Memo

17 January 2025

To: Craig Mcilroy, General Manager – Healthy Waters and Flood Resilience

cc: Mace Ward, General Manager – Group Recovery

From: Tom Mansell, Head of Sustainable Partnerships – Healthy Waters and Flood Resilience

Subject: Understanding flood risk and flood management challenges in Kumeū-Huapai

Executive Summary

In response to long-term flooding, Auckland Council's Healthy Waters & Flood Resilience Department (Healthy Waters) have thoroughly explored the potential infrastructure options to enhance flood resilience in the Kumeū-Huapai township. Any infrastructure options must represent good investment of public money, and reduce flood risk.

A comprehensive assessment of flood risk reduction options was undertaken in 2024. The options were narrowed down to three key approaches; 1. Stream widening (floodway), 2. Diversion, and; 3. Detention (dam) options. Additional, minor infrastructure upgrades were also considered as part of a broader approach to stormwater management. None of the infrastructure options assessed meet these requirements without considerable associated residual risk. While there is currently no suitable infrastructure option to build flood resilience for Kumeū-Huapai, Healthy Waters remains focused on implementing initiatives to improve community resilience and preparedness.

This document provides insight to other parties about the outcomes of options considered to date. It does not represent a formal position of the Auckland Council or provide recommendations on work that should be undertaken by other parties.

Introduction & Purpose

A large portion of the existing Kumeū-Huapai township is located within the 100yr floodplain for the Kumeū and Huapai River systems and experiences frequent flooding events. Over several decades, Auckland Council (and its predecessor Rodney District Council) have investigated flood risk and potential solutions in the Kumeū-Huapai area, with the aim of reducing flood risk for people living and working there. The impact of flooding in August 2021, and January and February 2023 has further increased the urgency of identifying flood management solutions.

This document summarises the work undertaken by Healthy Waters to date, with a particular focus on the latest options assessment report completed in 2024. The purpose of this document is to provide information on the current technical options available to Healthy Waters regarding flood risk management in Kumeū-Huapai. The conclusions made in this document provides insight to other parties about the outcomes of options considered to date. It does not represent a formal position of the Auckland Council or provide recommendations on work that should be undertaken by other parties. This information is provided in order to inform future decisions by Auckland Council, its Governing Body, and other parties regarding flood risk management and future land use in the Kumeū-Huapai area.

The intended audience for this document includes both internal and external stakeholders to Auckland Council's Healthy Waters and Flood Resilience department, including elected members, Council Controlled Organisations, other council departments, mana whenua, central government and the wider community.

Residents and businesses are highly impacted by flooding

The Kumeū-Huapai area has a long history of flooding. Extreme weather events have resulted in flood waters inundating the township and wider area on numerous occasions. One of the earliest post-settlement flooding events recorded was in 1926, when the Kumeū Post Office was reported to have flooded to a depth of 1.2m. Several other flood events have occurred since then, notably 1928, 1954, 1961, 1979, 1988, more recently in August 2021 and again in January and February 2023. The most recent floods severely impacted many low-lying commercial and residential premises (see Attachment A).

The Kumeū -Huapai community has been significantly impacted by the trauma of repeated flood events. These communities have been flooded multiple times over many years, most recently in early 2023. Many of these properties will be at greater risk of flooding in future due to the impacts of climate change.

There is a considerable financial and emotional stress to residents and businesses as a result of the floods. Costs include property repairs, disruption to business, anticipated reduction in property value, and increased insurance premiums. Understandably, the community is concerned and is looking for answers and some certainty for the future.

Healthy Waters interviewed approximately 100 affected residents and business owners in 2023 soon after the 27 January flooding and Cyclone Gabrielle. These interviews sought information on the level and velocity of flood waters experiences and to understand causes of flooding. As part of the interviews, respondents were invited to provide feedback on work they would like the council to undertake. The most common responses are listed below:

- River maintenance
- Upgrade existing stormwater infrastructure
- More maintenance of existing infrastructure
- Stop developments in the area
- More safe evacuation routes when flooded
- More flood warning and river peak height warning

Many of these concerns are addressed in the following sections of this document.

Flood hazard risk is now well understood

As of 12 December 2024, 34 residential properties had opted into the council's programme to seek a flood risk categorisation[1] in the Kumeū-Huapai area. At this point in time, twelve of these 34 properties had been categorised as having intolerable risk to life with no practical means for mitigating the flood risk (i.e. Category 3). The remaining properties are considered to have a tolerable risk but are still subject to flooding (i.e. Category 1) and three properties remain uncategorised[2]. The flood risk categorisation programme is nearing completion. Once finalised, it is forecast that 14 of the 34 properties (opted in) will be Category 3.

