



Hawke's Bay Coastal Strategy

Implementation approaches and indicative costs for planned retreat

Prepared for
Hawke's Bay Regional Council

Prepared by
Tonkin & Taylor Ltd

Date
July 2022

Job Number
1012519.v5



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Document Control

Title: Hawke's Bay Coastal Strategy – Planned retreat Implementation					
Date	Version	Description	Prepared by:	Reviewed by:	Authorised by:
4/03/22	V0.7	Preliminary draft for internal review	J. Clarke, R. Reinen-Hamill,	R. Reinen-Hamill	R. Reinen-Hamill
7/03/22	V1	Client review draft	J. Clarke, R. Reinen-Hamill, R. Haughey	R. Reinen-Hamill	R. Reinen-Hamill
29/03/22	V2	Final draft incorporating client comments	R. Reinen-Hamill	J. Clarke	R. Reinen-Hamill
25/05/22	V3	Edits based on Council feedback	R. Reinen-Hamill	J. Clarke	R. Reinen-Hamill
20/06/22	V4	Edits based on feedback	R. Reinen-Hamill	J. Clarke	R. Reinen-Hamill
8/7/22	V5	Final	R. Reinen-Hamill	J. Clarke	R. Reinen-Hamill

Distribution:

Hawke's Bay Regional Council

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Executive summary

Hawke's Bay Regional Council (HBRC) commissioned Tonkin & Taylor Ltd (T+T) to provide guidance on options to implement planned retreat and their associated high-level costs that include accounting for property value loss within the Hawke's Bay Coastal Strategy priority units of Whirinaki, Bayview, Westshore, Pandora, Ahuriri, East Clive, Haumoana, Te Awanga and Clifton. This assessment does not consider the potential reduction of costs through revenue that may occur, as this may occur at different timings, and costs will still be incurred.

The pathways developed under the coastal strategy to date recommend retreat in some priority units as a long-term response. This report provides guidance on what planned retreat might look like as an alternative to the recommended pathways. In other words, what would need to be retreated, by when, and at what cost, if nothing else was done to increase resilience to coastal hazards.

The term planned retreat in this document is used in preference to the more common term of managed retreat as it speaks to the proactive, planned and coordinated consideration of the movement and rebuilding of communities well in advance.

This work aims to identify the property and infrastructure potentially at risk within 100 years, a timeline of when planned retreat may be required, possible options for implementing planned retreat, discussion on options for re-establishment of property and assets and a high-level cost estimate to carry out planned retreat that accounts for losses associated with properties within the hazard zones.

The total number and the sum of private property losses based on land value and capital value of properties within the units potentially impacted over the three periods is shown in ES 1. The total lengths of road and rail reserves and the number of major council infrastructure impacted by erosion is shown in ES 2.

ES 1: Potential Number and value of private property losses within all high-risk units

	0 to 20 years	20 to 50 years	50 to 100 years	Total
No. of properties	106	339	515	960
Land value	\$27,853,000	\$113,275,000	\$223,824,000	\$364,952,000
Capital value	\$55,241,000	\$227,910,000	\$474,085,000	\$757,236,000

ES 2: Potential Length (m) of road and rail reserves and large council assets (No.) impacted by erosion

Feature	0 to 20 years	20 to 50 years	50 to 100 years	Total
Rail	0	98	341	439
Road	1,754	7,774	5,911	13,685
State Highway	0	1,434	538	1,972
Wastewater treatment plant	0	0	1	1

There are several different ways that proposed planned retreat of private property could be undertaken. All require some form of incentive or pressure, without which the process is difficult to implement and they will also face their own community, political and/or legal challenges. The Do nothing and compulsory acquisition options have not been considered. For the purposes of the high-

level cost estimate it has been assumed that private property losses based on the land and capital values of the affected properties would need to be accounted for and alternative subdivision areas within the bay developed. However, how funding is attributed is a public funding matter and is not considered in this report. It is also recognised that there is no legal compulsion that requires local government organizations to purchase any property.

There are a range of potential sites close to most of the areas affected by coastal erosion and inundation that could be established for affected members of those communities to move to, although District Plan changes would be required to enable this to occur. If a community wide planned retreat is to occur, people within Westshore and Ahuriri could move to a subdivision development within Bayview, the closest unit to these two areas.

The total high level cost estimate for each stage and timeframe is shown in ES 3 and the percentage breakdown of these costs for each stage and timeframe is shown in ES 4.

ES 3: Total high level cost estimate for each stage and timeframe for all nine coastal units including potential losses included in enabling investment

Stages	0-20 years	20-50 years	50 - 100 years	Total
Planning, preparation, and engagement	\$16,929,505	\$37,990,007	\$72,924,003	\$127,843,515
Enabling investment (including accounting for private property losses, management, and administration)	\$67,253,550	\$236,670,000	\$508,509,750	\$812,433,300
Active retreat	\$105,244,050	\$317,314,381	\$557,476,475	\$980,034,906
clean up	\$7,158,125	\$28,709,313	\$31,138,940	\$67,006,378
Totals	\$196,585,230	\$620,683,700	\$1,170,049,168	\$1,987,318,099

ES 4: Percentage of total cost for each stage and timeframe

Stages	0-20 years	20-50 years	50 - 100 years	Total
Planning, preparation, and engagement	9%	6%	6%	6%
Enabling investment	34%	38%	43%	41%
Active retreat	54%	51%	48%	49%
clean up	4%	5%	3%	3%

1 Introduction

1.1 Purpose

Hawke's Bay Regional Council (HBRC) commissioned Tonkin & Taylor Ltd (T+T) to provide guidance on options to implement planned/managed retreat and their associated high level costs within the Hawke's Bay Coastal Strategy priority units of Whirinaki (B), Bayview (C), Westshore (D), Ahuriri (E), Pandora (also part of unit E, but considered separately), East Clive (J), Haumoana and Te Awanga (both unit K, but considered separately) and Clifton (L), refer Figure 1.1.

This work was requested to consider what might need to be retreated, by when, and at what cost, if nothing else was done to increase resilience to coastal hazards. Its purpose is to inform a better understanding of possible methods and costs for planned/managed retreat in Hawke's Bay, in recognition that planned/managed retreat has been recommended as a long-term option in some priority units and is an alternative to the recommended option in others.

The term planned retreat in this document is used in preference to the more common term of managed retreat as it speaks to the proactive, planned and coordinated consideration of the movement and rebuilding communities well in advance (Carey, 2020).

The report of the northern and southern cell assessment panels (Bendall, 2018) considered a number of protection and adaptation options to mitigate future risks from natural hazards, but also acknowledged with increasing risks at some point in the future, for some areas, the only viable option may be to retreat.

The pathways developed under the coastal strategy to date recommend retreat in some priority units as a long-term response. This report provides guidance on what planned retreat might look like as an alternative to the actions considered in the recommended pathways. In other words, what would need to be retreated, by when, and at what cost, if nothing more was done to increase resilience to coastal hazards.

This report builds on previous work and recommendations presented in the Clifton to Tangoio coastal strategy and technical reports on the likely future hazard exposure and risk to assets (T+T 2016a, T+T 2016b). This report aims to establish;

- Property and infrastructure potentially at risk within 100 years.
- A timeline of when planned retreat may be required.
- Options for implementing planned retreat.
- Whether there may be suitable areas for re-establishment of property and assets in each priority unit.
- High level cost estimates to carry out planned retreat and accounting for public and private property losses.

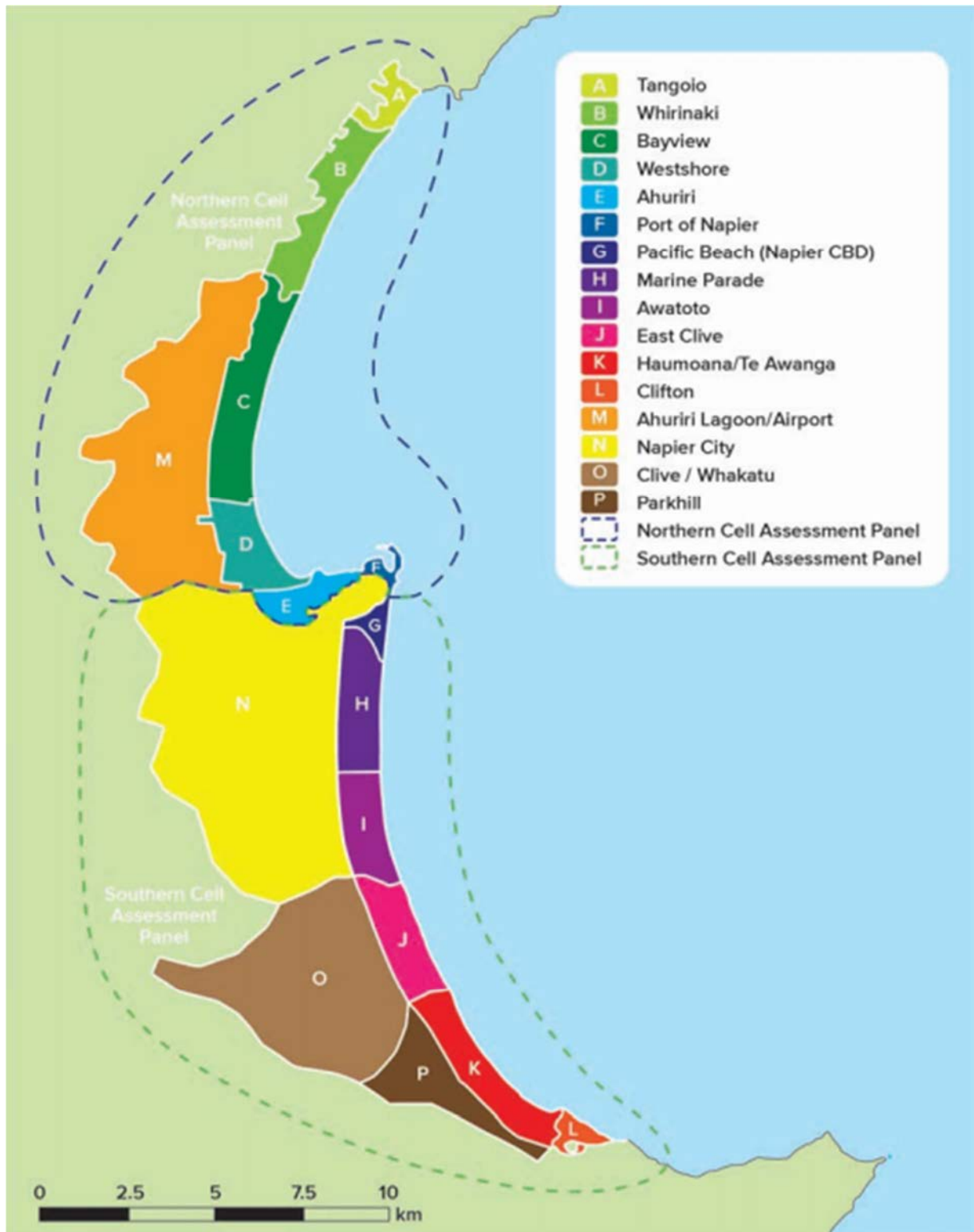


Figure 1.1 Coastal units

1.2 Limitations and applicability

This report does not constitute a recommendation for the implementation of planned retreat in preference to other options.

There is no legal compulsion that requires local government organizations to purchase any property.

Hazard extents are based on probabilistic hazard mapping carried out in 2016 using projected sea level rise values developed for the Hawke's Bay region. Different projections in sea level rise will change the hazard extents used for this study.

In most cases existing and identified coastal protection structures as part of a preferred pathways have been ignored in assessing the extent of assets at risk to provide the upper extent of potentially affected land and properties. This is to assist in understanding the cost/benefit of any works or actions to reduce the rate, or extent of protection measures. Protection works within Pandora were included as these were part of river flood protection works.

Land and capital values based on the estimates provided on the Hastings District Council GIS and Napier City Council GIS from 8 January 2019 for Hastings District Council and 9 January 2020 for Napier City Council. No allowance has been included for changes to property value since these valuations.

This assessment does not consider the potential reduction of costs that may accrue over time through revenue that may occur, as this may occur at different timings, and costs will still be incurred.

The rates utilised for this high-level cost estimate are based on assumed design concepts, estimated quantities and expert judgement. Consequently, a significant margin of uncertainty exists on the cost estimate and the contingency we have allowed should be considered as part of the cost rather than a potential add on.

It is assumed that national infrastructure within the units considered, such as state highways and the rail connection to the port will be maintained through a "protect" strategy by the relevant transport authorities and costs for these assets are not included in this assessment. Similarly non-council network costs, such as phone, internet and power are not included. However, lengths of the linear road and rail corridors were included to provide a sense of scale.

2 Property and infrastructure potentially at risk within 100 years

2.1 General approach

Coastal Erosion Hazard Zones (CEHZ) and Coastal Inundation Hazard Zones (CIHZ) have been used to identify the number of properties along the Hawke's Bay coast that may require retreat over the next 100 years (T+T, 2016a) if nothing else is done to increase resilience to coastal erosion and coastal inundation. This hazard mapping information is available through the HB Hazards Portal (<https://gis.hbrc.govt.nz/Hazards/>).

The land and capital value has been used from 2019/2020 to assess the potential loss in value of the property assets identified. Lengths of council owned road and rail corridors as well as the State Highway are quantified for each unit for risk of erosion as it is assumed that inundation will result in smaller scale consequences of outage and smaller scale damage. These road and rail corridors also frequently include utilities such as water, wastewater, and power, so erosion may affect these assets as well. Maps for each unit showing the erosion hazard extent and properties affected are included in Appendix A. The maps for each unit showing the inundation hazard extent and properties affected are included in Appendix B.

While there are properties that are affected by both erosion and inundation, each property affected by the dual hazard has only been counted once.

2.1.1 Approach for coastal erosion

Based on the property position relative to the three CEHZ time periods, the number of properties potentially impacted have been identified for three different retreat timeframes:

- 0 to 20 years: CEHZ 2015 P5%.
- 20 to 50 years: CEHZ 2065 P5%.
- 50 to 100 years: CEHZ 2120 P5%.

It is noted that these time scales are indicative. The actual requirement for action is based on impact-based triggers resulting from coastal hazard impacts because of climate change that affect land, infrastructure and properties to the extents indicated in the hazard maps. As such, it is stressed that the assessments made in this report are theoretical.

The following criteria was used to assess if the properties are considered impacted and potentially requiring retreat within the relevant timeframe:

- If private property or council owned infrastructure asset is seaward of the coastal hazard zone.
- If private property was within a band that is less than 10 m landward of the CEHZ.
- If the access road to the property is affected by coastal erosion.

2.1.2 Approach for coastal inundation

Road and rail networks affected by inundation were not included as it was assumed they could generally accommodate episodic inundation events in the short to medium term and would be more affected by erosion. Properties affected by the current 1% AEP inundation extent may also experience episodic inundation during extreme events over the next 20 years. However, the properties are likely to be able to remain habitable following the events and consequently are not likely to be required to retreat over the next 20 years and therefore are not included in the number of properties potentially affected within 0-20 years.

However, with continued sea level rise, in 20 to 50 years' time it is expected that the frequency and magnitude of coastal inundation events will increase on these properties. An assumption is made that a trigger point will be reached whereby the frequency of inundation is unpalatable and these properties may be required to retreat within 20 to 50 years' time. Based on this assumption the following categories for retreat due to inundation have been adopted:

- Properties within the current 1% AEP inundation extent may require retreat within 20 to 50 years' time.
- Properties within the 2065 1% AEP inundation extent may require retreat within 50 to 100 years' time.
- Properties within the 2120 1% AEP inundation extent may require retreat in 100 + years.

2.2 Property summaries by unit

2.2.1 Whirinaki (Unit B)

The hazard lines in Appendix A indicate properties along the Whirinaki shoreline are exposed to coastal erosion over the next 0 to 100 years (Figure 1, Appendix A). The risk of coastal inundation over the next 100 years is likely to be negligible (Figure 1, Appendix B). The number of properties affected for each period, and their land and capital value, are shown in Table 2-1 and the length of the road and rail reserves are shown in Table 2-2.

Table 2-1: Number of properties potentially required to retreat along Whirinaki over the next 100 years and their losses based on estimated land and capital value

	0 to 20 years	20 to 50 years	50 to 100 years	Total
Number of properties	43	8	111	162
Land value	\$14,375,000	\$1,270,000	\$30,590,000	\$46,235,000
Capital value	\$27,545,000	\$2,070,000	\$58,555,000	\$88,170,000

Table 2-2: Length (m) of road and rail reserves impacted by erosion

Feature	0 to 20 years	20 to 50 years	50 to 100 years	Total (m)
Rail	0	0	0	0
Road	720	150	1,750	2,620
State Highway	838	568	229	1,635

Over the next 0 to 20 years there are 43 properties along Northshore Road that are assumed to need retreating, some 720 m of road reserve and 838 m of state highway.

