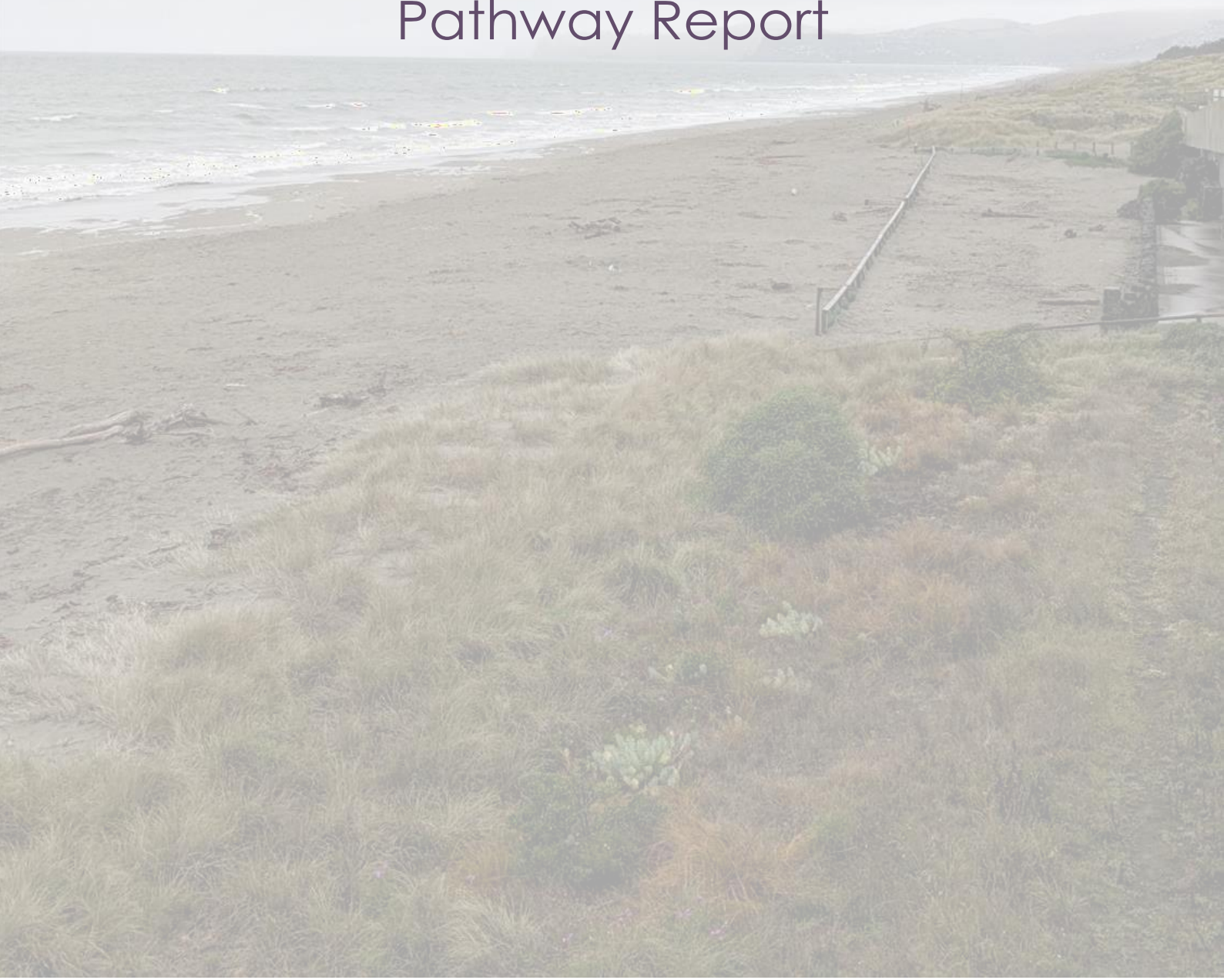


Blaketown School

Coastal Inundation Adaptive Pathway Report



Adaptive Pathway: Blaketown 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	Blaketown School
School ID	1564
MoE Region	Southern
Number of buildings on school site	3

