DEBRIS FLOW RISK: A way forward for the Awatarariki Fanhead

INDICATIVE BUSINESS CASE

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Better Business Cases
Indicative Business Case Template

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1.1	16 August 2017	Update RPS references and financial modelling.

1.1.4 Document Review

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1.1.5 Document Sign-off

Role	Name	Sign-off Date
Project Manager	Jeff Farrell	21 August 2017
Senior Responsible Owner/ Project Executive	Marty Grenfell	

Contents

Definitions

Compulsory retreat means there is no choice for property owners to relocate away from the 'high risk zone' within a stated timeframe. In the context of this IBC, this would be accomplished by the extinguishing of existing use rights by the BOPRC through a regional plan or legislative change by Central Government.

Consensus Development Group (CDG) refers to the group of six landowners, a Whakatāne District Council (WDC) councillor, WDC officers, a BOPRC officer, a Boffa Miskell planner, a geotechnical expert from Canterbury University, and a strategic government communications advisor. This group worked together over a series of full day workshops to examine a wide range of options (engineering and planning) to address the debris flow risk at the Awatarariki Stream fanhead.

Debris, in the context of debris flows, is loose, unconsolidated material of low plasticity. In texture, debris is a mix of silt, sand, gravel, cobbles, and boulders, often with a trace of clay, but not necessarily so. Debris may also contain a significant proportion of organic material including logs, stumps, and organic mulch (Hungr in GNS, 2005).

Debris avalanche is a very rapid (5-20 m/s, 15-60 km/hr) shallow flow of partially or fully water-saturated debris on a steep slope, without confinement in an established channel (Hungr in GNS, 2005).

Debris flood is a very rapid (up to 5 m/s) surging flow of water, heavily charged with debris, in a steep channel (Hungr in GNS, 2005).

Debris flow is a very rapid to extremely rapid (5-10 m/s, 15-30 km/hr) flow of water-saturated, non-plastic (granular) debris in a steep channel. Speeds faster than a fit human can run are common (Hungr in GNS, 2005).

Debris Detention Structure (DDS) refers to a previously proposed flexible barrier net debris flow mitigation structure suspended across the Awatarariki Stream designed to protect the community from destructive debris flows.

High risk zone is the geographical area of land where the level of risk has been assessed as unacceptable.

Loss-of-life risk relates to the frequency at which an individual may be expected to sustain a given level of harm from the occurrence of a specified hazard. It is usually reported as an annual probability for the "person most at risk" e.g. the person most at risk has a 1 in 10,000 chance (10^{-4}) per annum of being killed by the hazard.

Managed retreat refers to an incentivised approach to relocate people away from the high natural hazard risk through the use of a property acquisition process. This process will be complemented by proposed changes to the Operative Whakatāne District Plan and the Regional Land and Water Plan that give effect to the RPS and recognise the high debris flow risk to Awatarariki fanhead properties in formal planning instruments.

Property loss risk is usually reported either as a relative proportion of damage to the structure (damage ratio e.g. 60%), or as a dollar value.

Societal risk expresses the relationship between the frequency of an event and the number of people suffering from a specific level of harm in a given population. It is usually reported as a set of related probabilities e.g. the annual probability that the hazard will result in 1 or more fatalities in 100 years is expressed as 1×10^{-2}, 1 in 1000 years is 1×10^{-3}, 1 in 10,000 as 1×10^{-4} etc.

1.0 Executive Summary

This Indicative Business Case (IBC) outlines options for investing in a managed intervention to prevent a predictable disaster.

The people that live and/or own property in the 'high risk' area on the Awatarariki Stream fanhead in Matatā are at the centre of this IBC. Protecting life safety is the primary focus. Enabling property owners and the wider community to recover from the 2005 debris flow event is also a significant factor.

A highly destructive debris flow event at the Awatarariki Stream fanhead in Matatā is inevitable in the future. The people living in 16 homes in the debris flow fanhead area at the mouth of the Awatarariki Stream are exposed to an intolerable loss-of-life risk from future debris flows. The owners of a further 18 vacant sections are not permitted to develop their properties and have little prospect of being able to sell them. This IBC outlines options for a way forward for property owners which would allow them to relocate from the high hazard zone, and thereby mitigate the risk to life from future debris flow events.

The purpose of this IBC is to secure agreement, in principle, from partner organisations to invest in a way forward for the property owners of the Awatarariki Stream fanhead.

The IBC follows the Better Business Case methodology and is organised around the five case model to demonstrate that the investment:

- is supported by a compelling case for change – the 'strategic case'
- optimises value for money – the 'economic case'
- is commercially viable – the 'commercial case'
- is financially affordable – the 'financial case'
- is achievable – the 'management case'.

This IBC is based on the numerous research programmes and investigations that have been carried out following the 2005 debris flow event at Matatā.

1.2 Strategic Case

To understand the current situation, it is important to consider the events that occurred on 18 May 2005.

1.2.1 Debris flow event of 2005

A band of intense rain fell over the catchments behind the coastal settlement of Matatā triggering landslides and debris avalanches into the headwaters of a number of streams. The landslides and debris avalanches liquefied as they dropped to the bottoms of the numerous valleys reaching them as a dense fluid. Multiple tributaries fed into the main channel of each catchment resulting in several large debris flows.

Debris flows consist of a mass of fluid with the consistency of wet concrete. In the 2005 event at Matatā, debris flows from multiple catchments were capable of transporting rocks up to seven metres diameter at a velocity of 15-30 kilometres per hour, within the confines of the catchments,

before depositing an estimated 700,000+ cubic metres of rock, wooden debris, silt and slurry on to the various fanheads and into Te Awa o Te Atua (Matatā lagoon)[1].

The 2005 debris flows, with their associated flooding, cut major transport links, destroyed 27 homes and caused $20 million in damage in the Matatā area (Figure 1). Some of the people who experienced the event remain severely traumatised nearly 12 years later. It was extremely lucky that no one died in this event, as risk assessment modelling for an event of the same size and scale has indicated a likelihood of five fatalities.

Figure 1: Photo showing the extent of damage following debris flows May 2005

Following the 2005 event, debris flow mitigation protection measures for all affected catchments but the Awatarariki Stream catchment have been completed. For the Awatarariki Stream catchment, a number of potential engineering solutions were explored with the community and with debris flow experts. Options to protect the community residing on the Awatarariki Stream fanhead have included both engineering and planning solutions. It is difficult to engineer mitigation measures for debris flow events and, in 2012, the Council's engineering consultants advised that there was no viable engineering option to protect the Awatarariki Stream fanhead properties.

From late December 2012, the Council has focused on developing a planning solution.

A summary of the key decisions the Council has made in relation to this issue is attached as a separate document.

1.2.2 The people

The community is highly-frustrated with the lack of progress made over the 12-year timeframe and there is strong community support for a decision that will provide certainty for property owners.

Long term uncertainty has taken its toll on this small community. Fatigued, frustrated and apprehensive, the community remains in a difficult position. Many continue to reside in houses that represent their life savings, unable to sell and move on. Others have moved off the fanhead,

[1] The volume of debris deposited on the Awatarariki Stream fanhead in 2005 has been estimated at 300,000m^3 (Tonkin and Taylor, 2009).

unwilling to return to homes. A few residents have died during the 12-year period leaving the burden of managing the ongoing uncertainty to family members.

Following the 2005 event, the Council prohibited people from returning to their homes based on expert engineering advice on the potential risk of a further debris flow. In 2006, the Council applied for a determination from the Department of Building and Housing (DBH) under the Building Act 2004. The DBH determination (2006/119) over-ruled the Council decision and allowed people to return to their homes. Consequently, some property owners rebuilt homes on the fanhead. Rebuilding occurred within a small window of time when there was an intention to build a Debris Detention Structure (DDS) to mitigate the hazard. Engineering and cultural issues resulted in the DDS never being realised which meant that residents continue to remain exposed to property damage and loss-of-life risks associated with future debris flows.

1.2.3 High loss-of-life risk zone

Experts are in strong agreement that the Awatarariki Stream fanhead is a 'high loss-of-life risk zone' for future debris flows. Investigations into this event identified that historical destructive debris flow events, some potentially much larger, had occurred in the Awatarariki catchment at approximately 50-150 year intervals. The annualised loss-of-life risk identified through modelling, and validated by independent peer review, is significant, ranging from 10^{-2} to 10^{-4} for anyone residing in the high-risk zone on the stream fanhead. This means that for someone residing within the high risk zone, the risk ranges from a 1 in 100 to 1 in 10,000 chance per annum of being killed by the hazard.

The high risk area on the fanhead comprises 45 properties where the risk is assessed as 'intolerable' by international standards[2][3] or 'high' in terms of the Bay of Plenty Regional Council's RPS. This geographical area consists of 16 homes, 18 privately owned sections and 11 properties in public ownership. The experts have recommended that retreat is the only reliable option for addressing the loss-of-life risk in the high risk hazard zone. The Consensus Development Group (a group of six community members owning property in the *debris flow fanhead area*, regional and district council and planning and geotechnical experts) also agreed that managed voluntary retreat was the most feasible solution.

As a consequence of identifying the level of risk, the Whakatāne District Council (WDC) has declined to grant the issue of building consents for new dwellings within the high debris flow risk area. The appropriateness of that position has been endorsed by a Building Act determination issued by the Ministry of Business Innovation and Employment (MBIE) under the Building Act 2004. The inability of property owners to construct new dwellings, or undertake alterations that will increase the level of risk, will be a key driver of a proposal to undertake a change to the natural hazard provisions of the Whakatāne District Plan. The District Plan change objective is to rezone the high debris flow risk area from 'Residential' to a zone that better recognises the natural hazard risk, such as a natural hazard zone or coastal reserve zone.

1.2.4 A new direction: strengthening natural hazard risk management measures

International, national, regional and local natural hazard management policies are clearly focusing on strengthening natural hazard risk management measures. The new Bay of Plenty Regional Policy Statement (RPS) natural hazard provisions reflect the RMA responsibilities on regional councils to manage natural hazards within their jurisdiction. WDC and Bay of Plenty Regional Council (BOPRC) are both required to initiate actions to give effect to the RPS. This includes changing the risk classification from "high" to "medium" or "low" through a detailed prescribed methodology. WDC

[2] This risk assessment has been peer reviewed by two debris flow experts of international standing.

[3] This level of risk was also considered intolerable for "red zoned" properties in Christchurch that were subject to a high boulder roll hazard following the Canterbury earthquakes.

has limited control over existing residential uses which are protected by existing use rights under the Resource Management Act. In contrast, BOPRC has the legislative ability to extinguish existing use rights in a hazardous area through a regional plan rule. Giving effect to the RPS, i.e. reduce existing high risk on the fanhead, will require a Regional Plan Change.

Fair implementation of new RPS provisions to Awatarariki Stream fanhead properties should incorporate measures which will allow the community to recover from the 2005 debris flow event and foster community resilience for the future.

1.2.5 A compelling case for change

The Strategic Case clearly illustrates that there are compelling reasons for change and a need for investment to allow owners of properties within the high debris flow risk area on the Awatarariki Stream fanhead to retreat from the intolerable loss-of-life risk from future debris flow events. There is also a secondary need to provide certainty to Awatarariki Stream fanhead property owners about the future use of their properties and the future of the community.

The investment objectives for the proposal are:

- Protect the life safety of the residents at the Awatarariki Stream fanhead.
- Create a state of certainty as the basis for Matatā town and its community to recover from the 2005 event and to support future community resilience.

Table 1 illustrates the benefits to be delivered and key performance indicators (KPI's) for this proposal.

Table 1: Benefits to be delivered and associated key performance indicators

Benefits to be delivered	Key Performance Indicators (KPIs)
Protect the life safety of the residents at the Awatarariki Stream fanhead.	KPI1: Residual risk is assessed as an annualised loss-of-life risk of less than 10^{-5}. KPI2: The number of people residing on the Awatarariki Stream fanhead exposed to a high loss-of-life risk from future debris flows is minimised. KPI3: The level of risk is reduced from "high" to at least "medium" to meet statutory obligations under the RPS.
People provided with certainty to enable recovery from the 2005 event, through a fair and equitable process, to support future community resilience.	KPI4: Proportion of property owners that take-up the retreat offer and voluntarily relocate from the high risk zone. KPI5: Number of dwellings in Matatā township. KPI6: An increase in the level of 'liveability' in the wider Matatā township.

1.3 Economic Case

The economic case identifies and assesses options to address this natural hazard issue and to determine potential value for money. It does this through assessing options alongside investment objectives and critical success factors in order to identify a preferred way forward.

1.3.1 Shortlisting options

Options were identified and assessed by both the Consensus Development Group and the Project Team, including the option of status quo/doing nothing. On the basis of the initial assessment of the long-list options (by dimension), the following short-listed options were selected for further economic analysis. All options represent different levels of retreat and include 'managed retreat' and 'compulsory retreat'. Managed retreat refers to the property owner having to relocate away from the high risk zone within a stated timeframe through an incentivised funding package, complemented by proposed changes to the Operative Whakatāne District Plan and the Regional Land and Water Plan that give effect to the RPS and recognise the high debris flow risk to Awatarariki fanhead properties in formal planning instruments. The compulsory retreat option means forced retreat with potentially no funding incentive, as there is no legal requirement for BOPRC or Government to provide assistance in this way.

Shortlisted options are:

- **Option 0: Status quo** – to be used as baseline comparator.

- **Option 1 (do minimum): Managed retreat of existing dwellings in high risk zone (300,000m^3 event), short timeframe (2020), and Plan Changes**
  Managed retreat for existing dwellings only (16 homes), based on magnitude event of 300,000m^3, delivered by WDC by 2020 and funded by central and local government through a retreat package.

  A magnitude 300,000m^3 event has been chosen as this best represents a similar event to the 2005 debris flows (Tonkin & Taylor, 2015). Planning for anything less than this event is unacceptable as a high risk to life safety would remain. The risk to life safety of a repeat debris flow of this magnitude has been modelled as affecting an area containing 16 homes. Larger event sizes are considered in Options 3 and 4.

- **Option 2 (intermediate): Managed retreat of all properties in high risk zone (300,000m^3 event), short timeframe (2020), and Plan Changes**
  Managed retreat for all properties (16 homes and 18 vacant sections), based on a magnitude event of 300,000m^3, delivered by WDC by 2020 and funded by central and local government with a retreat package.

  The scale of event planned for is the same as Option 1. Option 2, however, also includes the 18 vacant privately owned sections as well as the 16 homes.

- **Option 3 (less ambitious): Managed retreat of all properties in high risk zone (450,000m^3 event), long timeframe (2036), and Plan Changes**
  Managed retreat for all properties (18 homes and 18 vacant sections), based on magnitude event of 450,000m^3, delivered by WDC by 2036 and funded by central and local government through a retreat package.

  A magnitude 450,000m^3 event was also modelled by Tonkin and Taylor (2015) as a possibility and has been chosen to represent planning for a larger event compared with the 2005 debris flows. The risk to life safety of a repeat debris flow of this magnitude has been

modelled as affecting an area containing 18 homes (2 additional properties to Options 1 and 2) and 18 privately owned sections.

- **Option 4 (ambitious): Compulsory retreat of all properties in high risk zone (450,000m^3 event), short timeframe (2020)**
  Compulsory retreat for all properties (18 homes and 18 vacant sections), based on a magnitude event of 450,000m^3, delivered by BOPRC or central government by 2020, and funded by homeowners and/or BOPRC and/or central government.

1.3.2 Costs, benefits and risks

All four options were explored in further detail to define costs, benefits and risks. Indicative project capital costs ranged from $3.0 million (option 0: Do nothing) to $15.3 million (Option 4: Compulsory retreat).

Cost benefit analysis (CBA) and Multi-Criteria Analysis (MCA) were used to compare the short-listed options. In the CBA, overall actual costs and benefits are comparable (options 1, 2 and 4 have either higher or similar benefits to costs). Benefits include the avoided costs of a repeat event, including the avoided cost of multiple fatalities for people remaining on the Awatarariki Stream fanhead. Not unusually, when applying nett present value (NPV) analysis to natural hazard projects, the NPV analysis resulted in significant negative values ranging from (-$4.8 million (Option 0) to -$14.0 million (Option 4). Reasons for such negative NPV's can be attributed to the significant upfront project costs coupled with discounted benefits (avoided costs) spread evenly over the 30-year timeframe.

Loss-of-life, wellbeing, stress, and providing certainty for residents are difficult factors to monetise, and therefore recognise, in CBA. Such factors are therefore considered as part of the MCA. The MCA short-listed options deliver different levels of benefits. Overall, managed retreat solutions (options 2 and 3) are assessed more favourably for benefits, as these options generally provide property owners with a choice, reduce stress levels, and are more likely to be achievable to implement.

Risk analysis has shown that the likelihood and impact of risks manifesting is similar for all four options. Option 4 (compulsory retreat) ranked most favourably, followed by the managed retreat options 2 and 3. A stakeholder risk analysis was also undertaken for the status quo option. This identified that there was a compelling case for the Government, BOPRC, and the Council, to support the managed retreat option as a collaborative preferred solution.

Project costs across the options range from $3.0 million (Option 0) for the cost of 'doing nothing' (this includes costs of a legal challenge and the creation of an escape route) to $15.3 million for compulsory retreat (majority of costs fall on private individuals through the loss of homes and land or to BOPRC/central government if a funding package is offered to property owners). The preferred option of managed retreat (Option 2) is costed at between $12.2 to $14.2 million, primarily for property acquisition of 75% to 100% of properties with dwellings, and 100% of sections, as well as reserve creation costs.

Figure 2 provides a summary of costs, benefits and risks as discussed above. In addition, the first section of the table provides an options assessment for a range of strategic interventions that could respond to the problem for all four options. The percentages within the table indicate the relative importance of each specific intervention. The percentage provided takes into account the balance of two factors. First, the relative importance of the intervention in delivering the KPIs, and second, the likely effort or cost involved. For Option 2 the strategic interventions of building an escape route, monitoring the catchment, and a District Plan change, are all deemed to be of limited effect in delivering the KPIs (5% each). In comparison, property acquisition will be reasonably effective (70%) in achieving the KPIs of protecting life safety and providing certainty for property owners but will also

be reasonably costly. A Regional Plan change and extinguishing existing use rights will be important in delivering the KPIs if property acquisition is of limited success. This reflects that it is, however, unlikely that a 100% voluntary take-up by property owners is achievable and that reality may be a hybrid or two staged approach between Options 2 and 4.

1.3.3 Preferred way forward –managed retreat

The preferred way forward is a managed retreat of 34 privately-owned properties on the Awatarariki Stream fanhead that have a high loss-of-life risk exposure to future debris flows (refer to hashed line on Figure 3). This option is represented by Option 2 in the short listed options – the 'intermediate' option. A managed retreat means that although residents are encouraged to voluntarily vacate their land and homes, the residents need to be made aware of the proposed Plan Change processes that may result in forced retreat with potentially no financial recognition for the loss of their homes.

Of the 34 privately-owned properties within the area proposed for managed retreat, 16 are residential homes and 18 are vacant sites. An additional 11 publicly owned vacant sites (owned by WDC, the Crown and KiwiRail) are also included within this area but are outside the scope of this IBC, primarily because the sites are in public ownership and the activity status of the land is not proposed to change.

The preferred approach provides a fair and equitable way forward for a community that has been living with uncertainty for the last 12 years. Although not legally required, the Council considers there is a moral obligation for public agencies to invest in retreat from high risk natural hazard situations that satisfy certain risk criteria. Successful retreat requires incentivised acquisition of identified at-risk property via an appropriate and transparent procedure that involves property owners. In the case of the Awatarariki debris flow risk, indicative retreat offers have been discussed with all affected property owners and are based on 2016 market values (without taking the 2005 debris flow event in to account). A significant majority are interested in seeing the property acquisition offer delivered.

If the majority of property owners decide to accept the retreat offer, an investment of approximately $12.2 million to $14.2 million[4] (capital project costs, excluding existing spend to date) in the 2017-2019 financial years would be required to acquire the 34 private properties on the fanhead. The preferred way forward is heavily dependent on external funding.

[4] The range indicates 75% to 100% take-up by affected property owners.

Figure 2: MCA analysis summarises the costs, benefits and risks.

Debris Flow Risk
A way forward for Matatā: Awatarariki Fanhead

Investor: <first name surname>
Facilitator: <first name surname>
Initial Workshop: <dd/mm/yyyy>
Version No.: 0.1
Last Modified by: Sarah Stewart 23/03/2017

	Strategic options				
	Option 0	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Strategic Interventions	Status Quo	Voluntary retreat existing dwellings only by 2020 (300,000m3 event)	Voluntary retreat all properties by 2020 (300,000m3 event)	Voluntary retreat all properties by 2036 (450,000m3 event)	Compulsory retreat by 2020 (450,000m3)
Build escape route	**5%**	**5%**	**5%**	**5%**	**5%**
Monitoring of catchment	**5%**	**5%**	**5%**	**5%**	**5%**
Property acquisition offer to property owners	**0%**	**40%**	**70%**	**50%**	**0%**
District Plan change - 'residential' to 'reserve'	**0%**	**5%**	**5%**	**5%**	**5%**
Regional Plan change & extinguish existing use rights	**0%**	**15%**	**15%**	**15%**	**60%**
Total	**10%**	**70%**	**100%**	**80%**	**75%**

NOTES

1 The range of strategic interventions that could respond to the identified problem and deliver the KPIs for the expected benefits are listed in the left-hand column.
2 Against the listed strategic interventions a spread of strategic options are structured to provide genuine alternative strategic responses to the problem.
3 Strategic options should be titled to reflect the underlying strategy.
4 The shaded boxes indicate which interventions are used in each option and the percentage (%) indicates the relative importance of each specific intervention within the option.
5 This is a balance of two factors: the importance of the intervention in delivering the KPIs and the likely effort/cost involved.

			Strategic options				
			Option 0	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Benefits			Status Quo	Voluntary retreat existing dwellings only by 2020 (300,000m3 event)	Voluntary retreat all properties by 2020 (300,000m3 event)	Voluntary retreat all properties by 2036 (450,000m3 event)	Compulsory retreat by 2020 (450,000m3)
Percentage of full benefit to be delivered			**0%**	**65%**	**83%**	**77%**	**76%**
Benefit 1	Protect life safety of the residents of the Awatarariki Stream fanhead.	70%	0	3.75	3.75	3.75	5
Benefit 2	People provided with certainty to enable recovery from the 2005 event through a fair and equitable process	30%	0	2	5	4	1
Cost							
Investment cost (range represents 75% to 100% take-			$3.0 mil - $n mil	$6.8 mil - $8.8 mil	$12.2 mil - $14.2 mil	$13.3 mil - $15.5 mil	$15.3 mil
Operational costs per annum (loss of rates &			nil	$38K - $51 K	$58K - $76K	$64K - $83K	$83K
Repeat event costs (range represents 75% to 100%			$32.5 mil	$0.6 mil - $8.0 mil	$0.7 mil - $8.1 mil	$2.4 mil - $7.9 mil	$0.5 mil
Avoided costs (benefits- range represents 75% to			nil	$20.8 mil - $29.6 mil	$26.9 mil - $34.3 mil	$14.9 mil - $22.0 mil	$23.6 mil
Time							
Year retreat complete			ongoing	2020	2020	2036	2020
Qualitative assessment							
Loss-of-life			0	3.75	3.75	3.75	5
Optimal land use			1.25	2.5	3.75	3.75	5
Stress levels			2.5	2.5	3.75	3.75	0
Preparation for future changes			2.5	2.5	2.5	2.5	0
Keeping community together			5	5	5	5	0
Providing certainty for residents/investors			0	5	5	5	5
Achievable in practice			2.5	2.5	3.75	3.75	1.25
Overall rank			5	4	1/2	1/2	3
NPV							
Net Present Value 30 years			-$4.8 mil	-$6.0 mil to -$7.0 mil	-$11.4 mil to -$12.7 mil	-$10.4 mil to -$11.7 mil	-$14.0 mill
Risks of not achieving benefits (likelihood / consequence - H/M/L)							
High costs of investigative work & additional funding not secured			L	H	H	H	L
Repeat debris flow event results in loss-of -life before			H	M	M	M	L
Awatarariki property owners do not support option			H	M	M	M	M
Iwi oppose approach			M	L	L	L	L
MBIE determination appealed and reversed			L	L	L	L	L
BOPRC do not support option (RPS alignment)			H	L	L	L	M
Pressure from non-Matatā ratepayers to not proceed			L	L	L	L	L
Reputational risk to agencies			H	M	L	L	H
Ranking							
1-3					**1**	**2**	**3**

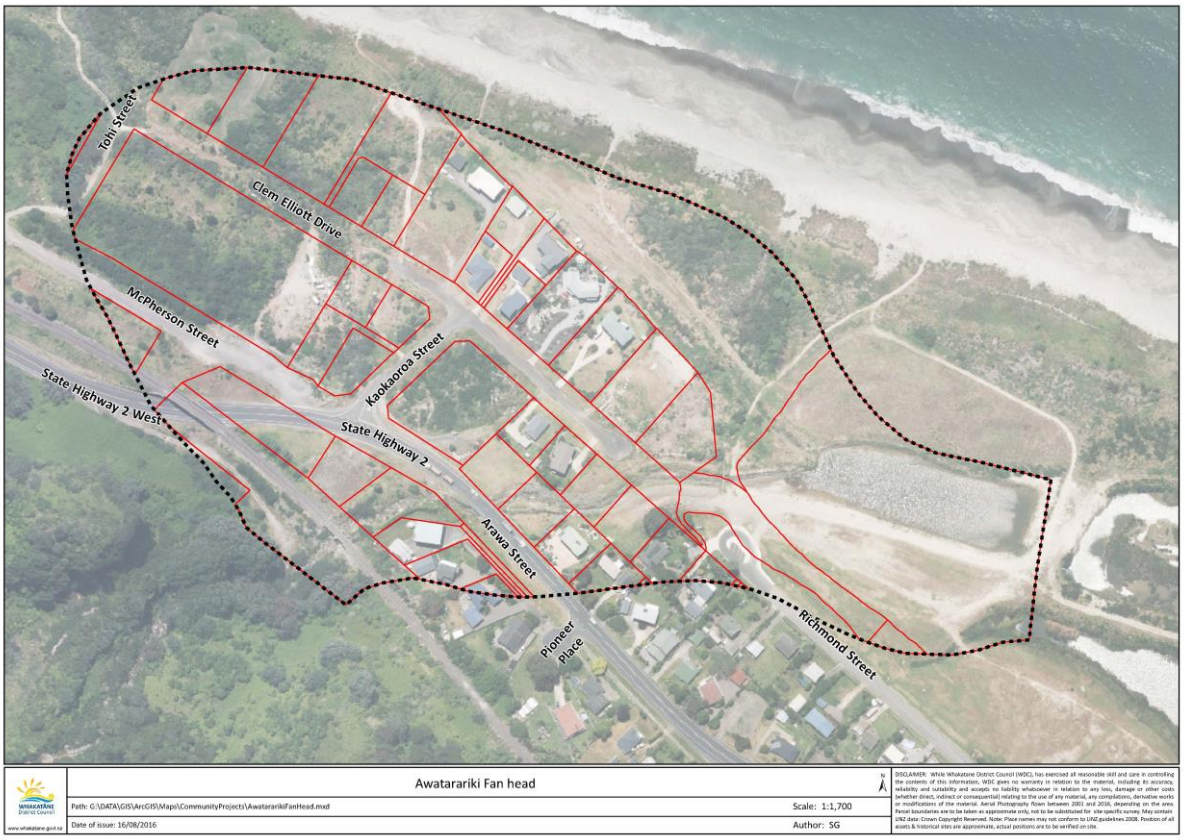
Overall Assessment:

Option 0 represents the option of 'doing nothing' and is the mostly risky option. This option is the baseline comparator and therefore is not included in the assessment summary:
Option 2 delivers the highest proportion of benefits.
Option 1 is the least costly option to deliver (investment cost), followed by option2.
Option 2 has the highest avoided costs (benefits) in the case of a repeat 2005 event.
Options 2 and 3 are the highest ranking options (1= highest) for qualitative assessment.
All options have negaive NPVs with Option 1 representing the option with the best NPV, folowed by option 3, then option 2.
Options 2, 3 and 4 have similar low risk rankings with the highest risk identified for these three options being the inability to secure additional funding.

Recommendation:

Option 2 is the preferred way forward.

Figure 3: Properties affected within the high debris flow zone



1.3.4 The preferred way forward and consistency with previous decision-making

In terms of consistency with previous decision-making, examples of Government intervention to reduce natural hazard risk to communities through relocation include: two landslide events at Little Waihī village at the southern end of Lake Taupō in 1846 and 1910; a very high avulsion risk to several properties on the south side of the Waiho River at Franz Joseph in 1993; a high debris flow risk at the Aoraki Mount Cook village in 2004; and the Port Hills red zone in Christchurch, where owners of properties exposed to a very high boulder roll risk were paid to retreat from the hazard (refer Section 3.9).

These four examples all reduced disaster risk by retreat of the high risk areas away from the hazard. In terms of the Awatarariki fanhead situation, there are three points of difference. First, meaningful engagement with the community has occurred with the majority of the affected community supporting the managed retreat proposal developed by the Council. Second, a previous Government accepted that an intolerable level of risk to the Awatarariki fanhead community existed and made a commitment to assist with implementing a solution. Finally, the proposed implementation of the solution is shared between the three levels of government, all of which have various responsibilities to manage natural hazard risk for New Zealand communities.

In situations such as the debris flow risk to the Awatarariki Stream fanhead properties at Matatā, the Awatarariki managed retreat proposal will create a precedent in terms of the collaborative nature of the process and implementation of the solution. This is a positive consequence as previous precedent examples have been Government initiatives largely driven and funded by Government. If the proposed Awatarariki solution is implemented, it reflects delivery of an achievable solution through a community-focused, multi-agency, collaborative, partnership, problem-solving process. This type of process has a lot of advantages over historical arrangements and provides a pathway forward as disaster risk reduction-based natural hazard policy intent starts to be realised in practice.

Not only is the Awatarariki managed retreat proposal a highly workable solution, it is much more preferable than leaving a 12 year problem unaddressed and the residual risk unmanaged.

1.4 Commercial Case

The commercial case outlines the proposed framework in relation to the preferred way forward – managed retreat of privately-owned properties in the high risk zone by 2020 (Option 2).

An acquisition strategy has been developed to encourage residents to relocate away from the high debris flow risk area on the Awatarariki Stream fanhead. Although there is no legal requirement for Council to provide any type of funding package for retreat, the Council wishes to ensure a fair and equitable process is implemented. An incentivised solution is therefore considered fair and necessary for voluntary retreat to be successful.

Initial conversations with all affected property owners have taken place. This included an indicative retreat offer modelled on 2016 market values without taking the 2005 debris flow event into account. Indicative offers were conditional upon Council receiving funding support from central and regional government. It is estimated that a significant majority are interested in seeing the property acquisition offer delivered. Realisation of the managed retreat strategy is not achievable by the WDC alone. Additional funding support from other parties is required complemented by changes to the BOPRC Regional Land and Water Plan

Procurement for the proposed services for the project will align with the Council's Procurement Strategy to ensure the Council obtains the best value for money. For the preferred option it is anticipated that the procurement approach will be a combination of external service providers under contract and in-house expertise.

The required services for the preferred approach that would be subject to procurement are:

- Implementing the acquisition strategy (includes negotiation with property owners, legal processes);
- Developing a Plan Change process to the Whakatāne District Plan to rezone the affected area from residential to reserve;
- Developing a Plan Change Request to the Regional Land and Water Plan to extinguish existing use rights for the 16 occupied homes;

Demolition/ relocation costs of existing residences;

- Section clean-up costs;
- Reserve creation following retreat; and
- Maintaining capacity to absorb future debris flow events on the reserve.

Service risks are planned to be apportioned between the Council and external suppliers as appropriate.

1.5 Financial Case

The estimated capital project cost for the proposed project ranges from $13.5M to $15.5M (including expenditure to date of $1.1M). Majority of costs consist of property acquisition costs and therefore are dependent on the proportion of take-up by property owners of the retreat offer (capital cost figures are based on 75% to 100% take-up by affected property owners).

Affordability to the community is the key determinant of whether or not the managed retreat option will proceed through to implementation. As set out in section 101A of the LGA, the Council has adopted a Financial Strategy as part of the Long Term Plan 2015-25 (LTP). The Financial Strategy

supports the delivery of Council activities and services in a manner which addresses rates affordability and ensures that the Council remains in a long-term stable financial position. The Financial Strategy includes limits set by the Council on rates, rates increases, interest expense and debt. The Strategy is reviewed every three years as part of the LTP process.

The financial impact of the project based on 67% external funding amounts to approximately an additional $21 to $24 per annum at individual ratepayer level (75% and 100% take up) or $13 to $15 (75% and 100% take up) based on 80% external funding. As such, the financial modelling indicates that the forecasted level of internal funding will exceed the upper rating increase and borrowing limits of the LTP 2015-25 Financial Strategy for both the 67% and 80% external funding scenarios. Affordability is reinforced when uncertainties around the final costs of recovery following Cyclones Debbie and Cook, and the contribution required for the Integrated Wastewater Management Project, are also taken into account.

The project team believes there are strong reasons for both central government and the BOPRC to invest in the Matatā community through supporting a collaborative funding response. The commitment to the Sendai Framework[5] and amendments to the RMA signal the Government's intentions to deliver improved natural hazard management in New Zealand through disaster risk reduction. BOPRC plays an important role in risk management of natural hazards in the region. The collaborative approach proposed will achieve the goals of the newly adopted Change 2 (Natural Hazards) to the RPS by reducing the risk to life safety on the Awatarariki Stream fanhead from 'High" to "Low".

The Council intends to work with funding partners to finalise the business case and the funding model.

1.6 Management Case

The management case addresses the achievability of the proposal and planning arrangements required to ensure successful delivery and to manage project risks.

A managed retreat (Option 2) will be operated as a project and managed in line with the Council's Project Management processes. The project will involve four stages:

1. Project initiation (of which this IBC is part)
2. Project planning
3. Project execution
4. Project completion and evaluation.

The Project Sponsor, Project Director and Project Manager will oversee the project in accordance with standard Council methodology.

1.7 Concluding Comments

Residents of the Awatarariki Stream fanhead have been living in a state of uncertainty following a significant debris flow event in 2005. Some of the people who experienced the event remain severely traumatised nearly 12 years later. In essence, this is a community that has been unable to recover. Implementation of the managed retreat option provides an opportunity for individuals and families to move on with their lives with confidence.

[5] Sendai Framework for Disaster Risk Reduction 2015-30 (SFDRR) was adopted by 187 member states at the 3rd UN World Conference for Disaster Risk Reduction in 2015. New Zealand is a signatory to the SFDRR.

There is strong agreement by experts that the Awatarariki Stream fanhead is, by international standards, a 'high risk zone' for future debris flows and triggers the need for action to be taken under the RPS. There is an existing policy framework and commitment towards improved risk management for natural hazards at the international, national, regional and district levels. If this framework is to be meaningfully implemented, a way forward for those living or owning property on the fanhead needs to be found.

There are no viable monitoring or engineering options. Retreat is the last and only option available to reduce the high natural hazard risk from future debris flows.

Retreat will not occur without financial and/or regulatory intervention. It is considered that regulation alone is an extreme solution that has yet to be tested by the Court.

The IBC clearly confirms the strategic need to invest. The preferred option is a managed retreat of the 34 affected properties. This involves an incentivised approach to voluntarily relocate away from the high natural hazard risk through the use of a property acquisition process underpinned by new District and Regional Rules to ensure an adequate risk reduction outcome is achieved and does not re-establish. Retreat will significantly reduce the risk to life and also create certainty and provide confidence for people to move forward with their lives. It will also enable wider community recovery and resilience.

There are a number of uncertainties associated with the Awatarariki Stream fanhead proposal, particularly around willingness to relocate, affordability and funding. These include:

- The level of 'take-up' by the 34 property owners;
- Political willingness for implementing policy;
- The ability to secure adequate external funding;
- The willingness for non-Matatā residents to contribute a proportion of funds through rates; and
- The successful outcome of the Regional Plan Change process.

This IBC recognises that funding support from Government and the BOPRC will be necessary to commence the process of property acquisition, based on the preferred way forward and the short-listed options above.

It is recommended that partner organisations consider the IBC and provide approval and commitment to funding the preferred way forward.