While the properties themselves are located landward of the Current CEHZ, Northshore Road and the water main which runs along the road are at risk to coastal erosion over the next 20 years. Should the road be eroded, the properties would be in imminent danger of damage through further erosion and would no longer have vehicular access, which is considered a trigger for managed retreat for the purposes of this report. An alternative service lane behind the properties is not likely to be feasible due to the existing houses along Pohutukawa Drive.

In 20 to 50 years' time, Whirinaki Road is likely to become at risk to coastal erosion and the length of road reserve potentially affected increased by 150 m and an additional 568 m of state highway.

Whirinaki Road currently provides access to over 100 properties. However, the properties back onto SH2 which may provide an alternative option for property access. There are 7 properties at the southern end of Whirinaki Road which do not back directly onto SH2 and therefore are assumed to need retreat if Whirinaki Road is eroded. There is also 1 property on Northshore Road which may become directly at risk to erosion in 20 to 50 years' time.

In 50 to 100 years' time all 111 the of the properties along Whirinaki Road may be directly at risk from coastal erosion. Road reserve lengths affected increase to 2,620 m for council roads and 1,635 m for the state highway.

In total there are 162 properties along Whirinaki that are assumed to need retreating over the next 100 years. Based on the Council rating valuations these properties have a total land value of \$46,235,000 and capital value of \$88,170,000.

2.2.2 Bayview (Unit C)

The hazard lines in Appendix A indicate properties along the Bayview shoreline are exposed to coastal erosion over the next 20 to 100 years (Figure 2, Appendix A). The risk of coastal inundation over the next 100 years is likely to be negligible (Figure 2, Appendix B). The number of properties affected for each period, and their land and capital value, are shown in Table 2-3 and the length of the road and rail reserves are shown in Table 2-4.

Table 2-3: Number of properties potentially required to retreat along Bayview over the next 100 years and their losses based on estimated land and capital value

	0 to 20 years	20 to 50 years	50 to 100 years	Total
Number of properties	0	98	22	120
Land value	-	\$28,490,000	\$7,860,000	\$36,350,000
Capital value	-	\$66,555,000	\$17,445,000	\$84,000,000

Table 2-4: Length (m) of road and rail reserves impacted by erosion

Feature	0 to 20 years	20 to 50 years	50 to 100 years	Total (m)
Rail	0	0	305	305
Road	0	1,750	0	1,750
State Highway	0	0	0	0

There are no properties directly at risk to coastal erosion or inundation over the next 0 to 20 years but some 88 m of Le Quesne Road reserve is potentially at risk.

In 20 to 50 years' time the majority of Le Quesne Road and the water main which runs along the road will potentially become at risk to coastal erosion. There are also 14 properties that are directly at risk from coastal erosion. Le Quesne Road is the only property access option for multiple houses, consequently if the road is eroded then 98 properties are considered to potentially require retreat in 20 to 50 years' time.

In 50 to 100 years' time there are several houses at the southern end of Le Quesne Road that are assumed to need retreating. There are also several houses off Mer Place and the seaward end of Gill Road that are at risk of coastal erosion. Some 305 m of the rail corridor will become at risk.

In total there are 120 properties along Bayview that are assumed to need retreating over the next 100 years (Table 2-3). Based on the Council estimates these properties have a total land value of \$36,350,000 and capital value of \$84,000,000.

2.2.3 Westshore (Unit D)

The hazard lines in Appendix A indicate properties along the Westshore shoreline are exposed to coastal erosion and inundation over the next 0 to 100 years (Figure 3 Appendix A and Figure 3 Appendix B respectively). The number of properties affected for each period, and their land and capital value, are shown in Table 2-5 and the length of the road and rail reserves are shown in Table 2-6.

Table 2-5: Number of properties potentially required to retreat along Westshore over the next 100 years and their losses based on estimated land and capital value

	0 to 20 years	20 to 50 years	50 to 100 years	Total
Number of properties	0	96	108	204
Land value	0	\$43,050,000	\$53,390,000	\$96,440,000
Capital value	0	84,540,000	\$95,377,000	\$179,917,000

Table 2-6: Length (m) of road and rail reserves impacted by erosion

Feature	0 to 20 years	20 to 50 years	50 to 100 years	Total
Rail	0	0	0	0
Road	200	1,400	850	2,450
State Highway	0	0	0	0

There is a section of road and a water main at the southern end of Charles Street that is at risk to coastal erosion over the next 20 years. If the road is eroded there are up to 7 houses between which are assumed to need retreating within 20 years' time due to loss of property access, but it is assumed their use could be retained until 20 to 50 years.

In 20 to 50 years' time there are an additional 89 properties that are assumed to need retreating. These include all the properties along the seaward side of Whakarire Avenue, another 16 properties towards the southern end of Charles Street and 4 of the properties along North Terrace. Majority of these properties may become directly at risk to coastal erosion in 20 to 50 years' time however the loss of road access and utilities (including the water main and sewer main) are likely to be the initial trigger for retreat. The properties at the northern end of The Esplanade are not likely to be directly impacted by erosion in 20 to 50 years, however there are sections of The Esplanade that are at risk to coastal erosion which would mean loss of road access to the properties. Due to the railway line running along the landward side of the properties, an alternative access option is not likely to be viable. Additionally, the water main that runs along The Esplanade may potentially be eroded within 20 to 50 years' time. Once the road and water utilities are lost there are up to 62 properties that are assumed to need retreating.

In 50 to 100 years' time there are multiple properties along Ferguson Ave, North Terrace, Charles Street, Meeanee Quay that are assumed to require retreating due to coastal erosion. There are also properties along The Esplanade which are assumed to require retreating due to loss of access road and water utilities. In addition to properties that are assumed to require retreating due to coastal erosion, there are several properties along The Esplanade that have been assumed to need

retreating due to regular coastal inundation in 50 to 100 years' time (i.e., they are within the 2065 1% AEP inundation extent).

The 2120 1% AEP inundation extent includes additional properties along Meeanee Quay, Pukeko Place and The Esplanade. This indicates that there are several additional properties that may experience future inundation under extreme events, however they are not likely to require retreat within the next 100 years.

In total there are 204 properties along Westshore that have been assumed to need retreating over the next 100 years due to either coastal erosion or inundation (Table 2-5). Based on the Council estimates these properties have a total land value of \$96,440,000 and capital value of \$179,917,000.

2.2.4 Ahuriri (Unit E1)

The hazard lines in Appendix A indicate properties along the Ahuriri shoreline are likely to be subject to coastal erosion and inundation over the next 0 to 100 years (Figure 4 Appendix A and Figure 4 Appendix B). The number of properties affected for each period, and their land and capital value, are shown in Table 2-7 and the length of the road and rail reserves are shown in Table 2-8.

Table 2-7: Number of properties potentially required to retreat along Ahuriri over the next 100 years and their losses based on estimated land and capital value

	0 to 20 years	20 to 50 years	50 to 100 years	Total
Number of properties	2	0	102	104
Land value	\$3,170,000	-	\$72,899,000	\$76,069,000
Capital value	\$3,630,000	-	\$142,255,000	\$145,855,000

Table 2-8: Length (m) of road and rail reserves impacted by erosion

Feature	0 to 20 years	20 to 50 years	50 to 100 years	Total (m)
Rail	0	98	36	134
Road	0	0	200	200
State Highway	0	28	198	226

Over the next 20 years some waterfront business and carpark areas may be required to retreat due to coastal erosion, although existing protection works may extend this time requirement if the adequacy of the protection works is confirmed.

In 20 to 50 years' time there are lengths of rail, road and a small extent of State Highway reserve impacted by erosion. The sewer main which runs along the seaward side of Hardinge Road may become at risk to coastal erosion. The water main which runs along the road as well as sections of Hardinge Road may also be impacted by erosion in the long term.

In 50 to 100 years' time there are up to 33 properties along Hardinge Road that are assumed to need retreating due to coastal erosion of the properties and access road. The 2065 1% AEP inundation extent includes many of the properties at the western end of Ahuriri, including commercial properties. In 50 to 100 years' time the frequency of inundation is likely to increase, and subsequently regular inundation may require these properties to retreat. There is an increased extent of road and rail reserve impacted.

In total there are 104 properties along Ahuriri which are assumed to need retreating over the next 100 years (Table 2-7). Based on the Council estimates these properties have a total land value of \$76,069,000 and capital value of \$145,855,000.

2.2.5 Pandora (Unit E2)

The hazard lines in Appendix A indicate properties along the Pandora inner harbour are primarily at risk from inundation over the next 0 to 100 years (Figure 9 Appendix A). The number of sections affected for each period, and their land and capital value, are shown in Table 2-9.

Table 2-9: Number of properties potentially required to retreat along Pandora over the next 100 years and their losses based on estimated land and capital value

	0 to 20 years	20 to 50 years	50 to 100 years	Total
Number of properties	0	1	27	28
Land value	\$0	\$3,940,000	\$55,820,000	\$59,760,000
Capital value	\$0	\$5,240,000	\$85,960,000	\$91,200,000

Over the next 20 years there are no properties that are considered to require retreat. However, some may still be exposed to low probability extreme inundation events. Facilities which require connection to the sea, may need specific treatment/consideration to enable them to continue to serve their function. However, it is anticipated that this will include relocation of those aspects that do not need to be located directly at the coastal edge.

In 20 – 50 years there is an increased risk of inundation along the wider Pandora industrial area. During the 50–100-year timeframe the increase in frequency and magnitude of inundation events will likely require the retreat of large parts of the Pandora industrial area, including assets along Thames Street and Humber Street if protection works are not carried out.

2.2.6 East Clive (Unit O)

The hazard lines in Appendix A indicate properties along Clive are exposed to coastal erosion and inundation over the next 0 to 100 years (Figure 5 Appendix A and Figure 5 Appendix B). The number of properties affected for each period and their land and capital value, are shown in Table 2-10 and the length of the road and rail reserves are shown in Table 2-11.

Table 2-10: Number of properties potentially required to retreat along East Clive over the next 100 years and their losses based on estimated land and capital value

	0 to 20 years	20 to 50 years	50 to 100 years	Total
Number of properties	-	18	9	27
Land value	-	\$2,689,000	\$1,641,000	\$4,330,000
Capital value	-	\$8,770,000	\$8,735,000	\$17,505,000

Table 2-11: Length (m) of road and rail reserves and council assets (No.) impacted by erosion

Feature	0 to 20 years	20 to 50 years	50 to 100 years	Total
Wastewater treatment plant			1	1

Feature	0 to 20 years	20 to 50 years	50 to 100 years	Total
Rail	0	0	0	0
Road	0	400	300	700
State Highway	0	0	0	0

Over the next 20 years there are no properties, roads or utilities identified as being at risk to either coastal erosion or inundation. Although, the corner of Bridge Street near the Tukituki River is close to the Current CEHZ.

In 20 to 50 years' time Bridge Street and the seaward end of Bell Street are likely to be exposed to coastal erosion. The sewer main which runs along the landward side of the road is also likely to be at risk. There are up to 18 properties in the block between Bridge Street and Albert Street that are assumed to need retreating due to loss of property access and direct loss of property from erosion.

In 50 to 100 years' time there are additional properties on Albert Street and School Road that are assumed to need retreating due coastal erosion. The wastewater treatment plant and 3 properties along Ferry Road are also assumed to need retreating. It is anticipated that there would be some write down of value for the treatment plant over its useful asset life and provision for alternative locations as part of the asset renewal process. While there are currently no houses on the properties on the southern side of the wastewater treatment plant, this land may be regularly inundated in 50 to 100 years' time.

In total there are 27 properties along Clive that are assumed to need retreating over the next 100 years (Table 2-10). Based on the Council estimates these properties have a total land value of \$4,985,000 and capital value of \$19,235,000.

2.2.7 Haumoana (Unit K1)

The hazard lines in Appendix A indicate properties along Haumoana are exposed to coastal erosion and inundation over the next 0 to 100 years (Figure 6 Appendix A and Figure 6 Appendix B). The number of properties affected for each period, and their land and capital value, are shown in Table 2-12 and the length of the road and rail reserves are shown in Table 2-13.

Table 2-12: Number of properties potentially required to retreat along Haumoana over the next 100 years and their losses based on estimated land and capital value

	0 to 20 years	20 to 50 years	50 to 100 years	Total
Number of properties	21	55	58	134
Land value	\$1,433,000	\$15,310,000	\$13,649,000	\$30,392,000
Capital value	\$5,456,000	\$27,010,000	\$26,070,000	\$58,536,000

Table 2-13: Length (m) of road and rail reserves impacted by erosion

Feature	0 to 20 years	20 to 50 years	50 to 100 years	Total (m)
Rail	0	0	0	0
Road	100	900	550	1,550
State Highway	0	0	0	0

Over the next 20 years there are 21 properties along the seaward side of Clifton Road and on Gaskin Place and Beach Road that are assumed to need retreating due to threat from coastal erosion

In 20 to 50 years' time just over 1 km of road and water main along Clifton Road and Beach Road are likely to be at risk to coastal erosion. Subsequently, loss of the roads and water utilities may result in up to 42 properties from Van Asch Road to the southern side of East Road requiring retreat. There are also 15 properties at the northern end of Beach Road assumed to need retreating due to direct loss of property from coastal erosion. If the Clifton Road is lost due to coastal erosion, an alternative road will need to be established to provide access to Te Awanga and Clifton.

In 50 to 100 years' time there will be an additional 58 properties assumed to need retreating due to coastal erosion. The entire length of Beach Road between East Road to Collison Terrace is likely to be exposed to erosion. Subsequently all the remaining properties along the landward side of the road may require to be retreated.

Seven of the properties on the landward side of Grange Road North are within the 2065 1% AEP inundation extent near the Tukituki River mouth. In 50 to 100 years' time inundation may occur regularly on these properties and subsequently they are assumed to require retreating.

In total there are 134 properties along Haumoana that are assumed to need retreating over the next 100 years (Table 2-12). Based on the Council estimates these properties have a total land value of \$30,392,000 and capital value of \$58,536,000.

2.2.8 Te Awanga (Unit K2)

The hazard lines in Appendix A indicate properties along Te Awanga are exposed to coastal erosion and inundation over the next 0 to 100 years (Figure 7 Appendix A and Figure 7 Appendix B). The number of properties affected for each period, and their land and capital value, are shown in Table 2-14. There are no length of the road and rail reserves affected by erosion.

Table 2-14: Number of properties potentially required to retreat along Te Awanga over the next 100 years and their losses based on estimated land and capital value

	0 to 20 years	20 to 50 years	50 to 100 years	Total
Number of properties	40	76	104	220
Land value	\$8,875,000	\$18,140,000	\$23,076,000	\$50,091,000
Capital value	\$18,610,000	\$35,670,000	\$46,773,000	\$101,053,000

There are 40 properties along the seaward side of Clifton Road that are currently at risk from coastal erosion and are assumed by this report to need to be retreated over the next 20 years.

In 20 to 50 years' time regular coastal inundation may require up to 76 properties along Wellwood Terrace, Leyland Road, Pipi Street and Kuku Street to retreat. The Current 1% AEP includes a large portion of Te Awanga, with these properties potentially becoming regularly inundated in 20 to 50 years' time. Some of the Te Awanga Holiday Park may also be exposed to coastal erosion and more regular inundation.

In 50 to 100 years' time most of Wellwood Terrace will be exposed to coastal erosion. Properties on Leyland Road and Wellwood Terrace may also have to retreat due to the loss of the access road.

In total there are 220 properties along Te Awanaga that are assumed to need retreating over the next 100 years (Table 2-14). Based on the Council estimates these properties have a total land value of \$50,091,000 and capital value of \$101,053,000.

2.2.9 Clifton (Unit L)

The hazard lines in Appendix A indicate properties along Clifton are exposed to coastal erosion and inundation over the next 0 to 100 years (Figure 8 Appendix A and Figure 8 Appendix B). In the short term the two campgrounds are at risk from both erosion and inundation, while the Café is at risk within 50 to 100 years, excluding the presence of the recently constructed seawall.

There are a range of fixed buildings and infrastructure within the campground areas, including reception, kitchen, and toilet facilities as well as some accommodation units. For the land where the café is situated, the same approach has been used.

The number of properties affected for each period, and their land and capital value, are shown in Table 2-15 and the length of the road and rail reserves are shown in Table 2-16.

