RMCG

AUGUST 2022

Climate Futures

Draft Report

Murray Dairy

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1 Introduction

ACKNOWLEDGEMENT OF COUNTRY

We acknowledge the Traditional Owners of the Country that we work on throughout Australia and recognise their continuing connection to land, waters and culture. We pay our respects to their Elders past, present and emerging and the Elders of other Aboriginal and Torres Strait Islander communities. Moreover, we express gratitude for the knowledge and insight that Traditional Owner and other Aboriginal and Torres Strait Islander people contribute to our shared work.

1.1 PURPOSE

THIS PROJECT

Across the world, there have been measurable changes in climate impacting on agriculture, the natural environment, infrastructure, and health. The impacts of global warming have been recognised by governments and industries everywhere. It is predicted that by 2030 there will be higher temperatures, more frequent hot days and fewer frosts, less rainfall, and an increase in catastrophic events including floods, fire, and drought.

These changes are expected to have several impacts on livestock in the Murray Basin region, including:

- Changes in pasture production
- Reduced productivity and reproduction
- Changed distribution of pests and diseases
- Reduced water security.

As a result, farm businesses have started to:

- Plan for secure water supplies
- Focus on water use efficiency and getting more from less
- Change to their farming systems and feedbase
- Implement more sophisticated risk management strategies
- Consider long-term and medium-term forecasts and how that fits in with their farm.

The purpose of this particular project is to ensure that the dairy industry remains productive across northern Victoria and southern NSW, while being sustainable and profitable given the increasing challenges of climate change impacts from now and towards 2050. Through a process of engagement with dairy stakeholders, there will be future scenario's and data around climate presented, the identification of strategies that will mitigate risks and the definition of roles and responsibilities for future actions.

1.2 METHOD

The method undertaken to achieve the outcomes was as follows:

- Assess and report on current and future climate data and modelling relevant to the dairy industry in the relevant region
- Identify areas where dairy farming is inclined to be affected by climate impacts
- Design workshops to farmers and service providers of the dairy industry, where we will outline the data and climate scenarios, and capture their views on impacts and gaps

- Facilitate workshops in Kyabram (16 participants), Cohuna (8 participants), and Finley (6 participants).
- Run 10 in-depth (phone) interviews to supplement the views gained from workshops
- Document strategies and priorities that will address the identified impacts
- Test the strategies and priorities with workshop participants and decide actions
- Document the actions in line with the strategies and priorities while defining key stakeholders at various levels who will implement the actions.

This report captures the outcomes of the workshops that will be used to build the strategies that will be tested with some of the workshop participants.

2 Climate change modelling

2.1 INFORMATION PRESENTED AT WORKSHOPS

Information about climate modelling outlined in Sections 2.2 to 2.9 were presented at the workshops.

2.2 CHANGING RAINFALL PATTERNS

Rainfall will continue to be very variable over time, but over the long term it is expected to continue to decline in winter and spring (medium to high confidence), and autumn (low to medium confidence), but with some chance of little change.

Changes in rainfall have already occurred. Work by DELWP, shown in Figure 2-1 identifies:

- Cool-season rainfall (April – October) continued to be lowest for the 23 years since 1997-2019 compared to any other 23-year period and in the period 1997 to 2018 was approximately 12% below the 1900 – 1959 average (Rauniyar and Power 2020).
- Since the end of the drought in 2010, there has been more warm season rainfall than average in the north of the state and through the southern Murray Darling Basin particularly due to heavy rains in 2010 – 2011 and 2016.
- Over the whole 22 years since the start of the Millennium Drought (1997), the pattern of generally lower than normal warm-season rainfall in the south and higher than normal warm-season rainfall in the north of the state is amplified.

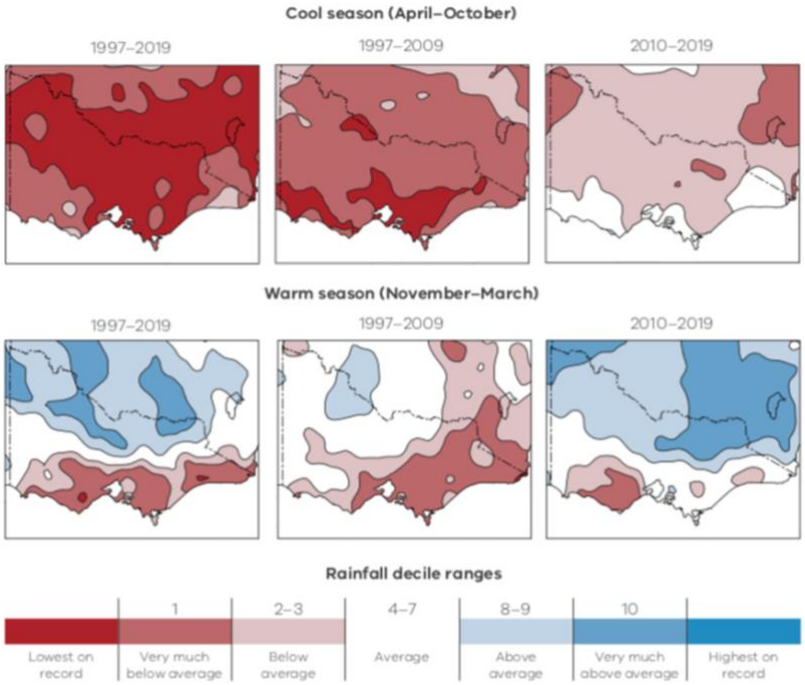

FIGURE 2.4 Rainfall decile maps for the cool season (April–October, top row) and warm season (November–March, bottom row). For the full period since the start of the Millennium Drought in 1997 (left column: 1997–2019), relative to all other 23-year periods; the Millennium Drought years (middle column: 1997–2009), relative to all other 13-year periods; and the years following the Millennium Drought (right column: 2010–2019), relative to all other 10-year periods. Data: Australian Gridded Climate Data (Evans et al. 2020).

Figure 2-1: Rainfall Decile Map from 'Victoria's Water in a Changing Climate' [1]

[1] Department of Environment, Land, Water and Planning; Bureau of Meteorology; Commonwealth Scientific and Industrial Research Organisation; The University of Melbourne (2020), Victoria's Water in a Changing Climate. Sourced https://www.water.vic.gov.au/__data/assets/pdf_file/0024/503718/VICWACI_VictoriasWaterInAChangingClimate_FINAL.pdf

There is a large range of uncertainty in Victoria's rainfall projections with a drying trend in the cool season.

