

The Waimakariri District Council will hold a Workshop Session in the Council Chambers,  
Rangiora Service Centre, 215 High Street, Rangiora, on

**Tuesday, 24 March 2026, from 9am to 11.45am**

**This Workshop and Briefing Session is a non-decision-making meeting.**

***Workshop Sessions are open to the public and are therefore advertised.  
However, Briefing Sessions are public excluded.***

## AGENDA

Time	Workshop or Briefing	Details	Pre-reading Material	Next Action
<p><b>9am to 9.30am</b> (30min)</p> <p>10 min (Pres) 20 min (Q &amp; A)</p>	<p><b>Workshop</b></p>	<p><b>Saline intrusion in the Kaiapoi River</b> – S Allen, R Measures (Earth Sciences New Zealand) and A Meredith (Environment Canterbury)</p> <p><b>Purpose:</b> Since the Canterbury earthquakes in 2010/11, community members have brought observations of a changing lower Kaiapoi River, such as the disappearance of weed beds, algal blooms, riverbank degradation, surface scums, and dying willows, to the attention of the Council and Environment Canterbury (ECan), most recently in 2024. Due to community concern, the Kaiapoi-Tuahiwi Community Board requested modelling, led by ECan, to identify the key drivers of saline incursions in the Kaiapoi and Ruataniwha Cam Rivers, incorporating tides, river flows, and salinity data.</p> <p>ECan commissioned a report from Earth Science NZ (formerly NIWA) that found a strong correlation between Waimakariri River flows and saline incursions up the Kaiapoi River, as well as an increase in salinity at Mandeville Bridge since the Council's 2020 Kaiapoi River dredging for navigability.</p>	<p>Attachments A and B</p>	<p>Ongoing</p>

Time	Workshop or Briefing	Details	Pre-reading Material	Next Action
<b>9.30am to 10am</b> (30min)  10 min (Pres) 20 min (Q & A)	<b>Workshop</b>	<b>Proposed Rooding Forward Works Programme - High-level overview-</b> J McBride, D Young and Y Warnaar  <b>Purpose:</b> The Rooding Capital Programme and Maintenance Budgets need to be submitted to the New Zealand Transport Agency (NZTA) by mid-year. It is essential that the Council understand and contributes to the key issues to be faced over the next 10 years.	None	Follow-up workshop in May/June 2026
<b>10am – 10.30am</b> (30min)  10 min (Pres) 20 min (Q & A)	<b>Workshop</b>  (at the request of the Mayor)	<b>Discussion with New Zealand Post</b> - M Kenning (Government Relations Advisor)  <b>Purpose:</b> To discuss the rationale behind the closure of four NZ Post service locations in Waimakariri, effective from May 2026. <ul style="list-style-type: none"> <li>• NZ Post Pegasus, 60c Pegasus Main Street</li> <li>• NZ Post Private Boxes Waikuku Beach, 54 Park Terrace</li> <li>• NZ Post Private Boxes Woodend, 73 Main Road</li> <li>• NZ Post Woodend, 53 Main Road</li> </ul> <b>Note: Woodend-Sefton Community Board Chair attending via Teams</b>	None	Ongoing
<b>10.30am to 10.45am</b> (15min)	<b>Break</b>			
<b>10.45am to 11.15am</b> (30min)  10 min (Pres) 20 min (Q & A)	<b>Workshop</b>	<b>CCTV &amp; Other Recording Devices Policy –</b> S Docherty and K Brocas  <b>Purpose:</b> To present a new policy which aligns the Council's handling of recorded information with the Privacy Act 2000. The Policy applies to data that is video-only, audio-only, or video and audio combined, and that is collected by the Council through different technologies. The Policy ensures that the purposes for the collection, storage, and deletion of private information align with the requirements of the Privacy Act.	Attachments C and D	Report to Council
<b>11.15am – 11.45am</b> (30min)	<b>Briefing</b>	<b>Update from the Mayor and the Chief Executive</b>		

**WAIMAKARIRI DISTRICT COUNCIL**

**REPORT FOR INFORMATION**

**FILE NO and TRIM NO:** DRA-07 / 240918159973

**REPORT TO:** KAIAPOI – TUAHIWI COMMUNITY BOARD

**DATE OF MEETING:** 21 October 2024

**AUTHOR(S):** Sophie Allen – Water Environment Advisor

**SUBJECT:** Saline incursions in the Kaiapoi and Ruataniwha Cam Rivers

**ENDORSED BY:**  
(for Reports to Council,  
Committees or Boards)

  
General Manager

  
Chief Executive

**1. SUMMARY**

- 1.1. This report examines community observations this year (2024) regarding changes in the Kaiapoi and Ruataniwha Cam Rivers, including emergent and submerged macrophyte (weedbed) dieback and freshwater mussel (kākāhi) deaths.
- 1.2. This report raises possible options for management by Waimakariri District Council (WDC) and areas for WDC to work with Environment Canterbury to understand better and consider management options.
- 1.3. Increasing saline incursions during 2024, potentially combined with frost effects, rather than herbicide usage, is the likely cause of the ecological dieback in the Kaiapoi and lower part of the Ruataniwha Cam River. Low flows in the Waimakariri River are believed to increase the frequency of saline incursions into the Kaiapoi and Ruataniwha Cam Rivers.
- 1.4. The Kaiapoi Ruataniwha Cam Rivers area could be part of a Climate Adaptation Plan under the WDC Climate Resilience Programme. Additional ecological monitoring and modelling of these river systems is recommended for further understanding of the drivers of saline incursions. No replanting of intertidal plants that have experienced dieback in 2024 is proposed until there has been an assessment of future species suitability for saline, and confirmation of any regrowth of the existing plants in the summer growth period.
- 1.5. WDC could consider whether to request Environment Canterbury to gather further understanding of Waimakariri River flows including any impact of the minimum flow set in the Waimakariri River Regional Plan.
- 1.6. This report does not consider coastal erosion caused by coastal inundation by storms, saltwater intrusion and raised groundwater levels in the Kaiapoi area due to climate change and sea level rise. This work is part of the WDC Climate Resilience Programme.

**2. RECOMMENDATION**

**THAT** the Kaiapoi-Tuahiwi Community Board:

- (a) **Receives** Report No. 240918159973.

*AND*

**THAT** the Kaiapoi-Tuahiwi Community Board recommends:

**THAT** the Council:

- (a) **Receives** Report No. 240918159973.
- (b) **Notes** that the cause of the Kaiapoi and Ruataniwha Cam Rivers ecological dieback observed in 2024 is primarily due to increased salinity, with potentially also some effect from frosts.
- (c) **Requests** for modelling to be led by Environment Canterbury to establish the key drivers of saline incursions in the Kaiapoi and Ruataniwha Cam Rivers, which incorporates tides, river flows and salinity data.
- (d) **Requests** that Environment Canterbury determine and employ methods to monitor water quality and aquatic ecology trends of the tidal section of the Kaiapoi River.
- (e) **Circulates** this report to the Waimakariri Water Zone Committee, at a WDC-Ngāi Tūāhuriri Rūnanga meeting, and to the Ohoka Rural Drainage Advisory Group.

### 3. **BACKGROUND**

- 3.1. Community observations from the winter of 2024 regarding changes in the Kaiapoi and Ruataniwha Cam Rivers, include emergent and submerged macrophyte (weedbed) dieback and kākāhi (freshwater mussel) deaths in the Ruataniwha Cam River around the Revells Road bridge. From communications with Council members, and discussion on social media and in a local newspaper it has been highlighted there is high community concern. A public meeting was called at the Kaiapoi Library on 17 September 2024 that voiced a proposal to form a catchment group to look after local waterways, with a belief that herbicide could be the cause of the dieback.
- 3.2. Soft-stem bulrush (*Schoenoplectus tabernaemontani*) beds in the Kaiapoi River have died back (Figure 1). Some stems are still green at the base, indicating there is still a possibility of recovery. This species was planted by the Council as part of the Kaiapoi River Rehabilitation Working Party work programme, to compensate for instream habitat loss following effects from the Canterbury earthquakes.



**Figure 1: Soft-stem bulrush (*Schoenoplectus tabernaemontani*) beds showing dieback in the Kaiapoi River as of September 2024**

- 3.3. Following the Canterbury earthquake sequence in 2010-11, community members brought similar observations of a changing lower Kaiapoi River, such as the disappearance of weed beds, algal blooms, riverbank degradation, surface scums, and dying willows, to the attention of the Waimakariri District Council and Environment Canterbury. There were also unconfirmed reports of kākahi (freshwater mussel) mass death event(s) in the mouth of the Ruataniwha Cam River.
- 3.4. A report into the cause of these observations post-earthquakes by Adrian Meredith at Environment Canterbury, entitled 'Assessment of the state of a tidal waterway – the Lower Kaiapoi River' (March 2018), concluded that observed changes were most likely due to increasing episodes of saline water intrusion flowing into the lower Kaiapoi River. The saline intrusions were thought to be a result of bed level changes following the 2010-11 Canterbury earthquakes. This report and its implications were discussed in a WDC report to the Utilities and Roading Committee on 16 April 2019 (TRIM 190115003326).
- 3.5. Due to a lack of salinity and bathymetry information for the lower Kaiapoi River prior to the 2010-11 Canterbury earthquake sequence, it is difficult to attribute to what degree the increasing saline water intrusion periods might have been caused by changes in bed levels.
- 3.6. Saline intrusion episodes in the lower Kaiapoi River are hypothesised by Meredith (2018) to result from low flows in the Waimakariri River, generally in summer and autumn, allowing saltwater to penetrate further up the mouth of both rivers, with river flow and salinity data supporting this hypothesis. Cumulative inflow from the Kaiapoi River and its tributaries was noted by Meredith (2018) to exert little influence on the occurrence of saline intrusions.
- 3.7. Summer 2023 – winter 2024 experienced lower than average rainfall. On 21 March 2024, a “moderate adverse event” was declared in Canterbury, as El Niño conditions and a warming climate took effect. Conditions continued to be very dry into the winter of 2024, with Environment Canterbury monitoring showing record low water levels across the region. There were also relatively a high number of frost nights in 2024 compared to average, including an unseasonably cold -6.3°C recorded at Christchurch Airport in May 2024.
- 3.8. In general, impacts of saline incursions are wide-ranging and predicted to include the following;
  - 3.8.1. less flushing and build-up of contaminants (eutrophication),
  - 3.8.2. scums and odour issues,
  - 3.8.3. scour and decreased bank stability, because the crumb structure of soil affected by saltwater,
  - 3.8.4. biota dieback or mobility such as inanga spawning habitats moving upstream,
  - 3.8.5. saltwater intrusion into groundwater, tidal groundwater with potential effects on infrastructure, and
  - 3.8.6. and loss of a freshwater port useful for naturally removing biofouling from boats.
- 3.9. Saline incursions are not thought by WDC staff to impact the Kaiapoi Wastewater Treatment Plant wetlands functioning or near-river water takes, as local water takes are for monitoring only, not abstraction.

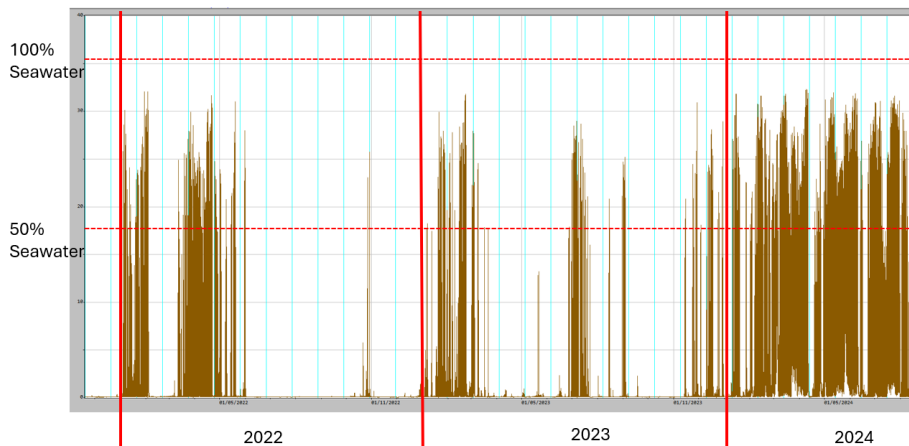
#### 4. ISSUES AND OPTIONS

##### ***Causes of the 2024 dieback***

There have been alternate hypotheses presented for the observed 2024 ecological dieback in the Kaiapoi and Ruataniwha Cam Rivers. Environment Canterbury has presented salinity data that supports a high frequency of saline episodes as a key driver for dieback. Heavy frosts, when combined with expose mudflats at low tide, have also been raised as an additional potential contributor to dieback of submerged weedbeds. Various community members have raised that herbicide application instream of the Ruataniwha Cam River could have caused the dieback.

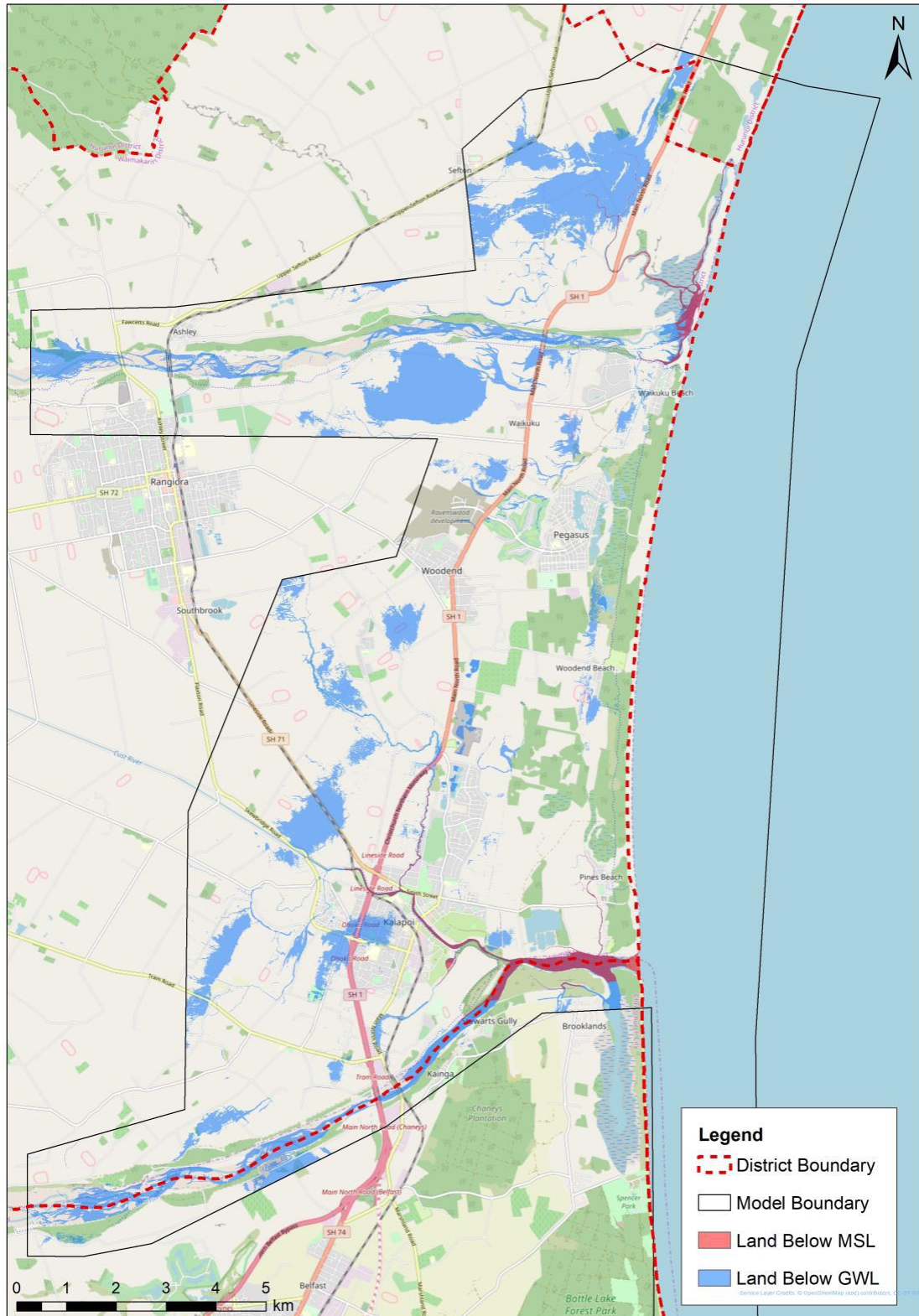
##### ***Salinity***

- 4.1. In 2024 there were much longer periods with saline incursions of all the years since Environment Canterbury commenced monitoring in 2016 in the Kaiapoi River at the Mandeville Bridge. These saline incursions affected not just the summer, as has been observed in previous years, but also the autumn and winter (Figure 2), essentially transitioning the Kaiapoi River and lower parts of the Ruataniwha Cam River into an estuarine environment for much of 2024. Climate conditions (i.e. the El Niño conditions and a warming climate) were likely drivers of the increased saline incursions.