Table 2-15: Number of properties potentially required to retreat along Clifton over the next 100 years and their losses based on estimated land and capital value

	0 to 20 years	20 to 50 years	50 to 100 years	Total
Number of areas	1	1	1	3
Land value	\$740,000	\$697,500	\$697,500	\$2,135,000
Capital value	\$960,000	\$1,395,000	\$1,395,000	\$3,750,000

Table 2-16: Length (m) of road and rail reserves impacted by erosion

Feature	0 to 20 years	20 to 50 years	50 to 100 years	Total (m)
Rail	0	0	0	0
Road	598	54	57	709
State Highway	0	0	0	0

2.3 Summary

The total number and value of properties in all the units within the coastal erosion and coastal hazard extents shown in Appendix A and B is shown in Table 2-17. The total lengths of road and rail reserves impacted by erosion is shown in Table 2-18.

Table 2-17: Number and losses based on the value of private properties potentially affected within all high-risk units

	0 to 20 years	20 to 50 years	50 to 100 years	Total
No. of properties	106	339	515	960
Land value	\$27,853,000	\$113,275,000	\$223,824,000	\$364,952,000
Capital value	\$55,241,000	\$227,910,000	\$474,085,000	\$757,236,000

Table 2-18: Length (m) of road and rail reserves and large council assets (No.) potentially impacted by erosion

Feature	0 to 20 years	20 to 50 years	50 to 100 years	Total
Rail	0	98	341	439
Road	1,754	7,774	5,911	13,685
State Highway	0	1,434	538	1,972
Wastewater treatment plant	0	0	1	1

3 Assessment criteria for potential sites for relocation

Removal of properties at the coastal fringe will reduce both the available housing within each local community affected as well as for the region. The displaced population will have to find alternative accommodation, and while this could feasibly be anywhere, the view is held that for most cases people would want to locate to the same area and certainly within the region. The reasons for this are typically due to employment, family and friends in the area, history within the region, and often a sense of belonging to the community they are part of.

Under a scenario of planned retreat, it is anticipated that, where practicable, councils would aim to facilitate the construction of an equivalent number of houses within each community area affected to maintain the population size and provide additional options for the displaced population.

To provide guidance on the suitability of land to support a planned retreat response, we set out assessment criteria framework for more detailed assessments for potential sites for physical suitability. While we are confident there are sites that are considered suitable, based on these criteria, we have not identified actual sites or areas in this report. It is recognised that these areas may also require changes to zones and planning rules to enable this development in areas that are not currently zoned for this development activity, which might introduce wider resource management considerations such as soil quality and versatility with no certainty of approvals.

A key requirement when considering sites for development, within these potential re-establishment areas, is that the site has a low natural hazard risk. Otherwise, the planned retreat process may just be swapping one set of risks for another that are likely to pose problems within the design life of the new development. The implementation of planned retreat is in many cases not considered necessary for several decades, consequently the consideration of hazards needs to extend beyond the 100-year horizon frequently used for other assessments. The assessment should also cover additional hazards that were not considered in this report as drivers for planned retreat, including seismic susceptibility and river flooding hazards.

Land should also be assessed in terms of the development difficulty in terms of the likely requirements for earthworks, ground improvements and additional infrastructure. The proximity of each site to the properties that are required to retreat should also be evaluated with the assumption that the closer sites are more preferred. The high-level assessment methodology ranks each criterion qualitatively on a 1-5 scale as set out below.

3.1 Coastal erosion hazard

The potential coastal erosion hazard would need to be assessed based on the hazard areas adopted for use in the coastal strategy (T+T, 2015) and defined in Table 3-1. Specifically, the proximity of the site to a line defined as having a 5% chance of being reached or exceeded by 2120 (2120 P5% CEHZ).

Table 3-1: Assessment ranking for coastal erosion susceptibility

1	The site is within the 2120 P5% CEHZ
2	The site is less than 50 m landward of 2120 P5% CEHZ
3	The site is less than 200 m landward of 2120 P5% CEHZ
4	The site is greater than 200 m landward of 2120 P5% CEHZ
5	The site is greater than 300 m landward of 2120 P5% CEHZ

3.2 Coastal inundation hazard

The potential coastal inundation hazard would need to be assessed based on the hazard areas adopted for use in the coastal strategy (T+T, 2015) and defined in Table 3-2. Specifically, the

proximity and elevation of the site compared to the inundation hazard area attributed with a 1% chance of occurrence in the year 2120 (2120 1% AEP).

Table 3-2: Assessment ranking for coastal inundation susceptibility

1	More than 50% of the site is at risk to 2120 1% AEP inundation
2	Less than 50% of the site is at risk to 2120 1% AEP inundation
3	The site is less than 100 m from 2120 1% AEP zone and elevated less than 5 m RL
4	The site is less than 100 m from the 2120 1% AEP zone and elevated less than 6.5 m RL
5	The site elevated greater than 6.5 m RL

3.3 River flooding hazard

Risks for river flooding hazards would need to be based on the adopted low (50 year ARI) and high risk (100 year ARI) hazard zones defined on the Hawkes Bay Regional Council hazard portal (<https://hbmmaps.hbrc.govt.nz/hazards/>) as defined in Table 3-3. It is acknowledged that these may not fully account for predicted climate change effects. Given the uncertainty on timing of planned retreat and construction of relocation areas it is considered reasonable to carry out a more detailed assessment when development sites are selected.

Table 3-3: Assessment ranking for river flooding susceptibility

1	Entire site within high-risk flood area
2	Part of site within high-risk flood area
3	Entire site within low-risk flood area
4	Part of site within low-risk flood area
5	Entire site outside of low-risk flood area

3.4 Liquefaction hazard

The liquefaction assessment would need to be primarily based on the Heretaunga Plains liquefaction hazard vulnerability work that is available on the HBRC hazards portal. Engineering judgement can be applied based on the available geological information and, where applicable, the spread of vulnerability zones across a site (Table 3-4).

Table 3-4: Assessment ranking for liquefaction vulnerability

1	Entire site has high liquefaction vulnerability
2	Site has high to medium liquefaction vulnerability
3	Site has medium liquefaction vulnerability
4	Site has low to medium liquefaction vulnerability
5	Entire site has low liquefaction vulnerability

3.5 Requirement for earthworks

The topography of a site is indicative of the scale of earthworks required for the layout of the site which may including levelling or retaining structures to establish sections suitable for development. A green-field site with little variation in elevation should not require extensive earthworks to create flat, developable land. Sites that are sloping and that have variable topographies will require more earthworks to create level building areas. An initial assessment can be based on the variations in levels across each site (Table 3-5), with engineering judgement used to refine the rank based on undulations and features evident from LiDAR contours. Consideration of vertical land movement

(VLM) over at least 100 years would need to be considered for assessments of the volume and levels required.

Table 3-5: Assessment ranking for required earthworks

1	Topography variation greater than 8 m
2	Topography varies between 6 m and 8 m
3	Topography varies between 4 m and 6 m
4	Topography varies between 2 m and 4 m
5	Topography variation less than 2 m

3.6 Requirement for ground improvements

The need for ground improvements generally relates directly to the liquefaction hazard associated with the land. Ground improvements are generally undertaken to provide a stable, suitable crust to mitigate potential displacements related to liquefaction. A high-level assessment based on the liquefaction susceptibility of each site and underlying geology would be needed to qualitatively assess the likely requirements for ground improvements (Table 3-6).

Table 3-6: Assessment ranking for ground improvement requirements

1	High intensity of ground improvements required
2	Moderate to high
3	Moderate intensity of ground improvements required
4	Low to moderate
5	Low intensity of ground improvements required

3.7 Requirement for new infrastructure

This criterion relates to the likely requirement for new infrastructure outside the boundary of the new site including road access and connection of utilities (Table 3-7).

Table 3-7: Assessment ranking for new infrastructure requirements

1	No existing roads or utilities. All new infrastructure required.
2	Minimal existing road network. No utilities nearby.
3	Minor road network, utilities limited.
4	Some road network and utilities nearby
5	Existing road network and utilities nearby with minimal new infrastructure required

3.8 Proximity to planned retreat area

The locations of the new sites could also be ranked relatively based on the distance from existing property that may be required to retreat (Table 3-8) assuming a preference of relocation being more desired close to the original area.

Table 3-8: Assessment ranking for required ground improvements

1	Greater than 1 km
2	Greater than 0.5 km
3	Greater than 0.3 km
4	Less than 0.2 km
5	Less than 0.1 km

4 Planned retreat implementation

4.1 Potential options

There are several different ways that proposed planned retreat of private property could be undertaken. Research (Boston, 2019) suggests that all will require some form of incentive or pressure, without which the process is difficult to implement. They will also face their own community, political and/or legal challenges. In this section the Do nothing and compulsory acquisition options have not been considered. It is also important to note that this report does not constitute a recommendation for the implementation of planned retreat in preference to other options.

There are also several new acts that are likely to support and provide additional guidance to retreat. The proposed Natural and Build Environment Act (NBA), Strategic Planning Act (SPA) and Climate Adaptation Act (CCA) should support long-term, proactive planning for retreat. The draft National Adaptation Plan (NAP) also identifies that central government has a key role, and will use legislation, funding, and regulation to do enable adaption to climate change. However, details of this guidance, and any funding mechanisms is not yet available.

Based on previous studies and literature, we have identified several options which can be used to implement some form of planned retreat. For each of the options we have discussed the advantages, disadvantages, and practical difficulties of implementation. These include:

- Property acquisition.
- Planning provisions.
- Signalling.
- Withdrawal of Insurance.

It is likely that planned retreat will be seen in the context of a range of approaches from managing the environmental consequences of abandoning coastal assets to full scale relocation of at-risk parts of the community discussed here. Regardless of the planned retreat option community acceptance is one of the key barriers to Planned retreat. Early and effective communication and engagement with the community is vital for building community understanding and acceptance of the option (Vandenbeld & McDonald, 2013 & Owen et al. 2018). Owen et al. (2018) discusses how early engagement should occur to identify the community values.

4.1.1 Property acquisition

This option of planned retreat involves a public entity acquiring private properties in at-risk locations. Boston (2019) suggests some form of public compensation or assistance for private property losses resulting from programmes of managed retreat will be unavoidable, although he expected that this would need to come from central government rather than from local government. Property acquisition can be expensive and the land acquired may require maintenance or other actions. Additionally, support and incentives may be required, such as assistance for legal and relocation fees. However, there is no legal compulsion that requires local government organizations to purchase any property, but by including losses based on land and property values, these losses are accounted for in the cost of planned retreat.

Ofulson (2019) outlines several approaches for acquisition of coastal property:

- 1 Purchase and lease back: Public purchase of the property and lease it back to original owner. This approach allows some of the acquisition cost to be offset by the lease.
- 2 Purchase covenant sell: Public purchase of the property with coastal hazard provisions added to the property before it is sold on. This approach establishes what the new owner can and

cannot do with the property (e.g., prohibiting development of protection works, prohibiting making of complaints about erosion, or that buildings must be removed once sea reach certain trigger point).

- 3 Purchase then demolish: Public purchase of the property and demolish it with the land maintained as public space. The property purchase and abandonment are delayed until necessary (i.e. when sea level reaches a pre-determined point).

. There are some examples in New Zealand where property acquisition has occurred, however these examples are not direct parallels. These examples represent situations that are responding to natural hazard events, and do not represent a strategic planned retreat approach. Property acquisition can have wider fairness and equity issues that will need to be addressed. Aside from funding issues, planned retreat will require robust public institutions and sound anticipatory guidance (Boston, 2019). This guidance is anticipated to be provided in the NBA, SPA and CCA.

4.1.2 Planning provisions

Another option for facilitating planned retreat is through planning provisions, such as plan changes, development and building restrictions. This could include planning provisions on existing development that restrict rebuilding after the occurrence of damage or for new development, requiring any rebuild to be behind a setback line while also avoiding any new development in areas of high risk. Examples of where plan changes and building restrictions have occurred as part of the planned retreat process in New Zealand include Ruby Bay and Matata. It is anticipated that planning provisions may be required under the NBA, SPA and CCA.

Ruby Bay is a New Zealand-based example that involved the development of a 'structure plan' to provide alternative areas for future expansion of development away from the high-risk areas. The structure plan involved extensive community engagement including extensive public debate. To achieve the objectives of the structure plan, Tasman District Council (TDC) revised its District Plan with new rules prohibiting further subdivision within the at-risk coastal zone. TDC was granted a declaration from the Environment Court for the new rules to have an immediate effect upon the public notification of the Plan change. This was to avoid rush of development applications under the old rules but there was no pressure to relocate existing buildings ahead of the risk manifesting.

In Matata, plan changes were used to implement a retreat. In June 2018, Plan Change 17 was publicly notified with new objectives and policies to reduce the natural hazard risk on the fan head from high to at least medium risk. A rule prohibiting residential activities on identified sites within the high-risk area was also introduced. Changes to the District Plan to rezone the land from 'Residential' to 'Coastal Protection Zone', to prohibit residential activities and require resource consent for any new activities were also notified in this process and there was also a voluntary buy out. It is noted for clarity that this example was not a retreat in response to coastal erosion or coastal inundation impacts or risks, and the process was directly financially supported by central government.

Hanna et al. (2018) states that while local authorities, such as territorial authorities and regional councils, may have overlapping responsibilities for natural hazard management, they have different legislative capacities which require integrated management.

4.1.3 Signalling

This planned retreat option would involve a reduction in the council investments and a reduction in the level of services provided in the high-risk area. In some cases, this may involve local government signalling to residents their intentions to reduce investment in area (i.e., stop maintaining facilities) and subsequently residents can then decide when to relocate or abandon their property.

By Council discontinuing to maintain public infrastructure in high-risk areas this can allow investments to be used elsewhere (i.e., location of proposed re-establishment). This could involve relocating community assets such as schools, hospitals, fire stations, community halls and reserves. Reduced level of service may also include more limited maintenance of public infrastructure as well as removal of coastal protection structures.

A benefit of this approach is that it enables Council to avoid costly maintenance and repair costs which are likely to become more frequent with rising seas. However, there would still be costs associated with property transfers and land rehabilitation and some of the limitations with this option are legal obligations of Council and equity and fairness considerations.

4.1.4 Insurance

While insurance is not a factor councils can control, it is an important factor to consider as insurance retreat could be one of the key factors informing decisions on residential property retreat.

Insurance covers risks for which there is significant uncertainty. As such, insurers will retreat from coastal properties once risks are sufficiently probable. Subsequently, insurance retreat from coastal properties could increase the unfunded fiscal risk faced by the Crown and decrease house prices as mortgages become unavailable (or more costly) (Storey and Noy, 2017).

Insurers are already withdrawing from some individual flood/earthquake prone properties and as climate hazards escalate this will accelerate. Insurance companies are unlikely to commit to long-term insurance contracts, therefore local government will need to do their own analysis of the when the timing and scale of insurance retreat occurs in locations (Storey and Noy, 2017). As insurance retreats, house prices in those areas are likely to be affected and infrastructure investments may be more difficult to justify.

4.2 Steps for planned retreat of an entire coastal community

Table 4-1 sets out the key stages, steps, and components for planned retreat based on property and title transfer (regardless of how costs and losses are attributed – noting the caveats and limitations in section 1.2) based on work by Oulfsen (2019). The table identifies that there is significant work in the planning, preparation, and engagement at the start of the process to enable the subsequent stages to occur.

Oulfsen (2019) identified that purchasing existing land/property, and the transfer from private to public ownership, is a pre-requisite for the process to progress. This is included in the enabling investment stage along with acquiring new land and ensuring the utility and transport networks are maintained around the areas where planned retreat occurs. Active retreat occurs with the development of the new subdivisions and this is followed by the clean-up phase in the areas where relocation has occurred.

Table 4-1: Key stages and components for planned retreat (modified from Oulfsen, 2019)

Stages	Steps	Key components
Planning, preparation and engagement	Community engagement	<ul style="list-style-type: none"> • Consultation on adaptation options and implementation of planned retreat.
	Planning	<ul style="list-style-type: none"> • Plan/rule changes to enable planned retreat and maintaining utility and transport network systems.

	Monitoring of actual physical changes compared to predicted	<ul style="list-style-type: none"> • Establishing trigger points for action. • Monitoring and evaluation.
Enabling investment	Accounting for losses for existing properties within hazard areas	<ul style="list-style-type: none"> • Property losses accounted for
	New community investment	<ul style="list-style-type: none"> • Acquisition of land for new subdivisions. • Plan changes to enable subdivision and development. • Implement utility and transport network requirements.
Active retreat	New subdivisions	<ul style="list-style-type: none"> • Redevelop public infrastructure, community facilities within new subdivisions.
Clean up of areas	Demolition	<ul style="list-style-type: none"> • Demolition and removal of abandoned infrastructure and removal of hazardous materials.
	Land rehabilitation and maintenance	<ul style="list-style-type: none"> • Making ground safe (where appropriate). • Landscaping and maintaining.

