

Private and Confidential

**Matata Debris Flow Management -
The Way Forward**

for

Whakatane District Council

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Matata Debris Flow Management – The Way Forward

1.0 Introduction

The present report has been prepared by the Matata Project Management Team to provide technical advice to the Matata Project Governance Group on the future management of debris avalanche, debris flow, and debris flood events at Matata. The report is based on specialist information provided by AECOM (engineering), Boffa Miskell (planning), Brookfields (legal) and GNS (debris hazard).

2.0 Debris Flow Events at Matata

On 18 May 2005 a period of intense rainfall triggered numerous landslips in the catchments behind Matata township and caused debris avalanches, debris flows and debris flooding that produced more than 700,000 cubic metres of debris and damaged, and in some cases destroyed, over 100 homes in Matata. Nobody was killed during the 2005 event but a fatality could easily have occurred.

The 2005 debris flow event was one of a number of similar events that have occurred historically in the vicinity of Matata. There is geological evidence that equally as large and larger debris flows have occurred a number of times in the past 7000 years.

Depending upon the precise location and orientation of intense rainfall events in the vicinity of Matata, debris flows could be triggered from a number of other catchments and coastal hill slopes in addition to those that were triggered during the May 2005 debris flow event. The Institute of Geological and Nuclear Sciences (GNS) has estimated the land areas in and around Matata township that (i) have been affected by debris flows in the geological past (most of Matata is built on debris flow fans) (Figure 1) and (ii) could conceivably be affected by debris flow events in the future (Figure 2).

In the geological past debris flow deposits have covered a much greater area than the area affected during the 2005 event and most of Matata is built on historical debris flow deposits. In the foreseeable future it is possible that debris flow events could also affect an area significantly larger than the 2005 area (Figure 2).

The fact that future intense rainfall events could trigger debris flow events and debris avalanches that could affect parts of Matata township in addition to those parts affected by the May 2005 debris flow event means that debris flow management options must address the wider issue of debris flow management for Matata and not just the debris flows that occurred in May 2005.

To date debris flow natural hazard management options for Matata have focussed on physical mitigation works for the Waitepuru (works completed) and Awatarariki streams (engineering designs developed) because these streams were most active during the May 2005 debris flow event. Some minor mitigation works were also carried out on the Waimea and Ohinaka Streams. However, future intense rainfall events could trigger debris flows and debris avalanches that affect other streams and, therefore, other parts of Matata township indicating that future management options must address the wider potential for debris flows in the vicinity of Matata and not just the areas affected by the May 2005 event.

