

# Erosion & Flood Damage on Grain Farms North & East of Clermont

## Post-Tropical Cyclone Koji Flood 12th January 2026

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**Introduction**

Grain properties in the Clermont district were severely flooded on the 12th January 2026 as ex-tropical cyclone Koji passed over the region. This report covers the flood and erosion damage that occurred and provides recommendations for grain growers to better manage future severe rainfall events.

Property visits were made to the district after an interview with one of the affected grain growers, Brendon Swaffer (Bungarra), was broadcast on the ABC on the 13th January 2026; (Interview starts at 2'20" and finishes at 7' 00")
https://www.abc.net.au/listen/programs/qld-country-hour/queensland-country-hour/106214008

**Properties visits**

The author visited 6 properties and inspected the damage with the owners/managers. Max Quinlivan (DPI Emerald) visited two of the properties; Max's up-to-date knowledge on grain growing was very handy as the author has had little involvement in the grain industry since 1988 when based in Atherton. Claire Cornel & Amelia Ross, trainees employed under the Queensland Soil Science Graduate and First Nations Engagement Program by NQ Dry Tropics/DPI, visited one of the properties

**Background before the flood**

- Five of the properties are in the Wolfang Creek Catchment (Fitzroy Basin); the 6th property in the West Logan & Miclere Creek Catchments (Suttor River catchment/Burdekin Basin).
- The Sandy Creek/Wolfang Creek confluence is on the NE outskirts of Clermont. At this point the Wolfang Creek catchment is the larger of the two and encompasses the vast majority of the prime cropping land and prime grazing land. (Wolfang Ck catchment - 86,900ha. Sandy Ck catchment above confluence 47,200ha).
- Soils are mostly basaltic black earths (vertosols) of shallow to moderate depth (0.3 to 0.7m). When fully saturated they have an infiltration rate of only a few mm/day. Soils in the broad drainage lines and adjacent to creeks are deep (>1.0m) alluvial clays of basaltic origin.
- Five of the six properties have approved soil conservation plans under the Soil Conservation Act 1986. These were developed in the late 1980s and '90s by soil conservation extension officers in the Clermont and Emerald DPI offices in conjunction with the owners of the day. Although the author has only sighted one of the plans, under the Act, all plans had to be well designed and technically sound. However, there were often small compromises made during the planning process or during implementation in conjunction with grain growers for a range of reasons, but the changes were often logical, but still functional and did not compromise the intent of the plan. In some cases not all of the plan was implemented, for example, some contour bank layouts were not fully completed, particularly where there have been changes in ownership. Three of the properties are still in the same family. Coordination of farm runoff water between properties was one of the main reasons for developing a plan in the first place. This was addressed by the plan in all instances. Properties with soil conservation plans can be identified on the Qld Globe. Copies of the plans and supporting designs are available as scanned copies. The originals are held in the Dept of Resources office in Emerald.
- Zero-till & controlled traffic farming practices are widely adopted by all growers that were visited. This is a component of best practice farming for grain production in Central Queensland.
- Paddocks with standing wheat stubble from the 2025 crop suffered the least amount of erosion.
- Stubble levels after last year's chick-pea harvest were surprisingly good due to record yields on most properties.
- Vegetation was more open in the watercourses where they were grazed by domestic livestock. However, many watercourses are not used for grazing.
- Fire was used by some growers to keep drainage lines more open, but this was not as effective as moderate to heavy grazing.

**The rainfall event**

- The 11th/12th January 2026 flood in Clermont township was the highest since the infamous and deadly 1916 flood. https://knowledge.aidr.org.au/resources/flood-clermont-and-peak-downs-queensland-1916/
- Antecedent soil moisture was high due to ~100mm rain in late December 2025 over most of the district including the Wolfang Creek catchment.
- 24-hour rainfall totals to 9:00am on the12th January 2026 ranged from 210mm at the outlet of the Wolfang Creek catchment (Clermont) to 400mm at the Peak Range ("Mt Hillary") which is at the catchment headwaters. Falls of approx. 200mm in 12 hours were common across the whole catchment. The rain was steady for most of its duration, but heavy for the last couple of hours. Monthly rainfalls for the December – January period are shown in Table 1.

| **Monthly Rainfall** (with selected daily totals) | |
|---|---|
| **Clermont**<br>December 2025 – monthly total 35mm (all small falls)<br>January 2026 – monthly total 388mm (incl 203mm 12th Jan & 105mm 16th & 17th Jan) | **"Mt Hillary"** ** (Peak Range)<br>December 2025 – monthly total 120mm (over 24th, & 25th Dec)<br>January 2026 – monthly total 451mm (incl 400mm 11th/12th Jan) |

**Table 1.** *Monthly (with some daily) rainfall totals for December 2025 & January 2026*

** The "Mt Hillary" rain gauge is on the eastern fall of the Peak Range, just outside the Wolfang/Table Creek catchment. Rainfall in the catchment on the western fall of the range was estimated to be 100mm greater on the 11th/12th Jan.

- Using the Design Rainfall Data System (2016) from BoM, the ~200mm total in 12 hours equates to an Annual Exceedance Probability (AEP) of ~1.0% for the whole Wolfang Creek catchment. https://www.bom.gov.au/water/designRainfalls/revised-ifd/ However, with a rainfall total of 400mm on one property (and possibly at more locations) at the top of the catchment, the overall flood in the Wolfang Creek would have had a lower AEP. It is not easy to determine the AEP for the rainfall event for individual grain farms using only rainfall totals. However the intense rain in the last 2 hours of the rainfall event could produce the same AEP of 1.0% for a typical paddock of 500ha in this district. A paddock of this size (2.0km x 2.5km) has a time-of-concentration* of 130 minutes (13 minutes for 120m of overland flow, 82 minutes for 2000m of contour bank flow and 35 minutes for 2500m of waterway flow.)
- Using the 2016 Intensity–Frequency–Duration data for Clermont, a rainfall event with a duration of 130 minutes and an AEP of 1.0% (I in 100 year), has an intensity of 52mm/hr.
  *https://www.bom.gov.au/water/designRainfalls/ifd/*
  This is in the realm possibility for the 12-hour rainfall event on the 11th/12th January considering the increase in rainfall intensity during the last couple of hours eg, 10mm/hr for 10 hours plus 52mm/hr for 2 hours totals to 204mm. However, as all paddocks and farms would have been saturated after several hours of lower intensity rain, the deluge at the end would have generated very close to 100% runoff, producing a flood with an AEP that is much smaller than 1.0%, ie a much longer return period.
- It should be noted that contour bank layouts are designed for an AEP of 10% (1:10 year rainfall event), but constructed grassed waterways are designed for an AEP of 10% for the width and an AEP of 2.0% for the depth (depending on the soil conservation officer who did the original design). Waterway location and the consequences of failure also have a bearing on the AEP used in the design. For example, an AEP of 10% is fine for a waterway in a natural drainage line, but an AEP of 1.0% is essential for a waterway that is perched against a fence where the cross-fall is into a paddock on either side.
- Given the heavy rainfall at the end of the rainfall event produced close to 100% runoff, it is not surprising that rapid stream rises and over-full contour bank layouts resulted in severe erosion and deposition of massive silt deposits on most properties.

**The time taken for runoff water to travel from the most remote location in a catchment or paddock to a chosen design point or outlet.*

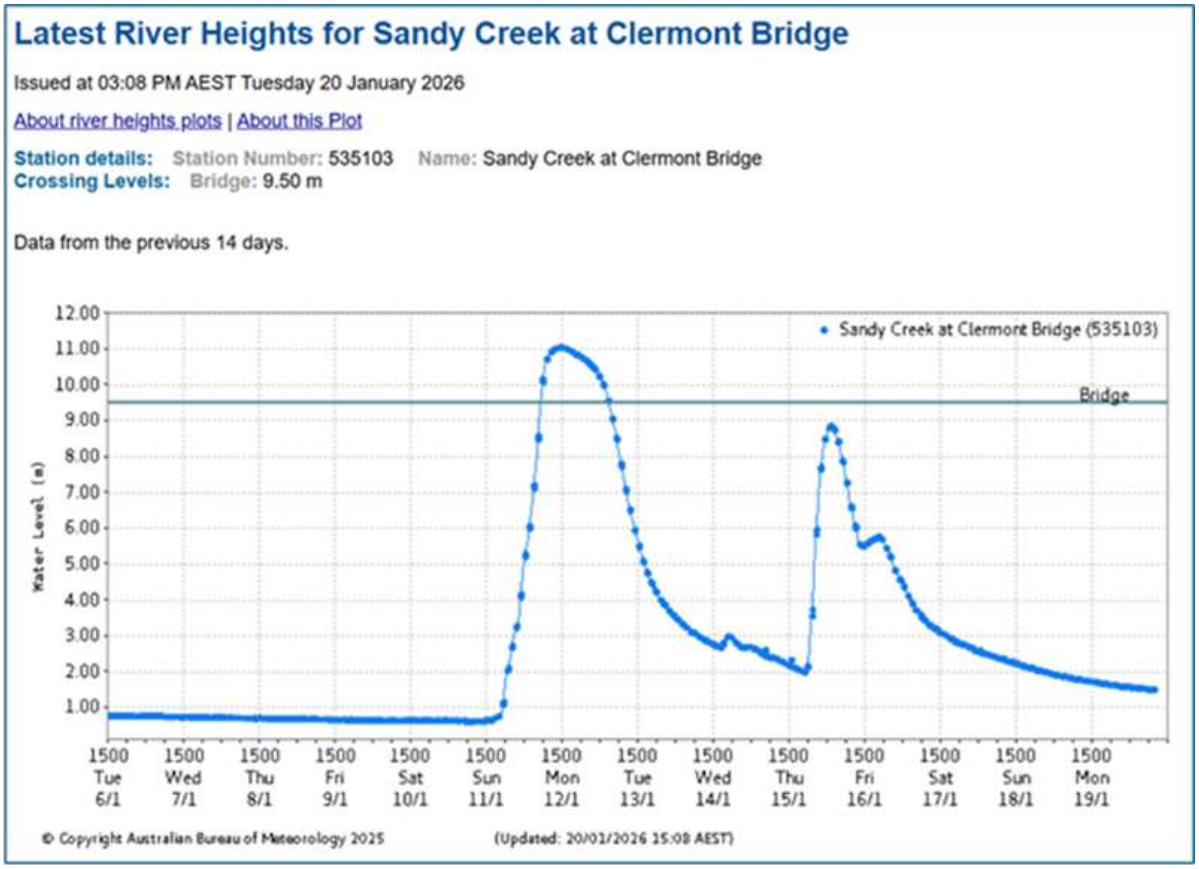


**Figure 1.** BoM Flood hydrograph Sandy Creek at Clermont bridge (just downstream from the Wolfang Creek confluence)

- The first flood peak of 11.00m was reached in a 9-hour period from 9:00pm 11th to 6:00am 12th January 2026.
- The steep rise over this period is a good indicator of the large totals of intense rainfall and high runoff rates during the preceding 24 hours.