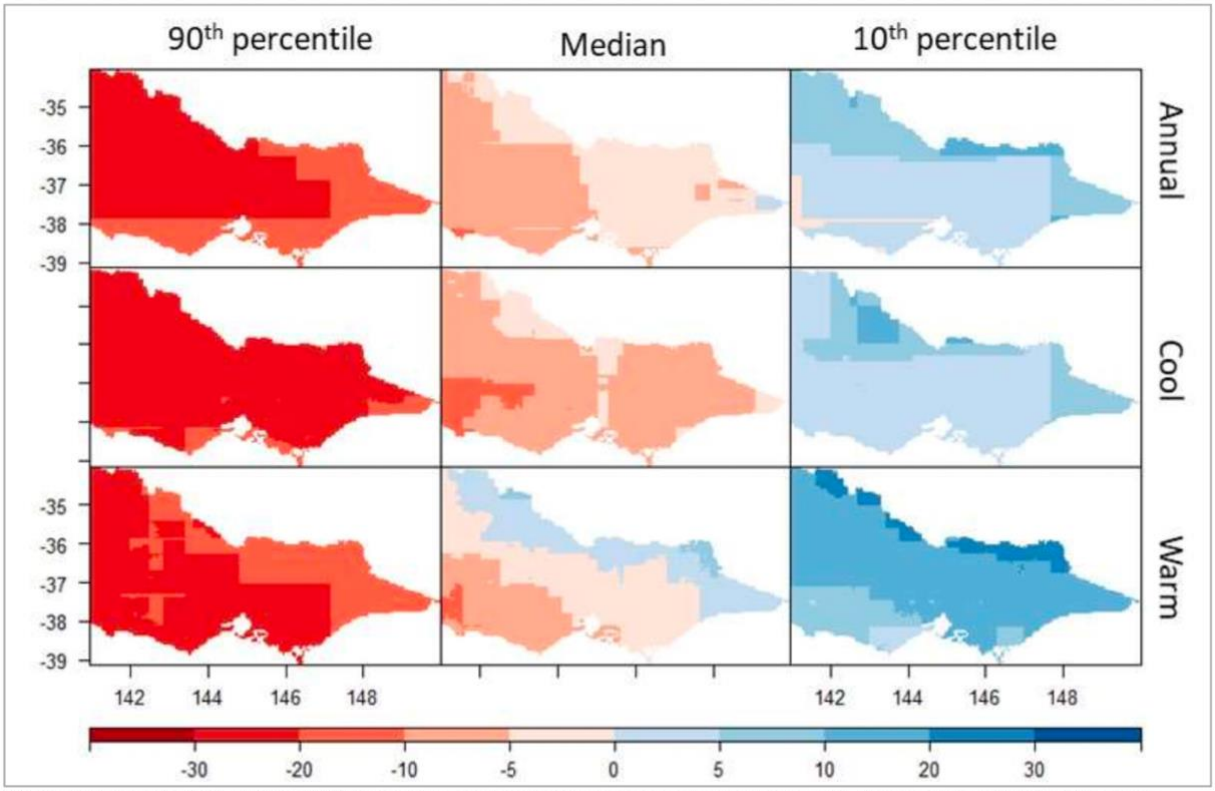

Figure 13 Projected 10th, 50th and 90th percentile cool and warm season rainfall changes (% change from 1995 value) across Victoria for RCP8.5 in the year 2065 (source: CSIRO)

Figure 2-2: Projected changes to Victoria's rainfall[2]

When looking at the median of the projected changes for northern Victoria this would suggest rainfall reductions of around 10% to 20% in cool season rainfall and potential increase of 5% in warm season rainfall.

At the same time potential evapotranspiration (ET), which drives irrigation demand is expected to increase.

[2] Department of Environment, Land, Water and Planning (2020), Guidelines for Assessing the Impact of Climate Change on Water Availability in Victoria. Final, November 2020.
Sourced https://www.water.vic.gov.au/__data/assets/pdf_file/0023/502934/GuidelinesClimateChangeWaterAvailVic_2020_FINAL.pdf

FIGURE 4.3 Median and range of projected percentage changes to mean annual potential evapotranspiration centred on 2065 relative to post-1975 average for a high emissions scenario (RCP8.5).

Figure 2-3: Projected changes to Victoria's annual potential ET[3]

This shows that irrigation demand in ML/ha is expected to increase by 10% to 30% in the Murray dairy Region.

2.3 IRRIGATION WATER AVAILABILITY

Irrigation water availability and implications on water price has the potential to have a very high impact on dairying in the region. The combination of changing rainfall patterns and lower total rainfall can impact on inflows that will change water availability. Potential for increased irrigation demand due to increased ET will amplify the impact.

The majority of climate models project a drier climate future for Victoria, particularly later this century under a high emissions scenario. The rainfall decline in areas that flow into the major storages of Eildon, Dartmouth and Hume has serious consequences for future allocations on the Murray and Goulburn systems.

Catchment specific projections in runoff are provided in the DELWP publication – Victoria's water in a changing climate – Insights from the Victorian Water and Climate Initiative – Amended February 2021 is shown in Figure 2-4.

[3] Department of Environment, Land, Water and Planning; Bureau of Meteorology; Commonwealth Scientific and Industrial Research Organisation; The University of Melbourne (2020), Victoria's Water in a Changing Climate.
Sourced https://www.water.vic.gov.au/__data/assets/pdf_file/0024/503718/VICWACI_VictoriasWaterInAChangingClimate_FINAL.pdf

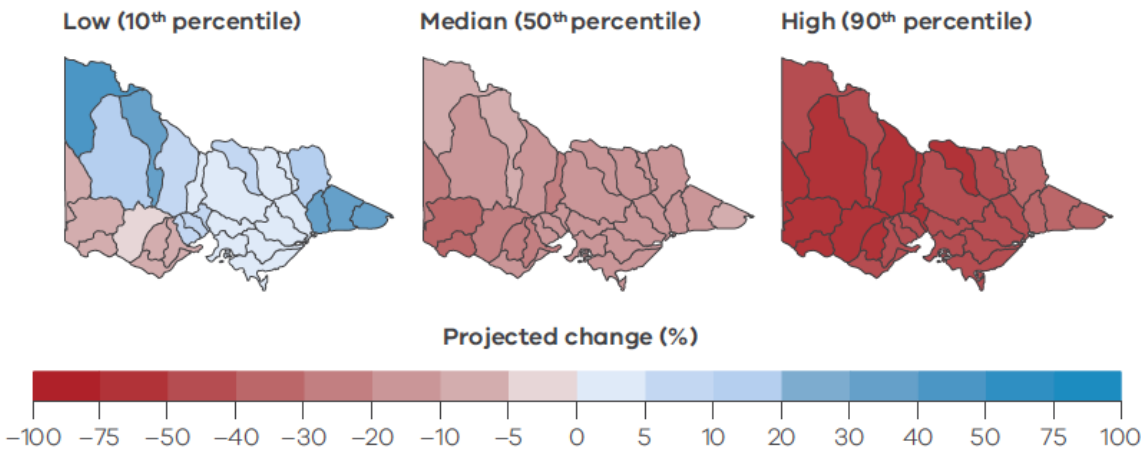

FIGURE 4.1 Median and range of projected percentage changes to basin mean annual runoff centred on 2065 relative to post-1975 average for a high emissions scenario (RCP8.5). (Source: Potter et al. 2016).

