Takutai Kāpiti.

Northern Adaptation Area

Shortlisted Pathway information for MCDA process

Presentation: Additional CAP Workshop 15 June 2023

Information compiled by the Takutai Kāpiti Technical Advisory Group
(KCDC, GWRC, Mitchell Daysh, Jacobs)

Short-list Adaptation Options

OPTIONS	ENHANCE	ACCOMODATE	PROTECT	RETREAT	AVOID
	We keep doing what we are doing, and do it better	We adapt where we are and learn to live with the hazard	We protect ourselves from the hazard	We move to safer ground	We avoid developing in places we know will be at risk in the future
					
ACTIONS	• Enhance existing inundation protection • Dune resilience 'package' (planting, managing access, sand trap fencing) • Education and emergency management	• Floodproof buildings and infrastructure • Adaptable and relocatable buildings • Elevate floor levels of buildings	Soft Engineering • Renourishment • Beach scraping/ dune reconstruction Hard Engineering • Sea walls • Stopbanks • Culverts and floodgates • Detached breakwaters • Pumpstations	• Retreat	• Zoning and setback controls • Trigger-based or time limited land use controls • Building design • Reducing further intensification or development

How to read the Adaptation Area Draft Pathways sheets

High Level Adaptation Option agreed on 27 April 2023

NB: Signals and triggers determined by CAP to transition from one action to the next.

Refers to menu of Adaptation options (from 27 April 2023 workshop).
NB: Some pathway options comprise of more than one adaptation action.

Number of dwellings at risk (*Range indicates the lower SSP2-4.5 and higher SSP5-8.5 scenario; no range if the same number of properties is effected for each scenario)*

Explanatory technical notes

Map of area - with legend

2130 predicted shoreline at SSP5 8.5 (33-66%) – with no adaptation actions

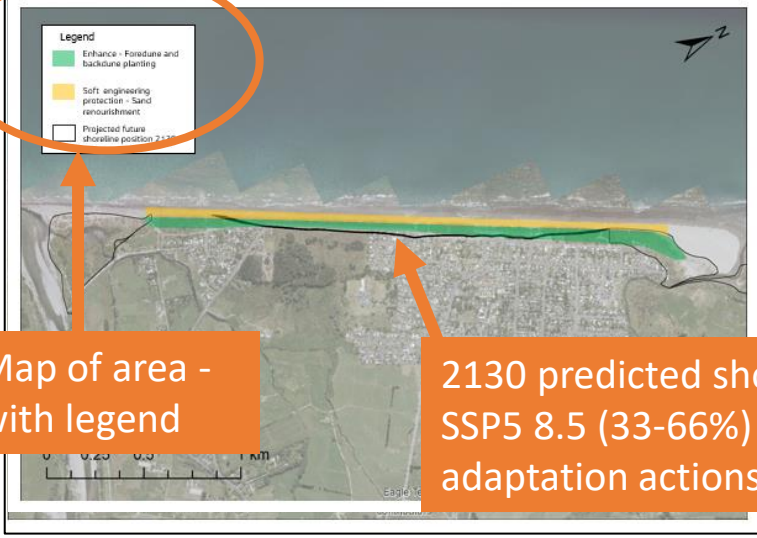
Northern Adaptation Area Draft Pathways

Management Unit: **1A: Otaki Beach Open Coast**

Pathway: **1**

2050 – 14 Properties at risk of erosion
2070 – 14 Properties at risk of erosion
2130 – 14-39 Properties at risk of erosion

Short term	Medium term	Long term
Enhance [3,4] Increase dune resilience by foreshore and backshore planting	**Enhance** [3,4] Increase dune resilience by foreshore and backshore planting	**Soft Engineering Protection** [9] Importing sand and distributing it on the foreshore to supply more bulk to the beach profile.



Notes:

Extensive foredune and backdune planting over the short-medium term with weed and pest control to enhance the existing dune system, and provide good protection in storms and faster recovery.

As sea levels rise and erosion of the dune system becomes more extensive, imported sand would be distributed along the foredune to add volume to the beach and reduce erosion. Additional replenishments nce would be undertaken as required olumes which provide sufficient

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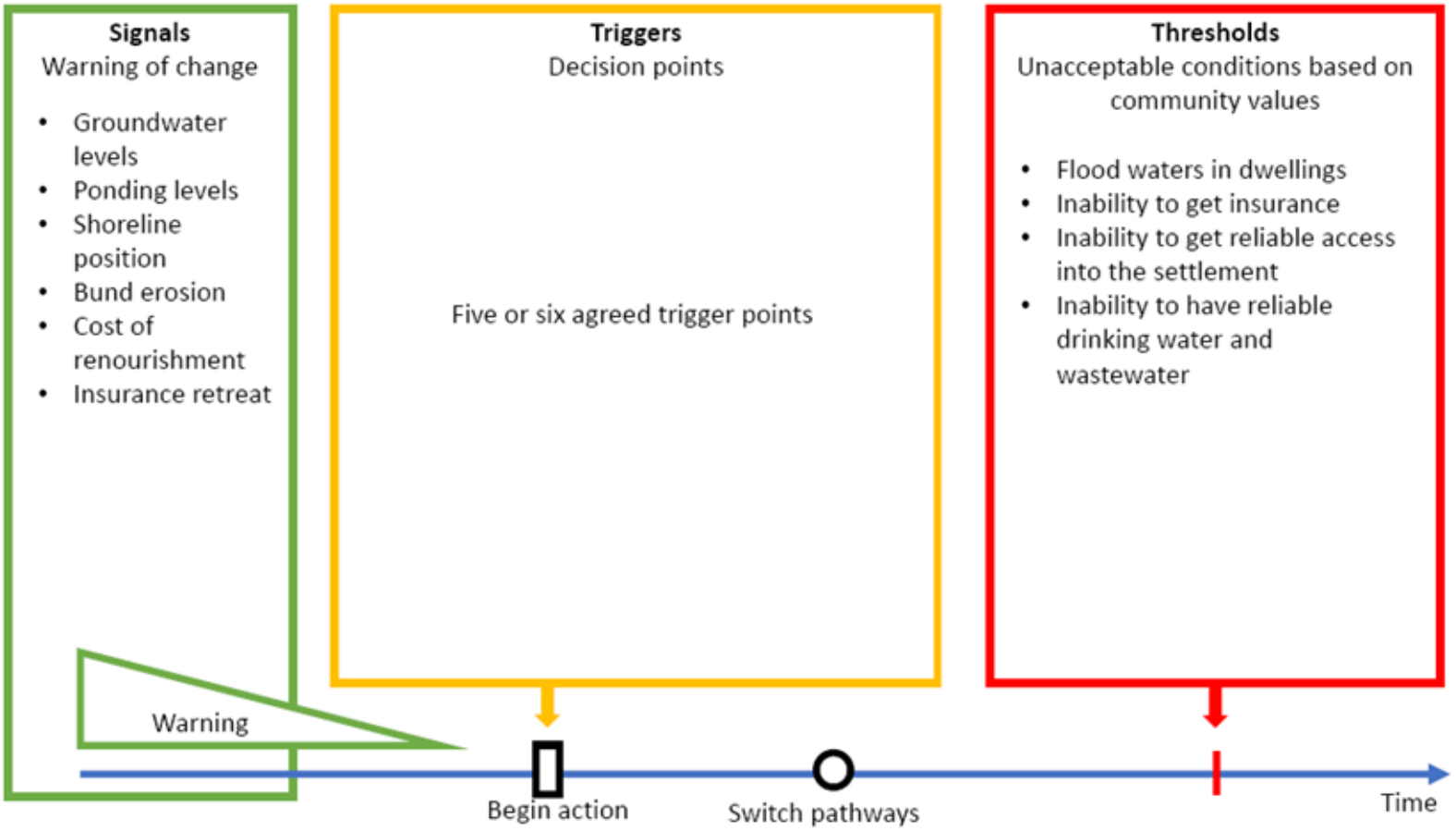
Other steps in Decision-making process

= Signals and triggers determined by CAP to transition from one action to the next.

Note for CAP: This process will be covered in the 3 April 2024 workshop for whole Kāpiti Coast District.



Source: Hurunui District Council. *Example of symbols for adaptation pathways.*

RESULTS OF DECISION MAKING

Te Awanga

MITCHELL DAYSH

The Decision-Making Process: Steps to Come

Te Awanga Coastal Unit Example

Unit K2: Te Awanga												
Pathway	**Short term**	→	**Medium term**	→	**Long term**	**MCDA Score**	**MCDA ranking**	**Cost + Loss[1] ($m)**	**Cost + Loss[1] ranking**	**VFM[2] ($'000/ point)**	**VFM[2] ranking**	**Short Term build costs[3] ($m)**
PW 1	Renourishment	→	Retreat the Line	→	Managed Retreat	50	4	24.15	6	403	6	8.84 (0.55 / yr)
PW 2	Renourishment + Control Structures	→	Renourishment + Control Structures	→	Retreat the Line	58	2	17.08	2	194	2	8.98 (0.60 / yr)
PW 3	Renourishment + Control Structures	→	Renourishment + Control Structures	→	Renourishment + Control Structures	62	1	16.77	1	171	1	8.98 (0.60 / yr)
PW 4	Renourishment + Control Structures	→	Renourishment + Control Structures	→	Sea wall	53	3	18.48	3	232	3	8.98 (0.60 / yr)
PW 5	Renourishment	→	Sea wall	→	Retreat the Line	43	5=	20.00	5	329	5	8.84 (0.55 / yr)
PW 6	Sea wall	→	Sea wall	→	Sea wall	43	5=	18.67	4	291	4	9.08 (0.66 / yr)
PW 30	Retreat the Line					–	–	14.94	–	--	–	

