



Water Resources Research

Supporting Information for

Quantifying the Effects of Sea Level Rise on Estuarine Drainage Systems

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Introduction

This supporting information includes maps locating floodgates servicing primary drainage systems within the Clarence Estuary and Hastings Estuary for which a surveyed floodgate invert level was available. The floodgate invert levels are tabulated against the predicted mean annual low tide levels to demonstrate the applicability of the drainage window methodology described in the manuscript (Figures S1 to S2 and Tables S1 to S2). It also includes graphs of river flow and rainfall data downloaded from the WaterNSW Water Information Hub (realtimedata.watersw.com.au) to demonstrate the selection of 2019 as a representative dry year for drainage window analysis (Figures S3 to S7).

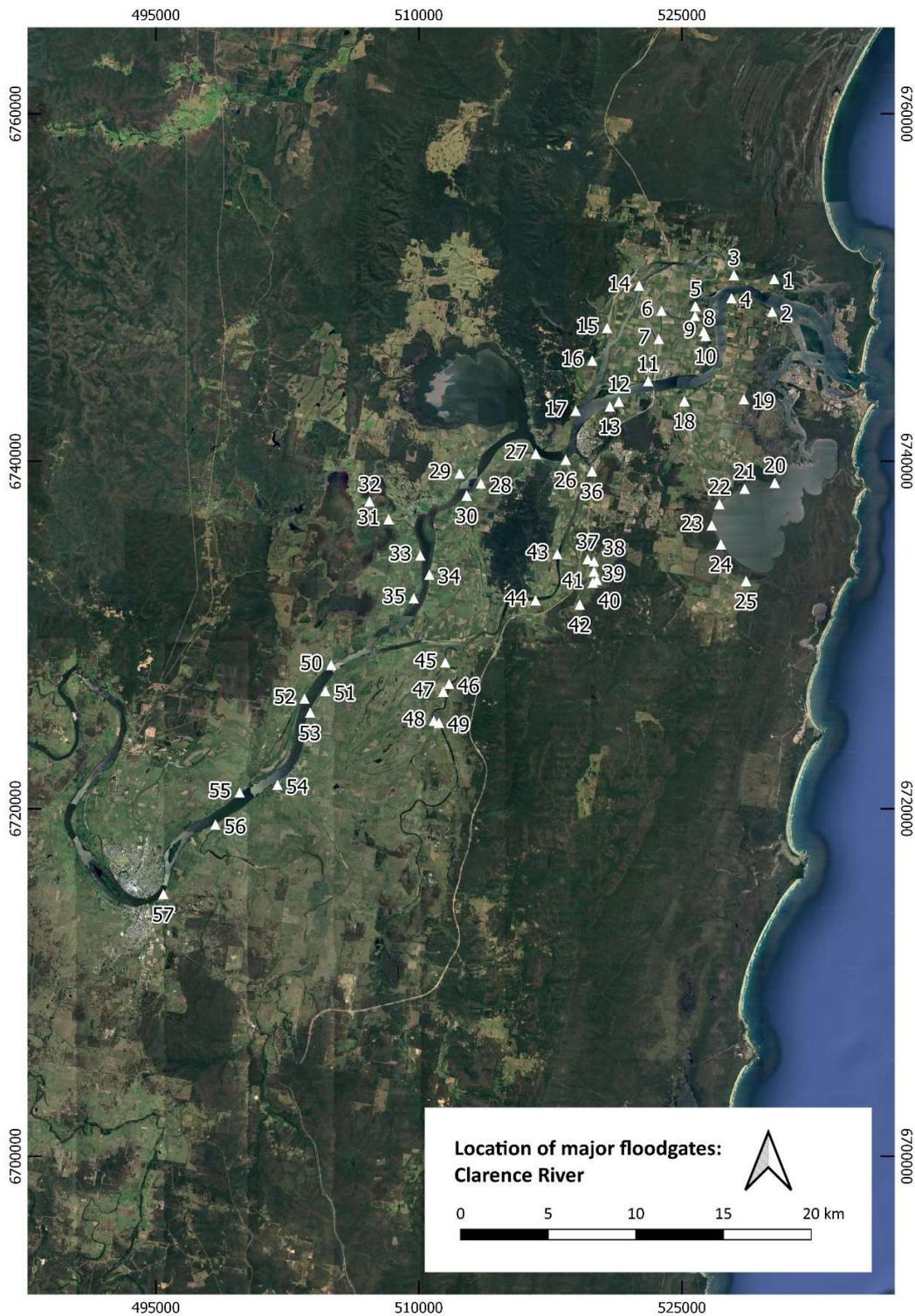


Figure S1. Location of surveyed primary floodgates on the Clarence River. Corresponding invert and mean low tide levels are presented in Table S1.

