Land River Sea Consulting Limited
5/245 St Asaph Street, Christchurch
PO Box 27121, Shirley
Christchurch 8640
http://www.landriversea.com

Memorandum

Recipient Name:	Dave Connor / Randal Beal
Recipient Organisation:	Environment Southland
Issue Date:	2 October 2024
Author:	Matthew Gardner

SUBJECT: RESPONSE TO MINUTE OF HEARING INTRODUCTION

1.1 Scope

On the 2nd of September, 2024, Commissioner Allan Cubitt released a minute requesting further information prior to finalising details for expert conferencing. In particular, the following points were requested to be addressed;

a) At section 3.4, the Model Build Report stated that various tide scenarios had not been modelled and that the model was simply demonstrating the trends within the system. It would assist myself and the submitters if the model can be run to determine at what water level it becomes apparent that the tide waters will have a more than minor effect on the upstream improved pasture land.
b) Clarification on what area of land would be affected by the removal of the gates. (Several figures, ranging from 9 hectares to 11,500 hectares have been referenced within the various documents).
c) Assessment of how the gates may be modified to enable the passage of kanakana.
d) Assessment of the downstream effects of removing the gate. What impact would this have on habitat now adapted to the current situation?

This memo addresses points a, b and d. Point c will be addressed by others.

1.2 Tide Scenarios – question (a)

As requested by the Commissioner the model has been run again and it shows that at all tide scenarios, including during neap and mean tides, water levels within the drainage network will

exceed the level of the tile drains during high tide periods, if the tide gates were to be removed. The methodology used to reach that conclusion is set out below.

In order to ensure that any tide scenarios are a true representation of actual water levels, I have managed to locate historic water level recordings from the 1980's courtesy of the Environment Southland archives, which are from a gauge located at the Titiroa Bridge. I have obtained one years worth of scanned data from 1985 and 1986. It is my understanding that the gauge was disestablished in 1986 and hence no more information from recent years is available. The location of the bridge where the historic water level gauge was situated is immediately downstream of the tide gates and is shown in Figure 1.

Figure 1 – Location of bridge where historic tide gauge was situated

We have been provided with a scanned copy of one year's worth of data and have digitised these and converted them to the same vertical datum as used in the model (NZVD2016). An example of the original scanned data is shown in Figure 2 below. A digitisation of a single months data is shown in Figure 3 and a plot of the modelled neap tide and mean tide scenarios at the same location is shown in Figure 4 confirming that our model accurately replicates similar tide ranges to that recorded in the 1980's at the bridge location.

