



Public Works  
Manly Hydraulics Laboratory

# NSW COASTAL RAINFALL ANNUAL SUMMARY 2011-2012

Report MHL2159  
October 2012



prepared for  
NSW Office of Environment and Heritage



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# NSW Coastal Rainfall Annual Summary 2011-2012

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October 2012

**Peter Leszczynski**

110b King Street

Manly Vale NSW 2093

T: 02 9949 0200

F: 02 9948 6185

E: [peter.leszczynski@mhl.nsw.gov.au](mailto:peter.leszczynski@mhl.nsw.gov.au)

W: [www.mhl.nsw.gov.au](http://www.mhl.nsw.gov.au)

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## Foreword

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Manly Hydraulics Laboratory (MHL) is a business group within NSW Public Works, a division of the Department of Finance & Services. The NSW rainfall database has been developed to support a number of NSW Office of Environment and Heritage (OEH) programs associated with coastal, floodplain and estuary management. The monitoring service is available to local government and other organisations, both in Australia and overseas.

This annual summary presents the results of rainfall measurements obtained by the automatic rainfall recording stations along the coastal estuaries and rivers of New South Wales over the period 1 July 2011 to 30 June 2012, and catalogues data collected in NSW by Manly Hydraulics Laboratory.

This summary has been prepared to provide ready access to Manly Hydraulics Laboratory's rainfall database and the data analysis capabilities at the Laboratory.

Requests for further information should be directed to:

Environmental Data Programs	E-mail	:	<a href="mailto:data-request@mhl.nsw.gov.au">data-request@mhl.nsw.gov.au</a>
Manly Hydraulics Laboratory	WWW	:	<a href="http://www.mhl.nsw.gov.au/">http://www.mhl.nsw.gov.au/</a>
110b King Street	Telephone	:	(02) 9949 0200
Manly Vale NSW 2093	Facsimile	:	(02) 9948 6185

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PW Report No. 12071  
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Manly Hydraulics Laboratory  
Report No. MHL2161  
PW Report No. 12072  
ISBN 978 0 7347 4461 6

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## Summary

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This report contains:

- a brief description of the coastal rainfall measurement program
- guidelines on how to use this report
- information on how to access the database
- a review of significant program developments and rainfall events in 2011-2012
- a list of all stations for which MHL collected rainfall data in 2011-2012 ([Table 5.1](#))
- the annual data summaries for each site
- [Appendix A](#) detailing the rainfall data available
- [Appendix B](#) outlining some of the data analysis suites and presentation formats available from MHL
- [Appendix C](#) a list of publications which may be of interest
- [Appendix D](#) maps of 2011-2012 site installation locations.

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# 1. Rainfall Measurement Program

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This report presents the twenty-seventh year of data collected by Manly Hydraulics Laboratory. The network of recorders and the associated analysis routines enable MHL to provide an efficient service in accessing rainfall data. As well as real time rainfall information at over 120 stations in NSW, a significant historical database of rainfall data can be made available on request.

The present program is based on a network of automatic rainfall recording stations installed at various coastal sites (see Station Location Maps). The network consists of 72 permanent stations funded by OEH, and over 50 short-term client-based project sites featuring distinctive, site-specific systems of rainfall monitoring and logging. The system utilises 0.2 mm, 0.5 mm and 1.0 mm tipping buckets and data loggers, shown in [Figure 1](#).

Rainfall data is transferred to the NSW Data Collection Warehouse, Data Centre 1 at Ultimo and to MHL's data server using a variety of telemetry techniques including internet protocol (IP), landline telephone, cellular networks and Event-reporting Radio Telemetry System (ERTS). The incoming raw data is then immediately available to external users to view on-line as schematised in [Figure 2](#).

The data is stored in a database and subjected to a quality assurance process which involves several control steps to ensure data quality is maintained. Computer programs are used to further format and analyse data.

The database is backed up daily and data archived to magnetic tape as a security measure at regular intervals. A complete mirrored backup database is also kept at Data Centre 1.

## 2. How to Use This Report

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This report aims to streamline access to the Laboratory's services and to the rainfall database.

The NSW coastline has been divided into geographic regions based on river systems. Location maps display the station locations and the annual plots confirm the availability and suitability of data for the particular period of interest. A list of rainfall data collected and stored on-line is included in [Appendix A](#).

Once a choice has been made of the period for which information is required, data and services can be obtained in a variety of formats, according to their intended use.

The following options, which are outlined in [Appendix B](#), are available:

### **Tabulated Output**

- daily totals
- intensity/duration tables
- time of tips of rain gauge or short period fixed time step data
- intensity-frequency-duration tables.

### **Graphical Plots**

- hourly, daily, monthly and yearly hyetographs
- intensity-frequency-duration curves.

### 3. How to Access the Data

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The Laboratory provides a full on-line data access service via the Internet for its clients, and a restricted service for the general public.

Typically the last seven days of data are available on-line in a non-quality controlled form to aid the fastest possible access to data records. The on-line service for clients can provide access to all data catalogued in [Appendix A](#).

Quality controlled data may be ordered via the MHL web page (<http://www.mhl.nsw.gov.au>), by emailing [data-request@mhl.nsw.gov.au](mailto:data-request@mhl.nsw.gov.au), or via customised decision support tools that can be provided upon request.

The MHL website has been updated in association with an updated database and data warehouse capability via Data Centre 1. The new website was launched in March 2012 and includes updated functionality, data access and availability of rainfall time-series plots.

## 4. Significant Events and Developments 2011-2012

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During 2011-2012, the Bureau of Meteorology modernisation and extension program continued to provide MHL with funding for station upgrades through OEH. The program funded the upgrade of all combined rainfall/water level monitoring stations to IP telemetry. Prior to this upgrade, data from the network was transferred from remote sites to MHL via a dial-up internal modem system. The upgrade to IP telemetry has dramatically improved the currency of data in the network and provided access to real-time water level and rainfall data.

During 2011-2012, all rainfall monitoring stations were upgraded from RRDL3 loggers to ML1 Mini-logs. The ML1 Mini-logs superseded the RRDL3 loggers. The loggers provide greater flexibility for telemetry options and have an internal lithium battery that continues to operate should the main power supply fail.

The following stations were relocated during the fiscal year:

- Huonbrook – relocated 400 m north-west of the original location due to the property owner prohibiting access to site
- Wooli Caravan Park – relocated 500 m east from the decommissioned Floatwell to the fire brigade building, for safety reasons
- Aldavilla Downstream – new station commissioned approximately 1 km east of Euroka Upstream, after the station was destroyed during a flood event in June 2011
- Kincumber – station relocated 50 m away from the original site due to tree coverage
- Toukley – station relocated 20 m south of the original location due to proposed development
- Wyee – station relocated 50 m away from the original site due to tree coverage.

In the 2011-2012 fiscal year, the maximum recorded rainfall intensities for 11 durations between 5 minutes and 72 hours occurred at six different sites across the OEH rainfall network ([Table 4.1](#)). To determine the significance of a rainfall event, the intensities are compared against the Annual Exceedance Probability (AEP), where the AEP is the probability of an event occurring in any one year. An event with a 1% AEP (or the 100-year flood) is an event that has a 1% chance of being equalled or exceeded in any one year.

A summary of rainfall events during 2011-2012 on the NSW east coast is provided in [Table 4.2](#).

The maximum recorded rainfall for durations of 5 minutes to 72 hours at each station for 2010-2011 is presented in [Table 4.3](#).

**Table 4.1 Maximum Recorded Intensities for all Stations 2011-2012**

Duration	Station	Date	Rainfall (mm)	Rainfall (mm/hr)	AEP (%)
5min	Mardi Dam	11/02/2012	19	228.0	~2
10min	Kincumber	5/01/2012	31.5	189.0	~2
20min	Mount George	6/11/2011	36	108.0	<5
30min	Kincumber	5/01/2012	57	114.0	<5
60min	Berkeley Vale	12/12/2011	90	90.0	<1
3hrs	Mount Pleasant	15/01/2012	113.5	37.8	<18
6hrs	Mount Pleasant	15/01/2012	138.5	23.1	>18
6hrs	Main Arm	25/01/2012	138.5	23.1	>18
12hrs	Main Arm	25/01/2012	208.6	17.4	>18
24hrs	Main Arm	25/01/2012	231.6	9.7	>18
48hrs	Main Arm	25/01/2012	313	6.5	>18
72hrs	Main Arm	27/01/2012	372.2	5.2	>18

Table 4.2 lists significant rainfall events that occurred in the 2011-2012 fiscal year. 100 mm of rain falling in a 24-hour period has been deemed a suitable significant rain event by OEH.

**Table 4.2 2011-2012 Summary of Rainfall Events**

Month	Summary of Rainfall Events
July 2011	Daily rainfall exceeding 100 mm in 24 hours occurred at Mount Elliot, Kincumber and Bateau Bay
August 2011	No events exceeding 100 mm in 24 hours occurred this month
September 2011	Daily rainfall exceeding 100 mm in 24 hours occurred at Seaham and ten Macquarie-Tuggerah Lakes region sites
October 2011	Daily rainfall exceeding 100 mm in 24 hours occurred at Port Kembla
November 2011	Daily rainfall exceeding 100 mm in 24 hours occurred at Yellow Rock Road, Middle Boambee and North Bonville
December 2011	Daily rainfall exceeding 100 mm in 24 hours occurred at six Macquarie-Tuggerah Lakes region sites
January 2012	Daily rainfall exceeding 100 mm in 24 hours occurred at 17 stations along the coast from Cudgera to Mount Pleasant
February 2012	Daily rainfall exceeding 100 mm in 24 hours occurred at seven stations in the Wollongong region
March 2012	Daily rainfall exceeding 100 mm in 24 hours occurred at Regatta Point
April 2012	Daily rainfall exceeding 100 mm in 24 hours occurred at Cudgera and at eight stations in the Central Coast
May 2012	No events exceeding 100 mm in 24 hours occurred this month
June 2012	Daily rainfall exceeding 100 mm in 24 hours occurred at three stations in the Brunswick River region and three in the Bellinger River region

## 4.1 Southern Oscillation Index

The Southern Oscillation Index (SOI) is a calculation of monthly or seasonal shifts in the air pressure between Darwin and Tahiti (source: Bureau of Meteorology). As well as affecting the temperature of the Pacific Ocean and the strength of Pacific Trade winds, the SOI also affects rainfall and can be used to predict whether higher or lower than average rainfall may occur in northern and eastern Australia.

A La Niña episode occurs when there are ongoing positive SOI values, and increases the probability of higher than average rainfall in northern and eastern Australia. Sustained negative SOI values have been coined El Niño events, and are associated with a reduction in rainfall over northern and eastern Australia. Even low to moderate El Niño events can lead to severe droughts in Australia. The SOI for the period July 1993 to June 2012 is graphically represented in [Figure 3](#).

## 4.2 Data Provision

Rainfall data is provided to the public on behalf of the NSW Office of Environment and Heritage, via:

- OEH's and MHL's public Internet home pages, providing near real-time access to a limited sample of data. Other methods of disseminating data include e-mail and traditional written correspondence.
- Data is being provided for presentation on the NSW Government Water Information website.
- Currently MHL provides customised web addresses to OEH offices at:
  - Parramatta
  - Alstonville
  - Armidale
  - Tweed Region
  - Kempsey
  - Coffs Harbour
  - Hunter
  - South Coast
- A number of State Emergency Service offices receive environmental data via Web pages:
  - Bulahdelah
  - Manning
  - Karuah Valley
  - Camden Haven
  - Wollongong
  - Pacific Palms
  - Lower Hunter
  - Ulladulla
  - Coffs Harbour
  - Lismore Tweed
  - Byron Bay
  - Southern Shoalhaven
- In excess of 527 individual, hard copy data requests were issued in 2011-2012.
- This year in excess of 200,000 public and customer Internet pages will be served by MHL per month.
- In excess of 2,653,475 individual, web-based data enquiries were accessed from MHL's web page in 2011-2012.
- A Web interface has been developed for OEH to access MHL's 'quality assured' database.

- A Web-based data request system has been established where electronic requests can be submitted via MHL's homepage at <http://new.mhl.nsw.gov.au/DataRequest>.
- Data access also continues to assist the Bureau of Meteorology, local government authorities, State Emergency Service, NSW Police, Sydney Catchment Authority, NSW Surf Life Saving Association, universities, the NSW court system, private consultancies, NSW Maritime and the Natural Resources Commission.
- Community groups such as the Manly and Pittwater Coastal Environment Centres, the Wetlands Centre, Australia (at Shortland) and Kooragang Island Rehabilitation Scheme continue to receive environmental data from MHL.

**Table 4.3 2011-2012 Maximum Recorded Rainfall (mm)**

Station	Duration											Total yearly rainfall (mm)
	5 min	10 min	20 min	30 min	60 min	3 hrs	6 hrs	12 hrs	24 hrs	48 hrs	72 hrs	
Cudgera	15/10/2011 9	15/10/2011 16	21/02/2012 23	21/02/2012 30	21/02/2012 37.5	25/01/2012 78	25/01/2012 117	25/01/2012 197	25/01/2012 212	25/01/2012 262	27/01/2012 325	1810
Main Arm	30/10/2011 7	30/10/2011 13	30/10/2011 23.5	30/10/2011 28.5	25/01/2012 41.5	25/01/2012 77	25/01/2012 138.5	25/01/2012 208.5	25/01/2012 231.5	25/01/2012 313	27/01/2012 372	2235
Huonbrook	8/02/2012 7	8/02/2012 14	8/02/2012 22	8/02/2012 22.5	21/02/2012 30.5	8/02/2012 62.5	8/02/2012 76	8/02/2012 78	29/06/2012 104	29/06/2012 155	18/01/2012 169	1783.5
Myocum	23/01/2012 9.5	20/02/2012 16.5	20/02/2012 28	20/02/2012 34	21/02/2012 42	8/02/2012 57	25/01/2012 85.5	25/01/2012 141	25/01/2012 171.5	25/01/2012 224	26/01/2012 253	2041.5
Lake Ainsworth	13/10/2011 9.5	13/10/2011 13.5	9/02/2012 22.5	9/02/2012 27	13/10/2011 32	9/02/2012 42	25/01/2012 65.5	25/01/2012 113.5	26/01/2012 161.5	26/01/2012 173	26/01/2012 184	1875.5
Wooli Caravan Park	3/04/2012 7.5	3/04/2012 15	3/04/2012 21	3/04/2012 22	3/04/2012 23	17/04/2012 30.5	10/06/2012 37.0	11/06/2012 51.5	11/06/2012 64	12/06/2012 99.5	12/06/2012 112.5	1213.5
Perry Drive	---	---	---	11/12/2011 45	11/12/2011 51.5	31/01/2012 85.5	31/01/2012 135	1/02/2012 151.0	1/02/2012 151.5	26/01/2012 189.0	27/01/2012 222.0	2033.5
Shepards Lane	---	---	---	11/12/2011 31.5	11/12/2011 41.5	31/01/2012 76.5	31/01/2012 135	1/02/2012 153	1/02/2012 154.1	26/01/2012 206.0	27/01/2012 241.0	2101
Red Hill	---	---	---	11/12/2011 33.5	11/12/2011 45	31/01/2012 76.5	31/01/2012 129	1/02/2012 151.5	1/02/2012 152.0	27/01/2012 222.0	27/01/2012 261.5	2128.5
Newports Creek	31/01/2012 14	31/01/2012 18.5	11/12/2011 21	26/01/2012 27	26/01/2012 45	26/01/2012 70.5	31/01/2012 100.0	1/02/2012 128.0	1/02/2012 149.5	27/01/2012 217.5	27/01/2012 257.0	2136.5
Middle Boambee	11/12/2011 11	11/12/2011 20	11/12/2011 26	31/01/2012 36.5	31/01/2012 49.5	31/01/2012 77.0	31/01/2012 116.0	1/02/2012 150.5	26/01/2012 161.0	27/01/2012 243	27/01/2012 286	2190.5
South Boambee	30/08/2011 9	30/08/2011 13.5	31/01/2012 21.5	31/01/2012 26	26/01/2012 35.5	31/01/2012 69.5	31/01/2012 89.5	1/02/2012 133.5	27/01/2012 149.5	27/01/2012 218.0	27/01/2012 265.5	2055.5
North Bonville	1/09/2011 8	1/09/2011 12	30/08/2011 18	26/01/2012 21.5	26/01/2012 37.5	26/01/2012 76.0	26/01/2012 93	1/02/2012 113.5	27/01/2012 175.0	27/01/2012 249.5	27/01/2012 268.5	2367.5
Kooroowi	17/11/2011 12.5	17/11/2011 22	17/11/2011 31.5	17/11/2011 38	17/11/2011 44	18/11/2011 48.0	8/02/2012 53.0	9/02/2012 55.0	25/11/2011 66.5	25/11/2011 119.0	26/01/2012 153.5	1560
Stuarts Island D/S	7/02/2012 9.5	7/02/2012 17.5	7/02/2012 27	7/02/2012 33	7/02/2012 40	7/02/2012 44.5	26/06/2012 51.5	27/06/2012 54	27/06/2012 90.5	25/11/2011 119	26/11/2012 132.5	1259
Utungun	8/10/2011 8	30/08/2011 12.5	30/08/2011 18.5	30/08/2011 19.5	30/08/2011 19.5	26/06/2012 32	7/12/2011 46.5	8/12/2011 60	25/11/2011 83.5	25/11/2011 119.5	26/11/2011 159	1190.5
Aldavilla Downstream <sup>3</sup>	7/02/2012 12	31/01/2012 21	31/01/2012 31	7/02/2012 39	31/01/2012 56	31/01/2012 86	31/01/2012 96	1/02/2012 102	1/02/2012 105	2/02/2012 143	2/02/2012 144	770
Green Valley	24/01/2012 11	24/01/2012 17	24/01/2012 26.5	24/01/2012 31.5	24/01/2012 48.5	24/01/2012 59.5	24/01/2012 67.5	24/01/2012 70.0	24/11/2011 92.5	25/11/2011 156	26/11/2011 196	1858

Station	Duration											Total yearly rainfall (mm)
	5 min	10 min	20 min	30 min	60 min	3 hrs	6 hrs	12 hrs	24 hrs	48 hrs	72 hrs	
Telegraph Point	11/02/2012 9	20/02/2012 15.5	20/02/2012 22	20/02/2012 27	24/01/2012 34.5	8/02/2012 52.5	8/02/2012 53.5	8/02/2012 65.5	26/11/2011 93.5	26/11/2011 137.0	26/11/2011 151	1726.5
Logans Crossing	30/10/2011 14	30/10/2011 22	13/02/2012 35	13/02/2012 43.5	13/02/2012 49.5	8/02/2012 60.5	8/02/2012 69.5	8/02/2012 77.0	2/02/2012 90.5	2/02/2012 154.5	26/11/2011 158	1732.5
Mount George	6/11/2011 9.5	6/11/2011 18.5	6/11/2011 36	6/11/2011 49	6/11/2011 54.5	20/02/2012 59.0	20/02/2012 61.0	20/02/2012 61.0	1/02/2012 89.5	2/02/2012 149.0	3/02/2012 155	1329.5
Nabiac	30/10/2011 13	30/10/2011 15.5	22/02/2012 20	22/02/2012 26	22/02/2012 32.5	22/02/2012 53.0	22/02/2012 53.0	8/02/2012 57.5	1/02/2012 78.5	2/02/2012 126.5	2/02/2012 128.0	1425
Tuncurry	30/10/2011 7	7/02/2012 12.5	7/02/2012 23	7/02/2012 34	7/02/2012 56.5	8/02/2012 71.5	8/02/2012 78.5	8/02/2012 94.0	8/02/2012 109.0	2/02/2012 115.5	2/02/2012 116.5	1420.5
Tiona <sup>2</sup>	7/12/2011 7.5	7/12/2011 9.5	25/09/2011 11	25/09/2011 14	25/09/2011 20.5	25/09/2011 46.5	25/09/2011 57	25/09/2011 75	25/09/2011 95.5	21/07/2011 100.0	22/07/2011 130.0	785
Tarbuck Bay	12/11/2011 9	10/02/2012 16	10/02/2012 24.5	10/02/2012 27	10/02/2012 30.5	7/02/2012 53.5	8/02/2012 61.0	25/09/2011 75.5	25/09/2011 98.5	19/04/2012 172.0	20/04/2012 222.0	1902.5
Bulahdelah	27/12/2011 8.5	27/12/2011 11	27/12/211 14	27/12/2011 15.5	22/11/2011 24.5	12/12/2011 30	02/10/2011 42	08/02/2012 57	01/02/2012 89.5	02/02/2012 150.0	03/02/2012 162	1610
Gostwyck	13/02/2012 8	13/02/2012 14.5	13/02/2012 19.5	13/02/2012 21.5	13/02/2012 24.5	7/03/2012 30.5	7/03/2012 46.0	2/10/2011 49	26/09/2011 63.5	2/02/2012 88.0	3/02/2012 101	1144.5
Seaham	10/02/2012 14	10/02/2012 22.5	25/09/2011 32.5	25/09/2011 43.5	25/09/2011 65.5	25/09/2011 75.5	25/09/2011 82.5	25/09/2011 102.5	25/09/2011 120.5	26/09/2011 125	22/07/2011 128.0	1244.5
Belmore Bridge	11/02/2012 12	11/02/2012 20.5	11/02/2012 28.5	11/02/2012 28.5	11/02/2012 28.5	12/12/2011 34.5	12/12/2011 36	25/09/2011 40	25/09/2011 61	02/02/2012 78	03/02/2012 84	1068
Hexham Bridge	25/09/2011 8	20/02/2012 12	20/02/2012 15	20/02/2012 17.5	7/03/2012 30	7/03/2012 45	25/01/2012 68.5	25/01/2012 79.0	25/01/2012 79.0	21/07/2011 107.5	22/07/2011 135.5	1358
Barnsley	10/02/2012 8.5	10/02/2012 12.5	10/02/2012 16	30/10/2011 16.5	30/10/2011 21	11/06/2012 25	11/06/2012 39	11/06/2012 52.5	12/06/2012 60	22/07/2011 100	22/07/2011 129.5	1339.5
Martinsville	14/01/2012 12	14/01/2012 22	14/01/2012 33	14/01/2012 39	14/01/2012 51.5	14/01/2012 89.5	14/01/2012 143.0	14/01/2012 143.5	15/01/2012 165.5	16/01/2012 173.0	16/01/2012 173.5	1493
Mandalong	10/02/2012 11.5	10/02/2012 17	25/09/2011 21.5	25/09/2011 24.5	25/09/2011 48.5	25/09/2011 60.5	25/09/2011 77.5	25/09/2011 95.0	25/09/2011 114	26/09/2011 133.0	26/09/2011 133	1527.5
Wyee	10/02/2012 7.5	10/02/2012 13.5	25/09/2011 21	25/09/2011 30	25/09/2011 47.5	25/09/2011 65.5	25/09/2011 92.5	25/09/2011 115.5	26/09/2011 134.0	26/09/2011 150.5	26/09/2011 151.2	1440.5
Whitemans Ridge	14/01/2012 7	14/01/2012 14	14/01/2012 20	14/01/2012 25	25/09/2011 33	25/09/2011 48	25/09/2011 66	25/09/2011 71	26/09/2011 78	18/04/2012 87	22/07/2011 102	988
Yarramalong	10/02/2012 13	10/02/2012 25	10/02/2012 34.5	10/02/2012 38.5	10/02/2012 39	10/02/2012 39.5	25/09/2011 50.5	25/09/2011 67.5	26/09/2011 79	26/09/2011 87	22/07/2011 96.5	1187.5
Kulnura	12/02/2012 7.5	10/02/2012 11	10/02/2012 15.5	10/02/2012 20.5	10/02/2012 21	25/01/2012 32.5	25/01/2012 46.5	25/01/2012 63	26/01/2012 64.0	22/07/2011 80.0	22/07/2011 107.0	1241.5

Station	Duration											Total yearly rainfall (mm)
	5 min	10 min	20 min	30 min	60 min	3 hrs	6 hrs	12 hrs	24 hrs	48 hrs	72 hrs	
Toukley <sup>2</sup>	14/01/2012 9.5	14/01/2012 17	14/01/2012 26.5	14/01/2012 30	12/12/2011 48	12/12/2011 58.0	14/01/2012 59.5	14/01/2012 60.5	19/04/2012 74.5	19/04/2012 105.0	19/04/2012 108	948.5
Hamlyn Terrace	12/12/2011 12.5	12/12/2011 23.5	12/12/2011 32.5	12/12/2011 38.5	14/01/2012 53	12/12/2011 102	12/12/2011 111	12/12/2011 114	26/09/2011 133.0	26/09/2011 148.0	22/07/2011 178.0	1537.5
Mardi Dam	11/02/2012 19	11/02/2012 22.5	25/09/2011 30	25/09/2011 40.5	14/01/2012 55.5	14/01/2012 98.5	14/01/2012 99.5	25/09/2011 112.5	26/09/2011 131.5	26/09/2011 146.5	22/07/2011 147.0	1495
Sterland	18/04/2012 7	18/04/2012 13	18/04/2012 18.5	18/04/2012 21	18/04/2012 27	18/04/2012 32.5	25/09/2011 49	25/09/2011 67	18/04/2012 94	18/04/2012 120	19/04/2012 122.5	1159
Kangy Angy	11/02/2012 15	11/02/2012 21	12/12/2011 25.5	12/12/2011 34	12/12/2011 56	12/12/2011 80	25/09/2011 92.5	25/09/2011 115.5	18/04/2012 141.5	18/04/2012 186.5	19/04/2012 191.5	1655
Berkeley Vale	25/09/2011 11.5	12/12/2011 20	12/12/2011 37.5	12/12/2011 53.5	12/12/2011 90	12/12/2011 113.0	12/12/2011 122.0	25/09/2011 139.0	25/09/2011 157.5	18/04/2012 189.5	19/04/2012 192.0	1774.5
Bateau Bay	11/02/2012 11	19/02/2012 16	25/09/2011 24.5	25/09/2011 32	25/09/2011 35	25/09/2011 55.5	25/09/2011 94.5	25/09/2011 121.5	25/09/2011 157.5	21/07/2011 208	22/07/2011 250	1757.5
Lisarow	12/12/2011 10.5	12/12/2011 17.5	12/12/2011 28	12/12/2011 35	12/12/2011 65.5	12/12/2011 103.5	12/12/2011 114	12/12/2011 119.0	18/04/2012 138	18/04/2012 176.5	22/07/2011 184.0	1775.5
Strickland	11/02/2012 9.5	11/02/2012 19	12/12/2011 28	12/12/2011 39.5	12/12/2011 65.5	12/12/2011 85.5	12/12/2011 97	18/04/2012 125	18/04/2012 151.5	19/04/2012 184.5	19/04/2012 189.5	1621.5
Narara	11/02/2012 18	11/02/2012 22	12/12/2011 30.5	12/12/2011 45	12/12/2011 81.5	12/12/2011 103.5	12/12/2011 116.0	12/12/2011 119.5	18/04/2012 150	19/04/2012 183.0	19/04/2012 184.0	1734
Mount Elliot	19/02/2012 10	19/02/2012 16.5	19/02/2012 30	19/02/2012 31	18/04/2012 35.5	12/12/2011 64.0	12/12/2011 77.0	20/07/2011 87.5	20/07/2011 113.0	21/07/2011 176.0	22/07/2011 210.0	1785
Wyoming	11/02/2012 11	8/10/2011 17	12/12/2011 27.5	12/12/2011 40	12/12/2011 62	12/12/2011 77.0	12/12/2011 84.5	18/04/2012 87	18/04/2012 112.0	19/04/2012 140.0	19/04/2012 140.0	1358
Kincumber	5/01/2012 17.5	5/01/2012 31.5	5/01/2012 52	5/01/2012 57	5/01/2012 58.5	5/01/2012 58.5	21/07/2011 71.5	21/07/2011 87	20/07/2011 116.0	21/07/2011 219.0	22/07/2011 268.0	1897.5
Webbs Creek	7/10/2011 8	7/10/2011 15.2	7/10/2011 18.4	7/10/2011 19.4	3/02/2012 25	20/08/2011 43.4	20/08/2011 57.8	20/08/2011 74.8	20/08/2011 89.5	20/08/2011 90.2	3/02/2012 98.6	1187.4
Colo Junction	11/02/2012 11	11/02/2012 16.2	20/02/2012 20.6	20/02/2012 20.8	19/08/2011 22.8	20/08/2011 35.4	20/08/2011 47.6	20/08/2011 61.0	20/08/2011 72.2	24/11/2011 78.7	25/11/2011 90.7	1164.2
Sackville D/S	14/01/2012 5.8	14/01/2012 10.8	14/01/2012 16.2	14/01/2012 19.2	19/02/2012 27.6	25/01/2012 38.8	25/01/2012 46.4	25/01/2012 50.4	23/11/2011 71.5	24/11/2011 81.6	25/11/2011 92.9	1101.6
Kelso Creek	---	---	---	23/12/2011 14	8/03/2012 24.5	8/03/2012 39.5	8/03/2012 54	8/03/2012 79.5	8/03/2012 86	19/04/2012 97.0	19/04/2012 99	1092
Rixons Pass	9/02/2012 13	9/02/2012 23	9/02/2012 30	9/02/2012 36	9/02/2012 60	15/01/2012 102.5	15/01/2012 123	15/01/2012 138	15/01/2012 139.5	15/01/2012 146.5	22/07/2011 183.5	1729
Russell Vale	15/01/2012 10	15/01/2012 17.5	15/01/2012 28.5	15/01/2012 36	15/01/2012 50.5	15/01/2012 97.5	15/01/2012 123.5	15/01/2012 136.0	15/01/2012 138	1/03/2012 146.0	22/07/2011 165.0	1749

