Tamar Lake Inc.
Incorporation Number IA 10501

Email: info@tamarlake.com.au

Web: www.tamarlake.com.au

The Tamar Estuary Catastrophic Flood Risk for Launceston

What can be done about it?

Executive Summary

The 2018 BMT (R.M20921.002.02. Final) Flood Modelling Report, prepared for the Launceston Council demonstrates what Tamar Lake Inc. (TLI) has long suspected that the climate change driven increase in forecast rainfall, flood levels, and sea level rise collectively mean that Launceston's levee system will no longer provide the desired level of Urban flood protection, not just in the long term but in the short term.
The report showed that if Northern Tasmania had a 1in 200-year flood event next week, the current levee system at 5.1m AHD would be topped and Invermay and the other low-lying areas of Launceston will be flooded.

The table below, figure 1., extracted from the 2008 and 2018 flood modelling reports shows the historical and projected flood flows in m^3 and the projected flood height in metres at the confluence of the three rivers in a 1 in 200-year flood event.

	2008	2018	2050	2090
South Esk	3430	4975	5656	6506
North Esk	710	1252	1414	1614
Flood height AHD	4.2	5.2	5.6	6.1

Figure 1- Projected Peak Flood flows and flood heights.

The 2018 report also estimated the number of properties that would be flooded from all magnitudes of flood events under existing conditions and forecast to 2090 - Figures 2 and 3 below.

Table 5-9 Flooded Properties

Climate Conditions	20% AEP	10% AEP	5% AEP	2% AEP	1% AEP	1 in 200 AEP	1 in 500 AEP	1 in 1000 AEP	1 in 2000 AEP
Existing	313	339	410	537	633	3,008	3,816	4,412	4,696
2050	344	399	500	619	2,178	3,369	4,266	4,695	5,009
2090	448	536	610	1,786	3,268	3,760	4,590	4,881	5,305

Figure 2- Number of flooded properties.

Table 5-10 Above Floor Flooding

Climate Conditions	20% AEP	10% AEP	5% AEP	2% AEP	1% AEP	1 in 200 AEP	1 in 500 AEP	1 in 1000 AEP	1 in 2000 AEP
Existing	21	27	48	89	106	1,819	1,972	2,086	2,095
2050	21	36	51	85	1,141	1,831	2,060	2,123	2,135
2090	38	53	83	358	1,803	1,930	2,118	2,133	2,138

Figure 3 - Number of properties flooded to above floor level.

It is estimated that the cost of remediation from property flood damage could be as high as $3b or as much as 10 times the capital cost of prevention.
This is an existential issue for much of Invermay and other areas of the city which are protected by the levee system.
It's clearly a problem of State (and arguably National) significance and as such demands a regional planning solution of similar scale.

Options that should be investigated include:

1. Levee system upgrade to achieve flood protection for the 2090 conditions shown in the 2018 report.
2. Urban withdrawal or abandonment of infrastructure areas that are forecast in the report to be damaged or destroyed by a 1 in 200-year flood event in the short term and long term.
3. Regional Scale Protection that includes a barrage across the Tamar to block the incoming tidal flows that exacerbates the flood levels in Launceston and enables the formation of a large flood buffer in anticipation of floods entering the Tamar.

Over the last 14 years Tamar Lake Inc. has investigated the feasibility of installing a barrage downstream the Tamar at Point Rapid with positive results, not just for the major community concerns of flooding and sedimentation in the Upper Reaches, but other major benefits such as an almost unlimited industrial and domestic freshwater supply, pest Rice Grass removal in the middle reaches, a huge improvement in Upper Reaches aesthetic presentation and recreational amenity and a boost to the Regional economy through tourism and agriculture.
The purpose of this document is to examine the cause and effect of the flood risk and sedimentation in the current tidal environment and the results that may be achieved with the installation of a barrage at Point Rapid.

Flood Insurance – are properties in the Launceston flood prone areas covered or not?

