IRRIGATION RELIABILITY

Prepared for: Amuri Irrigation Company

By: Mark Everest

Date: 4 December 2017

1. Introduction

This analysis has been prepared as requested by Andrew Barton and Peter Brown of Amuri Irrigation Company (AIC) to assess the potential on farm impacts of changing minimum flows in the Hurunui and Waiau rivers under the HWRRP.

The report looks only at pasture impacts of varied minimum flow takes. The two pastoral types considered are "Dairy" and "Non-Dairy", used to represent very intensive and intensive land uses respectively.

2. Summary

The average loss of yield forecasted for dairy is:

Hurunui river: 203kgDM/ha/year (at an average cost of $97/ha/year)
Waiau river: 108kgDM/ha/year (at an average cost of $52/ha/year)

The worst seasons are likely to see a reduction in yield that would cost $323/ha/year on the Hurunui River and $435/ha/year on the Waiau River. (approximately 10% of the EBITDA on a very well run, property).

The average loss of yield forecasted for non-dairy is:

Hurunui river: 196kgDM/ha/year (at an average cost of $78/ha/year)
Waiau river: 105kgDM/ha/year (at an average cost of $42/ha/year)

The worst seasons are likely to see a reduction in yield that would cost $323/ha/year on the Hurunui River and $351/ha/year on the Waiau River. (approximately 20% of the EBITDA on a very well run property).

The average increase of regrassing required due to water-limited death of pastures is forecasted to increase by:

Hurunui river: 6.8% of farm area (at an average cost of ($123/ha/year)
Waiau River: 4.6% of farm area (at an average cost of ($83/ha/year)

The worst seasons are likely to see irreparable damage to pastures that would cost an average of $583/ha on the Hurunui River and $566/ha on the Waiau River. (approximately 14% of the EBITDA on a very well run dairy property, or 26% of the EBITDA on a very well run non-dairy property).

Grain feeding:

To cost of installing grain feeders is estimated at approximately $347/ha, with an annual interest and depreciation cost of $39/ha. This would only apply to those farmers that don't already have in-shed grain feeding facilities. We estimate that 30% of properties would need to install in-shed grain feeding facilities.

When looking at the results it is important to consider that while the average of the time period does not incur significant cost relative to the worst seasons, 41% of the time in the Hurunui River catchment, and 14% of the time in the Waiau River catchment will incur pasture damage greater than 5% more than the current low flow regime

If is not the hard years alone that cost, but also the psychological effect on farmers ability to perform at historical in subsequent seasons. The stress of having to feed much more and re-grass more of the farm, bring in more feed, and in all reality drop production and profitability, in my experience often leads to a more conservative operator for the two subsequent seasons.

Feed costs assumed are long run average. While some operators would hold feed on hand awaiting a time when it is required, most will go to the market at the time which can cause inflated costs, especially in a semi-isolated area like the Amuri. This can mean silage cost can increase to 25c/kgDM standing in the paddock and grain may increase in cost by a further $50/t.

3. Process

Using soil moisture models as provided by Peter Brown, I have looked at the effects on growth rate of pasture on a daily time step model across both Waiau and Hurunui rivers, and assessed the river flow regimes across two soils (65mm profile available water and 80mm profile available water) and rainfall zones (Culverden and Riverside/Waiau). The time period assessed is from 1960 to 2017.

The daily time step model calculates potential growth based on expected pasture growth (from an internal MRB data set and external industry data) assuming no irrigation restriction, plus nitrogen effect, less soil moisture stress impact on pasture production.

Growth rate and nitrogen assumptions are below:

PASTURE GROWTH - PASTORAL (non dairy)			
	Un-boosted	N units	N Boosted
June	8	0	8
July	4	0	4
August	12	7	15
September	23	29	35
October	39	35	52
November	65	14	69
December	74	0	74
January	63	0	63
February	51	35	65
March	38	24	47
April	22	6	24
May	18	0	18
TOTAL	12,531	149	14,221

PASTURE GROWTH - PASTORAL (dairy)			
	un boosted	N units	N Boosted
June	8	0	8
July	4	0	4
August	12	14	18
September	23	28	34
October	39	39	53
November	65	36	77
December	74	28	83
January	63	28	72
February	51	33	64
March	38	27	48
April	22	15	28
May	18	0	18
TOTAL	12,531	247	15,218

Once the lost potential feed was calculated (on an annual basis), the cost to the business was calculated.