**General observations of the damage on properties inspected**

- Crop rotations were not ideal, however with cotton and chick-peas being the most profitable crops to grow and wheat being the least profitable, this is a "tough nut" to crack.
- Paddocks with rain-grown cotton stubble were most severely eroded. Wide row spacings for cotton (twin rows on 1.5m centres) made a bad situation worse.
- Stubble yields following grain sorghum were surprisingly low, also due to wide row spacings (twin rows on 1.5m centres.)
- Despite the magnitude of the rainfall event, contour banks that were maintained in the last 12 months functioned quite well. However, they breached where contour bank outlets were choked by vegetation particularly when entering constructed waterways. Across the six properties visited, the majority of contour banks were below design-specification therefore breaches were frequent.
- Given that the heavy rainfall at the end of the rainfall event produced close to 100% runoff, it is not surprising that rapid stream rises and over-full contour bank layouts resulted in severe erosion and deposition of massive silt deposits on most properties.
- One property did not have a professionally designed and implemented soil conservation plan on the property. Fortunately this property is located at the top of the catchment, so erosion due to flood flows was not an issue; however, sheet and rill erosion across the property was severe in places. Simon Hunt designed a detailed soil conservation plan for the property, so hopefully implementation will commence mid-2026.

- All designed & constructed "grassed" waterways were in very poor condition ie grossly undersized, little or no vegetative cover, eroded (some to decomposing basalt) and not always located in the lowest natural drainage lines across paddocks. Therefore they carried only a small fraction of the runoff that was generated and failed to function as designed resulting in severe erosion in adjacent cropping paddocks.
- Natural drainage lines along creeks and braided watercourses are wide (up to 300m) and heavily overgrown with woody plants (native and exotics eg leucaena). Combined with poorly defined channels, the capacity of watercourses is low, resulting in flood flows up to 1.0km wide across broad valley floors. Fortunately the soils in these locations are alluvial basaltic clays which are several metres deep, but they did suffer from severe flood erosion and large silt deposits.
- Levee banks have been constructed by many grain growers along the margins of remnant vegetation on both sides of watercourses including major creeks (eg Wolfang Creek). The intention was to control flooding on adjacent cropped floodplains. Bank heights were between 1.0 & 2.0m above original ground level. Most of the banks breached during this flood causing serious scouring and gully erosion when the water rushed through in a confined flow onto adjoining croplands. In addition to the magnitude of the flood, the high density of vegetation (sorghum alum, leucaena, willow wattle (*Acacia salicina*), prickly acacia, and other shrubby plants) resulted in very high vegetal retardance to flood flows. High vegetal retardance results in greater flood depths which puts more pressure on levee banks. Prior to the point of failure, levees confined flows leading to higher velocities and more erosion in some locations and may have contributed to adverse effects on downstream properties.
- Restrictions on managing remnant vegetation in all drainage lines & watercourses makes mitigating the effects of flooding difficult to impossible. Relaxing the regulations will help in some circumstances (see attached Fact Sheet "Clearing vegetation in the Mackay region after Cyclone Koji – January 2026".) This factsheet has been sent to the 6 grain growers that were visited. The second attachment "Guidance information for repairing silt build up and gully erosion" is a draft document, so is not ready for distribution to landholders. It contains useful additional information/guidelines for working within the Vegetation Management Act 2008 after the 2026 flood.
- All fences along creeks and drainage lines were destroyed, with only steel strainer assemblies remaining. New steelies and wire will be required to re-instate fences. No one mentioned any loss of livestock.
- Sheet erosion from flood flows was widespread across those paddocks adjacent to watercourses. Headlands became preferential flow paths; therefore they carried the highest velocity flood water resulting in soil being eroded to a depth of 0.5m and a width of 6 to 10m in places.
- Large levee banks to confine flood flows to the creeks and drainage lines failed in many instances due to the magnitude of the runoff event; however poor location (causing constrictions of flood flows) and lack of pasture cover to stabilise the banks also had an effect on the flood erosion damage.

**Costs of reclamation & repair**

- The cost of repairing erosion damage in cropped paddocks is difficult to estimate, but all growers were talking several $100'000s.
- While the length of damaged and destroyed fencing and farm access tracks is not known, it could be easily estimated and costed by growers.
- Using funds to purchase diesel for repairs to soil conservation earthworks and erosion features was stated by growers as the best use of any disaster assistance.
- Damage also occurred to public infrastructure such as main and local council roads.

**Recommendations**

- **Crop rotations:** Although wheat is the least profitable crop grown in the Clermont district, its soil conservation benefit cannot be underestimated. Crop rotations are difficult to plan as the Central Highlands grain belt is in an opportunity cropping area. While the rainfall is summer dominant, rain can fill the soil profile at any time of the year presenting growers with a decision to make as to which crop is best planted at that time of year. However a concerted effort to grow more wheat is essential to achieving higher ground cover before each summer.

- **Matching crops to paddocks:**
    - Paddocks that are either sloping with contour bank layouts or low sloping floodplains will benefit from the increased frequency of wheat in the rotation. Based on the amount of severe flood erosion damage, these paddocks should be prioritised for wheat production.
    - Conversely low stubble residue crops such as skip-row cotton and skip-row sorghum should be more frequent in paddocks that are not flood-prone but have land slopes less than 0.5%.
- **Row direction:** A review of row direction under controlled traffic/tram-line farming systems in each paddock is essential to minimise the number of crop rows that breach in the middle of a paddock. In flood prone paddocks row direction re-orientated to be at right angles to the direction of flood flows will provide more resistance to erosion.
- **Strip-cropping:** Although seldom used on Central Qld grain properties, strip cropping is widely adopted on the flood plains of the Darling Downs and the NW floodplains of NSW. The practice consists of strips of crops based on multiples of the width of the widest machine used on the property (usually sprayers or planters). So strips may be 120m wide (4 passes of a 30m spray unit). A 260ha area of strip cropping that has been adopted on a grain property in the Jambin area north of Biloela is shown photo 2. Here the strips are 4 times the width of the grower's 27m wide spray rig ie 108m.

  The strips are orientated at right angles to the direction of flood flows. Crops are grown in rotation within each strip such that alternate strips either have a growing crop or the residue from a high stubble yielding crop. The flood plain is never bare and the standing crop or standing stubble reduces the velocity of the floodwaters.

  Floodplains that have preferential flow paths along their length (caused by past erosive flooding) must be land-planed to close-up these channels. Strip cropping works best where runoff remains spread at a relatively even depth across the floodplain. The alternating strips of standing crop and crop stubble reduces the velocity of the overland flow as shown in Figure 2 & Photo 1.