5 High level cost estimates to carry out planned retreat

High level cost estimates to carry out planned retreat has been based on the potential loss in value of the properties within the coastal hazard zones based on their capital and land values, the cost of retreating the properties and to reinstate the coastal fringe. It also includes costs to re-establish new subdivisions to accommodate the relocated communities within adjacent potentially suitable areas following the steps set out in Table 4-1. The timeline follows the three periods set out in Section 2 and are consistent with the approach used in the coastal strategy:

- 0 to 20 years: CEHZ 2015 P5%.
- 20 to 50 years: CEHZ 2065 P5%.
- 50 to 100 years: CEHZ 2120 P5%.

The high-level costs are set out in Table 5-1 and the following sections explain the rationale for these costs.

5.1 Planning, preparation, and engagement

This stage will require resource from Councils and their advisors for community engagement, process management, planning and monitoring. Legal and consultant input will be required during the planning phase and likely throughout the rest of the process. These costs are difficult to quantify, and to a degree are dependent on the success of the scheme and response from private asset owners.

Previous case studies of managed retreat in NZ quantify the planning component as 7%-10% (Matata/Two Rivers) of the value of properties requiring retreat. The management of the retreat process itself is likely to take years to resolve and finalise negotiations with residents. This is expected to require substantial resources from council and additional legal and consultancy services in addition to the sum allowed for initial planning. There is a lot of uncertainty around whole project costs for this element, but the assumption is made that given the size of the retreat areas in Hawke's Bay, and number of properties, there would be some economies of scale.

For this exercise costs are based on 10% of the losses of properties within the coastal hazard areas in the short term and 7% for the medium and long term but recognising these percentages carry a high degree of uncertainty. The reduction in percentage value from 10% is to recognise the processes and approaches should be established and refined in the short term. However, the actual costs will to a degree be dependent on the approach taken to implement retreat and any future guidance/legislation from central government that may streamline the process.

5.2 Enabling investment

In the enabling phase there will be some cost savings because of the reduction in maintenance of public infrastructure in those areas planned to be retreated, but significant additional costs for acquisition of land for new relocation site. The main task in this phase is to establish an equitable and effective funding regime to account for the losses of the existing properties and acquiring land for future subdivision. Present day valuations for properties potentially at risk over the next 100 years are summarised in Section 2. These are largely representative of the open market valuations as denoted by the council rates assessment. However, the housing market has seen large gains since the last rateable value reassessment, with present day median values being around 26% higher (Figure 5.1) between January 2020 and January 2021, although more recent data suggests the market is cooling. Based on the coastal hazard assessment the properties and assets have a remaining useful life, which in many cases exceeds 50 years. This represents a large proportion of the valuation, and we consider it fair to assume the actual value (equivalent to present day) at the time planned retreat is required could be lower. This is illustrated by the change in capital value for

properties on the seaward side of Clifton Road, Haumoana (Figure 5.2). This shows that properties generally reduced in value from 2008 to 2020. However, for the purposes of this assessment we have used the 2019/2020 valuations to indicate the potential loss in value of the property asset. An additional sum of 5% of the properties land and capital value was included for transaction costs, management and administration of this process.

Table 5-1: High level cost estimate for planned retreat

Stages	Actions		0-20 years	20-50 years	50 - 100 years	Total
Planning, preparation and engagement	10% of enabling investment and active retreat costs in years 0-20, 7% for years 20-100	Unit	\$ 16,929,505	\$ 37,990,007	\$ 72,924,003	\$ 127,843,515
Enabling investment	Losses based on existing properties at 2019/2020 values (land value + capital value)	Whirinaki	\$ 27,545,000	\$ 4,070,000	\$ 58,555,000	\$ 90,170,000
		Bayview	\$ -	\$ 66,555,000	\$ 17,445,000	\$ 84,000,000
		Westshore	\$ 7,850,000	\$ 76,690,000	\$ 95,377,000	\$ 179,917,000
		Pandora	\$ -	\$ 5,240,000	\$ 85,960,000	\$ 91,200,000
		Ahuriri	\$ 3,630,000	\$ -	\$ 142,255,000	\$ 145,885,000
		Clive	\$ -	\$ 8,770,000	\$ 10,465,000	\$ 19,235,000
		Haumoana	\$ 5,456,000	\$ 27,010,000	\$ 26,070,000	\$ 58,536,000
		Te Awanga	\$ 18,610,000	\$ 35,670,000	\$ 46,773,000	\$ 101,053,000
		Clifton	\$ 960,000	\$ 1,395,000	\$ 1,395,000	\$ 3,750,000
		Sub-total	\$ 64,051,000	\$ 225,400,000	\$ 484,295,000	\$ 773,746,000
	5% of purchase for management and administration		\$ 3,202,550	\$ 11,270,000	\$ 24,214,750	\$ 38,687,300
		Combined total	\$ 67,253,550	\$ 236,670,000	\$ 508,509,750	\$ 812,433,300
Active retreat	Land purchase, section preparation and construction	Whirinaki	\$ 33,656,000	\$ 6,202,000	\$ 92,171,625	\$ 132,029,625
		Bay View	\$ -	\$ 87,981,731	\$ 18,293,231	\$ 106,274,963
		Westshore (Alternative)	\$ 6,125,000	\$ 76,125,000	\$ 94,500,000	\$ 176,750,000
		Ahuriri (Alternative)	\$ 3,630,000		\$ 89,250,000	\$ 92,880,000
		Pandora (Alternative)	\$ -	\$ 5,240,000	\$ 85,960,000	\$ 91,200,000
		Clive	\$ -	\$ 15,784,650	\$ 7,892,325	\$ 23,676,975
		Clive (treatment plant)			\$ 40,000,000	\$ 40,000,000
		Haumoana	\$ 21,667,800	\$ 48,486,200	\$ 50,861,650	\$ 121,015,650
		Te Awanga	\$ 39,205,250	\$ 76,099,800	\$ 77,152,644	\$ 192,457,694
		Clifton	\$ 960,000	\$ 1,395,000	\$ 1,395,000	\$ 3,750,000
Sub-total	\$ 105,244,050	\$ 317,314,381	\$ 557,476,475	\$ 980,034,906		
Clean up	Demolition, removal, landscaping	Whirinaki	\$ 2,022,000	\$ 409,500	\$ 5,400,250	\$ 7,831,750
		Bay View	\$ -	\$ 5,397,750	\$ 920,250	\$ 6,318,000
		Westshore	\$ 456,750	\$ 4,607,250	\$ 4,789,500	\$ 9,853,500
		Ahuriri	\$ 213,500	\$ -	\$ 1,080,000	\$ 1,293,500
		Pandora	\$ -	\$ 366,800	\$ 6,017,200	\$ 6,384,000
		Clive	\$ -	\$ 1,234,500	\$ 707,250	\$ 1,941,750
		Haumoana	\$ 1,219,250	\$ 4,979,750	\$ 2,682,000	\$ 8,881,000
		Te Awanga	\$ 1,815,000	\$ 5,046,500	\$ 4,047,750	\$ 10,909,250
		Clifton	\$ 115,250	\$ 925,400	\$ 200,000	\$ 1,240,650
		Subtotal	\$ 5,726,500	\$ 22,967,450	\$ 25,844,200	\$ 54,538,150
	Contingency	\$ 1,145,300	\$ 4,593,490	\$ 5,168,840	\$ 10,907,630	
	Professional Fees	\$ 286,325	\$ 1,148,373	\$ 125,900	\$ 1,560,598	
	Sub-total	\$ 7,158,125	\$ 28,709,313	\$ 31,138,940	\$ 67,006,378	
	Total	\$ 196,585,230	\$ 620,683,700	\$ 1,170,049,168	\$ 1,987,318,099	

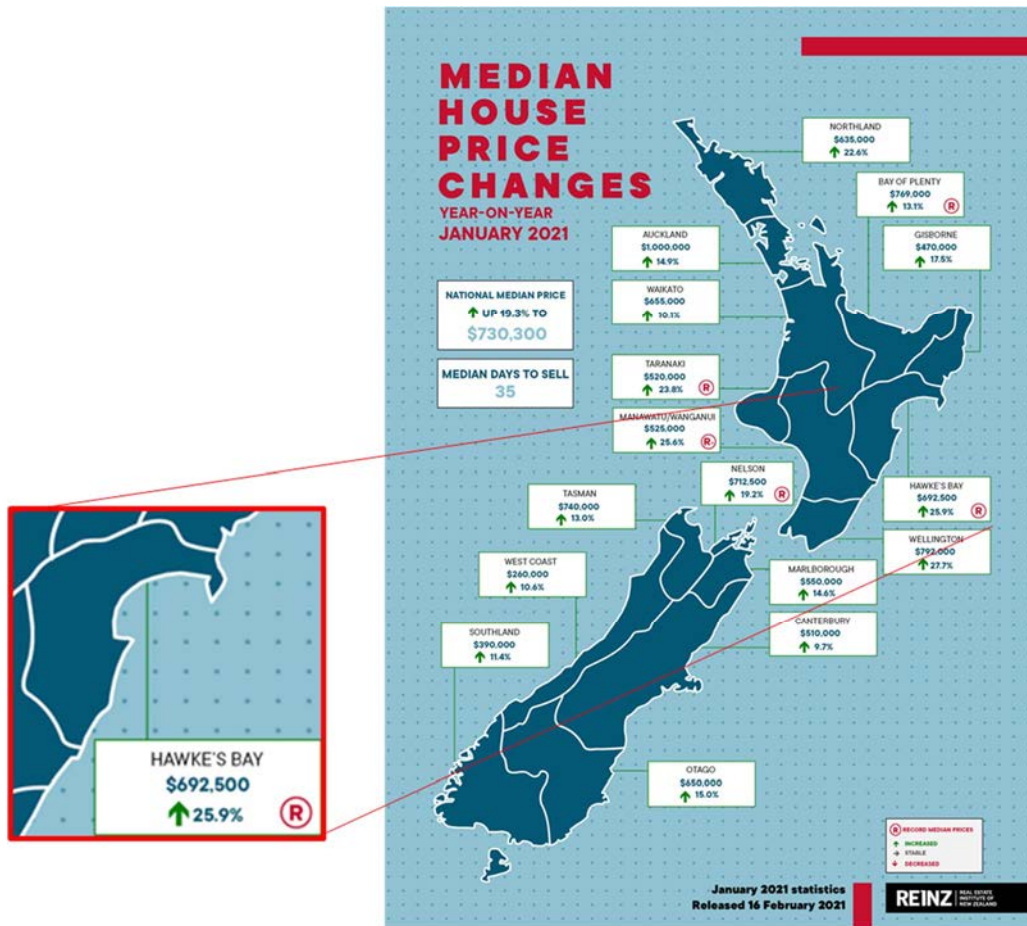


Figure 5.1: Median house price changes in Hawke's Bay (Source: REINZ)

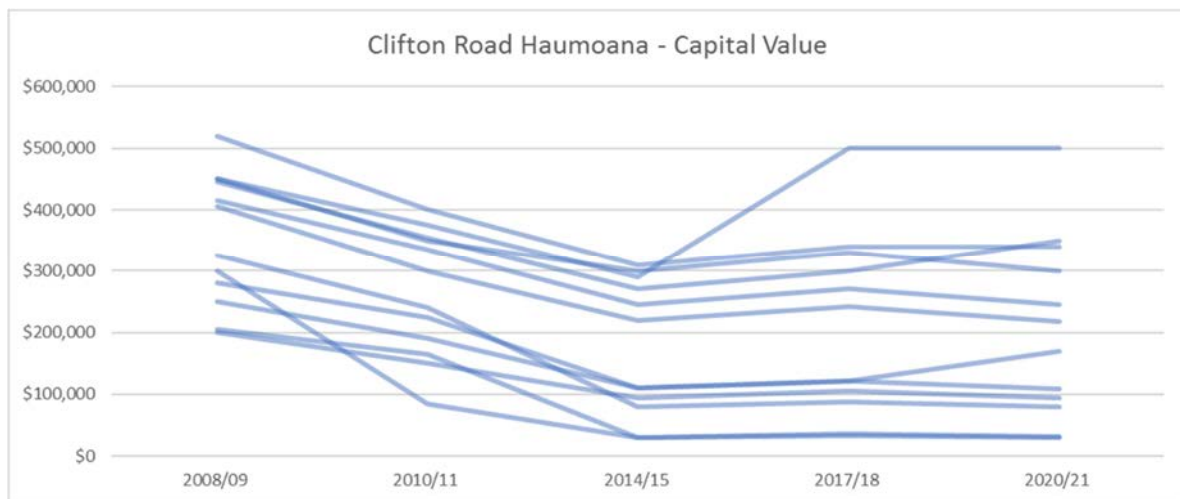


Figure 5.2: change in capital value of residential properties on the seaward side of Clifton Road in Haumoana

5.3 Active retreat

Active retreat is considered to constitute the construction an equal volume of new housing stock relative to those properties that are likely to require retreat and ultimately the vacation of those at-risk properties when a pre-defined trigger point is reached. To facilitate the planned retreat, it is deemed necessary to transfer the ownership of these properties to public ownership.

5.3.1 New sub-divisions

Land costs are difficult to accurately determine, with re-zoning likely required and negotiations with current landowners. There are also multiple options for each unit in terms of where the subdivision may be sited. A rate was used that was consistent with the North Island regions and lower than the major centres of Auckland, Wellington, and Christchurch. For areas where properties are expected to retreat in the short- and medium-term land purchase costs are included in the first epoch. This allows for the design and layout of the subdivision with space 'reserved' for development in the second epoch. There is a great deal of uncertainty on the timing of retreat for properties that may be at risk in the longer term (50-100 years) so it is considered prudent to defer the sub-division land purchase and associated development costs to this period.

For areas where there is suitable land that may be available, high level development costs have been estimated. Properties at risk from coastal hazards, which ultimately may be required to retreat, vary markedly throughout the Hawke's Bay region. It is not considered practical, or appropriate, to provide like for like replacements for individual properties.

For this exercise a standard house and land package has been considered with a floor area of 180 m² and a section size of 650 m² and standard fixtures and fittings. This is consistent with other recent developments in Hawkes Bay (Figure 5.3) and provides the basis for the estimate. Should planned retreat occur the housing types, including actual type, design, and size of buildings, may vary to suit the demand. However, this would be determined in the planning phase and may reflect housing needs, lifestyle choices and trends that are difficult to predict decades in advance. Estimated costs based on a standard property provide enough detail to allow for feasibility planning and the required land area for development.



Figure 5.3: Cost estimates and required land area were based on a standard property equivalent to recent developments in Hawke's Bay (example of new build in Napier).

A required land area for each subdivision was based on an equivalent number of properties to those identified as requiring planned retreat, with an additional allowance for features such as roads, footpaths and reserves as a percentage of the subdivision footprint. The breakdown of costs is based on industry averages as provided by REINZ and summarised in Figure 5.4.

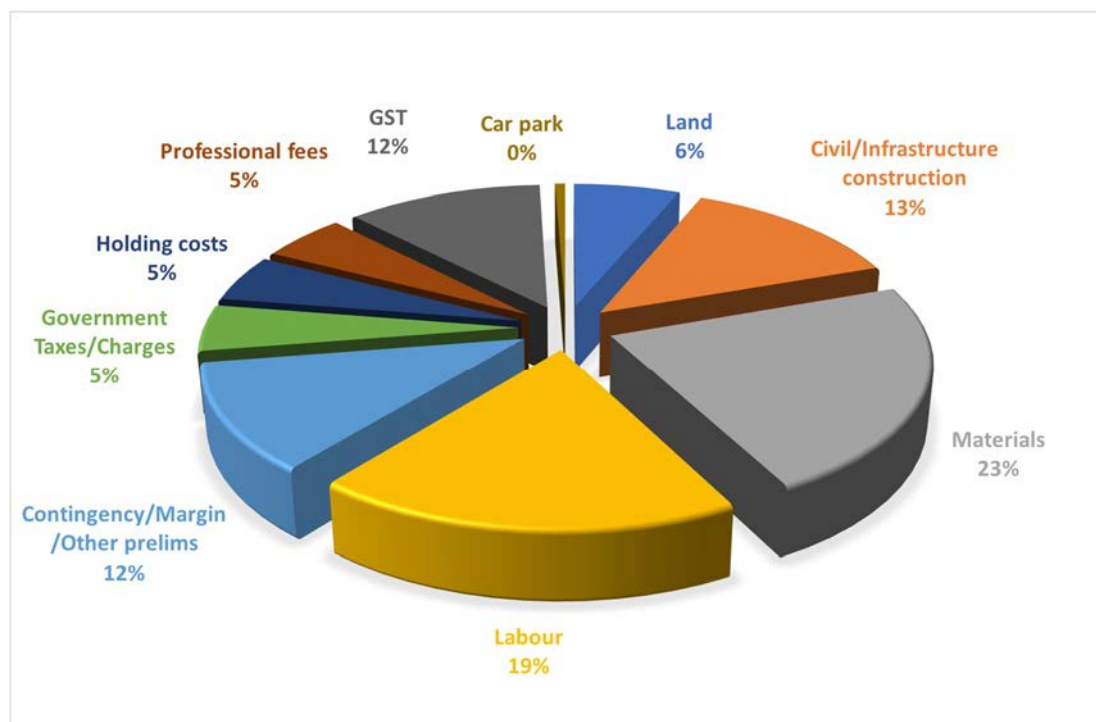


Figure 5.4: Breakdown of subdivision costs

Cost estimates are provided to the sub-division boundary only. Depending on the site location, and proximity to existing roading infrastructure and utilities, the additional costs can vary considerably. There may also be capacity issues with existing utilities or they may not be present, for example a mains sewer. However, most of these costs should be covered with building levies and the existing rates model.