It is assumed that the "dairy" would buy in grain and baleage to replace pasture not grown. PKE was excluded from analysis as the amount that is permitted to be fed currently is only 3kgDM, also there is risk that it will become a banned product for use in some markets in future. The replacement feed costs for the "dairy" type systems are detailed below:

FEED COSTS - PASTORAL (dairy)		
Grain:	$380	/t delivered
	86%	dry matter
	$442	/tDM delivered
	$20	/tDM to crush and feed
	98%	ulilisation
	$471	**/tDM consumed**
Baleage:	$180	/tDM standing
	$144	/tDM mow, bale and wrap ($46/320kgDM)
	$31	/tDM to cart ($10/320kgDM)
	$56	/tDM to feed ($18/320kgDM)
	85%	ulilisation
	$484	**/tDM consumed**
AVERAGE	**$478**	**/tDM consumed**

It is assumed that the "non-dairy" represents other enterprises including beef fattening, lamb finishing, dairy grazing and silage sales. These enterprises would likely employ a combination of selling stock that they could have added more weight to, not trading stock as they don't have the feed, and buying in feed. The bought in feed would be all pasture silage except some grain for breeding ewes or lambs, which would free up pasture for other grazing cattle. The replacement feed costs and finishing/grazing margin reductions for "non-dairy type systems are detailed below:

FEED COSTS - PASTORAL (non dairy)		
Grain: (20%)	$380	/t delivered
	86%	dry matter
	$442	/tDM delivered
	$20	/tDM to feed
	80%	ulilisation
	$577	**/tDM consumed**
Baleage: (40%)	$180	/tDM standing
	$144	/tDM mow, bale and wrap ($46/320kgDM)
	$31	/tDM to cart ($10/320kgDM)
	$56	/tDM to feed ($18/320kgDM)
	85%	ulilisation
	$484	**/tDM consumed**
Lost Margins: (40%)	$180	/tDM Lamb Finishing
	$278	/tDM Calf Trading
	$197	/tDM R2 Finishing
	$218	**/tDM consumed**
AVERAGE	**$396**	**/tDM consumed**

4. Results

4.1. Non-Dairy - Pasture Yield

The MAX yield represents the best year in the data set from 1960 to 2017, the MIN yield represents the worst year (the most expensive year for a farmer under the HWRRP regime in comparison to current) and the AVERAGE yield is the average of all of the seasons.

HURUNUI RIVER - PASTORAL (non-dairy)								
Rainfall	Culverden				Riverside and Waiau			
Soil PAW (mm)	65		80		65		80	
Minimum flow	Current	HWRRP	Current	HWRRP	Current	HWRRP	Current	HWRRP
MAX Yield (KgDM/ha/yr)	14,429	14,429	14,429	14,429	14,429	14,427	14,429	14,429
(HWRRP % Currrent)		100.0%		100.0%		100.0%		100.0%
(Yield Loss kgDM/ha/yr)		0		0		3		0
(Cost of bought in feed/ha/yr)		$0		$0		$1		$0
MIN Yield (KgDM/ha/yr)	12,019	11,327	12,108	11,449	12,080	11,444	12,161	11,592
(HWRRP % Currrent)		94.2%		94.6%		94.7%		95.3%
(Yield Loss kgDM/ha/yr)		691		659		637		569
(Cost of bought in feed/ha/yr)		$274		$261		$252		$225
AVERAGE Yield (KgDM/ha/yr)	14,190	13,968	14,239	14,041	14,227	14,032	14,265	14,095
(HWRRP % Currrent)		98.4%		98.6%		98.6%		98.8%
(Yield Loss kgDM/ha/yr)		222		197		195		171
(Cost of bought in feed/ha/yr)		$88		$78		$77		$68

WAIAU RIVER - PASTORAL (non-dairy)								
Rainfall	Culverden				Riverside and Waiau			
Soil PAW (mm)	65		80		65		80	
Minimum flow	Current	HWRRP	Current	HWRRP	Current	HWRRP	Current	HWRRP
MAX Yield (KgDM/ha/yr)	14,429	14,429	14,429	14,429	14,429	14,427	14,429	14,429
(HWRRP % Currrent)		100.0%		100.0%		100.0%		100.0%
(Yield Loss kgDM/ha/yr)		0		0		3		0
(Cost of bought in feed/ha/yr)		$0		$0		$1		$0
MIN Yield (KgDM/ha/yr)	13,992	12,892	14,113	13,269	14,071	13,196	14,152	13,424
(HWRRP % Currrent)		92.1%		94.0%		93.8%		94.9%
(Yield Loss kgDM/ha/yr)		1100		844		876		728
(Cost of bought in feed/ha/yr)		$436		$334		$347		$288
AVERAGE Yield (KgDM/ha/yr)	14,302	14,182	14,334	14,230	14,326	14,216	14,351	14,264
(HWRRP % Currrent)		99.2%		99.3%		99.2%		99.4%
(Yield Loss kgDM/ha/yr)		120		104		110		87
(Cost of bought in feed/ha/yr)		$48		$41		$43		$34