Station	Duration											Total yearly rainfall (mm)
	5 min	10 min	20 min	30 min	60 min	3 hrs	6 hrs	12 hrs	24 hrs	48 hrs	72 hrs	
Mount Pleasant	29/10/2011 11.5	29/10/2011 19	15/01/2012 32.5	15/01/2012 43	15/01/2012 70	15/01/2012 113.5	15/01/2012 138.5	15/01/2012 144.5	29/02/2012 149.5	1/03/2012 195.0	2/03/2012 224.5	2148
Mount Kembla	10/02/2012 8.5	10/02/2012 12	10/02/2012 23.5	10/02/2012 30	10/02/2012 41	10/02/2012 47.5	10/02/2012 49.5	1/03/2012 67.5	29/02/2012 119.0	1/03/2012 154.5	2/03/2012 181.0	1610
Dombarton Loop	1/04/2012 10	1/04/2012 18.5	1/04/2012 30	1/04/2012 34	1/04/2012 36.5	29/02/2012 40.0	29/02/2012 66	1/03/2012 87.5	29/02/2012 143.0	1/03/2012 177.0	2/03/2012 198	1591
Wongawilli	8/11/2011 10.5	8/11/2011 17.5	8/11/2011 24	8/11/2011 24.5	8/11/2011 24.5	25/09/2011 34.5	15/01/2012 48.5	29/02/2012 57.5	29/02/2012 98.5	1/03/2012 120	2/03/2012 135.5	1273
Port Kembla	10/02/2012 10	10/02/2012 17	10/02/2012 26	10/02/2012 34.5	10/02/2012 51.5	10/02/2012 61.5	15/10/2011 74.0	15/10/2011 101.5	10/02/2012 131.0	1/03/2012 152.0	2/03/2012 170.5	1491
Darkes Road	11/12/2011 6	19/04/2012 10	14/01/2012 15.5	14/01/2012 19.5	14/01/2012 26	19/04/2012 38.0	15/01/2012 56.5	15/01/2012 70.5	15/01/2012 74.5	22/07/2011 96.5	22/07/2011 120.0	1065.5
Cleveland Road	8/11/2011 7.5	8/11/2011 13.5	8/11/2011 19.5	8/11/2011 20	8/11/2011 20	19/04/2012 38.5	19/04/2012 42	29/02/2012 57.5	29/02/2012 102	1/03/2012 127	2/03/2012 141.0	1233
Huntley Colliery	8/11/2011 10	8/11/2011 11	19/04/2012 18.5	19/04/2012 25	19/04/2012 31	19/04/2012 48.5	19/04/2012 51.5	19/04/2012 68.5	29/02/2012 106.0	19/04/2012 136.0	2/03/2012 143.0	1362.5
Upper Calderwood	13/02/2012 6.5	13/02/2012 11	26/01/2012 17	26/01/2012 20	26/01/2012 24	19/04/2012 39.5	26/11/2011 54.5	26/11/2011 85.5	29/02/2012 103.5	19/04/2012 145	19/04/2012 146.0	1341
Little Lake <sup>2</sup>	8/11/2011 8	8/11/2011 12	8/11/2011 15.5	8/11/2011 16	8/11/2011 16	25/09/2011 25.5	15/10/2011 35.0	15/10/2011 47.0	22/07/2011 58.5	21/07/2011 104.5	22/07/2011 139.0	833.5
North Macquarie	16/03/2012 4.5	16/03/2012 8	27/02/2012 11	9/02/2012 13	9/02/2012 16.5	26/11/2011 35.0	26/11/2011 53.5	26/11/2011 81	26/11/2011 85.4	1/03/2012 102.7	1/03/2012 126.7	1230.5
Clover Hill	8/11/2011 9.5	8/11/2011 15.5	10/02/2012 20.5	10/02/2012 24.5	10/02/2012 29	5/06/2012 36.5	8/03/2012 58.0	26/11/2011 86.5	26/11/2011 98.0	19/04/2012 126.5	22/07/2011 152.5	1675
Nurrewin	12/02/2012 7	10/02/2012 12	27/02/2012 18.5	27/02/2012 19	17/02/2012 19	27/02/2012 35.5	26/11/2011 54	26/11/2011 80.0	29/02/2012 96.5	1/03/2012 121.0	1/03/2012 155.5	1505.5
Yellow Rock Road	19/04/2012 6.5	19/04/2012 10.5	27/02/2012 16.5	27/02/2012 19	27/02/2012 20.5	26/11/2011 42.5	26/11/2011 71.5	26/11/2011 108	26/11/2011 117.0	26/11/2011 134.0	1/03/2012 145.0	1449.5
Barlows Bay	09/02/2012 7	09/02/2012 13.5	09/02/2012 21.5	09/02/2012 24	09/02/2012 32.5	09/02/2012 43	10/02/2012 67.5	10/02/2012 81	10/02/2012 88.5	01/03/2012 107	02/03/2012 133	1205.5
Regatta Point	9/11/2011 7.5	8/03/2012 13	8/03/2012 22	8/03/2012 27	8/03/2012 35	8/03/2012 62.0	8/03/2012 72	8/03/2012 78.5	1/03/2012 104.5	8/03/2012 116.5	2/03/2012 146.0	1208.5

<sup>1</sup> Dates listed refer to the time that the recorded maximum rainfall ends

<sup>2</sup> Some measure of data loss occurred at these sites. See individual plots for further details

<sup>3</sup> Station decommissioned and relocated

- Indicates station with 15-minute interval data

## 5. Index of Figures

**Table 5.1 Index of Figures**

	Figure
Typical Pluviometer Station	1
Data Transfer Schematic	2
Southern Oscillation Index, June 1994-June 2012	3

Region	Short Name	Station No.	MGA	Easting	Northing	Figure
Station Locality Map						4
Tweed	Cudgera	558046	56	549668	6859164	5
Brunswick	Main Arm	558053	56	542469	6847276	6
Brunswick	Huonbrook	558049	56	538665	6840760	7
Brunswick	Myocum	558036	56	550528	6837390	8
Station Locality Map						9
Richmond	Lake Ainsworth	203455	56	557863	6816160	10
Station Locality Map						11
Bellinger	Wooli Caravan Park	205463	56	524551	6697797	12
Station Locality Map						13
Bellinger	Perry Drive	559019	56	510149	6650415	14
Bellinger	Shepards Lane	559017	56	508200	6650890	15
Bellinger	Red Hill	559016	56	506655	6649689	16
Bellinger	Newports Creek	559051	56	505893	6646681	17
Bellinger	Middle Boambee	559048	56	504720	6645291	18
Bellinger	South Boambee	559049	56	504818	6643568	19
Bellinger	North Bonville	559050	56	500593	6641143	20
Bellinger	Kooroowi	205440	56	482965	6629668	21
Station Locality Map						22
Nambucca	Stuarts Island Downstream	205466	56	499502	6608568	23
Nambucca	Utungun	205414	56	485797	6600327	24
Station Locality Map						25
Macleay	Aldavilla Downstream	206459	56	479318	6561231	26
Hastings	Green Valley	207406	56	486422	6540269	27
Hastings	Telegraph Point	207415	56	481049	6534532	28
Station Locality Map						29
Camden Haven	Logans Crossing	207428	56	470912	6502301	30
Manning	Mount George	208440	56	419224	6472247	31
Station Locality Map						32
Karuah	Nabiac	209404	56	436821	6446458	33
Karuah	Tuncurry	209401	56	450591	6442284	34
Karuah	Tiona	209403	56	454412	6425971	35
Karuah	Tarback Bay	209465	56	451230	6418348	36
Karuah	Bulahdelah	209460	56	425463	6413372	37

Region	Short Name	Station No.	MGA	Easting	Northing	Figure
Station Locality Map						<a href="#">38</a>
Hunter	Gostwyck	210402	56	369104	6396070	39
Hunter	Seaham	210462	56	381105	6385316	40
Hunter	Belmore Bridge	210458	56	364435	6377790	41
Hunter	Hexham Bridge	210448	56	376768	6367608	42
Station Locality Map						<a href="#">43</a>
Macquarie-Tuggerah Lakes	Barnsley	561067	56	367910	6355832	44
Macquarie-Tuggerah Lakes	Martinsville	561083	56	351245	6341595	45
Macquarie-Tuggerah Lakes	Mandalong	561081	56	355224	6335165	46
Macquarie-Tuggerah Lakes	Wyee	561097	56	358609	6328268	47
Station Locality Map						<a href="#">48</a>
Macquarie-Tuggerah Lakes	Whitemans Ridge	561026	56	343664	6324896	49
Macquarie-Tuggerah Lakes	Yarramalong (S)	561137	56	338871	6322384	50
Macquarie-Tuggerah Lakes	Kulnura	561078	56	333767	6321516	51
Macquarie-Tuggerah Lakes	Toukley	211401	56	362602	6318536	52
Macquarie-Tuggerah Lakes	Hamlyn Terrace	561133	56	357399	6319854	53
Macquarie-Tuggerah Lakes	Mardi Dam	561082	56	351036	6314557	54
Macquarie-Tuggerah Lakes	Sterland	567138	56	342434	6315398	55
Macquarie-Tuggerah Lakes	Kangy Angy	561132	56	350168	6310609	56
Macquarie-Tuggerah Lakes	Berkeley Vale	561134	56	353191	6309376	57
Macquarie-Tuggerah Lakes	Bateau Bay	561069	56	358100	6305651	58
Macquarie-Tuggerah Lakes	Lisarow	561079	56	348927	6305252	59
Hawkesbury	Strickland	561136	56	345370	6305548	60
Hawkesbury	Narara	561085	56	344531	6303941	61
Hawkesbury	Mount Elliot	561084	56	350645	6302922	62
Hawkesbury	Wyoming	561098	56	346487	6302051	63
Hawkesbury	Kincumber	561077	56	350391	6294474	64
Station Locality Map						<a href="#">65</a>
Hawkesbury	Webbs Creek	212408	56	312346	6303935	66
Hawkesbury	Colo Junction	212407	56	303218	6298170	67
Hawkesbury	Sackville Downstream	212438	56	302831	6291440	68
Station Locality Map						<a href="#">69</a>
Sydney Coastal	Kelso Creek	213430	56	313763	6241029	70
Station Locality Map						<a href="#">71</a>
Wollongong Coastal	Rixons Pass	568317	56	305280	6196896	72
Wollongong Coastal	Russell Vale	568318	56	306378	6196138	73
Wollongong Coastal	Mount Pleasant	568229	56	303305	6191991	74
Wollongong Coastal	Mount Kembla	568314	56	299550	6186447	75
Wollongong Coastal	Dombarton Loop	568307	56	294718	6185611	76
Wollongong Coastal	Wongawilli	568320	56	293261	6182391	77
Wollongong Coastal	Port Kembla	568316	56	306636	6182721	78
Wollongong Coastal	Darkes Road	568309	56	297450	6182478	79
Wollongong Coastal	Cleveland Road	568308	56	295799	6179730	80
Wollongong Coastal	Huntley Colliery	568311	56	290680	6178916	81
Wollongong Coastal	Upper Calderwood	568319	56	288750	6175161	82
Wollongong Coastal	Little Lake	214466	56	304089	6173338	83
Wollongong Coastal	Nurrewin	568228	56	284569	6173438	84

Region	Short Name	Station No.	MGA	Easting	Northing	Figure
Wollongong Coastal	Clover Hill	568310	56	284232	6172390	85
Wollongong Coastal	North Macquarie	568315	56	291440	6171495	86
Wollongong Coastal	Yellow Rock Road	568321	56	292886	6167651	87
Station Locality Map						88
South Coast	Barlows Bay	218415	56	239467	5988955	89
South Coast	Regatta Point	219405	56	236890	5971052	90

(S) – Indicates station is standalone (non-telemetered)

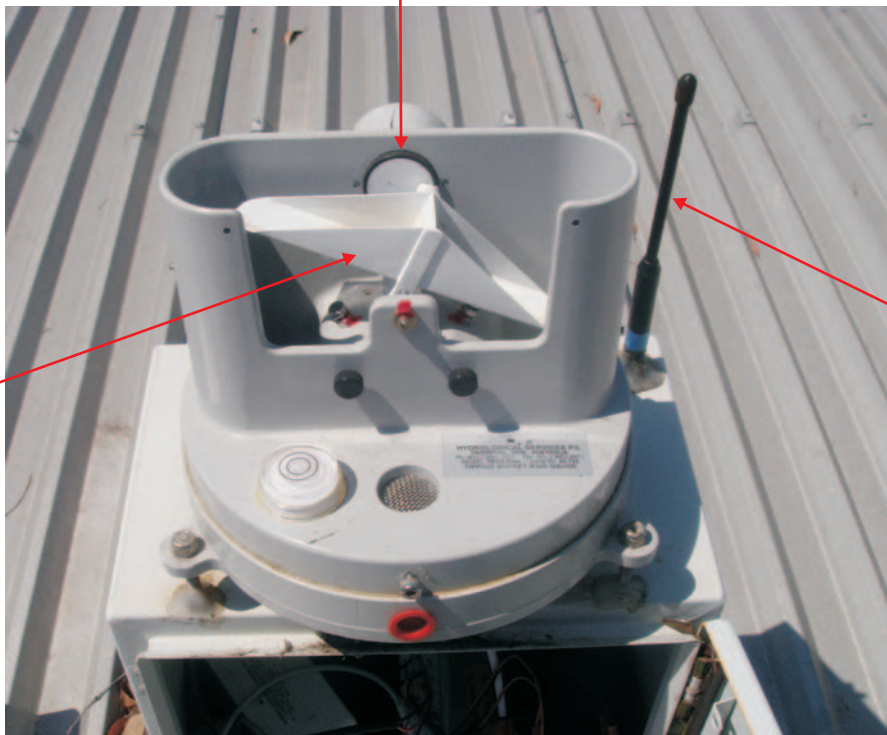
**Table 5.2 Index of Appendix B Figures**

Sample Rainfall Data Outputs	Figure
Daily Rainfall Table, North Bonville, Bellinger River	B1
15-Minute Hyetographs, North Bonville, Bellinger River	B2
Intensity-Duration Table, Newports Creek, Bellinger River	B3
Intensity-Frequency-Duration Rainfall Table, South Boambee, Bellinger River	B4
Intensity-Frequency-Duration Rainfall Curves, Middle Boambee	B5
Rain Gauge Tip Times, Newports Creek, Bellinger River	B6

**Table 5.3 Index of Appendix D Figures  
(Station Location Maps)**

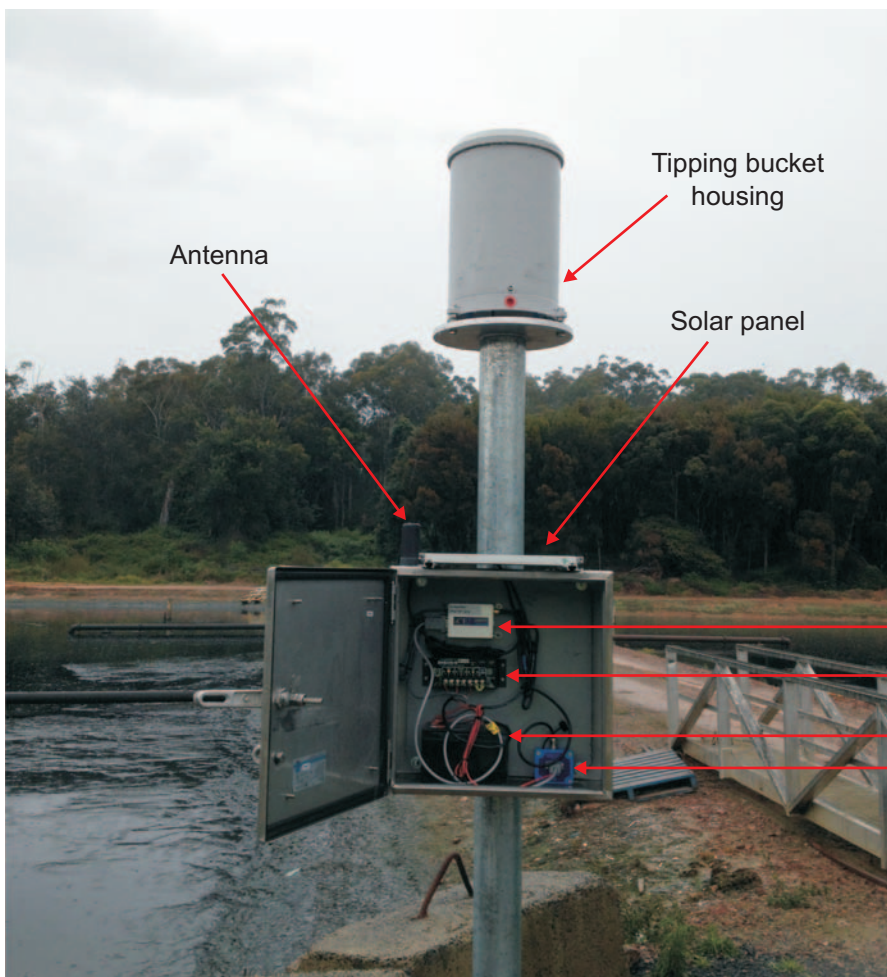
Region	Station	Figure
Macleay	Aldavilla Downstream	D1

Reed switch registers bucket tips



Tipping bucket

Communication antenna



Antenna

Tipping bucket housing

Solar panel

Modem

Solar regulator

Battery

ML1-Minilog



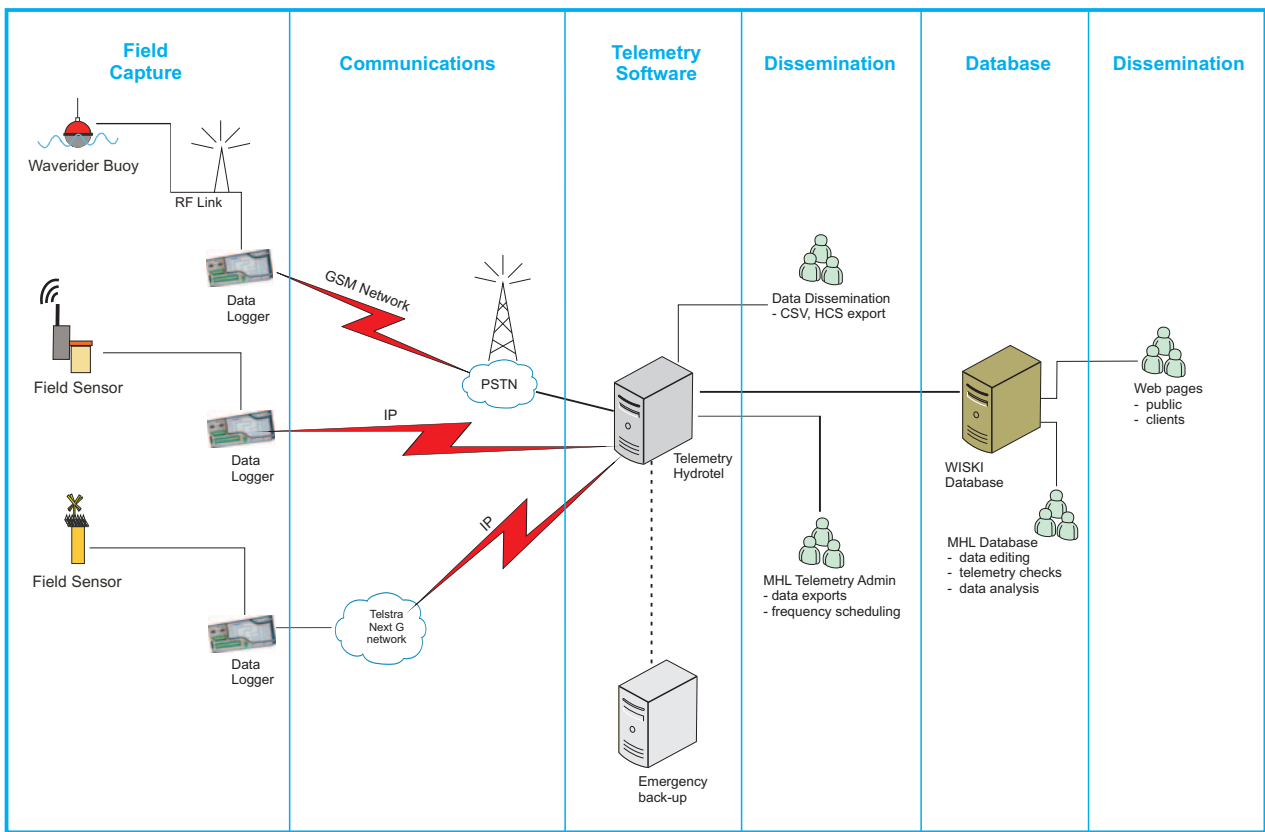
Public Works  
Manly Hydraulics Laboratory

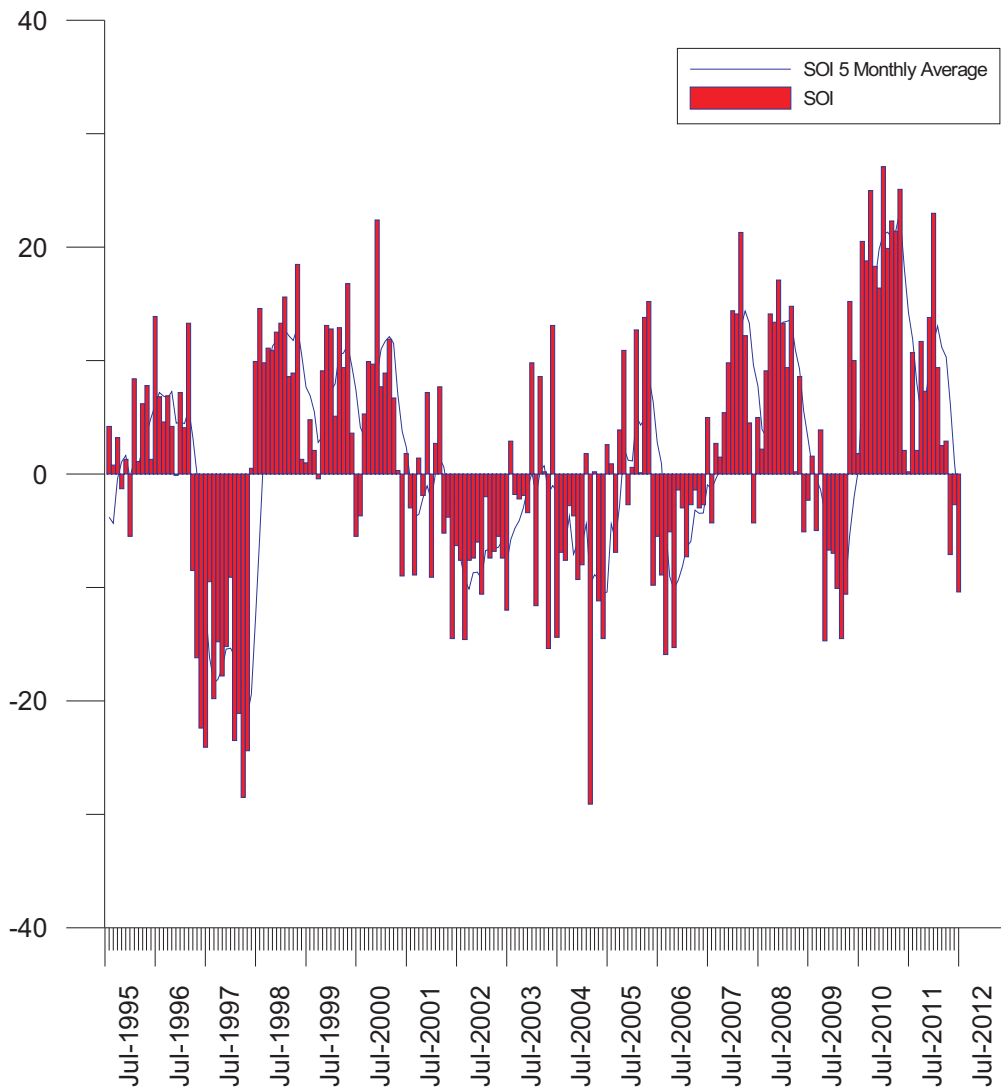
## TYPICAL PLUVIOMETER STATION

MHL  
Report 2159

Figure  
1

DRAWING 2159-01.cdr





Source: Bureau of Meteorology



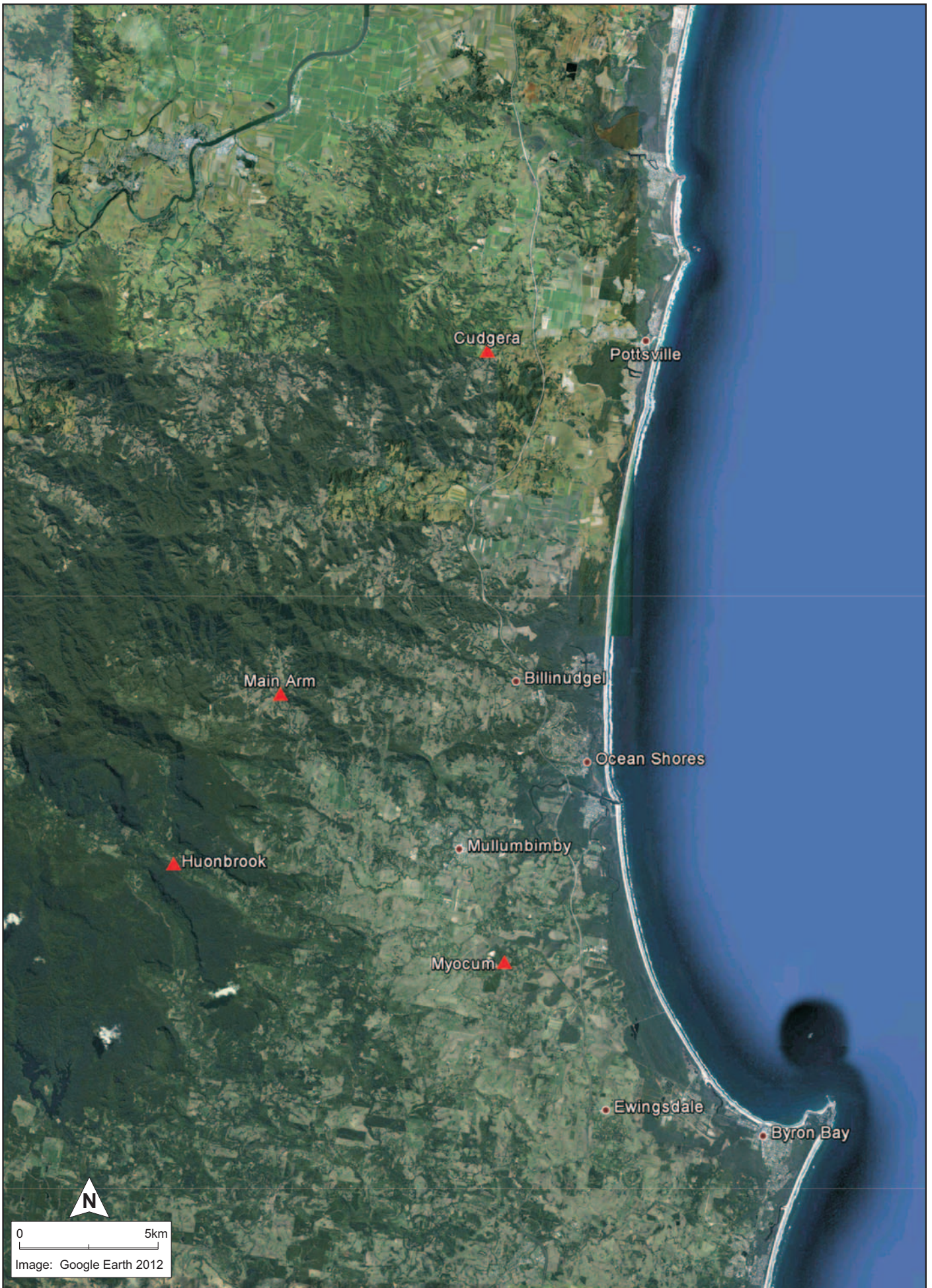
**Public Works**  
Manly Hydraulics Laboratory