**Figure 2: Salinity monitoring at the Mandeville footbridge, Kaiapoi River (source: Environment Canterbury, Adrian Meredith)**

- 4.2. Modelling by Jacobs Ltd published in 2020, on behalf of the Council, has indicated that the bed of the Ruataniwha Cam River along lower Camside Road, and Kaiapoi River up to upstream of the railway line is currently below Mean Sea Level (see Figure 3). However the ability for saltwater to pass upstream during tidal cycles in these waterways is generally prevented by freshwater river flows, particularly from the Waimakariri River.

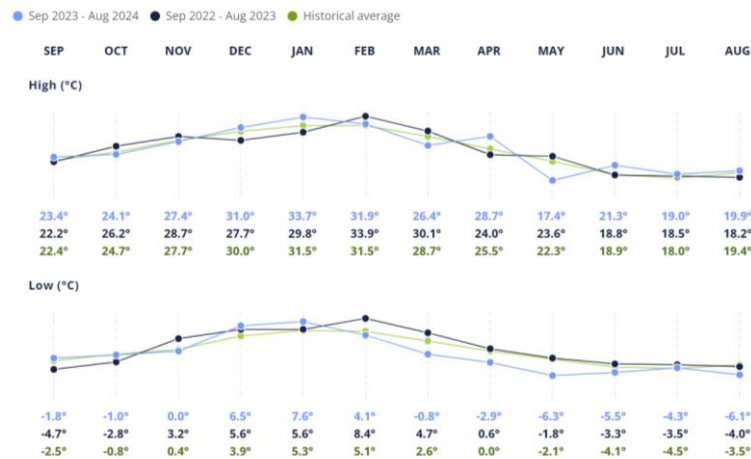


**Figure 3** Areas of land below mean sea level (MSL), areas of land below the median groundwater level (GWL) and overlapping areas where initial ponding is specified (0m sea level rise). Source: Jacobs Ltd report, 12 March 2020 TRIM 200312034365.

**Frosts**

- 4.3. This year has experienced low temperatures below average (Figure 4) and seen a high number of frost nights to-date; 50 nights measured at Christchurch Airport. May 2024 was a particularly frosty month, with 15 frost nights (Christchurch Airport data). A particular frost

in May was unseasonably cold at -6.3°C. When frosts coincide with low tides, plants such as aquatic macrophytes are exposed to colder temperature on frosty mud flats. An example of how frost is known to cause dieback is that this is a control method by hydropower generators to deliberately draw down water in dams to expose weedbeds during frosts. Although not the key driver of the observed dieback, it is possible that frosty mud flats, particularly in the Kaiapoi River could have also contributed to the dieback of the weedbeds (submerged macrophytes).



**Figure 4: Temperature data for September 2023-August 2024 compared to previous years. (Source: Metservice)**

### ***Herbicide usage***

- 4.4. Community members have raised that herbicide application instream of the Ruataniwha Cam River could have caused the dieback, with a river engineer from Environment Canterbury allegedly stating to a community member that herbicide had been applied in-stream in 2024. This was later clarified by Environment Canterbury to only relate to herbicide applied to the banks of the waterway, with no in-stream application.
- 4.5. Environment Canterbury has confirmed that after flooding in winter 2023, they removed several willow trees upstream and downstream of Bramleys Road Bridge on the Ruataniwha Cam River. Environment Canterbury sprayed the remaining stumps on the banks with an approved herbicide, to prevent regrowth.
- 4.6. The Environment Canterbury consent for herbicide use has recently been renewed. They strictly follow manufacturer's recommendations, Environmental Protection Agency (EPA) rules, and consent conditions when using herbicides. This includes advising landowners, publishing public notices, and restricting access when spraying occurs. Herbicides that have been used recently along the Ruataniwha Cam River banks are glyphosate and triclopyr.
- 4.7. WDC Drainage staff have also confirmed that there has been no instream herbicide usage in the Ruataniwha Cam River in the section managed by WDC, above Bramleys Road Bridge.
- 4.8. There is no evidence to suggest that an unknown third party may have applied herbicide directly instream, however a resource consent from Environment Canterbury would have been required to carry out such an application legally.

### ***Modelling and monitoring***

- 4.9. A model that links river flow for the Waimakariri River and tributaries, tides and salinity data from the Kaiapoi River at Mandeville Bridge could give strength to the hypothesis that low river flows in the Waimakariri River are a key driver of saline incursions in the Kaiapoi and Ruataniwha Cam Rivers, and what effect tidal range has on these incursions.
- 4.10. WDC staff are in discussion with Environment Canterbury about a proposal to commission this modelling work. WDC staff recommend that Environment Canterbury commission and support this modelling work with provision of river flows and salinity data. WDC could provide partial funding assistance for this work of \$10,000 from existing Zone Implementation Programme Addendum (ZIPA) budget.
- 4.11. WDC staff recommend Council to request that Environment Canterbury continue salinity monitoring, to further information on the extent of saline intrusions. This investigation should also investigate, to consider the relative effects of abstraction from the Waimakariri River and predict the effect of sea level rise on increasing saline intrusions in the lower Kaiapoi River due to climate change.
- 4.12. WDC is recommended by 3 Waters staff to request for Environment Canterbury to monitor of the extent of submerged weedbeds and kākāhi (freshwater mussels) in the Kaiapoi and Ruataniwha Cam Rivers over time.
- 4.13. It is recommended for WDC staff to monitor whether there is recovery of the emergent soft-stem bulrush *Schoenoplectus tabernaemontani* and *Typha australis* (Raupō) beds in the Kaiapoi River. These beds were planted by WDC, under the Kaiapoi River Rehabilitation Working Party work programme and were spreading successfully until the spring of 2024. This monitoring would inform whether replanting of these species should be considered, whether salt-tolerant (i.e. saltmarsh) species should be encourage due to salinity constraints, or whether there is likely to be a natural recovery with replanting not required.

### ***Community Engagement and Governance***

- 4.14. WDC staff propose to engage with agencies such as Fish and Game, community groups such as fishermen associations and the nascent 'Save our Rivers' community group, and the wider community with an interest in this issue. An Environment Canterbury councillor has raised the idea of the re-establishment of the Kaiapoi River Rehabilitation Working Party to work collaboratively with the local community and other management agencies to discuss the 2024 dieback issues. The need for a specific governance group could be considered if an inter-agency work programme was created that required oversight.
- 4.15. The Kaiapoi Ruataniwha Cam Rivers area could be part of a Climate Adaptation Plan under the WDC Climate Resilience Programme. This work is scheduled to take place from 2026 onwards. A plan would allow for community involvement and discussion of appropriate responses to climate change impacts, which are projected to increase saline incursions due to sea level rise and decreased summer flows in the Waimakariri River. The Kaiapoi Ruataniwha Cam Rivers area is also well-suited for implementation of blue-green infrastructure concepts, which is an objective 1.2.2 in the recently-adopted Waimakariri Natural Environment Strategy.

### ***Waimakariri River flows***

- 4.16. The flow of the Waimakariri River which the Kaiapoi River empties into, is also thought to play a role in whether a saline intrusion occurs. As noted by Meredith (2018) 'more detailed monitoring and modelling of the river system is necessary to explain the complicated interactions of earthquake mediated bed level changes, river flow regimes, and tidal height

interactions.’ This would allow for better prediction and management of the saline episodes in the Waimakariri and Kaiapoi rivers. Meredith has noted a rule of thumb whereby saline incursions appear to occur in the Kaiapoi River at the Mandeville Bridge when Waimakariri River flows are <50 m<sup>3</sup>/s (cumecs).

- 4.17. The Waimakariri has been in low flow (<50 m<sup>3</sup>/s and often less than 30 m<sup>3</sup>/s) at State Highway 1 for almost all of the summer/autumn and winter 2024 with very few freshes and only four floods. Small freshes (i.e. 31 July and 10 August 2024) did not maintain the flow above 50 m<sup>3</sup>/s. The recent rainfall and snow generating the flood of 20 August 2024 was significant event to maintain and stabilise river flows well above the thresholds allowing desalination of the Kaiapoi River (50 m<sup>3</sup>/s). A further flood on 24 August 2024 of 600+ m<sup>3</sup>/s likely ended the long continuous salinity period. Salinity incursion periods can still re-establish, leading to ‘flip-flopping’ between freshwater and estuarine conditions.
- 4.18. Environment Canterbury sets the minimum flow levels for Canterbury’s rivers, balancing the needs of mana whenua, extraction (such as drinking water and irrigation), community values, and government policy. The current minimum water flow level for the Waimakariri River is 46 m<sup>3</sup>/s measured at Otarama, which is effectively equivalent to a minimum flow of 41 m<sup>3</sup>/s at the Old Highway Bridge site, due to 5 m<sup>3</sup>/s lost to groundwater over that distance. A further 5 m<sup>3</sup>/s is able to be extracted below this minimum flow for ‘AA permits’ giving a flow of 36 m<sup>3</sup>/s at the Old Highway Bridge before full restrictions on extraction. This level was set in the Waimakariri River Regional Plan, which came into effect in 2004.
- 4.19. Minimum flow levels for the Kaiapoi and Ruataniwha Cam Rivers are set in the Canterbury Land and Water Regional Plan. In 2017, the Waimakariri Water Zone Committee requested a review of these levels – the resulting changes were publicly notified in 2019 and Plan change 7 (PC7) came into effect in 2023.
- 4.20. Although, in theory, low minimum flows in the Waimakariri River could potentially contribute to increased salinity, with 2024 as a very dry year, that have often been full restrictions with no take for large periods (i.e. people were not irrigating), so water takes cannot be considered due to be a contributing factor to saline incursions this year.
- 4.21. The Waimakariri River Regional Plan is expected to be next reviewed in 2028 by Environment Canterbury. WDC staff recommend that Environment Canterbury carries out investigations and research into what impact, if any, minimum flows may have in the salinity in the Kaiapoi River. Any findings from this research should be considered in the review of this plan, and to set a minimum flow which includes consideration of saline incursion effects in Kaiapoi and more extreme weather events including drought conditions as our climate changes.

#### **Implications for Community Wellbeing**

- 4.22. There are implications on community wellbeing of Kaiapoi residents and river users for the issues that are the subject matter of this report.
- 4.23. The Management Team has reviewed this report and support the recommendations.

### **5. COMMUNITY VIEWS**

#### **5.1. Mana whenua**

Te Ngāi Tūāhuriri hapū are likely to be affected by, or have an interest in the subject matter of this report. This report is proposed to be circulated to at a WDC-Ngāi Tūāhuriri Rūnanga meeting.

#### **5.2. Groups and Organisations**

There are groups and organisations likely to be affected by, or to have an interest in the subject matter of this report.

Local waterway users, such as fishers, independently contacted the Council in winter 2024 regarding observations of declining species in the Kaiapoi and Ruataniwha Cam Rivers.

A community meeting was held on 17 September 2024 regarding the recent changes in the Kaiapoi and Ruataniwha Cam Rivers. A nascent group called 'Save our Rivers' has been established from this public meeting from community volunteers with the aim of improving the health of local waterways.

### 5.3. **Wider Community**

The wider Kaiapoi community is likely to be affected by, or to have an interest in the subject matter of this report. Kaiapoi is viewed by locals, and marketed by WDC, as a 'historic river town'. This is due to the town's connection with the lower Kaiapoi River, and the historically bustling freshwater port area. It is recommended that WDC works with the community and other agencies to communicate that this 'historic river town' area is in flux, with challenges however some opportunities to support the transition to an estuarine environment.

## 6. **OTHER IMPLICATIONS AND RISK MANAGEMENT**

### 6.1. **Financial Implications**

There are no financial implications of the decisions sought by this report. The Climate Adaptation Plan proposed by this report is included in existing budget for the WDC Climate Resilience Programme.

A budget of \$10K from the existing pool for the Canterbury Water Management Strategy Zone Implementation Programme Addendum (ZIPA) is proposed to support Environment Canterbury with the development of a model to combine river flow, tides and salinity data already. This budget is already included in the Annual Plan/Long Term Plan.

### 6.2. **Sustainability and Climate Change Impacts**

The recommendations in this report do have sustainability and/or climate change impacts about how to adapt to climate change. Although the current state of the rivers is primarily considered by this report, climate change will further affect river flows and sea level, with effects on the Kaiapoi and Ruataniwha Cam Rivers, infrastructure and community into the future. Therefore this area is potentially identified for a Climate Adaptation Plan, developed in conjunction with the community under the WDC Climate Resilience Programme.

### 6.3 **Risk Management**

There are no risks arising from the adoption/implementation of the recommendations in this report.

### 6.3 **Health and Safety**

There are no health and safety risks arising from the adoption/implementation of the recommendations in this report.

## 7. **CONTEXT**

### 7.1. **Consistency with Policy**

This matter is not a matter of significance in terms of the Council's Significance and Engagement Policy.

### 7.2. **Authorising Legislation**

#### 7.2.1. Resource Management Act (1991)

Section 6(h); management of significant risks from natural hazards must be recognised and provided for.

Section 7(i); decisions must have regard to the effects of climate change.

**7.3. Consistency with Community Outcomes**

The Council's community outcomes are relevant to the actions arising from recommendations in this report, particularly environmental outcomes:

7.3.1. People are supported to participate in improving the health and sustainability of our environment.

7.3.2. Land use is sustainable; biodiversity is protected and restored.

7.3.3. Our communities are able to access and enjoy natural areas and public spaces.

**7.4. Authorising Delegations**

7.4.1. This report is for information only.



**Earth Sciences**  
New Zealand

# **Causes of saline intrusion in the Kaiapoi River**

Analysis of monitoring data

*Prepared for Environment Canterbury*

*December 2025*

Prepared by:  
Richard Measures  
Bruce Dudley

For any information regarding this report please contact:


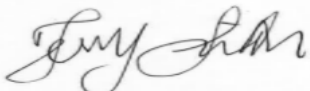
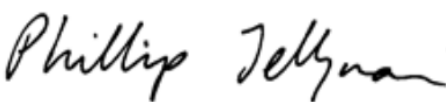
Richard Measures  
Hydrodynamics Scientist  
Sediment Processes Group  
+64 3 343 8066  
richard.measures@earthsciences.nz

New Zealand Institute for Earth Science Limited  
PO Box 8602  
Riccarton  
Christchurch 8440

Phone +64 3 348 8987

Client Report No: 2025349CH  
Report date: December 2025  
Project No: ENC26504

Revision	Description	Date
Version 1.0	Draft version sent to client	18 November 2025
Version 1.1	Edits to improve clarity regarding salt wedge intrusion mechanism and sensor elevations.	18 December 2025
Version 1.2	Correcting organisation names	2 March 2026

Quality Assurance Statement		
	Reviewed by:	Doug Booker
	Formatting checked by:	Terry Smith
	Approved for release by:	Phillip Jellyman

© New Zealand Institute for Earth Science Limited (“Earth Sciences New Zealand”) 2025. All rights reserved. This publication may not be reproduced or copied in any form without the permission of the copyright owner(s). Such permission is only to be given in accordance with the terms of the client’s contract with Earth Sciences New Zealand. This copyright extends to all forms of copying and any storage of material in any kind of information retrieval system.

