

Supplementary Materials

Figure S1. The rainfall hyetograph and runoff hydrograph of the storm event on 16 December 2021 were used for validating the catchment time of concentration and catchment runoff coefficient.

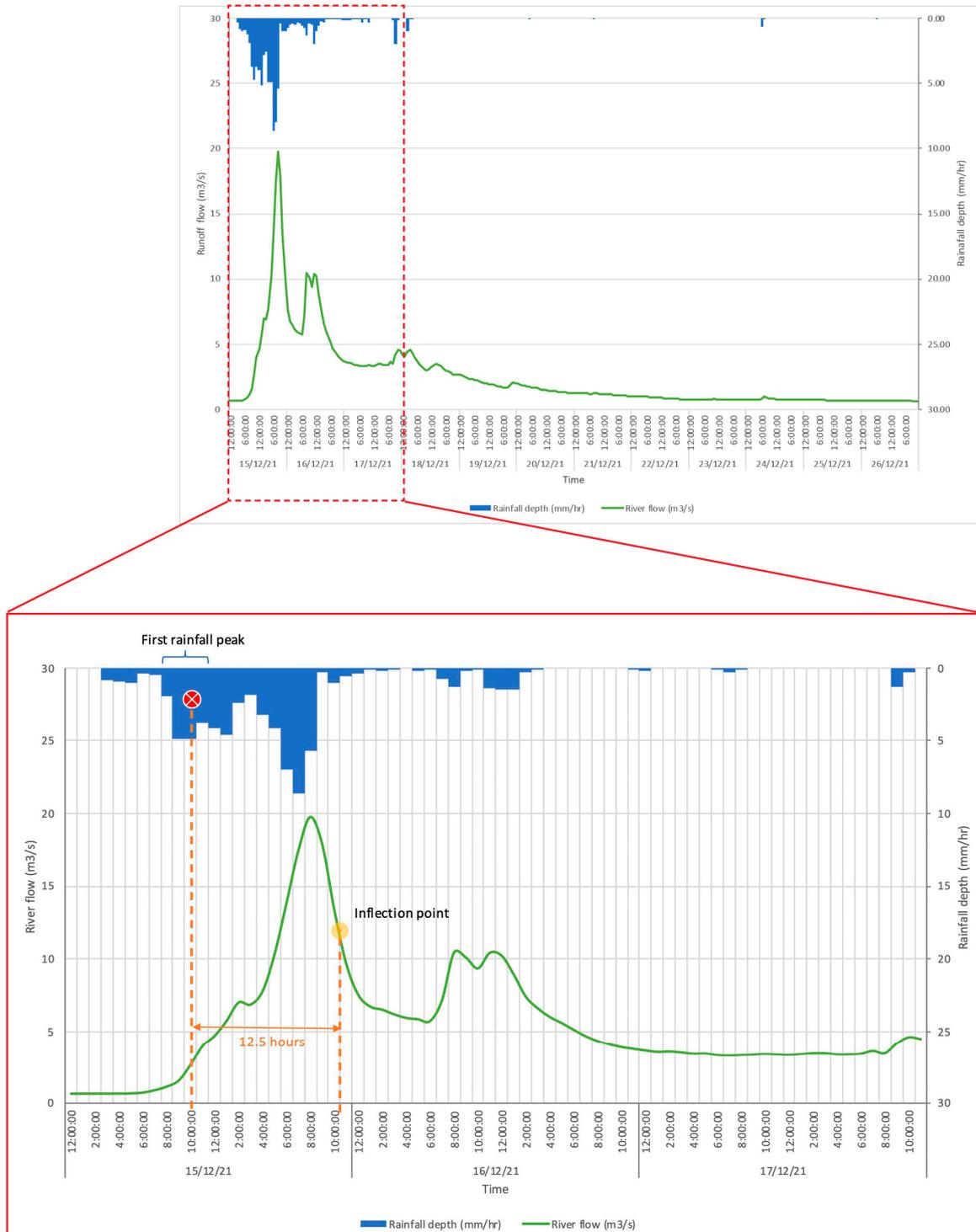


Table S1. The comparison between modelled and volumetric runoff coefficients of the monitoring station's drainage area.

| | C_5 | C_{50} |
|-------------------------------|-------|---------------------------|
| Modelled runoff coefficient | - | 0.48 |
| Volumetric runoff coefficient | 0.27 | $0.27 \times 1.68 = 0.46$ |

Table S2. The average ratio between the runoff coefficient of a 50-year storm to a 5-year storm for the monitoring station's drainage area.

| Land covers | Areas (km ²) | Percentages of drainage area | C_{50}/C_5 | Source |
|--------------------------------|--------------------------|------------------------------|--------------|---|
| Business areas | 15.51 | 20.1% | 1.12 | Christchurch City Council (2020) https://ccc.govt.nz/assets/Documents/Environment/Water/waterways-guide/21.RainfallAndRunoff.pdf (accessed on 28 November 2021) |
| Low-density residential areas | 0.08 | 0.1% | 1.2 | |
| High-density residential areas | 15.56 | 20.1% | 1.2 | |
| Hilly residential areas | 3.14 | 4.1% | 1.07 | Froehlich (2016) https://ascelibrary.org/doi/abs/10.1061/%28ASCE%29IR.1943-4774.0001054 (accessed on 28 November 2021) |
| Undeveloped areas | 42.76 | 55.3% | 2.1 | n/a |
| Water | 0.23 | 0.3% | 1 | n/a |
| Average | | | 1.68 | |