Figure 2-4: Extract on Victorian runoff projection changes from DELWP 2021[4]

Figure 2-4 suggests that runoff could be expected to decline between 0% to 30% in the sMDB system.

(Note: An earlier version (2016) of the same information was presented at the workshops but the key message did not change. Reference to the most recent information has been presented here for completeness).

In making projections it is important to recognise that any impact from climate change will still interact with long term wetting and drying patterns as is shown in the Hume Dam graph below (Figure 2-5). It would appear that the Hume catchment has been in a drying phase but recent wet conditions may see this change. However, a drying prognosis is expected with the climate change scenarios expected.

[4] Victoria's water in a changing climate – Insights from the Victorian Water and Climate Initiative – Amended February 2021

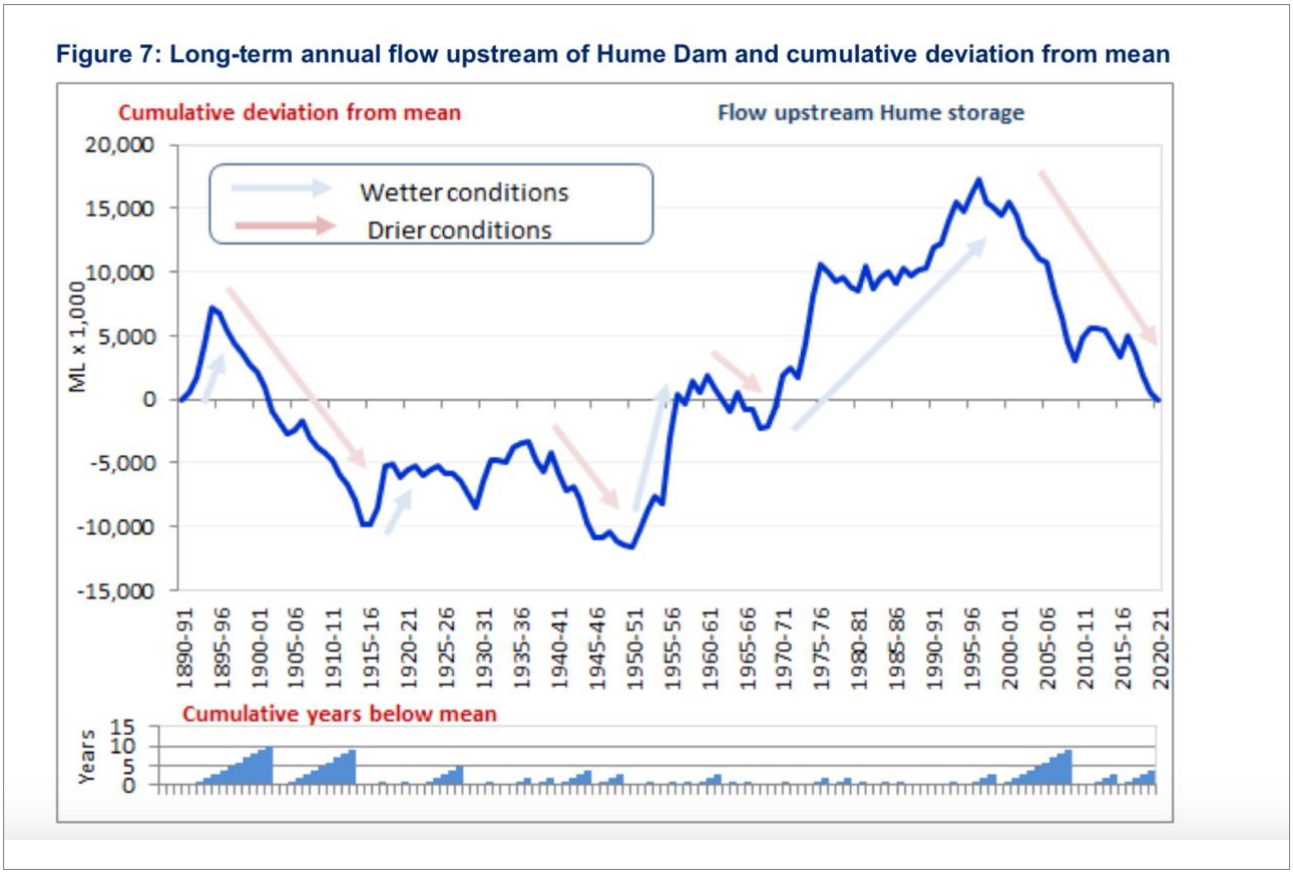

Figure 2-5: Long-term annual flow upstream of Hume Dam and cumulative deviation from mean[5]

If using projections from the table Figure 3-1 it is assumed that in a high climate change scenario average water availability is reduced by 30% in all years this would be expected to:

- Reduce water availability by 30%
- This reduction can be offset by productivity gain (including less competitive businesses exiting) in each industry, as occurred to offset the impacts of water recovery in the Basin Plan. But this productivity gain is happening anyway so there is a real loss to each industry in terms of water use and scale.
- Reduce average availability by around 1,000 GL/y in the southern Murray Darling Basin (sMDB), which is estimated to increase average price from approximately $200/ML to $300/ML. i.e. an increase of $100/ML on average.

