5 Site Specific Design

5.1 Tararu Community and the Tararu Stream

5.1.1 Description of Environment

The Tararu Stream catchment is located on the northern edge of the Thames urban area. It is a steep, well-forested catchment that is drained by the Tararu Stream.

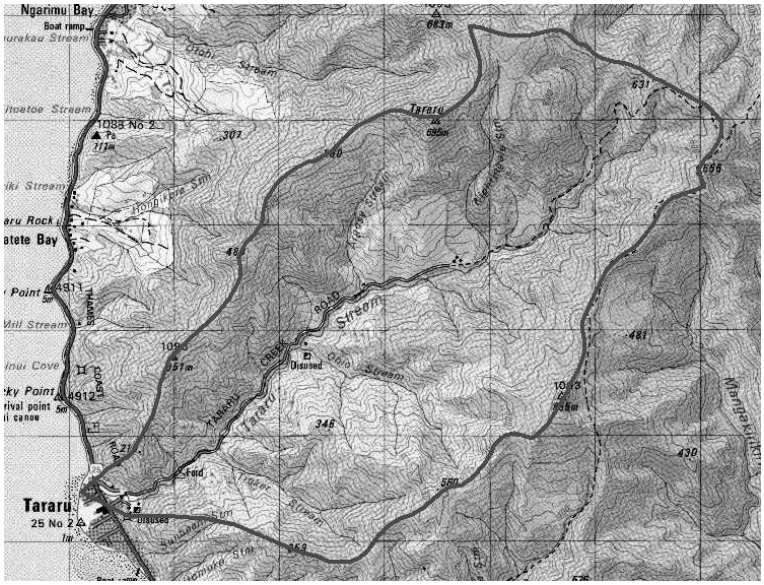

Figure: The Tararu Stream catchment

The physical characteristics of the Tararu Stream catchment are summarised in the following table.

Catchment Area	15.6 km^2
% Urban area	< 1%
% Indigenous Forest/Scrub	97%
% Included in Coromandel Forest Park	72%
Average Channel Slope	6%
Time of Concentration	60 minutes

Table: Summary of physical characteristics of the Tararu Stream catchment

The Tararu community is located at the base of the Tararu Stream catchment on a coastal alluvial fan. The community consists of mainly residential development on both banks of the Tararu Stream. State Highway 25 runs through the Tararu community and crosses the Tararu Stream using a dual lane single span bridge.

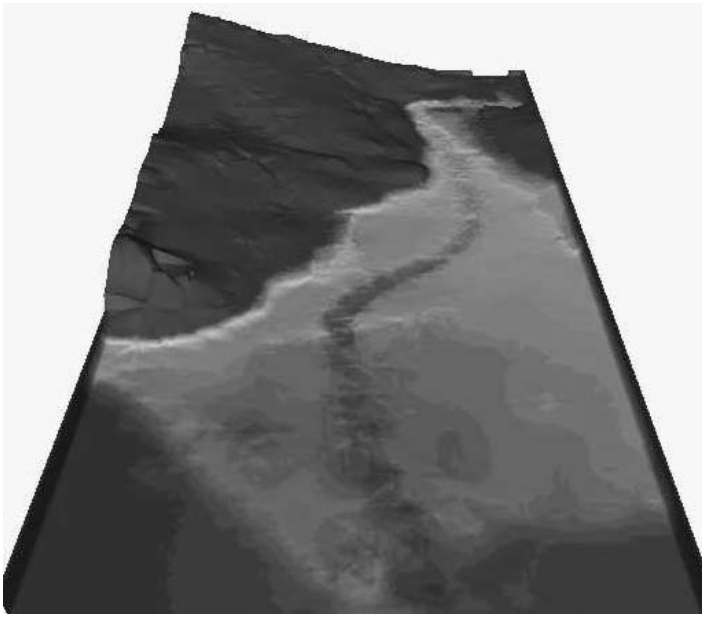

Figure: The Tararu Stream coast alluvial fan (looking inland from the Firth of Thames)

During significant flood events, overland flow occurs just downstream of the Victoria Road ford and around both approaches to the State Highway 25 bridge.