Table S1. Invert and mean low tide levels for Clarence River floodgates (where available)

| ID | Culvert/Floodgate | | | Mean annual low tide (m AHD) | | |
|----|-------------------------|---------------------------|-------------------------|------------------------------|-------------|------------|
| | Invert level (m AHD) | Height or Diameter (m) | Obvert level (m AHD) | Present-day | Near-future | Far-future |
| 1 | -1.053 | 1.6 | 0.547 | -0.34 | -0.21 | 0.30 |
| 2 | -1.171 | 1.6 | 0.429 | -0.34 | -0.21 | 0.30 |
| 3 | -1.335 | 1.6 | 0.265 | -0.34 | -0.21 | 0.30 |
| 4 | -1.061 | 1.2 | 0.139 | -0.20 | -0.08 | 0.41 |
| 5 | -0.835 | 1.5 | 0.665 | -0.34 | -0.21 | 0.30 |
| 6 | -1.317 | 1.8 | 0.483 | -0.34 | -0.21 | 0.30 |
| 7 | -1.02 | 1.5 | 0.48 | -0.11 | 0.01 | 0.49 |
| 8 | -0.746 | 1.5 | 0.754 | -0.34 | -0.21 | 0.30 |
| 9 | -0.46 | 1.52 | 1.06 | -0.11 | 0.01 | 0.49 |
| 10 | -0.793 | 1.5 | 0.707 | -0.11 | 0.01 | 0.49 |
| 11 | -1.184 | 1.7 | 0.516 | -0.11 | 0.01 | 0.49 |
| 12 | -0.726 | 0.9 | 0.174 | -0.11 | 0.01 | 0.49 |
| 13 | -0.943 | 1.5 | 0.557 | -0.11 | 0.01 | 0.49 |
| 14 | -0.96 | 1.52 | 0.56 | -0.08 | 0.03 | 0.51 |
| 15 | -0.709 | 1.2 | 0.491 | -0.08 | 0.03 | 0.51 |
| 16 | -0.953 | 1.6 | 0.647 | -0.08 | 0.03 | 0.51 |
| 17 | -1.335 | 1.6 | 0.265 | -0.11 | 0.01 | 0.49 |
| 18 | -1.058 | 1.5 | 0.442 | -0.11 | 0.01 | 0.49 |
| 19 | -0.807 | 1.2 | 0.393 | -0.20 | -0.08 | 0.41 |
| 20 | -1.036 | 1.5 | 0.464 | 0.05 | 0.16 | 0.62 |
| 21 | -0.882 | 1.5 | 0.618 | 0.05 | 0.16 | 0.62 |
| 22 | -0.919 | 1.5 | 0.581 | 0.05 | 0.16 | 0.62 |
| 23 | -0.948 | 1.5 | 0.552 | 0.05 | 0.16 | 0.62 |
| 24 | -0.867 | 1.5 | 0.633 | 0.05 | 0.16 | 0.62 |
| 25 | -0.932 | 1.5 | 0.568 | 0.05 | 0.16 | 0.62 |
| 26 | -0.644 | 1.2 | 0.556 | -0.07 | 0.05 | 0.51 |
| 27 | -0.442 | 1.5 | 1.058 | -0.07 | 0.05 | 0.51 |
| 28 | -1.093 | 2.3 | 1.207 | -0.08 | 0.03 | 0.49 |
| 29 | -1.188 | 2.15 | 0.962 | -0.08 | 0.03 | 0.49 |
| 30 | -0.443 | 1.5 | 1.057 | -0.07 | 0.04 | 0.50 |
| 31 | -1.019 | 1.6 | 0.581 | -0.08 | 0.03 | 0.49 |
| 32 | -1.031 | 1.5 | 0.469 | -0.08 | 0.03 | 0.49 |
| 33 | -0.716 | 1.5 | 0.784 | -0.08 | 0.03 | 0.49 |
| 34 | -1.497 | 2.1 | 0.603 | -0.08 | 0.03 | 0.49 |

