9. Climate Change Integrated Work Programme—Flood Protection & Control

(Chair) (Report prepared by Kaye McIlveney & Geoff Dick) **E320-003-001**

Purpose

1. To consider the climate change related activities of the Flood Protection and Control Activity covering existing flood protection areas.

Context

2. This report is the first in the Climate Change Integrated Work Programme series. It details how climate change adaptation and mitigation are incorporated into the decisions made in flood protection and control.

3. The Programme aims to inventory the data and information Council needs to make climate change related decisions. It will assess each Activity Group as to the impacts that climate change may have on that activity and will ensure that climate change is being properly taken into account when relevant and that the staff have the data/information they need to assess the impacts of climate change.

4. Council has powers and obligations in relation to flood protection and control under a number of statutes including the Soil Conservation & Rivers Control Act 1941, the Land Drainage Act 1908, the River Boards Act 1908, and the Local Government Act 1974.

5. This report looks at Council's work programme for considering climate change impacts on current flood protection and drainage schemes. Other areas may be impacted by climate change but these will be assessed separately.

6. Council's Infrastructure Strategy lists the significant asset management challenges for rivers and land drainage as—

    - the need to respond to higher expectations related to flood protection and environmental outcomes
    - the impacts of coastal storm waves and sea level rise on the effectiveness of the existing land drainage system
    - potential impacts of climate change on flood flows

7. The Infrastructure Strategy identifies Council's 30 year Flood Protection Goals as—

    - To maintain and upgrade the Lower Wairau River flood protection works to the 100 year ARI flood protection level
    - Complete a technical review of the Wairau River Floodway Management Plan taking account of climate change and levels of service commencing in 2021. New standards for flood protection may be agreed & adopted in response to the review

8. The Wairau floodplain's major rivers and stop-banked floodways cover 20,000 hectares of fertile land around Blenheim, and contains the Council's major river control and drainage activity. A review of the Wairau flood protection and drainage networks is scheduled to be completed this year and will take into account land use changes over the past 25 years as well as the predicted impacts of climate change. An extract from Council's Infrastructure Strategy on managing the impact of climate change on drainage is attached to this report.

Climate changes expected

9. The current advice from the Ministry for Environment is outlined below.

Temperature: by 2040 temperatures are likely to be 0.7°C – 1.0°C warmer. The number of days when the temperature exceeds 25°C is increasing and the number of frosts is decreasing. By the end of the 21st century these very hot days could rise from 6 days to 38 days per year and frosts could decrease from 19 to 7 days per year respectively.

Rainfall: The incidence of summer rainfall in Blenheim and extreme rainfall events are both likely to increase. However, there will be some regional variation.

Precipitation in the winter is likely to fall as rain rather than snow. This may increase river flows during the winter with subsequent potential for flooding. Less snow melt could decrease river flows during spring, reducing the water available for abstraction.

Sea level rise: Average sea level rose by 1.7mm per year over the last century. This rate has increased over the last 20 years and is predicted to continue to rise. The effects are exacerbated by changing tide patterns and an increase in storm surges.

Analysis and Advice

10. There are many factors which will influence this activity. Climate variables or hazards include more than just rainfall and river flows. Also relevant are the nature of the weather events, wind, sea level rise, and ground water levels.

11. All of these things together are expected to increase the number and severity of flooding events in the future. The potential effects of this are obvious—flooding of homes and land and infrastructure not being able to cope or being damaged.

Implications of climate change on flood protection and control

12. Council may need to dig larger drainage channels, increase the height of existing stopbanks and provide added bank protection to cope with increased rainfall intensity and provide the same or better ARI flood protection.

13. As the sea level rises, pumped outfalls are also likely to be required far more frequently to assist with drainage of flat, low-lying land on the Lower Wairau plain where we can no longer rely on gravity to achieve discharges to the sea.

14. More frequent high intensity rainfall events will place greater demands on the stormwater system. Urban drainage reticulation will be tested, detention areas will temporarily fill with storm water and overland flow paths will need to be utilised.

15. The decisions until now as to how and where to invest in protection and control of rivers have been based on—

- Picton Rivers Review (Williman, 2004)
- Wairau River Floodways Management Plan (August 1994)
- Rainfall, river bed level and groundwater monitoring
- Information including photographs of prior flood events

16. The normal review cycle for flood protection and control is up to 40 years. It was last reviewed in 1994. However, with climate change we need to review the Wairau Flood Drainage Scheme early.