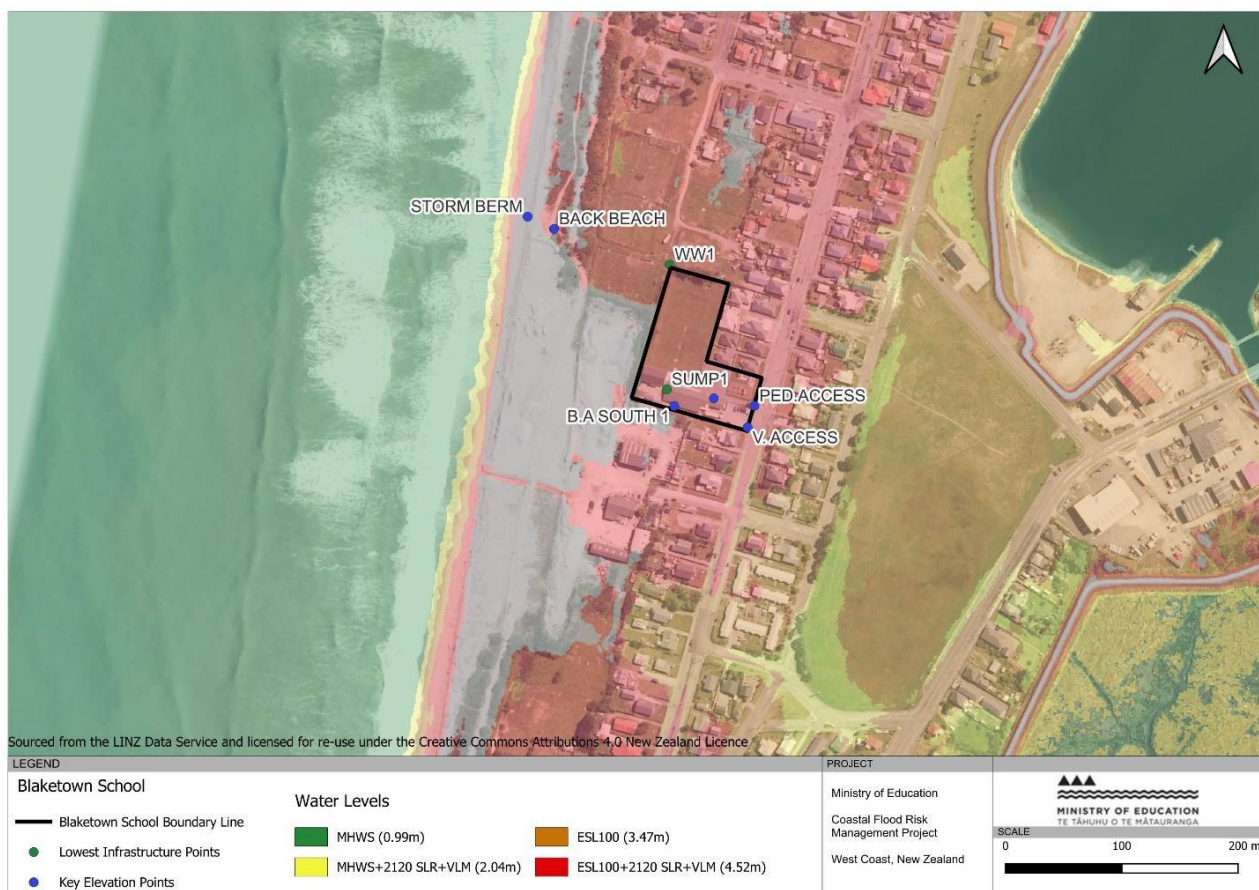


Figure 1 - Map of Blaketown School with the indicative inundation zones based on land elevation from LiDAR.

Latitude	-42.452586
Longitude	171.192977
Community Setting	School grounds at same elevation as the community, therefore likely to have similar flooding issues from the coast. The surrounding water bodies are the Tasman Sea / Te Tai-o-Rēhua, and Grey River ~200m to the north.
Community Emergency Hub	Yes – Blaketown School is a Community Emergency Hub
General Subsidence/Tectonics information	The Blaketown area is subsiding at a current rate of -0.87 mm per year (Site 6036) (NZSeaRise Takiwa Programme, 2022).

Key Elevation Points

Note: Points are in NZVD 2016.