Table S1. (cont'd)

| ID | Culvert/Floodgate | | | Mean annual low tide (m AHD) | | |
|----|-------------------------|---------------------------|-------------------------|------------------------------|-------------|------------|
| | Invert level (m AHD) | Height or Diameter (m) | Obvert level (m AHD) | Present-day | Near-future | Far-future |
| 35 | -1.03 | 2.15 | 1.12 | -0.08 | 0.03 | 0.49 |
| 36 | -1.434 | 2.5 | 1.066 | -0.06 | 0.05 | 0.52 |
| 37 | -0.409 | 1.2 | 0.791 | -0.06 | 0.06 | 0.52 |
| 38 | -0.366 | 2.2 | 1.834 | -0.06 | 0.06 | 0.52 |
| 39 | -1.1 | 1.2 | 0.1 | -0.06 | 0.06 | 0.52 |
| 40 | -1.126 | 1.2 | 0.074 | -0.06 | 0.06 | 0.52 |
| 41 | -0.368 | 1.5 | 1.132 | -0.06 | 0.06 | 0.52 |
| 42 | -0.583 | 1.2 | 0.617 | -0.06 | 0.06 | 0.52 |
| 43 | -1.13 | 2.13 | 1 | -0.06 | 0.06 | 0.52 |
| 44 | -0.931 | 1.8 | 0.869 | -0.06 | 0.06 | 0.52 |
| 45 | -0.329 | 1.8 | 1.471 | -0.08 | 0.03 | 0.49 |
| 46 | -1.313 | 2.4 | 1.087 | -0.08 | 0.03 | 0.49 |
| 47 | -0.888 | 1.2 | 0.312 | -0.08 | 0.03 | 0.49 |
| 48 | -0.728 | 1.2 | 0.472 | -0.08 | 0.03 | 0.49 |
| 49 | -1.32 | 2.4 | 1.08 | -0.08 | 0.03 | 0.49 |
| 50 | -0.898 | 2.1 | 1.202 | -0.10 | 0.01 | 0.46 |
| 51 | -1.03 | 2.6 | 1.57 | -0.10 | 0.01 | 0.46 |
| 52 | -0.997 | 1.5 | 0.503 | -0.10 | 0.01 | 0.46 |
| 53 | -0.537 | 2.5 | 1.963 | -0.10 | 0.01 | 0.46 |
| 54 | -1.12 | 2.4 | 1.28 | -0.11 | 0.00 | 0.45 |
| 55 | -0.804 | 2.2 | 1.396 | -0.11 | 0.00 | 0.45 |
| 56 | -1.1 | 2.1 | 1 | -0.12 | -0.01 | 0.44 |
| 57 | -0.909 | 2.1 | 1.191 | -0.13 | -0.02 | 0.44 |



Figure S2. Location of surveyed primary floodgates on the Hastings River. Corresponding invert and mean low tide levels are presented in Table S2.

Table S2. Invert and mean low tide levels for Hastings River floodgates (where available)