[5] NSW Department of Planning and Environment (2020), General Purpose Water Accounting Report NSW Murray Catchment 2020-21 Sourced from https://www.industry.nsw.gov.au/__data/assets/pdf_file/0004/517666/gpwar-2020-21-nsw-murray-catchment.pdf

Table 2-1: Current water used by different industries within the sMDB dynamic equilibrium

INDUSTRY & FEATURES	ANNUAL WATER USE RANGE (GL)
Horticulture (excluding almonds) slowly increased by 50% over 50 years	800 - 900
Almonds have increased form almost zero demand in mid 1990's	500 - 600
Cotton has replaced rice and pasture in the Murrumbidgee since 2000	450 - 700
Dairy peaked in the year 2000 but is now about half of that in terms of irrigation water use	800 - 900
Irrigated cereals and corn etc (winter and summer)	200 - 600
Rice has reduced and production now varies greatly from year to year	50 - 1,000
Mixed grazing declined from the dominant water-use from peak in the 1980's of 2500 GL to now	250 - 500
Carryover is used to store water in wet years for use in dry years. Optimisation of the utilisation of carry-over is still developing.	+600 - 300
Total water available (includes up to 500GL of ground water)	**Typical 3,000 - 5,600 GL**
	Averages around 4,500 GL but in a drought could be as low as 2,200 GL (incl 500GL Ground water)

Understanding the interactions between industries and water availability is important to assess the impacts of declining consumptive pool on each industry and therefore the impact on dairy.

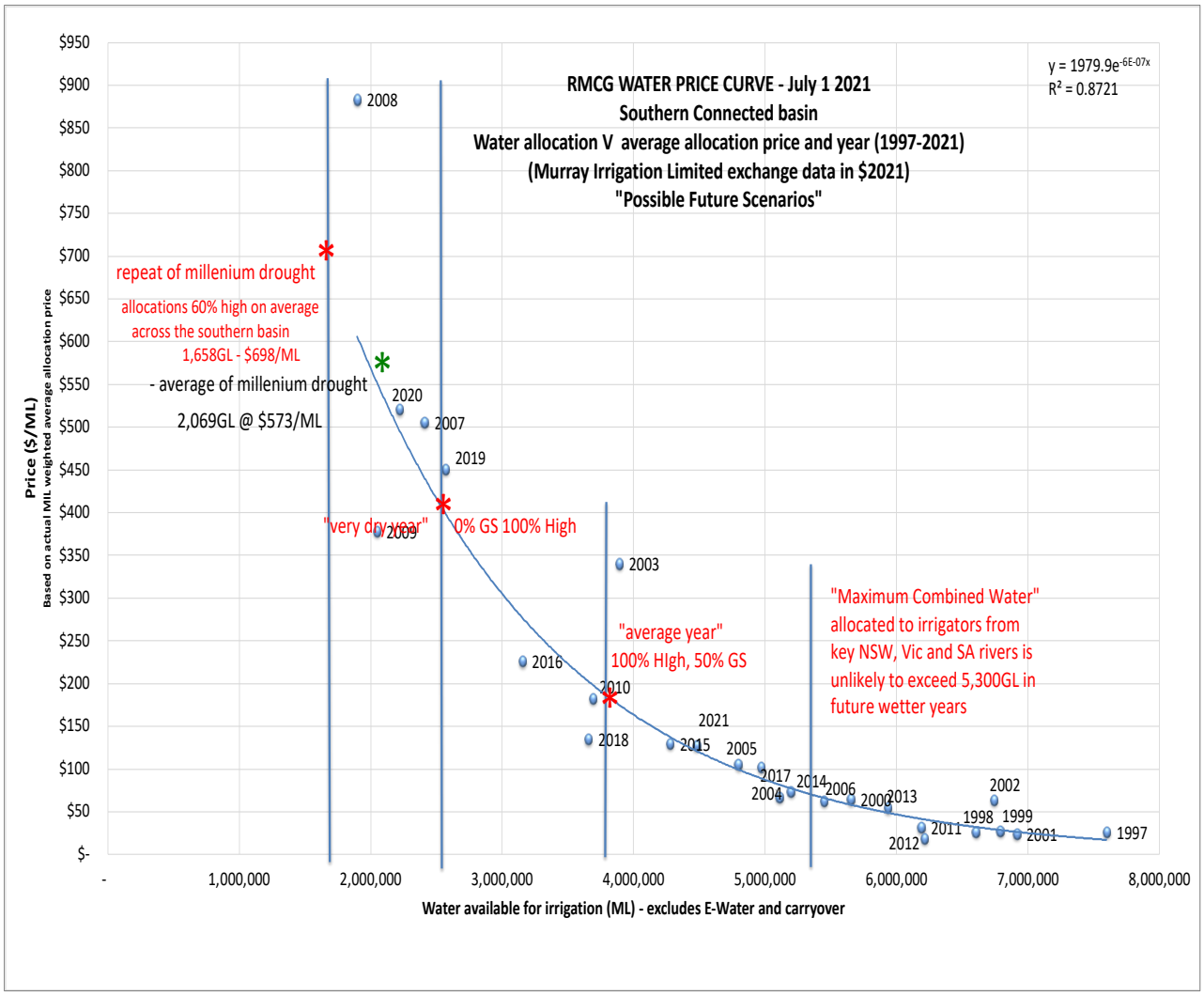

Figure 2-6: RMCG derived water demand price curve for the sMDB

The RMCG "Derived water demand price curve" shows the relationship between the total combined annual volumes allocated to the three main river systems and the price paid (i.e. the trade volume-weighted average annual allocation water prices per ML (VWAP) paid on the Murray Irrigation Ltd (MIL) exchange (Figure 2-6).

The derived water demand price curve has not changed over the last 25 years. That is for any given aggregate volume of water available the annual average allocation price paid (cpi adjusted) has been the same.

It seems counter intuitive that the supply curve has not materially changed given the large reduction in water volumes (drought and basin recovery) and increasing horticulture demand. But the reduction in the consumptive pool simply shifts the position for each season, in terms of the combined volume of ML available along the curve rather than change the curve. However, there are a number of key things that have enabled industries to adapt to the reducing volumes and increasing demand i.e:

- Less efficient growers exit the industry allowing for the average production per ML to increase.
- Increasing water use efficiency through better irrigation technology, improved knowledge about matching irrigation with demand, plant breeding breakthroughs and improvements in on-farm & supply system water management. For example: the dairy industry is seeing more "cut/carry" fodder system with maize and possibly barns which double/treble the production per ML relative to the traditional grazing system.

- The policy adoption enabling carryover gives more water security to all industries but also provides more “very secure” water to horticulture noting that carryover becomes more limited in successive dry years.
- Over time the water market has become less “sticky” as more irrigators learn and adapt to the different seasons and develop a greater willingness to “sell” water when prices rise. This has effectively made more water available to the higher value producers in all seasons.

Converting climate change predictions into possible water market scenarios is almost impossible. On top of climate change in 30 years’ time there will be considerable policy changes and agricultural industry changes.

