline around the school.

It is recommended that Evans Bay Intermediate School and the Ministry of Education liaise with these parties to collaborate on appropriate mitigation/adaptation strategies for the school and its community and mana whenua.

<sup>5</sup> Sea level rise increments added to MHWS and ESL100 are the median values on the NZSeaRise programme charts as there are associated confidence intervals associated with each scenario.



## Elevation Profile

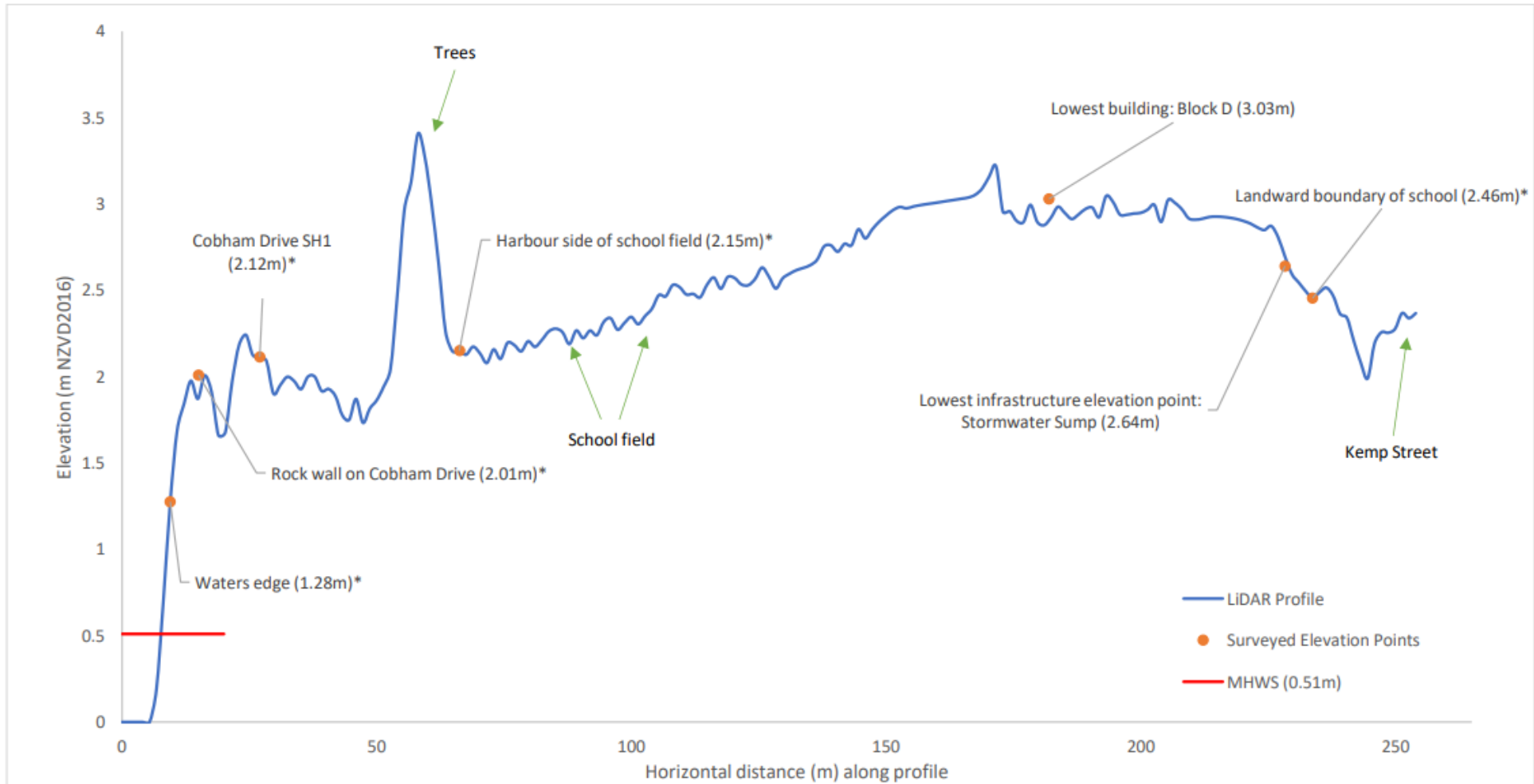


Figure 3 – Indicative profile extracted from LiDAR (1m DEM) and surveyed elevation points on site

## Risk of Coastal Inundation (Past/Current/Future)

See Appendix B for further information.