RESULTS OF DECISION MAKING

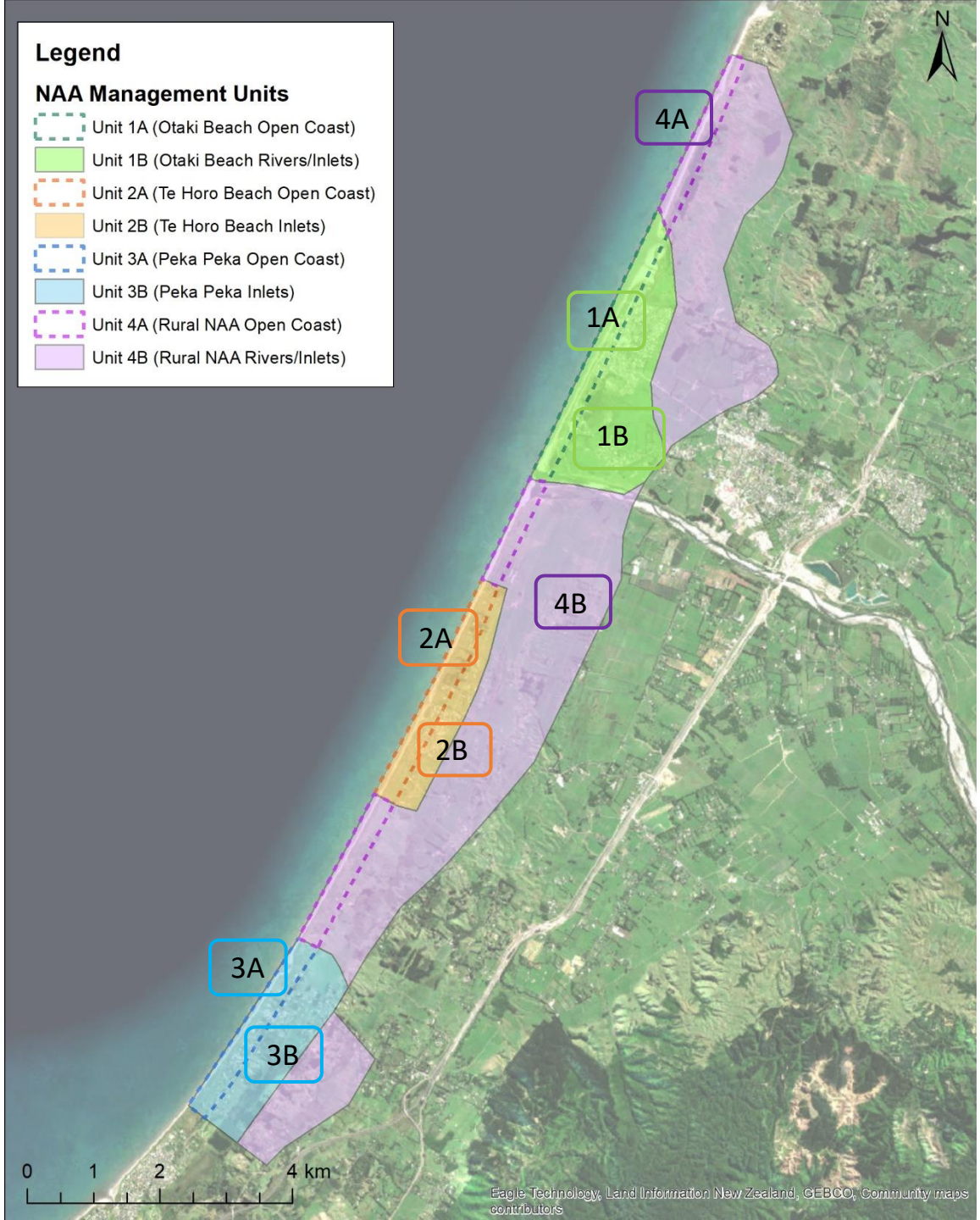
Westshore

MITCHELL DAYSH

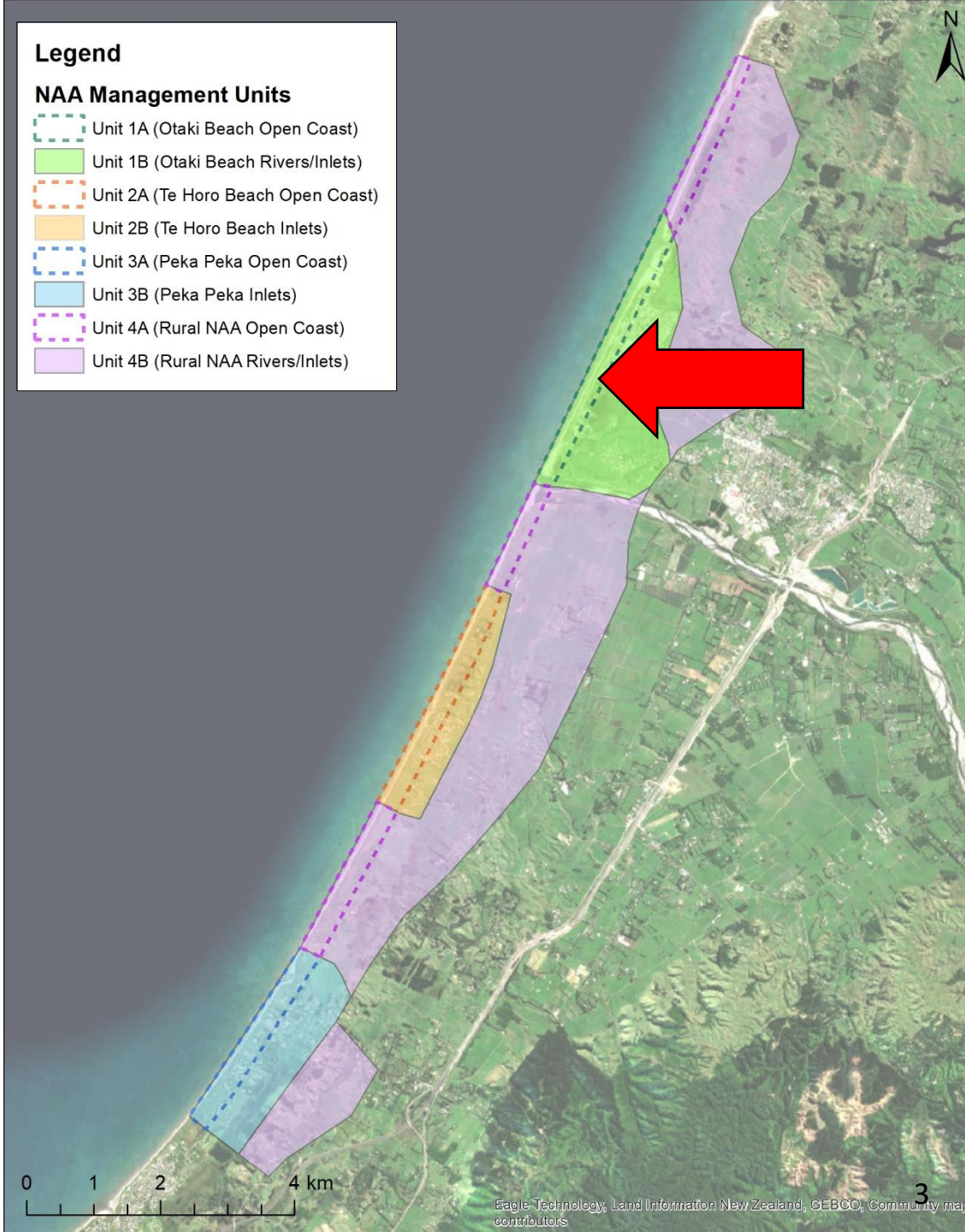
Westshore Coastal Unit Example

Unit D: Westshore												
Pathway	**Short term**	→	**Medium term**	→	**Long term**	**MCDA Score**	**MCDA ranking**	**Cost + Loss[1] ($m)**	**Cost + Loss[1] ranking**	**VFM[2] ($'000/ point)**	**VFM[2] ranking**	**Short Term build costs[3] ($m)**
PW 1	Renourishment	→	Managed Retreat	→	Managed Retreat	65	1	91.6	6	1392	6	13.26 (0.71 / yr)
PW 2	Renourishment	→	Renourishment + Control Structures	→	Managed Retreat	60	2	53.2	5	839	5	13.26 (0.71 / yr)
PW 3	Renourishment	→	Renourishment + Control Structures	→	Renourishment + Control Structures	51	4=	25.2	1	387	1	13.26 (0.71 / yr)
PW 4	Renourishment	→	Renourishment + Control Structures	→	Sea wall	54	3	28.9	2	432	2	13.26 (0.71 / yr)
PW 5	Renourishment + Control Structures	→	Renourishment + Control Structures	→	Sea wall	51	4=	29.0	3	459	3	16.17 (1.09 / yr)
PW 6	Sea wall	→	Sea wall	→	Sea wall	47	5	31.2	4	546	4	21.96 (1.59 / yr)
PW 9	Renourishment + Control Structures		Renourishment + Control Structures		Renourishment + Control Structures	--	--	25.3	--	--	--	--

Northern Adaptation Area Management Units



Unit 1A: Otaki Beach Open Coast

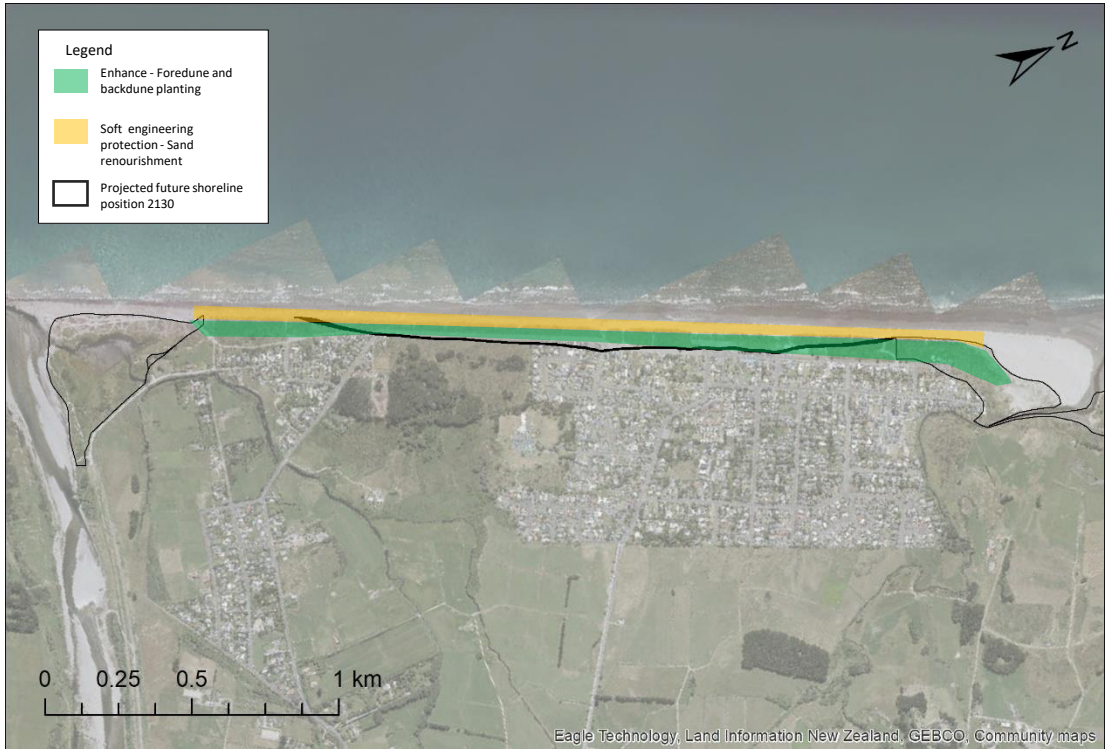


Management Unit:	**1A: Otaki Beach Open Coast**

Pathway:	**1**

2050 – 14 Properties at risk of erosion
2070 – 14 Properties at risk of erosion
2130 – 14-39 Properties at risk of erosion

Short term	Medium term	Long term
Enhance [3,4]	**Enhance** [3,4]	**Soft Engineering Protection** [9]
Increase dune resilience by foreshore and backshore planting	Increase dune resilience by foreshore and backshore planting	Importing sand and distributing it on the foreshore to supply more bulk to the beach profile.



Notes:
Extensive foredune and backdune planting over the short-medium term with weed and pest control to enhance the existing dune system, and to provide good protection in storms and faster recovery.

As sea levels rise and erosion of the dune system becomes more extensive, imported sand would be distributed along the foredune to add volume to the beach and reduce erosion. Additional replenishments and dune maintenance would be undertaken as required to maintain dune volumes which provide sufficient protection.

Management Unit:	**1A: Otaki Beach Open Coast**	Pathway:	**2**

2050 – 14 Properties at risk of erosion
2070 – 14 Properties at risk of erosion
2130 – 14-39 Properties at risk of erosion

Short term	Medium term	Long term
Enhance [3,4] Increase dune resilience by foreshore and backshore planting	**Soft Engineering Protection** [9] Importing sand and distributing it on the foreshore to supply more bulk to the beach profile.	**Soft Engineering Protection** [9] Importing sand and distributing it on the foreshore to supply more bulk to the beach profile.

Notes:
Extensive foredune and backdune planting over the short term with weed and pest control to enhance the existing dune system, and to provide good protection in storms and faster recovery.

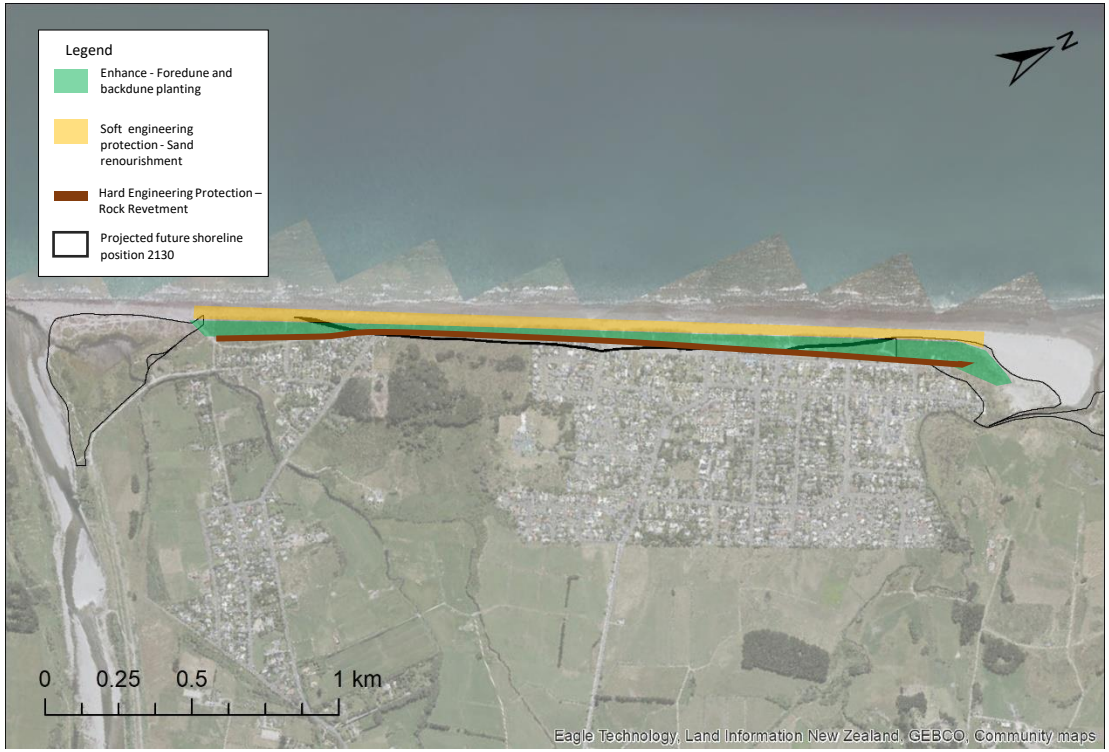
Over the medium term, as sea levels rise and erosion of the dune system becomes more extensive, imported sand would be distributed along the foredune to add volume to the beach and reduce erosion. Additional replenishments and dune maintenance would be undertaken as required.

As sea levels rise, increased replenishments and maintenance would be required to reduce the effects of erosion.

Management Unit:	**1A: Otaki Beach Open Coast**	Pathway:	**3**

2050 – 14 Properties at risk of erosion
2070 – 14 Properties at risk of erosion
2130 – 14-39 Properties at risk of erosion

Short term	Medium term	Long term
Enhance [3,4] Increase dune resilience by foreshore and backshore planting	**Soft Engineering Protection** [9] Importing sand and distributing it on the foreshore to supply more bulk to the beach profile.	**Hard Engineering Protection**[11] Rock revetment structure along the front of the settlement.



Notes:

Extensive foredune and backdune planting over the short term with weed and pest control to enhance the existing dune system, and to provide good protection in storms and faster recovery.

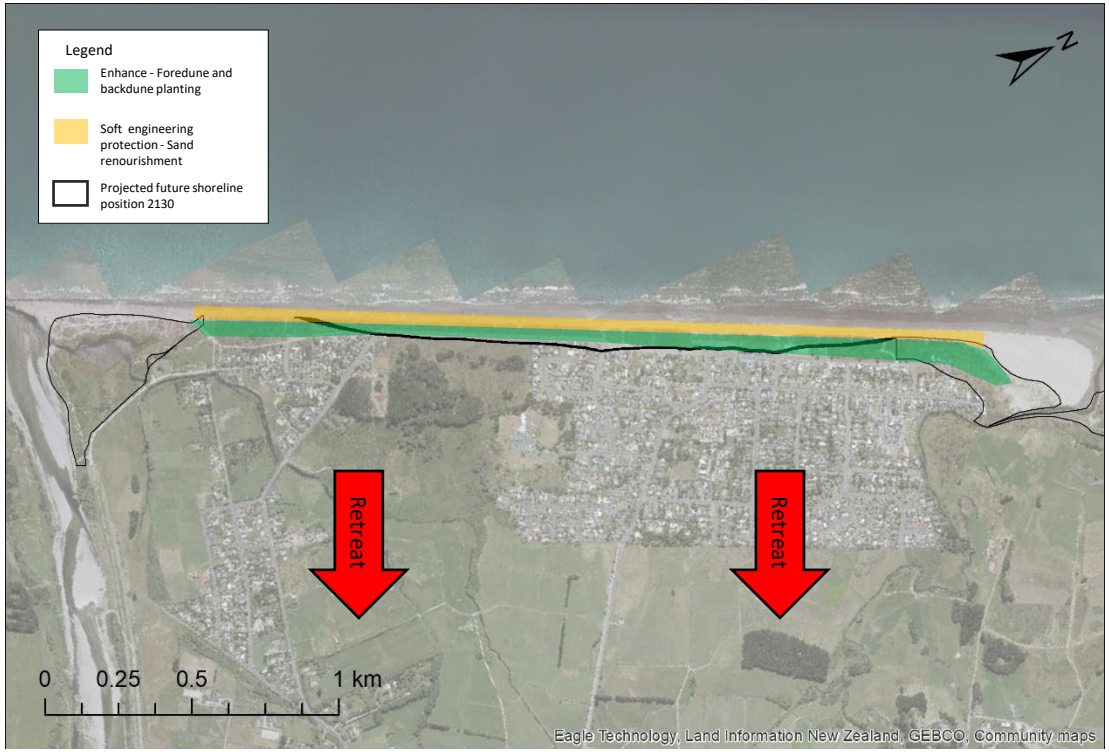
Over the medium term, as sea levels rise and erosion of the dune system becomes more extensive, imported sand would be distributed along the foredune to add volume to the beach and reduce erosion. Additional replenishments and dune maintenance would be undertaken as required.

When soft engineering is no longer cost effective, a rock revetment would be constructed along the front of the settlement to protect infrastructure and property, and effectively 'hold the line'.

Management Unit:	**1A: Otaki Beach Open Coast**	Pathway:	**4**

2050 – 14 Properties at risk of erosion
2070 – 14 Properties at risk of erosion
2130 – 14-39 Properties at risk of erosion

Short term	Medium term	Long term
Enhance [3,4]	**Soft Engineering Protection** [9]	**Retreat** [8]
Increase dune resilience by foreshore and backshore planting	Importing sand and distributing it on the foreshore to supply more bulk to the beach profile.	Proactively moving people out of the way of the hazard.



Notes:

Extensive foredune and backdune planting over the short term with weed and pest control to enhance the existing dune system, and to provide good protection in storms and faster recovery.