However, what can be indicated is that in the foreseeable future will be a mix of seasons plus the possibility of a wet summer and extreme drought. It is likely that there could be more of the drier year scenarios than the wet ones in the future.

What is becoming evident is that it is the “variable water” or the allocations attached to the “General Security” entitlements, such as those in NSW MIL will decline first in the event of a drying climate.

Because of reduced inflows there will effectively be more storage relative to inflows in future. This will mean that there is more capacity to “carryover” water and make the supply more reliable year in year out. This will advantage and support the higher value industries like horticulture but will mean less water for annual crops.

2.4 INCREASING TEMPERATURE

Maximum and minimum daily temperatures will continue to increase over this century (very high confidence).

By the 2030s, increases in daily maximum temperature of 0.9 to 1.8°C (since the 1990s) are expected.

By the 2040s, at Shepparton, the number of days above 35°C are expected to increase from 14.8 (1981-2010) to a range of 19.8 to 31.4 with a median of 25.7 days (RCP 4.5 medium emissions). The median increases to 29.6 days at RPC 8.5 high emissions[6].

In a warming climate, frosts are expected to become less frequent over time. However, it is possible for there to be an increased risk of frost in some regions and seasons when cold clear nights persist longer than is suggested by the projected change in minimum temperature. Over time the effect of increasing minimum temperatures is expected to gradually overpower the other effects and lead to a decrease in frost risk in almost all regions and seasons.

At Shepparton the number of days/year below 0°C are projected to fall from 12.4 days (1981 to 2010) to a range of 6.3 days to 8.1 days with a median of 7.0 days (RCP 4.5 medium emissions) This drops to a median of 5.3 days at RPC 8.5 high emissions[6].

[6] https://www.climatechange.vic.gov.au/__data/assets/pdf_file/0036/429876/Goulburn-Climate-Projections-2019_20200219.pdf (accessed 11 May 2022)

2.5 EXTREME WEATHER – STORM CELLS AND HEAVY RAINFALL EVENTS[7]

Extreme rainfall events are expected to become more intense on average through the century (high confidence) but remain very variable in space and time (CSIRO).

The challenge of extreme events are they are difficult predict when and where they will occur, but further research is being directed to developing models to better predict extreme events.

2.6 EXTREME WEATHER – DROUGHT[8]

The CSIRO is predicting more dry years and potentially very dry years and that more time will be spent in drought.

Australia's warming over the next decades is already set by historical greenhouse gas emissions (those already in the atmosphere), Bettio 27/10/2020. This means that rising temperatures are one of the most predictable aspects of our climate futures.

Higher temperatures will drive more evaporation, and pastures will require more frequent irrigation otherwise extended dry periods will result in moisture stressed pastures or crops which will impact on forage growth and quality.

2.7 EXTREME WEATHER – BUSHFIRES[9]

The number of high and extreme fire danger days is predicted to increase across regions, particularly in southern Australia, coupled with increasingly drier catchment areas. It is predicted there will be less recovery time between fire seasons. Fire risk has increased in the irrigation region as more land is now not irrigated and susceptible to fire.

2.8 REGULATORY COMPLIANCE[10]

There is increasing focus and attention on contamination of rivers or streams due to nutrient or effluent run-off from farms. High rainfall events will increase the risk of this occurring on some farms.

The onus will be on the owner to demonstrate the safety of their system. This can extend to feed pads where there is an accumulation of effluent.

Some states are also introducing new codes of practices to cover increasing intensification to meet the needs of higher intensity TMR/PMR based systems. These systems will also have the potential for increased scrutiny around the right to farm.

Demonstration of reduction in emissions will also be part of the future regulatory environment.

2.9 ENERGY RELIABILITY[11]

Extreme events such as flooding, strong winds or extreme heat days can challenge energy reliability and supply. Hot water, milk cooling and milk harvesting represent 81% of energy use on dairy farms (about 40kWhr/kL milk).

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7 Dairy Australia 2022, "Climate Futures Assessing Climate Risk on Your Farm Dairy Workbook", accessed 18 August 2022, p. 5
8 Dairy Australia 2022, "Climate Futures Assessing Climate Risk on Your Farm Dairy Workbook", accessed 18 August 2022, p. 6
9 Dairy Australia 2022, "Climate Futures Assessing Climate Risk on Your Farm Dairy Workbook", accessed 18 August 2022, p. 7
10 Dairy Australia 2022, "Climate Futures Assessing Climate Risk on Your Farm Dairy Workbook", accessed 18 August 2022, p. 11
11 Dairy Australia 2022, "Climate Futures Assessing Climate Risk on Your Farm Dairy Workbook", accessed 18 August 2022, p. 12

3 Workshop Outcomes

3.1 CONTEXT

Participants were taken through the range of climate data as outlined in Section 2 to seek their view on the potential impacts on their businesses. It is difficult to assess the different aspects of climate change in isolation as it is the combination of all the changes that will impact on farm. Lower rainfall will impact on crop irrigation requirements as will higher temperatures and increases in evaporation transpiration rates. Rainfall changes will impact inflows, changing water availability and influencing water price which will drive different crop decisions. Higher temperatures can influence the suitability of certain crops and will have direct impacts on cow productivity.

The responses to these changes will be varied and will be influenced by a range of factors at the farm level including:

- Age and stage
- If there is another generation coming through
- Scale of the operation
- Individual farmer preferences (grazing vs cut and carry).

This will mean there will be a high degree of complexity on how the industry will adapt and respond to the different potential futures that may eventuate. There was a sentiment expressed at the workshops that the changes over the past 20 years have already seen a lot of adaptation. A big driver has been the step change in water availability (combination of policy change and lower inflows) resulting in higher water prices forcing a change in what farmers grow. A lot of the changes have been farmer led and has been ahead of the research and development. Learning from what some farmers are already doing and extending that knowledge to the wider farming community, will be part of a strategy that will best place the industry as a whole to adapt to a range of potential climate futures.