Whilst Earth Sciences New Zealand has used all reasonable endeavours to ensure that the information contained in this document is accurate, Earth Sciences New Zealand does not give any express or implied warranty as to the completeness of the information contained herein, or that it will be suitable for any purpose(s) other than those specifically contemplated during the project or agreed by Earth Sciences New Zealand and the client.

# Contents

- Executive summary ..... 5**
- 1 Introduction ..... 7**
  - 1.1 Background .....7
  - 1.2 Saline intrusion process .....8
  - 1.3 This analysis .....8
- 2 Data .....10**
  - 2.1 Salinity data ..... 10
  - 2.2 Sea level .....14
  - 2.3 Waimakariri River flow ..... 14
  - 2.4 Tributary flow ..... 15
- 3 Analysis and results .....16**
  - 3.1 Developing a dataset for analysis ..... 16
  - 3.2 Testing for significant drivers of salinity .....16
  - 3.3 Waimakariri River flow and high tide level .....21
  - 3.4 Dredging .....25
  - 3.5 Sea level rise .....26
  - 3.6 Earthquake effects .....27
- 4 Conclusions .....29**
- 5 Acknowledgements.....30**
- 6 References .....31**

**Tables**

- Table 3-1: Sea level rise effect on saline intrusion for a range of Waimakariri river flows. 27

**Figures**

- Figure 1-1: Map of the Kaiapoi and Waimakariri Rivers showing the location of monitoring sites used for analysis. 7
- Figure 1-2: Schematic diagram of salt wedge saline intrusion process. 8
- Figure 2-1: Schematic showing the elevation of different salinity sensors installed at the Mandeville Bridge. 11

Figure 2-2:	Timeline of availability of salinity data from different instruments.	11
Figure 2-3:	Comparison of overlapping salinity data from Solinst LTC and AquaTROLL multi-parameter sonde.	13
Figure 2-4:	Comparison of concurrent data from top and bottom salinity sensors.	14
Figure 3-1:	Pairwise scatter plot showing correlation between different measured variables representing potential drivers of saline intrusion.	18
Figure 3-2:	Histogram showing distribution of observed peak salinity at Kaiapoi.	19
Figure 3-3:	Fitted GAM model showing partial effect of high tide level, Waimakariri flow, tributary flow and tidal range on peak salinity.	20
Figure 3-4:	Scatter plot showing observed peak salinity versus high tide level and Waimakariri flow.	22
Figure 3-5:	Heatmap showing the proportion of observed tides experiencing saline intrusion under different high tide level and Waimakariri flow conditions.	23
Figure 3-6:	Proportion of observed tides with measured saline intrusion for different Waimakariri flows.	24
Figure 3-7:	Waimakariri at Old Highway Bridge flow duration curve.	25
Figure 3-8:	Change in observed saline intrusions under different flow/tide conditions from before and after dredging.	26

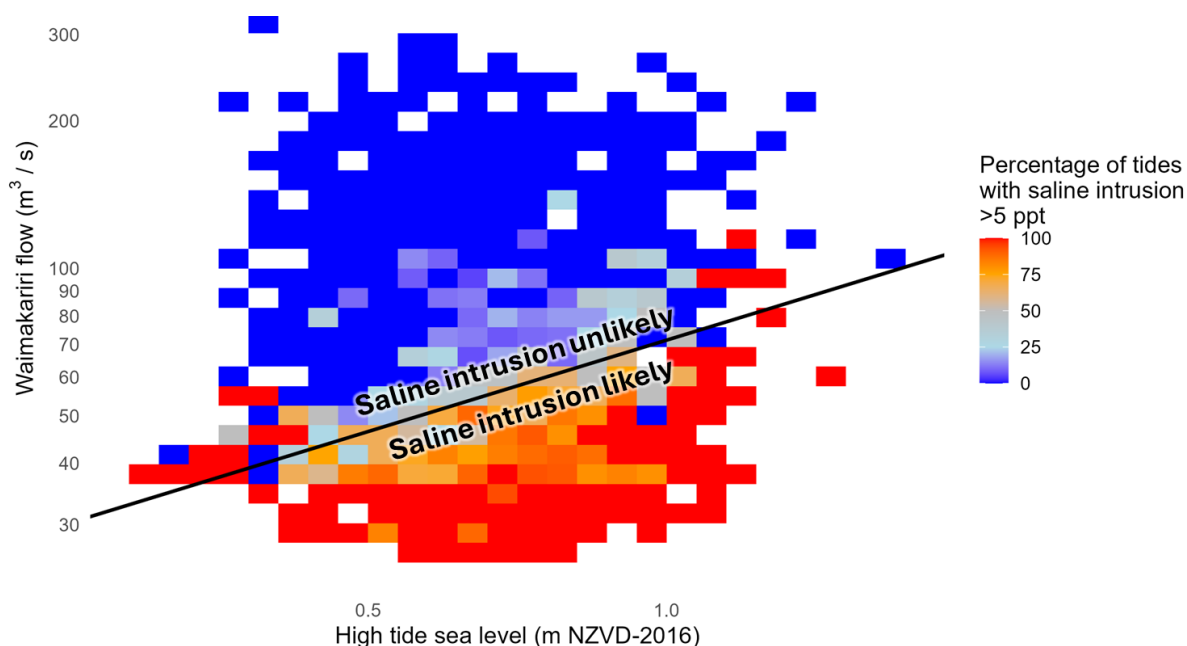
## Executive summary

Increased frequency of saline intrusion in the Kaiapoi River has been linked to observations of macrophyte dieback and kākahi (freshwater mussel) deaths in 2024. The purpose of this report is to inform understanding of what causes saline intrusion as a first step towards making more informed management decisions.

The report describes analysis of continuous salinity monitoring data recorded in the Kaiapoi River at the Mandeville Bridge. Salinity data are available since February 2017, although the installed monitoring instruments have gone through several iterations since then and there are uncertainties and gaps in some of the earlier data. Data collection since 2020 has been consistent and data for this period are of good quality.

For each tide where salinity data were available, we identified: peak salinity, average Waimakariri River flow (measured at the Old Highway Bridge flow recorder), average tributary flows (combined Cam River and Cust Main Drain flow data), high tide level (measured at Sumner sea-level recorder), and tidal range. Using this dataset, we carried out statistical analysis indicating that Waimakariri flow and high tide level are strongly predictive of saline intrusion. Tributary flows and tidal range also have smaller, but still statistically significant, effects on salinity.

The combined effect of Waimakariri flow and high tide level on observed salinity are shown in the summary figure below. Under current sea levels, saline intrusion into the Kaiapoi River occurs on almost all tides when flow is less than 35 m<sup>3</sup>/s, only on approximately 10% of tides when flow is greater than 72 m<sup>3</sup>/s, and almost never when flow is greater than 105 m<sup>3</sup>/s. For flows in the range 35–72 m<sup>3</sup>/s the likelihood of saline intrusion depends on the combination of river flow and tide level, with higher tides required to drive saline intrusion when Waimakariri flows are higher.



**Summary figure: Heatmap showing the proportion of observed tides experiencing saline intrusion under different high tide level and Waimakariri flow conditions.** Black line is fitted to the data and represents a threshold dividing conditions where the likelihood of saline intrusion is more or less than 50%.

Earthquakes can change river channel bed levels and geometry, potentially affecting saline intrusion. Kaiapoi experienced subsidence during the 2010–11 Canterbury earthquake sequence, and subsidence is likely to increase saline intrusion. The 2016 Kaikoura earthquake had negligible effect on bed levels and is unlikely to have affected salinity.

Analysis of the monitoring data shows that there was a significant change in observed saline intrusion in 2020, coinciding with dredging of the Kaiapoi River. Saline intrusion became more frequent and occurred at higher Waimakariri flows following the dredging.

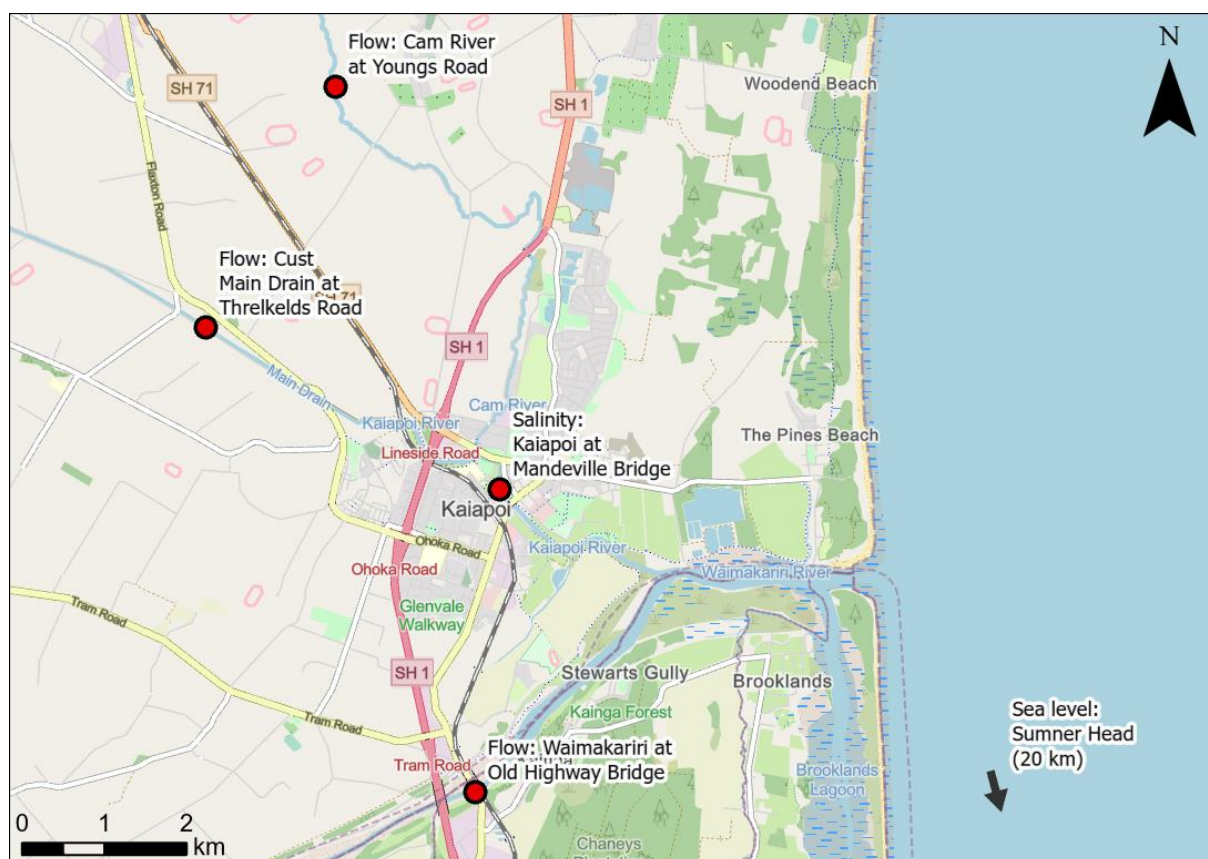
Saline intrusion is sensitive to high tide level, so sea level rise is expected to increase saline intrusion. We used the relationship between Waimakariri flow, high tide level and saline intrusion to investigate the sensitivity of saline intrusion to sea level rise for a range of river flows. Under current sea levels, a flow of 72 m<sup>3</sup>/s prevents intrusion on 90% of tides, but with 0.1 m of sea level rise a flow of 77 m<sup>3</sup>/s is needed to achieve the same effect, and with 0.5 m of sea level rise a flow of 97 m<sup>3</sup>/s is needed to achieve the same effect.

# 1 Introduction

## 1.1 Background

Environment Canterbury (Canterbury Regional Council) has been approached by Waimakariri District Council regarding public observations of emergent and submerged macrophyte dieback and kākahi (freshwater mussel) deaths in the Kaiapoi and Ruataniwha/Cam Rivers during winter 2024. These observations are described in a Waimakariri District Council report (Allen 2024). The report concludes that the cause of the Kaiapoi and Ruataniwha Cam Rivers ecological dieback observed in 2024 is primarily due to increased salinity, with potentially also some effect from frosts.

Environment Canterbury has maintained continuous monitoring of salinity and dissolved oxygen in the Kaiapoi River at the Mandeville Bridge since 2016 (location shown in Figure 1-1). These data are plotted in the Waimakariri District Council report and show that while salinity intrusion has historically occurred during summer months, 2024 experienced much longer periods with regular saline intrusion, including during autumn and winter.



**Figure 1-1: Map of the Kaiapoi and Waimakariri Rivers showing the location of monitoring sites used for analysis.**

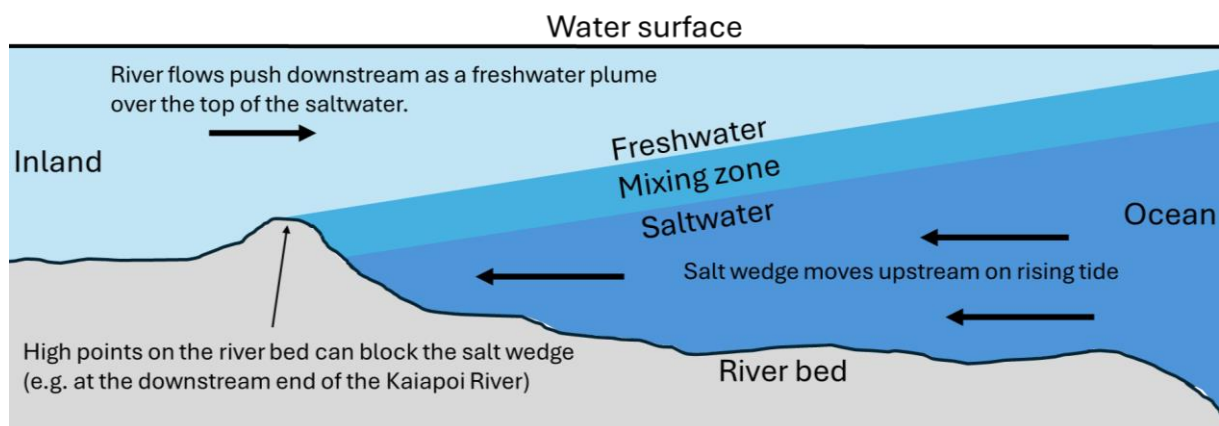
Salinity intrusions were previously investigated by Environment Canterbury in 2018 following previous observations of macrophyte dieback and kākahi deaths over the period 2012 to 2018 (Meredith 2018). They concluded that salt wedge intrusion was the most likely cause of the observed ecological changes (several potential alternative causes were identified but considered unlikely to be the primary cause). The Kaiapoi River is a tributary of the Waimakariri

River and saline intrusion was found to be strongly linked to Waimakariri River flows, with flows less than 40 m<sup>3</sup>/s associated with saline penetration on every tide and flows greater than 60 m<sup>3</sup>/s having little saline penetration on any tides. Meredith (2018) hypothesised that bed level changes resulting from the Canterbury earthquake sequence could have allowed increased saline intrusion.

Another cause of bed level changes on the Kaiapoi River is dredging. Dredging occurs periodically to maintain navigation, and we understand that a significant dredging programme funded by an earthquake recovery loan was carried out over the period June–August 2020 (Allen 2020).

## 1.2 Saline intrusion process

Salinity profiling conducted in 2016 informs our current understanding of the saline intrusion process (Meredith 2018). The profiling showed that salinity intrusion in the Waimakariri and Kaiapoi Rivers generally takes the form of a ‘salt wedge’, with near-bed salinity close to sea water and surface salinity close to freshwater. Seawater has a salinity of approximately 30–35 ppt which increases its density, making it significantly denser than freshwater. The density difference makes it more difficult for the freshwater and saltwater to mix, meaning that the rivers remain stratified with a layer of saltwater near the bed and freshwater near the surface. On an incoming tide seawater pushes upstream along the Waimakariri river bed, whilst the river surface remains relatively fresh. If this salt wedge rises to a level above the bed level of the Kaiapoi River, it can push into and up the Kaiapoi River towards the town.