1.8 Next Steps

Proposed next steps are:

1. Formal engagement with Government and BOPRC to obtain support to implement the Acquisition Strategy.

2. Once funding has been confirmed, voluntary retreat from the properties in private ownership will be initiated and managed through the Acquisition Strategy approved by the Council. The Acquisition Strategy recognises that:

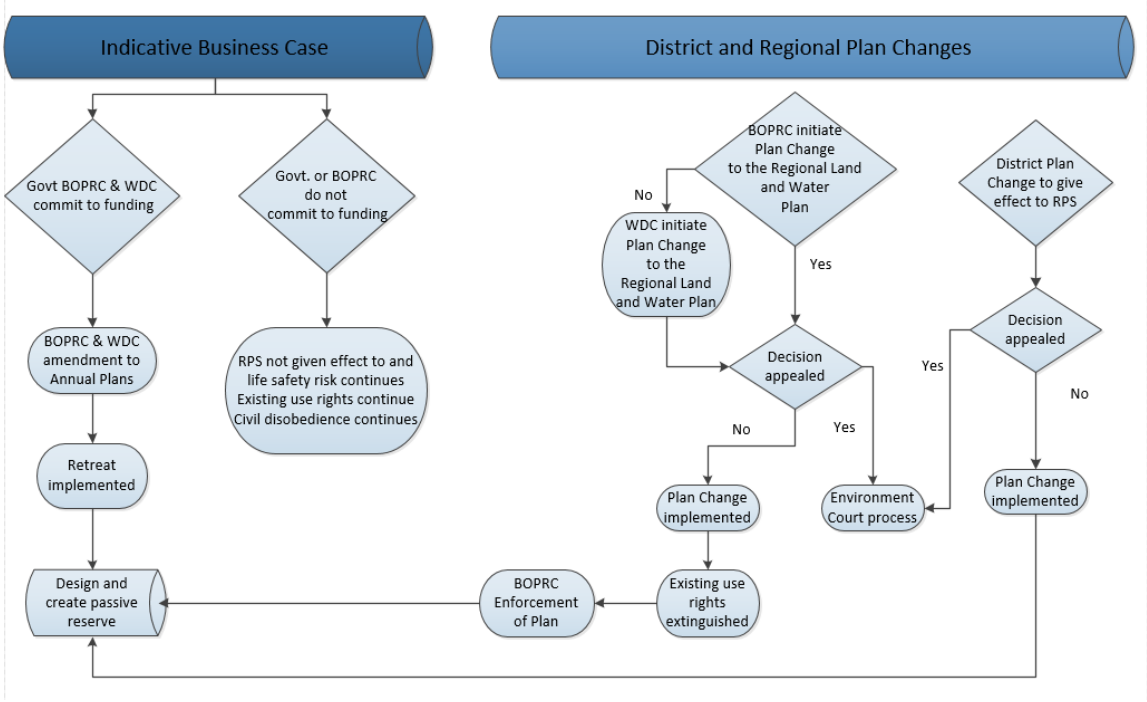
    - Mitigating high loss-of-life risk is the key driver of the Strategy
    - Property owners have a choice to participate
    - Implementation of the Strategy is reliant on the Council securing funding support from the Government and the BOPRC

- The process must be fair and legal (despite the Public Works Act not being applicable in this instance, its tried and tested acquisition principles have been incorporated in the Strategy).

3. Initiation of a plan change to the District Plan to rezone residential land on the Awatarariki Stream fanhead to reserve.

4. A change to the Operative Regional Land and Water Plan to introduce an additional measure of a Prohibitive Activity status for new development in the high debris flow risk area would be consistent with the RPS natural hazard provisions. In the absence of a Plan Change being prepared by the Regional Council, a private Plan Change Request is being developed by WDC. A decision flow chart (Figure 4) shows the potential course of decision making on this issue.

Figure 4: Decision flow chart illustrating the potential course of decision making



A summary of the IBC's five cases is illustrated in Figure 5 and a summary of the decision journey the Council has gone through with associated timeline is provided in Appendix IX. This appendix identifies the key actions, decisions, influences and outcomes that, combined, succinctly inform the decision pathway of this project.

Figure 5 – Summary of five cases

Indicative Business Case

Strategic Case:

Need to Invest

- *Geomorphological and other evidence indicates debris flows have affected the fanhead (some larger than 2005) at approx. 50-150 year intervals.*
- *Some individual properties have an individual loss of life risk of 10^{-4} or greater (unacceptable by internationally standards)*
- *Experts have proposed a 'high risk zone' unsuitable for residential activity and have estimated a repeat 2005 event would result in 5 fatalities.*
- *Property owners are unable to develop properties due to building constraints and report that financial costs have been high following 2005 event (insurance, rates, low market values)*
- *Community is fatigued and frustrated after more than 10 years with no decision.*
- *Community agreement that 'doing nothing' is not a desirable option.*
- *There is a robust policy framework signalling that action needs to be taken.*

Strategic Context

- *Sendai Framework for Disaster Risk Reduction (2015-30).*
- *CDEM Act 2002*
- *RMA 1991*
- *LGA 2002*
- *Building Act 2004*
- *Bay of Plenty RPS and Change 2 (Natural Hazards)*
- *Proposed Whakatāne District Plan.*

Investment Objectives and Case for Change

Objective 1:	***To protect the safety of the residents at Awatarariki Fanhead***
Existing arrangements	Future debris flows at Awatarariki continue to pose a significant risk to residents' life safety (individual loss of life risk is 10^{-4} for many). Societal risks for much of the fanhead are significant (cumulative risk is in excess of 10^{-3}). Risk modelling has identified at least 45 properties, including 16 homes, are considered to be in the high risk zone from future debris flows.
Business Needs	To protect the life safety of the residents of the Awatarariki fanhead from a repeat debris flow event.
Objective 2:	***To create a state of certainty as the basis for Matatā town and its community to recover from the 2005 event and to support future community resilience.***
Existing arrangements	Property owners have endured a state of uncertainty over the last 11 years. Uncertainty has come from a multitude of sources, including: when a repeat event will occur; if an engineering option will be developed for protection; if they are able to continue to reside on the Awatarariki fanhead in the long term. Uncertainty has affected property owners in terms of negative impacts on health, families and finances. This has resulted in a stressed and frustrated community that has been unable to recover from an event that happened 11 years ago.
Business Needs	To establish an opportunity for Awatarariki fanhead property owners to move forward with their lives with certainty, to develop a safe and resilient community that can contribute to the Whakatāne District and the wider Bay of Plenty.

Economic Case:

Initial Options Analysis

Description	Option 0 Do nothing	Option 1 Vol. retreat – exisitng dwellings 300,000 m3	Option 2 Vol. retreat – all properties 300,000 m3	Option 3 Vol. retreat – all properties 450,000 m3	Option 4 Compul. retreat 450,000m3
Appraisal Period (years)	30	30	30	30	30
Capital Project Costs ($m)*	$3.0	$6.8	$12.2	$13.3	$15.3
Repeat Event Costs ($m)*	**$32.5**	**$8.0**	**$8.1**	**$7.9**	**$0.5**
*over 200 year timeframe Cost-Benefit Analysis (of monetary benefits and costs at the Public Sector Discount Rate 6 %)					
Net Present Value of Benefits ($m)	nil	$1.1	$1.4	$0.2	$1.3
Net Present Costs ($m)	$4.8	$7.1	$12.9	$10.6	$15.3
Net Present Value (NPV, $m)	-$4.8	-$6.0	-$11.4	-$10.4	-$14.0
Multi-criteria analysis (ranking of non-monetary benefits and costs)	5	4	1/2	1/2	3
Multi-Criteria Analysis (ranking of non-monetary benefits and costs, if any)					
Objective 1	No	Partial	Partial	Partial	Yes
Objective 2	No	Partial	Yes	Yes	Yes
Preferred Option:			**PREFERRED**		

The Preferred Way Forward: Managed retreat for all properties in the high risk zone, delivered by WDC by 2020 and funded by central and local government with a voluntary retreat package. A voluntary retreat package offered to all private property owners within the 'high risk zone' regardless of the existence of a dwelling. Those that chose to stay cannot develop on sections or redevelop dwellings.

Financial Case:

Indicative Costs

	2017/18	Total 10yrs
Capital Expenses	$10.4M	13.5M
Operating Expenses	$ -	$-
External Funding Required	$9.0M	$9.0M
Operating Funding required	$0.5	$2M

Affordability and Funding:
The financial impact based on 67% external funding amounts to approximately an additional $21 - $24 or $13 to $15 per annum at ratepayer level based on 80% external funding. Financial modelling indicates that the forecasted level of internal funding will exceed the upper limits imposed by the LTP 2015-25. This may therefore be considered beyond affordable for the community.

Commercial Case:

The Potential Deal: An acquisition strategy that encourages residents to relocate away from the high debris flow risk . Although there is no legal requirement to provide any type of funding package for retreat, an incentivised solution is considered necessary for a voluntary retreat to be successful. The funding package will provide an incentive for residents to voluntarily relocate away from a high natural hazard risk. Realisation of the voluntary retreat strategy is not achievable by the Council alone. Additional funding support from other parties is required.

Management Case:

2017 → 2018 → 2020

Engage affected property owners to gauge intent with indicative offer. **February 2017**	→	Indicative Business Case. Council decision to approve IBC **April 2017**	*Approval Sought* →	Funding partners formally approached. Commitment in principle received **August 2017**	*Approval Sought* →	LTP process March- July 2018. Funding partners confirm. **July 2018**	*Approval Sought* →	Property owners formally approached with property acquisition offer. Commitment received. **August 2018**	→	Implementation phase: Retreat and works complete **2018-2020**

Plan for successful delivery:
Key uncertainties associated with this project are the level of 'take-up' by property owners and the ability to secure adequate external funding. Engagement with affected property owners indicates a willingness to retreat, subject to the funding package. Formal engagement with Government and BOPRC to obtain support to implement this project will be the key to implementing a successful retreat.

2.0 Introduction

The primary focus of this business case is protecting the life safety of residents on the Awatarariki Stream fanhead. It is about investing in a managed intervention to prevent a predictable and inevitable disaster from a future highly destructive, debris flow natural hazard event.

On 18 May 2005, a band of intense rain fell over the catchments behind the coastal settlement of Matatā triggering landslides and debris avalanches in stream headwaters. That event resulted in several large debris flows. The debris flows were a mass of dense fluid with the consistency of wet concrete, containing rocks up to several metres diameter together with trees, stumps, sand and silt, and were travelling at 15-30 kilometres per hour within the confines of the Awakaponga, Awatarariki, Waimea, Waitepuru, and Ohinekoao stream catchments. The discharges upon the fanheads of the debris flows with their associated flooding, cut major transport links, destroyed 27 homes, damaged 87 other properties, and caused $20 million in damage.

Social and scientific research, undertaken post-event, has identified historical records of previous destructive debris flow events at Matatā, including within the Awatarariki Stream catchment.

Engineered debris flow mitigation works have been completed for the Awakaponga, Waitepuru, Waimea, and Ohinekoao Streams. Provision of an engineering solution to protect against future debris flows from the Awatarariki Stream catchment has, however, proven problematic.

As a consequence of the complexity of a solution for the Awatarariki Stream catchment, residents have been living with uncertainty for the last 12 years. This uncertainty has left some severely traumatised. Long-term uncertainty about the future use of land and buildings, coupled with the uncertainty of a recurring event, has taken its toll on this sector of the Matatā community. A few residents have died during the 11 year period leaving the burden of managing the ongoing uncertainty to family members. The result is a fatigued, frustrated and apprehensive community that has been unable to recover from the 2005 natural hazard event.

There is unanimous agreement by experts that the Awatarariki Stream fanhead is a 'high risk zone' for future debris flows and that a way forward for those living, or owning property, on the fanhead needs to be found. An extensive investigation process to provide an engineering solution to manage the debris flow risk from the Awatarariki catchment resulted in the Council receiving advice that no engineered solution was viable. As a consequence, in December 2012, the Council moved to a planning solution using a risk-based approach to natural hazard management that reflected national and international best practice. A managed retreat process was subsequently identified as the best planning framework option.

This Indicative Business Case (IBC) seeks formal approval to invest up to $14.2 million to implement a managed retreat for properties located in the high risk zone for future debris flows at the Awatarariki Stream fanhead at Matatā. The high risk zone has been identified by experts as having an intolerable risk to life for residents by international standards. This level of risk was also considered intolerable with respect to the rockfall hazard to Port Hills properties in Christchurch following the 2010/2011 earthquakes[6].

[6] Refer GNS report (2012) (Understanding life-safety risk concepts for rockfall and cliff collapse in the Port Hills).

2.1 Purpose of this IBC

The purpose of this IBC is to:

- Confirm the strategic context and fit of the proposed investment
- Confirm the need to invest and the case for change
- Identify a wide range of potential options
- Recommend a preferred way forward for further development of the investment proposal, supported by a limited number of short-listed options for further analysis
- Seek the support of partner organisations (such as Ministry for the Environment, Department of Internal Affairs, Ministry of Business, Innovation and Employment, Ministry of Civil Defence and Emergency Management, and BOPRC) to invest in the Awatarariki Stream fanhead community, based on a preferred way forward.

2.2 Methodology

This IBC has been coordinated by the WDC and is underpinned by the numerous expert studies and reports generated from the 18 May 2005 debris flow event. It also builds on the work carried out by the Consensus Development Group (see 2.2.2).

2.2.1 Project team

The project team has evolved over time to reflect the various stages of the project. For completeness, all participants have been included.

Council Project Team

Marty Grenfell	Chief Executive and Project Sponsor
David Bewley	General Manager, Environment and Policy
Julie Gardyne	General Manager, Community and Strategy
Helen Barnes	General Manager, Finance
Jeff Farrell	Strategic Project Manager
Sarah Stewart	Strategic Advisor

Matatā Governance Group

Councillors Orr and Pullar; Marty Grenfell, Chief Executive(WDC); Tomasz Krawczyk, General Manager Infrastructure (WDC); Helen Barnes, General Manager Finance (WDC)

Project Advisors

Craig Batchelar	Boffa Miskell Limited
Martin Butler	Bay of Plenty Regional Council
Tim Davies	University of Canterbury
Andrew Green, Linda O'Reilly and Rachel Ward	Brookfields Lawyers
Glenda Hughes	Collingwood Promotions
Konrad Hurren, Kel Sanderson and Fiona Stokes	Business and Economic Research Ltd (BERL)
John Reid	Added Valuation Limited
Debbie Sanders	The Property Group Limited
David Stimpson	Stimpson and Co

2.2.2 Community engagement – Consensus Development Group

Since 2012, the Council has actively engaged the Awatarariki Stream fanhead community to work towards a way forward for the management of debris flow risk on the Awatarariki Stream fanhead. A series of facilitated workshops held with the Matatā Consensus Development Group (CDG) in 2015 significantly contributed to the IBC development.

Council officers worked with the CDG to examine a wide range of options (engineering and planning) to address the debris flow risk at the Awatarariki Stream fanhead. This group included six landowners, a WDC councillor, WDC officers, a BOPRC (BOPRC) officer, a Boffa Miskell planner, a geotechnical expert from Canterbury University, and a strategic government communications advisor. Members of the CDG were:

Michelle Beach	Landowner
Neville Harris	Landowner
Bob Martin	Landowner
Greta Nicholson	Landowner
Marilyn Pearce	Landowner
Stephanie Stuart	Landowner
Cr Russell Orr	WDC Councillor
Jeff Farrell	Strategic Project Manager, WDC
Sarah Stewart	Strategic Advisor, WDC
Ken Tarboton	Bay of Plenty Regional Council
Tim Davies	Canterbury University (geotechnical / engineering advice)
Craig Batchelar	Boffa Miskell (planning advice)
Glenda Hughes	Collingwood Communications
David Stimpson	Workshop facilitator
Ross Chesney	Workshop facilitator

Full day workshops were held on the following dates and findings were disseminated throughout the affected community

- 23 and 24 March 2015
- 8 April 2015
- 5 May 2015.

Regular correspondence between the affected property owners and the Council has occurred over the years. Individual and group meetings have also been held from time to time.

2.2.3 Scientific research and investigations

This IBC relies on scientific and technical reports to inform our understanding about the nature of debris flows, the frequency of occurrence, and the levels of risk to life safety for those that reside on the Awatarariki Stream fanhead. Key investigations and reports include:

- Davies, T (2005): The Matatā debris flows of 2005: inevitable events, predictable disaster. Natural Hazards Research Centre, Department of Geological Sciences, University of Canterbury.

- McSaveney, M.J Beetham, R.D. and Leonard, G.G. (2005): The 18 May 2005 debris flow disaster at Matatā: Causes and mitigation suggestions, Institute of Geological and Nuclear Sciences for WDC, Client report 2005/71.

- McSaveney, M.J., Davies, T (2015) Peer Review: Awatarariki debris-flow fan risk to life and retreat zone extent.

- Tonkin & Taylor Ltd (2005): The Matatā debris flows preliminary infrastructure and planning options report, Client Report for WDC.

- Tonkin & Taylor Ltd (2013): Quantitative landslide risk assessment, Matatā escarpment, Client Report for WDC.

- Tonkin & Taylor (2015a): Supplementary risk assessment, debris flow hazard, Matatā, Bay of Plenty, Client Report for WDC.

- Tonkin & Taylor Ltd (September 2015b): Awatarariki debris-flow fan annual individual fatality risk calculations and map.

2.2.4 Options assessment

During the series of CDG workshops in 2015, the CDG undertook a high level assessment of 8 options on a continuum from 'Stay' to 'Full retreat'. Options included: stay/accept risk and build; status quo/do minimum; various collective and site-by-site engineering solutions; and various forms of retreat.

An important point of agreement among the group was that a high loss-of-life risk from future debris flows exists for occupied properties on the fanhead. Additionally, the group recognised that personal tolerance of the loss-of-life risk varies between individuals and that the Council has statutory responsibilities to manage natural hazard risk that individuals do not. The Group identified the managed full retreat option as a possible way forward.

Following this process, and building on the information from the CDG and the research findings from the many investigations listed in section 2.2.3, the Project Team completed an assessment of the long list options (by dimension). The short listed options that potentially met the objectives and criteria were selected for further analysis. These consisted of:

- **Option 0: Status quo** – to be used as baseline comparator.

- **Option 1 (do minimum): Managed retreat of existing dwellings in high risk zone (300,000m^3 event), short timeframe (2020), and Plan Changes**
  Managed retreat for existing dwellings only (16 homes), based on magnitude event of 300,000m^3, delivered by WDC by 2020 and funded by central and local government through a retreat package.

  A magnitude 300,000m^3 event has been chosen as this best represents a similar event to the 2005 debris flows (Tonkin & Taylor, 2015). Planning for anything less than this event is unacceptable as a high risk to life safety would remain. The risk to life safety of a repeat debris flow of this magnitude has been modelled as affecting an area containing 16 homes. Larger event sizes are considered in Options 3 and 4.

- **Option 2 (intermediate): Managed retreat of all properties in high risk zone (300,000m^3 event), short timeframe (2020), and Plan Changes**
  Managed retreat for all properties (16 homes and 18 vacant sections), based on a magnitude event of 300,000m^3, delivered by WDC by 2020 and funded by central and local government with a retreat package.

  The scale of event planned for is the same as Option 1. Option 2, however, also includes the 18 vacant privately owned sections as well as the 16 homes.

- **Option 3 (less ambitious): Managed retreat of all properties in high risk zone (450,000m^3 event), long timeframe (2036), and Plan Changes**

Managed retreat for all properties (18 homes and 18 vacant sections), based on magnitude event of 450,000m^3, delivered by WDC by 2036 and funded by central and local government through a retreat package.

A magnitude 450,000m^3 event was also modelled by Tonkin and Taylor (2015) as a possibility and has been chosen to represent planning for a larger event compared with the 2005 debris flows. The risk to life safety of a repeat debris flow of this magnitude has been modelled as affecting an area containing 18 homes (2 additional properties to Options 1 and 2) and 18 privately owned sections.

- **Option 4 (ambitious): Compulsory retreat of all properties in high risk zone (450,000m^3 event), short timeframe (2020)**
  Compulsory retreat for all properties (18 homes and 18 vacant sections), based on a magnitude event of 450,000m^3, delivered by BOPRC or central government by 2020, and funded by homeowners and/or BOPRC and/or central government.

2.2.5 Analysis

A high level analysis of costs, benefits and risks was carried out by the CDG. This work was reconsidered by the project team. Financial impacts were primarily carried out by Council staff. Business and Economic Research Ltd (BERL) assisted with the Multi Criteria Analysis. The Property Group developed the Acquisition Strategy that primarily forms the Commercial Case.

2.2.6 Limitations to the IBC

Limitations to this report are acknowledged. In particular:

1. The preferred approach is heavily dependent on the willingness of property owners to take up the retreat package offer. Although initial conversations indicate that a large part of the community is willing to consider this, it will be difficult to estimate take-up numbers until property acquisition offers are formally made and accepted.

2. High levels of inherent uncertainty are associated with probabilistic modelling of the future occurrence of any natural hazard event that has a long recurrence interval. In any reasonable planning time-frame (even 500 years), the number of 2005-type events that will occur is so small that the probabilistic forecast of events is likely to be very different from what actually occurs. In recognition of this limitation, a precautionary approach has been followed in order to prevent an underestimation of the risk.

3. There are limitations in using cost benefit analysis as an economic analysis tool for natural hazard situations. Cost benefit analyses assume what will happen will happen, but with the high levels of uncertainty around natural hazards generally, that fundamental assumption, and its reliance upon it for analysis, comes under challenge. Specifically in the context of this indicative business case, the frequency and volumes of future debris flows are highly uncertain. The biggest concern is that overestimation of recurrence intervals between events significantly underestimates the overall fatality risk. This makes the utility of cost-benefit analyses for debris flow hazard mitigation proposals highly problematic.

4. Cost benefit analysis also only represents a small part of the picture. Natural hazard events are intrinsically linked with social and cultural factors that are very difficult to measure and, in most cases, impossible to monetise. High levels of stress on individuals, families and communities are inherent with natural hazards and /or the threat of natural hazards. Although loss-of-life is required to be considered in monetary terms, the cost benefit analysis tool is arguably lacking in its inability to capture the wider social values such as the loss of loved ones. Multi-criteria analysis has been carried out in an attempt to counter this limitation.

5. The lack of national guidance around levels of tolerable loss-of-life risk from natural hazard events has resulted in reliance on: international guidelines and best practice; use of the 2005 event as a benchmark; and a peer review process using New Zealand experts of international repute. Taking all of these factors into account, the preferred option reflects a managed, acceptable outcome for a 2005 scale event. Although a larger event is possible, and was modelled, the debris flow peer reviewers considered that a poorly quantified residual risk remains beyond the proposed area of retreat and extending the area of the retreat zone may be socially contentious.

6. Further work with the BOPRC is needed to better understand the Regional Council's views on using their powers under the RMA to extinguish existing use rights, required under option 4 if BOPRC were the delivery agent.

7. The wider Matatā context is not fully considered in this proposal. A significant wastewater reticulation system is also proposed for the Matatā township requiring external funds from BOPRC and Government. Although these two issues have been addressed separately, financial implications for both projects are discussed in tandem in the financial section.

3.0 The strategic case – the case for change

This part of the strategic case confirms the strategic context for the investment proposal. It establishes the investment objectives, existing arrangements and business needs and makes a compelling case for change.

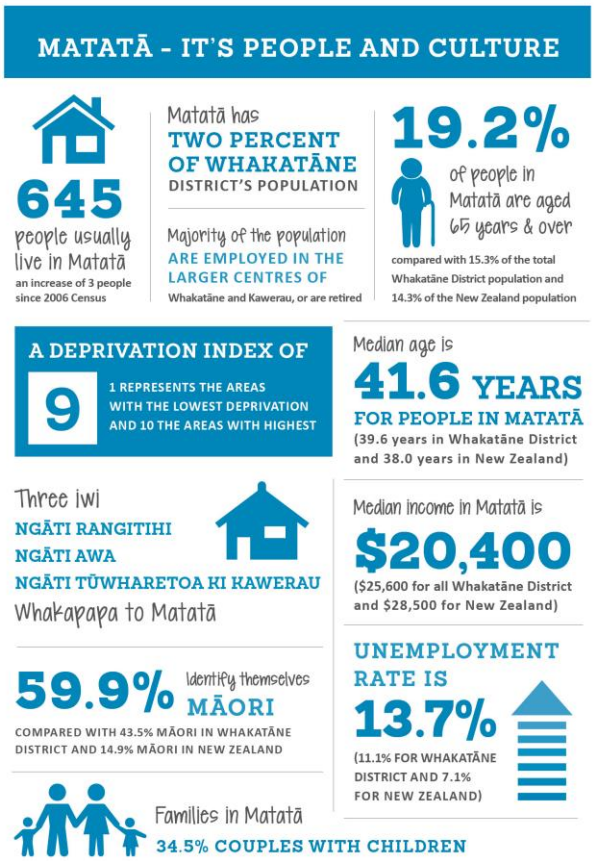
3.1 Context and background

Demographic information and background to the 2005 debris flow event are provided as context to this IBC.

3.1.1 Matatā community

Matatā is a small coastal community with approximately 645 residents, comprising two percent of the Whakatāne District's total population. Matatā is located on State Highway 2, between the Whakatāne township and Tauranga City, and has a strong sense of community. The town has two schools, two preschools (of which one is a kohanga reo), three marae (Ngāti Rangitihi; Umutahi; and Ōniao), two churches, several shops, one hotel, a DOC camping ground, and tennis and rugby clubs. Currently, the community has a static population characterised by low average incomes (median annual income is $8,100 less than for New Zealand), high unemployment (almost double that for New Zealand) and high levels of deprivation (deprivation rating of 9). Refer to Figure 6 for key demographic information from the Census of 2013.

Figure 6: Key demographics for Matatā



Approximately equal proportions of the population identify as Māori (60%)[7] and European.

[7] A proportion of the population identify as belonging to more than one ethnic group.

3.1.2 Awatarariki Stream fanhead community

The affected community of the Awatarariki stream fanhead is at the western end of the Matatā township. This small section of Matatā consists of 45 properties, 34 in private ownership. Of these 34, 16 have homes that are permanently occupied. In this small sector of the community, capital values average approximately $502,188[8] for those properties with dwellings and $252,222 for vacant sections. A map in Appendix I illustrates the Awatarariki Stream catchment and the town of Matatā.

3.1.3 Natural hazards in Matatā

Like many towns in New Zealand, Matatā has a potential for exposure to several natural hazards. Far-sourced natural hazards include tsunami and volcanic eruption. Earthquakes, landslides, debris flows, floods, and coastal erosion and coastal inundation are more localised natural hazards.

Matatā township ranges in elevation from 4.0m to 33.0m above mean high water springs (MHWS) with the majority of the town between 6.0m and 15m above MHWS. With the exception of the Awatarariki Stream fanhead area, properties are set back from the coast in excess of 200m. The combination of elevation and set back provides good natural defences against sea level rise and coastal hazards.

Tsunami modelling, based on very large earthquakes (Mw 9.0 and above) along the Kermadec Trench and the northern part of the Hikurangi Margin, predicts a maximum tsunami elevation along the coastline from 3.0m to 13.0m above the ambient wave level. Matatā is at the upper end of the range due to the directional effect of offshore islands, submarine ridges and nearshore bathymetry[9] which steers most of the energy towards Ōpōtiki and the coastline from Thornton to Pikowai (Prasetya and Wang, 2011).

Matatā is also situated on the western margins of the Taupō Volcanic Zone (refer Figure 7). This is a zone of active back-arc rifting (extensional faulting) and volcanism. There are a number of active faults in close proximity to the town which have the potential to rupture every 30 – 200 years. The magnitude 6.5 1987 Edgecumbe earthquake is typical of Taupō Volcanic Zone earthquakes (Beetham et al, 2004).

3.1.4 Debris flow hazard

In order to understand the fundamental nature of the risk that underpins the primary life safety objective of this business case, it is helpful to understand the behaviour and characteristics of a debris flow. This provides an appreciation of the nature of the risk that owners of properties on the Awatarariki Stream fanhead are exposed to in comparison with properties faced with other more manageable natural hazards.

Debris flows occur in steep erodible catchments and are typically initiated by intense rainfall. The high intensity rainfall generates landslides with high fine sediment content that enter streams converting flood water into a dense slurry with a similar consistency to wet concrete. This slurry flows in a series of discrete surges with coarse material at the surge front. The flow of slurry is able to erode stream beds and stream banks. Rocks, boulders and logs are held in suspension while they are transported at rapid speed down confined catchments. Larger debris (boulders, trees etc.) are carried at the front of the flow forming a battering ram with large destructive capability. Upon exiting the catchment, the debris flows are no longer confined. The lack of confinement enables the debris flow to spread. In an unconfined situation, flow velocity reduces as a factor of distance, resulting in debris and sediment being deposited upon the fanhead.

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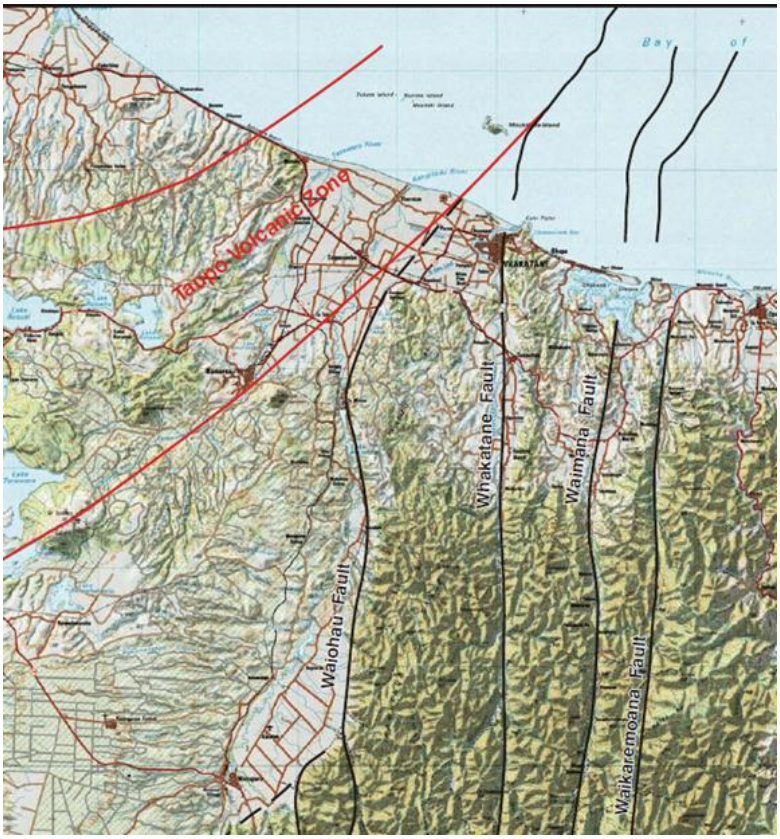
[8] Based on current market valuations provided by TelferYoung (Tauranga) Limited (2016) at 1/07/2016 excluding constraints associated with the event.

[9] Bathymetry refers to submarine topography or the depths and shapes of underwater terrain.

Figure 7: Taupō volcanic zone



Debris flows that impact upon the built environment are extremely hazardous. Also, engineered debris flow risk mitigation structures are enormously expensive[10]. In the majority of debris flow hazard situations the risk is, in effect, unmanageable (Davies, 2005). For this reason, debris flow fanheads should not be built upon.

3.1.5 Debris flow event in 2005

It is important to consider the events that occurred on 18 May 2005 to understand the current situation. A band of intense rain fell over the catchments behind the coastal settlement of Matatā triggering landslides and debris avalanches into the headwaters of a number of streams. The landslides and debris avalanches liquefied as they dropped to the bottoms of the numerous valleys reaching them as a dense fluid. Multiple tributaries fed into the main channel of each catchment resulting in several large debris flows.

The 2005 event at Matatā transported rocks up to seven metres diameter at a velocity of 15-30 kilometres per hour within the confines of the catchments[11], before depositing an estimated 700,000+ cubic metres of rock, wooden debris, silt and slurry on to the fanhead properties and into Te Awa o Te Atua (Matatā lagoon).

[10] Aoraki Mount Cook village has the only engineered debris flow risk mitigation structure in New Zealand.

[11] Peak debris flow in the Awatarariki catchment has been estimated by Tonkin and Taylor Ltd (2013) to be 700m3s-1. In comparison, 1 in 100 year and 1 in 500 year peak flood flows are estimated to be 44 m3s-1 and 57 m3s-1 respectively (Tonkin and Taylor Ltd (2007)).

The volume of debris deposited on the Awatarariki Stream fanhead in 2005 has been estimated at 300,000m^3 (Tonkin and Taylor, 2009). Deposition of 300,000m^3 of debris on the Awatarariki Stream fanhead dramatically changed property topographies.

A total of 27 homes were destroyed and a further 85 other properties damaged at Matatā. Major transport links were also severed (road and rail) including the State Highway that is an important freight link for the Port of Tauranga. Total damage was estimated at over $20 million (Bassett, 2006) (photographs provided in Appendix II). It was extremely lucky that no one died in this event, as risk assessment modelling for an event of the same size and scale has indicated a likelihood of five fatalities.

A short time after the event, and acting on expert advice, the Council issued dangerous building notices to prevent people from reoccupying those buildings on the fanhead that were still relatively habitable. In 2006, in response to demand for residents to reoccupy their homes, the Council sought a determination from the Department of Building and Housing to clarify whether or not it was reasonable for re-occupancy of those vacated homes to occur. The Department of Building and Housing Determination 2006/119[12] reversed the Council's decision not to remove dangerous building notices on houses on the Awatarariki Stream fanhead. This decision by a Government department provided policy guidance to the Council in its administration of the Building Act in relation to the fanhead properties.

Between the release of Determination 2006/119 and December 2012, six homes were rebuilt on the fanhead under the provision of sections 71-74 of the Building Act 2004. Other properties remain undeveloped.

Some of the people who experienced the event remain severely traumatised and, although they still own property on the fanhead, are unwilling to live there.

3.1.6 Investigations into hazard management options from 2007

Following the 2005 event, the Council received professional and legal advice on its responsibilities to mitigate the potential risk from future debris flow events. Taking into consideration the legal advice provided at the time, the Council resolved to proceed with works to control the effects of future debris flows from the Awatarariki Stream Catchment. The Council engaged Tonkin & Taylor Ltd to investigate risk management options (Tonkin and Taylor 2005a, 2005b & 2005c). Some 11 options were identified in a preliminary options report (*The Matatā Debris Flows, Preliminary Infrastructure and Planning Options Report* (Tonkin & Taylor, 2005a). One option identified was to "retreat" from the hazard and limit development on the debris fanhead of the Awatarariki Stream. The risk management option selected by the Council, after consultation with the Matatā community, was to construct a debris dam in the catchment upstream of the escarpment, and a debris flood channel on the fanhead beside the existing Awatarariki Stream, including the replacement of the East Coast Main Trunk railway bridge and road underpass, and repair of the State Highway 2 bridge.

The Council made an application to Central Government for funding support for the preferred option. A grant of $2.890 million from the Ministry of Civil Defence and Emergency Management for project costs was provided. The Grant was to be used solely for risk mitigation measures for the Waitepuru and Awatarariki streams. The Council then approved a budget of $3.558 million for its share of the works. The combined amount was considered sufficient funding to carry out the proposed mitigation works based on the costs estimated ($5.3 million).

[12] Dangerous building notices for houses in Matata, Bay of Plenty

Debris flow hazard mitigation works were completed on the Awakaponga, Waitepuru, Waimea and Ohinekoao streams, and flood mitigation works were completed on the Awatarariki Stream and Te Awa o Te Atua (Matatā lagoon).

In 2007, a range of possible debris detention structures (DDS) were developed to manage the debris flow risk from the Awatarariki Stream. The initial preferred solution was an earth dam but this was subsequently discounted following concerns from iwi over the environmental footprint within a waahi tapu site. An alternative option using a flexible ring net was developed by Tonkin and Taylor Ltd, in conjunction with Geobrugg A G of Switzerland. The cost of the ring net was estimated at $2.1 million. It was to have a height of 10 metres and contain 95,000$m^3$of debris. The Council approved the ring net option on 23 July 2008.

In June 2009, Tonkin and Taylor Ltd presented its Preliminary Detailed Design Report to the Council (Tonkin and Taylor, 2008). The height of the retained debris was proposed as 12m and the net at 14m high. The project cost for the supply of the barrier and construction of the fanhead earthworks was revised to $2.789 million. In 2011, estimated costs escalated again exceeding the original budget.

A design peer review process, involving AECOM Ltd and the University of Canterbury, identified concerns with the proposed design of the flexible ring net structure. As the estimates of volume of debris deposited in the May 2005 event were refined, the Council's consultants concluded it was necessary to increase the dam size to contain the larger volume [250,000m^3] resulting in the dam height increasing to 17 metres[13]. This increased the estimated cost of the project to $5.262M excluding the bridge replacements. In 2012, Tonkin and Taylor Ltd advised the Council that investigations during the detailed design phase had identified that ground conditions were inadequate to retain the anchor loads from the ring net during a debris flow event and that an engineering solution was neither financially nor practically viable.

At May 2012, expenditure on Awatarariki Catchment works totalled $4.814 million and a DDS had not been constructed.

With mounting concerns, the Council commissioned an independent review. This was carried out by Mr Alan Bickers in 2012. Bickers (2012) concluded that there was no reasonable possibility of constructing a DDS upstream of the escarpment and recommended that the Council take no further action to implement the ring net design. Reasons to support this recommendation included: that the ring net proposal was to have a maximum design life of 50 years; that the estimated costs were greater than originally envisaged because of the increased loads on the net anchors and the poor ground conditions; and that community objections, particularly those of tangata whenua, could not be satisfactorily resolved.

Further recommendations from Bickers (2012) included that if Council adopted the recommendations to abandon the debris net proposal and not pursue any other DDS option upstream of the escarpment, it must, therefore, decide whether or not to take any further action to mitigate the risk of future debris flows in the Awatarariki Stream catchment. Bickers (2012) cautioned that if the Council decided to take no action, then it must have regard to the possible planning, legal and financial consequences that could follow.

