WALLABADAH CREEK CATCHMENT COMMUNITY (WCCC) – BUILDING DROUGHT RESILIENCE AND WATER SUSTAINABILITY FOR OUR FUTURE (Report)

Submitted May 25, 2022

Photographs of Back Creek
January 2022

OUR WATER OUR COMMUNITY OUR RESPONSIBILITY

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WALLABADAH CREEK CATCHMENT COMMUNITY

Photographs on Report Cover Page

Left - A simple weir working in the higher catchment after the November 2021 rains. Note the estimated 1.5 m of sediment dropped on the upstream approach caused by the slowing of water. The movement of such sediment into the stability afforded by these or natural log structures is, on multiple levels, fundamental to catchment health.

Right - Our issue is that our entire catchment creek sediment structure is now unstable and moving. This instability is evident in the sediment dumped on Back Creek crossing and other crossings with the Wallabadah Creek catchment (WCC) after these same rains, illustrating the ever increasing water velocities on the same amount of rainfall which are, in a vicious cycle, both the engine and the outcome of sediment scouring and bed lowering across the full extent of our catchment.

The deposition of gravel on crossings after every flood flow is an existential example of how our creeks and our underground water table are literally being washed away! We ignore that at our peril!

The good news is that this situation is primarily the result of our catchment land use over the last 180 -200 years, and can be reversed over time by an acknowledgement of responsibility, an understanding of catchment hydrology and a committed individual and collective whole of catchment approach.

The available records show us that we are not receiving less average rainfall than we did last century, nor using more water. WCC is no longer retaining the rainfall it once did.

The interpretation of available data and the observed evidence (both current and in the memories of older catchment residents) also emphasizes that rainwater is leaving our catchment and taking our topsoil faster and more prolifically than it has ever done.

The inescapable conclusion is that our catchment is no longer functioning as it should and needs our help to remain viable on all levels – environmental, social and commercial. We need to find ways to keep more rainfall in our catchment for longer.

Looking the other way, blaming others or causes beyond our control or simply doing nothing is no longer an option. Drought resilience and water security is our legacy and our future.

WALLABADAH CREEK CATCHMENT COMMUNITY

This project is delivered by North West Local Land Services, through funding from the Australian Government and Catchment Action NSW

Australian Government

NSW GOVERNMENT | Local Land Services

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ACKNOWLEDGEMENTS

WCCC acknowledges the significant contributions of many people inside and outside our community to the development of the WCCC and our improving understanding of the hydrology and other aspects of our country. However, the authors take full responsibility for any errors of fact or/and opinion.

Those acknowledged include without limitation:

- The farmers in the WCC and adjacent catchments who have participated at any level in the past 3 years
- The people of Wallabadah and the Wallabadah community
- Tamworth Regional Landcare Association
- North West Local Land Services and in particular Angela Baker and Tim Watts
- Liverpool Plains Shire Council
- Tamworth Regional Council
- National Parks & Wildlife Service of NSW
- EastWest Online
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- Tom Schroder and Shanti Mors, South pole Carbon
- McLean Contracting
- And many individuals and organisation other too numerous to mention

These substantial contributions from our interrelated communities and stakeholders have included intellectual capital, physical capital and financial capital contributions without which the project would not have achieved the progress and coverage to date that it has achieved.

WALLABADAH CREEK CATCHMENT COMMUNITY

WCCC REPORTS AND REFERENCE MATERIAL

The Report draws heavily from these materials, and they are available to those who wish to read them on WCCC's Google Drive. This is accessible upon request to wallabadahwater@gmail.com. The materials include the following:

- Preliminary Overview of the Wallabadah Creek Sub-Catchment from a Geomorphological and Hydrological Perspective 2022 (Brad Davies, adaptiv Management)
- Back Creek Restoration Concept Plan – Future Priorities April 2021 (Brad Davies, adaptiv Management)
- Back Creek Restoration Concept Plan – Consultation Draft 4 April 2021 (Brad Davies, adaptiv Management)
- Project Proposal -Water Gully Wallabadah 11 November 2021 (Brad Davies, adaptiv Management)
- A3 Project Plan and specifications Water Gully Elizabeth Street 110322 (Brad Davies, adaptiv Management)
- A3 Project Plan and specifications Water Gully Nankivell 10322 (Brad Davies, adaptiv Management)
- Joby's Hill Water Management Report_090919 (Brad Davies, adaptiv Management)
- Joby's Hill Water Management Report Drainage Rehab (all drawings) 250719 (Brad Davies, adaptiv Management)
- Joby's Hill Water Management Report Water Mgt System (all drawings) 250719 (Brad Davies, adaptiv Management)
- Wallabadah Creek Catchment Community Soil Testing Notes 120520 (WCCC& Agricultural Consulting & Extension Services/Peter McKenzie and colleagues (ACES))
- Wallabadah Creek Catchment Community-Soil Chemistry Report and General Notes September 20 (ACES)
- Wallabadah Creek Catchment Group Interim Benchmarking Report 0619 (WCCC/ACES)
- WCCC Agricultural Consulting & Extension Services Catchment Soils presentation_040720 ACES
- Wallabadah Creek Catchment_ Carbon Insights Report Final July 21 (CarbonLink Ltd)
- WCCC Feral Barrier Fence Feasibility_Nowlands Gap to Lindsays Gap -December 2021 (David Worsley, Invasives Consulting Pty Ltd and AWI & WCCC)
- Barrier Fence Alignments December 2021 (Australian Spatial Analytics)
- Overview of Wallabadah Catchment Groundwater February 2019 (Martin O'Rourke, DPIE)
- Various communications with DPIE Water 2019-2022 including recommendations for water level monitoring
- Catchment Bird Audit 2002 (Peter Eckert)
- Summary Soil Carbon - Notes 181219 Dr Judy Earl)
- WCCC Report and Management Summary_0720 (Dr Judi Earl)

- Soil test comments 080720 (Dr Judi Earl)
- Earl Presentation Notes_Carbon 080620 (Dr Judi Earl)
- Earl Presentation Slides_Carbon 080620 (Dr Judi Earl)
- Soil is Critical_Wallabadah Catchment 020219 (Dr Robert Banks)
- Soil Test Analysis – Wallabadah Catchment 100719 Dr Robert Banks)
- WCCC - Summary of Progress 180919 (Dr Robert Banks)
- WCCC_Groundwater Level Report 271119 (Dr Robert Banks)
- WCCC_Groundwater Level Analysis PP 050419 (Dr Robert Banks)
- Bore Test Data 2019 and 2020 (Eastwest Online)
- Soli Test Data 2019 (Eastwest Online)

Moving topsoil in the lower WCC after rains in February 2020 (L), Mud flow in drainage in the aftermath (below)

SERIES OF PHOTOGRAPHS OVER THE 2020/21 PERIOD which illustrate the impact of weir structures in a heavily eroded drainage in the lower WCC to slow flood flows and catch sediment, lifting the bed and allowing regeneration and rehydration. The relevant weir structure was constructed in October 2019.

The **top photo** shows the drainage downstream from weir structure in late 2020, as a deeply eroded excised gully, essentially reflecting the original state of the drainage. The **second photo** shows the substantial amount of sediment captured by the structure after the rains in early 2020, up to 2 m over 150 m.

The **third photo** taken in late 2021 illustrates the powerful remedial impact of sediment and moisture as the platform for phragmites and other riverine plants to reestablish and secure the structure. Further work has now been done on the downstream reach towards the Racecourse, resulting in continuous and substantially complete remediation over 800 m in a little over 2 years.

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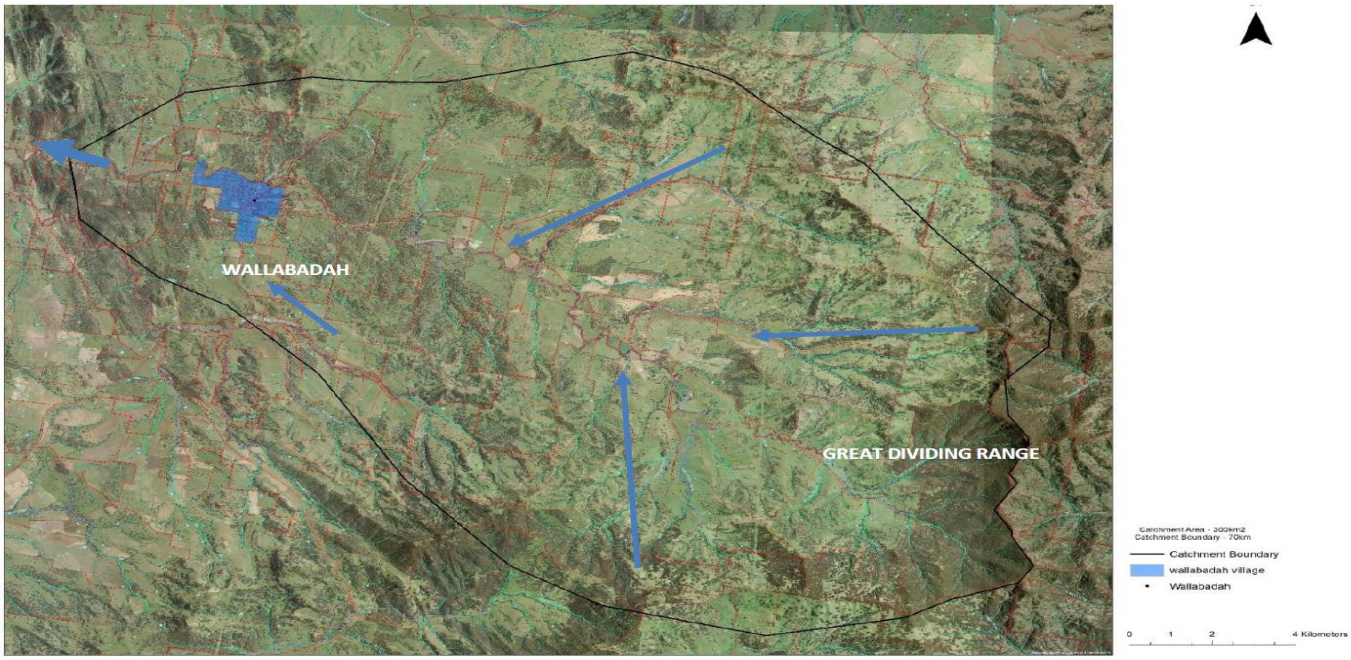
WALLABADAH CREEK CATCHMENT – VITAL STATISTICS



Watershed Perimeter - 78 kilometers
Area 30 km2 in total and 17km2 E of the New England Hwy, the latter being the primary agriculture area surrounding Wallabadah and the sole source of domestic water for Wallabadah village.
Distance (top to bottom) – 18 kms
Height above sea level – 480–500 m at the bottom of the catchment to in excess of 900 m at the Great Dividing Range watershed
Soils – primary basalt clays on the ridges and alluvial/colluvial soils in the valleys
Average slope - 12.8%
Average annual rainfall - 700 – 800 m
Gross water balance per annum – 127,000 megalitres per annum
Inhabitants - 640
Sheep - 30000 season dependent
Cattle - 4000 season dependent
Water requirement (households/stock) per annum – 6,200 megalitres or 6% of average annual rainfall
Net water balance per annum – 120,800 megalitres per annum in surplus
Chaffey Dam total volume – 103,000 megalitres

The black line indicates the catchment watershed. Blue lines indicate general flowlines of both surface and subterranean water in the catchment exiting the catchment over a sandstone fault at Flora's Ponds. The sandstone fault line which confines and contains the exit of catchment water to the W is clearly visible in the left hand corner of the image, as are the basalt folds, running N to S essentially parallel with main Great Dividing Range.

