

**BEFORE INDEPENDENT HEARING COMMISSIONERS APPOINTED BY CANTERBURY
REGIONAL COUNCIL AND WAIMAKARIRI DISTRICT COUNCIL**

IN THE MATTER of the Resource Management Act 1991 (**RMA** or **the Act**)

AND

IN THE MATTER of the Waimakariri River Regional Plan (**WRRP**); the Canterbury Land and Water Regional Plan (**LWRP**); the Proposed Plan Change 7 to the LWRP (**pPC7**) and Proposed Plan Change 2 to the WRRP (**pPC2**); the Canterbury Air Regional Plan (**CARP**) and the Waimakariri District Plan (**WDC**)

AND

IN THE MATTER of applications to the Canterbury Regional Council by **Woodstock Quarries Limited** for various resource consents to establish and operate a hard rock quarry and a landfill (**CRC214073-CRC214077**)

AND

IN THE MATTER of an application to the Waimakariri District Council by **Woodstock Quarries Limited** for resource consents to establish a landfill and associated earthworks at 513 Trig Road within an area currently being used as a quarry (**RC215276 / 221101189245**).

**FURTHER EVIDENCE OF MICHAEL JOHN CRAWSHAW GREER FOR THE
APPLICANT
IN REPLY TO MATTERS WHICH AROSE DURING THE HEARING
29th April 2024**

Presented for filing by:

Saunders & Co

Margo Perpick

PO Box 18, Christchurch 8140

T 027 227 2026

E margo.perpick@saunders.co.nz

- 1 My name is Michael John Crawshaw Greer. A full description of my qualifications and experience can be found in my Statement of Primary Evidence¹.
- 2 I have read the updated Environment Court Practice Note (2023), including the Code of Conduct for Expert Witnesses, and agree to comply with it. The matters addressed in my evidence are within my area of expertise. However, where I make statements on issues that are not in my area of expertise, I will state whose evidence I have relied upon. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in my evidence.
- 3 I provide this further statement of evidence in reply to matters that have arisen through during the hearing of the applications.

SCOPE OF EVIDENCE

- 4 In my evidence I address the technical matters relating to surface water quality and freshwater ecology raised in responses of the Canterbury Regional Council's (CRC) and submitters to the Applicants Additional Information Supplied as per 18th and 19th Minute to Parties.

MATTERS RELATING TO THE RESULTS OF THE MUDFISH AND FISH SURVEYS REQUESTED IN MINUTE 18

- 5 In their further submitter evidence, Mses Cassandre Walker, Maria Lowe and Shirley Farrell suggest the mudfish survey results presented in my Statement of Supplementary Evidence in Response to Minute 18² "*should be disregarded by the Commissioners*" in the basis that "*it is not an accurate assessment*". It is my understanding that their primary concern with the mudfish survey is that it was conducted during summer when mudfish may be aestivating due to "*heat and dryness*".
- 6 The available water quality, hydrology and flow data collect on the day of the mudfish survey does not support Mses Walker's, Lowe's and Farrell's view that mudfish were not caught because of high temperatures and low flows causing fish to aestivate. While air temperatures were high on the days the surveys were made, water temperatures were not (potentially because of the significant upstream shading of the Woodstock Stream). Instream Consulting recorded water temperatures at all sampling locations, and these did not exceed 16.5°C despite most being recorded between 2:00 pm and 4:00 pm (Table 1). Interrogation of the New Zealand Freshwater Fish Database (NZFFD) show Canterbury mudfish have been successfully caught at water temperatures up to 21°C. While I have not been able to find any temperature thresholds for aestivation in the scientific literature Ling (2001) notes that mudfish do not suffer thermal stress until 22°C. Furthermore, that Canterbury mudfish were

¹ Evidence of Michael John Crawshaw on Behalf of Woodstock Quarries Ltd (dated 24th March 2023)

² Supplementary Evidence of Michael John Crawshaw on Behalf of Woodstock Quarries Ltd in response to Matters Raised in the 18th Minute to Parties Issued by the Hearing Commissioners on the 11th of March

not found cannot be attributed to flow conditions at the time. As described in para. 28 of Ms Shirley Hayward's (Canterbury Regional Council (CRC) Team Leader – Surface water quality and ecology) Supplemental Section 42A Officer's Report (dated 17th April 2024), there was sufficient water to fish on the time of sampling (see Table 1). Consequently, there is no evidence to suggest that the reason why mudfish were not caught is due to high temperatures and low flows causing fish to aestivate.