In an estuary river system fed by freshwater flood events from the catchment, the flood effect is exacerbated where the incoming tide from the sea meets the outgoing flood flows. The confluence of the Tamar River with the North and South Esk Rivers in Launceston is a prime example of this effect.
Suffering from the Lismore, Hawksbury, and other estuary flooding disasters in recent years, the Insurance Industry has recognised that there are many 'tidal' river situations. (e.g. Lismore is 32 km inland and is impacted by a tidal river).
To cover themselves in this situation, Insurance companies have introduced an exclusions clause in their policies of 'Actions of the Sea' type. (AAMI Insurance calls it 'Movements of the Sea'). Legal opinions sought TL indicated that they may exclude

claims under this policy. An insurance Broker estimates 80% of Launceston 'thinks' they are covered for flood damage but are not aware of this exclusion clause.
The potential distress when they are not successful in making a claim can be imagined.

Flood risk and sedimentation in the current tidal environment.

It is a typical wet winters day in Northern Tasmania with heavy rain falling in the South and North Esk river's catchment area, 20% of the size of Tasmania.
As the rain falls on farms and logging coupes it picks up clay particles and topsoil, carries it in suspension in the South and North Esk tributaries and main river streams and eventually into the Tamar at Launceston.

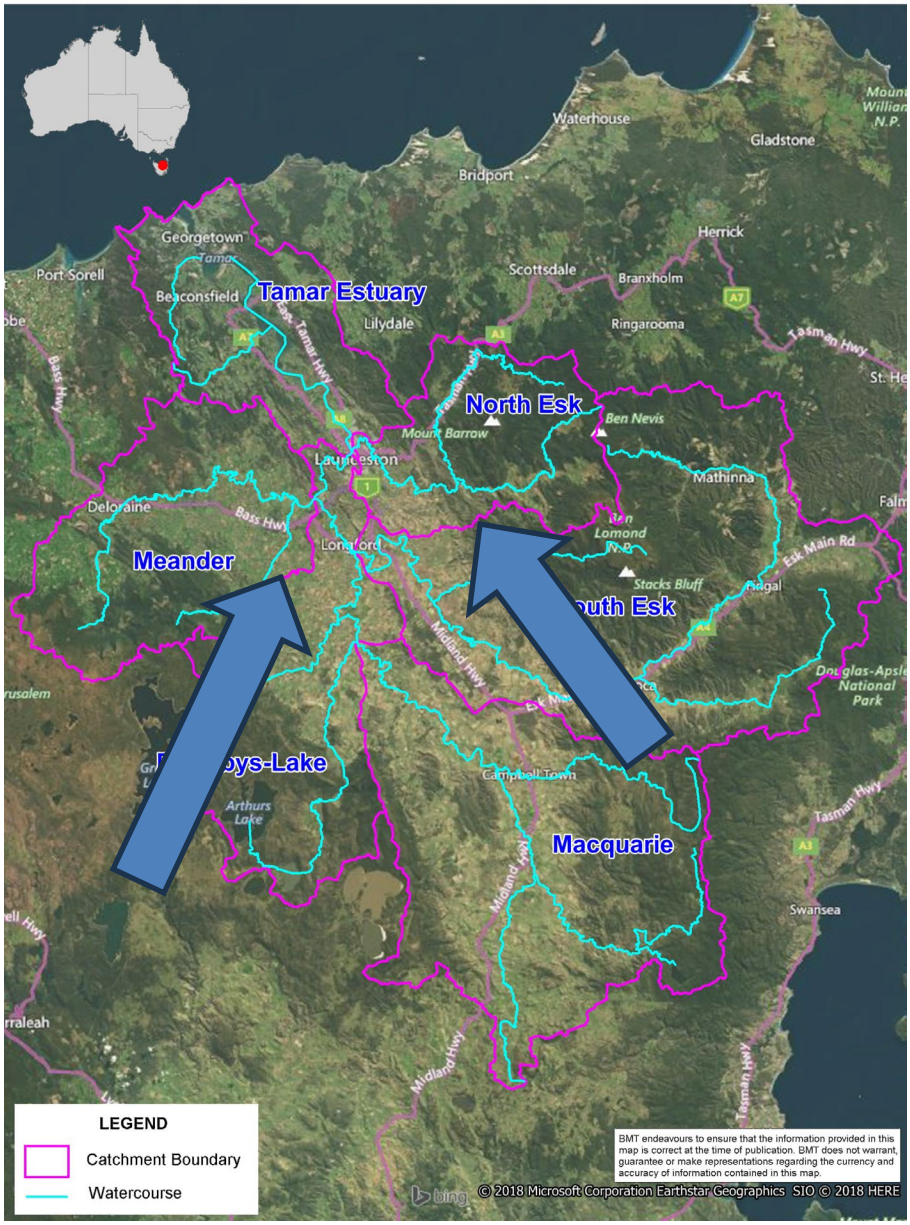


Figure 4- North and South Esk Rivers catchment area.

The flood water from the South Esk and enters the Tamar via Lake Trevallyn and the Trevallyn dam. Flood flows topping the dam may be as low as 1000 and up to 4900 cubic metres per second today, but up to 5600 in 2050 and 6500 in 2090 according to the 2018 BMT Flood Modelling report. Note the brown colour of the lake with sediment in suspension.

