

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of applications for resource consent by the Central Plains Water Trust and a notice of requirement for the designation of land by Central Plains Water Limited associated with the construction and operation of the Central Plains Water Scheme

**SUPPLEMENTARY STATEMENT OF EVIDENCE OF JOE HAY ON BEHALF OF
THE NORTH CANTERBURY FISH AND GAME COUNCIL**

1. INTRODUCTION

- 1.1 My qualifications and experience are set out in my primary brief of evidence.
- 1.2 In this supplementary evidence I will address the supplementary evidence of Mr Walter Lewthwaite (Response to questions from commissioners Brief No 4, July 2008). I have been asked by Fish and Game to consider two specific areas: 1) the proposed mitigation options for Hacketts Creek, and 2) the proposed intake arrangements and the potential risk of fish stranding.

2. HACKETT'S CREEK

- 2.1 Mr Lewthwaite's proposed options for passing the canal flow under or over Hackett's Creek (Mr Lewthwaite's Appendix 5) more clearly define potential mitigation of effects on salmon spawning habitat and fish passage in this area. There are essentially two key potential impacts that these mitigation options seek to address: 1) reducing or avoiding loss of spawning habitat in the footprint area of the crossing; and 2) maintaining passage beyond the footprint area of the crossing so that spawning habitat further upstream remains accessible.
- 2.2 For either option Mr Lewthwaite proposes that construction would be timed to occur between January and March, in order avoid interfering with upstream or downstream migrating salmon. This timing would avoid impinging on downstream migrating juveniles (as discussed in my evidence in chief, paragraph 5.12), but is likely to impinge on upstream migrating adults to some extent. A slightly earlier temporal window for construction, of say November to January (I assume based on Mr Lewthwaite's evidence that a three month construction window is required), may be preferable to avoid impacts on the majority of migrants in both directions. However, even this period is not without risk, as some early season migratory adult salmon may begin arriving in the area of Hackett's Creek during these months. Therefore, I consider that as far as practicable fish passage along Hackett's Creek should be maintained throughout the construction period.

2.3 Mr Lewthwaite proposes moving the canal towards the Waimakariri River “enabling the race to avoid the valued ~100 m stretch of Hackett’s Creek” (Mr Lewthwaite’s point 7 paragraph 4). I assume that what Mr Lewthwaite means by this is that rather than impacting ~100 m of the stream, as the original canal alignment would have, the new crossing options would reduce this to ~15-30 m (see Mr Lewthwaite’s Appendix 5), depending on which option is ultimately adopted. This is because the canal would cross the stream less obliquely under the new proposal. The reach where the newly proposed crossing would be located is still within the area which I understand to be most heavily used by spawning salmon (see Figure 2 in my evidence in chief, and Map 2 in Appendix 1 to the evidence of Mr Robison on behalf of the New Zealand Salmon Anglers Association). While the proposed realignment of the canal will reduce the impacted area, it should be borne in mind that any part of Hackett’s Creek which is stable (i.e. is not disturbed by high flow events in the Waimakariri River), and has suitable substrate, is likely to provide spawning habitat. When I visited to the site in February 2008 the majority of the reach in question appeared to possess those characteristics, and the established vegetation in the aerial photograph of Mr Lewthwaite’s Appendix 5 attests to the stability of this site. Consequently, maintaining the potential spawning habitat within the footprint area of the crossing may also be desirable to minimise potential effects.

2.4 Of the two options set out in Mr Lewthwaite’s evidence, passing the canal flow under Hackett’s Creek would address fish passage concerns with most certainty. This option is also likely to be preferable with regard to impacts on salmon spawning habitat, so long as appropriate remediation was undertaken following any riverbed or bank disturbance, and assuming that any pipes placed under the bed were buried deeply enough to avoid interfering with intra-gravel flow. Maintaining intra-gravel flow is critical for successful ova development, as it delivers oxygenated water to the incubating ova and removes metabolic waste products before they build up to toxic levels. Chinook salmon excavate redds (nests) in the streambed gravel and lay their eggs in pockets generally 15-50 cm below the natural streambed level (DeVries 1997).