Figure 1: Areas affected by previous debris avalanches and debris flows

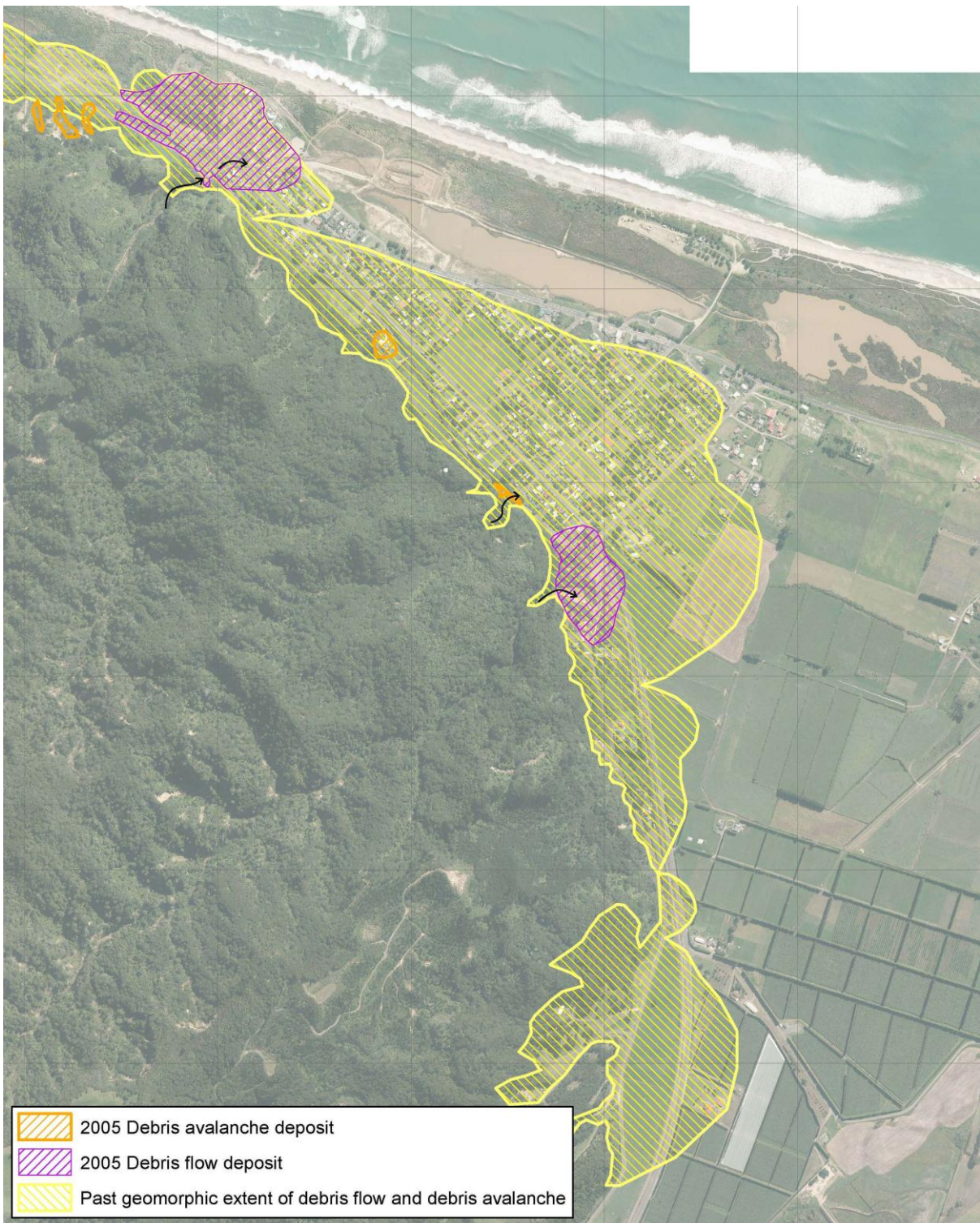
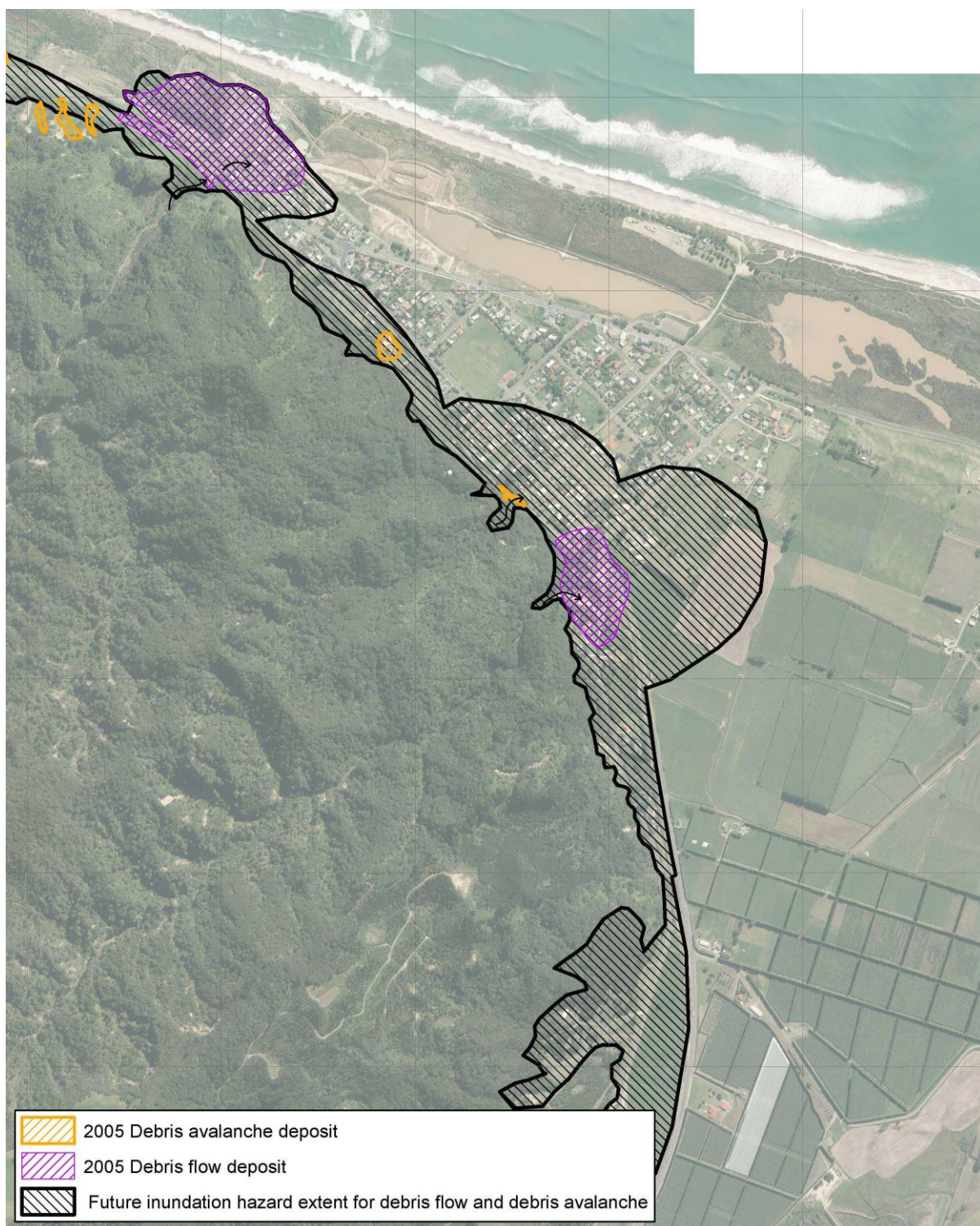