| Culvert (floodgate) details | | | | Mean annual low tide (m AHD) | | |
|-----------------------------|-------------------------|---------------------------|-------------------------|------------------------------|-------------|------------|
| ID | Invert level (m AHD) | Height or Diameter (m) | Obvert level (m AHD) | Present-day | Near-future | Far-future |
| 1 | -0.417 | 1.5 | 1.083 | -0.40 | -0.24 | 0.27 |
| 2 | -0.52 | 1.2 | 0.68 | -0.40 | -0.24 | 0.26 |
| 3 | -0.329 | 1.8 | 1.471 | -0.40 | -0.24 | 0.26 |
| 4 | -0.4 | 1.1 | 0.7 | -0.40 | -0.24 | 0.26 |
| 5 | -0.8 | N/A | N/A | -0.40 | -0.24 | 0.26 |
| 6 | -0.635 | 1.8 | 1.165 | -0.40 | -0.24 | 0.26 |
| 7 | -0.2 | 2.15 | 1.95 | -0.27 | -0.13 | 0.32 |
| 8 | 0.017 | 1.5 | 1.517 | -0.27 | -0.13 | 0.32 |
| 9 | -0.2 | 2.15 | 1.95 | -0.27 | -0.13 | 0.32 |
| 10 | -0.113 | 0.5 | 0.387 | -0.27 | -0.13 | 0.32 |
| 11 | -0.567 | 0.9 | 0.333 | -0.27 | -0.14 | 0.31 |
| 12 | -0.266 | 0.9 | 0.634 | -0.27 | -0.14 | 0.31 |
| 13 | -0.569 | 0.9 | 0.331 | -0.27 | -0.14 | 0.31 |
| 14 | -0.6 | 1.5 | 0.9 | -0.28 | -0.15 | 0.29 |
| 15 | -1.1 | 2 | 0.9 | -0.28 | -0.15 | 0.29 |
| 16 | -0.8 | 1.5 | 0.7 | -0.28 | -0.15 | 0.29 |
| 17 | -0.5 | 1.5 | 1 | -0.28 | -0.15 | 0.29 |
| 18 | -0.935 | 1.55 | 0.615 | -0.28 | -0.15 | 0.29 |
| 19 | -0.858 | 1.2 | 0.342 | -0.28 | -0.15 | 0.29 |
| 20 | -0.415 | 1.2 | 0.785 | -0.26 | -0.14 | 0.28 |
| 21 | -0.415 | 1.2 | 0.785 | -0.26 | -0.14 | 0.28 |
| 22 | -0.703 | 1.4 | 0.697 | -0.26 | -0.14 | 0.28 |
| 23 | -1.229 | 1.5 | 0.271 | -0.26 | -0.14 | 0.28 |
| 24 | -1.2 | 1.6 | 0.4 | -0.26 | -0.14 | 0.28 |
| 25 | -0.415 | 1.2 | 0.785 | -0.26 | -0.14 | 0.28 |
| 26 | -0.415 | 1.2 | 0.785 | -0.26 | -0.14 | 0.28 |
| 27 | -0.75 | 1.5 | 0.75 | -0.26 | -0.14 | 0.28 |
| 28 | -0.72 | 1.2 | 0.48 | -0.26 | -0.14 | 0.28 |
| 29 | -1.04 | 1.5 | 0.46 | -0.26 | -0.14 | 0.28 |
| 30 | -0.441 | 1.6 | 1.159 | -0.26 | -0.14 | 0.28 |

