



memorandum

TO Brent Walton FROM Bas Veendrick
Waimakariri Irrigation Ltd DATE 18/5/2020
RE Waimakariri minimum flow site

1.0 Introduction

Waimakariri Irrigation Ltd (WIL) is authorised to take water from the Waimakariri River under consent CRC166677, which is classed by Environment Canterbury (ECan) as A-permit water. This consent allows WIL to abstract water at a maximum rate of 11,041 L/s. Abstraction of water is restricted when the flow in the Waimakariri River is between 41 and 63 m³/s and abstraction must cease when flows are at or less than 41 m³/s. Restrictions are determined based on the unmodified flow estimated by ECan from measurements at Old Highway Bridge. The unmodified flow is the flow measured at the Old Highway Bridge flow recorder with the upstream abstractions added back to the measured flow.

Under the Waimakariri River Regional Plan the minimum flow site for all permit holders taking water from the Waimakariri River will change from the 'Old Highway Bridge' monitoring site to the 'Otarama' monitoring site. A-permits will be restricted when the flow at 'Otarama' is between 46 and 68 m³/s and abstraction must cease when flows are at or less than 46 m³/s.

ECan have indicated in a recent presentation to the Zone Committee that they can now move the flow allocation monitoring point for their consents to the Otarama site. This would only happen during a consent review or when consents expire and need to be renewed, although WIL could apply to vary the conditions of their consent to change the flow monitoring point at any time. It is noted that the current WIL consent (CRC166677) does not expire until 18 November 2031.

Based on the considerations above you have asked us whether it is time for WIL to change the measuring site from OHB to Otarama and to assess the effect this may have on the supply reliability.

This memorandum summarises the available flow data, the supply reliability analyses and the associated results.

2.0 Available data

ECan has supplied PDP with the available flow data for OHB and Otarama. For OHB the unmodified flow series was obtained from ECan based on the low flow database. This is effectively the daily flow reported on the ECan website that determines the restrictions for Waimakariri River water permit holders.

For Otarama the mean daily flow was provided. This flow series consists of flow from two sites:

1. Waimakariri at Otarama (site 66403) – 1/7/2008 till 24/3/2016
2. Waimakariri at below Otarama (site 66442) – 24/3/2016 till 12/3/2020

These two sites are located in very close proximity to each other and effectively measure the same flow. The original site (site 66403) was moved downstream as this new site was deemed to be 'more stable' and less susceptible to 'rating changes'.

3.0 Supply reliability

In order to provide an indication of the effect of changing the minimum flow site from OHB to Otarama a spreadsheet model was developed based on the flow data obtained and the minimum flows specified in the current WIL consent and the Waimakariri River Regional Plan. The model was developed for the period 1 July 2008 to 12 March 2020. This modelling period was based on the available amount of overlapping flow data for the two recorder sites. The following supply reliability measures were used:

- ∴ Number of days in full restrictions. For OHB this is the number of days the unmodified flow is below 41 m³/s and for Otarama this is the number of days the flow is below 46 m³/s.
- ∴ Number of days in partial restriction. For OHB this is the number of days the unmodified flow is between 41 m³/s and 63 m³/s and for Otarama this is the number of days the flow is between 46 m³/s and 68 m³/s.
- ∴ Total number of days in restriction (partial and full). For OHB this is the number days the unmodified flow is less than 63 m³/s and for Otarama this is the number of days the flow is less than 68 m³/s.
- ∴ Total volume of water available for abstraction.

For the four supply reliability measures mentioned above totals were determined for each irrigation season (1 September – 30 April). In other words any restrictions outside the irrigation season were not included in the calculations. Example hydrographs for OHB and Otarama for the 2012-2013 irrigation season are included in Appendix A. This graph also shows the A - permit minimum flow and the flow at which partial restrictions need to be implemented for A -permit holders.

4.0 Results

Table 1 is a summary of the results of the analyses and the associated graphs are included in Appendix B. The results indicate that there can be significant differences in supply reliability depending on what minimum flow site is used. On average the number of days in full restriction is the same between OHB and Otarama. It is noted that there are only three years out of the twelve year modelling period where the number of days in full restriction is greater at the OHB site. Generally speaking from 2010/2011 onwards most years have a greater amount of days in full restrictions when the Otarama site is used.

The modelling for the number of days in partial restriction indicates that for eleven out of the twelve year modelling period the number of days in partial restriction is greater when Otarama is used as the minimum flow site. There is one season (2010/2011) where the number of days in partial restriction is the same. The average number of days in partial restriction per irrigation season for OHB and Otarama is 48 and 59 respectively.