Figure 2: Areas potentially affected by future debris avalanches and debris flows



GNS believes that significant debris flow events are not likely to occur at Matata for rainfall events with a return period of less than 100 years. Relatively small debris flows appear to have reached the heads of the Waitepuru and Awatarariki fans with a return period of about 50 years but these smaller debris flow events would be unlikely to cause significant property damage. It has been estimated that the May 2005 debris flow event at Matata was caused by a rainfall event with a return period of 200 to 500 years and rainfall intensities of greater than 2 mm/minute. GNS estimate that it would take a rainfall event of similar magnitude or greater to cause significant future debris flows or debris avalanches in the vicinity of Matata.

It is possible that climate change may progressively affect weather patterns to the extent that rainfall events with high rainfall intensities similar to the 2005 Matata rainfall event may occur more frequently than the presently estimated 200 to 500 year return period.

The concept of return period is important because if engineering mitigation works are carried out at Matata for an event similar to the 2005 event, Council will be setting a potential precedent for mitigation of natural hazards with return periods of up to 500 years.

Significant debris flow events, such as the May 2005 event, appear to be more aligned with natural hazard risks from earthquakes or volcanic eruptions that occur infrequently but can have significant adverse effects on built structures. These large but relatively infrequent natural hazard events have historically been managed without recourse to engineering mitigation solutions. However, engineering mitigation structures for debris flows have been installed in the vicinity of the Aoraki Mt Cook village.