Figure 5 - Flood waters flowing over the Trevallyn Dam

Flood waters from the North Esk enter the Tamar at Home Point with the three rivers forming an area of confluence with the incoming Tamar tides.
On entering the Tamar at the Yacht basin, depending on tidal flows the freshwater from the South Esk catchment mixes with the flood waters from the North Esk catchment and moves rapidly downstream with the lighter freshwater riding on top of the heavier tidal saltwater from Bass Strait until in the Stephenson Bend to Freshwater Point area the freshwater and saltwater mix in a chemical process called flocculation, causing the sediment to precipitate out onto the bed of the river, principally in the Tamar Island area. Scientific modelling has estimated 120,000 cubic metres of new sediment enters the Tamar each year.
When the flood flows have subsided the twice daily asymmetric tidal flows "pump" the newly settled bed sediment from the Stephenson's Bend to Freshwater Point area back into the quiescent areas of Home Reach, the Yacht Basin and Lower North Esk where it will deposit and continue to accumulate until regime equilibrium is reached. Figure 6 shows the principal area of deposition in the Upper Reaches of the Tamar.

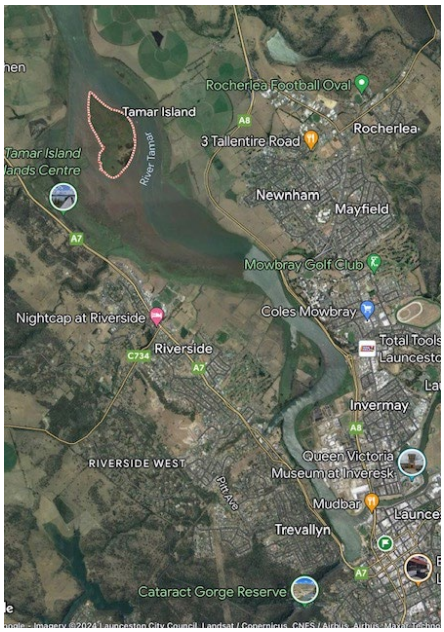


Figure 6 - Principal Flood deposition area.

Figure 7 - Yacht Basin with sediment accumulation at low tide.

Figure 7 shows the extent of the mud flats in the Yacht Basin at low tide. Note the very limited navigation depth in the channel.

In contrast, figure 8 shows the Yacht Basin, Home Reach and Lower North Esk at high tide. This gives an indication of a Tamar Lake perspective 24 hours a day, seven days a week with a barrage downstream forming a lake.

Figure 8 - Yacht Basin, Home Reach and Lower North Esk at high tide.

