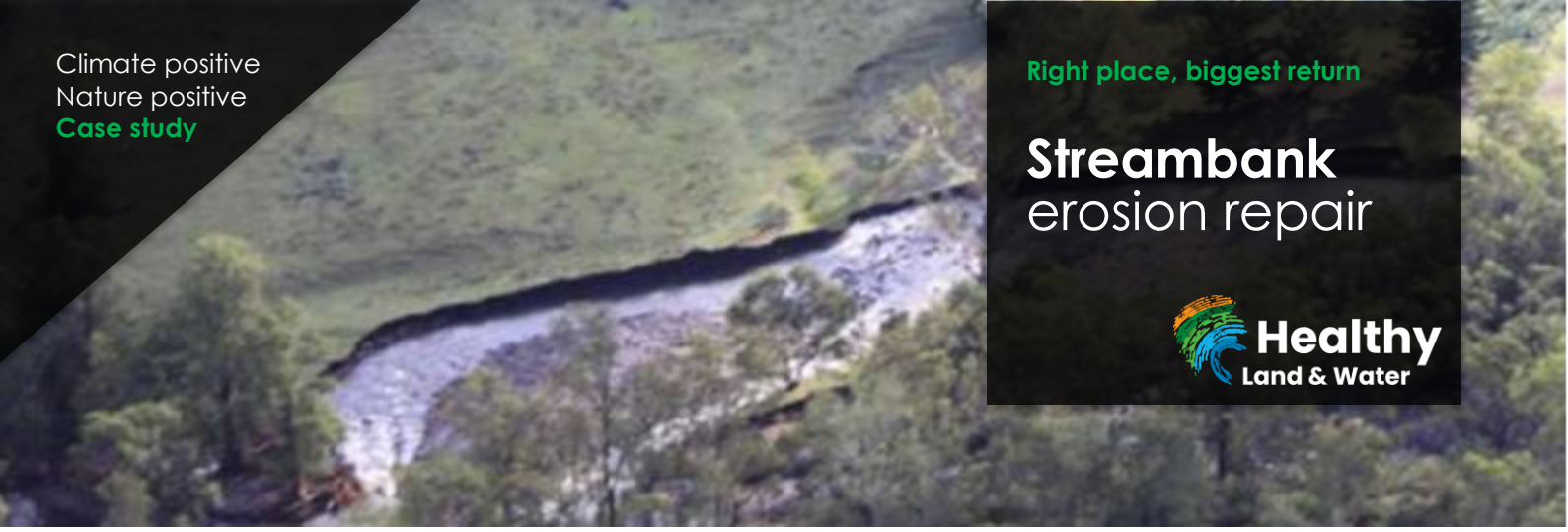

Climate positive
Nature positive
Case study

Right place, biggest return

Streambank erosion repair

Healthy Land & Water

Case study: Streambank erosion repair in the Laidley Creek

This case study outlines the steps taken in restoration activities in Laidley Creek after the 2011 and 2013 flood events. This is a complex example involving a number of stages to address multiple threatening processes occurring simultaneously.

Laidley Creek drains north from the Border Ranges for around 56km before joining the Lockyer Creek. The Lockyer catchment meets the Brisbane River below Wivenhoe Dam.

Defining the problem: Laidley Creek

Laidley Valley is a highly productive horticultural area within the nationally important Lockyer Valley. Laidley Creek is degraded and unstable and, as a result, is placing production areas at risk during times of flood.

The stability of the banks in 2013 was affected by the:

- Lack of riparian vegetation as a result of clearing for agriculture and recent flooding.
- Unstable banks where mass failure had recently occurred.
- Subtropical climate susceptible to high intensity rainfall.
- Relatively narrow valley.
- Modified levee system.
- Cropping system not in tune with seasonal climate risks.
- Placement of hard infrastructure and its influence on stream flow.

Streambank mass failure occurred along with bank scour.

Flood events can affect more than the streambanks. Loss of topsoil and damage to assets can be significant. Floodplain erosion removed valuable topsoil from paddocks, especially where paddocks had been cultivated or were only recently planted and crops were immature.

Critically, the creek bed suffered from erosion and lowered in response to the flood. Bed lowering affects not only infrastructure such as the foundation of bridges, but also the stability of the streambanks as they typically widen in response to bed lowering.

This can impact adjoining assets including roads and tracks, mature trees, irrigation lines, productive land, fences, buildings and yards and safety.

Laidley Creek sub-catchment forms part of the Lockyer catchment (outlined in red) that drains into the Brisbane River system.

Soil cover in the form of mature crops can minimise topsoil loss and reduce impacts on farm productivity.