WALLABADAH CREEK CATCHMENT COMMUNITY

WCC FACT *– If our average annual rainfall fills the equivalent of Chaffey Dam every year, how many years would it take us to fill Sydney Harbor? Leaving aside infiltration and transpiration impacts operating in a healthy system the answer is around 3.5 – 4 years. In a healthy system, it would take more than twice that time.*

ABSTRACT

This Report is produced for 5 primary reasons, as follows:

1. As a report on progress against objectives and learnings of the WCCC since it was conceived in late 2018, and achievements the various water management focused contracts/projects involving WCCC, Wallabadah Racecourse Trust and 11 individual landholders with North West Local Land Services (NWLLS) in 2019, 2020 and 2021.

2. As a call to action for the broader Wallabadah community – the landholder farmers in the WCC footprint and those down catchment like residents of Wallabadah village, surrounding farms that rely on the catchment for water and stakeholders like NWLLS and Liverpool Plains Shire Council - for ongoing collective actions and responses on WCC water management.

3. As a call to action to the broader regional and NSW community about the critical importance of the western facing watershed catchments along the Great Dividing and other adjoining ranges, and their sponges, which are the source of waters which feed the western NSW and the Murray-Darling system, and without which there could be no discussion about water management and shortages in the western rivers. They would not exist! More focus needs to be applied and more knowledge of how these catchments work needs to be generated so they can remain functional and healthy.

4. As a final deliverable under a project contract dated 31/01/2021 between North West Local Land Services (NWLLS) and Tamworth Regional Landcare (TRLA) on behalf of the WCCC. It is delivered in lieu of a formal catchment management plan, including benchmarking and a hydrology plan, required under the terms of that contract. It reports on the status of achievement of the project deliverables and explains why WCCC chooses not to formalize a catchment management plan at this point in time.

5. Finally, and most importantly, to present as a consultation draft the terms of social compact between the WCCC members themselves, the broader Wallabadah community and key external stakeholders, and future generations who may choose to come to this valley, concerning water management specifically and land management in the

Wallabadah Creek catchment generally. This compact can be inclusive of landholders from adjacent catchments draining west from the watershed of the Great Dividing Range.

Whilst its preparation has involved consultation within and without the immediate stakeholders and the Wallabadah community over the past 4 years, this latter document is presented as a **consultation draft** because WCCC acknowledge that without broad community consensus and endorsement on the principles, we will fail to deliver on our fundamental objective of building water resilience and sustainability in this Catchment and for our community.

It is intended that the social compact will be consulted and co-drafted with all interested stakeholders over the next 12 months, as time and resources allow.

WCC FACT – *In the driest year of the 2015-19 drought the rainfall in the catchment was just over 300 mm in 2018. This produced enough water in the catchment, if managed efficiently, to fill Quipolly Dam to overflowing. Yet a number of catchment landholdings ran dry, the majority of landholdings had significant underground water failures in their alluvial bores, and the new village water borefield dropped precipitously in both flow rate and quality.*

Whilst we landholders might like to characterize ourselves as rugged individualists who do what we need to do to survive economically, without each other and a set of principles to guide the way for the next 5, 10, 50 or 100 years, we risk leaving our country and our valley in a state where the hydrology dysfunction and unnecessary water shortages we have had a hand in creating will continue to deteriorate, perhaps to the point of irreparability, and certainly to the point where it does not support the community in the manner it does currently, and has historically. For its long term productive future, this valley will need to be repaired by future and generational inhabitants. Is this a legacy we wish to leave?

On the basis that those who do not remember history are bound to repeat it, we are reminded that ultimately fertile regions like the Tigris and Euphrates, the Nile Delta, the civilization around Angkor Wat and many others have disappeared substantively through their failure to understand and address their water sustainability and the links between their land use and water. Like some in our community, those civilization presumably thought it could not or would not happen to them.

Those who have tuned in to the Murray Darling debate, Tamworth water restrictions debate or the failure of groundwater resources at Murrurundi, Willow Tree or any number towns across NSW during the last 20 years (including our own at Wallabadah) will recognize that

is not a controversial statement in our region or our State. The warning signs for our Wallabadah Creek catchment are clear.

On the available data, and the lived experience in our community over the past 50 plus years (in some cases over 80 years), it is looking possible that Wallabadah will be like a significant and growing number of towns and communities around us who have exhausted local groundwater sources and/or live with increasingly inferior quality water! With every dry that number increases. And we have already had it happen once, with Wallabadah going dry in the 1990s.

What can we do? Or the question people sometimes want to ask, who can we blame?

It is almost universally acknowledged by long term residents and community members that some of our creeks do not run the way they used to and generational farmers that our lucerne flats do not produce in the way they used to produce. Why? It does not require a degree in rocket science to identify a deterioration trend in our local water cycle and catchment hydrology.

These trends are confirmed by borefield records on levels and flow rates (running back 30 years) in the Quirindi Creek, made available to WCCC by the Liverpool Plains Shire Council.

Both comfortingly and confrontingly, we are starting to understand that there are actions we can take as individual landholders and as a catchment community to mitigate this trend. Moreover, these actions can be entirely consistent with increased productivity(profitably) and improved income security.

Some of our members started actively protecting their sections of creeks and drainages and running their properties with an eye toward water management and sustainability 20 or 30 or more years ago. From Google images, the relative health of those sections of those sections of drainages are apparent from the riverine plant regeneration.

Where fencing drainages to control/manage stock usage of waterways is feasible, it is a powerful tool targeting riparian deterioration, bed and riparian stabilization, and hence creating water resilience over time as drainages self-repair. It can also provide "standing haystacks" for landholders. On the other side, it is not always feasible due to terrain or cost considerations.

We know, however, that there are a range other active and passive actions or practices that landholders might employ to manage water and drainages. NWLLS support over the past 3

years has enabled WCCC and a significant number of individual WCCC members (11) to trial water resilience actions and practices in our catchment environment. These and their associated lessons are described later in this Report.

One of our founding principles was to seek to operate on evidence based research. This requires more than empirical observation, however valuable and useful. Accordingly, we are also working on ways to monitor the impacts on our water so we can determine their cost/benefit and benchmarks. *Without measurement against realistic targets there can be no accountability and no demonstrable progress.* The latter is as important for us as it is to the outside world. Again, these initiatives are outlined later in this Report.

The proposed social compact thematically asks each one of us and our families to engage and take personal responsibility for the resilience and sustainability of the water which underwrites the lives of each of us, our community and the future of our valley.

Not at the expense of productivity, nor through ceding control of our operations or the way we choose to run them and nor for any other social or "woke" agenda other than….we like living here and we want that to continue into the future, for us and those that follow.

The aspirations represented by this social compact do not have a term or a finite end date. It has taken 200 plus years of land use to get to this tipping point.

None of that land use was intentionally destructive but the long term impacts are clearly visible and remain inertial unless we recognize and consider the impacts of our approach to future land use, whatever our operation. That inertia and its effects will not be turned around in the short term, or with a single "silver bullet."

The issues in the compact are intended to recognize that we do not have all the solutions at this point, nor do we necessarily agree on the solutions amongst ourselves. They recognize that views can change, and the ownership of landholdings can change over time, so the terms must move as we move and learn.

At the same time, they also recognize that managing our water is our most fundamental existential problem in the long term, that community wide engagement is needed and that **doing nothing and expecting it to go away is not an answer**.

Being an ongoing compact, the principles are designed to address the reality that our stewardship and understanding of this country is limited in time, by our own mortality,

and must pass from generation to generation of landowners if the deterioration is to be recognised and addressed.

Most importantly, engagement with these principles recognizes we have a community problem and, as the adage goes, once you recognize a problem, we are well on the way to fixing it. **We are all in this together!**

It is anticipated that the consultation draft will be discussed with interested stakeholders and settled during 2022/23.

WCC FACT

Applying Soilcon soil runoff co-efficients developed in the 1970s and 80s to topsoil loss from the Wallabadah Creek Catchment as the 2015-19 drought broke in 2020, with conservative parameters including:

1. *Catchment rainfall of 500 mm (it was more like an average 1000 mm for the 2020 calendar year across the catchment)*
2. *Average catchment slope of 15%*
3. *Average catchment groundcover < 40% (which was probably more like < 20%)*

we can calculate that ***between 150 and 250 million tonnes of topsoil left the catchment during the 2020 calendar year alone – probably in the first half of 2020.***

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Moreover, this loss principally represented the Phosphorous and mineral rich top 1 to 2 centimetres of soils across the 17000 hectares of our catchment.

WALLABADAH CREEK CATCHMENT COMMUNITY

OUR CHALLENGE

This photograph reflects our challenge. It was taken in early January 2020 and shows the impacts wrought by different approaches to managing country within our catchment through the 2016/2019 drought. It also anticipates the different possible outcomes when climatic conditions change.

This photo is not presented as a criticism or an approval of the differing management regimes – both have their justifications. The photograph does, however, reflect the reality of our varying land use practices and imperatives across the WCC under the stress of a regular climatic event. In its stark presentation, it asks questions we all need to consider.

This photograph was taken at the end of the period in which WCCC was born. It is not the first time WCC has seen droughts and the conditions they can create. It is a reminder of the issues we sought to address then and will no doubt face again in the near future. It is a reminder that we need to prepare for the inevitable in a manner which gives us confidence that we will be better prepared in the future.

That is why the principal vision of WCCC is to improve catchment drought resilience and water security, with particular focus on our underground aquifers. It also underwrites why we need to approach this vision collectively and on a whole of catchment basis**. Water does not recognize fences or boundaries but everything we do in our home paddock can (and probably will) have impacts on the water resources of the whole catchment community**.