4.2. Dairy – Pasture Yield

HURUNUI RIVER - PASTORAL (dairy)								
Rainfall	Culverden				Riverside and Waiau			
Soil PAW (mm)	65		80		65		80	
Minimum flow	Current	HWRRP	Current	HWRRP	Current	HWRRP	Current	HWRRP
MAX Yield	15,450	15,450	15,450	15,450	15,450	15,447	15,450	15,450
(HWRRP % Currrent)		100.0%		100.0%		100.0%		100.0%
(Yield Loss kgDM/ha/yr)		0		0		3		0
(Cost of bought in feed/ha/yr)		$0		$0		$1		$0
MIN Yield	12,985	12,249	13,072	12,378	13,041	12,364	13,119	12,522
(HWRRP % Currrent)		94.3%		94.7%		94.8%		95.5%
(Yield Loss kgDM/ha/yr)		736		694		677		597
(Cost of bought in feed/ha/yr)		$352		$331		$323		$285
AVERAGE Yield	15,201	14,971	15,253	15,048	15,240	15,038	15,282	15,105
(HWRRP % Currrent)		98.5%		98.7%		98.7%		98.8%
(Yield Loss kgDM/ha/yr)		230		204		202		176
(Cost of bought in feed/ha/yr)		$110		$98		$97		$84

WAIAU RIVER - PASTORAL (dairy)								
Rainfall	Culverden				Riverside and Waiau			
Soil PAW (mm)	65		80		65		80	
Minimum flow	Current	HWRRP	Current	HWRRP	Current	HWRRP	Current	HWRRP
MAX Yield	15,450	15,450	15,450	15,450	15,450	15,447	15,450	15,450
(HWRRP % Currrent)		100.0%		100.0%		100.0%		100.0%
(Yield Loss kgDM/ha/yr)		0		0		3		0
(Cost of bought in feed/ha/yr)		$0		$0		$1		$0
MIN Yield	14,999	13,852	15,118	14,252	15,079	14,171	15,163	14,438
(HWRRP % Currrent)		92.4%		94.3%		94.0%		95.2%
(Yield Loss kgDM/ha/yr)		1147		866		908		725
(Cost of bought in feed/ha/yr)		$548		$413		$434		$346
AVERAGE Yield	15,316	15,192	15,351	15,244	15,341	15,228	15,369	15,280
(HWRRP % Currrent)		99.2%		99.3%		99.3%		99.4%
(Yield Loss kgDM/ha/yr)		124		107		113		89
(Cost of bought in feed/ha/yr)		$59		$51		$54		$42

4.3. Increased Regrassing

The MAX increased regrassing represents the worst year in the data set from 1960 to 2017 (the most expensive year for a farmer under the HWRRP regime in comparison to current), the MIN increased regrassing represents the best year, and the AVERAGE yield is the average of all of the seasons.

The cost of regrassing includes the cost of supplementary feed bought in to replace the pasture not growing at the time of regrassing (assumed at 60 days from first spray out to first grazing). The pasture not grown is assumed as the average growth rate over that time, less the dry matter made available to first grazing in the new grass.

HURUNUI RIVER - PASTORAL (Regrassing Required - non-dairy and dairy)								
Rainfall	Culverden				Riverside and Waiau			
Soil PAW (mm)	65		80		65		80	
	Years	% area	Years	% area	Years	% area	Years	% area
HWRRP more than Current regrassing	31	54%	30	53%	30	53%	30	53%
MAX increased regrassing		32%		32%		32%		33%
Estimated cost (per ha in worst year)		$577		$569		$583		$602
MIN increased regrassing		0%		0%		0%		0%
Estimated cost (per ha in worst year)		$0		$0		$0		$0
AVERAGE increased regrassing		7%		7%		7%		7%
Estimated cost (per ha in worst year)		$118		$127		$123		$124

WAIAU RIVER - PASTORAL (Regrassing Required - non-dairy and dairy)								
Rainfall	Culverden				Riverside and Waiau			
Soil PAW (mm)	65		80		65		80	
	Years	% area	Years	% area	Years	% area	Years	% area
HWRRP more than Current regrassing	22	39%	26	46%	24	42%	24	42%
MAX increased regrassing		29%		30%		33%		33%
Estimated cost (per ha in worst year)		$521		$547		$601		$593
MIN increased regrassing		0%		0%		0%		0%
Estimated cost (per ha in worst year)		$0		$0		$0		$0
AVERAGE increased regrassing		4%		5%		5%		5%
Estimated cost (per ha in worst year)		$72		$91		$87		$82

4.4. Cost of Grain Feeding

The cost of retrofitting a rotary dairy shed (60 bail) with a grain feeding system (180t silo, mill, hopper silo, PLC, and feed bins is approximately $80,000.

This would be suitable for a 230ha or 800 cow farm, making the capital cost approximately $347/ha in capital.

There would be:	an interest bill on the borrowed money at 7.25%:	$25/ha/year
	depreciation over a 25 year lifespan:	$14/ha/year
	TOTAL	$39/ha/year

This cost if farm specific – it does vary greatly by property and would only affect the farmers that do not already feed grain in milking sheds.