A feasibility study of downstream engineering options was subsequently undertaken by Domain Environmental Ltd on behalf of the Matatā Project Management Team. The Domain Environmental Ltd report *Matatā Debris Flow Management – The Way Forward for the Matatā Governance Group*

[13] Equivalent to a five storey building.

contained preliminary MCA analysis of potential fanhead engineering and planning options. Engineering options included the Chute to Sea option that had been promoted by some members of the fanhead community. The report recommended abandoning all engineering options and developing two planning options (information-based, and event-based) to manage the risk from future debris flows.

In December 2012, the Council determined there were no viable engineering solutions to manage the debris flow risk from the Awatarariki catchment and agreed to pursue planning-based options. The planning options resulted in quantitative debris flow hazard and risk analyses that concluded an intolerable level of loss-of-life risk (by international standards) from future debris flows exists for residents of a large part of the Awatarariki Stream fanhead. In recognition of that intolerable level of risk, the WDC declined applications for new building consents in the fanhead area and had that position endorsed by a Building Act 2004 determination issued by the Ministry of Business and Innovation (Determination 2016/034).

A Change to the District Plan under the Resource Management Act 1991 to rezone the affected area from residential to a more appropriate zoning, such as reserve or specific natural hazard zone is underway. The Plan Change will give effect to the BOPRC Regional Policy Statement.

A change to the Operative Regional Plan for the Tarawera River Catchment is required to align with the RPS and would extinguish existing use rights in the high risk area.

3.1.7 Work in other catchments complete

Debris flow mitigation works to manage risk from future debris flows have been completed for all other catchments at Matatā (Awakaponga, Waitepuru, Ohinekoao and Waimea). Flood management works have been undertaken on the Awatarariki Stream but debris flow mitigation works have proven to be not viable.

3.1.8 Future Matatā

Future growth in Matatā is likely via subdivision of land to the east of the town and potential development and intensification of existing lots. There are currently approximately 350 surveyed lots, including 70 empty lots. As discussed by Council on 20 May 2013, in relation to the report on 'Matatā Sewerage Scheme Options Deliberation and Decision', the ability to subdivide sections to smaller lot sizes may be realised if individual sections within the town are not restricted by the area required for on-site effluent treatment systems. In addition, further land to the east of Matatā is zoned Rural 4, allowing for additional residential growth.

Ngāti Rangitihi's Treaty of Waitangi settlement claim is currently under preparation for negotiation with the Crown. Ngāti Rangitihi's redress principles include that the settlement package "….should meaningfully contribute to uplifting the mana and rangitiratanga of Ngāti Rangitihi" (Te Mana O Ngāti Rangitihi, 2016, p2)". Cultural and economic revitalisation opportunities highlighted by Ngāti Rangitihi for Matatā include: a Ngāti Rangitihi museum and tourism centre; a centre for research, teaching and employment training; cultural, eco-tourism, and other business activities; and Papakāinga development.

Taking into account the natural hazard issue, a proposed wastewater reticulation system, and the social aspirations of Ngāti Rangitihi, the potential for future growth in Matatā has led to an expectation of an extra 90 houses within the medium-term (20 years), bringing the total number of households to 370 by 2033.

Growth of an additional 90 houses in Matatā is considered realistic over the next 20 years based on:

- Appropriate and reliable infrastructure being in place, e.g. water, roads, schools, churches, marae, sporting clubs etc;
- Ability to subdivide if a wastewater solution is provided;
- Land availability;
- Desirability to reside in a coastal environment;
- Internal migration - rising property prices in Auckland resulting in residential drift to Tauranga City and the districts beyond, including the Whakatāne District;
- Matatā being within easy commuting distance of both Whakatāne (24 km) and Tauranga (65 km), particularly now that the Tauranga Eastern Link has significantly reduced travel time from Matatā to Tauranga; and
- Ngāti Rangitihi's economic plans for investment in the Matatā township.

3.2 Strategic context

This section demonstrates strategic alignment of the proposal with legislation and national and regional policies along with the Council's strategic intentions.

3.2.1 Whakatāne District Council

Council's overarching plan is documented in the Long Term Plan (LTP), a ten-year plan updated every three years.

The LTP 2015-2025 sets out the Council's vision which is a high-level, key driver for all its activities:

> *To be known as the place of choice for people to live, work and play. In achieving our vision, our community will be safe and inhabited by people who are friendly and caring, businesses will be thriving, there will be respect for, and pride in our history and we will be successful guardians of our natural environment*.

Council's purpose is to lead the Whakatāne District to meet the current and future needs of our community through good governance, leadership and advocacy; integrated long-term planning; effective and reliable community infrastructure; and, outstanding service delivery.

Community outcomes are a high-level set of desired goals that the Council aims to achieve. They help guide and inform planning and the setting of priorities. Natural hazard management is directly linked with the following community outcomes and associated goals as outlined in the Council's LTP (Figure 8). Of particular relevance is the Council's goal to create 'safe communities'. In accordance with the 'Effective Leadership' community outcome, Council has been working in partnership with the community through the Consensus Development Group to achieve transparent and inclusive decision making on this issue (see Section 1.1 Methodology).

Figure 8: WDC relevant community outcomes and goals

The management of natural hazards is a key issue for the Whakatāne District and is identified as a key issue in the LTP and in the Whakatāne District Plan, which has a chapter dedicated to the issue. The LTP also outlines that Council is mindful that change in rainfall patterns as a result of climate change can adversely affect people and property in the District.

3.3 Alignment to existing strategies, policies and plans

Many of the strategic considerations for this project relate to international accords, and national, regional, and district regulatory and planning frameworks administered through the Resource Management Act 1991 (RMA), Local Government Act 2002 (LGA), Building Act 2004 (BA) and the Civil Defence Emergency Management Act 2002 (CDEMA).

A suite of key policies and legislation relevant to natural hazard management in New Zealand is summarised in Table 2 and discussed further in the 'strategic considerations and challenges' section.

Table 2: Key legislation and policies relevant to natural hazard management in New Zealand

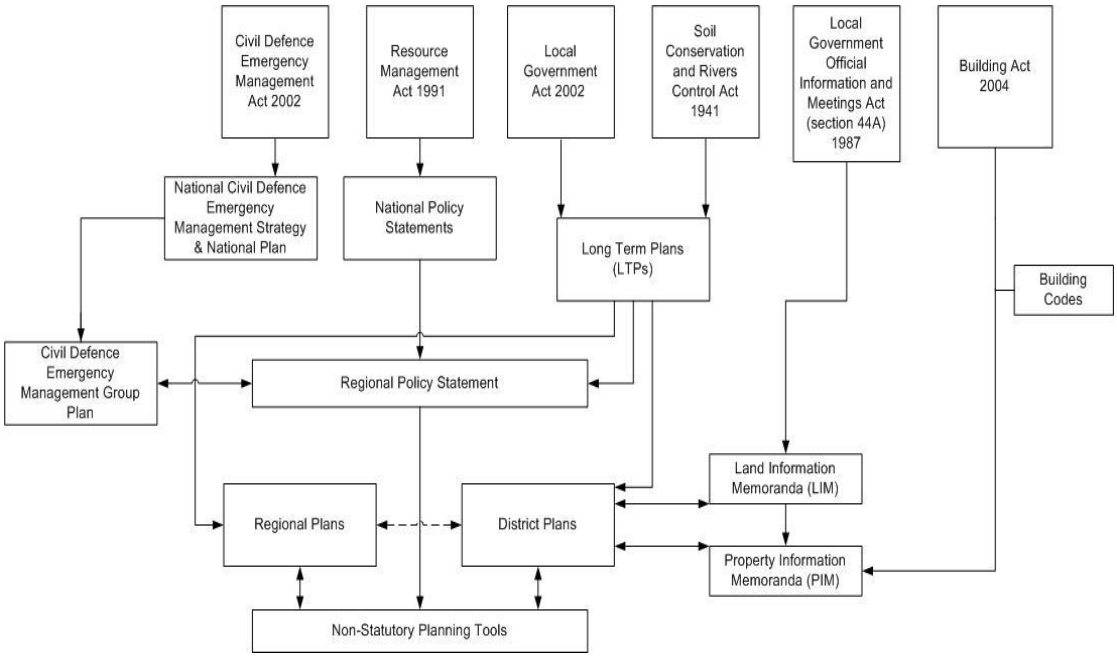
Strategic documents	Description	Relevance
Sendai Framework for Disaster Risk Reduction 2015-2030	SFDRR was adopted by 187 member states at the 3rd UN World Conference for Disaster Risk Reduction in March 2015 in Sendai, Japan. The SFDRR places increasing emphasis on disaster risk management, as opposed to disaster management, with risk reduction and strengthening resilience being anticipated outcomes achieved through involving communities and making prevention and reduction of disaster risk a primary responsibility of signatory governments.	New Zealand is a signatory to the SFDRR. As a nation we have committed to reduce levels of risk that have been identified as being unacceptably high.
Civil Defence Emergency Management Act 2002 (CDEM)	The purpose of this Act is to improve and promote the sustainable management of hazards in a way that contributes to the social, economic, cultural and environmental well-being and safety of the public and the protection of property. The CDEM Actencourages and enables communities to achieve acceptable levels of risk by identifying, assessing, and managing risks, consulting and communicating about risks, and identifying and implementing cost-effective risk reduction. Government agencies, regional and district councils all play a role in managing risk related to hazards under this Act. All of these organisations are expected to incorporate CDEM and business continuity arrangements into their business planning and risk management processes.	Both the BOPRC and Council are part of the CDEM Group and contribute to the CDEM Group Plan. The CDEM Group is tasked with managing hazards and risks in the region. The Plan provides a framework for civil defence and emergency management decisions to be made across the Bay of Plenty. The plan covers all hazards and emphasises the four 'Rs' – risk reduction, maintaining a state of readiness, responding at the time of emergency, and overseeing recovery. The Plan is linked to the RPS, then down to regional and district plans.
Resource Management Act 1991 (RMA)	New Zealand's main piece of legislation that sets out how we should manage our environment, including the integrated management of natural and physical resources.	Proposed amendments to this Act will make natural hazards a matter of national importance. Natural hazard responsibilities for both regional and territorial authorities are set out in sections 30 and 31. In the context of this business case, a key difference between the powers of regional and territorial authorities is the ability of regional authorities to extinguish existing use rights.

Local Government Act 2002 (LGA)	The purpose of the Act is to meet the current and future needs of communities for good-quality local infrastructure, local public services, and performance of regulatory functions in a way that is most cost-effective for households and businesses.	Section 11A states that local authorities must have particular regard to the contribution that a number of core services make to its communities. One of the core services to be considered is the avoidance or mitigation of natural hazards (section 11A(d)).
Land Drainage Act 1908 and Soil Conservation and Rivers Control Act 1941	Overriding purpose is to make provision for the conservation of soil resources, the prevention of damage by erosion and to make better provision for the protection of property from damage by floods.	These Acts provide the regional council with powers to undertake works or maintain existing works to minimise and prevent flooding and damage within a catchment area. Some mitigation measures have been carried out under these Acts following the 2005 debris flow event.
Local Government Official Meetings and Information Act (s 44A) 1987 (LGOIA)	Contains provisions for Land Information Memoranda (LIM) and Property Information Memoranda (PIM). These are Council prepared reports containing knowledge about a particular property or section or special features of the land, including hazard information.	Debris flow risk within the hazard areas on the Awatarariki Stream fanhead are identified in Land Information Memorandum (LIM) reports.
Building Act 2004	Performance standards to deliver the Act are prescribed in the NZ Building Code. These include functional requirements for buildings and performance criteria which buildings must comply with. Sections 71-74 relate to building consent limitations and restrictions for the construction of buildings on land subject to natural hazards.	The Council applied to the Ministry of Business, Innovation and Employment (MBIE) for a determination to clarify whether or not it is reasonable for the Building Consent Authority (BCA) to grant a waiver or modification of the Building Code under section 72(c) of the Building Act 2004 for two building consent applications to construct dwellings within the high debris flow risk zone. The Building Act determination supports Council's decision to not issue a building consent due to the high level of loss-of-life risk.
Bay of Plenty Regional Policy Statement (RPS)	The operative and proposed RPS provides an overarching policy for the Bay of Plenty, which is given effect through regional and district plans. For natural hazard management, the coordination role of the RPS is clearly evident in Figure 2. The RPS draws on the long term plan, national policy statements and standards, and CDEM Group Plans (the latter being influenced by the National Civil Defence Emergency Management Strategy and National Civil Defence and Emergency Plan).	The BOPRC recently (July 2016) introduced a risk management approach to natural hazards (Plan Change 2 – Natural Hazards). The RPS now requires both the Regional Council and District Council to take steps to reduce high natural hazard risk.

Whakatāne District Plan	This document identifies the important resource management issues in the District. It contains a number of objectives, policies and methods that guide and shape development in the district. It is a planning tool that helps ensure Whakatāne is developing the way the community wants it to.	Currently, the District Plan zones the Awatarariki Stream fanhead as Residential. The Council has commenced a process to introduce a plan change to re-zone the land to stop further development on the Awatarariki fanhead as a planning response to manage the high debris flow and debris flood risk to property and people. This will also fulfil the Council's responsibilities under the new natural hazard provisions of the RPS for the debris flow hazard from the Awatarariki Stream catchment.

Figure 9 describes the relationship between the various Acts, regional and district plans and other documents in New Zealand that contribute to the management of natural hazards in New Zealand.

Figure 9: Relationships between key legislation for natural hazards in New Zealand[14]



3.4 Strategic considerations and challenges

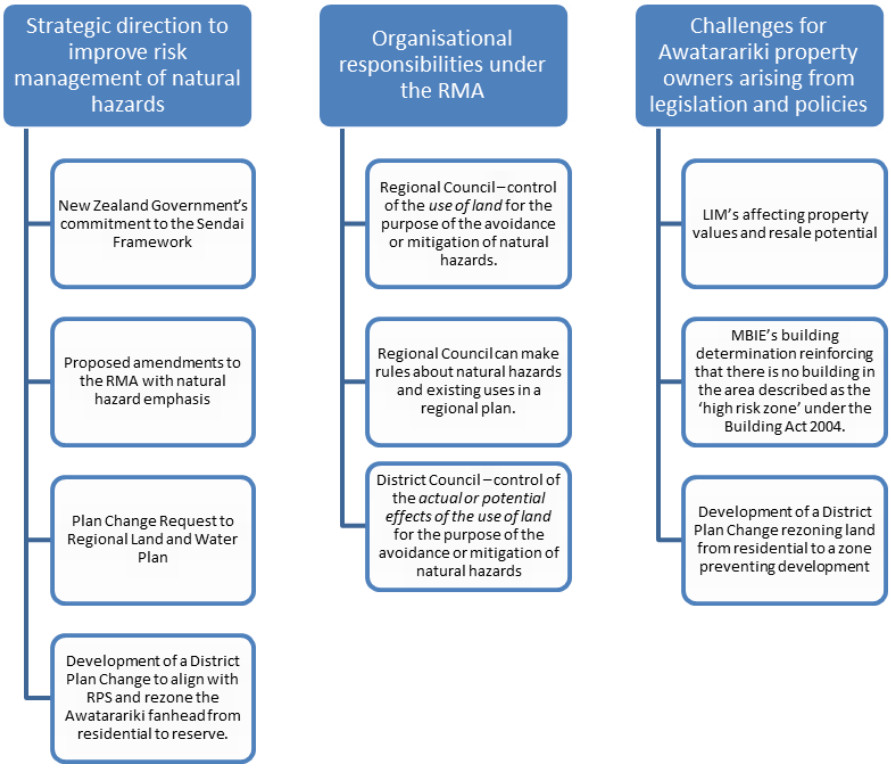
The following factors have been identified as significantly influencing and/or challenging natural hazard management options for the Awatarariki Stream fanhead. These can be categorised into three key areas:

1. New strategic directions to improve risk management of natural hazards.
2. Overlapping organisational responsibilities under the RMA.
3. Challenges for Awatarariki property owners arising from legislation and policies.

[14] The RMA Quality Planning Resource (http://www.qualityplanning.org.nz/index.php/planning-tools/natural-hazards/introduction-to-natural-hazards-and-the-legislative-framework-for-hazard-management)

Key factors are summarised in Figure 10 and discussed below, along with implications for the Awatarariki Stream fanhead.

Figure 10: Key strategic considerations and challenges of natural hazard management at Awatarariki Stream fanhead



3.4.1 New strategic directions – improving natural hazard management in New Zealand

New strategic directions are emerging for natural hazard management in New Zealand. This is evident in the New Zealand Government's commitment to international disaster risk reduction frameworks, proposed amendments to the RMA that aim to improve the management of significant natural hazard risks, scoping work for a NPS on natural hazards, and the recent adoption of the BOPRC's RPS Change 2 (Natural Hazards) that introduces a risk-based approach to natural hazards management for the Bay of Plenty.

The Sendai framework

Commitment to the Sendai Framework for Disaster Risk Reduction 2015-2030 (The United Nations for Disaster Risk Reduction, 2015) with its increased focus on proactive management of disaster risk through active intervention, establishes New Zealand's future direction to the way in which natural hazard risk should be managed. In order for a policy framework that places increasing emphasis on disaster risk management - as opposed to disaster management - to be successful, the proactive assessment of risk must be supported by commitment to reduce levels of risk that have been identified as being unacceptably high. The Sendai Framework provisions make prevention and reduction of disaster risk a primary role of signatory governments. These provisions signal the need for involvement by the New Zealand Government in the development of national natural hazard risk management policies and frameworks, and mitigation of risk from future inevitable and predictable natural hazard events of high social and economic impacts that are beyond an individual community's means to address.

Amendments to the RMA on natural hazards

The Resource Legislation Amendment Act 2017 contains changes that impact on the management of natural hazards, including "the management of significant risks from natural hazards" as a new matter of national importance in section 6 of the RMA. The statutory intent of this significant change is to elevate the weight given to the consideration of natural hazards in resource management decision-making. The concept of management of significant risks introduces the requirement for risks to be identified, quantified, and then managed according to priority. Ongoing challenges for communities and regulatory decision-makers using a risk management approach include the ability to reliably model the consequences of natural hazard events due to the complex and uncertain nature and frequency of natural hazard events, particularly those that are of low likelihood, coupled with the limited availability of robust data (if any) sourced from historical events.

Scoping for a National Policy Statement on natural hazards

Currently there are no national policy statements (NPS) or national environmental standards (NES) for particular natural hazards in New Zealand. The Ministry for the Environment has initiated scoping for a NPS on natural hazards through commissioned research using a risk-based approach to natural hazard management under the RMA. The research and recommendations in this report will be taken into account in the policy work for the proposed NPS (Tonkin and Taylor, 2016).

BOPRC's Regional Policy Statement – Change 2 (Natural Hazards)

A risk management approach to natural hazards was adopted by the BOPRC (2016) as part of Plan Change 2 (Natural Hazards). The risk management approach taken by the regional council means that the extent to which natural hazards are managed depends on the risk they present. Risk is the combination of likelihood and consequence. That is, the risk associated with a natural hazard is determined by a combination of an event's likelihood (i.e. the chance of it occurring in a specified time-frame) and its potential consequence (i.e. amount of damage or loss it would cause should it occur). For most natural hazards, whether an event occurs is largely beyond human control. In such circumstances, the policy intent is to ensure that the consequences of events, when they do occur, are as low as practicable.

The BOPRC RPS sets out the importance of land use control as a tool available to local authorities to manage risk associated with natural hazards. The Regional Council also acknowledges the tension between controlling land use to limit the potential consequences of a natural hazard (that can be costly and disruptive to communities) and enabling economic development desired by local communities. It is recognised that under-acknowledgement of high hazard risk in land use planning decisions has contributed to the high level of natural hazard vulnerability that many New Zealand communities are exposed to. New Zealand is ranked as having the third most vulnerable economy in the world (after Bangladesh and Chile) to the impact of natural disasters as a percentage of GDP. Based on data going back to 1990, natural disasters can be expected to cost NZ just under 1% of its GDP or about $1.6B in any year (Insurance Council of New Zealand, 2014).

Reducing high natural hazard risk under the RPS

A series of policies is anchored by Policy NH 1B incorporating the risk management approach:

> *Take a risk management approach to control the use, development and protection of land to avoid or mitigate natural hazards by assessing the level of risk according to the likelihood of natural hazards occurring and their potential consequences.*

Under this framework, policies require both the Regional Council and district councils to consider options for reducing high natural hazard risk. Policy NH 2B requires risk to be classified as:

1. *High natural hazard risk* being a level of risk beyond what should be tolerated.

2. *Medium natural hazard risk* being a level of risk that exceeds the Low level but does not meet the criteria for High risk.

3. *Low natural hazard risk* being the level of risk generally acceptable.

Application of Policies NH 7B and NH 8A achieves the following natural hazard risk strategy:

(a) In natural hazard zones subject to High natural hazard risk, reduce the level of risk from natural hazards to Low (although Medium may be tolerable for existing land uses if achieving Low is not reasonably practicable).

(b) In natural hazard zones where an existing use is subject to Medium natural hazard risk, reduce the level of risk from natural hazards to be as low as reasonably practicable.

(c) In areas subject to Low natural hazard risk, maintain the level of risk within the low natural hazard risk range where Low risk exists and achieve it for new development.

The Awatarariki Stream fanhead is considered a high natural hazard risk with respect to debris flows.

Aligning with the RPS

Debris flow risk from the Awatarariki catchment was one of three case studies used by the Regional Council to test the natural hazard risk assessment methodology developed for Plan Change 2 to the RPS. The case study assessment confirmed that the debris flow risk to the Awatarariki Stream fanhead properties was 'High'. The Regional Council also confirmed that the risk assessment methodology used by WDC is consistent with that in the RPS. The RPS requires areas of 'High' natural hazard risk to be reduced to 'Low', or to 'Medium" if 'Low' is not achievable. Managed retreat is recognised as an appropriate risk reduction option when other options have been investigated and proved to be not viable.

WDC is proposing two Plan Changes to give effect to the RPS by recognising the debris flow risk in formal planning instruments. The planning instruments are the Whakatāne District Operative Plan and the BOPRC Regional Land and Water Plan.

Implications for the Whakatāne District Plan

The current zoning of the land at the Awatarariki Stream fanhead is 'Residential' under the District Plan. This zoning allows a dwelling to be built as a 'permitted activity'. The current zoning fails to recognise:

- The high debris flow risk that has now been established as existing in this location;
- That building is not permitted under the Building Act following the determination decision from MBIE;
- The new natural hazard provisions introduced by Plan Change No.2 requiring risk in high risk areas is to be actively managed to reduce that risk.

The Council is developing a plan change to incorporate natural hazard provisions specifically for the Awatarariki Stream fanhead. The purpose of this Plan Change is to give effect to the Regional Policy Statement and formally recognise the debris flow risk in the District Plan. The plan change will seek to rezone the land from 'Residential' to a more appropriate zoning, such as coastal reserve or specific natural hazard zone. The plan change will give effect to relevant objectives and policies in the RPS.

Hazard lines and re-zoning are both measures that will be instituted by a change to the District Plan and are both subject to challenge. Section 85 of the RMA provides a system for any person having an interest in land to challenge a proposed provision of a plan on the grounds that the plan would render that interest incapable of reasonable use. The success of such a challenge would depend on whether the Council could demonstrate that the Plan Change measures are based on sound and robust evidence of the need for them and their efficacy. Legal advice received by the Council indicates that any section 85 challenges would not have a high chance of succeeding as landowners would be required to prove to a Court that the development of their land is a reasonable use of it, despite the risk of future debris flows and their associated consequences.

District Plan measures have limited control over existing residential uses which are protected by existing use rights under the RMA, i.e. residential use can continue provided the effects are of the same or similar character, scale, and intensity. Changes to the District Plan could permit upgrading and alterations to existing buildings but only where the new building work will reduce the risk to occupants from the debris flow hazard. The alterations must not also increase the risk to other properties.

The Council approved a District Plan Change discussion document for consultation on 19 May 2017.

Implications for the Regional Land and Water Plan

The purpose of this Plan Change is to give effect to the Regional Policy Statement and formally recognise the debris flow risk in the Regional Land and Water Plan. The objective of the Regional Plan Change is to reduce the level of risk to existing uses, namely 16 properties in the high risk area with dwellings.

The Council approved the preparation of a Regional Plan Change application on 29 June 2017.

In order to optimise process efficiencies for all parties, both councils agreed to run both plan change processes in parallel. This resulted in a revision of the District Plan Change discussion document to incorporate a separate section to cover the Regional Plan Change proposal. The amended discussion document was distributed to affected property owners in early August 2017. Key proposed milestones for the Plan Change processes are:

August 2017	Community consultation
October 2017	Formal approval of Plan Change proposal by Council Consideration of Private Plan Change request by BOPRC
November – December 2017	Public notification and submission period
February 2018	Further submission period
March – April 2018	Pre-hearing meetings
May 2018	Hearing
June 2018	Decision
July 2018	Appeal period
August-September 2018	Mediation (if decision appealed and Court agrees)
First half of 2019	Environment Court hearing (if required)

Organisational responsibilities – regional and district councils

Under the RMA, avoidance or mitigation of natural hazards is the responsibility of both regional and district councils. Responsibilities for regional and district councils are set out in section 30 and section 31 respectively. These sections specify that the control of the use of land, and the control of the actual or potential effects of the use of land, for the purpose of the avoidance or mitigation of natural hazards is the function of regional and territorial authorities respectively.

Regional Councils

Under the RMA, regional councils are responsible for:

- Setting rules, including conditions on resource consents;
- Addressing existing land uses subject to natural hazards and all land in the coastal marine area;
- Developing relevant regional plans include provisions requiring the reduction of risk to tolerable levels wherever the risk from natural hazards exceeds a tolerable level;
- Catchment management and avoidance or mitigation of natural hazards;
- The control of use of land to avoid or mitigate the effects of hazards.

The responsibility of the regional council for upper catchment management is in accordance with its functions under the Land Drainage Act 1908 and the Soil Conservation and Rivers Control Act 1941. The regional council has the power to construct and maintain drains and measures to minimise and prevent damage by flooding.

District Councils

Under the RMA, district councils have primary responsibility for:

- Establishing land use rules under District Plans (other than in the coastal marine area);
- Controlling subdivision for the avoidance or mitigation of natural hazards;
- Specific requirements for the construction of buildings on land subject to natural hazards;
- Developing desired community outcomes in respect to natural hazards in a Long Term Plan.

Addressing the overlap

Pursuant to section 62 of the RMA, overlapping roles can be addressed by allocating responsibility through a regional policy statement (RPS). This has been addressed by Change 2 to the Bay of Plenty RPS which introduced a risk-based approach to natural hazard management.

Powers to revoke existing use rights

The RMA includes the provision for regional councils to extinguish existing use rights in a hazardous area through a regional plan. Change 2 (Natural Hazards) to the RPS explicitly recognises this. District councils do not have any power to revoke an existing use right in a hazardous area, as existing uses are unaffected by new rules in a District Plan. This allocation reflects the distribution of powers in the RMA, that existing uses are unaffected by new district rules but not by regional rules.

A change to the Operative Regional Plan for the Regional Land and Water Plan to introduce an additional measure of a Prohibitive Activity status for new development in the high debris flow risk area would be consistent with the RPS natural hazard provisions. As the organisation that introduced the RPS provisions, and the organisation with the statutory authority to extinguish existing use rights in a hazardous area through a regional plan, it was anticipated that the plan change would be prepared by BOPRC. However that proved to not be the case which resulted in WDC preparing a private Plan Change request to be submitted to BOPRC.

3.4.2 Challenges for property owners arising from legislation and policy

Some of the Council's statutory roles and responsibilities relate to keeping people and communities safe. Implementation of these statutory roles and responsibilities for the debris flow risk from the Awatarariki Stream catchment has been challenging for the Council. Implementation of these statutory roles and responsibilities by the Council has also been challenging for owners of those properties identified as being exposed to a high debris flow risk. For many affected residents, this has translated into high levels of stress and frustration which have been compounded by an economic loss as a consequence of the natural hazard event.

Specific Council roles that have been found to be particularly challenging for some Awatarariki property owners include:

- Administration of the Building Act 1991, including the consideration of building consent applications over an 11 year timeframe involving changed circumstances, i.e. initial proposal to manage debris flow risk by an engineering solution not proceeded with and new evidence being provided on the level of life risk;
- Land use planning, especially the existing zoning of the land for residential purposes;
- Management of natural hazard risk through the RMA in the absence of national guidelines around tolerable levels of risk for New Zealand communities; and
- Communication of natural hazard risk information, including disclosure of that information to potential property buyers through land information memoranda.
- Administration of rating policies to pay loans obtained to undertake debris flow hazard management works at other locations within Matatā.

The lack of national guidance, delays in developing a solution, and confused inter-relationships between the RMA and the Building Act have been major causes of uncertainty causing issues of concern for the property owners affected. The inability to obtain a building consent from the Council on land zoned as residential has increased uncertainty and generated additional frustration for some.

Landowners consider that management of the natural hazard risk they are exposed to is a national rather than a local issue. They have difficulty in differentiating their circumstances from those in Canterbury where, following a disastrous event, the Government effected relocation of red-zoned property owners through compulsory acquisition of properties despite the majority of those properties not being subject to a high loss-of-life risk. The Awatarariki Stream fanhead property owners believe that they should be entitled to a package that is consistent with what was offered by the Government to Cantabrians[15].

Implications from Land Information Memoranda

District councils have particular roles in communicating information about natural hazards under the Local Government Official Information and Meetings Act 1974. Debris flow risk within the hazard areas on the Awatarariki Stream fanhead is identified in Land Information Memorandum (LIM) reports. The following standard condition is included on any LIM issued for a property in the high debris flow risk zone. This alerts the applicant to the hazard and Council's work to endeavour to mitigate the risk:

> *"This property has been identified by the Council as being within the (low/medium/high) landslide risk and high debris flow risk zone. Further information on the landslide hazard and associated risk can be obtained from the following two reports prepared by Tonkin and Taylor Limited: Quantitative Landslide and Debris Flow Hazard Assessment, Matatā Escarpment (2013) and Supplementary Risk Assessment, Debris Flow Hazard, Matatā, Bay of Plenty (2015).*
>
> *The Council is part of the way through a programme to manage the risk from future debris flows to properties on the Awatarariki fanhead that have a high risk exposure. [Property*

[15] Anecdotal evidence from multiple landowners provided to J Farrell (WDC) and G Bates (The Property Group Ltd) during indicative retreat proposal offer meetings with individual property owners in November and December 2016.

> *address] is one of these properties. The underpinning philosophy of the risk management programme is one of voluntary managed retreat from the hazard. Implementation of a voluntary retreat package is conditional upon acceptance by property owners and financial support from central and regional government agencies.*
>
> *Technical and Council reports are available for viewing at the Council offices or on the Council's website, http://www.Whakatāne.govt.nz/about-the-council/council-projects/debris-flow-and-landslide-hazards*
>
> *If you have any queries in relation to this matter please contact the Council."*

Implications for property owners have proven to be significant in relation to difficulties around sale of properties, obtaining insurance, as well as negative impacts upon property values.

Inability to build in natural hazard areas under the Building Act 2004

Landowners perceive that the Council's resolution in 2012 to no longer proceed with the DDS as a hazard mitigation measure, has positioned them in a difficult situation. This has generated a significant amount of frustration. Post 2005, a number of landowners did rebuild houses on their properties when the debris detention structure (DDS) option was the focus of the Council's mitigation solution for the Awatarariki Stream debris flow hazard and the Department of Building and Housing determined in 2006 that it was safe for people to occupy houses on the fanhead.

As a consequence of the Council's resolution in 2012 to no longer proceed with the DDS option, and the Council receiving information on the high levels of loss-of-life risk to properties on the fanhead, owners of vacant sites within the high risk area have subsequently been unable to develop their properties. Upon receipt of this risk information, the Council's building consent authority (BCA) has refused to grant building consents for new dwellings due to the ongoing unmitigated high natural hazard risk. This has led to a perception that property owners have been treated inconsistently in their ability to be able to develop their properties.

The Building Act 2004 prescribes the legal requirements for all buildings in New Zealand. Sections 71-74 relate to building consent limitations and restrictions for the construction of buildings on land subject to natural hazards.

A second Building Act determination was issued in July 2016 by the Ministry of Business, Innovation and Employment (MBIE) relating to two properties within the Awatarariki Stream fanhead. The Council applied to MBIE for a determination to clarify whether or not it was reasonable for the BCA to grant a waiver or modification of the Building Code under section 72(c) of the Building Act 2004 for building consent applications for new dwellings on land on the Awatarariki Stream fanhead that is subject to debris flow and debris flood natural hazards for which no mitigation has been proposed. The two properties that were the subject of the application are situated within the high debris flow risk area. The Council's view was that it was not reasonable to grant a waiver from the Building Code.

MBIE released its decision on 25 July 2016[16] concluding that the authority was correct to refuse the waiver under section 72 of the Act due to the high life safety risk that exists:

> *. . . a high probability for loss-of-life, non-compliance with the Building Code clauses and a lack of any mitigating features for the proposed buildings, lead to the decision that it is not reasonable for a waiver to be granted under section 72 of the Act.*

[16] MBIE Determination 2016/034

3.5 Existing arrangements: A small community living in a 'high risk zone' with limited opportunity to move forward with confidence

'People' are at the very centre of this issue. Not only are they continuously at risk in terms of being exposed to a life-threatening natural hazard event, they are also struggling to recover from the residual impacts of the 2005 debris flow event.

Residents of the Awatarariki Stream fanhead have been living in a state of uncertainty following the debris flow event in 2005. Some who experienced the event remain severely traumatised twelve years later. Long term uncertainty has taken its toll on this small community. Fatigued, frustrated and apprehensive, the community remains in a difficult position. Many remain in houses that represent their life savings, unable to sell and move on. Market values have been negatively affected (see discussion below) and insurance is costly (or for a few impossible) to obtain. Many are paying mortgages and rates on properties they cannot sell or use. Some have moved off the fanhead, unwilling to return to homes. A few have rebuilt in a small window of time where there was a proposal for protection (DDS), which never eventuated. Others endured the two-year waiting time for a determination decision from MBIE to decide if they can develop properties as originally envisioned, only to find that they cannot.

No matter how Awatarariki residents feel about the 2005 event and the sequence of events that has transpired, the fact remains that they continue to live in a high risk environment. There is strong agreement by experts that the Awatarariki Stream fanhead is a 'high risk zone' for future debris flows. The risk to life safety was assessed as high by Tonkin and Taylor (2015a) according to international assessment systems (New Zealand does not have an assessment system for defining these terms). McSaveney and Davies (2015) reconfirmed this level of risk and recommended a geographical area of high risk that is unsuitable for residential occupation. The risk assessments were also reconfirmed by MBIE during the determination process (2016) and by BOPRC during the RPS Plan Change 2 –Natural Hazards processes (2016). Findings from these studies are discussed in the 'The need for investment' section (Section 3.6).

The existing arrangements on the Awatarariki Stream fanhead and their impacts are summarised in Table 3. Existing arrangements have been categorised into two key factors: residual impacts from the 2005 debris flow event; and the impacts arising from continuous risk to life safety.

Table 3: Existing arrangements on the Awatarariki Stream fanhead

Residual impacts from 2005 debris flow event	Stressed / frustrated community	12 years with no action from Council (despite promises at one stage)
		Perceived inequality as rebuilding was allowed within a small timeframe with proposed DDS
		High rates despite no solution
		Clean-up in some areas is still needed creating an eyesore and a constant reminder (e.g. boulders still evident & cannot be removed because of Koiwi)
	Affordability / financial pressure	Can't sell or develop (MBIE's determination) properties
		Insurance is costly/difficult/or unable to be secured
		Reduced market values of properties
		Unaffordable to move on because can't sell
Continuous risk to life safety	Community acknowledges risk	Community realises a high risk of debris flow exists
		Individual personal tolerance of risk varies.
	Risk assessed by experts as 'high' for residents and visitors	5 fatalities estimated for a similar repeat event
		Historical evidence of larger events
		Climate change may increase the frequency
	Uncertainty	Impacts on individual's health and families
		Stress of bequeathing a problem rather than an asset
		Timing of next event unknown

3.5.1 Market impact of the 2005 event on property values

Research into market valuations on affected properties demonstrates that the impact of the 2005 debris flow and/or the continuous threat to life and property affects today's property values. Findings include that the impact extends further than those properties directly affected, to the wider Matatā community as well.

TelferYoung (2016) carried out valuation assessments of the individual properties that included:

- A pre-event estimated market value at 2005;
- A 2016 market value as if the event never occurred (no restrictions);
- A 2016 market value recognising the unmitigated debris flow risk exposure and building restrictions (with restrictions).

The significant variances between the valuations with and without restrictions clearly illustrates the impact that the 2005 event has had on property values. Table 3 compares average valuations prior to the 2005 debris flow (2005) with today's valuations (2016) for both vacant sections and properties with a dwelling. There is a distinct difference when comparing valuations and considering factors arising from the debris flow (restrictions) or not (no restrictions).

Table 4 also shows the negative impact of the 2005 debris flow event has had on the value of vacant sections in the high risk area. This is also supported by changes to the rating valuations, the

percentage change from 2004 to 2017 was negative 28% for vacant sections (compared to 19% for properties with dwellings).

