

FINAL REPORT

Thames Coast Flood Risk Assessment

Prepared for

**Environment Waikato and
Thames-Coromandel District Council**

PO Box 4010
HAMILTON EAST

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URS

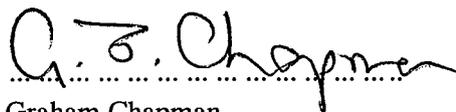
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Introduction

Environment Waikato (EW) and the Thames-Coromandel District Council (TCDC) engaged URS New Zealand Limited (URS) to carry out a quantitative assessment of the risks due to flooding along the Thames Coast in order to:

- Estimate the lives risk due to flooding with an annual exceedance probability of 1% (i.e. equivalent to a 1 in 100 year flood) at Tararu, Tapu, Waiomu-Pohue, Te Puru and Coromandel and compare the lives risk with available guidelines or criteria.
- Prioritise the risks to facilitate the development of a defensible and transparent risk management plan.
- Quantify the benefits from risk mitigation works to aid in the evaluation of the identified risks and mitigation measures.

Risk is defined in general terms as the product of the frequency (or probability) of a particular event and the consequence of that event, be it in terms of lives lost, financial cost and/or environmental impact. The overall risk assessment methodology developed for this study is consistent with the Australian and New Zealand standard for risk management (AS/NZS 4360) and what is now becoming the industry standard for risk assessments dealing with natural hazards such as landslides (AGS, 2000). The risk assessment approach is also consistent with the guidelines published by the Australian National Committee On Large Dams (ANCOLD, 1994), which has been accepted by the Australian dams industry and regulatory authorities as providing an appropriate methodology for the systematic and defensible evaluation of dam safety.

Risk Quantification

Models were developed as part of this study to calculate the lives risks and financial risks due to the nominated flood hazard. The risk models are based on a systematic examination of the various factors that determine the likelihood of people being located within a flood hazard zone and the probability of people being killed and property damaged due to the floodwaters. The lives risks have been calculated and evaluated for the existing situation and following various risk mitigation options. The risks are presented as:

- Individual risk.
- Annualised Lives Risk (ALR), which has been ranked for each community and also presented for various activities within each community.
- Societal risk in terms of the cumulative frequency (F) of N or more deaths as plotted on a F-N chart.
- The financial risks have also been calculated and used to evaluate the benefit cost ratios for the various risk mitigation options considered.

Conclusions

Based on the results of this risk assessment the following conclusions are drawn:

- The calculated annual individual risks for the various cases examined are less than the intolerable limit of 1×10^{-4} (equivalent to 100 per million years). By comparison, risks of fatality in the community such as from smoking and travelling by motorcar are 5000 per million years and 145 per million years respectively.
- Although less than intolerable, the level of individual risk for individual residents and campers (in caravans and tents) in high flood hazard zones is above desirable levels. Flood risk mitigation measures should be directed at reducing the risk for individuals in these categories, as a priority.
- The total calculated Annualised Lives Risk is highest at Te Puru (0.015) followed in order of descending risk by Waiomu-Pohue (0.010), Tapu (0.007), Coromandel (0.006) and Tararu (0.003). This is higher than suggested guidelines, which vary between 0.01 and 0.001. The ALR ranking is also reflected in the societal risks for each community represented on a F-N chart.
- Evaluation of the level of societal lives risks calculated for the Thames Coast area indicates that risk reduction measures should be implemented at least for Te Puru, Waiomu-Pohue, Tapu and Coromandel to reduce the lives risks at these communities to more tolerable levels.
- Although the calculated lives risks are in many cases above suggested risk guidelines, comparison of the risk levels with other flood studies in New Zealand and overseas, as well as other risks commonly tolerated in society, indicates that the risk level at the subject communities is not extreme and any risk mitigation plans should be developed in a careful, systematic and transparent manner.
- In light of current risk management practices the identified risks should be reduced until it can be demonstrated that the residual risk level is as low as reasonably practicable, given the level of resources available within the local communities for flood alleviation.
- Considerable risk reduction can be achieved by implementing various engineering and non-engineering risk treatment measures, and in most cases the lives risk can be reduced below generally intolerable levels.
- The enhancement of flood warning and evacuation systems provides a significant reduction in the level of lives risk for relatively modest investment, which is reflected in benefit cost ratios typically greater than 2.5. However, this does not affect the risk to property and community assets.
- Given that the overall level of property damage due to the nominated flood hazard is relatively moderate and engineering mitigation works require considerable investment, the benefit cost ratios calculated for the various mitigation options are less than 1 in all cases. The benefit cost ratios are also very dependent on the value of a life adopted for the financial risk calculation.