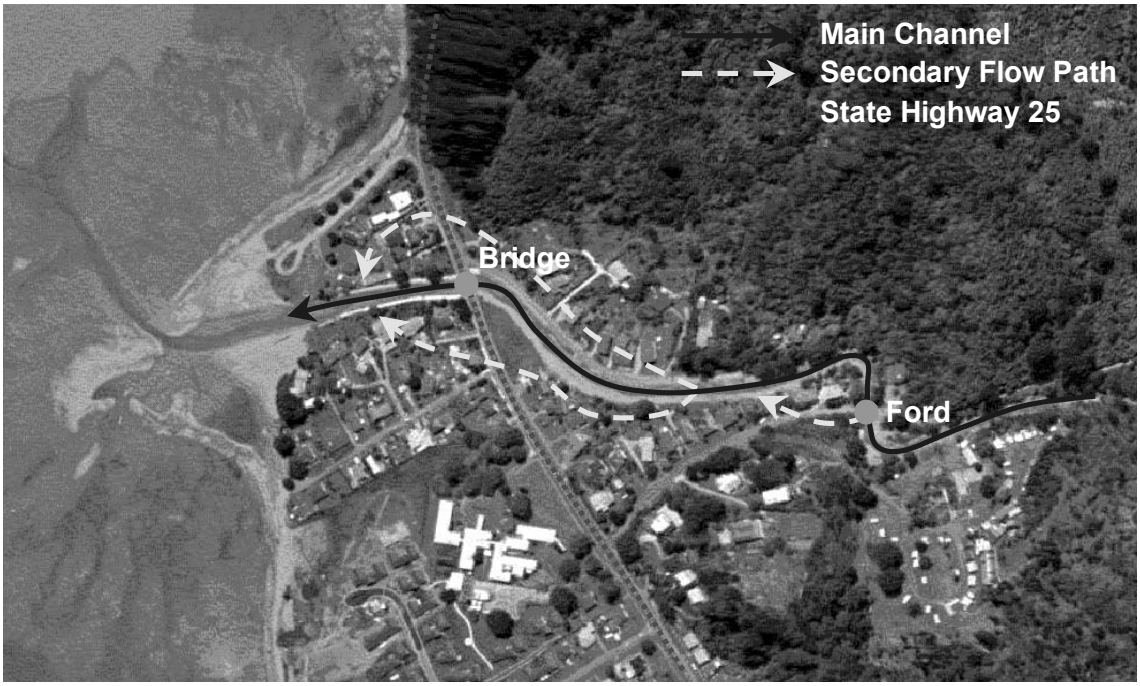

Figure: Flooding scenario within the Tararu community during a 100 year event

Damage to properties within the Tararu community is focused on those properties immediately adjacent to the Tararu Stream and those that are within the secondary flow paths.

Figure: Property damage within the Tararu community during the 'weather bomb'

5.1.2 Previous Works

During the 1980s the Hauraki Catchment Board completed channel works within the lower Tararu Stream to increase the capacity of the channel from 30-40 m^3/s to 100 m^3/s. These works included enlargement of the channel and stabilisation of the banks using either rock rip rap or concrete mattresses (refer to Hauraki Catchment Board Report 130). Maintenance of these works is currently funded by Environment Waikato through the Waihou Valley Scheme.

Figure: Example of engineering works undertaken on the Tararu Stream.

5.1.3 Hydrological Assessment

A summary of the hydrological assessment completed for the Tararu Stream catchment is presented in the following table.