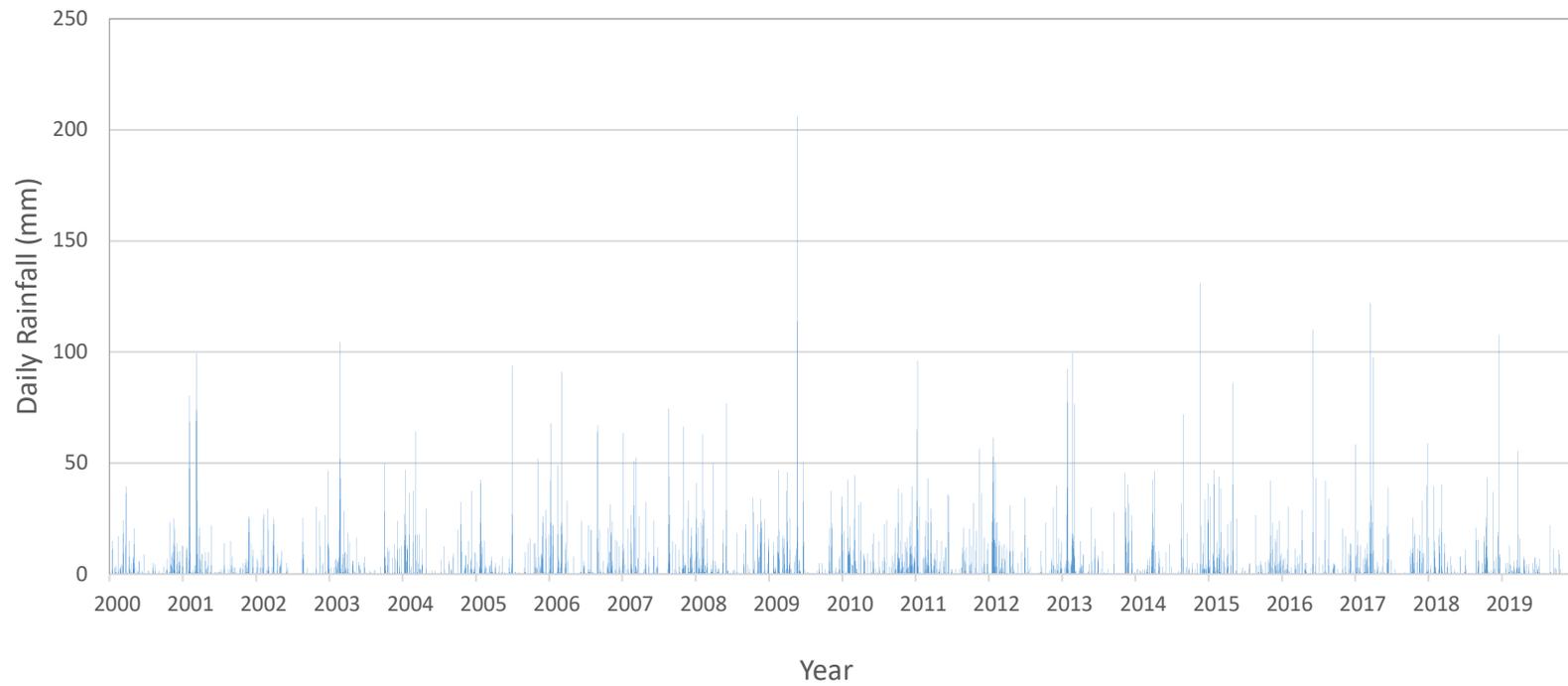


Figure S3. Daily rainfall recorded for the Clarence River at Newbold Crossing, Lilydale (Source: WaterNSW, Station 204007)