The photograph poses many drought resilience and water security related questions not limited to the following:

- Which side of the fence do we as landholders want to be when the next drought breaks to have a more sustainable catchment water future?
- Which management practices optimise infiltration of rain at source to best feed regrowth and recharge groundwater aquifers?
- Which land will fill dams quicker and hold for longer? Which will fill dams with water, and which will fill with sediment?
- On which side of the fence will the soil profile fill faster and hold longer?
- On which side will productive pastures regenerate quicker and last longer?
- Which side will drive productive capacity and profitability more rapidly when it rains?
- What are the economic justifications for these different land use practices and outcomes over time? Does water and environment have a value? How can we place a value on our topsoil? Does the ecology have a value in a healthy water cycle?
- Given that the majority of our timber is old, with over 70% of it approaching terminal age, is that a concern for our long term water resilience?
- What is the value of dead timber, both fallen and standing? Does it have an impact on catchment hydrology?
- Does the economic imperative justify existing land use practices in both droughts, which are a regular fact of life, and abundant seasons?
- Is it ever justified to create uncovered or bare country through our land use when we know with certainty that future rains and water flows will create massive and uncontrollable erosive damage to uncovered country?
- Which side will generate more soil loss and erosion when it rains?
- On which side will water run off faster?
- What is the impact of soil loss on long term productivity? infiltration? pasture recovery? water residence/residence in our landscape?
- How much soil loss can be justified by droughts which, as we know, are a fact of life?
- What is the cumulative impact of such management practices and soil loss over decades and centuries?
- From which side of the fence would you rather drink the rainwater runoff?
- On which side will the run off water and groundwater be of higher quality?
- What is our individual and collective responsibility to those downstream and upstream?
- What are the downstream/down catchment impacts of these different land uses?
- Can productivity be maintained or improved in ways which also improves the functionality of rainfall which falls in our catchment ?

- What will be acceptable in our future if we want future generations to live in this generous valley as we have done?
- Recognising the vagaries of weather and our individual imperatives to remain profitable, what active and passive management practices can generate a preferred water retention/resilience outcome?
- Can we develop a set of principles which guide our approach towards managing our water and our soils moving forward?

WALLABADAH CREEK CATCHMENT COMMUNITY

WALLABADAH CREEK CATCHMENT COMMUNITY - DROUGHT RESILIENCE AND WATER SECURITY PROJECT

Introduction

In terms of its ability to rejuvenate/sustain its water (and hence drought) resilience in a volatile climate environment, the Wallabadah Creek Catchment (WCC) community is blessed relative to most of the rest of the planet.

Annual rainfall, assessed over 150 years, averages between 700 and 800 mm (enough to comfortably fill Chaffey Dam to overflowing every year from within the Wallabadah Creek catchment alone), and elevation (500 to 1400 m) ensuring a relatively temperate climate, cool enough to sleep soundly at night for most of the year, and fertile basalt clays and alluvial soils which support a variety of commercial grazing and farming operations and activities.

As assessed by DPI, the carrying capacity of this country is 3 to 5 plus DSE or dry sheep equivalent per acre, being an assessment of the productivity of our country, which would be the envy of many. It has successfully supported many successful agricultural activities since the early 1800s, predominantly wool sheep originally, and latterly also cattle, mixed cropping, timber among other agricultural activities.

The community in the Wallabadah Creek Catchment, which includes the village of Wallabadah, and adjacent catchments backing into the Great Dividing Range, shares a common history. Starting from the agricultural aggregation of over 90K acres in the 1800s to the 34 different agricultural and other land holdings it is today.

Starting where the Quirindi Creek exits the WCC at Flora's Pond and connected initially by Quirindi Road into Wallabadah, it is then accessed via a road which ends under the brow of Mt Crawney in the high catchment near the watershed. This road connects the catchment with the village of Wallabadah, which has provided education, farm merchandise, vehicle and machinery services and communion throughout our history.

The Wallabadah village water supply is sourced from the alluvial and connected aquifers that run out of the WCC, and the village has traditionally supplied much of the local agricultural workforce in the surrounding catchments. There is a fundamental community connection.

In short, enviable circumstances for a functional community with a solid agricultural economy and a fertile environment to protect its water resilience.

Despite these apparent advantages this has not been the case….

- the Wallabadah village alluvial bore field ran dry in the 1990s and data collected by the Liverpool Plains Shire Council since the 1980s shows continuing deterioration of creek flow rates and the water levels in the replacement deeper village borefield since then (including a precipitous drop in the 2015-2019 drought)
- the quality of village water deteriorated visibly in taste, and some residents who had backyard bores mentioned they had the smell of sewerage from time to time. All said the quantity of their flows had diminished over time in spite of wet periods like the current.
- a substantial number of alluvial bores supporting agricultural operations in the WCCC ran dry (or alarmingly close) in 2018-19 for the first time in living memory, and there were sharp drops in water levels in some deep rock bores. Dr Robert Banks made the point in his work on the WCC that over 90% of bores within the catchment were in the alluvials
- older residents of the village and the catchment recall
    - streams that "ran for 9 months of the year, and now don't run at all now"
    - a time when "13 or so individual springs drove flows in the main creek, you would be lucky to see a couple now over rock faults"
    - memories of "thunderstorm waters from the high Catchment which used to take a week or so to get to Quirindi [24 kms from the watershed] and now they take 4 hours" (this is supported by LPSC flow rate data) and
    - school days when "we used to do swimming lessons under the bridge…it was too deep to stand for 100 m… and now you would give yourself gravel rash if tried"
    - and according to the octogenarians there was a permanent swimming hole in Water Gully and the first time the village flooded was "in the 1950s".

Early 2021 images contrasting drought recovery within the Catchment

Setting Our Objectives – 2018/early 2019

A tipping point occurred in 2018/19 after 3 years of well below average rainfall, when a substantial number of catchment landholders were forced to start carrying water and/or taking other drastic actions to secure stock and drinking water. Community conversations in the Wallabadah General Store on a Saturday morning became focused on whether we could regenerate and maintain a more secure and resilient resource of water into the future – both surface and subterranean – and how that might be done.

Of course, it was and remains more complicated than that, because WCCC members, other farmers and the village residents affected by upstream landuse all have their own reality, different views and land use imperatives/ practices – born of tradition, education and many other factors. As the old truism goes, community is complicated.

However, **the objective that essentially everyone could agree was the fundamental value of increasing water resilience for our community**, and so WCCC was born.

In addition to the primary water resilience objective of WCCC, there **are a number of guiding principles** which were considered to progress the fundamental goal.

These included:

- the catchment and surrounding community need to be and remain commercially viable, otherwise the primary principle cannot be achieved - accordingly, increasing or at least maintaining landholder and general commercial productivity is a key criterion in all actions and decisions.
- members run different operations in different ways and with different objectives, and their individual operating decisions and choices are paramount and their adherence to catchment principles is voluntary
- individual and collective actions and decisions on water management impact other members of the catchment and in particular downstream and upstream water users
- given water affects us all, we can achieve better water outcomes for all with a whole of catchment approach operating in a collaborative manner
- a properly informed knowledge base across the members (e.g., the context of catchment geology, hydrology), and ultimately the community, is important to determining actions and guiding decisions aimed at promoting catchment water resilience both at an individual and collective level
- evidence based decision making is a critical tool - without benchmarking (objectives set against historical, regional or other measure), monitoring, evaluation and feedback, there can be only limited and temporary achievement of the primary objective, at both individual and catchment scales.

WALLABADAH CREEK CATCHMENT COMMUNITY

WCCC - Formation, Structure, Governance and Basic Facts

The organisation Wallabadah Creek Catchment Community (WCCC) is an unincorporated subcommittee of Tamworth Regional Landcare (TRLA), representing member landholders in the WCC including several in the adjacent Jacob & Joseph Creek and Kangaroo catchments.

WCCC has no formal membership requirements or obligations, except to advise its members that they will not be covered by TRLA insurances where they are not individually paid up members of the organisation. Membership is entirely voluntary and inclusive of landholders and land managers within the various catchments surrounding Wallabadah.

The coordination of WCCC is done through a voluntary committee of 3 members and is assisted from time to time by our local Landcare Coordinators, Ali Chaffey, Penny Milson, Lisa Bates and Lana Andrews. It is intended that membership of the committee will rotate over time.

TRLA provides auspicing, banking and financial reporting services for WCCC.

WCCC recognizes stakeholders such National Parks & Wildlife Service (NPWS) (who manage 2000 ha within the Catchment), the village of Wallabadah and the Liverpool Plains Shire Council (LPSC), who operate in or rely on the catchment, as key partners.

Around 400 people vote in the village of Wallabadah, and the total community population is estimated at around 650 residents.

The land area covered by WCC is host to around 30,000 sheep, primarily for wool growing and approximately 4000 cattle. These numbers are lower than capacity as a result of market conditions and the drought ending in 2019/20.

Cattle grazing has increased over the last 50 years as the consequence of the economics of wool and the impact of wild dogs on sheep/lambs in the high catchment. There is some fodder cropping on the alluvial flats and until late last century timber was logged in the Forestry Lease (now the Wallabadah Nature Reserve).

***WCC FACT** - Based on the average rainfall – 750 mm - across the catchment, the water balance indicates that less than 2% of water which falls annually in the catchment is required to water all the stock, agricultural landholdings and residents of the catchment including the village of Wallabadah and surrounds. How can we run out of water? What if we targeted retention of 5 – 10% of annual rainfall? Even in the driest recorded rainfall year in 160 years 6% retention would be more than double our basic annual catchment water reauirement.*

The up catchment WCC, to the E of the New England Highway, is the sole source of Wallabadah village drinking water. It covers in excess of 17000 ha within its watershed bounded on the eastern or top side by the Great Diving Range at Mt Crawney.

The entire WCC to its exit point at Flora's Ponds covers around 30000 ha (30 km2) bounded by 78 km of watershed.

The Journey Starts – Gathering the Facts and Understanding the Wallabadah Creek Catchment – 2018/2020

Since late 2018, with the objective of better understanding our country, its hydrology and the interrelationships, a number of projects and trial/demonstration have been conceived, planned and completed with funding sourced through NWLLS and matched (and in some cases funded) by farmer members and/or other stakeholders.