Recommendations

We recommend that this risk assessment be used as the basis for developing a strategic flood risk management plan for the subject communities that incorporates the risk prioritisation and evaluation tools presented in the report, along with consultation with stakeholders.

Specific recommendations include:

- For the campgrounds at Te Puru, Waiomu and Tapu we recommend the following risk treatment measures be implemented as a priority:
 - Provide information for campground users on the flood hazards associated with various areas within the campground, such as signposts, leaflets etc.
 - Formally document flood warning and evacuation plans including routes for safe access and egress, muster points etc. These should include physical flood monitoring protocols, trigger levels and associated response actions.
 - Ensure appropriate communication between regional and local authorities, emergency authorities and the campground owners/operators to co-ordinate flood risk management activities.
- Engineering mitigation measures should be implemented to reduce flood hazards for residential areas within high and medium flood hazard zones at Coromandel, Te Puru, Waiomu-Pohue and Tararu.
- Initially, risk mitigation works should be designed to reduce the Annualised Lives Risk at the identified locations and for those recommended activities to at least 1 in 1,000 (0.001). Further risk mitigation should then be planned in accordance with the ALARP principle across the whole risk inventory.

1.1 General

Environment Waikato (EW) and the Thames-Coromandel District Council (TCDC) engaged URS New Zealand Limited (URS) to carry out an assessment of the risks due to flooding at selected communities along the Thames Coast. URS was awarded this project under contract number AM 2002/09 in accordance with our proposal dated 17 December 2002.

1.2 Scope of Work

This Quantitative Risk Assessment (QRA) has been undertaken to evaluate flooding risks at specific communities on the Coromandel Peninsula between Thames and Coromandel. Flooding resulting from rainfall corresponding to an annual exceedance probability of 1% (i.e. a 1 in 100 year event) was examined. The communities included in the study are Tararu, Te Puru, Waiomu-Pohue, Tapu and Coromandel, which are shown in Figure 1-1.

The scope of work for this study follows that detailed in our proposal, which in general terms comprises:

- Review of background information.
- Quantification of the risks due to flooding in terms of risk to life (lives risk) and financial risk.
- Evaluation of the identified risks.
- Recommendations for risk reduction works to reduce the lives risks to more tolerable levels.
- Economic evaluation of various risk treatment works.

1.3 Report Layout

The risk assessment report is set out in the following format:

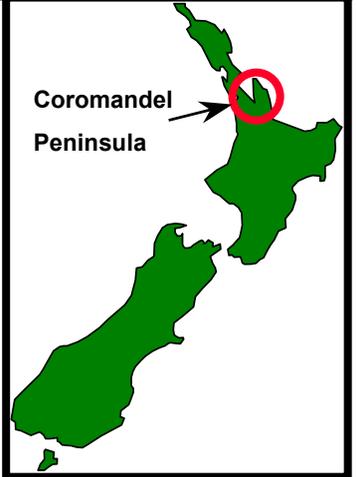
- Section 1: Introduction** Presents a broad introduction to the report and explains the purpose of this document.
- Section 2: Background** Provides a brief discussion on the reasons why this report is produced and summarises some of the previous flood management work that sets the context for the risk assessment.
- Section 3: Methodology** This section presents the detailed methodology adopted for the risk assessment.
- Section 4: Risk Assessment** Details of the consequence analysis and risk calculation are provided in this section. Further information including a discussion on some of the key assumptions

and input data for the risk modelling are presented in the Appendices, together with a general discussion on risk criteria and how they apply to this study.

Section 5: Risk Assessment Results This sections presents the results of the risk assessment including lives and financial risk profiles, individual risk estimates, comparison of the risk estimates with lives risk criteria and the costs of risk treatment works.

Section 6: Conclusions and Recommendations Summarises the outcomes of the risk assessment project.

Appendices follow the main text of the report, which provide further details and explanation of various issues or concepts raised in the document. The appendices also provide background data to support assumptions and parameters presented in the text while keeping the report as clear and concise as possible.



Source: NZ Topographic Maps at 1:1 Million scale.
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Figure 1-1 Site Location Plan