Period	Vulnerability	
	MHWS	ESL100
Current	Low	Low
Short-term (Present-2050)	-	Low
Medium-term (2050-2070)	-	Low
Long-term (2070-2120)	Low	Low

## Other Hazards

### School anecdotal evidence

No recorded or anecdotal flooding from coastal inundation, based on on-site conversations with the school principal and administration or limited search online.

### Infrastructure

Cobham Drive which is part of State Highway 1 is located between the school and the Wellington Harbour, the suburb of Kilbirnie is located between the school and Lyall Bay on the south coast / Cook Strait.

### Other types of flooding

No anecdotal or recorded flooding from fluvial sources. Evans Bay Intermediate School has experienced surface flooding around the school site after heavy rainfall. Ponding of water on the school field (survey point E.field1 on map) formed in 2020 and has never fully receded, even during drier months. As a result, use of that half of the school field has been restricted. Size of ponding water fluctuates with rainfall, where it will expand towards the south-western corner of the school grounds under heavy and consistent rainfall. School administration state that investigations have been completed, however no cause was found.

MoE Update: conversations with the school Property Advisor in July 2023 indicate that the problem may now be resolved. Since this report was drafted by WSP, Wellington Water investigated and fixed a large mains leak, and subsequently the field, and other local areas, have been dry.

### Erosion

Erosion potential of the coastline within the inner Wellington Harbour is regulated by the rock revetment operated and maintained by Waka Kotahi New Zealand Transport Agency. More detailed investigations into the erosion trends of the stretch of coastline is required to make an accurate judgement on the erosion potential of the beach, particularly associated with increasing sea levels.

## Preferred Adaptive Pathway

The preferred adaptive pathway for Evans Bay Intermediate School has been suggested due to its practicality, taking the school's current vulnerability into consideration as well as any future increase in vulnerability with predicted rises in sea level. The pathway anticipates the possibility of future community-level conversations and activities that the Ministry of Education and school should be aware of and consider contributing to as well.

The short-term pathway for Evans Bay Intermediate School should be considered, i.e. finding the cause of the small-scale surface water flooding issue on the school field, and potentially addressing this through relatively minor and cost-effective options. (See MoE Update note on Page 5.)







In the future, the long-term pathway for Evans Bay Intermediate School should be to continue with a 'Business as Usual' approach, as the school has a low vulnerability to coastal inundation.

The preferred adaptive pathway is subject to monitoring of the site and community, and monitoring by the Ministry of Education of how the preferred pathway responds to sea level rise. As it is adaptive, it also suggests/assumes that the Ministry of Education will review the pathway options at regular intervals (at least every 10 years), before significant changes to school site, or, after a coastal inundation event.





The preferred adaptive pathway suggested for Evans Bay Intermediate School considers the coastal inundation (flooding) risk and does not consider/include the impact of pluvial and fluvial inundation, the erosion of the coastal shoreline, the demographic changes associated with the school such as the school roles and the forthcoming asset management interventions to enhance current school assets.

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### Preferred Adaptive Pathway – Short Term (Present-2050)

Pathway Approach	Business as Usual and Accommodate	 
Preferred Pathway	Consider investigating the surface flooding on the school field and consider stormwater improvements on the school field (to reduce current exposure to other flooding hazards to the site). Consider also maintaining other existing infrastructure and continue emergency management and environmental monitoring activities to existing level of service.	   
Trigger Points	The trigger for investigations into the flooding on the field has been reached due to the current observed flooding of the school field.*	

### Preferred Adaptive Pathway – Medium Term (2050-2070)

Pathway Approach	Business as Usual	
Preferred Pathway	Consider maintaining other existing infrastructure and continue emergency management and environmental monitoring activities to existing level of service.	 
Trigger Points	If flooding of field occurs again then trigger to start to investigate the drainage of the whole school site.*	

## Preferred Adaptive Pathway – Long Term (2070-2120)

Pathway Approach	Business as Usual	
Preferred Pathway	Consider maintaining other existing infrastructure and continue emergency management and environmental monitoring activities to existing level of service.	  
Trigger Points	If any flooding from coastal inundation occurs on the school site, review SLR and adaptive pathway of the school. Indicative timeframe for when this could occur is from 2100.	