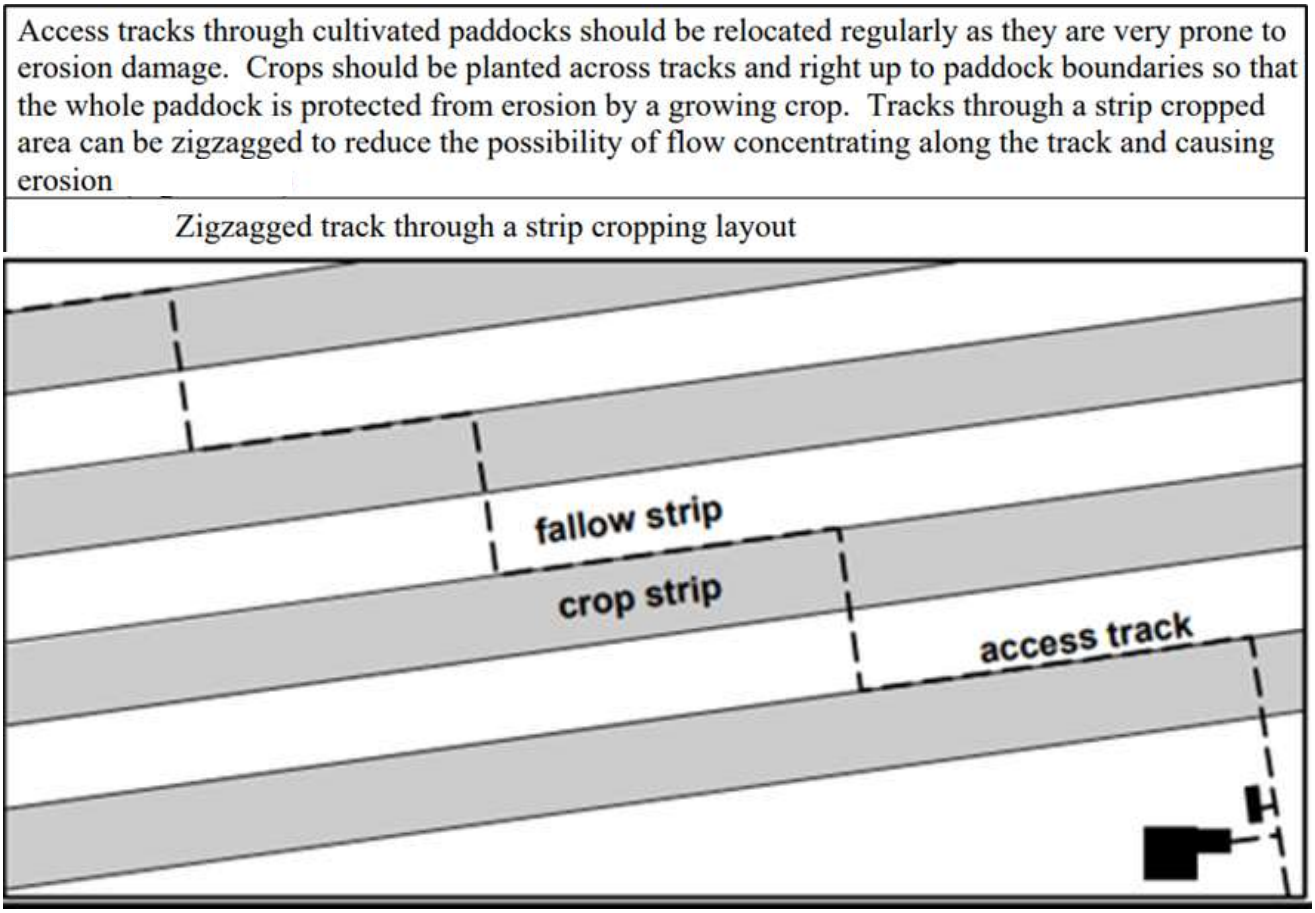


**Figure 2.** *Correct method of vehicle access across a flood plain through a strip cropping layout. This method will prevent erosion from occurring along the track.* *(Page 12-10 in* https://www.dsda.org.il/uploads/n/1525855149.8949.pdf

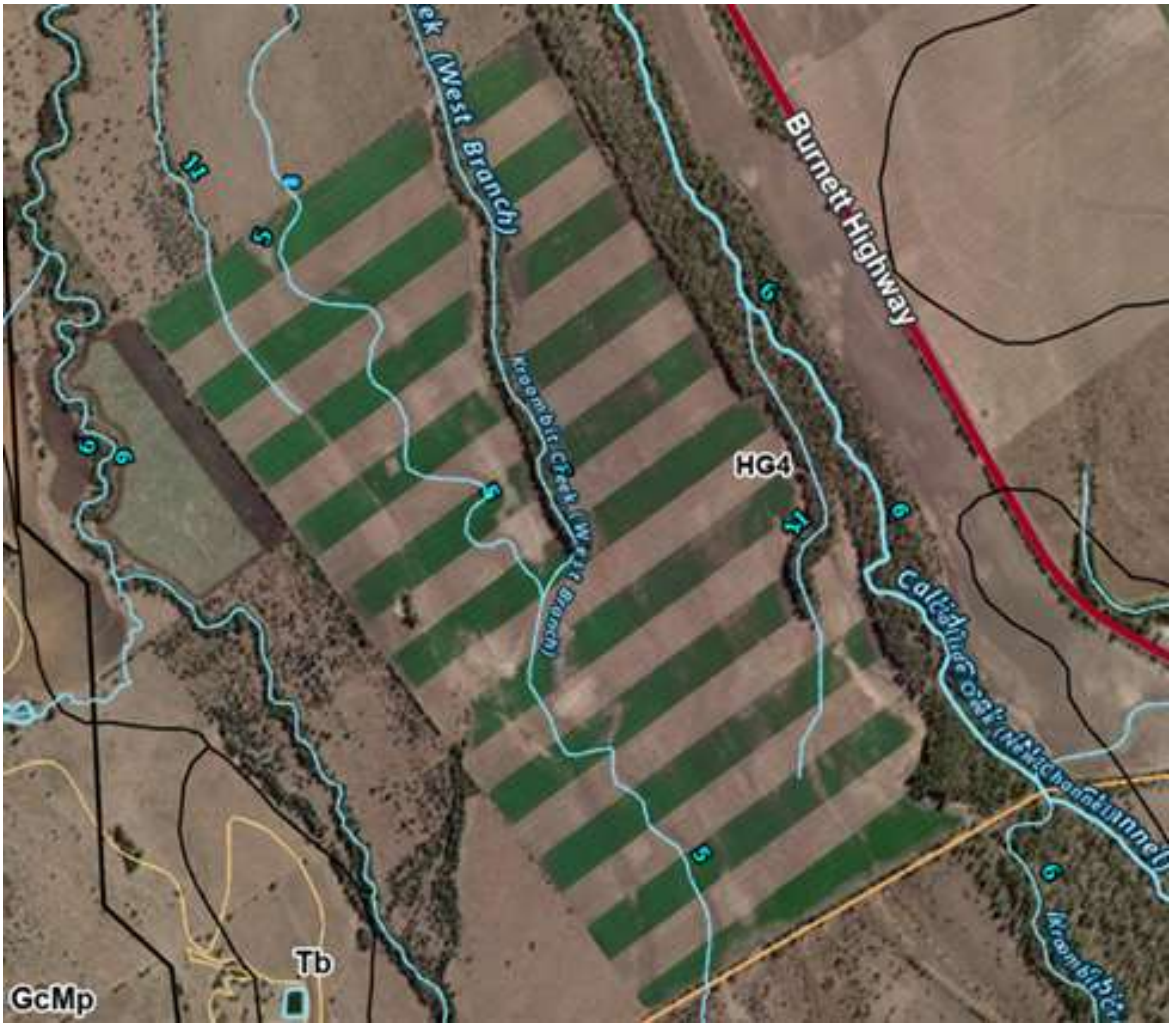


**Photo 1.** Google Earth image of s*trip cropping layout on a grain property near Biloela. The layout consists of 21 by 108m wide strips. Every second strip is in the same rotation. The land slope in this area is 1 in 1,000 (0.1%); the land slopes along the Wolfang Creek floodplain vary between 1 in 800 (0.13%) to 1 in 500 (0.2%).*

- **Levee banks:** Levee banks counter the basic principle of spreading flood flows. Levees along watercourses which are property boundaries will cause more extensive flooding on the neighbouring property on the opposite side of the stream. If agreement could be obtained by all grain growers along all watercourses, levee banks should be removed. Some Local Authorities with floodplains have established Local Laws under the Local Government Act 1993 to give them control over levee bank construction. Construction of levee banks may also be controlled under the provisions of a Water Resource Plan approved under the Water Act 2000, relating to control of overland flows; particularly where the stream is a property boundary. (https://www.dsda.org.il/uploads/n/1525855149.8949.pdf page 12-11)
- **Vegetation management in watercourses**: Remnant vegetation in and adjacent to watercourses has dramatically thickened over the decades on 5 of the 6 properties that were inspected. There are restrictions to the actions that can be taken in these areas under the Vegetation Management Act 2008. Burning and/or grazing with livestock are the two easiest management actions to help manage vegetation density. Some properties are running cattle; however, most properties are not set up to run cattle, and in-fact several growers see cattle as incompatible with grain production. Therefore, the use of fire to thin vegetation along watercourses should adopted by these growers.

  On several properties the density of woody plants in watercourses has reached the stage where combustible vegetation (grass) is sparse to absent. Under this scenario the feasibility of using fire is extremely limited. Native woody vegetation can legally be removed from constructed waterways where they have been built in accordance with a soil conservation plan. However, even on the properties that do have soil conservation plans, watercourses (creeks and braided streams) are not part of those plans. Recent advice from Dept of Resources indicates that under certain circumstances, remnant vegetation

can be cleared to remove silt from watercourses. While sediment accumulation is definitely an issue on most of the properties that were visited, it is not feasible to remove the silt mechanically. The vegetation requires thinning within the watercourses and the surrounding flood prone remnant vegetation. This will allow flood flows to attain the velocities reached when the vegetation was open. Fire and/or grazing will then be essential to maintain the openness of the remnant vegetation.

