

5.2 Te Puru Community and the Te Puru Stream

5.2.1 Description of Environment

The Te Puru Stream catchment is located around eight kilometres north of the Tararu community. It is a steep, well forested catchment that is drained by the Te Puru Stream.

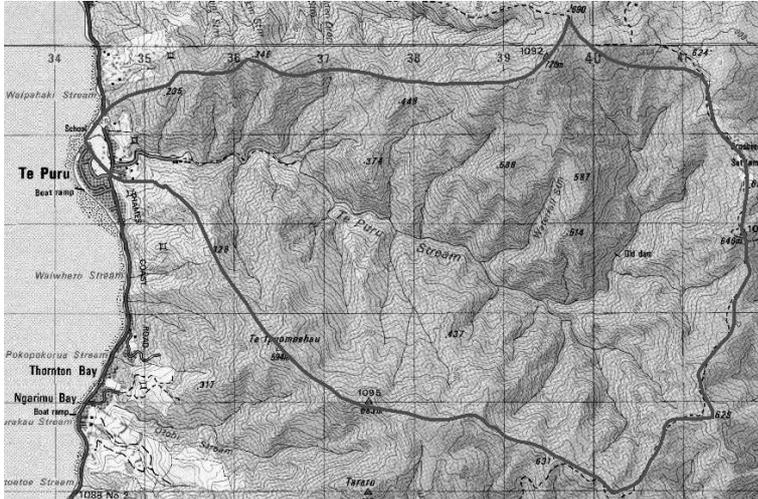


Figure: The Te Puru Stream catchment

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

Catchment Area	23.5 km ²
% Urban area	1%
% Indigenous Forest/Scrub	98%
% Included in Coromandel Forest Park	92%
Average Channel Slope	4%
Time of Concentration	75 minutes

Table: Summary of physical characteristics of the Te Puru Stream catchment.

The Te Puru community is located at the base of the Te Puru Stream catchment on a coastal alluvial fan. The community consists of mainly residential development on both banks of the Te Puru Stream, but also includes the Te Puru Motor Camp. State Highway 25 runs through the Te Puru community using a dual lane single span bridge.

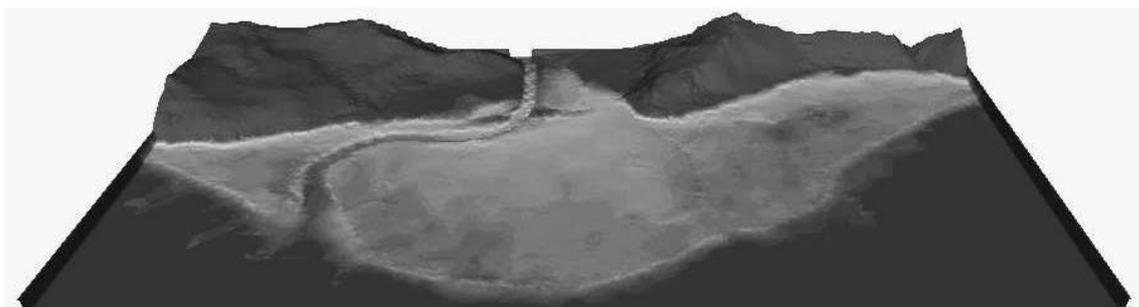


Figure: The Te Puru Stream coastal alluvial fan (looking inland from the Firth of Thames)

During significant flood events, overland flow first occurs downstream of the State Highway 25 bridge around the bottom of the informal earth embankment (overland flow path 1). Once the flood flow rises to 180 m³/s the State Highway 25 bridge becomes a restriction, causing overflow across Te Puru Creek Road and down the old path of the Te Puru Stream (overland flow path 2).



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

Damage to properties within the Te Puru community is focused on those properties within the secondary flow paths and within ponding areas.



Figure: Property damage within the Te Puru community during the 'weather bomb'.

5.2.2 Previous Works

During the 1980s the Hauraki Catchment Board completed channel works within the lower Te Puru Stream to increase the capacity of the channel to 180 m³/s. These works included enlargement of the channel and stabilisation of the banks using rock rip rap (refer to Hauraki Catchment Board Reports 117 and 194). Maintenance of these works is currently funded by the Thames Coromandel District Council.



Figure: Example of engineering works undertaken on the Te Puru Stream

5.2.3 Hydrological Assessment

A summary of the hydrological assessment completed for the Te Puru 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)	26	37	43	54	66
Peak Stream Flow (m ³ /s)	121	168	197	245	300

Table: Summary of Te Puru 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 Te Puru community.

Event	Peak flood flow (m ³ /s)	Event Return Period (years)
April 1981	130	5
February 1985	170	10
Weather Bomb	345	>100

Table: Summary of historical flood events on the Te Puru Stream

5.2.4 Hydraulic Assessment

The performance of the Te Puru Stream channel was assessed using reports completed by the Hauraki Catchment Board.