Table 1 – Forecast property flood risk categorisation figures after the January and February 2023 storms (as at 12 December 2024).

Current Property Classification Forecast Figures (Existing development and rainfall scenario)	Number of buildings at risk
Category 1	20
Category 3	14

[1] The only properties described as a 'category' are the ones that registered for the categorisation scheme (opted in) following the January and February 2023 Auckland floods.

[2] Commercial properties were not eligible for the buy-out scheme as determined through the formal flood risk categorisation funding agreement between Auckland Council and Central Government (pertaining to the 2023 floods).

The flood risk category classification (i.e. Category 1, 2, 3) was developed as part of the response to the North Island Weather Events 2023, as directed by the government. Detailed flood risk assessments undertaken in Auckland through this categorisation programme typically compared the two weather events (Anniversary Weekend flooding and Cyclone Gabrielle) with the 100-year ARI model – existing rainfall / development scenario. This methodology was developed to establish the *existing* flood risk to life for those impacted residential properties that chose to opt-in to the categorisation process. In contrast, any mitigation option assessments for properties deemed as having 'intolerable risk to life' (e.g. raising habitable floors) needed to accommodate future flood risk.

Traditionally, infrastructure project planning adopts a different approach; one that needs to consider the lifespan of the asset, and for this reason the method applied typically uses the 100-year ARI model – *future* rainfall / development scenario. This type of flood risk assessment is usually undertaken at a catchment or sub-catchment scale and differs from the recent categorisation process in that it considers all properties potentially at risk, including non-habitable buildings, e.g. commercial premises.

Another difference between the flood risk categorisation and risk assessment for infrastructure planning is the classification description, i.e. Category versus Danger Rating. The 'High Danger' rating used in the infrastructure planning risk assessment is similar to a Category 3 (intolerable risk to life) classification, however the High Danger numbers may also include properties where mitigation is possible i.e. properties that would be considered 'Category 2' under the categorisation framework.

Despite the recent residential property buy-out scheme, many commercial properties, residential properties and public assets remain vulnerable to future storm events now and into the future (see Table 2 for 'buildings at risk' data).

The model data output below includes properties that have been categorised under the flood risk categorisation buy-out scheme. These figures include a 38% rainfall adjustment factor (see Footnote[3]). Climate change is influencing rainfall patterns, increasing the frequency of high intensity storm events that will continue to impact on these properties and assets if no action is taken.

Table 2 - Modelled flood risk data for buildings.

Modelled Flood Risk (Future development and rainfall scenario)	**Total (Full Catchment)**	**Upstream of Kumeū**	**Kumeū township**	**Downstream of Kumeū**
Residential – High Danger*	219	23	105	91
Residential - Habitable floor flooding (not considered 'High Danger')	67	6	50	11
Additional residential buildings exposed to floodwaters (habitable floor not flooded)	108	12	62	34
Commercial floor flooding	249	52	169	28

**High hazard habitable floor flooding and there is no safe (or low hazard) evacuation route available.*

Healthy Waters have undertaken numerous catchment studies and options assessments to identify a viable and affordable solution to reduce flood risk in this area. This body of work spans several decades and has resulted in flood plain mapping (amongst other outcomes) that has influenced spatial planning and building controls. The key catchment studies completed in the last two decades are listed in Attachment B.

[3] NIWA is in the process of updating the rainfall depths used for hydrological analysis by including rainfall data post-1999. Preliminary analysis of the new, updated rainfall data (up to and including 2023) indicates that in the Kumeū-Huapai area, the existing NIWA rainfall depths for the 100yr ARI event are 36-40% under-estimated. We have used an adjustment value of +38% in our calculations.

Causes of flooding in Kumeū-Huapai are well understood
Understanding flooding causes informs possible solutions. Refer to Attachment A for specific detail of flooding causes in 2023. Studies have consistently shown that the causes of flooding generally include:

- large catchment (6,010ha)
- low lying topography
- proximity of development to waterways
- spilling of Kumeū River and Huapai Streams,
- overtopping of bridges and culverts, and
- local catchment runoff.