Table 4: Summary of valuation data for properties, including percentage increases 2005 to 2016 (no restrictions), and 2005 to 2016 (with restrictions)

		2005	2016 (no restrictions)	2016 (restrictions)	2005 – 2016 (no restrictions)	2005 – 2016 (with restrictions)
Sections	**Valuation range**	$100,000 - $750,000	$100,000 - $750,000	$10,000 - $50,000		
	Valuation average	$292,778	$252,222	$23,611		
	% change				-14%	-92%
Properties with dwellings	**Valuation range**	$200,000 - $710,000	$330,000 - $$710,000	$210,000 - $470,000		
	Valuation average	$457,187	$502,188	$338,750		
	% change				10%	-26%

For vacant sections, average valuations show a 92% decrease in market valuations from 2005 when considering today's market values with restrictions (i.e. recognising the 2005 event and the continuous debris flow risk) that have arisen from the 2005 disaster and a 14% decrease with no restrictions (i.e. as if the 2005 event did not occur). In comparison, the percentage change for properties with dwellings is not as substantial with average valuations having a 26% decrease with restrictions and a 10% increase when considering no restrictions. TelferYoung (2016) concluded that the 2005 event has had a major impact on this part of Matatā and to a lesser degree the rest of Matatā's property market:

> *"The saleability of the properties affected has been severe with a high percentage of potential purchasers not willing to take on the potential risk. Values have undoubtedly been impacted significantly. Getting consent to re-build or add improvements since 2005 has been a lot more difficult and very restrictive. The uncertainty of not having the issue resolved for such a long period (eleven years and counting) has clearly added a lot of stress to owners and the community as a whole."*

From the research and analysis of the data that were collated, TelferYoung (2016) also concluded that the Matatā residential market (excluding the affected area) has been impacted from a re-sale and value perspective ever since the event of 2005, although the degree of impact was thought to be more subtle than affected areas:

> *"It is evident that the event has placed a slight stigma on the entire residential market as most buyers are unlikely to do the level of research required to know what areas are potentially at risk. It is likely they would make assumptions that don't match the reality of the situation. "*

3.6 The need for investment – protecting life safety on the fanhead

There is strong agreement by experts that there is a continuous high level of risk to life safety for residents on the Awatarariki Stream fanhead.

Evidence of risk to life safety

- There is a range of geomorphological and other evidence that indicates debris flows, debris avalanches, and/or debris floods may have affected this particular fanhead at approximately 50-150 year intervals. Some events, potentially larger than that experienced in May 2005, have occurred but these are expected to sit outside of the 50-150 year return period.
- Experts have proposed a 'high risk zone' on the Awatarariki Stream fanhead, a geographical area of land containing 45 properties where the level of risk is unacceptable.
- Many properties have an individual loss-of-life risk of 10^{-2} to 10^{-4}
- Societal risks are significant with cumulative risk being in excess of 10^{-3}.
- Risk assessments by experts have estimated a repeat 2005 magnitude event would result in 5 fatalities on the fanhead (18% of the population).
- Internationally, reasonable interpretations typically adopted as the level of tolerable risk is 10^{-4} to 10^{-5}/annum for the person most at risk, with the level of acceptable risk being one order of magnitude less.
- What that means in practice is the risk of deaths on the Awatarariki Stream fanhead is likely to be at least 10 – 100 times greater than that generally considered to be acceptable.

3.6.1 Historical debris flows evident pre-2005 event

As a consequence of research commissioned by the Council after the 2005 event, and consultation with the public, the Council has been made aware that debris flows have occurred in this area in the past, some of a lesser magnitude than the 2005 event, and some of a greater magnitude.

There is geomorphological evidence of debris flows having occurred previously, some potentially larger than the 2005 event. McSaveney et al (2005, p.32) confirm that the land at Matatā has been built by large prehistoric debris avalanches and debris flows over the last 7000 years and reference the following photograph as one example as evidence of a past debris flow at Matatā (refer Figure 11).

Similarly, Tonkin and Taylor (2015) concluded the following:

- Large potentially destructive debris flows have previously occurred on the fanhead of the Awatarariki Stream, as well as other locations around Matatā;
- There is geomorphologic evidence of debris flows potentially much larger than the 18 May 2005 event having occurred previously; and
- There is some evidence of smaller debris flows and/or floods having affected the fanhead at approximately 50 year intervals.

In 2013, GNS Science provided the Council with geomorphic maps of Matatā as well as maps of the 2005 debris avalanches and debris flows around Matatā. Figure12 represents the geomorphic extent of debris flow and debris avalanches at Matatā.

Figure 11: Photographic evidence of large prehistoric debris avalanches and debris flows

Figure 12 indicates that all of Matatā is built on debris deposited during historic and pre-historic debris flows, debris floods and debris avalanches. It is also clear from Figure 9 that there have been debris flows at Matatā much larger than the 2005 event, however the dates of these larger events are unknown.

Dr, The Honourable Ian Shearer (2005) listed 28 floods that have occurred in the eastern Bay of Plenty in the last 137 years, some of which affected Matatā with several confirmed as debris flows. One in 1869 was reported to have destroyed a flour mill on the fan of Awatarariki Stream[17]. The boulders from another in 1950 were illustrated in the Whakatāne Beacon of 1 June 2005. Floods in 1906 and 1939 may also have been debris flows (McSaveney et al, 2005).

Anecdotal evidence from several Matatā residents mention the presence of boulders on their land discovered during digging of the ground. Three residents who experienced the 2005 event confirmed they observed a smaller debris flow in the Awatarariki catchment in 2013 (Schlichting, Schlichting and Harris, 2013).

[17] Residents have subsequently confirmed it is well known within the community that a flour mill with a water wheel used to be situated adjacent to the Awatarariki Stream up to 1869 when it was completely demolished by boulders during a large flood and what is now referred to as a debris flow.

Figure 12: Map of Matatā showing the geomorphic extent of historic debris flow and debris avalanches

3.6.2 Frequency of debris flow events in the future

In relation to the frequency of debris flow events at Matatā, the major uncertainties are not around whether or not a debris flow has occurred in the past, but rather how frequently they have occurred, how big they were, when will the next event occur, and what size will that next event be?

Historical information suggests the recurrence interval for a debris flow from the Awatarariki Stream catchment has been between 50-150 years. The 2005 debris flows were triggered by a rainfall event with rainfall intensity estimated to have a return period of between 200 and 500 years. The volume of debris discharged from the Awatarariki Stream catchment during the May 2005 event was initially estimated at 200,000m^3 (McSaveney et al, 2005). This was subsequently increased to 300,000m^3 (Tonkin and Taylor Ltd, 2009) following light detection and ranging (LiDAR) analysis supported by field survey.

Although there is considerable uncertainty around a specific recurrence interval for a future debris flow from the Awatarariki catchment, there is sufficient evidence to establish that a debris flow event from the Awatarariki catchment can be realistically anticipated in the foreseeable future. It should also be noted a future debris flow event may not require the same rainfall characteristics as those that initiated the 2005 event. High intensity rainfall events of a smaller duration may generate debris flows of different volumes depending on the antecedent sediment availability and ground

moisture conditions existing at that time, combined with an intensity of rainfall sufficient to trigger landslides and transform these into debris flows. Future debris flows may be smaller or larger than the 2005 event. Climate change projections indicate that a higher frequency of extreme weather events can be expected in the future (Ministry for the Environment, 2007). It is not unreasonable to conclude that the frequency of debris flow events will increase as a consequence of climate change.

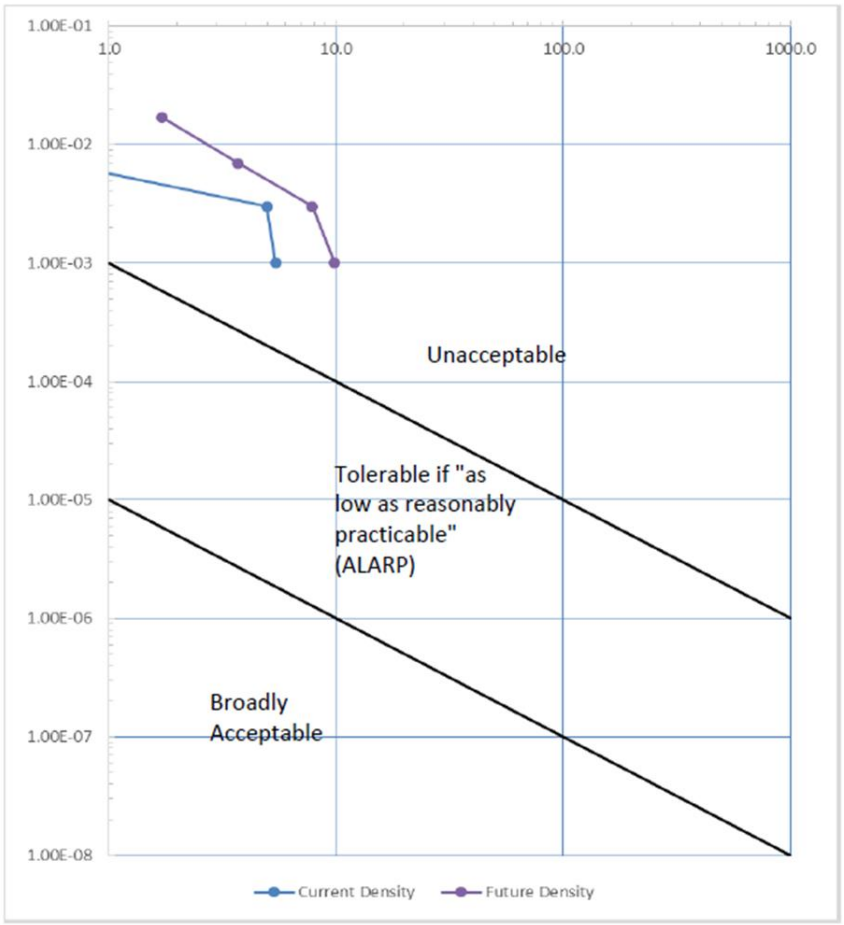
3.6.3 Quantitative risk assessment of the debris flow hazard and defining the high risk zone

A study was commissioned by the Council to confirm the risk rationale and the boundaries of individual annualised loss-of-life risk levels from future debris flows on the Awatarariki Stream fanhead. This was carried out to define the area of land that is considered to have an intolerable loss-of-life risk from future debris flows.

A quantitative risk assessment of the debris flow hazard in the vicinity of the Awatarariki Stream was undertaken by Tonkin and Taylor Ltd (2015a) based mainly on detailed numerical modelling calibrated to observations made of the 2005 debris flow event. A summary of the results of Tonkin and Taylor Ltd's (2015) analysis included:

- The area affected by the 18 May 2005 event is considered to be a high hazard zone.
- The individual annualised loss-of-life risk for the Awatarariki Stream fanhead west of the stream is typically between 10^{-2} and 10^{-4}. This means that there is an annual probability of 1 in 100 to 1 in 10,000 of an individual permanent resident being killed depending on where they live on the fanhead.
- The individual loss-of-life risk east of the stream is significantly lower than the west, which is consistent with the distribution of damage observed in 2005. Nevertheless, some properties have a risk of 10^{-4} or greater, with a larger number being 10^{-5} or 10^{-6}. The steep gradient of these eastern risk contours requires extreme caution to be used when interpreting the risk to individual properties in this area.
- Societal risks are significant and have been plotted by Tonkin and Taylor Ltd on the following Frequency-Number chart (Figure 13) taken from an Australian Geomechanics Society (2017) publication which reflects commonly adopted acceptance criteria. The 'Y" axis represents the frequency of the hazard (F), and the 'X" axis represents the number of fatalities (N). Two scenarios were calculated and plotted. Scenario1 reflects the current number of houses existing in the high risk zone. Scenario 2 assumes all residential sections in the high risk zone were developed.

Figure 13: Frequency-number chart showing acceptable and unacceptable levels of risk



The quantitative risk assessment description and summary of findings by Tonkin and Taylor Ltd (2015) in relation to the Awatarariki Stream fanhead are presented in Tables 5 and 6. When considering risk to people, there is often a distinction drawn between the risk to an individual (i.e. loss-of-life risk) and the risk to groups of people (i.e. societal risk). Included in Table 5 are definitions of the types of risk (summarised from Tonkin and Taylor Ltd's 2015 report). For further information on how risk was assessed refer to the Tonkin and Taylor Ltd (2015)report.

Table 5: Types and levels of risk at Awatarariki Stream fanhead (summarised from Tonkin and Taylor, 2015)

Type of risk	Description	Application to Awatarariki Stream fanhead
Loss-of-life risk	The frequency at which an individual may be expected to sustain a given level of harm from the occurrence of a specified hazard. It is usually reported as an annual probability for the "person most at risk" e.g. the person most at risk has a 1 in 10,000 chance (10^{-4}) per annum of being killed by	New Zealand does not have established criteria for determining whether a particular annual loss-of-life risk is acceptable, tolerable or unacceptable. A number of overseas government and non-government organisations have published what they consider to be reasonable interpretations of these limits with 10^{-4} to 10^{-5}/annum typically being adopted as the limit for tolerable risk for the person most at risk. If such commonly adopted criteria were also to be adopted at Matatā, significant parts of the fanhead would be considered to have an unacceptable level of risk, especially the part west of the stream (Clem

	the hazard.	Elliot Drive area). The value of a statistical life is estimated by Treasury as $4.2 million[18].
Societal risk	This expresses the relationship between the frequency of an event and the number of people suffering from a specific level of harm in a given population. It is usually reported as a set of related probabilities e.g. the annual probability that the hazard will result in 1 or more fatalities in 100 years is expressed as 1 x 10^{-2}, 1 in 1000 years is 1 x 10^{-3}, 1 in 10,000 as 1 x 10^{-4} etc.	A number of different agencies have defined acceptable, tolerable (if reduced as low as reasonably practicable) and unacceptable for societal risk. Tonkin and Taylor (2015) found that the societal risk for Debris Flow Intensity Zones 1 and 2 (which cover much of the fanhead – see Appendix III and the full report for further detail) lie in the unacceptable risk category. Societal risk calculations developed by Tonkin and Taylor (2015) are summarised in Table 3. The modelling concludes that for the current residential density with a 75 percent occupancy rate, a similar event to 2005 (300,000m3 flow) is estimated to result in 5 fatalities, and an event magnitude of 450,000m3 flow is estimated to have 6 fatalities (5.4 rounded up to a whole number).
Property loss risk	The risk to property is usually reported either as a relative proportion of damage to the structure (damage ratio e.g. 60%), or as a dollar value.	The potential for future damage to property was also assessed by Tonkin and Taylor (2015) based on calculated debris flow intensities. The report summarised that significant property damage can be expected to occur for a range of debris flow event magnitudes and that the most significant damage can be expected to occur west of the Awatarariki Stream, although, as was experienced in 2005, some property loss can be expected to the east. They also concluded that the level of property loss can be expected to be very significant should the Clem Elliot Drive area be more developed than it currently is.

Table 6: Summary of societal risk calculations for the current residential density[19]

		Event magnitude and return period (years)			
		50,000m³ flow	150,000m³ flow	300,000m³ flow (approximate 2005 event)	450,000m³ flow
Number of houses	Risk zone 1	0	0	3	3
	Risk zone 2	0	4	5	8
	Total	0	4	8	11
Occupants	Risk zone 1	0	0	7.5	7.5
	Risk zone 2	0	10	12.5	20
	Total	0	10	20	27.5
Vulnerability	Risk zone 1	0.75	0.75	0.75	0.75
	Risk zone 2	0.2	0.2	0.2	0.2
No of fatalities	Risk zone 1	0.0	0.0	5.6	5.6

[18] http://www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis/guide/41.htm

[19] Taken from Tonkin and Taylor (2015), Table 6.4

Risk zone 2	0	0.8	1	1.6
Assumed average occupancy	0.75	0.75	0.75	0.75
Estimated fatalities	0.0	0.6	5.0	5.4
% of total residents killed	0.0	2.2	18.1	19.7

Two of New Zealand's pre-eminent debris flow experts (Professor T. Davies, Department of Geological Sciences, Canterbury University, and Dr.M. McSaveney, Scientist Emeritus, GNS Science) were engaged to peer review the Tonkin and Taylor Ltd quantitative debris flow risk assessment modelling for the debris flow hazard from the Awatarariki Stream. The peer review concluded that:

1. The Tonkin and Taylor Ltd work appropriately acknowledged the uncertainties in the modelling caused by data limitation (one scientifically documented event) and the difficulty in assigning return periods to event magnitudes.

2. Although the software model used is one of the best available, it does not model large woody debris and large boulders well.

3. The Tonkin and Taylor Ltd work is based on the best available information and is fit for purpose.

4. Due to uncertainties that are difficult to quantify, the minimum 'high risk zone' should be that area of the fanhead delineated on the Tonkin and Taylor Ltd map as having an annualised loss-of-life risk of 10^{-5} or greater. This does not imply that a limit of 10^{-5} annual fatality risk be adopted, but rather to be more certain that the area of the 'high risk zone' includes the 10^{-4} limit.

5. Conclusions reached are based on a combination of the model outputs and a review of aerial photographs and boulder logging post event.

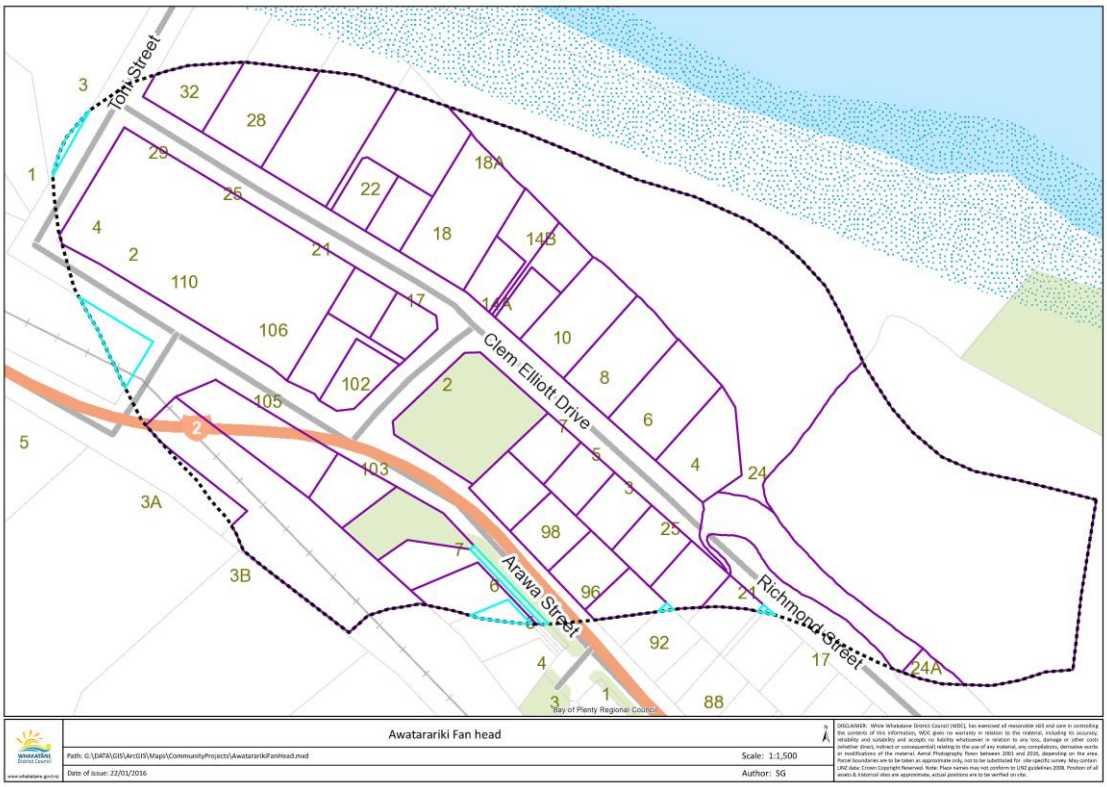
6. Due to the high degree of uncertainties associated with debris flow modelling, a precautionary approach is appropriate because overestimation of the 2005 event could result in underestimation of the overall fatality risk.

7. A poorly quantified residual risk to life exists for occupants of properties outside of the 'high risk zone' area which could be reduced further through extending this zone.

8. There is a need for all stakeholders (including road and rail authorities) to coordinate activities on the fanhead with risks to others in mind.

The finalised 'high risk zone' proposed by the peer reviewers (McSaveney and Davies, 2015) is the geographical area of land within the black hashed lines in Figure 14. This 'high risk zone' contains 45 properties.

Figure 14: Quantitative Debris Flow Risk Assessment – High Risk Zone



A summary of properties together with current occupancy and private/public ownership is provided in Table 7.

Table 7: Number of privately and publicly owned properties in the 'high risk zone'

Description	Privately Owned	Publicly Owned	Total Number
Pre 2005 house continuing	10	0	10
Pre 2005 house rebuilt	6	0	6
Total homes 2015	16	0	16
Pre 2005 house now vacant site	4	1	5
Site vacant pre & post 2005	14	10	24
Vacant sites 2015	18	11	29
TOTAL SITES	**34**	**11**	**45**

3.7 Risk Comparisons

In the absence of any national guidance or regulation, the Australian Geomechanics Society Practice Note Guidelines for Landslide Risk Management (2007) were considered by the Council's expert advisors as an appropriate methodology to follow to undertake a quantitative assessment of debris flow risk to Awatarariki Stream fanhead properties. The Christchurch City Council also referenced these guidelines when determining intolerable levels of risk for properties below the Port Hills escarpment exposed to boulder roll hazard. The guidelines suggest an intolerable risk threshold of 10^{-4} for existing risk and 10^{-5} for new development (Table 1, p.77).

The levels of annualised life safety risk that exist on the Awatarariki Stream fanhead range from greater than 10^{-2} through to less than 10^{-6}. The Council adopted the peer reviewers' recommendation to retreat from the area of the fanhead delineated on the Tonkin and Taylor Ltd

map as having an annualised loss-of-life risk of 10^{-5} or greater. In making this decision, the Council noted the peer reviewers' comments that uncertainties existed around the boundary of the 10^{-4} limit and therefore there was a need to be conservative when defining a minimum area of retreat in order that the risk was not understated. The area of retreat therefore represents that area of land that has a conservative loss of life risk equal to, or greater than, 10^{-4}.

Following the findings of the Royal Commission of Inquiry into the Canterbury Earthquakes, the Department of Building and Housing (now MBIE) commissioned a study into a risk framework to support an earthquake-prone building policy review. The study included an assessment of earthquake risk against other risks within New Zealand using a number of single metric comparisons. The annualised loss of life metric was presented as a series of tentative ranges in Figure 9 of the study report (Taig et al., 2012, p.21). In every case, the risks shown in the Figure are the subject of some form of intervention to reduce the risk to a level that is more societally acceptable. In order to provide a perspective of where the Awatarariki Stream fanhead debris flow risk fits into a broader New Zealand context, the Awatarariki fanhead annualised loss-of-life risk, as modelled by Tonkin and Taylor Ltd and peer reviewed by McSaveney and Davies, was added to the Taig Table 5 diagram and reproduced as Figure 15 below. It is clear from Figure 15 that the life safety risk in the Awatarariki high debris flow risk area is at a level that requires a risk reduction intervention.

Figure 15 Comparisons of Loss of Life Risk

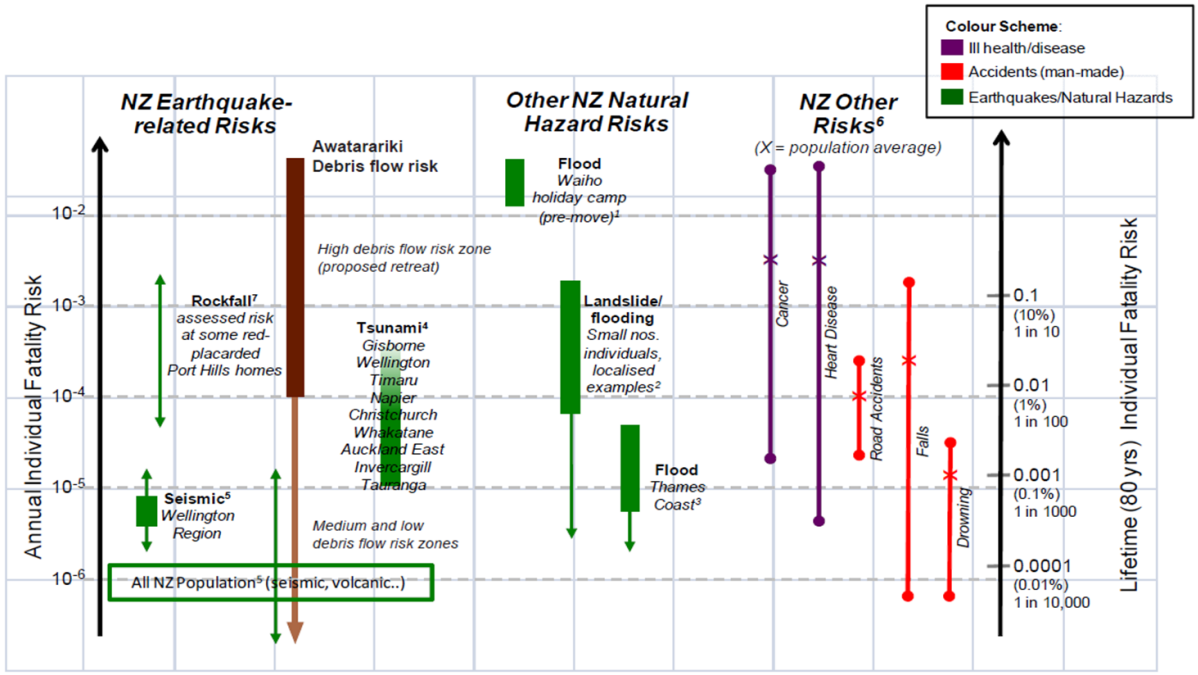


Figure 9: Selected Individual Risk Comparisons

Notes on Figure 9:

1. *Derived by the author from results of 2002 Optimx risk assessment for MCDEM*
2. *Estimated by the author for Waihi & Aoraki Villages and Matata – see GNS Consultancy Report 2011/319*
3. *Upper estimate (URS, 2003) for High Risk zones; arrow denotes wide range of risks downward*
4. *AIFR at 2-4m above sea level, no effectiveness assumed for warning (Webb, 2005)*
5. *Averages over large populations; arrows denote likelihood of substantial groups of people at higher/lower risk*
6. *Bars show range of values across age bands for men and women (NZ Ministry of Health, 2008)*
7. *Based on recent GNS risk assessments for rockfall and cliff collapse – see GNS CR 2011/311 and CR 2012/57*

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3.8 The case for change

The Consensus Development Group (CDG) workshops provided a community view on the investment drivers and the need to invest in change. The stakeholders identified and agreed that the key problem that needs to be addressed is the risk to life safety of the residents of the Awatarariki Stream fanhead.

Life safety remains the key driver of this proposal, however, it became clearly evident through the CDG workshops from property owner participants that the uncertainty surrounding the future use of their land and homes has lasted too long (nearly 12 years with still no certainty) and consequently has affected people's health, wellbeing, families and finances. Some of this may have stemmed directly from the 2005 event, but much of it was attributed to the long term uncertainty the community has been living with. Essentially, the community has not been able to recover from the 2005 debris flows. This has resulted in a frustrated, stressed and fatigued community with limited resilience[20].

After further consideration of the community's concerns and the Government's commitment to the Sendai Agreement, the Project Team added a second investment objective. The investment objectives for this business case are to:

1. Protect the life safety of the residents at the Awatarariki Stream fanhead.

2. Create a state of certainty as the basis for Matatā town and its community to recover from the 2005 event and to support future community resilience.

Although there is a lot of scientific information in this IBC (for example, about debris flow modelling and risk assessments) it is vital not to lose sight that this is addressing a 'community issue'. In essence it is about the people that live and/or own property in the area deemed to be 'high risk'.

The case for change for each objective is summarised in Table 8.

Table 8: Summary of the existing arrangements and business needs

Investment Objective One	**To protect the life safety of the residents at Awatarariki Stream fanhead.**
Existing arrangements	Future debris flows from the Awatarariki Stream catchment continue to pose a significant risk to residents' life safety (individual loss-of-life risk is greater than 10^{-4} for many). Societal risks for much of the fanhead are significant and sit well outside international commonly adopted loss-of-life risk acceptance criteria. Risk of damage to property is significant for a range of debris flow event magnitudes, with greatest damage expected to occur to the properties located west of the Awatarariki Stream. Risk modelling has identified at least 45 properties, including 16 homes that are considered to be in the 'high risk zone' from future debris flows (Tonkin and Taylor, 2015).
Business needs	To protect the life safety of the residents of the Awatarariki Stream fanhead from a repeat debris flow event.
Potential scope	A core requirement is to reduce the risk to life from a High level to a Medium level based on an

[20] The Sendai Framework for Disaster Risk Reduction references the United Nations Office for Disaster Risk Reduction definition of "resilience" which is: "The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management."

	event magnitude of 300,000m^3 debris flow (as modelled by Tonkin and Taylor and reviewed and updated by McSaveney & Davies, 2015). A more desirable solution would be to reduce the risk to a Low level for an event magnitude of 450,000m^3 flow.
Potential benefits	The risk to life safety of Awatarariki Stream fanhead residents from a repeat debris flow is significantly reduced. KPI1: Residual risk is assessed as an annualised loss-of-life risk of less than 10^{-5} KPI2: The number of people residing on the Awatarariki Stream fanhead exposed to a high loss-of-life risk from future debris flows is minimised. KPI3: The level of risk is reduced from "high" to at least "medium" to meet statutory obligations under the RPS.
Potential risks	A repeat debris flow event occurs before action is taken resulting in loss-of-life, injury and property damage. A lack of commitment to the project by external agencies. Incurring high costs doing investigative work and not securing additional funding from external agencies. Awatarariki property owners and residents do not support the preferred way forward. Iwi oppose the retreat proposal. A future MBIE determination is inconsistent with Determination 2016/034. BOPRC does not support the preferred way forward and does not exercise its powers to extinguish existing use rights under s10(4) of the RMA. Pressure from non-Matatā ratepayers to not proceed with the project.
Constraints & dependencies	The regional framework for natural hazard management is prescribed in Plan Change 2 to the Regional Policy Statement. Credibility of the engineering evidence underpinning the risk assessment. Level of commitment from regional and/or central government. Willingness of Awatarariki Stream fanhead residents to retreat. Adequate funding secured from external partners.

Investment Objective Two	**To create a state of certainty as the basis for Matatā town and its community to recover from the 2005 event and to support future community resilience.**
Existing arrangements	Property owners have endured a state of uncertainty over the last 12 years. Uncertainty has come from a multitude of sources, including: • when a repeat event will occur that places themselves and their property in danger; • an engineering option proposed as a protection measure was subsequently found to not be viable; • no alternative engineering solution being identified as viable; • changes overtime to the ability to (re)develop properties through the Building Act; • the ability to continue to reside on the Awatarariki Stream fanhead in the future; • the ability to obtain property insurance; • the inability to sell property. Uncertainty has affected fanhead residents and property owners in many ways, in terms of negative impacts on health, families and finances. This has resulted in a stressed, frustrated and fatigued community that has been unable to recover from the 2005 debris flow event.
Business needs	• To establish an opportunity for Awatarariki Stream fanhead property owners to move forward with their lives with certainty; • To develop a safe and resilient community that can continue to contribute benefits to the Whakatāne District, the Bay of Plenty region, and New Zealand as a nation. • A fair and equitable way forward is implemented for those Awatarariki fanhead property

	owners.
Potential scope	A core requirement is for a fair and equitable decision to be made about the future of property owners within the high risk zone, known as the Awatarariki Stream fanhead. A more desirable solution is that the implementation of this decision occurs in the short-term (before 2020).
Potential benefits	A base of certainty is established from which the community can recover from the 2005 debris flow disaster, ensuring future existence and growth. Certainty will support social, economic and cultural opportunities in Matatā. Rezoning of the land to reserve optimises a low risk activity use of the land and provides continuity of the coastal reserve between the Tarawera River and Otamarakau. KPI4: Proportion of property owners that take-up the retreat offer and voluntarily relocate from the high risk zone. KPI5: Number of dwellings in Matatā township. KPI6: An increase in the level of 'liveability' (reflecting wellbeing and safety) in the wider Matatā township.
Potential risks	A repeat debris flow event occurs before action is taken resulting in loss-of-life, injury and property damage. A lack of commitment to the project by external agencies. Incurring high costs doing investigative work and not securing additional funding from external agencies. Awatarariki property owners and residents do not support the preferred way forward. Iwi oppose the retreat proposal. A future MBIE determination is inconsistent with Determination 2016/034. BOPRC does not support the preferred way forward and does not exercise its powers to extinguish existing use rights under s.10(4) of the RMA. Pressure from non-Matatā ratepayers to not proceed with project.
Constraints & dependencies	Level of commitment from regional and/or central government. Willingness of Awatarariki Stream fanhead residents to retreat.

Many of the wider benefits from this proposal relate to the concept of 'livability', which is incorporated in KPI6. This concept has become increasingly popular in international planning and policy circles. Livability is essentially about the sum of the factors that make a community a desirable place to live. Research by the University of Melbourne and the Department of Health, Government of Victoria, to identify and evaluate livability indicators adopted the following definition for 'livability':

> *"Livability reflects the wellbeing of a community and comprises the many characteristics that make a location a place where people want to live now and in the future"* (Lowe et al., 2013).

In addition, Lowe et al (Ibid., p11) conceived a livable place to be one that is "safe, attractive, socially cohesive and inclusive, and environmentally sustainable . . ."

'Livability' has decreased substantially for owners of properties on the Awatarariki Stream fanhead over the last 12 years. As described in Table 7, uncertainty has affected fanhead residents and property owners in many ways, in terms of negative impacts on health, families and finances. This has resulted in a stressed, frustrated and fatigued community. The need to invest is therefore not only about protecting life-safety in the high risk zone, it is also about providing an opportunity for:

- those affected property owners to finally move forward with their lives; and
- the wider Matatā township to recover from the 2005 event;
- the wider Matatā township to develop a safe and resilient community that can continue to exist, grow and prosper and contribute to the wider Whakatāne District.

3.9 Consistency with previous decision-making

In making any decision to contribute funding to a managed retreat package, precedent is always a relevant factor. However, precedent can often be answered by a case-by-case distinction according to the circumstances of each case.

The Awatarariki debris flow risk management programme has involved a risk-based approach to natural hazard management that is supported by community engagement, to manage an identified high risk situation that has no viable engineering solution, i.e. it is both unacceptable and unmanageable. The process has followed an integrated, structured, evidence-based approach to resolving a long-standing high risk natural hazard community issue. Implementation of the solution will require collaborative funding arrangements between the Government, BOPRC and WDC. The overall approach, process, and implementation of the solution, provide a highly transferable and effective management framework that the Government and local authorities are able to utilise elsewhere to resolving situations involving natural hazards where the following criteria apply:

- The risks to human life from the hazard have been accepted as being unacceptable; and
- There are no viable alternative life-risk-reduction strategies available (such as warning and evacuation and/or construction of mitigation measures), and
- The costs to manage the risk are beyond the fiscal capability of the local authority to manage.

These criteria do not apply to all natural hazard situations.

In terms of consistency with previous decision-making, examples of Government intervention to reduce natural hazard risk to communities include:

- Little Waihī village at the southern end of Lake Taupō where two large landslide events in 1846 and 1910 caused 64 fatalities and one fatality respectively, and resulted in the majority of the village being relocated north of the landslide zone following the 1910 event (Taig et al, 2012).
- In 2002, as a consequence of the quantified and very high landslide-dam break-flood risk to several properties on the west side of the Waiho River at Franz Josef, Westland, the Ministry of Civil Defence and Emergency Management decreed that a number of dwellings, including the Franz Josef Holiday Park and Franz Josef Lodge, be relocated from the high risk zone (https://www.beehive.govt.nz/release/civil-defence-issues-hazard-warning-waiho-area-0).
- The Department of Conservation (DOC) adopted a strategy in 2004 to relocate dwellings exposed to high debris flow risk at the Aoraki Mount Cook village. The DOC strategy adopted was: *"Existing facilities subject to natural hazards at unacceptable levels will be relocated to safer ground, as resources permit. Where no safer alternative is available the facility may be closed as a temporary measure during times when the risk is considered by the Area Manager to be unacceptably high."* (DOC, (2004) cited in Taig et al, 2012, p.21).
- Port Hills red zone in Christchurch where owners of properties exposed to an unacceptably high boulder roll risk were paid to retreat from the hazard.