Direct funding/investment from NSW Government is estimated at in excess of $300K to date, with contributions from stakeholders and volunteers in planning, labor, materials and machinery estimated to be at least $ for $, and probably more like 1.5:1 if one includes the contributions of LPSC, DPI Water and University of New England. *This would make the total estimated investment in catchment water resilience in the vicinity of $600-$700K.*

The contributing stakeholders included principally DPI Water and specific technical support personnel from DPI, NWLLS in kind expert technical support, LLS Feral Animal Control, Tamworth Regional Landcare and the University of New England, in addition to the soil, water, pasture and stock management expertise retained by WCCC from time to time who went well beyond the commercial terms of their relationships.

As indicated, all these activities are guided by an evidence based approach, which is characterized and identified in this section as follows:

External expert technical input /General	TI
Local input/Specific to WCCC	LI
Expert technical analysis/Specific	TA
Local management/analysis	LM
Data gathering	D
Data analysis/reporting/presentation	DA
Trial/demonstration site	TS
Monitoring/Feedback	M

Project Activities in the Period Since 2019

Include without limitation:

- Review and advice on rehabilitation of Water Gully at Jobys Hill reach and review of water storage options (TI, LM, TS, D, M)
- Presentation on catchment hydrology and associated geology by Martin O'Rourke, DPI (TI)
- Presentation at benchtop level by Dr Robert Banks on catchment soils and geological imperatives(TI, TA)
- Measurement of bores levels and bore sampling involving 17 member landholdings and 34 bores (LI)
- 18 soil samples off 16 landholdings collected by the farmers or managers (TI)
- Comprehensive analysis, reporting and presentation of this initial soil and water data by EastWest Online (TA, DA, M)
- Mapping, analysis, reporting and presentation of that work product by Dr Robert Banks seeking to understand the nature of water use and water sources (both deep and shallow aquifers) (TA, DA)
- 2 soil pits in the middle catchment – one into country under subtropicals and one under unimproved native pasture – presented at an open field event by Dr Robert Banks (TI, DI, LM)
- Several field visits to the DPI Research Centre in Calala on presentations targeting pasture management involving particular improved pastures [comparing subtropicals v lucerne] (TI, TA)
- Field visit to Tallawang, Willow Tree to see ongoing water and associated property management program (TI, TS)
- Visit to the property of Tim and Susan Wright for a presentation on their regenerative merino wool operation (TI, TS)
- Numerous presentations (some open and some members only and some with field content) as follows:
    - David Carr, Stringybark – native pasture identification (TI, TS)
    - David Carr, Stringybark – considering biodiversity offsets as a revenue broadening activity (TI, TA)
    - Aryan Wilkie – the basics of monetizing carbon as a potential income stream (TI, TA)
- Soil sampling at both 0 to 15 cms (28 samples) and 15 to 30 cms(4 samples) covering 15 landholdings by AgCon Agricultural Consulting (Agcon) and analysis (D, LM, DA)
- Preparation and presentation to interested members of a report on management of catchment soils including recommendations at an individual landholding and catchment scale by Peter McKenzie, the principal of Agcon and his team (TI, TA)
- 2 hour field visits by Dr Judi Earl to 11 member farms to speak with farmers about pasture management (TA, LM, LI)

- Presentation by Dr Earl of her findings and recommendations at both individual landholding and catchment scale to interested members (TA)
- Supplementary reports by each Dr Earl and Agon to address specific questions concerning prioritization and low chemical management implications (TA, LI, LM)
- The consultation and development with the support of DPI, NWLLS, Invasives, NPWS and numerous other stakeholders of a feasibility study for a Feral Barrier Fence with 3 conceptual alignments, consulted with the community through the Chilcott's Creek Wild Dog Group (TI, TA, LM)
- Design, consultation and completion of 8 structures and associated riparian exclusion fencing over 4 separate landholdings over a 7 km reach of Back Creek. The concept design report prioritized up to 20 structures for further works on Back Creek. (D, TA, TI, LM, TS)
- An analysis of the deeply incised and deteriorating Water Gully catchment and various water/irrigation options for the Jobys Hill property was performed by Brad Davies adaptiv including the preparation and costing of a project to rehabilitate the Joby's Hill and Racecourse reaches (TA, LI)
- In partnership between NWLLS and Joby's Hill, a demonstration site including 3 major weirs and riparian revegetation was built at the Joby's Hill reach by adaptiv.(TA, LI, TS, D)
- Subsequent maintenance and modification of these structures by adapativ, as well as 4 more structures involving readily available materials, occurred in this reach in mid-2020. (LM, D, TS)
- Open day at Water Gully Racecourse and Joby's Hill reaches attended by Wallabadah community members ((TS, DA)

Water Gully Jobys Hill reach Structure 2 – L-October 2019, R-March 2021

- Using the catchment plan developed by adaptiv, and capacity developed in previous works in Water Gully Jobys reach, the Wallabadah Racecourse Trust raised funds to construct a further 5 pioneering prefabricated steel structures were constructed to repair the badly eroded Racecourse reach in mid-2021.(TA, LI, LM,D, M, TS)
- In partnership with NWLLS, minor maintenance works required as the result of heavy rains in recent months carried out to add necessary rock to abutments in the Water Gully Jobys and Racecourse reaches. .(TA, LI, LM,D, M)
- A review and proposed plan for Water Gully through the village, originally prepared by adaptiv as the basis for a comprehensive flood flow study by LPSC, was used to secure NWLLS funding for a joint project with Wallabadah Community Association (WCA), LPSC and Crown Lands Tamworth. Works in that reach from the NE Highway to the Quirindi Creek will commence in May 2022, and will see a stretch of over 7 kms of the Water Gully drainage, serving more than half the catchment, repaired to a point of sustainable stability. The initial investment of NWLLS has been leveraged by an estimated further $50 K funding from LPSC and Crown Lands, (TS, LM, TI, TA).
- Community consultation process and consultation with key external stakeholders regarding the above project which will initially include structures on 4 separate landholdings (LM)
- Preparation of a Preliminary Hydrological and Water Management Review Of the Water Creek Catchment from Source to Quirindi Creek by Brad Davies of adaptiv Management as the basis for ongoing project works in the catchment (TA, TI, LM)
- Water resilience/management projects including works on 6 separate landholdings in the WCC, funded by NWLLS, overseen by the WCCC during the period 2020/21. These are further described in the next section of this Report (TA, LM, DS)
- Collaboration and the formation of an informal MOU with DPIE Water (DPIEW) involving preliminary analysis by DPIEW to identify bores for monitoring and ultimately modelling underground water follows in the catchment (TI, TA, LM, M)
- Working collaboration with University of New England and DPIEW to design, install and monitor 5 to 8 bores in WCC to analyze the impacts of funded works (TA, LM, TS,M)
- Developing and working in a UNE led consortia (involving variously LPSC, Tamworth Regional Council, Tamworth Regional Landcare Association, NPWS, DPIW and other community land management groups) to submit substantial project funding applications to the National Water Grid and the Murray Darling Basin Authority.
- It is generally acknowledged that demonstration/trial sites have employed and proven concept for a range of simple technologies and materials readily available to and deployable by landholders in the ordinary course of their operations, and highly cost effective relative to traditional water management measures such as dams and contour banks.

WALLABADAH CREEK CATCHMENT COMMUNITY

WCCC Summary Stat Sheet

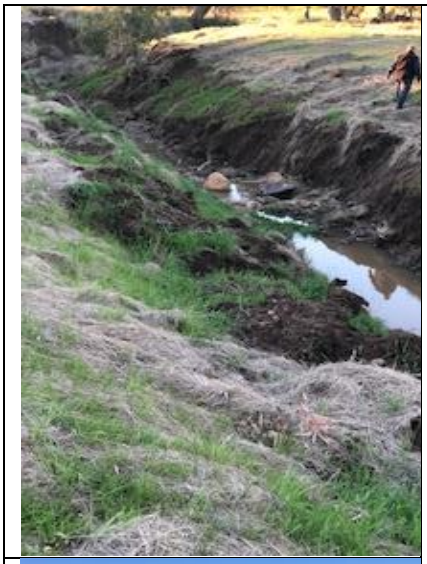
Timeframe	3 years – 2019-2022
External Investment (primarily NWLLS)	>$300K
Other complimentary investment contributions including members/UNE/Crown/DPIW/LPSC	>$400K
Total investment in water security mobilized	$700 K - $800K
Landholder/landholding involvement/analysis	17 farms – 20/30000 km2
Total community and regional involvement	Est 200 persons
Individual projects completed/planned	13
Regional collaborations/partnerships	5

Activities Across the Projects and the Period included:

Comprehensive soil testing and analysis over 17 landholdings

Grass cover testing and analysis

Heritage surveys of prospective works sites

	Trialing native grass hay rolls on scalded and open ground
	Extensive hydromorphological field work to select target sites for drainage remediation demonstration sites
	Consultation and preparation of a Feral Barrier Feasibility Fence using Catchment and a range of other sources and data across NSW and Queensland

What Do We Know About the WCC So Far?

Some of the key additional information we now know about the natural characteristics of the Wallabadah Creek Catchment are as follows:

- Wallabadah Creek Catchment is a discrete western draining folded rock catchment with its watershed on the Great Dividing Range, comprising draining basalt clays on the ridges and alluvials in the valley floors.
- At European settlement, the valleys were alluvial and rock fill. The current excised drainages did not exist. These valleys drained with ephemeral streams (chains of ponds) through perched flood plains, many of which still exist (mostly disconnected from flows).
- As the consequence of land usage post 1800, the original floodplains have been first elevated, and more latterly, significantly eroded with incised erosion drainages, some of which formed permanent drainages – Quirindi Creek, Basin Creek and Back Creek prime among them. This has led to continuous stream bed lowering and ongoing instability and deterioration in drainages particularly the main Quirindi Creek and tributaries.
- This deterioration continues unabated, as illustrated by moving rock from the beds of drainages which appeared on all flood crossings after the rains in November 2021. Whilst these rock depositions have been greater in the recent past, the reality that these most recent depositions occurred on low flows illustrates the point that deeper channels create more destructive velocity for the same amount of flow, exacerbates the bed lowering and increases instability.

The following photo shows the amount of gravel which was washed out of the upstream bed at the Back Creek crossing on Wallabadah Creek Road – estimated on a conservative basis to be several thousand tonnes. Like washes occurred on every crossing in the catchment and through the Wallabadah village reach.

One landholder noted, "it was not even a really big flow," and another, that "it was hard to sleep with the deafening sound of gravel moving down the creek."

More gravel being washed out of the bed, deeper beds, more velocity for the same amount of water, washing even more gravel and causing more downstream damage, the

start of a vicious cycle. Following the immutable laws of gravity, water including groundwater travels to the lowest point, which is the ever lowering creek bed and then out of our catchment. In doing so it lowers the water table even further and away from the roots of sheoaks and plants on the already struggling floodplains.