**Figure 1-2: Schematic diagram of salt wedge saline intrusion process.** Note that in this schematic the vertical scale is very exaggerated, i.e. water depths are approximately 3–8 m whilst the distance from the ocean to the upstream limit of the salt wedge can be more than 5 km.

## 1.3 This analysis

This report describes analysis of the continuous salinity monitoring data recorded in Kaiapoi River at the Mandeville Bridge. This analysis extends the previous work described by Meredith (2018) by:

- Extending the analysis to include newer data.
- Undertaking a more detailed analysis into the effect of multiple different potential drivers of saline intrusion.

The analysis involved:

1. A site visit to the water quality monitoring station to understand the source of the data, how this has changed over time, and any local effects which could influence observations.
2. Analysing salinity data for the full period available (i.e., 2016–present), including investigating relationships between the peak salinity recorded on each tide and:
  - River flow in the Waimakariri.
  - High tide sea level.
  - Tidal range over the previous tidal cycle.
  - Kaiapoi River tributary flows.
3. Discussing the role of different drivers influence on saline intrusion, including:
  - Canterbury earthquake sequence changes in bed level.
  - Kaikoura earthquake.
  - Kaiapoi River dredging (June–August 2020).
  - Waimakariri River flow.
  - High tide levels and tidal range.
  - Sea level rise.

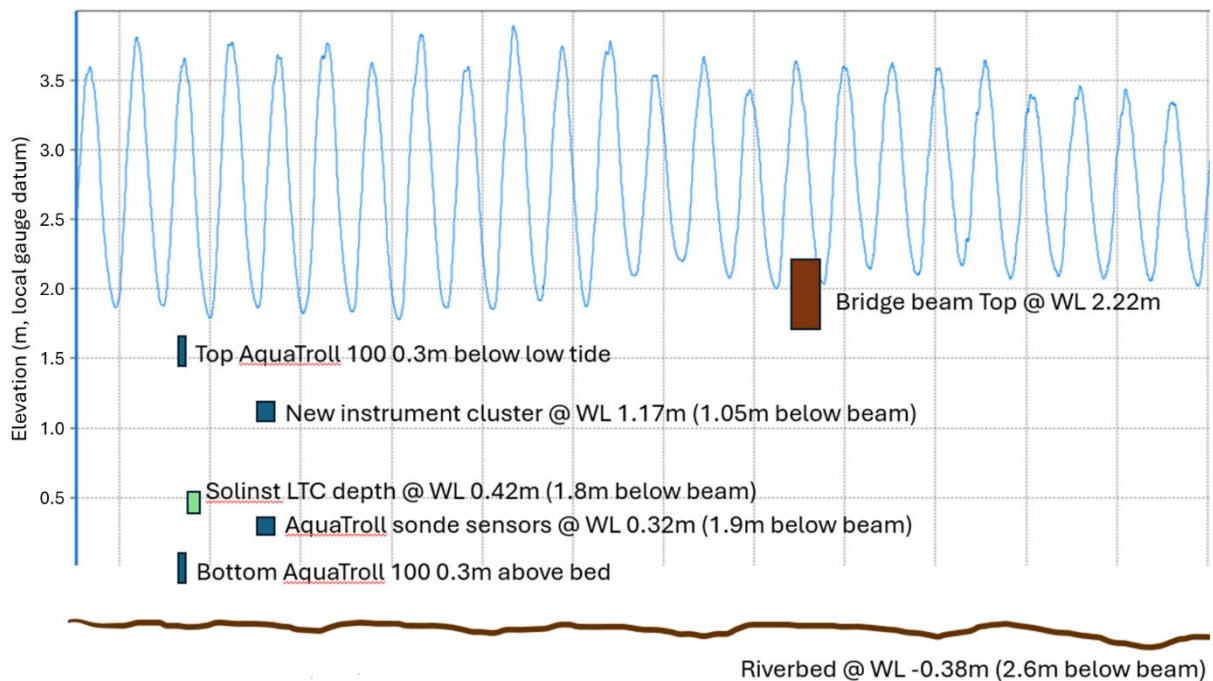
## 2 Data

### 2.1 Salinity data

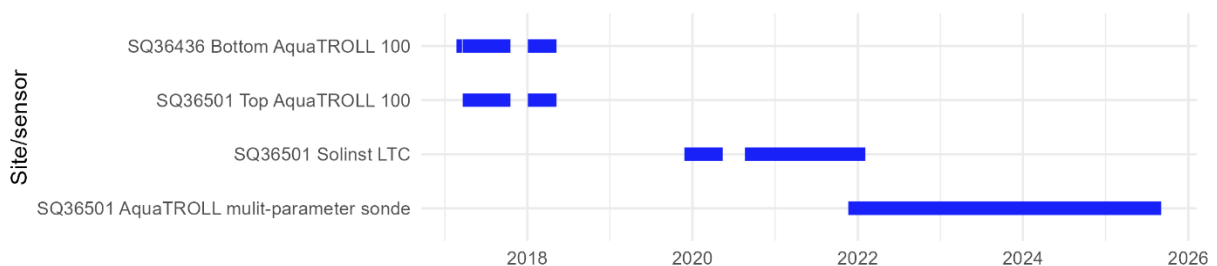
Continuous salinity monitoring instruments were first installed by Environment Canterbury in February–March 2017, initially as a temporary installation and later as a long term site. Salinity monitoring instruments are located on a bridge pier of the Mandeville Bridge in Kaiapoi. The first sensors to be installed were two AquaTROLL 100 salinity loggers. A “bottom” sensor was installed 30 cm off the riverbed (Site SQ36436, approximately 2 m below low tide level) and a second “top” sensor was installed above that, approximately 30 cm below low tide level (SQ36501). The sensors recorded and stored data locally and data were manually downloaded at monthly intervals during cleaning visits. These sensors were maintained until May 2018 (with a gap in data from October 2017 to January 2018).

Initial analysis of data from these two sensors showed that the bottom sensor provided an early record of saline presence, as it could identify the tip of the salt wedge propagating up the river bed. However, ecological effects were not observed unless a stronger salt wedge had developed (detectable higher in the water column, at the top sensor). Based on this observation all subsequent salinity monitoring installations in the Kaiapoi River have been installed at levels selected to monitor depths in the water column that are most indicative of likely effects on ecology (although sensor levels have varied slightly as described in the following paragraphs).

In November 2019 a Solinst LTC sensor was installed around 1.3 m below low tide level. This sensor was assigned the same site identifier as the original “top” sensor (SQ36501). In November 2021 the sensor was upgraded to a telemetered AquaTROLL multi-parameter sonde positioned slightly deeper. The Solinst data were continued until February 2022 to capture an overlapping period of data allowing the data to be cross-checked for consistency. In September 2025 a custom sensor array was installed to replace the AquaTROLL with both sensor arrays running in tandem to capture an overlapping period of data. As only a short period of record was available from this new sensor array at the time of analysis, we did not include this latest data in our analysis. Figure 2-1 shows the elevations of the different sensors and Figure 2-2 shows a timeline of data availability from the different sensors.



**Figure 2-1: Schematic showing the elevation of different salinity sensors installed at the Mandeville Bridge.** Blue line shows an indicative period of water level observations showing typical tidal range. Rectangles mark the elevation of the different salinity sensors. Also shown is the approximate bed level, and the level of a major beam on the bridge pier (for reference). All levels in this plot are in a local gauge datum.



**Figure 2-2: Timeline of availability of salinity data from different instruments.**

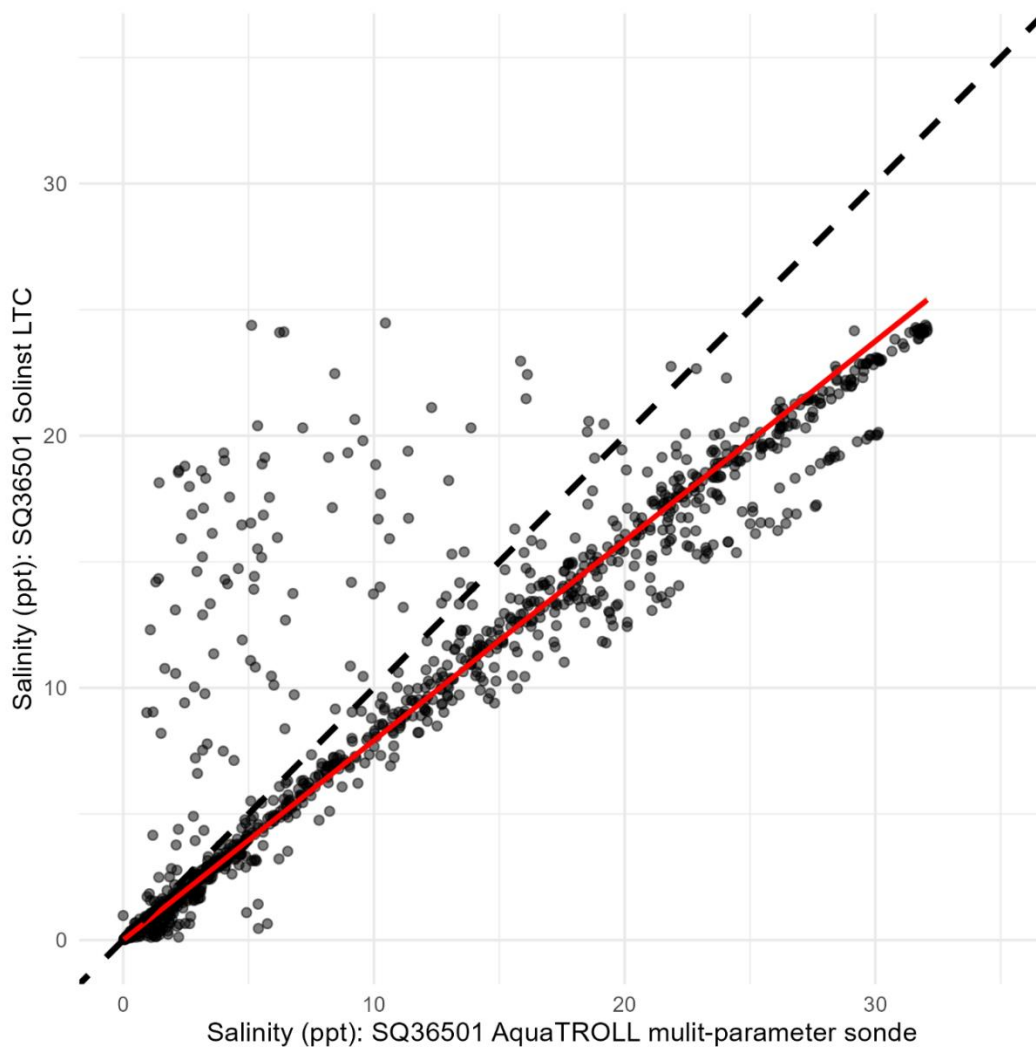
As well as salinity the current sensor array also includes monitoring of water temperature, conductivity, turbidity, chlorophyll-*a*, phycocyanin and nitrate, but these data were not analysed for this report. The instruments are all operated/maintained by Environment Canterbury, recording measurements every 15 minutes and transmitting data via telemetry.

A site visit to the instruments was conducted at low tide on 10 October 2025 when Environment Canterbury were conducting a cleaning/servicing visit. The current sensors appeared well maintained with appropriate procedures for cleaning, calibrating and checking against water sample data. The sensor quality and maintenance regime has generally improved over time meaning that uncertainty associated with the observed data may be higher in the older data.

All the different salinity sensors installed at the site work in a similar way, measuring water conductivity and temperature and calculating salinity using standard calibration relationships.

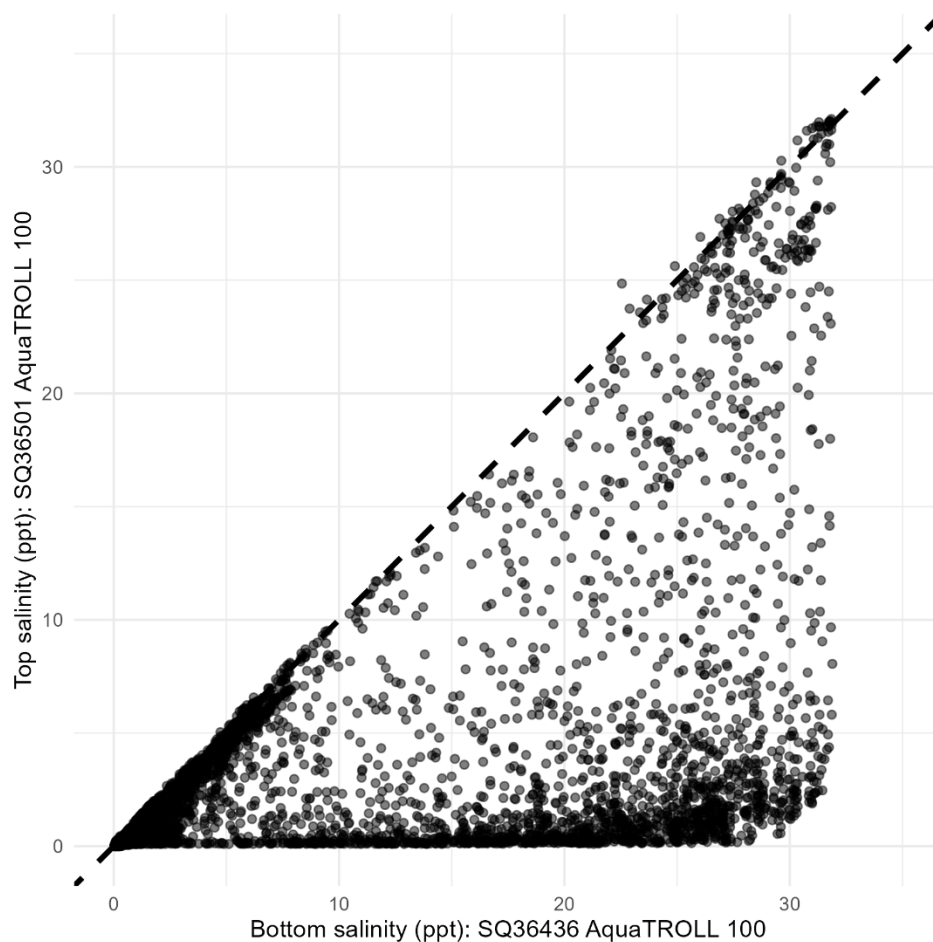
Salinity was supplied in practical salinity units (PSU), equivalent to parts per thousand (ppt) or grammes per kilogram (g/kg). We verified the supplied salinity data against the supplied conductivity and temperature data, confirming that all the data were consistent (after correcting some very minor issues with units in some of the supplied conductivity data). As there were some periods where conductivity and temperature were in the supplied data, but salinity was missing, we calculated salinity for these periods from conductivity and temperature.

We checked the period of overlapping Solinst LTC and AquaTROLL multi-parameter sonde data to test for consistency between the two sensors. We found there was a bias between the sensors with the Solinst tending to record a salinity 21% lower than the AquaTROLL, although there was also some scatter in the data. It is notable that the highest salinities recorded from the AquaTROLL were approximately 32 ppt, roughly matching seawater, but the highest salinities from the Solinst were less than 25 ppt. This suggests that the AquaTROLL was providing more accurate data. To make the data as accurate as possible for the analysis we scaled up all data from the Solinst (based on the linear fit between the two datasets - red line in Figure 2-3). The scattered points above the black dashed line show times when the Solinst LTC recorded higher salinity than the AquaTROLL sonde. This is unexpected as the Solinst LTC was slightly higher in the water column (see Figure 2-1), so would be expected to experience saline conditions less often than the AquaTROLL sonde. The reason for these scattered points is unclear, but they only represent approximately 1% of the overlapping period.



