Interim Economic Assessment of the Healthy Catchments Project proposed “Solutions Package”

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Assess the effect of changes in farm incomes across the different sectors, following:

• Changes to the Opihi River flow and allocation regime, and the establishment of new minimum flows
  • ZIPA Initial Minimum Flow Recommendations (Step 1 & Step 2 in page 53 and 55)
  • Cultural flow preferences (COMAR)
  • “Flow and Allocation Party” flow preference
  • Ecological minimum flow requirements, NIWA

This presentation shows the interim results for Step 1 and Step 2. COMAR flow regime is still being reviewed, and the Flow and Allocation Party flow preference and NIWA flow requirements are yet to be determined.
Assumptions

- Surface water supply availability under different regimes provided by ECAN (1998 – 2015), post Opuha dam.

- There was one significant drought year (2014-15) during this period, with the remaining years being relatively mediocre.

- ZIPA Initial Minimum Flow Recommendations are Step 1 (5-years) and Step 2 (10-years)

- ZIPA recommendations incorporate 150 day stream depletion calculation

- No drought mitigations (e.g. increase in supplements purchased) are factored into this analysis

- Apparent anomalies in some flow data allocation blocks (Temuka A block moving to Temuka B in some instances)
The impact of proposed flow regimes on Cash Operating Surplus for different land uses

1. Calculate the impact of existing and proposed flow regimes
2. Conversion into agronomic effects
3. Financial Impact on irrigated Farm Financial Models
4. Financial impact on total area
5. Flow-on effects
Calculate the impact of supply reliability of irrigation

Aqualinc

- Daily modelled irrigation demands:
  - For a range of crop / soil / climate combinations,
  - Based on demand modelling done for the OTOP groundwater modelling project.

- Supply reliability calculated on a daily basis (accounting for both supply and demand)

- Reliability summarised for each combination of scenario / allocation block / soil / crop
Irrigation consents are classed into four categories:

- Non-Affiliated A Permits (AN)
- Non-Affiliated B Permits (BN)
- Affiliated A Permits (AA)
- Affiliated B Permits (BA)

<table>
<thead>
<tr>
<th>Surface Water Allocation Zone</th>
<th>Allocation blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opihi SH1</td>
<td>AN</td>
</tr>
<tr>
<td></td>
<td>BN</td>
</tr>
<tr>
<td>Opihi Saleyards</td>
<td>AA + BA</td>
</tr>
<tr>
<td>North Opuha</td>
<td>AA + BA</td>
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<tr>
<td></td>
<td>AN</td>
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<tr>
<td>South Opuha</td>
<td>AA + BA</td>
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<tr>
<td></td>
<td>AN</td>
</tr>
<tr>
<td></td>
<td>BN</td>
</tr>
<tr>
<td>Opihi Rockwood</td>
<td>AA + BA</td>
</tr>
<tr>
<td></td>
<td>AN</td>
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<td></td>
<td>BN</td>
</tr>
<tr>
<td>Te Ana Wai</td>
<td>AA + BA</td>
</tr>
<tr>
<td></td>
<td>AN</td>
</tr>
<tr>
<td></td>
<td>BN</td>
</tr>
<tr>
<td>Temuka</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>B</td>
</tr>
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</table>
Calculate the impact of supply reliability of irrigation - Aqualinc
Calculate the impact of supply reliability of irrigation

Comparison of the impact of the current situation and ZIPA Step 1 and Step 2 on irrigation reliability in Temuka (A Block), 1998-2015 average and 2014-15 drought
Conclusion

- The proposed flow regimes for Steps 1 & 2 are relatively small in most cases; this is reflected in relatively small changes to the supply reliability.
Conversion of agronomic impacts

Four elements of Supply Reliability:

• Severity – full or partial days restrictions.
• Frequency – how often it occurs.
• Duration – period of consecutive days.
• Timing – when in the season it occurs.
Conversion of agronomic impacts

Conversion of Plant Available Water (PAW):

- PAW is 80 MM.

- The soil is full at the commencement.

- Evapotranspiration is 4.0 mm / day.

- After 20 days without irrigation, plant growth stops completely.

- Loss of production assumed to start after 6 days

- Recovery is not necessarily instantaneous.
Conversion of agronomic impacts

Formula for the calculation is:

\[
\text{Pasture production (kgDM/ha)} = D \times GR \times F
\]

Where:
- \( D \) = average days lost
- \( GR \) = average daily growth rate
- \( F \) = loss modification factor
Conversion of agronomic impacts

The impact of the current situation and ZIPA Step 1 and Step 2 on pasture production in Temuka (A Block), 1998-2015 average and 2014-15 drought

Pasture production (tDM/ha)

- Current
- Current (Drought year)
- ZIPA Step 1
- ZIPA Step 1 (Drought year)
- ZIPA Step 2
- ZIPA Step 2 (Drought year)

Dairy
Sheep, Beef and Dairy Support
Impact on farm financial models

Representative models used:
• Dairy Production System 3
• Dairy Production System 4
• Arable
• Sheep, Beef and Dairy Support

Use of SOPI data to create averages for product returns
Impact on farm financial models

Dairy Model
Key assumptions

• 230 ha effective

• System 3: 10% of cows diet imported supplements

• System 4: 25% of cows diet is imported supplements

• Cow numbers and total MS production are driven off kgDM/ha.