- **Paddock workability:** Paddocks that are tortuous or broken ie they have slopes that exceed 3% and have multiple ridges and natural drainage lines across them, are marginal for cropping. They are most often the paddocks where soil conservation earthworks (contour banks and constructed waterways) are most prone to failure, even under zero-till farming systems. These paddocks would benefit from a sown pasture phase of 3 or 4 years before another cropping phase for 3 to 4 years. Besides grazing by cattle, pastures could be used for hay production in favourable seasons or pasture seed production.
- **Soil conservation plans:** Copies of approved soil conservation plans including design specifications will be provided to all grain growers so they can fully appreciate the intent of the plan and determine which sections of the property were never completed; for example in many contoured paddocks, the distance from the top of the paddock to the location of the first contour bank is too far. It should be 1.5 times the recommended vertical interval for the slope of the paddock. Contour banks only protect the land down slope. They are of no benefit to the land up slope. Similarly, the lowest contour bank in many paddocks is too far from the actual lowest point in the paddock. An additional 2 or 3 contour banks are required below the last contour bank in many paddocks.
- **Contour bank layouts:** A review of the contour bank layouts in each paddock is required to determine if they match the design in the original soil conservation plan in terms of location, design capacity, points where the direction of contour bank flow changes, bank shape, and trafficability.
  Where contour banks discharge into remnant vegetation, the outlets must be kept open (slashing is ideal) so that runoff continues into the bush. Even a well-constructed and maintained contour bank will breach 10 to 20m from the outlet end if the runoff hits a wall of dense vegetation.
  Well maintained contour banks are crucial on all paddocks that exceed 0.5% slope. Poorly maintained banks will breach in most runoff events – particularly those banks that exceed 1500m in one direction. Banks that exceed 1,500m should be individually designed to ensure they function effectively. Many growers wait for banks to overtop before commencing a maintenance program. *(Contour banks cannot be rolled up and put in the shed to be rolled out when they are needed!)*
- **Constructed waterway management:** Waterways on the properties visited are in very poor state. However, it is important to recognise that establishing suitable sown pastures (stoloniferous grasses) in heavy black cracking clays is difficult. Waterways in cropping country are designed to have a dense pasture cover that is kept at approx 15 to 20cm length or a fair pasture cover kept at 30 to 60cm length. This is vegetal retardance 'C' as shown in the Table 2.
  Some research work was conducted on establishing pasture cover on heavy black cracking clay soils in Central Queensland many decades ago. Generally the results were not successful. Eroding constructed waterways are the source of a lot of the sediment from this high value land on the Central Highlands. With a wider selection of available species and the presence of a high achieving RD&E pastures team in the Rockhampton and Emerald DPI offices, there is an opportunity to apply for GRDC funding to do further research work to stabilise constructed waterways.

| Guide to selection of vegetal retardance | | |
|---|---|---|
| **Average height of vegetation** | **Degree of retardance based on quality of vegetation** | |
| | **Good** | **Fair** |
| Longer than 75 cm | A | B |
| 30 cm to 60 cm | B | C |
| 15 cm to 25 cm | C | D |
| 5 cm to 15 cm | D | D |
| Less than 5 cm | E | E |

**Table 2.** *Vegetal retardance afforded by waterway pasture cover.*
(From:- https://www.dsda.org.il/uploads/n/1525855149.8949.pdf Page 8-6)

- **A change of culture** is required amongst grain growers to recognise the importance of, and the need for constructed waterways that are:-
    - Located in natural drainage lines where possible
    - Built to design specifications (bottom width, top width, depth, slope of bank batters)
    - Topsoil (100mm) excavated and stockpiled before construction of the actual waterway begins
    - Topsoil replaced over all disturbed/exposed areas
    - Sown and stabilised with stoloniferous grasses (and fertilised based on soil test results)
    - Ensuring that waterways are grassed and stabilised before contour banks are constructed and discharged into the waterway.
    - Kept slashed to the recommended height (or grazed/burnt to achieve a similar result)
    - Maintained by removing silt deposits and stabilising eroded areas during the early stages of deposition/erosion
    - Not used as access tracks up and down the farm.
    - Not being used as a sites to stockpile sticks, rocks, fallen tree branches & tree trunks
    - Are easily crossed by all farm machinery (planters, spray rigs, & headers) by having low sloping batters of 1V in 6H
    - Not sprayed out when controlling weeds in adjacent paddocks ie shut off sprayers when crossing waterways.
    - If seasons allow, waterways in very good condition may occasionally be cut for hay.
- **Farm assess:** All access tracks/roads should be located at the origin end of contour bank layouts. This should be on headlands where the contour banks flow away from the headland, or in the middle of paddocks where contour banks that traverse a paddock from one side to the other change the direction of flow, ie the runoff flows away from the centre to each side of the paddock. Access over flood prone paddocks should be across the direction of flow where possible. Access through strip cropping layouts is shown in Figure 2.

**Acknowledgements**

- Brendon Swaffer "Bungarra" Clermont contacted other grain growers who were interested in discussing the flood/erosion damage with DPI extension officers. This resulted in visits to and inspections of 6 grain properties to the east and north of Clermont.
- Satellite data/images captured by the Planet satellite https://www.planet.com/ were initially provided by Dan Tindall, Science Leader and Rebecca Farrell, Scientific Data Manager, Earth Observation – Vegetation Monitoring and Environmental Compliance, DETSI, Brisbane. Further production of Planet satellite images before & after the flood event for use in the field when visiting each of the 6 properties, were produced by Simon Hunt, Senior Soil Conservation Officer, DPI, Charters Towers.
- Max Quinlivan, Development Extension Officer (Grains), DPI, Emerald attended 2 of the property visits to provide current information on modern-day cropping systems on the Central Highlands of Qld.
- Unless otherwise noted, the photos in this document were taken by the author.

***The following section "A picture is worth a 1000 words" consists of a series of photographs taken after the flood; and several post-flood satellite images. Details are provided in the captions with each photograph.***

**“A picture is worth a 1000 words”**



**Photo 2.** *Severe sheet erosion & erosion along subtle preferential flow paths/channels across the alluvial soils adjacent to Wolfang Creek.* ***Note:*** *the straight levee bank on the LHS of the image and the “tram-lines” down the centre. The levee bank was breached at the yellow star. (Photo credit Brendon Swaffer)*




**Photo 3.** *An example of an early soil conservation plan prepared in co junction with the landholder in the early 1990s. These plans featured technically sound designs. While this landholder had retained the plan, the accompanying specifications could not be located.*



**Photo 4.** *An unvegetated levee bank along a watercourse.* ***Note:*** *the breaches near the two yellow stars. The rapid discharge of large flood flows onto the adjacent croplands has caused old flood channels to deepen and widen significantly.*



**Photo 5.** A closer view of a breached levee *bank along a watercourse. Some of the beaches had as much capacity as the creeks that they were meant to contain i.e. most of the runoff in the creeks discharged onto the floodplain in preference to following down the creek.*



**Photo 6.** *A large erosion feature where runoff has flowed parallel to a creek either because of a levee bank or high flood levels in the creek preventing paddock runoff from entering the creek or drainage line; or the site is below a breached levee bank. A large volume of soil will be required to reinstate the natural/original land surface.*



**Photo 7.** *A severely eroded headland adjacent to a densely grassed and timbered creek. The velocity of floodwaters in the creek was comparatively slower than a scenario where in a similar watercourse the grass was shorter and the timber more open. The preferential flow path for the water then moves to the adjacent cropped lands. This highlights the need to manage the vegetation – particularly the volume of grass plus woody plants by either grazing or regular burning; and for all grain growers in the catchment to further reduce soil erosion so that the rate of sediment accumulation in watercourses is significantly reduced. Failure to do so will result in the ground surface in the creeks being higher than the adjoining cropped paddocks, causing even minor floods to spread into the paddocks.*



**Photo 8.** *A severely eroded headland adjacent to a broad watercourse to the right. The density of the grass and woody vegetation in the watercourse has "pushed" the water onto the adjacent croplands where the vegetal retardance is low, and runoff velocities can increase dramatically.*



**Photo 9.** *Severe erosion along the edge of a cropped paddock following the failure of a watercourse levee bank in the centre of the photo.*



**Photo 10.** *A silt deposit from an upstream adjacent paddock at the top of a natural drainage line that has a strip of remnant vegetation for most of its length through the property. As in Photo 16 the runoff then flows across the cultivation down each side of the timbered strip causing erosion for the full length of the tree-line. Silt deposits occur where the land slope is less eg near-flat area.*



**Photo 11.** *A large silt deposit running R to L in front of the tree line which has ponded runoff over most of the photo (the area with the swept appearance.) As the tree line is a designated stream order 1 watercourse which has accumulated silt, it is difficult for contour banks to discharge into the watercourse. See more detail in the next 3 images Photos 12a, 12b &13.*

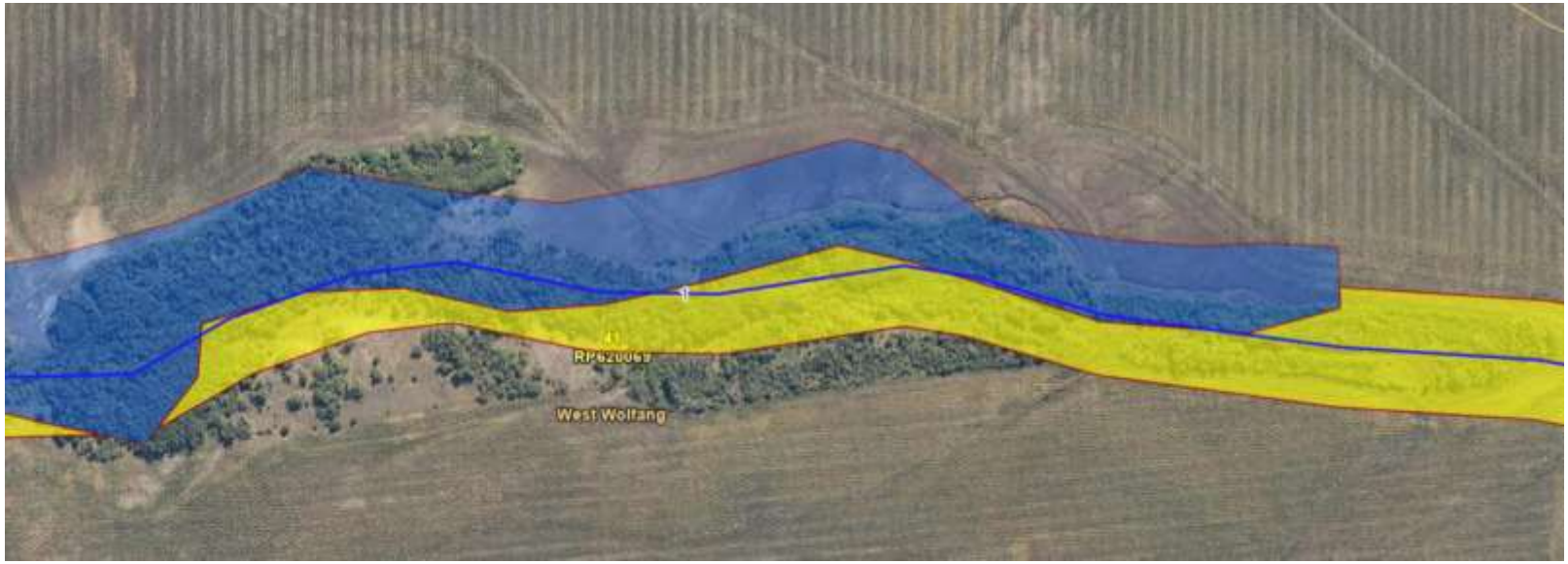


**Photo 12a.** *The same area as Photo 11 on the previous page. This area has three vegetation management attributes:-*

- *Cat B remnant vegetation (shaded in blue)*
- *Reef regrowth in a watercourse (shaded in yellow)*
- *Watercourse – stream order 1 (fine blue line)*

***Both images from the Qld Globe cover the same area of land***




**Photo 12b.** *The same area as in Photo 12a above showing the extent of the tree cover and the eroded section of headland on the top side of the tree line; this area is becoming the watercourse as the ground level in the timbered area is proud of the paddock level on both sides.*

Much of the woody vegetation in this area consists of very large prickly acacia trees, making its value as remnant vegetation very degraded.



