Date and time that the period ended	Duration of Rationing (hours, for periods >24hrs)	Max Rationing step reached (1=20% cut; 2=35% cut; 3=50% cut)	Date Start (yymmdd)	Time Start (hhmmss)	Mean flow rationing Step 1 (l/sec)	Date start Step 2 start	Time start Step 2 start	mean flow rationing Step 2	Date start Step 3	Time start Step 3	mean flow rationing Step 3
19/01/2004 14:00	140	1	040113	190000	2465						
28/01/2004 06:00	137	1	040122	140000	2377						
8/04/2004 09:00	79	1	040405	30000	2915						
11/02/2005 16:00	45	1	050209	200000	2890						
7/03/2005 02:00	79	1	050303	200000	2733						
25/03/2005 02:00	286	1	050313	50000	2560						
25/10/2005 07:00	73	1	051022	70000	2858						
31/10/2005 04:00	129	1	051025	200000	2493						
7/11/2005 08:00	154	1	051031	230000	2304						
15/11/2005 04:00	185	1	051107	120000	2102						
21/11/2005 17:00	125	1	051116	130000	2255						
24/11/2005 16:00	48	1	051122	170000	2520						
6/12/2005 22:00	256	1	051126	70000	2076						
10/12/2005 03:00	62	1	051207	140000	2189						
15/12/2005 02:00	98	1	051211	10000	2618						
4/01/2006 07:00	181	1	051227	190000	2475						
14/01/2006 10:00	193	1	060106	100000	2263						
19/01/2006 02:00	100	1	060114	230000	2179						
24/01/2006 21:00	94	1	060120	240000	2302						
6/02/2006 04:00	57	1	060203	200000	2827						

Date and time that the period ended	Duration of Rationing (hours, for periods >24hrs)	Max Rationing step reached (1=20% cut; 2=35% cut; 3=50% cut)	Date Start (yymmdd)	Time Start (hhmmss)	Mean flow rationing Step 1 (l/sec)	Date start Step 2 start	Time start Step 2 start	mean flow rationing Step 2	Date start Step 3	Time start Step 3	mean flow rationing Step 3
8/02/2006 08:00	30	1	060207	30000	2669						
3/04/2006 05:00	882	3	060225	120000	2279	060311	120000	1842	060325	120000	1700
7/04/2006 07:00	29	1	060406	30000	2698						

APPENDIX III – AGFIRST CONSULTANTS REPORT

AGFIRST CONSULTANTS

20/10/2006

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WAIMEA WATER AUGMENTATION PROJECT - ECONOMIC ASSESSMENT OF THE NON-AUGMENTATION (Do-Nothing) SCENARIO.

This report follows on from the river data supplied by Andrew Fenemor of Landcare Research.

Scenario

- That the current minimum in-stream requirement of 500 l/s at the Appleby Bridge is raised to 800 l/s.
- That the allocation response to this is a reduction of security of supply (rather than a reduction in water permits issued).

The economic assessment of the non-augmentation scenario is to:

- Assess the change in value of production from the currently irrigated areas of the Waimea Plains that would result from the above assumptions (i.e. from the more limited irrigation scenario).

The assessments were based on the hydrological records for the two dry summers of 1982/83 and 2000/01, and for the "average" summer of 2004/05.

Process

The hydrological data provided by Andrew Fenemor was arranged in a different manner, so that it would be easier for farmers to assess the years being investigated, and to put a figure on what they felt the losses would be for the different years being studied. (Attached as Appendix A.) The objective was to arrive at a dollar loss figure for a range of crops, and for these losses to be multiplied by the area that each crop represented. When the various crop losses were combined, we would arrive at the dollar loss that the Waimea Plains might forgo, if we experienced these various scenarios this summer.

I placed the drought records in front of three different parties, explained how the figures were arranged, and asked for their assessment of losses for the crops that they had experience with (Appendix A).

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We had some discussion as to if the TDC had ever gone beyond the 3-step rationing point, and Joseph Thomas said that they had gone to an additional 10% cut (giving a total cut of 60% of allocation). The scenarios from Andrew do not go beyond a 50% cut. In 2000/2001, the river went dry at the Appleby Bridge. I presume that if the TDC had a requirement to leave a minimum of 800 l/s in the Waimea River at the Appleby Bridge, and we then had another 2000/01 year summer river flow, then Council would have to impose an even more restrictive rationing regime this year than they did in 2000/2001. If this was the case, then we could get the situation that some/many irrigators, especially those growing other than pasture crops, might decide that the financial risks attached in growing their crops were too great, and that they stopped growing these crops & either reverted to pasture, or some less demanding water crop (possibly grapes). This might mean a financial reduction from kiwifruit or apples, down to irrigated pasture and maybe dairying. Another option could be to swap to a crop that could still produce a crop, despite a big water reduction (possibly grapes).