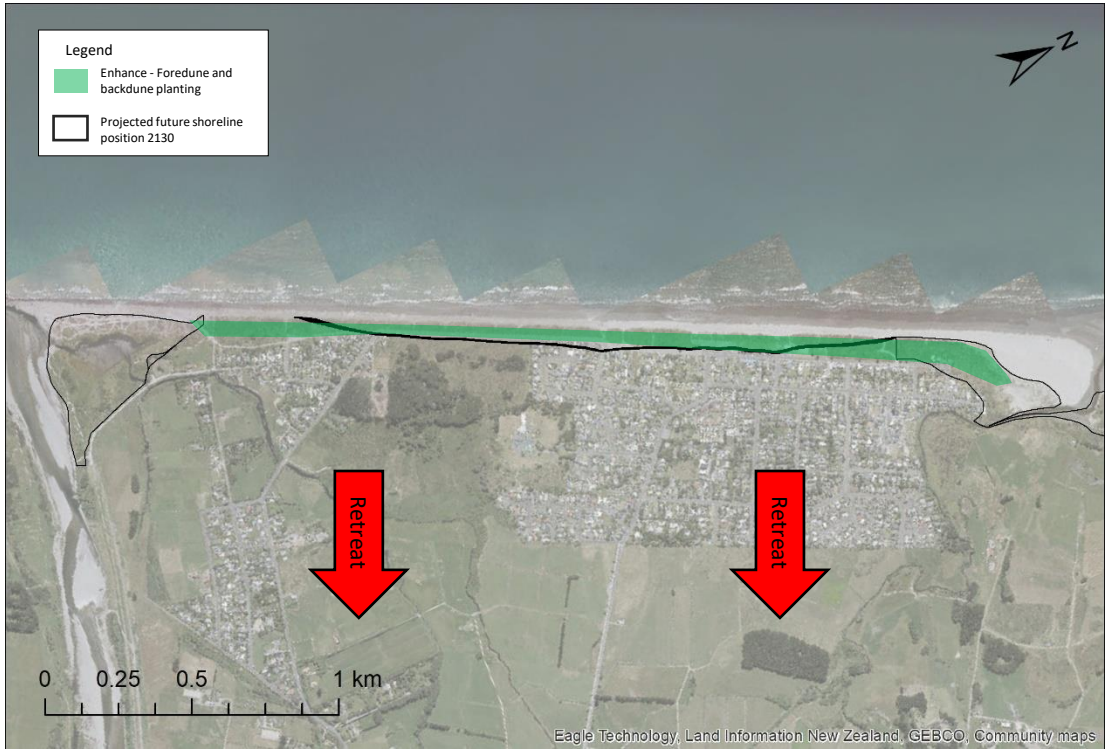
Over the medium term, as sea levels rise and erosion of the dune system becomes more extensive, imported sand would be distributed along the foredune to add volume to the beach and reduce erosion. Additional replenishments and dune maintenance would be undertaken as required.

When soft engineering is no longer cost effective, beachfront properties exposed to the erosion hazard would undergo managed retreat and be proactively relocated away from the hazard.

Management Unit:	**1A: Otaki Beach Open Coast**	Pathway:	**5**

2050 – 14 Properties at risk of erosion
2070 – 14 Properties at risk of erosion
2130 – 14-39 Properties at risk of erosion

Short term	Medium term	Long term
Enhance [3,4]	**Enhance** [3,4]	**Retreat** [8]
Increase dune resilience by foreshore and backshore planting →	Increase dune resilience by foreshore and backshore planting →	Proactively moving people out of the way of the hazard.

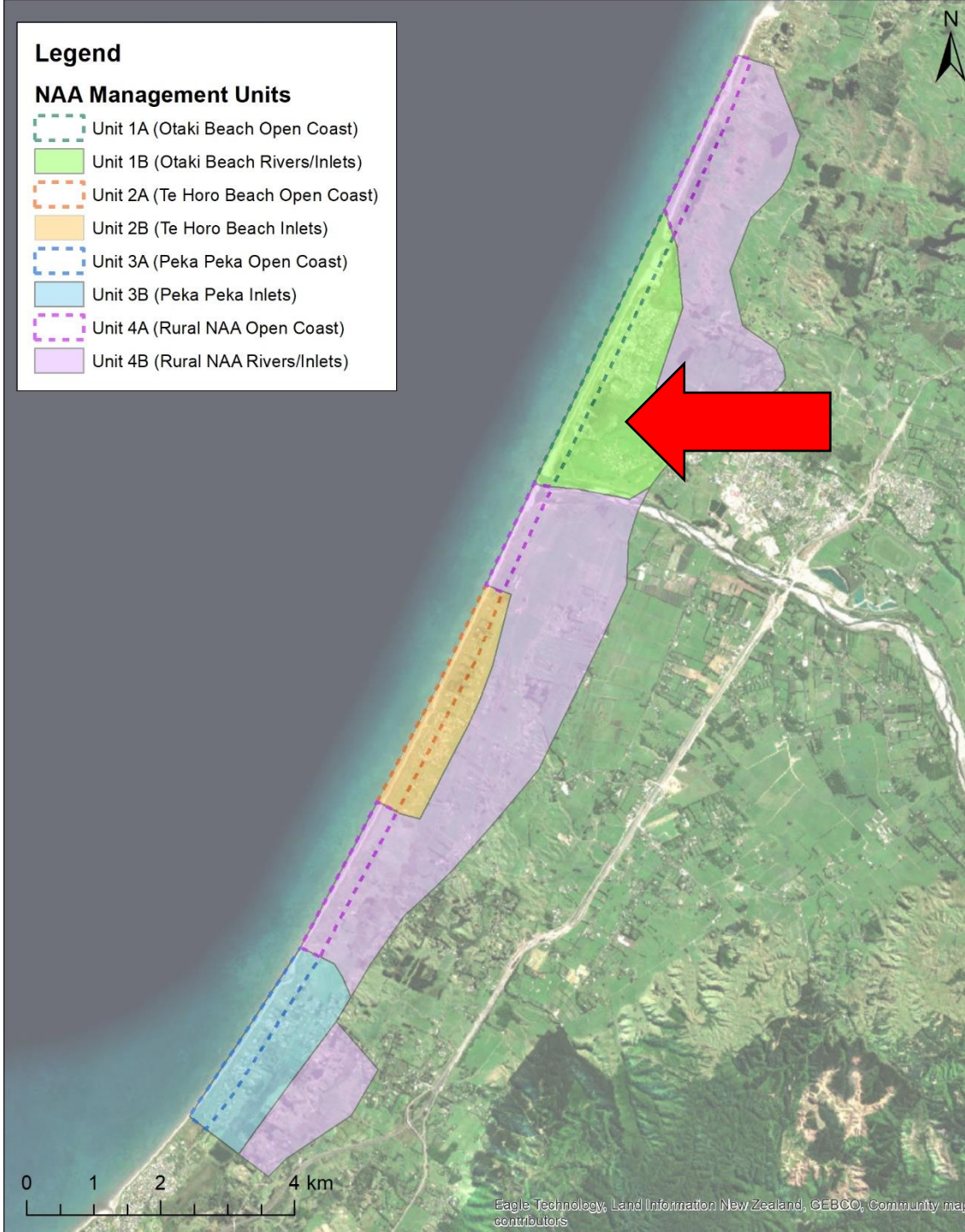


Notes:
Extensive foredune and backdune planting over the short term with weed and pest control to enhance the existing dune system, and to provide good protection in storms and faster recovery.

This is continued over the medium term where efforts to enhance the dune system are increased, and this approach is undertaken until a trigger is met, and this approach is no longer effective at managing the erosion risk.

At this point, beachfront properties exposed to the erosion hazard would undergo managed retreat and be proactively relocated away from the hazard.

Unit 1B: Otaki Beach Rivers/Inlets



Management Unit:	**1B: Otaki Beach River/Inlets**	Pathway:	**1**

2050 – 220 Properties at risk of inundation
2070 – 281-355 Properties at risk of inundation
2130 – 546-653 Properties at risk of inundation

Short term	Medium term	Long term

Enhance [2,3]

Strengthen existing stopbanks and structures, enhance wetlands.

→

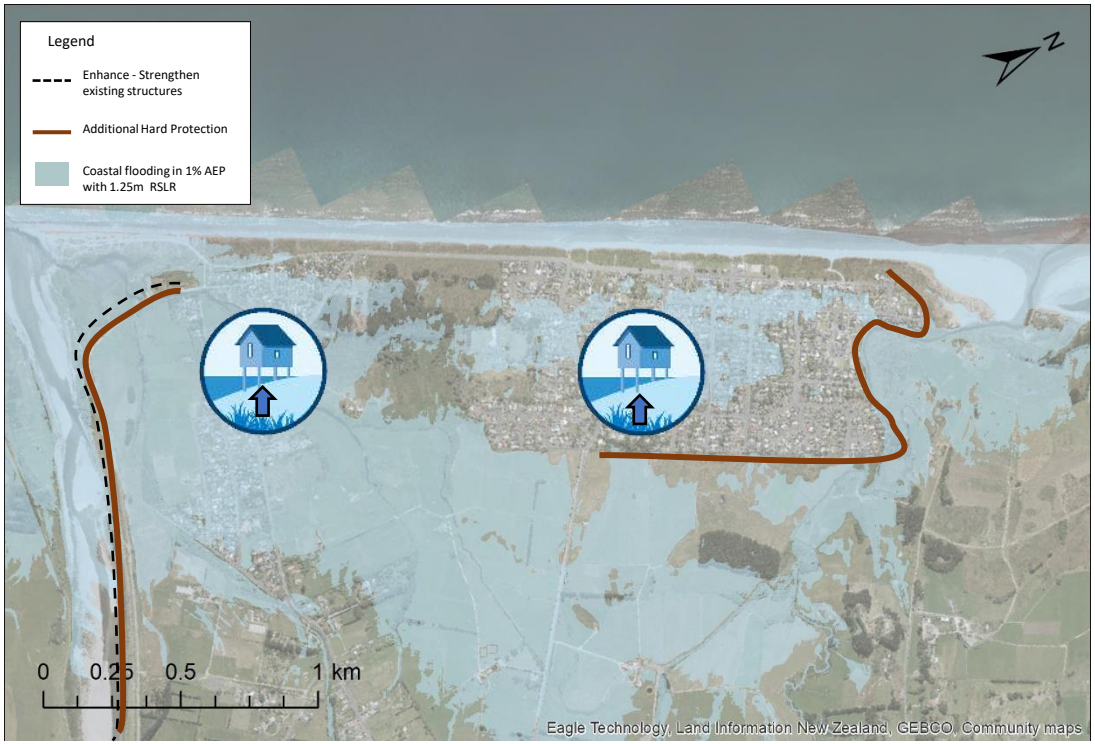
Accommodate [7]

Pro-actively raise floors of homes which could be flooded.

→

Additional Hard Protection [12, 13, 15]

Installation of floodgates, pump stations and stopbanks to prevent sea water entering the settlements



Notes:

Over the short term, upgrades and maintenance of existing infrastructure to manage the short-medium term flood risk for the settlement. This could include enhancing existing stopbanks, increasing drainage capacity of the existing stormwater outfalls. Enhance coastal wetlands through effective planting and management.

Over the medium term, dwellings where the flood risk is not being effectively managed through the broader flood protection scheme would be proactively raised so floor levels were above projected water levels in large storms to avoid being flooded. Although dwellings would be protected, access to properties and services may still be impacted.

Over the longer term, feasibility of increased hard protection schemes would be investigated and installed to manage coastal water entering the settlement via low lying waterways, overtopping the seafront, or via the stormwater network.

Management Unit:	**1B: Otaki Beach River/Inlets**	Pathway:	**2**

2050 – 220 Properties at risk of inundation
2070 – 281-355 Properties at risk of inundation
2130 – 546-653 Properties at risk of inundation

Short term	Medium term	Long term
Enhance [2,3]	**Additional Hard Protection** [12, 13, 15]	**Retreat** [8]
Strengthen existing stopbanks and structures, enhance wetlands. →	Installation of floodgates, pump stations and stopbanks to prevent sea water entering the settlements →	Proactively moving people out of the way of the hazard.

Notes:

Over the short term, upgrades and maintenance of existing infrastructure to manage the short-medium term flood risk for the settlement. This could include enhancing existing stopbanks, increasing drainage capacity of the existing stormwater outfalls. Enhance coastal wetlands through effective planting and management.

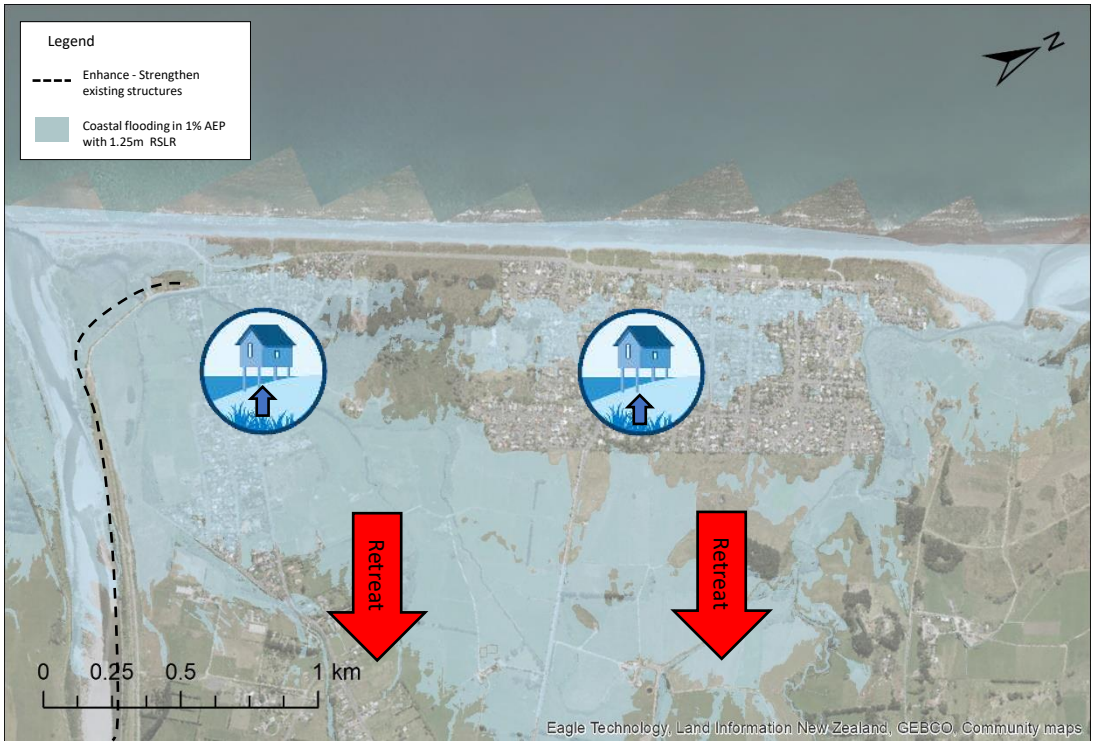
Over the medium term, feasibility of increased hard protection schemes would be investigated and installed to manage coastal water entering the settlement via low lying waterways, overtopping the seafront, or via the stormwater network.

As sea levels continue to rise, where the flood protection scheme is not longer effective in managing the risks to coastal inundation, dwellings at risk would be retreated away from the hazard.

Management Unit:	**1B: Otaki Beach River/Inlets**	Pathway:	**3**

2050 – 220 Properties at risk of inundation
2070 – 281-355 Properties at risk of inundation
2130 – 546-653 Properties at risk of inundation

Short term	Medium term	Long term
Enhance [2,3]	**Accommodate** [7]	**Retreat** [8]
Strengthen existing stopbanks and structures, enhance wetlands. →	Pro-actively raise floors of homes which could be flooded. →	Proactively moving people out of the way of the hazard.



Notes:

Over the short term, upgrades and maintenance of existing infrastructure to manage the short-medium term flood risk for the settlement. This could include enhancing existing stopbanks, increasing drainage capacity of the existing stormwater outfalls. Enhance coastal wetlands through effective planting and management.

Over the medium term, dwellings where the flood risk is not being effectively managed through the broader flood protection scheme would be proactively raised so floor levels were above projected water levels in large storms to avoid being flooded. Although dwellings would be protected, access to properties and services may still be impacted.

As sea levels continue to rise, dwellings with inundation risks that are no longer effectively being managed through the broader flood protection scheme or raised floor levels would be retreated away from the hazard.

Management Unit:	**1B: Otaki Beach River/Inlets**

Pathway:	**4**

2050 – 220 Properties at risk of inundation
2070 – 281-355 Properties at risk of inundation
2130 – 546-653 Properties at risk of inundation

Short term	Medium term	Long term

Accommodate [7]

Pro-actively raise floors of homes which could be flooded.