**Figure 2-3: Comparison of overlapping salinity data from Solinst LTC and AquaTROLL multi-parameter sonde.** Overlapping period from 19 November 2021 to 3 February 2022. Translucent black points represent concurrent measurements recorded at two sensors, black dashed line shows a perfect one to one match, and red line shows a linear fit to the observed data.

We also investigated the effect of sensor elevation on observed salinity by comparing concurrent data from the top and bottom AquaTROLL 100 sensors (Figure 2-4). It is clear that sensor elevation has a systematic effect on salinity, with the bottom sensor often recording saline conditions when the top sensor was recording fresh water. This difference is consistent with the presence of a salt wedge, with salinity moving upstream along the river bed as described in Section 1.2. The systematic effect of sensor elevation on salinity highlights that any differences in sensor elevation between the different sensor installations could bias our analysis and care is needed when comparing data from different installations.



**Figure 2-4: Comparison of concurrent data from top and bottom salinity sensors.** Concurrent data from 21 March 2017 to 10 May 2018. Translucent black points represent concurrent measurements, black dashed line shows a perfect one to one match.

## 2.2 Sea level

The closest sea level monitoring recorder is located at Sumner Head (site 66699), approximately 20 km south of the Waimakariri River mouth. Sumner Head is a long term sea-level monitoring site maintained by Earth Sciences New Zealand and has continuous data since 1994. We used 1-minute interval sea level data, which we smoothed to remove noise then identified high and low tides (level and time) to use for further analysis.

We used observed tide data rather than predicted tide levels as observed data includes storm surge and sea-level rise effects. Tide data were analysed in New Zealand Vertical Datum 2016 (NZVD-2016).

## 2.3 Waimakariri River flow

River flow is monitored by Environment Canterbury at the Waimakariri at Old Highway Bridge monitoring site (site 66401), approximately 3.5 km upstream of where the Kaiapoi River enters the Waimakariri (Figure 1-1). Water level is recorded every 15 minutes at the monitoring site. Flow is derived from the water level record using a “rating curve” established and maintained by regular measurements of flow undertaken at different water levels.

To accurately represent flow the rating curve relies on the river being free flowing, but at high tide the Waimakariri at Old Highway Bridge site is affected by a tidal backwater effect. Environment Canterbury process the observed data to filter out the tide influenced water levels before calculating river flow. We used the best estimate of Waimakariri river flow supplied to us by Environment Canterbury.

## 2.4 Tributary flow

There is no flow recorder in Kaiapoi as the river is tidal making flow monitoring impractical. To represent tributary flow we used data from two flow recorders within the Kaiapoi River catchment: Cust Main Drain at Threlkelds Road (site 66417) and Cam at Youngs Road (site 66409). The location of these sites is shown in Figure 1-1. Flow data are also available in the catchment from Ohoka Spring at Dalleys Weir (site 66435), but this generally has very low flows and the selected sites are more representative of the catchment as a whole.

Further synthetic flow records are available for other sites within the catchment (Kaiapoi River at Neeves Rd and Ohoka Stream at Kaiapoi River confluence). These data are derived from measured relationships between these sites and primary monitored sites (e.g., Cust Main Drain at Threlkelds Road) and are used for consenting purposes. For this analysis of Kaiapoi salinity data we primarily consider the patterns of flow variation over time rather than the absolute flow values. Whilst these sites are in useful locations we chose to focus on the sites with continuous monitoring as the pattern of flow over time at the synthetic sites is derived from the monitored sites anyway.

## 3 Analysis and results

### 3.1 Developing a dataset for analysis

Our analysis focussed on understanding the drivers for saline intrusion into the Kaiapoi River. Peak saline intrusion always occurs close to high tide, so the first step of our analysis was to simplify the continuous monitoring data to a dataset where each entry represented conditions associated with a separate high tide. For each tide we calculated:

- **Observed high tide level at Sumner (high tide level):** As the raw sea level data are noisy (due to the influence of waves/surges etc) we smoothed the raw 1-minute timeseries with a 10-minute rolling average before identifying the tide peaks.
- **Maximum Kaiapoi salinity (peak salinity):** Maximum salinity observed at Kaiapoi within 3 hours either side of the Sumner high tide time.
- **Observed tidal range (tidal range):** We identified low tide levels from the smoothed sea level observations in the same way that we identified high tide levels and calculated tidal range as the level difference between each high tide and its preceding low tide.
- **Average Waimakariri River flow (Waimakariri flow):** We calculated mean river flow over the rising tide (i.e., over the period from the preceding low tide to the high tide). This period was selected as we assumed that it was flow during the rising tide which affected salinity propagation up the river.
- **Average tributary river flow (tributary flow):** We summed flows from Cust Main Drain at Threlkelds Road and Cam at Youngs Road and calculated the mean of the summed flow over the rising tide. As the two flows are highly correlated it is difficult to analyse them separately. Summing the two observed flows was assumed to be proportional to total freshwater flow in the Kaiapoi River at the upstream end of tidal influence.
- **Whether the tide was before or after dredging took place (dredging):** We classified each datapoint based on whether it was before or after dredging was carried out in the Kaiapoi River. Points prior to 1 June 2020 were classified as pre-dredging and points after 1 September 2020 classified as post-dredging. As the dredging took place during June-August 2020 this period was classified as during-dredging.

From 21 March 2017 to 22 July 2025 there are 5831 high tides, of which salinity data were available for 4401. Full data for all variables is available for 4315 high tides.

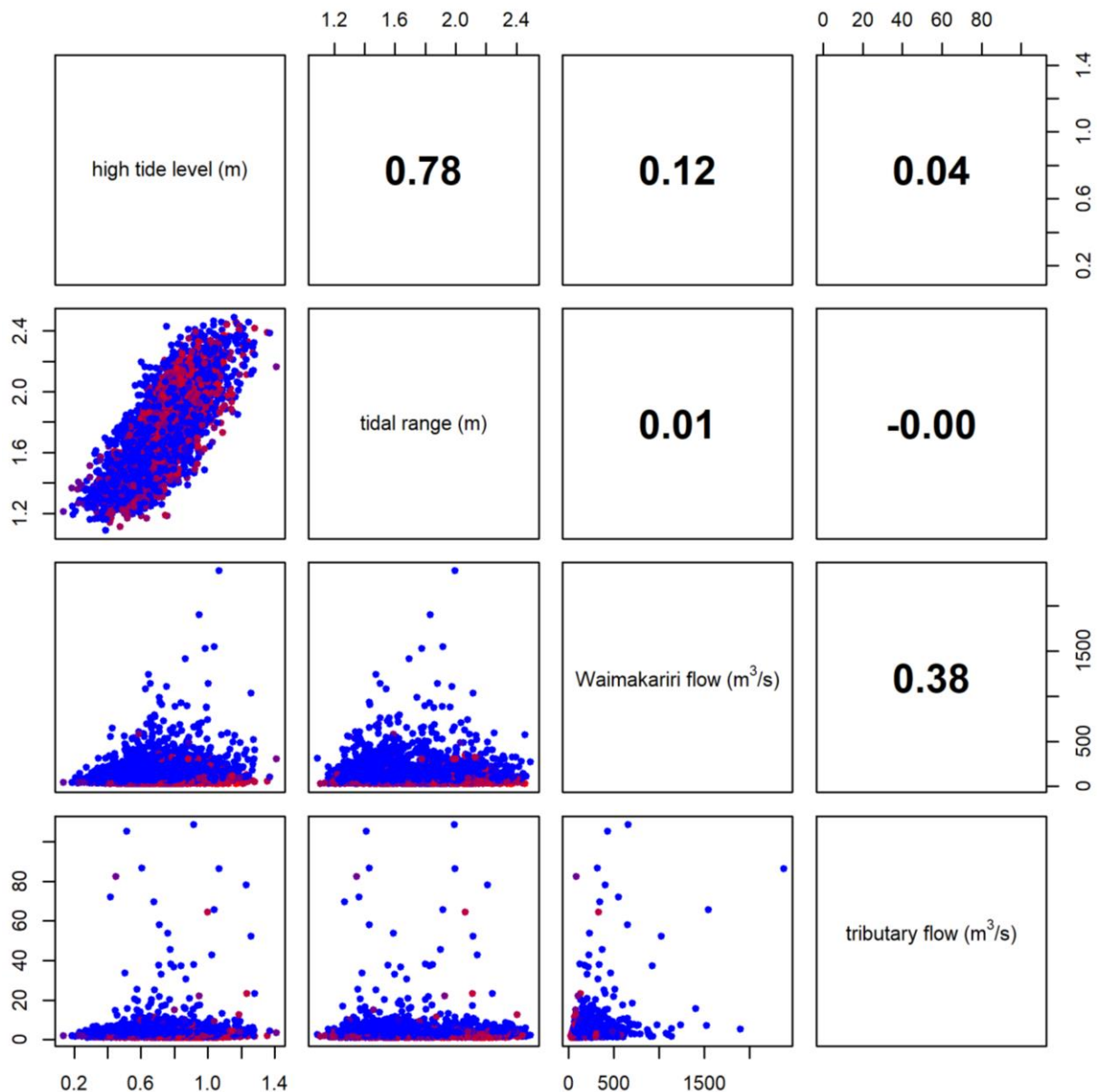
### 3.2 Testing for significant drivers of salinity

Using the created dataset, we investigated the strength of relationship between variables (high tide level, tidal range, Waimakariri flow and tributary flow) and peak salinity at Kaiapoi (initially ignoring any effect of dredging). For this analysis we only used data from 2019 onwards due to differences in the sensor elevation of the early top and bottom salinity sensor installations compared to the more recent salinity data. Excluding data from prior to 2019 leaves 3714 high

tides for which all variables were available. Prior to undertaking statistical analysis we checked for correlation between the variables as correlation could make it difficult to separate out their individual relationships with salinity. The results of the correlation check are shown in Figure 3-1. The correlation check showed that:

- There was a moderate positive correlation between Waimakariri flow and tributary flow (Pearson correlation = 0.39).
- There was a strong correlation between high tide level and tidal range (Pearson correlation = 0.78).

The scatter plots in Figure 3-1 also highlight that Waimakariri flow and tributary flow both have very skewed distributions. For this reason, we log transformed the flow data for all our statistical analysis. High tide level and tidal range were normally distributed.

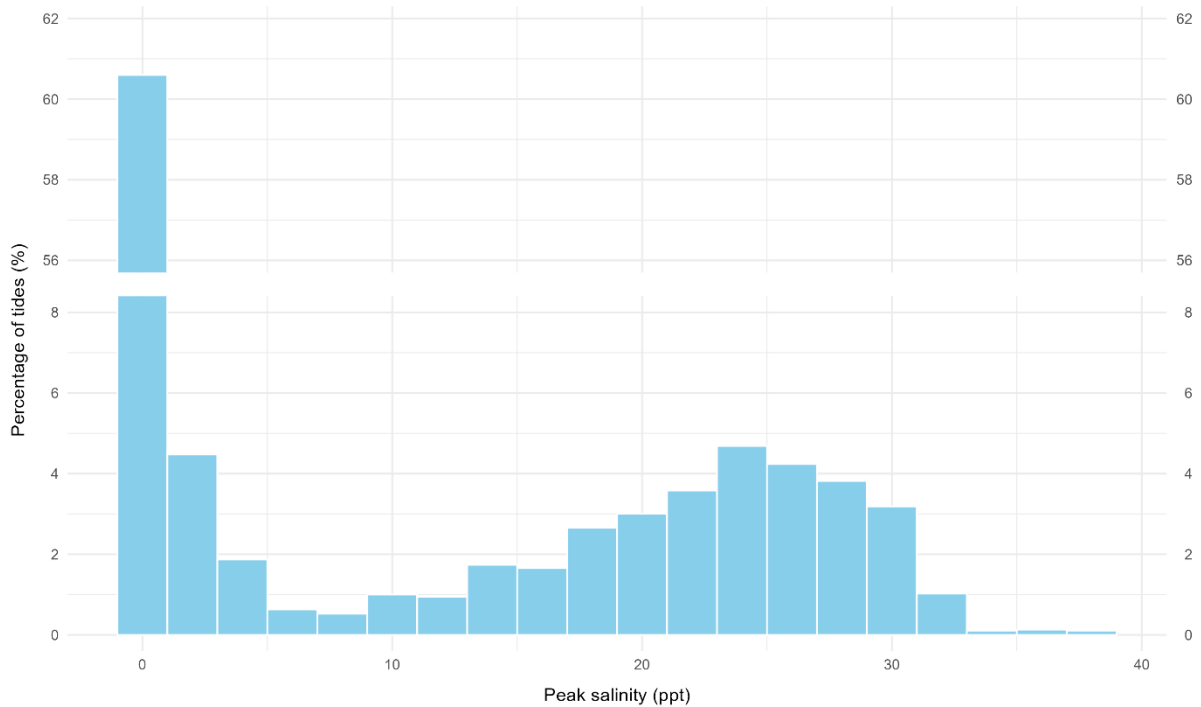


**Figure 3-1: Pairwise scatter plot showing correlation between different measured variables representing potential drivers of saline intrusion.** Each point represents a single high tide. Points are coloured by maximum salinity observed at Kaiapoi, blue = fresh water, red = saline. Bold numbers are the Pearson correlation coefficient for each pair of variables.

We then checked for multicollinearity to test whether the degree of correlation might influence our ability to separate out the degree to which each variable is independently related to salinity. Despite the correlation between high tide level and tidal range all variables had an acceptable level of multicollinearity (Variance Inflation Factor (VIF) below 3), indicating that each variable contributes unique information, so it is ok to include all the variables into our statistical analysis.

We trialled various approaches to investigate the relationship between each of the variables and the peak salinity. First, we tried fitting a generalised linear model (GLM), but peak salinity is bimodal which means the GLM does not perform well. The distribution of observed peak salinity

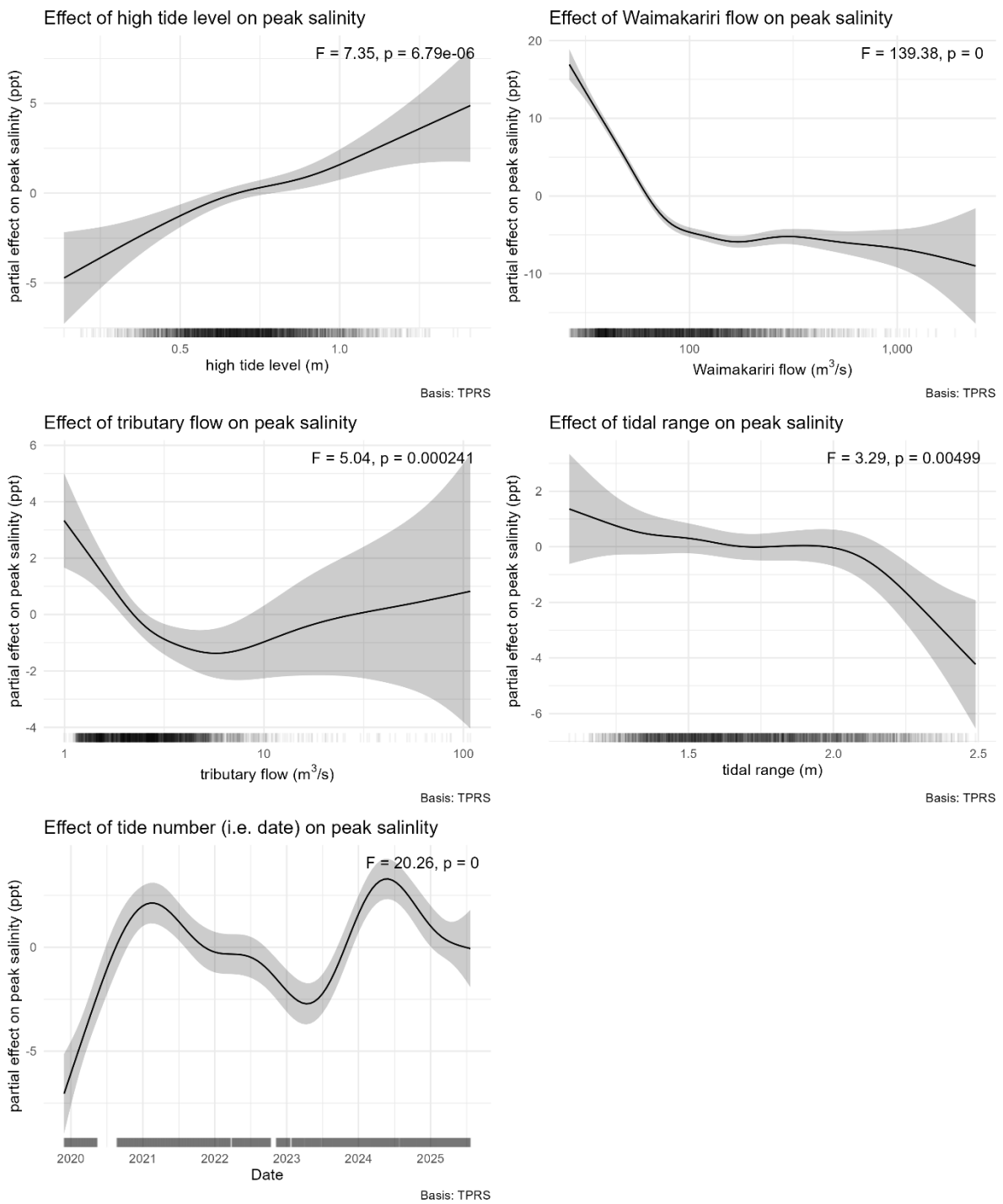
is shown in Figure 3-2, it tends to either be close to zero or significantly saline, with few observations between 5 and 13 ppt.