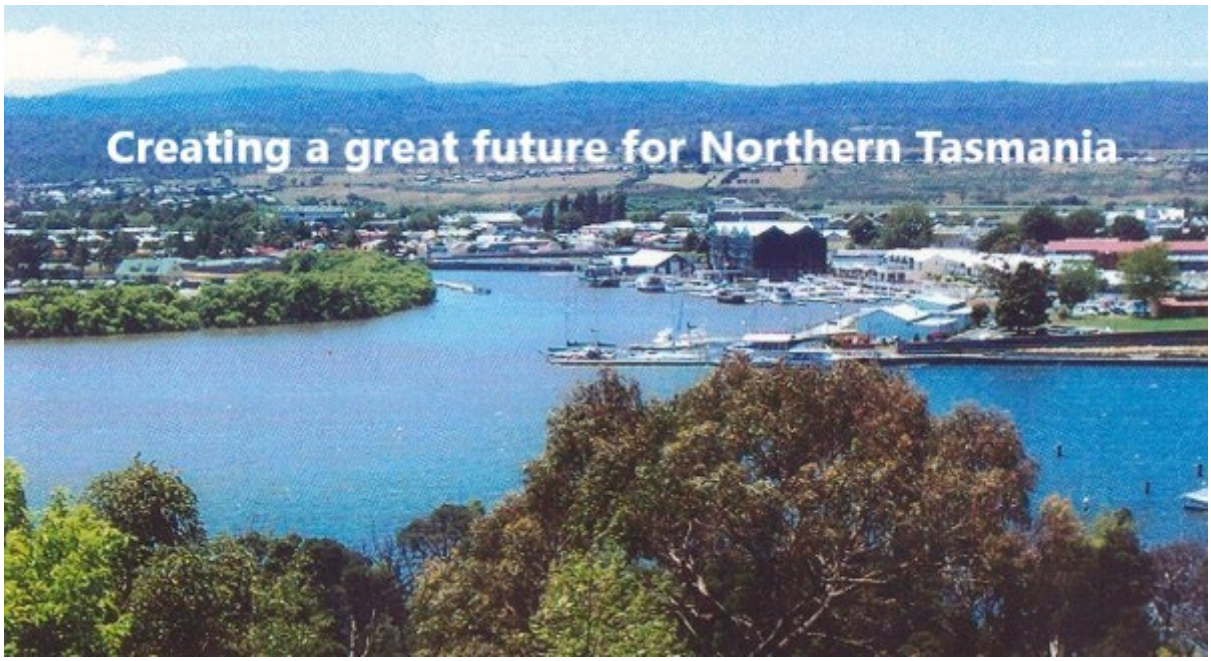


Figure 9 – Blue water in Tamar Lake at Home Point 24/7

Figure 9 shows what Tamar Lake at Home Point would look like 24/7. The blue water instead of the usual brown muddy water was photographed when Hydro released great quantities of freshwater when they emptied Trevallyn Lake.

2018 Flood modelling report - predictions

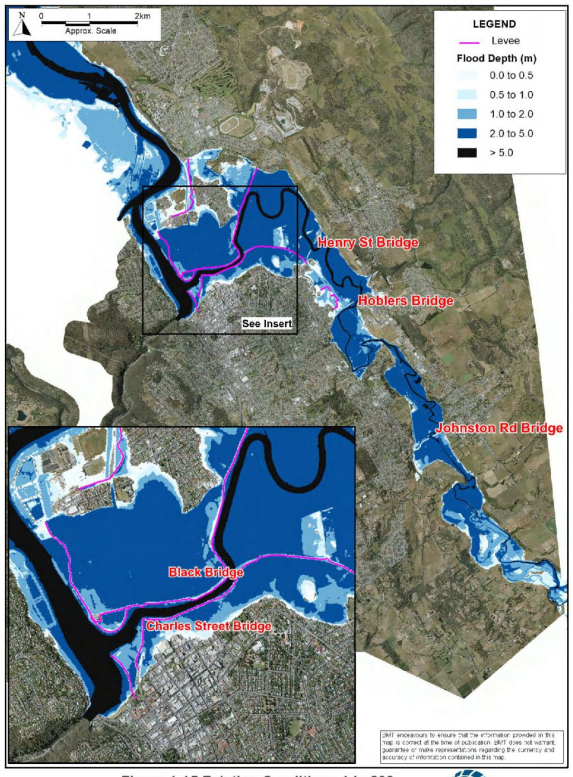


Figure 1-15 Existing Conditions 1 in 200 AEP Event Flood Depth

Existing conditions

- If Launceston had a 1 in 200-year flood event next week, Invermay would be flooded to a depth of at least 2 metres and up to 5 metres.