**SOUTHERN OSCILLATION INDEX**  
JUNE 1994-JUNE 2012

MHL  
Report 2159

Figure  
**3**

DRAWING 2159-03.cdr



0 5km  
Image: Google Earth 2012



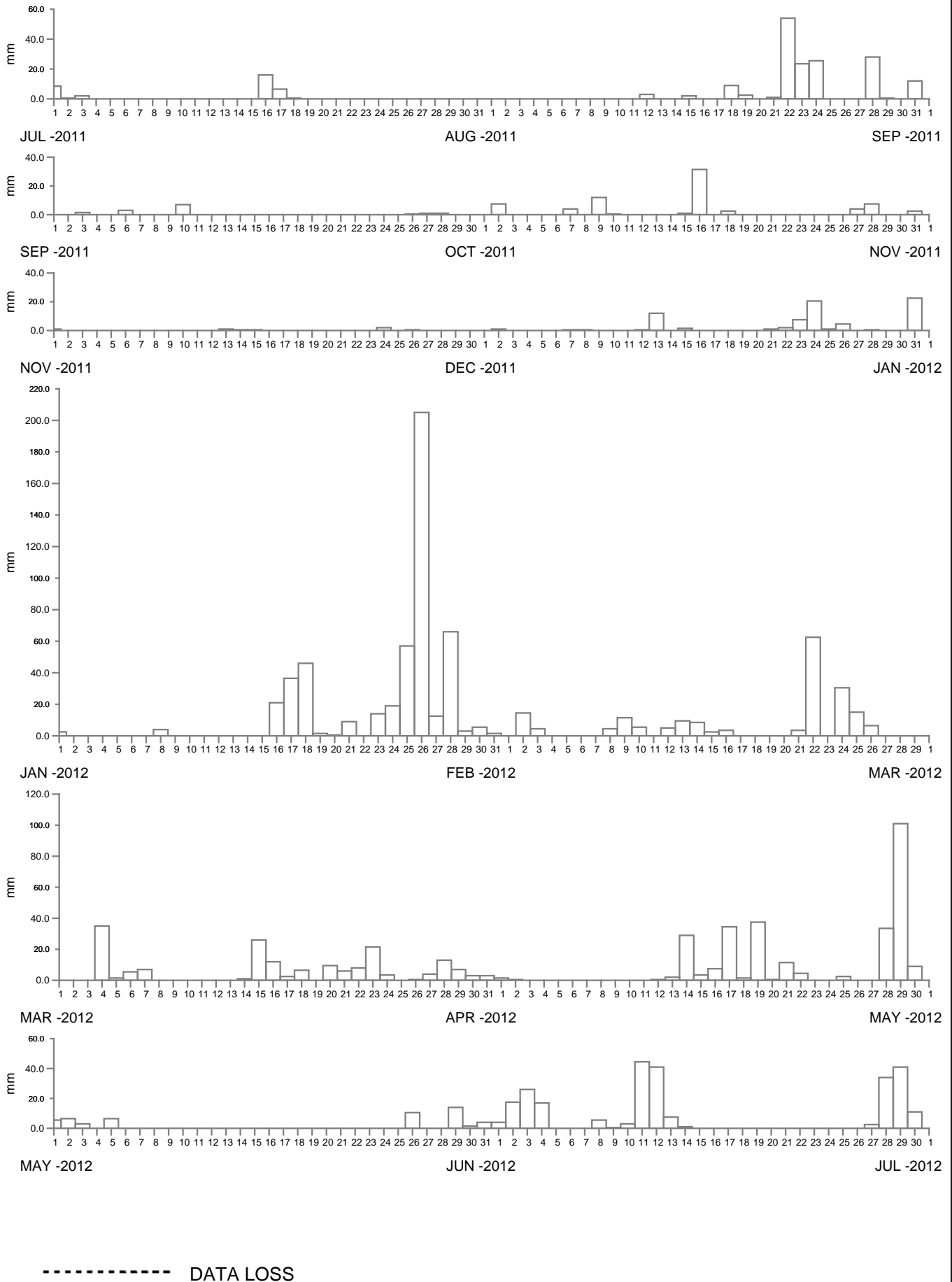
**Public Works**  
Manly Hydraulics Laboratory

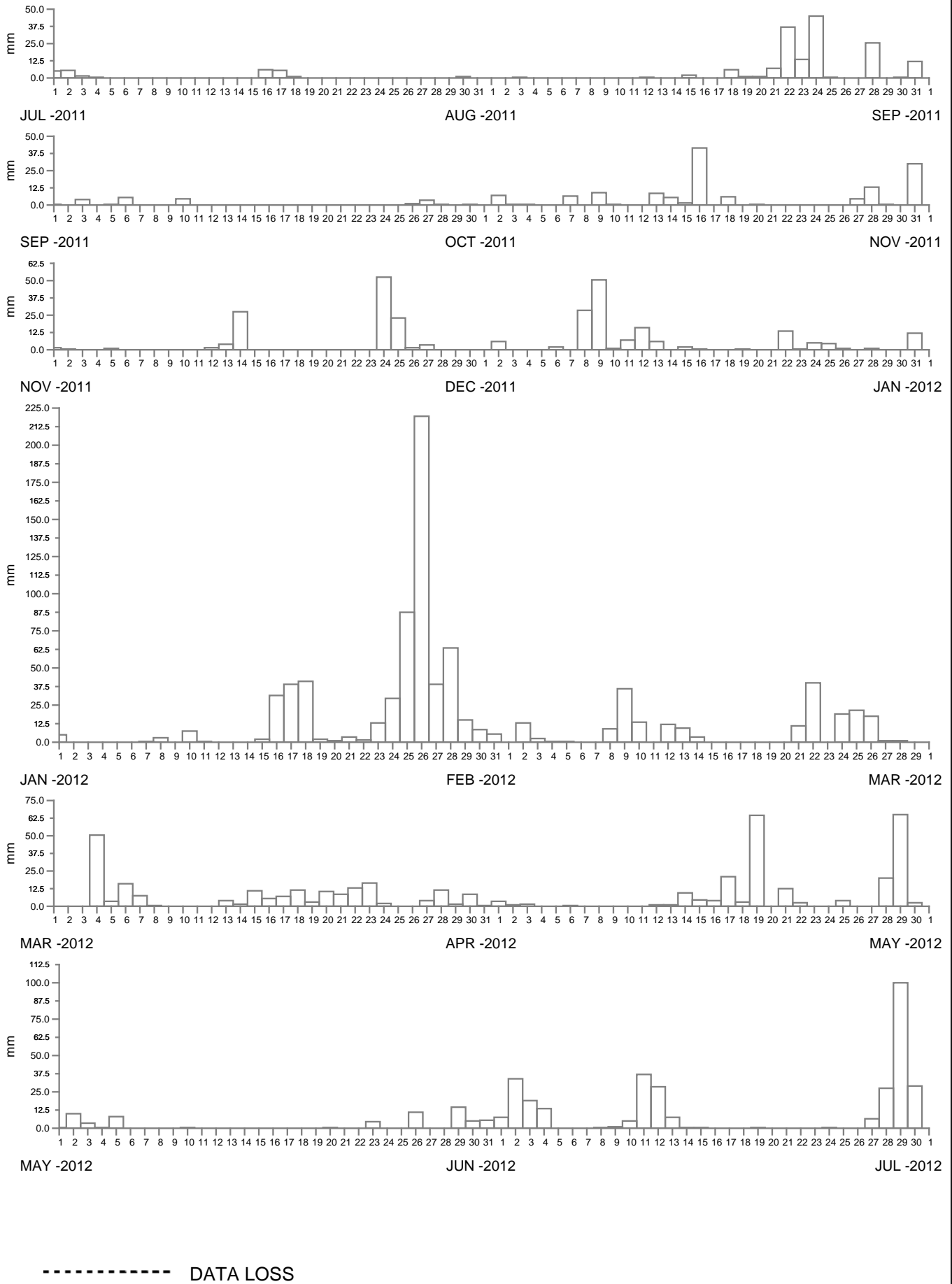
**RAINFALL STATION LOCATIONS  
TWEED RIVER AND BRUNSWICK RIVER REGIONS**

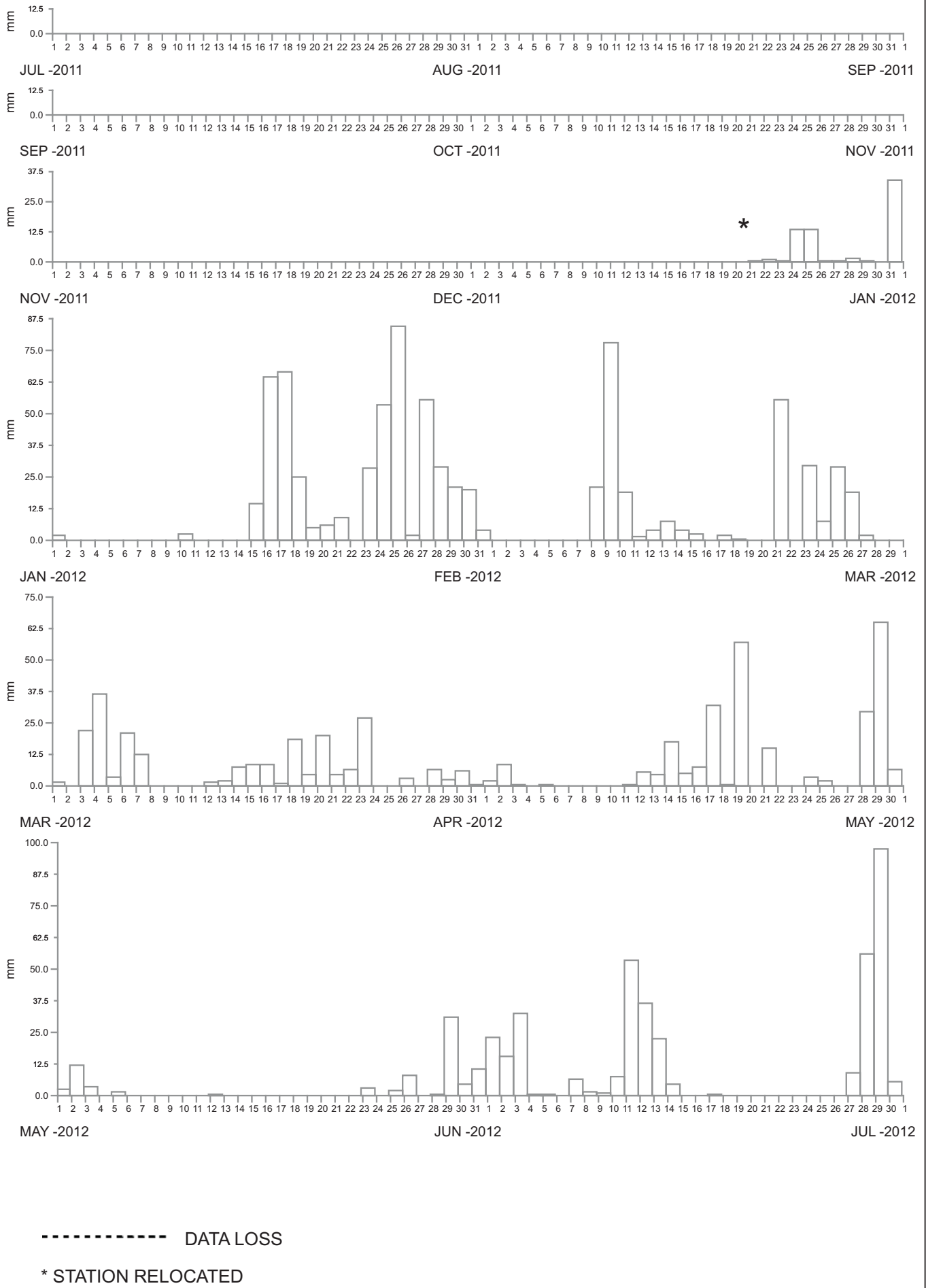
MHL  
Report 2159

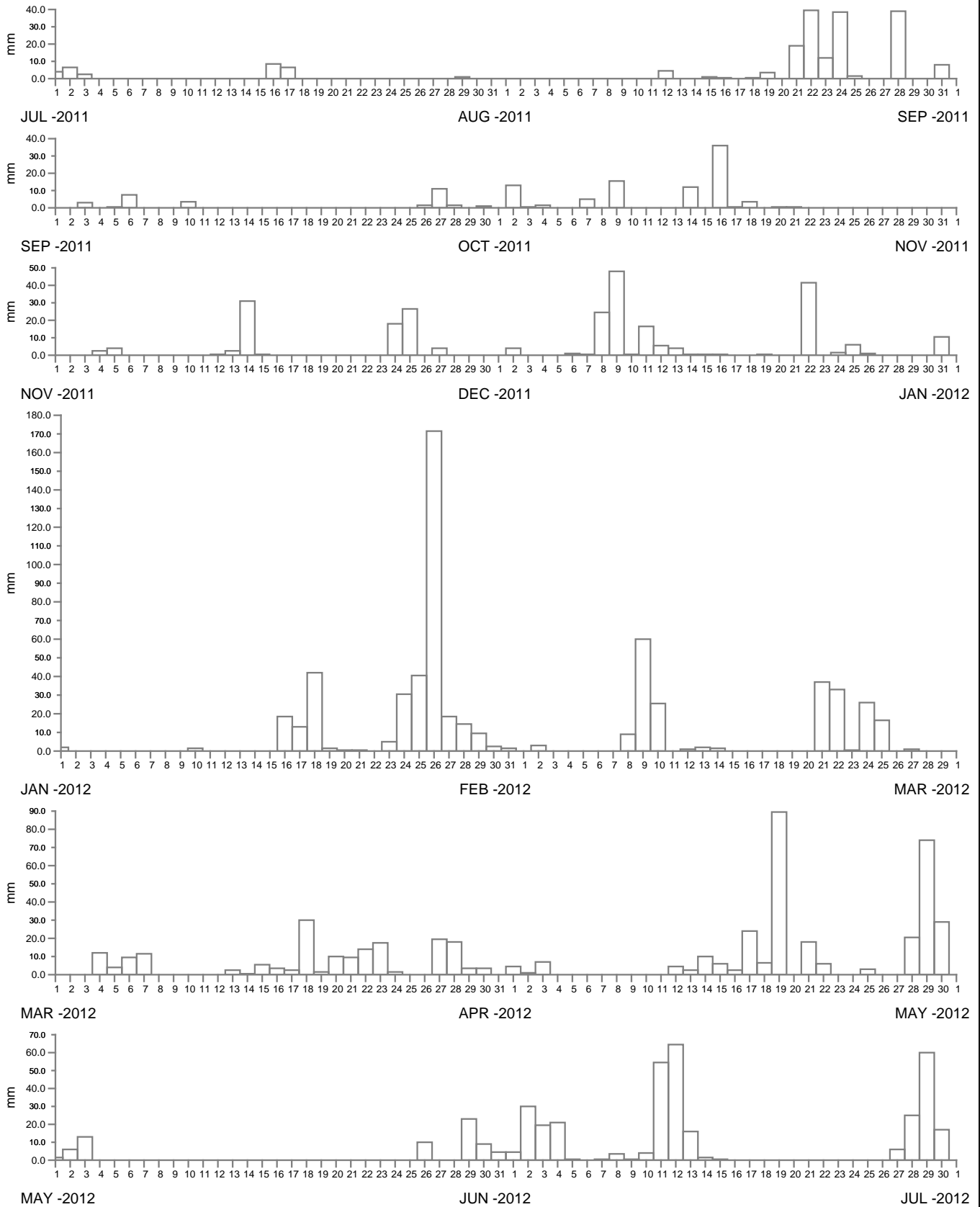
Figure  
4

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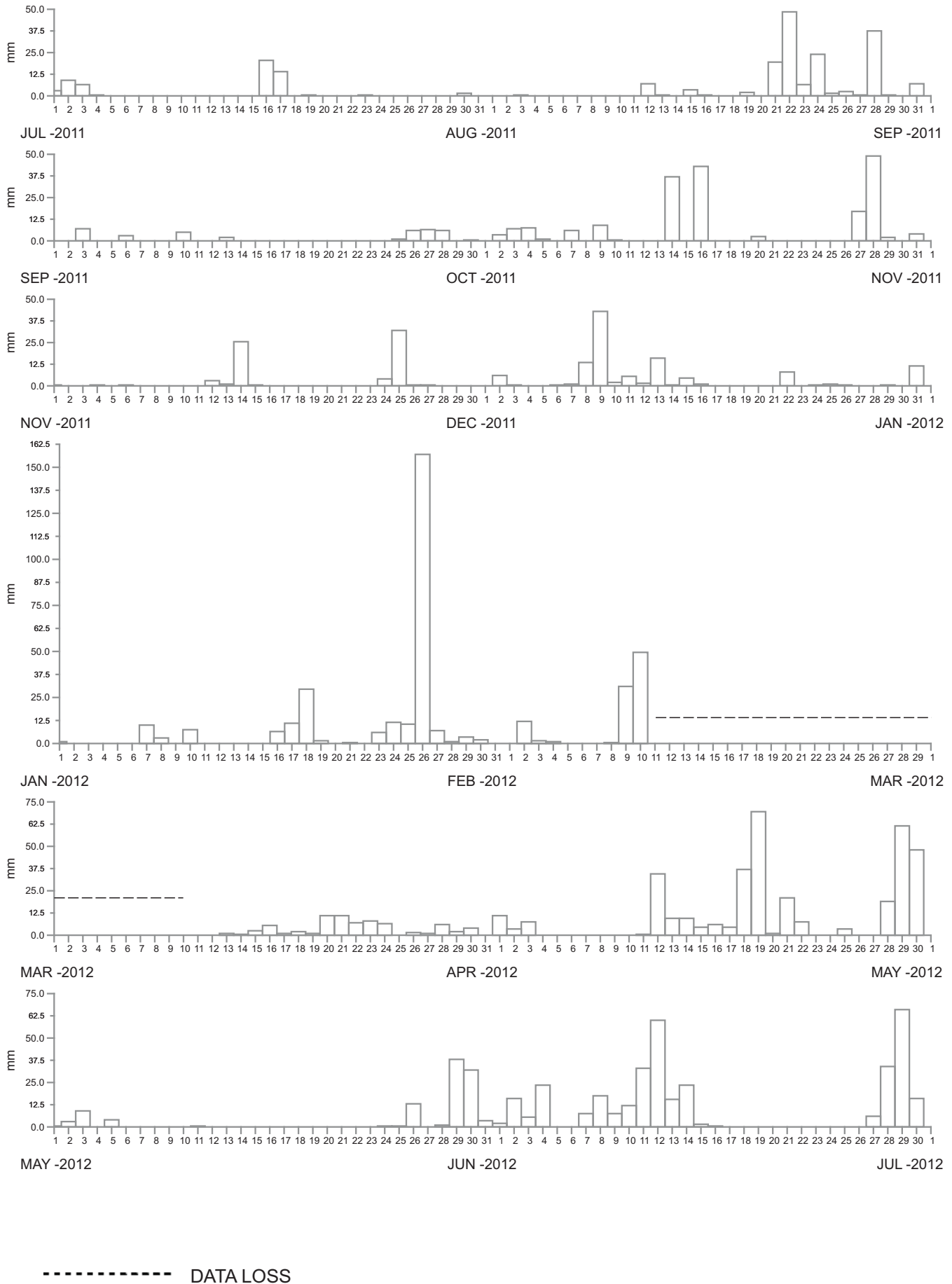














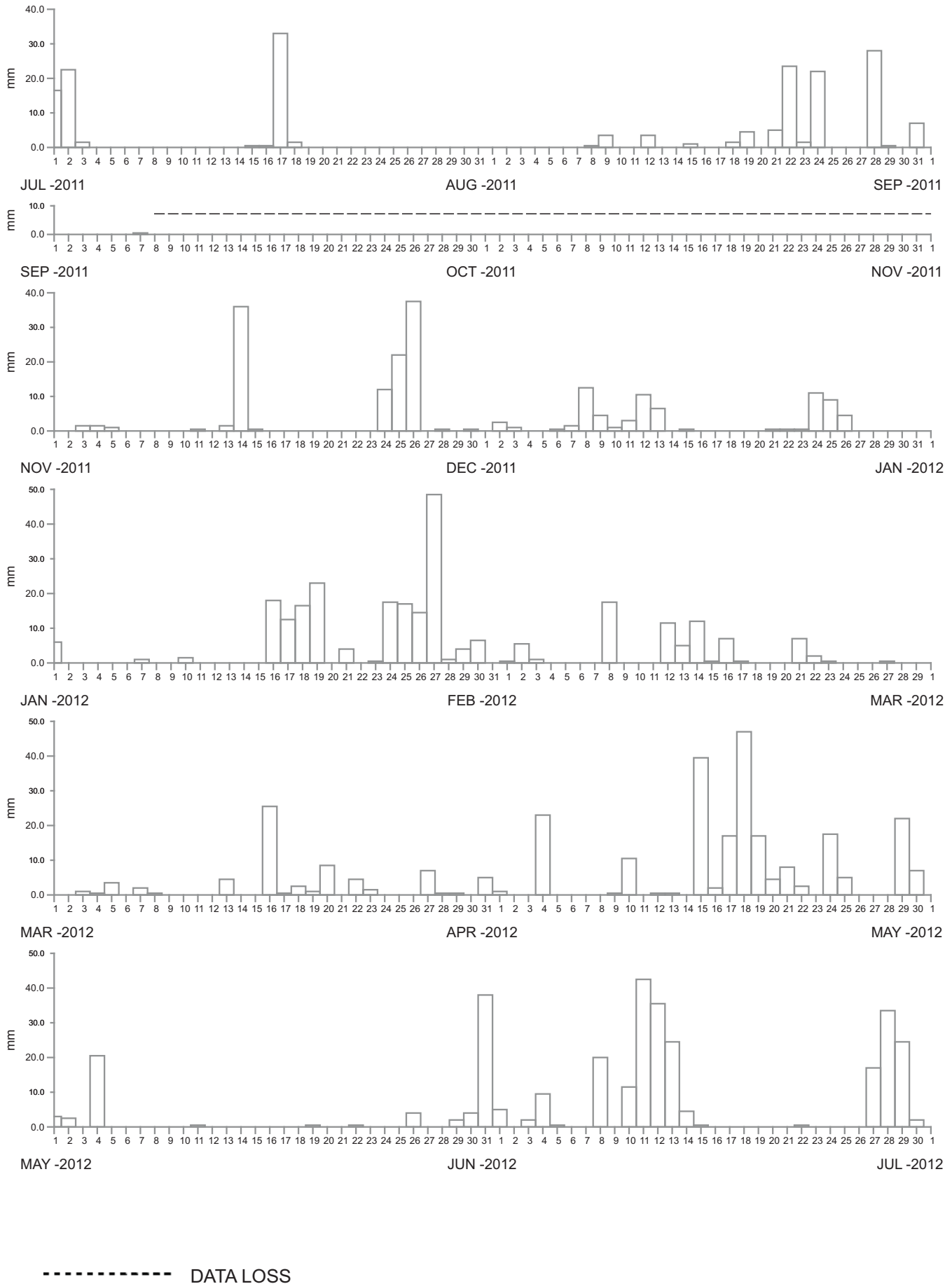
**Public Works**  
Manly Hydraulics Laboratory

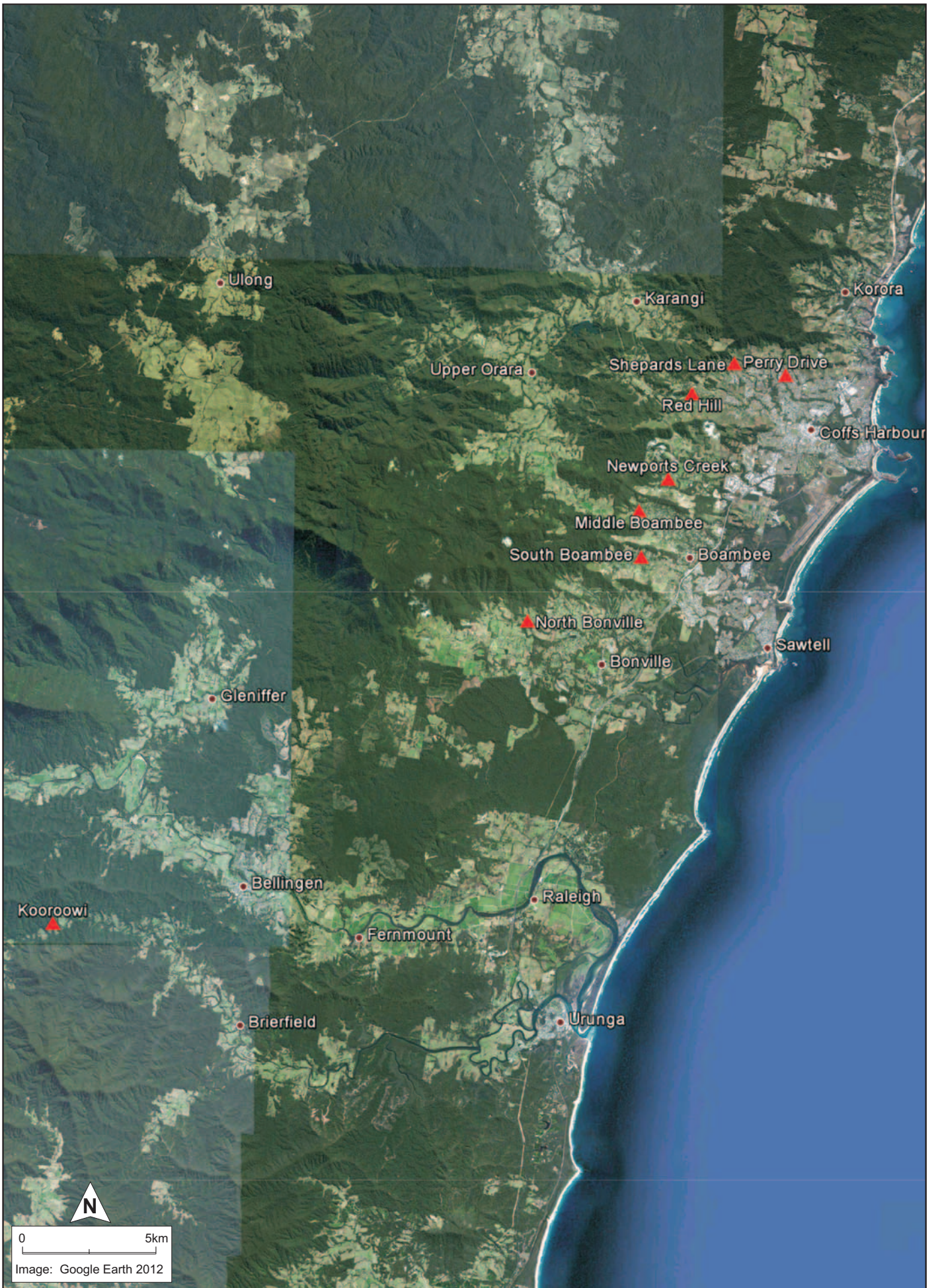
**RAINFALL STATION LOCATIONS  
BELLINGER RIVER REGION (NORTH)**

MHL  
Report 2159

Figure  
**11**

DRAWING 2159-11.cdr





0 5km  
Image: Google Earth 2012



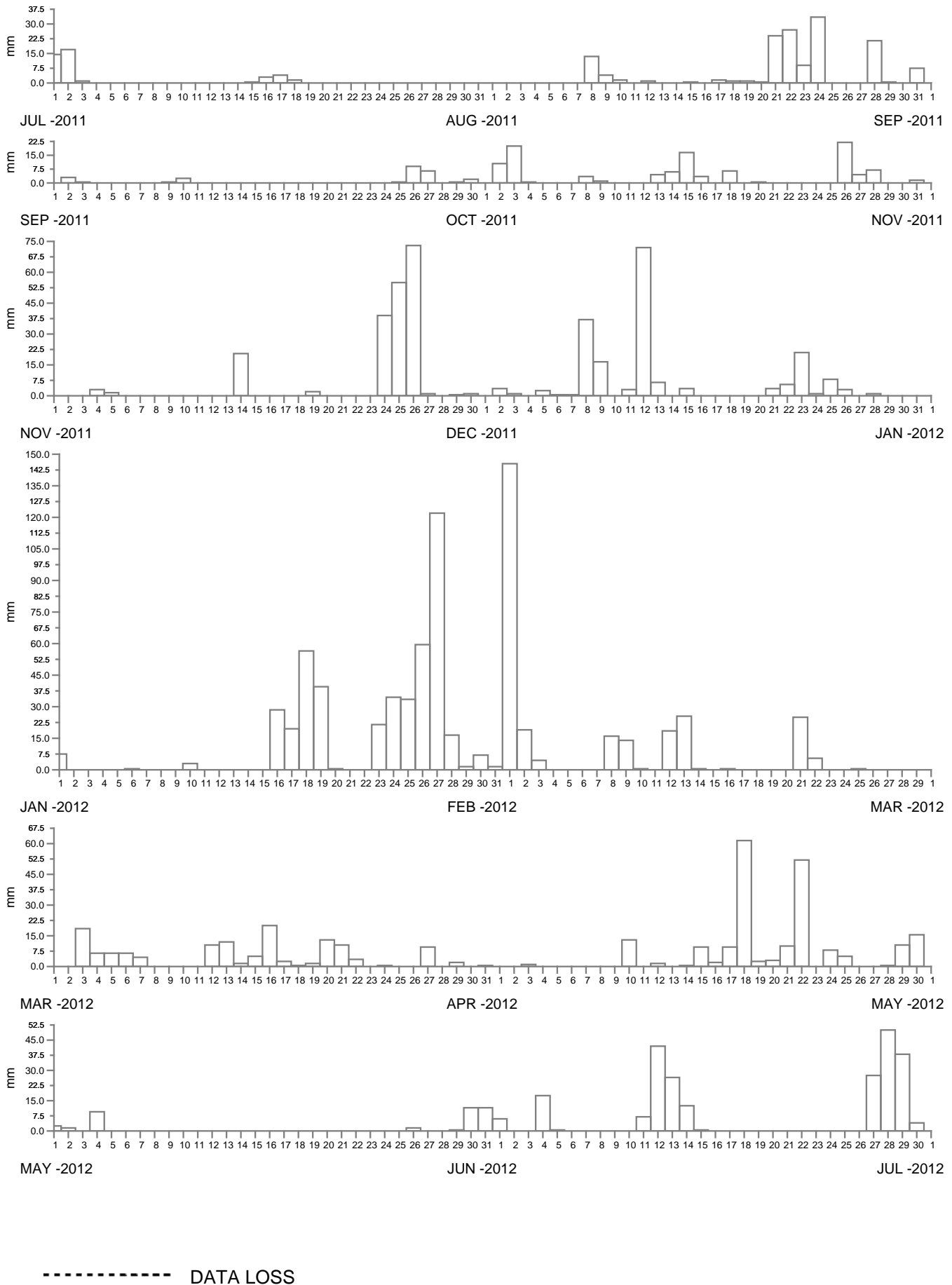
**Public Works**  
Manly Hydraulics Laboratory

