

# **Hutt River Maoribank Erosion Study – Stage 1 Risk Assessment**

## ***Executive Summary***

### **Study Purpose and Staging**

The purpose of the Maoribank Erosion Study is:

“To determine a sustainable integrated strategy to manage degrading bed levels in the adjacent reaches upstream and downstream of Maoribank Bend, and headward greywacke bedrock erosion through Maoribank Bend, on the Hutt River at Upper Hutt”.

The Maoribank Erosion Study is divided in three stages.

- Stage 1 - Risk Assessment (this stage)
- Stage 2 - Erosion Management Strategy (treatment) Options
- Stage 3 - Strategy Implementation

### **Hutt Riverbed Degradation**

Riverbed degradation has occurred over most of the Hutt River. Degradation is due to a combination of: heavy gravel extraction from the late 1940s to the mid-1970s; confining the river and increasing transport capacity; strengthening bank edges to increase security but removing a sediment source; a relatively stable indigenous catchment that limits sediment supply; and the constrained flow patterns of the river along the Wellington fault

Bed levels in the lower reaches of the river have partially recovered following the moratorium on extraction in the mid 1970's and controlled extraction from the late 1980's. However with some exceptions within reaches, bed levels above Taita Gorge, including the Maoribank reach, have continued to degrade.

### **Maoribank**

At Maoribank (Figure 1) the Hutt River changes direction by more than 90 degrees. The change in direction is the river's response to geological features that result from earthquake activity, principally movement on the Wellington fault. This movement has resulted in uplifted and outcropping bedrock at the Maoribank Bend. The river falls steeply (more than 5 metres) through the eroding fractured greywacke outcrop.

The bedrock outcrops became visible around the mid to late 1970's as a direct consequence of degrading gravel bed levels above and below the bend. Bedrock headward erosion is now actively occurring through the outcrop. Gravel bed levels in the reaches upstream and downstream of Maoribank have continued to degrade.

### **Issues at Maoribank**

Degrading bed levels are progressively undermining bank edge protection works in the reaches downstream and upstream of Maoribank Bend. The concern is that if bed degradation continues edge protection works will become ineffective and the security of the flood protection scheme will be increasingly threatened. The consequence is that community assets and residential property will be at risk.

Of particular concern is that the rapid headward bedrock erosion occurring through Maoribank Bend will break through the northern extent of the rock outcrop. This breakthrough will release and lower gravel held in the river reach upstream of the bend and bank edge protections within the reach will be undermined and fail. The latter could occur in a single flood event seriously threatening the river berm and right bank stopbank with consequent risk of flooding and damage to community assets and residential development in Totara Park. Corresponding left bank erosion could threaten relatively recent residential development below Harcourt Park, in doing so severing the Hutt Valley trunk sewer. The Norbert Street Footbridge left abutment would be similarly threatened

In the reach downstream of Maoribank Bend SH2 runs on the left bank river berm, Totara Park Bridge crosses the river, and Awa Kairangi Park is on the right bank berm. These assets are also vulnerable to damage by riverbank erosion, again exacerbated by degrading riverbed levels.

### Risk Identification

The major risks identified for the Maoribank reach are shown in the table below.

### Risks and Descriptions

Risk No.	Risk Title	Risk Description
Risk 1	Totara Park RB Stopbank Failure	The risk of right bank erosion resulting in breach and failure of the Totara Park stopbank and equivalent flooding for each scenario.
Risk 2	Harcourt Area LB Erosion	The risk of left bank erosion extending into private property below Harcourt Park, this erosion would also sever the Hutt Valley trunk sewer.
Risk 3	State Highway 2 LB Erosion	The risk of left bank erosion extending into or preventing traffic thoroughfare on SH2 River Road.
Risk 4	Awa Kairangi Park RB Erosion	The risk of bank erosion through the existing buffer zone into the grassed park, and over a reasonable length (in the order of 100 to 200 metres)
Risk 5	Totara Park Bridge LB Isolation	The risk of Totara Park Bridge being isolated at the left abutment due to bank erosion.
Risk 6	Major LB and RB Reach Damage	The risk of protection works destruction, major bank collapses and substantial erosion over the majority of the study reach. The resulting damage is likely to leave the system severely vulnerable for a considerable period of time.
Risk 7	Norbert Street Footbridge LB Isolation	The risk of Norbert Street Footbridge being isolated at the left abutment due to bank erosion. This erosion would not sever the Hutt Valley trunk sewer.