- Infrastructure in Invermay, on both sides of the North Esk and the west side of Home Reach would suffer catastrophic damage and possible loss of life.

- In 2090 the forecast is for a flood depth of 5 metres in Invermay

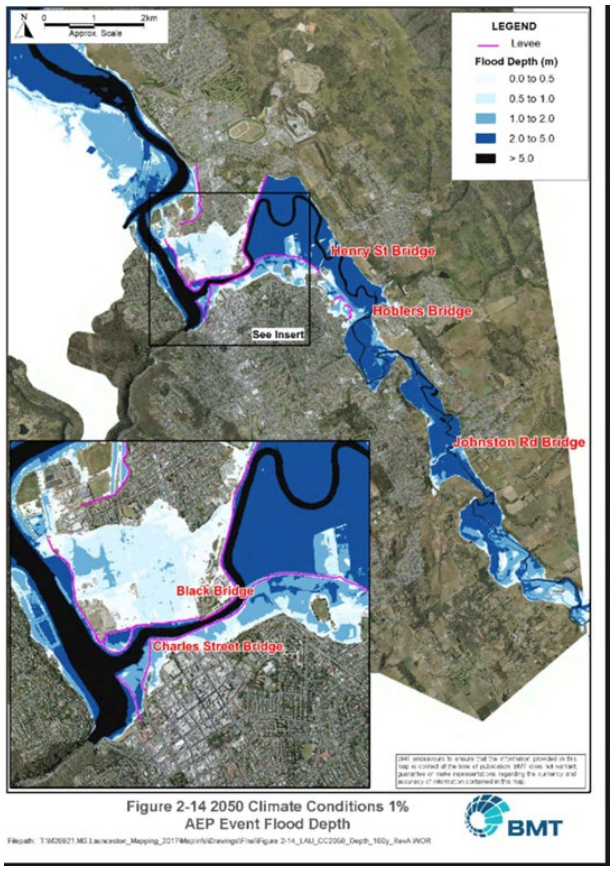


Figure 2-14 2050 Climate Conditions 1% AEP Event Flood Depth

2050 Climate conditions

- In 2050 if Launceston had a 1 in 100-year flood event Invermay would be flooded to a depth of 0.5m to 2.0 metres