**Photo 13.** Looking downstream from a crossing over a watercourse choked with dense vegetation. The woody plants are a mix of native trees and exotic leucaena (light-green clump in centre of the photo). The grasses are strongly dominated by tall Johnson grass (an exotic weed). The impenetrable barrier formed by this mix of native & exotic woody species and tall vigorous exotic grasses, significantly reduces the capacity of watercourse channels and adjoining areas of remnant vegetation. Flood flows are then forced onto adjoining croplands; or breach levee banks where they have been constructed to confine flood water to the watercourse. Some of the most severe soil erosion has occurred on croplands below breaches in levee banks. *(Photo credit Brendon Swaffer)*.

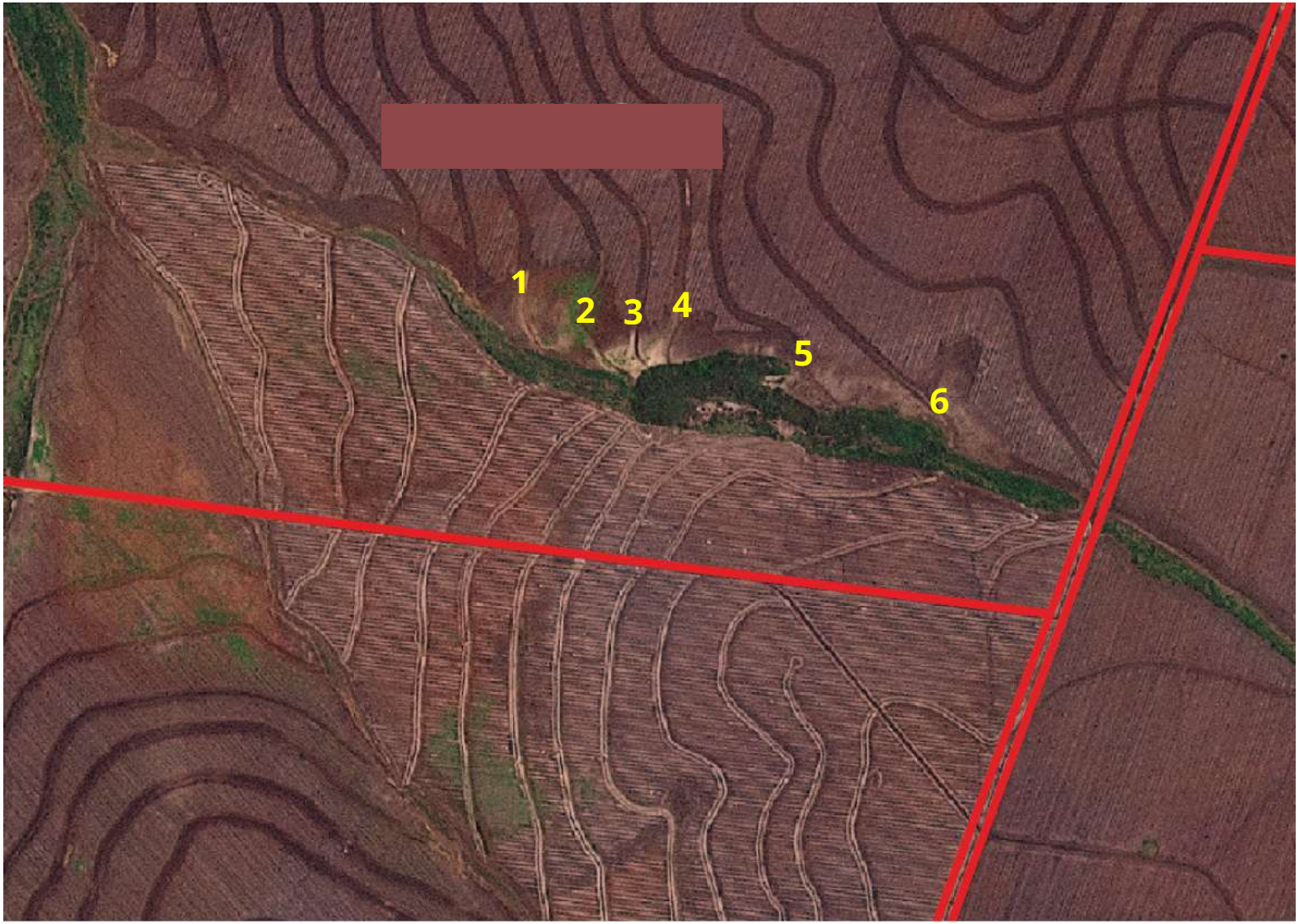


**Photo 14.** Planet satellite image of the same area as Photos 11, 12a & 12b taken after the flood on the 11th/12th January. *Both paddocks at the top and bottom of the image are contoured, and despite the extreme rainfall event, there are few breaches in the banks as they were topped up during 2025. The only exception is the banks on the top side of the image where 6 banks have breached just before the outlet due to the inability of the water to flow into the tree line.*



**Photo 15.** *Sheet erosion through chick-pea stubble on an alluvial floodplain. The width of flooding at this point was approx 1.0km*



**Photo 16.** *A large deposit of silt on an existing area of dead-flat land adjacent to a watercourse (in the tree line)*



**Photo 17.** *A large silt deposit at the end of a broad drainage line. Much of this soil was eroded from the paddock above (note the rill erosion in the top LH of the photo), but a significant volume of soil has been eroded from the cropland adjacent to the strip of remnant vegetation which is in the lowest part of the natural drainage line. The dense vegetation prevents most of the runoff from entering the tree-line, therefore it follows the line of least resistance which in this case is across the cultivation where the erosion is severe* ***Note:*** *the erosion along the edge of the trees. (This photo is looking upslope.)*



**Photo 18.** *A massive silt deposit at the downstream boundary of a property along Wolfang Creek. Similar deposits were frequent along the major watercourses however they would represent a fraction of the total soil that was eroded off paddocks.*



**Photo 19.** *The grass strip along the RHS of the photo is a constructed waterway which is designed to carry runoff from a large area upslope. Due to the lack of capacity and poor maintenance of the waterway, it has overtopped and flowed over the cultivation adjacent to the waterway, making a wide and deep channel down the LHS of the photo. There is a large silt deposit near the tree-line at the top of the photo, which has in turn been eroded by flood waters from the creek (also in the tree-line.)*



**Photo 20.** *The waterway as shown down the grass strip in the previous Photo 19. The waterway channel is too narrow for the runoff from the contributing catchment and has eroded to form a gully. Despite the gully erosion increasing the capacity of the waterway, it still over-topped and eroded the adjacent paddock (also shown in Photo 19)*



**Photo 21.** *A breached contour bank 30m before discharging into the waterway as shown in the previous Photo 20. The high waterway bank and dense grass at the outlet caused this otherwise adequate-sized contour bank to fail, discharging additional water into the erosion channel as shown down the LHS of Photo 19.*



**Photo 22.** *A constructed waterway, not maintained and severely eroded with contour banks discharging in from both sides.* ***Note:*** *the erosion is gradually moving into the contour bank channels. This is visible on the first contour bank on the RHS. Meanders are forming in this waterway, which is another indicator of inadequate maintenance. (Photo is taken looking downslope.)*



**Photo 23.** *Inadequately maintained contour bank, failed at the top of a contoured paddock. This bank is the one furthest up the paddock to fail. The runoff from the first breached bank has cascaded downslope and breached every remaining contour bank to the bottom of the paddock. The cover afforded by the chick-pea stubble would have reduced the amount of runoff and the speed and erosive power of the water as it moved across the paddock. The damage to the contour banks would have been much worse if the paddock was bare or had sparce cover.*



**Photo 24.** *A deep rill caused by inadequate sized contour banks breaching at the top bank in the paddock and cascading through all banks below. This is a major hindrance to operating all farm machinery.*



**Photo 25.** *A severe damage at the outlet end of a contour bank, caused by inadequate bank capacity and overtopping of the natural drainage line (grassed area – centre-top of photo) further upstream to the right.*



**Photo 26.** *Chick-pea stubble provides moderate to low cover levels. Due to record yields on most grain farms in the district in 2025, cover levels from chick-peas was higher than expected. Being a leguminous crop, this residue is short lived.*



**Photo 27.** *Wheat stubble provides the greatest ground cover of all crops grown in the Central Highlands. Being almost inert, wheat stubble is long lasting with some cover persisting into a second summer under zero-till cropping systems.*



