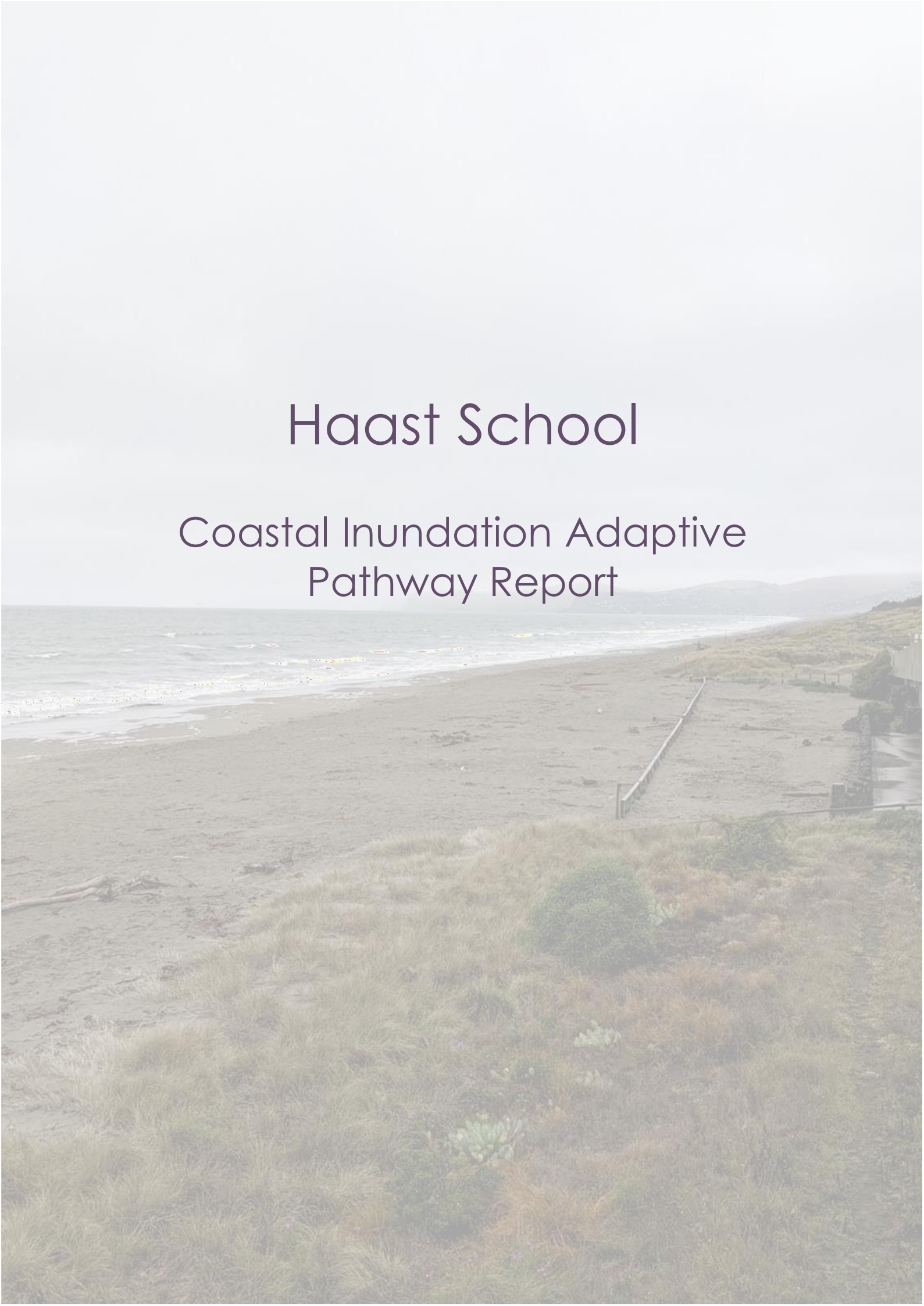
Haast School

Coastal Inundation Adaptive Pathway Report



Adaptive Pathway: Haast 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	Haast School
School ID	1577
MoE Region	Southern
Number of buildings on school site	2

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

Latitude	-43.940784
Longitude	168.857148
Community Setting	School grounds at same elevation as the community, therefore likely to have similar flooding from the coast. The surrounding water body is the Tasman Sea / Te Tai-o-Rēhua
Community Emergency Hub	No – Haast School is not a Community Emergency Hub
General Subsidence/Tectonics information	The Hannah's Clearing/Jackson Bay area is uplifting at a current rate of 0.955 mm per year (Site 5898) (NZSeaRise Takiwa Programme, 2022).