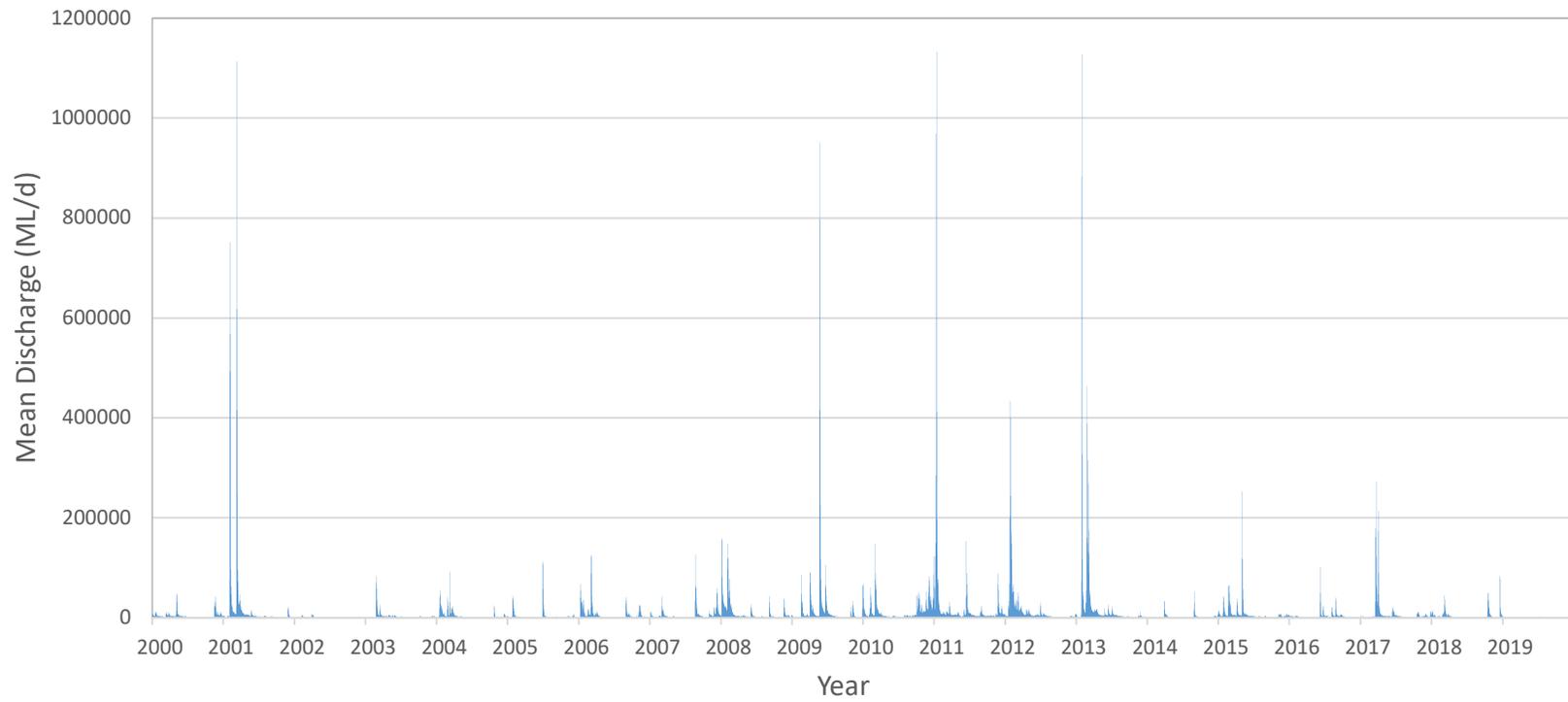


Figure S4. Daily river flow recorded for the Clarence River at Newbold Crossing, Lilydale (Source: WaterNSW, Station 204007)