Event Return Period (years)	2	10	20	50	100
AEP (%)	50	10	5	2	1
Rainfall Intensity (mm/hour)	29	41	48	60	72
Peak Stream Flow (m^3/s)	88	124	146	182	218

Table: Summary of Tararu Stream catchment hydrology

To put these figures in perspective, the following flow estimates have been compiled from historical flood events that have significantly affected the Tararu community:

Event	Peak flood flow (m^3/s)	Event Return Period (years)
April 1981	70	< 2
February 1985	150	20
January 2002	200	100
Weather Bomb	200	100

Table: Summary of historical flood events on the Tararu Stream

5.1.4 Hydraulic Assessment

The performance of the Tararu Stream channel was assessed by constructing a one-dimensional hydraulic model extending from the Victoria Road ford to the Firth of Thames.

The one-dimensional hydraulic model was calibrated for the bank full flow using the design flood levels included in Hauraki Catchment Board Report 130.

The one-dimensional hydraulic model of the Tararu Stream was used to simulate the bank full flood event in the Tararu Stream along with the 100 year flood event (assuming that the flow would be restricted to the channel using floodwalls).

This hydraulic assessment of the Tararu Stream derived the following facts:

- The bank full capacity of the Tararu Stream was confirmed as 100 m^3/s, although this flow was re-evaluated as the five-year event (at the time that works were completed in the Tararu Stream this flow was assessed as the 10 year event).

- The unrestricted capacity of the State Highway 25 bridge is around 100 m^3/s (increasing to 150 m^3/s when the water level increases to the level of the roadway). Although this does not represent a significant restriction to the bank full flow in the Tararu Stream, it would become a restriction if the channel were confined by any proposed floodwalls.

5.1.5 Hazard Assessment

The flood hazard affecting the Tararu community is summarised on the following aerial photograph.

Figure: Tararu community flood hazard map

5.1.6 Hazard Mitigation Proposals

The hazard mitigation proposals for the Tararu community are presented in three sections:

- Planning and building controls
- The proposed river and catchment management works for the Tararu Stream catchment.
- The proposed engineering works within the lower section of the Tararu Stream (within the Tararu urban area).

5.1.6.1 Planning and Building Controls

The following map shows the recommended planning and building controls for the Tararu community based on the current environment (without the adoption of any new engineering works).

Figure: Recommended planning and building controls for the Tararu community

It is important to note that these proposed planning and building restrictions will vary depending on the engineering works that are adopted by the Tararu community to improve the capacity of the lower Tararu Stream channel. The higher the level of flood protection that is adopted by the Tararu community, the fewer development restrictions there will be on land within the Tararu flood hazard zone.

5.1.6.2 River and Catchment Management Works

It is proposed that the river and catchment management works within the Tararu Stream catchment will cover the following areas:

- Protection of existing indigenous vegetation from livestock through retiring and fencing land.

- Implementation of a goat and possum control programme (currently no formal possum or goat control is completed within the Tararu Stream catchment).

- Removal of channel obstructions and accumulated sediment in the middle and upper reach of the Tararu Stream and tributaries (where there is appropriate access).

- Re-vegetation of areas prone to erosion (landslide material and riparian margins).

The indicative cost estimate for the river and catchment management works within the Tararu Stream catchment is presented in the following table.

	Initial Capital Costs	Ongoing Annual Costs
Channel Management	$1,155	$1,155
Pest Management	$75,900	$14,876
Riparian Management	$2,233	$59
Soil Conservation	$36,760	$887
+ Design and Management (20%)	$23,210	$3,395
+ Contingency (10%)	$11,605	$1,698
GRAND TOTAL	$150,900	$22,100

Table: Indicative costs for the proposed river and catchment management works within the Tararu Stream catchment

5.1.6.3 Engineering Works

The proposed engineering works for the lower Tararu Stream have the following general objectives:

- Improvement of the performance of the Tararu Stream channel and floodway downstream of the Victoria Road ford.

- Provision of additional flood protection for the Tararu community where economic.

- Relieving the restriction created by the State Highway 25 bridge.