In light of some of the comments above, the losses suggested below may be less than could happen in such an event. Another outcome from a bad drought that is often hard to place a cost on is the carryover effect into the next crop. Two successive drought years have the potential to be worse than the same two droughts that may be separated by a couple of wetter than average years.

Crop Areas

The following crop areas have been used in other reports:

Pasture	= 1,600 ha
Apples, KF, et al	= 1,850 ha
Grapes & Olives	= 350 ha
Total	= 3,800 ha

Market gardening (including especially glass house growers, and within that group especially hydroponics growers) is a crop not mentioned above, but is one that has the potential to be significantly affected in a bad drought. These are include in with the Apples and KF, so should be well catered for here.

In coming up with the possible losses for the above crops, we have tried to also allow for the fact that these crops are also grown over a range of soil types. The assessment of crops by soil moisture holding capacity was taken as:

	Soil Type (By Soil Moisture Holding Capacity in mm)			
	38 mm	**78 mm**	**130 mm**	
Pasture	600 ha	100 ha	900 ha	
Apples, KF et al	760 ha	190 ha	900 ha	
Grapes Olives	200 ha	20 ha	130 ha	
Totals	1560 ha	310 ha	1930 ha	= 3,800 ha.

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Generally speaking, droughts are felt quickest and most severely in the lower soil moisture-holding soils first, and take longer to have an effect on the heavy soils. However, in a very bad/prolonged drought, all soils will be affected, and the heavy clay soils (and high organic matter soils, if we had them), can take time, and be difficult to rewet.

Financial Losses from Rationed Water

I have approached several people to try and arrive at a likely loss of income from the restriction in water that would result from the sample droughts and "average year" figures from Andrews's hydrological data.

Steven Spark and Grant McKay both Horticultural Consultants with Agfirst Motueka have supplied the horticultural losses. Table 1 that follows have the three main crops covered for both last year and the current year. I would use this years figures, as they will be closer to a normal year. Last year was a very low year for crop returns. I have included development costs, should you want to consider that the reduced irrigation water might lead to some growers pulling out their current crops and moving in to a crop that uses less water. Note that there would also be a gap of several years before the new crop returned the sort of income streams shown under the Net figures. The table also includes gross crop figures, as if a grower moved out of apples and went into pasture, then the gross dollars would be lost to the district each year that pasture was grown instead of the apples.

Steven Spark's commentary is attached as Appendix B

Table 1

		Returns / Ha Forecast Actual 2005/06		Returns / Ha Forecast 2006/07	
Crop	**$/ha development**	**$Gross**	**$Net (EBT)**	**$Gross**	**$Net (EBT)**
Kiwifruit	$ 45,000	$ 30,560	-$ 45	$ 47,376	$ 16,556
Apples	$ 45,000	$ 35,203	-$ 9,329	$ 59,541	$ 14,254
Grapes	$ 55,000	$ 23,336	$ 9,776	$ 23,315	$ 9,468
Olives	$ 7,000				

Notes:

EBT = Earnings before Interest and Tax
Development $ is variable e.g. Grapes contouring etc.
2005/06 Sourced from MAF monitoring
2006/07 have built in returns on what we are seeing currently
Olives not sure if this is a suitable crop

The other growers I have sought comments from are both in the Augmentation Study Group.

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Murray King (Dairy Farming) has supplied the following figures: -

> Gross Margin per hectare for dairy farming (after deducting costs) of $2,100/ha. Dairy farms will experience more significant dollar losses with early feed shortages [as their peak milk production is probably late October to early December where as apple and Kiwifruit losses will be worst later in the season (late February to April for Kiwifruit)].
>
> Murray King's first impression was that losses for the two significant drought years (1982/83 and 2000/01) would be about $750/ha. He later revised this figure upwards to $1,250/ha.

John Bealing
Engineering Consultant
Agfirst

JB: C:MYDOCUMENTS\TYPING\IRRIGATION\AUGMENTATIONT&TECONASSESDATA1206.DOC

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WAIROA RIVER WATER RESTRICTIONS

1. "Average Year"

Comparing the 2004/05-year as an average, I can see no major impact on either horticultural crop, as 20% should be manageable for all producers. Kiwifruit, apples and viticulture will not suffer any detrimental effects from a 20% restriction. Apples and viticulture commence harvesting in February and March and water could be switched to non-harvested varieties to satisfactorily complete harvesting.

No major impact is expected next season providing the vines/trees were healthy at leaf fall, which I would expect in this scenario.