Access / Egress Points	Vehicle Access along Blake Street (V.ACCESS) - 3.66 m	Pedestrian Access along Blake Street (PED.ACCESS) - 3.72 m
Lowest Finished Floor Levels	Building A North (B.A NORTH 2) - 4.25 m	Building A South (B.A SOUTH 1) - 4.31 m
Lowest Infrastructure levels	Wastewater Manhole (WW1) - 3.83 m	Stormwater Sump 1 (Sump 1) - 3.98 m
Coastal Defences	Gravel Berm with Vegetation (BACK BEACH) - 4.13 m	Gravel Storm Berm (STORM BERM) - 5.82 m

Water levels (current and future)

Note: Points are in NZVD 2016.

MHWS	0.99 m	ESL100 + 2050 SLR (+VLM) ¹	3.75 m
MHWS + 2120 SLR (+VLM) ²	2.04 m	ESL100 + 2070 SLR (+VLM) ³	3.92 m
ESL100	3.47 m	ESL100 + 2120 SLR (+VLM) ⁴	4.52 m

¹ This reference level is the ESL100 (3.47 m) with the 2050 (+VLM) SLR scenario (0.28 m) added to it.

² This reference level is the MHWS (0.99 m) with the 2120 (+VLM) SLR scenario (1.05 m) added to it.

³ This reference level is the ESL100 (3.47 m) with the 2070 (+VLM) SLR scenario (0.45 m) added to it.

⁴ This reference level is the ESL100 (3.47 m) with the 2120 (+VLM) SLR scenario (1.05 m) added to it.