This hydraulic assessment of the Te Puru Stream derived the following facts:

- The bank full capacity of the Te Puru Stream upstream of the State Highway 25 bridge is around 180 m³/s.
- The unrestricted capacity of the State Highway 25 bridge is around 180 m³/s. Although this does not represent a significant restriction to the bank full flow in the Te Puru Stream, it does place a restriction on increasing the bank full flow by the construction of floodwalls.
- The bank full capacity of the Te Puru Stream downstream of the State Highway 25 bridge is around 150 m³/s, with overflow during flood flows greater than this limited to the overland flow path downstream of the Te Puru Motor Camp embankment.

5.2.5 Hazard Assessment

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

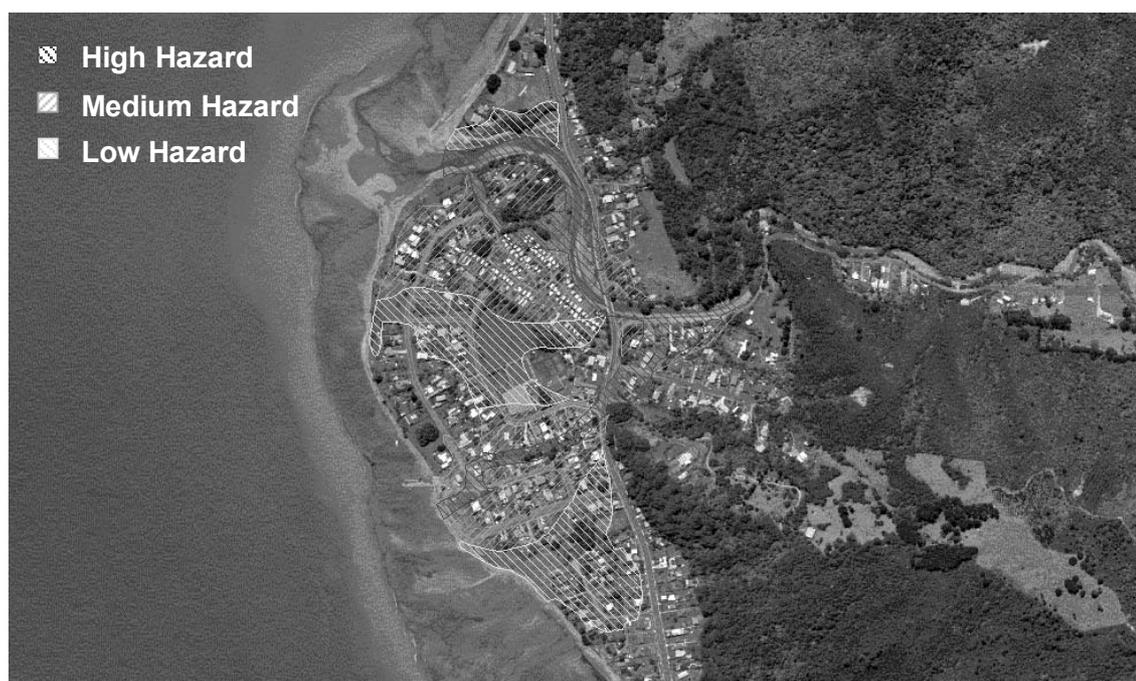


Figure: Te Puru Community flood hazard map

5.2.6 Hazard Mitigation Proposals

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

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

5.2.6.1 Planning and Building Controls

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



Figure: Recommended planning and building controls for the Te Puru 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 Te Puru community to improve the capacity of the lower Te Puru Stream channel. The higher the level of flood protection that is adopted by the Te Puru community, the fewer development restrictions there will be on land within the Te Puru flood hazard zone.

5.2.6.2 River and Catchment Management Works

It is proposed that the river and catchment management works within the Te Puru 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 control is only completed within around half of the Te Puru Stream catchment).
- Removal of channel obstructions and accumulated sediment in the middle and upper reach of the Te Puru 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 Te Puru Stream catchment is presented in the following table.

	Initial Capital Costs	Ongoing Annual Costs
Channel Management	\$1,395	\$1,395
Pest Management	\$78,862	\$13,454
Riparian Management	\$2,697	\$71
Soil Conservation	\$48,780	\$1,208
+ Design and Management (20%)	\$26,347	\$3,226
+ Contingency (10%)	\$13,173	\$1,613
GRAND TOTAL	\$171,300	\$21,000

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

5.2.6.3 Engineering Works

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

- Improvement of the performance of the Te Puru Stream channel and floodway in the vicinity of Te Puru Creek Road and downstream of the State Highway 25 bridge.
- Provision of additional flood protection for the Te Puru community where economic.
- Relieving the restriction created by the State Highway 25 bridge.

The key limitation on engineering works in the lower Te Puru Stream is the close proximity of residential development 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 Te Puru Stream channel by implementing a programme to remove accumulated debris and sediment from the lower Te Puru Stream. The extent of the proposed base level engineering works is shown on the following aerial photograph.