**Figure 3-2: Histogram showing distribution of observed peak salinity at Kaiapoi.**

We then tested fitting a generalised additive model (GAM). This statistical model assumes that peak salinity can be predicted by summing smooth functions related to each of the variables. Fitting the model involves optimising the shape of the smooth functions describing the partial effect of each of the predictors on peak salinity. Our initial attempts to fit a model were promising, but when checking the model results, we found there is temporal autocorrelation in the residuals. This indicates that the salinity on each high tide is partially linked to salinity on the previous high tide. The presence of temporal autocorrelation violates the assumptions of our initial model, so we modified the model to account for autocorrelation by: (a) adjusting the likelihood to account for first-order autoregressive correlation in the model residuals ( $\rho(1) = 0.51$ ), and (b) explicitly including a smooth function for time within the model (time was expressed in terms of number of high tides since the first data point). Our final model took the form shown in (1) using the ‘bam’ function of the mgcv package (Wood 2025). The resulting partial effect curves are shown in Figure 3-3.

$$\begin{aligned}
 \text{Salinity} \sim & s(\text{high tide level}) + s(\log_{10}(\text{Waimakariri flow})) \\
 & + s(\log_{10}(\text{tributary flow})) + s(\text{tidal range}) + s(\text{tide number})
 \end{aligned}
 \tag{1}$$



**Figure 3-3: Fitted GAM model showing partial effect of high tide level, Waimakariri flow, tributary flow and tidal range on peak salinity.** The shaded region shows the 95% confidence interval. Black markers on the x-axis show the distribution of observed data (1-marker per observed tide). The F and p statistics for each parameter are shown in the top right of each plot. The F-value indicates the overall significance of the individual parameter (higher F indicates greater significance), and the p-value indicates the probability that the observed effect of a parameter is due to chance (low p indicates high confidence that the parameter influences salinity).

All variables had very significant relationships with salinity (p-value < 0.005). The partial effect curves (and F-values) show that Waimakariri flow has the biggest effect on salinity, followed by tide number and high tide level. Tributary flow and tidal range have smaller effects.

As expected, higher tide level, lower Waimakariri flow and lower tributary flow are all associated with higher peak salinity. Higher tidal range results in slightly lower peak salinity. At first inspection this seems counterintuitive but because tidal range is considered separately to high tide level, higher tidal range equates to lower low-tide level (for any given high tide level). Lower low tide level potentially allows salinity to flush from the river system more effectively.

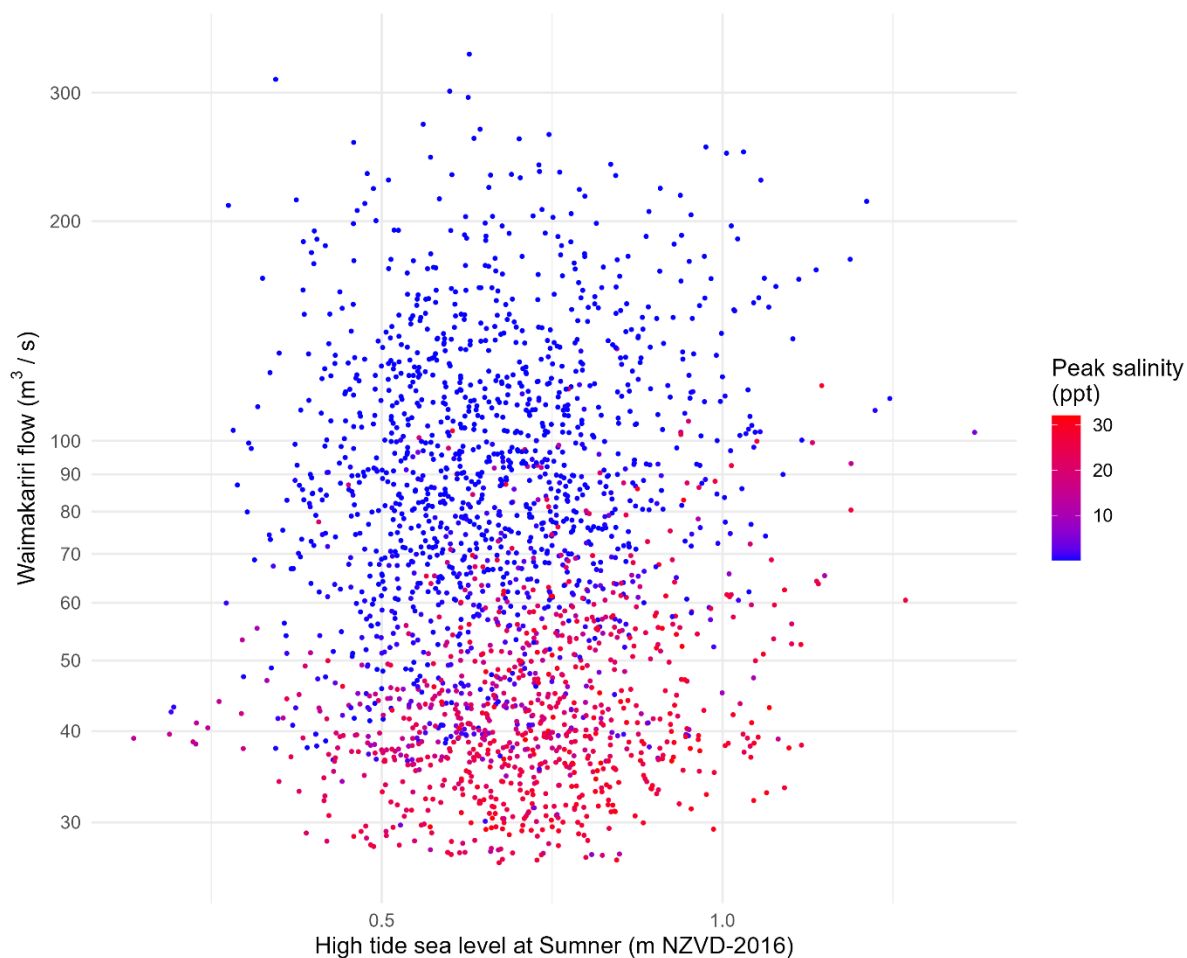
The shape of the partial effect curves helps explain the way each parameter influences salinity. For high tide level salinity increases continuously as high tide level increases. For Waimakariri flows up to approximately 75 m<sup>3</sup>/s increasing flow results in reducing salinity, but beyond this flow threshold there is little effect (as salinities are already low).

The partial effect curve for tide number suggests that there are some temporal changes in the pattern of measured high tide salinity which are not explained by changes in flows or tides. These may be the result of changes in sensors (e.g., type, elevation, drift in calibration), physical changes in the river (e.g., dredging, sedimentation) or other factors. The potential for dredging to have influence salinity is explored further in Section 0.

### 3.3 Waimakariri River flow and high tide level

Having identified that Waimakariri flow, followed by high tide level, have the biggest effect on saline intrusion (ignoring temporal changes for now) we undertook a more detailed analysis of how they combine to control salinity. For this analysis we only used data from the recent AquaTROLL multi-parameter sonde (November 2021 onwards). We selected these data because they: a) make up the largest part of the salinity record (Figure 2-2); b) are the most reliable; c) are at a consistent sensor elevation; and d) are all from after dredging was completed.

Figure 3-4 shows observed peak salinity plotted against the observed high tide level and Waimakariri flow. Whilst there are clear trends visible in the raw data it is difficult to draw clear conclusions due to the number of data points and the noise present.



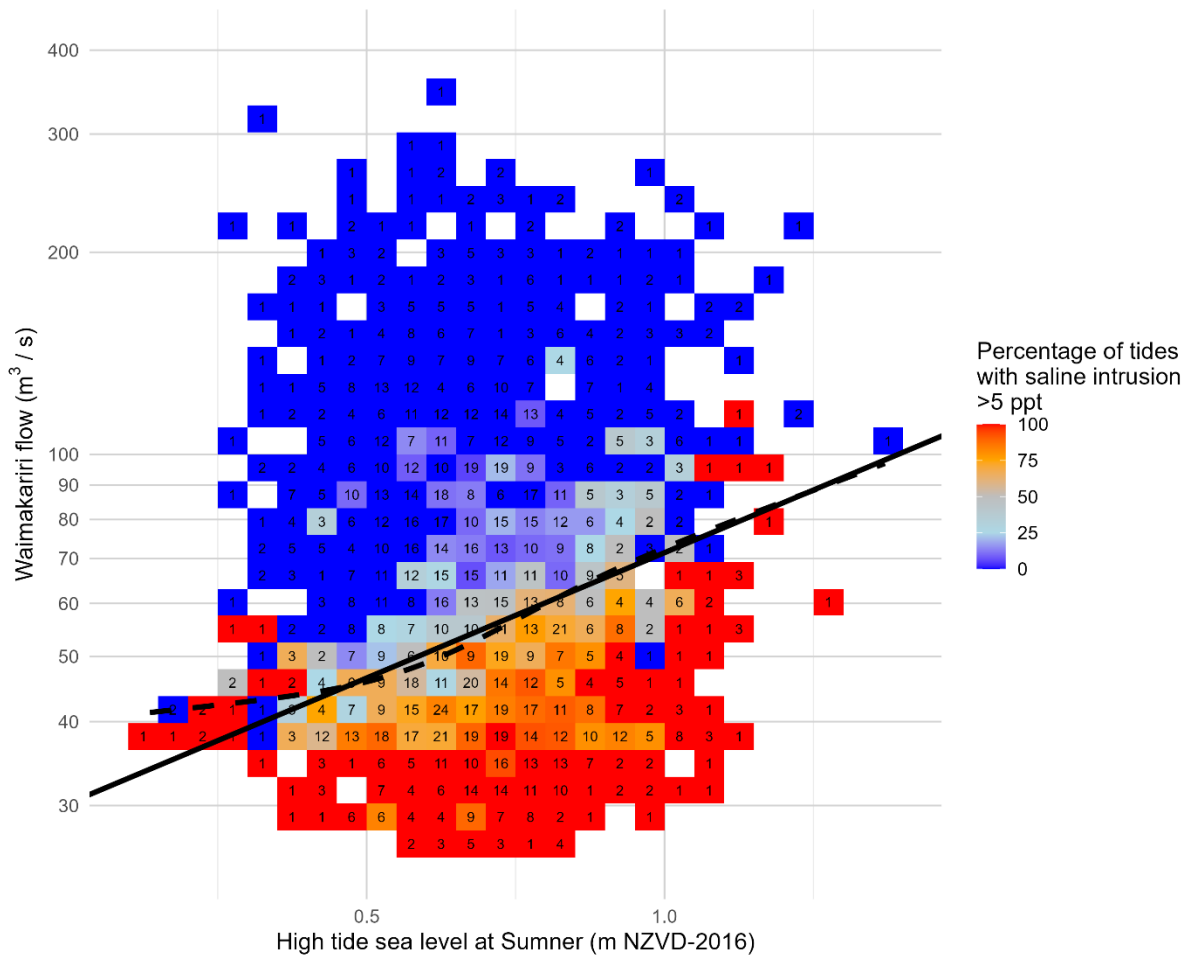
**Figure 3-4: Scatter plot showing observed peak salinity versus high tide level and Waimakariri flow.** Data only shown from the highest quality period of record since November 2021. Data points from periods where the Waimakariri flow is changing rapidly (more than 100 m<sup>3</sup>/s in the 24 hours prior to high tide) have been excluded.

We noticed that outlier points often occurred during periods of rapidly changing flow. Rapidly rising Waimakariri flow following a period of low flow with saline intrusion appears to trap salinity temporarily inside the Kaiapoi River, leading to saline intrusion being observed at high tide during high flows. This effect only persists for one or two tides and is part of the autocorrelation identified in the statistical analysis. We filtered out all data points where Waimakariri flow changed more than 100 m<sup>3</sup>/s in the 24 hours prior to high tide to be able to more clearly analyse the relationship between flow and saline intrusion.

As the salinity data are bimodal, tending to either be close to fresh or relatively saline, we simplified the data by classifying each high tide as either saline or non-saline depending on whether salinity was greater than 5 ppt. The conclusions of our analysis are insensitive to the specific threshold selected within the range of roughly 5–13 ppt as observed salinity is very rarely in this range, tending to be less than 5 ppt or greater than 13 ppt (see Figure 3-2). 5 ppt was selected as it is roughly indicative of salinity sufficient to impact river ecology.

To make the large number of data points easier to visualise we binned the data into discrete bands of high tide level and (log transformed) Waimakariri flow, calculating the number of observed tides in each bin, and the proportion of observed tides which were saline. These

binned data are plotted as a heatmap in Figure 3-5. The heatmap clearly shows the combined influence of high tide level and Waimakariri flow. Some noise is visible close to the upper and lower bounds of observed high tide level, but this represents a very small number of observations.