### Risk Model

A fundamental concept for risk assessment is that risk is expressed as the product of LIKELIHOOD (or PROBABILITY) times IMPACT (or CONSEQUENCES):

viz. **RISK = LIKELIHOOD x IMPACT**

Risk is often expressed as zones on a matrix where the vertical axis is IMPACT and the horizontal axis is LIKELIHOOD. Refer Figure 2.

The LIKELIHOOD of a particular risk is calculated, and is a function of the probability of a flood that will result in the risk occurring and the time period in which it may occur. The time periods chosen for this study, and for which riverbed level predictions were made, are 5 years, 10 years and 20 years.

IMPACT is a measure of the consequences that will result from the risk occurring. Consequences are measured against pre-selected criteria with corresponding descriptors or measures. Criteria were assigned weightings to reflect their importance to the risk.

The criteria used for the Maoribank risk assessment are:

- The reputation of Greater Wellington Regional Council and the Flood Protection Group
- Health / safety / wellbeing of GWFP staff and the community
- Social and cultural impacts, community disruption
- Environmental impacts
- Breaching regulation, compliance or contract requirements or other agreements
- Floodplain and infrastructure damage
- Flood Protection system damage and repairs (system as a whole)
- GW Strategic direction implications (system as a whole)
- Flood Protection security / level of service (after event)
- Operational impact on staff (system as a whole)

### **Technical Investigations**

Technical investigations were carried out to predict future riverbed levels and the erosion behaviour that lower bed levels would induce. The riverbed levels were predicted for periods of 5, 10 and 20 years

The technical investigations also deduced that breakthrough of the outcropping bedrock at Maoribank bend is not likely to occur within five years, but it is likely to be well before 10 years.

Other technical investigations were carried out to estimate various damages and system repair costs. These are required to determine the fit to appropriate measures against the criteria.

### **Risk Analysis**

The outcomes of the risk analysis, after the technical and other information is assigned to each risk for the 5, 10 and 20 year riverbed scenarios, are shown on Figure 2.

### **Risk Evaluation – Tolerable Risk**

The risk categories (MINOR, LOW, MEDIUM, HIGH, EXTREME) were developed by a subjective process that considered a number of factors. From these considerations “tolerable risk” was determined as the boundary between MEDIUM and HIGH risk categories. For a best practice situation it means that risks above the tolerable risk line should receive immediate treatment to control and reduce the level of risk, at least to below the tolerable risk line.

This does not imply that risks below the tolerable risk line are acceptable and need not be treated to the target risk level (the latter is considered to be LOW).

### **Current Intolerable Risks**

The four Maoribank risks that fall above the tolerable risk line in the HIGH to EXTREME category are:

- Risk 1 - Totara Park RB Stopbank Failure
- Risk 6 – Major RB and LB Reach Damage
- Risk 2 – Harcourt Area LB Erosion
- Risk 3 – State Highway 2 LB Erosion (in the 20 year scenario)

Three of the four risks that fall in the HIGH to EXTREME category and above the tolerable risk line are those that are all or in part located upstream of the Maoribank Bend bed rock outcrop. If Risks 1 and 2 were controlled to an acceptable level, Risk 6 would fall to a risk category below the tolerable risk line.

### **Risk Treatment**

Risk treatment involves identifying the range of options for treating (or mitigating) risks, assessing these options and preparing and implementing treatment plans.

If the three major risks are to be treated before rock outcrop breakthrough at the Maoribank Bend, and to prevent the risks progressing to the 10 year and 20 year scenarios, then treatment of Risks 1 and 2 would need to be completed within five years. There are three levels of risk treatment that can be considered by Greater Wellington Flood Protection.

### **Treat all Maoribank Reach Risks**

Treat all risks so that their risk will be rated at an acceptable level (around LOW to MEDIUM for a well planned and managed flood protection system). However, it is well recognised that even the highest risks in this Maoribank reach are likely to be lower than those prevailing in other reaches on the Hutt system, for example the Boulcott or City Centre reaches.

### **Treat Maoribank HIGH Risks to a tolerable risk level**

This involves treatment options that will bring the three major risks – Totara Park Stopbank Breach, Harcourt Area Erosion, and Major Reach Damage - down to a level so that they would be rated as MEDIUM risk and for the foreseeable period be

tolerable. The remaining risk would then need to be dealt with when the Maoribank reach becomes a priority in the Hutt River Floodplain Management Plan improvement process.

