

Date: 7 December 2007  
 To: Leo Fietje, Principal Consents Advisor, Environment Canterbury  
 From: Cliff Tipler, Senior Principal, URS  
 Subject: Central Plains Water Enhancement Scheme  
 Section 92 request: Frequency and Duration of Low Flow Events

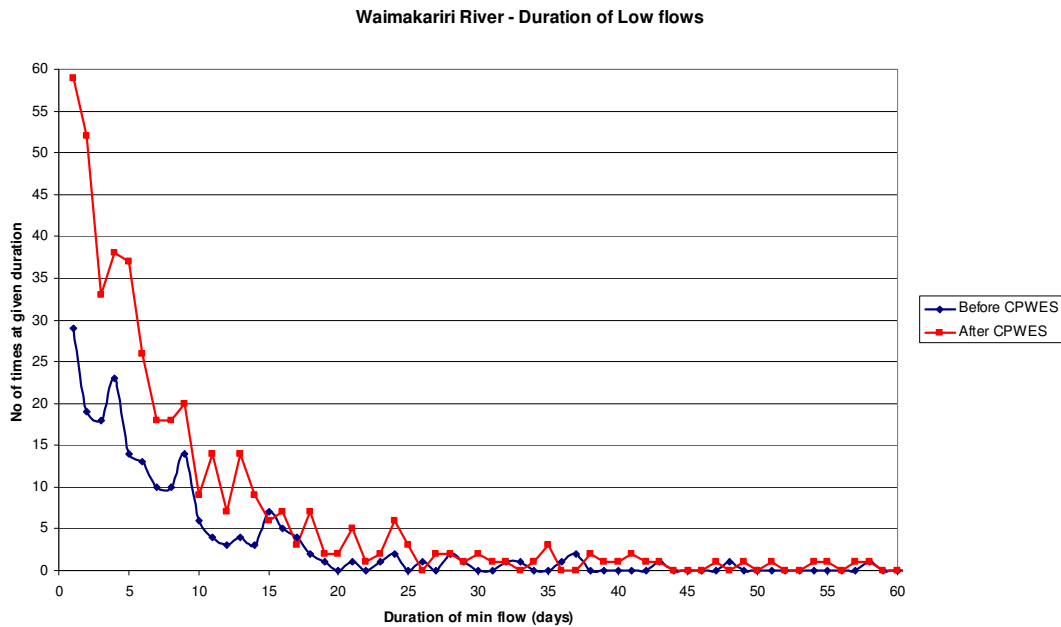
This memo responds to a Section 92 request from Environment Canterbury to Central Plains Water Trust dated 2 November 2007. Under the heading *“Mitigation against effects from freshes”*, the letter requests:

*“Please provide mitigation measures to reduce the effects of the takes on freshes in both the Waimakariri and Rakaia Rivers.”*

We have analysed the frequency and duration of the low flow events in the Waimakariri River before and after the scheme for the 34 years of data available. Table 1 following contains relevant data to the duration of low flows in the Waimakariri River. The longest period of continuous low flow (at or below the minimum flow) was 91 days before CPWES. After the scheme the longest period would have been 143 days, however there were only two occasions that the duration of low flows would have exceeded 90 days. The mean duration of the low flow periods only increases by 0.4 days, and the median duration will fall from 6 days to 5 days. This demonstrates that while the river flows will be at the minimum flow of 41 cumecs more frequently, the duration of these events does not change to any significant extent.

**Table 1; Low flow data for Waimakariri River**

	<b>Before CPWES (m<sup>3</sup>/s)</b>	<b>After CPWES (m<sup>3</sup>/s)</b>
Mean duration of min flow	9.4	9.8
Median duration of min flow	6	5
Maximum duration of minimum flow	91	143



Note: Duration of minimum flows truncated at 60 days

**Figure 1: Frequency and duration of low flow events**

Figure 1 shows that there are more low flow events of short duration after the scheme. This is shown by the deviation between the lines on the graph for durations less than ~ 25 days where for example the frequency of low flow events of 5 days will increase from 14 before the scheme to 37 after the scheme. The frequency of the longer events (say above 25 days) does not change to any significant extent. Our interpretation of this is that there will be no significant alteration to the low flow regime of the river, given that the longer duration events are more significant and therefore no specific mitigation measures are required.

Nevertheless we have considered a condition that would restrict the ability of CPWES to take water following periods of prolonged low flows. This is in response to the concern expressed by submitters that the river will be held a low flows for excessive periods with consequential adverse effects. For example, if the river was at the minimum flow as a consequence of takes and/or natural conditions for a continuous period in excess of 21 days, CPWES could delay the start of its take by 2 days or until the modified flow in the river exceeded 100 m<sup>3</sup>/s (an arbitrary suggestion), which ever came first. In this example we have assumed the modified flow to be that at the old state highway bridge after all other takes. Small freshes would be allowed to pass and/or a significant increase in river flow would have occurred before CPWES commenced its take.

Such a condition would only affect those events with durations in excess of 21 days, i.e. on the right hand side of Figure 1. It would not bring the two lines on the graph closer together on the left hand side. It is a necessary consequence of the CPWES take for there to be more occasions where the river is reduced to the minimum flow in the WRRP of 41 m<sup>3</sup>/s but as discussed above, there is no real change in the number of long period events of low flows. While we believe there is no significant change in the low flow regime, and that such a condition would fail to serve a resource management purpose, it would be acceptable to CPWES.