Streambed lowering impacts on structural integrity of man-made assets as well as the stability of streambanks.

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Understand the causes

Due to the complexity of the issue and the multiple processes occurring together, expert input was sought.

After walking the reach and talking to local landholders, detailed modelling was undertaken to identify critical points for intervention in the landscape and options to increase resilience into the future.

Modelled data was checked against known flood heights and community meetings were held to cross check the information.

Designing a solution: Laidley Creek

Expert advice and modelling results showed that it would be necessary to first halt bed lowering to successfully stabilise the streambanks in this reach.

Many of the issues ranged across a number of properties.

Whilst bed lowering, or creek deepening, most likely occurred in the 2011 flood event, there was substantial widening along many parts of the creek in the 2013 event.
The cross-section of the creek measured at one location shows an example of this widening (right).

The relatively steep banks post-2011 are even steeper post-2013 with a broader base and larger distance between upper banks.

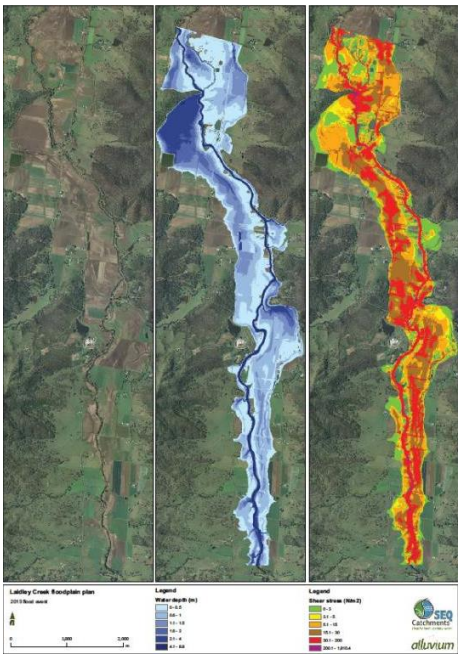
Measurements show that 12,000 m^3 of soil was lost from bank erosion along an 800m section of the creek, ignoring losses from topsoil scour over the floodplain.

On-farm and downstream impacts were substantial.

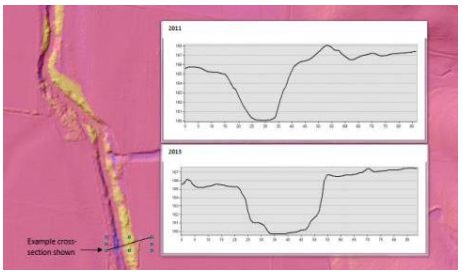
In order to stabilise this section of creek a number of measures were needed.

Several bed control structures, consisting of rock chutes, were engineer-designed to reduce the advancing front of the stream bed erosion upstream.

Battering of the banks to reduce the likelihood of mass failure, provide increased channel capacity and provide a suitable surface for plant establishment was planned.



For complex interactions between the floodplain and stream the use of modelling results, verified with local observations can help inform restoration activities.



Modern tools such as LiDAR are sometimes available to help define the extent of the problem. This cross-section of the creek shows that is has widened by more than 20m in some areas between 2011 and 2013.

For complex issue ranging across property boundaries it is important to involve the community in developing solutions and consult with the relevant authorities for permission to implement the agreed plan of works.

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Design options

Three potential management paths were identified for Laidley Creek post 2013.

Option 1:

Armouring the system against further channel change using rock beaching or a similar hard engineering approach as vegetation alone would probably not be successful for the phase of creek incision at the time.

Option 2.

Reducing the channel capacity and increasing floodplain inundation to reduce the energy impacting on the banks.

Option 3:

Halting the incision and increasing the channel capacity by bank profiling (widening).

Implementing the design: Laidley Creek

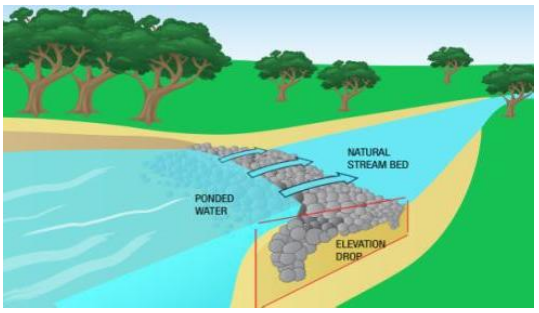
Funds were insufficient and risk of failure was relatively high under Option 1.

Based on discussions with adjoining landholders, Option 2 was undesirable as farms have been established based on low occurrence of inundation (10 year average recurrence compared with less than a 2 year recurrence needed to reduce the stream energy to low erosion risk levels).