Table 1: Water depth and temperature data for sites fished by Instream consulting for the mudfish surveys. Data was entered into the NZFFD but not reproduced in my Supplementary Evidence in response to Matters Raised in the 18th Minute to Parties. Note, only one set of measurements were made for the Woodstock Stream itself.

Site	Date and time	Water temperature	Minimum depth	Maximum depth
Wetland (Narbey's)	17/01/2024 9:45	15.9 °C	0.07 m	0.75 m
Wetland (Applicant's)	17/01/2024 15:42	16.5 °C	0.02 m	0.5 m
Woodstock S. in wetland	17/01/2024 14:30	13.7 °C	0.08 m	0.59 m
Woodstock S. US of wetland				
Woodstock S. US of DS1				

- 7 Mses Walker, Lowe and Farrell, and the Oxford-Ohoka Community Board also suggest in their further submitter evidence that
 - 7.1 Mudfish surveys should have been conducted in Autumn
 - 7.2 The absence of mudfish in a single survey does not mean they are not present; and
 - 7.3 Multiple surveys should have been made.
- 8 While ideally the mudfish survey would have been undertaken in Autumn as recommended in Ling *et al.* (2013) that was simply not possible given the time frames specified by the Commissioners in Minute 18. Regardless, river flows in the Eyre River catchment during January 2024 (including the 17th) were actually higher than those recorded between March and May (Figure 1). As a result, there may actually have been an (unintended) advantage sampling in January instead of Autumn.

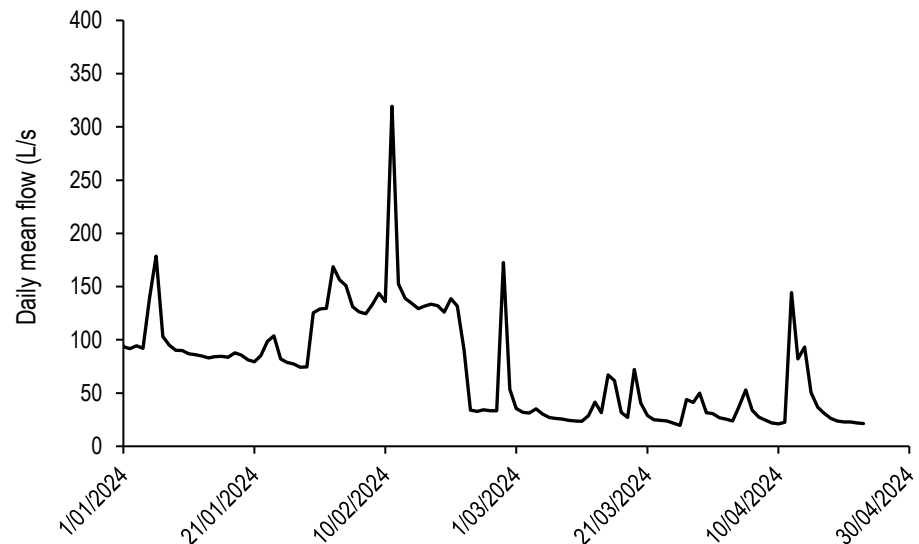


Figure 1: Daily mean flows in the Eyre River at Trig pole Road in 2024 (to date)

- 9 I concur that a species not being found in a single survey is not categorical evidence of absence; a point also raised by Ms Hayward in her her Supplemental Section 42A Officer's Report (dated 17th April 2024). Indeed, proving absence is very difficult even through repeat surveys. However, my Statement of Supplementary Evidence in Response to Minute 18² was not intended to suggest that the survey alone was proof that they do not occur in the lower wetland. Rather, that the results lend support to the detailed distribution analysis in para. 17 to para. 20 of my original Statement of Evidence in Reply³ which suggests that Canterbury mudfish are unlikely to be in the lower wetland. A view that Ms Hayward also appears to support in para. 24 her Supplemental Section 42A Officer's Report (dated 17th April 2024)

"However, it seems unlikely that a substantial population of Canterbury mudfish exists in the Woodstock or Narbey wetland at present.

- 10 I disagree with Mses Walker, Lowe and Farrell, and the Oxford-Ohoka Community Board assertions that multiple mudfish surveys are needed. The lower wetland is outside the range of 99% of recorded mudfish populations (see para. 17 to 19 of my Statement of Evidence in Reply³) and they were not detected in a rigorous one off survey, despite adequate temperature and flow conditions. Consequently, it is my opinion that there is no scientific justification to warrant repeat fishing in the lower wetland.