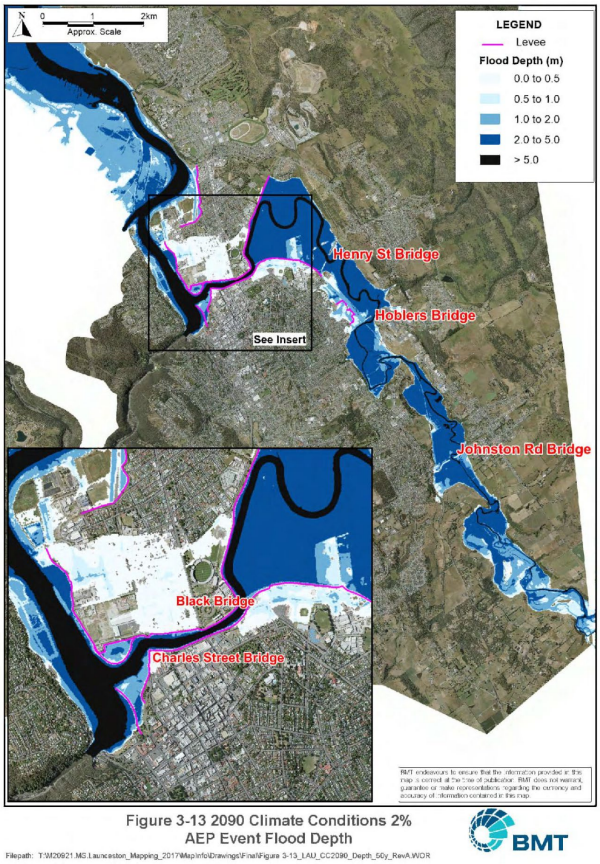


Figure 3-13 2090 Climate Conditions 2% AEP Event Flood Depth

2090 Climate conditions

- In 2090 if Launceston had a 1 in 50-year flood event, Invermay would be flooded to a depth of 0.5 to 1.0 metres.
- A 1 in 200-year event in 2090 would flood Invermay to a depth of 5m.

What effect could a barrage have on the mitigation of both the flood risks for all the low-lying areas of Launceston and the reduction in sediment accumulations in the Upper Reaches?

Tamar Lake Inc., a not-for-profit member funded Incorporated Association, proposed the installation of a barrage at the 800m wide Tamar River at Point Rapid at the Southern end of Long Reach in 2010 and subsequently has spent $850,000 on investigating the feasibility of all aspects of this proposal.

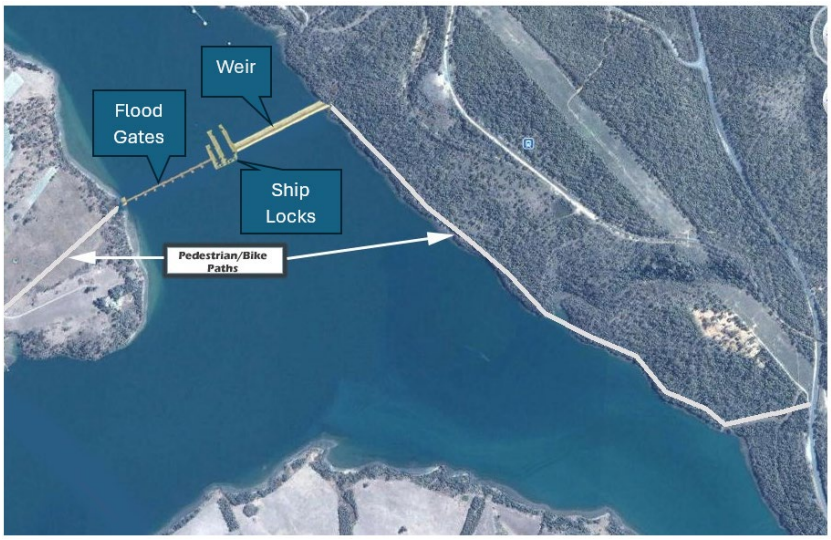


Figure 10 - Tamar Barrage at Point Rapid

Barrage construction based on 2008 flood modelling results.

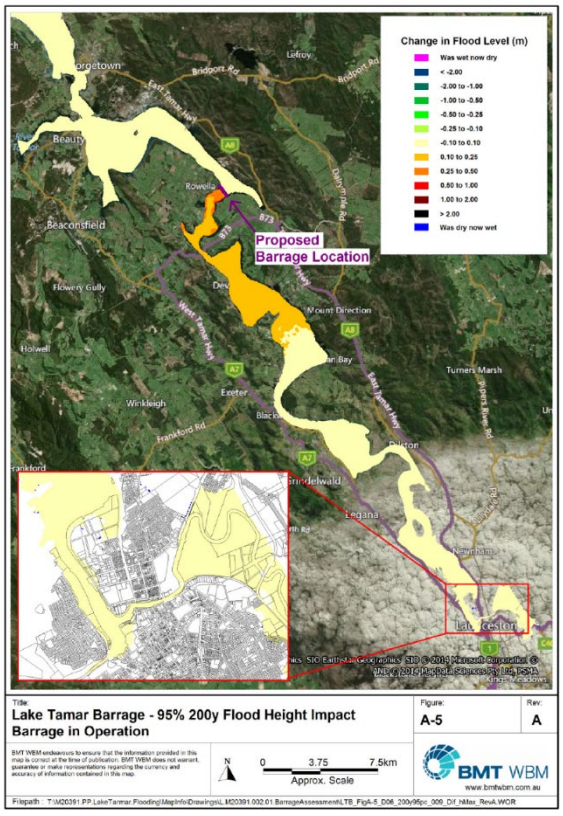
There are four major sections of the barrage.