17. The review will examine the current level of service, customers' expectations and land use changes. It will also model flood flows under different conditions so that the range of effects that may result from climate change and sea-level rise can be more accurately predicted. Minor upgrades will be sufficient to preserve existing levels of service to about 2050 but after that time other options, where risks are the highest and protection costs very challenging, may need to be considered.

18. Central government is considering its role and that will become clearer over time. It will include assistance with mapping to national standards.

19. Council has climate change predictions at a national level but we need specific data/information specific to Marlborough. The modelling would look at the effects of climate change to 2100. However, forecasting beyond 2050 is too uncertain to base firm decisions on beyond 2050.

20. The hydrology brief will be developed by Rivers, RMA Policy and Environmental Science and Monitoring. It will be able to be used across Council.

21. The outcome will assist Council to adopt an action plan to 2050 in various areas whilst keeping 2100 on the horizon and adapting as the data/information on the changes to the climate become more certain. That action plan will provide the scope to review Council's current drainage schemes and to prepare work programmes (including community engagement).

Next steps

22. The proposed review of the Wairau Scheme will be presented to Council at a future meeting.

23. A report on the 3 Waters Activity Group will be presented to the next Planning, Finance & Community Committee.

RECOMMENDED

That the report be received.

Appendix 1

Extracts from Infrastructure Strategy

1.3 Climate change

Managing the impact of coastal storm waves and sea level rise on drainage

The lower Wairau Floodplain includes several thousand hectares which are less than 2 metres above sea level.

Sea level rise will impact on coastal erosion and drainage of this low-lying farm land. Average sea levels are predicted to rise by 0.3 m by 2050, which will impact on drainage gravity outfalls and require more pumping, alter general water table levels and may increase saline intrusion in the very low-lying areas. Sea level rise is also likely to lead to an increase in wave lap type erosion in the lower reaches of the Wairau and Opawa Rivers.

The marine storm wave forces are a very important factor. In the past they have formed a sand bar, typically extending a kilometre to the north. The bar is formed by a combination of marine forces, tidal flows into the Vernon Lagoons and river flows from the lower Wairau and to a lesser extent the lower Opawa. A training groyne at the mouth of the Wairau River has helped to maintain an open channel to the sea and scour any sand accumulation. There is some evidence of increased accretion at the mouth of the Lower Opawa. The situation continues to be monitored and may require additional dredging. If required dredging will be a significant maintenance cost.

Potential impacts of climate change on flood flows

Climate change will also alter the frequency and severity of flood events. Current advice to Council is that by 2050 a given 100 year or 1% AEP flood will increase in size by 10 – 15%. That means the current 5500 cubic metres per second (cumecs) Wairau flood could increase to over 6000 cumecs. However, flood flows are likely to be variable — in some catchments they may actually decrease, while increasing in other areas.

The various scenarios will be investigated through a detailed technical review to commence in 2019. The potential effects on levels of service and options will be presented to the Council for consideration (see options below)

2.3 Climate change

Managing the impact of coastal storm waves and sea level rise on drainage	
Options to address it	**Implications of the options (financial and non-financial)**
Pro-actively upgrade wave-lap erosion control measures and prepare plans for up to three additional drainage pump stations.	***Benefits*** Retain the current level of service for flood protection and land drainage. Reduced storm damage remedial costs. Planning preparation for sea-level rise but physical works deferred until greater clarity on the extent of climate change effects. ***Costs*** Capital costs to be determined following the review.
React to storm wave damage only	***Benefits*** *Avoids capital costs of upgrades.* ***Costs*** *Additional damage to wave band protection and*

Managing the impact of coastal storm waves and sea level rise on drainage	
Options to address it	**Implications of the options (financial and non-financial)**
	adjacent land. Additional remedial costs and maintenance. *Loss of some existing land uses over time.*
Potential impacts of climate change on flood flows	
Options to address it	**Implications of the options (financial and non-financial)**
PREFERRED OPTION Undertake a comprehensive review of the Lower Wairau Flood Protection Scheme including climate change scenarios and to consult with the community on both the desired levels of flood protection and their willingness to pay.	***Benefits*** Community involvement in decision-making. Retains ability to adapt to changes over time. Include the most recent climate change projections and high quality hydraulic modelling. Decision making using high quality information. ***Costs*** Consultancy costs to perform analysis and modelling. Potential delay in decision making. Financial and practical resources will be required for monitoring and for adaptation to changing flood flows and frequencies of flood events.
Accept lower levels of flood protection over time in areas where climate change increases the magnitude and frequency of flood events.	***Benefits*** Recognises ongoing and increasing nature of climate change. ***Costs*** Flood damage to private property and public infrastructure. Loss of some existing land uses over time. Costs of managed retreat. Possible reputational damage from flood damage.