**Photo 28.** *Grain sorghum stubble on 1.5m row spacings provides poor ground cover, however it would provide better protection against flood erosion if it was planted across the direction of the flood flow. Sorghum stubble will last longer on the ground than chick-pea stubble.*



**Photo 29.** *Severe erosion down a natural drainage line through a cropping paddock. Additional erosion gutters are eating into the paddock on both sides of the main erosion feature.* ***Note:*** *the depth of the erosion (approx 0.5m); most of the basaltic black cracking clay soils on the Central Highlands are less than 0.6m deep. When a soil conservation plan is implemented in this paddock, this site will be the location of a major constructed and grassed waterway.*



**Photo 30.** *A narrow gutter eroded to a depth of 0.3m across the paddock. In addition to the loss of soil, these gutters make working the paddock difficult and potentially damaging to farm machinery.*



**Photo 31.** *A wide erosion channel in a location where a major waterway will be constructed as a part of a soil conservation plan.* ***Note:*** *the soil is 0.4m deep, but the erosion has already reached decomposing basalt.*



**Photo 32.** *A similar situation to the previous Photo 31, except that the added protection afforded by wheat stubble has reduced the quantity of runoff and the speed of overland flow resulting in a less severe erosion channel.*



**Photo 33.** *A wide-angled photo showing a severely sheet eroded alluvial paddock, with a preferential flow path developing down the centre of the photo. Filling preferential flow paths would be required if strip cropping was to be implemented. The alternating strips of standing stubble and growing crops would be oriented at right-angles to the direction of flow.*



**Photo 34.** *Most fences along and through timbered watercourses were completely destroyed by the flood. Steel strainer assemblies were the only components of the original fence that could be used when the fences are rebuilt.*



**Photo 35.** A severely damaged gravelled roadway that used to provide the main access to paddocks on the other side of watercourses/major drainage lines.



**Photo 36.** *Erosion in a constructed waterway beside a formed-up, gravel-capped access road on the RHS on very low sloping cultivation (0.2% slope away from the camera towards the top of the photo). As the slope on the paddock is too low to warrant contour banks, the only option to prevent the erosion from re-occurring is to revisit the waterway design, and if built to design specifications, establish a dense grass cover in the floor of the waterway and keep it slashed.*



**Photo 37.** *Silt deposited from an adjacent sloping paddock to the right, onto a main road verge that has filled the table drain and culverts under the road.* ***Note:*** *the depth of silt in the paddock on the RHS of the fence; it is nearly up to the second wire in the fence. Removing silt deposits from public infrastructure is expensive for local Councils and government departments.*

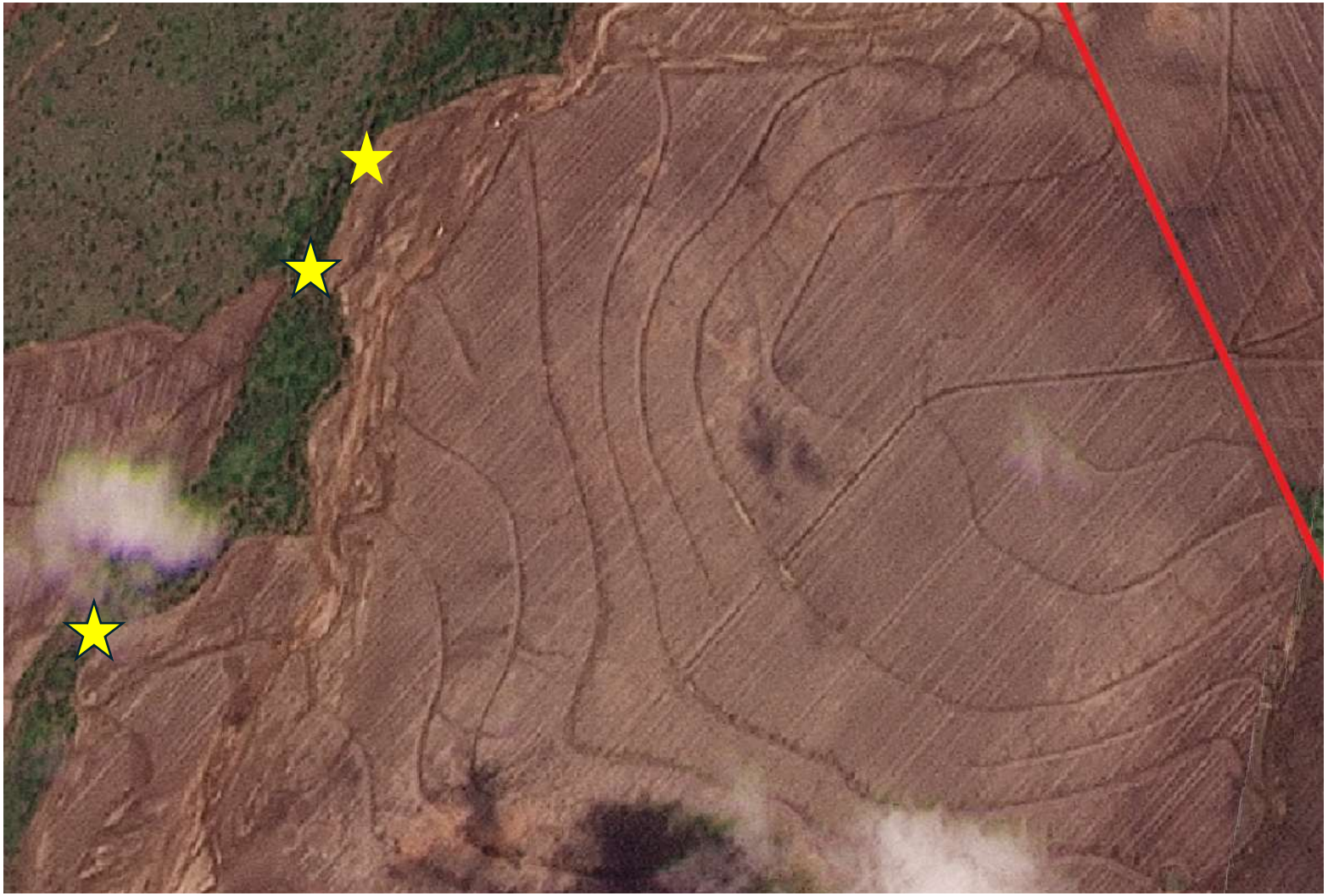

**Photo 38.** *Post-flood image showing severe erosion adjacent to the drainage line down the LHS of the image. There is hill in the top LH corner of the image which pushes flood waters onto the cultivation side of the drainage line at a point where it is narrowest (top star). This is one of several 'pinch-points' in the width of vegetation along the drainage line (all stars). These areas should be left to grass up to increase the capacity of the drainage line. The contour banks have functioned well even though there is some rill erosion between the banks. The only breaches occurred where the flood waters have gone over the contour bank outlets along the drainage line. Contour banks are not designed to carry flood waters.*