Key Elevation Points

Note: Points are in NZVD 2016.

Access / Egress Points	Vehicle Access (Access 1) – 5.25 m	Pedestrian Access (Access 2) – 5.55 m
Lowest Finished Floor Levels	Building A Ramp Entrance (RAMP B1) – 5.37 m	Building A Northeast (B1) – 5.72 m
Lowest Infrastructure levels	Water tanks (WATER TANK) – 5.23 m	Internet satellite/aerial for the school (WIFI) – 5.27 m
Coastal Defences	Crest of vegetated dune (BACK BEACH) – 6.03 m	Southern beach pathway to school (BACK BEACH 2) – 3.89 m and Northern beach pathway to school (BACK BEACH 3) – 3.95 m

Water Levels (current and future)

Note: Points are in NZVD 2016.

MHWS	0.99 m	ESL100 + 2050 SLR *(+VLM)*[1]	3.33 m
MHWS + 2120 SLR (+VLM)[2]	1.83 m	ESL100 + 2070 SLR *(+VLM)*[3]	3.47 m
ESL100	3.14 m	ESL100 + 2120 SLR *(+VLM)*[4]	3.98 m

[1] This reference level is the ESL100 (3.14 m) with the 2050 (+VLM) SLR scenario (0.19 m) added to it.
[2] This reference level is the MHWS (0.99 m) with the 2120 (+VLM) SLR scenario (0.84 m) added to it.
[3] This reference level is the ESL100 (3.14 m) with the 2070 (+VLM) SLR scenario (0.33 m) added to it.
[4] This reference level is the ESL100 (3.14 m) with the 2120 (+VLM) SLR scenario (0.84 m) added to it.