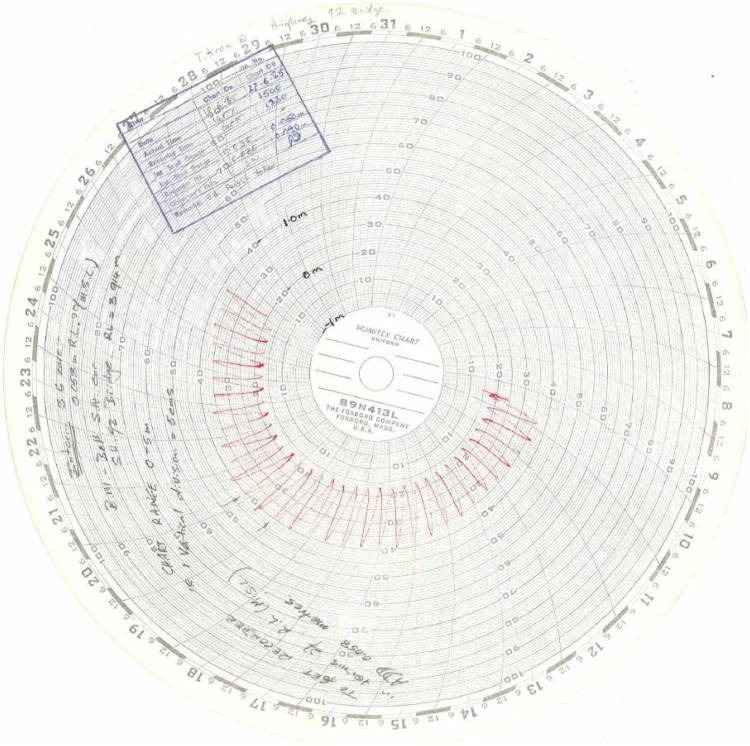

Figure 2 – Historic Tide Level data

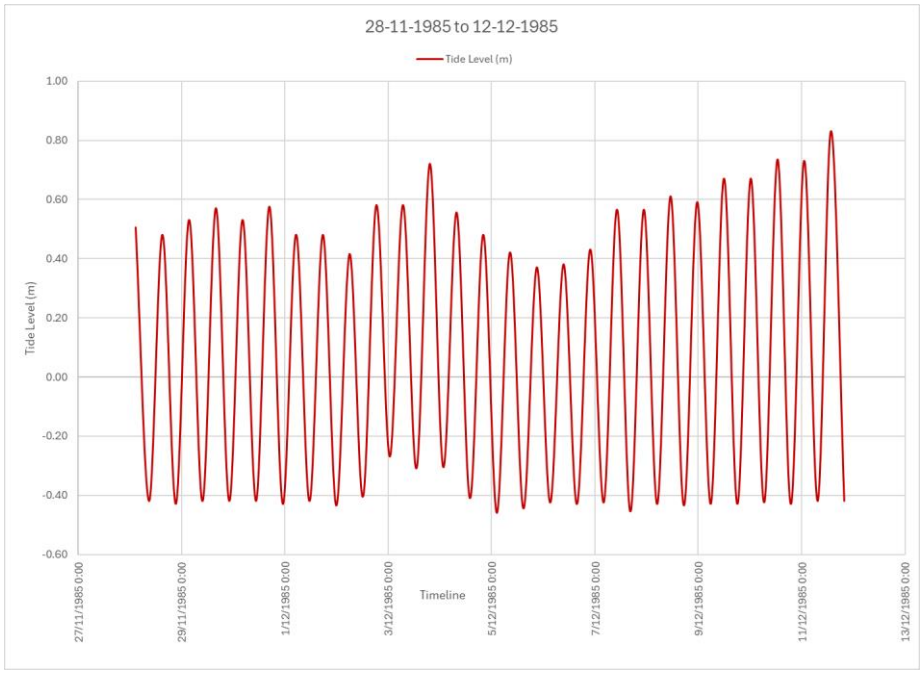

Figure 3 – An example of a typical months tide data

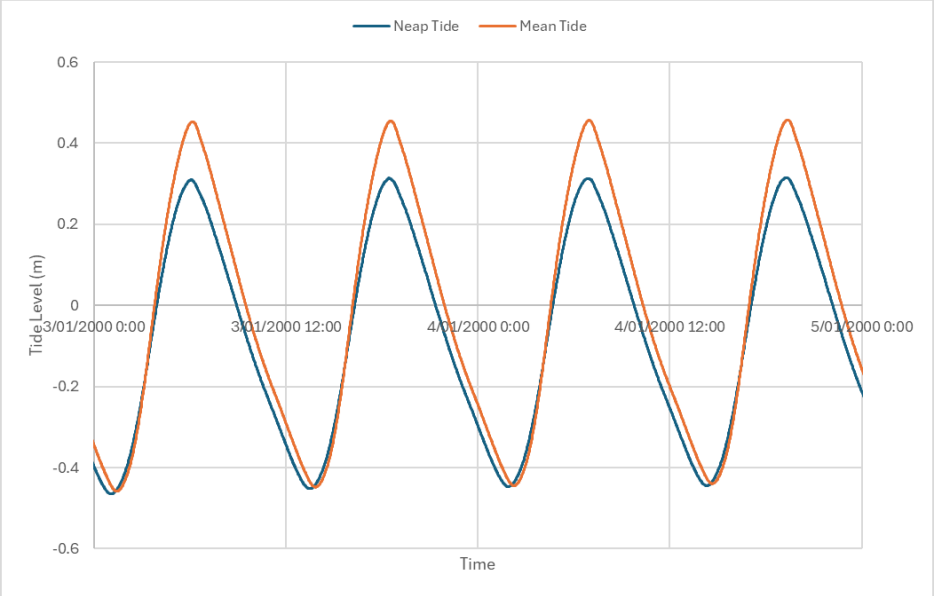

Figure 4 – Modelled Neap tide and Mean Tide levels at the bridge (no stormsurge, or wave allowance)

The historical data also show that the tide range at the bridge site varies significantly from day to day and is clearly heavily influenced by sea conditions. The peak water level for a high tide cycle range in the historic data ranged from around 0.4m to 1.2 m. It is also important to note that Les Frisby indicates the gates overtop during a king tide which indicates that water levels are even higher than this in recent times (with the top of the gate having a level of 1.35 m).

We have run the model again with both a neap tide and a mean tide scenario, based on the Land Information New Zealand (LINZ) tide tables for Bluff and find that even with these tide scenarios which have a lower range and peak water level, the majority of the surveyed tile drains will be completed inundated if the gate was to be removed, however the drains manage to flow freely if the tide gate is in place. A summary of the modelled peak water levels is presented in Table 1 and Table 2 below with the location of the surveyed tile drain outlets shown in Figure 5.