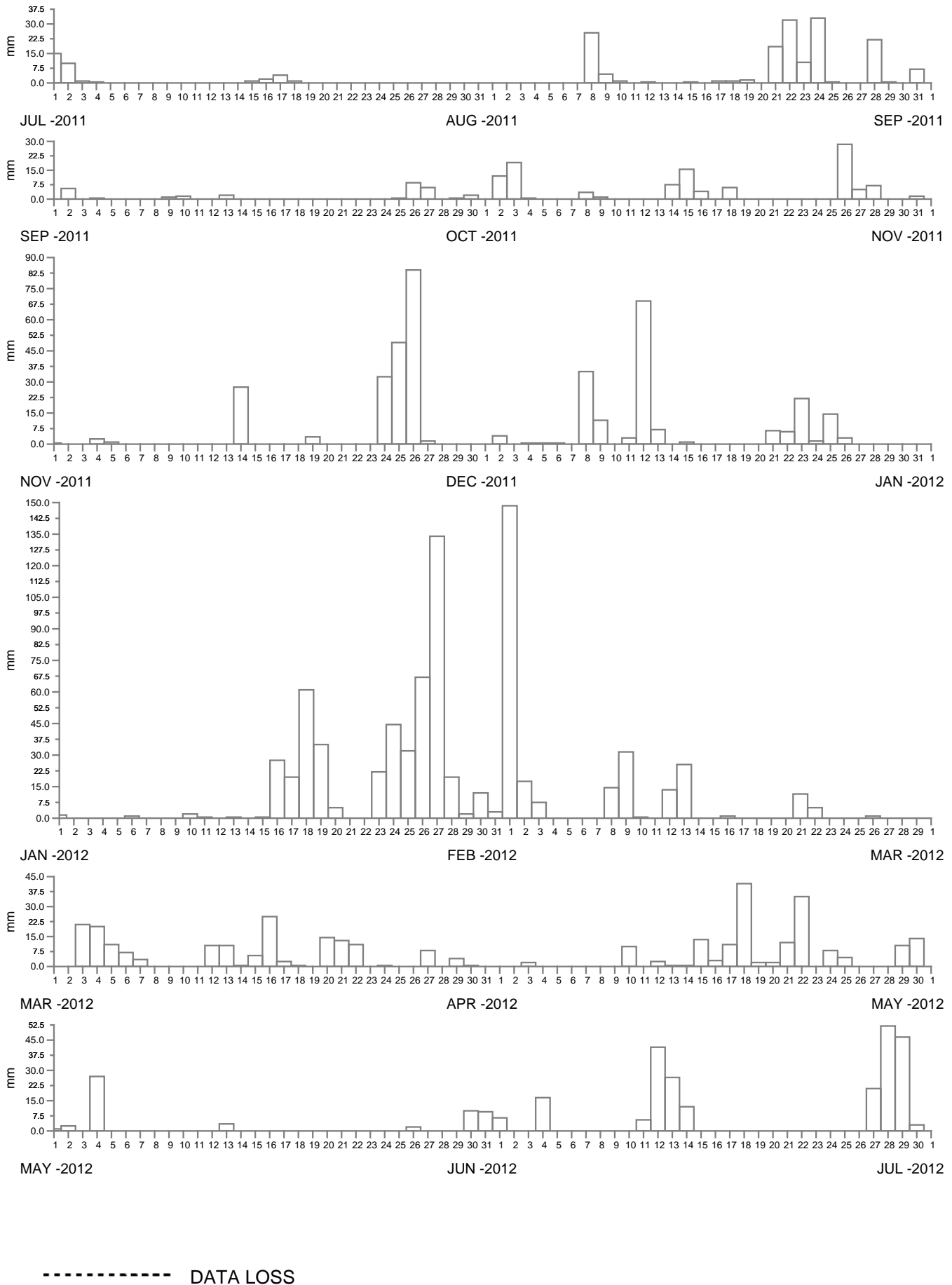
**RAINFALL STATION LOCATIONS  
BELLINGER RIVER REGION**

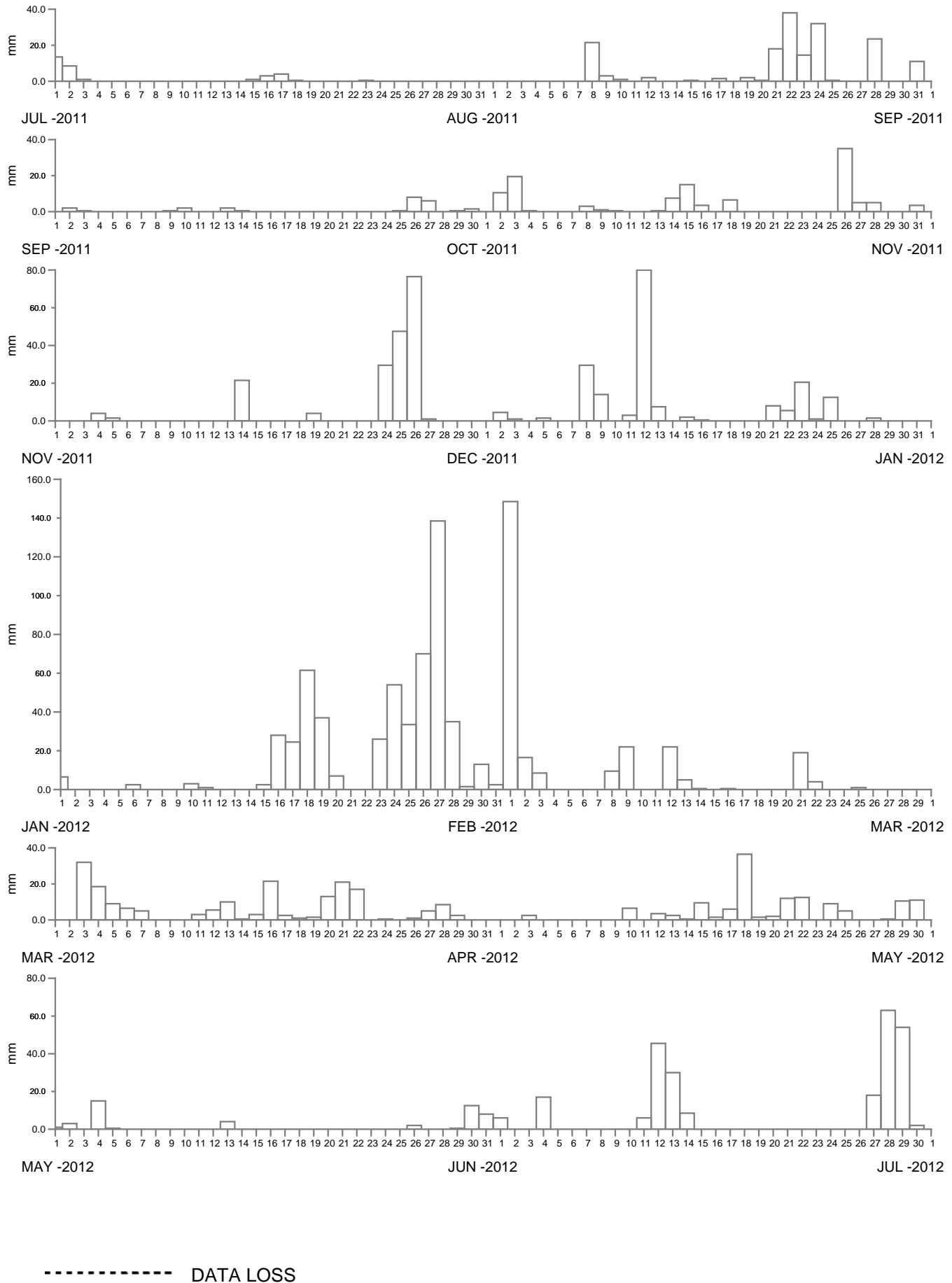
MHL  
Report 2159

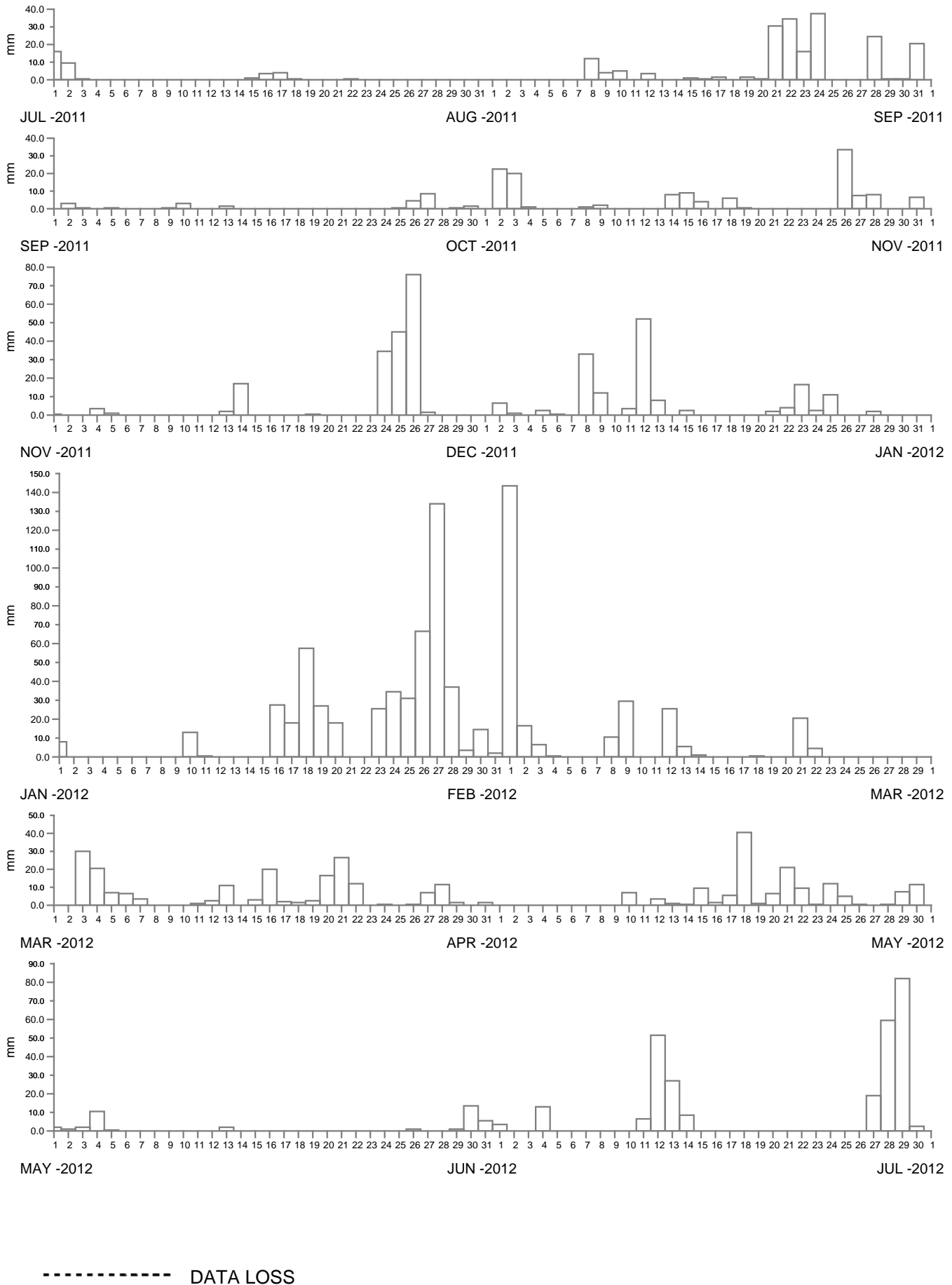
Figure  
**13**

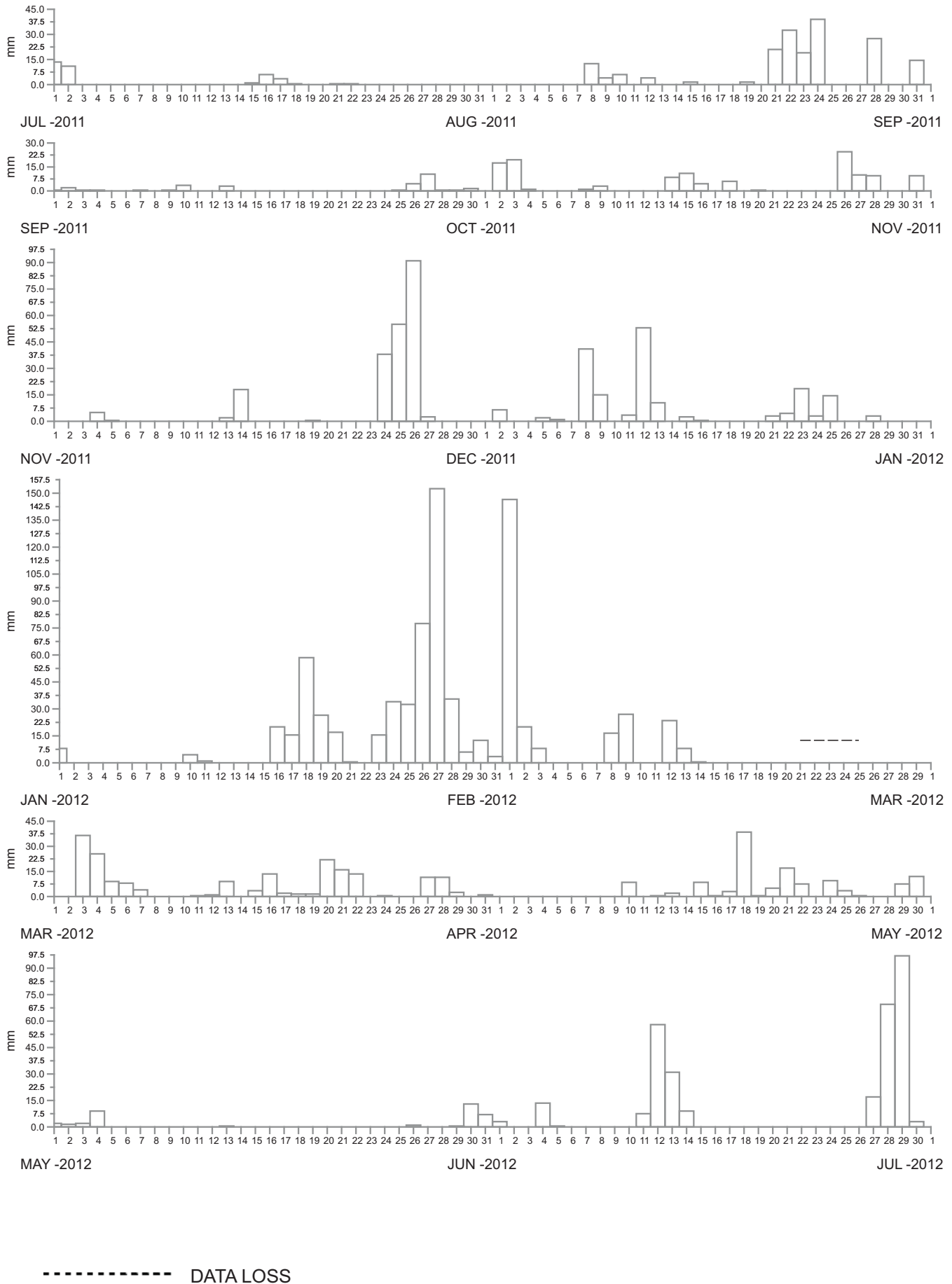
DRAWING 2159-13.cdr

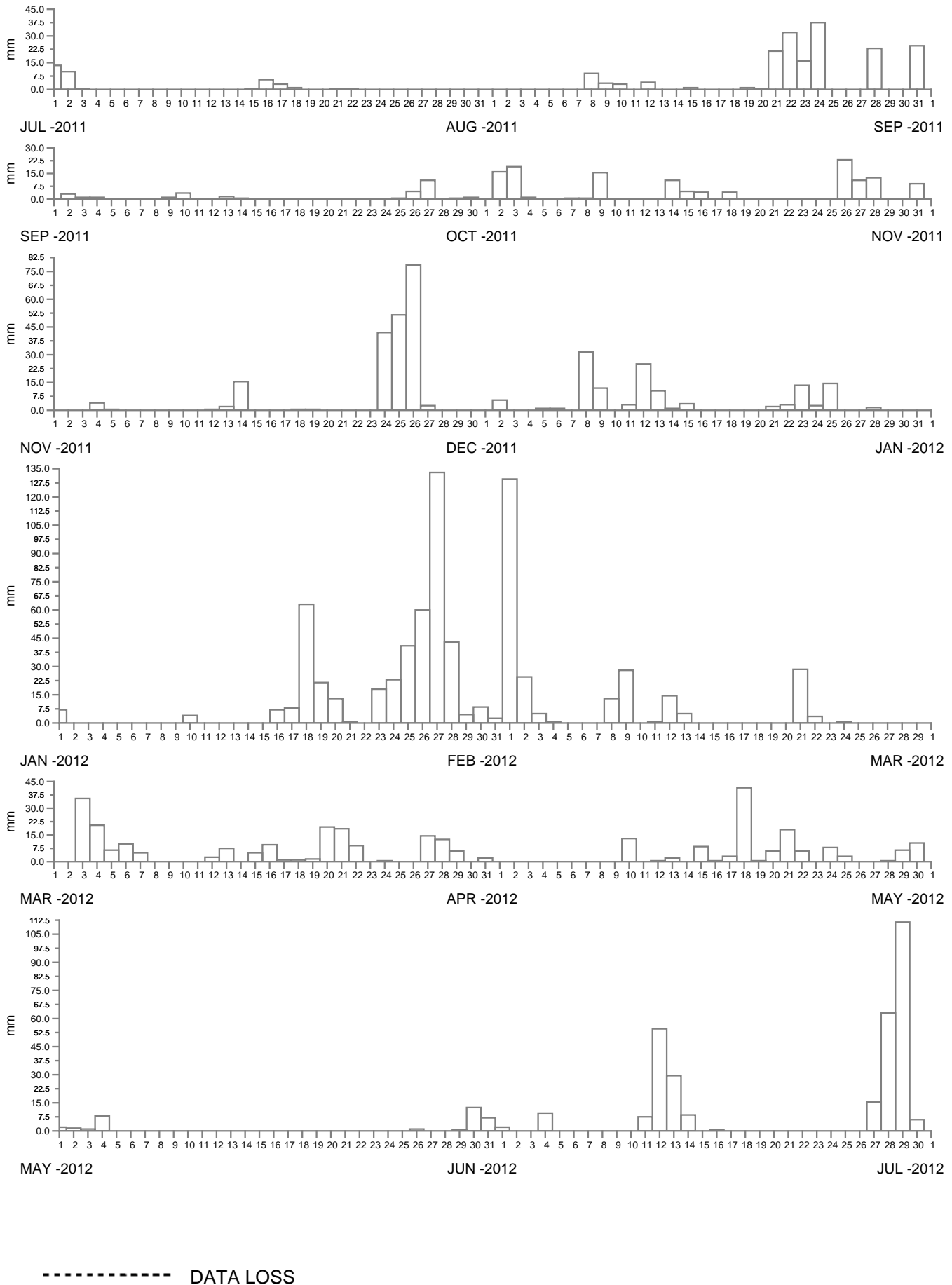


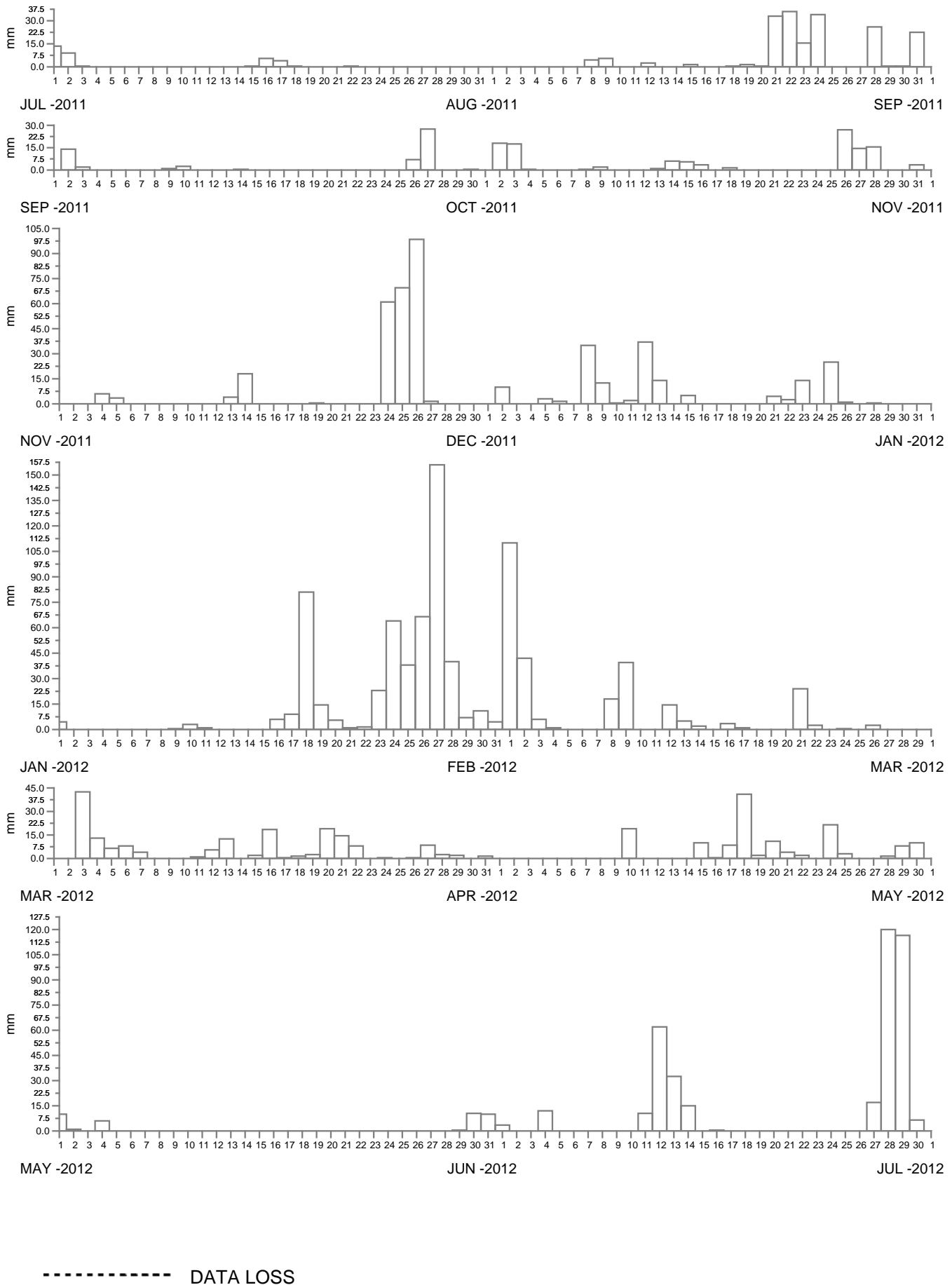


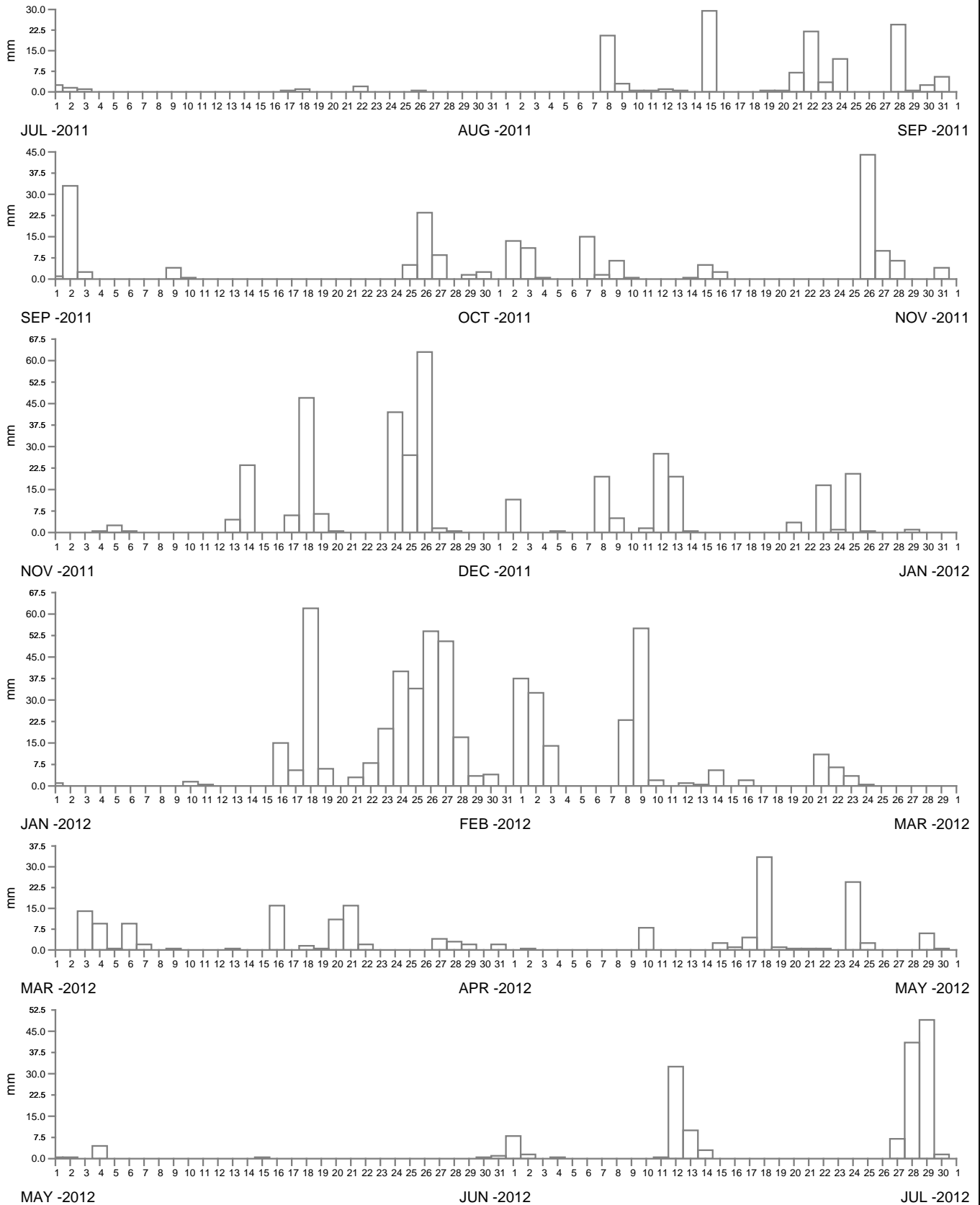


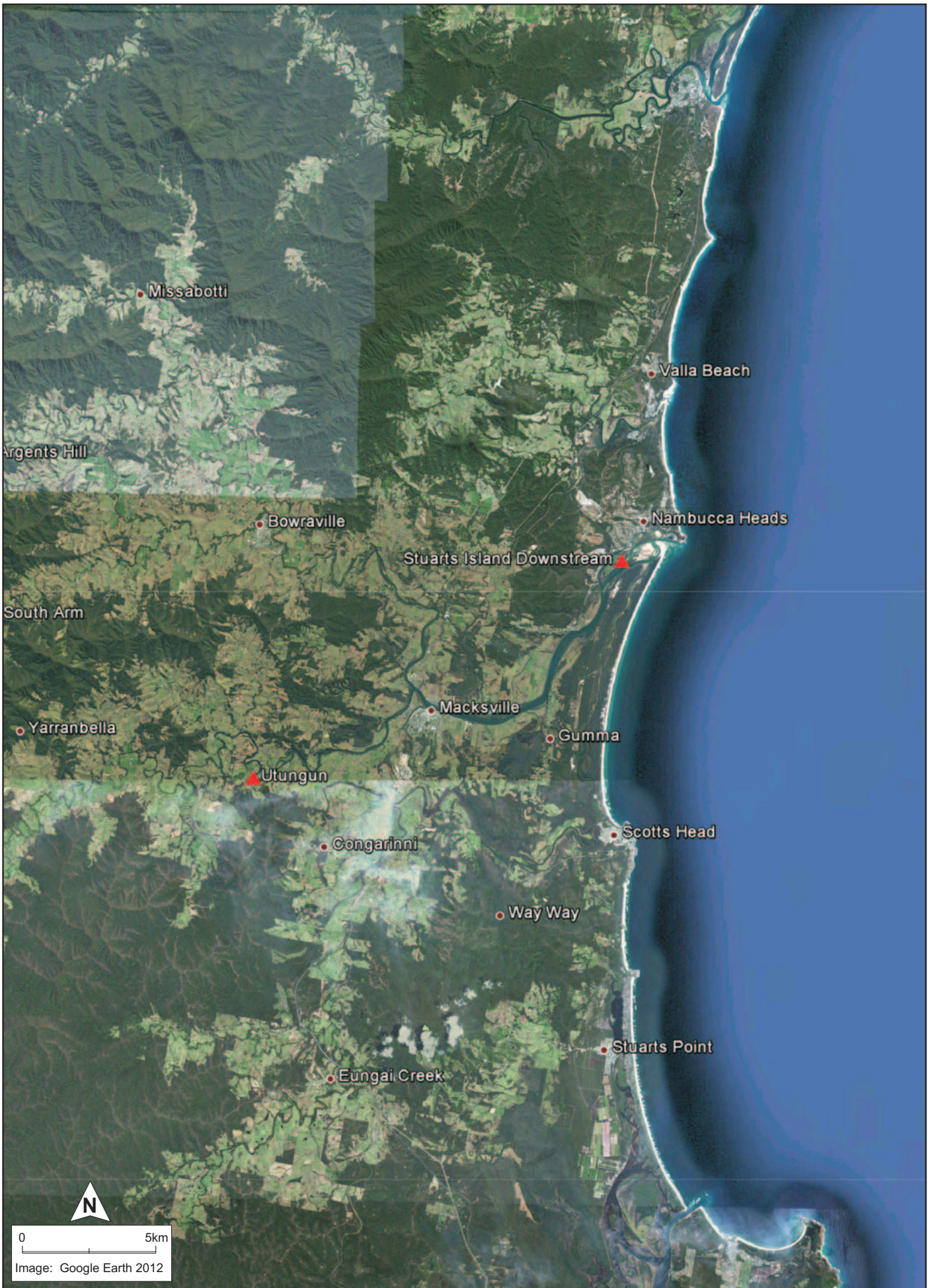












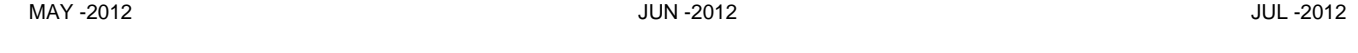
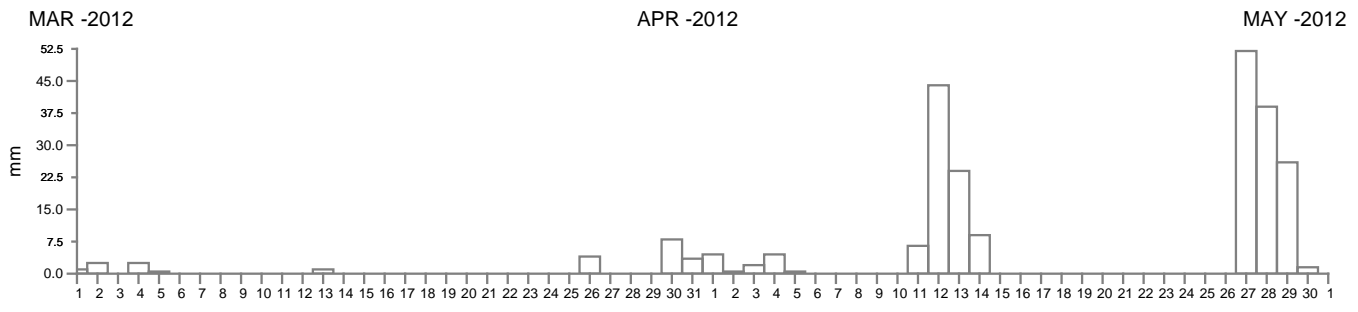
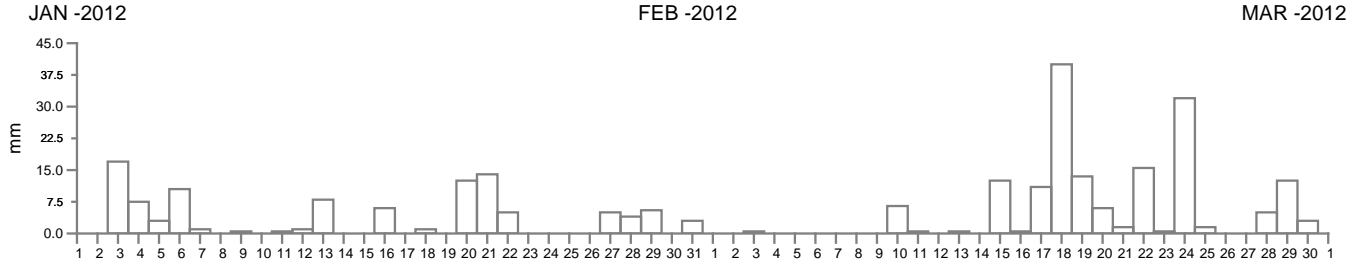
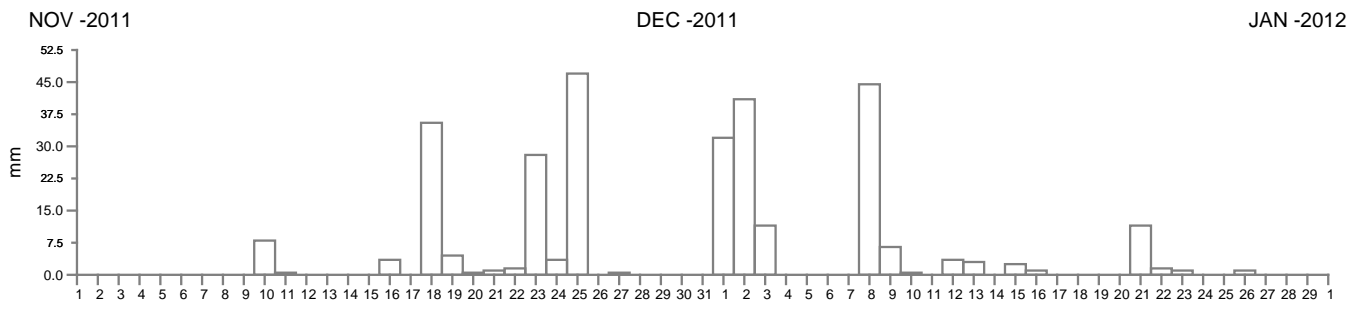
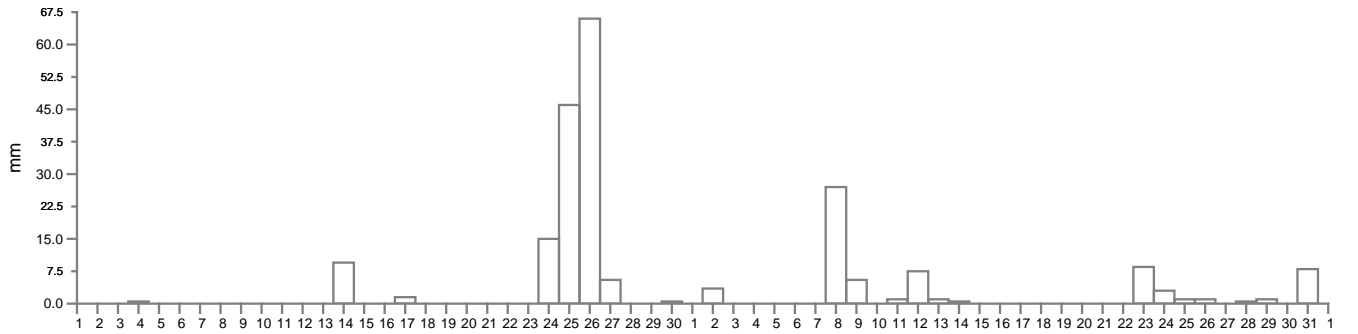
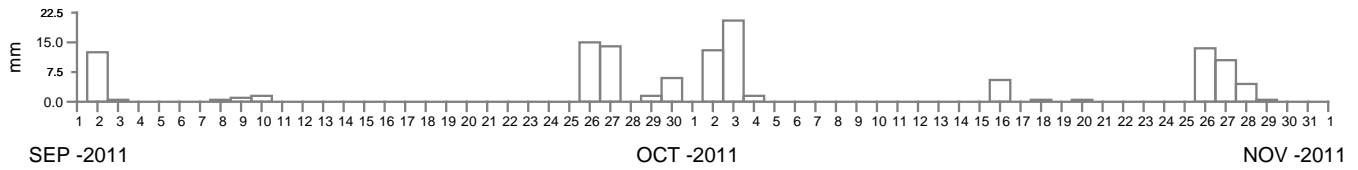
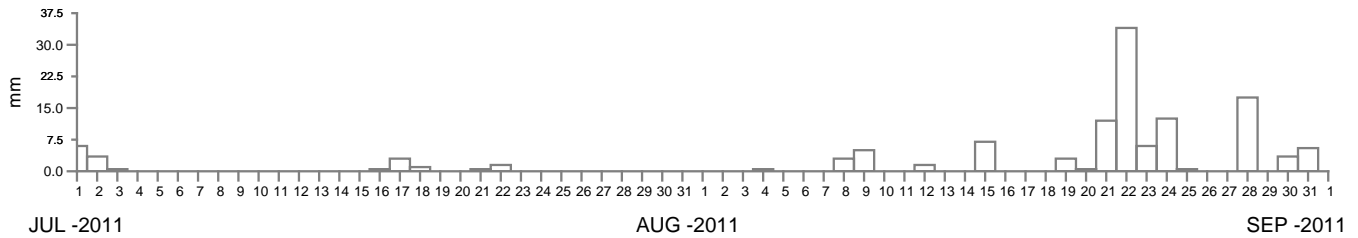
  
 0 5km  
 Image: Google Earth 2012



**Public Works**  
 Manly Hydraulics Laboratory

**RAINFALL STATION LOCATIONS  
 NAMBUCCA RIVER REGION**

MHL  
 Report 2159  
**Figure  
 22**  
DRAWING 2159-22.cdr



----- DATA LOSS



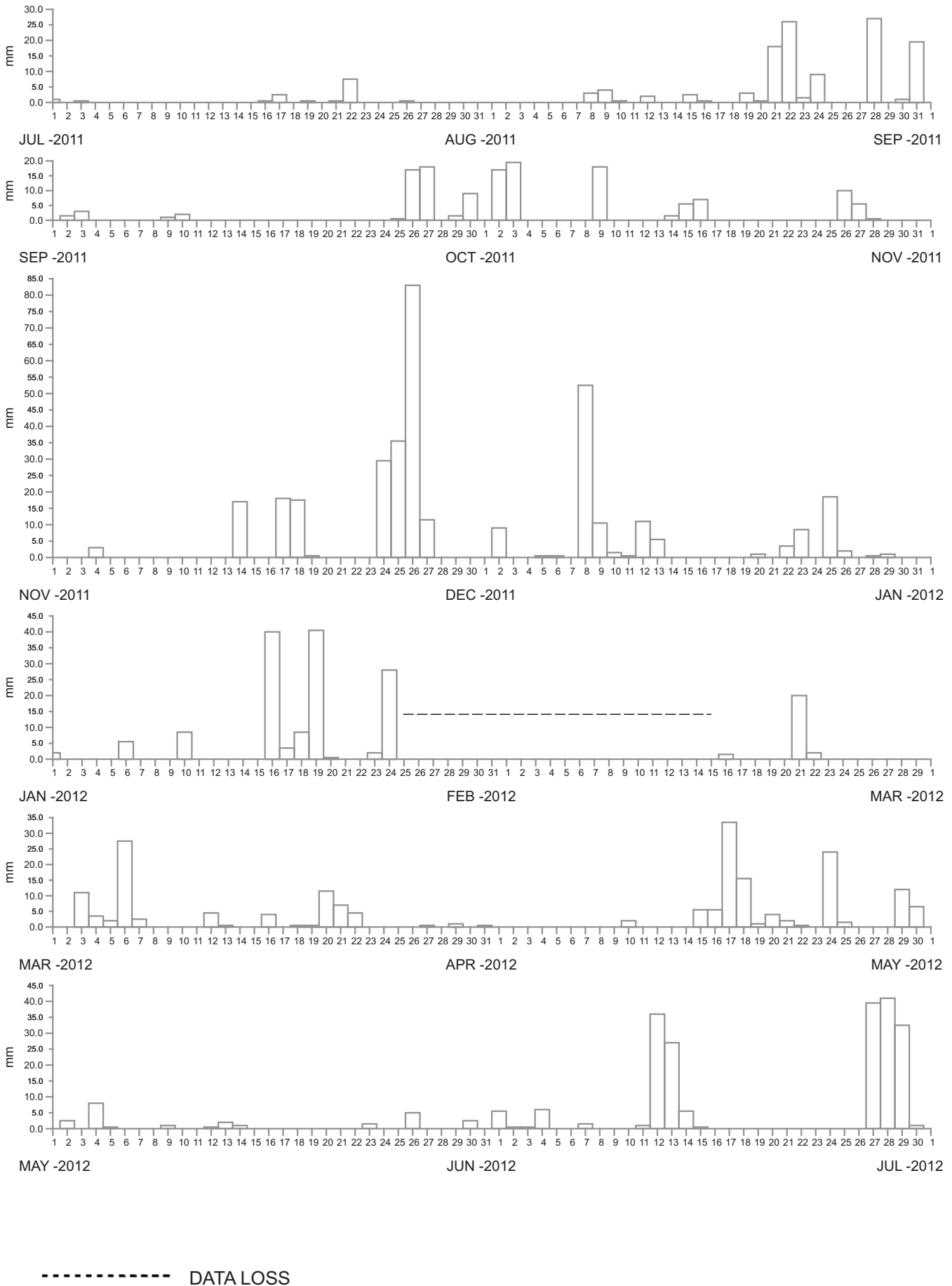