Figure: Base level engineering works on the Te Puru Stream

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

	Initial Capital Costs	Ongoing Annual Costs
Channel Maintenance	-	\$16,500
Channel Monitoring	-	\$1,560
+ Design and Management (15%)	-	\$2,709
+ Resource Consents (20%)	\$3,612	-
+ Contingency (10%)	-	\$1,806
GRAND TOTAL	\$3,700	\$22,600

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

The pros and cons of adopting this proposal are:

- ✓ Low initial capital cost.
- ✓ The lower Te Puru Stream is maintained at the current level of performance.
- ✗ Little or no reduction in the risk to the Te Puru community due to the flood hazard.

Proposal 2: Intermediate Engineering Works

Proposal 2 improves the existing performance of the lower Te Puru Stream channel to contain the 50 year flood event (245 m³/s) by implementing the following works:

- Construction of an embankment on the true left bank, upstream of the State Highway 25 bridge by raising Te Puru Creek Road. This will include a controlled spillway point for events that exceed the design standard of the works (the 50 year flood event).
- Construction of an earth embankment on the true left bank (downstream of the State Highway 25 bridge).
- Placement of rock rip rap to improve the stability of the channel and protect the other works associated with this proposal.
- 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 that form of a spillway, rather than a channel.

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



Figure: Intermediate engineering works on the Te Puru Stream

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

	Initial Capital Costs	Ongoing Annual Costs
Channel Maintenance	-	\$16,500
Channel Monitoring	-	\$1,560
Channel Improvements	\$540,000	\$16,200
Floodwalls	\$134,800	\$5,444
Overland Flow Path	\$50,000	\$2,000
+ Design and Management (15%)	\$108,720	\$6,256
+ Resource Consents (20%)	\$144,960	-
+ Contingency (10%)	\$72,480	\$4,170
Property Purchase	\$1,521,000	-
GRAND TOTAL	\$2,572,000	\$52,200

Table: Indicative costs for intermediate engineering works on the Te Puru Stream

The pros and cons of adopting this proposal are:

- ✓ Risk to Te Puru 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.
- ✗ Residual risk that affects most properties due to the performance standard that is less than the critical return period for the hazard and risk assessment.

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 \$50,000 to around \$400,000.

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 Te Puru Stream channel to contain the 100 year flood event (300 m³/s) by implementing the following works:

- Construction of an embankment on the true left bank upstream of the State Highway 25 bridge by raising Te Puru Creek Road to eliminate the existing overland flow path along the historical stream channel.
- Construction of an earth embankment on the true left bank (downstream of the State Highway 25 bridge) and on the outside of the last bend before the Te Puru Stream discharges to the Firth of Thames.
- 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 works detailed under Proposal 1 (base level engineering works).



Figure: Full engineering works on the Te Puru Stream

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

	Initial Capital Costs	Ongoing Annual Costs
Channel Maintenance	-	\$16,500
Channel Monitoring	-	\$1,560
Channel Improvements	\$540,000	\$16,200
Floodwalls	\$198,800	\$8,064
+ Design and Management (15%)	\$110,820	\$6,349
+ Resource Consents (20%)	\$147,760	-
+ Contingency (10%)	\$73,880	\$4,232
Property Purchase	\$975,000	-
SUB TOTAL	\$2,046,260	\$52,905
+ Replace SH 25 Bridge	\$1,500,000	
GRAND TOTAL	\$3,546,300	\$53,000

Table: Indicative costs for full engineering works on the Te Puru Stream

The pros and cons of adopting this proposal are:

- ✓ Risk to Te Puru 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 upgrading of the State Highway 25 bridge.

5.2.6.4 Summary of Indicative Costs and Local Rates

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

Mitigation Proposal	Initial Capital Cost	Ongoing Annual Cost
River and Catchment Management	\$171,300	\$21,000
Engineering Works Proposal 1	\$3,700	\$22,600
Engineering Works Proposal 2	\$2,572,000	\$52,200
Engineering Works Proposal 3	\$3,546,300	\$53,000

Table: Summary of total indicative costs for the Te Puru community

It is proposed that the catchment management, river management engineering works developed to assist the Te Puru 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 Te Puru 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.

Mitigation Proposal	Capital Repayment Phase		Maintenance Phase	
	Direct	Community	Direct	Community
Engineering Works Proposal 1	\$88	\$18	\$87	\$17
Engineering Works Proposal 2	\$1,406	\$250	\$200	\$40
Engineering Works Proposal 3	\$1,163	\$233	\$203	\$41

Table: Summary of direct and community rates for the Te Puru community

5.2.6.5 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 Te Puru community:

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

If the owner of a property within the Te Puru 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 an average property within the Te Puru community will be:

- \$11,500 (if within the hazard zone).
- \$2,300 (if outside the hazard zone).