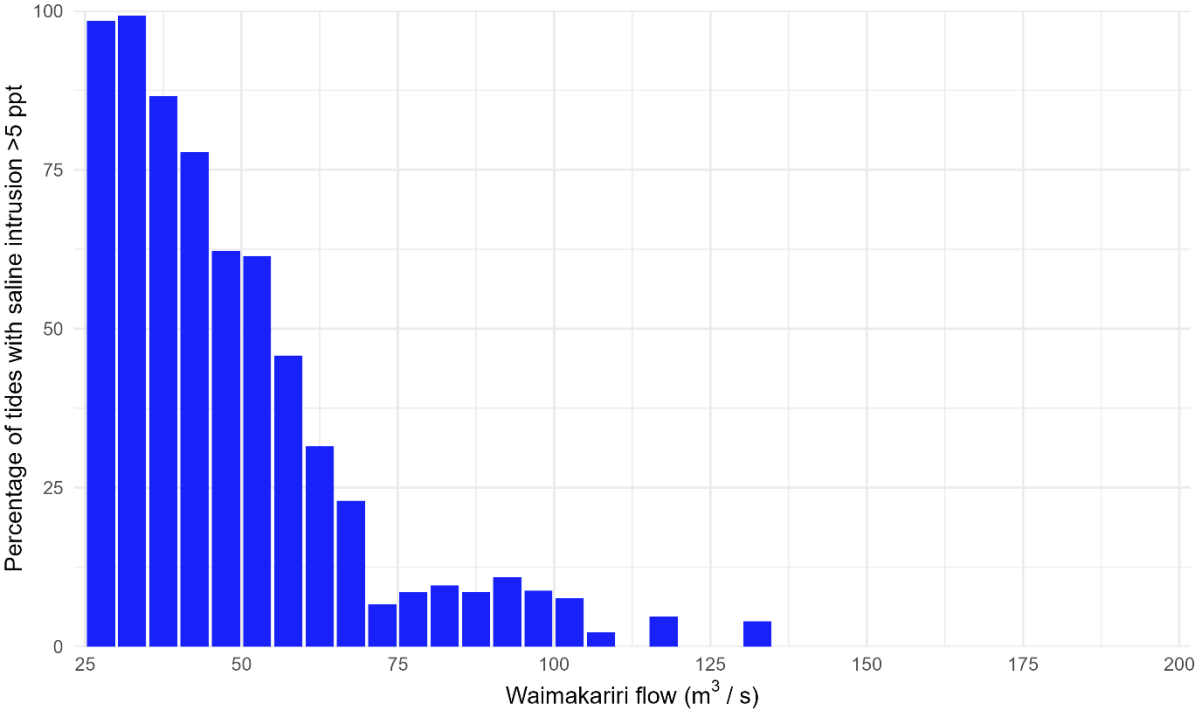
**Figure 3-5: Heatmap showing the proportion of observed tides experiencing saline intrusion under different high tide level and Waimakariri flow conditions.** Black values show the number of observed tides within each bin/cell. Two threshold lines are shown: the solid line is a fitted linear model, and the dashed line is a fitted non-linear GAM.

To aid in interpreting the data threshold lines were fitted to the observed data, identifying the combinations of high tide level and Waimakariri flow likely to result in salinity (>5 ppt) being observed in Kaiapoi. We tested fitting linear (solid line in Figure 3-5) and non-linear (GAM, dashed line in Figure 3-5) models to determine a threshold, with both models giving very similar results except for close to the lower bound of observed high-tide levels (high tide level less than 0.40 m). Given that very few tides of these levels are observed, and uncertainty of the models is greater at the edges of the fitted data range, we prefer the simpler linear threshold.

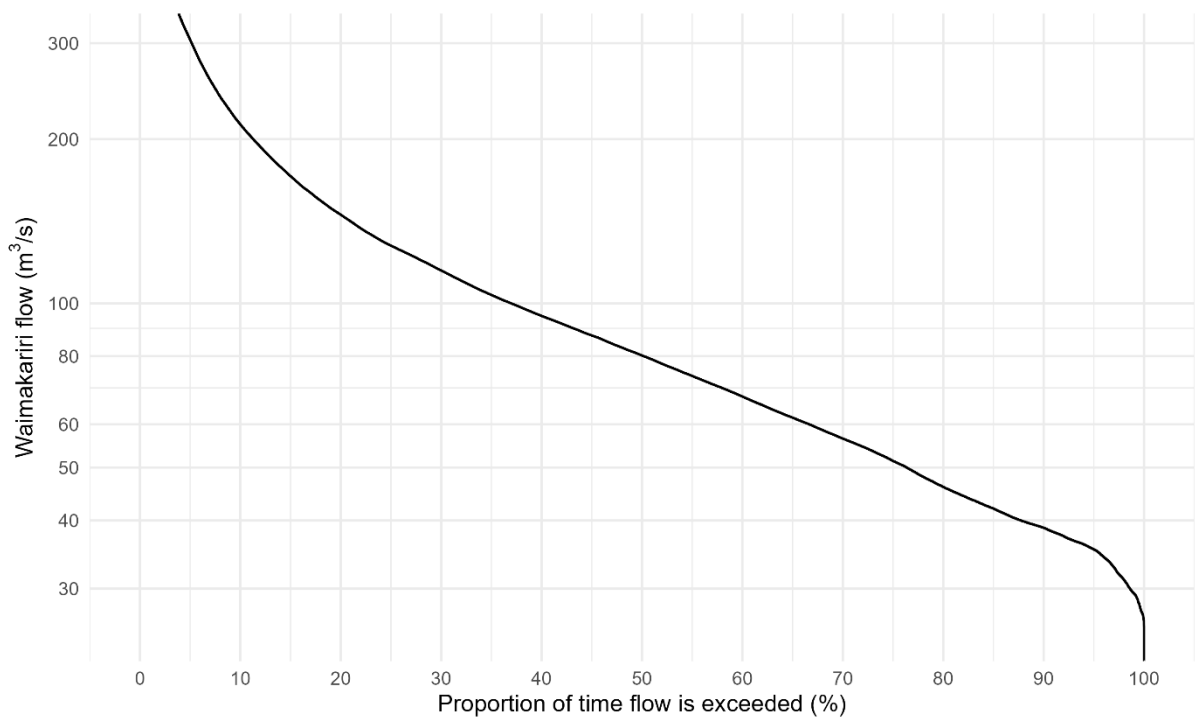
Focussing on the effect of Waimakariri flow only, we computed the proportion of observed tides experiencing saline intrusion (>5 ppt) for different Waimakariri flows. This shows that (under 2017–2025 sea levels), saline intrusion occurs on almost all tides when flow is less than 35 m<sup>3</sup>/s, only on approximately 10% tides when flow is greater than 70 m<sup>3</sup>/s, and almost never

when flow is greater than 105 m<sup>3</sup>/s. For flows between 35 and 70 m<sup>3</sup>/s the proportion of tides with saline intrusion reduces as flow increases.

Figure 3-7 puts these flows into context by showing the observed flow duration curve for the Waimakariri. Flows less than 35 m<sup>3</sup>/s (i.e. regular saline intrusion) only occur about 5% of the time, while flows between 35 and 70 m<sup>3</sup>/s (saline intrusion likelihood varies with flow) occur about 40% of the time. Flows in the Waimakariri are influenced by water abstraction, primarily for irrigation. Consent rules progressively restrict abstraction as river flows drop and require that all abstraction cease at flows below 41 m<sup>3</sup>/s.



**Figure 3-6: Proportion of observed tides with measured saline intrusion for different Waimakariri flows.**



**Figure 3-7: Waimakariri at Old Highway Bridge flow duration curve.** Flow duration curve calculated for the period 2016--2025.

### 3.4 Dredging

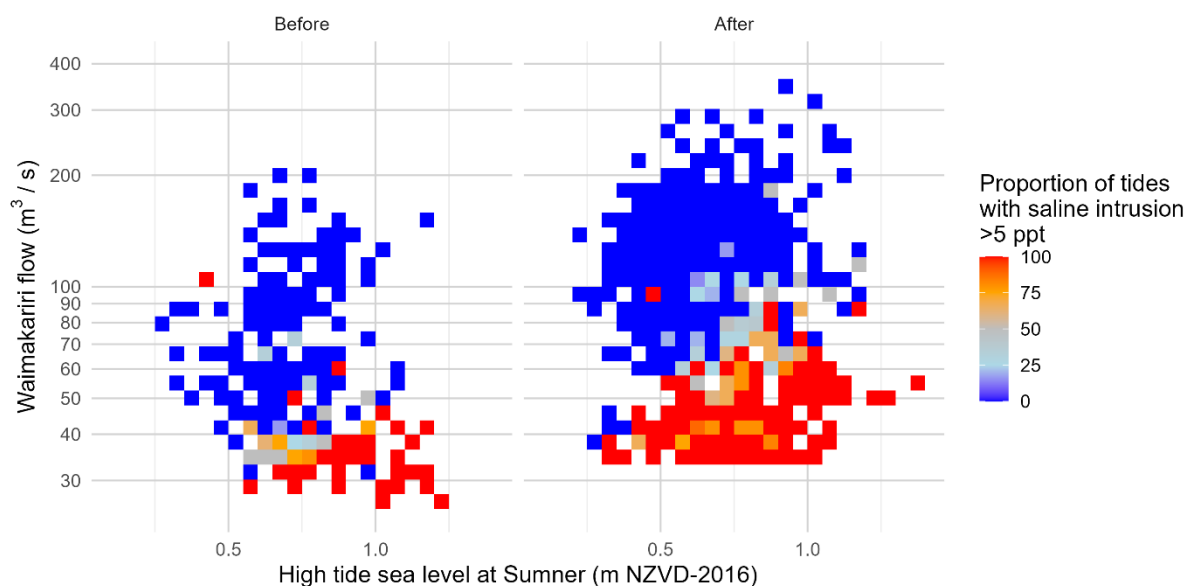
Dredging has the potential to increase saline intrusion as deepening the channel may make it easier for sea water to propagate upstream. Salinity increases water density and salt water generally propagates along the bed of the deepest part of the channel. High points in the thalweg of the channel (i.e. shallow areas) can block the propagation of a salt wedge (see Figure 1-2). The bed levels at downstream end of the Kaiapoi River, where it meets the Waimakariri, are likely to be an important control on the ability of saltwater to enter the Kaiapoi. The bed of the Kaiapoi River is likely perched above the bed of the Waimakariri with this difference in bed level helping to prevent salinity entering the Kaiapoi River.

To test whether there was a significant change in salinity intrusion from the before-dredging to after-dredging periods, we included a factor which indicated before or after dredging within the GAM statistical model. This allowed us to investigate the role of before/after dredging on salinity while controlling for the effects of high tide level and Waimakariri flow. For this analysis we excluded data from the “during dredging” period. Because salinity is so sensitive to depth we focussed on data from the Solinst LTC sensor only. Data from this sensor spans from before the dredging took place to after so allows us to investigate the effects of dredging without the added complexities of accounting for changes in sensor type or elevation.

There were 326 high tides with available data from the Solinst LTC salinity sensor before dredging and 1006 after dredging (including data from the AquaTROLL Sonde and Solinst LTC sensors as they were at a similar elevation and the data is comparable). The fitted GAM confirmed that dredging had a statistically significant effect on salinity ( $p \sim 0$ ,  $t = 7.2$ ).

The effect of dredging was explored further by repeating the analysis of Waimakariri flow and high tide level effect on salinity separately for the before dredging and after dredging periods

(Figure 3-8). The heatmaps show that saline intrusion is being observed at lower Waimakariri flows and lower tide levels after dredging compared to before dredging.



**Figure 3-8: Change in observed saline intrusions under different flow/tide conditions from before and after dredging.** Data is only shown for the Solinst LTC sensor to avoid any complications due to changes in sensor depth.

Whilst the statistical analysis and heatmaps confirm that saline intrusion is being observed more frequently after dredging took place in 2020, and under lower river flow/tide level conditions, it cannot confirm dredging is the cause of this change. However, the observed increase in saline intrusion is consistent with anecdotal observations and there is a plausible mechanism for dredging to have increased salinity intrusion. The change in observed intrusion for given Waimakariri flow / high tide level conditions is quite large. This finding indicates that there is most likely a real increase in saline intrusion following dredging.

### 3.5 Sea level rise

Saline intrusion is sensitive to high tide level, so sea level rise is expected to increase saline intrusion. The relationship between Waimakariri flow, high tide level and saline intrusion provides a powerful tool to predict the influence of sea level rise (SLR) on saline intrusions. Sea levels measured at Lyttelton Harbour increased by an average of 2.77 mm/yr over the period 1961–2020 and continue to increase at an accelerating rate as a result of climate change (Bell et al. 2022). Applying the linear threshold in Figure 3-5, in combination with the distribution of observed high tide levels, enables calculation of how the frequency of saline intrusion is likely to change for different river flows, under different amounts of sea level rise. The results of this calculation are presented for a range of flows and sea level rise in Table 3-1. For example, for a river flow of 60 m<sup>3</sup>/s, 0.1 m of sea level rise would increase the frequency of saline intrusion from 44% of tides to 66% of tides, and 0.5 m sea level rise would mean saline intrusion occurred on every tide. Another way of interpreting the sea level rise effect is to consider how sea level rise impacts the Waimakariri flow required to prevent most intrusion. For example, under current sea levels a flow of 72 m<sup>3</sup>/s prevents intrusion on 90% of tides, but with 0.1 m of sea level rise a flow of 77 m<sup>3</sup>/s is needed, and with 0.5 m of sea level rise a flow of 97 m<sup>3</sup>/s is needed.

**Table 3-1: Sea level rise effect on saline intrusion for a range of Waimakariri river flows.** High tide level required to cause intrusion has been taken from the straight line threshold in Figure 3-5. The distribution of high tide levels relative to mean sea level taken from observed sea level data for the period analysed (2017 to present) was used to calculate the proportion of high tides exceeding the level threshold. Predictions for the effect of sea level rise greater than 0.5 m are not presented as this takes high tide levels well outside the range of current tides and it may not be appropriate to extrapolate the linear Waimakariri flow/high tide level threshold to these levels.

Waimakariri flow (m <sup>3</sup> /s)	High tide level required to cause intrusion (m)	Proportion of high tides exceeding the level required to cause saline intrusion			
		Current sea level	0.1 m SLR	0.2 m SLR	0.5 m SLR
30	0.153	100%	100%	100%	100%
35	0.252	100%	100%	100%	100%
40	0.351	100%	100%	100%	100%
45	0.451	100%	100%	100%	100%
50	0.550	86%	100%	100%	100%
55	0.649	66%	86%	100%	100%
60	0.748	44%	66%	87%	100%
65	0.847	25%	44%	66%	100%
70	0.946	13%	25%	44%	100%
75	1.045	5%	13%	25%	87%
80	1.145	2%	5%	13%	67%
85	1.244	1%	2%	5%	44%
90	1.343	0%	1%	2%	25%
95	1.442	0%	0%	1%	13%
100	1.541	0%	0%	0%	5%
105	1.640	0%	0%	0%	2%

### 3.6 Earthquake effects

Earthquakes can cause vertical land movement (uplift or subsidence) as well as lateral spreading and liquefaction, all of which can change river channel bed levels and geometry, potentially affecting saline intrusion. There is no continuous salinity monitoring data available in Kaiapoi from prior to the 2010–11 Canterbury earthquake sequence, or the 2016 Kaikoura earthquake to directly analyse the effect of the earthquakes on salinity intrusion.

LiDAR measurements show that during the Canterbury earthquake sequence areas of Kaiapoi bordering the Kaiapoi River generally subsided (CERA 2012). Subsidence was highly spatially variable with subsidence of more than 0.1 m widespread and more than 0.5 m locally, particularly in areas influenced by liquefaction and/or lateral spreading. The degree of vertical movement is likely to have impacted saline intrusion in Kaiapoi. Any subsidence of the riverbed would be likely to increase saline intrusion (similar to dredging).

Vertical land movements in the Christchurch/Kaiapoi area as a result of the 2016 Kaikoura earthquake were much smaller (subsidence of ~0.01–0.02 m, LINZ 2017) and are not expected to have had a significant impact on saline intrusion.

## 4 Conclusions

Continuous salinity monitoring data collected from the Kaiapoi River provide a powerful dataset for analysis into the drivers of saline intrusion. Current monitoring data are reliable because they are associated with robust quality control, but the installed sensors have been through several iterations and the earlier data (prior to 2020) has greater uncertainties. The exact elevations of historically deployed sensors are unknown, and measured salinity is sensitive to sensor elevation, this increases uncertainty when comparing data from different sensors/periods.

The occurrence of saline conditions in the Kaiapoi River on any given tide are strongly associated with the combination of Waimakariri River flow and high tide level. Tributary flows and tidal range/low tide level have smaller (but still statistically significant) effects on salinity. The combined effect of Waimakariri flow and high tide level on the likelihood of saline intrusion is clearly shown in Figure 3-5. Saline intrusion occurs on almost all tides when flow is less than 35 m<sup>3</sup>/s, only on approximately 10% of tides when flow is greater than 72 m<sup>3</sup>/s, and almost never when flow is greater than 105 m<sup>3</sup>/s. For flows in the range 35–72 m<sup>3</sup>/s the likelihood of saline intrusion depends on the combination of river flow and tide level, with higher tides required to drive saline intrusion when Waimakariri flows are higher.