3.0 Debris Flow Management Options

There are two broad types of debris flow management options:

- (i) Engineering options, and
- (ii) Planning options.

3.1 Engineering Options

There are three broad types of engineering option for possible mitigation of future debris flows from stream catchments at Matata:

1. A debris dam in the upstream catchment,
2. A debris deflection bund and/or debris detention basin on the fan, and
3. A debris chute across the fan to the sea (this option was suggested by a Matata community group for the Awatarariki Stream).

Two debris dam concepts were designed by Tonkin and Taylor for the upper Awatarariki catchment (embankment dam and flexible net barrier) and both design concepts had fatal flaws and were abandoned by Council either for cultural sensitivity or technical reasons. Similar problems could be encountered for all three types of engineering options.

All engineering mitigation options would involve high capital costs and high on-going operational costs for maintenance and debris clearance that would continue in perpetuity. Preliminary cost estimates for a debris chute (chute-to-the-sea) and a debris deflection bund for the Awatarariki fan have been prepared by AECOM (Table 1).

Table 1: Costs for Awatarariki engineering mitigation options

	Cost	Annual Maintenance
Chute-to-Sea	\$10m	\$200k
Deflection Bund	\$5.6m	\$300k

Note: Costs do not include purchase of properties

The capital cost estimates for the engineering options of \$6m to \$10m are likely to be at the lower end of final design cost estimates and actual construction costs are likely to be significantly higher. The chute option would be particularly expensive because the railway and SH2 would need realignment and new bridges constructed. Council would be responsible for funding the on-going annual operational costs of about \$200k to \$300k.

Engineering options for mitigation would need to be considered for all the stream catchments above Matata that could produce debris flows and not just the stream catchments that produced debris flows during the May 2005 event. This would potentially increase costs significantly.

It would not be possible to construct engineering mitigation structures to prevent debris landslides from the hill slopes behind Matata so that some properties would be unprotected in the event of possible future extreme rainfall events.

Council would potentially be more exposed to claims if new buildings were constructed in reliance on engineering mitigation structures were built that were not effective in preventing damage to properties from future debris flow events or if those structures exacerbated damage in some way. For example if mitigation structures were designed for a May 2005 type debris flow event but the next event was larger than the May 2005 event then significant property damage could still occur as well as significant damage to the mitigation structures.

As discussed previously, Council also needs to be aware of the potential for setting a precedent by carrying out engineering mitigation works for a natural hazard with a return period of about 500 years.

3.2 Planning Options

Legislation and regional and local plans provide a framework for considering an appropriate planning response to debris hazards. The Regional Policy Statement is a particularly important part of this framework as the District Plan must “give effect” to the relevant regional natural hazard policies.

It is also notable that any District Plan hazard rules have no retrospective effect due to existing use rights that apply to existing development.

Two hazard zoning alternatives have been developed for consideration: Event Based Hazard Zones” and “Risk Based Hazard Zones”.

The “*Event Based Hazard Zone*” alternative would identify hazard risk on a relatively broad brush basis using currently available information on debris avalanches, debris flows and debris floods at Matata. This alternative would enable owners to undertake further expert risk assessment to determine acceptability if they wished to undertake significant new development in some areas.

The “*Risk Based Hazard Zone*” alternative would identify hazard risk up front using quantitative estimation of risk of loss of life and property damage. This alternative would provide more certainty to landowners on what development could or could not occur on their land, based on the assessed degree of risk.

An “*Information Based Approach*” has also been described. The Information Based Approach uses the specific powers and duties prescribed in the Building, Local Government Official Information and Meetings Act, and Resource Management Act for the management of natural hazards.

Other planning methods can also form part of unified hazard management approach. These methods include changes to regional plans to better enable hazard protection and post event restoration activities, Civil Defence warnings to enable evacuation when an event may be imminent, public education, and considering natural hazard issues in broad scale settlement strategies.