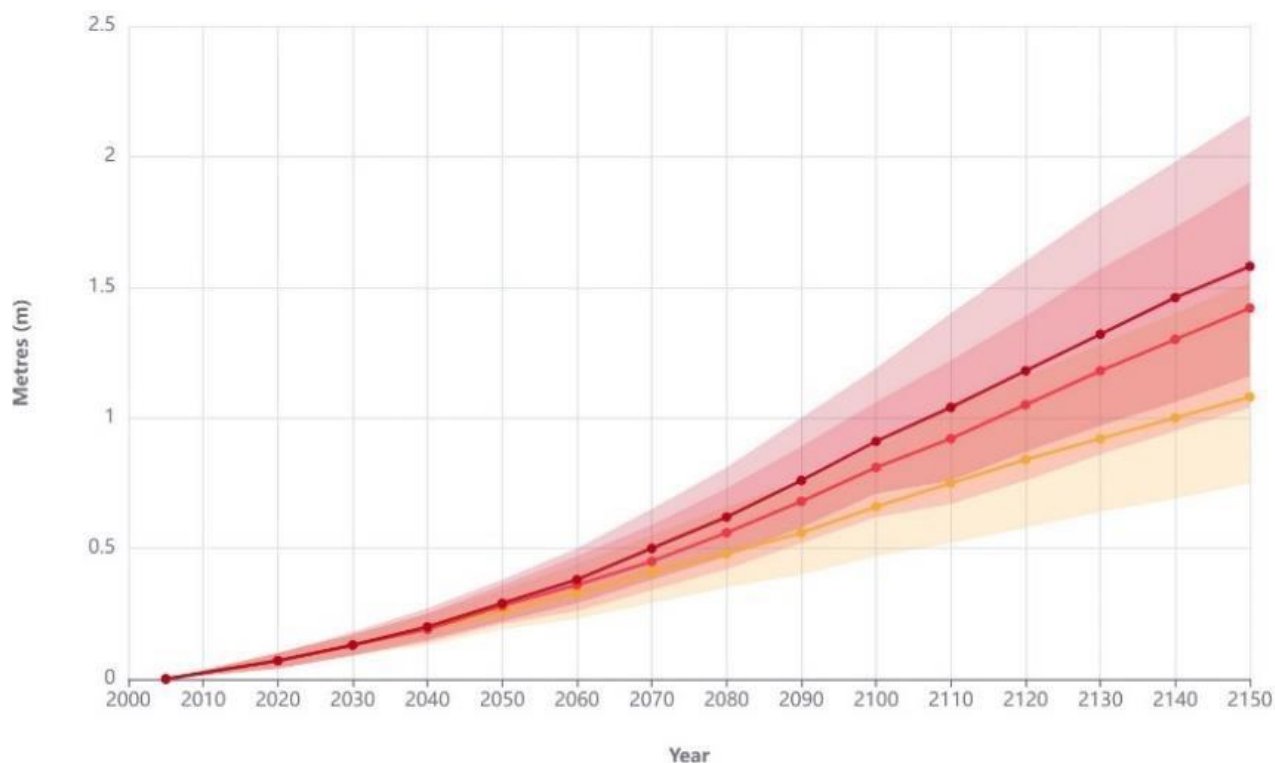


Figure 2 - Sea level rise (SLR) increments⁵ with vertical land movement under potential climate change scenarios (SSP2-4.5+VLM in orange, SSP3-7.0+VLM in red and SSP5-8.5 in deep red) and likely confidence intervals (faded colour blocks) (NZSeaRise Takiwa Programme, 2022). MfE (2022) recommends that 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 Blaketown School are listed in Appendix C of this document and summarised below.

The West Coast Regional Council (WCRC) have identified in their Long-Term Plan that they will work with communities to manage coastal hazards, as the potential cost implications from possible solutions are a significant issue for many communities, and typically solutions are short term in nature and have considerable cost and risk implication. WCRC has utilised external funding to inform decision-making, better understand the issue and examine the short-, medium- and long-term options to discuss with the community.

These may include managed retreat, or other options, instead of traditional engineering solutions. The long-term solution will be balanced with meeting the immediate needs of the community, and providing time to allow for a meaningful long-term solution to be identified and socialized with the affected community.

There is currently no specific evidence (as of yet) in these plans if they may include works to the West Coast coastline adjacent to Blaketown School. It is recommended that Blaketown 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.

⁵ Sea level rise increments added to MHWS and ESL 100 are the median values on the NZSeaRise programme charts as there are associated confidence intervals associated with each scenario.



