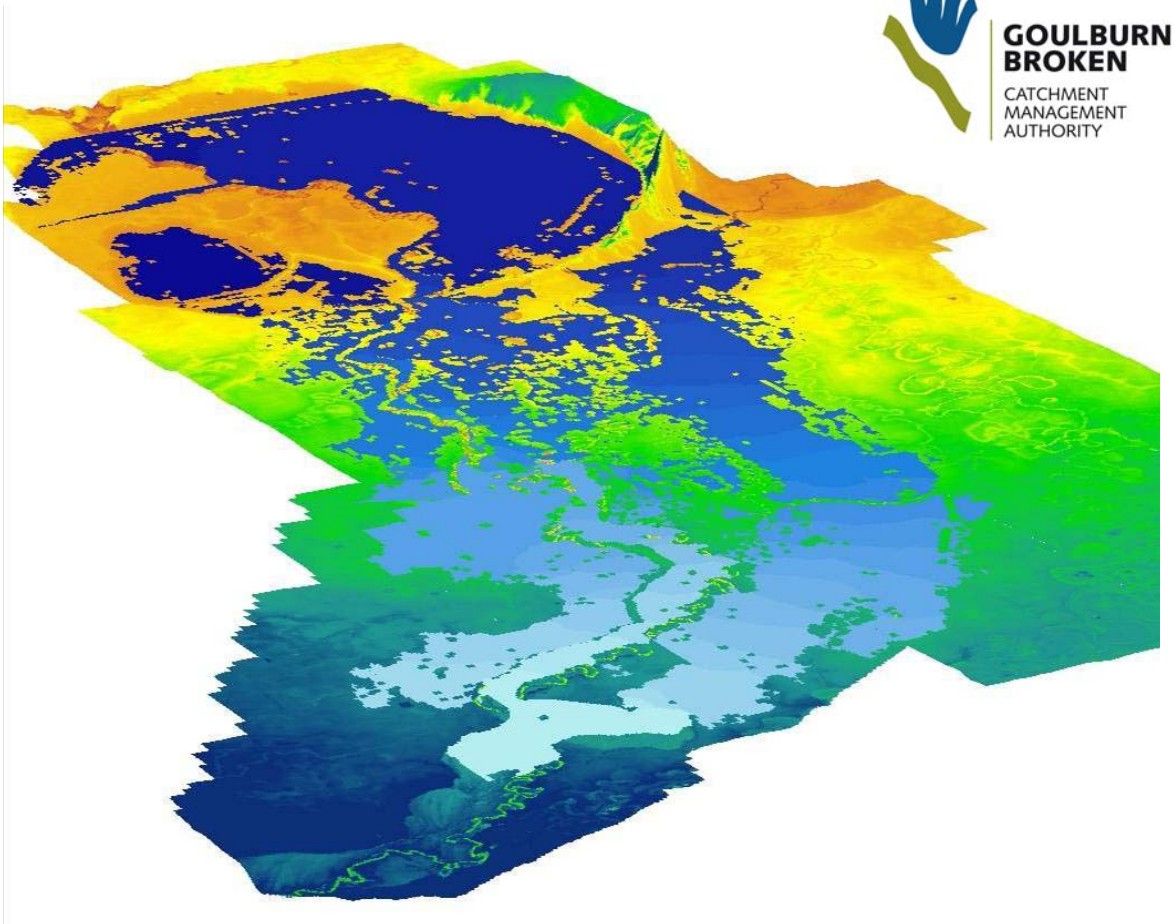
Lower Goulburn Floodplain Rehabilitation Scheme
Addendum A
Hydraulic Performance of the Engineered Option 2



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Addendum A – Lower Goulburn Floodplain Rehabilitation Scheme, Hydraulic Performance of Engineered Option 2

1 Engineered Option Evaluation

The Goulburn Broken Catchment Management Authority commissioned this preliminary evaluation following requests from community members to test the performance of the engineered option, known as Option 2, using the established 2D-hydrodynamic model (WT & SKM, 2006) developed as part of the Lower Goulburn Floodplain Rehabilitation Scheme.

1.1 Engineered Option Components

The intention of the engineered option seeks to largely protect the existing levees by constructing a number of high level 'flood surcharge structures' with some realignment of the levee system. These structures were to be designed to distribute floodwaters onto the floodplain in a controlled manner during large floods.