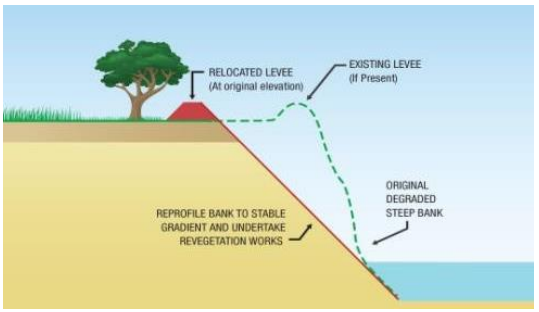
As such Option 3 was adopted. Option 3 involved grade control structures in several locations, bank battering and revegetation.

A comprehensive set of implementation plans were developed showing engineering details and scheduled timing of work stages.

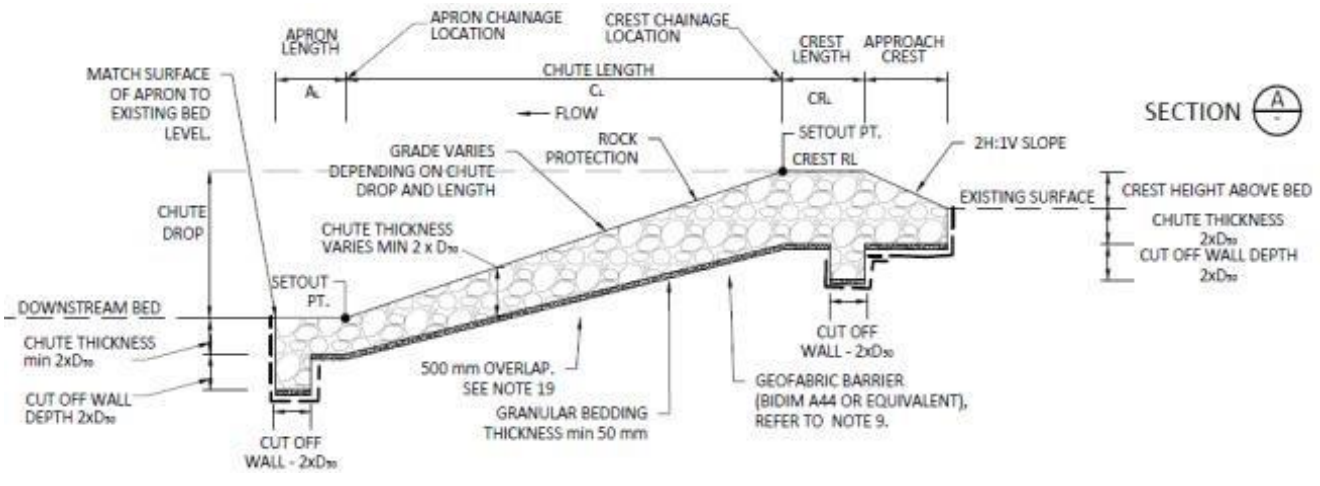
On site supervision during the installation process was critical to successful implementation of the plan according to the specifications.



A rock chute was designed for use as a grade control structure to halt stream bed deepening. Rock size, placement and keying in to the bed and bank are critical for a lasting result.



Bank battering involves setting back the bank to reduce the steepness. Associated infrastructure may need to be relocated. A mix of vegetation including groundcover, shrubs and trees need to feature in the final solution.



Evaluate and improve: Laidley Creek

Like all farm investments, monitoring and maintenance is an important component of implementing the proposed works.

Success will require regular maintenance to ensure integrity of the works is retained and longevity maximised.

Scheduled inspections are especially important early on as vegetation is establishing. It is also critical in response to specific flow events.

At least quarterly inspections have been conducted since works completion and more frequently after rainfall events in early 2015.

After three years inspections will be event driven to check for and repair:

- Evidence of settlement of placed rock including rills, low areas or threatened integrity.
- Significant voids, surface irregularities or loose rocks resulting from removal of smaller rock material from the chute surface by high flow events.
- Indications of tunnelling of bank material around the abutments.
- Changes in bed level immediately downstream of each chute that suggest scour at the end of the apron.
- Debris that has become lodged or any vegetation that has established on the chute in a location which may cause flow to accelerate around it or cause damage to the chute if it moves during a high flow event.
- Establishment and survival of desirable vegetation and the impact of weeds on planted and desirable regenerating plant species.

Photo points have been taken to build a picture of progress over time from before the start of works and will continue into the future.

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