\*: See MoE Update note on Page 5



## PATHWAYS EVANS BAY SCHOOL

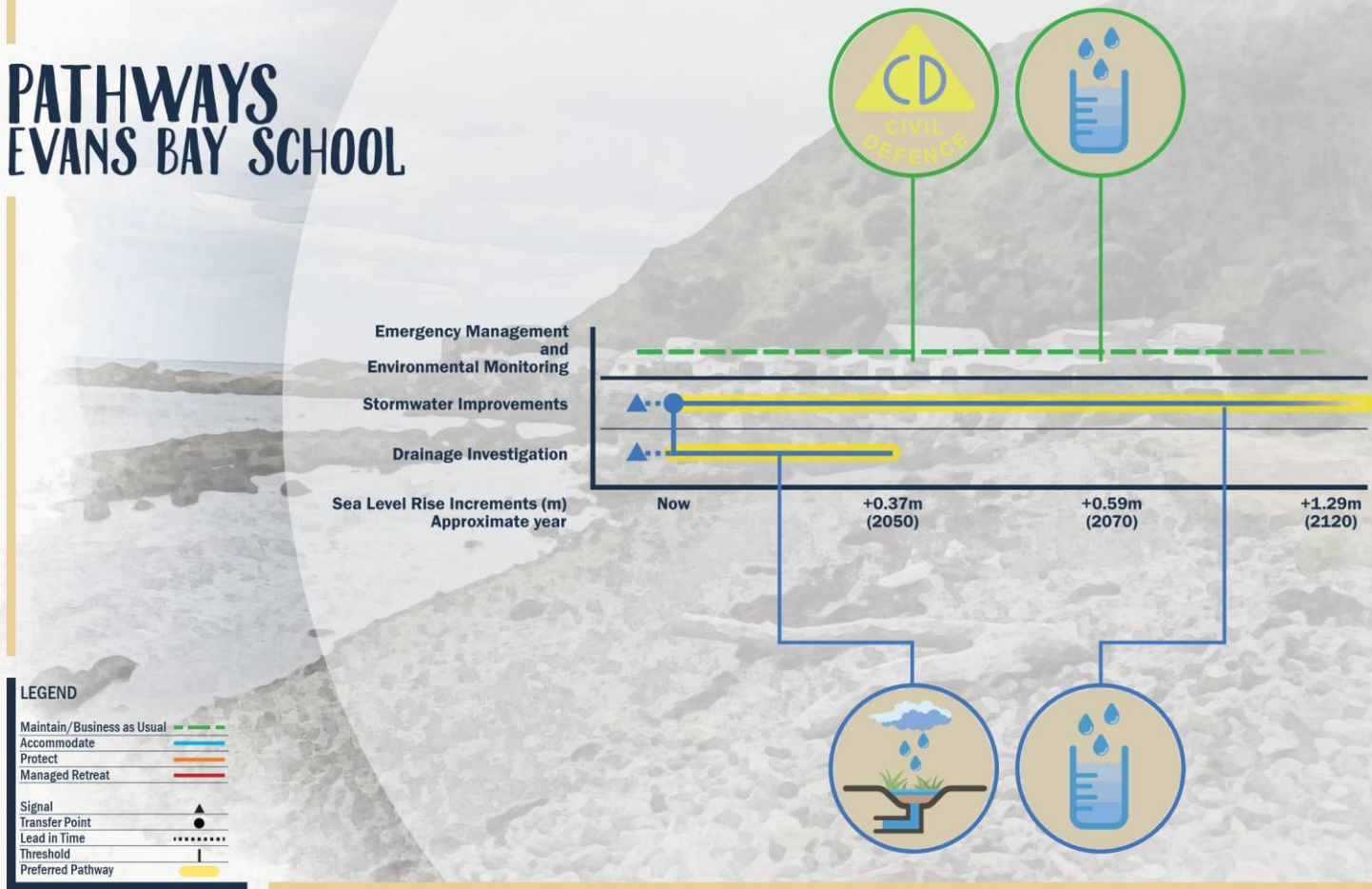













Figure 4 – Coastal Inundation Adaptation Pathway infographic for Evans Bay Intermediate School