**Public Works**  
Manly Hydraulics Laboratory

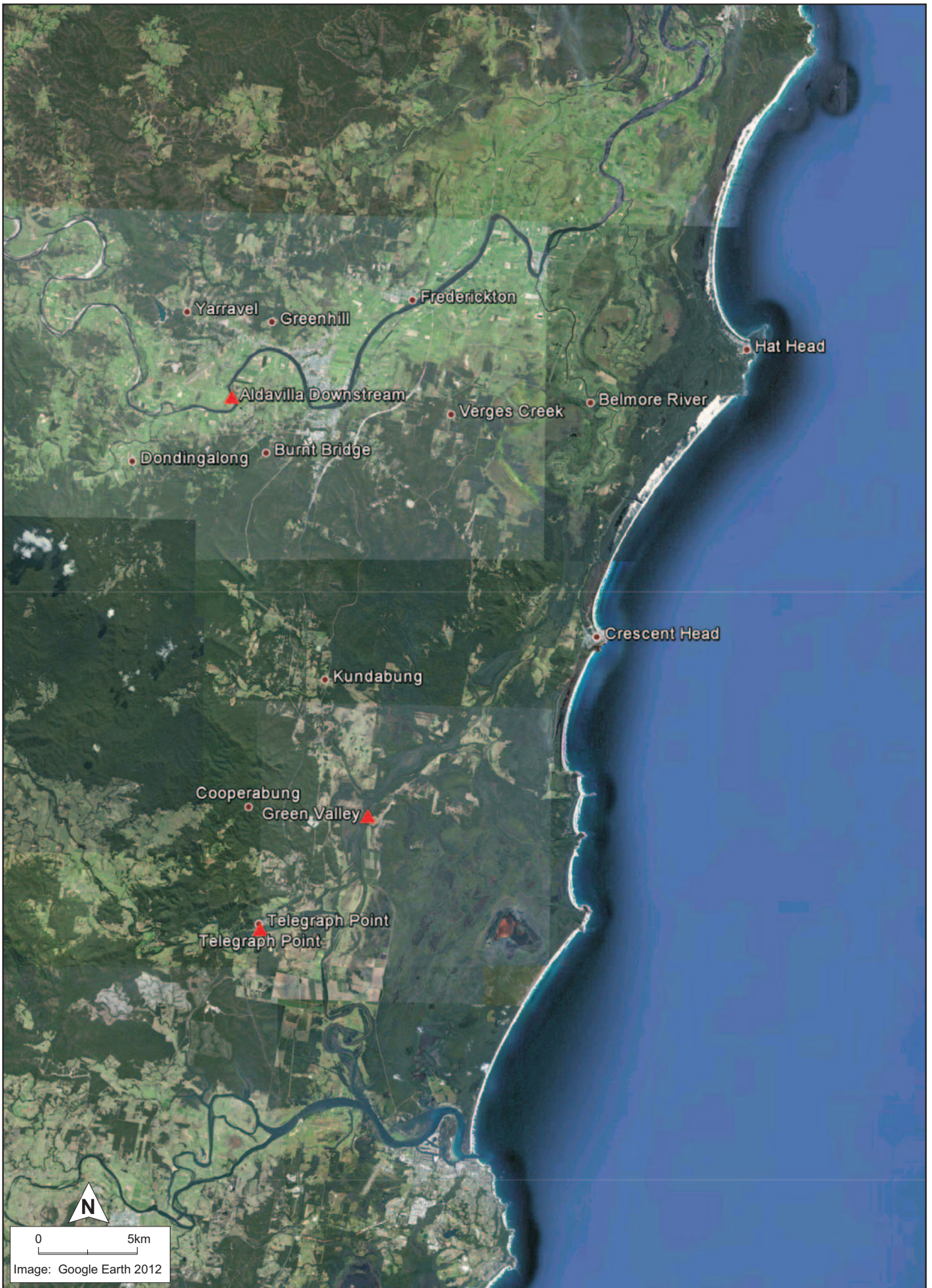
NAMBUCCA RIVER AT STUARTS ISLAND DOWNSTREAM  
2011-2012

MHL  
Report 2159

Figure  
**23**

DRAWING 2159-23





**Public Works**  
Manly Hydraulics Laboratory

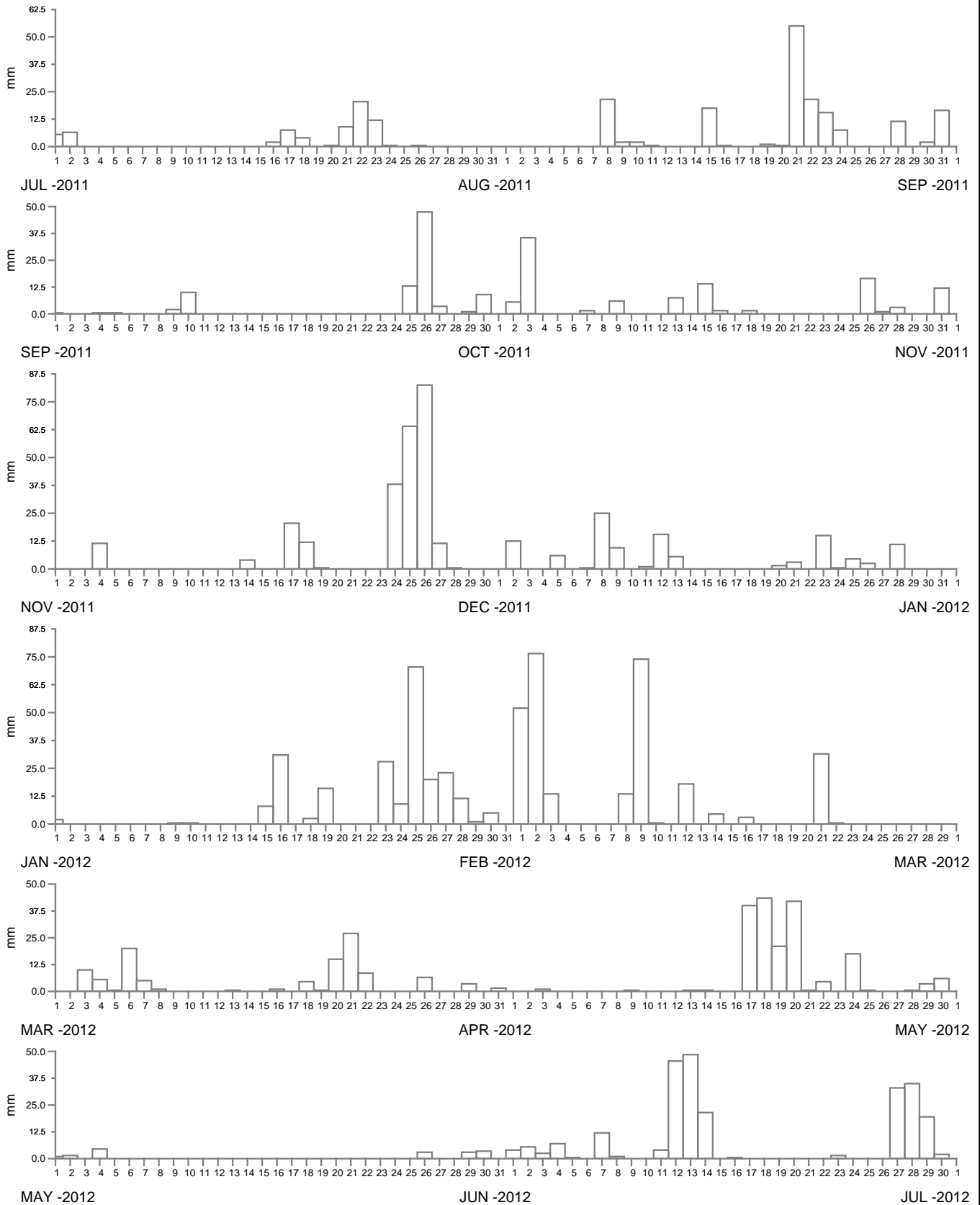
**RAINFALL STATION LOCATIONS  
MACLEAY RIVER AND HASTINGS RIVER REGIONS**

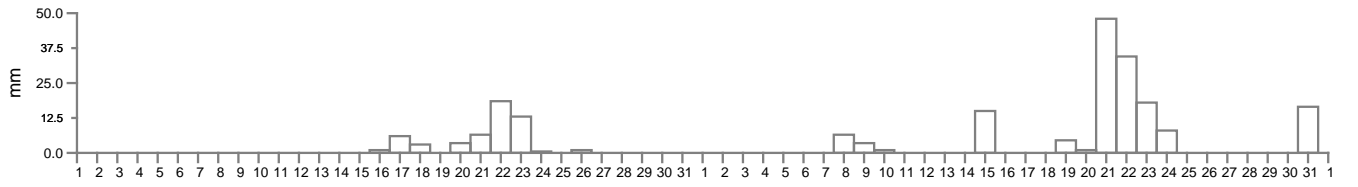
MHL  
Report 2159

Figure  
25

DRAWING 2159-25.cdr



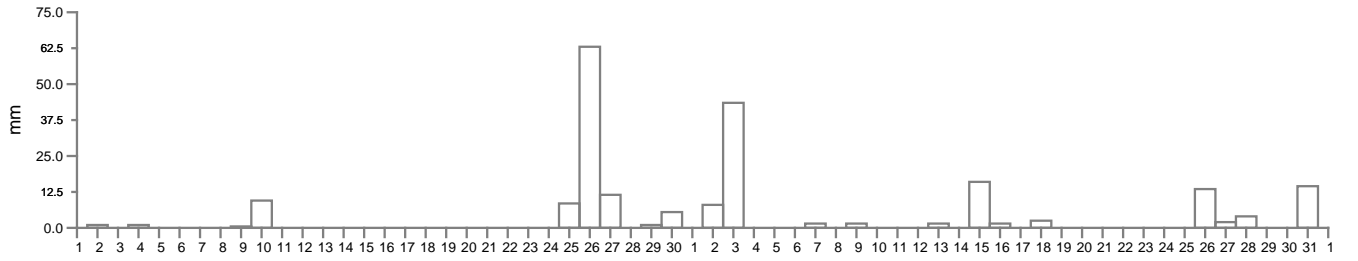




JUL -2011

AUG -2011

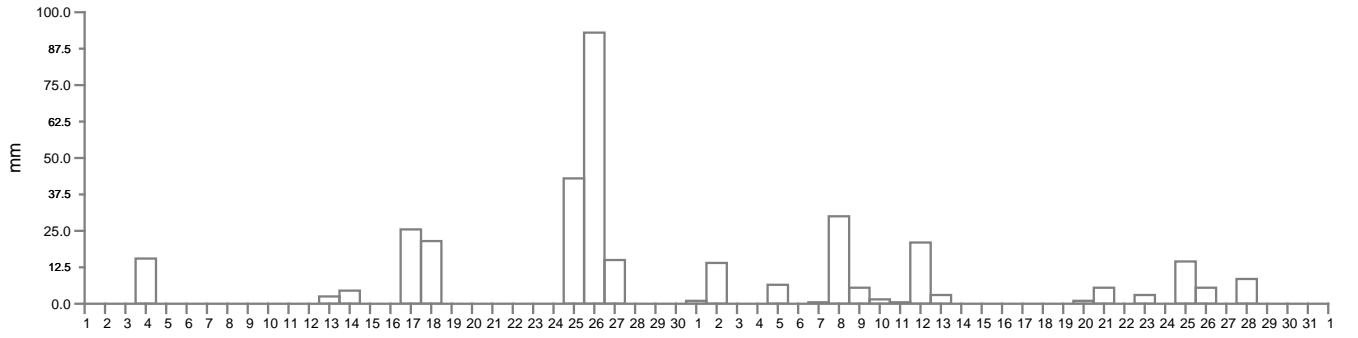
SEP -2011



SEP -2011

OCT -2011

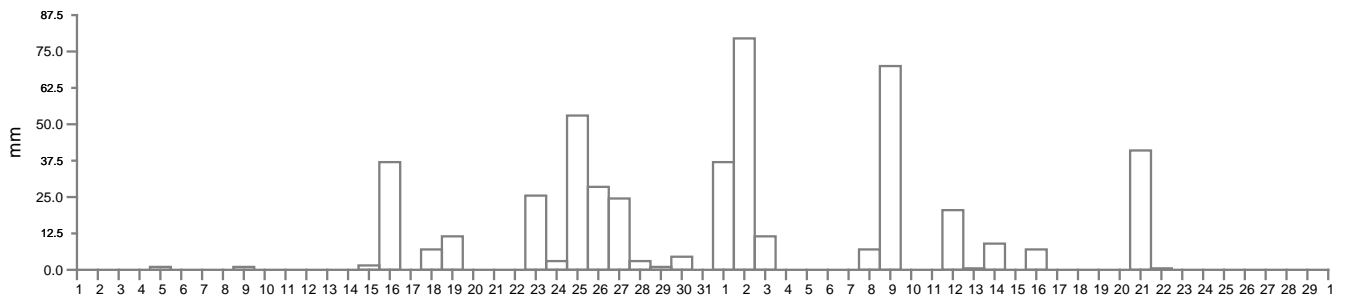
NOV -2011



NOV -2011

DEC -2011

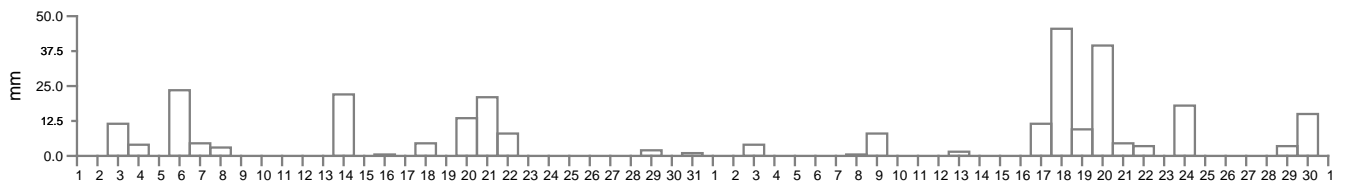
JAN -2012



JAN -2012

FEB -2012

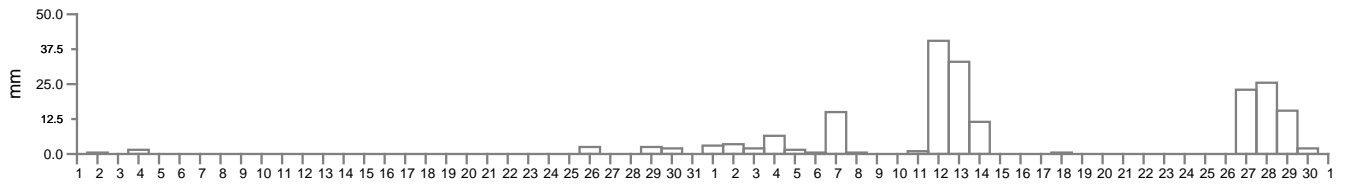
MAR -2012



MAR -2012

APR -2012

MAY -2012



MAY -2012

JUN -2012

JUL -2012

----- DATA LOSS



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**WILSONS RIVER AT TELEGRAPH POINT**  
2011-2012