• Cow numbers drive variable expenses
Impact on farm financial models

Sheep, Beef and Dairy Support

Key assumptions

- 220ha trading and finishing property

- 16.3 ha kale (13.5t/ha base), contract grazing dairy cows

- 16.3ha spring barley (9t/ha grain base)

- Pasture production drives stock units per hectare. Stock units drive variable expenses.

- 68% SU- lambs; 32% SU- steers.
Impact on farm financial models

Arable

Key assumptions
160ha mixed cropping property

<table>
<thead>
<tr>
<th>Crop</th>
<th>Ha</th>
<th>Yield tDM/ha (base model)</th>
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</thead>
<tbody>
<tr>
<td>Ryegrass seed</td>
<td>40</td>
<td>2.0</td>
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<tr>
<td>Kale</td>
<td>20</td>
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<tr>
<td>Potatoes</td>
<td>20</td>
<td>50.0</td>
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<tr>
<td>Wheat</td>
<td>20</td>
<td>12.0</td>
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<tr>
<td>Barley</td>
<td>40</td>
<td>9.0</td>
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Rating up the existing model

Irrigated land use in Opihi and Temuka catchments
### Rating up the existing models

**Total hectares by land use, SWAZ and allocation block**

<table>
<thead>
<tr>
<th>SWAZ</th>
<th>Allocation blocks</th>
<th>Dairy System 3</th>
<th>Dairy System 4</th>
<th>Sheep, Beef and Dairy Support</th>
<th>Arable</th>
<th>Total</th>
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<td>Te Ana Wai</td>
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<td><strong>TOTAL</strong></td>
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<td>7314</td>
<td>4874</td>
<td>4225</td>
<td>1821</td>
<td>18235</td>
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Flow On Effects

- Utilised multipliers created from the 2013 55 sector industry sector for Canterbury:
  - Gross Output,
  - Value added,
  - Employment (FTE) and
  - Personal Income.
The tyranny of averages

Impacted by:

- The variability of the flow regime.

- The use of average income data.

- The use of representative farm models.
## Average data (1998-2015 average)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Total revenue ($ million)</th>
<th>Total expenses ($ million)</th>
<th>Total Cash Operating Surplus ($ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>133.4</td>
<td>82.2</td>
<td>49.5</td>
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<tr>
<td>Step 1</td>
<td>129.9</td>
<td>77.9</td>
<td>47.7</td>
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<tr>
<td>Step 2</td>
<td>131.1</td>
<td>78.4</td>
<td>48.4</td>
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</table>
### Financial Results

#### Maximum data (2014-15 drought)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Total revenue ($ million)</th>
<th>Total expenses ($ million)</th>
<th>Total Cash Operating Surplus ($ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>123.7</td>
<td>77.8</td>
<td>44.4</td>
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<tr>
<td>Step 1</td>
<td>107.2</td>
<td>67.8</td>
<td>35.4</td>
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<tr>
<td>Step 2</td>
<td>108.8</td>
<td>68.5</td>
<td>36.3</td>
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Financial Results

The impact of the current situation and ZIPA Step 1 and Step 2 on farm financials averaged over all land uses and allocation blocks, 1998-2015 average and 2014-15 drought.
% change in Cash Operating Surplus per hectare for each consent block (1998-2015 average)
% change in Cash Operating Surplus per hectare for each consent block (2014-15 worst drought)
Financial Results

Gross Output (flow-on effects)

1998-2015 average

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Current</td>
<td>Step 1</td>
</tr>
<tr>
<td>Dairy</td>
<td></td>
<td>152.1</td>
<td>148.1</td>
</tr>
<tr>
<td>Sheep and Beef</td>
<td></td>
<td>19.2</td>
<td>18.8</td>
</tr>
<tr>
<td>Arable</td>
<td></td>
<td>13.8</td>
<td>13.3</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>185.0</td>
<td>180.2</td>
</tr>
</tbody>
</table>

Gross Output ($ million)

Land Use

Dairy 140.6 121.8 123.7
Sheep and Beef 18.0 16.5 15.5
Arable 12.9 10.4 9.9
TOTAL 171.6 148.7 149.0
Financial Results

Percentage change in Total Gross Output from the Current Scenario

1995-2015 average
-2.6%  -2.9%

2014-15 (worst drought year)
-15%  -15%

% change in Gross Output from current

ZIPA Step 1  ZIPA Step 2

0.0%  -2.0%  -4.0%  -6.0%  -8.0%  -10.0%  -12.0%  -14.0%  -16.0%  -18.0%
Consideration of the data.

- The average data indicates that there is a marginal change from the current and very little difference between Step 1 and Step 2.

- Because of the nature of the river flow regime consideration of the average data should be taken with caution.

- The impact of a maximum restriction event is quite severe.

- Depends upon the frequency of events modelled.

- It is the difference between allocation regimes which is the most relevant more than the absolute values.
Possible next steps

- Review the Aqualinc data
- Create financial models representative of each SWAZ
- Report individual SWAZ impacts
- Test variability of different product prices