Elevation Profile

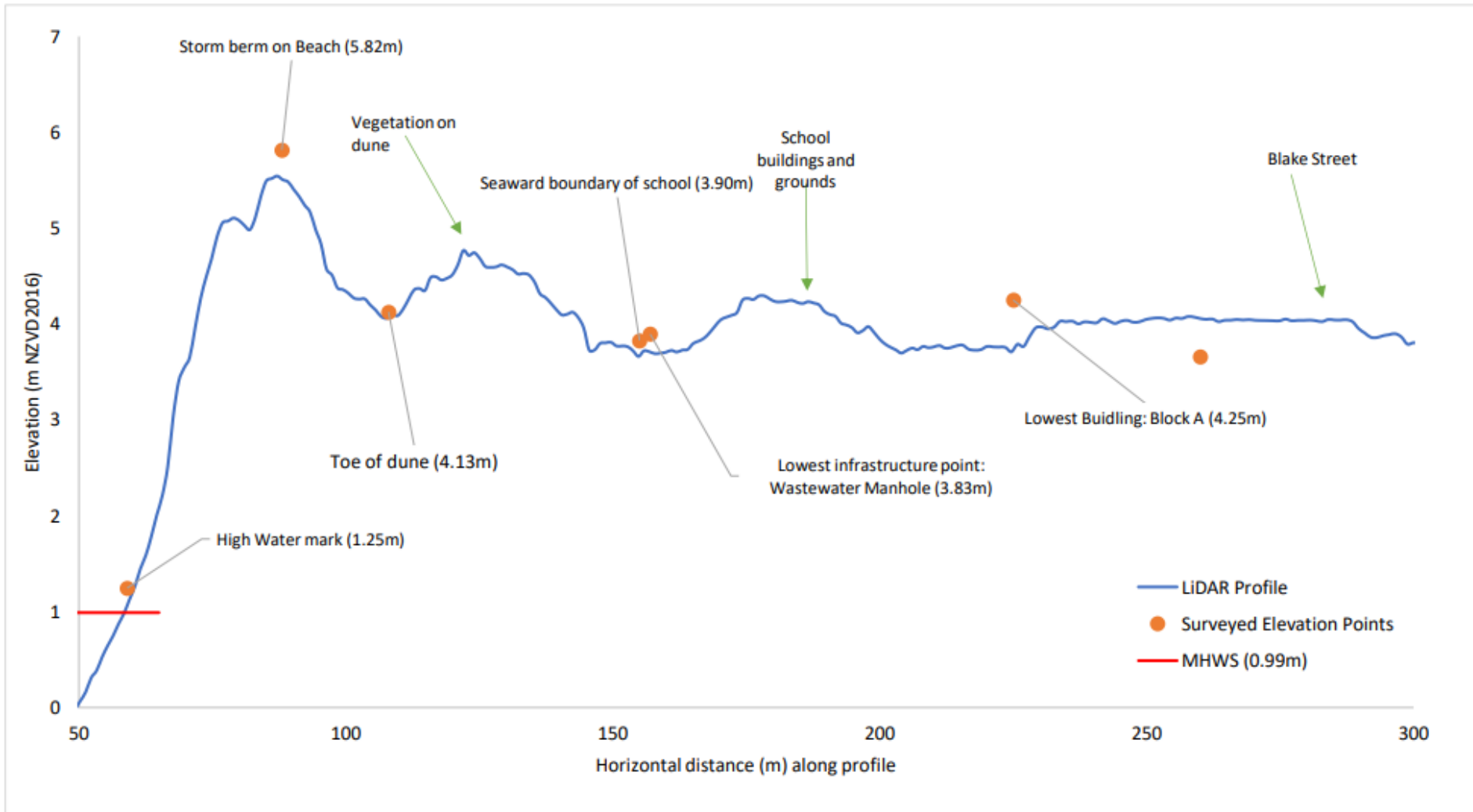


Figure 3 –Indicative profile extracted from LiDAR (1m DEM) and surveyed elevation points on site.

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)	-	Medium
Long-term (2070-2120)	Low	High

Other Hazards

Anecdotal evidence

No recorded or anecdotal flooding from coastal inundation, based on on-site conversations with the school principal and administration for the last 30 years, or a limited online search.

Infrastructure

No existing infrastructure (e.g. stop banks, State Highways, railways) is located between the school and the coast. Gravel extraction works and associated large gravel storage piles are located between the school site and the coast. Blake Street is located along the eastern boundary of the school site.

Other flooding

No recorded or anecdotal flooding from fluvial, pluvial nor stormwater sources, based on on-site conversations with the school principal and administration for the last 30 years.

Erosion

No significant evidence of erosion of coastline during on-site surveys. The gravel extraction works may have an impact on the erosion rates at the coastline. More detailed investigations into the long-term erosion trends of the stretch of coastline are required to make an accurate judgement on the erosion potential of the beach, particularly associated with increasing sea levels. It is noted that coastal erosion also has the potential to impact coastal inundation risk, and this has not been taken into account for this assessment.

Preferred Adaptive Pathway





The preferred adaptive pathway for Blaketown 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.

This preferred pathway includes short-term and longer-term options such as maintaining the current level of service at the school, and, in the future, considering relatively minor and cost-effective options to help address the potential small-scale flooding issues.



The preferred pathway is supposed to be adaptive and is therefore subject to monitoring. This includes the local school site and community, as well as the Ministry of Education reviewing how the preferred pathway is responding to rising sea levels. 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 Blaketown School considers the coastal inundation (flooding) risk and does not consider/include the impact of pluvial and fluvial inundation, the erosion of the coastline, the demographic changes associated with the school such as the school roles, and the forthcoming asset management interventions to enhance current school assets.




Preferred Adaptive Pathway – Short Term (Present-2050)

Pathway Approach	Business as Usual	
Preferred Pathway	Consider maintaining infrastructure, continue current emergency management and environmental monitoring activities to existing level of service.	  
Trigger Points	Leakages, blocks in infrastructure and general maintenance of buildings that impacts the operation of the school at the existing level of service.	

Preferred Adaptive Pathway – Medium Term (2050-2070)

Pathway Approach	Accommodate	
Preferred Pathway	Consider stormwater improvements on the school site (to reduce current exposure to other flooding hazards to the site).	
Trigger Points	Stormwater improvements could be triggered when surface flooding occurs on the school site that impacts the operation of the school. An indicative timeframe for when this could occur is from 2050.	

Preferred Adaptive Pathway – Long Term (2070-2120)

Pathway Approach	Accommodate	
Preferred Pathway	Consider raising the finished floor levels of buildings and infrastructure at risk across the school site.	
Trigger Points	The raising of floor levels and infrastructure could be triggered when overtopping of waves or inundation of the school from the coast occurs. An indicative timeframe for when could occur is from 2070.	 