MHL  
Report 2159

Figure  
**28**

DRAWING 2159-28



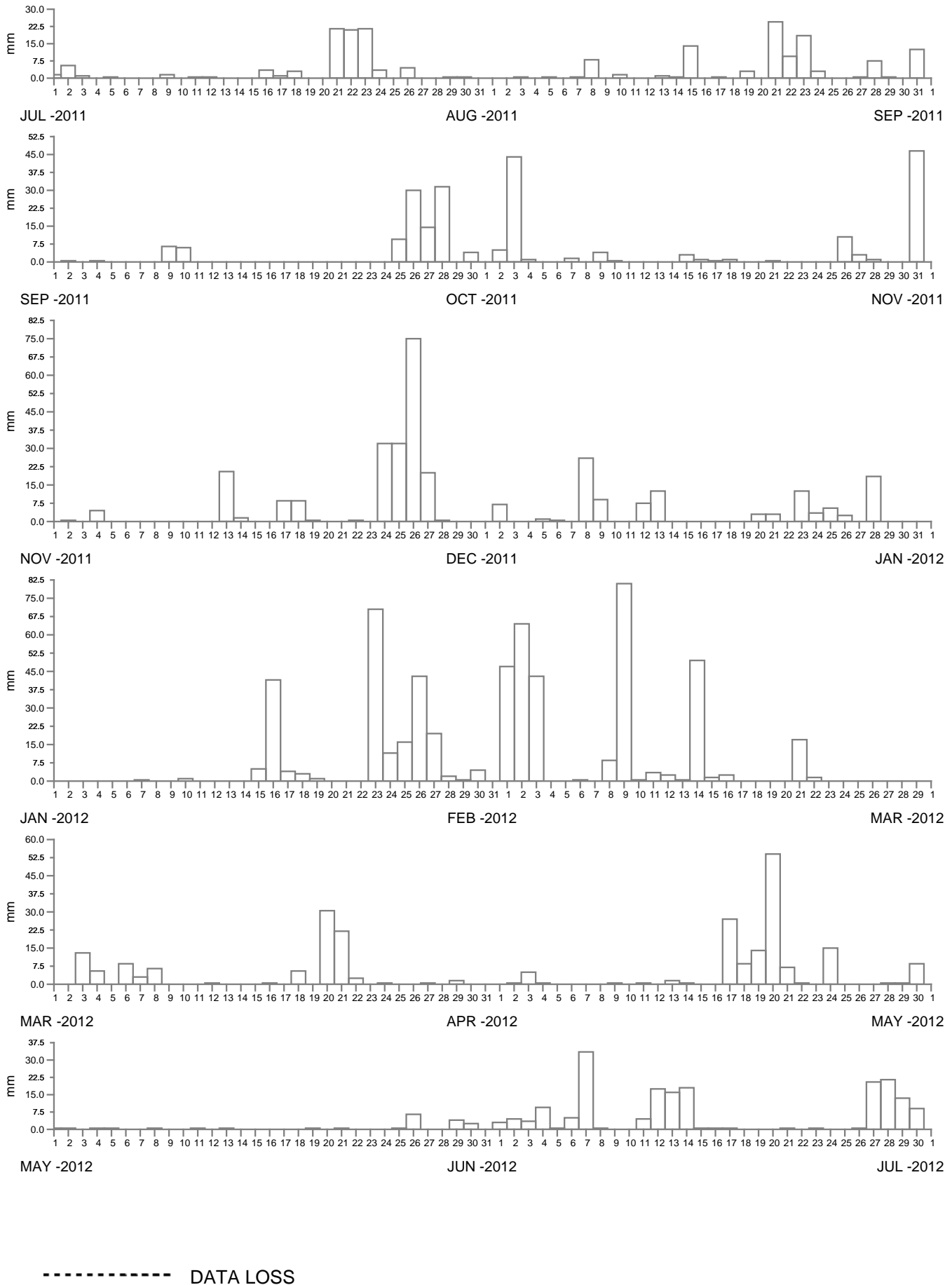
**Public Works**  
Manly Hydraulics Laboratory

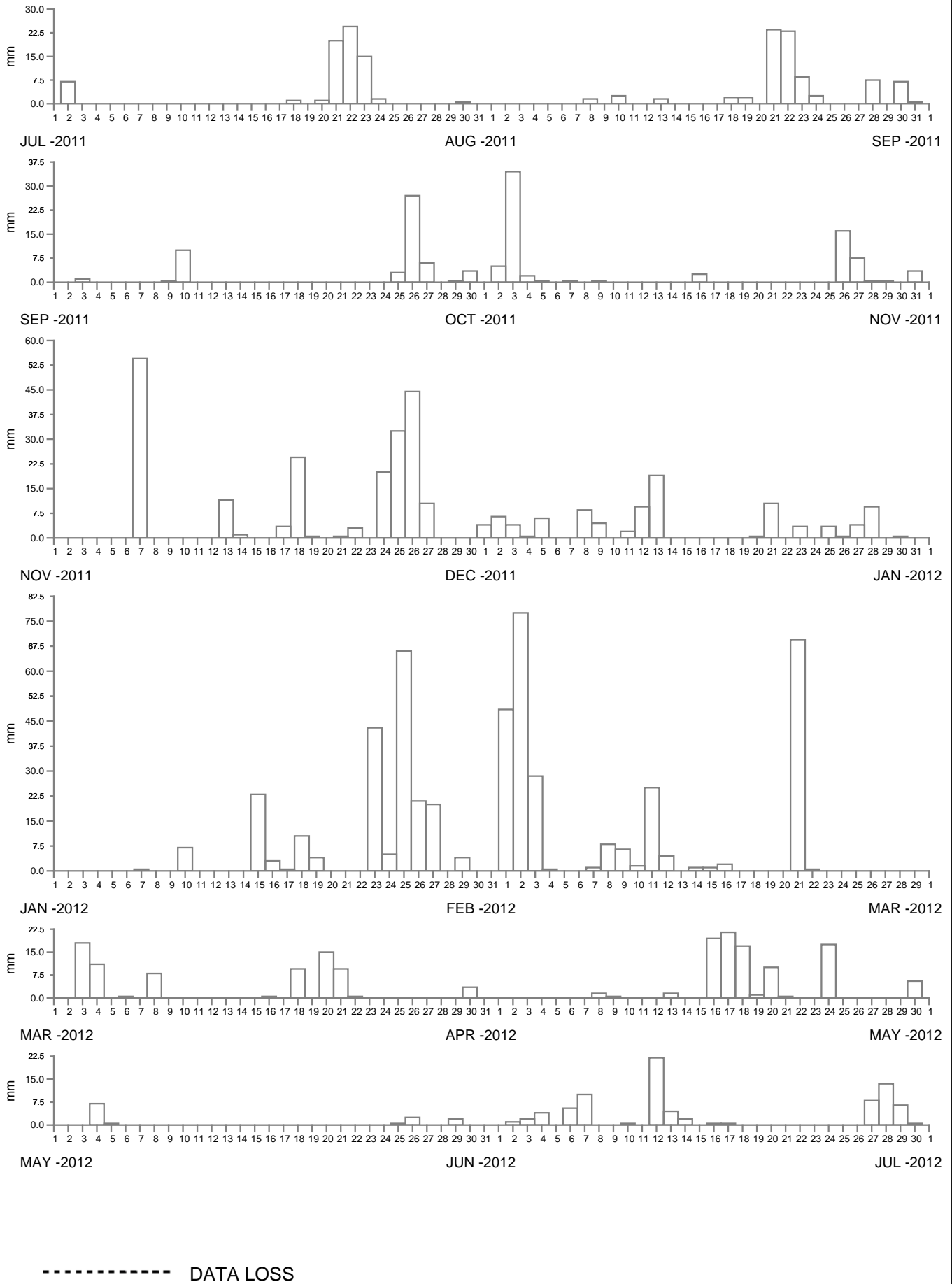
**RAINFALL STATION LOCATIONS  
CAMDEN HAVEN REGION**

MHL  
Report 2159

Figure  
29

DRAWING 2159-29.cdr







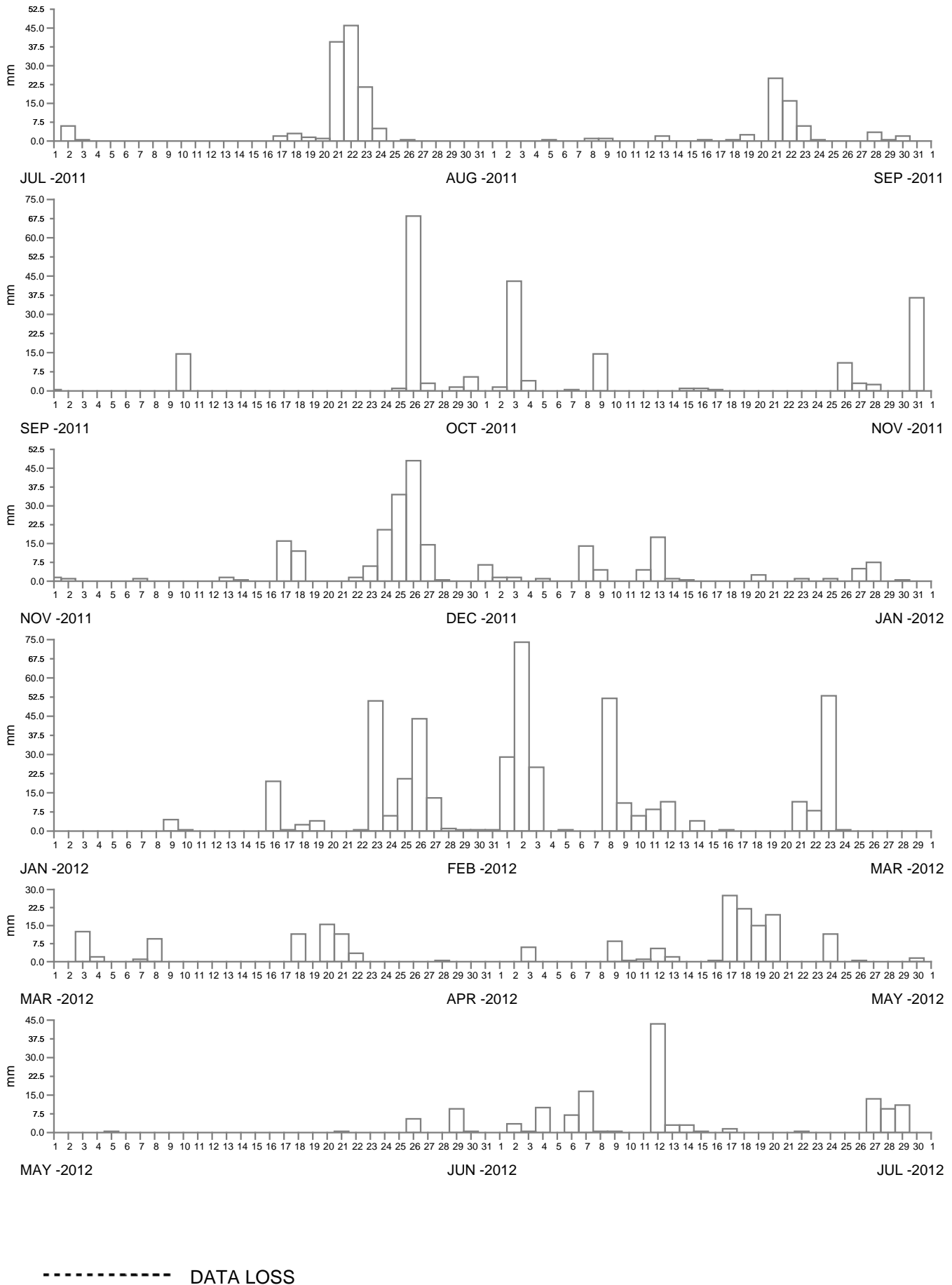
0 10km  
Image: Google Earth 2012

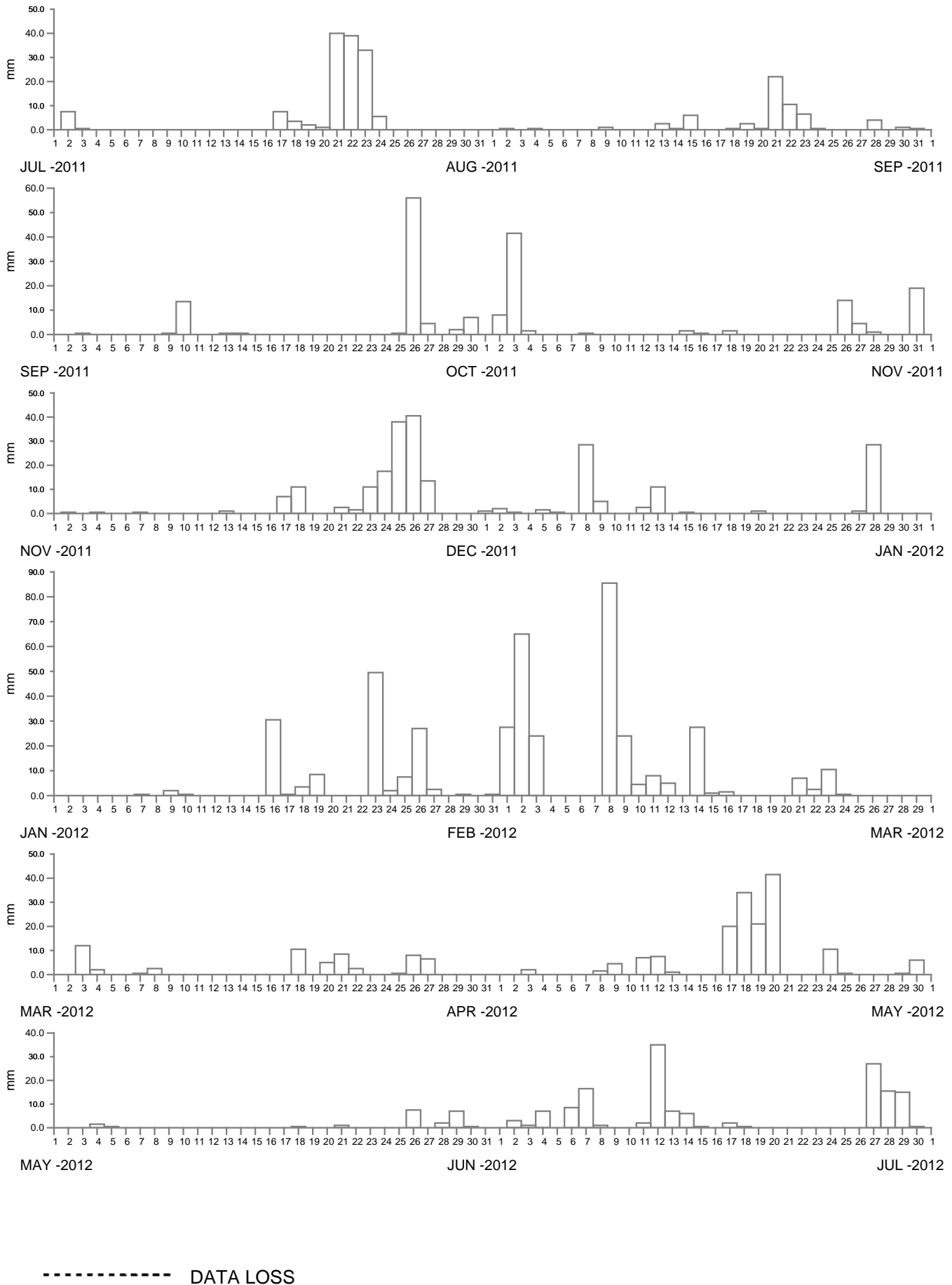


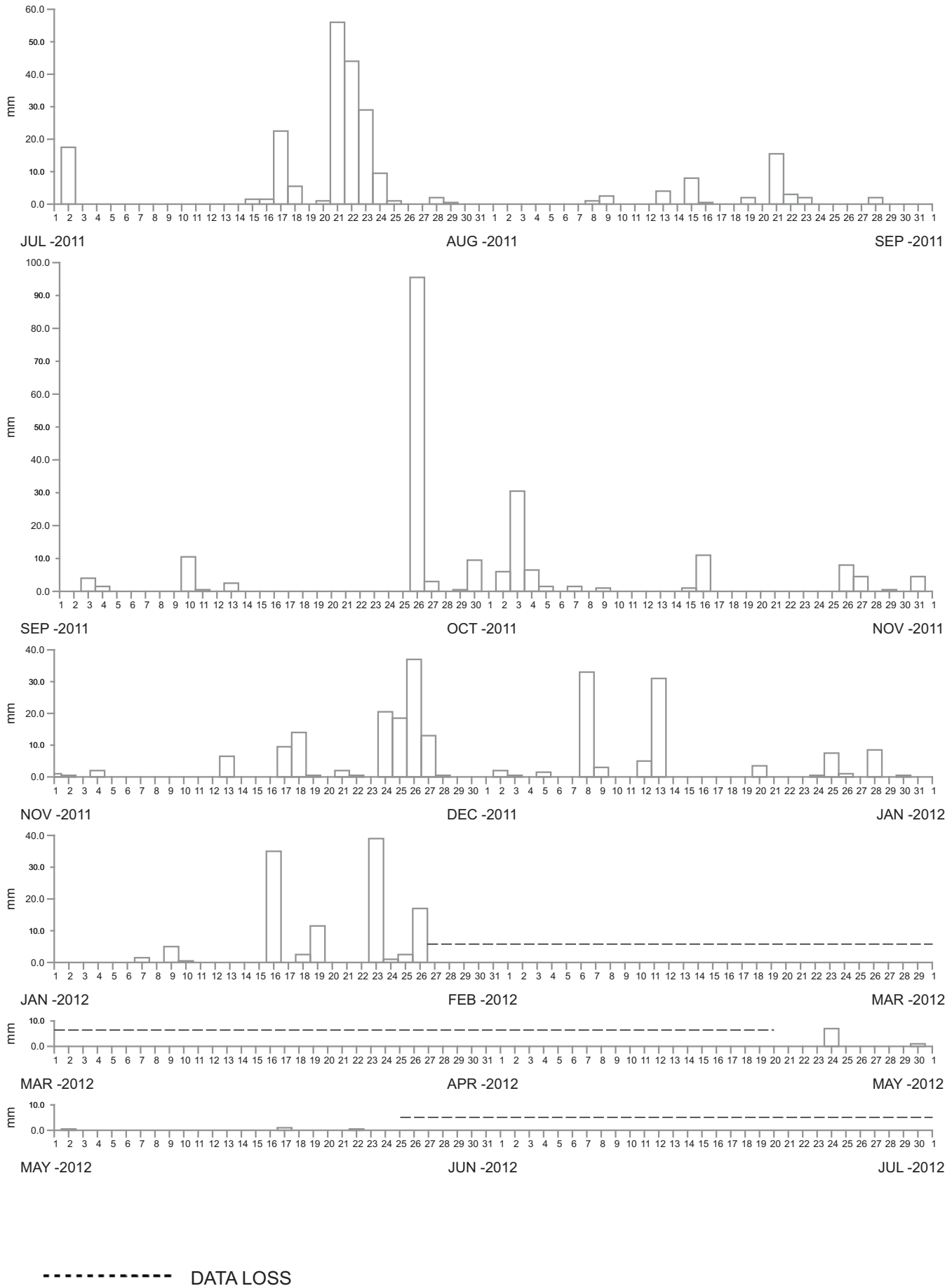
**Public Works**  
Manly Hydraulics Laboratory

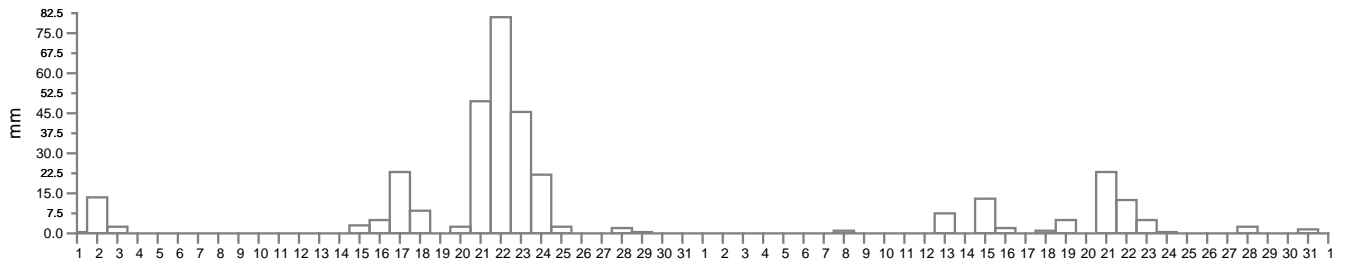
**RAINFALL STATION LOCATIONS  
KARUAH RIVER REGION**

MHL  
Report 2159  
**Figure  
32**  
DRAWING 2159-32.cdr





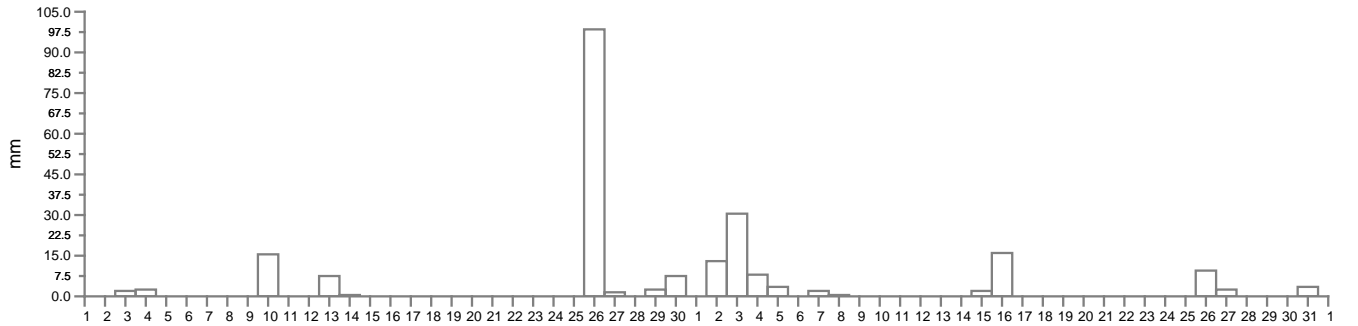




JUL -2011

AUG -2011

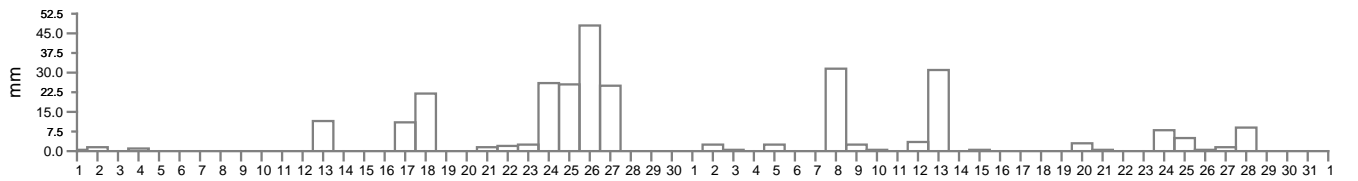
SEP -2011



SEP -2011

OCT -2011

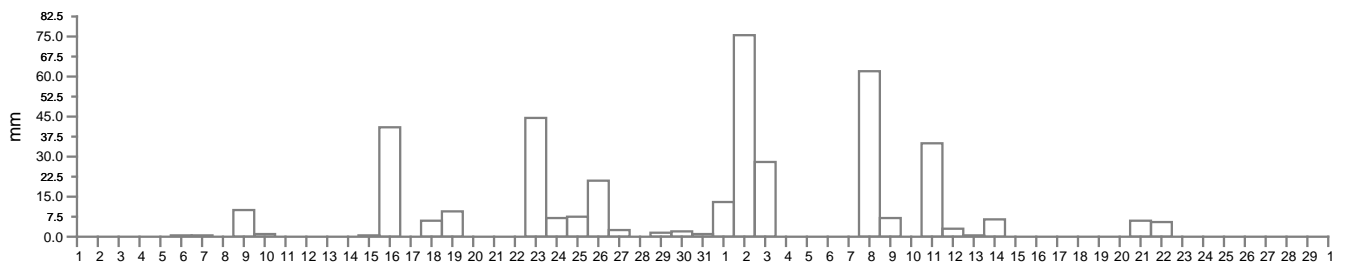
NOV -2011



NOV -2011

DEC -2011

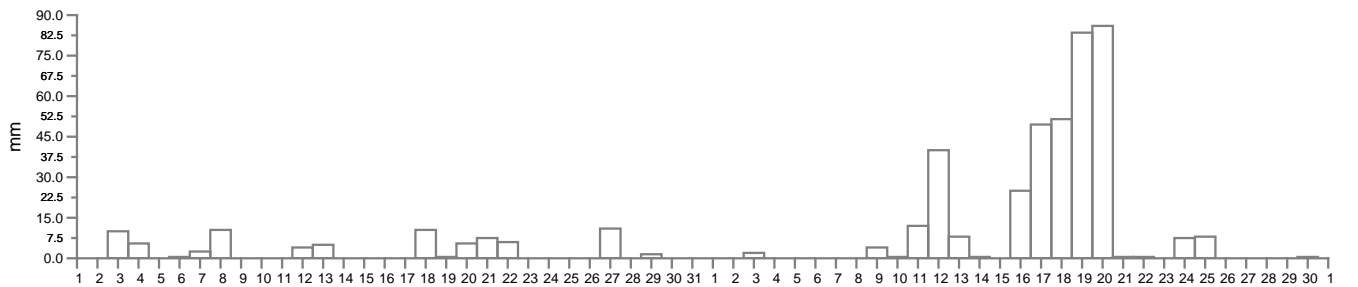
JAN -2012



JAN -2012

FEB -2012

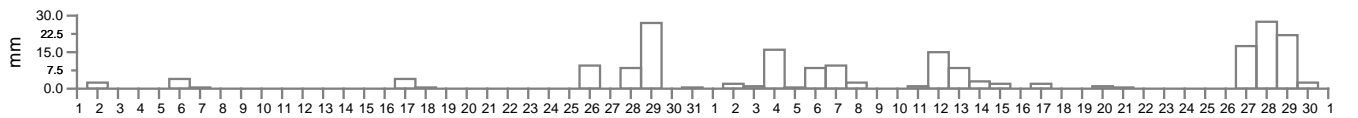
MAR -2012



MAR -2012

APR -2012

MAY -2012



MAY -2012

JUN -2012

JUL -2012

----- DATA LOSS



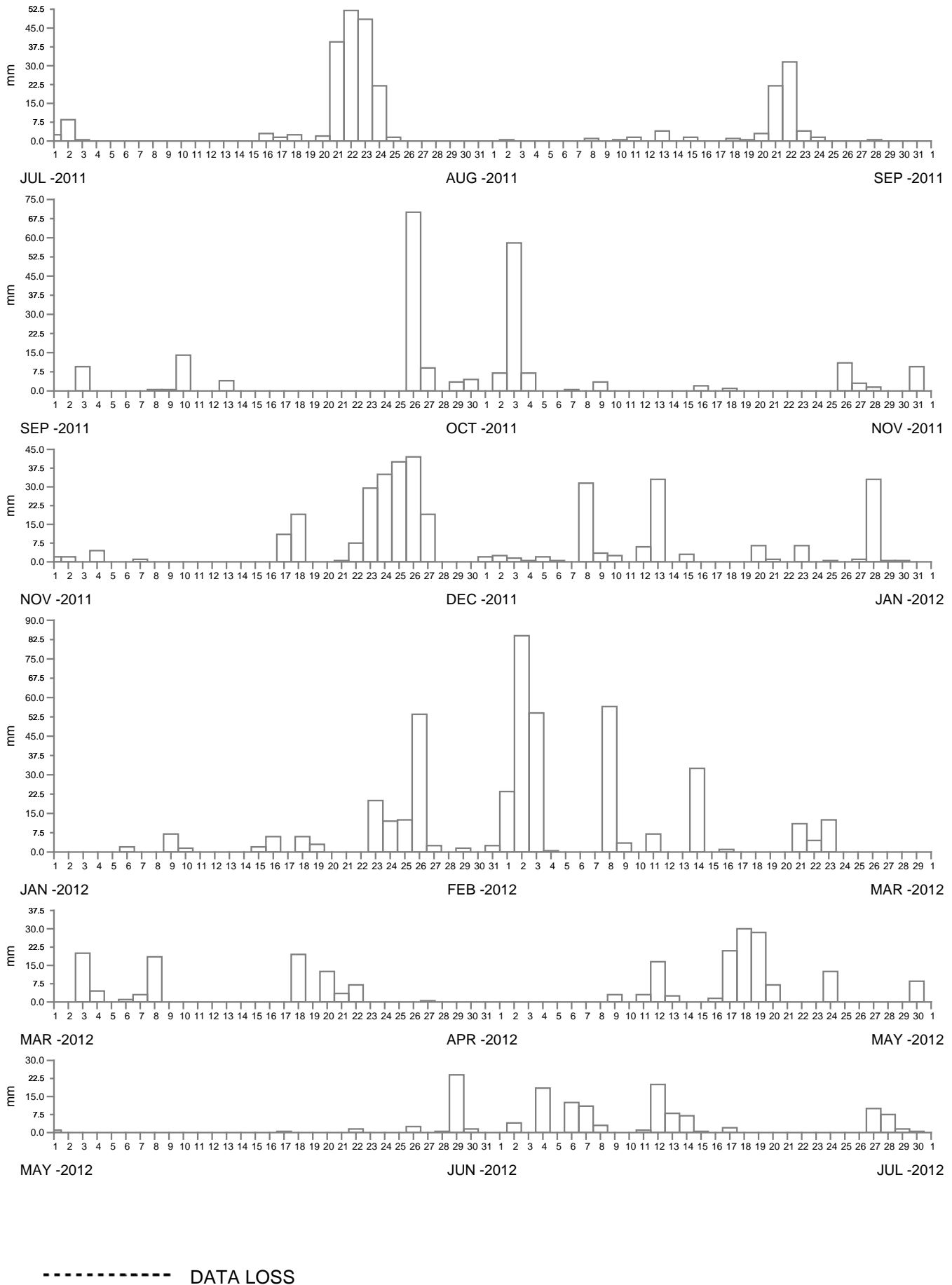
**Public Works**  
Manly Hydraulics Laboratory