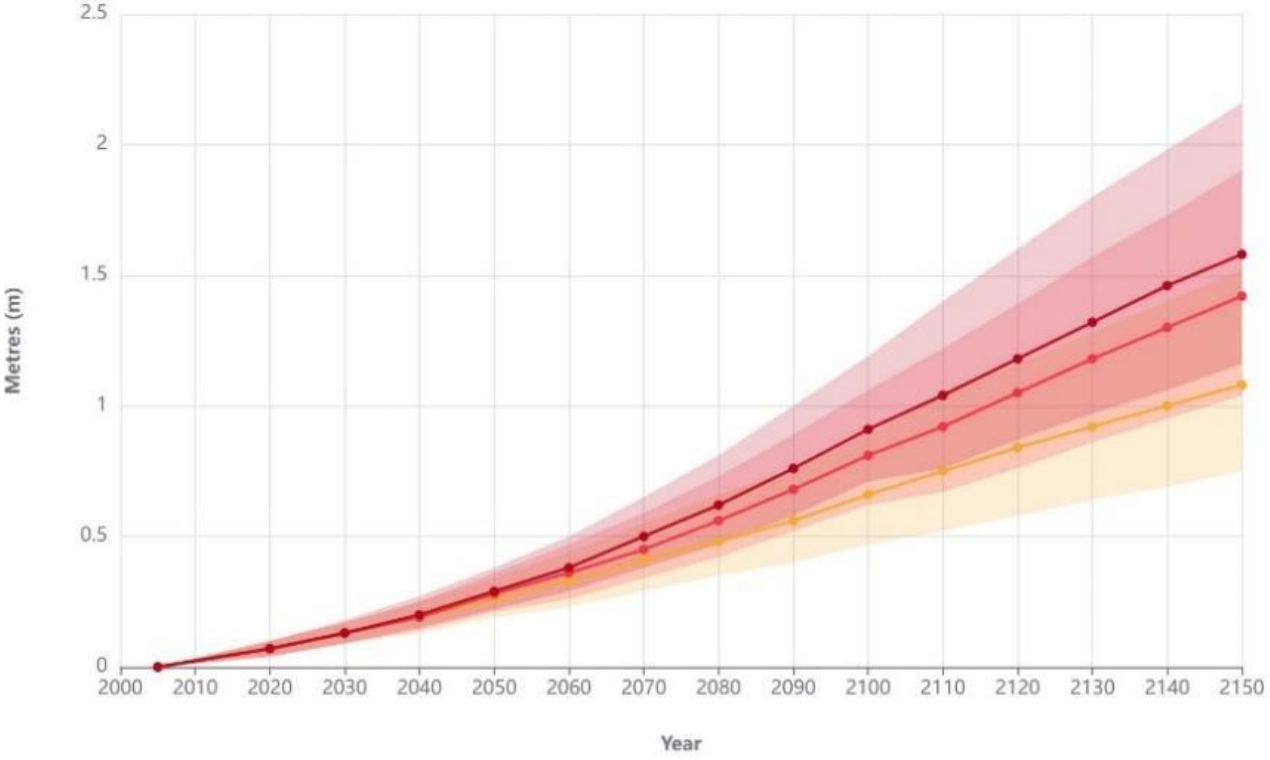


Figure 2 - Sea level rise (SLR) increments[5] with vertical land movement under potential climate change scenarios (SSP2-4.5+VLM in orange, SSP3-7.0+VLM in red and SSP5-8.5 in deep red) and likely confidence intervals (faded colour blocks) (NZSeaRise Takiwa Programme, 2022). MfE (2022) recommends that 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 Haast 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. However, there is no specific evidence (as of yet) in these plans if they may include works to the West Coast coastline adjacent to Haast School.

It is recommended that Haast 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 ESL100 are the median values on the NZSeaRise programme charts as there are associated confidence intervals associated with each scenario.