**Hold HIGH Risks at current risk levels (Holding measures)**

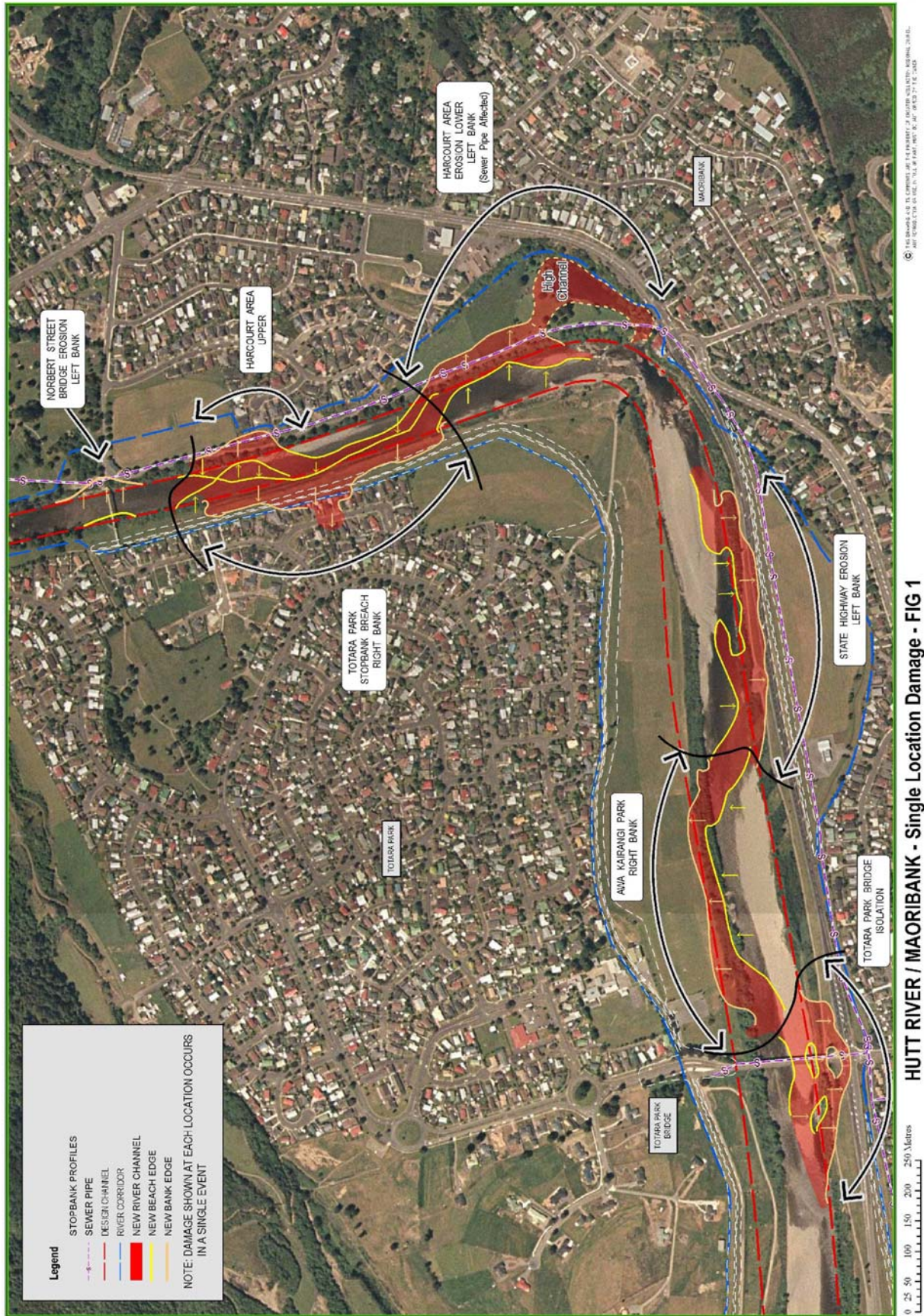
This treatment option would hold the three major risks (and the other risks) at current levels. It would involve sufficient works to prevent breakthrough of the outcropping bedrock at Maoribank Bend (and prevent the consequent lowering of upstream gravel bed levels) and maintenance work such that the major and other risks are held at current levels.