→

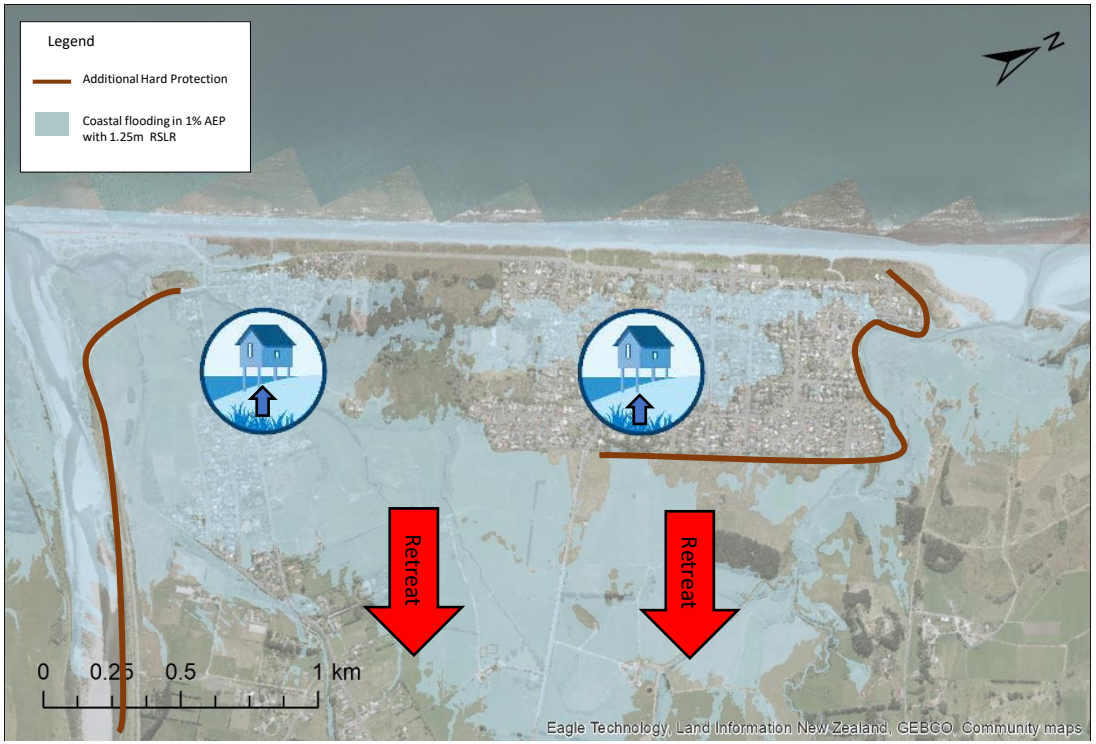
Additional Hard Protection [12, 13, 15]

Installation of floodgates, pump stations and stopbanks to prevent sea water entering the settlements

→

Retreat [8]

Proactively moving people out of the way of the hazard.



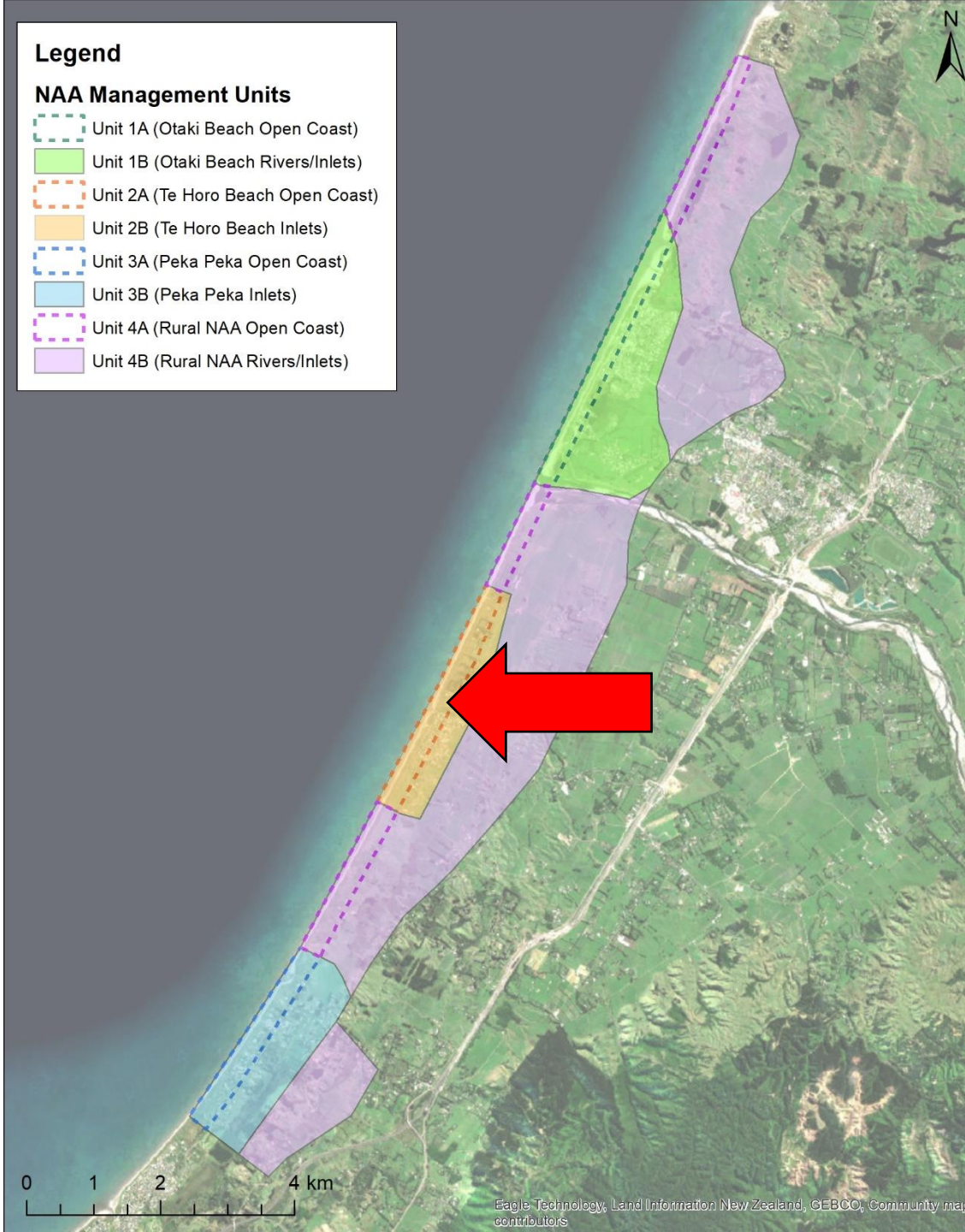
Notes:

Initially, dwellings at immediate risk of frequent flooding during storm events with significant water depths would be proactively raised so floor levels were above projected water levels in large storms to avoid being flooded. Although dwellings would be protected, access to properties and services may still be impacted.

Over the medium term, feasibility of increased hard protection schemes would be investigated and installed to manage coastal water entering the settlement via low lying waterways, overtopping the seafront, or via the stormwater network.

As sea levels continue to rise, dwellings with inundation risks that are no longer effectively being managed through the broader flood protection scheme or raised floor levels would be retreated away from the hazard.

Unit 2A:
Te Horo Beach
Open Coast



Management Unit:	**2A: Te Horo Beach Open Coast**

Pathway:	**1**

2050 – 14 Properties at risk of erosion
2070 – 14 Properties at risk of erosion
2130 – 14-18 Properties at risk of erosion

Short term	Medium term	Long term
Enhance [3,4] Increase dune resilience by foreshore and backshore planting	**Enhance** [3,4] Increase dune resilience by foreshore and backshore planting	**Soft Engineering Protection** [10] Beach scraping to increase crest elevation and reduce over-washing

Notes:
Extensive foredune and backdune planting over the short-medium term with weed and pest control to enhance the existing dune system, and to provide good protection in storms and faster recovery.

As sea levels rise and erosion of the beach becomes more extensive, beach scraping would be undertaken along the gravel beach to increase the crest elevation and reduce erosion as a result of overtopping.

Management Unit:	**2A: Te Horo Beach Open Coast**	Pathway:	**2**

2050 – 14 Properties at risk of erosion
2070 – 14 Properties at risk of erosion
2130 – 14-18 Properties at risk of erosion

Short term	Medium term	Long term
Enhance [3,4] Increase dune resilience by foreshore and backshore planting	**Soft Engineering Protection** [10] Beach scraping to increase crest elevation and reduce over-washing	**Soft Engineering Protection** [10] Beach scraping to increase crest elevation and reduce over-washing

Notes:
Extensive foredune and backdune planting over the short-medium term with weed and pest control to enhance the existing dune system, and to provide good protection in storms and faster recovery.

As sea levels rise and erosion of the beach becomes more extensive, beach scraping would be undertaken along the gravel beach to increase the crest elevation and reduce erosion as a result of overtopping.

Management Unit:	**2A: Te Horo Beach Open Coast**	Pathway:	**3**

2050 – 14 Properties at risk of erosion
2070 – 14 Properties at risk of erosion
2130 – 14-18 Properties at risk of erosion

Short term	Medium term	Long term
Enhance [3,4]	**Soft Engineering Protection** [10]	**Hard Engineering Protection**[11]
Increase dune resilience by foreshore and backshore planting	Beach scraping to increase crest elevation and reduce over-washing	Rock revetment structure along the front of the settlement.

Notes:
Extensive foredune and backdune planting over the short-medium term with weed and pest control to enhance the existing dune system, and to provide good protection in storms and faster recovery.

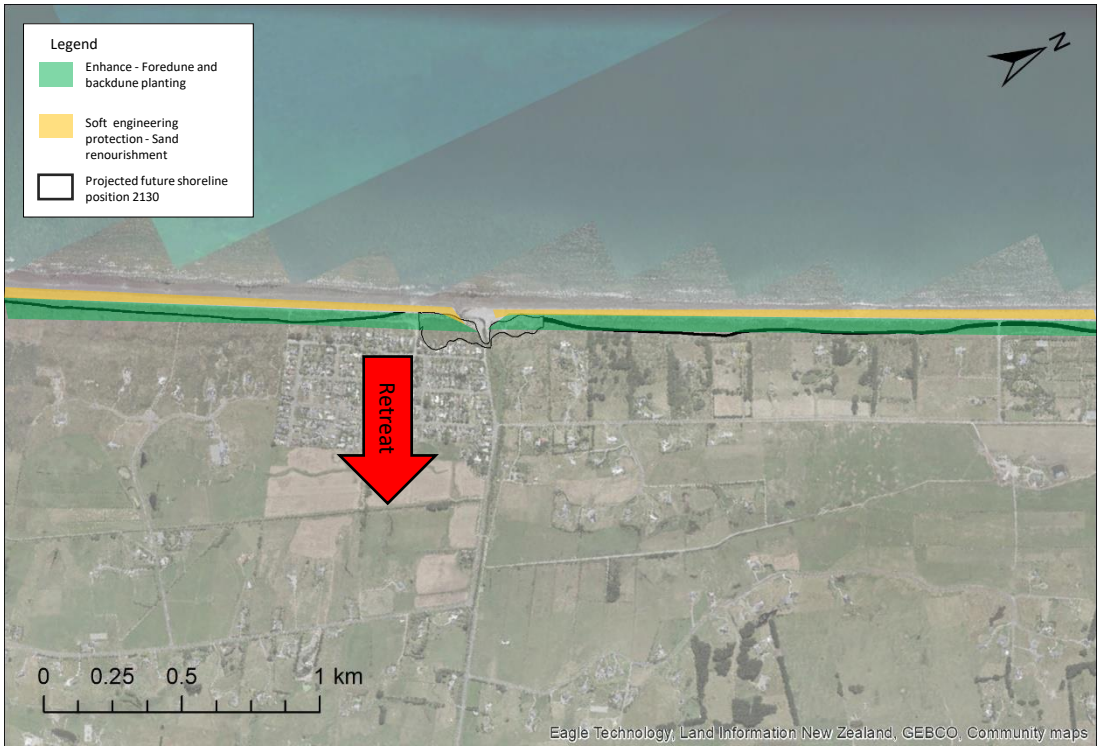
As sea levels rise and erosion of the beach becomes more extensive, beach scraping would be undertaken along the gravel beach to increase the crest elevation and reduce erosion as a result of overtopping.

When beach scraping is no longer cost effective, a rock revetment would be constructed along the front of the settlement to protect properties, and effectively 'hold the line'.

Management Unit:	**2A: Te Horo Beach Open Coast**	Pathway:	**4**

2050 – 14 Properties at risk of erosion
2070 – 14 Properties at risk of erosion
2130 – 14-18 Properties at risk of erosion

Short term	Medium term	Long term
Enhance [3,4]	**Soft Engineering Protection** [10]	**Retreat** [8]
Increase dune resilience by foreshore and backshore planting	Importing sand and distributing it on the foreshore to supply more bulk to the beach profile.	Proactively moving people out of the way of the hazard.



Notes:
Extensive foredune and backdune planting over the short term with weed and pest control to enhance the existing dune system, and to provide good protection in storms and faster recovery.

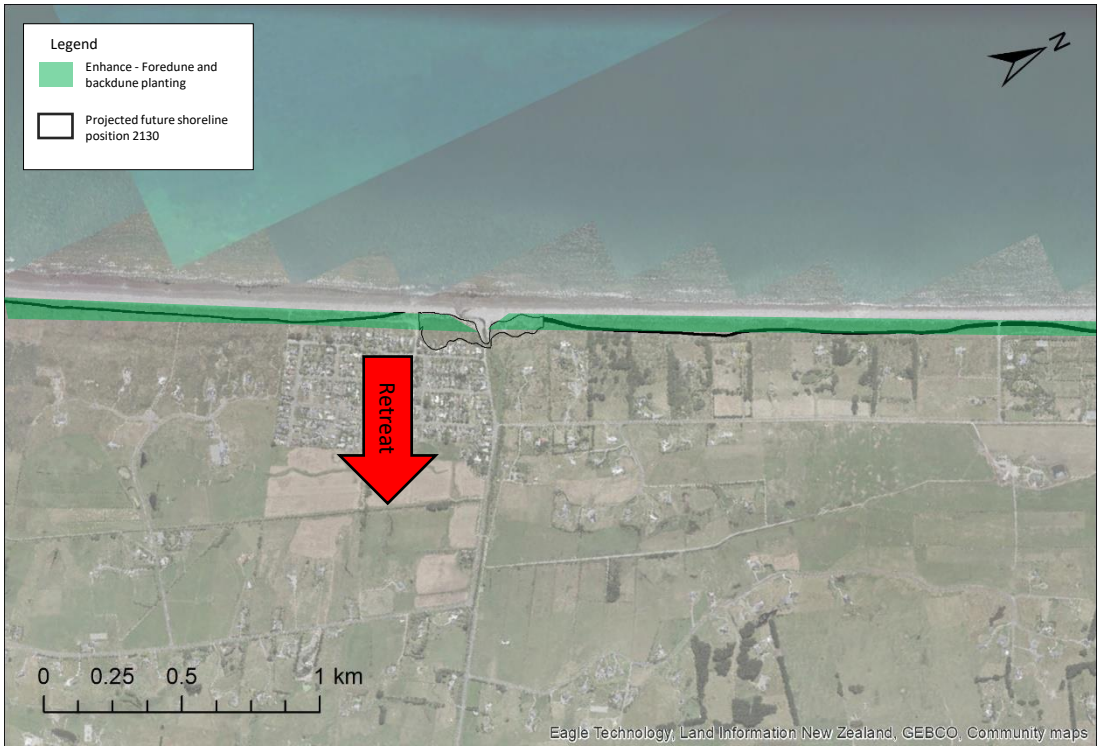
Over the medium term, as sea levels rise and erosion of the beach becomes more extensive, beach scraping would be undertaken along the gravel beach to increase the crest elevation and reduce erosion as a result of overtopping.