Realignment of the levees was proposed in five locations. These are listed below:

1. Mitchell Lane
2. Hagens Lane
3. Downstream of Verings Lane
4. Waradgery Road
5. Goddards Road

It should be noted that the Mitchell Lane, Waradgery Road and variation of the Goddards Road levee realignments recommended in the Lower Goulburn Floodplain Management Plan (SKM, 1998) were adopted and incorporated into the design of the Lower Goulburn Floodplain Rehabilitation Option.

A total of seven flood surcharge structures were recommended as part of the engineered option. The flood surcharge structures were located with consideration to the progressively expel floodwater onto the adjoining floodplains to minimise levee failure. The flood surcharge structures were designed to operate only during larger flood events, with the majority of structures not predicted to begin operating until a flood approximately greater than or equal to a 15-year ARI flood. The location of the proposed structures is indicated in Figure 1-1. The structure details, crest levels and design ARI's as determined from the engineered option are presented in Table 1-1.

Table 1-1 Proposed Flood Surcharge Structure Details

Location	Length (m)	Crest Level (m AHD)	ARI	Gauge Ht, Shepp m/ft	Flows at 2.5% AEP (ML/d)
Coomboona	400	107.8	18	11.34/37.2	7,800
Loch Garry	200	107.4	17	11.31/37.1	2,600
Bunbartha Ck	200	105.7	15	11.31/37.1	6,200
Dunnamores Ck	250	104.1	17	11.31/37.1	4,000
Delma Lagoon	200	97.2	5	10.82/35.5	11,300
Rodney MD	150	102.4	50	11.83/38.8	-
Medland Rd	250	108.5	40	11.73/38.5	-

Reproduced from Lower Goulburn Floodplain Management Plan, Volume 1 (SKM, 1998)

1.2 Engineered Option Modelling

A preliminary evaluation of the engineered solution has been undertaken with the 2D-hydrodynamic model. The major components of the engineered solution were incorporated into the hydraulic model description. This involved modification of the model topography to represent the proposed levee realignments and addition of the flood surcharge structures. The hydraulic model representing the engineered solution was then simulated with a 35-year ARI flood. This flood represents the design flood magnitude under which the proposed Lower Goulburn Floodplain Rehabilitation Scheme is predicted to operate whilst maintaining 300 mm of levee freeboard. The comparison between the two scenarios at this flood magnitude provides a useful means of assessing the relative performance of the two options. To put the 35-year ARI flood into perspective, the 1993 flood is smaller representing a 27-year ARI.

To enable a valid comparison between the two options, the engineered solution was simulated with infinite levee crest heights, to prevent levee overtopping from occurring in the model. This allowed the resulting water surface profile along the Goulburn River to be compared against the existing levee crest heights to determine the extent of works required to raise the levees to prevent uncontrolled overtopping and failure with the engineered option.

1.2.1 Results

The results of the engineered option simulation are presented in Figure 1-1. in terms of the predicted maximum extent and depth of inundation and maximum flow splits through the flood surcharge structures, assuming no levee overtopping due to levees made infinitely high in the model.

Figure 1-2 displays a comparison of the modelled water surface profile against the existing southern levee crests. Also included is the predicted water surface profile modelled for the 35-year ARI flood with the proposed Lower Goulburn Floodplain Rehabilitation Option.