Elevation Profile

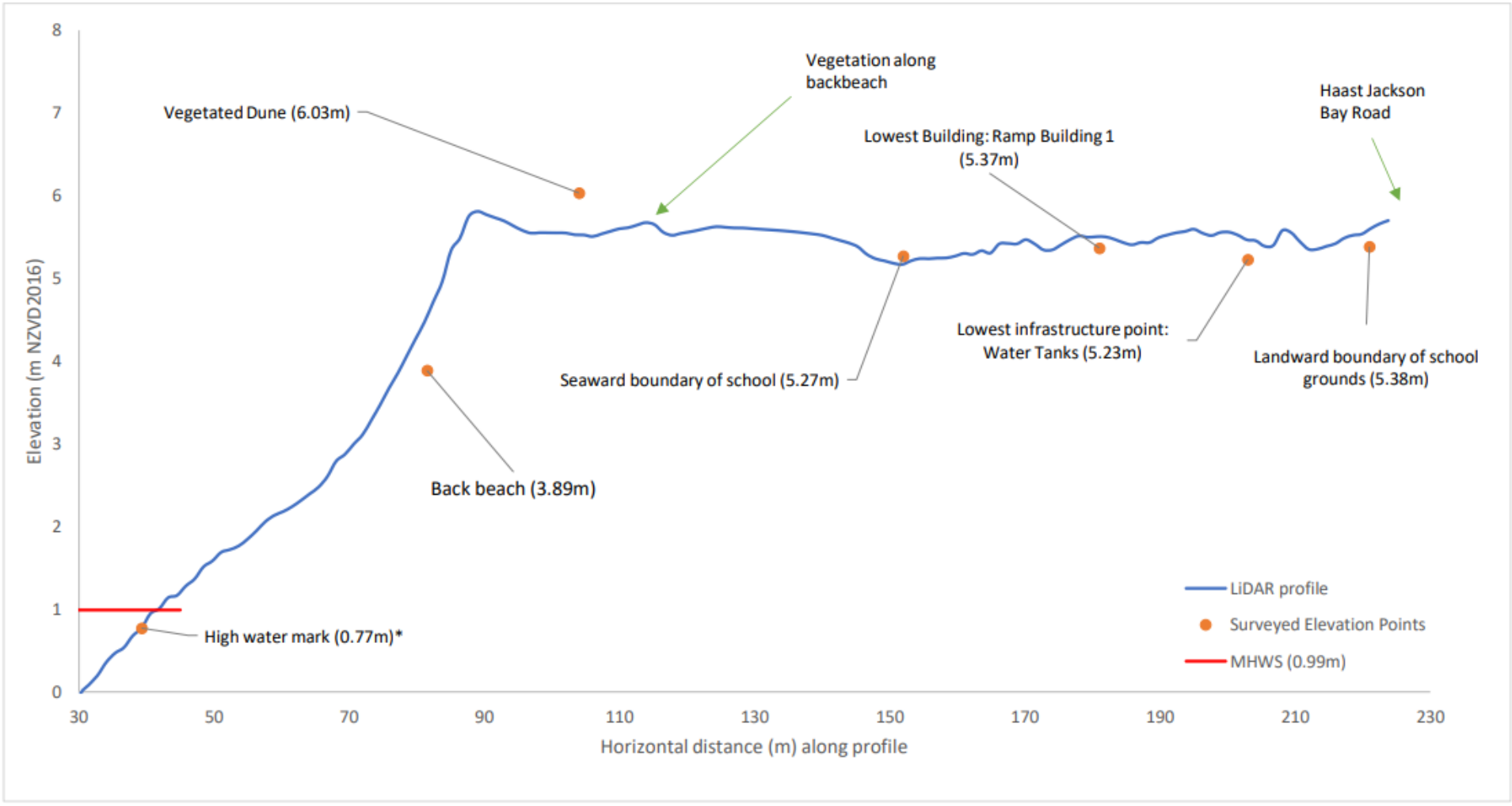


Figure 3 – showing an indicative profile extracted from LiDAR (1m DEM) and surveyed elevation points on site

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Risk of Coastal Inundation (Past/Current/Future)

See Appendix B for further information.

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

Other Hazards

School anecdotal evidence

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

Infrastructure

There is no existing infrastructure (State Highways, railways) located between the school and the coast. The school site is located directly adjacent to the shoreline.

Other types of flooding

No recorded or anecdotal flooding from fluvial, pluvial and stormwater sources. Based on on-site conversations with the school principal and caretaker, a creek located on the eastern side of the residential area that is located landward of the school has resulted in occasional flooding in the area during heavy rainfall; however, this has never flooded the school ground or impacted the operation of the school.

Erosion

No significant evidence of erosion of coastline during on-site surveys. The vegetated wide back beach and steep foreshore is suggested to provide some resistance of the shoreline from any current erosion phases. More detailed investigations into the long-term 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 Haast 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 Haast School should be considered in order to maintain the current level of service and to help inform any future erosion investigations. In the future, as the vulnerability of the school to coastal inundation is predicted to remain low, the long-term pathway should be considered in order to continue to maintain the school's level of service and should there be evidence of erosion, the Ministry of Education should have a site-specific erosion assessment conducted.

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 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 Haast School considers the coastal inundation (flooding) risk and does not consider/include the impact of pluvial and fluvial inundation, the erosion of the coastal, 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 and Accommodate	
Preferred Pathway	Consider maintaining existing infrastructure and continue current emergency management to existing level of service. Consider starting to monitor the vegetation line along the shoreline to help any future erosion investigations.	
Trigger Points	Business As Usual activities should be maintained to existing level of service.	

Preferred Adaptive Pathway – Medium Term (2050-2070)

Pathway Approach	Business as Usual and Accommodate	
Preferred Pathway	Consider maintaining existing infrastructure and continue current emergency management to existing level of service. Consider continuing monitoring vegetation line along the shoreline to help any future erosion investigations.	
Trigger Points	Business As Usual activities should be maintained to existing level of service. Should there be evidence of erosion, the Ministry of Education should have a site-specific erosion assessment conducted.	

Preferred Adaptive Pathway – Long Term (2070-2120)

Pathway Approach	Business as Usual and Accommodate	
Preferred Pathway	Consider maintaining existing infrastructure and continue current emergency management to existing level of service. Consider continuing monitoring vegetation line along the shoreline to help any future erosion investigations.	
Trigger Points	Business As Usual activities should be maintained to existing level of service. Should there be evidence of erosion, the Ministry of Education should have a site-specific erosion assessment conducted.	