## Appendix A: Adaptive Pathways

### Short-list Options Considered

Note: Refer to Appendix A in the Guidance Document (WSP, 2023)

	Guidance document reference	Options considered
Short Term	A & B & C   	All current coastal inundation management activities continue. Maintain existing infrastructure, and current emergency management and environmental monitoring activities to existing level of service.
	C 	Consider drainage investigations into the surface flooding on the school field
	D 	Consider stormwater improvements on the school site (to reduce current exposure to other flooding hazards to the site).
Medium Term	A & B & C   	All current coastal inundation management activities continue. Maintain existing infrastructure, and current emergency management and environmental monitoring activities to existing level of service.
Long Term	A & B & C   	All current coastal inundation management activities continue. Maintain existing infrastructure, and current emergency management and environmental monitoring activities to existing level of service.

## Appendix B: Risk of Coastal Inundation (Past/Current/Future)

### Current Vulnerability to MHWS:

Evans Bay Intermediate School has a low vulnerability to coastal inundation under current MHWS (0.51 m). No buildings or infrastructure surveyed are vulnerable to coastal inundation as they are at an elevation above the referenced level for MHWS.

### Long Term (2070-2120) Vulnerability to MHWS with SLR:

Evans Bay Intermediate School has a low vulnerability to coastal inundation under MHWS with the SSP3-7.0+VLM 2120 SLR scenario (1.80 m). No buildings or infrastructure surveyed are vulnerable to coastal inundation as they are at an elevation above the referenced level for this predicted event.

### Current Vulnerability to ESL100:

Evans Bay Intermediate School has a low vulnerability to coastal inundation under the current day ESL100 scenario (0.99 m). No buildings or infrastructure surveyed are vulnerable to coastal inundation as they are at an elevation above the referenced level for this predicted event.

### Short term (Present Day-2050) vulnerability to ESL100 with SLR:

Evans Bay Intermediate School has a low vulnerability to coastal inundation under ESL100 with the SSP3-7.0+VLM 2050 SLR scenario (1.36 m). No buildings or infrastructure surveyed are vulnerable to coastal inundation as they are at an elevation above the referenced level for this predicted event.

### Medium term (2050-2070) Vulnerability to ESL100 with SLR:

Evans Bay Intermediate School has a low vulnerability to coastal inundation under ESL100 with the SSP3-7.0+VLM 2070 SLR scenario (1.58 m). No buildings or infrastructure surveyed are vulnerable to coastal inundation as they are at an elevation above the referenced level for this predicted event.

### Long term (2070-2120) Vulnerability to ESL100 with SLR:

Evans Bay Intermediate School has a low vulnerability to coastal inundation under ESL100 with the SSP3-7.0+VLM 2120 SLR scenario (2.28 m). No buildings or infrastructure surveyed are vulnerable to coastal inundation as they are at an elevation above the referenced level for this predicted event. The estimated elevation of Cobham Drive (based on LiDAR) located between the school and the Wellington harbour is 2.12 m, this is below the referenced level for this predicted event and therefore overtopping of waters could occur.

## Appendix C: Local, district and regional adaptation and infrastructure plans

### National Adaptation Plan (MfE)

National Adaptation Plan outlines a programme of work to support communities to better understand the climate impacts that affect them and adapt to build their resilience.

### Waka Kotahi New Zealand Transport Agency

Waka Kotahi New Zealand Transport Agency (Waka Kotahi) release 'Tiro Rangi Climate Adaptation Plan' in December 2022. To ensure that the land transport system is resilient with climate change, Waka Kotahi in alignment with the National Adaptation Plan adaptation framework (avoid, protect, accommodate and retreat), will use a combination of these categories to effectively adapt in different locations and over different timescales. These adaptation strategies will be built into long-term planning to avoid ongoing expensive repairs, disruption and declining levels of service (date accessed 18/04/2023).