These four examples satisfy the criteria outlined earlier. The preferred solution in each was to reduce disaster risk by retreat of the high risk areas away from the hazard. In addition to the

Awatarariki fanhead situation also satisfying all of the criteria, the following additional factors stand out as points of difference:

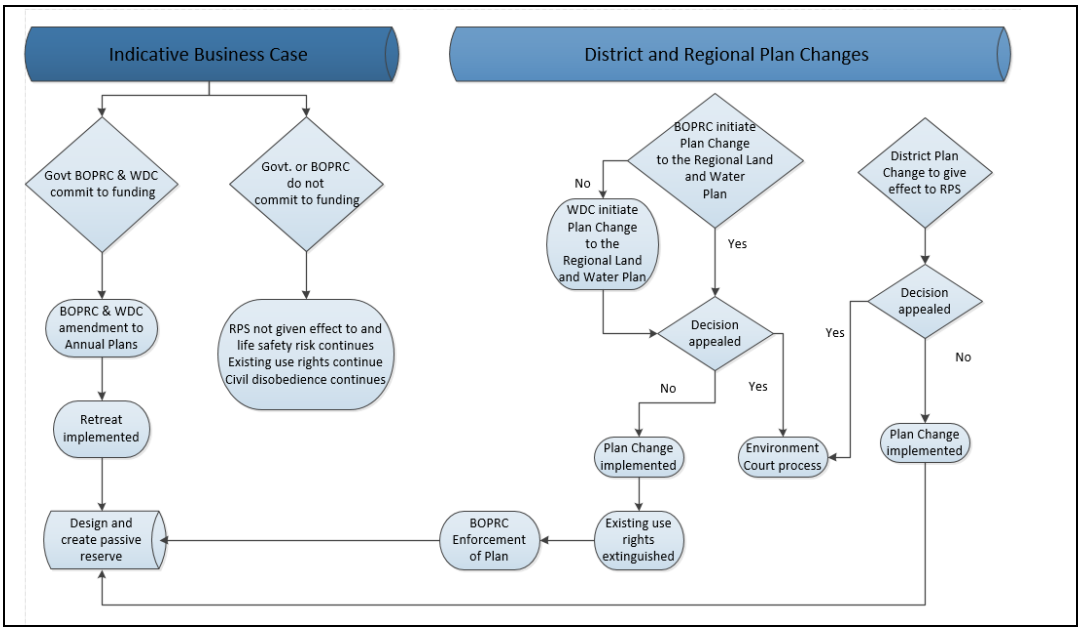
- Extended and meaningful engagement with the community has occurred with the majority of the affected community supporting the retreat proposal developed by the Council; and
- A previous Government accepted that an intolerable level of risk to the Awatarariki fanhead community existed and made a commitment to assist with implementing a solution; and
- Implementation of the solution is shared between the three levels of government, all of which have various responsibilities to manage natural hazard risk for New Zealand communities.

In situations similar to the debris flow risk to the Awatarariki Stream fanhead properties at Matatā, the Awatarariki managed retreat proposal will create a precedent in terms of the collaborative nature of the process and implementation of the solution. This is a positive consequence as previous precedent examples have been Government initiatives largely driven and funded by Government. If the proposed Awatarariki solution is implemented, it reflects delivery of an achievable solution through a community-focused, multi-agency, collaborative, partnership, problem-solving process. This type of process has a lot of advantages over historical arrangements and provides a pathway forward as disaster risk reduction-based natural hazard policy intent starts to be realised in practice. Not only is the Awatarariki managed retreat proposal a highly workable solution, it is much preferable to leaving a 12 year problem unaddressed and the residual risk unmanaged.

3.10 Potential decision pathways for consideration

Potential decision pathways for this proposal are shown in Figure 16. Although not legally required, the Council considers there is a moral obligation for public agencies to invest in retreat from high risk natural hazard situations that satisfy certain risk criteria. Successful managed retreat requires incentivised acquisition of identified at-risk properties via an appropriate and transparent procedure that involves property owners. In the case of the Awatarariki debris flow risk, indicative retreat offers have been discussed with all affected property owners and are based on 2016 market values (without taking the 2005 debris flow event in to account). A significant majority are interested in seeing the property acquisition offer delivered.

Figure 16: Decision tree showing potential course of decision making



Parallel to this process, a change to the District Plan has been initiated to rezone the high risk zone on the Awatarariki Stream fanhead from Residential to Reserve. This signals the Council's position that no new development should occur in this area. It also aligns with the Plan Change 2 – Natural Hazards to the RPS, which sets out that district and regional councils are required to take steps to reduce high natural hazard risk. Although the planning process is separate to this IBC, it is helpful to consider the full picture, including the potential pathways for decision-making.

If managed retreat from the high risk area is unsuccessful, the Council has exhausted all but one option available to address this issue. The only other available option is for Council to lodge a private plan change request with the Regional Council to extinguish existing use rights in the high risk zone on the Awatarariki Stream fanhead.

3.11 Conclusions from the strategic assessment

The Strategic Case clearly illustrates that there is a compelling case for change and a need for investment to reduce the risk to life safety of Awatarariki Stream fanhead residents to a tolerable level.

There is strong agreement by experts that the Awatarariki Stream fanhead is a 'high risk zone' for future debris flows. International, national, regional and local strategic directions to strengthen natural hazard risk management have been set. It is considered appropriate that an intervention is required to reduce the high risk to life and property damage from damaging future debris flows. Detailed investigations have confirmed that no engineering intervention is available. The recommended managed retreat intervention will support the community to recover from the 2005 debris flow event and will foster community resilience for the future.

The need to invest is summarised in the following key points.

- *There is irrefutable evidence that there is a continuous and intolerable risk to life safety for those residing on the fanhead, with no possibility of reducing that risk by engineering:* There is geomorphological evidence of past debris flows, some more significant than that experienced in 2005, which destroyed 27 houses, damaged 87 other properties, and caused

about $20 million in damage. Future debris flows at Awatarariki continue to pose a significant risk to residents' life safety (individual loss-of-life risk is greater than 10^{-4} for many). Societal risks for much of the fanhead are also significant. In addition, risk of damage to property is likely to be significant for a range of debris flow event magnitudes.

Quantitative debris flow risk assessments by Tonkin and Taylor (2015) have identified individual and societal loss-of-life risk levels across the fanhead. In recognising the inherent constraints of the modelling, expert peer reviewers (Davies and McSaveney (2015)) recommend retreat from an area that has been modelled as having an annualised loss-of-life risk of 10^{-5} or greater.

- *Members of the affected community have not recovered from the 2005 event and need an opportunity to move forward with their lives:* There is strong community support for a decision that will provide certainty of outcome for property owners. Investment in this proposal would create confidence for people to be able to move forward with their lives. It would also support the wider Matatā community to recover from the 2005 natural hazard disaster ensuring future existence and fostering community growth and resilience.

- *The community recognises the continuing debris flow risk and is calling for a decision:* The community agrees that there is a significant risk to residents, although it is also recognised that individual personal risk tolerance varies throughout the community. Other points of community agreement are that doing nothing is not an option that is desirable to any party and that a managed retreat offers the best solution.

  In relation to funding sources associated with a decision, landowners consider that management of the natural hazard risk they are exposed to is a national issue rather than a local issue and believe that they should be entitled to a Government package consistent with that offered to earthquake-affected property owners in Canterbury.

- *There is a robust policy framework in place signalling that action needs to be taken:* Natural hazard management is a key issue for New Zealand and its importance has started to be reflected in all levels of government and local government policy, statute, and planning frameworks. The Government, regional councils and territorial authorities all have responsibilities to fulfil when life safety of people has been identified. The BOPRC's RPS requires high natural hazard risk to be reduced. To achieve a safe community, it is clear that investment is needed to minimise loss-of-life risk on the Awatarariki fanhead.

- *Transferability:* The Awatarariki retreat proposal provides a workable solution to an un-mitigatable natural hazard risk that is highly transferable. It provides a pathway to achieve a good community outcome involving the community and the three levels of government, and features robust scientific rigour and collaborative partnerships.

4.0 The Economic Case – exploring the preferred way forward

The purpose of the economic case is to identify the investment option that optimises value for money. Having determined the strategic context for the investment proposal and establishing a robust case for change, this part of the economic case:

- identifies critical success factors
- generates a wide range of long-list options
- undertakes an initial options assessment to identify a limited number of short-listed options, and
- identifies a preferred way forward based on the short-listed options.

4.1 Potential business scope and key service requirements

The potential business scope and key service requirements were identified and assessed by the Consensus Development Group (CDG) members during the workshops held between March and May 2016. These were later updated by the Project Team and are summarised in Table 9.

Table 9: Potential business scope and key service requirements

Service Requirements (in decreasing order of relevance compared to investment objectives)	Scope Assessment			
	Minimum Scope	**Intermediate Scope**	**Maximum Scope**	**Out of Scope**
Scope ***magnitude of possible debris flow from Awatarariki Stream***	< 300,000m^3 flow	300,000m^3 flow (approximate 2005 event)[21]	450,000m^3 flow	Debris flows from other streams along the Matatā Escarpment.
Service solutions	Monitoring and site-specific improvements / works to protect individual properties	Engineering solutions to protect the fanhead community	Planning options for retreat	Debris retention deflection structure within catchment or on the fanhead
Service delivery	Individual property owners	WDC	Regional or central govt	External party
Implementation	Defer	By 2036	By 2026	Post 2036
Funding	Individual property owners	Combination of WDC, BOPRC & Central Govt. via retreat package offered to property owners.	One of: • WDC • BOPRC • Central Govt.	

[21] This refers to the updated work following Davies & McSaveney's peer review of Tonkin and Taylors Ltd's (2015) report.

4.2 Critical success factors

The following critical success factors (Table 10) were identified and discussed by the CDG during the workshop series and later refined by the Project Team at the options workshop held on 10 May 2016. The following generic descriptions were agreed as being crucial to the successful delivery of the project.

Table 10: Critical Success Factors

Generic Critical Success Factors	Broad Description	Proposal-Specific Critical Success Factors
Strategic fit and business needs	How well the option meets the agreed investment objectives, related business needs and service requirements, and integrates with other strategies, programmes and projects.	• Aligns with international accords • Aligns with current international best practice. • Aligns with RMA changes and RPS.
Potential value for money	How well the option optimises value for money (i.e., the optimal mix of potential benefits, costs and risks).	• Fit for purpose or the right option at the right time at the right price.
Supplier capacity and capability	How well the option matches the ability of potential suppliers to deliver the required services, and is likely to result in a sustainable arrangement that optimises value for money.	• Sustainable arrangement
Potential affordability	How well the option can be met from likely available funding, and matches other funding constraints.	• Affordable within the forecasted capital funding of WDC and external funding partners.
Potential achievability	How well the option is likely to be delivered given the organisations ability to respond to the changes required, and matches the level of available skills required for successful delivery.	• Politically acceptable at local, regional and national level • Acceptable to key stakeholders (including iwi). • Operationally and physically achievable.

4.3 Long-list options and initial options assessment

A wide range of options has been generated in accordance with best practice through a series of workshops with the CDG (refer to methodology section and Appendix IV), and then later with the Project Team. Potential options for meeting the investment objectives were considered within the boundaries determined by the scope and constraints. The long-list was generated by considering potential solutions within the five dimensions of choice listed in the left hand column of Table 10.

An initial appraisal of the long list was undertaken to filter out options that were less likely to offer value for money, and to determine a short list for further economic appraisal. Each option was assessed against how well it met the investment objectives and critical success factors. Additional assessments against available evidence on potential costs, benefits and risks were undertaken before arriving at a moderated overall score.

A three-point ranking basis was agreed as being fit for purpose, as follows:

√ √ meets the criteria

√ may met the criteria

X does not meet the criteria

This process resulted in options either being removed from further appraisal, carried forward to the short-list for further consideration, or identified as a preferred way forward. Some options were also carried over to the shortlist as a base case option. This acts as a baseline for comparing marginal costs and benefits of alternative investment options or courses of action.

A summary is provided in Table 10. The full long-list options assessment is shown in Appendix IV.

4.3.1 Service scope – what levels of coverage are possible?

Planning for an event that has a magnitude of less than 300,000m^3 (less than the 2005 event) is considered unacceptable because of the level of residual risk to residents' life safety. Scope options SCO1-3 do not, therefore, meet Investment Objective 1. As discussed above, local government has a responsibility to act to avoid or mitigate the life safety risks to Awatarariki residents through the RMA and LGA.

Although scoping options SCO1-3 are discounted, SCO1 is carried through as a baseline comparative for assessing value for money (VFM).

SCO4 is the preferred option as this meets the investment objectives and critical success factors as well as aligning with the Building Code. The Building Code specifies an annual probability of exceedance ultimate limit state design standard of 500 years for wind and earthquake hazards for residential housing. Davies (2005, p.6) proposes that it seems logical to apply the annual probability of exceedance for ultimate limit states for wind and earthquake to debris flows. That line of reasoning was accepted by MBIE in Determination 2016/034. What that means in practice is that, in the absence of mitigation, the risk of deaths on the Awatarariki Stream fanhead is likely to be at least 10 – 100 times greater than that generally considered to be acceptable.

4.3.2 Service solutions – how can services be provided?

Catchment monitoring, engineering and planning solutions have been considered as possible service solutions. For ease of reading, they are represented in Table 11 as separate service solutions but should be viewed as a continuous list.

Engineering service solutions

A description of engineering options assessed, included:

- *On-Site Mitigation to protect existing property* – measures to protect a specific property from the natural hazard using, for example, property specific bunds. Apart from the questionable practicality of designing effective site-specific mitigation measures, a significant constraint to this solution is that the mitigation measures are not permitted to create an adverse effect on other properties during a predictable event.

- *Channel Out to Sea* - the flood diversion channel (also called the "chute-to-sea") diverts large flood and debris flow events away from the existing Awatarariki Stream and directly to the sea.

  Bund to Protect the East - protects the Matatā residential area with an earth bund that deflects the debris flows to the west.

Table 11: Possible long-list options classified by the five dimensions of choice

Dimension	Do Minimum . . .		Intermediate . . .		More ambitious . . .
Scale, scope and location In relation to the proposal, what levels of coverage are possible?	SCO1: Status Quo	SOC2: Plan for a magnitude of flow of: 50,000m3 (50-100 yr. return)	SCO3: Plan for a magnitude of flow of: 150,000m3 (100-250 yr. return)	SCO4: Plan for a magnitude of flow of: 300,000m3 (200-500 yr. return)	SCO5: Plan for a magnitude of flow of: 450,000m3 (500-1000 yr. return)
	Continued for VFM	**Discount**	**Discount**	**Preferred**	**Possible**
Service solution: Engineering options How can services be provided?	SOLE1: No works	SOLE2: Catchment monitoring / early warning system	SOLE3: On-site mitigation measures to protect existing	SOLE4: Bund to protect the east.	SOLE5: Channel out to Sea
	Discount	**Discount**	**Discount**	**Discount**	**Discount**
Service solution: Planning options How can services be provided?	SOLP1: Stay accept risk & build	SOLP2: Stay, protect existing & escape	SOLP3: Managed retreat for existing dwellings only	SOLP4: Managed retreat (dwellings & undeveloped sections)	SOLP5: Compulsory retreat
	Discount	**Discount**	**Possible**	**Preferred**	**Possible**
Service delivery Who can deliver the services?	SD1: Individual property owners	SD2: WDC	SD3: WDC & BOPRC	SD4: BOPRC	SD5: Central Govt.
	Discount	**Preferred**	**Possible**	**Possible**	**Possible**
Implementation When can services be delivered?	IM1: Defer decision and project	IM2: Deliver by 2036	IM3: Deliver by 2026	IM4: Deliver by 2020	
	Discount	**Possible**	**Possible**	**Preferred**	
Funding How can it be funded?	F1: Property owners	F2: Property owners & local govt.	F3: WDC, regional council & central govt. via retreat package	F4: Central govt. (compulsory retreat)	F5: BOPRC (compulsory retreat) No retreat package
	Discount	**Possible**	**Preferred**	**Possible**	**Possible**

Table 11 illustrates that all five engineering solutions were discounted from further analysis. Solutions SOLE1, 2, 3 and 5 (respectively no works, on-site mitigation to protect existing, and the creation of a channel out to sea) were discounted as they did not meet the core objective to protect the life safety of residents. Monitoring of the catchment and placement of an early warning system (SOLE2) was investigated by GNS (2015). GNS concluded that:

> *Given the velocity and volume of potential debris flows in the Awatarariki catchment and the risk to residents and road and rail users, it is unlikely that an early warning system based on detecting a debris flow once it initiates would be effective. This is because there would be little notification time between: i) the identification of a debris flow, ii) a warning being issued and acted upon, and iii) the debris reaching the at-risk people and infrastructure.*

An engineering review of the Channel to the Sea proposal (SOLE5) also confirmed the proposal was fatally flawed from an engineering design basis.

Option SOLE4 (Bund to protect the east) was also discarded. Although SOLE4 possibly could meet the investment objective to protect life safety of residents, road and rail corridors through the bund create complexity and present an unquantified residual risk. It was also questionable whether SOLE4 represented an option that delivered sustainable value for money. Option SOLE4 also represents a very expensive option to develop and maintain, and therefore was deemed unaffordable.

Planning service solutions

Five planning solutions were also assessed. SOLP5 (stay, accept risk and build) and SOLP6 (stay, escape and plan change) were both discarded from further assessment as neither protect life safety of residents.

All three retreat options (SOLP7-9) were considered worthy of further assessment. The 'managed retreat' option (SOLP8) is the preferred option as this is considered more societally acceptable than the 'managed retreat for existing dwellings' (SOLP7) resulting in those with undeveloped sections being left with unusable land. SOLP8 was considered more politically acceptable than the 'compulsory retreat' option (SOLP9). All three options (SOLP7-9) have associated affordability issues for one or more parties.

4.3.3 Service delivery – who can deliver the services?

Option SD1 (individual property owners) is removed from further analysis. It is considered unachievable for residents within the high debris flow risk area to protect their own life safety from this natural hazard.

The ability of property owners to construct physical works to mitigate the debris flow risk is also not viable. Not only is the ability to construct a building to resist debris flows problematic, but an isolated mitigation structure on one property would potentially increase adverse effects on adjoining properties which is not permitted by the Building Act or Resource Management Act. This matter was robustly tested by the Council and other stakeholders through a two year Building Act determination process which concluded that Council was correct in refusing to issue building consents for two new

dwellings on the Awatarariki Stream fanhead by not granting a waiver from the structural provisions of the New Zealand building code[22].

An early warning system was investigated as a mechanism to warn road and rail users and any dwelling occupants of the possible imminent hazard of a dangerous debris flow in the catchment. Based on advice from GNS, it was concluded that an early warning system was not a viable risk mitigation option for the debris flow hazard from the Awatarariki Stream catchment.

Although residents have indicated varying degrees of acceptance of natural hazard risk, the WDC, BOPRC, and Government, all have overarching legislative responsibilities to act on behalf of communities to reduce or mitigate risk to life safety from natural hazards.

Service delivery by WDC (SD2, SD3, SD4), and BOPRC or central government (SD5) are all carried forward for further analysis. The preferred option is SD2. This is considered more politically acceptable than either the regional council or central government delivering the service. These options would also assume the implementation of a compulsory retreat using regional council powers to revoke existing use rights under sections 2A and 30 of the RMA or central government invoking new legislation, similar to the process followed after the 2010-11 Christchurch earthquakes.

4.3.4 Implementation – when can services be delivered?

The continuing debris flow risk to residents of the Awatarariki Stream fanhead and their property is a long standing issue. It is considered preferable to address this issue by 2020 (IM4) to meet both investment objectives, i.e. to minimise risk to life safety and to provide certainty to landowners. The option to defer implementation (IM1) was therefore discounted from further analysis.

4.3.5 Funding – how can it be funded?

The preferred funding option is F3, a mix of funding sources including WDC, BOPRC and central government via a 'retreat package' offered to property owners. Under this option Council would make a 'one time only' retreat offer to property owners based on a fair and reasonable valuation assessment of properties. It should be noted that WDC does not have the statutory ability to force property owners to retreat.

Option F3 is considered more favourable in a political sense than either central government (F4) or BOPRC (F5) being sole funding providers. As discussed above, F4 and F5 are linked to a compulsory retreat option being developed with/without a retreat package on offer to property owners.

Funding option F2 may also be possible (funding by individual property owners, WDC/BOPRC), although this would need a longer implementation time (e.g. by 2036) which therefore carries residual risk to life safety of residents. Central government funding may also still be required for F2.

4.4 Short-list options

On the basis of the initial assessment of the long-list options (by dimension), the following short-listed options were selected for further economic analysis. Options are all variations of retreat that can be differentiated by whether they are:

- For existing dwellings only, or all properties (dwellings and vacant sites);

[22] Refer Ministry of Business Innovation and Employment Determination 2016/034

- Managed retreat (with retreat package) or compulsory retreat (no retreat package probable);
- Magnitude 300,000m^3 (similar to 2005 event) or 450,000m^3 event (larger than 2005 event);
- Implemented by 2020 or 2036.

Managed retreat refers to the property owner having a choice to stay or relocate away from the high risk zone within a stated timeframe. Managed retreat options also include a funding package to incentivise property owners to relocate. The compulsory retreat option includes no choice for property owners and potentially no funding package as there is no legal requirement for BOPRC or Government to provide assistance in this way.

Table 12 provides a summary of each option's characteristics and a full description is also provided below.

Table 12: Characteristics for each proposed option.

Option	Planned for event magnitude of:	Risk assessed as:	Choice to stay or go?	How many properties affected?	Timeframe	Delivered	Funded
0	none	-	√	-	-	-	-
1	300,000m^3	5 fatalities in 200 yrs	√	16 homes	2020	WDC	WDC BOPRC Central Govt.
2	300,000m^3	5 fatalities in 200 yrs	√	16 homes 18 vacant sections	2020	WDC	WDC BOPRC Central Govt.
3	450,000m^3	5.4 fatalities in 500 yrs	√	18 homes 18 vacant sections	2036	WDC	WDC BOPRC Central Govt.
4	450,000m^3	5.4 fatalities in 500 yrs	X	18 homes 18 vacant sections	2020	BOPRC or Central Govt.	Property owners BOPRC Central Govt.

The short-listed options are :

- **Option 0: Status quo** – to be used as the baseline comparator.

- **Option 1 (do minimum): Managed retreat of existing dwellings in high risk zone (300,000m^3 event), short timeframe, and Plan Changes**
  Managed retreat for existing dwellings only (16 homes), based on magnitude event of 300,000m^3, delivered by WDC by 2020, and funded by central and local government through a retreat package.

A magnitude 300,000m^3 event has been chosen as this best represents a similar event to the 2005 debris flows (Tonkin & Taylor, 2015). Planning for anything less than this event is unacceptable as a risk to life safety would remain. The risk to life safety of a repeat debris flow of this magnitude has been modelled as affecting an area containing 16 homes.

- **Option 2 (intermediate): Managed retreat of all properties in high risk zone (300,000m^3 event), short timeframe, and Plan Changes**
  Managed retreat for all properties (16 homes and 18 vacant sections), based on a magnitude event of 300,000m^3, delivered by WDC by 2020, and funded by central and local government with a retreat package.

  The scale of event planned for is the same as Option 1. Option 2, however, also includes the 18 vacant privately owned sections as well as the 16 homes.

- **Option 3 (less ambitious): Managed retreat of all properties in wider risk zone (450,000m^3 event), long timeframe, and Plan Changes**
  Managed retreat for all properties (18 homes and 18 vacant sections), based on a magnitude event of 450,000m^3, delivered by WDC by 2036, and funded by central and local government through a retreat package.

  A magnitude 450,000m^3 event was also modelled by Tonkin and Taylor (2015) as a possibility and has been chosen to represent planning for a larger event compared with the 2005 debris flows. The risk to life safety of a repeat debris flow of this magnitude has been modelled as affecting an area containing 18 homes (2 additional occupied properties than Options 1 and 2) and 18 privately owned sections.

- **Option 4 (ambitious): Compulsory retreat of all properties in wider risk zone (450,000m^3 event), short timeframe**
  Compulsory retreat for all properties (18 homes and 18 vacant sections), based on a magnitude event of 450,000m^3 delivered by BOPRC or central government by 2020, and funded by property owners/BOPRC and/or central government.

4.5 Economic analysis

Table 13 and Figure 17 present a summary of economic information for each of the options.

Project costs across the options range from $3.0 million (Option 0) for the cost of 'doing nothing' (this includes costs of a legal challenge and the creation of an escape route) to $15.3 million for compulsory retreat (majority of costs fall on private individuals through the loss of homes and land unless BOPRC or Central Government provide a funding package).

Figure 17 illustrates the different costs for each option categorised into project costs, costs associated with a repeat debris flow event and avoided costs or monetised benefits. It is clearly shown that the status quo (Option 0) is not a desirable option. Option 0 has significant costs associated with a repeat event when property owners continue to occupy the high risk area. Estimated costs of $32.5 million would be incurred with a repeat event of the same size of the 2005 debris flows. This is over $24 million more than any other option. Option 0 also has no associated benefits or 'avoided costs'.

The preferred option of managed retreat (Option 2) is estimated at $12.2 million (plus GST), being the costs of the acquisition of 75% of properties with dwellings and 100% of privately-owned vacant sections, as well as reserve creation costs.

Option 1 represents the best NPV (after the option of doing nothing – Option 0). Option 1 has also been assessed as having the highest risk. It is considered that Awatarariki property owners would not support this option as it means only those with properties would be offered a funding package to incentivise relocation from the high risk area, leaving 18 vacant section owners with effectively unusable land. Option 4 is also assessed reasonably favourably. This option is, however, dependent on the Regional Council or central government's willingness to enforce compulsory retreat. This therefore may be viewed as an alternative option if retreat is unsuccessful.

Table 13: Awatarariki Stream fanhead Options Cost Benefit Analysis

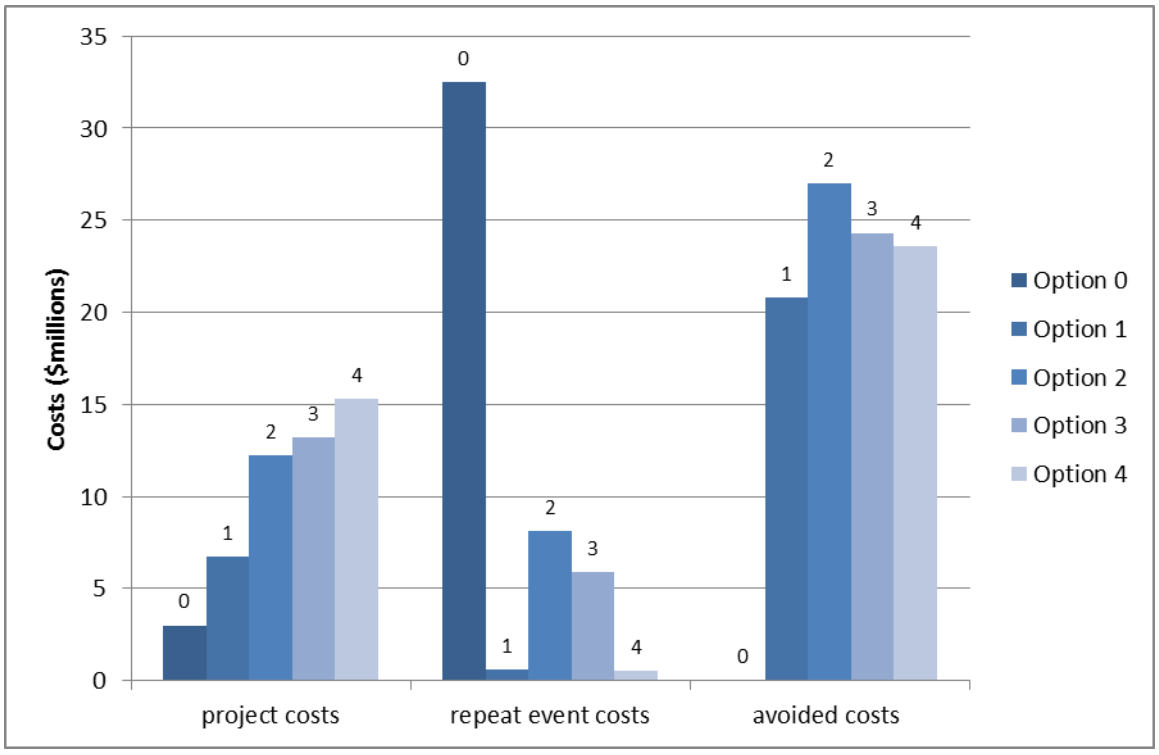
Options	0	1	2	3	4
Description	**Status Quo**	**Managed retreat – existing dwellings only**	**Managed retreat – all properties (short timeframe)**	**Managed retreat – all properties (long timeframe)**	**Compulsory retreat (short timeframe)**
Magnitude event	300,000m^3	300,000m^3	300,000m^3	450,000m^3	450,000m^3
Appraisal Period (years)	30	30	30	30	30
Capital Costs – project ($m)	**$3.0**	**$6.8**	**$12.2**	**$13.3**	**$15.3**
Repeat event costs	**$32.5**	**$8.0**	**$8.1**	**$7.9**	**$0.5**
Operational Costs ($m)	-	**$0.4**	**$11.5**	**$11.5**	**$16.3**
Benefits ($m)	nil	$20.8	$26.9	$23.6	$23.6
Net Present Value of Benefits ($m)	nil	$1.4	$1.8	$0.4	$1.6
Net Present Costs ($m)	$5.3	$7.3	$13.1	$10.8	$15.5
Net Present Value (NPV, $m)	-$4.8	-$6.0	-$11.4	-$10.4	-$14.0
Objectives met[23]	No	Yes/Partial	Yes/Partial	Yes/Partial	Yes
Multi-Criteria Analysis rank	5	4	1/2	1/2	3
Non-Monetary Benefit score (out of 10)	1.6	4.9	5.2	5.1	5.5
Benefit Rank	5	4	2	3	1
Risk Score (out of 10)	4.7	3.2	3.0	3.0	2.3
Risk Rank	5	4	2/3	2/3	1
No. of properties affected	35	16	35	37	37
Preferred option			**Preferred**		

Note: *Net Present Value (NPV) is a capital budgeting technique that takes into account the time value of money. Table 11 represents the difference between the present value of cash inflows and the present value of cash outflows associated with each option over a 30 year time period.*

[23] Options 1-3 meet the objective if all people choose to relocate.

The cost-benefit analysis was reviewed by Business and Economic Research Ltd (BERL). The primary conclusions of the review confirmed the difficulty in monetising social benefits for economic analysis, and the unsuitability of using NPV as a meaningful economic analysis tool for natural hazard events with long recurrence intervals. BERL recommended that multi-criteria analysis was a more appropriate tool for assessing benefits in such circumstances and assisted with development of the criteria and weightings that were subsequently used by the project team with guidance from BERL senior staff members.

Figure 17: Summary of costs and avoided costs across options



4.5.1 Assumptions for economic analysis

For purposes of economic analysis, the following assumptions have been made:

- The assumed life of all options is 200 years. For consistent analysis, the larger events at 500 years are presented in proportion to the 200-year appraisal period. All costs, including repeat event costs and avoided costs are represented over the 200-year period.

- Based on GNS (2005) and Tonkin & Taylor (2015), it is assumed that an event of a magnitude 300,000m^3 will occur over 200 years and an event of a magnitude 450,000m^3 will occur over 500 years. This reflects a precautionary approach in order that the risks are not understated. Costs associated with each of these events are mutually exclusive and therefore included depending on the scope of the option (i.e. if the option is based on a 300,000m^3 event, loss-of-life costs for only a 300,000m^3 event are included).

- The benefits of each option are assessed as the value of avoided losses that might otherwise occur. Losses incurred by the Matatā community as a result of the May 2005 event are used

as proxies for the values of potential future costs, adjusted to 2016 values using the Reserve Bank of New Zealand's inflation calculator[24].

- The discount rate used to derive Nett Present Values of costs is set at 6% per annum with an appraisal period of 30 years. This is consistent with the approach set out by NZ Treasury on current discount rates set in May 2016. Sensitivity testing at 3% per annum, 6% per annum, and 10% per annum, has also been carried out.

- Continued 'loss-of-life' risk exposure is included as a cost and spread over the relevant period. The value used for a statistical life (VOSL) is $4,214,914 based on NZTA and NZ Treasury's Impacts Database 2016. This is the value society is willing to pay to avoid one premature statistical death[25]. It should be noted that injuries have not been included in this analysis as there is no method to quantify the number or nature of potential injuries or their associated costs to society.

- The 'high risk zone' for future debris flow is based on the work carried out by Tonkin and Taylor Ltd (2015) and peer reviewed by Davies and McSaveney (2015). This includes 45 properties on the Awatarariki Stream fanhead (refer to Figure 4).

- 11 of the 45 properties are in public ownership and are excluded from the analyses as no change to the use of the public land is proposed.

- Each option is modelled on a future event of either a 300,000m^3 (Options 1 & 2) or 450,000m^3 (Options 3 & 4) debris flow and therefore costs associated with smaller, more frequent debris flow events are excluded from analysis.

- Options 1 and 2 are based on a future event of a magnitude of 300,000m^3. This model includes 34 affected private properties, including 16 homes.

- Option 3 is based on a future 450,000m^3 event. This model is extended to include two additional private properties, each with a residential dwelling. The total affected properties is therefore 47, including 18 homes.

- Options 1, 2 and 4 are all planned to be implemented by 2020. Option 3 has a planned implementation timeframe of 2036.

- Property acquisition costs comprise costs for purchasing properties as part of the retreat for those within the identified 'high risk zone'. Property values used are calculated by a framework developed by The Property Group (2016) using a combination of valuations. It is assumed that 75% of property owners with dwellings and 100% of section owners take-up the offer.

- All properties have been valued by TelferYoung (Tauranga) Limited with valuations peer reviewed by an independent valuation expert. The 'base value' of the 'baseline components'

[24] http://www.rbnz.govt.nz/monetary-policy/inflation-calculator

[25] This approach involves asking individuals the amount they would pay for safety improvement. From the trade-off between risk and economic measures, economists then calculate the marginal rate of substitution between wealth and risk of death or injury, which forms the basis for determining VOSL. (Ministry of Transport (2009): *Understanding Transport Costs and Charges*. Phase 2 – Value of statistical life: a meta analysis. Ministry of Transport, Wellington.)

for the retreat indicative offer process was provided to the Council by The Property Group Ltd (2016)following consideration of the following rating and estimated market values:

- 2004 GV
- 2004 EMV
- 2013 GV
- 1/7/2016 EMV (with hazard recognition)
- 1/7/2016 EMV (without hazard recognition).

A 10% contingency was included to reflect market movement subsequent to that date.

- Indirect financial losses (e.g. business losses from road and/or rail network failures) as a result of a repeat debris flow event are excluded from the analysis as costs would be similar for all four options.

- Costs of developing a reserve are included in all retreat options but costs to maintain the passive reserve over time were considered negligible and therefore not included.

- WDC and BOPRC recovery costs include special policy costs, staff costs, water scheme costs and recovery works. These costs are based on the 2005 event and are adjusted to 2016 figures (NZIER, 2005).

- Welfare response and recovery costs are also based on the 2005 event adjusted to 2016 figures. Costs include Civil Defence, Bay of Plenty DHB, school reinstatement, Child, Youth and Family, and Te Puni Kokiri costs (NZIER, 2005).

- Operational costs include the loss of rates from those retreated properties over the 200-year period. Maintenance costs of maintaining volume for future debris flow events on the fanhead are also included as an operational cost.

- Additional costs to property owners arising from living in a high debris flow risk area are unaccounted for due to the difficulty in quantifying costs, including:

    - An inability for some property owners to insure houses or the need to pay a premium price for insurance;
    - An inability to get a loan;
    - Difficulty in selling;
    - Difficulty in maintaining asset value as the intended plan change will stop new development;
    - Social and health costs associated with the stresses of living in an area with a high loss-of-life risk exposure.

4.5.2 Managed retreat and the importance of take-up by property owners

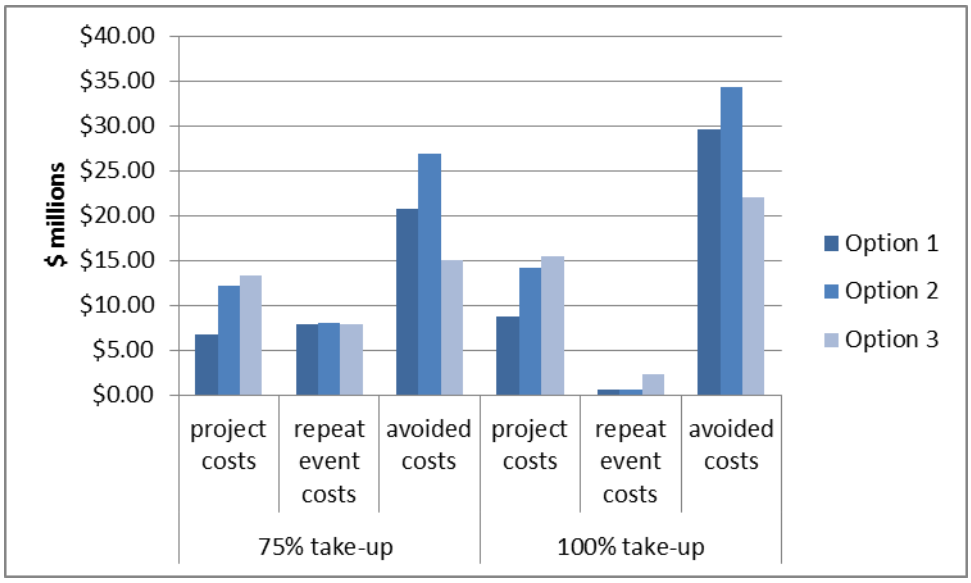
Assuming a managed retreat is adopted, a comparison of costs (both project costs and costs associated with a repeat event) and benefits for 75% take-up and 100% take-up is provided in Table 13 and Figure 18. Table 14 shows the relevance of take-up by property owners to reduce costs associated with a repeat event and the level of benefits realised (avoided costs of loss of lives, property and recovery costs). A high level of take-up by property owners is required if benefits are to be fully realised.