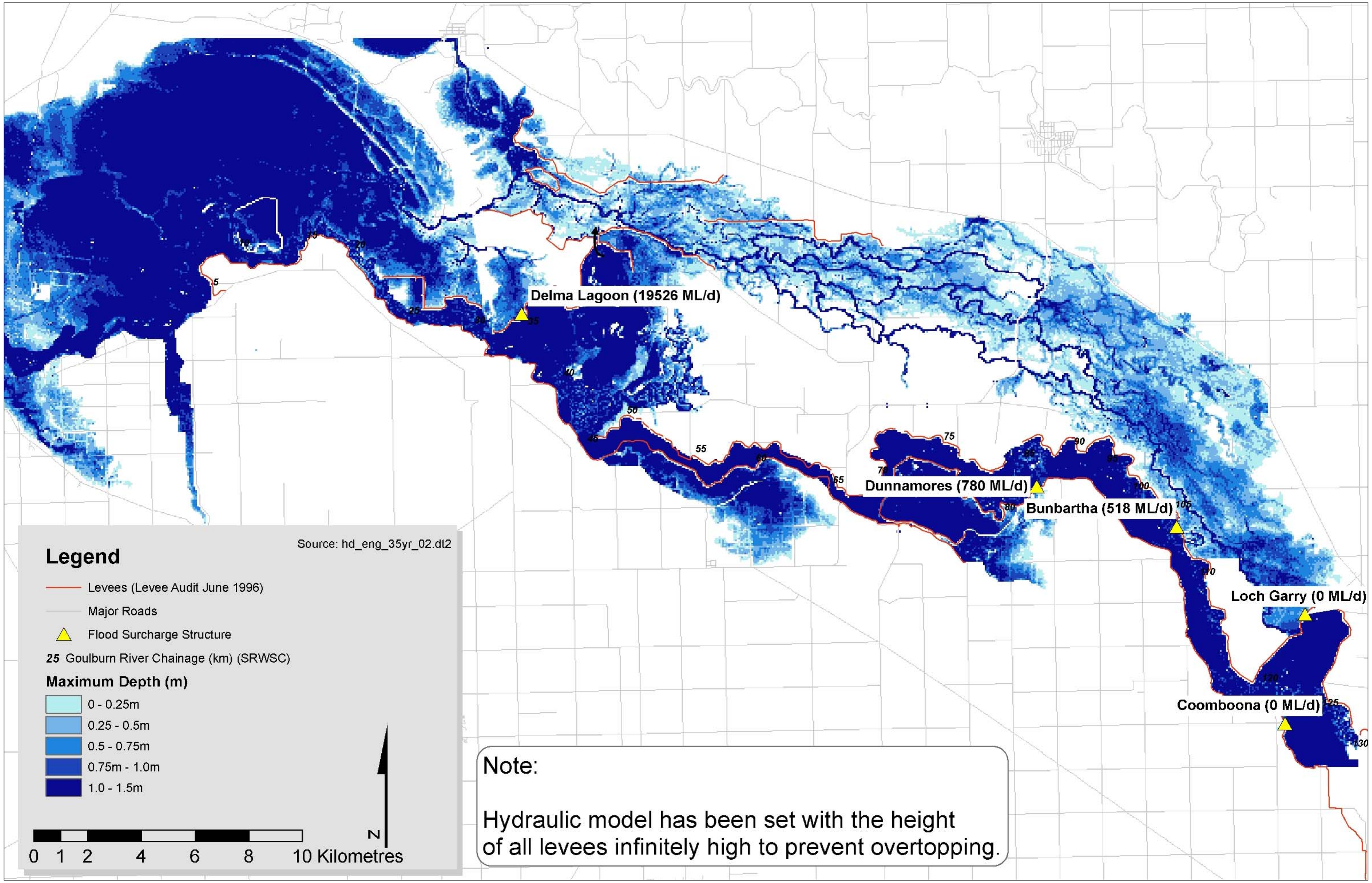
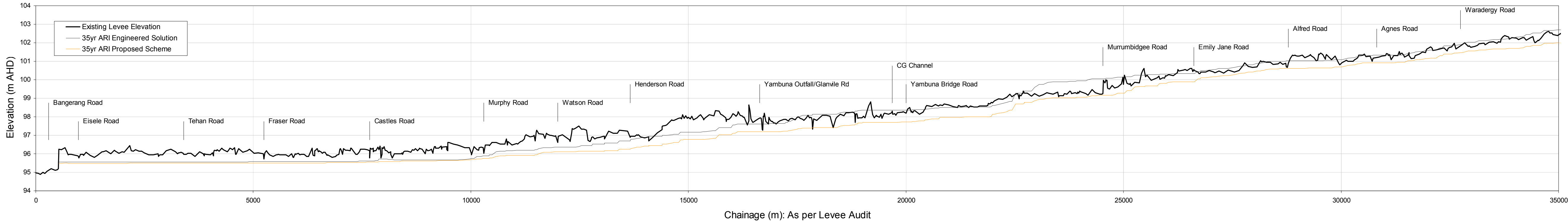