³ Evidence of Michael John Crawshaw Greer for the Applicant in Reply to Matters which Arose During the Hearing (dated 23rd November 2023).

OTHER MATTERS RELATED TO MUDFISH

- 11 In their submitter evidence Ms Walker's, Lowe's and Farrell's raised concerns regarding the validity of the following statement in para. 8 of my Statement of Supplementary Evidence in Response to Minute 18²:

"That mudfish were not present in these waterbodies is consistent with the known limits of their distribution in relation to the location of the lower wetland"

Specifically, they ask, *"who knows what the known limits of their distribution is"*. By definition, the known limits of Canterbury mudfish are known. Furthermore, they are clearly mapped and plotted in Figures 3 and 4 of my Statement of Evidence in Reply³. Those figures show that the lower wetland is outside of the geographical range in which 99% of known Canterbury mudfish populations exist.

- 12 In their submitter evidence the Oxford-Ohoka Community Board state that mudfish have been found downstream of the lower wetland. As stated in para. 18 of my Statement of Evidence in Reply³, this is not the case. The NZFFD contains no record of Canterbury mudfish occurring in the Woodstock Stream, the mainstem of the Eyre River or the mainstem of the Waimakariri River. The known mudfish sites on the Kowai Stream discussed in para. 30 and 31 of Ms Barkle's original submitter evidence for the Oxford-Ohoka Community Board are not downstream of the proposed landfill, they are simply further inland (i.e., they are not fed by the Woodstock Stream).

MATTERS RELATING TO CONTINUOUS MONITORING IN THE EYRE RIVER

- 13 In their submitter evidence Timperley Farming Ltd & Timperley Manor Ltd raise concerns regarding my Statement of Evidence in Reply³ that continuous monitoring of pH and electrical conductivity in the Eyre River should not be conducted as it *"serves no purpose other than to impose additional monitoring costs and complexity on the applicant"*.
- 14 To demonstrate the redundancy of such monitoring I have re-run the mass balance assessment presented in my Statement of Primary Evidence¹ using:
- 14.1 The lower/upper pH and upper electrical conductivity values presented in Table 5-5 of wasteMINZ *"Technical Guidelines for Disposal to Land Revision 3"*⁴;
- 14.2 A background conductivity of three millisiemens per metre(mS/m)⁵; and
- 14.3 A background pH between 6.0 and 8.9⁶.

⁴https://www.wasteminz.org.nz/files/Disposal%20to%20Land/TG%20for%20Disposal%20to%20Land_12Oct22_FINAL.pdf

⁵ Minimum value for Canterbury Rivers in Stevenson *et al.* (2010). This is a conservative value as accuracy decreases as conductivity increases.

⁶ The minimum and maximum value for Canterbury Rivers in Stevenson *et al.* (2010). This is a conservative value as accuracy decreases as conductivity increases.

15 The modelled median and 95th percentile change in pH and conductivity have then been compared to the cited accuracy of commonly used continuous monitoring probes⁷ (Figure 2 and Figure 3). This analysis suggests that if all of the maximum agreed leachate volume⁸ was discharged to the Eyre River, the impact on conductivity and pH would be less than 12% and 1% of the accuracy of the monitoring probes respectively. On that basis any leachate effects on the pH and conductivity of the Eyre River will not be measurable, let alone distinguishable from background natural variability. Consequently, I disagree with Timperley Farming Ltd & Timperley Manor Ltd (and Mr Tim Johnston (CRC Principal Consents Planner))⁹ that this monitoring should be required by the conditions of consent. Further detail is provided by Mr Zeb Etheridge in his Statement of Further Evidence in Reply¹⁰