Note there is no difference in costs and benefits for Options 0 and 4 as these do not involve any choice by property owners. These have therefore been excluded from Figure 18.

Table 14: Comparison of costs and avoided costs (benefits) for different levels of take-up if a managed retreat option is adopted.

	0: Status Quo	1: Do Minimum	2: Intermediate	3: Less Ambitious	4: Ambitious
		Managed retreat – existing dwellings only	Managed retreat – all properties (300,000m^3; 2020 timeframe)	Managed retreat – all properties (450,000m^3; 2036 timeframe)	Compulsory retreat (450,000m^3; 2020 timeframe)
Description[26]					
Project costs ($M)					
75% take-up	$3.0	$6.8	$12.2	$13.3	$15.3
100% take-up	$3.0	$8.8	$14.2	$15.5	$15.3
Repeat event ($M)					
75% take-up	$32.5	$8.0	$8.1	$8.0	$0.5
100% take-up	$32.5	$0.6	$0.7	$2.4	$0.5
Avoided costs($M)					
75% take-up	-	$20.7	$26.9	$15.0	$23.6
100% take-up	-	$29.6	$34.3	$22.0	$23.6

Figure 18: Comparison of costs and avoided costs (benefits) for different levels of take-up for managed retreat options.



[26] Costs are for a 200 year period.

4.5.3 Scenario testing – varying the timing of a repeat debris flow event

There are significant costs to all retreat options. The timing of a repeat debris flow event and the proportion of property owners willingly retreating from the fanhead are the variables that influence different costs and benefits (avoided costs).

A scenario analysis using cost benefit methodology was also carried out and is presented in Appendix V. This shows that the timing of a repeat event only has a significant bearing on the costs and benefits if a debris flow occurs prior to the completion of retreat.

The timing of natural hazard events is something that cannot be predicted. What is known is that: debris flow events from the Awatarariki Stream catchment have occurred in the past, some of which were larger than the 2005 event; that a future event is inevitable; and that a future event could happen tomorrow, given the right conditions. Delays in implementing this project result in continued risk and uncertainty for residents of the Awatarariki Stream fanhead and do not reflect the precautionary approach to natural hazard risk management enshrined in legislation and policy frameworks.

4.5.4 Sensitivity analysis

Sensitivity was tested by varying the discount factor for each option and scenario. Varying the discount factor was found to not significantly change costings. See Appendix VI for a summary of sensitivity testing for all options and scenarios with a 3%, 6% and 10% discount factor.

4.5.5 Limitations of cost benefit analysis applied to natural hazards

High levels of inherent uncertainty are associated with probabilistic modelling of the future occurrence of any natural hazard event that has a long recurrence interval. This makes the utility of cost-benefit analyses for hazard mitigation proposals problematic. Cost benefit analysis therefore only represents a small part of the picture. In addition, natural hazard events are intrinsically linked with social factors that are very difficult to measure and, in most cases, impossible to monetise. High levels of stress on individuals, families and communities are inherently linked with natural hazards and /or the threat of natural hazards. A loss-of-life financial value identified by Treasury is arguably inadequate in its inability to capture monetarily the economic, emotional and ongoing social costs associated with the loss of loved ones. Multi-criteria analysis (MCA) was carried out with BERL to capture the key intangible factors associated with this proposed project and thereby endeavour to address this aspect of the inadequacies of the cost-benefit analysis.

Further consideration of Table 12 highlights the difficulties in using cost-benefit analyses for long return period natural hazard events to provide meaningful information. To place the difficulties above into context for this business case, we considered the Avoided Costs for Option 2 and Option 3 (refer Figure 12). Option 2 is based on a 200 year return period event and 5.0 deaths and Option 3 is based on a 500 year return period event and 5.4 deaths. For the purposes of the cost-benefit analysis (30 year appraisal period), this means that the Avoided Costs (i.e. benefits of people not killed) for Option 2 equals the costs of 5 deaths discounted over 200 years, and Option 3 is 5.4 deaths discounted over 500 years. Discounting over such a long timeframe makes the relevance of the analysis highly questionable due to the high margins of error that exist when predicting the certainty that one event will occur either at 200 years (Option 2) or 500 years (Option 3).

Also, if a 500 year return period event were to occur, it would mean that the parameters of the 200 year scenario had been satisfied, (possibly on multiple occasions) in which case should multiple occurrences of the Option 2 financial data be aggregated with the 500 year Option 3 data? In Table

12 and Figure 12, the smaller events have not been aggregated within the larger event because it would result in the smaller event being considered more than once. It would mean that, despite multiple occurrences of 5 people being killed and properties extensively damaged, the area devastated by the debris flow(s) would have had to have been reinstated on one or more occasions over the 500 year period. This is not considered realistic.

Another area of uncertainty relates to differences that future events may have from the one confirmed data set (2005 event) used in the debris flow risk modelling that has provided the base data for the cost-benefit analysis. Impacts of future debris flows may be very different or greater in scale than the 2005 event. There is evidence of historical debris flows from the Awatarariki Stream catchment greater than the 2005 event. In addition, the effects of climate change on the scale and frequency of debris flows from this catchment are also unknown.

For all of the reasons discussed above, the project team was open to the recommendation from BERL that a MCA was a more appropriate analysis tool to use in this business case for the assessment of benefits.

4.5.6 Multi-criteria analysis

MCA is a tool that provides an indicator of the overall performance of options based on individual criteria. Some important impacts of this project cannot readily be quantified in a way which could be set against a scale of monetary values. For example, outputs with diffuse social consequences, such as the stress of living with such uncertainty for a long time period.

A workshop was held with some project members and BERL in November 2016 to discuss the MCA process and criteria. BERL Economics developed a MCA model for assessment. As part of this assessment, options were assessed against six criteria:

1. *Loss-of-life* – A person loses their life as the result of a debris flow event. This loss can be avoided by relocating residents *ex ante.*

2. *Optimal land use* – Land is able to be used in the most desirable way, whether that be residential or commercial buildings, or a reserve. This is a *present focussed* criterion.

3. *Stress levels* – The general feeling of stress amongst community members.

4. *Preparation for future changes* – How will the proposed solution affect land use within the area in the future?

5. *Keeping community together* – The degree to which a sense of belonging and community can be maintained under the proposed solution, whether by providing current neighbours properties that are close together or by mitigating as much as possible the exit of people from Matatā as a result of the proposed solution.

6. *Providing certainty for residents/investors* –Uncertainty is created by the Council's perceived inaction or inability to come to a regulatory decision. Regulatory uncertainty affects potential investors and residents of Matatā by forcing them to question whether their holdings will be "safe" from considerable restrictions being imposed their properties by either WDC or BOPRC in the future. This uncertainty will inhibit investment and migration into the town.

The Project Team, with oversight by BERL, scored and weighted each criterion resulting in each option being ranked. A summary of the overall results, including the options rankings (rank 1 is highest) are outlined in Table 15 along with the standardised scores from the standardised pairwise comparison.

The MCA resulted in Options 2 and 3 (both managed retreat options) being ranked first equal, followed by Option 4 compulsory retreat.

Table 15: Overall rankings of options from MCA and standardised scores

Proposed solution	Utility of solution	Overall ranking of option (1 = high; 5 = low)
Status Quo – do nothing	17.22	5
Managed retreat – only dwellings	73.10	4
Managed retreat – 300,000m³	78.23	1,2
Managed retreat – 450,000m³	78.23	1,2
Compulsory retreat – 300,000m³	74.11	3

Standardised scores

Proposed solution	Loss-of-life	Optimal land use	Stress levels	Preparation for future	Keep community together	Provide certainty	Achievable in practice
Status Quo – do nothing	0	0.25	0.5	0.5	1	0	0.5
Managed retreat – only dwellings	0.75	0.5	0.5	0.5	1	1	0.5
Managed retreat – 300,000m³	0.75	0.75	0.75	0.5	1	1	0.75
Managed retreat – 450,000m³	0.75	0.75	0.75	0.5	1	1	0.75
Compulsory retreat – 300,000m³	1	1	0	0	0	1	0.25

4.5.7 Wider benefits

As discussed earlier, many benefits of this project are not tangible in a monetary sense; however they deliver social and cultural benefits to the Awatarariki Stream fanhead residents and wider Matatā community that are measurable in money terms and represented in the NPV of Benefits row in Table 13. Key benefits that cannot be readily quantified were included in the MCA above (Table 15).

Consideration of wider benefits for each option was also carried out. Non-monetary benefits were identified and ranked by the Project Team. A summary of this exercise is provided in Table 16 and a full description of each benefit is provided in Appendix VIII, including who benefits and the type of benefit. This shows that Option 4 (Compulsory retreat) ranks the highest for benefits as it provides certainty, improves amenity, minimises stress and risk arising from a hazardous event, and provides protection for personal items as well as protection from hazards. Option 2 (Managed Retreat) ranks second highest for benefits, slightly above Option 3. This reflects the lack of certainty provided with these options as some benefits are highly influenced by the level of take-up by property owners.

Table 16: List of non-monetary benefits with average rankings across options

Main Benefits	0 status quo	1 300,000m3 16 dwellings	2 300,000m3 34 properties	3 450,000m3 36 properties	4 450,000m3 Compulsory 36 properties
Certainty for property owners about future options	2	5	5	5	10
Minimise social and health effects of displacement (i.e. moving off the fanhead)	10	1-5	5-10	5-10	1
Minimise stress and uncertainty of continual exposure to a high loss-of-life risk	1	5	5	5	10
Protection of personal items with no market value (i.e. memorabilia, photos)	1	5	5	5	10
New development in Matatā through relocation stimulates additional development	1	4	4	4	7
Improved hazard protection to the built environment from coastal processes through a wider coastal reserve area.	1	2-10	2-10	2-10	10
Passive reserve space created for community with improved links to coast	1	5	5	5	10
Improved visual amenity to the entrance to Matatā and the gateway to the Whakatāne District	3	5	5	5	10
Peace of mind from escape route created in interim or for those choosing to stay	5	3	3	3	1
Reputational benefits to government, regional council and WDC through proactively implementing natural hazard changes to the RMA & also implementing RPS.	1	4	8	7	3
Ease of future clean-up on fanhead	2	5	5	5	8
Contribution to the national & international natural hazard knowledge base	3	8	8	8	8
Minimising risk to emergency management personnel	1	5	5	5	10
TOTAL	**21**	**63**	**67**	**66**	**72**
Average benefit score	**1.61**	**4.85**	**5.15**	**5.08**	**5.53**
Rank	**5**	**4**	**2**	**3**	**1**

4.5.8 Main risks

Risks result from uncertain events, and either improve or undermine the achievement of benefits. Appendix VIII (Register of Initial Risks) provides an initial risk analysis. It identifies the main risks or those risk events which could account for 80 percent of the total potential risk of the proposal. The risk register will be progressively updated throughout the project.

Analysis of the main risks that might create, enhance, prevent, degrade, accelerate or delay the achievement of the investment objectives across options is reported in Table 16 (Risk Rankings). Table 17 shows the likelihood and consequence scores for each risk (1 (low risk) – 5 (high risk)), including final scores and ranking of each option. Option 4 (Compulsory Retreat) is the lowest risk option, followed by Options 2 and 3 (Managed Retreat Options for all properties over different timeframes).

A summary of the risk scores and rank is also reported in Table 13 (Cost-Benefit Analysis).

The risk of 'doing nothing' to key stakeholders

The risk to key stakeholders of 'doing nothing' requires separate consideration. Based on a repeat '2005 event' of (approximate magnitude of 300,000m^3) resulting in property and infrastructure damage and a loss of 5 lives, as modelled by Tonkin and Taylor (2015), an assessment of the level of risk to property owners, central government, BOPRC and WDC was undertaken by the Project Team (using likelihood and consequence scores). Table 18 outlines the categories of risk and the likelihood and consequence for each risk identified (1=low; 5=high).

Categories with the highest levels of risk vary across stakeholders:

- 'Loss-of-life' and 'property damage' are the highest risk categories for property owners;
- 'Community resilience' and 'accountability' are the highest risk categories for central government;
- 'Accountability', 'community resilience' and 'reputation' are the highest risk categories for BOPRC; and,
- 'Emergency response' and 'reputation' are the highest risk categories for WDC.

The assessment indicates that the levels of risk to BOPRC, followed by WDC, were higher than to other stakeholders.

Table 17: List of risk rankings across options

Main Risks	0		1		2		3		4	
	Status Quo		300,000m3 Existing dwellings 2020		300,000m3 All properties 2020		450,000m3 All properties 2036		450,000m3 Compulsory 2020	
	L	C	L	C	L	C	L	C	L	C
Incurring high costs doing investigative work and not securing additional funding from external agencies	1	**5**	3	5	4	4	4	4	1	1
[Weighted x2]	10		30		32		32		2	
Repeat debris flow event results in loss-of-life, injury and property damage before project completion	3	5	2	5	2	5	2	5	1	5
[Weighted x2]	30		20		20		20		10	
Awatarariki property owners and residents do not support the option.	5	4	3	3	2	3	2	3	5	2
[Weighted x2]	40		18		12		12		20	
Iwi oppose approach	3	5	2	2	1	1	1	1	3	1
	15		4		1		1		3	
MBIE determination appealed and reversed	2	3	1	4	1	4	1	4	1	1
	6		4		4		4		1	
BOPRC do not support the option (RPS alignment).	5	5	1	3	1	3	1	3	4	4
	25		3		3		3		16	
Pressure from non-Matatā ratepayers to not proceed with project	1	2	2	1	2	1	2	1	3	2
	2		2		2		2		6	
Total (250)	**117**		**81**		**74**		**74**		**58**	
Out of 10	**4.7**		**3.2**		**3.0**		**3.0**		**2.3**	
Rank	**5**		**4**		**2/3**		**2/3**		**1**	

Table 18: Assessment of risk to key stakeholders for the option of 'doing nothing'

		Land Owners			Central Government			BOPRC			WDC		
Risk category		Likelihood	Consequence	Risk level	Likelihood	Consequence	Risk level	Likelihood	Consequence	Risk level	Likelihood	Consequence	Risk level
Emergency response:	*Unplanned allocation of resources for CD management*				5	1	5	5	2	10	5	3	15
Loss-of-life	*Residents and/or visitors killed or injured*	4	5	20									
	Emergency workers killed or injured										1	3	3
Property damage	*Repairing or relocating costs unaffordable*	5	4	20									
	Damage of central govt. properties				3	1	3						
	Damage to WDC property										3	1	3
Utility damage to:	*NZTA & KiwiRail utilities*	5	1	5									
	local roads & water services										5	1	5
Legal challenge:	*by insurance companies*	1	4	4	1	1	1						
	by property owners				3	1	3	4	2	8	4	2	8
Recovery implementation	*Unplanned funds contributed*				5	1	5	5	2	10			
	Unplanned resources & time allocated										5	2	10
Costs	*EQC pay outs needed*				5	1	5						
	Rating losses through rates remission or property demolition.										5	1	5
Reputation damaged from perspective of:	*NZ community*	1	4	4									
	Regional community							4	2	8			
	Local Government				3	1	3						
	Matatā community				3	1	3	5	3	15	5	3	15
Community resilience not achieved	*Policies and frameworks not realised (issue)*				5	2	10	5	3	15			
	Wider plan for district compromised										5	1	5
Accountability questioned	*Public enquiry initiated*				3	3	9	3	4	12	3	2	6
	BOPRC &/or WDC hold central govt. accountable				5	2	10						
	WDC holds BOPRC accountable through PR / media.							5	4	20			
	Central govt. intervention							1	5	5			
TOTAL RISK LEVELS				**44**			**66**			**103**			**75**

4.6 Key constraints and dependencies

Constraints are limitations imposed on the investment proposal from the outset and include constraints on available resources. Dependencies are external influences on the success of the project, where project success is contingent on the future actions of others.

The proposal is subject to the following constraints and dependencies outlined in Table 19. These dependencies will be carefully monitored during the project.

Table 19: Key constraints and dependencies

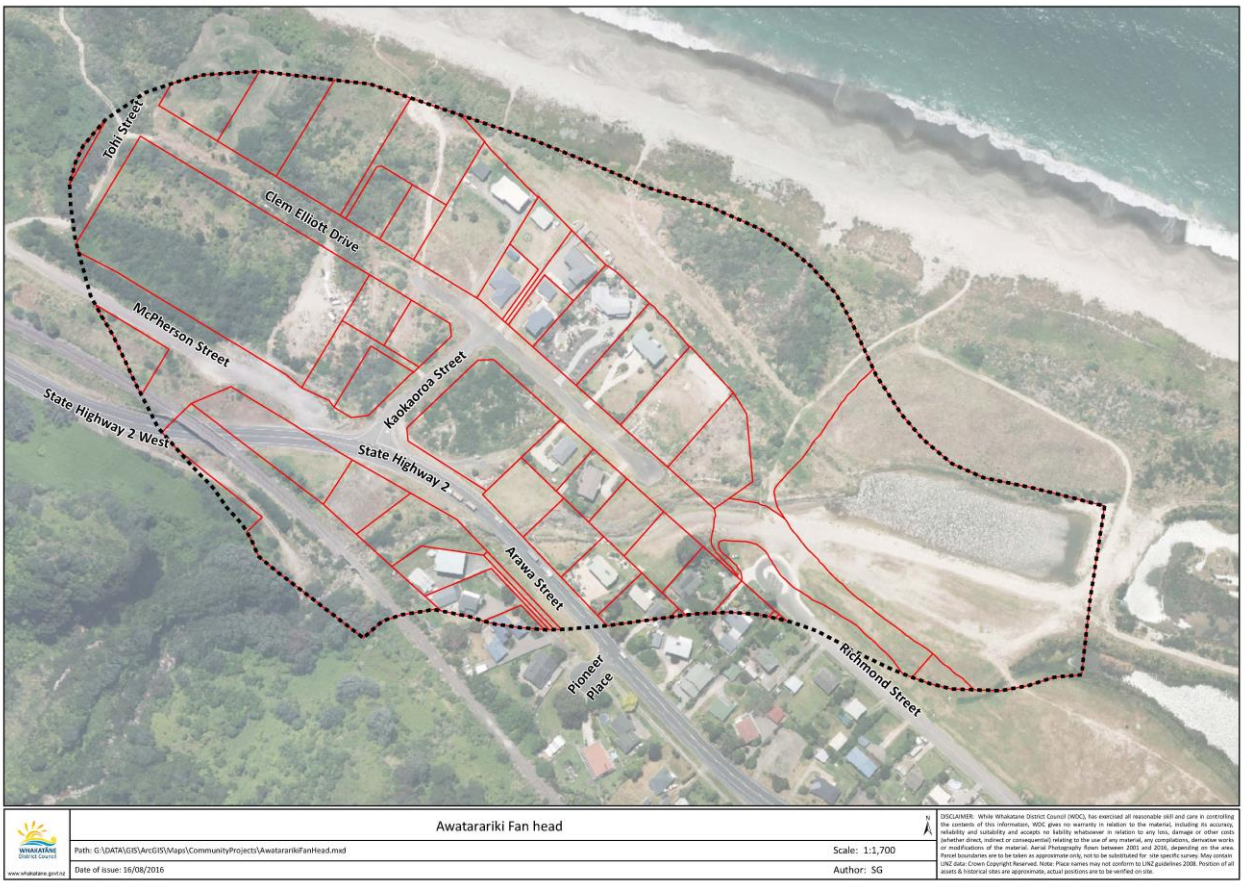
Constraints	Notes and Management Strategies
Plan Change 2 (Natural Hazards)to the RPS	The provisions of the Regional Policy Statement introduced by Plan Change 2 have a high degree of influence over options for addressing the high debris flow risk at Awatarariki Stream fanhead. Policy NH 6B aims to achieve the following natural hazard risk strategy: *"In natural hazard zones subject to High natural hazard risk reduce the level of risk from natural hazards to Low (although Medium may be tolerable for existing land uses if achieving Low is not reasonably practicable)."*
Level of commitment from regional and/or central government	Sections 20A and 30 of the RMA include the ability for regional councils to revoke an existing use right in a hazardous area, as existing use rights do not apply to land uses affected by a Regional Plan. The natural hazards variation to the RPS explicitly recognises this. Central government also has the ability to revoke existing use rights through legislation as it did in Canterbury following the Christchurch earthquakes.
Level of take-up by property owners (managed retreat options)	Success of managed retreat options is dependent on the proportion of take-up by the affected community. Continuous community engagement provides an indication of willingness to vacate properties. This is expected to be in excess of 75%. An acquisition offer that incentivises affected parties to relocate will also be influential in achieving this.
Affordability for the community	If the Integrated District Wastewater project (addressing wastewater issues at Matatā) and the Awatarariki Fanhead project both proceed, this will have significant financial implications for the community in terms of affordability.
Dependencies	**Notes and Management Strategies**
Additional funding partners secured	Any option to mitigate or avoid this natural hazard is significantly dependent on regional and/or central government funding.

4.7 Preferred way forward – managed retreat by 2020 for all properties in the high risk zone based on a repeat debris flow event of magnitude 300,000m^3

On the basis of the initial assessments summarised in Table 11, the preferred option is a managed retreat. This option is represented by Option 2 in the short listed options – the 'intermediate' option. A managed retreat means that property owners are encouraged to vacate their land and homes through an acquisition process, with those owners not wishing to participate, having to manage a planning framework that may involve new restrictive District and Regional Plan provisions that give effect to the RPS.

Option 2 involves 34 privately owned properties on the Awatarariki Stream fanhead. This reflects properties within the high debris flow zone depicted in Figure 19. The high debris flow zone consists of 16 residential homes, 18 private vacant sites and an additional 11 publicly owned vacant sites (owned by the WDC, the Crown and KiwiRail) - refer Table 6.

Figure 19: Properties affected within the high debris flow zone



Managed retreat (Option 2) is the preferred way forward as it:

- Delivers on the investment objective to protect life safety if people choose to relocate away from the Awatarariki Stream fanhead (and only partially delivers if some decide to stay).

- Delivers on the investment objective to provide a state of certainty to support recovery and to encourage community resilience in the future.

- Ranks first equal in the MCA (along with Option 3), which takes into account the key non-monetary factors of loss-of-life and five other key criteria.

- Ranks second for wider non-monetary benefits.

- Ranks second in terms of risk. Risks will be further minimised through the development of a retreat offer that is reasonable and equitable and incentivises property owners to move on.

- Demonstrates a reasonable value for money in that capital costs and monetised benefits over the 200 year period are very comparable (capital cost $7.2 M and monetised benefits $7.1M). This option does not represent the option with the best NPV, but as discussed, NPV analysis provides limited meaningful economic analysis in these circumstances.

An acquisition strategy has been developed to encourage residents to relocate away from the Awatarariki Stream fanhead. Although Council is not legally required to provide any type of funding package for retreat, a funding package is considered necessary for successful managed retreat to occur as it provides an incentive for residents to relocate. The acquisition strategy is outlined in the Commercial Case and is based on developing a fair and equitable retreat offer to allow meaningful conversations with property owners.

4.7.1 Choosing to stay

If the preferred way forward is implemented, it is important to note that retreat is voluntary. However, if Plan Changes are successful, the second stage of the process may include the extinguishing of existing use rights resulting in compulsory retreat. If Plan Changes are unsuccessful, for those that may choose to remain living on the Awatarariki Stream fanhead, several disbenefits are likely to occur:

- Economic loss - Property valuations of the Awatarariki Stream fanhead properties undertaken to inform indicative managed retreat proposal offers included current[27] estimated market values including and excluding the implications of the high debris flow risk that exists. The valuers (TelferYoung (Tauranga) Ltd) estimate significant differences between the two values ranging between 28% and 43% for properties with existing houses and 90% to 93% for vacant sites. These estimated market valuations were supported by independent expert peer review. Property owners that elect to remain will need to factor in the significant reduction in their property asset as a consequence of the continuing exposure to the unmitigated debris flow risk that exists.

- Insurance – Irrespective of when the next debris flow event occurs, property owners are likely to face increasing challenges to secure property insurance. Where insurers are prepared to provide property cover, policy premiums, exclusions, and excesses, are all likely to reflect the high levels of debris flow risk that will become more publicly available through the Council's District Plan Change process to rezone the high risk area from residential to reserve.

- Another debris flow event – Not only does the inevitable occurrence of another debris flow have potential property damage and life-threatening consequences, but post-event recovery

[27] Valuations were based on market conditions at 1 July 2016.

decisions by the Government, BOPRC and WDC are highly unlikely to be consistent with the recovery decisions made following the 2005 event. In situations where insurance and EQC cover are not in place, property owners will be largely left to their own resources to manage property damage themselves. Related to this are the potential increased costs associated with relocating a house in the future, or in the case of loss of a dwelling, the costs associated with buying or renting another home. Diminished levels of infrastructure services by WDC after another event are also likely, based on decisions made during the Awatarariki debris flow risk management programme and pending District Plan Change that promote retreat from the high risk area as the preferred risk management strategy for this hazard. Should property owners walk away from their properties, public agencies could be left with building demolition and clean-up costs of affected sites.

- Social well-being – Those that wish to stay may do so for a number of reasons. If the retreat offer proposal is inadequate for people to move on with their lives, the concept of choice severely diminishes resulting in the desire to remain becoming an in voluntary one. Residents remaining under these circumstances will almost certainly suffer from stresses generated by continual exposure to a high loss-of-life risk from future debris flows, and challenges around the ability to obtain insurance and the uncertain outcome from the Regional Plan Change process. Examples of people in this category are superannuitants on fixed incomes with an inability to take on new financial debt.

- Decreased amenity – Assuming that most property owners take-up the property acquisition offer and retreat from the Awatarariki Stream fanhead, demolition and/or relocation of dwellings as well as earthworks associated with reserve creation will happen. This is likely to result in decreased amenity through increased loss of community for those deciding to stay.

- Economic inefficiency – The anticipated landuse zoning of the high risk area in the future is as natural hazard reserve or coastal reserve. Piecemeal creation of the reserve results in additional costs to establish the reserve as well as additional costs to maintain existing infrastructure to service those properties where the owners elect to remain. The additional costs would be met by Whakatāne district ratepayers.

- Existing use rights – BOPRC has the statutory ability to extinguish existing use rights through making and enforcing a rule in a regional plan that removes those rights under section 20A of the RMA. There is no provision in the RMA that would require BOPRC to pay compensation to land owners for extinguishing their existing use rights when lawfully exercising its functions.

These disbenefits apply to all managed retreat options (options 1, 2 and 3).

In addition to the above, a further disbenefit that applies to the three levels of government, and to a lesser extent to individual property owners who wish to remain, is that of damage to reputation. Another debris flow from the Awatarariki catchment in the future is inevitable. The hazard has been identified and the risks modelled to the best level of science and engineering knowledge available. The risk assessment and modelling has been peer reviewed by New Zealand experts with international affiliations. Policy and legislative frameworks exist that promote proactive disaster risk reduction. In a situation where no risk management options are implemented and another debris flow event occurs resulting in extensive property damage and multiple losses-of-life, the government and the two councils have a significant reputational risk exposure.

5.0 The Commercial Case – preparing for the potential deal

This section outlines the proposed framework in relation to the preferred way forward - a managed retreat for all properties (option 2) by 2020.

5.1 Managed retreat offer process

The Property Group Limited was engaged to develop an acquisition strategy based on the following guiding principles[28]:

- Equivalence – The land owner should be no better or worse off after the acquisition and pay out.
- Liberality – Benefit of doubt must run in favour of land owner.
- Ultra Vires – The acquisition process must be in accordance with the law.
- Natural Justice – Full information and disclosure required.

The underpinning philosophy of the managed retreat proposal is to use public funds to provide a group of property owners the opportunity to retreat from land that has been proven to have a high loss-of-life risk from a natural hazard. If funding support can be achieved, a retreat proposal offer will be a one-off offer to relocate from the high natural hazard risk area. It is proposed that the offer would not be repeated in the future.

The Property Group Ltd's advice stated that an essential element of any property acquisition strategy is to have a confirmed funding package in place to enable meaningful property acquisition discussions and negotiations with property owners to occur. In this instance, the voluntary nature of the proposal introduces additional challenges and presented the Council with a 'chicken and egg' scenario. It was considered that funding agencies would require certainty on the financial parameters of the fiscal envelope to which they would be asked to contribute. Definition of the fiscal envelope requires confirmation of the number of property owners who will sign up to the managed retreat package. On the other hand, property owners require confirmation of the financial offer to voluntarily retreat from the area before committing themselves.

The approach adopted by Council was to approach landowners with an indicative retreat offer that is conditional upon the Council receiving funding support from central and regional government. The level of positive property owner response to indicative offers should provide a reasonable indication of property owner intent that will help inform funding discussions with Government and the BOPRC.

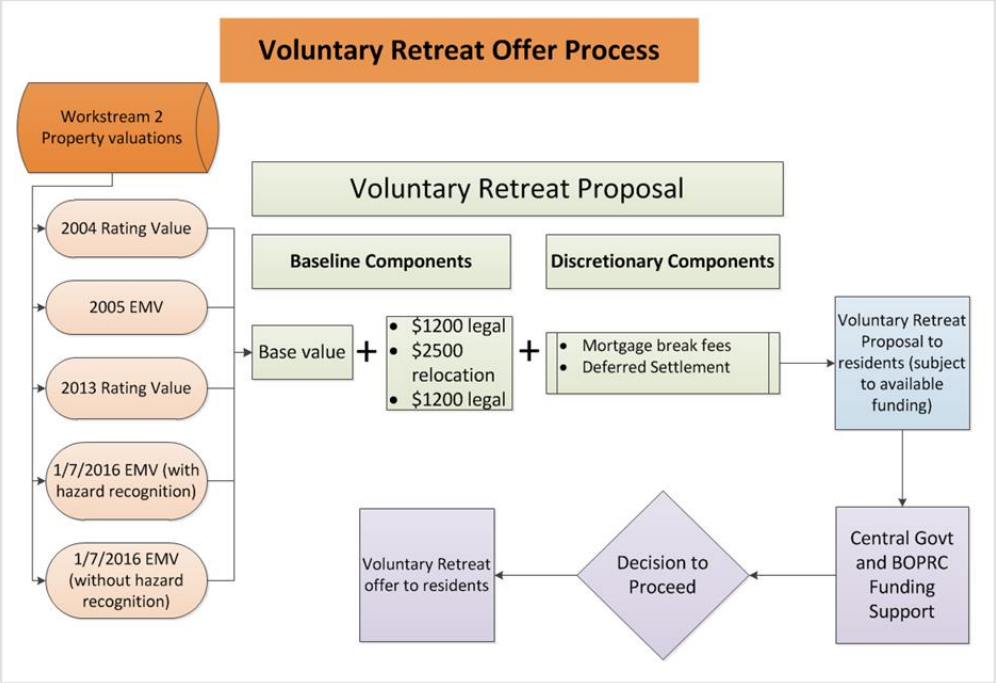
Indicative retreat offer proposals, calculated in accordance with the Council's Awatarariki Acquisition Strategy were presented to owners at individual face-to-face meetings in late 2016. A registration of interest form was included as part of the documentation provided. The registration of interest form sought non-binding expressions of interest in participating further in a voluntary retreat proposal, the delivery of which is conditional on the Council securing adequate external funding support. One property owner has returned the registration of interest form declining to participate further, four of

[28] These guiding policy principles are from the Public Works Act 1981 and are used when land is required for public works. Although this project is not subject to this Act, the principles provide a useful foundation for an acquisition strategy.

the 34 property owners have indicated verbally they do not wish to participate in a managed retreat process, and one owner has indicated they wish to retain ownership for the purposes of a Māori Reservation to commemorate the historic battle of Kaokaoroa. A further 11 property owners have yet to return the registration of interest form .

The process for managed retreat is outlined in Figure 20.

Figure 20: Proposed process for retreat offers



5.2 Procurement strategy

The Council's Procurement Manual 2014 has been developed in accordance with the Local Government Act 2002. This requires the Council to provide good-quality local infrastructure, local public services, and performance of regulatory functions in a way that is most cost-effective, efficient, effective and appropriate for households and businesses.

The Council's Procurement Strategy sits alongside various Council strategies and policies to assist with their respective delivery of the LTP, which is the shared vision for all of Whakatāne District and its people. It sets out that Council will procure the best value for supplies, services and infrastructure by:

- Ensuring good practice in procurement which then helps to deliver the Council's key outcomes and priorities for improvement.
- Applying effective and up to date procurement procedures and practices
- Developing a whole of life cycle approach to the goods, services and infrastructure it procures – by contract or by other means.

The project would be implemented in several separate contracts. Council's Procurement Manual prescribes that where the value of the goods or works proposed to be purchased or sold exceeds $100,000, publicly advertised tenders are to be invited unless there are exceptional circumstances.

Where the value of the goods or works proposed to be purchased or sold falls between $25,000 and $100,000, a short form procurement plan and at least three written competitive prices shall be sought and recorded, unless there are exceptional circumstances, for which approval must be recorded in writing in accordance with the Council's Delegation Manual.

Where the value of the goods or works proposed to be purchased is less than $10,000, existing suppliers can be used.

Purchases with a value between $10,000 and $25,000 require three written quotes; evidence of this must be kept and made available for auditing purposes.

5.3 Required services

To fully implement this project, contracts will be required for:

- Implementing the retreat offer process (negotiation with property owners);
- Developing the Plan Change process to the Whakatāne District Plan;
- Demolition and relocation costs of existing residences;
- Reserve creation following retreat;
- Ongoing maintenance of reserve and restoration of storage volume following future debris flow events.

With the exception of demolition and relocation of buildings and reserve creation, the service contracts required are expected to be less than $100,000 and therefore will not require a publicly advertised tender process. For all projects, the contracting of services will follow the Council's Procurement Manual.

The Project Team considers that there are suppliers available to provide the required services outlined above.

5.4 Contract provisions

The Council intends to make payments with respect to the proposed services as follows:

- Demolition contracts will be paid on measure of completed works.
- Other contracts will be paid on receipt of invoice at completion of work or on the completion of agreed milestones.

It is anticipated that the implementation milestones for this project will be:

- Engage with affected property owners about the managed retreat package and gauge each property owner's intent.
- Provisional funding agreed with funding agencies.
- Council's approval of the project's scope and financial arrangements.
- Finalisation and payment of managed retreat packages.
- Plan change initiated and developed.

- Awatarariki Stream fanhead cleared and reserve created.

5.5 Potential for risk sharing

An initial assessment of how the associated risks might be apportioned between the organisation and potential providers is outlined in the risk allocation table (Table 20).

Table 20: Risk allocation table

Risk Category	Potential Risk Allocation		
	WDC	Consultant/ Contractor	Shared
Design risk			√
Construction and development risk			√
Transition and implementation risk			√
Availability and performance risk			√
Operating risk			√
Variability of revenue risks	√		
Termination risks			√
Technology and obsolescence risks	√		
Control risks	√		
Residual value risks	√		
Financing risks	√		
Legislative risks			√
Reputational risks			√
Other project risks			√

6.0 Financial Case – affordability and funding requirements

The purpose of this section is to set out the indicative financial implications of the preferred way forward – *Option 2: Managed Retreat*.

6.1 Financial strategy

As set out in section 101A of the LGA, the Council has adopted a Financial Strategy as part of the Long Term Plan 2015-25 (LTP). The Financial Strategy supports the delivery of Council activities and services in a manner which addresses rates affordability and ensures that the Council remains in a long-term stable financial position. The Financial Strategy includes limits set by the Council on rates, rates increases, interest expense and debt. The Strategy is reviewed every three years as part of the LTP process. Interim changes to the Strategy require a formal resolution of the Council.

6.2 Overall affordability

Affordability to the community is the key determinant of whether or not the project will proceed through to implementation. The project is not affordable if funded solely by Whakatāne District ratepayers. Project implementation therefore relies on securing additional funding from other funding partners to make this important project financially feasible for the Whakatāne District community.

The Council is also investigating the delivery of a wastewater reticulation system to Matatā. This project is the subject of a separate business case[29] that has evolved from a $17 million dollar project to deliver a local wastewater solution for Matatā, to a $32 million dollar integrated wastewater solution that optimises existing consented wastewater infrastructure at Edgecumbe and Whakatāne and overcomes the environmental legislative and policy constraints of the receiving environment around Matatā. Financial modelling, based on shared multi-agency funding contributions for each project, has been undertaken. The modelling confirms that an annual average rate increase in the order of $90 for each rateable property is required to cover the Council's contributions if both projects are supported by the external funding partners to the levels specified in each of indicative business cases.

The project team believes there are strong reasons for central government and the BOPRC to partner with WDC to invest in the Matatā community through supporting a collaborative funding response for both projects.

In relation to the Awatarariki Stream debris flow risk management project, the commitment to the Sendai Framework and amendments to the RMA signal the Government's intentions to improve natural hazard risk management within New Zealand. BOPRC plays an important role in risk management of natural hazards in the region. The collaborative approach proposed would achieve the goals of the newly adopted Change 2 (Natural Hazards) to the RPS by reducing the risk to life safety from future debris flows impacting on the Awatarariki Stream fanhead.

[29] Future Wastewater Options for Matatā: Indicative Business Case, Whakatāne District Council, 2017.