It is possible that any development would be larger than that required for those properties that must retreat from the coast. This may align with growth targets within each district and would effectively dilute some of the costs associated with infrastructure and utilities outside of the development footprint. Although the costing exercise assumes a single development, it is also possible that multiple sites could be developed.

5.4 Clean up

The coastline is considered one of the regions greatest assets, this includes the outlook, access, and amenity value. The assumption is therefore made that any planned retreat exercise would include the demolition and removal of all assets and the remediation of the coastline. This would be regarded as the do minimum approach for planned retreat but would still involve some form of property transfer.

Demolition costs are expected to vary greatly depending on the type and size of property, number of assets (e.g., services, roads, existing coastal defences etc.), and the presence of hazardous waste including asbestos. An assumption is made that demolition under planned retreat would occur while land-based access is available and before coastal hazards necessitate work in the coastal zone, apart from existing coastal defences.

Following demolition and removal of assets remediation of the coastline is likely required and would involve the placement of suitable gravel to fill depressions resulting from the removal of assets, landscaping in the form of planting and pedestrian/cycling paths, and beach access.

5.5 Summary

The total high level cost estimate for each stage and timeframe is shown in Table 5-2 and the percentage breakdown of these costs for each stage and timeframe is shown in Table 5-3. This reflects the upper range of economic costs and losses involved in replacing the assets because of a planned retreat approach (noting that at least some assets can be physically moved) but does not account for the funding regime that might be adopted or any associated income.

Table 5-2: Total high level cost estimate for each stage and timeframe including potential losses included in enabling investment

Stages	0-20 years	20-50 years	50 - 100 years	Total
Planning, preparation, and engagement	\$16,929,505	\$37,990,007	\$72,924,003	\$127,843,515
Enabling investment (including private property losses, management, and administration)	\$67,253,550	\$236,670,000	\$508,509,750	\$812,433,300
Active retreat	\$105,244,050	\$317,314,381	\$557,476,475	\$980,034,906
clean up	\$7,158,125	\$28,709,313	\$31,138,940	\$67,006,378
Totals	\$196,585,230	\$620,683,700	\$1,170,049,168	\$1,987,318,099

Table 5-3: Percentage of total cost for each stage and timeframe

Stages	0-20 years	20-50 years	50 - 100 years	Total
Planning, preparation, and engagement	9%	6%	6%	6%
Enabling investment	34%	38%	43%	41%
Active retreat	54%	51%	48%	49%
clean up	4%	5%	3%	3%

6 References

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7 Applicability

This report has been prepared for the exclusive use of our client Hawke's Bay Regional Council, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Tonkin & Taylor Ltd

Report prepared by:



Jonathan Clarke

Richard Reinen-Hamill

Rebekah Haughey

RRH

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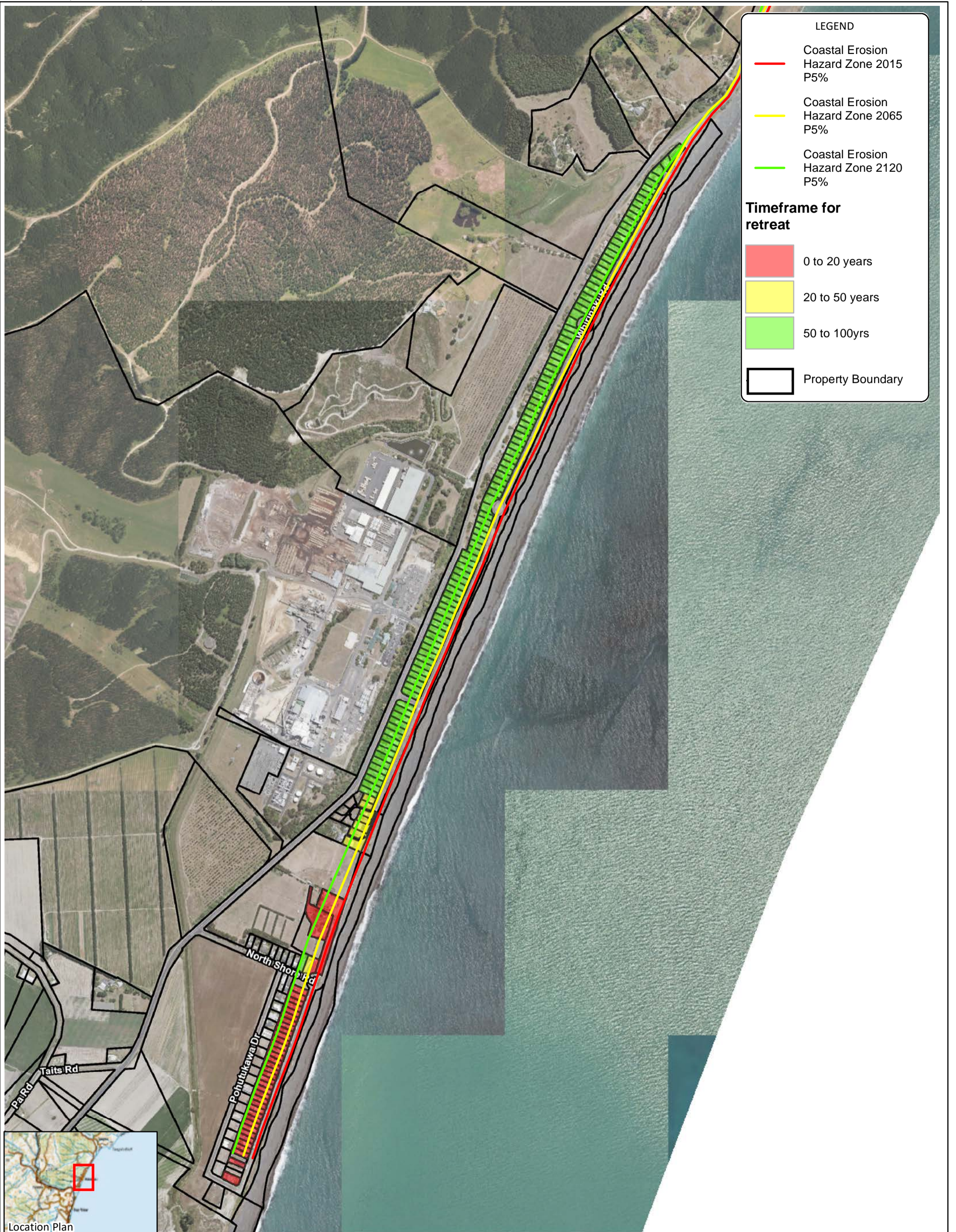
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Richard Reinen-Hamill

Project Director

Appendix A: Coastal erosion hazard extents and
assets potentially affected

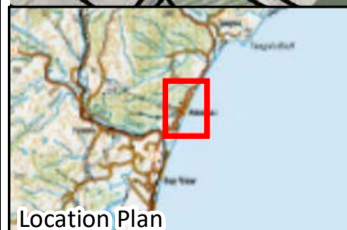


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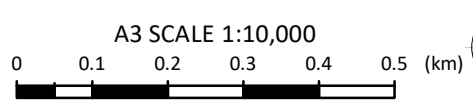
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- Coastal Erosion Hazard Zone 2065 P5%
- Coastal Erosion Hazard Zone 2120 P5%

Timeframe for retreat

- 0 to 20 years
- 20 to 50 years
- 50 to 100yrs
- Property Boundary



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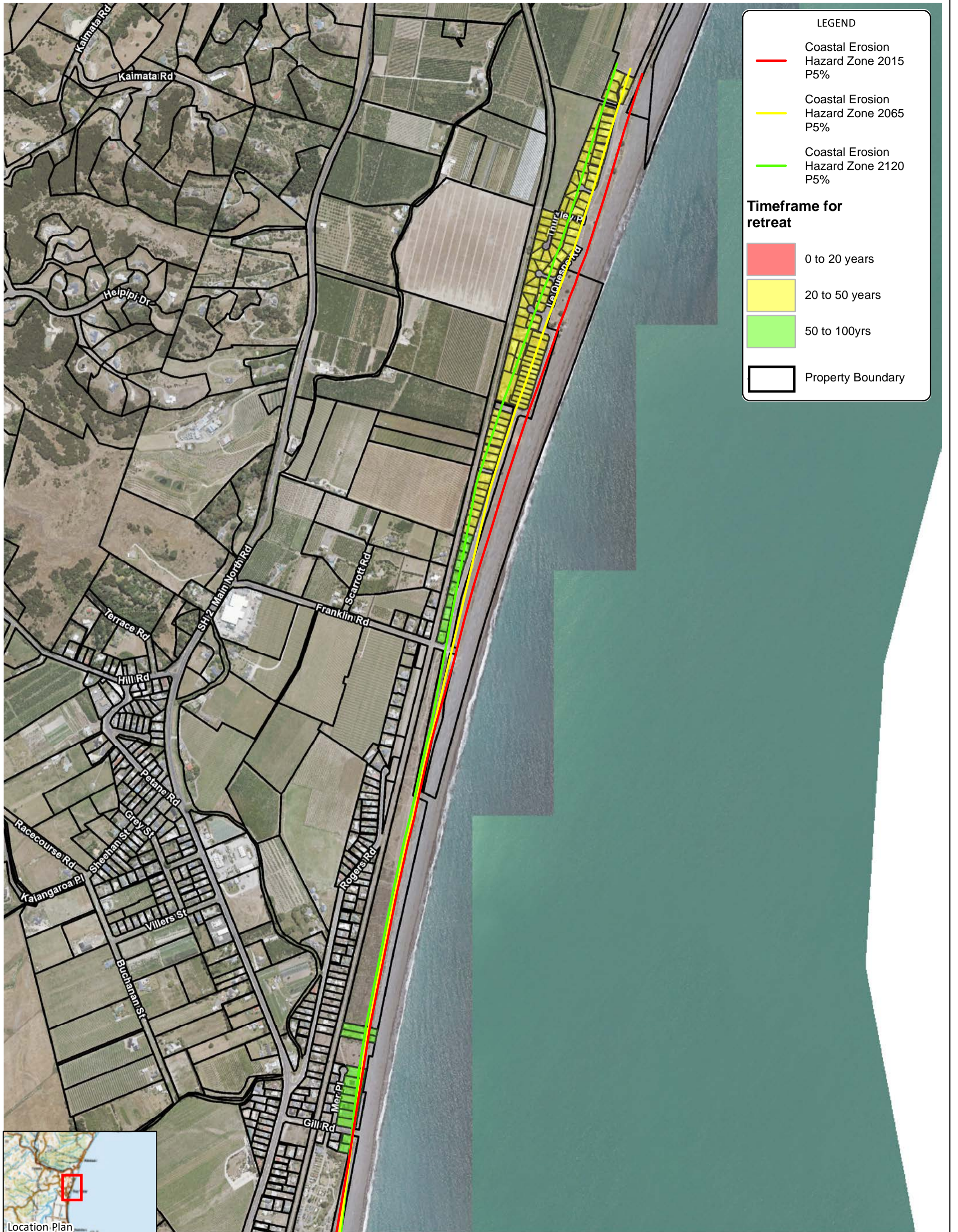


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Hawke's Bay Coastal Strategy - Managed Retreat
Timing of Retreat
Whirinaki

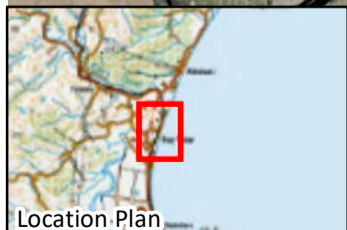


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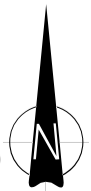
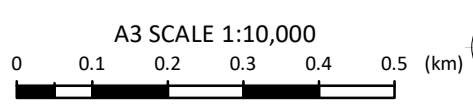
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Timeframe for retreat

- 0 to 20 years (Red box)
- 20 to 50 years (Yellow box)
- 50 to 100yrs (Green box)
- Property Boundary (Black outline)



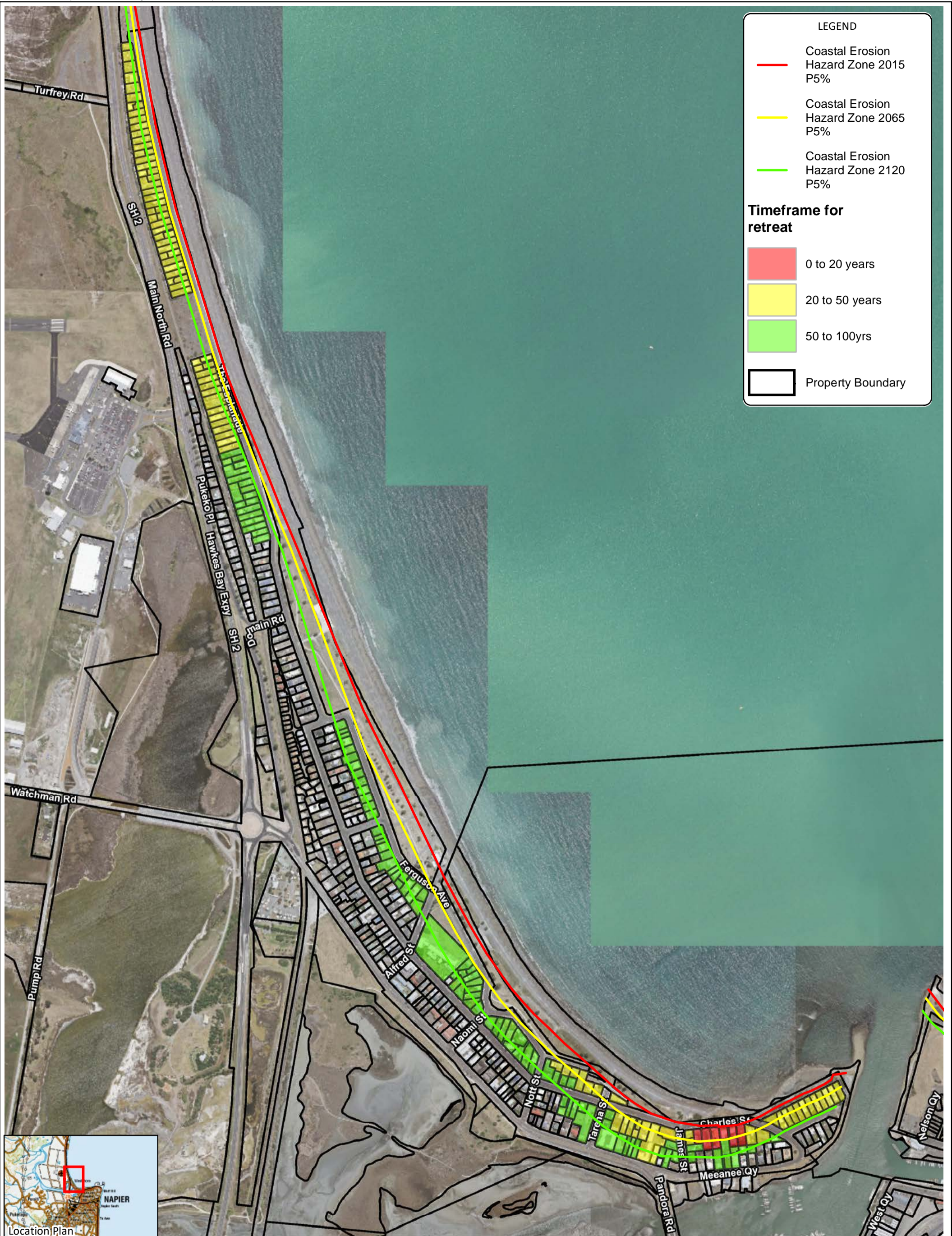
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Hawke's Bay Regional Council
 Hawke's Bay Coastal Strategy - Managed Retreat
 Timing of Retreat
 Bayview