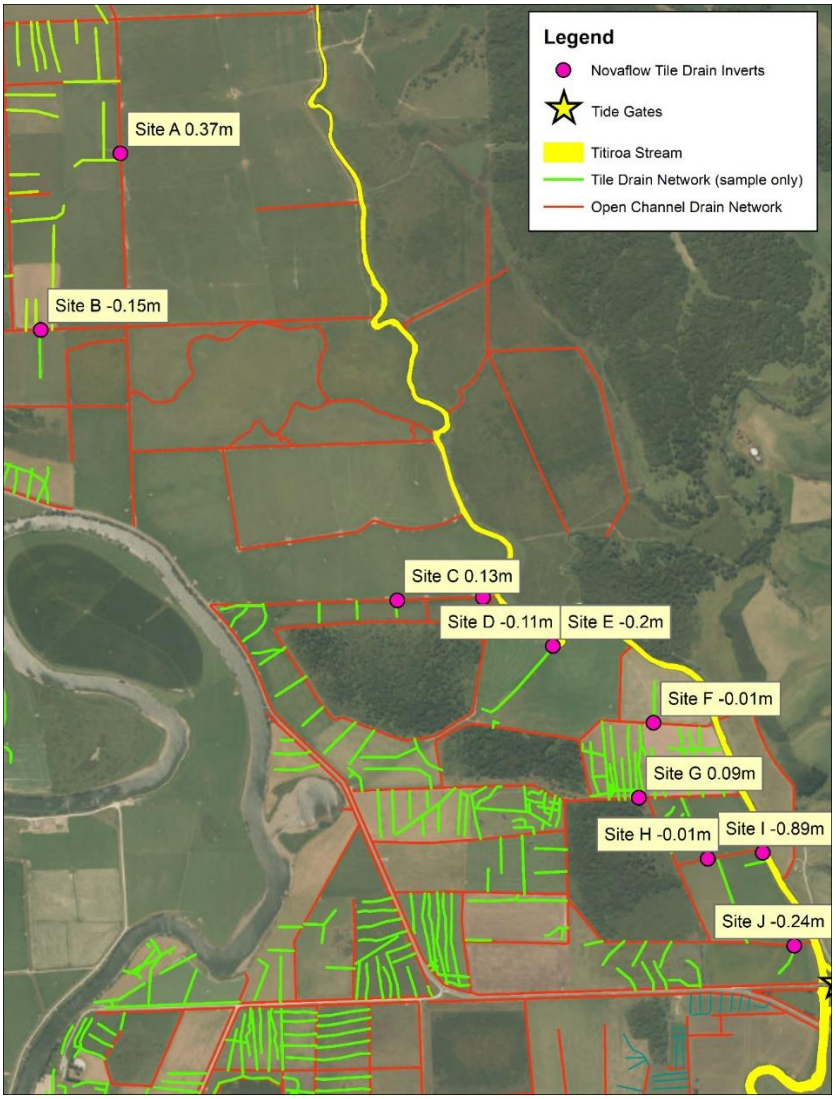

Figure 5 – Location of surveyed tile drains

Table 1 – Impact of gates during with a mean tide

	Pipe Invert (NZVD2016)	Peak WL No Gate	Peak WL With Gate
Site A	0.37	No Water*	No Water*
Site B	-0.15	No Water*	No Water*
Site C	0.13	0.24	0.00
Site D	-0.11	0.21	-0.26
Site E	-0.2	0.23	-0.31

Site F	-0.01	0.25	-0.28
Site G	0.09	0.31	No Water*
Site H	-0.01	0.28	-0.70
Site I	-0.09	0.30	-0.28
Site J	-0.24	0.42	No Water*

Table 2 – Impact of gates during with a neap tide

	Pipe Invert (NZVD2016)	Peak WL No Gate	Peak WL With Gate
Site A	0.37	No Water*	0.00
Site B	-0.15	No Water*	-0.77
Site C	0.13	0.16	0.00
Site D	-0.11	0.13	-0.28
Site E	-0.2	0.13	-0.33
Site F	-0.01	0.15	-0.29
Site G	0.09	0.21	No Water*
Site H	-0.01	0.16	-0.70
Site I	-0.09	0.19	-0.30
Site J	-0.24	0.42	No Water*

These results show that the tide gates are critical for allowing on farm drainage, even during neap and mean tide scenarios which will occur on a daily basis. Removing the gates is likely to limit drainage within the tile drain network, even during low tide ranges and water levels.

1.3 Clarification on affected land area – question (b)

I can confirm that the 9ha in my initial report was a typo. The unit should have been square kilometres (km^2) i.e. 9 km^2, which equates to 900 ha.

Specifically, the polygon drawn on the map has an area of 885 ha (8.85 km^2), which was intended to approximate the most impacted area. If, as discussed during the hearing, the impact extends up to the old railway line crossing, then the total area impacted will be closer to 1,200 ha (12 km^2). To accurately determine the exact extent of impact, then more detailed channel survey would be required.

1.4 Assessment of the downstream effects of removing the gate – question (c)

Model results for a range of tide conditions confirm that the impact of removing the gate will be negligible for the downstream area.

The model results show for a wide range of tide scenarios that there is no more than a minor impact within a few hundred metres of the gate (which is a reduction in water level in the order of 10 cm if the gates were to be removed), and this tapers off to about 2 to 3 cm within 1 km of the gate. (Note this area is all farmland). Beyond that, there is no noticeable impact on water levels in the model results as the levels are controlled by the tide level and flow within the Mataura River, which is spread over a very wide area. It should also be noted that the greatest impact is experienced in the highest tide level scenario with any impact being even less noticeable in a normal and neap tide scenario.

Please contact me if you need further clarification.

Kind regards,

Matthew Gardner (CMEngNZ, CPEng)
Director, Land River Sea Consulting Ltd