These causes make reducing flood risk to the township challenging. The focus to date has been on conveyance options along the Kumeū River. The impact of flood risk from the Kumeū and Huapai Rivers was raised in the community-led Kumeū-Huapai Centre Plan (2017), which referred to the Kumeū-Huapai Floodway project as an integral way of managing this risk, providing it was able to be implemented. A detailed review of this floodway option is discussed below.

As part of the Making Space for Water programme, the floodway and two other infrastructure solutions have been considered, seeking to identify a preferred approach to flood management infrastructure. This engineering assessment was supported by the latest stormwater catchment model. At the time of preparing this document, both the models used were yet to undergo internal QA review. For this reason, the output of the options report remains in draft and should be considered as preliminary findings. It has been almost two years since the 27 January 2023 flood event and council is cognisant of the need to update the Kumeū-Huapai community on the outcomes of this study. For this reason, Healthy Waters are comfortable sharing this information, despite the draft status of the recent work.

Kumeū Flood Response Options Development - WSP (Draft)
A comprehensive assessment of flood risk reduction options was undertaken in 2024. The options were narrowed down to three key approaches; 1. Stream widening (floodway), 2. Diversion, and 3. Detention (dam) options. Additional, minor infrastructure upgrades were also considered as part of a broader approach to stormwater management. Seven diversion sub-options and five different dam sub-options were assessed. The results of this options assessment are summarised below. Further detail regarding sub-options and the options evaluation is presented in the draft option report entitled: Kumeū Flood Response Options Development (31 October 2024). [4]

Table 3 - Three key flood management options assessed in detail for Kumeū-Huapai (costs are P95)

Option	Description of core sub-option	Cost Estimate	Comment
Floodway	A 70m-wide, 2.8km-long extension to the existing Kumeū floodway to increase capacity and reduce conveyance constraints.	$573m	Uneconomical and increases flood levels downstream near Waimauku.
Diversion	A 4.5m diameter, 1.9km-long tunnel to divert flows from upstream of Kumeū village to the Waitematā Harbour.	$295m	Very expensive relative to the flood risk benefit provided. Significant reliance on inlet not blocking. Would generate considerable opposition during the consenting process.
Dam	A 1,800,000m^3 storage basin on the main channel of Kumeū River, between Kumeū and Taupaki. Includes some minor ancillary works.	$163m**	The most cost effective of the three options and appeared initially to provide considerable flood risk reduction benefit.

***Note that this cost estimate figure excludes any costs associated with managing the additional +38% rainfall adjustment factor explained in Footnote[1]*

[4] Any requests for the full draft Kumeū Flood Response Options Development (31 October 2024) report, should be directed to Auckland Council via bluegreen@aucklandcouncil.govt.nz

All three of the key infrastructure options assessed reduced flood risk. After evaluating each option against criteria including benefits, costs, consentability, and social and cultural outcomes only the dam option was considered potentially viable. Analysis of the dam sub-options identified Option 4a (a 1,800,000m^3 dam between Taupaki and Waitākere Roads) as the most effective at reducing flood risk.

Further analysis of Dam Option 4a was undertaken using the latest rainfall information[3] and included maximum probable development based on current Auckland Unitary Plan controls and climate change scenarios. This further step in the analysis raised some serious concerns about the benefits of this dam option. These concerns are outlined below.

In the 100yr Average Return Interval (ARI) future scenario[5], the 4a Dam option is predicted to protect 277 properties from floor flooding. However, a similar number (232) would remain vulnerable to flood risk. A cost estimate has not been completed for a dam that can accommodate the future scenarios, but it is likely to be considerably more than the $163M shown in Table 3. The key issue with Dam Option 4a is the residual risk associated with this option for existing 232 habitable floors, and commercial property and public assets.

Construction of a large dam upstream of the township between Taupaki and Waitākere Roads creates a perception of safety and would encourage further development in the existing flood plain, downstream of this structure. It is likely that the benefits of unlocking development downstream of a dam would be relied upon to justify the business case. Investment in this dam option would likely commit Council to supporting further development in an area potentially still at-risk of flooding.

Any further development and commercial activity in the existing floodplain will place properties at risk if the dam were to overflow or fail. The dam would be designed to a theoretical design storm. When this design storm is exceeded, overflows would place properties downstream at risk of flooding.