- Flood gates, 10 gates each of 35m wide, that when opened fully on an ebb tide pass all flood waters up to a 1 in 200-year flood event with a projected sea level rise of 0.8M and when closed block all incoming tides.
- A fixed weir wall 300m wide with a crest at 2.2m AHD which is 2.9m below the levee crest in Launceston and that will allow extra high flood waters to spill downstream.
- Two ship locks for the passage of both commercial and private vessels
- A fish ladder adjacent to the west bank for the passage of fish species requiring fresh and saltwater environments for life cycle purposes.

The following video of the Warragamba dam flood gate operations in Sydney is a typical example of flood gate operations in the Tamar barrage.

https://youtu.be/1VFyKsrXKPk?si=C52T4mAetyjUupj8

Flood mitigation - current environmental conditions - tidal flows upstream blocked at the barrage.



1 in 200-year flood event – Barrage in operation.

All the flood studies carried out to date have shown that the flood levels in the Lower North Esk are exacerbated by the coincidental arrival of the South and North Esk rivers with high tide up the Tamar at the confluence of the three rivers at Home Point.
With the installation of the barrage TL proposed that with at least 24 hours' notice the flood gates will be opened on an ebb tide to lower the level of the lake to create a large buffer for the initial flood flows and then closed again at the beginning of each flood tide to block the incoming tide. The TL studies carried out in 2014 showed that with automatic gate operations as described over 6 tidal cycles and up to a 1 in 200-year flood event there would be no adverse effect on flood levels in Launceston and some limited mitigation for both current and sea level rise scenarios.

Flood mitigation up to 2090 – 1 in 200-year flood event – summary.

The 2018 report covers all the flood event volumes and levels up to a forecast 1 in 2000-year event, however for the purposes of this report we will focus on the 1 in 200-year event which was the design goal for the current levee.

	2008	2018	2050	2090
South Esk	3430	4975	5656	6506
North Esk	710	1252	1414	1614
Flood height AHD	4.2	5.2	5.6	6.1

Figure 11 - Projected Peak Flood flows and flood heights.

The results shown in figure 11 have been extracted from both the 2008 and 2018 reports. This clearly shows that if we had a 1 in 200-year event tomorrow, with the current levee crest at 5.1m Invermay would be flooded to a depth of up to 5 metres with enormous damage to the infrastructure and possible loss of life.
Looking to the future in 2050 and 2090 there can be no doubt the Council must take urgent action to accommodate potential flood levels up to 6.1m.

Sedimentation management

With the removal of the tide upstream of the barrage and the 24/7 maintenance of a lake level about 0.9m below current spring high tide level, freshwater entering the Tamar Valley from the catchments will flow one way downstream to the barrage where it will be released through the flood gates as required to maintain that level.
As described before, sediment remains in suspension in the fast-moving freshwater entering the Tamar in times of floods, particularly in the narrow and shallow section of the lake from the Yacht Basin to Freshwater Point but will slow down and tend to deposit the sediment in the wider and deeper sections from Freshwater Point to the barrage. The Long-Term TL sedimentation study carried out in 2023 reported that in this section of the lake there would be an increase in sediment depth of only 1.8mm per year. At this rate it would take 46 years for sedimentation to reduce 1% of the lake volume of 400 GL.

Figure 12 - Tamar Sediment erosion and accumulation over a 10-year period.

