

IN THE MATTER OF the Resource Management Act
1991

AND

IN THE MATTER OF applications by Central Plains Water
Trust to:

Canterbury Regional Council for
resource consents to take and use
water from the Waimakariri and
Rakaia Rivers and for all associated
consents required for the
construction and operation of the
Central Plains Water Enhancement
Scheme

Selwyn District Council for resource
consents to construct and operate
the Central Plains Water
Enhancement Scheme

AND

IN THE MATTER OF a notice of requirement by Central
Plains Water Limited to:

Selwyn District Council for the
designation of land for works
associated with the construction and
operation of the Central Plains
Water Enhancement Scheme

**SUPPLEMENTARY BRIEF OF EVIDENCE OF WALTER LEWTHWAITE
FOR RECONVENED HEARING**

OCTOBER 2009

BUDDLEFINDLAY
Barristers and Solicitors
Christchurch

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Qualifications and experience

1. My full name is Walter James Lewthwaite, and the basis on which I am preparing this brief is set out in my previous evidence for this hearing.

Scope of Evidence

2. I have prepared this supplementary evidence to address engineering issues related to the location of the proposed Lower Waimakariri intake

The Commissioners have invited CPW to indicate how visible the proposed intake site, including its overhead works, will be from the north end of the bridge and from the north approach to the bridge. They also want to understand the practicalities of requiring the intake to be shifted upstream so that it would be more out of sight, in particular the engineering practicalities of that and what it would mean in terms of channel maintenance work and where machinery would get into the river if that is required.

Background

3. The following information has been submitted previously on behalf of CPWES.
 - 3.1 My evidence-in-chief, January 2008, stated (#38) "Further investigation is needed before selecting the exact location, but it would be about 100 – 200 m upstream [from the existing stockwater intake], leaving the existing stockwater tunnel intact." My evidence also included in Appendix B plan C-202, March 2006, showing the proposed general arrangement for the lower Waimakariri intake works; and Map 3, designation plans, January 2008, showing the proposed extent of designation. The location shown in C-202 was within the designation. That plan has been adapted and enlarged for this evidence and is attached.
 - 3.2 My supplementary evidence, July 2008, with plan cp547-c-006 and a further description in #6 included as one proposed condition: "Recess the intake into the face of the rock cliff so that all gates, together with their supports, and at least the upper part of the trash rack are built behind the general natural line of the cliff face". This was part of a response to a request from the Commissioners for further details including plans and proposed conditions in relation to safety for kayakers and other boaters. Plan cp547-c-006 was an enlargement of part of plan C-202, i.e. the intake was shown

in the identical location, and that plan has been adapted and enlarged for this evidence.

- 3.3 Supplementary evidence from Chris Glasson, July 2008, with visualisations in drawing PPT 03. This location was about 100 m further downstream from the location on my plans, and outside the designation area. As I recall it, this site was selected after discussion between Chris Glasson and me, following further consideration of operational ease and boater safety.
4. Mr Leo Fietje of ECan in his S42A report for the October 2009 reconvened hearing quotes a comment from me. That comment was part of an email dated 21 September 2009: it was provided only as a preliminary holding comment, was not intended for publication and should not be given any weight.

Approach to addressing the issue

5. To address the issue I have:
 - visited the site a number of times,
 - discussed operations of the existing Selwyn District Council intake with SDC representatives,
 - discussed river braiding at the site with farmers and river users,
 - discussed options and practicalities with other experienced river and construction engineers,
 - viewed aerial photographs showing river braid movements at occasions over a number of decades (supplied by Ms Di Lucas, taken from her evidence of June 2008).

Options

6. During development of the design there has been discussion about three potential intake sites:
 - Site 1: As on plan C-202,
 - Site 2: As on Mr Glasson's visualisation of July 2008,
 - Site 3: A site a further ~150 m upstream from the C-202 site, i.e. at the head of a bay rather than on the cliff face.

Sites 2 and 3 are outside the designated area. Site 3 has not been presented on any plans: it has been raised by various parties but I do not recall whether it has been discussed at the hearing. I present it in this evidence for completeness.

These three sites are shown on the attached plan.

7. In his S42A report for the October 2009 Mr Leo Fietje quotes Ms Lucas as preferring a site downstream from the Gorge Bridge, 10 m lower than currently proposed by CPW. This would be a different concept from the above three proposals and it would:
 - require more operational effort to keep water flowing into the intake as the river is not confined at this site,
 - lead to substantial changes in the engineering of the scheme within the riverbed further downstream,
 - lead to the whole 56 km of headrace being lowered,
 - require relocation and redesign of the Rakaia intake,
 - require amendments to the Notice of Requirement for the headrace across the plains.

Ms Lucas's proposal is therefore outside the scope of this hearing. I consider it is also not practical compared with the three locations listed above and I have not addressed it further in this evidence.