Net EBT in "Average year" based on the 2006/07 return

Soil Type	Kiwifruit	Apples	Grapes
30mm/week	$10,256	$14,254	$9,468
35mm/week	$10,256	$14,254	$9,468

2. "25-33 year drought"

This situation is a bit more critical. 20% restrictions starting early in November and progressing on to 40% restrictions in mid February till early April will impact upon the main crops grown. The early deficits would suggest not enough soil moisture is available to sustain the crops over the early summer period. I would assume kiwifruit size will suffer 10% and for overall yield to be 12% lower for kiwifruit. This would lower the Net EBT, (based on the 2006/07), to $4,410/ha on the lighter 35 mm/week soils, and a lesser effect on the heavier soils (5% smaller size and 8% crop reduction) to $5,740. If rain occurred in April prior to harvest, I would also expect an increase in fruit storage (5%) losses as kiwifruit do not store well most years when grown under dry drought conditions, followed by rain prior to harvest. Fruit firmness in coolstore would also be severely compromised and fruit would have to be shipped to market 1-2 months earlier than normal to meet the in market requirements for minimum flesh firmness. This could reduce grower returns by 30 cents per tray or -$1800/ha.

Viticulture is better suited to early restrictions as minimal water reduces canopy growth and can improve wine quality providing ample water is available at harvest time. This scenario indicates water restrictions would still be in place over harvest; therefore grape quality would suffer with the 40% restrictions at harvest. Viticulturists may be able to manage this by irrigating the early harvested varieties then switching water over to the late harvested varieties. However it is becoming more common to plant fewer varieties (mainly Sauvignon Blanc) and this makes this strategy not always possible. Therefore I would expect at least a 10% reduction in yield due to smaller berry size. Grape quality is more complex. Depending on how viticulturists handle the restrictions, there could only be a small reduction in wine quality (price 5% lower) providing the vines are not

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pushed too far. On the lighter soils (35 mm/week) this would reduce Net EBT to $7,565/ha and on the heavier soils a lesser reduction of Net EBT to $8,406/ha.

Apple and pear size would be reduced by 10% with this type of restriction. Mostly because of the length or number of weeks a restriction has been in place. Growers would have had to achieve a very successful chemical thinning program to keep this size reduction at only 10%. Some years this is not always possible if temperatures are cooler than normal at the critical chemical thinning time of September/October. Extra hand thinning costs would be required to remove small fruit throughout the season. This would necessitate at least a 10-15% reduction in crop load to maintain fruit size. The Net EBT would be $6,584/ha on the lighter soils (35mm/week). The heavier soils (30mm/week) will be less affected at $9,068/ha.

In extremely dry years trees react differently. It was noticeable that some trees (Cox Orange Pippin and Royal Gala) tend to have a lighter return bloom following a dry year. I would expect that under this scenario, production could be 10-20% lower for these varieties in the next season.

Net EBT in "25-33 year drought" /ha

Soil Type	Kiwifruit	Apples	Grapes
30mm/week	$5,740	$9,068	$8,406
35mm/week	$4,410	$6,584	$7,565

3. "27-85 year drought"

This situation provides a greater number of third stage restrictions, however the number of stage 1 and 2 cuts is less than the "25-33 year drought". The fact that there are fewer restriction days is offset by the severity of the stage 3 restrictions. Growers would not have had the early warnings to set appropriate tree crop loads as in section 2 and would therefore find themselves in a potential over cropping situation with limited water to finish the crop at harvest. Because the heavier soils have a greater buffering capacity, I would expect the losses to be the same as in the "*25-33 year drought*" (5% smaller size and 8% crop reduction) to return a Net EBT of $5,740/ha. The lighter soils would suffer greater reduction to the Net EBT ($2,520/ha) as fruit size would be 10% smaller and crop yield 12% lower. Kiwifruit can gain size in autumn prior to harvest if satisfactory rain occurs in late April early May, however sufficient rain cannot always be counted on.

Net EBT in "27-85 year drought" /ha

Soil Type	Kiwifruit	Apples	Grapes
30mm/week	$5,740	$6,584	$7,565
35mm/week	$2,520	-$1,663	$2,086

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On the heavier soils, apples would experience an estimated reduction of Net EBT $6,584 as per the "*25-33 year drought*" (10% smaller size and 8% crop reduction). The lighter soils would suffer a greater reduction in fruit size (as much as 15%) and a reduced yield of 20% because of the late notice of water restrictions. Crops would have been set but water restrictions would not enable them to be finished. The lighter soils do not have the buffering capacity. This would reduce Net EBT to -$1663/ha.