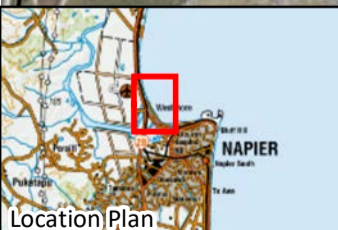


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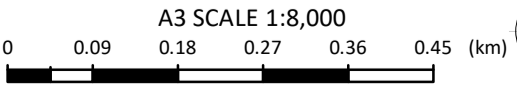
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Timeframe for retreat

- 0 to 20 years
- 20 to 50 years
- 50 to 100yrs
- Property Boundary



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 Timing of Retreat
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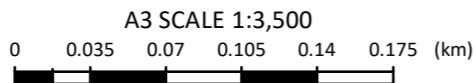
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Timeframe for retreat

- 0 to 20 years (Red fill)
- 20 to 50 years (Yellow fill)
- 50 to 100yrs (Green fill)
- Property Boundary (Black outline)

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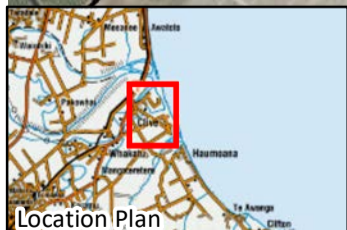
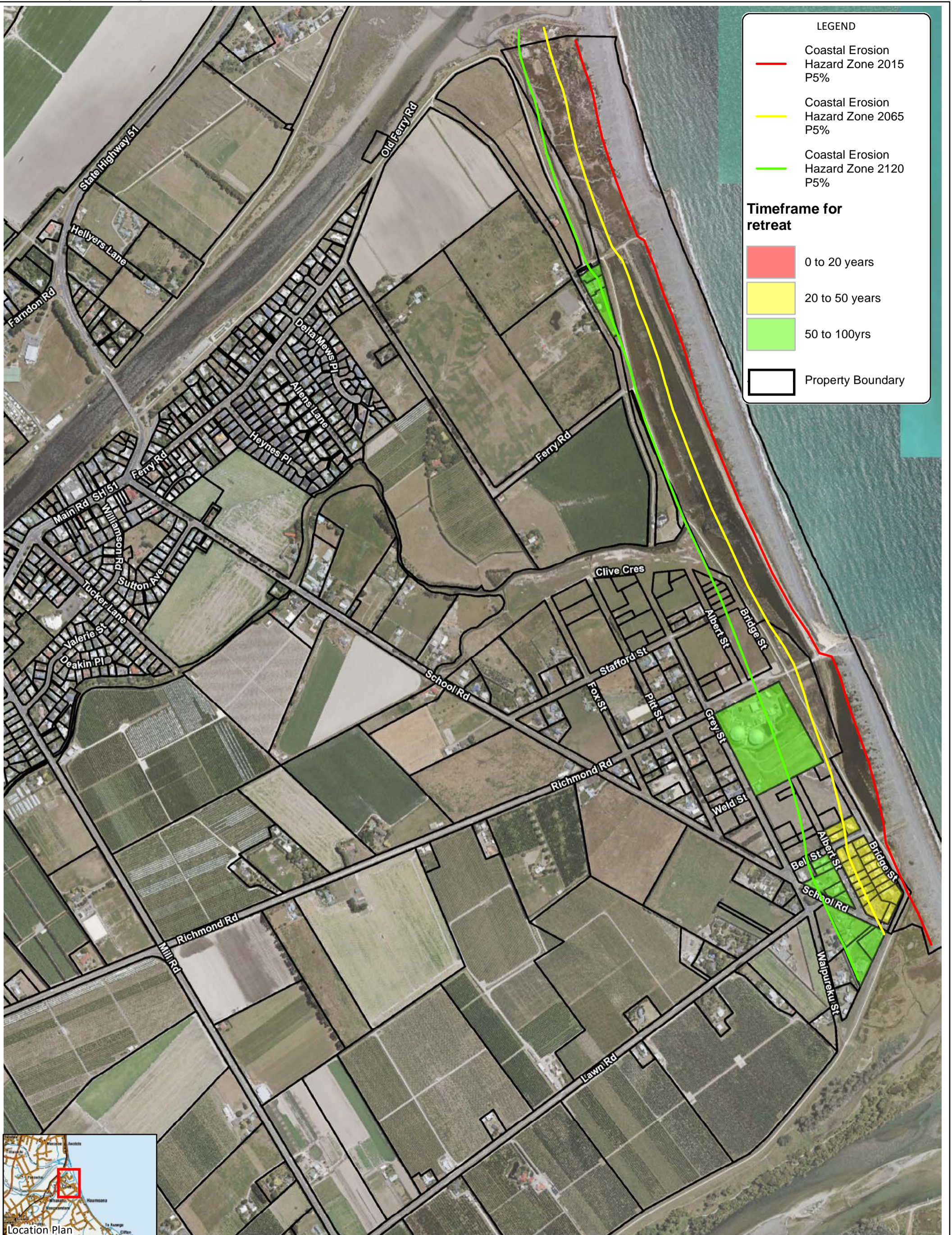
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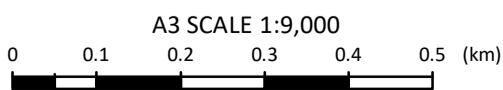
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 Timing of Retreat
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FIGURE No. Figure 4

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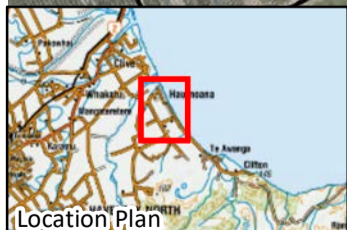
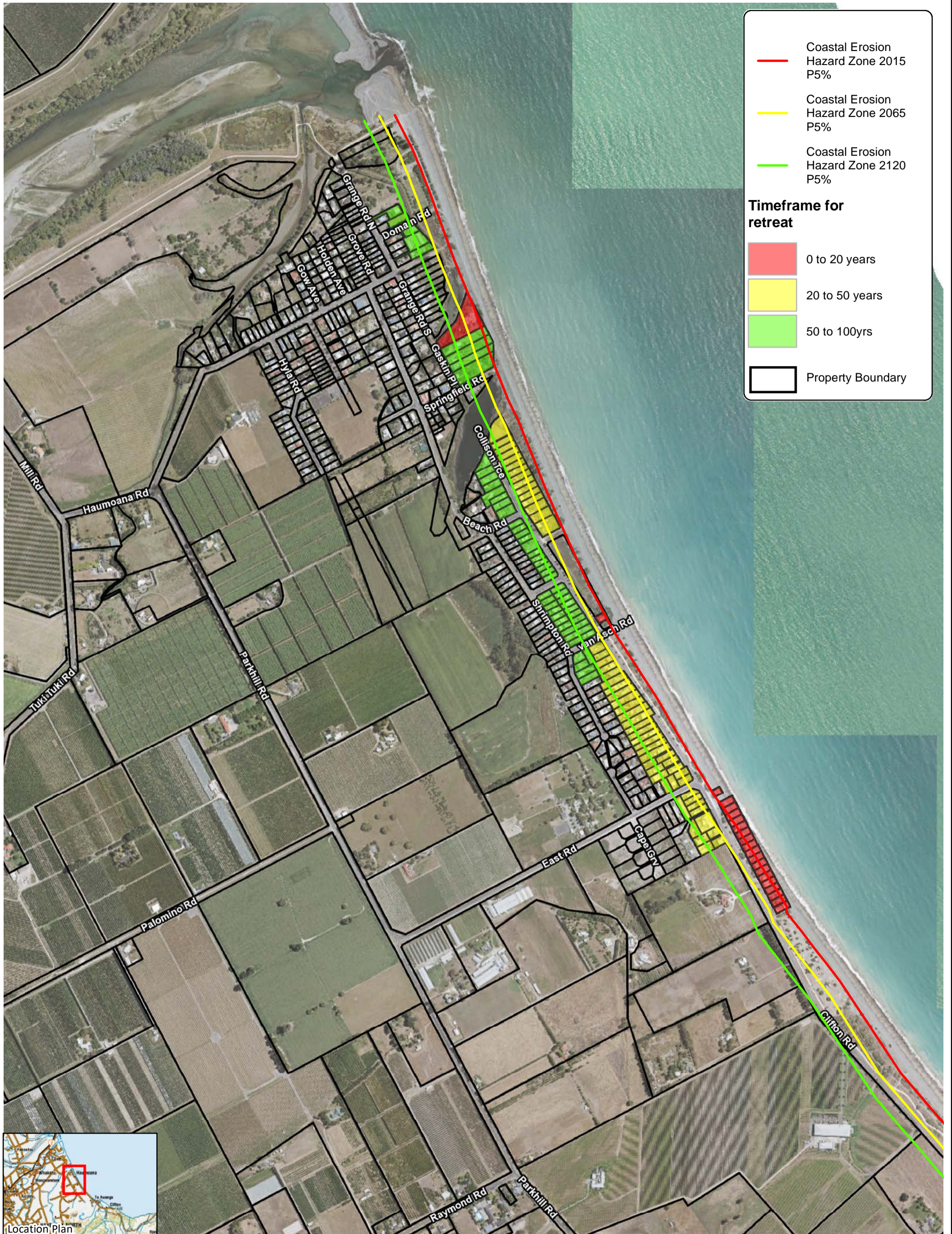
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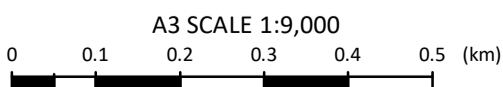
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Timing of Retreat
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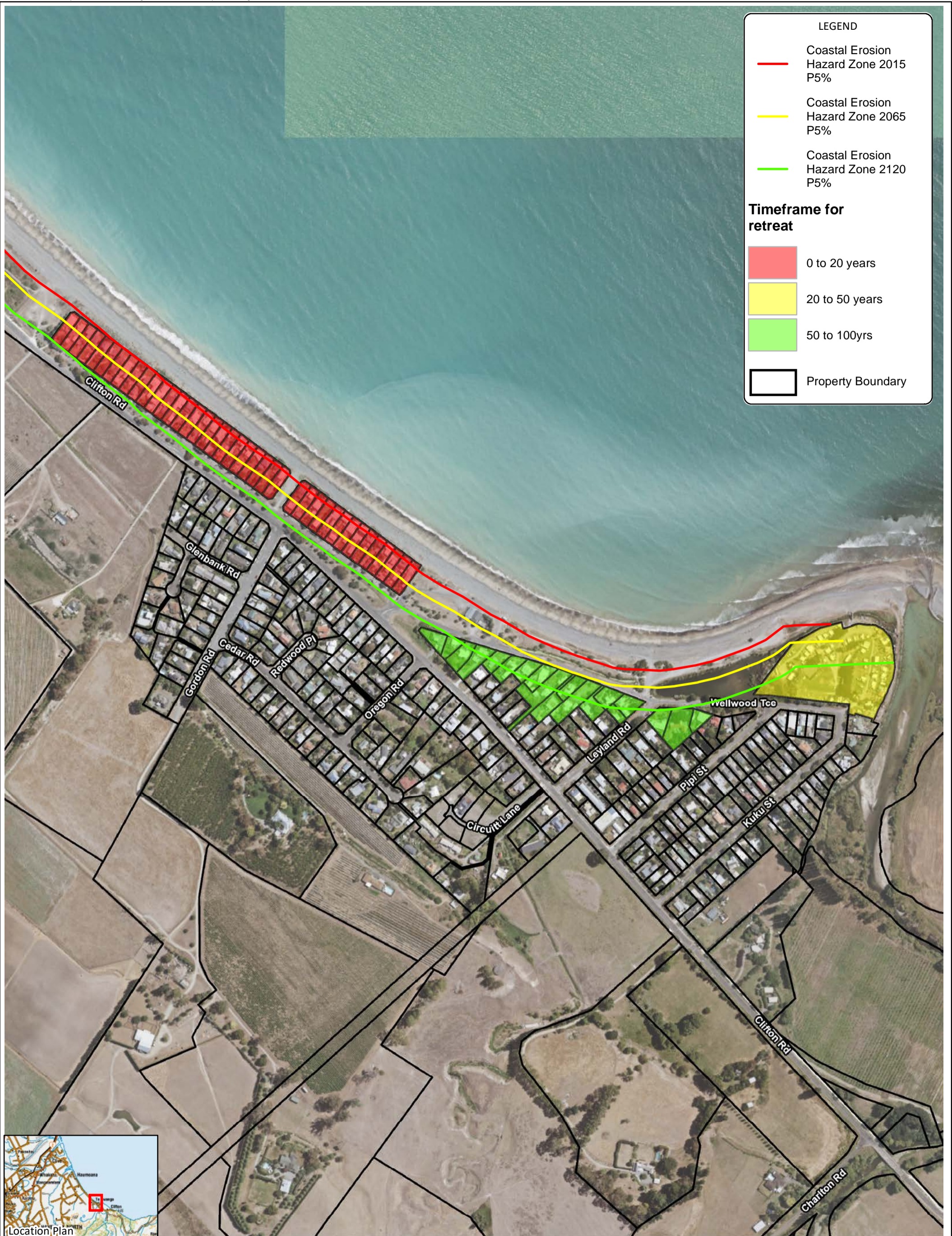
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Timing of Retreat
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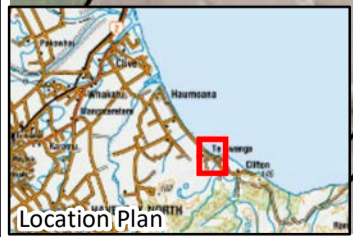


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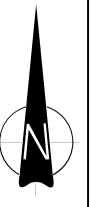
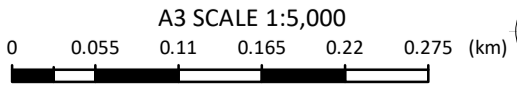
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- Coastal Erosion Hazard Zone 2065 P5%
- Coastal Erosion Hazard Zone 2120 P5%

Timeframe for retreat

- 0 to 20 years
- 20 to 50 years
- 50 to 100yrs
- Property Boundary



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Timing of Retreat
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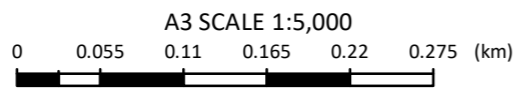
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- Coastal Erosion Hazard Zone 2120 P5% (Green line)

Timeframe for retreat

- 0 to 20 years (Red fill)
- 20 to 50 years (Yellow fill)
- 50 to 100yrs (Green fill)
- Property Boundary (Black outline)

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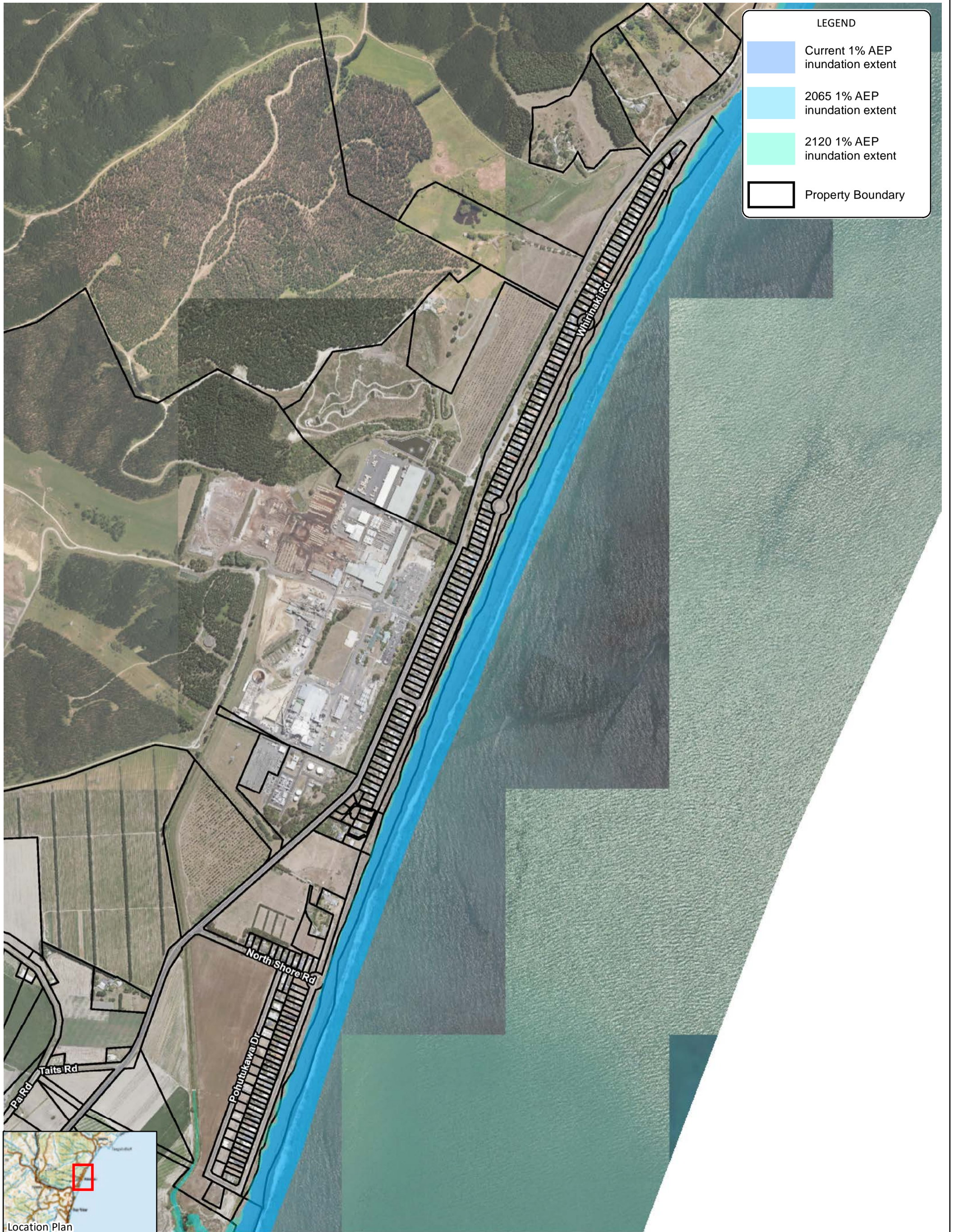
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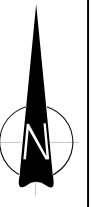
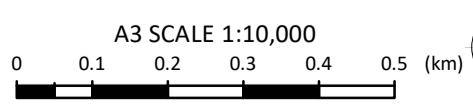
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Appendix B: Coastal inundation hazard extents and
assets potentially affected