### Greater Wellington Regional Council / Wellington City Council

Greater Wellington Regional Council (GWRC) and Wellington City Council (WCC) are developing a regional climate change impacts assessment and adaptation plan. The development of Phase 1: The Wellington Regional Climate Change Impact Assessment will bring together a consistent regional evidence base of the climate change risks and impacts over the next century. The assessment will provide findings regarding impacts to communities, infrastructure, natural ecosystems, economy and governance systems. Phase 2: The Regional Adaptation Plan is to develop an Adaptation Plan in response to the findings in the Impact Assessment. Through the Adaptation Plan, it will inform development in the region to increase community resilience to climate change and which prioritises the key opportunities for strengthening climate resilient development.

A regional risk assessment for key climate change impacts is being developed which will underpin the subsequent regional approach to climate change impacts and WCC's work focused on its communities adapting to climate impacts (date accessed 03/04/2023).

### Wellington City Council

Coastal reports commissioned by Wellington City Council (WCC) to help understand coastal hazards and sea level rise in Wellington City such as NIWA 2021, "Coastal hazards and sea-level rise in Wellington City" (date accessed 17/04/2023). This report highlights an escalation of coastal hazards for low-lying areas such as Kilbirnie and makes note of the possibility of coastal inundation via stormwater connections to the coast.

WCC are building their knowledge about the effects of climate change. WCC jointly commissioned the 2019 report Preparing Coastal Communities for Climate Change, which identified the coastal areas that are vulnerable to climate change, sea level rise and natural hazards (date accessed 03/04/2023).

Over the past few years, WCC have implemented actions to reduce exposure to climate risks. These include, making improvements to stormwater infrastructure, maintenance of seawalls, better access to information about future coastal hazards and risks, and have begun engagement with high-risk communities to begin planning for climate change.

### Greater Wellington Regional Council

Greater Wellington Regional Council (GWRC) commissioned a report 'Assessing the implications of sea level rise Kilbirnie Town Centre' in September 2009 to better understand the risks for the Kilbirnie area around sea level rise and storm surge, identify physical and social infrastructure that will be affected, determine the extent of adaptation and need to consider other options (retreat); if engineering structures are implemented, then what are the key physical works required to future proof the area and to identify opportunities to reduce risk through future planned upgrades and renewals (accessed 18/04/2023).

## Glossary and Acronyms

Key term	Definition
Adaptation	The process taken to adjust to the impacts and risks of coastal inundation.
Adaptation approaches and options	Compendium of five approaches of physical climate change adaptation and resilience measures relevant for coastal inundation across Aotearoa New Zealand, which can help to support the Ministry of Education address the climate change impacts to schools from Coastal Inundation.
Annual exceedance probability	Annual Exceedance Probability (AEP) is the probability of an event occurring in any given year. i.e. a 1% AEP means there is a 1% chance in any given year of the event occurring. This means that on average 1 event of this size will occur every 100 years.
Climate change	Large-scale, long-term shifts in the planet's weather patterns and average temperatures
Climate change impacts	The consequences of climate change, both experienced and expected, for natural and human systems and environments.
Coastal inundation adaptation approaches/options	Practical things that can be done to adjust to, prepare for, respond to, and recover from coastal inundation impacts and risks.
Coastal inundation threshold/ reference water level event	Predicted water levels under current and future climate using the current day MHWS and ESL100 at each school location with SLR+VLM in 2050, 2070, and 2120 added.
Coastal inundation vulnerability	Identification of resources at risk from coastal inundation.
Extreme Sea Level (ESL100)	Extreme sea level from a storm which has a statistical 1% chance of being exceeded in any given year based on present day conditions.
Finished Floor Level (FFL)	Elevation level of the ground-floor of a building
Mean High Water Spring (MHWS)	The long term average of the highest high- tide that water levels reach at the time of spring tides.
Resilience	Capacity to prepare for, respond to, and recover from climate impacts and risks while incurring minimal damage to wellbeing, the economy, and the environment.
Shared Socioeconomic Pathways (SSP)	Range of future climate change pathways determined by a series of socio- economic assumptions that drive future greenhouse gas emissions.
Signal/Trigger	A point in time that allows any change that occurs to be monitored and to have a point on which to adapt. Signals/triggers highlight impending changes in risk.
SSP3-7.0	Climate change scenario under medium-high future emissions and warming (3°C warmer world). This scenario was used in the CIAPs.
Vertical Land Movement (VLM)	Rate per year (mm) by which the land is subsiding or uplifting.