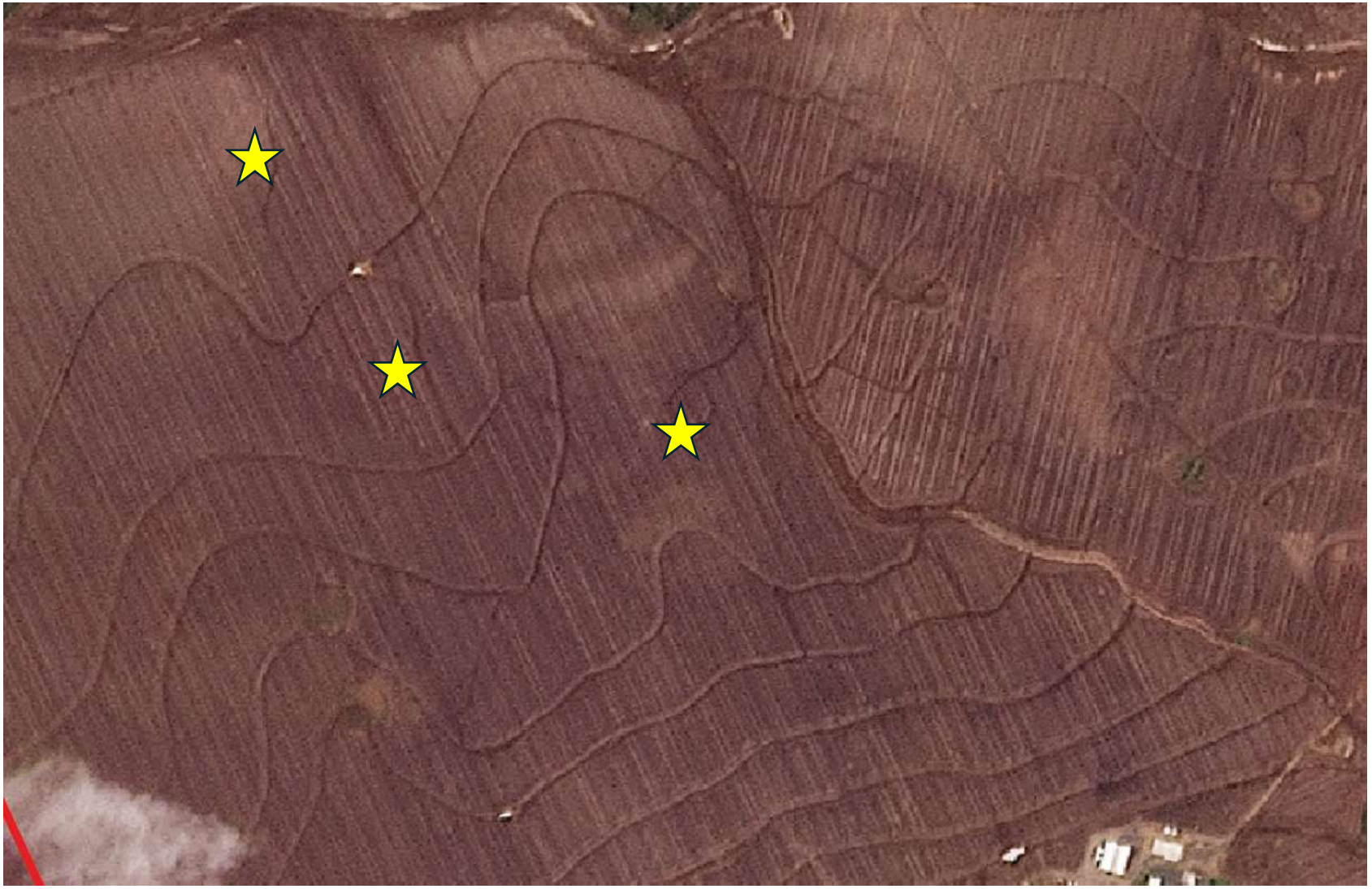

**Photo 39.** (*Post-flood image) The fact that the bare-earth waterway constructed diagonally across image has not overtopped onto the cultivation indicates that it has sufficient width, but not being grassed, it is at risk of eroding down to the underlying basalt. The contour bank layout to the left of the waterway has performed well; it appears that these banks were maintained during 2025. The wide distance between banks and erosion near the 3 stars, indicates that extra contour banks may be needed. The contour banks on the RHS of the waterway have breached in several locations indicating that they may have been overdue for a top-up.*



**Photo 40.** *Post-flood image showing the same area as the high oblique aerial image in Photo 2. Although this is amongst the most seriously eroded areas in the catchment, the soils being deep alluvials of basaltic origin, are still the best for crop production. A greater frequency of wheat in the rotation and a trial area of strip cropping may provide some solutions to cropping flooded country without incurring high erosion rates. The direction of flood flow is from R to L. The contributing catchment area at the boundary (red line) is approx 39,300ha which consists of the Peak Range at the top, grazing land covering approx ¼ of the catchment west of the range and increasing areas of cropping land with some grazing land across the lower ¾ of the catchment.*



**Photo 41.** *Post-flood image showing the performance of contour banks that were maintained in 2025. While significant large rills can be seen between the banks no breaches occurred. The erosion along and beside the waterway in the top LH corner is the biggest concern in this area. The light-coloured strip down its centre indicates the waterway has been eroded to the basalt. While the basalt is stable, erosion then commences into the adjoining cropland at right-angles to the waterway. Erosion has also commenced into the outlet and channel of the last contour bank in the top LH corner. Eventually fingers of erosion will advance at a right-angle from the eroded contour bank channel into the cultivation as shown in the enlarged image on the right.*

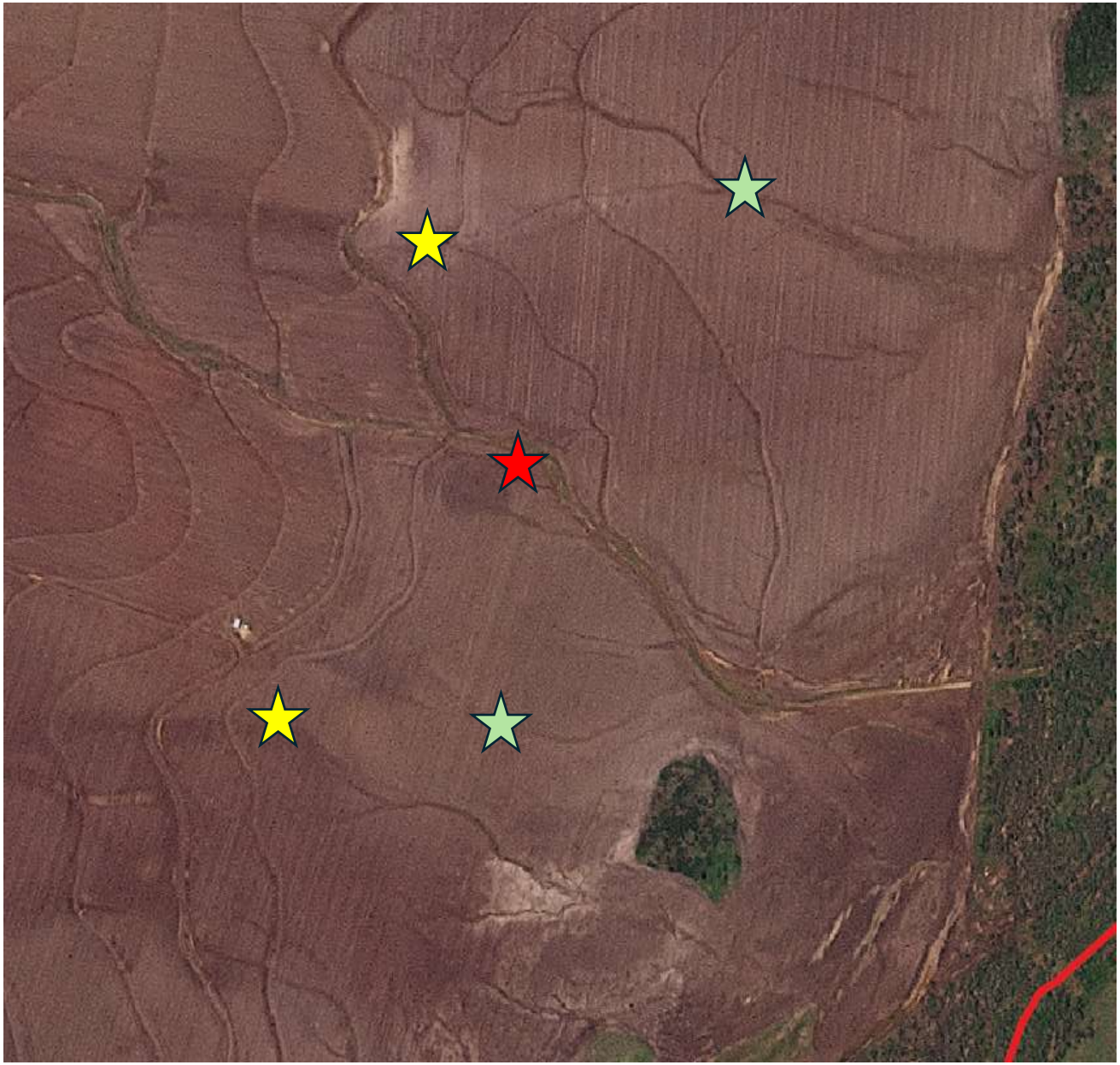

**Photo 42.** *Post-flood image showing an inadequately maintained soil conservation layout; the waterway across the image (L to R) has overtopped and eroded the adjacent cropland and the contour banks have overtopped in several locations. This situation is made more challenging by a less than optimum layout design; primarily the location of the main waterway being on a very broad ridge (red star), instead of locating waterways in natural drainage lines (yellow stars). The area below the lowest contour banks on either side of the existing waterway, requires additional contour banks to control the erosion in the cropland down to the creek (green stars).*