This position can be justified on the grounds that (while best practice would require immediate attention to bring the three major risks at least into the tolerable risk zone) there are other higher priority reaches on the Hutt River system that require works more urgently.

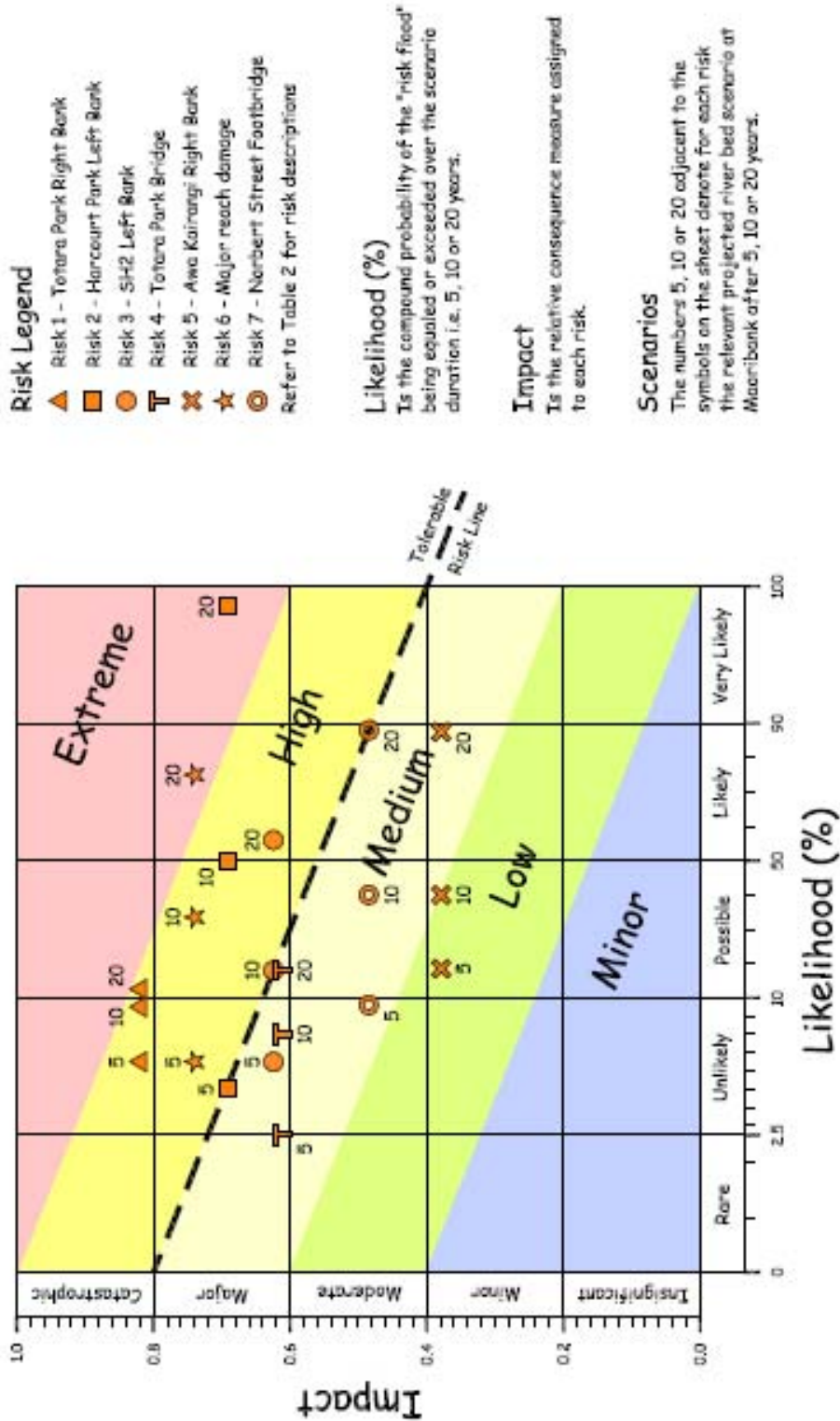
**Stage 2 – Risk Treatment Option Investigations**

The Stage 1 risk assessment concluded with a scoping session to assess potential treatment options that could reduce Maoribank risks to the three treatment levels (from full treatment to holding measures) discussed above. A brief was prepared to define the scope and depth of the investigations. Preliminary outcomes from the treatment options investigations are covered in a separate report.









Presentation of Current and Projected Risks  
Figure 2