When soft engineering is no longer cost effective at maintaining the shoreline, beachfront properties exposed to the erosion hazard would undergo managed retreat and be proactively relocated away from the hazard.

Management Unit:	**2A: Te Horo Beach Open Coast**	Pathway:	**5**

2050 – 14 Properties at risk of erosion
2070 – 14 Properties at risk of erosion
2130 – 14-18 Properties at risk of erosion

Short term	Medium term	Long term
Enhance [3,4]	**Enhance** [3,4]	**Retreat** [8]
Increase dune resilience by foreshore and backshore planting →	Increase dune resilience by foreshore and backshore planting →	Proactively moving people out of the way of the hazard.

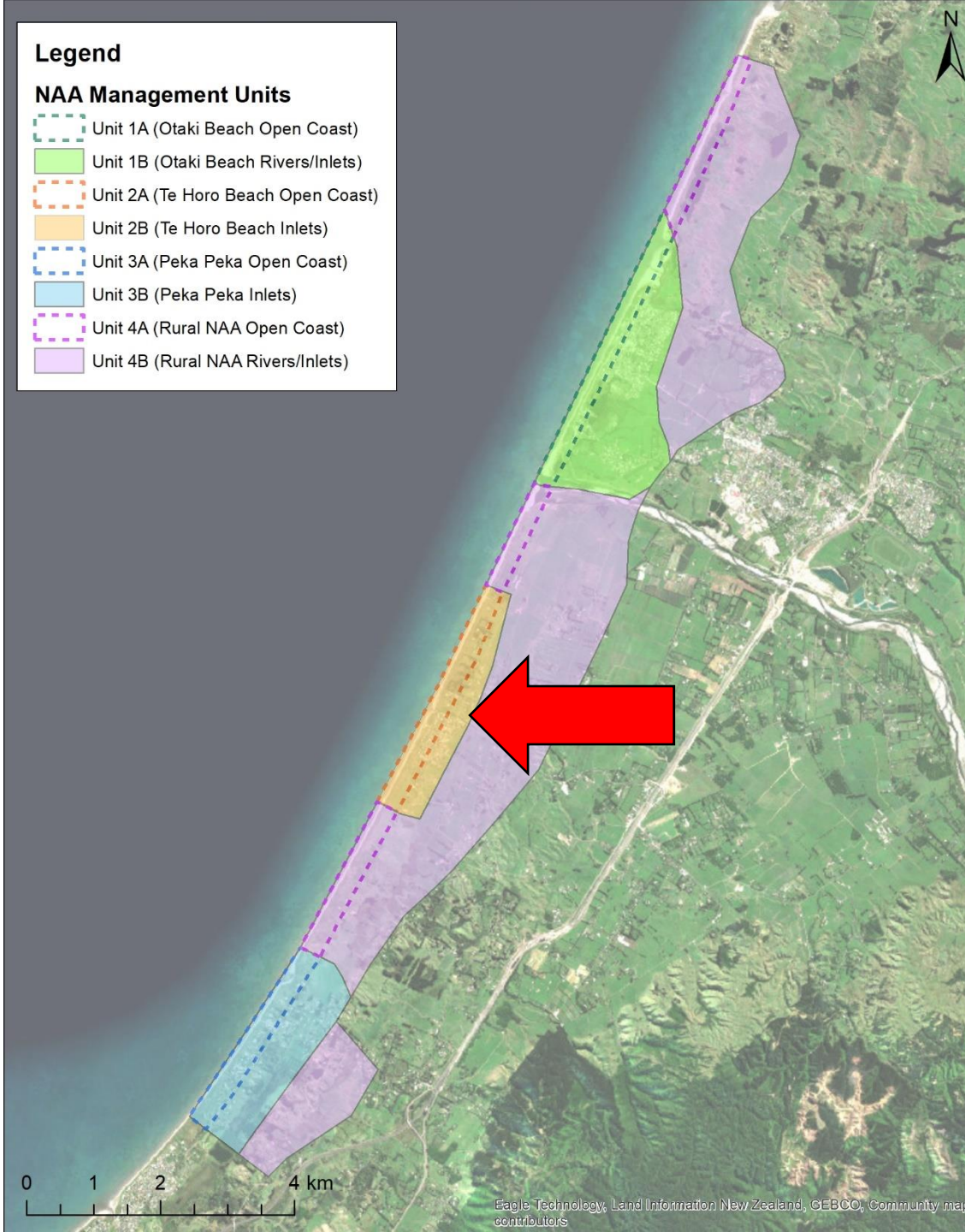


Notes:
Extensive foredune and backdune planting over the short term with weed and pest control to enhance the existing dune system, and to provide good protection in storms and faster recovery.

This is continued over the medium term where efforts to enhance the dune system are increased, and this approach is undertaken until a trigger is met, and this approach is no longer effective at managing the erosion risk.

At this point, beachfront properties exposed to the erosion hazard would undergo managed retreat and be proactively relocated away from the hazard.

Unit 2B:
Te Horo Beach Rivers/Inlets



Management Unit:	**2B: Te Horo Beach River/Inlets**	Pathway:	**1**

2050 – 63 Properties at risk of inundation
2070 – 87-98 Properties at risk of inundation
2130 – 130-152 Properties at risk of inundation

Short term	Medium term	Long term

Enhance [2,3]

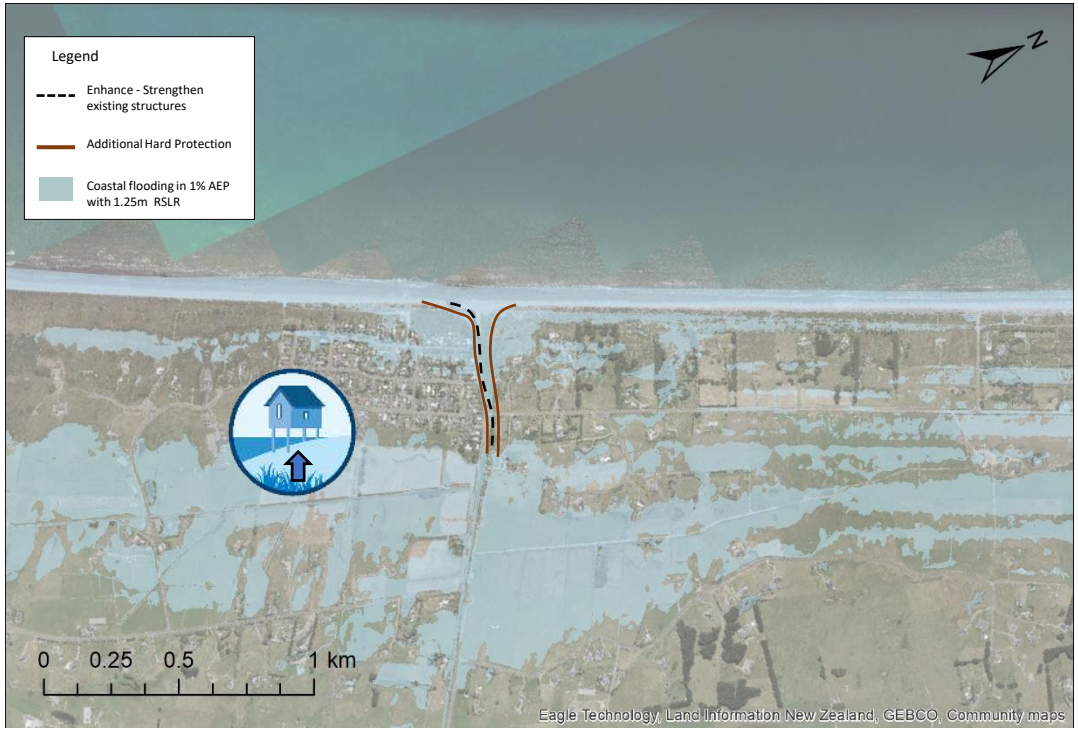
Strengthen existing stopbanks and structures, enhance wetlands.

Accommodate [7]

Pro-actively raise floors of homes which could be flooded.

Additional Hard Protection [12, 13, 15]

Installation of floodgates, pump stations and stopbanks to prevent sea water entering the settlements



Notes:

Over the short term, upgrades and maintenance of existing infrastructure to manage the short-medium term flood risk for the settlement. This could include enhancing existing bunds, increasing drainage capacity of the existing stormwater outfalls. Enhance coastal wetlands through effective planting and management.

Over the medium term, dwellings where the flood risk is not being effectively managed through the broader flood protection scheme would be proactively raised so floor levels were above projected water levels in large storms to avoid being flooded. Although dwellings would be protected, access to properties and services may still be impacted.

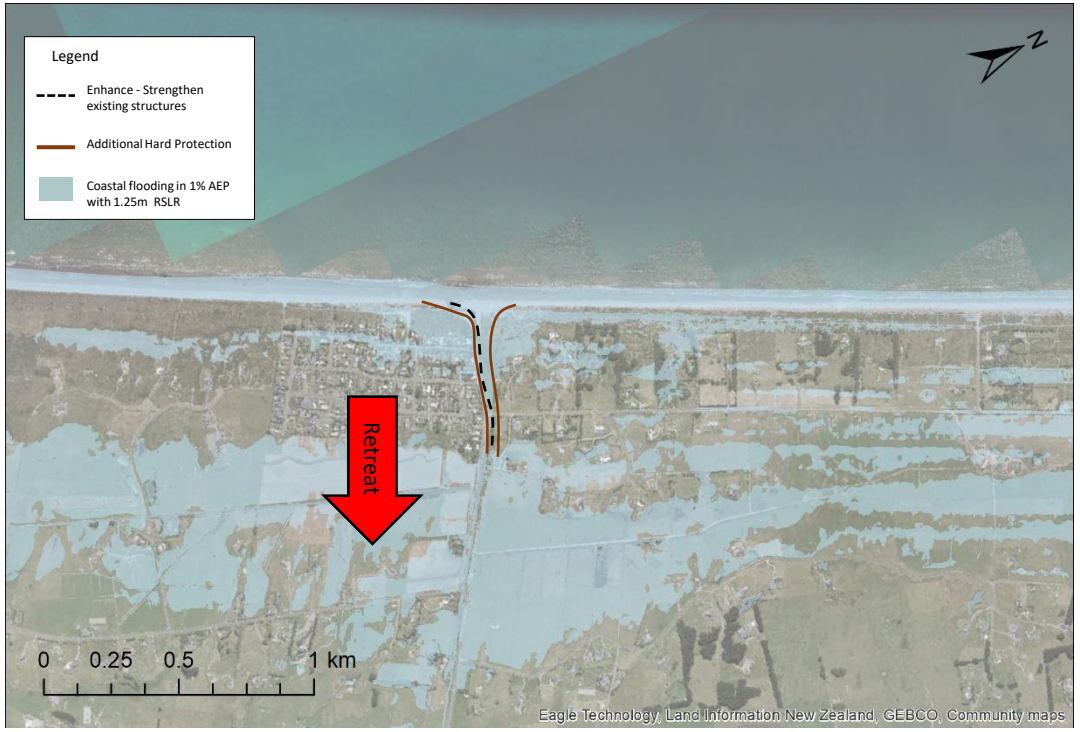
Over the longer term, feasibility of increased hard protection schemes would be investigated and installed to manage coastal water entering the settlement via low lying waterways, overtopping the beach, or via the stormwater network.

Management Unit:	**2B: Te Horo Beach River/Inlets**

Pathway:	**2**

2050 – 63 Properties at risk of inundation
2070 – 87-98 Properties at risk of inundation
2130 – 130-152 Properties at risk of inundation

Short term	Medium term	Long term
Enhance [2,3]	**Additional Hard Protection** [12, 13, 15]	**Retreat** [8]
Strengthen existing stopbanks and structures, enhance wetlands. →	Installation of floodgates, pump stations and stopbanks to prevent sea water entering the settlements →	Proactively moving people out of the way of the hazard.



Notes:

Over the short term, upgrades and maintenance of existing infrastructure to manage the short-medium term flood risk for the settlement. This could include enhancing existing bunds, increasing drainage capacity of the existing stormwater outfalls. Enhance coastal wetlands through effective planting and management.

Over the medium term, feasibility of increased hard protection schemes would be investigated and installed to manage coastal water entering the settlement via low lying waterways, overtopping the seafront, or via the stormwater network.

As sea levels continue to rise, where the flood protection scheme is no longer effective in managing the risks of coastal inundation, dwellings at risk would be retreated away from the hazard.

Management Unit:	**2B: Te Horo Beach River/Inlets**	Pathway:	**3**

2050 – 63 Properties at risk of inundation
2070 – 87-98 Properties at risk of inundation
2130 – 130-152 Properties at risk of inundation

Short term	Medium term	Long term

Enhance [2,3]

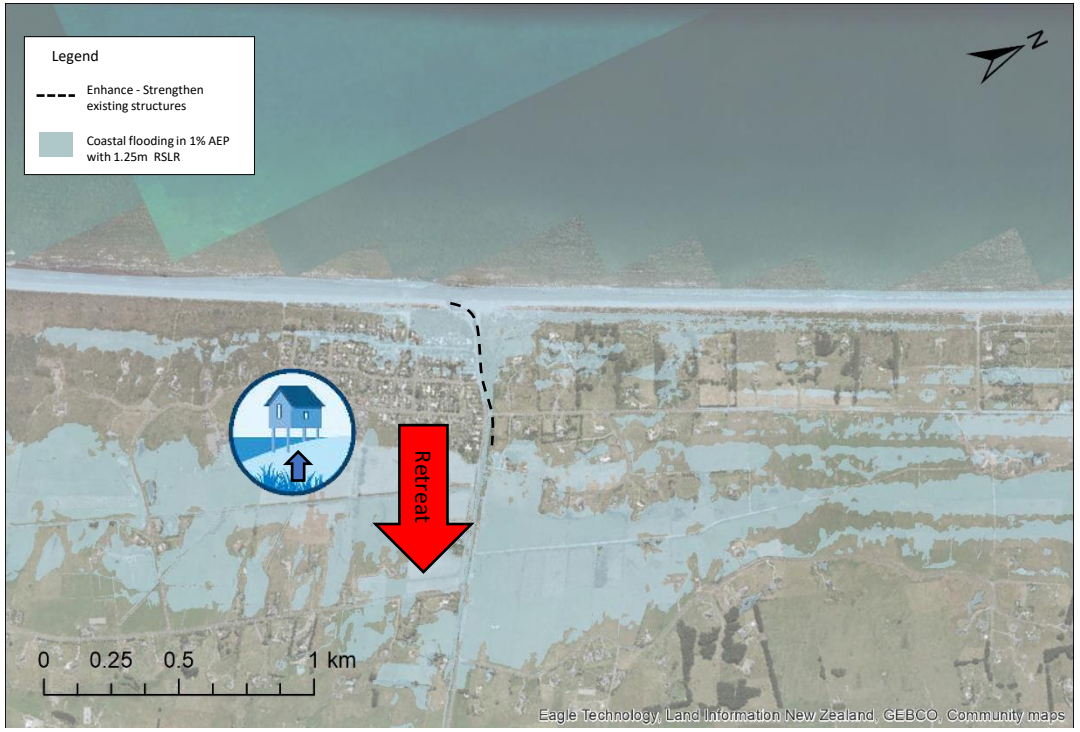
Strengthen existing stopbanks and structures, enhance wetlands.

Accommodate [7]

Pro-actively raise floors of homes which could be flooded.

Retreat [8]

Proactively moving people out of the way of the hazard.