The risk presented in a dam break scenario would also be significant. This event would have catastrophic impacts as it would result in a sudden release of flood water moving at high velocity through the flood risk area, causing significant damage and increasing the risk to life for people in the area. Given the size of the dam proposed and the location of the Kumeū-Huapai and Waimauku townships downstream, this would most likely be classified as a High Potential Impact Classification (PIC) dam under the Building (Dam Safety) Regulations 2022. As such it will be subject to scrutiny regarding its design in order to manage risk and consequence of dam failure and be subject to higher ongoing operational costs.

<u>Placing Critical Infrastructure at Risk & Associated Approvals</u>

Significant existing and proposed infrastructure is downstream of the preferred dam site, including power and water utility mains, culverts and bridges, the main trunk rail network to Northland, and SH16. This critical infrastructure is in the flow path downstream and is therefore at risk in a dam break scenario.

The railway is currently at risk of inundation in several locations (see Attachment A 'The Problem'). The 4a detention option will either require a parallel embankment to the rail line or utilise part of the existing rail embankment as the detention dam. Both scenarios will require culverts under the railway to take the over-design event flows as well as the low flows of the river. Kiwirail will be an affected party in the consenting process and are likely to be particularly concerned with the over-design storm event, the spillway, and dam break scenarios.

It is worth noting that Supporting Growth initiatives are planned in the area, in particular, the upgrade and realignment of SH16. The designation for the SH16 upgrade includes conditions pertaining to mitigating the effects of flooding and stormwater. Any upgrade of SH16 would need to accommodate

[5] 100yr ARI + 38% rainfall adjustment factor (see Footnote[2]) + Maximum Probable Development (MPD) + 3.8[0] Climate Change (CC) scenario

flood risk, including the overspill and dam break scenarios associated with this dam option. If the SH16 upgrade works go ahead, this may impact the hydrology of the area. Healthy Waters will assist NZTA where necessary to explore stormwater management opportunities associated with the project.

It also needs to be recognised that while policy and planning may be seen as a powerful tool in reducing flood risk in this area, such initiatives take time, sometimes decades to reflect change. In the meantime, Healthy Waters will continue to engage with the community through flood resilience and asset management programmes and by supporting local initiatives where applicable.

There are other ways to build flood resilience for the community and businesses
Healthy Waters have thoroughly explored the potential stormwater infrastructure options to enhance the flood resilience of Kumeū-Huapai. None of the infrastructure options assessed represented good investment of public money, nor did they significantly reduce flood risk without considerable associated residual risk. While there is currently no viable infrastructure option to resolve flooding in Kumeū-Huapai currently, Auckland Council Healthy Waters continues to support this township. Healthy Waters remain focused on a range of ways to improve community resilience and flood preparedness, some of which are already in place:

- Monitoring flood risks
- Proactive monitoring for key assets
- River level monitoring accessible to public
- Piloting machine learning for flood prediction
- Maintaining conveyance
- Removing significant debris within the banks of the stream and on flood plains where required
- Renewing at-risk assets
- Responding to blockages-based monitoring
- Reducing future risk through planning
- Working with Auckland Council Planning and Resource Consents Department on the Natural Hazards Plan Change
- Providing technical advice on flood risk for the future urban zone (as identified in the Future Development Strategy) and other spatial planning opportunities
- Individual preparedness
- Flood Viewer provides risk and preparedness information
- Regionwide marketing campaigns promote preparedness at property level