Criteria to consider

8. In my evidence in chief of January 2008 I listed (#32) the functional requirements for the scheme's intakes. Criteria relevant to selecting the exact site for the lower Waimakariri intake include:
 - 8.1 A river level that services the downstream requirements. All three sites are at the same level, i.e. ~250 masl, and this is suitable for the works proposed downstream. This criterion is not a differentiator and is not addressed further in this evidence.
 - 8.2 Excluding sediments from the intake as far as practicable. For this it is required that the opening be on the outside of a bend as that is where the river will provide a strong sweeping bypass flow, generating a helical current that will create a deep channel against the river bank.

- 8.3 A site that is constructible. Construction would require dewatering of the site to make it possible to install the structure and to create convenient and safe access for machinery and people, and convenient egress if required when the river was rising.

At the macro scale, diversion of the main river channel/s would be required to remove flows away from the site for much of the construction period, and a coffer dam would also be built. This work would be done by bulldozers and excavators, which would work from either the left or right river bank depending on the need. For access to the riverbed from the left bank there is a gully about 300 m upstream from the bridge which would provide a convenient route. For access to the riverbed from the right bank the best route for Sites 1 and 3 would be down the face of the terrace just upstream from Site 3. Both of these routes would provide self-driven access for construction equipment. For Site 2 it is possible that access might be easier from downstream, then requiring water to be pumped into the SDC intake: the choice between this and access from an upstream causeway would be a matter for the contractor to decide. Within the riverbed, access to Site 1 would probably be by constructing a causeway along the face of the cliff from Site 3, and for Site 2 the causeway would probably be from downstream. These works in the riverbed would need to be maintained from time to time during construction, or even fully reconstructed, depending on the incidence of floods and freshes.

At the micro scale, i.e. at the intake structure itself, site drainage would be by sheet pile and pumps, assisted by the coffer dam. This would be needed for building concrete works and installing equipment at the face of the structure.

For long term operations a platform would be created further up the cliff face, above flood level, and this would also be helpful for the construction stage for craning equipment into and out of the site. This platform would be best accessed from the top of the cliff, and would be run near the interface between the unconsolidated overburden and the underlying rock.

Careful attention would need to be paid to worker safety issues.

- 8.4 A site that enables suitable safety features to be built for river users. This was addressed in my supplementary evidence of July 2008. The following comments pick those up as far as they are related to selection of the intake site.

- Encourage a strong sweep velocity past the face of the structure. This is to encourage floating objects to move past the intake and on down the river. The key requirement is to have a strong flow along the face of the intake ports. A good sweep velocity would be relatively easy to provide as, with the revised application, CPWES would not take more than (25/113 =) ~22% of the bypassing river flow.
- Reduce velocities onto the face of the structure as far as practical. This requires the opening to be large enough to reduce velocities onto the trash rack to an acceptable level.
- Provide a good alignment of the structure face with regard to the river flow. This would include recessing the intake a short distance into the rock face so the momentum of passing river users would keep them away from the intake ports and reduce the potential for recreators to be snagged on protruding parts of the structure. It would also include aligning the front of the intake to be parallel to the passing river flow.
- Ensure good exit features for any boats or people who might venture too close to the structure. A combination of inclined trash rack, safety ledge and easy-access exit routes is proposed.

8.5 A site that requires a minimum of operational effort to maintain river flows into the intake. One of the main reasons for selecting the lower Waimakariri Gorge site for CPWES was because it is a stable site with a strong flow along the face of a cliff on the outside of a bend, as described above, and is therefore ideal for self maintenance. But see comments below on comparative evaluation of the three sub-options.

8.6 A site that offers reasonable access for maintenance. Maintenance could be required for two purposes: (a) moving the river braids to maintain a good flow to the intake, and (b) doing works on the intake structure. Access for maintenance would be very similar to the requirements noted above for access for construction. The most common need would be for managing the directions of the main river braid/s, and this would require access to the riverbed by bulldozers or hydraulic diggers, using the routes described above. It could also be expected that at some occasion during the life of the scheme access would be needed for works on the intake structure itself, and then a coffer dam, causeway, sheet piling, or other works could be required, to fit the maintenance situation.

8.7 Visibility. This is not an engineering issue but is noted here as it is a differentiator between the three sites and is a driver for addressing the engineering issues. The issue of most concern to the commissioners is visibility from the Gorge Bridge and its approaches.

Comparative evaluation

9. The following table provides an assessment of how each of the three sites would perform against the criteria listed above.