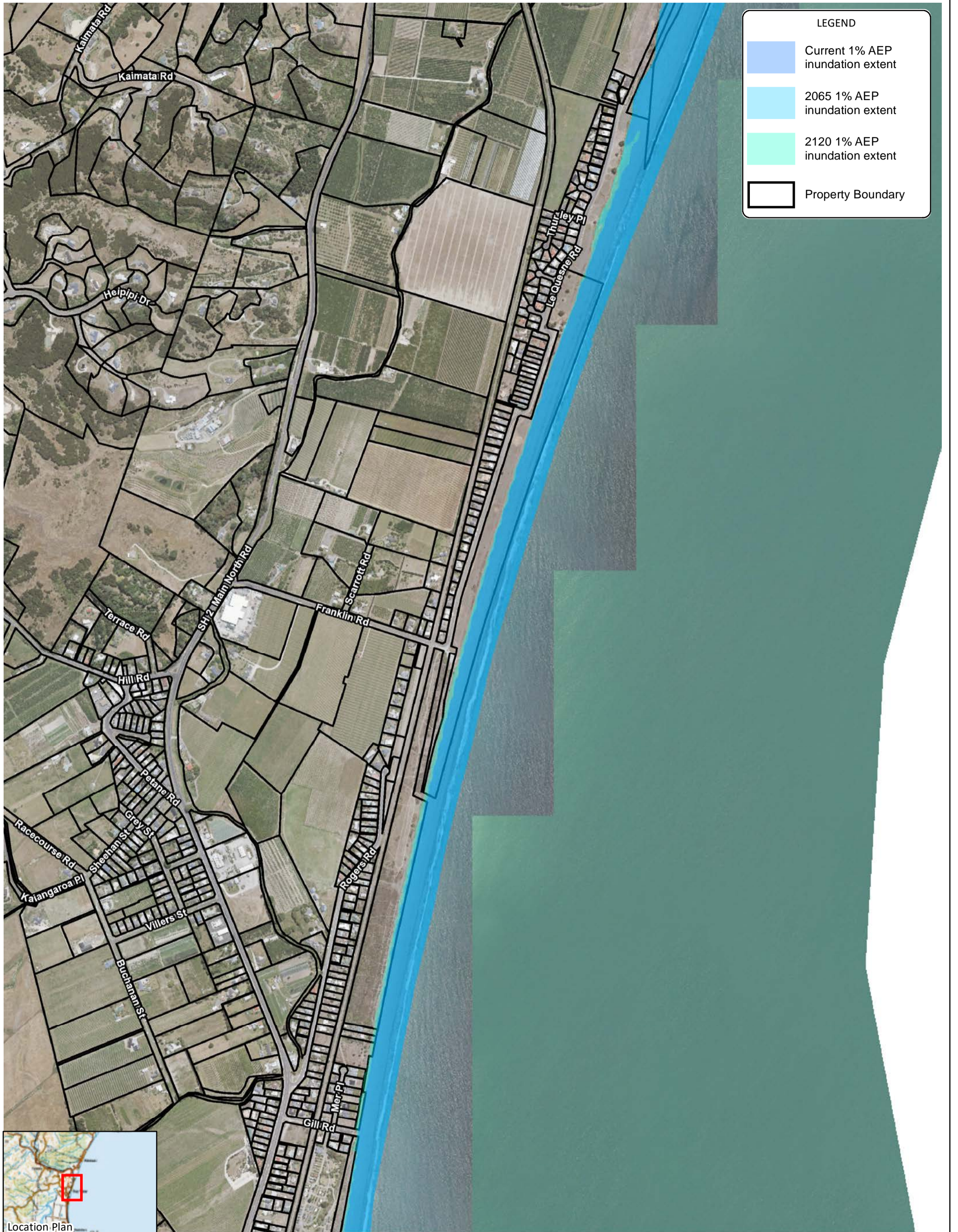
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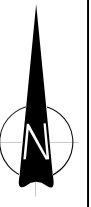
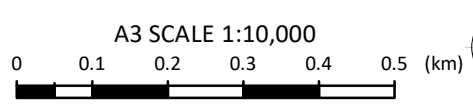
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Timing of Retreat
Whirinaki



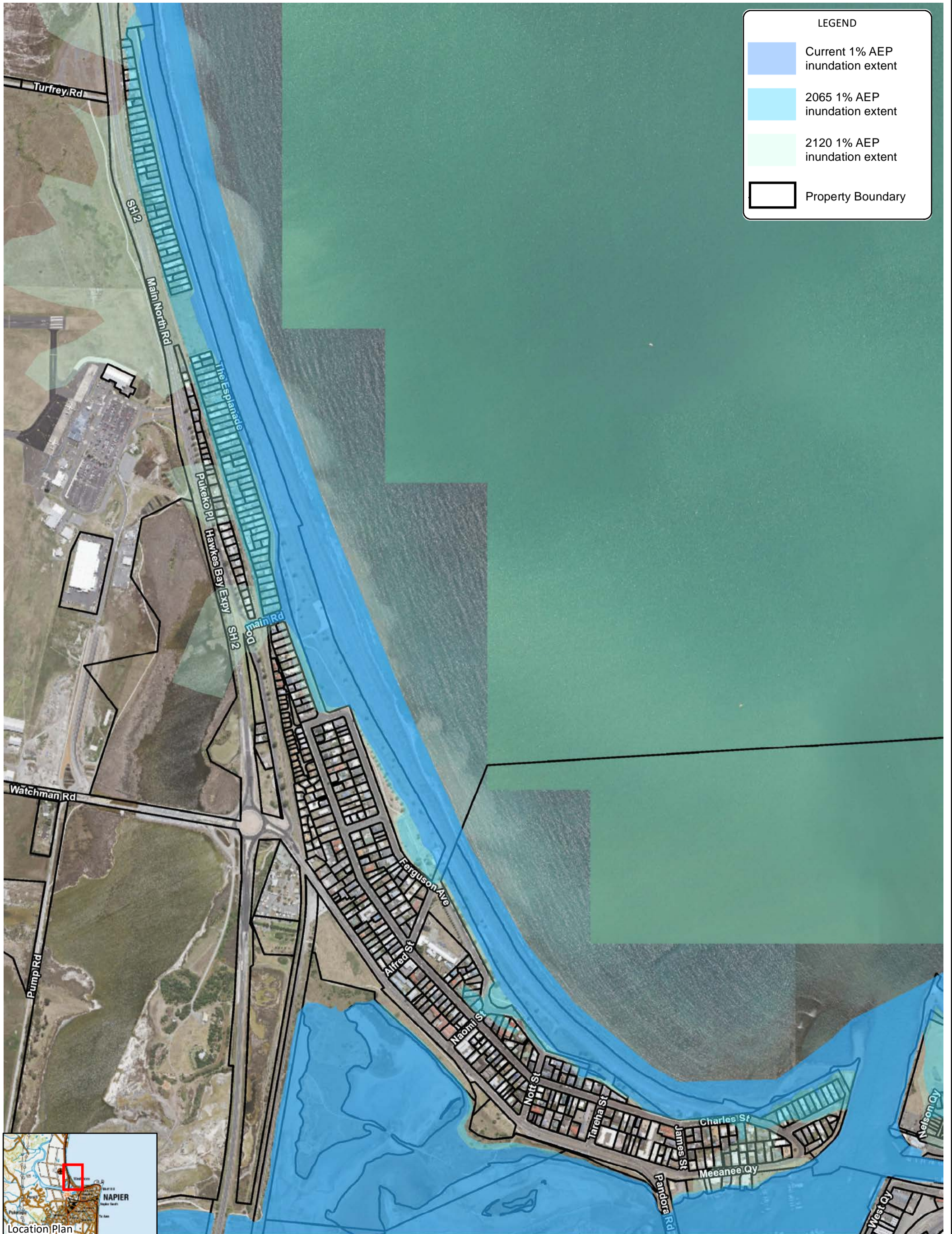
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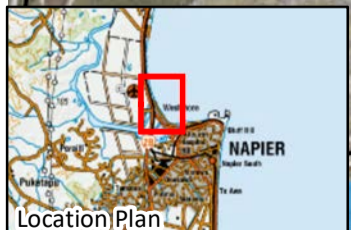
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Timing of Retreat
Bayview

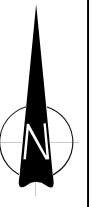
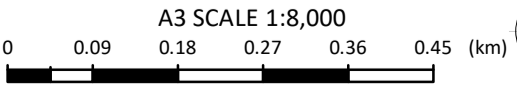


LEGEND

- Current 1% AEP inundation extent
- 2065 1% AEP inundation extent
- 2120 1% AEP inundation extent
- Property Boundary



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Timing of Retreat
Westshore

LEGEND

- Current 1% AEP
- 2065 1% AEP
- 2120 1% AEP
- Property Boundary



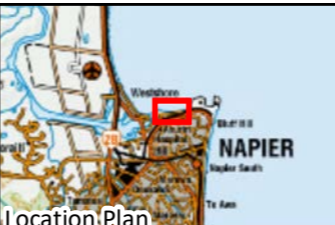
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Location Plan



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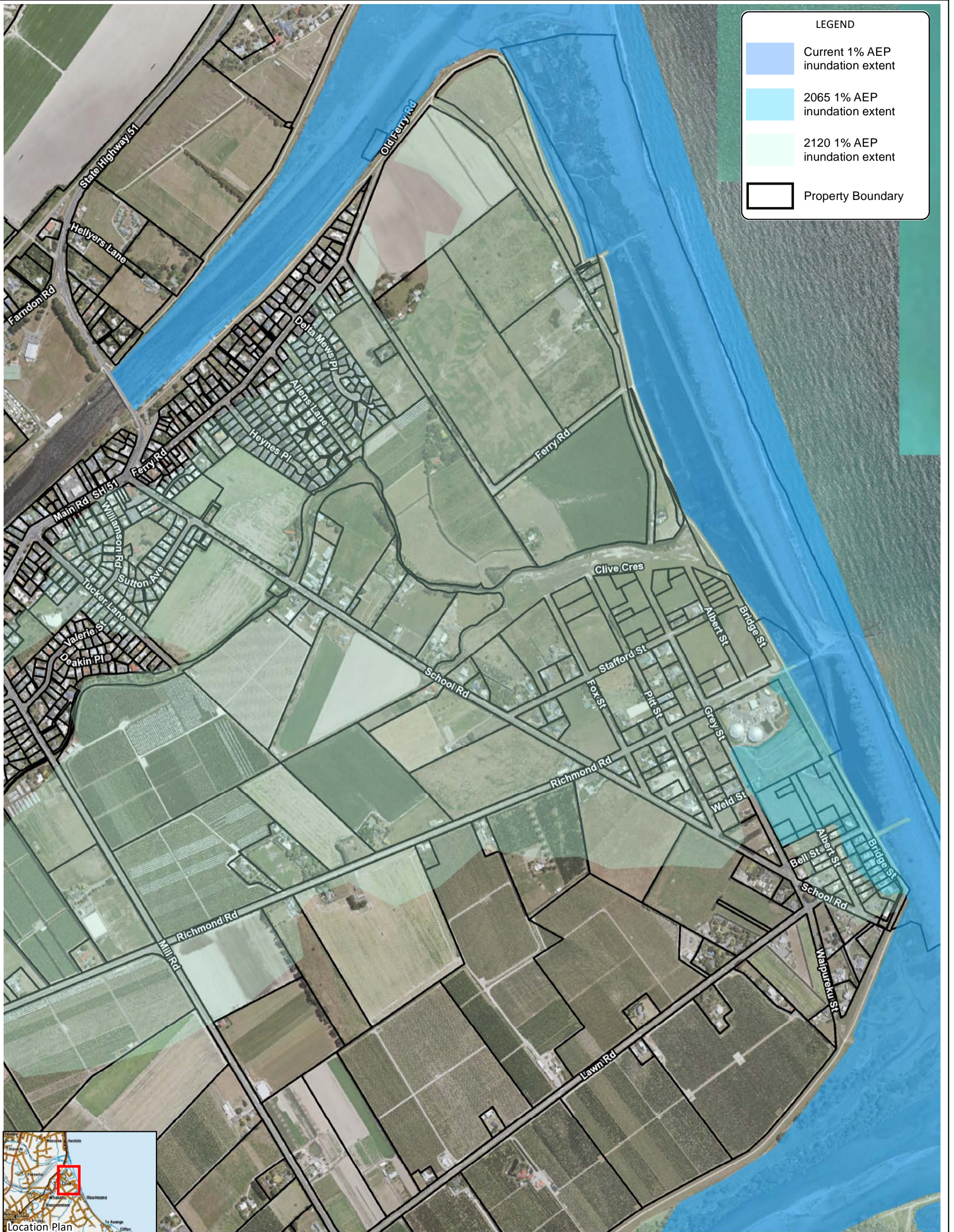
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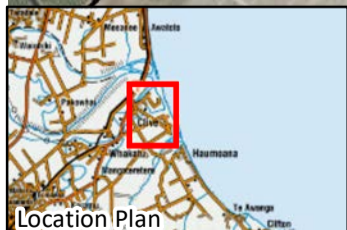
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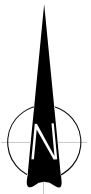
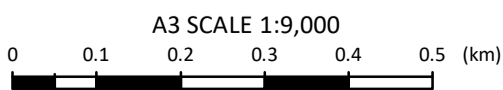


LEGEND

- Current 1% AEP inundation extent
- 2065 1% AEP inundation extent
- 2120 1% AEP inundation extent
- Property Boundary



Notes:

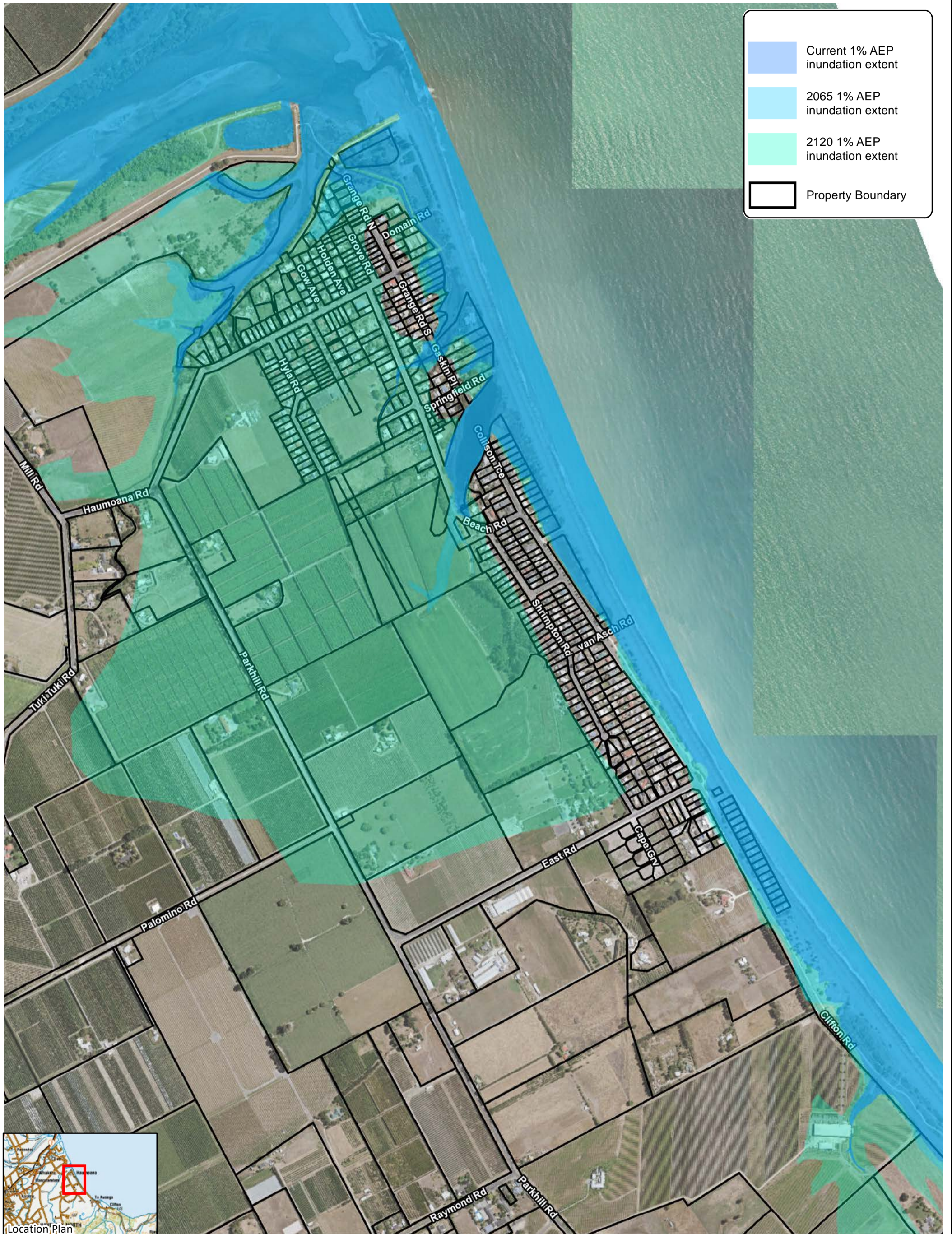


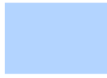
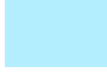
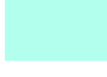

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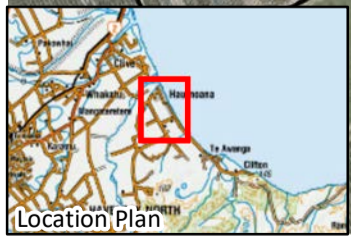
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Timing of Retreat
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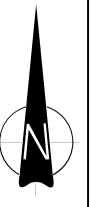
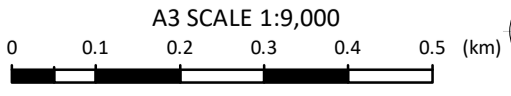
FIGURE No. **Figure 5**



	Current 1% AEP inundation extent
	2065 1% AEP inundation extent
	2120 1% AEP inundation extent
	Property Boundary



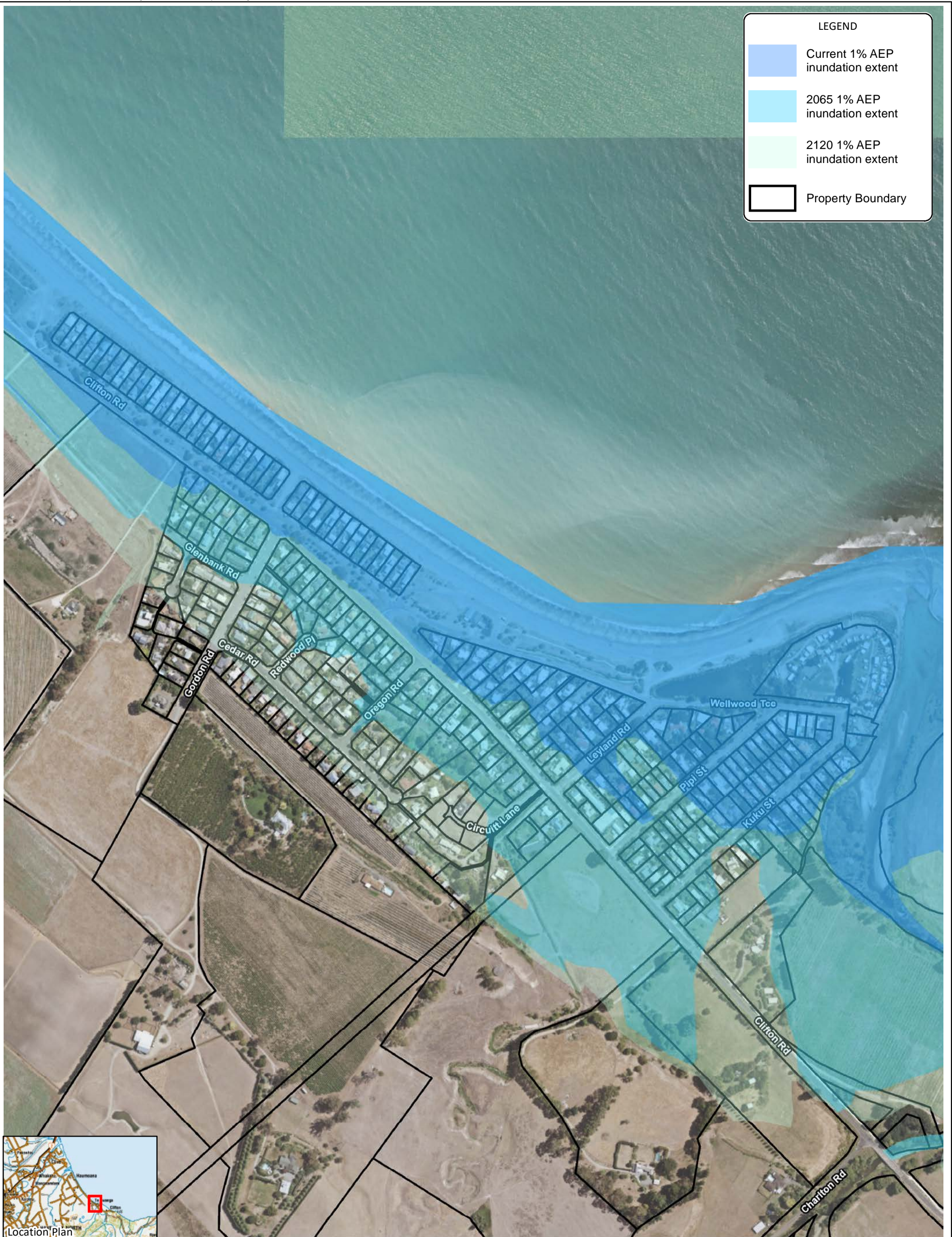
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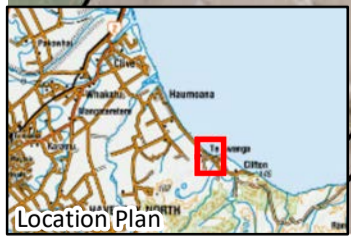
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Timing of Retreat
Haumoana

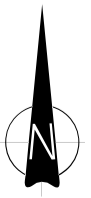
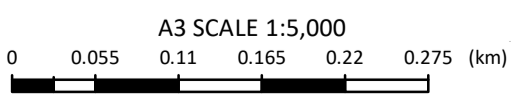


LEGEND

- Current 1% AEP inundation extent
- 2065 1% AEP inundation extent
- 2120 1% AEP inundation extent
- Property Boundary



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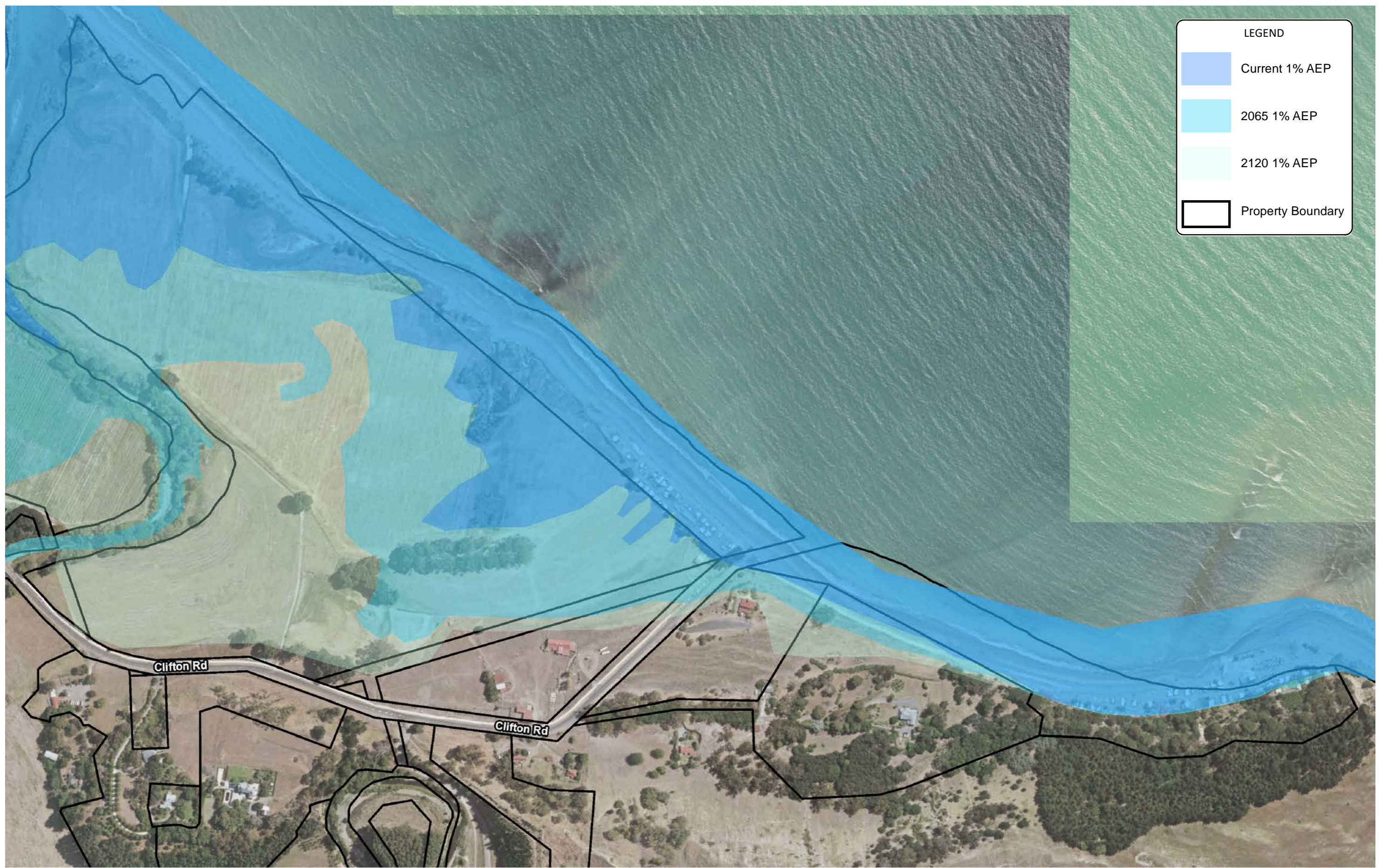
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Timing of Retreat
Haumoana

FIGURE No. **Figure 7**

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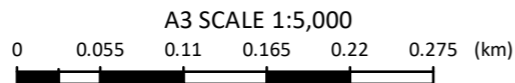


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- Current 1% AEP
- 2065 1% AEP
- 2120 1% AEP
- Property Boundary

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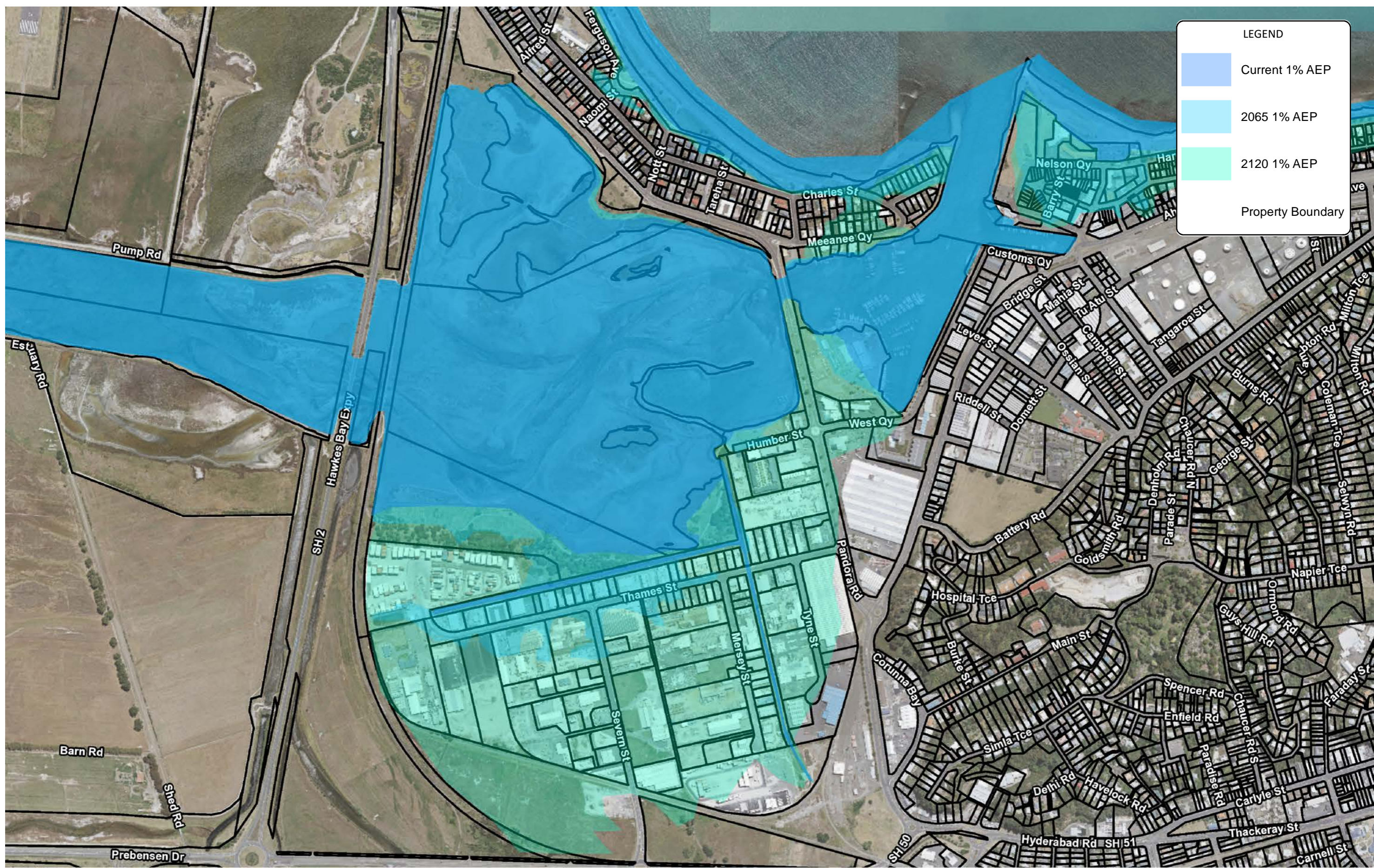
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Hawkes Bay Regional Council
 Hawke's Bay Coastal Strategy - Managed Retreat
 Timing of Retreat
 Clifton

FIGURE No. **Figure 8**

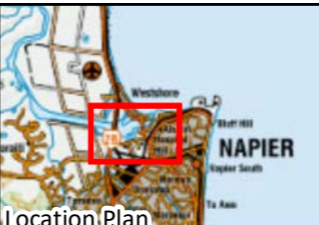
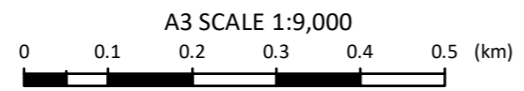
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LEGEND

- Current 1% AEP
- 2065 1% AEP
- 2120 1% AEP
- Property Boundary

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 Timing of Retreat
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FIGURE No. **Figure 9**

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