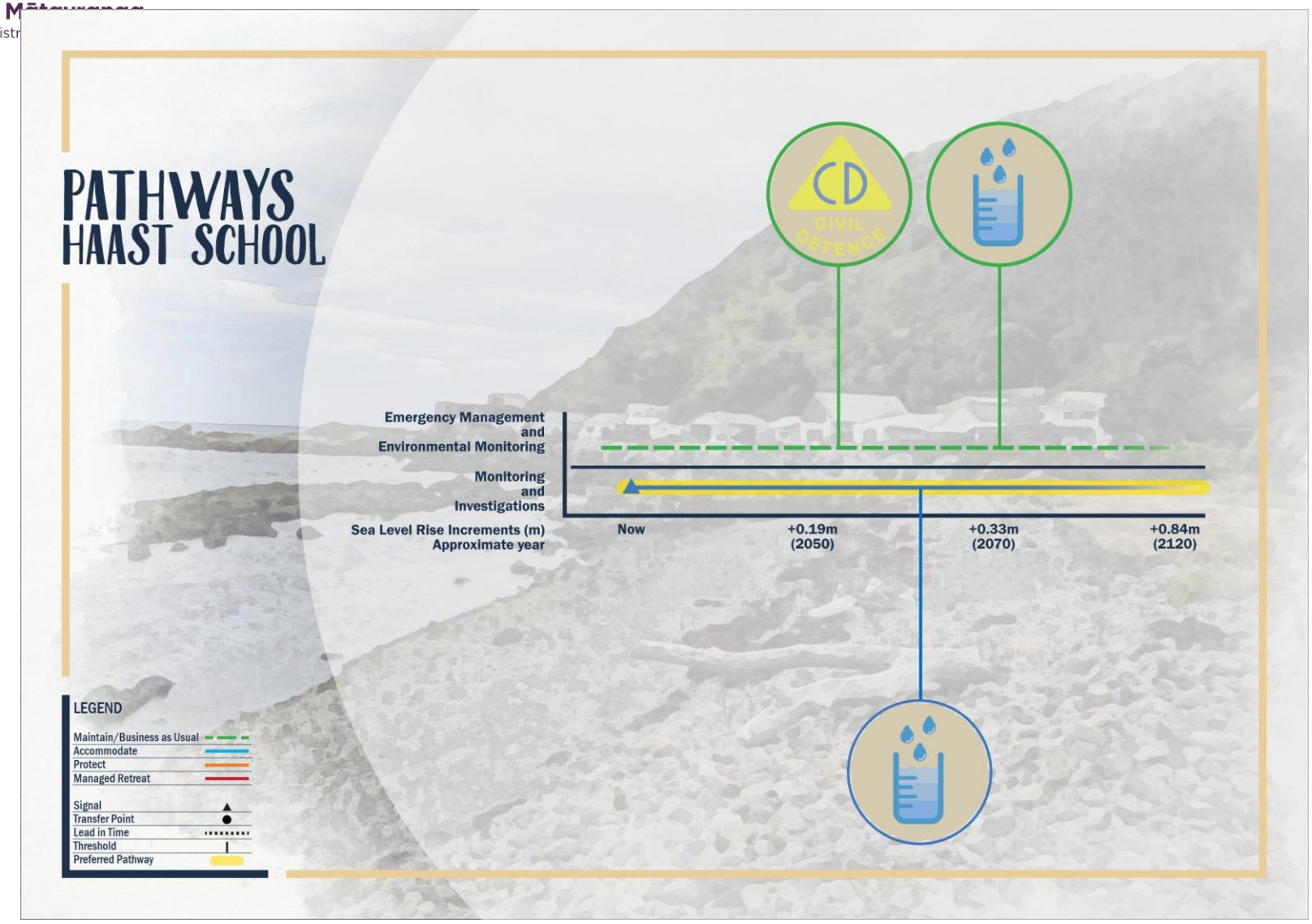

Figure 4 – Coastal Inundation Adaptation Pathway infographic for Haast School

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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 continue current emergency management and environmental activities to existing level of service.
	C & J 	Maintain vegetation and use vegetation line to monitor erosion of the back beach for future erosion and hazard assessments.
Medium Term	A & B & C 	Continue to maintain infrastructure, continue current emergency management and environmental monitoring activities to existing level of service. Continue to monitor vegetation line for evidence of erosion.
Long Term	A & B & C 	Continue to maintain infrastructure, continue current emergency management and environmental monitoring activities to existing level of service. Continue to monitor vegetation line for evidence of erosion.

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

Current Vulnerability to MHWS:

Haast 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:

Haast School has a low vulnerability to coastal inundation under MHWS with the SSP3-7.0+VLM 2120 SLR scenario (1.83 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:

Haast School has a low vulnerability to coastal inundation under the current day ESL100 scenario (3.14 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:

Haast School has a low vulnerability to coastal inundation under ESL100 with the SSP3-7.0+VLM 2050 SLR scenario (3.33 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:

Haast School has a low vulnerability to coastal inundation under ESL100 with the SSP3-7.0+VLM 2070 SLR 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.

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

Haast School has a high vulnerability to coastal inundation under ESL100 with the SSP3-7.0+VLM 2120 SLR scenario (3.98 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.

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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 NZ Transport Agency

Waka Kotahi NZ 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).

West Coast Regional Council

The West Coast Regional Council (WCRC) 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 reported determine that the Haast Beach to Waiatoto area is a medium-risk CHA. This report also highlights that within the Haast Beach CHA, State Highway 6 is vulnerable to coastal hazards.

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 what maintenance or additional protection is 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 WCRCs 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 stopbanks, groynes, sacrificial bunds, drainage channels, seawalls and river training works. However, no works are stated regarding Haast for 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 socialized with the affected community.

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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.