**SMITHS LAKE AT TARBUCK BAY**  
2011-2012

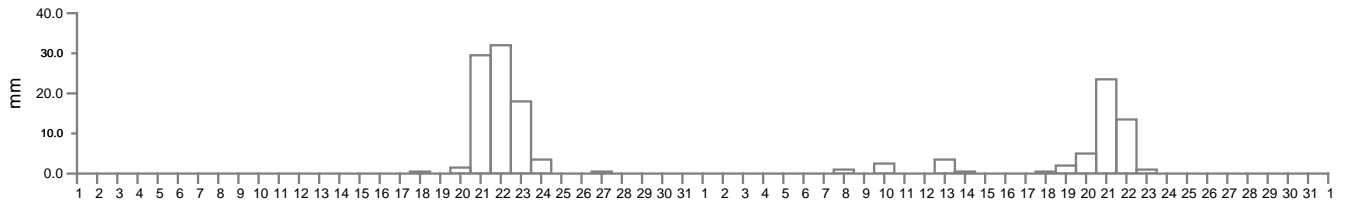
MHL  
Report 2159

Figure  
**36**

DRAWING 2159-36



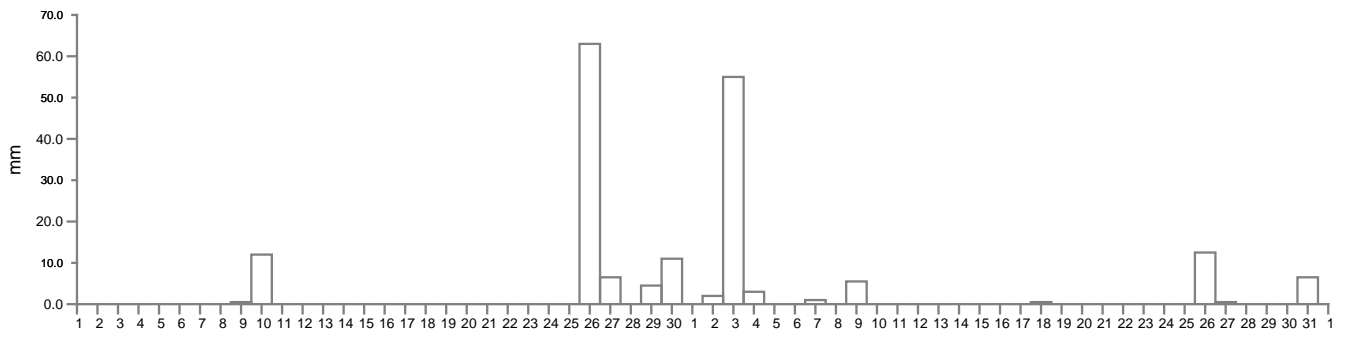




JUL -2011

AUG -2011

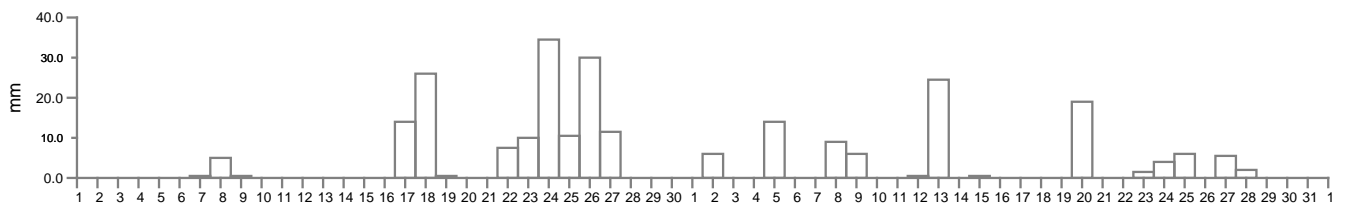
SEP -2011



SEP -2011

OCT -2011

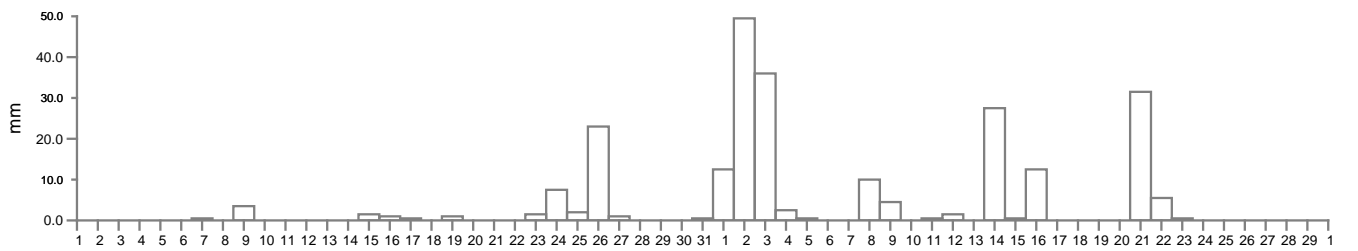
NOV -2011



NOV -2011

DEC -2011

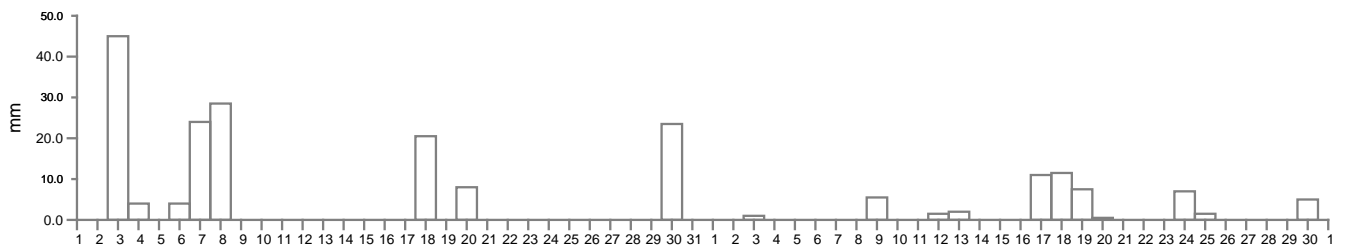
JAN -2012



JAN -2012

FEB -2012

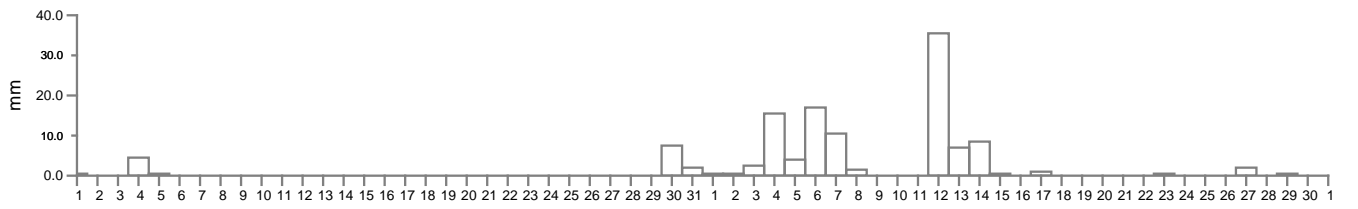
MAR -2012



MAR -2012

APR -2012

MAY -2012



MAY -2012

JUN -2012

JUL -2012

----- DATA LOSS



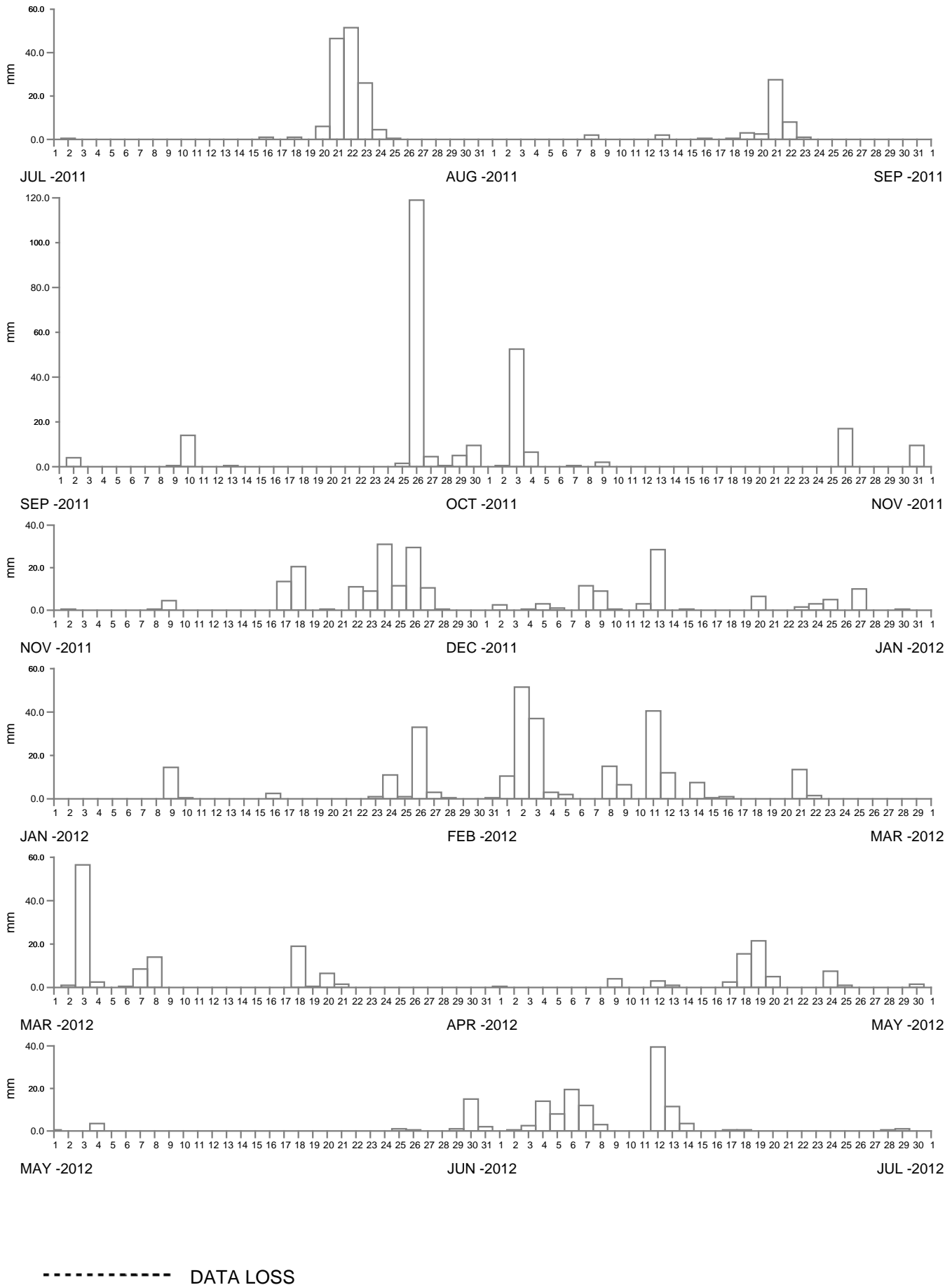
**Public Works**  
Manly Hydraulics Laboratory

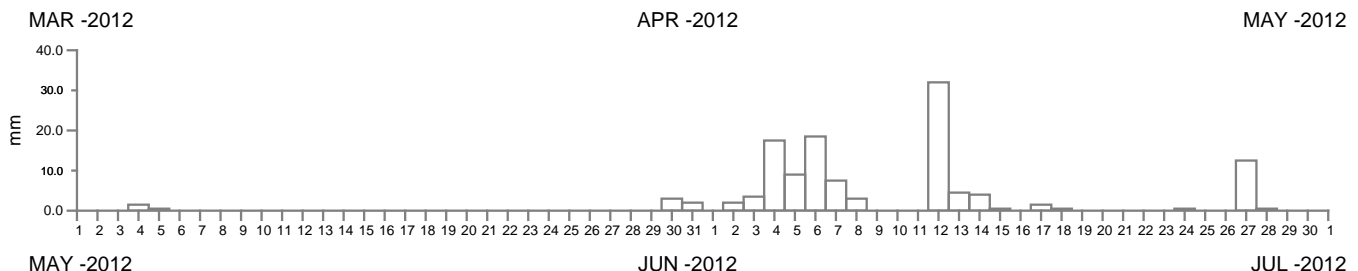
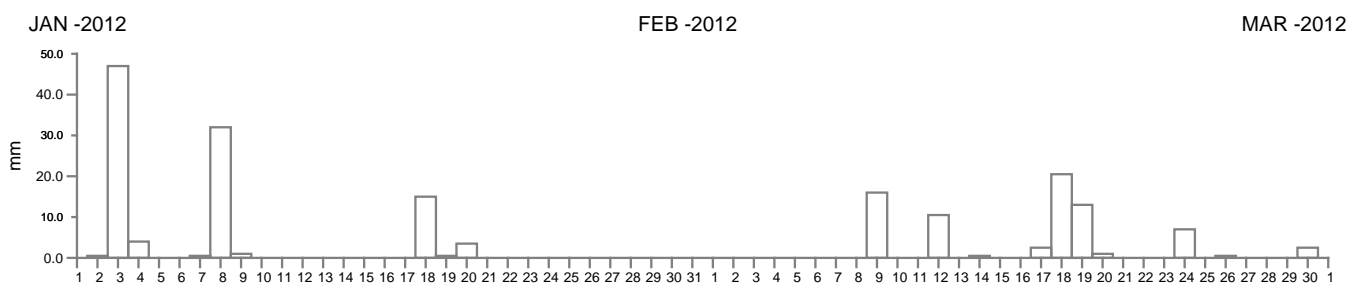
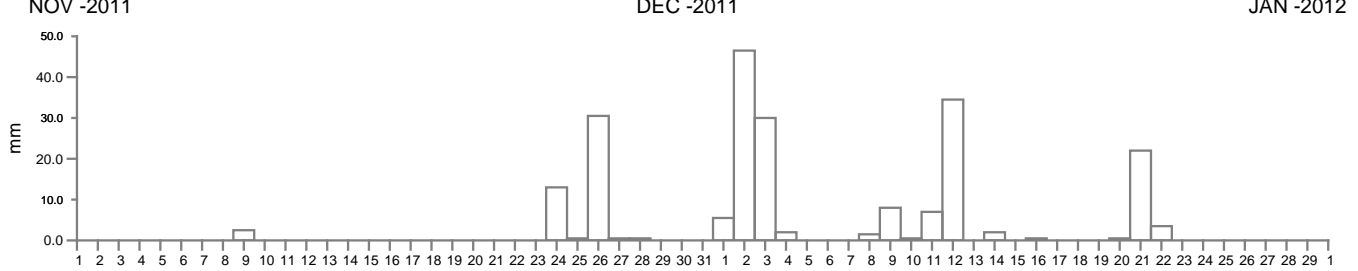
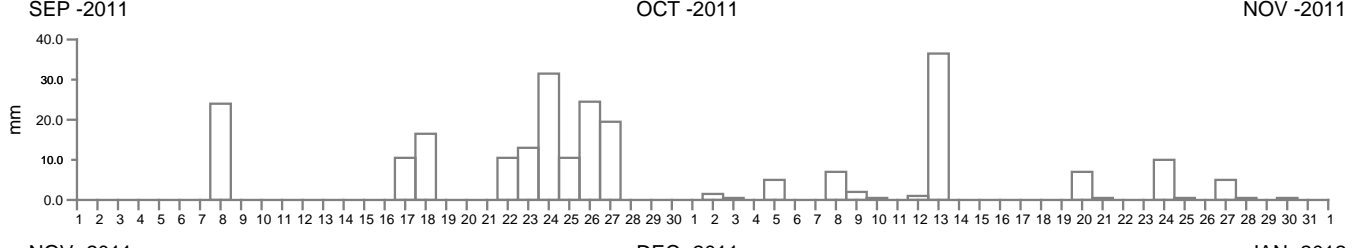
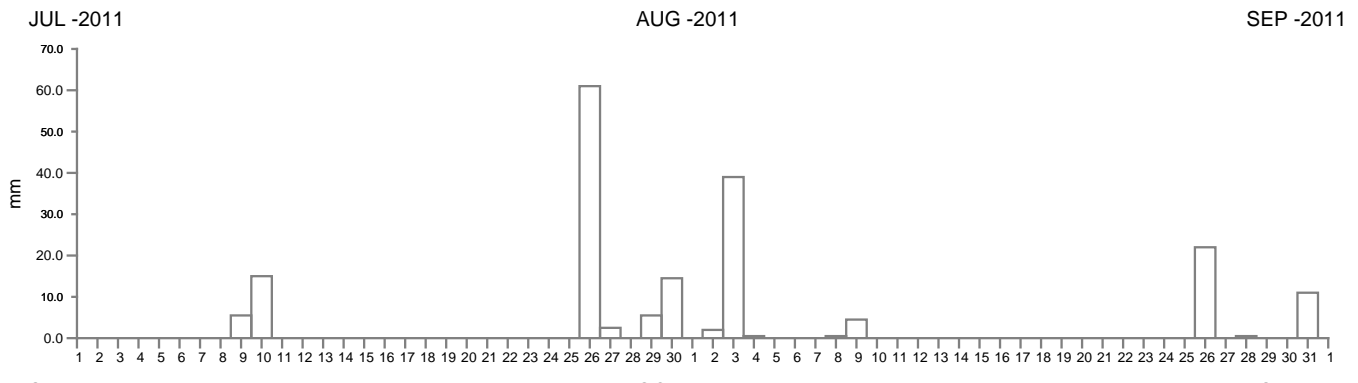
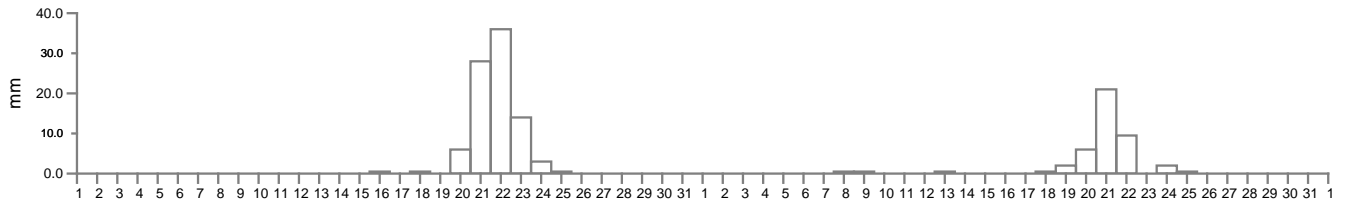
**PATERSON RIVER AT GOSTWYCK**  
2011-2012

MHL  
Report 2159

Figure  
**39**

DRAWING 2159-39





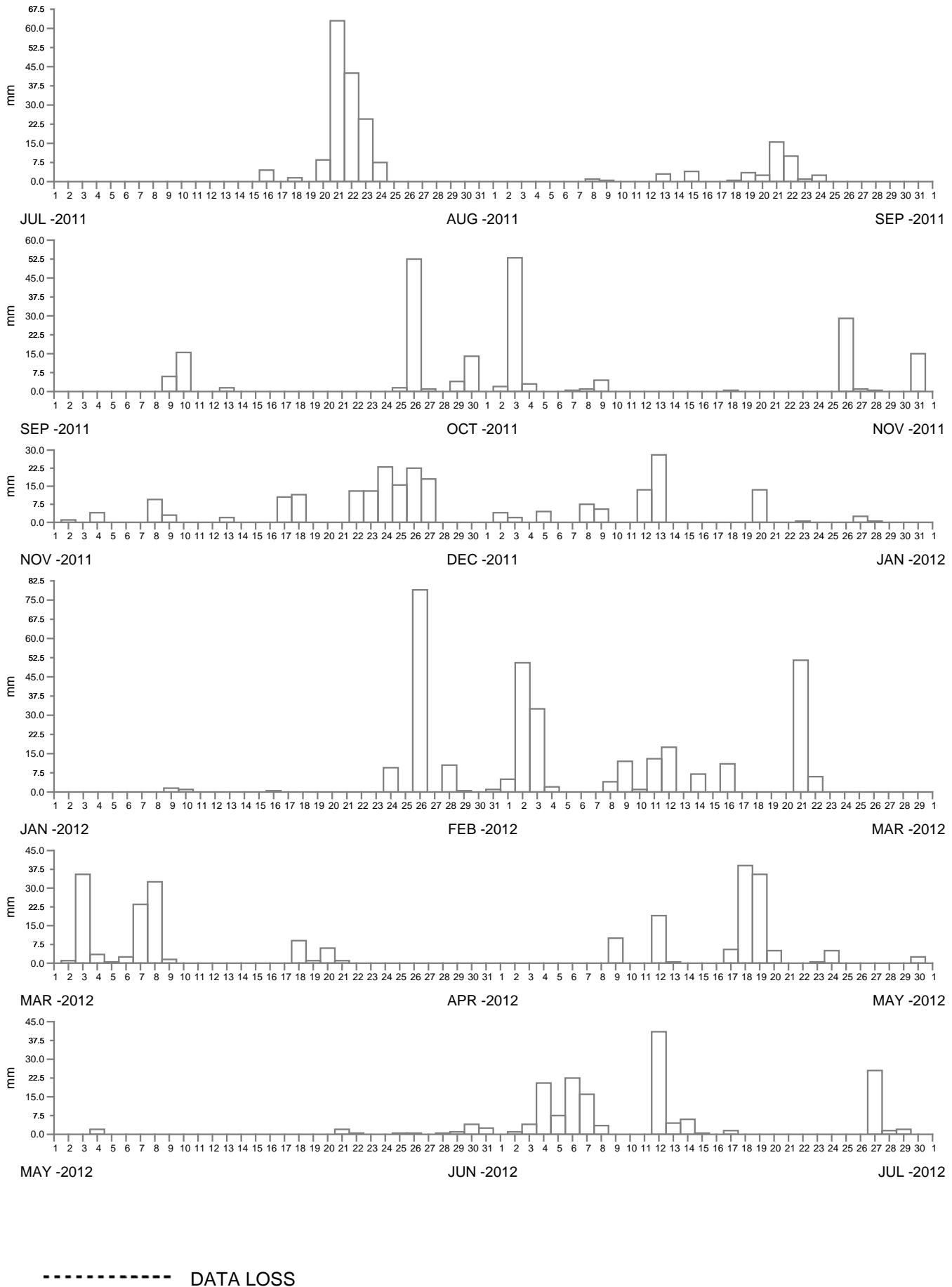
----- DATA LOSS

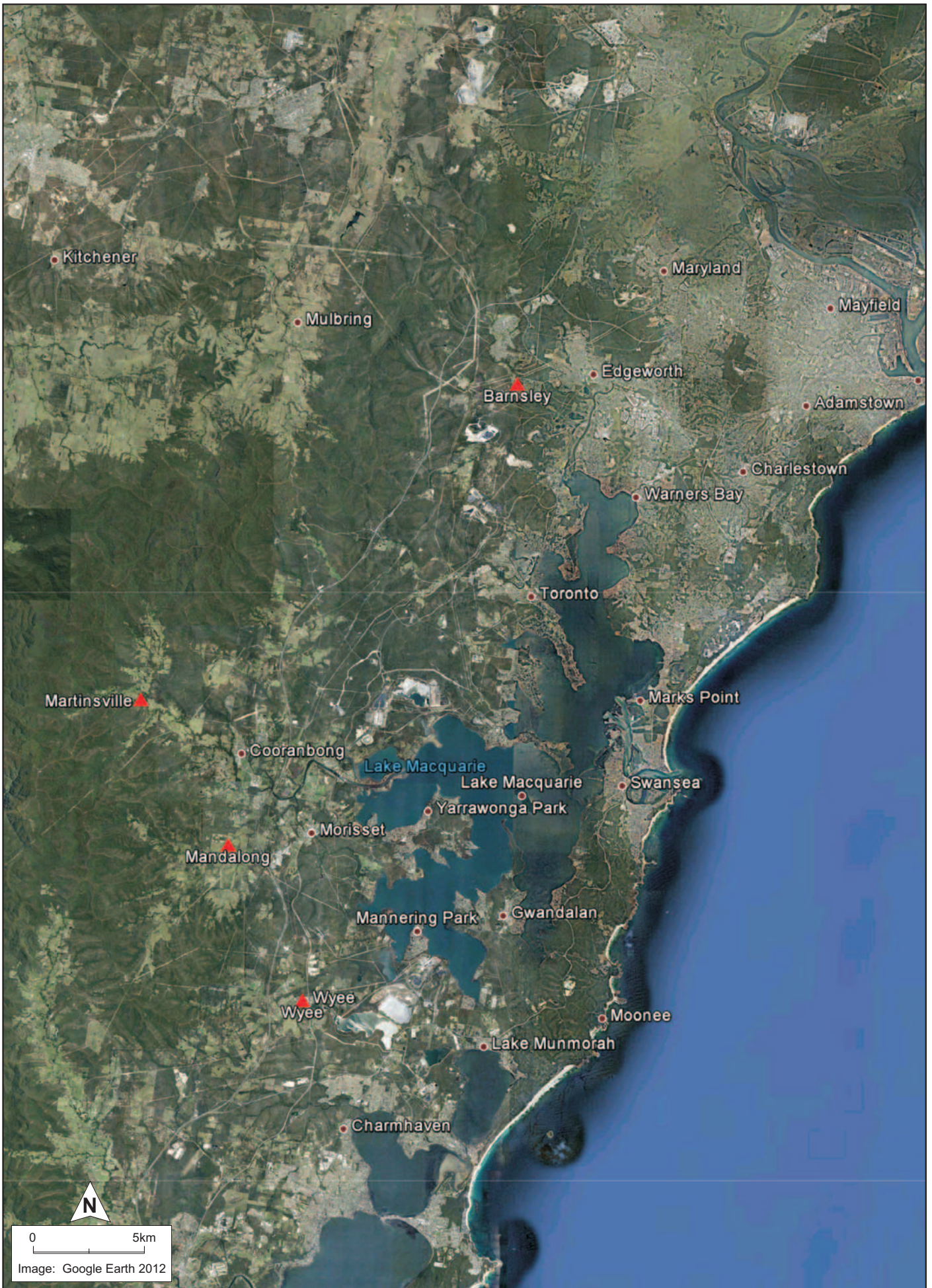


**Public Works**  
Manly Hydraulics Laboratory

**HUNTER RIVER AT BELMORE BRIDGE**  
2011-2012

MHL  
Report 2159  
Figure  
**41**  
DRAWING 2159-41





0 5km  
Image: Google Earth 2012



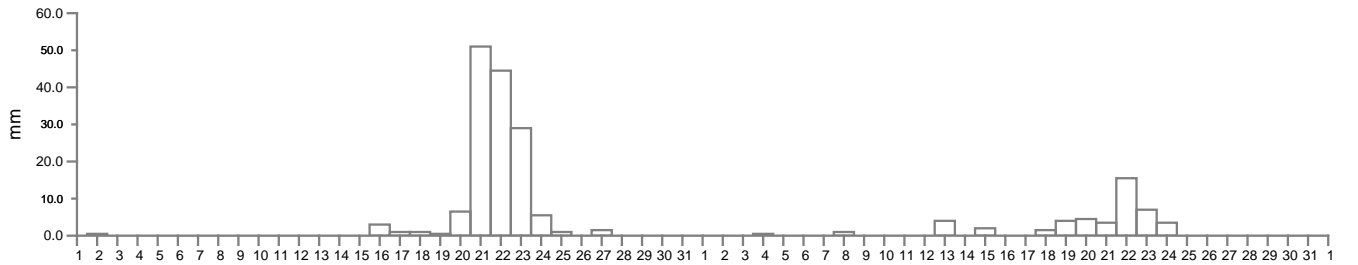
**Public Works**  
Manly Hydraulics Laboratory

