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Report to the Hutt River Floodplain Management Advisory Committee
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Hutt River Floodplain Management Plan : Detention Dams

1. Purpose

To report to the Advisory Committee on the outcomes of the investigations for detention dams in the Hutt catchment.

2. Background

The Advisory Committee, at its meeting on 21 September 1998, endorsed the consideration of detention dams as a flood mitigation measure for the Hutt River. Detention dams can reduce peak flows in the lower reaches of the river and hence can reduce the costs of the flood defence system required to provide a given level of protection. A desktop study carried out by consultants Connell Wagner Limited and NIWA Christchurch to identify sites with good storage characteristics was completed in May 1999. The following outlines the outcomes of that study.

3. Sites for Detention Dams

Six sites, based on available contour information, were selected for the study of storage characteristics of potential detention dams. The sites, one in each of the five tributaries and the other in the upper reaches of the Hutt River are:

1. Hutt River at Te Marua.
2. Hutt River at Kaitoke.
3. Pakuratahi River at Pakuratahi Forks.
4. Akatarawa River near Crest Road.
5. Whakatikei River upstream of the Hutt confluence.
6. Mangaroa River upstream of the Railway Bridge.

The locations of the sites are shown in **Attachment 1**.

The impacts the dams will have on the flood flows in the lower reaches were simulated using the RORB hydrologic model (developed by NIWA in 1990 during the Phase 1 investigations for the Hutt River Floodplain Management Plan).

4. Assessment

Of the six possible dams, three had no impact on flood levels in the lower reaches of the river, due to poor storage characteristics, and were not considered further. These are:

1. Hutt River at Te Marua.
2. Hutt River at Kaitoke.
3. Whakatikei River upstream of Hutt confluence.

The following table shows a comparison of characteristics of the remaining three sites.

	Akatarawa	**Mangaroa**	**Pakuratahi**
Dam Height metres	30	17	20
Potential storage area ha	75	100	135
Number of houses located in the dam storage (ponding) area	40	50	2
Reduction of flood peak at Taita gauging station during a 2800m^3/sec flood	10%	< 1%	13%
Rough order of costs excluding compensation for houses and property, ($ million)	17.5	24.5	8

5. Discussion of Dam Options

Mangaroa Dam

A 17 metre high dam in the Mangaroa Valley has hardly any impact on flood peaks in the lower reaches of the river. A further increase in dam height will result in the storage area extending to intensively developed terraces, inundating significantly more houses than the 50 houses identified for the 17 metre dam.

Akatarawa Dam

The dam at Akatarawa has to be at least 30 metres high to make a significant reduction in flood peaks. At full storage the dam would inundate about 40 houses. The Akatarawa and Mangaroa dams are considered not practical due to the high costs, inundation of a large number of properties and houses, and the risks associated in maintaining and operating large dams.

Pakuratahi Dam

The Pakuratahi Valley has the best storage characteristics. The dam, at a height of about 17 metres, has a potential storage area of about 135 ha covering part of Kaitoke Regional Park and private pastoral land. The dam intercepts about 80km^2 of the 470km^2 of the upper catchment of the Hutt River. Hydrologic analysis shows that about a 13 percent reduction in flood peak is possible during a rare event (2800m^3/sec) with uniform rainfall over the whole catchment.

However, the storms producing major floods are not always uniform as occurred during the 27–28 October 1998 flood events. The October 1998 storm event resulted in 26, 75 and 59 year return period flood peaks at Taita, Akatarawa and Whakatiki respectively. The peak at Pakuratahi during the same storm was only a six year return period event.

The Pakuratahi catchment is mostly covered with forest (exotic and native) and will generate large amounts of tree debris during a major flood event. The chances of debris blocking the culvert mouth during an event are very high and the dam may not perform to design under such conditions. The dam will also have adverse effects on local ecology and the aesthetic value of the Regional Park.

The construction costs of the Pakuratahi dam are in the order of $8 million and may go up to $9 million with land compensation costs. The costs would also increase further if foundation investigations show that a more complex design is required. An approximate analysis of the costs and benefits of the Pakuratahi Dam is given below.

Pakuratahi Dam Economics

The dam at its best performance reduces the 2800m^3/sec flood peak in lower reaches by 13 percent to 2436m^3/sec. This means that at best the Pakuratahi dam and a system upgraded to 2400m^3/sec will meet the 2800m^3/sec standard for the lower reaches. The estimated costs for "with dam" and "without dam" cases are:

Case 1 : Upgrade existing stopbank system (without dam)

Cost of upgrading system to 2800m^3/sec	$85 million

Case 2 : Upgrade existing stopbank system to 2400 m3/sec with Pakuratahi Dam

Cost of upgrading the system to 2400m^3/sec	$75.4 million (by interpolation)
Cost of Pakuratahi Dam	$9 million
Total costs of stopbank upgrade + Dam	$84.4 million

Although the costs are similar in both cases, the "with dam" option will not always provide the designed level of protection due to likely rainfall variations and potential debris blockages of the dam. The "with dam" option will also involve the additional costs (not included above) and risks of maintaining a high dam above the developed area of the catchment.

In summary a stopbank system upgrade alone (without dam) provides more security and better value for money than a "with dam" option.

6. Summary

Only one site with reasonable storage characteristics is available. However, the site is located in one of the five tributaries and may not be effective during storm events concentrated elsewhere in the catchment. The dam may also not perform at the design optimum during major flood events due to debris build up at the culvert mouth. The economic argument for detention storage is marginal.

7. Recommendations

That the Hutt River Floodplain Management Advisory Committee:

(1) Note that detention dams are no longer considered a viable flood mitigation option for the Hutt River.

(2) Recommend to the Landcare Committee that no further investigations of detention dams are required to complete the Hutt River Management Plan.

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Attachment 1 : Sites for Detention Dams