The key limitation on the engineering works in the lower Tararu Stream is the close proximity of residential development and Tararu Creek Road to the channel and the restriction created by the State Highway 25 bridge.

Proposal 1: Base Level Engineering Works

Proposal 1 maintains the existing performance of the lower Tararu Stream channel by implementing a programme to remove accumulated debris and sediment from the lower Tararu Stream. The extent of the proposed base level engineering works is shown on the following aerial photograph.

Figure: Base level engineering works on the Tararu Stream

The proposed base level engineering works are similar to that which is currently funded by Environment Waikato through the Waihou Valley Scheme.

The indicative cost estimate for base level engineering works on the Tararu Stream is presented in the following table.

	Initial Capital Costs	Ongoing Annual Costs
Channel Maintenance	-	$30,800
Channel Monitoring	-	$1,440
+ Design and Management (15%)	-	$4,836
+ Resource Consents (20%)	$6,448	-
+ Contingency (10%)	-	$3,224
GRAND TOTAL	$6,500	$40,300

Table: Indicative costs for base level engineering works on the Tararu Stream

The pros and cons of adopting this proposal are:

✓ Low initial capital cost.

✓ The lower Tararu Stream is maintained at the current level of performance.

× Little or no reduction in the risk to the Tararu community due to the flood hazard.

Proposal 2: Intermediate Engineering Works

Proposal 2 improves the existing performance of the lower Tararu Stream channel to contain the 50 year flood event (182 m^3/s) by implementing the following works:

- Construction of a concrete floodwall along the true left bank of the Tararu Stream (upstream of the State Highway 25 bridge) to eliminate the existing overland flow path around the southern approach to the State Highway 25 bridge. This will include a designated overflow area for flood events that cause overtopping of the floodwall.

- Construction of timber floodwalls along both banks of the Tararu Stream (downstream of the State Highway 25 bridge) to improve the performance of the channel and prevent overflow onto adjacent properties.

- Provision for an overland flow path to the north of the State Highway 25 bridge to address the current restriction created by the State Highway 25 bridge. The overland flow path will take the form of a spillway, rather than a channel. This proposed spillway will be required to pass 32 m^3/s during the 50 year event.

- Placement of rock rip rap to improve the stability of the channel and protect the other works associated with this proposal.

Proposal 2 also includes the channel monitoring and maintenance works detailed under Proposal 1 (base level engineering works).

Figure: Intermediate engineering works on the Tararu Stream

The indicative cost estimate for intermediate engineering works on the Tararu Stream is presented in the following table.

	Initial Capital Costs	Ongoing Annual Costs
Channel Maintenance	-	$30,800
Channel Monitoring	-	$1,440
Channel Improvements	$90,000	$2,700
Floodwalls	$297,600	$10,888
Overland Flow Path	$138,000	$4,380
+ Design and Management (15%)	$78,840	$7,531
+ Resource Consents (20%)	$105,120	-
+ Contingency (10%)	$52,560	$5,021
Property Purchase	$476,320	-
GRAND TOTAL	$1,238,500	$62,800

Table: Indicative costs for intermediate engineering works on the Tararu Stream

The pros and cons of adopting this proposal are:

- ✓ Risk to Tararu community reduced for a majority of properties that are currently affected.
- ✓ Avoids the need for the costly and possibly premature replacement of the State Highway 25 bridge.
- × Significant initial capital cost, resulting in a relatively high rates burden on properties that directly benefit.
- × Does not provide protection for the properties on the true right bank upstream of the State Highway 25 bridge.

A variation to Proposal 2 is the construction of a concrete overflow channel to facilitate the overland flow path to the north of the State Highway 25 bridge. However this will significantly increase the capital cost of the overland flow path from around $138,000 to around $790,900.

Due to the significant increase in capital cost of this variation, it has not been included in this report to the same level of detail as the other proposals.