Figure 12 shows the sediment accumulation over the whole lake and lower estuary over a period of 10 years. Note the sediment bed erosion in the Upper Reaches due to the fast-flowing floods entering the Tamar down the Cataract Gorge and the even spread of sediment accumulations over the rest of the lake mainly in the channel sections.
With no new accumulations in the Yacht Basin, Home Reach and the Lower North Esk and continued erosion of the existing sediment bed with each flood event excellent boat navigation of a minimum 3m depth 24/7 will be maintained in this area.
Also note the minimal sediment accumulations in the estuary section downstream the barrage with the report claiming an increase in sediment depth of only 0.7mm per year and that it would take the lower estuary 5,000 to 10,000 years to reach regime equilibrium.

IN SIMPLE TERMS, IN THE TIDAL SITUATION THE 120,000 CUBIC METRES OF NEW SEDIMENT ENTERING THE TAMAR EACH YEAR ACCUMULATES IN THE VERY SHALLOW AND NARROW HEAD OF THE ESTUARY BUT IN A TAMAR LAKE SCENARIO MOST OF THIS NEW SEDIMENT ACCUMULATES IN THE VERY MUCH WIDER, DEEPER AND LONGER SECTION FROM FRESHWATER POINT DOWN TO THE BARRAGE.

Summary

All the studies carried out to date using the data determined in the 2008 Council flood studies have shown that the installation of a barrage with the current specifications at Point Rapid will have no detrimental effect on flood levels in Launceston and will solve the Upper Reaches sedimentation problem.
The additional benefits that will accrue to the Northern Tasmanian community include:

- Greatly improved water quality in Zone 1 with low turbidity.
- A near constant freshwater lake 24/7 with greatly improved aesthetic presentation and aquatic amenity in Launceston.
- A minimum navigation depth of 3m from Low Head to the Seaport 24/7
- The gradual removal of the 400 hectares of the pest Rice Grass in the Middle Reaches and the sediment bed in which it grows and the return to the natural ecology of the region. Resident and tourist access to the lake for aquatic activities will also be greatly improved.
- An almost unlimited supply of freshwater from any location on the lake including Bell Bay for irrigation and industrial applications.
- With the installation of the barrage, the TL Economic studies forecast a rise of 3% in Gross Regional Product over the 15 years post formation of the lake principally in tourism and agriculture.

The 2018 Council flood modelling report.

Assuming the Council accepts the current and future results shown in the report, what effect will this have on flooding and sedimentation in the Upper Reaches?

Flooding

The current proposed barrage at Point Rapid is not designed to accommodate flood flows in 2090 which are 60% above the current design parameters.
However, the Point Rapid location with its 800m width and 30m depth will accommodate a much larger set of flood gates and a spillway for overflows so TL proposes that the Council and TL commission BMT to design a barrage in this location and specify the operating parameters that will retain the 2090 flood levels within the current 5.1m levee infrastructure.

Sedimentation

Although the forecast flood flows from the 2018 report are considerably stronger than previously acknowledged, provided the barrage can be designed to accommodate flood levels in Launceston within the current levee infrastructure, the results for sedimentation should be the same with perhaps a small increase in total sediment deposited in the lake.

Conclusion and recommendation

Of the options listed in the Executive Summary, the Council must immediately determine whether 1 or 2 are feasible and if so take immediate action to plan and implement a solution.

With it's studies over the last 14 years based on the 2008 flood study report, and now with a much higher 2090 climate driven flood design goal, TL is confident that a barrage could be designed and installed at Point Rapid that not only maintains the 2090 predicted 1 in 200-year flood event within the current levee system but also solves the Upper Reaches sediment accumulation problem and delivers the wide ranging benefits listed above including the possibility that the barrage construction and operations could be privately funded because of the huge economic boost this project will deliver for the Region.

As a first step it is our recommendation that Tamar Lake Inc. and the Council get together to raise the funds to commission BMT to re-design the barrage at Point Rapid with the design goal of the 2090 1 in 200-year predicted flood event being contained within the current levee infrastructure.
If the modelling of this goal shows success, then move on to the detailed planning necessary for the environmental impact and economic approvals required for construction.

Robin Frith

8th February 2024