The total number of days in restriction (partial plus full restrictions) is also generally greater for Otarama. The exception to this is the first three seasons where the total number of days in restrictions is greater at OHB or where the total number of days is the same.

Total available seasonal allocation volume is greater for OHB for nine out of twelve seasons with only three seasons having a greater available volume when Otarama is used.

Overall it can be concluded that switching to Otarama as the minimum flow site is likely to result in negative impacts on supply reliability for WIL in most years.

Table 1: Supply Reliability

| Irrigation Season | Number of days in full restriction | | Number of days in partial restriction | | Number of days in restriction (partial + full) | | Available Allocation (Mm3) | |
|-------------------|------------------------------------|-----------|---------------------------------------|-----------|--|-----------|----------------------------|------------|
| | Old Highway Bridge | Otarama | Old Highway Bridge | Otarama | Old Highway Bridge | Otarama | Old Highway Bridge | Otarama |
| 2008/2009 | 37 | 14 | 37 | 56 | 74 | 70 | 179 | 188 |
| 2009/2010 | 39 | 12 | 45 | 59 | 84 | 71 | 168 | 188 |
| 2010/2011 | 0 | 0 | 40 | 40 | 40 | 40 | 219 | 222 |
| 2011/2012 | 0 | 7 | 84 | 90 | 84 | 97 | 194 | 181 |
| 2012/2013 | 39 | 39 | 36 | 37 | 75 | 76 | 171 | 170 |
| 2013/2014 | 10 | 17 | 60 | 62 | 70 | 79 | 192 | 175 |
| 2014/2015 | 22 | 27 | 47 | 67 | 69 | 94 | 185 | 176 |
| 2015/2016 | 1 | 10 | 51 | 73 | 52 | 83 | 215 | 185 |
| 2016/2017 | 0 | 7 | 40 | 49 | 40 | 56 | 207 | 199 |
| 2017/2018 | 2 | 0 | 33 | 54 | 35 | 54 | 214 | 205 |
| 2018/2019 | 8 | 18 | 73 | 86 | 81 | 104 | 191 | 176 |
| 2019/2020 | 0 | 0 | 27 | 30 | 27 | 30 | 171 | 174 |
| Average | 13 | 13 | 48 | 59 | 61 | 71 | 192 | 187 |

5.0 Other Considerations

The criteria in the Waimakariri River Regional Plan to change the flow allocation monitoring site is set out as follows:

For any existing resource consent that specifies the Old Highway Bridge site as the Waimakariri River minimum flow monitoring site, notice of the Canterbury Regional Council's intention to review such a condition will not be given:

1. *prior to 1 July 2011; or*
2. *if the relationship of 41 m³/s at OHB = 46 m³/s at Otarama is shown to be inaccurate.*

The relationship is "inaccurate" if, for the period 1 February 2009 to 31 March 2010 and 1 October 2010 to 31 March 2011, the number of days that the existing abstractors are calculated by the Canterbury Regional Council to be on restriction, as if the Otarama flow site was being used, varies (plus or minus) by more than seven days from the number of days that the existing abstractors are on restriction based on flows at the OHB site.

An analysis of this criteria for whether the relationship is “inaccurate” is presented in Table 2. It is noted that the analyses was undertaken for the number of days in full restriction and for the total number of days in restriction (partial plus full restrictions) as it is unclear from the wording in the Waimakariri River Regional Plan whether the number of days relates to full restrictions or all restrictions (partial plus full restrictions).

Table 2: Assessment of whether the OHB – Otarama relationship is inaccurate, as specified in the WRRP Supply Reliability

| Monitoring Period | Number of days in full restriction | | Number of days in restriction (partial + full) | |
|-----------------------------------|------------------------------------|-----------|--|------------|
| | Old Highway Bridge | Otarama | Old Highway Bridge | Otarama |
| 1/2/2009 – 31/3/2010 ¹ | 62 | 24 | 126 | 109 |
| 1/10/2010 – 31/3/2011 | 0 | 0 | 30 | 20 |
| Total | 62 | 24 | 156 | 129 |

Note 1: Calculated over period 1/2/2009 - 6/5/2009 plus 5/10/2009 - 31/3/2010. No data available for unmodified OHB flow for period 7/5/2009 - 4/10/2009.

The analysis shows that , the number of days that the existing abstractors are on restriction, as if the Otarama flow site was being used, varies (plus or minus) by more than seven days from the number of days that the existing abstractors are on restriction based on flows at the OHB site. Based on the criteria outlined in the Waimakariri River Regional Plan this means that the relationship can be considered inaccurate and therefore ECan should not initiate a review of the WIL consent to impose the Otarama flow restrictions specified in the WRRP (although they could initiate a review to impose some different flow restrictions if they chose to do that).