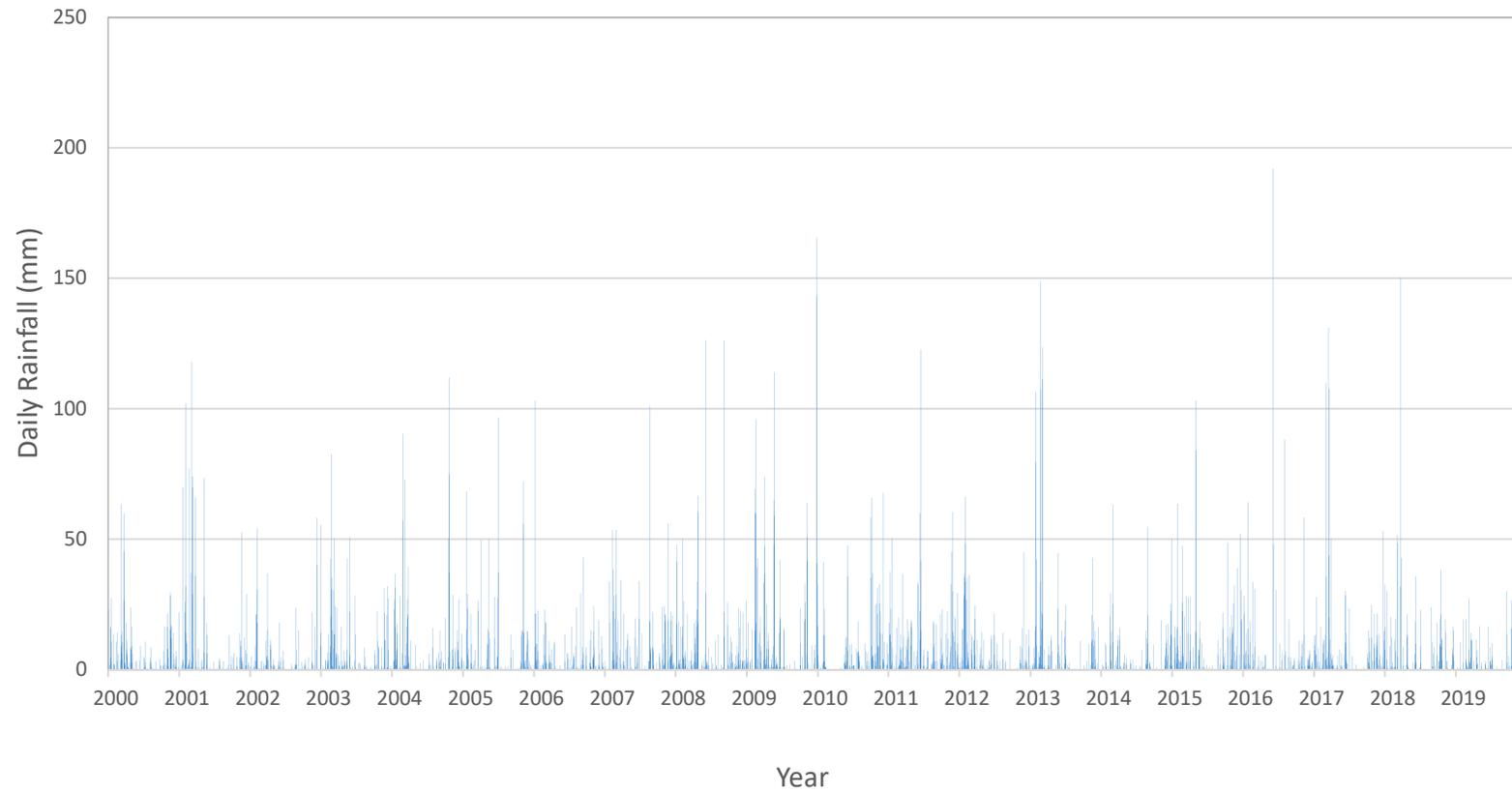


Figure S5. Daily rainfall recorded for the Hastings River at Kindee Bridge, Ellenborough (Source: WaterNSW, Station 207004)