6.3 Financial analysis

The estimated capital project cost for the proposed project ranges from $13.5M to $15.5M (including expenditure to date of $1.1M).

Sustainable funding limits for the WDC are identified in the Council's Financial Strategy that supports the 2015-2025 Long Term Plan (LTP). The Financial Strategy sets the following financial limits to help contain and provide much more predictability to rates increases:

- A maximum borrowing limit of $75 million; and
- A maximum annual rate increase not exceeding the Local Government Cost Index (LGCI) plus 2%.

To assist with consideration around an appropriate funding structure, two financial scenarios have been modelled based on an internal contribution of 20% and 33% of the project range and 75% and 100% take-up by property owners. The modelling indicates that the level of internal funding for both scenarios will exceed the upper limits of the Financial Strategy.

6.3.1 Financial assumptions

The following assumptions have been included in the financial analysis:

- A shared funding arrangement will exist between central government, BOPRC and WDC.
- Interest costs have been set at 5.3% per annum with debt repaid over a maximum term of 25 years.
- Subsidies are received in the 2018 financial year.
- Contingency of 10% added to purchase and reinstatement costs to cover market movement in property prices.
- Any funding requirement for the Matatā (Integrated) Wastewater project has been removed from the LTP base figures and the assumption is made that only interest costs are incurred on the outstanding Matatā Wastewater reserve balance at $180,000 per annum. It is noted that the existing overdrawn reserve balance ($2,800,000 at 30 June 2016) will need to be addressed through rate funding should that project not proceed.
- No operating costs have been modelled for maintenance, rates, overheads etc, in regard to the properties rezoned to reserve.
- Although the buildings are being purchased for the purpose of demolition, both purchase and demolition costs are being recognised as Capital Expenditure. It is acknowledged that there will be a write off through the Statement of Comprehensive Income at the time the buildings are demolished.
- No funded depreciation has been provided for on reserve assets created.

6.3.2 Government contribution to date

The original Business Case to the Government in 2005 for financial assistance was based on an estimated capital expenditure of $5.262M for the Awatarariki catchment. Of this total Government was asked to fund one third i.e. $1.754M (plus $200,000 for project management).

Government grants via the Department of Internal Affairs (DIA) were for a total of $2.890M[30].

6.3.3 Expenditure to date

The Council has incurred significant post-2005 event expenditure in relation to the Awatarariki catchment totalling 4.9M. Historic costs have been incurred through:

- Stream bed and stream bank works to reinstate and enhance the hydraulic capacity of the Awatarariki Stream to avoid flooding;
- Land purchase to enable the stream works to be undertaken;
- Obtaining resource consents for the stream works, creation of a debris deposition area, and defending the granting of those consents at Environment Court appeals;
- Engineering investigations to provide a debris detention structure (DDS) in the Awatarariki catchment together with preliminary resource consent and peer review costs;
- Planning costs to develop and implement a risk-based planning solution to manage the debris flow risk to residents of the Awatarariki Stream fanhead.

Historical costs and associated funding streams have been applied against previous capital expenditure in the Awatarariki catchment. As at 30 June 2016, the Council has loans associated with the Matatā disaster mitigation works to the value of $4.25 million which are being repaid over a 25 year term with maturities through to 2041, funded by General Rates.

Spending from 2005 to 2012 directly attributable to this project (mitigating debris flow risk) is limited to expenditure for the proposed debris detention structure totalling $1,064,702 (refer Table 21).

Table 21: Direct existing spend relating to debris flow risk on the Awatarariki Stream fanhead

Awatarariki Catchment – Direct Spending from 2005 to 2016	
Debris Dam/DDS	$1,002,482
Resource Consents DDS	$62,220
Total	**$1,064,702**

6.3.4 Financial analysis

Financial modelling has been completed for both 75% and 100% of property owners with dwellings taking up the property acquisition offer. Both scenarios include 100% of property owners with vacant sections taking up the property acquisition offer.

[30] Comprising $1,756M for the Awatarariki catchment and $1,134M for the Waitepuru catchment.

The financial impact of the project based on 33% internal funding amounts to approximately an additional $21 to $24 per annum at individual ratepayer level (75% and 100% take up) or $13 to $15 (75% and 100% take up) based on 20% internal funding. As such, the financial modelling indicates that the forecasted level of internal funding will exceed the upper rating increase and borrowing limits of the LTP 2015-25 Financial Strategy for both the 33% and 20% internal funding scenarios. Affordability concerns are reinforced when uncertainties around the final costs of recovery following Cyclones Debbie and Cook, and the contribution required for the Integrated Wastewater Management Project, are also taken into account.

The following tables, figures, and commentary reflect the modelling for a 33% WDC contribution.

Table 22: Financial modelling based on 75% uptake by property owners with dwellings and 100% vacant sections

Stated in 2016/17 $	up to 2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	Total 10 Year
Capital Expenses	108,900	0	10,440,046	634,428	1,617,553	653,125	0	0	0	0	**13,454,053**
Operating Expenditure											**0**
Funded Depreciation											**0**
Overheads											**0**
Total Expenditure	**108,900**	**0**	**10,440,046**	**634,428**	**1,617,553**	**653,125**	**0**	**0**	**0**	**0**	**13,454,053**
External Funding	0	0	8,969,368		0	0	0	0	0	0	**8,969,368**
Debt Servicing (includes Reserve Balance)	0	0	54,814	132,286	204,716	297,403	327,840	327,840	327,840	327,840	**2,000,578**
Operating Funding Required	**0**	**0**	**54,814**	**132,286**	**204,716**	**297,403**	**327,840**	**327,840**	**327,840**	**327,840**	**2,000,578**

Table 23: Financial modelling based on 100% uptake by property owners with dwellings and 100% vacant sections

Stated in 2016/17 $	up to 2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	Total 10 Year
Capital Expenses	108,900	0	11,978,053	845,904	1,919,804	653,125	0	0	0	0	**15,505,787**
Operating Expenditure											**0**
Funded Depreciation											**0**
Overheads											**0**
Total Expenditure	**108,900**	**0**	**11,978,053**	**845,904**	**1,919,804**	**653,125**	**0**	**0**	**0**	**0**	**15,505,787**
External Funding	0	0	10,337,191		0	0	0	0	0	0	**10,337,191**
Debt Servicing (includes Reserve Balance)	0	0	59,289	150,331	240,626	347,398	377,834	377,834	377,834	377,834	**2,308,980**
Operating Funding Required	**0**	**0**	**59,289**	**150,331**	**240,626**	**347,398**	**377,834**	**377,834**	**377,834**	**377,834**	**2,308,980**

6.3.5 Impact on ratepayers

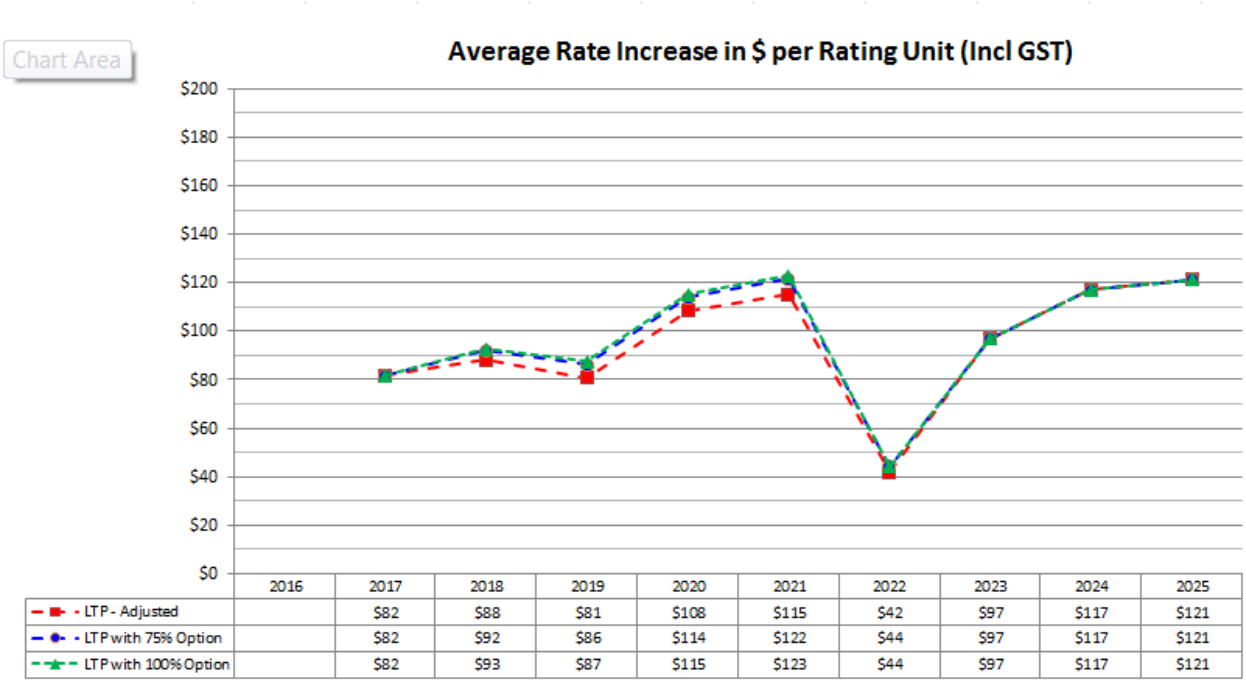
The projected additional annual rate requirement (including GST) for either option is expected to stabilise from the 2022 financial year as the debt servicing costs are incurred for final capital expenditure (Table 24).

Table 24: Projected rates to 2025 based on 75% and 100% uptake of property acquisition offer

	Projected Rates in 2017 Dollars Incl. GST									
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
75% Uptake	$0	$0	$63,036	$152,129	$235,424	$342,014	$377,016	$377,016	$377,016	$377,016
100% Uptake	$0	$0	$68,183	$172,881	$276,720	$399,508	$434,509	$434,509	$434,509	$434,509

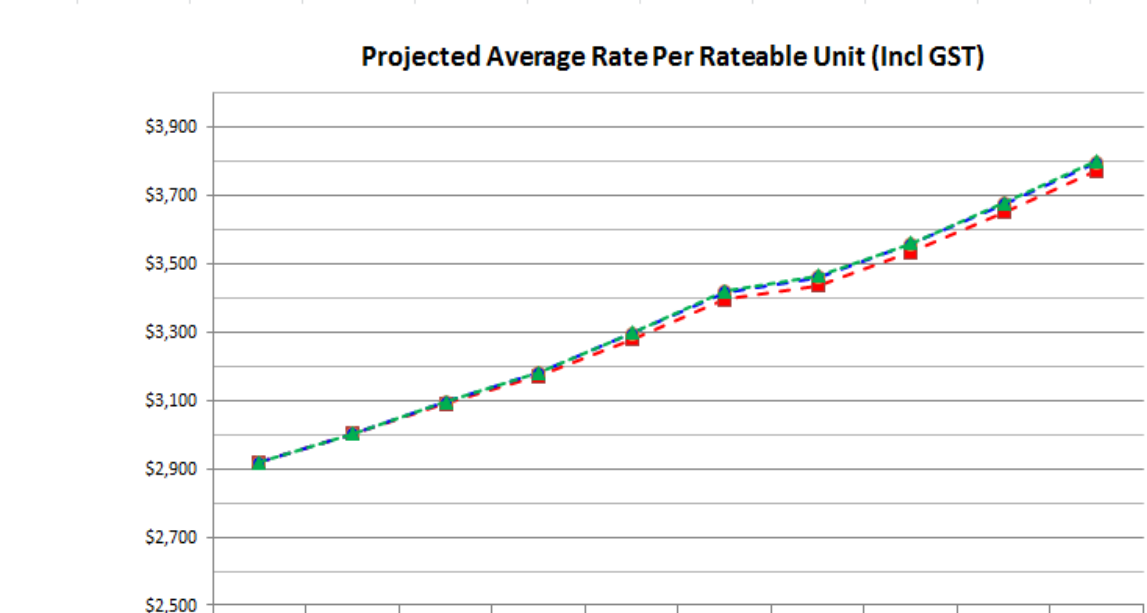
Figures 21 and 22 model the financial impact of the proposal at a ratepayer level, based on the 67% external funding contribution. The impact on individual ratepayers is reflected below as an average increase per rating unit and is expected to range from an average increase of $82 in 2017 to $123 in 2021 when considering 100% take-up by property owners.

Figure 21: Average rate increase in $ per rating unit for all Whakatāne District ratepayers (incl. GST)



The additional rating requirement, when added to the adjusted LTP indicative rate requirement rises from $3,002 in 2017 through to $3,799 in 2025 for the 100% option. Once debt repayment costs stabilise in 2022, the ongoing fluctuations in the average rate are driven by fluctuations in the LTP.

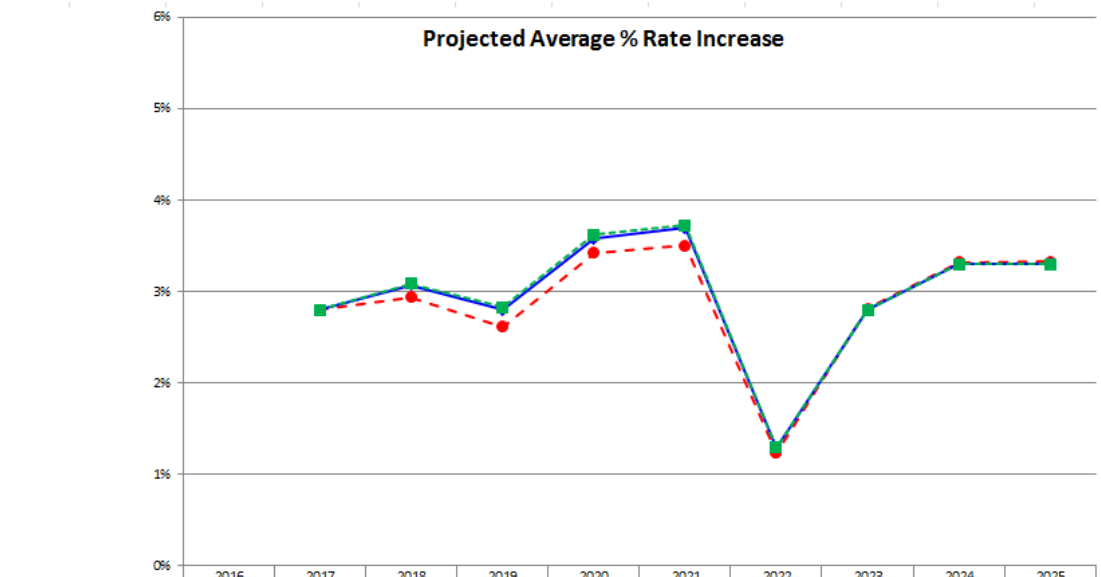
Figure 22: Projected average rate per rateable unit (incl. GST) for all Whakatāne District ratepayers



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
LTP - Adjusted	$2,920	$3,002	$3,090	$3,171	$3,279	$3,394	$3,436	$3,533	$3,650	$3,771
LTP with 75% Option	$2,920	$3,002	$3,094	$3,180	$3,294	$3,416	$3,460	$3,557	$3,674	$3,795
LTP with 100% Option	$2,920	$3,002	$3,094	$3,182	$3,297	$3,419	$3,464	$3,560	$3,678	$3,799

Figure 23 demonstrates the impact of the expenditure on the average annual percentage rate increase, with the greatest impact in 2021.

Figure 23: Projected average percentage rate increase



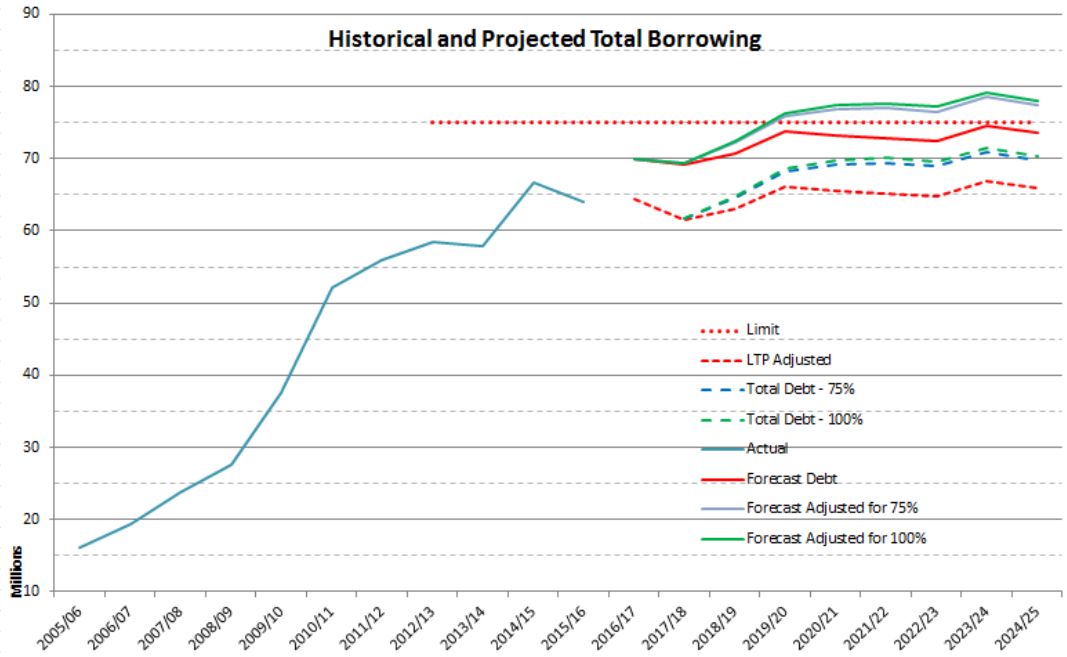
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
LTP - Adjusted		2.80%	2.94%	2.62%	3.42%	3.51%	1.24%	2.82%	3.32%	3.32%
LTP with 75% Option		2.80%	3.07%	2.80%	3.58%	3.70%	1.29%	2.80%	3.30%	3.30%
LTP with 100% Option		2.80%	3.08%	2.83%	3.62%	3.73%	1.29%	2.79%	3.29%	3.30%

6.3.6 Historical and projected borrowing

For both the 75% option and the 100% option, debt exceeds the $75 million limit imposed by the 2015-25 Long Term Plan, based on debt levels adjusted for additional projects or spending not

scoped through the 2015-25 Long Term Plan (refer Figure 24). It should be noted that this limit is based on what Council felt is affordable to the community.

Figure 24: Historical and projected borrowing to 2025



7.0 Management Case – planning for successful delivery

In the event that this investment proposal receives formal approval, a project will be established to deliver the required services and will be managed using the Council's project methodology.

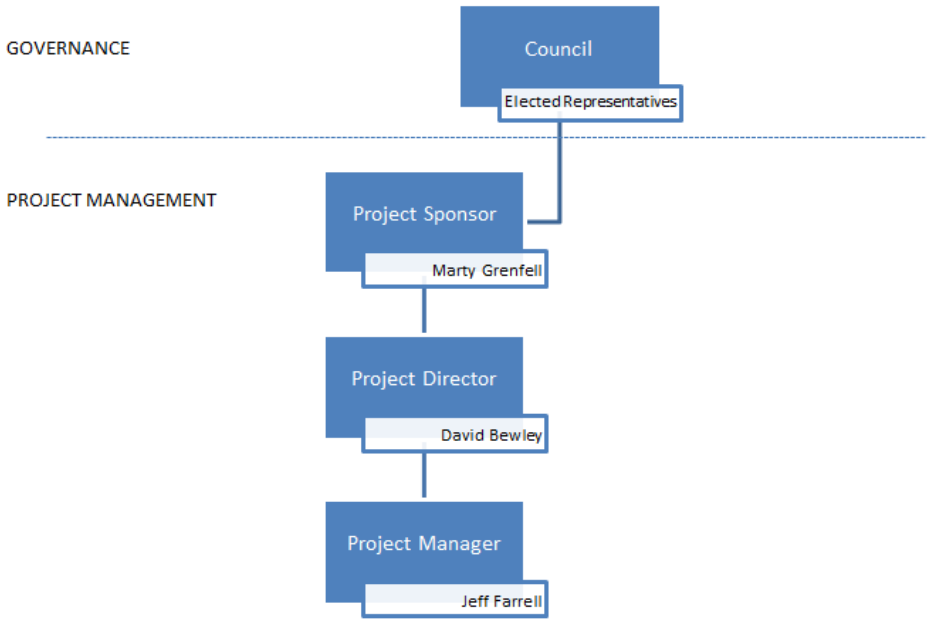
7.1 Project management arrangements

The project will involve four stages:

1. Project initiation (of which this IBC is part)
2. Project planning
3. Project execution
4. Project completion and evaluation.

The relevant project management and governance arrangements are proposed in Figure 25.

Figure 25: Proposed governance arrangements



7.2 Roles and responsibilities

Project Sponsor – The Project Sponsor will be held ultimately accountable for the success of the project and the delivery of agreed benefits. The Project Sponsor is the Chief Executive. The sponsor appoints a project manager, approves the business case and feasibility study, approves the project plan, provides strategic direction and reviews and monitors all aspects of the project. The full description of the project sponsor's role is contained within Council's Project Management Manual.

Project Director – The Project Director will be responsible for managing the delivery of the project budget, milestones and risks to plan. The Project Director is responsible for the delivery of the

project to the sponsor on time, at agreed quality and within budget. The director is responsible for the procedures and tasks as described in the Project Management Manual.

Project Manager – The Project Manager will be responsible for the day to day delivery of this project, any RFP and contractual processes and project delivery.

Project Team – A Project Team will be established with relevant staff from across the organisation responsible for project delivery. The Project Team are the individuals who are assigned the specific tasks in order to carry out the project, under the direction of the Project Manager. Given the significant nature of the project, it may be appropriate to include iwi representatives, key service suppliers and contractors.

Regular reporting will be undertaken to the Project Sponsor and Council where appropriate.

7.3 Proposed timelines

With the risk of not reaching agreement with key funding contributors, it is proposed to follow a structured gateway process to ensure the decision to proceed is carefully considered at each gateway.

The timeline (Table 25) is proposed to progress this project forward.

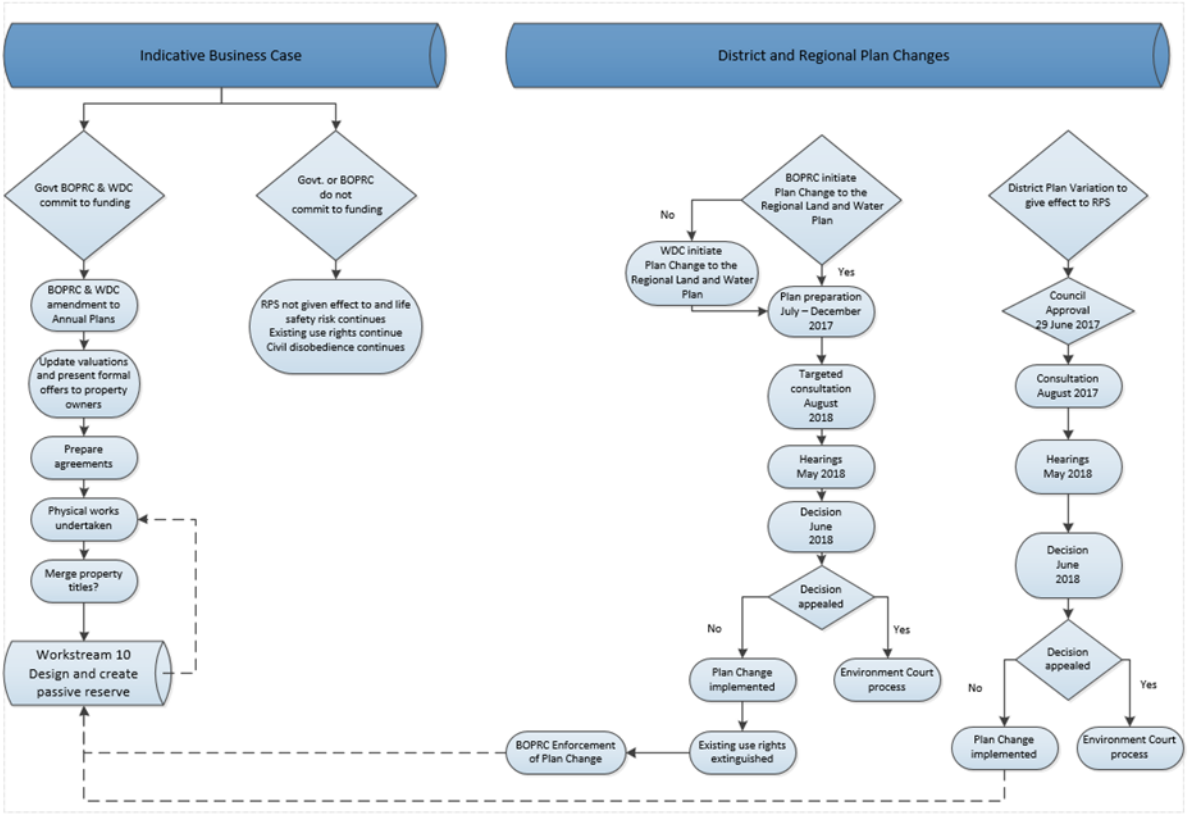
Table 25: Timeline for implementation

Key date	Milestone
August 2017	District and Regional Plan Change commences
August 2017	Formal engagement with Government and BOPRC
March 2018	Submissions to WDC and BOPRC Long Term Plans
30 June 2018	Budgets confirmed District Plan Change completed
	Gateway 2
July/August 2018	Updated valuations undertaken and formal agreements offered to property owners
August 2018	Signed formal agreements received by Council
August/September 2018	Cash payout (subject to regional and central government approval)
September 2018	Retreat process begins and relocation phase implemented
End 2020	Reserve creation finalised

7.4 Potential decision pathways

Full consideration of potential decision pathways and timing is set out in Figure 26.

Figure 26: Potential pathways and timing for decision making



8.0 Summary, recommendations and next steps

This IBC clearly confirms the strategic need to invest. The Awatarariki Stream fanhead community has been unable to recover from the 2005 debris flow event. Long term uncertainty has taken its toll on this small community. Fatigued, frustrated and apprehensive, the community remains in a difficult position. Many remain in houses that represent their life savings, unable to sell and move on. Others have moved off the fanhead, unwilling to return to homes. A few residents have died during the 12 year period leaving the burden of managing the ongoing uncertainty to family members. Some property owners rebuilt in a small window of time when there was an intention to build a structure to mitigate the hazard which subsequently was confirmed as non-viable. For those that remain, no engineering solution means that residents of the Awatarariki Stream fanhead continue to be exposed to property damage and high loss-of-life risks associated with future debris flows.

There is strong agreement by experts that the Awatarariki Stream fanhead is a 'high risk zone'. An existing policy framework and commitment towards improved risk management for natural hazards at international, national, regional and district levels support this proposal. If this framework is to be properly implemented, a way forward for those living or owning property on the fanhead needs to be found.

There are no viable engineering options; retreat is the last option available to mitigate the risk to people and property from this hazard. A managed retreat of the 34 affected privately-owned properties that have been identified within the 'high risk zone' is the preferred way forward. This involves an incentivised approach to relocate people away from the high natural hazard risk through the use of a property acquisition process. This process will be complemented by proposed changes to the Operative Whakatāne District Plan and the Regional Land and Water Plan that recognise the high debris flow risk to Awatarariki fanhead properties in formal planning instruments. This will significantly reduce the risk to life and also provide certainty and create confidence for people to move forward with their lives. It will also enable wider community recovery and resilience.

There are a number of uncertainties associated with the Awatarariki Stream fanhead proposal, particularly around willingness of property owners to relocate, affordability and funding. These include:

- Level of 'take-up' by the 34 property owners (initial consultation indicated that this is likely to be in excess of 75% however returns of registration of interest forms are currently less than this)
- Political willingness to implement a managed retreat policy
- Ability to secure adequate levels of external funding
- Willingness for non-Matatā residents to contribute a proportion of funds through rates
- Success of proposed Plan Changes to the Operative Whakatāne District Plan and the Operative Regional Land and Water Plan.

Many of these uncertainties will be addressed through the next stage of the process.

This IBC demonstrates that funding support from *Government and the BOPRC* will be necessary to commence the process of property acquisition, based on the preferred way forward and the short-listed options above.

Proposed next steps are:

1. Formal engagement with Government and BOPRC to obtain support to implement the Acquisition Strategy.

2. Once funding has been confirmed, managed retreat from the properties in private ownership will be initiated and managed through the Acquisition Strategy approved by the Council. The Acquisition Strategy recognises that:

    - Mitigating high loss-of-life risk is the key driver of the Strategy
    - Property owners have a choice to participate
    - Implementation of the Strategy is reliant on the Council securing funding support from the Government and BOPRC
    - The process must be a fair and legal (despite the Public Works Act not being applicable in this instance, it's tried and tested acquisition principles have been incorporated in the Strategy).

3. Initiation of a plan change to the District Plan to rezone residential land on the Awatarariki Stream fanhead to reserve.

4. Initiation of a plan change to the Operative Regional Land and Water Plan to introduce an additional measure of a Prohibitive Activity status for existing uses in the Awatarariki fanhead high debris flow risk area.

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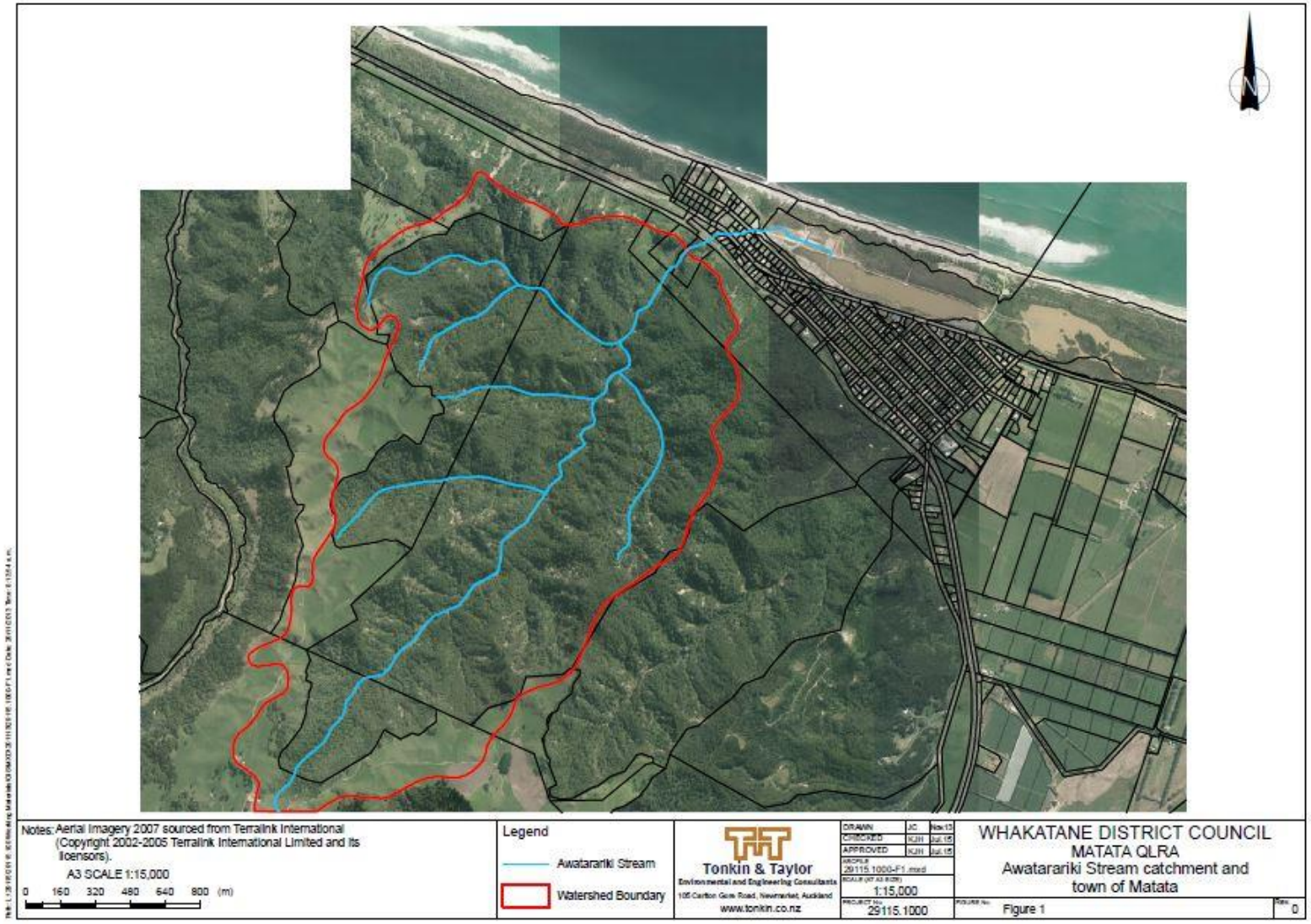
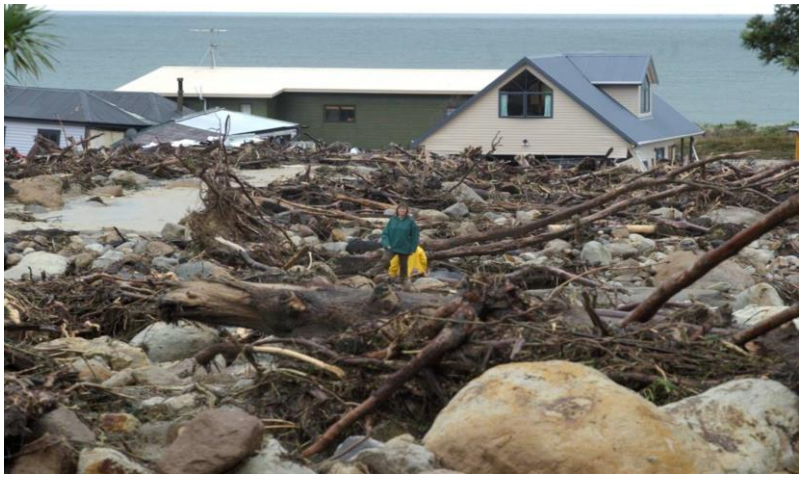
Appendix I – Map of the Awatarariki stream catchment and the town of Matatā[31]

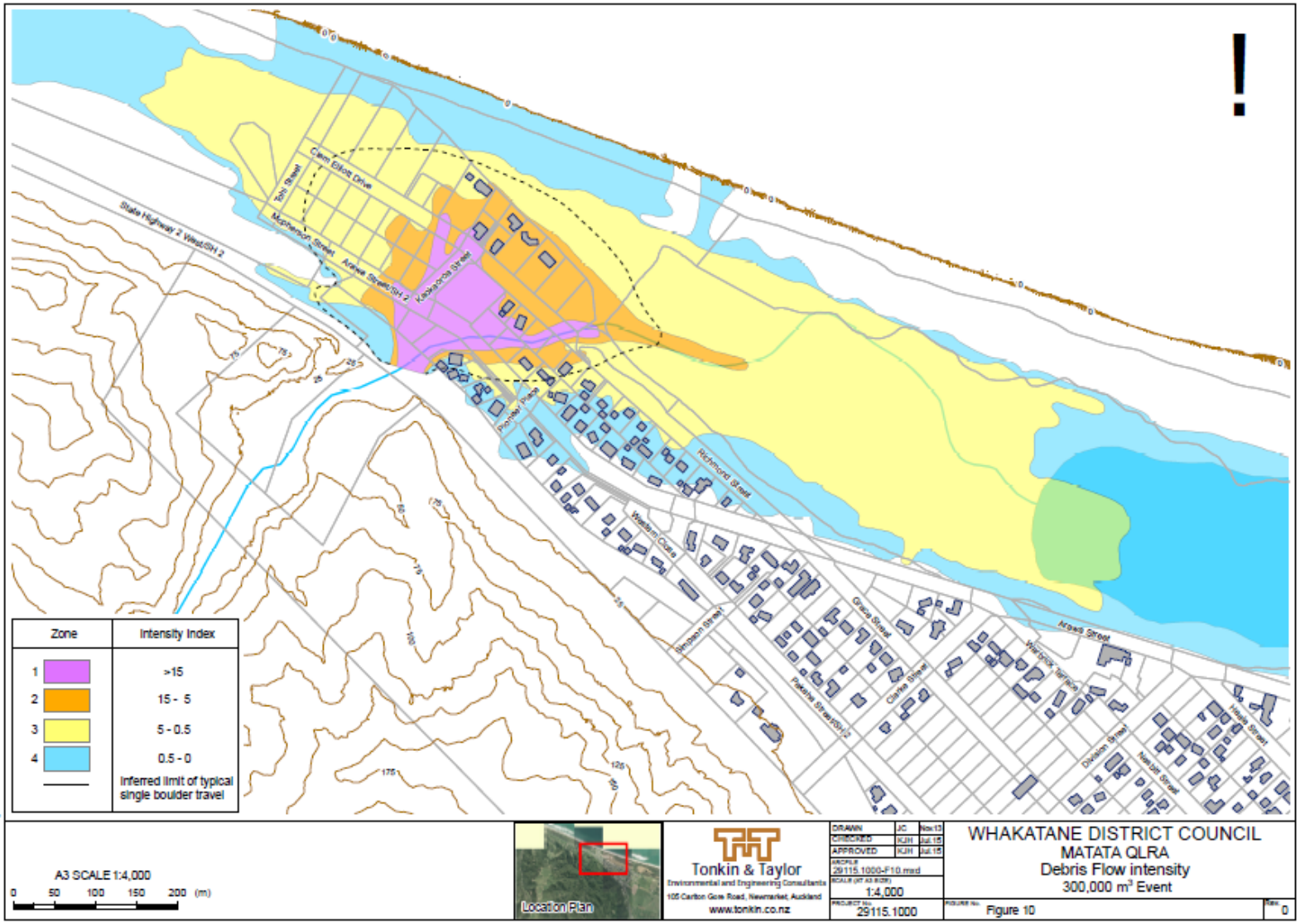


[31] From Tonkin & Taylor, 2005.