Criterion	Site 1 (as on original plans)	Site 2 (furthest downstream)	Site 3 (furthest upstream)
Excluding sediments	A good site in that the river will usually have a strong flow past this point. It would not be desirable to go any further upstream as the frequency will increase of times when the river will not have a strong channel flowing past this point.	A good site as the river will usually have a strong flow past this site, being downstream of where the main braid usually crosses to the right bank. It would not be desirable to go any further downstream as the flow tends to move away from the right bank, creating shoals against the right bank.	This site would be problematic as it would normally be on a backwater where there would not be a strong flow past the intake, and sediments would tend to be high against the face of the intake. A deep pool would need to be excavated.
Constructability	This site would require careful planning, large scale works in the riverbed, and some reconstruction of diversion works during construction. Access from the top of the cliff would be via Site 3, with an additional causeway.	This site would require careful planning, possibly large scale works in the riverbed, and some reconstruction of diversion works during construction. Access would be along an additional causeway either from the top of the cliff via Site 3 or from downstream.	The easiest site for construction in that it is often on a relatively quiet backwater that would be easier to protect from the river. Access from the top of the cliff would lead directly to the site and would enable self access by machinery.
Safety for river users	It is considered that the features above, and as described in my supplementary evidence of July 2008, would provide a Grade 2 solution, i.e. maintaining the present safety rating	It is considered that the features above, and as described in my supplementary evidence of July 2008, would provide a Grade 2 solution, i.e. maintaining the present safety rating	It is considered that the features above, and as described in my supplementary evidence of July 2008, would provide a Grade 2 solution, i.e. maintaining the present safety rating

	of the river.	of the river.	of the river. The exception would be that it would not generally be possible to provide a strong sweep velocity, but this would be compensated by having fewer river users passing the site as it would be generally on a quiet backwater. However river users would pass this site from time to time when the main river channel took this route, so there would be a need for the same suite of safety features as for the other sites.
Maintenance of deep flows to and past the intake	River channel maintenance would be required only infrequently, e.g. on occasions when the main channel approaches from further towards the left bank.	River channel maintenance would be required only infrequently, e.g. on occasions when the main channel reaches the right bank too far upstream, and veers away from the right bank before Site 2.	This site would be problematic in that there is not often a strong river channel flowing past the site. Maintenance of flow to the site would be likely to be required after most major channel forming freshes as, in the absence of a strong passing flow, an excavated pool would fill. Channel forming freshes occur on average 5 to 10 times per year, and the amount of maintenance would often be substantial.
Access for structure operation and maintenance	Operation would generally be by remote and/or automated control. Operational inspections would be conducted from access routes built into the cliff at the time of construction. Major structure maintenance would be required very infrequently, and	Operation would generally be by remote and/or automated control. Operational inspections would be conducted from access routes built into the cliff at the time of construction. Major structure maintenance would be required very infrequently, and	Operation would generally be by remote and/or automated control. Operational inspections would be conducted from access routes built into the gully at the time of construction. Major structure maintenance would be required very infrequently, and

	would be as for initial intake construction.	would be as for initial intake construction.	would be as for initial intake construction.
Visibility	Neither intake structure nor operating platform would be visible from bridge or approaches. Clearly visible from river.	Visible from bridge and approaches Clearly visible from river.	Neither intake structure nor operating platform would be visible from bridge or approaches. Clearly visible from river but might not be noticed as frequently as Sites 1 and 2 as it would usually be on a side braid or backwater.

Conclusions

10. From the point of view of scheme activities the original site as shown on the attached plan (listed as Site 1 in this evidence) or the later site as on Mr Glasson's visualisations (listed as Site 2 in this evidence) would both be favoured as they would minimise ongoing river diversion and sediment removal works, and would therefore be best for long term operations.
11. An intake (listed as Site 3 in this evidence) at the head of the bay upstream from Site 1 would be easier to construct in that it would require less works in the riverbed and would be less vulnerable to damage from freshes and floods in the river. However it would require more frequent ongoing maintenance of river channels and excavation of sediments following channel forming freshes. These differences would become progressively greater the further the intake site was moved upstream from Site 1. In my opinion the long term operational difficulties would outweigh the ease of construction.
12. As far as visibility may be an issue I note that neither of Sites 1 and 3 would be seen from the Gorge Bridge or its approaches.
13. I note that Site 1 is within the current Notice of Requirement, but neither of the other sites fits within the NoR.
14. In conclusion I therefore prefer the original site (Site 1) as shown on the attached plan.
15. I would repeat my comment from my evidence in chief of January 2008 that the exact location needs more investigation, but it would be about 100 –

200 m upstream from the existing stockwater intake. Any site within this band would not be visible from the Gorge Bridge or its approaches.



Legend

- Intake Locations
- Designation Band

Rev	Description	App	Date



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CENTRAL PLAINS WATER ENHANCEMENT SCHEME Location of Lower Waimakariri Intake Structure			
File: 42156547	Designed: SEW	Status	DRAFT
Scale: 1:2,000	Drawn: SEW		
Original Size: A3	Checked: WL	Drawing Number	Rev
Date Created: 14 Oct 2009	Approved: WL		A