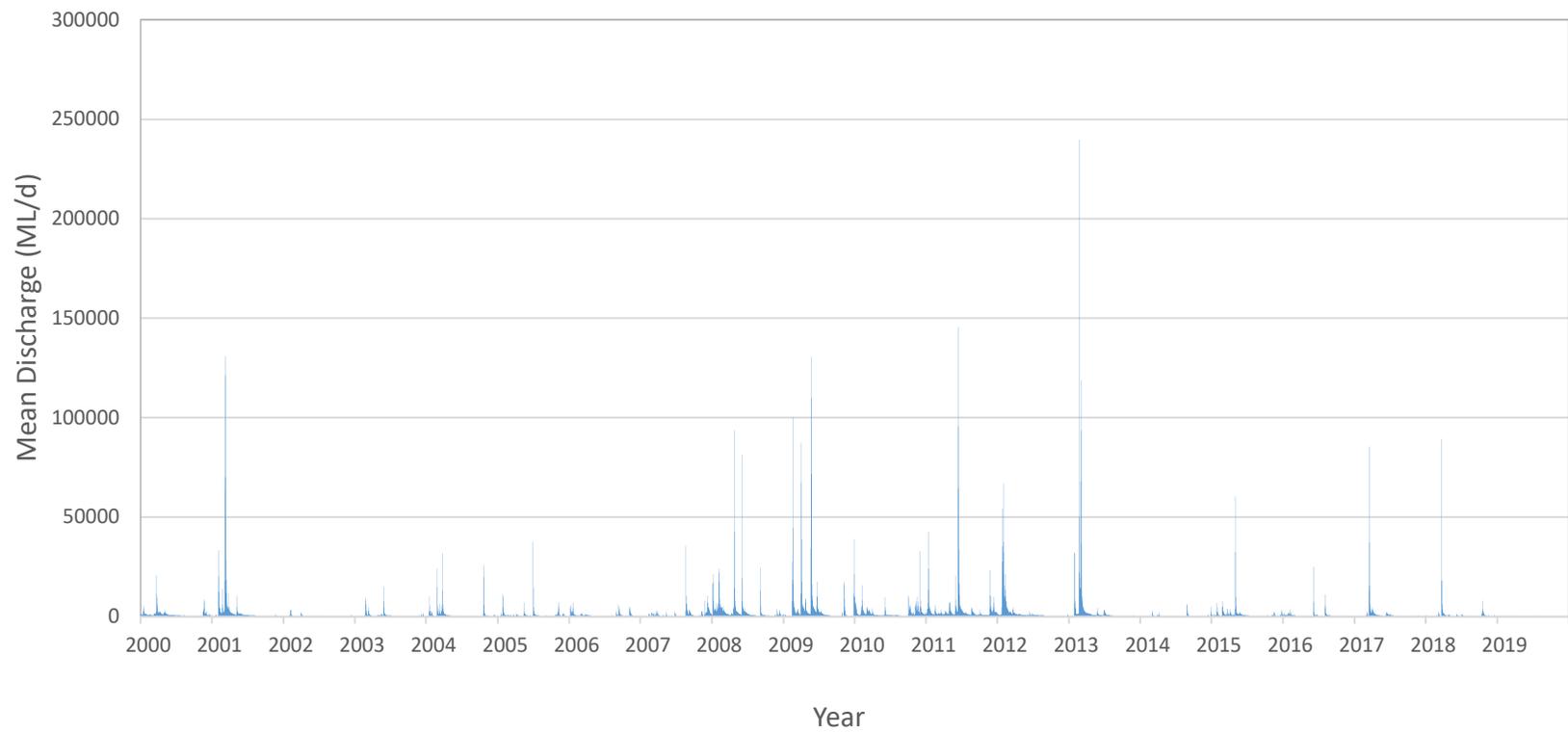


Figure S6. Daily river flow recorded for the Hastings River at Kindee Bridge, Ellenborough (Source: WaterNSW, Station 207004)

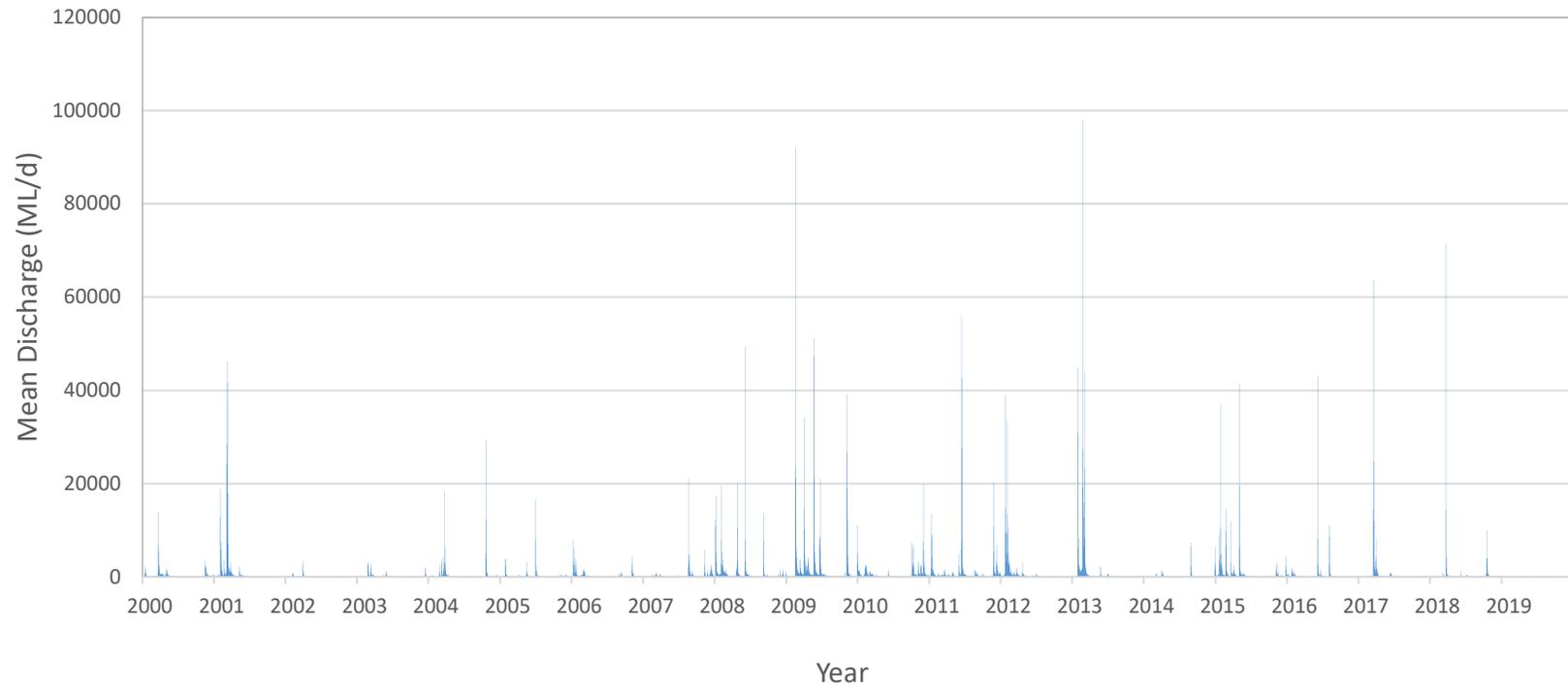


Figure S7. Daily river flow recorded for the Wilson River at Avenel (Source: WaterNSW, Station 207014)