3.2 WORKSHOP OUTCOMES

Three workshops were run across the region at Kyabram, Cobram and Finlay. A list of issues and points raised at the workshops are provided in Appendix 1. A review of the discussions and points raised from the workshops has been conducted and summarised under 5 themes:

1. Fodder
2. Heat impact – Cows
3. Greenhouse Gas Emissions
4. Social Licence
5. Risk Management.

3.3 FODDER

Table 3-1: Fodder Summary

ISSUES	GAPS /CHALLENGES	POTENTIAL STRATEGIES
What to grow?	▪ Most of the challenge is around what to grow ▪ *'haven't bought a bag of ryegrass for four years'* ▪ *'we dabble here and dabble there but no core R&D'* (in relation to multi species crops) ▪ Limited research on fodder cereals ▪ Quantifying the impact potential lower cool season rainfall on winter cereals and annual ryegrass ▪ Annual summer fodder grazing options with a protein emphasis ▪ Understanding of potential challenges in pest and diseases of new and existing crops (i.e. armyworm) ▪ Implications to soil health with more intensive cropping regimes	▪ More farm based trials on different fodder options ▪ Investigation of summer protein crops ▪ Collaboration with GRDC on fodder cereal options ▪ R&D options for multi species crops ▪ Investigate pest and disease challenges faced by northern farm crops that could present in the south due to changing climate ▪ Identification of cost effective soil amelioration strategies including utilising organic wastes (dairy effluent, compost, pig and chicken manure)
How to grow it?	▪ On-going support to improve agronomy skills for dairy farmers – for both existing crops and new options ▪ Identifying best management practices to implement double cropping regimes with Mazie as a base ▪ Making every drop count to optimise yield – rainfall and irrigation ▪ Continued improvement on irrigation practices – Irrigation infrastructure – fast flow, drip, overhead sprays – Soil moisture conservation techniques – Soil moisture monitoring	▪ A program to learn from good crop farmers (including those double cropping) ▪ Continued demonstration of best management irrigation practices ▪ Economic analysis of irrigation investment – with changed settings (water price, crop yields)
How to utilise it?	▪ Increasing number of housed systems – opportunity for more economic analysis of implemented systems ▪ Grazing management of different/new fodder options ▪ Ongoing assessment of PMR systems and cost benefit of improved feeding management (feed pads, feeding equipment)	▪ Build on the Raise the roof initiative ▪ Case studies in feeding infrastructure investment (PMR systems)

3.4 HEAT IMPACTS – COWS

Table 3-2: Heat Impacts

ISSUES	GAP /CHALLENGES	STRATEGIES
Increasing number of hot days impacting on cow production and reproductive performance	▪ Ongoing identification of cost effective management options for farms who are not implementing a barn system ▪ Assessing dual benefits of shelter belts and biodiversity benefits. ▪ Risk of higher humidity that will increase the heat impact	▪ Increased promotion of the work and information that is already available – Cool cows ▪ Review of biodiversity benefits of shelter belts on farms ▪ Ongoing extension of cooling options both for traditional and barn systems

3.5 GREEN HOUSE GAS EMISSIONS

Table 3-3: Green house gas emissions

ISSUES	GAP /CHALLENGES	STRATEGIES
Increasing focus on reducing green house gas emissions	▪ Significant knowledge gap both for farmers and consumers ▪ Not knowing current position and hard to improve what is not measured ▪ Capacity to distinguish between fact and fiction in relation to both the level of emissions and the reduction strategies ▪ Increasing pressure to demonstrate action from consumers ▪ Changing goal posts in relation to Carbon trading schemes and lack of understanding of the risks	▪ Development of an education program targeted at farmers to allow for more informed decisions ▪ Promote more uptake of the DairyBase Carbon Calculator ▪ Accessing Agvic programs that will help assess current emission status and strategies for reduction ▪ Identify opportunities for collaboration with other industries on strategies to reduce emissions (i.e. MLA)
Livestock enteric fermentation	▪ Perceptions that “the cow is the devil” in relation to climate change and lack of understanding about the methane lifecycle ▪ Feed additives – what has merit	▪ Develop a fact sheet to help educate farmers and consumers about the methane life cycle and how it relates to burning of fossil fuels ▪ Provide economic assessment of different feed additives that could help reduce emissions ▪ Review of all of the potential options for reduced methane emissions from the cow
Effluent management	▪ Ensuring effluent systems are correctly designed to minimise methane production – particularly relevant for barn systems ▪ Improved understanding of compost systems and their potential for contribution to emissions.	▪ Further promote work already completed and ensure systems are adequately designed. Include nutrient balance calculations to ensure sufficient area for reuse ▪ Investigate the carbon implications for compost barns
Renewable energy	▪ Methane harvesting - cost effectiveness of potential capture technologies that could be implemented	▪ Promote opportunities for potential subsidy of methane harvesting opportunities

ISSUES	GAP /CHALLENGES	STRATEGIES
	▪ Knowledge on the advancement of battery technology and opportunities that may present with solar.	▪ Further investigate the viability of methane harvesting and suitability for the dairy industry ▪ Investigate opportunities that improved energy storage may mean for solar investment
Fertiliser	▪ Options to reduce the reliance on nitrogen based fertilisers	▪ Promote the need for green coating urea at the supplier end rather than the user end

3.6 SOCIAL LICENCE

Table 3-4: Social licence

ISSUES	GAP /CHALLENGES	STRATEGIES
Perceptions on Barn Farming systems	▪ Negative public perceptions about housed dairy farming systems	▪ Develop some positive case studies
Demonstration of environmental credentials	▪ Growing potential for market access based on environmental credentials ▪ Lack of data that can demonstrate the industry is making positive steps to reduce emissions and build its environmental credentials	▪ Identify some key measurable credentials that the industry can assess itself ▪ Review DairySat and raise awareness of tools that are already available ▪ Identify what the processors are considering in this area and have a collaborative approach to the response

3.7 RISK MANAGEMENT

Table 3-5: Risk management

ISSUES	GAP /CHALLENGES	STRATEGIES
Reduction in inflow putting more pressure on access to water	▪ Majority of dairy farm operations will need to purchase allocation water to meet their needs – this will have more pressure over time	▪ Continue to develop water access strategies that will involve – Owning – Leasing – Allocation Market – Forward contracts – Carryover
More frequent droughts	▪ Developing longer term management plans that are not about next year but next three years ▪ Ability to maintain quality and minimise wastage when considering longer term storage options ▪ We need to be “Flexitarians” - have the capacity to flexible and nibble to take opportunities when they present (i.e. frosted crops)	▪ Ongoing delivery of Our Farm Our Plan with further refinement of feed risk management strategies ▪ Consider including the “Climate futures – assessing climate risk on your farm as part of the OFOP program ▪ Ongoing research and extension on optimal utilisation of a variable feedbase and the complexity that it presents

ISSUES	GAP /CHALLENGES	STRATEGIES
	▪ Maybe a need to have more conservative stocking rates to land area – i.e., have more capability to have a higher % fodder requirements from home grown. And focus of high water use efficiency on what is home grown (rain and irrigation	

4 Next Steps

A selection of the participants from the workshops plus some industry stakeholders (processors/banks) will be interviewed to test some of the strategies and ensure that there has not been any important considerations that have not been identified. This will also include discussions on who might be best positioned to respond to the identified needs.