It is noted that for the specific periods specified in the Waimakariri River Regional Plan (1/2/2009 – 31/3/2010 and 1/10/2010 – 31/3/2011) the number of days in restriction (full restrictions and full plus partial restrictions) for Otarama are less than for OHB. However, as detailed in Table 1 for most other years the number of days in restriction are less when OHB is used as the minimum flow site.

The Otarama site is a more straightforward and reliable monitoring site, but a change to that location should only occur when the flow criteria for restrictions do not disadvantage WIL

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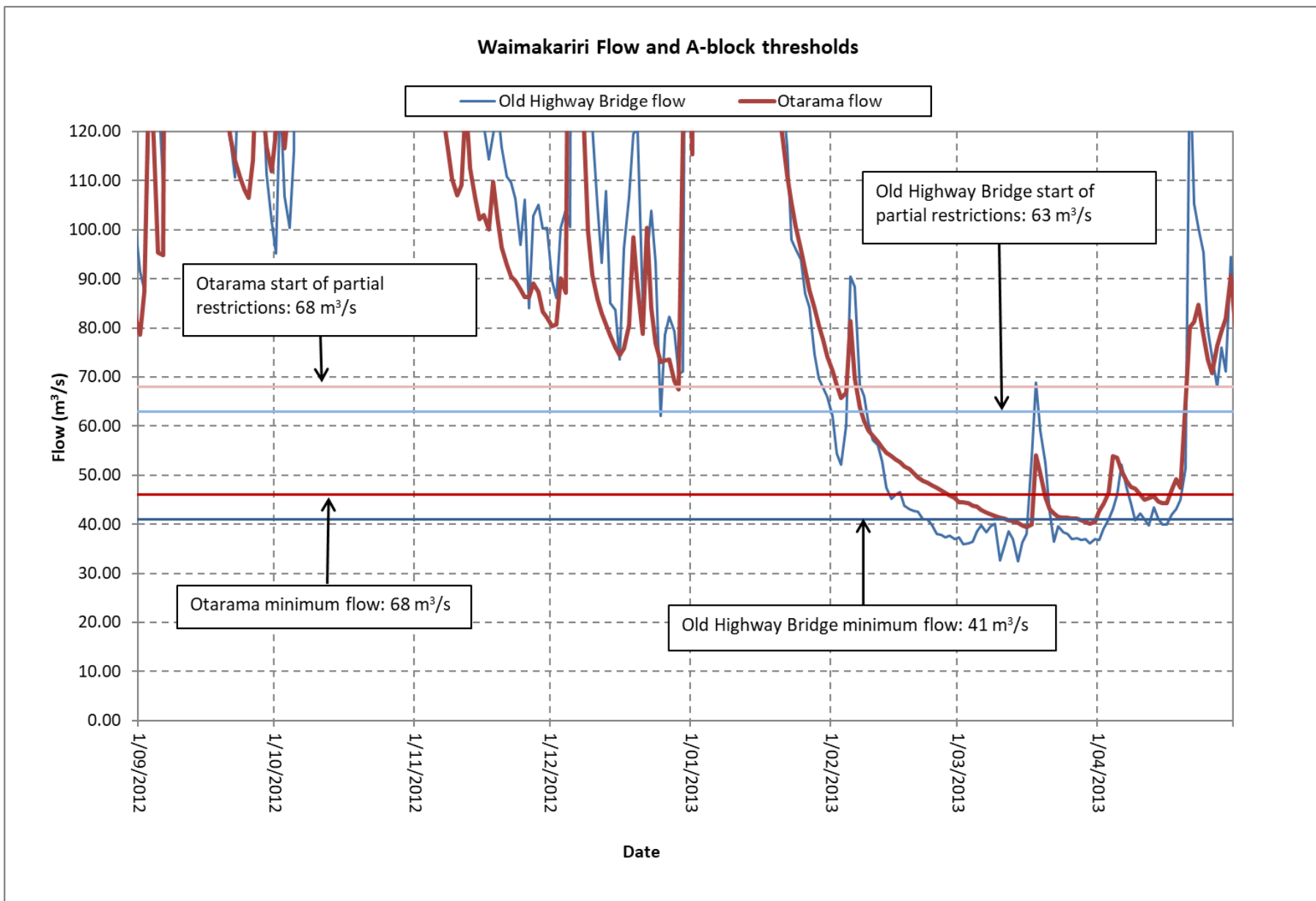
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Limitations

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Appendix A: Example Hydrograph



Appendix B: Restrictions