- 2.5 I note in Mr Lewthwaite's initial evidence in chief (dated 31/1/08) he stated that the headrace would be siphoned under other rivers, including the Kowai River, Hororata River, Hawkins River and Selwyn River (his paragraphs 42 and 126). For those rivers Mr Lewthwaite stated that "*siphons will be constructed from pre-cast concrete box culvert units installed at least 3m below bed level*" (his paragraph 126). It is not clear if the siphon option mooted for passing the canal flow under Hackett's Creek would be intended to be of a similar depth. However, if the siphon was buried beneath 3 m of loose, clean gravel, then I consider it is unlikely that it would interfere with intra-gravel flow in redds constructed in the streambed above.
- 2.6 Mr Lewthwaite's stated preference is for the other option of culverting Hackett's Creek under the canal on the basis of cost minimisation (Lewthwaite, Supplementary Evidence, point 7.2). However, if this option involved a traditional boxed culvert with a concrete invert, it would be more likely than the siphon option to interfere with intra-gravel flow, and therefore less likely to maintain spawning opportunity in the affected reach.
- 2.7 A possible alternative would be an open-bottomed culvert (essentially a bridge) to leave the streambed largely untouched (suitable streambed remediation would likely be required following construction, to remove excessive fine sediment for example). I consider that this approach would be preferable to a standard boxed culvert design, in terms of maintaining both fish passage and spawning habitat. If this proved infeasible to engineer, and loss of spawning habitat was incurred, some form of off-set mitigation such as a requirement to fund, or undertake, spawning enhancement activities elsewhere along Hackett's Creek may be an alternative.
- 2.8 Perhaps the issue of maintaining salmon spawning habitat in the reach affected by the canal crossing could be addressed by including a clause that alteration of intra-gravel flow in the streambed, to a depth relevant to salmon redd construction, shall be avoided, as a condition of consent.
- 2.9 I understand the landowner at Hackett's Creek, Mr B. Mehrtens, is concerned that a culvert would preclude fish passage. Obviously, the risk of physically obstructing

fish passage exists if the culvert was not designed or installed correctly (see paragraph 5.8 in my evidence in chief for key considerations in design and installation of culverts to maintain fish passage). Mr Mehrtens also raised a concern that fish may not pass through a culvert because it created unnaturally dark conditions. In paragraph 5.9 of my evidence in chief I discussed the need for lighting in culverts, and concluded that based on the evidence I am aware of it is not likely to be useful (and the evidence on which this conclusion was based includes research on Chinook salmon, which demonstrated that they will pass through unlit culverts and pipes), but that providing a gradual transition from light to dark is a key consideration. This can be achieved by using overhead vegetation (preferably evergreen, rather than deciduous vegetation) at the exit and entrance to the culvert, or by widening the culvert opening to provide a gradient in lighting conditions through the transition. In this regard I note that Mr Lewthwaite suggested that the culvert *“could be installed with open space above the normal water level. Depending on levels the invert of the scheme race could be raised to provide more headroom over the water surface without disrupting flow in the canal”* (Mr Lewthwaite’s point 7.1). If a culvert is used, providing reasonable headroom in the culvert would help meet the goal of a gradual light transition, and would have the additional advantage of allowing access for people, e.g. for fish or redd counting or ova planting.

3. PROPOSED DIVERSIONS AND ARTIFICIAL CHANNELS

3.1 The scenarios of flow through the various parts of the diversion in (Appendix 2 & 3 of Mr Lewthwaite’s supplementary) raise the possibility of fish stranding in the fish bypass canal below the fish screens, and possibly also in the diversion canal downstream of the intake structure. This could occur whenever takes cease (e.g. river flows fall below minimum flow for take, or become too high and dirty), since flow in the bypass canal would reduce from 5 m³/s to zero, presumably relatively suddenly.

3.2 There also appears to be a possibility of fish stranding occurring in small braids of the natural river channel, whenever the diversion flow is rapidly and substantially altered (e.g. as abstraction recommences on the falling limb of a high flow event).

There appears to be potential for previously flowing braids to be largely dewatered, possibly creating isolated pools or channels.

- 3.3 A consent condition, stipulating maximum permissible ramping rates (i.e. rates of change in flow) in the constituent channels of the diversions and bypasses, may be required to mitigate this stranding potential.

J Hay

August 2008

Reference:

DeVries, P. 1997: Riverine salmonid egg burial depths: review of published data and implications for scour studies. *Canadian Journal of Fisheries and Aquatic Sciences* 54: 1685-1698.