Without recreating stability in and across the system, this cycle will likely become increasingly vicious, the impacts downstream greater, the pace of drainage deterioration and the exit of water in the form of surface flows from our catchment increasingly rapid.

It can only lead to one outcome – less water, less infiltration, less groundwater aquifers, less rainwater stored in our soils – being less available less resilient and lower quality water for the entire catchment community and our neighbors.

It is worth noting that the LPSC "fix" for the Back Creek crossing in December 2021 included piling up the gravel to constrain and deepen the channel, which illustrates how little we understand about it a community!

- There are alluvial and deep rock aquifers within the catchment with significant interconnection.
- These alluvial aquifers are host to over 90% of the water bores servicing catchment agriculture.
- Applying Soil Conservation run-off coefficients developed in the 1960s and 70s for this type of country, we can calculate conservatively that during calendar year 2020 (when the drought broke) between 1.5 and 3.0 million tonnes of the most valuable topsoil – P rich top 1 to 2 cm - from the WCCC was carried way through drainages.
- It is likely that a similar amount of topsoil runoff occurred in 2021 year as above average rainfall fell on country which was still repairing itself with less than 75% groundcover in many areas.
- The WCC soils, mineral rich low sulphur basaltic kraznezome clays, drain rapidly providing a relatively low window between a saturated soil profile after rain and plant wilting point. Whilst highly fertile, they are generally **inappropriate for soil dams as a means of medium and long term water storage**.
- Why discrete? Discrete because the catchment does not have any subterranean aquifers which enter or supplement rainwater filled aquifers, nor does it have any subterranean leakages.
- Discrete because the **only water that is available for both WCC surface and underground aquifers – the only water over which WCCC members can control - is that rain which falls within the 78 km boundary of the watershed**.
- Discrete because all catchment waters including subterranean waters exits the catchment over a sandstone fault at Flora's Ponds some 6 kms west of the village of Wallabadah.
- Given its folded rock nature, the most likely exit points for underground leakages would be north or south but given the visible geology, this is a highly unlikely possibly.

- There is no scientific or commonsense way in which downstream irrigators on the Liverpool Plains or elsewhere can lower the WCC water table. The respective Liverpool Plains and WCC water tables do not connect in this manner, and for the extraction argument to be successful would require WCC water going up slope in defiance of the laws of gravity.
- Despite what we read and are told about increasing climate volatility, or possibly because of it, rains which fall - waters WCCC members can influence - remain significant. In 2018, which was the lowest rain year of the worst drought in recorded history, over 300 mm of rain fell in the Catchment - enough water to fill Chaffey Dam to half full. In 2020, we would have filled 1.5 Chaffey Dams and more than 20% of Sydney Harbor, and 2021 was a larger rain year than 2020.r to 2020.
- A water balance applied to the gross water which falls in the WCCC shows that water needs for all users – landholders, stock and village residents – are less than 2% of the average rainfall in our catchment and, based on available records, would never have exceeded 4% of actual annual rainfall.

Of themselves, these facts ask the obvious questions – why do we even have a water security problem in the catchment? How can our underground aquifers go dry in the way that they did in the last drought? Why are the hydrology changes described by our older residents taking place? How could the village water supply have been visibly deteriorating for the last 35 years, which period is limited only by available records? How do/can we increase the residence time of rainwater that falls in our catchment? How do/can we increase infiltration at the highest point where rain falls? Or will the deterioration reverse itself? Can it be reversed? How quickly can it be reversed? What happens when the next drought comes around in 7 to 10 years?

The questions for WCCC members and stakeholders are, what can we as individuals and as a community do if anything about it? Do we believe the trends we are seeing in the statistics and on our own landholdings? How do we take responsibility as landholders and as a catchment, recognising that what we do as individuals, the way we operate, the way in which we choose to use our land has a direct and indirect impact – in both quantity and quality - on water on which our operations rely, our neighbors upstream and downstream, our village community and the future viability of our valley valley relies.

This is where the story of WCCC's involvement with its own broader community and NWLLS, and a broad cross section of their officers comes in, as well as advice from and partnerships with the likes of DPIE Water, University of New England, TRLA, Peter McKenzie/Agcon, Dr Robert Banks, Judi Earl, Brad Davies, EastWest Online and David Carr. All these people and organisations provided subject matter advice and clear eyes in the process of developing sufficient knowledge and confidence to start answering these questions.

The Journey Towards Greater Knowledge and Empowerment

Many of these facts and circumstances about water and hydrology generally in the WCC were not generally understand and, in many cases, accepted by catchment members when WCCC was formed and sought the assistance and funding support from NWLLS in 2018/2109 and then again in 2021.

WCCC in its formation recognized a number of fundamentals:

1. The primary objective of WCCC, to which all others are subservient, is the regeneration and maintenance of water security particularly aquifers for the catchment, its community (including the village of Wallabadah) and livestock
2. Water resilience/management is both an individual and a community responsibility.
3. Each landholder member has unique knowledge of and imperatives (including economic imperatives) for their country and operations, which may determine any actions or timeframe they apply to catchment water resilience objectives.

Within this framework, fresh eyes, expert subject matter advice, knowledge and out of region experience were sought with these funds to interrogate the traditional or accepted paradigms, in tandem with the deep knowledge and expertise in country, in many cases generational, residing in the catchment landowners.

Funds were also sought and expended on a broad range of water resilience demonstration and related projects by a number of individual landholders as a part of the WCCC initiative. Transparency and persuasion were pursued through establishing direct communication channels and a social media platform. The underlying principle was that everyone needed to be heard and ideas publicly road tested. *As an aside, those who live in urban environments might assume that internet access is universal, as is mobile telephone coverage. In the WCCC case, access of that nature might be available to <50% of members <50% of the time. Communication in rural Australia continues to be an issue.*

Some of the views at the outset that were predicating landholder thinking and preventing the taking of action (or taking different action than that which had been taken traditionally) on water management included views that:

- It is not really happening, our creeks have always been like this
- Climate change is impacting on our water, and we cannot do much about that
- I am not responsible for the village water supply or anybody else's; they are, and the Council is

- These subterranean waters come into the Catchment from as far away as the Artesian Basin, PNG and even the Himalayan snow melt, and they were being dried up by climate change
- the WCC operates like a bath, and irrigators on the Liverpool Plains are essentially removing the plug and taking our water
- you have to get all trees (carbon) live and, particularly, dead out of all of the drainages, they wreck your fences and cause flooding because the water cannot get away quick enough
- native timber and particularly dead timber have no production, water security or other value and should be cleared, burnt or chopped for firewood
- dams are the cheapest, quickest and best way of retaining water in the landscape and watering stock
- what can I do anyway, problem's too big and it has taken 180 years to create

Achieving consensual answers to these views, and others, requires time and evidence. It requires trial and error. It requires monitoring and feedback. It requires pragmatism. It requires a recognition of the need of individual landholders to increase productivity. WCCC is not there yet by a long shot, and nor is the community it serves of one mind, but this is the journey upon which it has embarked. Given the stakes for the entire community, which is reliant on the health of the WCC, it is a journey worth taking.

Nature assisting in regeneration. Rough Barked Apple falling upstream to create the perfect natural weir in Water Gully

WALLABADAH CREEK CATCHMENT COMMUNITY

PROJECTS WITHIN THE WALLABADAH CREEK CATCHMENT 2021 – SUMMARY AND LEARNINGS

This summary is in 3 parts as follows:

1. General strategies considered by WCCC and members to improve catchment water security and drought resilience
2. Final reports from individual landholders regarding their projects
3. Final report for the WCCC demonstration creek remediation projects in Back Creek.

1. Identification and Prioritization of Catchment Water Security and Drought Resilience Strategies

Since its inception in 2019 at the end of a severe drought, WCCC's main focus has been to find strategies for improving water security and drought resilience in our catchment. As indicated previously, we have sought drought management advice from a range of NSW Government farm extension and subject matters experts in the areas of catchment hydrogeology, soil health, drainage management, pasture and general farm management. This included direct consultation with and visits to, as well as soil and bore sampling and analysis from all but 2 of the separate landholders/landholdings in the WCC, one of which was the National Park.

These consultations recognised the unique nature of landholdings, operations, expertise and local knowledge. Two priority strategies emerged as a consequence of these strategies within a whole of catchment approach.

The overall approach accepted that all land use has an impact downstream/down catchment and upstream and that decisions must consider the broader WCCC community including the village of Wallabadah. Ideally actions concerning water management would be collaborative, but such strategies would need to be demonstrated, proven and in some cases accepted over time. It is an existential reality that impacts which had taken 180 years to manifest are not solvable overnight or even over 2, 5 or 20 years. It is also a reality that not all catchment members will agree on the best way forward all the time.

This has led to the concept of a set of principles or social compact, which could be co-drafted and endorsed by catchment members (and future members of the catchment), to guide the future approach to creating and sustaining water security and improving drought resilience. A consultation draft drawn from the work and experience of members to date is set in the concluding section of this Report. This is intended to guide/frame further consultation and co-

drafting of these principles, with a view to having a universally acceptable position the end of 2022.

Through these consultations two main management strategies emerged as priorities for improving drought water security within the catchment. Both strategies can be used concurrently, and they are complementary. Both are relatively low cost and can be applied at an individual landholding or catchment scale, the latter being preferred.

The primary strategy for a healthy water is pasture or grazing management which maintains at least 75% (LLS) or 100% pasture cover at all times to maximise water infiltration at source and minimise erosive run off of rainwater. Dr Judi Earl adds an addition target on continuous 100% groundcover by targeting 2000-2500 kg of dry matter per hectare for maximum grazing productivity. Given pasture is our most abundant catchment resource (as it should be in a grazing environment), the single most effective management action we can take to improve catchment hydration is to manage and maintain stock and pastures to achieve these ground coverage ratios.

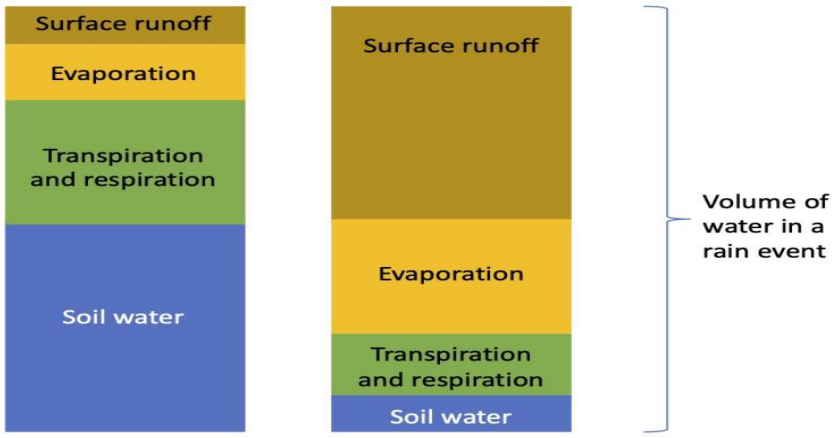
Stream or drainage remediation and rehydration is a secondary but critical strategy, which acknowledges existing erosion and instability in the catchment hydrology – incised gullies, bed lowering and widening and disconnections between aquifers and their floodplains. It endeavours to provide intermediate stability – slowing, spreading and stopping water flows – so the catchment's natural processes can re-establish themselves.