Notes:

Over the short term, upgrades and maintenance of existing infrastructure to manage the short-medium term flood risk for the settlement. This could include enhancing existing bunds, increasing drainage capacity of the existing stormwater outfalls. Enhance coastal wetlands through effective planting and management.

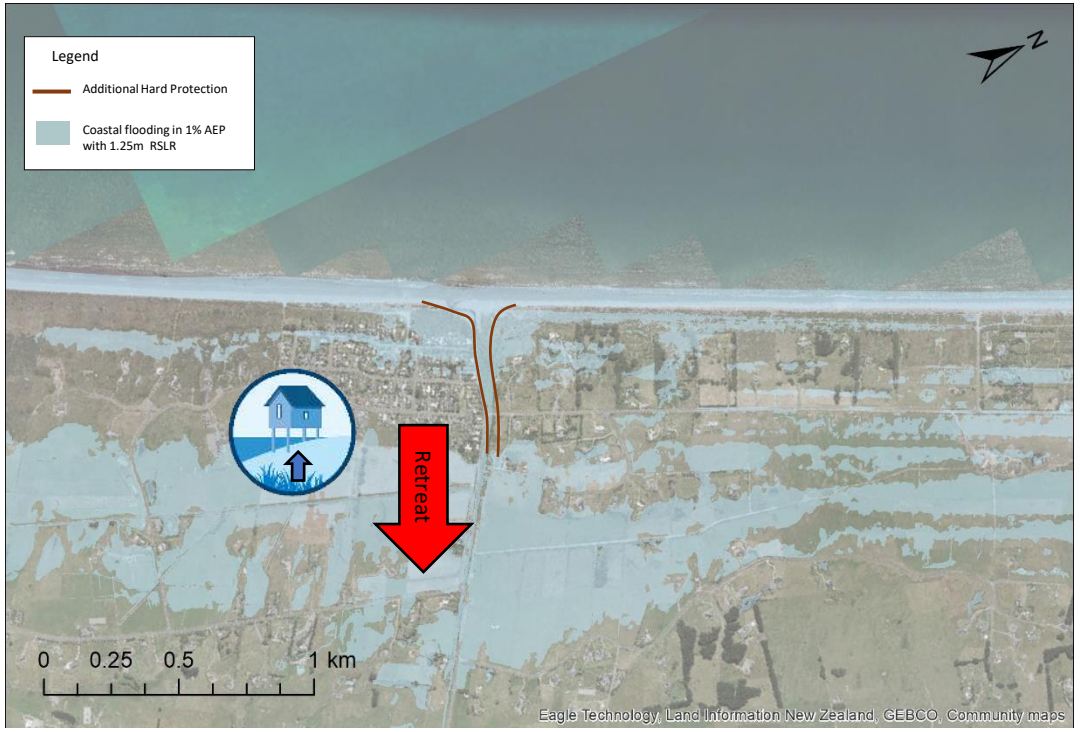
Over the medium term, dwellings where the flood risk is not being effectively managed through the broader flood protection scheme would be proactively raised so floor levels were above projected water levels in large storms to avoid being flooded. Although dwellings would be protected, access to properties and services may still be impacted.

As sea levels continue to rise, dwellings with inundation risks that are no longer effectively being managed through the broader flood protection scheme or raised floor levels would be retreated away from the hazard.

Management Unit:	**2B: Te Horo Beach River/Inlets**	Pathway:	**4**

2050 – 63 Properties at risk of inundation
2070 – 87-98 Properties at risk of inundation
2130 – 130-152 Properties at risk of inundation

Short term	Medium term	Long term
Accommodate [7]	**Additional Hard Protection** [12, 13, 15]	**Retreat** [8]
Pro-actively raise floors of homes which could be flooded. →	Installation of floodgates, pump stations and stopbanks to prevent sea water entering the settlements →	Proactively moving people out of the way of the hazard.



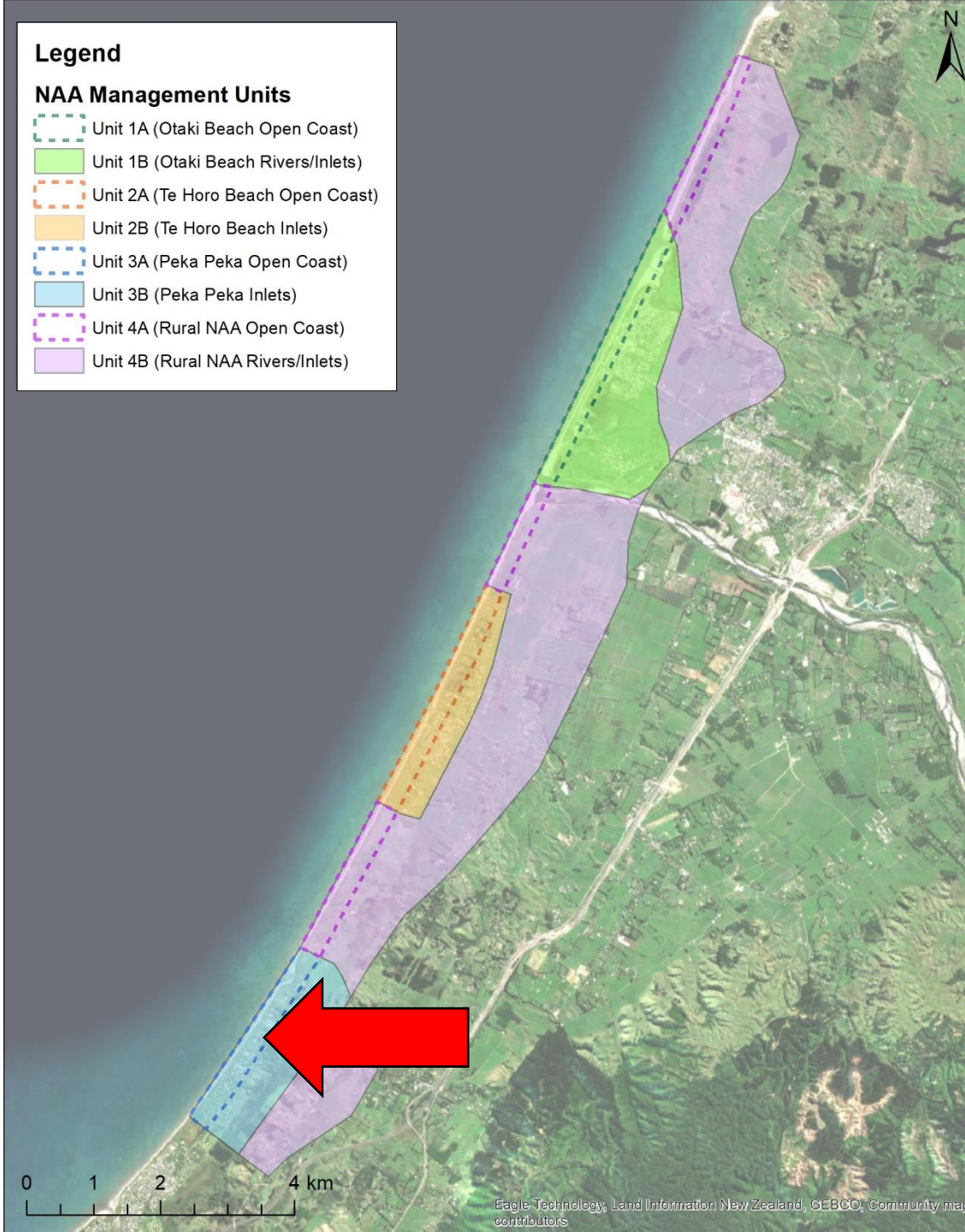
Notes:

Initially, dwellings at immediate risk of frequent flooding during storm events with significant water depths would be proactively raised so floor levels were above projected water levels in large storms to avoid being flooded. Although dwellings would be protected, access to properties and services may still be impacted.

Over the medium term, feasibility of increased hard protection schemes would be investigated and installed to manage coastal water entering the settlement via low lying waterways, overtopping the seafront, or via the stormwater network.

As sea levels continue to rise, dwellings with inundation risks that are no longer effectively being managed through the broader flood protection scheme or raised floor levels would be retreated away from the hazard.

Unit 3A: Peka Peka Open Coast



Management Unit:	**3A: Peka Peka Open Coast**	Pathway:	**1**

2050 – 0 Properties at risk of erosion
2070 – 0 Properties at risk of erosion
2130 – 9-33 Properties at risk of erosion

Short term	Medium term	Long term

Enhance [3,4]

Increase dune resilience by foreshore and backshore planting

→

Enhance [3,4]

Increase dune resilience by foreshore and backshore planting

→

Soft Engineering Protection [9]

Importing sand and distributing it on the foreshore to supply more bulk to the beach profile.

Notes:
Extensive foredune and backdune planting over the short-medium term with weed and pest control to enhance the existing dune system, and to provide good protection in storms and faster recovery.

As sea levels rise and erosion of the dune system becomes more extensive, imported sand would be distributed along the foredune to add volume to the beach and reduce erosion. Additional replenishments and dune maintenance would be undertaken as required to maintain dune volumes which provide sufficient protection.

Management Unit:	**3A: Peka Peka Open Coast**

Pathway:	**2**

2050 – 0 Properties at risk of erosion
2070 – 0 Properties at risk of erosion
2130 – 9-33 Properties at risk of erosion

Short term	Medium term	Long term
Enhance [3,4]	**Soft Engineering Protection** [9]	**Soft Engineering Protection** [9]
Increase dune resilience by foreshore and backshore planting	Importing sand and distributing it on the foreshore to supply more bulk to the beach profile.	Importing sand and distributing it on the foreshore to supply more bulk to the beach profile.

Notes:
Extensive foredune and backdune planting over the short term with weed and pest control to enhance the existing dune system, and to provide good protection in storms and faster recovery.

Over the medium term, as sea levels rise and erosion of the dune system becomes more extensive, imported sand would be distributed along the foredune to add volume to the beach and reduce erosion. Additional replenishments and dune maintenance would be undertaken as required.

As sea levels rise, increased replenishments and maintenance would be required to reduce the effects of erosion.

Management Unit:	**3A: Peka Peka Open Coast**

Pathway:	**3**

2050 – 0 Properties at risk of erosion
2070 – 0 Properties at risk of erosion
2130 – 9-33 Properties at risk of erosion

Short term	Medium term	Long term

Enhance [3,4]

Increase dune resilience by foreshore and backshore planting

→

Soft Engineering Protection [9]

Importing sand and distributing it on the foreshore to supply more bulk to the beach profile.

→

Hard Engineering Protection[11]

Rock revetment structure along the front of the settlement.

Notes:

Extensive foredune and backdune planting over the short term with weed and pest control to enhance the existing dune system, and to provide good protection in storms and faster recovery.

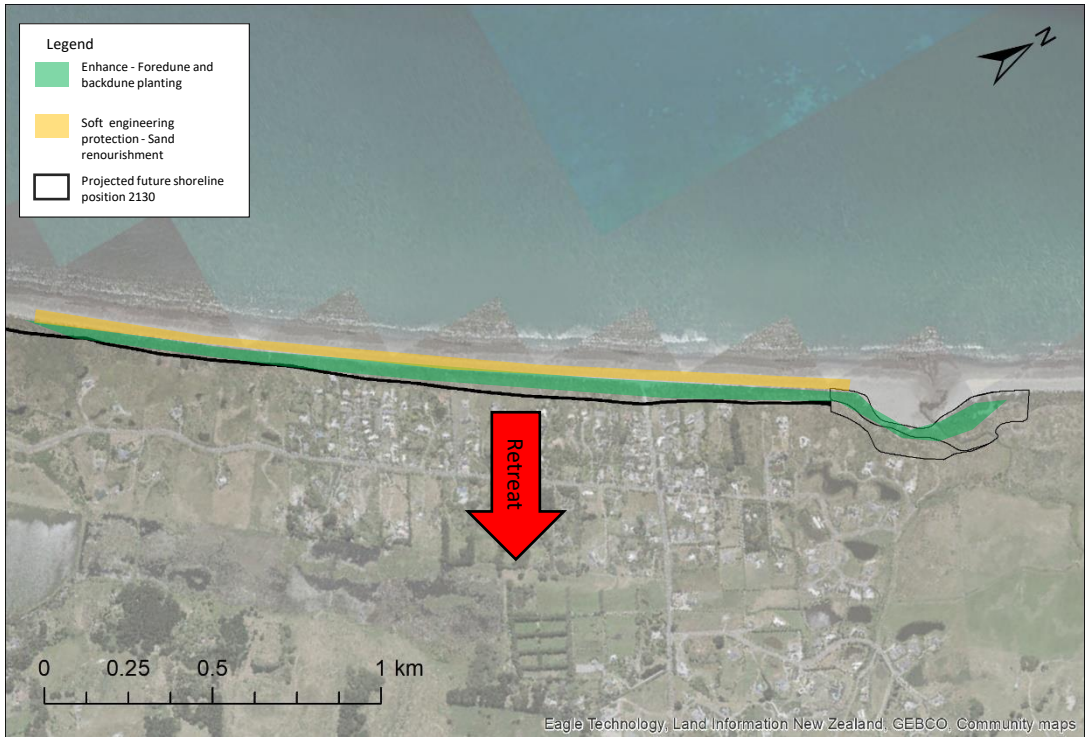
Over the medium term, as sea levels rise and erosion of the dune system becomes more extensive, imported sand would be distributed along the foredune to add volume to the beach and reduce erosion. Additional replenishments and dune maintenance would be undertaken as required.

When soft engineering is no longer cost effective, a rock revetment would be constructed along the front of the settlement to protect infrastructure and property, and effectively 'hold the line'.

Management Unit:	**3A: Peka Peka Open Coast**	Pathway:	**4**

2050 – 0 Properties at risk of erosion
2070 – 0 Properties at risk of erosion
2130 – 9-33 Properties at risk of erosion

Short term	Medium term	Long term
Enhance [3,4]	**Soft Engineering Protection** [9]	**Retreat** [8]
Increase dune resilience by foreshore and backshore planting	Importing sand and distributing it on the foreshore to supply more bulk to the beach profile.	Proactively moving people out of the way of the hazard.



Notes:
Extensive foredune and backdune planting over the short term with weed and pest control to enhance the existing dune system, and to provide good protection in storms and faster recovery.

Over the medium term, as sea levels rise and erosion of the dune system becomes more extensive, imported sand would be distributed along the foredune to add volume to the beach and reduce erosion. Additional replenishments and dune maintenance would be undertaken as required.

When soft engineering is no longer cost effective, beachfront properties exposed to the erosion hazard would undergo managed retreat and be proactively relocated away from the hazard.