Appendix 1: Workshop Summary

WORKSHOP ANSWERS TO "WHY ARE YOU HERE TODAY?"

- To learn new things
- Looking for answers about climate change
- Looking to the future
- Want to know what to do with the information
- Concerned about water policies
- Want to learn options for growing feed
- Want to be ready for the future
- To learn about renewable energy options
- Looking for sentiments and impacts for dairy farmers.

WORKSHOP ANSWERS TO "WHAT ARE YOUR BIGGEST CONCERNS?"

- Temperature
- Water
- Rainfall
- Energy Reliability
- Costs
- How to be carbon neutral etc.

Table A1-2: Workshop answers to "What will the impact be?" when talking about climate change

WHAT WILL THE IMPACTS BE?		
Lower cool season rain	Impacts on farmer health & wellbeing	There will be the need for cost benefit analysis on different circumstances to assess best options
The millennial drought was a template of what's to come (i.e. Drought and storms etc)	Perception issue with farming and urban out of touch	Expect there will be assistance in new products, seasonal updates, planning etc.
Exit and industry shrinkage, or diversification of businesses	Farmers are the best custodians of the land	There will be increased competition on resources
Leaving the region for land in other regions with higher reliability	Requirement for more feed risk management	Cow emissions and their effect on climate change. Changes will be needed in breeding, feeding and offsets
May see less cows milked and more mixed business farming with beef cattle	Right to farm issues are real	Look at farming structure systems for individuals
Looking at gaps in the market/differentiation	Mono cultures – implications with biodiversity challenge – "need a lot of spray to crop "	There will be a change in crop types, possibly up to 95% annuals

WHAT WILL THE IMPACTS BE?		
Farms forced to get bigger	Always need to get more from the water available – both the rain and irrigation	Soil health will decline e.g. Cut & Carry impacts on soil biota, soil pH, and carbon levels
Need for change in infrastructure in dealing with water, move away from flood irrigation	Some implications now with milk contracts and requirement for flat milk	Cereal crop yields will decline
Changes in season means a change in when you grow crops	Implications of reduction of irrigation in the district – reduced green crops and local impacts	New pests and diseases for both animals and crops
Will be taking advantage of wet years when the water is cheap	Need to take into consideration the impact of heat on the dry cow / calving implications	Carbon credits sold prior to understanding of the market and future implications
Will move to long term storage but will need to be better management of wastage	It may lead to a better price received for milk	A need to be sustainable in order to gain finance from banks, as they will change their risk perception
Longer hot days will increase the humidity which has a bigger impact on cows	Lower water availability will increase prices	Likewise, processors will assert pressure for sustainability
Productivity will decrease as the comfort of the cows decreases	Increased financial impact with more input costs	Change in farm systems with a move to feed out systems which is expensive and will tighten margins
Capital offsets – using different financial tools and new product options		

Table A1-3: Workshop answers to 'How will we mitigate the impacts?'

HOW WILL WE MITIGATE THE IMPACTS?
Fodder
Change crop types & Adapt season to season
Better long-term feed storages
Look at burying feed
Research opportunities for multi species
Research into new feed types – especially fully feeding, crops that yield well, store well and test well in protein
Less feed wastage
Switch to more WVI crops and hay, decrease perennials and increase annuals
Increasing land to support the herd with crops
Growing soybeans in summer for cash crops and also as a protein source for your cows
Use crops to lock in nitrogen and reduce weeds to improve soil health

HOW WILL WE MITIGATE THE IMPACTS?
Capture carbon with a coverage of crops over summer and apply microbes to increase humus
Improve the soil structure to retain more water i.e., worm farms, increasing microbes in the soil and building the soil structure
Use soil measure technology to help with irrigation scheduling
Feed pad to reduce feed wastage (and reduce damage to paddock structure)
Deep rooted perennials to make use of summer rainfall
Gain direct contracts with grain growers
Reduce stock ratio to ease workload on labour and demand on feedbase requirements
Increase the support area to grow more fodder and try to be more self sufficient
Increase carbon in soils (organic matter) to increase water holding capacity and get income from carbon farming
Need to learn more from the croppers – soil moisture conservation, timing, agronomy, maximising what is grown
Not much R&D on the cereal crops for grazing/silage
Cereals provide some more flexibility – capacity to get more DM when conditions are tough
Best learning is seeing what others are doing
Need a new mind set to our cropping activities
Double cropping work – important to get it right with maize as the base
Multi species crops – more work required – there is a dabble here and a dabble there but no core R&D
We are experimenting all the time on farm i.e., sowing radish to help open up the soil
Need larger field trials for fodder options
How can we get the yields while trying to reduce the spray requirement and fertiliser requirement
Implications of reduction of irrigation in the district – reduced green crops and local impacts
Quote ‘have not bought a bag of ryegrass seed for four years’
More work around the suitability of different forage species
Finding a good grazing fodder option in summer with protein value
Need to have a range of fodder options to be able to access that will best suite particular season
Need to continually improve our cropping skills
Unknown of future pest risks – i.e. armyworm
90% of our challenge is around our fodder and what we can sustainably and profitably grow and utilise
Farmers are the best custodians of the land

HOW WILL WE MITIGATE THE IMPACTS?
Water
Larger storage of water
Use water carry over using the facilities available
Improve water efficiency on farm
Improve irrigation infrastructure to reduce water wastage
Improve water movement on farm
Reuse Dams
Use irrigation technology to increase water usage effectiveness
Capturing of water in storage facilities
Always need to get more from the water available – both the rain and irrigation
Really need to maximise our winter rainfall and capacity to irrigate in winter if required (lower cool season rainfall will magnify that).
Most don't own enough water to what they need – water access strategies important. Some actively sold but more about the fact that used to own 100 ML of water right but got access to 200 ML of water
Need that focus of getting the most out of every drop of water we get access to (rainfall and irrigation)
Water use efficiency – sub surface drip – do we need more of this for cropping
Heat impact – Cows
More shade e.g., Trees, sheds with fans, sprinklers
Barns that are totally controlled/enclosed are better for ongoing heated days
The next generation is the barn generation
More assistance around strategies to manage heat for those not going down the housed pathway
Cost /benefit of the cooling investment – "can always throw money at it but does it stack up?"
Calving date moved towards Autumn
Better genetic choices of cows that are heat tolerant or suitable for barns
Improve quality of feed and feed additives to reduce cow heating
Need to take into consideration the impact of heat on the dry cow / calving implications
Genetics – more emphasis on heat tolerant traits
GHG Emissions
Better understanding and use of soil carbon