3.3 Preliminary Multi-criteria Analysis

Potential engineering and planning options for management of debris flow risks at Matata have been analysed using a multi-criteria analysis technique. Preliminary scores have been assigned to the analysis criteria to evaluate the pros and cons of the different options (Table 2). The multi-criteria analysis can be used to guide selection of a preferred risk management option for Matata and to provide a framework for consultation with stakeholders which may lead to weightings being applied to the different factors.

Table 2: Preliminary multi-criteria analysis of potential engineering and planning Options

Factor	Engineering Options		Planning Options			
	Chute	Bund	Purchase properties and rezone as reserve	Information based (LIM/s72)	Event based hazard zones	Risk based hazard zones
Cost	1	1	2	5	4	3
Feasible	2	4	1*	5	5	4
Consentable	2	3	4	5	4	4
Applicability Elsewhere	2	2	2	4	4	4
Physical Disruption	2	3	5	5	5	3
Cultural Impact	3	3	5	5	5	5
Environmental Impact	2	3	1	5	5	5
Mitigate Risk	4	4	4	1	3	3
Total	18	23	25	35	35	31

* Potential fatal flaw for option because current property owners would need to be relocated

The two engineering options scored significantly lower in the multi-criteria analysis than the planning options for a combination of the following reasons:

- (i) Future debris flows could occur from all the streams and hill slopes behind Matata and not just those from which debris flows occurred in May 2005.
- (ii) Engineering mitigation structures would be expensive to construct and would involve significant operational and maintenance costs for Council in perpetuity,
- (iii) Engineering mitigation options could be rejected for cultural sensitivity, environmental or technical reasons,
- (iv) Consenting could be difficult and physical disruption during and following construction would be significant.
- (v) Expensive engineering mitigation works designed to cope with the extreme May 2005 event (up to 500 year return period) could introduce a precedent for management of other natural hazard events in the district.

The highest scoring planning options were the Information Based and Event Based Hazard Zones options. These options scored more highly than the Risk Based Hazard Zones option because the risk based approach would be more costly to develop and more complex to apply.

The planning option to purchase properties and rezone the land as reserve scored less highly than the other planning options mainly because of the cost of purchasing properties and likely difficulties in relocating existing property owners. Difficulties in relocating property owners may be a fatal flaw for the rezoning to reserve option.

The multi-criteria analysis indicates that Council should not continue to consider engineering options for management of debris flow risks at Matata but should focus on a suitable planning option.

4.0 Council Liability

Council has sought legal advice from Brookfields Lawyers (Auckland) on several occasions since the 2005 event at Matata. The advice provided by Brookfields includes:

4.1 Building Act

The fact that building consents for building works in the floodplain of the Awatarariki catchment have been granted pursuant to section 72 of the Building Act 2004 ("the BA'04") offers the Council protection against certain civil proceedings. The Council is not liable in any civil proceedings brought by any person who has an interest in the building on the grounds that it issued a building consent knowing the building or land was likely to be subject to flood damage.

Registration on the title to the land that a building consent has been granted under section 72 generally has consequences for the landowner in relation to the availability of insurance cover for any building works on that land. The Earthquake Commission may decline a claim made under any insurance of any such property in the event of a further flood. Private insurers may similarly decline to insure, exempt from cover, or offer insurance on less favourable terms in relation to such properties.

4.2 RMA

The proposed debris dam in the Awatarariki catchment was not a consideration for the Court in the granting of any of the rehabilitation consents. This is made clear in the decisions and therefore whether there is or is not a debris dam in place (or any other physical works to mitigate flood damage) will not have any effect on the consents already issued.

The Council may institute a re-zoning or other plan change introducing measures limiting development in the area to avoid debris flow and debris flood risk to property and people. Hazard lines and re-zoning are both measures that could be instituted by a change to the District Plan and are both subject to challenge. The success of such a challenge would depend on whether the Council can demonstrate that the measures are based on sound and robust evidence of the need for them and their efficacy.