Proposal 3: Full Engineering Works

Proposal 3 improves the existing performance of the lower Tararu Stream channel to contain the 100 year flood event (218 m^3/s) by implementing the following works:

- Construction of a concrete floodwall along the true left bank of the Tararu Stream (upstream of the State Highway 25 bridge) to eliminate the existing overland flow path around the southern approach to the State Highway 25 bridge.

- Construction of timber floodwalls along both banks of the Tararu Stream (downstream of the State Highway 25 bridge) to improve the performance of the channel and prevent overflow onto adjacent properties.

- Placement of rock rip rap to improve the stability of the channel and protect the other works associated with this proposal.

- Replacement of the State Highway 25 bridge, with the primary objective of increasing the capacity to the 100 year flow.

Proposal 3 also includes the channel monitoring and maintenance works detailed under Proposal 1 (base level engineering works).

Figure: Full engineering works on the Tararu Stream

The indicative cost estimate for full engineering works on the Tararu Stream is presented in the following table.

	Initial Capital Costs	Ongoing Annual Costs
Channel Maintenance	-	$30,800
Channel Monitoring	-	$1,440
Channel Improvements	$234,000	$7,260
Floodwalls	$251,600	$10,768
+ Design and Management (15%)	$72,840	$7,540
+ Resource Consents (20%)	$97,120	-
+ Contingency (10%)	$48,560	$5,027
Property Purchase	$289,640	-
SUB TOTAL	$993,760	$62,835
+ Replace SH25 Bridge	$900,000	-
GRAND TOTAL	$1,893,800	$62,900

Table: Indicative costs for full engineering works on the Tararu Stream

The pros and cons of adopting this proposal are:

✓ Risk to Tararu community reduced for all properties that are currently affected.

× Significant initial capital cost, resulting in a high rates burden on properties that directly benefit.

× Requires buy-in and a funding commitment from Transit New Zealand for the upgrade of the State Highway bridge.

5.1.6.4 Summary of Indicative Costs and Local Rates

A summary of the indicative costs for the flood hazard mitigation proposals prepared for the Tararu Stream catchment and the Tararu community is presented in the following table.

Mitigation Proposal	Initial Capital Cost	Ongoing Annual Cost
River and Catchment Management	$150,900	$22,100
Engineering Works Proposal 1	$6,500	$40,300
Engineering Works Proposal 2	$1,238,500	$62,800
Engineering Works Proposal 3	$1,893,800	$62,900

Table: Summary of total indicative costs for the Tararu community

It is proposed that the catchment management, river management and engineering works developed to assist the Tararu community be funded according to the funding policy contained in this report. The exception to this is the replacement of the State Highway 25 bridge, which has been assumed as the responsibility of Transit New Zealand.

A summary of the direct and community rates that will be charged to an average property within the Tararu community to fund the proposed engineering works is presented in the following table. It is important to note that in line with the above assumption regarding the funding of the State Highway 25 bridge replacement, the capital cost of this has been omitted from the rates calculations.

	Capital Repayment Phase		Maintenance Phase	
Mitigation Proposal	Direct	Community	Direct	Community
Engineering Works Proposal 1	$386	$77	$379	$76
Engineering Works Proposal 2	$1,450	$300	$590	$118
Engineering Works Proposal 3	$1,729	$346	$591	$118

Table: Summary of direct and community rates for the Tararu community

5.1.6.5 Flood Hazard Mitigation Recommendation

It is recommended that Environment Waikato and the Thames Coromandel District Council use the following flood hazard mitigation proposals as a basis to begin consultation with the Tararu community:

- Planning and building controls within the Tararu flood hazard zone
- River and catchment management works within the Tararu Stream catchment
- Engineering works proposal 2 on the lower Tararu Stream channel

If the owner of a property within the Tararu community chooses to cover their share of the initial capital costs of the recommended engineering works proposal using a lump sum payment, the approximate payment for a average property within the Tararu community will be:

- $13,500 (if within the hazard zone).
- $2,700 (if outside the hazard zone).