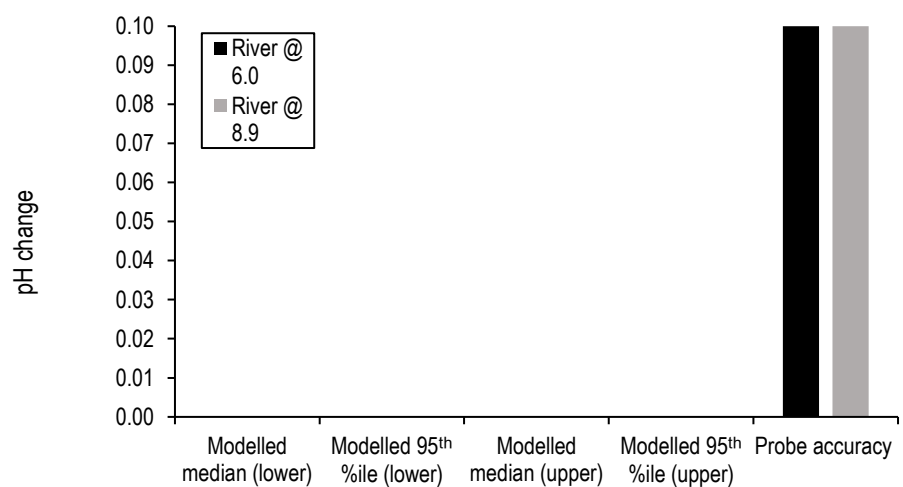


Figure 2: Predicted median and 95th percentile change in pH in the Eyre River due to an unintended leachate discharge compared to the accuracy of commonly used continuous pH probes. The black bars are based on an in-river pH of 6.0 (minimum recorded in Canterbury rivers) while the grey bars are based on an in-river pH of 8.9 (maximum recorded in Canterbury rivers).

⁷ <https://www.ysi.com/File%20Library/Documents/Specification%20Sheets/YSI-EXO-Sonde-Platform-Specification-Sheet.pdf>

⁸ 586 L/d. 'Joint Witness Statement – Liner Design, Underdrainage System, and Potential Volume of Liner Leachate Leakage' (dated 31st of May 2023).

⁹ Condition 77. Supplementary Section 42A Officer's Report Report of Tim Johnston (dated 19th April 2024).

¹⁰ Further Evidence of Zeb Etheridge for the Applicant in Reply to Matters which Arose During the Hearing (dated 29th April 2024).

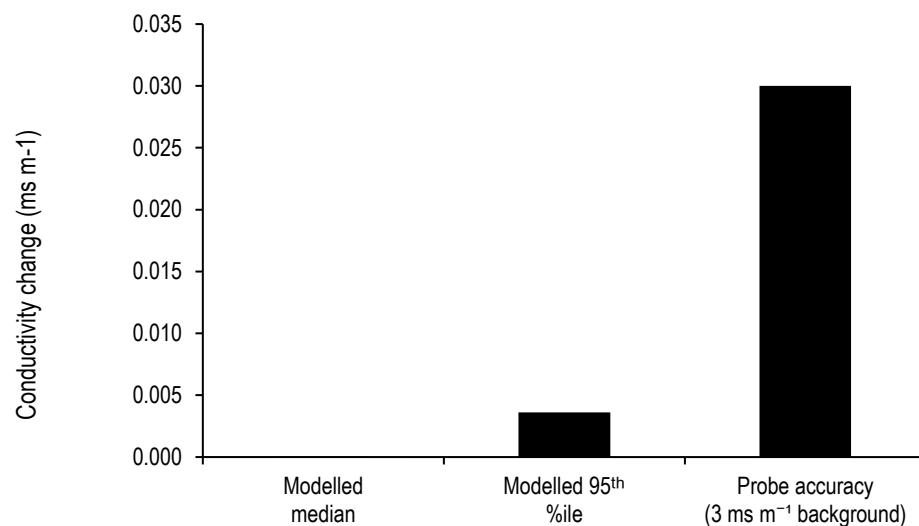


Figure 3: Predicted median and 95th percentile change in electrical conductivity in the Eyre River due to an unintended leachate discharge compared to the accuracy of commonly used continuous conductivity probes .

REFERENCES

- Ling, N., 2001. New Zealand mudfishes: a guide. Department of Conservation, Science & Research Division contract 2485, Wellington, New Zealand.
- Ling, N., Miller, R., Lake, M.D., 2013. A revised methodology to survey and monitor New Zealand mudfish (Inventory and monitoring toolbox: Freshwater fish No. DOCDM-452382), Inventory and monitoring toolbox: freshwater fish. Department of Conservation, Wellington, New Zealand.
- Stevenson, M., Wilks, T., Hayward, S., 2010. An overview of the state and trends in water quality in Canterbury's rivers and streams (Environment Canterbury Technical Report No. R10/117). Environment Canterbury, Christchurch, New Zealand.

Dr Michael John Crawshaw Greer

29/04/2024