Management Unit:	**3A: Peka Peka Open Coast**

Pathway:	**5**

2050 – 0 Properties at risk of erosion
2070 – 0 Properties at risk of erosion
2130 – 9-33 Properties at risk of erosion

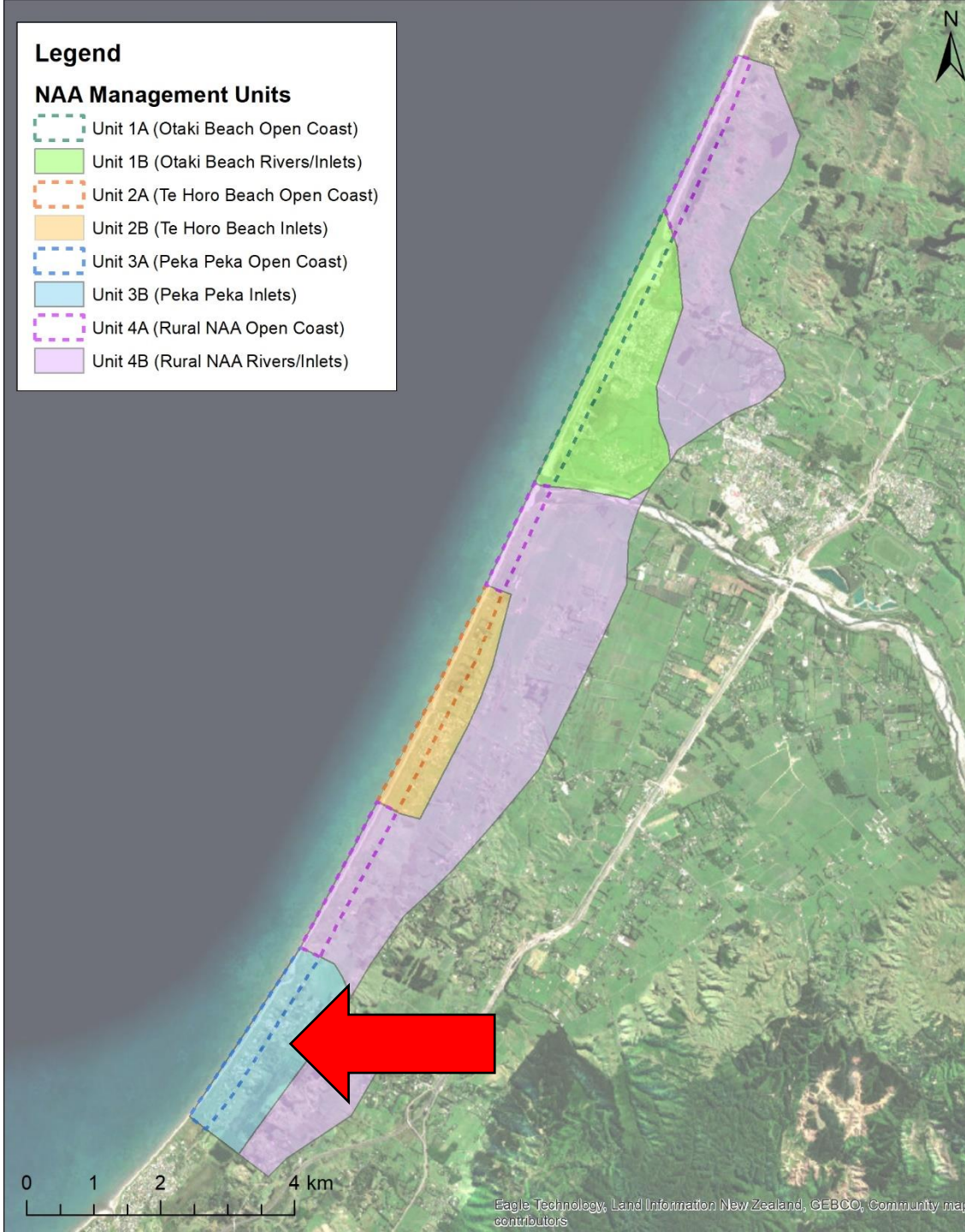
Short term	Medium term	Long term
Enhance [3,4]	**Enhance** [3,4]	**Retreat** [8]
Increase dune resilience by foreshore and backshore planting →	Increase dune resilience by foreshore and backshore planting →	Proactively moving people out of the way of the hazard.

Notes:
Extensive foredune and backdune planting over the short term with weed and pest control to enhance the existing dune system, and to provide good protection in storms and faster recovery.

This is continued over the medium term where efforts to enhance the dune system are increased, and this approach is undertaken until a trigger is met, and this approach is no longer effective at managing the erosion risk.

At this point, beachfront properties exposed to the erosion hazard would undergo managed retreat and be proactively relocated away from the hazard.

Unit 3B: Peka Peka Rivers/Inlets



Management Unit:	**3B: Peka Peka River/Inlet**	Pathway:	**1**

2050 – 96 Properties at risk of inundation
2070 – 131-145 Properties at risk of inundation
2130 – 171-206 Properties at risk of inundation

Short term	Medium term	Long term

Enhance [2,3]

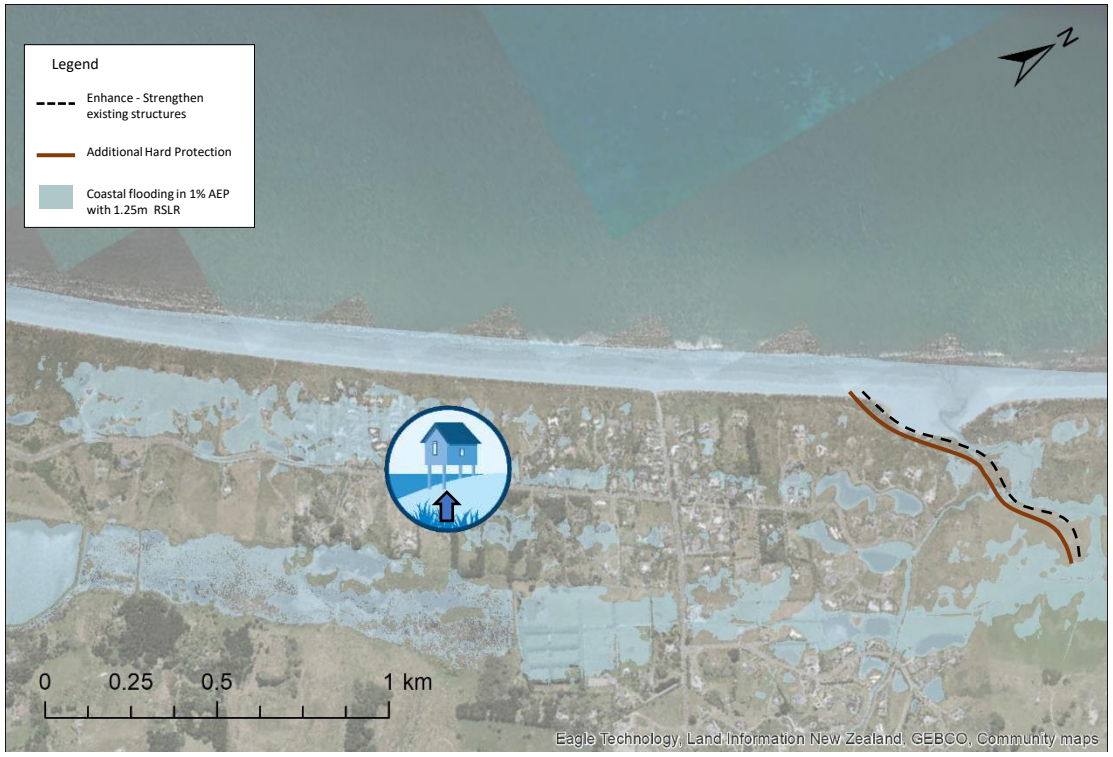
Strengthen existing stopbanks and structures, enhance wetlands.

Accommodate [7]

Pro-actively raise floors of homes which could be flooded.

Additional Hard Protection [12, 13, 15]

Installation of floodgates, pump stations and stopbanks to prevent sea water entering the settlements



Notes:

Over the short term, upgrades and maintenance of existing infrastructure to manage the short-term flood risk for the settlement. This could include enhancing existing bunds, increasing drainage capacity of the existing stormwater outfalls, and enhancing coastal wetlands through effective planting and management.

Over the medium term, dwellings where the flood risk is not being effectively managed through the broader flood protection scheme would be proactively raised so floor levels were above projected water levels in large storms to avoid being flooded. Although dwellings would be protected, access to properties and services may still be impacted.

Over the longer term, feasibility of increased hard protection schemes would be investigated and installed to manage coastal water entering the settlement via low lying waterways, overtopping the beach, or via the stormwater network.

Management Unit:	**3B: Peka Peka River/Inlet**	Pathway:	**2**

2050 – 96 Properties at risk of inundation
2070 – 131-145 Properties at risk of inundation
2130 – 171-206 Properties at risk of inundation

Short term	Medium term	Long term
Enhance [2,3]	**Additional Hard Protection** [12, 13, 15]	**Retreat** [8]
Strengthen existing stopbanks and structures, enhance wetlands.	Installation of floodgates, pump stations and stopbanks to prevent sea water entering the settlements	Proactively moving people out of the way of the hazard.

Notes:

Over the short term, upgrades and maintenance of existing infrastructure to manage the short-medium term flood risk for the settlement. This could include enhancing existing bunds, increasing drainage capacity of the existing stormwater outfalls, and enhancing coastal wetlands through effective planting and management.

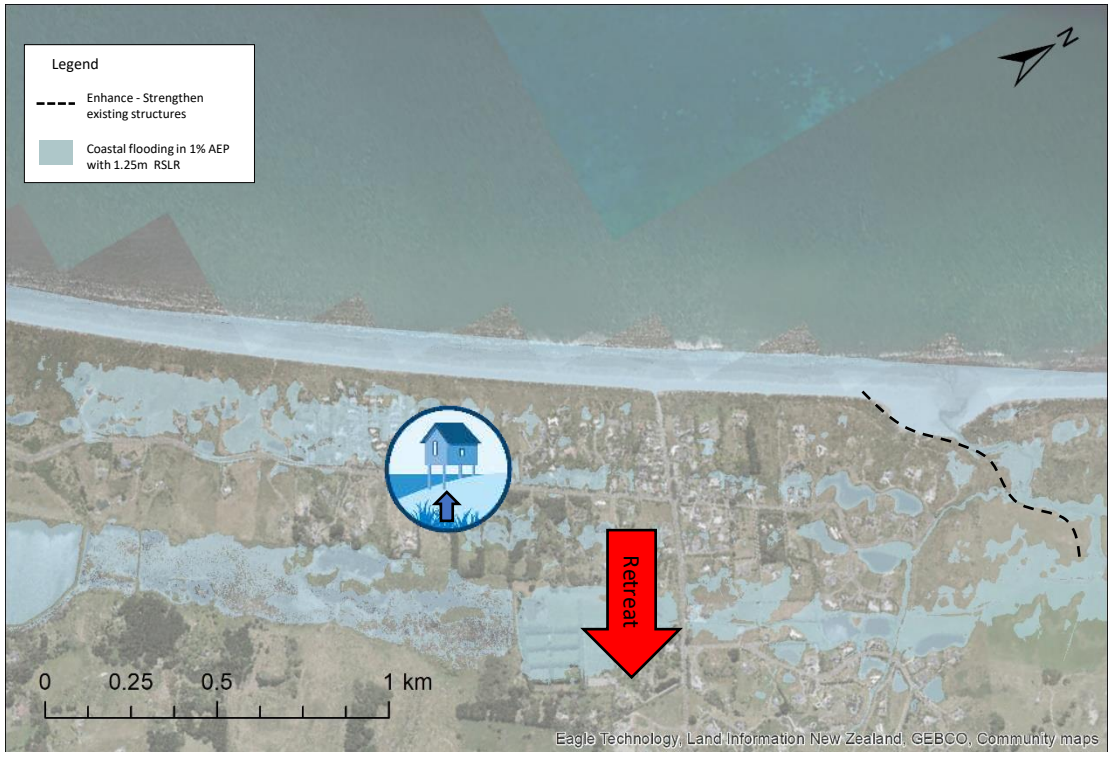
Over the medium term, feasibility of increased hard protection schemes would be investigated and installed to manage coastal water entering the settlement via low lying waterways, overtopping the seafront, or via the stormwater network.

As sea levels continue to rise, where the flood protection scheme is no longer effective in managing the risks of coastal inundation, dwellings at risk would be retreated away from the hazard.

Management Unit:	**3B: Peka Peka River/Inlet**	Pathway:	**3**

2050 – 96 Properties at risk of inundation
2070 – 131-145 Properties at risk of inundation
2130 – 171-206 Properties at risk of inundation

Short term	Medium term	Long term
Enhance [2,3]	**Accommodate** [7]	**Retreat** [8]
Strengthen existing stopbanks and structures, enhance wetlands. →	Pro-actively raise floors of homes which could be flooded. →	Proactively moving people out of the way of the hazard.



Notes:

Over the short term, upgrades and maintenance of existing infrastructure to manage the short-medium term flood risk for the settlement. This could include enhancing existing bunds, increasing drainage capacity of the existing stormwater outfalls, and enhancement of coastal wetlands through effective planting and management.

Over the medium term, dwellings where the flood risk is not being effectively managed through the broader flood protection scheme would be proactively raised so floor levels were above projected water levels in large storms to avoid being flooded. Although dwellings would be protected, access to properties and services may still be impacted

As sea levels continue to rise, dwellings with inundation risks that are no longer effectively being managed through the broader flood protection scheme or raised floor levels would be retreated away from the hazard.

Management Unit:	**3B: Peka Peka River/Inlet**	Pathway:	**4**

2050 – 96 Properties at risk of inundation
2070 – 131-145 Properties at risk of inundation
2130 – 171-206 Properties at risk of inundation

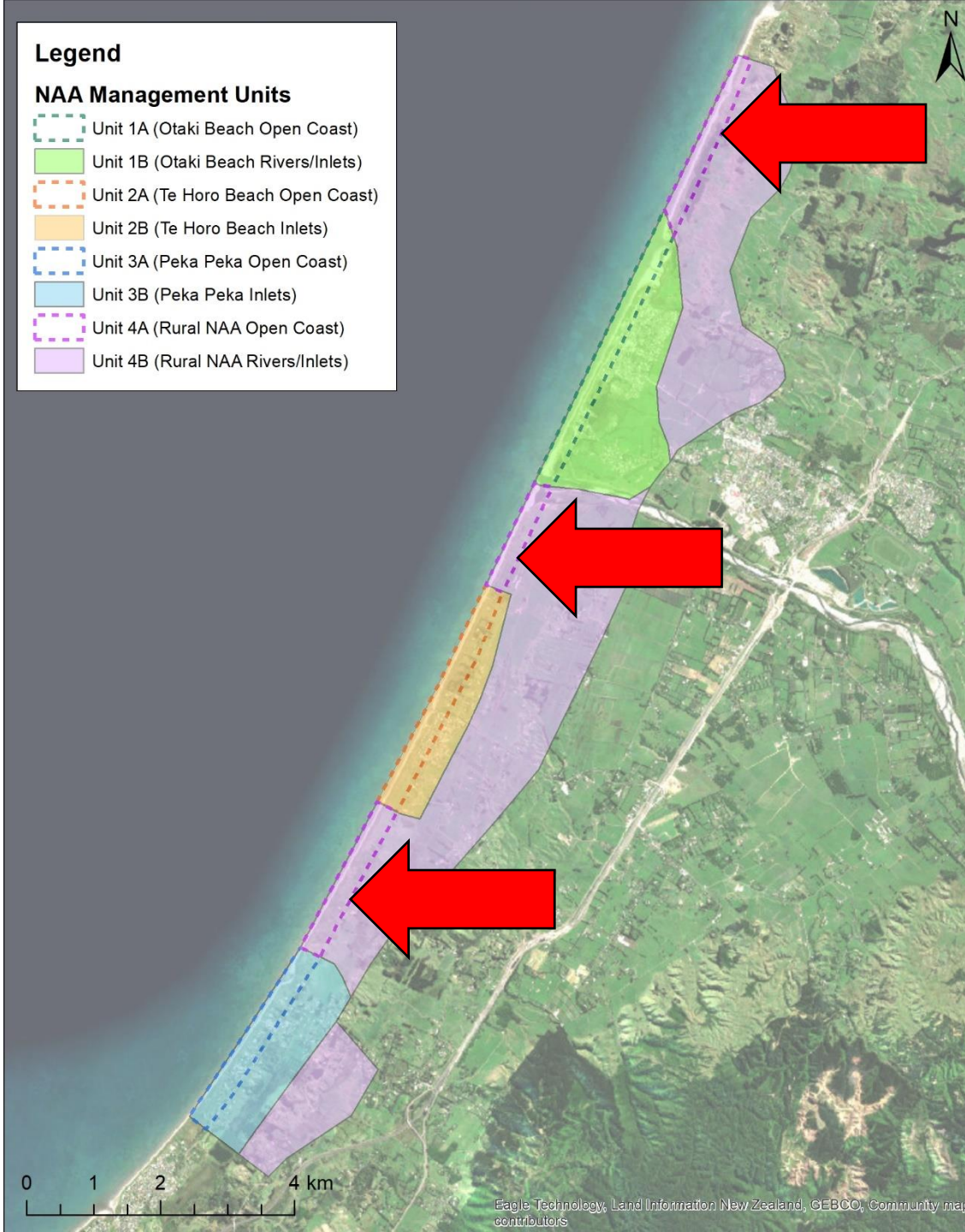
Short term	Medium term	Long term
Accommodate [7]	**Additional Hard Protection** [12, 13, 15]	**Retreat** [8]
Pro-actively raise floors of homes which could be flooded.	Installation of floodgates, pump stations and stopbanks to prevent sea water entering the settlements	Proactively moving people out of the way of the hazard.