Figure 1-1 Hydraulic performance of engineered option for the 35 year ARI flood



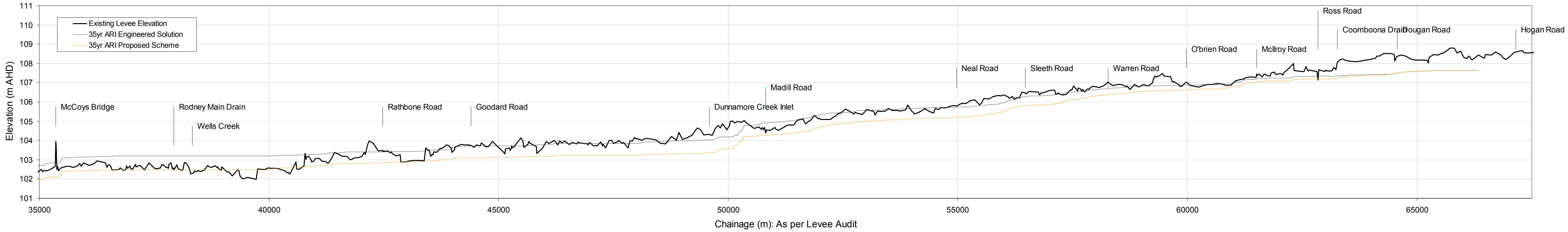


Figure 1-2 Goulburn River – Southern Levee Crest Longitudinal Profile

1.2.2 Discussion

In 1998, the engineered option was proposed to safely pass 185,000 ML/d. However, in this preliminary review the engineered option has been compared to the Floodplain Rehabilitation Option with a design flow of 160,000 ML/d, which has been determined as a 35-year ARI flood event. To provide a sense of perspective, the 1993 flood is representative of the 27-year ARI flood which corresponds to a flow of 150,000 ML/d.

Based on results of the newly developed 2D-hydrodynamic model as part of the Lower Goulburn Floodplain Rehabilitation project, the engineered option is not predicted to operate as intended, even with the significantly reduced design flow.

In particular, the spillway crest heights are set significantly too high which only allows a fraction of floodwaters to escape to the floodplain. This results in significantly elevated water levels between the infinitely high modelled levee system along the Goulburn River. Consequently, substantial levee raising would be required to prevent extensive levee overtopping and failure during larger floods. The flood profile indicates many substantial reaches of levees would require raising by more than one metre.

There has been some discussion regarding the possibility of designing spillways (spilling to the Deep Creek floodplain) which commence operation at a 5-year ARI flood level, and are designed to cater for the 35-year ARI flood.

Please note that there are practical difficulties/constraints in laying out such a scheme. In order for this scheme to provide the required level of protection, flows within the Goulburn River levee system must be reduced down to “safe” carrying capacities. For the 35-year ARI event, this means that:

- approximately 40,000 ML/d must be spilled via a spillway to the Deep Creek floodplain in the reach between the Loch Garry regulator and Hurricane Bend, and
- a further 7,800 ML/d (approximately) must be spilled via a spillway to the Deep Creek floodplain in the reach between Hurricane Bend and Dunamore Creek.

While this option has not been modelled in detail, “order of magnitude” type calculations indicate that (due to the relatively low hydraulic grades that can be achieved through this area), these spillways would have to have a combined spillway length of the order of between 5 and 6 km to be able to effectively and safely transfer this flow from the Goulburn to the Deep Creek floodplain.

1.2.3 Conclusion

Based on the work detailed in the previous sections, the following conclusions can be made:

1. The previously proposed "engineered" option incorporating high level spillways does not transfer enough flow to the Deep Creek floodplain to guarantee "safe" discharges within the existing Goulburn levee system.
2. To reduce the flows within the Goulburn levee system to "safe" levels, the spillways transferring flow to the Deep Creek floodplain need to be substantially longer and lower than those previously proposed as part of the engineered option.
3. "Order of magnitude" calculations indicate that up to 6 kilometres of spillways would be required to achieve "safe" discharges within the Goulburn levee system if spillways were set to commence operation at a 5-year ARI level for a 35-year ARI design flood.
4. It is the study team's understanding that this length of spillway has substantial drawbacks and is not a practical option.