The principle of pasture cover management, which has many current pseudonyms but a long history including "intensive grazing" in this catchment, is to manage grazing to maximise pasture health, rather than by traditional set stocking rates which can result in over grazing during dry times.

Pasture Management - The principle follows that overgrazing leads to stunted pastures and root growth and impoverishes soils. Healthy pastures grow deeper more abundant root networks which foster healthy soils. Healthy pastures (defined by LLS as 75% and Dr Earl as 100%) with complementary healthy root system and soil will not only minimise run off and enable permit the majority of rainfall to infiltrate at source but they will:

- Maximise soil water retention capacity and residence time
- enable slow percolation of rainfall through to groundwater aquifers.

The diagrams below illustrate the impact of these conditions..



Healthy Soil **Dysfunctional Soil**

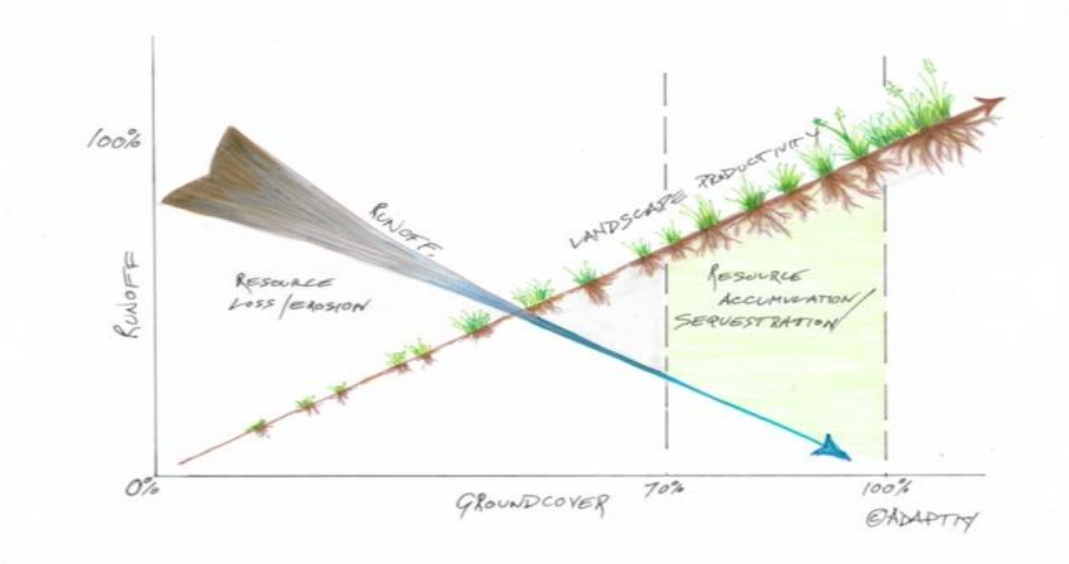
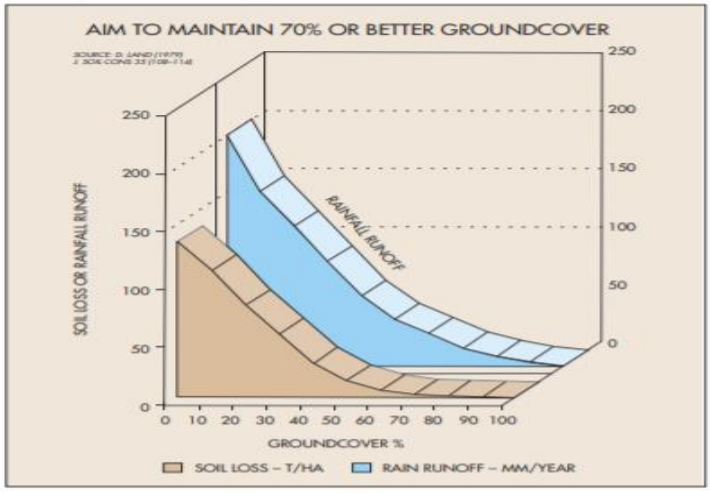


Figure 1. Effect of groundcover on the amount of soil loss and water run-off from pastures.
(Adapted from Lang 1979)



Healthy pastures and coverage ratios do not come at the cost of productivity. As Dr Earl illustrated they are entirely consistent with improved grazing productivity, and the additional benefits of increasing soil carbon levels (which have a potential commercial value in their own right). .

Streams Remediation - The principle is to slow and spread water flowing in drainages after rain events to minimise further bed lowering and widening and bank erosion by recreating stability.

Relatively low cost low tech log, rock or steel weirs are typically placed in flow channels to catch sediment upstream, lifting the bed level and creating ponds and riffles to slow down flows. Creating moist sediment provides fertile ground for riverine vegetation which re-establishes long term stability and further slows flows. Raising the bed levels also raises the water table, facilitating the storage of water within the landscape by rehydrating the adjacent alluvial creek flats.

Fencing the creek to control grazing facilitates the regrowth of riverine vegetation - e.g. reeds and river oaks – and is important for increasing the efficacy of in stream works. Where feasible, fencing should accompany in stream works. In addition, fencing can also provide a grazing adjunct as a "standing haystack."

Strategic use of a subsurface geotextile membrane across a drainage in suitable locations can slow/catch subsurface flows and create subsurface water pools for slow release in dry times.

The effect of these strategies is to minimise storm runoff and further erosion, which lowers the water table, by holding moisture in the soil and flood plains, for slow release of flows during prolonged dry spells.

2. Member Projects

In 2020/22, LLS funded 6 individual projects on 9 landholdings within the WCCC footprint, which are all representative of one or both sustainable strategies, as follows::

- The Oaks
- Wilgabah
- Temi
- Redlands
- Thurles, Crow Trap Farm and The Raven
- Jobys Hill
- Wallabadah Racecourse Reserve

The Oaks

The owners subdivided a large paddock for strategic grazing.

A solar powered water pump, pipework, tank and drinking troughs have been installed to provide water to previously unwatered country, and make stock utilize country more efficiently.

Fencing has been updated with electric fencing for more flexible control of grazing.

Subtropical pasture species have been sown for better water infiltration and reduced wind and water erosion.

For creek remediation, young trees and reeds have been sown in the main creek area. The new plantings are growing well in the favourable seasonal conditions.

Status – project complete except for ongoing maintenance. Benefits being realised

.L-Photo of subtropical pasture species, R-subdivision fencing to further control grazing in high catch

Wilgabah

The owners subdivided their alluvial creek grazing flats with additional fencing, water piping and troughs to create additional paddocks for controlled grazing.

They also fenced off their higher rougher mountain country (some 700 acres) which has high Indigenous heritage and biodiversity values.

Status – Project near complete with only final trough to be connected and top barb fitted.. The project is working as planned and benefits are being realised.

Temi

The owners have implemented 2 projects .

To facilitate improved grazing management, they have provided a solar water supply to remote paddocks previously without water during dry times to manage stock movement and grazing. The solar bore pump is installed with auto control, pumping to a remote tank and 4 troughs via 2km of 50mm poly pipe. The system is near complete and working manually.

Status - The funds have been spent and the project is delivering benefits as planned. The auto pump controls will shortly be commissioned to complete the project.

The second project is for stream remediation of 2 gullies which have been subject to erosion. These gullies have been fenced off and 250 trees planted.

The photo below shows part of the drainage regeneration planting areas.

Status – complete

Redlands

This project is a stream remediation and drainage erosion mitigation project.

A previous owner had diverted the creek which resulted in massive and unstable erosion of the adjacent cropping paddock. The creek line has now been moved back to its original bed which has slowed the flow, arrested the erosion problem and avoided further instability in the flood plain.

Status - Realising the planned benefits. To complete the planned works a causeway is to be built across the creek, this will be done as soon as flows from 2021/22 rains subside. LLS funds will be fully spent once the causeway is complete.

Thurles

The Thurles Partners implemented a project to facilitate regenerative grazing on the property.

A water system of 3.5km poly pipe, 2 tanks and 7 troughs were installed to 7 paddocks with unreliable or no water. Contour banks have also been rebuilt in the 7 paddocks to retain water within the paddocks and control stormwater erosion on the steep slopes. The previous banks installed in the 1950's was failing. Pasture herbage mass is now seasonally monitored to maintain healthy growth and stock regularly rotated between paddocks.

Status - LLS funds are fully spent on the project which is now complete. The project to transition to regenerative grazing is being progressively implemented on Thurles. Every indication is that this will be successful.

Wallabadah Racecourse Trust/Wallabadah Racecourse Reserve

This project is a downstream continuation of the successful drainage remediation and rehydration project immediately adjacent to the Racecourse at Jobys Hill. This demonstration project was completed in 2019 and has resulted in a significant lift in the water table in a localised bore on that property (+ 2m). It also demonstrated the use of a wide range of local materials.

Following is a photograph of the Racecourse drainage in the early 1900s, showing a shallow grassy-bottomed ephemeral drainage located on the edge of a floodplain in the background.

Massive and accelerating gully erosion and instability, created by upstream land use and flood mitigation works in the 1980s, were threatening racecourse structures adjacent to the drainage.

5 steel and rock weir structures were constructed over a reach of 800 m in April 2021 and fencing to control from getting into the drainage was completed in May 2021. Banks were planted out and phragmites planted in the drainage line. This exhausted LLS funds.

Significant flows in the 6 months to December saw the weirs working as planned and catching up to 20kt of upstream sediment. Minor repairs were completed in December to remedy abutments in accordance a maintenance plan which recognised that the original grant did not fund sufficient stone in the abutments.

Status – Subject to minor ongoing maintenance this project is now working successfully. Both this project (now 9 months old) and the upstream Jobys project (now nearly 3 y.o.) provided the impetus and learning for the downstream project in Water Gully in the village reach.

Photographs illustrating construction technology based on bore casing and the substantial trapping of sediment after late 2021 rains, just 4 months after completion.