Notes:
Initially, dwellings at immediate risk of frequent flooding during storm events with significant water depths would be proactively raised so floor levels were above projected water levels in large storms to avoid being flooded. Although dwellings would be protected, access to properties and services may still be impacted.

Over the medium term, feasibility of increased hard protection schemes would be investigated and installed to manage coastal water entering the settlement via low lying waterways, overtopping the seafront, or via the stormwater network.

As sea levels continue to rise, dwellings with inundation risks that are no longer effectively being managed through the broader flood protection scheme or raised floor levels would be retreated away from the hazard.

Unit 4A: Rural NAA Open Coast



Management Unit:	**4A: Rural NAA Open Coast**	Pathway:	**1**

2050 – 9 Properties at risk of erosion
2070 – 9 Properties at risk of erosion
2130 – 9 Properties at risk of erosion

Short term	Medium term	Long term
Status Quo[1]	**Enhance[3,4]**	**Enhance[3,4]**
No additional changes to current management of the erosion hazard	Increase dune resilience by foreshore and backshore planting	Increase dune resilience by foreshore and backshore planting

Notes:
Over the short term, undertake no additional changes to the current management of the erosion hazard in rural areas, and continue to monitor any changes in risk.

As sea level rise continues and greater risk is identified, extensive foredune and backdune planting over the short-medium term with weed and pest control to enhance the existing dune system, and provide good protection in storms and faster recovery, and slow the rate of erosion on the open coast.

Management Unit:	**4A: Rural NAA Open Coast**	Pathway:	**2**

2050 – 9 Properties at risk of erosion
2070 – 9 Properties at risk of erosion
2130 – 9 Properties at risk of erosion

Short term	Medium term	Long term
Status Quo[1]	**Enhance**[3,4]	**Soft Engineering Protection**[9,10]
No additional changes to current management of the erosion hazard	Increase dune resilience by foreshore and backshore planting	Beach renourishment and beach scraping.

Notes:
Over the short term, undertake no additional changes to the current management of the erosion hazard in rural areas, and continue to monitor any changes in risk.

As sea level rise continues and greater risk is identified, extensive foredune and back dune planting over the short-medium term with weed and pest control to enhance the existing dune system, and provide good protection in storms and faster recovery, and slow the rate of erosion on the open coast.

When dune enhancement mechanisms are no longer managing the erosion risks, undertake beach renourishment (or scraping on gravel beaches) to further reduce the rate of erosion.

Management Unit:	**4A: Rural NAA Open Coast**	Pathway:	**3**

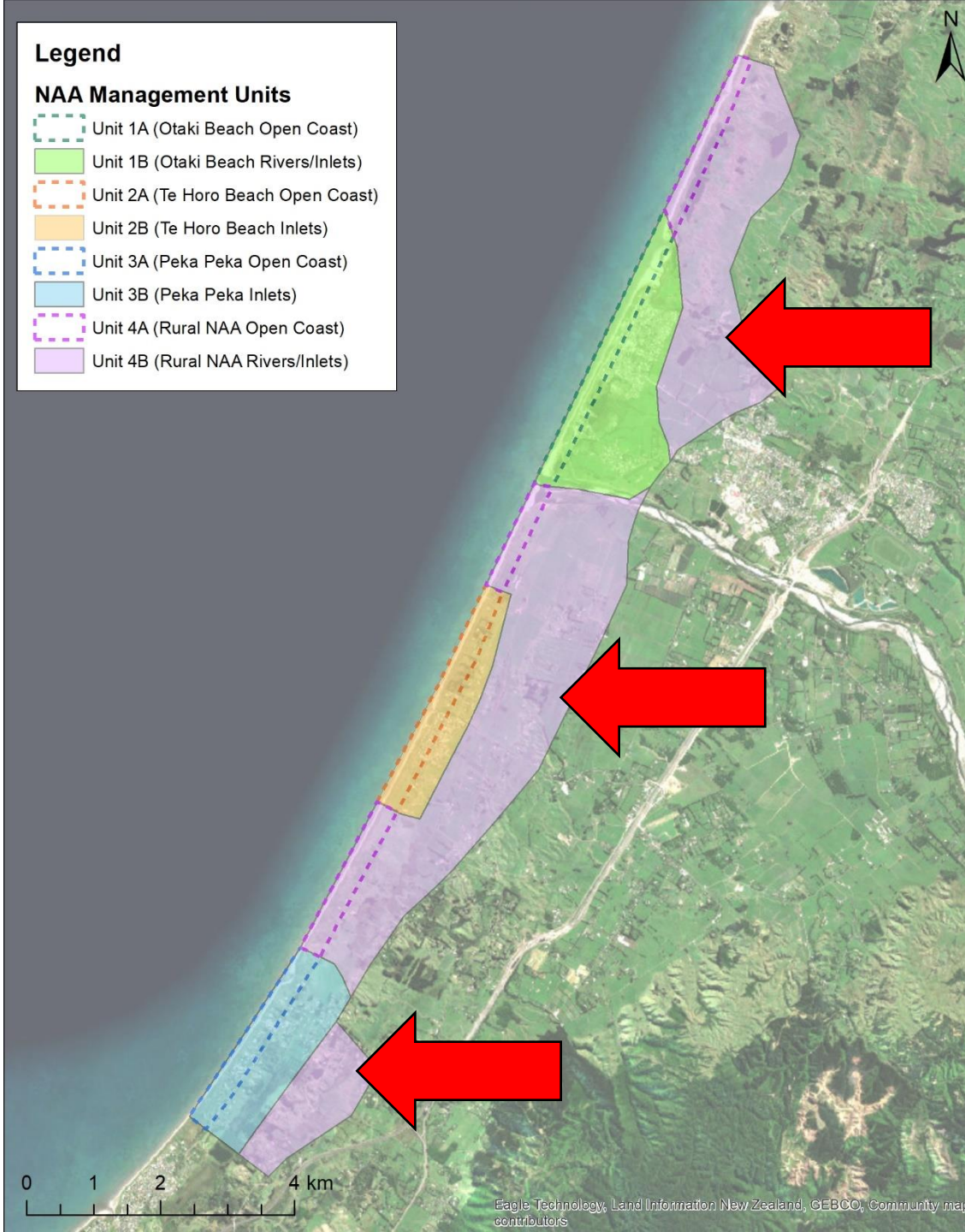
2050 – 9 Properties at risk of erosion
2070 – 9 Properties at risk of erosion
2130 – 9 Properties at risk of erosion

Short term	Medium term	Long term
Enhance[3,4]	**Enhance**[3,4]	**Soft Engineering Protection**[9,10]
Increase dune resilience by foreshore and backshore planting →	Increase dune resilience by foreshore and backshore planting →	Beach renourishment and beach scraping.

Notes:
Undertake foredune and back dune planting over the short-medium term with weed and pest control to enhance the existing dune system, and provide good protection in storms and faster recovery, and slow the rate of erosion on the open coast.

When dune enhancement mechanisms are no longer managing the erosion risks, undertake beach renourishment (or scraping on gravel beaches) to further reduce the rate of erosion.

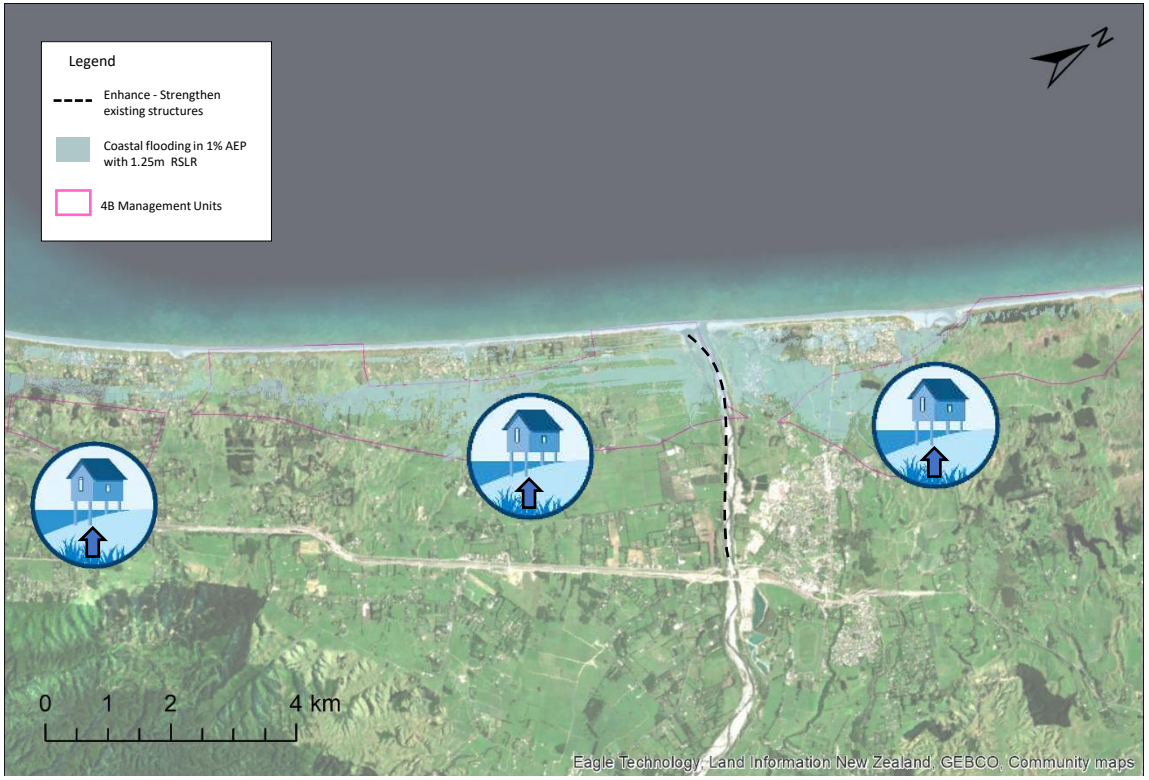
Unit 4B: Rural NAA Rivers/Inlets



Management Unit:	**4B: Rural NAA River/Inlets**	Pathway:	**1**

2050 – 86 Properties at risk of inundation
2070 – 99-106 Properties at risk of inundation
2130 – 135-176 Properties at risk of inundation

Short term	Medium term	Long term
Status Quo[1]	**Enhance[2,3]**	**Accommodate[7]**
No additional changes to current management of the inundation hazard →	Strengthen existing stopbanks and structures, enhance wetlands. →	Pro-actively raise floors of houses susceptible to flooding.



Notes:
Over the short term, undertake no additional changes to the current management of the flood hazard in rural areas, and continue to monitor any changes in risk.

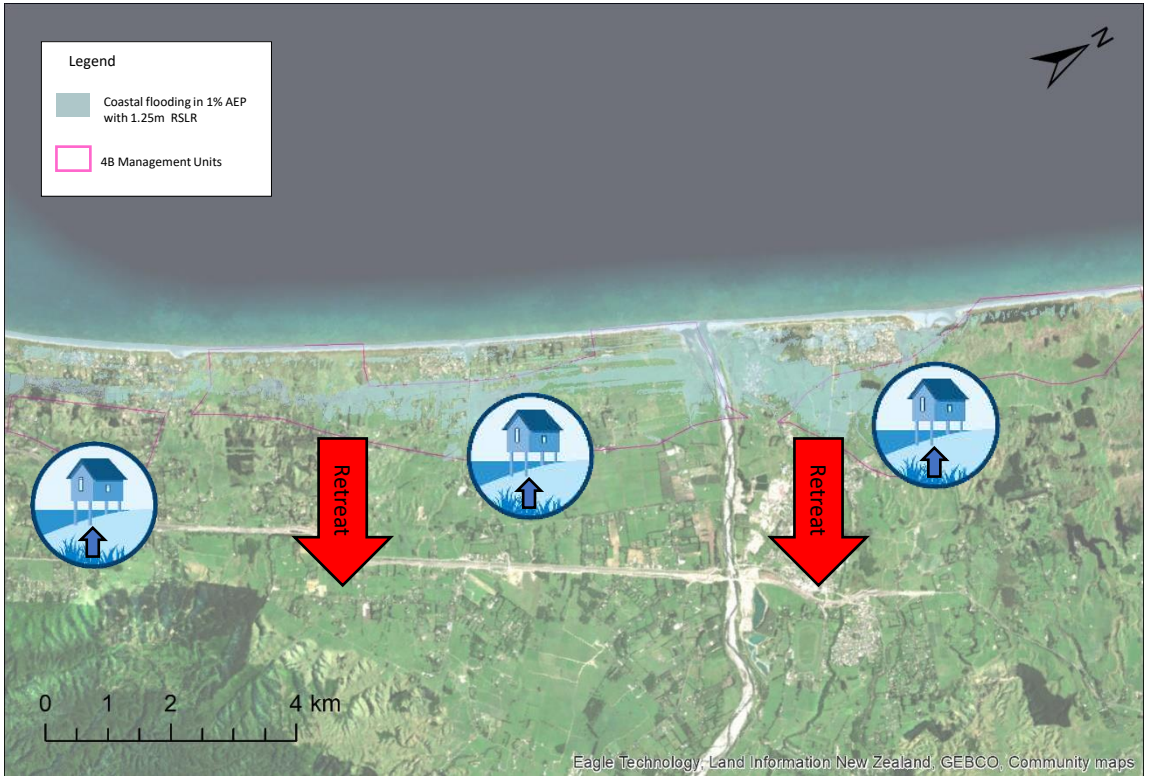
Over the medium term as SLR increases, strengthen stopbanks and stormwater networks to manage the flood risk across the wider rural area. Enhance coastal wetlands through effective planting and management.

Over the long-term, dwellings at risk of frequent and deep flooding that can not be managed through the wider protection scheme would be proactively raised so floor levels were above projected water levels in large storms to avoid being flooded. Although dwellings would be protected, access to properties and services may still be impacted.

Management Unit:	**4B: Rural NAA River/Inlets**	Pathway:	**2**

2050 – 86 Properties at risk of inundation
2070 – 99-106 Properties at risk of inundation
2130 – 135-176 Properties at risk of inundation

Short term	Medium term	Long term
Accommodate[7]	**Accommodate**[7]	**Retreat**[8]
Pro-actively raise floors of houses susceptible to flooding. →	Pro-actively raise floors of houses susceptible to flooding. →	Proactively retreat infrastructure and properties



Notes:
Over the short-medium term, dwellings that were impacted by frequent and deep flooding would have floor levels proactively raised about projected flood levels with SLR. Although dwellings would be protected, access to properties and services may still be impacted.

Over a longer timeframe as SLR accelerates, dwellings where the flood risk was no longer effectively being managed via accommodation options would be proactively retreated away from the flood hazard.