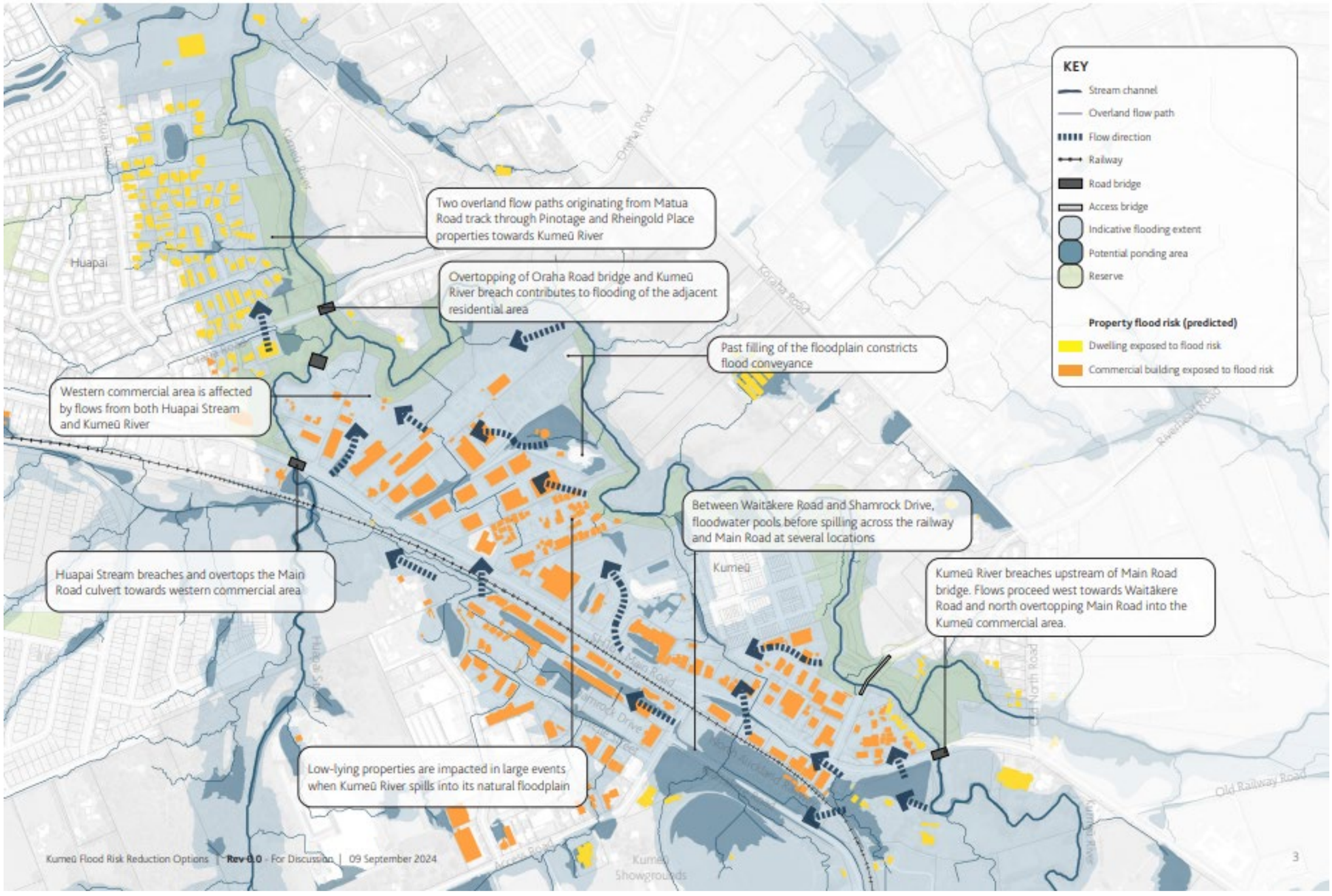
Continued partnership with communities, businesses, asset owners, and mana whenua will improve the efficacy of these measures for reducing flood risk and help the Auckland Council group to respond to changes within the township and wider catchment.

Conclusion
On the basis of the flood risk options work completed to-date, Healthy Waters does not currently believe there is a viable and cost-effective infrastructure solution available to satisfactorily reduce flood risk in Kumeū-Huapai township. For this reason, at this stage Healthy Waters will not be investing further in assessing, planning or constructing large-scale flood-risk reduction infrastructure projects in Kumeū-Huapai. The support of this view from key stakeholders has informed the advice contained in this document.