3. **Back Creek Remediation** – *Thurles, Glen Idol, Crowtrap Farm, The Raven*

WCCC in collaboration with 4 landholders on Back Creek implemented a creek remediation and rehydration project at a number of selected works sites located on 3 of the properties. The in stream works and associated fencing were only limited by budget.

Back Creek was selected as it rises near the watershed and runs for some 8 kms through the higher steeper NE section of the catchment. It has a history of increasing instability and gravel movement, and was the last of the streams, with Basin Creek, to run clear after the drought. Gravel has been recorded covering the Wallabadah Creek Road crossing in previous floods to a

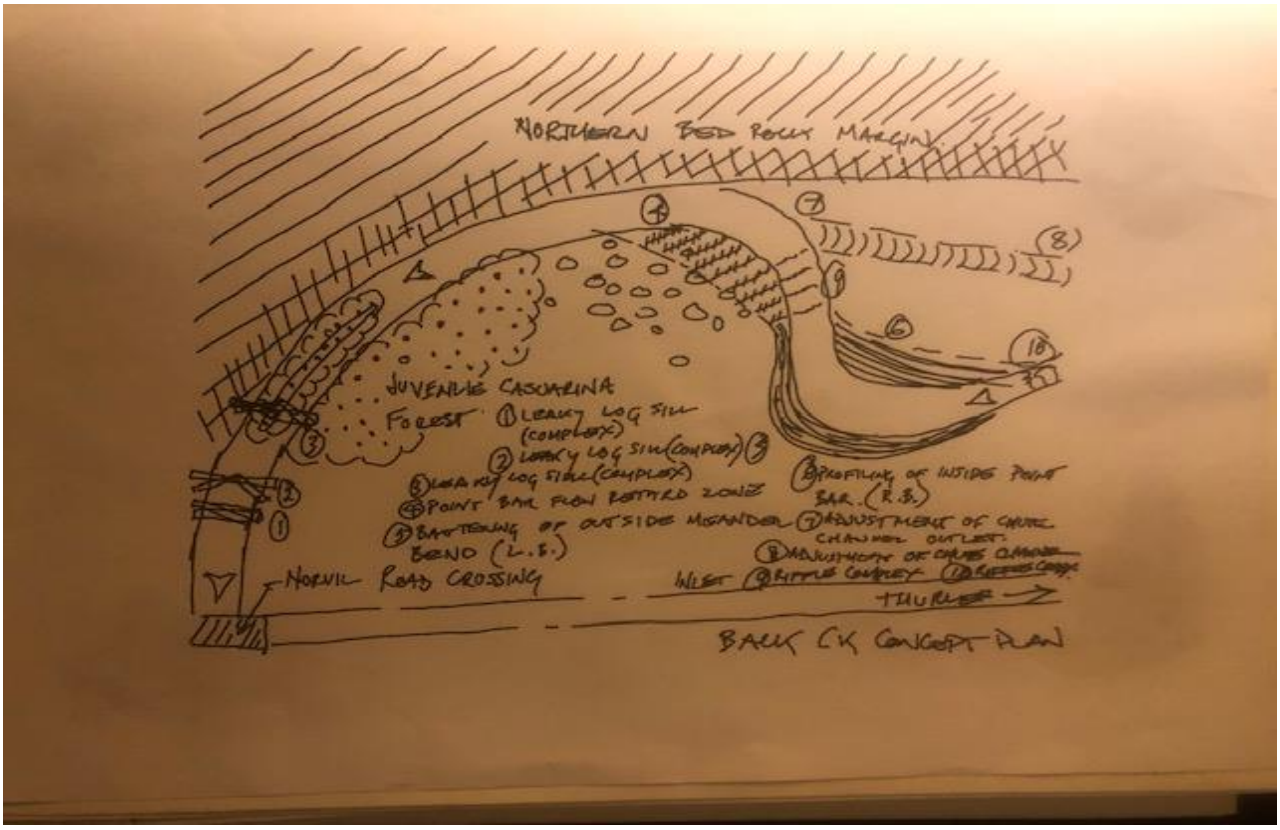
depth of over 1 m. It was selected as a high value visible demonstration site which could support a number of landholders and ultimately prove concept on an entire catchment which was similar to other in the catchment and could be replicated.

Back Creek and Wallabadah Creek, around the area where they join, have been the subject of remediation projects some 20 years ago, involving drainage fencing, tree plantings (principally River Oaks) in the riverine environment and some in stream works. 5 landholdings were involved at that time. The beneficial effects of these works are visible in situ, and particularly in a relative sense where fencing has been allowed to deteriorate or removed. The positive impacts are particularly evident in Google overhead images over time.

Initial consultations with the 5 holders of the landholdings through which Back Creek passes indicated that Basin Creek did not wish to participate in this project but that all other landholders were interested These included properties Glen Idol, Crow Trap Farm, Thurles and The Raven..

Two consultation reports were prepared to identify potential sites (based on landholder need and drainage value), preliminary design, priority sites and future sites. Some 20 sites were identified, and the project completed the first 3 works projects and associated fencing and regeneration planting on 3 landholdings with the existing budget.

Concept drawing underlying the log structures on Crow Trap Farm creek reach.



These can be summarised as follows:

Crow Trap Farm

These works built on previous works in this landholding and involved the installation of 2 sets of interlocking log weirs abutting a basalt bank. The log weirs have been successful in slowing/spreading stormflows and significantly raising the upstream beds. This has been achieved with substantial storm flows in late 2021, and the landholders would like to introduce additional structures up and down stream.

Colin Lorna have previously fenced off parts of this reach of Back Creek resulting in good vegetation regrowth, which has enabled them to now reintroduce controlled stock grazing in the riparian zones.

The Raven

This project involves 2 elements. The first being installation of subsurface geotextile membrane across the creek above the road causeway. The intention is to retain the subsurface flows (using the stability created by the existing concrete causeway and force them back into the adjacent floodplains to be used by pastures and stored.

This is a valuable site because of the 1000s of such concrete causeways across the region and the country and the minimal cost of installation. If this creates a beneficial impact in the riparian zone and floodplain upstream it will have wide application potential.

At this time, the geofabric membrane has yet to be evaluated due to the prevailing high rainfall conditions since installation. Its performance in dry times will be monitored.

The second addressed element the straightening and widening of the creek below the causeway and towards its junction with the main Wallabadah Creek, which has long suffered from the straightening effects of the LPSC and others moving gravel, washed from upstream onto the causeway in high flows, and piling it along the edges of the stream. This has created a channel the flood waters cannot escape and a newer straighter, deeper channel, and alienating it from its original channel.

The works involved battering/ armouring and increasing the sinuosity of the upstream banks to flatten the stream and then an open a log weir downstream to maintain upstream deposition. . Leonie and Ali have also fenced off this riparian zone and a further upstream riparian zone, to facilitate revegetation and general regrowth by controlling grazing, and replanting of both these sections is underway.

Whilst the weir structure fractured after high flood loads in late 2021, it and the armoured banks remain substantial in place and are still slowing flows and creating some deposition. More works and more budget on this structure and downstream would be valuable.

However, this objective is not being assisted by the treatment of gravel and rock washed downstream onto the culvert by the same rain, which has been pushed and stored by LPSC in the same fashion as previously, to create the bunded channel.

The 2 learnings demonstrated here are:

1. The high energy erosional capability of this steep upland creek and the speed at which bed lowering is occurring because, as one long-time resident said, "this was not a big flow event," and
2. The collaboration and partnership required with the LPSC and the manner in which they approach water management in the catchment.

Culvert clearing by LPSC illustrating downstream rockpiles and reinstatement of the original issue.

Thurles

This project involved the remediation of approximately 350m of the Back Creek system to protect the primary source of bore water on the Thurles property, which had run dry in 2018/19.

Works aimed at routing the creek back into its original and more stable channel, creating flood blocks to protect erosion hot spots in the new channels and lifting the creek generally over the project footprint to hold more water in the subsurface aquifers.

Project works included the installation of 3 sets of interlocking log weirs sequentially along the reach to raise the creek bed, remove erosion hotspots, create ponds, and riffle zones.

This reach of the creek has also been fenced off for stock exclusion. Around 80 new trees, shrubs, river oaks and reeds planted within the riparian zone. It is hoped the exclusion fencing will encourage many more reeds river oaks to naturally germinate in the stream bed to further slow the storm flows in this high energy creek.

To date, and in the face of the substantial flood flows in late 2021, the remediation work has been successful. The stream bed and water table within the reach has lifted by around 0.6m.

The project is complete pending more plantings. Some periodic maintenance of the remediation work will be needed until new creek vegetation grows, due to the high energy flood flows in this steep upland creek.

Status – the above Back Creek remediation projects are now complete, and funds exhausted.

Following are upstream and downstream photographs of the works operating successfully under flood conditions. Note the log weir in the downstream image directing flows into the original channel and the roughness created in the upstream view.

Collaborative Monitoring Project in Development

The informal collaboration between DPIE Water, University of New England and WCCC has previously been referred to in this Report. Discussions arising out of analysis, works and desk top studies have focused on monitoring, measurement and reporting of impacts, which aligns with WCCC principles.

DPIEW previously identified 4 – 5 existing bore sites within the catchment which would be suitable for water probes and monitoring.

However, a recent commitment by DPIEW to provide 5 and up to 8 probes in a collaboration with UNE, who will provide a postgraduate student to work with WCCC and landholders to install the probes and establish the monitoring regime, has allowed the parties to better define project targets and locations as follows:

1. Back Creek to Wallabadah Creek Demonstration Project – Monitoring Site 1

   LLS have committed a further $15K for remediation works in the back Creek system at Thurles. It is anticipated that 2-3 monitoring probes will be installed from the Thurles works to the Wallabadah Creek. 1-2 probes may be considered in the Wallabadah Creek above the junction with Back Creek.