PATHWAYS BLAKETOWN SCHOOL

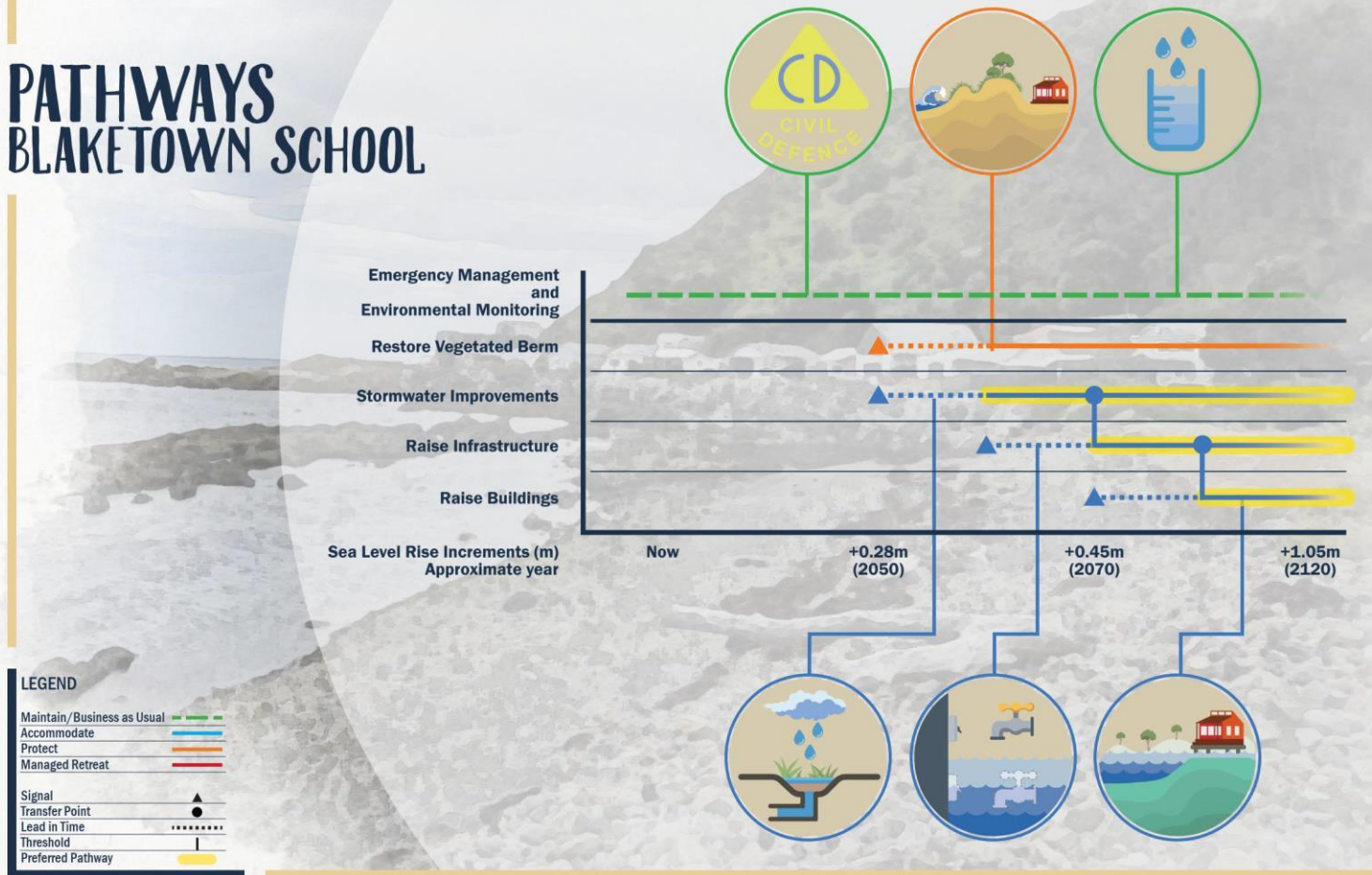










Figure 4 – Coastal Inundation Adaptation Pathway infographic for Blaketown School

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, continue current emergency management and environmental monitoring activities to existing level of service.
Medium Term	J 	Reinstate and restore vegetated gravel berm along the school's western boundary.
	D 	Consider stormwater improvements on the school site (to reduce current exposure to other flooding hazards to the site)
Long Term	D & E   	Consider raising the finished floor levels of buildings and infrastructure at risk across the school site.

