THE BIG FLOOD:
WILL IT HAPPEN AGAIN?

Artificial levees: friend or foe?

Artificial levees may protect your land from being flooded but increase flood depth in channels and increase the risk of channel and bank erosion, and the amount of sediment delivered to the end of the catchment.

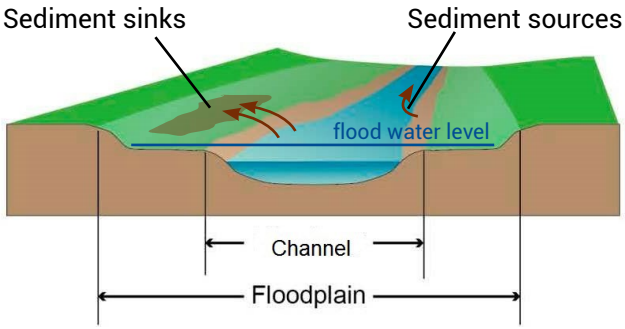
Floodplains act as sediment sinks during flood events.

Floodplain inundation also reduces the flood peak and stream power.

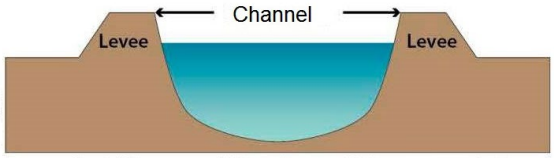
Artificial levees, including small structures, trap the water in the channel preventing floodplains from being sediment sinks.

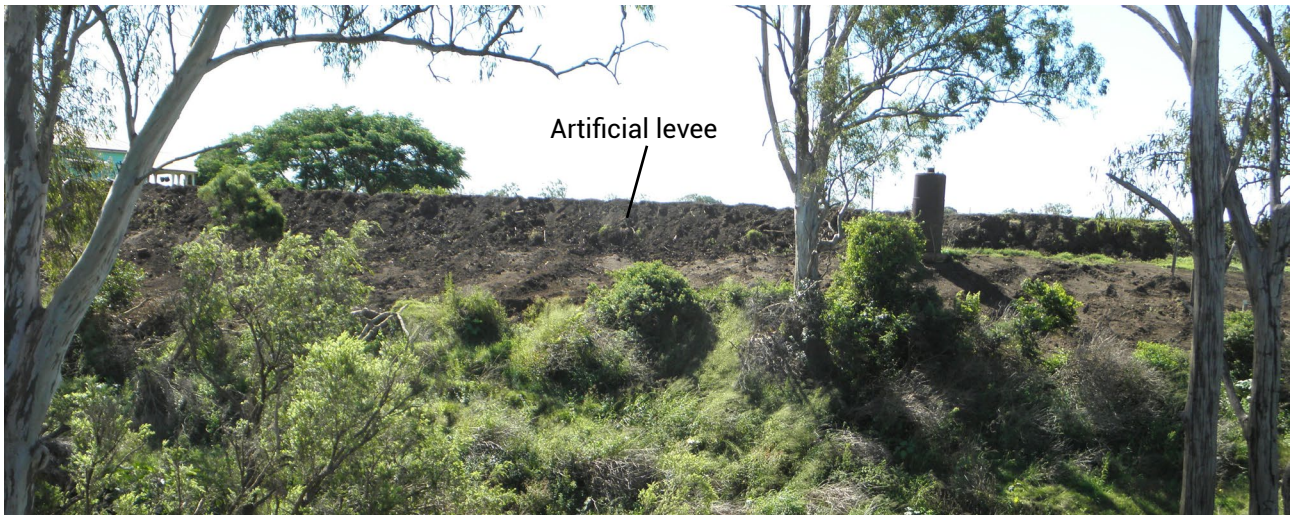
Levee breach points become high stream power and erosion zones. If levees are required, it is a good practice to design the levee to first overtop at a location where the risk to property is minimal.

Natural system - floodplains connected



Modified system - floodplains disconnected





FURTHER READING

Thompson, C., Croke, J. and Dent, C. 2014. Potential Impacts of levee construction in the Lockyer Valley, in Vietz, G., Rutherford, I.D., and Hughes, R. (editors), Proceedings of the 7th Australian Stream Management Conference, Townsville, Queensland, Pages 109-115.

7th Australian Stream Management Conference - Full Paper

Potential impacts of levee construction in the Lockyer Valley

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Key Points

- Natural levees occur along 48 km of the lower Lockyer Creek
- The natural levees have reached threshold set up conditions for channel avulsion
- Post-flood land management has seen the construction of bank-top levees on existing natural levees
- Artificial levee bank construction can increase specific stream power and sediment transport capacity, decrease overbank deposition and lead to increased sediment delivery to end of catchment

Abstract

Natural levees are formed by the process of overbank flood sedimentation. In laterally-stable rivers, the height of levee development is assumed to reach some maximum whereby continued aggradation reduces overbank flooding. Large floods are required to overtop the levees and such events increase the risk of significant geomorphic change such as bank erosion, removal of inset floodplains/benches and channel avulsion. Lockyer Creek is a water supply catchment for Brisbane and managing the catchment for water quality as well as quantity to supply the local horticultural industry is critically important. Natural levees have evolved over the lower third of the main trunk stream, but since the recent floods of 2011 and 2013, uncontrolled artificial levee construction has occurred for flood protection. Terrain analysis showed natural levees occurring along 48 km of the lower Lockyer. Here, the natural levees have reached threshold set up conditions for channel avulsion. A one-dimensional (1-D) hydraulic model was constructed to assess the flow hydraulics of bankfull discharge along the lower Lockyer Creek under scenarios of both natural and artificial levees built on top of the natural levees to explore potential changes in hydraulics and sediment dynamics. Results show that increased channel capacity due to levee enhancement has increased bankfull mean specific stream power from 123 to 153 Wm^{-2}, but at a number of locations the specific stream power produced by the enhanced levees meant that the flow exceeded the threshold for geomorphic change (300 Wm^{-2}). The reduced flooding of the floodplain will decrease overbank sediment storage, thereby potentially increasing catchment sediment delivery to the mid-Brisbane River.

Keywords

Levees, avulsion, stream power, channel-floodplain connectivity, legislation