There is a significant change in observed saline intrusion in 2020, coinciding with dredging of the Kaiapoi River. Saline intrusion became more frequent and occurred at lower Waimakariri flows following the dredging. It is not possible to definitively link the observed changes to dredging, however the observed changes are consistent with observations of ecological changes (Allen 2024) and there is a plausible mechanism for dredging to have increased salinity intrusion. We conclude that there is most likely a real increase in saline intrusion because of dredging.

Saline intrusion is sensitive to high tide level, indicating that sea level rise is expected to increase the frequency of saline intrusion. We used the relationship between Waimakariri river flow, high tide level and saline intrusion to investigate the sensitivity of saline intrusion to sea level rise for a range of river flows, finding that even small amounts of sea level rise are associated with notable increases in the frequency of saline intrusion. Under current sea levels a flow of 72 m<sup>3</sup>/s prevents intrusion on 90% of tides, but with 0.1 m of sea level rise a flow of 77 m<sup>3</sup>/s is needed, and with 0.5 m of sea level rise a flow of 97 m<sup>3</sup>/s is needed.

Earthquakes can change river channel bed levels and geometry, potentially affecting saline intrusion. Kaiapoi experienced subsidence during the 2010–11 Canterbury earthquake sequence which is likely to have increased saline intrusion.

## 5 Acknowledgements

Adrian Meredith and Suz Gabites assisted with understanding the background to this analysis and planning the analysis approach. Hamish Carrad provided the salinity data, coordinated the field trip to the monitoring instruments, answered questions regarding instrumentation and monitoring and drafted Figure 2-1 showing the sensor elevations. This analysis would not have been possible without the ongoing water quality and hydrometric data collection by Environment Canterbury and Earth Sciences New Zealand.

## 6 References

Allen, S. (2020) Kaiapoi River Management. *Waimakariri District Council presentation to the Kaiapoi Promotion Association*.

Allen, S. (2024) Saline incursions in the Kaiapoi and Ruataniwha Cam Rivers. *Waimakariri District Council Report 240918159973 to Kaiapoi – Tuahiwi community board*.

Bell, R., Hannah, J., Andrews, C. (2022) Update to 2020 of the annual mean sea level series and trends around New Zealand. *NIWA Report 2021236HN prepared for Ministry for the Environment*. <https://environment.govt.nz/assets/publications/update-to-mean-sea-level-series-and-trends.pdf>

Canterbury Earthquake Recovery Agency (2012) *Area-wide geotechnical information summary for CERA zoning review panel* <https://www.dpmc.govt.nz/sites/default/files/2024-04/geotech-summary-01-kaiapoi-south.pdf>

Land Information New Zealand (2017) *Information for surveyors about the 2016 Kaikoura earthquakes*. <https://www.linz.govt.nz/guidance/survey/earthquakes/kaikoura-earthquakes>

Meredith, A. (2018) Assessment of the state of a tidal waterway-the lower Kaiapoi River. *Environment Canterbury Regional Council Report R18/7*. <https://api.ecan.govt.nz/TrimPublicAPI/documents/download/3368316>

Wood, S. (2025) *Package ‘mgcv’: Mixed GAM Computation Vehicle with Automatic Smoothness Estimation*. Version 1.9-3. <https://cran.r-project.org/package=mgcv>

# Closed Circuit Television (CCTV) and Other Recording Devices Policy

---

## 1. Introduction

Waimakariri District Council (WDC) owns, operates and manages devices capable of recording information in the Waimakariri District. WDC must comply with the provisions of the Privacy Act 2020 and the Local Government Official Information and Meetings Act 1997 (LGOIMA) in the collection, dissemination, storage and removal of personal information, and this policy follows best practice in relation to individual's rights to privacy in accordance with the Privacy Act 2020.

## 2. Policy Context

WDC, in operating recording devices, will maintain the protection of individuals' privacy by:

- ensuring information is collected for necessary and lawful purposes only
- taking reasonable steps to make individuals aware that information is being collected and the reason for such collection
- ensuring that information is collected in a fair manner
- ensuring the appropriate management and security of recorded information
- ensuring information is used only for the purpose for which it was collected
- complying with Principles 6, 9 and 11 of the Privacy Act relating to access to and retention and disclosure of information.

## 3. Policy Objective

This Policy sets out the purpose for collecting audio and visual recordings, how the information is collected, how long it is retained and how the privacy impacts will be minimised. Access to Council recorded information is limited and controlled by the WDC.

This policy applies to all Council employees, contractors to Council, councillors, the New Zealand Police (Police) and the general public who may access areas where recording devices may be operating.

## 4. Policy Statement

### 4.1. Purpose of collection of personal information

4.1.1. The WDC operates or facilitates recording devices to support public and staff safety on Council property, facilitate regulatory enforcement and support the closed-circuit television network that is utilised by the Police. These purposes align with Principle 1 of the Privacy Act 2020, specifically:

- Personal information is connected with the function or activity of the agency; and

- The collection of the information is necessary for that purpose.

4.1.2. The WDC Privacy Policy is located on the WDC website and is available in hardcopy by request. This Policy sets out the following:

- General notice that information is being collected
- The purpose/s of that information being collected
- Advising other external agencies may access the information collected

## **4.2. CCTV Recording**

4.2.1. WDC facilitates or operates CCTV in locations for the following purposes:

- Crime Prevention Through Environmental Design (CPTED)
- Community-led initiatives involving government agencies, social service agencies, businesses and community groups or volunteers
- To provide a security presence during seasonal/short term issues
- Compliance and enforcement of bylaws, resource consent conditions and legislation
- Managing traffic and monitoring traffic movements in particular areas
- Enhancing public safety and community wellbeing by deterring and preventing criminal and antisocial behaviour in public places throughout the district, including for the protection of public assets from acts of vandalism

4.2.2. Signage notifying that CCTV is operating within public buildings is displayed in a prominent position. The sign should be prominent enough to advise the public that cameras are operating before they are close enough to be filmed.

4.2.3. Only authorised people will be able to watch the CCTV footage for the purposes mentioned above or to regularly check the system is working. We will not actively attempt to identify individuals from the CCTV footage unless a reported or suspected incident needs investigation.

4.2.4. WDC does not accept ownership or operational control over any vested cameras from third parties.

## **4.3. Live streaming and recording of meetings and ceremonies**

4.3.1. In the interests of making our decision-making process transparent and accessible, public Council meetings are broadcast live online and then made available on our website.

4.3.2. Meetings that are being filmed will be signposted clearly stating they are filmed at the entry into the meeting room. Most of the filming will cover elected members as they speak and debate at the meeting, however, the filming may also include members of the public in the background and of anyone speaking at a public forum. The footage will be publicly available and can be accessed from our website.

4.3.3. Photos or video footage may be recorded by WDC at civic events in Waimakariri (e.g. citizenship ceremonies and other public or community events that we manage) for internal or external publications. Signage on display or other communication at an event will let members of the public know if photography or filming will be taking place. Members of the public who do not want to be included in any photos or video footage may request this of our staff members present at the event.

## **4.4. Body worn cameras**

4.4.1. Cameras are worn by our compliance officers as a deterrent to anti-social behaviour towards them and to provide a clear record of events if an altercation occurs. The officer

will only start recording if an interaction escalates and will notify those present when the recording device is activated.

- 4.4.2. When inside a building where public are excluded or within a private property the compliance officer will inform that footage is being recorded and gain consent at the time.
- 4.4.3. When in a publicly accessible space, or outside of a building, the compliance officer will inform those present of the recording device in situations where it is safe to do so.
- 4.4.4. Body-worn cameras are always recording but do not store the information until activated. The only time this footage is stored is if a staff member activates their camera. The last 30 seconds of video is clipped to the recording to add context to the video (e.g. how a situation unfolded prior to the staff member pressing record).
- 4.4.5. All authorised staff who are equipped with body worn cameras are also equipped with appropriate signage on their uniform to indicate an audio and visual recording device is being worn at that time.

#### **4.5. Audio only recording devices**

- 4.5.1. Audio only recording devices may be used for the purposes of regulatory enforcement. In circumstances where audio monitoring devices are to be used on a property, the informed written consent of the homeowner will be obtained prior to placing the device within their property.
- 4.5.2. Placement of the device will be made in a way that minimises the incidence of inadvertently collecting other audio and will be within the boundaries of the property that has given permission to record.

#### **4.6. Request for official Information from the public**

- 4.6.1. LGOIMA provides for people to make a request for official information held by government agencies. Any person may make a request for information held by WDC.
- 4.6.2. Official information requests for CCTV images made under LGOIMA will be processed by the Governance team and managed in accordance with section 7 of LGOIMA.
- 4.6.3. If CCTV footage is requested because of an incident or alleged crime, the first point of contact is the local Police who can request the footage

#### **4.7. Requests by WDC staff for release of footage**

- 4.7.1. Internal requests made by WDC staff shall be made using the footage request form available on the WDC intranet. Requests for footage require approval from the General Manager of the department requesting the footage. Release of the footage is at the discretion of the **\*nominated person/s\***
- 4.7.2. Internal requests for camera footage must:
  - 4.7.2.1. Be recorded in the WDC's information management system
  - 4.7.2.2. The use of the information must be for the purpose that it was collected
  - 4.7.2.3. Is subject to the provisions of the Privacy Act 2020
- 4.7.3. All internal requests for footage will be reported to the **\*nominated persons/business unit\*** and will include the requestors details, the authoriser's name, the reason for accessing the data and the period and location covered by the footage.
- 4.7.4. Each time the footage is accessed it will be recorded electronically in a log, including access by Elected Members, individuals and the Police. This log will be presented at the

\*nominated persons/business unit\* for review.

#### **4.8. New Zealand Police and other agencies**

- 4.8.1. WDC undertakes to cooperate and assist the New Zealand Police (Police) where requests for footage are made and are justifiable. Should a member of the public request footage relating to a criminal matter, this will be referred to Police who may, at their discretion, request the footage, complying with the provisions of the Privacy Act 2020.
- 4.8.2. WDC makes its properties available for Police and Waka Kotahi to install monitored CCTV equipment. These cameras are owned and operated by the Police and WDC does not have access to this footage.

#### **4.9. Retention and disposal of recorded information**

- 4.9.1. Video and audio will be recorded and retained on secure servers for a period of up to 90 days from recording. All footage will remain the property of WDC during this time until it is erased in line with this Policy. Servers and technology containing recorded footage are housed in a secure location and accessible only by those authorised personnel only. A record of those personnel is held and maintained by the Privacy Officer.
- 4.9.2. The only exception to the 90-day retention period is where an incident of a serious or potentially serious nature has been captured on the footage. Retention of the footage will be used for investigation or resolution of the incident, or for use by the Police or potential legal proceedings.
- 4.9.3. Written permission of the Privacy Officer is required for partial retention of the footage over and above the 90-day period.
- 4.9.4. Public requests for images or footage relating to a criminal matter will be referred to the Police in the first instance.

### **5. Definitions**

#### **5.1. CCTV**

- 5.1.1. In this policy, the phrase “CCTV” is used to mean any type of camera, recording device, or other related technology. It is recognised that CCTV is a legacy term, specific to an increasingly redundant technology. However, it is widely understood to refer to the types of surveillance and monitoring technologies with which this Policy is concerned.

### **6. Links to legislation and other policies**

#### **Legislation:**

- [Privacy Act 2020](#)
- [Local Government Official Information and Meetings Act 1987](#)
- [Health and Safety at Work Act 2015](#)
- [Local Government Act 2002](#)

#### **Other Policies:**

- [Privacy Policy](#)
- [Privacy Commissioners Guidance on CCTV](#)

## 7. Questions

Any questions regarding this policy should be directed to the **Position Title of Policy Owner** in the first instance.

## 8. Relevant documents and legislation

## 9. Effective date

**Date Month Year**

## 10. Review date

**Date Month Year**

## 11. Policy owned by

Manager, **Insert Department Name e.g. Regulation**

## 12. Approval

Approved:

**INSERT CHIEF EXECUTIVE'S  
SIGNATURE IN PLACE OF THIS TEXT**

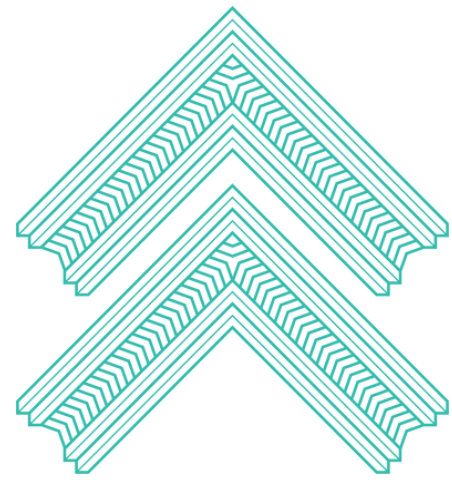
**Chief Executive**

Waimakariri District Council

**OR**

**Adopted by** Waimakariri District Council on **Date Month Year**

# A quick tour of the privacy principles



The Privacy Act 2020 has 13 privacy principles that govern how you should collect, handle and use personal information.

**1** You can only collect personal information if it is for a lawful purpose and the information is necessary for that purpose. You should not require identifying information if it is not necessary for your purpose.

**2** You should generally collect personal information directly from the person it is about. Because that won't always be possible, you can collect it from other people in certain situations. For instance, if:

- the person concerned gives you permission
- collecting it in another way would not prejudice the person's interests
- collecting the information from the person directly would undermine the purpose of collection
- you are getting it from a publicly available source.

**3** When you collect personal information, you must take reasonable steps to make sure that the person knows:

- why it's being collected
- who will receive it
- whether giving it is compulsory or voluntary
- what will happen if they don't give you the information.

Sometimes there may be good reasons for not letting a person know you are collecting their information – for example, if it would undermine the purpose of the collection, or if it's just not possible to tell them.

**4** You may only collect personal information in ways that are lawful, fair and not unreasonably intrusive. Take particular care when collecting personal information from children and young people.

**5** You must make sure that there are reasonable security safeguards in place to prevent loss, misuse or disclosure of personal information. This includes limits on employee browsing of other people's information.

**6** People have a right to ask you for access to their personal information. In most cases you have to promptly give them their information. Sometimes you may have good reasons to refuse access. For example, if releasing the information could:

- endanger someone's safety
- create a significant likelihood of serious harassment
- prevent the detection or investigation of a crime
- breach someone else's privacy.

---

**7** A person has a right to ask an organisation or business to correct their information if they think it is wrong. Even if you don't agree that it needs correcting, you must take reasonable steps to attach a statement of correction to the information to show the person's view.

**8** Before using or disclosing personal information, you must take reasonable steps to check it is accurate, complete, relevant, up to date and not misleading.

**9** You must not keep personal information for longer than is necessary.

**10** You can generally only use personal information for the purpose you collected it. You may use it in ways that are directly related to the original purpose, or you may use it another way if the person gives you permission, or in other limited circumstances.

**11** You may only disclose personal information in limited circumstances. For example, if:

- disclosure is one of the purposes for which you got the information
- the person concerned authorised the disclosure
- the information will be used in an anonymous way
- disclosure is necessary to avoid endangering someone's health or safety
- disclosure is necessary to avoid a prejudice to the maintenance of the law

**12** You can only send personal information to someone overseas if the information will be adequately protected. For example:

- the receiving person is subject to the New Zealand Privacy Act because they do business in New Zealand
- the information is going to a place with comparable privacy safeguards to New Zealand
- the receiving person has agreed to adequately protect the information – through model contract clauses, etc.

If there aren't adequate protections in place, you can only send personal information overseas if the individual concerned gives you express permission, unless the purpose is to uphold or enforce the law or to avoid endangering someone's health or safety.

**13** A unique identifier is a number or code that identifies a person in your dealings with them, such as an IRD or driver's licence number. You can only assign your own unique identifier to individuals where it is necessary for operational functions. Generally, you may not assign the same identifier as used by another organisation. If you assign a unique identifier to people, you must make sure that the risk of misuse (such as identity theft) is minimised.