Council has a function under section 31 of the RMA to control development and use of land for the purpose of avoiding and mitigating natural hazards. If the risk of another debris flow event that would put life and property at significant risk is low, the Council might consider the continued use of land in the flood path for residential purposes to be acceptable. If that risk is high, then the Council has a duty to avoid or mitigate that risk, which it could do by instituting hazard lines or re-zoning the land for other purposes.

Measures taken under the Building Act may not be sufficient to protect the Council from liability in relation to its RMA duty if the hazard is such that the land ought not to be available for residential development at all. It is not clear whether or not that is the case at Matata, and in any case hazard lines and/or re-zoning will not eliminate the risks to existing residences.

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 whereby the Regional Council has the power to construct and maintain drains and measures to minimise and prevent damage by flooding. Under the RMA, the Regional Council also has responsibility for the control of use of land to avoid or mitigate the effects of hazards. The Regional Council's responsibilities at the time of the 2005 debris flow event are likely to be limited to the measures already in place.

4.3 Loss of Insurance Cover

It is unlikely that a claim by landowners against the Council for the loss of insurance cover in the absence of a debris dam would be successful. The owners would have to demonstrate that the actions and statements of the Council gave rise to a legitimate expectation that the debris dam would be built. In relation to the debris dam construction, the Council can point to statements and actions which demonstrate that it was always contingent on a number of factors. Since there has always been a lack of certainty that the debris dam would be built, it is unlikely that a claim can be made out that a legitimate expectation existed so that reliance on that expectation caused or may cause any loss.

For the same reasons, a claim in negligence relating to the issue of consents since the 2005 event is also likely to fail. The owners would have to show that the Council acted negligently in the statements it made about the debris dam project or acted negligently in issuing building consents, and that actual losses flowed from those acts. The Council is not likely to be found liable for issuing a building consent knowing the building or land was likely to be subject to debris flow or debris flood damage because the owners were put on notice by the fact that the consents were subject to section 72 of the Building Act.

4.4 Loss Following a Further Debris Flow Event

If, in another debris flow event, the owners, who relied upon the debris dam being built, suffered damage, it is unlikely that any causation could be made out. The owners would have to show that the damage would not have occurred if the debris dam were in place. The owners would find it difficult to show that, given the technical issues that have now been found to exist concerning the utility of such a structure. In addition, to succeed in any claim against the Council, the owners would have to prove that they undertook building works in reliance on the expectation that a debris dam would be built, and that it was reasonable to rely on that expectation. It is unlikely that this could be made out.

4.5 Homeowners' Insurers

The damage that the insurers might claim for is limited to loss occurring if there is another debris flow event before the expiry of the term of any current policies. This would be on the basis that, in granting cover, they relied on statements made by the Council that a debris dam would be built. However, we do not think that this claim could be successful because the Council never indicated that the debris dam would be in place before any certain date, and its construction was always contingent on engineering design and advice, and upon the grant of resource consent. It is unlikely to be found that insurance companies could reasonably have relied upon the project. Furthermore, the Council made it clear that it considered that there was a risk to the buildings, by granting further building consents under section 72.

4.6 General Comment

If another 2005 type event occurred, it is likely that residents who suffered losses would be looking to the Council for compensation, whether for breach of statutory duty or negligence. This will be the case particularly if the properties are uninsurable. If insured, the insurers themselves would be looking for compensation. This would equally be the case if any measures instituted by the Council were insufficient to prevent loss. There is no risk free option for the Council. It will always be a question of balancing risk against the cost and effects of whatever action is proposed, including the "do nothing" option.

The minimum action that the Council should take is to ensure that landowners are informed that they are building in a known flood plain by the use of LIM notations, and the issuing of building consents under section 72 of the Building Act.

5.0 Recommendation

The Project Management Team makes the following two recommendations to the Governance Group:

1. Engineering mitigation options for management of debris flow events for Awatarariki Stream, or any other location in the vicinity of Matata, should not be pursued further, and
2. The planning options identified in the present report for management of debris flow events at Matata should be evaluated in more detail including consultation with the Matata community and other stakeholders.