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

Current Vulnerability to MHWS:

Blaketown School has a low vulnerability to coastal inundation under current MHWS (0.99 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:

Blaketown School has a low vulnerability to coastal inundation under MHWS with the SSP3-7.0+VLM 2120 SLR scenario (2.04 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:

Blaketown School has a low vulnerability to coastal inundation under the current day ESL100 scenario (3.47 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:

Blaketown School has a low vulnerability to coastal inundation under ESL100 with the SSP3-7.0+VLM 2050 SLR scenario (3.75 m). The vulnerable buildings and infrastructure surveyed below the referenced level for this predicted event are:

- All access points to school site

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:

Blaketown School has a medium vulnerability to coastal inundation under ESL100 with the SSP3-7.0+VLM 2070 SLR scenario (3.92 m). The vulnerable buildings and infrastructure surveyed below the referenced level for this predicted event:

- All access points to school site
- Wastewater manhole (WW1 -3.83 m)

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

Blaketown School has a high vulnerability to coastal inundation under ESL100 with the SSP3-7.0+VLM 2120 SLR scenario (4.52 m). The vulnerable buildings and infrastructure surveyed below the referenced level for this predicted event:

- All infrastructure surveyed
- All FFL's of buildings surveyed (except for Meeting Room)

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

MfE's National Adaptation Plan:

The 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) released '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).

KiwiRail

KiwiRail have identified through their Sustainability Strategy 2022-2025 that they have an objective targeted to improve their understanding of climate change impacts and that the adaptation requirements and management plans are in place for existing assets and new capital projects.

West Coast Regional Council (WCRC)

The West Coast Regional Council undertook a review of the Regional Coastal Plan and the existing 18 Coastal Hazard Areas (CHAs), to determine whether the current CHAs stay the same, whether any CHAs need to be removed, whether any new hazard areas need to be added and, if possible, highlight whether the hazard risk is low, medium, or high for the Te Tai o Poutini Plan. This report determined that the Blaketown to Karoro area is a medium-risk CHA. It recommends that monitoring of the shoreline changes is continued, to allow for improved understanding of coastal processes and the impacts of the gravel extraction to the beach, and further research into the effects of the gravel extraction and the Grey River training walls.

WCRC Long Term Plan (LTP) 2021-2031 identifies cross-section studies and aerial photography of some coastal areas to be carried out, to monitor changing patterns in beach systems. This assists identification of any maintenance or additional protection needed. This work will be undertaken as required, depending on the urgency and seriousness of the risks and consequences. Within the LTP it states that new infrastructure requests are received from individual West Coast communities for WCRC to investigate and implement protection works. New infrastructure work over the last decade has largely related to coastal protection. The requests for new or improved infrastructure are not driven by population growth but a desire to maintain and protect property from the impacts of climate change.

- Infrastructure strategy in the LTP: This Strategy sets out WCRC's thirty-year plan for protection against river flooding, erosion and coastal inundation and the assets to deliver on this. The assets involved for flood protection, erosion control and coastal erosion include stop banks, groynes, sacrificial bunds, drainage channels, seawalls and river training works. However, no works are stated in regard to Blaketown coastal protection.
- Through the LTP, WCRC will work with communities to manage coastal hazards. Potential cost implications from potential solutions are a significant issue for many

communities. Typically, solutions are short term in nature and have considerable cost and risk implications due to the user-pays (based on benefits) model for funding such works. A feature of several recent reports has been the inclusion of recommendations supporting managed retreat.

- WCRC has utilised EnviroLink funding to inform decision-making by better understanding the issue, and examining the short-, medium- and long-term options to discuss with the community. These may include managed retreat, or other options, instead of traditional engineering solutions. The long-term solution will be balanced with meeting the immediate needs of the community, and providing time to allow for a meaningful long-term solution to be identified and discussed with the affected community.

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.