HOW WILL WE MITIGATE THE IMPACTS?
Use energy and water saving technology
Consider feed additives to help with methane emissions
There is an understanding about keeping waste on farm, but farmers would like to make the most of effluent ponds
Looking at composting and are wanting to improve on it, however set up and labour are an issue. It is currently a fairly manual process
Some farmers are wanting to put more investment into the effluent side to screen the liquids from the solids
Could there be opportunities to aggregate effluent from smaller farms, like in Denmark. They take effluent and selling silage and abattoir pieces to a central facility and then accept finished product back for their investment
There are Biogas plants in NSW with approximately 18 farms linked on a pipeline. Could there be opportunity in this region?
Biodiversity enhances the environment, and they see that it could be something to make money from
Risk to biodiversity as temperatures rise and it gets drier, and the soils get drier
High concern about the changing goal posts and snake oil salesmen in relation to carbon options
Need more collective action i.e., look at getting the 5 or 6 main urea importers to green coat urea rather trying to get 80,000 farmers to do it
A lot of myths around methane and the cow as the “devil”
How can we improve something when we don’t know our current position
When we do know our C emissions no real clear path on “so what can we do about it”
Need a good fact sheet that dispels the myths and provides some solid (research backed) strategies that can be implemented
Some direction on options – don’t sign up for anything yet – too much uncertainty
Soil C sequestration – a lot of uncertainty and volatile
Additives that can help – what are they, what is the R&D behind them, what is the cost/benefit
A big gap in knowledge and a lot of miss information – farmer and consumer
Need to measure what is important and what is sound
Need to have those measures and options that truly make a difference
Need to know where we stand and be on the front foot.
Improved utilisation of tools already available –i.e. Carbon calculator, Cool cows
Don’t know what pathways to take to reduce emissions
The science is out but it’s not flowing through to the farm level
There are pushes to reduce diesel machinery and move to hydro power

HOW WILL WE MITIGATE THE IMPACTS?
We spoke about there being big investments in hydro power and a move away from gas
Waiting on grants from government to give a good opportunity to move to reduction in emissions
It's expensive to set up the infrastructure but prices are coming down. Quantity makes a difference with the need for 1000 cows to make it worthwhile to set up
Believe alternative fuel supply to machinery will make the biggest difference
Will get a premium for product if it's greener
There are risks of a methane tax like New Zealand but also opportunity with premiums
The Farm Monitor Program provides a desktop result but need more rigid examples of contributions that the dairy industry is making
Need to be able to do what Kilter does but on a smaller scale
Farmers would like to get a have a better understanding of what their carbon footprint is as they can't fix what they can't measure
What options are there with methane capture – need the science to back up the developments
Grants to capture CH4
Knowledge and strategies that can be implemented to reduce CH4
Pathway to C neutral – is it possible, what can we do, what are the opportunities and good economics to back it
Data is king and we need to know our position
Need a more ridged understanding of what we are producing
Carbon farming – more questions than answers
Our effluent systems – with the growth are we getting the ponds and systems sized accordingly
Renewables – what are the opportunities
Is there some government kick start to assist in energy efficiency – methane capture
If our C footprint it is high what are the practical options to improve and get the biggest bang for buck
What are others doing? All ruminants under the similar pressure
What collaboration options are there with MLA
Social licence
Perception issue with farming and urban out of touch
Right to farm issues are real
Perceptions of barn systems and social licence – a high concern – How can we demonstrate the positive aspects of barn farming

HOW WILL WE MITIGATE THE IMPACTS?
Risk Management
Planning for 3+ years ahead, not year by year
Technical improvements – e.g., water moisture probes to schedule irrigation
Using water products to manage risk
Push for better weather and water forecasting
Be “Flexitarian” farmers
Could we irrigate through winter or have a flexible irrigation season
Be proactive in climate
Diversification of business, possibly to Beef
Use capital offsets to help manage risk
Generate off farm income
Requirement for more feed risk management
Be wary of flexible systems as they are complex
More economics on the systems – from the feedpad to the feed barn
More focus on risk management and have more conservative stocking rates to land area – i.e., have more capability to have a higher % fodder requirements from home grown. And focus of high water use efficiency on what is home grown (rain and irrigation)
Continued requirement to develop sound water access strategies and decision support around that i.e. when to buy when to sell, ownership/leasing/allocation trade, carryover strategies
Increased preparedness for drought – building reserves – feed, water, cash
Need to be able to adapt while continuing to adopt new technology – increasing uptake of robots
More emphasis on feed risk management and improved fodder conservation
Increased planning and preparation
Need for flexibility but there is complexity in that

Table A1-4: Workshop answers to "Where will the focus be?"

WHERE WILL THE FOCUS BE?		
Ability to understand your farm and how you respond	Sourcing information and knowing how to react	Risk management in line with future variability, with feed inventory, water product mix etc.
Flex based on the circumstances. Take out peaks by securing feed resources	Purchasing and sourcing feed to maintain profitability	Adoption of technology around irrigation, milking and reducing cow heat stress
Expect change and be adaptable	Increased ability to predict and react to the future	Help new entrants into the industry
Cow comfort – e.g., shade, cooling infrastructure, and management	What is the current output and potential mitigation	Help young farmers
Aim to make a profit, not just get by	Cost of de-carbonisation	Improve feed out facilities with feed pads
Community and local support systems for faced change	Consumer perceptions	Upgrade effluent systems and look to improve reuse in the farm system
Facilities and infrastructure to manage changing systems	Power reliability – alternative power sources and back up systems	Water efficiencies
Adjusting calving pattern so it works for climate and farm	Soil Health	Looking into different crop types
Improve efficiencies through additives for cow feed and fertiliser for crops	Looking at other income streams e.g. cash crops	Feed security through water, land and miss peaks
Lots of flexibility and planning (and re-planning)	Each year will be different	Soil health becoming more of a focus

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Document review and authorisation

Project Number: 1611

Doc Version	Final/Draft	Date	Author	Project Director review	BST QA review	Release approved by	Issued to
1.0	Draft	18/08/2022	D. Poole L. Jones	D. Poole	J. Longford	D. Poole	Murray Dairy
2.0	Final	1/9/2-22	D. Poole L. Jones	D. Poole		D. Poole	L. Barns – Murray Dairy