As for the other crops, grapes should be capable of achieving only small reductions in yields and quality on the heavier soils as per the "*25-33 year drought*" section. Net EBT for the heavier soils $7,565/ha. However the lighter soils would have greater loss in yield (20%) due to smaller berry size and potentially a 15% reduction in quality (price). Net EBT for the lighter soils is $2,086/ha.

Steven Spark
Horticultural Consultant
Agfirst

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Augmentation Study

Sept 2006

Wairoa River
Water Restrictions When Flow Below 800 L/S

Year	Month	Day 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
82/83	Nov				1	1	1	1	1	1	1	1	1	1	1	1	1				1	1	1	1	1	1	1
	Dec	1	1	1	1	1	1	1	1	1	1	1/2				1	1	1	1	1	1				1		
	Jan	1	1	1	1					1	1	1	1														
	Feb	1	1	1	1	1	1	1	1	1	1	12	12	12	12	12	12	12	12	12	12	12	12	12	12	123	123
	Mar	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123
	Apr	1	1	1	1	1	1						1	1	1/2												
00/01	Dec						1	1	1	1	1															1	1
	Jan													1	1	1			1/2	1	1	1	1	1	1	1	
	Feb	1	1	1	1	1	1	1	1	1	12	12	12	12	12	12	12	12	12	12	12	12	12	12	123	123	123
	Mar	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123	123
	Apr	123	123		1	1	1	1	1	1	1	1	1	1	1	1	1	1	12	12	12						
04/05	Feb									1	1																
	Mar			1	1	1								1	1	1	1	1	1	1	1	1	1	1	1		
	Apr																										

1 represents a first stage water restricition, or 20% (1mm/day with an allocation of 5 mm/day)
12 " " second " " " " 35% (1.7 mm/day " " " " " ")
123 " " third " " " " 50% (2.5 mm/day " " " " " ")

WITH A 30 MM/WEEK ALLOCATION

ET figures, on average are: -		Water Allocation	Restriction by Stage (mm/day) Gives 1 Shortfall	12 Shortfall	123 Shortfall
Nov	4 mm/day	4.3 mm/day	3.5 0.5	2.8 1.2	2.2 2.1
Dec	4.6 "	"	" 1.1	" 1.8	" 2.4
Jan	4.8 "	"	" 1.3	" 2	" 2.6
Feb	4.2 "	"	" 0.7	" 1.4	" 2
Mar	3.0 "	"	" +0.5	" 0.2	" 0.8
April	2.0 "	"	" "+1.5	" +0.8	" +0.2

Days of Stage Cuts

27	28	29	30	31	1	2	3		30mm/week Approx Deficit 1	12	123	Total Deficit	35 mm/week Approx Deficit 1	12	123	
1	1			1	XXX	**23**		Nov	mm 23				0			
		1	1	1		**21**		Dec	22.6				12.3			
	1	1	1	1		**12**		Jan	15.6				9.6			
123	123	XXX	XXX	XXX		**10**	**14**	**4** Feb	7	19.6	8		2	13.3	6.8	
123	123			1	1	**2**		**28** Mar	0		22.4		0		14	
						7		Apr	0				0			
						76	**16**	**35**	**68**	**20**	**30**	**118**	**24**	**13**	**21**	**58**
						Considered a 25 - 33 year drought.										
						7		Dec	7.7				4.2			
1	1	1	1	1		**15**		Jan	19.5				12			
123	123	XXX	XXX	XXX		**9**	**14**	**5** Feb	6.3	19.6	10		1.8	13.3	8.5	
123	123	123	123	123				**31** Mar	0		24.8		0		15.5	
						14	**3**	**2** Apr	0		0		0	0	0	
						45	**17**	**38**	**34**	**20**	**35**	**88**	**18**	**13.3**	**24**	**55**
						Considered a 27 - 85 year drought										
						2		Feb	1.4				0.4			
						15		March	0				0			
						17	**0**	**0**	**1**	**0**	**0**	**1**	**0.4**	**0**	**0**	**0.4**
						Considered an "Average Year".										

Note: No Allowance made for Crop Factor

WITH A 35 MM/WEEK ALLOCATION

ET figures, on average are: -		Water Allocation	Restriction by Stage (mm/day) Gives 1 Shortfall	12 Shortfall	123 Shortfall
Nov	4 mm/day	5 mm/day	4 0	3.25 0.75	2.5 1.5
Dec	4.6 "	"	" 0.6	" 1.35	" 2.1
Jan	4.8 "	"	" 0.8	" 1.55	" 2.3
Feb	4.2 "	"	" 0.2	" 0.95	" 1.7
Mar	3.0 "	"	" +1	" +0.25	" 0.5
April	2.0 "	"	" "+2	" +1.25	" +0.5