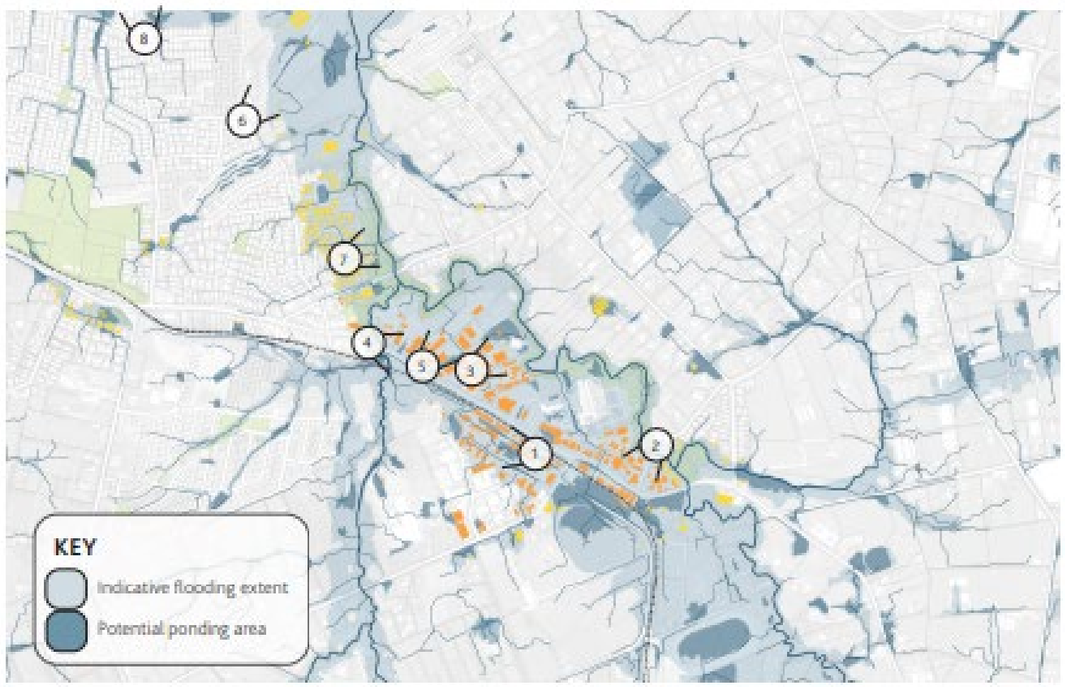
Attachment A: Flooding in Kumeū – Problem, Affected Neighbourhoods and Opportunities Graphics

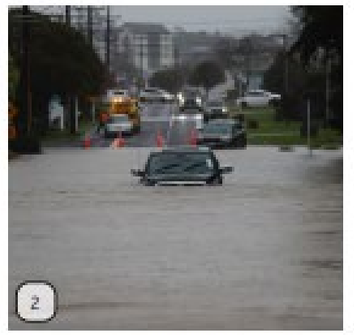
The Problem - Kumeū and Huapai

Scale 1:5500 @ A3



Affected Neighbourhoods





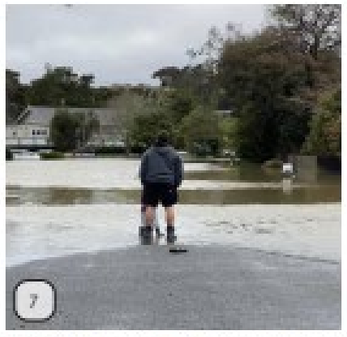


Image Source: 1. 1News, 2. New Zealand Herald, 3. Newshub, 4. Stuff, 5. New Zealand Herald, 6. Newshub, 7. Guardian, 8. Newshub, 9. Newshub

Kumeū Opportunities

Scale 1:25000 @ A3

Options may be subject to the voluntary buyout process, allowable funding, constructability, consentability, community and stakeholder acceptance, and demonstration of value. These factors will be fully considered during subsequent design phases.

All options are likely to require additional ancillary works to address residual flooding issues.

Floodway

Flood Diversion

Flood Detention

KEY

- Stream channel
- Overland flow path
- Diversion
- Floodway bund
- Railway
- Floodway proposed
- Flood detention structure
- Reserve

Attachment B: Key Recent Catchment Studies Undertaken by Auckland Council and Rodney District Council

1. Kumeū/Kaipara River Catchment Management Plan - Identification of Options, prepared by Opus, dated: 28/06/2005 to 1/11/2006.
2. Kaipara – Kumeū Catchment Management Plan Hydraulic Modelling, dated: December 2009.
3. Kumeū/Kaipara River - Catchment Management Plan, dated: 8 March 2010.
4. Options Analysis Report Kumeū Floodway - Stage 2 Works, prepared by URS, dated: 5 August 2011.
5. Kumeū River Floodway Project Update Report, prepared by Morphum, dated: 30/04/2012.
6. Kumeū Kaipara River Catchment RFHA Model AECOM 2018
7. Kumeū Kaipara SW Model Update 2018-19
8. Review of the Kumeū Flood Event of 30-31 August 2021, prepared by WSP, dated: 22 July 2022.
9. Kumeū-Kaipara River Catchment Stormwater Modelling – Model Extents and Data Assessment Report, prepared by AECOM, dated: August 2022.
10. Kumeū Flood Mitigation Options Modelling, prepared by AECOM, dated: 20 September 2024.
11. Kumeū Flood Response Options Development, prepared by WSP, dated: 31 October 2024.