Appendix II – Photographs of the 2005 Debris Flow Event



Appendix III – Map showing intensity zones (debris flow intensity 300,000m^3 event)[32]



[32] From Tonkin & Taylor (2015)

Appendix IV – Summary presentation of the long-list options assessment

		Scope Options (What)				Service Options (How)										Service Delivery Options (Who)					Implementation Options (When)				Funding Options				
	SCO1	SCO2	SCO3	SCO4	SCO5	SOL1	SOL2	SOL3	SOL4	SOL5	SOL6	SOL7	SOL8	SOL9	SOL10	SD1	SD2	SD3	SD4	SD5	IM1	IM2	IM3	IM4	FO1	FO2	FO3	FO4	FO5
	Management of possible debris flow (magnitude of flow)					Engineering Solutions					Planning Solutions																		
Description of Option:	Status Quo (none)	50,000m^3 (50-100 yr return)	150,000m^3 (100-250 yr return)	300,000m^3 (200-500 yr return)	450,000m^3 (500-1000 yr return)	No works	Catchment monitoring / early warning system	On-Site Mitigation to protect existing	Bund to protect the east	Channel out to Sea	Stay, accept risk & build	Stay, escape & plan change	Managed voluntary retreat for existing dwellings	Managed voluntary retreat all properties	Compulsory retreat	Individual Property Owners	WDC	Colloborative WDC & BOPRC	BOPRC	Central Govt	Defer	By 2036	By 2026	By 2020	Individual Property Owners	Individual property owners & local govt	WDC, regional council & central govt. via retreat package	central govt (compulsory retreat)	BOPRC (compulsory retreat) No compensation
Investment Objectives:																													
To protect the life safety of residents at Awatarariki Fanhead	intolerable	intolerable	intolerable	tolerable	acceptable		not effective (GNS)		Road & rail creates residual risk	Refer Davies peer review			some may choose to stay	some may choose to stay								Residual risk	Residual risk			If by 2036			
To create a state of certainty as the basis for Matatā town and its community to recover from the 2005 event and to support future community resilience																													
Critical Success Factors																													
Strategic fit & Business Need (LGA, RMA, Building Act, CDEM, LTP, RPS, DP)																													
Value for Money (fit for purpose)									$27M				$5M	$10M	$nil?														
Supplier capacity & capability (are there potential suppliers and is this a sustainable arrangement?)									Sustainable?																				
Potential affordability (is funding available?)				External funds required	External funds required				Very expensive				impact on landowners	External funds required	impact on landowners		need regional & central govt funds	need central govt funds					need WDC, BOPRC & central govt funds	need WDC, BOPRC & central govt funds		need central govt funds			
Potential achievability (is this technically, politically & socially possible?)					political support unlikely								Socially acceptable?		Politically acceptable?				Politically acceptable?	Politically acceptable?						If by 2036	Poltically acceptable (3)	Poltically acceptable (2)	Poltically acceptable (1)
Overall Assessment:	Continued for VFM	Discount	Discount	Preferred	Possible	Discount	Discount	Discount	Discount	Discount	Discount	Discount	Possible	Preferred	Possible	Discount	Possible	Preferred	Possible	Possible	Discount	Possible	Possible	Preferred	Discount	Possible	Preferred	Possible	Possible
Short-listed options:																													
Option 0: Status Quo - Do Nothing																													
Option 1: Do Minimum	300,000m3 (200-500 yr return)					Managed Voluntary retreat for existing dwellings										Colloborative WDC & BOPRC					2020				Individual property owners & WDC/BOPRC & central govt.				
Option 2: Less Ambitious	300,000m3 (200-500 yr return)					Managed Voluntary retreat for all properties										Colloborative WDC & BOPRC					2020				Individual property owners & WDC/BOPRC & central govt.				
Option 3: Intermediate	450,000m3 (200-500 yr return)					Managed Voluntary retreat for all properties										BOPRC or Central Govt					2036				BOPRC o r Central Govt.				
Option 4: More Ambitious	450,000m3 (200-500 yr return)					Compulsory retreat										BOPRC or Central Govt					By 2020				BOPRC or Central Govt				

Appendix V – Scenarios and cost benefit analysis

Recognising that debris flow events of varying sizes have previously occurred in the Awatarariki catchment and will occur again in the future, a scenario-type methodology has been carried out varying the year of a single repeat event similar in magnitude to that of 2005 taking place. This recognises the costs associated with a repeat event in the year that it occurs, rather than spreading costs across large timeframes.

This methodology considers costs and benefits as a single snapshot in time, as well as providing traditional present value analysis. For the purposes of this analysis, a repeat event is considered in years 1 (2017), year 4 (2010), year 10 (2026) and year 50. Scenarios are described in more detail below.

Scenario 1 *The costs associated with a debris flow event and avoided costs (benefits) are spread across a 200 year timeframe, reflecting the uncertainty of when a repeat event will occur. These reflect the figures provided in Table 10 above.*

Scenario 2 *Debris flow occurs in Year 1 (2017). Property acquisition has not been implemented with high costs to lives and properties.*

Scenario 3 *Debris flow occurs in Year 4 (2020) immediately following completion of property acquisition for options 1, 2 and 4. High costs to lives and properties associated with Option 3 as only a small portion have vacated (implementation complete in 2036).*

Scenario 4 *Debris flow event in Year 10 (2026). At this time, property acquisition has been fully implemented for options 1, 2 and 4. High costs to lives and properties associated with Option 3 as only half have vacated (implementation complete in 2036).*

Scenario 5 *Debris flow event occurs in Year 50 (2066). At this time, property acquisition has been fully implemented for options 1, 2, 3 and 4.*

Economic analyses of each scenario are presented in Figures 1 to 3. As expected, project costs mostly remain the same across the scenarios for a single option, it is the costs of a repeat event and the benefits that vary. This reflects the timing of the repeat event and whether properties have vacated the high risk zone before the event occurs or after. If properties have been vacated before the event, the avoided cost to lives, property and contents become a benefit. The costs are for 75% take-up of the property acquisition offer for the 16 households and 100% take-up from section owners.

Figure 1: Project capital costs for each option and scenario

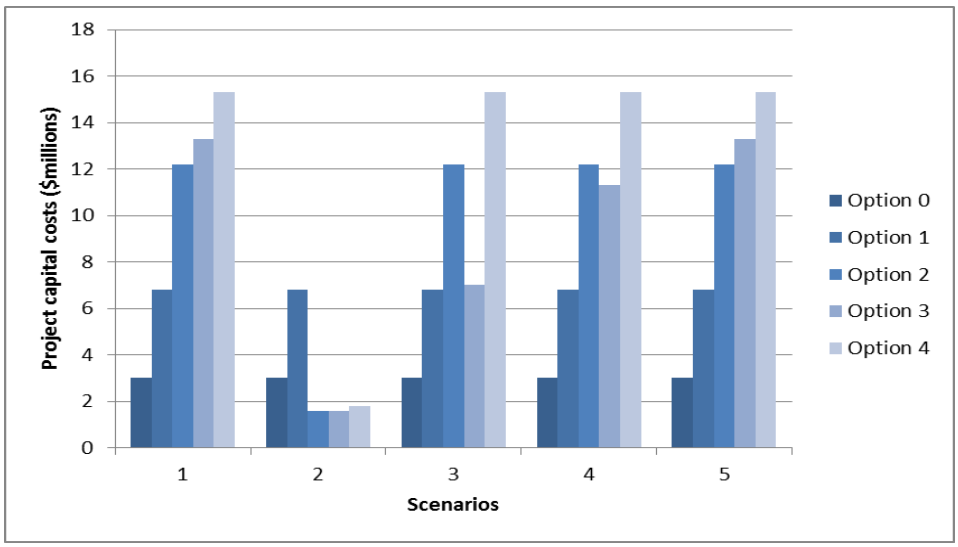


Figure2: Costs associated with a repeat event for each option and scenario

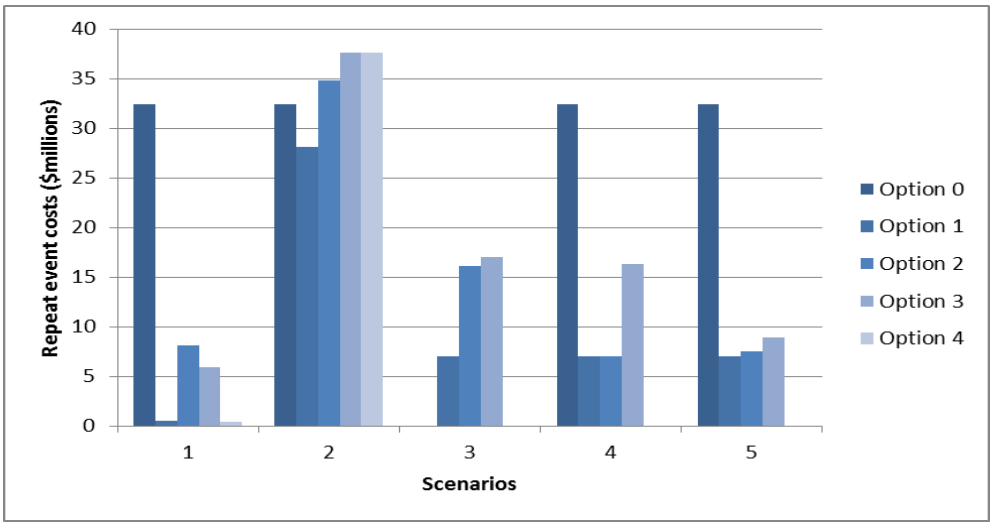
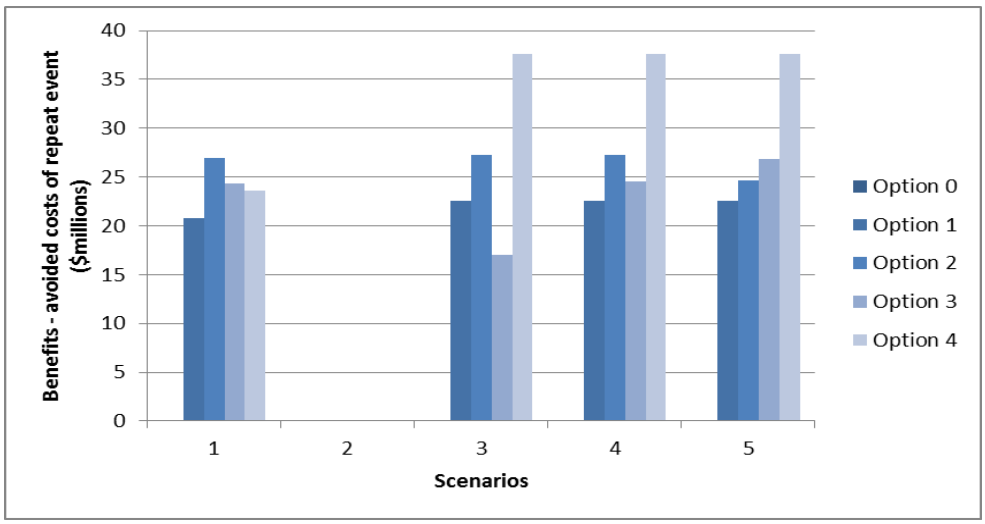


Figure 3: Avoided costs (benefits) for each option and scenario



Appendix VI – Sensitivity testing for all options and scenarios

	Scenario 1: Repeat event 1-200 yrs	**Scenario 2: Repeat event Year 1 (2017)**	**Scenario : 3 Repeat event 2020 (after properties vacated)**	**Scenario 4: Repeat event in Year 10 (2026)**	**Scenario 5: Repeat event in Yr 50 (2066)**
Option 0: status quo	Costs: **$35,556,268** Project: $3,029,000 Repeat event: $32,527,268 Benefits: nil NPV: (6%)- $4,831,269 NPV (3%): -$6,065,565 NPV (10%) -$3,796,886	Costs: **$35,394,441** Project: $3,029,000 Repeat event: $32,365,441 Benefits: nil NPV (6%) -$32,953,817 NPV (3%) - $6,065,565 NPV (10%) - $3,796,886	Costs: **$35,394,441** Project: $3,029,000 Repeat event $32,365,441 Benefits: - nil NPV (6%): -$27,799,587 NPV (3%): -$26,636,617 NPV (10%) -$13,525,485	Costs; **$35,394,441** Project: $3,029,000 Repeat event:$32,365,441 Benefits: - nil NPV (6%): -$19,962,818 NPV (3%): -$26,636,617 NPV (10%): -$13,525,485	Costs: **$35,394,441** Project: $3,029,000 Repeat event: $32,365,441 Benefits: - NPV (6%): -$2,530,302 NPV (3%): - $2,769,560 NPV (10%): - $2,240,354
Option 1: managed retreat dwellings only (300,000m3) by 2020	Costs: **$15,151,376** Project: $6,760,901 Repeat event: $7,995,705 Benefits: $20,791,685 NPV (6%): -$6,018,016 NPV (3%): -$5,315,907 NPV (10%): -$5,670,902	Costs: **$35,300,084** Project: $6,670,901 Repeat event: $28,144,413 Benefits: nil NPV (6%): -$32,651,967 NPV (3%) - $33,796,851 NPV (10%) -$31,145,678	Costs: **$14,672401** Project: $6,760,901 Repeat event: $7,036,103 Benefits: $22,550,192 NPV (6%): $5,916,390 NPV (3%): $6,812,245 NPV (10%): $4,047,748	Costs: **$14,672,401** Project: $6,760,901 Repeat event: $7,036,103 Benefits: $22,550,192 NPV (6%) $1,124,412 NPV (3%): $3,525,989 NPV (10%) -$1,076,615	Costs: **$ 14,672,401** Project: $6,670,901 Repeat event: $7,036,103 Benefits: $22,550,192 NPV (6%): -$6,196,218 NPV (3%): -$6,496,770 NPV (10%) -$5,815,706
Option 2: managed retreat all properties (300,000m3) by 2020	Costs: **$31,840,137** Project: $12,240,956 Repeat event: $8,100,907 Benefits: $26,919,677 NPV (6%): -$11,431,784 NPV (3%): -$11,718,512 NPV (10%): -$10,927,275	Costs: **$47,951,126** Project: $1,606,500 Repeat event:$34,846,352 Benefits: nil NPV (6%): -$34,692,291 NPV (3%): -$36,224,519 NPV (10%): -$30,624,025	Costs: **$39,880,409** Project: $12,240,956 Repeat event: $16,141,178 Benefits: $27,329,622 NPV (6%): -$3,106,308 NPV (3%): -$4,440,605 NPV (10%): $9,529,250	Costs: **$30,775,334** Project: $12,240,956 Repeat event:$7,036,103 Benefits $27,329,622 NPV (6%): -$911,278 NPV (3%): $2,273,697 NPV (10%) -$3,864,346	Costs: **$31,255,961** Project: $12,240,956 Repeat event: $7,516,731 Benefits: $24,692,882 NPV (6%): -$11,841,674 NPV (3%): - $12,691,233 NPV (10%): -$10,940,258
Option 3: managed retreat dwellings and sections (450,000m3) by 2036	Costs: **$32,755,163** Project: $13,269,920 Repeat event: $7,970,587 Benefits: $14,994,913 NPV (6%): -$10,392,937 NPV (3%): -$12,385,629 NPV (10%): -$8,106,413	Costs: **$51,864,721** Project: $1,644,000 Repeat event: $37,645,572 Benefits: nil NPV (6%): -$36,703,132 NPV (3%): -$38,592,626 NPV (10%): -$34,654,893	Costs: **$40,290,234** Project: $6,951,159 Repeat event: $17,004,765 Benefits: $17,004,765 NPV (6%): -$11,169,774 NPV (3%): -$9,807,395 NPV (10%): -$6,429,208	Costs: **$39,769,422** Project:$11,302,568 Repeat event: $16,379,647 Benefits: $24,639,246 NPV (6%): -$3,968,559 NPV (3%): -$4,062,571 NPV (10%): -$3,855,129	Costs: **$33,721,644** Project: $13,269,920 Repeat event:$8,937,068 Benefits: $26,811,205 NPV (6%): -$9,025,996 NPV (3%): -$11,078,042 NPV (10%) -$7,079,684

Option 4: compulsory retreat by 2020 (450,000m3)	Costs: **$32,093,777** Project: $15,279,719 Repeat event: $479,785 Benefits: $23,629,412 NPV (6%): -$13,994,343 NPV (3%): -$14,414,110 NPV (10%): -$13,329,825	Costs: **$55,973,000** Project: $1,756,500 Repeat event: $37,645,572 Benefits: nil NPV (6%):-$37,843,700 NPV (3%): -$39,632,061 NPV (10%): -$35,775,937	Costs: **$31,613,992** Project: $15,279,719 Repeat event: nil Benefits: $37,645,572 NPV (6%): $14,568,535 NPV (3%): $11,820,891 NPV (10%) -$532,336	Costs: **$31,613,992** Project: $15,279,719 Repeat event: nil Benefits: $37,645,572 NPV (6%): $5,453,268 NPV (3%): $11,820,891 NPV (10%): -$532,336	Costs: **$31,613,992** Project: $15,279,719 Repeat event: nil Benefits: $37,645,572 NPV (6%): -$14,823,206 NPV (3%): -$15,939,862 NPV (10%): -$13,658,535

Appendix VII – Non-monetary benefits

Table 9: Analysis of potential benefits that cannot be reliably expressed in monetary terms

Main Benefits	Who Benefits	Direct or Indirect	Quantitative or Qualitative	Description and Possible Measures
Certainty for property owners about future options.	Property owners	Direct	Qualitative	The CDG findings included that the impact of uncertainty for property owners in terms of the ability for future use of the land has been high over the last 10 years. The status quo option will continue with a high amount of uncertainty that will be exacerbated by the probability of another debris flow event, climate change and the Regional Councils ability to extinguish existing use rights. All managed retreat options (options 1-3) enable individual choice to live with uncertainty or not. Compulsory retreat offers complete certainty but removes all aspects of individual choice which may be regarded negatively by property owners.
Minimising stress and uncertainty of continual exposure to a high loss-of-life risk.	Awatarariki Residents	Direct	Qualitative	Health and wellbeing issues can arise from the continued risk of living in a hazardous area. At least one resident has passed away since 2005 with family commenting that stresses associated with the uncertainty accelerated his illness.
Minimising the social and health effects of displacement.	Property owners	Direct	Qualitative *Dis-benefit*	Health and social issues can arise from loss of property and community networks of people having to resettle elsewhere. The loss of cultural and/or family links with land and property can negatively affect individuals and groups. For some, the stress of moving and living in a new location can also negatively impact on health and wellbeing, particularly for the elderly.
Protection of personal items with no market value.	Property owners	Direct	Qualitative	Protection of personal items with no market value but potentially significant intrinsic value to the owner from a repeat debris flow.
New development in Matatā.	Matatā residents	Indirect	Quantitative	With retreat, it is assumed that some will want to relocate in other parts of Matatā. This relocation may stimulate additional development of the township.
Improved hazard protection to the built environment from coastal processes through a wider coastal reserve area.	Matatā residents	Direct	Quantitative	The retreat from this high risk area will effectively provide hazard protection to the built environment from coastal processes. The risk from coastal processes is likely to increase with climate change.
Passive reserve space created for community with improved links to coast	Matatā residents	Indirect	Qualitative	If retreat occurs this will have a positive effect on amenity and recreational values in Matatā with the creation of a passive reserve in the high risk zone. This will improve access to the coast for western Matatā, which is difficult with SH30 and the rail way line restricting access.

Main Benefits	Who Benefits	Direct or Indirect	Quantitative or Qualitative	Description and Possible Measures
Improved visual amenity to the entrance to Matatā and the gateway to the Whakatāne District	Matatā residents, general travelling public	Indirect	Qualitative	The creation of a passive reserve will also greatly improve the western entrance to Matatā, which is currently partially littered with debris material. The scope of the reserve will be dependent on the number of property owners willing to take up the retreat offer.
Peace of mind from escape route created in interim or for those choosing to stay	Awatarariki Stream fanhead residents	Direct	Qualitative	The CDG highlighted that in the event of a debris flow event the stress of not being able to escape was high. This forms part of all project options, which will be irrelevant if or when retreat is implemented.
Reputational benefits to government, regional council and WDC through proactively implementing natural hazard changes to the RMA & also implementing RPS.	Government, regional council and WDC	Indirect	Quantitative Qualitative	If managed retreat goes ahead there may be strong public relations benefit for tackling life safety risk (options 1-3). Compulsory retreat (option4) has an associated political risk for regional council or central government. If status quo continues this may arise give rise to a legal challenge for not taking action, especially if there is a repeat event.
Ease of future clean up on fanhead	Local and central government	Direct	Quantitative	The ease of future cleanup of a repeat debris flow will improve with fewer residents on the fanhead.
Contribution to the national and international natural hazard knowledge base	Academia, natural hazard experts & local government	Indirect	Qualitative	Natural hazard management in New Zealand is increasingly becoming important. The body of work that informs this IBC will be useful in informing further work in this area.
Minimising risk to emergency management personnel	Emergency management personnel	Direct	Qualitative	Natural hazard events also pose a risk to those that attend emergency events. This benefit is directly proportional to the number of people residing on the fanhead.

Appendix VIII – Initial risk register

Main Risks	Reasons for risks	Risk Management Strategy
Incurring high costs doing investigative work and not securing additional funding from external agencies	• Not a priority politically. • Cautious of setting precedence. • Not convinced economically viable solution. • Not convinced that community is on board with solution. • Not convinced that science supports retreat.	• All signing off at appropriate stages of the business case process will ensure that external funding agencies are on board with the project throughout its development. • Communications and engagement occur on a regular basis to ensure the community is on board with the solution. • Scientific reports have been developed and peer reviewed independently by experts in their field..
Repeat debris flow event results in loss-of-life, injury and property damage before project completion	• Retreat solution has not occurred in time and residents are impacted by significant event. • People choose to reside in the high risk zone. • Debris flow event occurs not aligning with modelling affecting different properties and residents.	• Additional escape route developed as a basic life safety requirement. • Scientific reports have been developed independently by experts in their field and also peered reviewed independently. These have included a significant amount of modelling, including using evidence of past debris flow events. • Residual risks (lower than the high risk zone) remain to properties outside the high risk zone.
Awatarariki property owners and residents do not support the option.	• A high proportion of property owners are unhappy with the terms of the property acquisition offer and decide to stay. • Many decide that they are willing to take the risk of living in a high risk zone. • Property owners are not willing to accept that there is no viable engineering solution	• Keeping residents fully informed will assist. • Gauging the level of support with an indicative property acquisition offer early in the process will assist.
Iwi oppose approach	• Iwi decide that they want to use land for residential purposes.	• Full iwi consultation and engagement will assist in minimising this risk.

Main Risks	Reasons for risks	Risk Management Strategy
MBIE determination appealed and reversed	• Property owners appeal determination rather than retreat.	• Determination supports Council's decision to not waiver section 72 notice thereby ensuring no new development on the fanhead. • Scientific evidence is strong that this is a high risk debris flow zone.
BOPRC does not support the preferred way forward.	• Decide not to part-fund the preferred way forward. • Decide do not want to support preferred solution as sets precedence. • Decide that the retreat does not fit the RPS natural hazard policy recently adopted.	• Sharing information and working alongside BOPRC will encourage support and ensure no surprises.
Pressure from non-Matatā ratepayers to not proceed with project	• Non-Matatā residents do not want to fund increase in rates due to retreat option. • Non-Matatā residents do not want retreat to proceed because of potential implications for other areas that have been identified as hazardous.	• Funds have been identified for this purpose in the LTP. The community will be kept informed of any major changes in the strategic direction of the project and any additional costs.
Central government does not support the preferred way forward.	• Decide not to part-fund the preferred way forward. • Decide do not want to support preferred solution as sets precedent.	• Sharing information and working alongside Government will encourage support and ensure no surprises.

Appendix IX – Key actions, decisions, influences and outcomes

May 2005	Awatarariki catchment • 700 cumecs peak debris flow rate (66 cumecs = 1 in 100 year peak flood flow) • Boulders up to 7.0 metres diameter mobilised • 300,000m3 of debris (boulders, trees, silt) deposited on the fanhead • Road and rail links destroyed • Houses destroyed and damaged	GNS report confirms recurring natural hazard event triggered by intense rainfall. •
August 2005	Council considered 11 mitigation options. Option A2 selected - a debris dam in the catchment and debris flood channel on the fanhead.	Property owners want to continue to reside on the fanhead.
August 2006	Building Act determination concluded properties were not dangerous and residents could reoccupy their homes.	Building consents subsequently issued subject to section 72 of the Building Act for the rebuild of 6 houses.
2007-2008	Options for debris detention structures in the upper catchment presented to the Matatā community for consultation. Concerns expressed about the environmental and cultural footprint of proposed structures.	23 July 2008 - A flexible ring-net design selected as the preferred option.
August 2011	Following multiple landslides in 2010 and 2011, one of which resulted in a fatality, the Council commissioned a quantitative landslide risk assessment (QLRA) of Whakatāne and Ohope escarpments as a key input into development of natural hazard objectives, rules and policies for incorporating into the District Plan.	Tonkin and Taylor Ltd carried out the work which was peer-reviewed by GNS and GHD.
March 2012	Tonkin and Taylor recommended that the Awatarariki debris detention structure project be comprehensively reviewed.	

4 July 2012	The Projects and Services Committee considered a report from Alan Bickers that recommended the ring net design be abandoned; that WDC not pursue any further upstream options; and a detailed feasibility study of the 4 identified downstream options is the next logical step if a "no action" strategy is not acceptable. It was noted that all downstream options are likely to require modification of the railway bridge and possible replacement of the SH2 road bridge.	The Committee resolved to take no further action to develop solutions for debris detention of the Awatarariki Catchment upstream of the escarpment, and to commence a process of re-evaluation of downstream options.
1 August 2012	Council considered a report proposing a project to consider downstream options as proposed by Alan Bickers, as well as the community proposed Chute to Sea option.	Downstream Options Project approved.
12 December 2012	The Projects and Services Committee considered a report from AECOM which reviewed engineering concepts and costings for fanhead solutions. Included Chute to Sea and Deflection Bunds options.	The Committee resolved to abandon engineering options and develop 2 planning options (information-based, and event-based). The Council decision formally recognised that the properties known to be at risk from the debris flow hazard from the Awatarariki Stream catchment would continue to be exposed to levels of risk associated with that hazard in the future.
April 2013	Tonkin and Taylor Ltd commissioned to undertake QLRA of Matata escarpment and Awatarariki fanhead.	
June 2013	Final report of Whakatāne and Ohope QLRA received with recommended hazard lines.	
August 2013	Tonkin and Taylor Ltd commissioned to undertake a site specific debris flow risk assessment for all properties on the Awatarariki fanhead. GHD engaged to undertake peer review.	

11 December 2013	Draft *Supplementary Risk Assessment – Awatarariki Debris Flow Hazard, Matatā: Issues and Options* and draft *Awatarariki Fanhead Strategy – Issues and Options* presented to the Policy Committee	The Committee resolved to consult with the Awatarariki fanhead property owners and encouraged property owners to provide feedback
		
18 December 2013	Draft *Landslide and Debris Flow Risk Reduction Strategy and Draft Variation to the Proposed District Plan* presented to the Council	Council resolved to continue with current approach and wait for new BOPRC RPS natural hazard provisions to be finalised before proceeding further
		
2 July 2014	WDC application to the Ministry of Business, Innovation and Employment for a determination under the Building Act 2004 to clarify whether or not it is reasonable for the Building Consent Authority (BCA) to grant a waiver or modification of the Building Code under section 72(c) of the Building Act 2004 for building consent applications for dwellings on land that is subject to debris flow and debris flood natural hazards.	Determination 2016/034 concluded that based on the high probability for loss of life, it is not reasonable for a waiver to be granted under BA s72.
		
23 October 2014	BOPRC presentation to WDC on Proposed Change 2 to the RPS	Overall purpose of Change 2 is to guide those preparing regional, city and district plans and considering resource consent applications to manage land use and associated activities according to the level of natural hazard risk they are subject to (high, medium, or low).
		
March – June 2015	Work with Consensus Development Group over four day-long meetings. The Group: • Identified the need for collective definitive research to be undertaken to clarify the boundary between acceptable loss of life risk and unacceptable loss of life risk on the Awatarariki fan head and recommended GNS review and refine the debris flow risk assessment modelling by T&T; • Agreed that a high debris flow risk to the community	See 'Awatarariki Option Summary from all CDG Meetings' and David Stimpson Report and PowerPoint presentation to Council 3 June 2015 +

	exists;
	• Noted that individuals vary widely in their personal tolerance to risk with some wanting to take individual responsibility for accepting the risk;
	• Recognised the Council is legally bound to consider the risk to all people, including the young, the elderly, and visitors;
	• Considered the following range of options
	  • Stay, accept the risks and allow further building on all sites;
	  • Stay, with works to protect existing buildings only;
	  • Status quo (existing homes stay with existing use rights but no/uncertain further development and risk of legal action);
	  • Mitigation of risks with works on each private dwelling (i.e. either a collective plan across all sites to raise floor levels and strengthen foundations, or a plan pursued by individual site owners or sets of site owners by mutual agreement);
	  • Channel out to sea;
	  • Bund to protect the east;
	  • Managed full retreat over time;
	  • Managed voluntary retreat over time.
	• Agreed that engineering options are likely to be unaffordable (1 of the members was a party to the Building Act determination);
	• Considered and provided feedback on a preliminary settlement agreement proposal;
	• Identified urgent work regardless of the long-term solution. This included:
	  • Establishment of improved escape routes;
	  • Investigation of early warning systems;
	  • Investigation of rates relief
	• Noted that while it is accepted that landowners and the Council are likely to continue for some time to disagree on the detailed content of a way forward, it was noted that a solution requires early agreement between Council and landowner at least on the process to be followed;
	• Invited Council officers to prepare the details of a proposed settlement process and to report this to WDC, BOPRC, and landowners;
	• Noted that funding and other details will be critical to acceptance but support the proposed process suggested.
		D Stimpson report back to landowners and Council – 3 March 2015
		
		+
		
		Communiques to landowners:
		
		Communique 1 – 3 March 2015
		
		Communique 2 – 24 April 2015
		
		Communiques 3 – 7 May 2015

18 March 2015	NZ signs up to the Sendai Framework for Disaster Risk Reduction 2015-2030 in Sendai, Japan. Makes prevention and reduction of disaster risk a primary responsibility of signatory governments.	Government committed NZ to an international policy agreement to actively reduce levels of natural hazard risk that have been identified as being unacceptably high.

5 May 2015	BOPRC commissioned AECOM to include the Matatā debris flow risk scenario in a pilot test of the proposed RPS assessment methodology.	Conclusion was 'High Risk'
		
2 July 2015	The Policy Committee considered a report on the work of the CDG and a proposed plan moving forward. Some of the property owner members of the CDG presented to the Committee – Neville Harris, Marilyn Pearce, Greta Nicholson, Bob Martin.	The Committee confirmed: • that planning-based options continue as the focus of investigation during the process of developing a settlement framework to mitigate debris flow risks on the Awatarariki Fanhead; and • that a "do minimum" option is not the preferred outcome from the process; and • staff progress the development of a voluntary managed retreat option; and • that a voluntary managed retreat option is contingent upon securing funding support across all three levels of government (Whakatāne District Council, Bay of Plenty Regional Council, and Central Government); and • approval of the following work with a view to having the work completed by the end of October 2015: a) Definition of hazard lines at Awatarariki at a property boundary level; b) Definition of current market valuations of properties potentially affected at Awatarariki; c) Investigation of early warning systems and escape routes; d) Initiate informal approaches to Bay of Plenty Regional Council and central

		government for the funding of a managed voluntary retreat at Awatarariki; e) A review of the rating circumstances for each property owner on the Awatarariki Fanhead going back to 2005; f) Investigation of solutions to the hazard of right hand turning traffic from SH2 into Kaokaoroa Street. 11 discrete workstreams were developed that form the Awatarariki Debris Flow Risk Management Programme.
10 November 2015	Opus investigated additional Escape Routes. Report Identified best option for residents of properties on the east side of the Awatatarariki Stream is to evacuate through Arawa Street and Richmond Street. For residents in the Clem Elliott Drive area, recommendation was to open up Clem Elliott Drive to Tohi Street to McPherson Street to high ground by the SH2 by-pass. Estimate of cost $30,000.	
17 November 2015	Tim Davies (Canterbury University) and Mauri McSaveney (GNS) *Peer Review: Awatarariki debris-flow-fan risk to life and retreat zone extent.*	Review recognised area subject to high risk; recognised limitations with the T&T risk modelling that underestimated the loss of life risk, and recommended extending the minimum area of retreat from the modelled 10^{-4} annualised loss-of-life line to the modelled 10^{-5} line.
19 November 2015	Opus report on Right Turning Bay concluded: • Basic Right turn bay widening is warranted based upon existing traffic numbers but the current crash risk and low probable crash reduction means that this treatment is unlikely to be a high priority for funding by the Transport Agency. • A short right turn bay is warranted based upon predicted traffic volumes if the subdivided lots were	

	to have dwellings constructed on them. Again the low predicted crash reduction means this treatment is unlikely to be a high priority for funding by the Transport Agency.	
10 December 2015	GNS advise of the difficulties in establishing an effective debris flow early warning system for the Awatarariki fanhead	GNS conclude that an early warning system in this situation is likely to be highly ineffective.
23 February 2016	Report to Policy Committee providing an update on all workstreams.	The Committee resolutions included: • **THAT** in regard to Workstream 1 (Review Hazard and Risk Line Definition) the geographical area of the fanhead for retreat from debris flow risk be the area bounded by the black hatched lines in Figure 1 Quantitative Debris Flow Risk Assessment on page 39 of the agenda; and • **THAT** in regard to Workstream 3 (Escape Routes) staff develop a project plan and project budget to establish an additional escape route for Clem Elliott Drive residents through the designated unformed public road to the west; and • **THAT** in regard to Workstream 4 (Early Warning Systems) the development of a debris flow early warning system not be pursued at this point in time due to the uncertainties around the effectiveness of the system; and • **THAT** in regard to Workstream 6 (Right Turning Hazard) the New Zealand Transport Authority be provided with a copy of the Opus

		report on the hazard to east bound traffic through west bound traffic turning right into Kaokaoroa Street from State Highway 2; and • **THAT** staff progress Workstream 2 – Property Valuations; and • **THAT** staff progress Workstream 7 - development of a voluntary managed retreat option.
		
25 July 2016	MBIE Determination 2016/034 received	Confirmed that building consents for new dwellings should not be issued due to high debris flow risk
		
28 July 2016	Council meeting considered voluntary retreat framework and approval to construct alternative escape route from Clem Elliott Drive	Council adopted the Acquisition Strategy prepared by The Property Group Ltd and dated July 2016 as the basis for developing Voluntary Retreat Proposals to owners of the 34 private properties in the high debris flow risk area, and directed staff to prepare for Council consideration a Plan Change to the natural hazard provisions of the Proposed District Plan.
		
10 November 2016	Report to Council updating workstream progress including RPS now operative and receipt of MBIE determination.	Council approved the release of indicative voluntary retreat proposal offers to owners of the private properties in the high debris flow risk area, and for owners to be provided with copies of The Property Group Ltd memorandum '*Methodology to Determine the Base Value for Awatarariki Fanhead Voluntary Retreat Offers'*, dated 31 October 2016.

December 2016	Indicative voluntary retreat proposal offers given to property owners at individual face-to-face meetings at their properties (or other location convenient for them). Letter also included a non-binding registration of interest form for property owners to complete indicating whether or not they wished to participate further in a voluntary retreat proposal or not.	

15 December 2016	Update report to Council on the Indicative Business Case (IBC) and seeking permission to engage formally with BOPRC and Government to finalise the IBC and seek formal recognition of funding partnership.	Council agreed to the objectives and key concepts of the Draft Indicative Business Case as outlined in the report; and to formally engage with the Bay of Plenty Regional Council and central government to further develop the Draft Indicative Business Case, particularly in relation to funding arrangements with key partner agencies.

23 January to 3 February 2017	Follow up phone calls to property owners who had not returned registration of interest/decline to participate further forms	23 (68%) of landowners provided registrations of interest. 21 (91%) were in support of continuing. 2 (9%) declined (one being Māori Trust who agree with proposal but want to retain land as a Māori Reservation). 11 (32%) property owners did not respond.

21 April 2017	Presentation to BOPRC councillors focusing on the District Plan Change and the need for a Regional Plan Change	

17 August 2017	Presentation to BOPRC councillors on Indicative Business Case	