2. Water Gully Jobys Hill to Quirindi Creek Demonstration Project – Monitoring Site 2

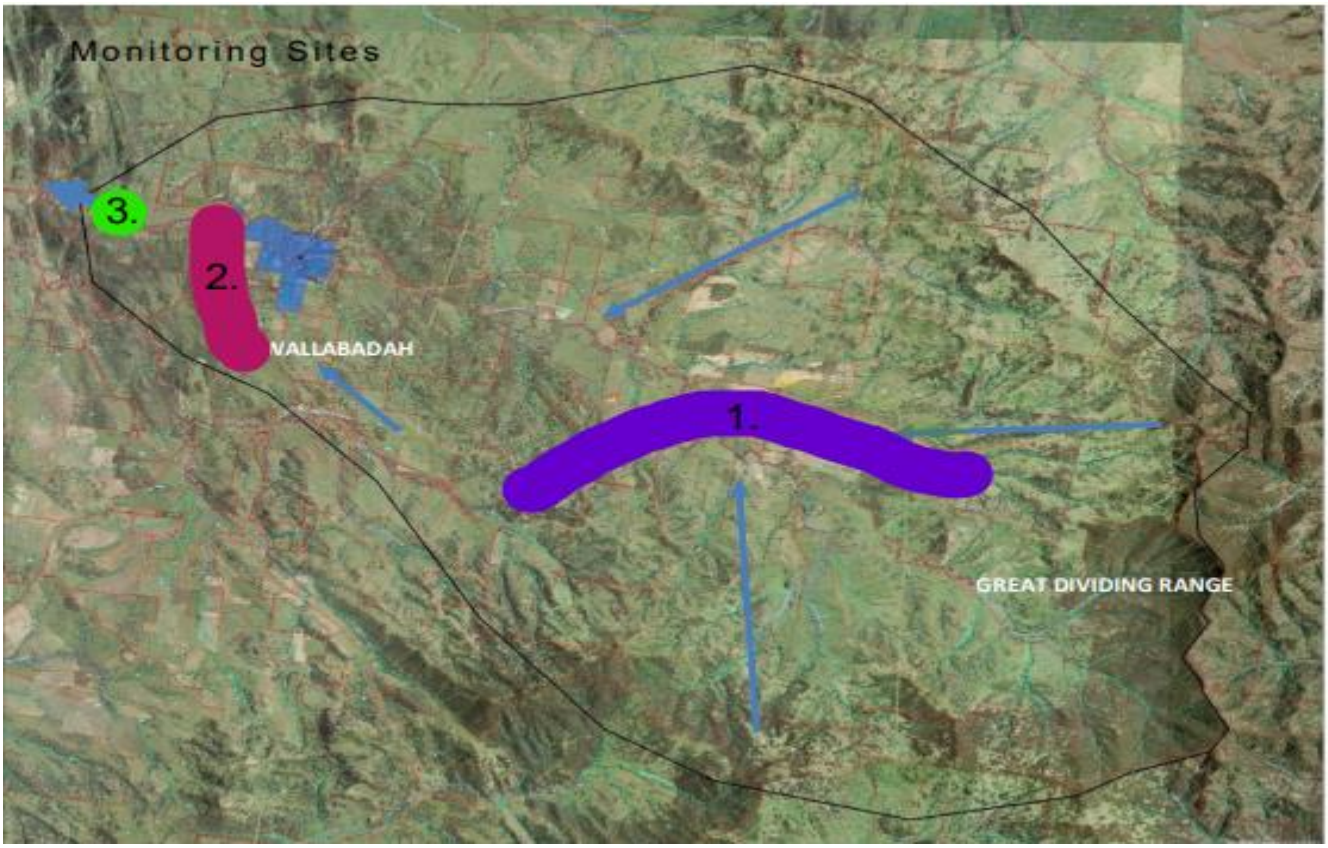
   In the context of previous works in Jobys Hill (which already appear to have raised groundwater levels), downstream works completed in 2021 in the Racecourse Reserve and ongoing works in the lower reach of Water Gully through Wallabadah village to the Quirindi Creek, locations for 2-3 probes may be identified and located from the Jobys Hill works to the Quirindi Creek

3. Quirindi Creek above Flora's Ponds Demonstration Site – Monitoring Site 3

   It is anticipated that a further project will be framed around stream remediation in the drainage network in and around the Quirindi Creek before it passes over the fault and exits the catchment at Flora's Ponds. This will provide locations for a further 1-2 water monitoring probes.

Not only will this monitoring feedback and analysis target the outcomes of stream remediation Demonstration Projects 1-3, but they will be targeted to providing monitoring/feedback for/on:

1. A Wallabadah Creek Catchment hydrology model (which ultimately may be applicable to 100s of other water shed catchments on the western fall of the Great Diving Range from Queensland to Victoria
2. Other water sustainability and drought resilience projects in the catchment



Further Potential Projects/Initiatives

WCCC is committed to broad community engagement beyond its own catchment, taking the view that water management is a universal issue which benefits all. To this end it has been an initiator of partnerships with UNE, DPIEW and other external stakeholders with an interest in water management as follows:

1. The establishment of a hub within UNE to support regional drought resilience and water management initiatives
2. Participation is consortium led by DPIEW and UNE for substantial grant funding to pursue National Water Grid, Murray Darling Basin and commonwealth Drought Resilience objectives. These grant funding initiatives remain outstanding.

WALLABADAH CREEK CATCHMENT COMMUNITY

WALLABADAH CATCHMENT COMMUNITY SOCIAL CONTRACT (Compact)

[to be consulted and co-drafted with interested members]

This Compact concerns access to, quantity, quality and resilience under all foreseeable climatic conditions of water – particularly drought conditions - within the watershed of the Wallabadah Creek sub-Catchment, from where it rises on the Great Dividing Range under Mt Crawney to where it exits into the broader Namoi catchment at Flora's Ponds (Catchment).

This Compact belongs to the landholders, businesses and individuals who live within the Catchment or rely directly on the Catchment water for their livelihood including external stakeholders without limitation such as the National Parks & Wildlife Service, Roads & Maintenance Service, NSW Common Lands and Liverpool Plains Shire Council who are direct landholders, land users or decision makers concerning land within the Catchment, and our successors in the Catchment (Community).

It is implicit in the Compact that our Catchment cannot continue in its current form to support the livelihoods of the Community in the way it does currently, nor those livelihoods of our children and successors in the Catchment, without improved drought resilience and water security. Without secure water, an agriculturally based community, like that which has existed for 180 years in this Catchment, cannot survive. It follows from this conclusion, that **although we may not be entirely certain how to proceed nor have consensus around approach to Catchment water management and water security, doing nothing is simply not an answer.**

Principles

Those who commit themselves to this Compact acknowledge/accept the following:

- Their commitments and the commitments of others are entirely voluntary
- The Compact neither creates nor implies any enforceable obligations
- The land use decisions of every member of the Community have a potential impact on other members of the Community, both up Catchment and down Catchment
- Climatic conditions impact on resilience and sustainability of water resources in the Catchment
- Our individual and collective land use decisions have the capacity to change and/or ameliorate the effects of climatic conditions on drought resilience and sustainability of water resources within the Catchment
- The current status of access to, quantity, quality and resilience of water within the Catchment has been affected by changes in the landscape caused by over 180 years of agricultural and residential land use

- Accordingly, if we choose to rectify them, these impacts of historical land use on Catchment water should not, cannot and will not be addressed in full in the short term or by the current Community, and have a generational period
- We value the Catchment and the livelihoods of all which it supports, and wish to ensure that our children and successors within the Catchment have at least the same opportunities
- Accordingly, we recognize action, individually and collectively, as the **only** option for the ongoing health and wellbeing of our Community
- The principal land use within the Catchment which impacts on water is agricultural in various forms
- The Catchment is primarily supported by agriculturally focused landholdings with their own unique operations, productivity and profit imperatives, at both an individual and collective level, and these need to be recognised, respected and accommodated in land use decisions/discussions
- Individual landholder decisions regarding land use will be guided by their own rational principles and those decisions will be unique to each agricultural operation, and will be respected

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Vision

Our vision is to build, through both passive and active land use decisions/actions at all levels of Community, drought resilience and water sustainability, particularly in relations our underground aquifers, within the Catchment.

This vision recognizes:

- That Catchment water recognizes no boundaries or fences
- That without improved drought resilience and sustainable water in an increasingly volatile climate the livelihoods that the Catchment has historically supported will not be available to our children and our successors in this Catchment
- That there is an overabundance of water received in Catchment rainfall on an annual basis to achieve the vision
- That the way in which land use has been traditionally practiced and managed does not properly value or optimise the retention of water in the Catchment required to enhance drought resilience and water sustainability
- That land use changes which impact Catchment water, its resilience, availability and quality can be optimised by a whole of Catchment approach
- That whilst individual commitments to the vision and consequent actions are vital, Community collaboration on all levels is optimal
- The importance of Community members taking responsibility for Catchment water and related land use decisions at an individual, individual landholding ownership/control and collective level.

- The limitations in resources and consensus among Community members about how this vision might be achieved in the short to medium term
- The need to reflect and incorporate generational and commercial changes in Community membership and landholding ownership over time, as well as changing views and evidence about how to achieve the vision
- That increasing the residence time of water from rainfall in our Catchment is fundamental to the success of the visions
- That residence time is positively correlated to infiltration ratios, which in turn have a direct positive correlation with residence time in our soil profiles and pasture root zones, as well as infiltration ratios into our underground aquifers
- That infiltration of Catchment rainfall at source is directly correlated to pasture cover with 75% at all times being the DPI prescribed minimum and a target of 100% being the ideal for productivity
- The necessity in the short term, and perhaps in the longer term, of targeted strategic stabilization measures in all Catchment drainages to slow, spread and stop water flows starting from the watershed in order to lift drainage beds, lift and buffer the alluvial water table and reconnect water flows with existing floodplains
- The beneficial value of exploring underground bore water solutions outside the Catchment alluvial zones
- The fundamental importance of monitoring, recording, analyzing and providing timely accessible feedback on drought resilience and water related actions/projects we pursue at an individual or collective level, so they can be discarded or adopted.

Objectives

- Improve and maintain Catchment groundcover ratios to in excess of a target 75%, and on slopes exceeding 15% in gradient to a target 100%, at all times irrespective of climatic conditions
- Target increases in root depth and density of pastures (exotic and/or native), and particularly on country exceeding 15% in gradient
- Increase grazing uniform utilization of country, and particularly on country exceeding 15% in gradient, by any means possible including without limitation feral control, control of watering and fencing
- Control stock grazing in Catchment drainages if possible and/or feasible, by management practices and/or fencing – this does not exclude grazing
- Within the bounds of necessity, and particularly on sloping country exceeding 12.5% gradient and riverine areas, retain standing and fallen dead timber, recognising both its ecological and environmental value
- Increase the regrowth of native trees and understory on country exceeding 12.5% in gradient and in traditional stands of timber reaching terminal age

- Progressively, commencing at the watershed (both on a Catchment and an individual landholding scale) and moving down catchment, implement actions/works within flow lines and drainages that slow, spread and catch water flows in order to optimise the opportunity for rain waters which have not infiltrated at source to infiltrate into Catchment soils. This final objective, which is considered a last resort, need not be complex, time consuming or expensive when one recognizes that
    - every stick in the right place at the right angle is a dam, and
    - every star steel and bundled log with wire twitching can slow a torrent

Day 0, Day 180, Day 540