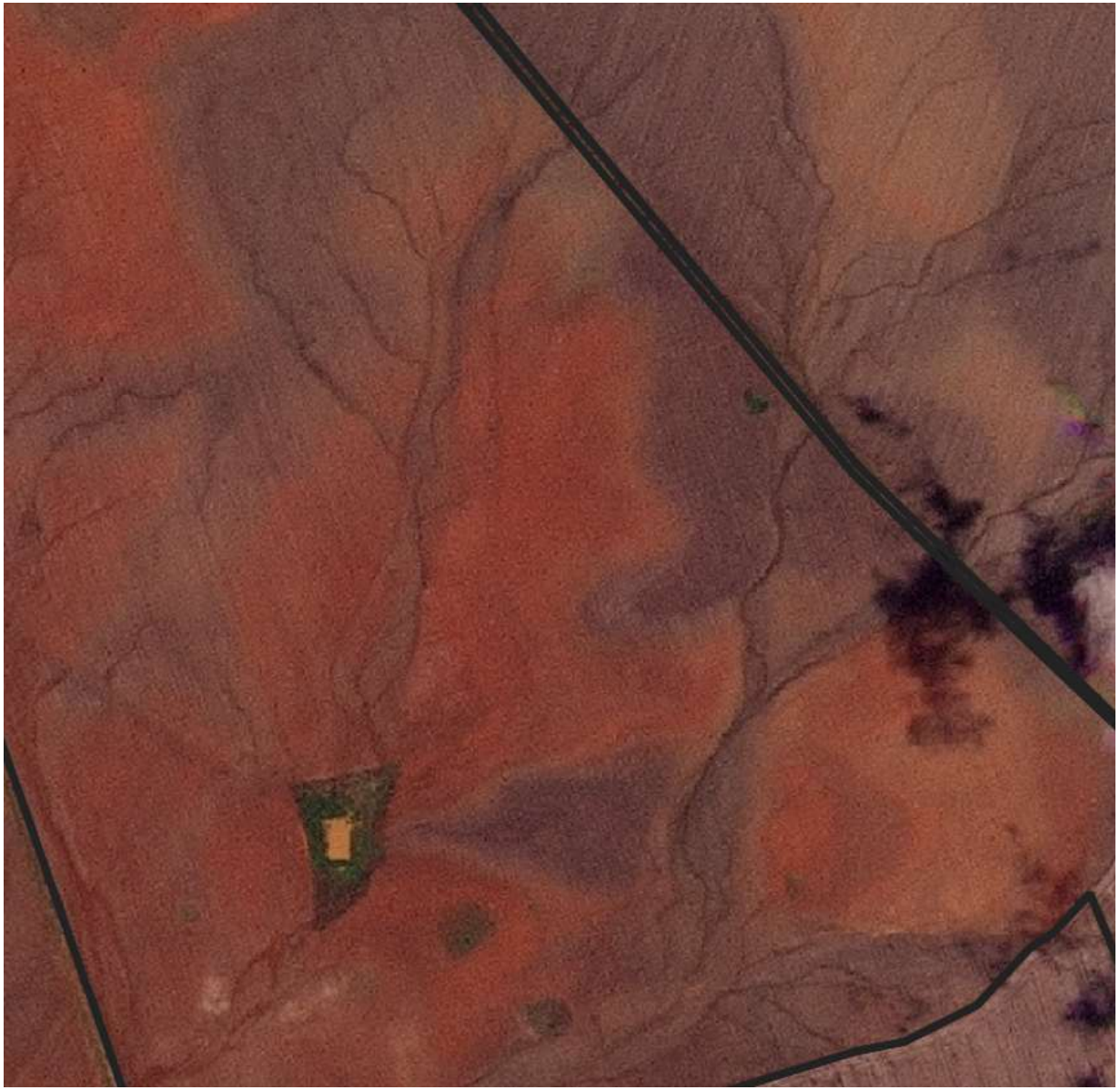

**Photo 43.** *Post-flood image showing a paddock that requires the implementation of a soil conservation layout. As the implementation of a soil conservation plan across a whole property may take several years, maximising the area under wheat will provide the greatest protection to manage erosion in the interim.*



**Photo 44.** *A Google Earth image of an area that has multiple natural drainage lines, ridges, shallower soil depth and outcrops with skeletal basaltic soils. While the soils are good quality and (where deep enough) will grow good crops, they are termed tortuous paddocks due to their broken nature. They are more prone to erosion, even when contour bank and grassed waterway layouts have been installed. Adopting a long-term rotation of 4 years sown pasture, 4 years cropping will contribute to their sustainable use.*

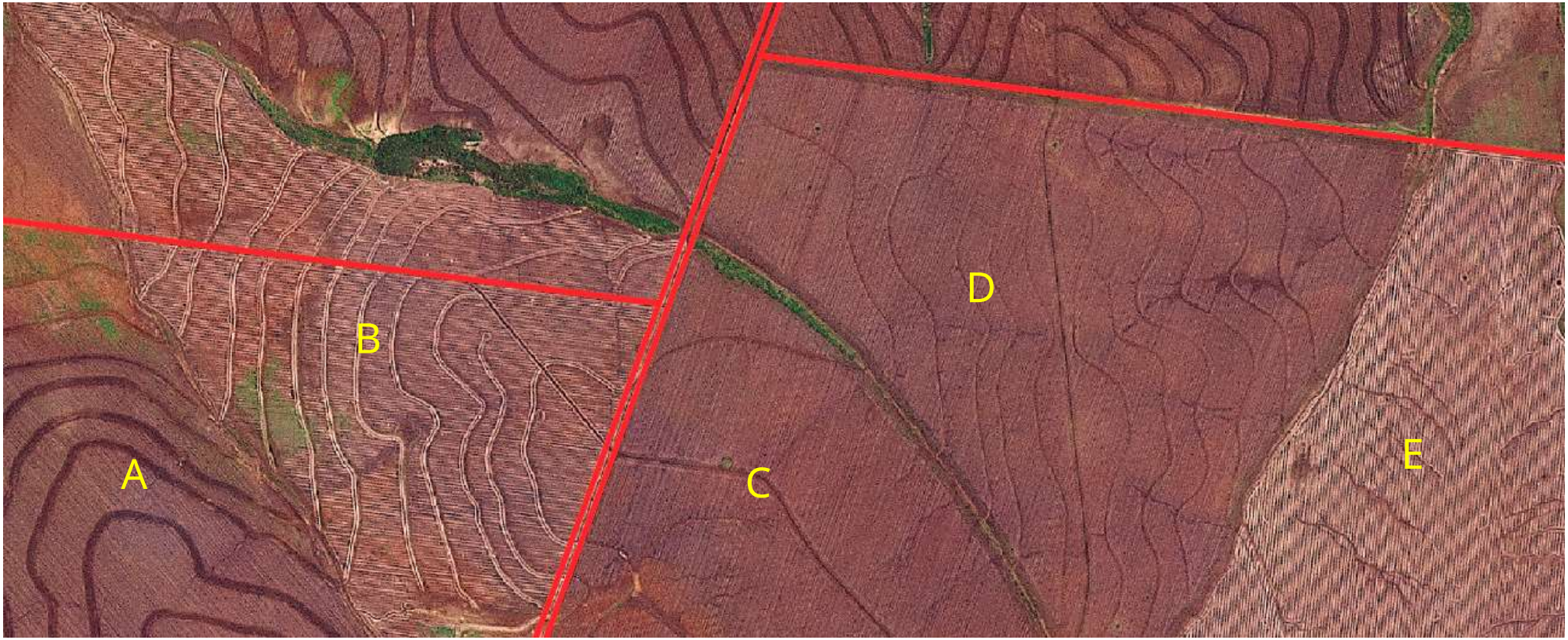


**Photo 45.** *Post-flood image showing a range of soil conservation practices, including:-*

- *"A" - recently maintained contour banks with modest stubble cover – some erosion between banks.*
- *"B" - well maintained contour banks with moderate to high stubble cover – minor rill erosion in old erosion gutters.*
- *"C" – no contour banks and low stubble cover – many small erosion rills.*
- *"D" – contour banks in need of maintenance and low stubble cover – many rills between banks and breaches through banks.*
- *"E" – no contour banks and high stubble cover – frequent rill erosion in deep old erosion gutters.*

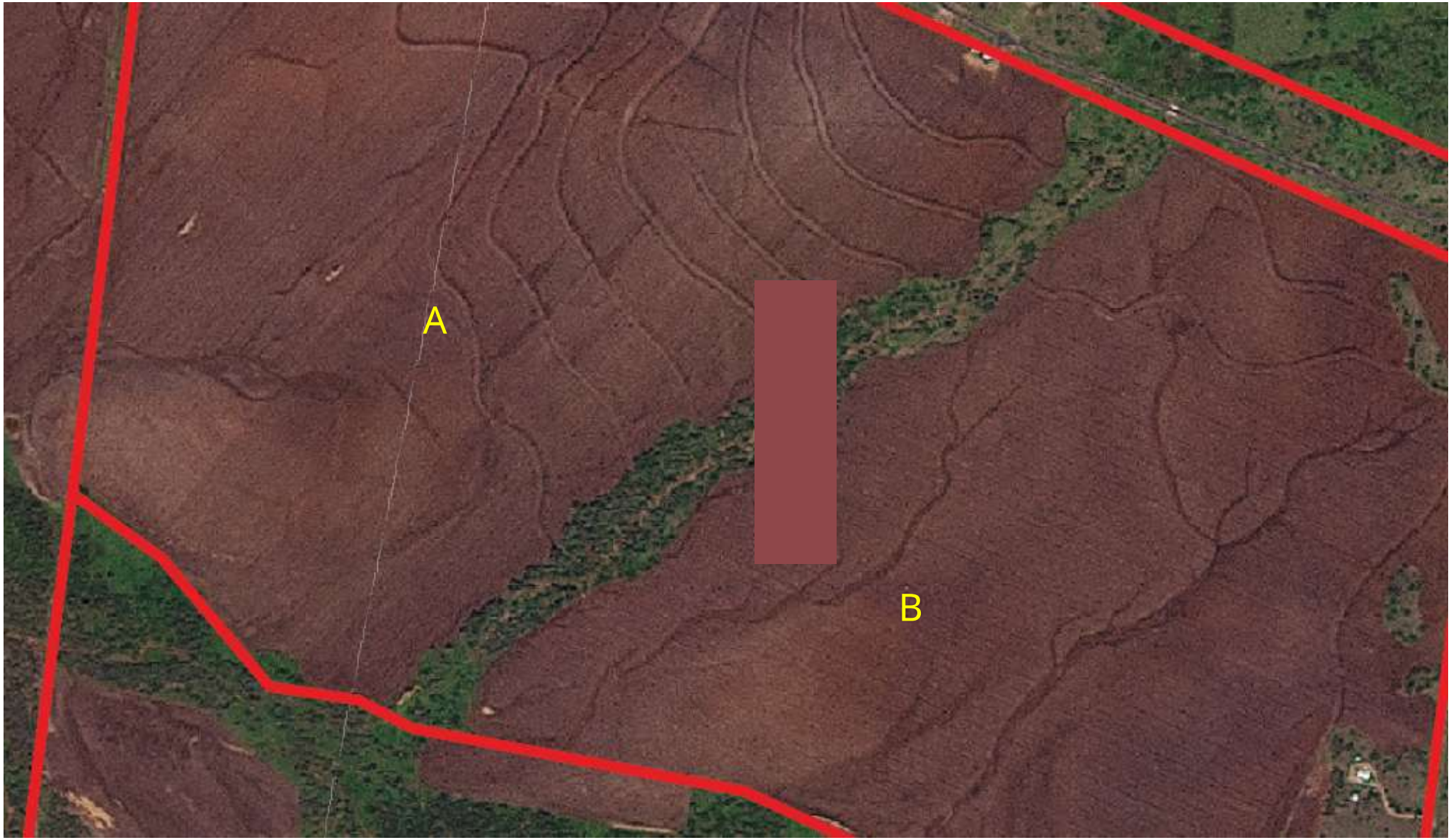


**Photo 46.** *Post-flood image showing the difference between 2 paddocks with & without contour banks. ("A" and "B" respectively.)*