**RAINFALL STATION LOCATIONS  
MACQUARIE-TUGGERAH LAKES (NORTH) REGION**

MHL  
Report 2159

Figure  
**43**

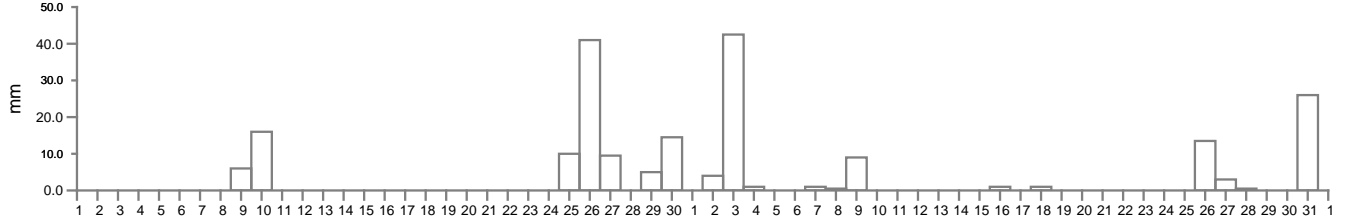
DRAWING 2159-43.cdr



JUL -2011

AUG -2011

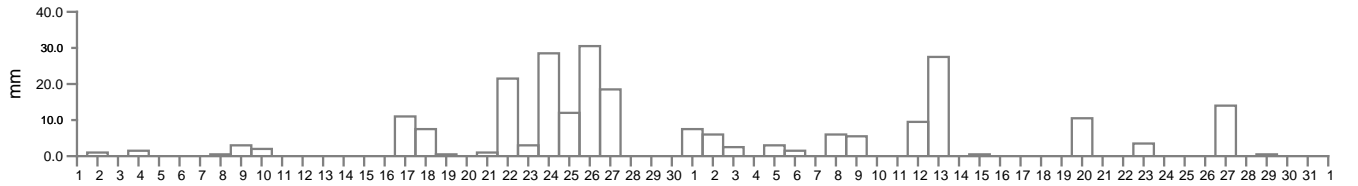
SEP -2011



SEP -2011

OCT -2011

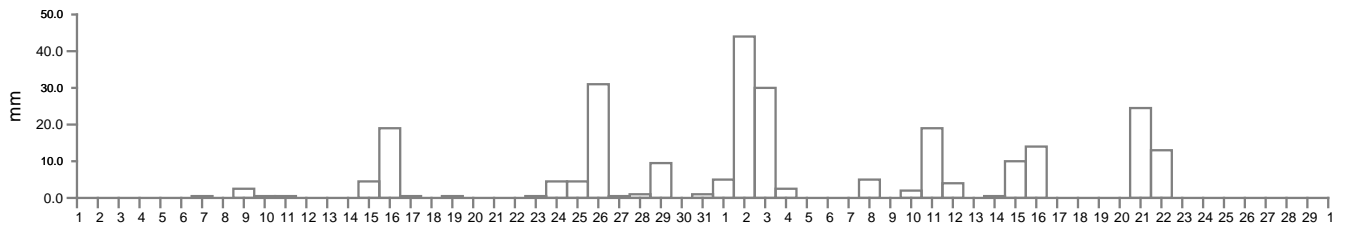
NOV -2011



NOV -2011

DEC -2011

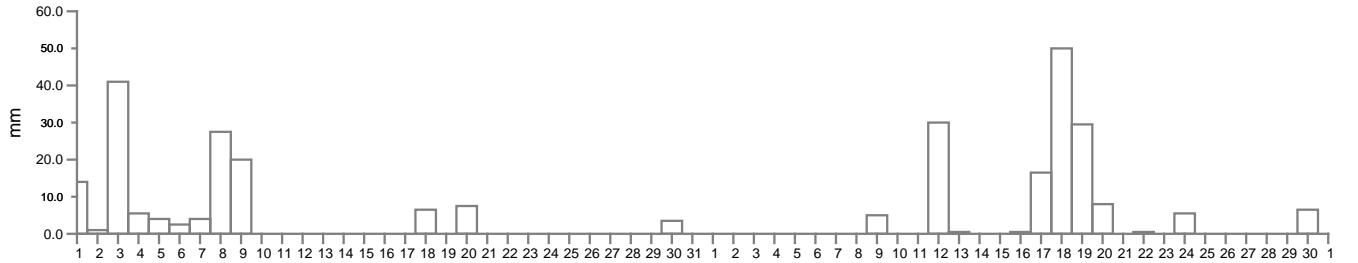
JAN -2012



JAN -2012

FEB -2012

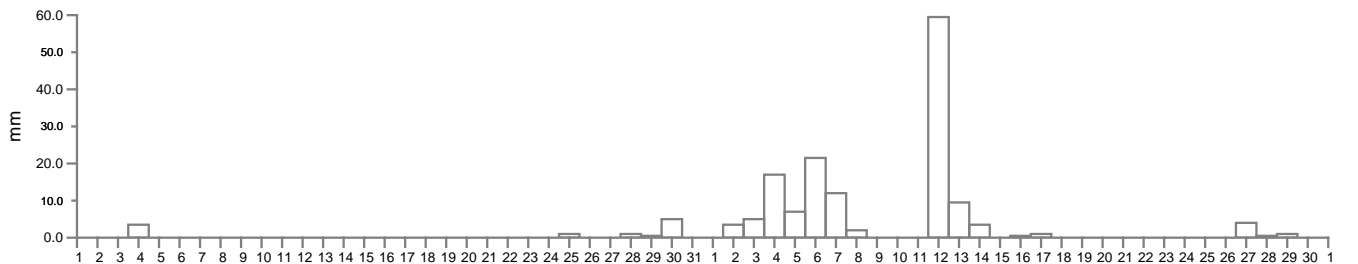
MAR -2012



MAR -2012

APR -2012

MAY -2012



MAY -2012

JUN -2012

JUL -2012

----- DATA LOSS



Public Works  
Manly Hydraulics Laboratory

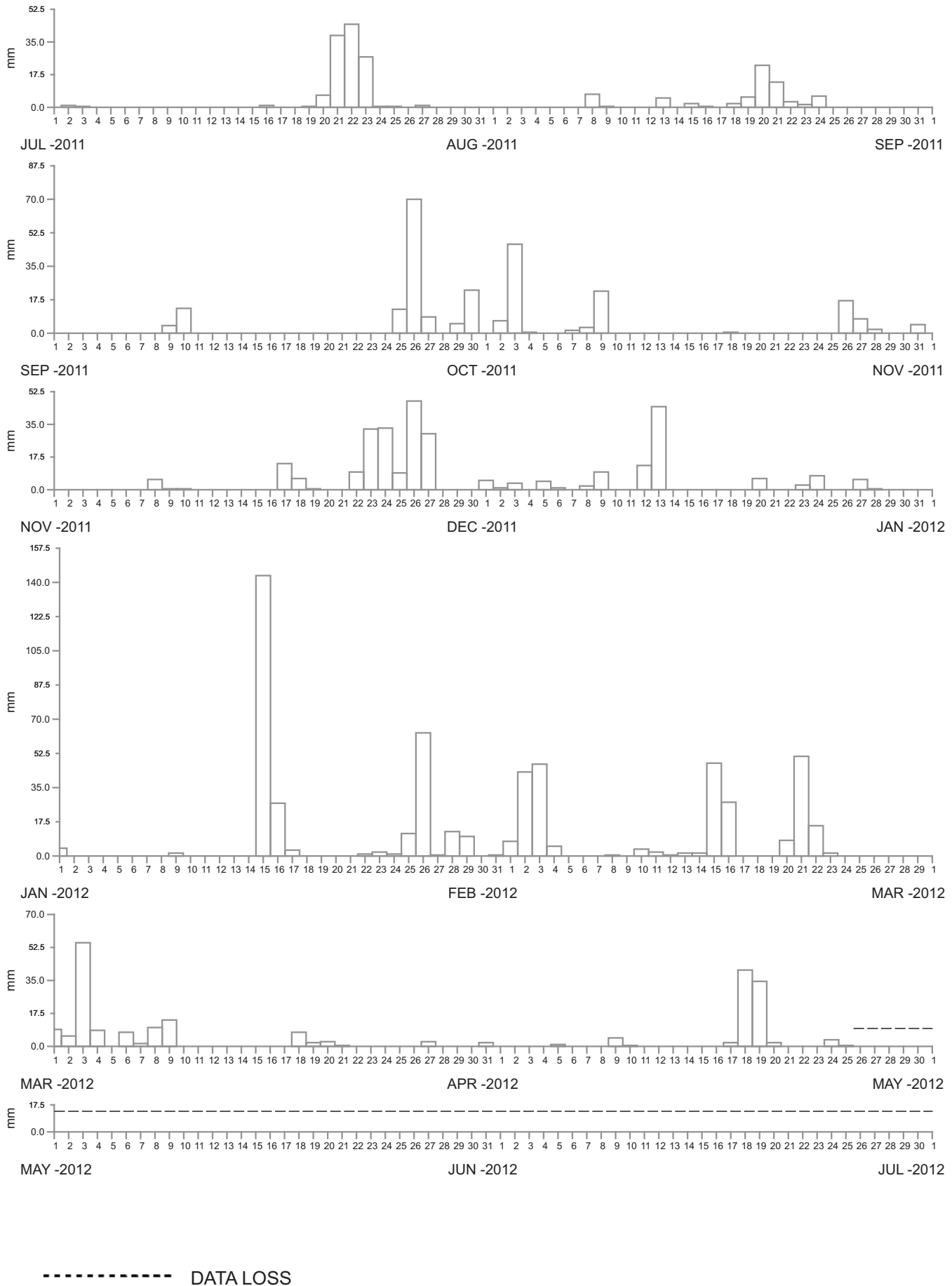
BARNSLEY AT JOHNSON AVENUE  
2011-2012

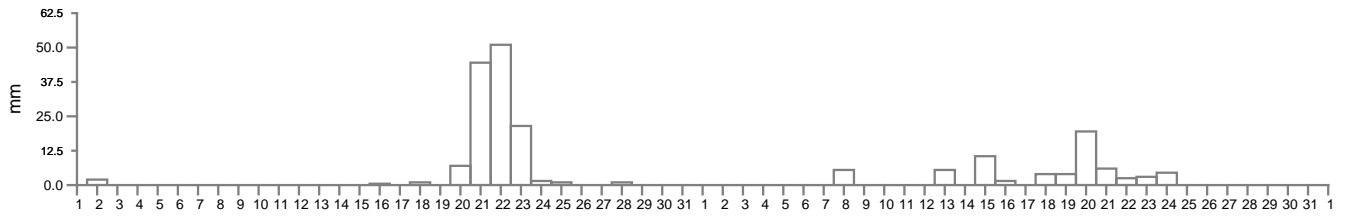
MHL  
Report 2159

Figure

44

DRAWING 2159-44

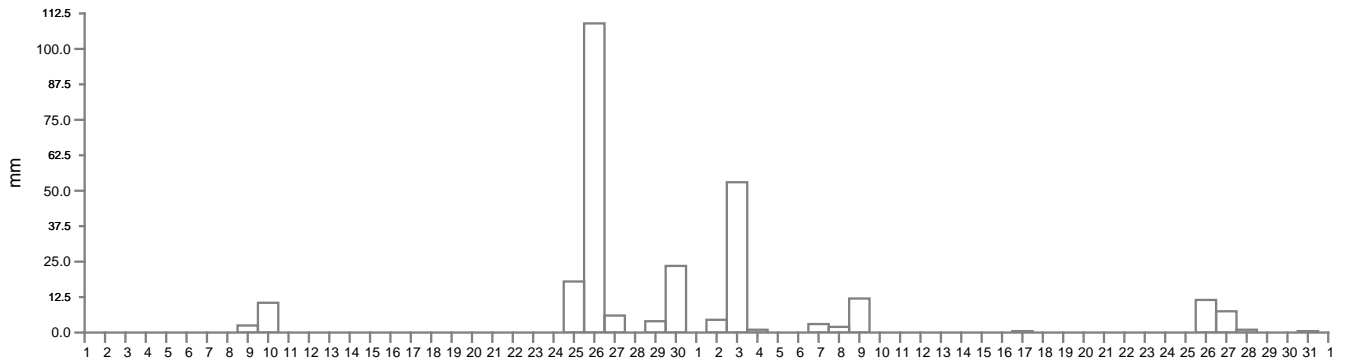




JUL -2011

AUG -2011

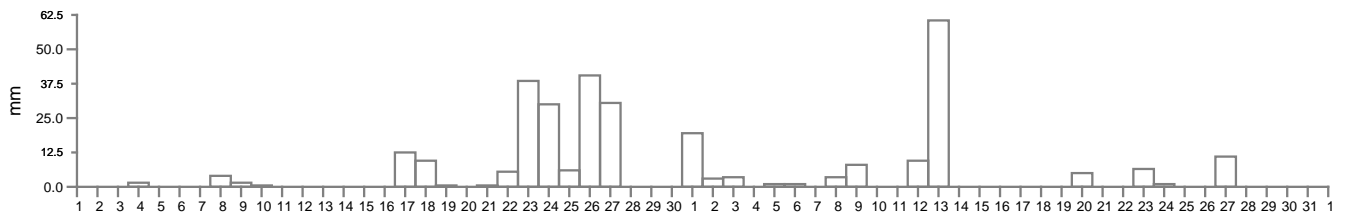
SEP -2011



SEP -2011

OCT -2011

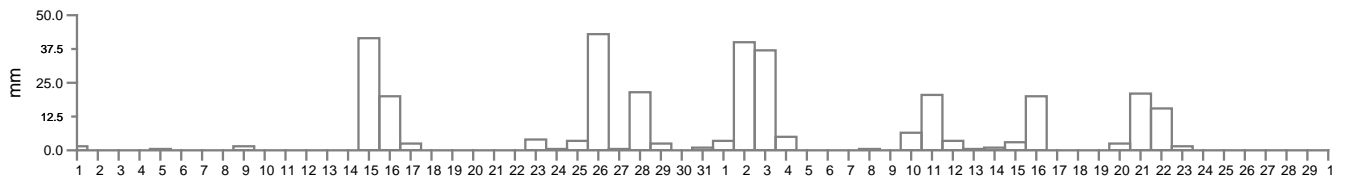
NOV -2011



NOV -2011

DEC -2011

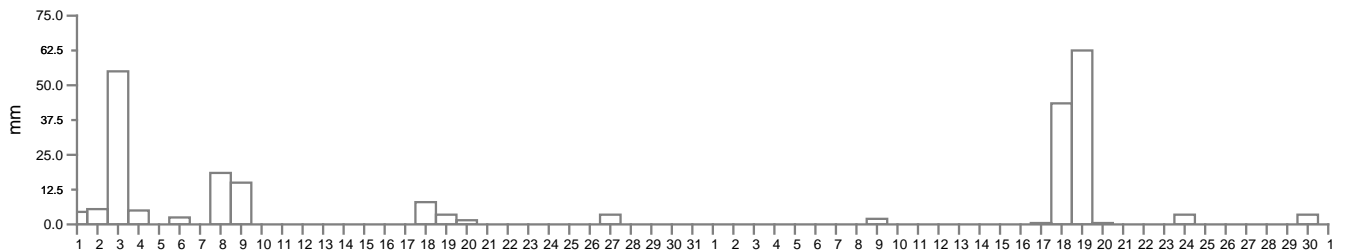
JAN -2012



JAN -2012

FEB -2012

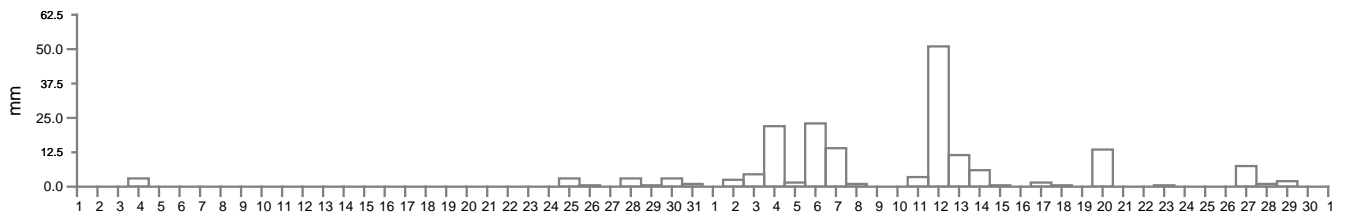
MAR -2012



MAR -2012

APR -2012

MAY -2012



MAY -2012

JUN -2012

JUL -2012

----- DATA LOSS



**Public Works**  
Manly Hydraulics Laboratory

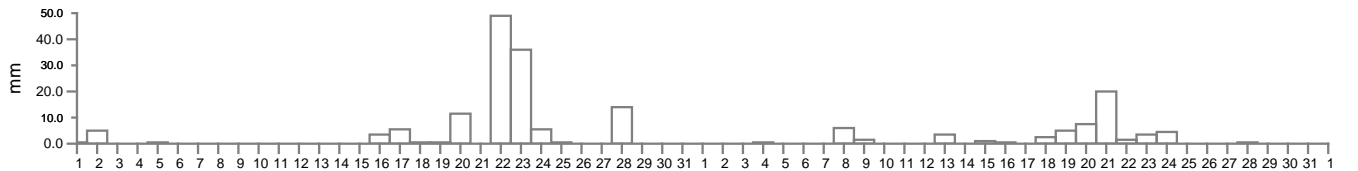
**MANDALONG AT DEAVES ROAD**  
2011-2012

MHL  
Report 2159

Figure

**46**

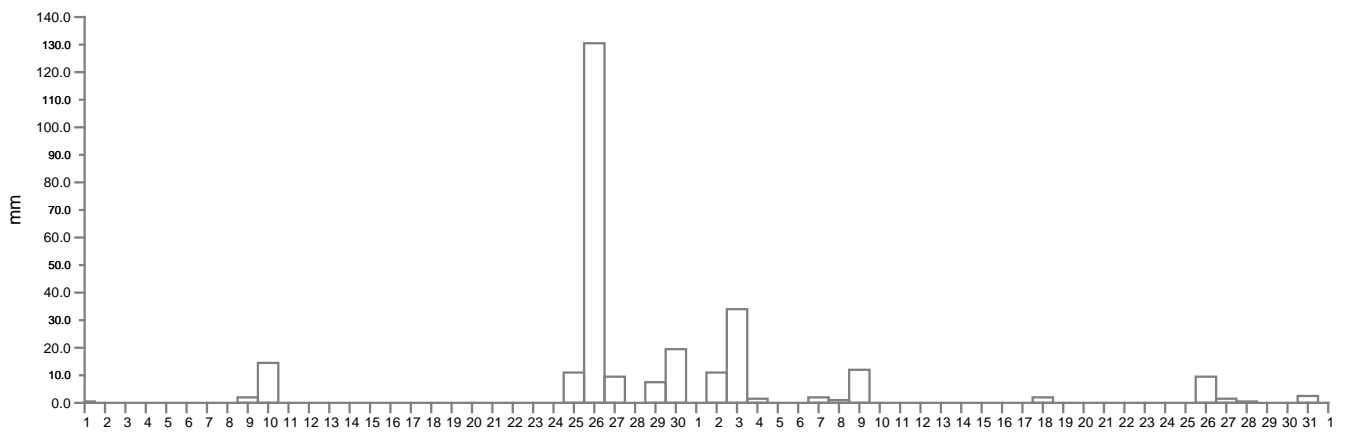
DRAWING 2159-46



JUL -2011

AUG -2011

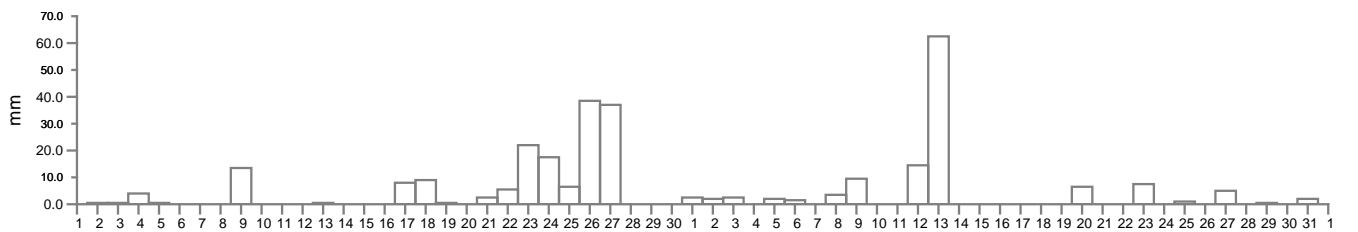
SEP -2011



SEP -2011

OCT -2011

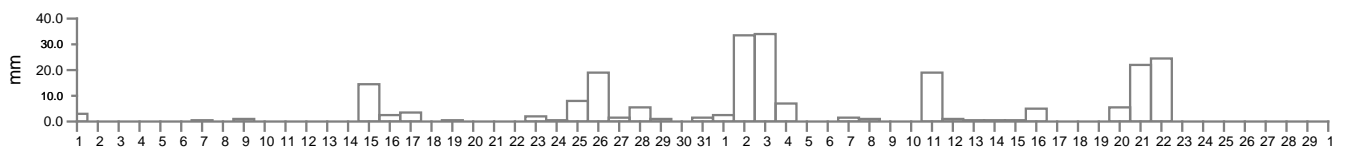
NOV -2011



NOV -2011

DEC -2011

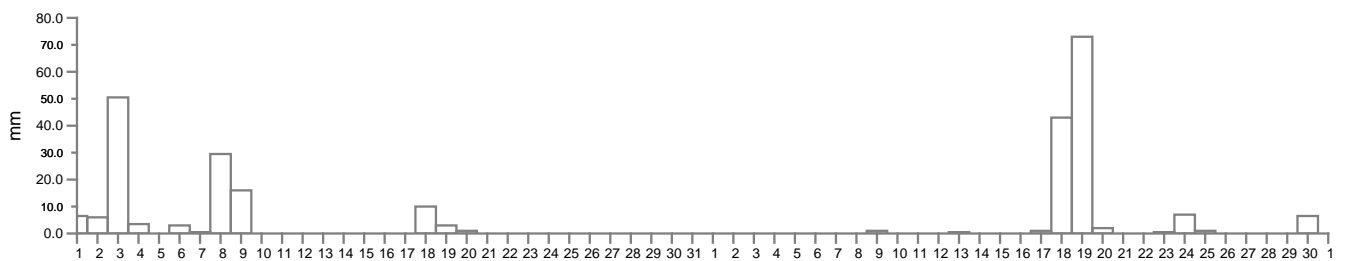
JAN -2012



JAN -2012

FEB -2012

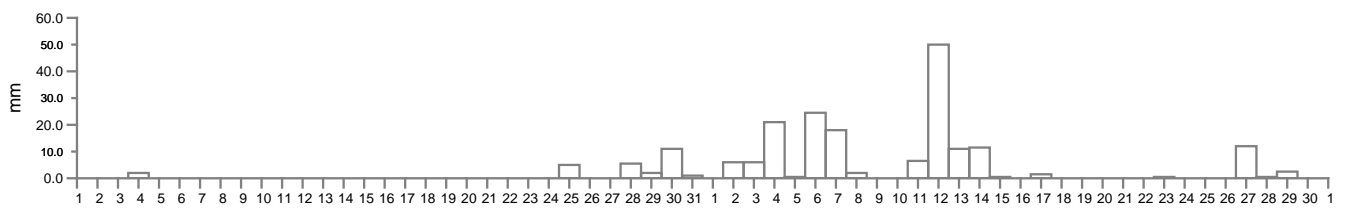
MAR -2012



MAR -2012

APR -2012

MAY -2012



MAY -2012

JUN -2012

JUL -2012

----- DATA LOSS



**Public Works**  
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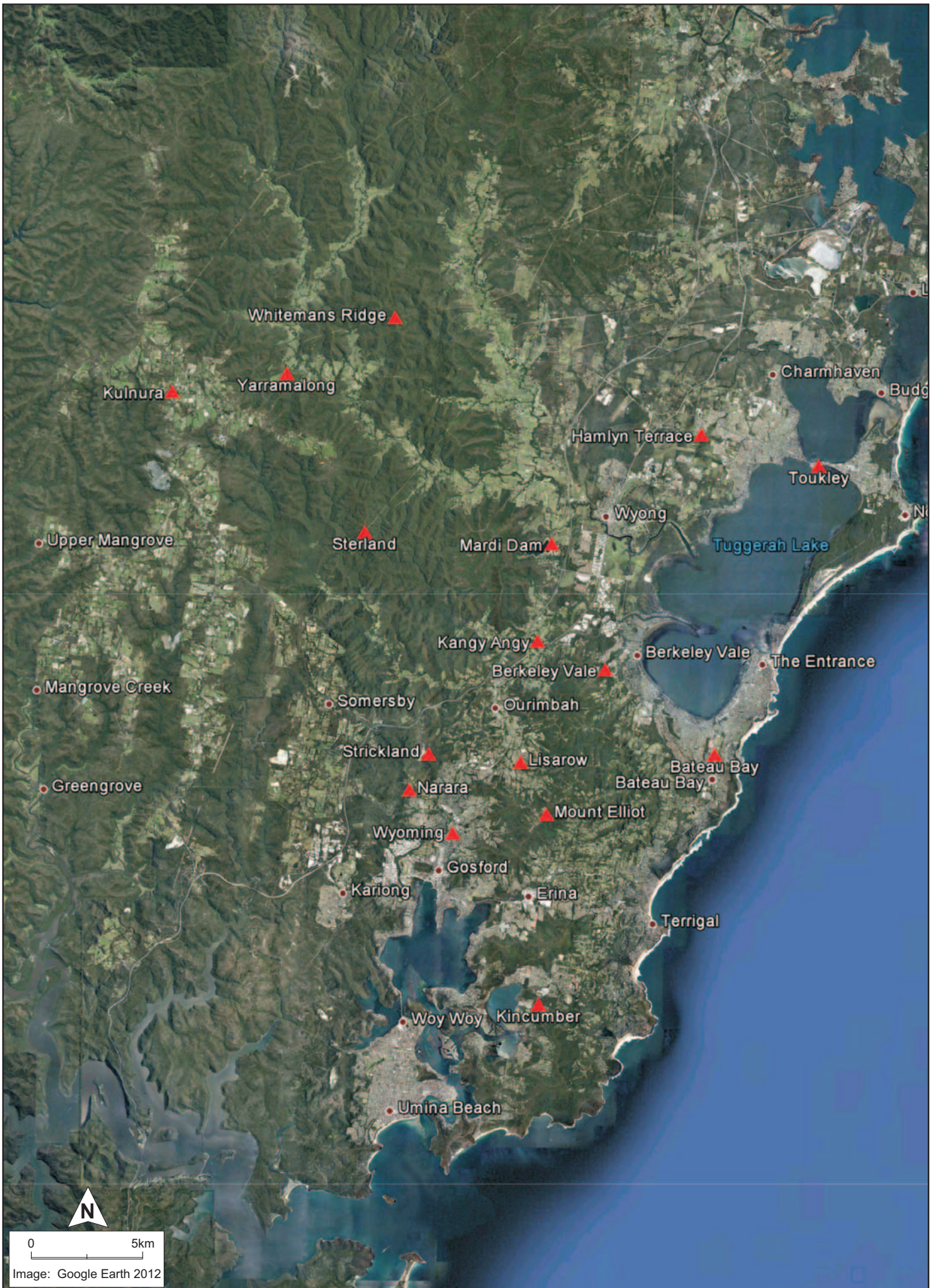
**WYEE AT COLLUNGRA STREET**  
2011-2012

MHL  
Report 2159

Figure

47

DRAWING 2159-47



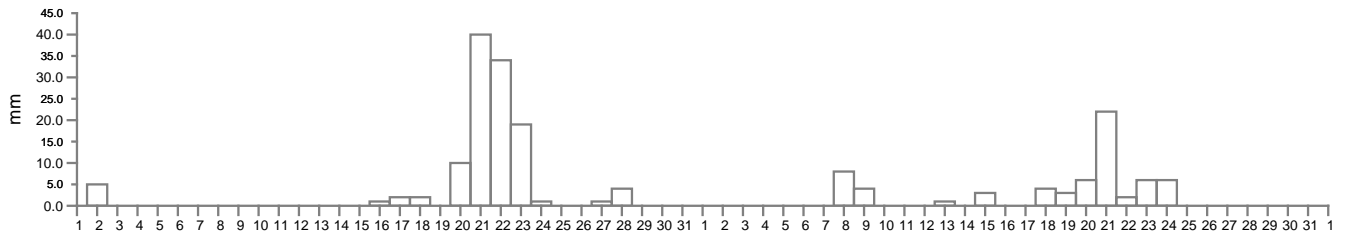
**Public Works**  
Manly Hydraulics Laboratory

**RAINFALL STATION LOCATIONS  
MACQUARIE-TUGGERAH LAKES (SOUTH)  
AND HAWKESBURY RIVER REGIONS**

MHL  
Report 2159

Figure  
48

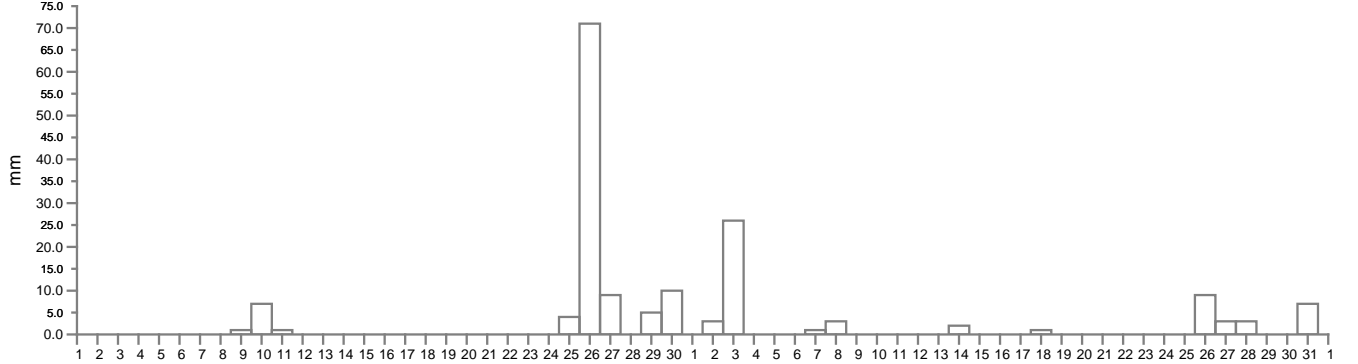
DRAWING 2159-48.cdr



JUL -2011

AUG -2011

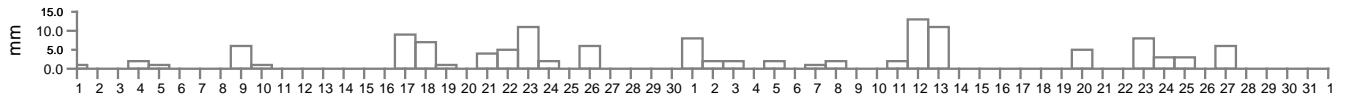
SEP -2011



SEP -2011

OCT -2011

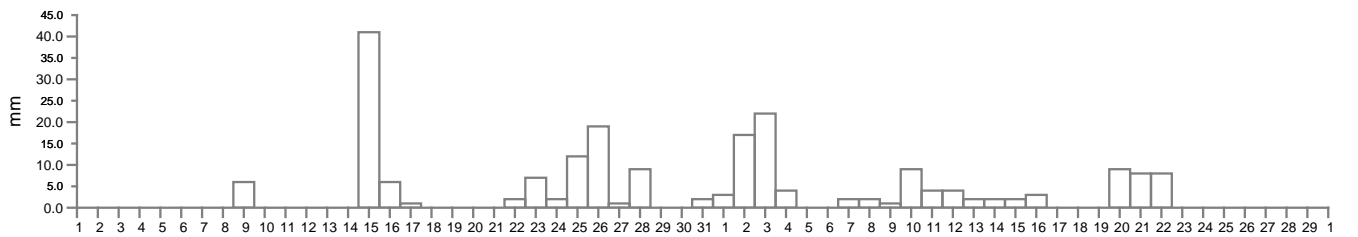
NOV -2011



NOV -2011

DEC -2011

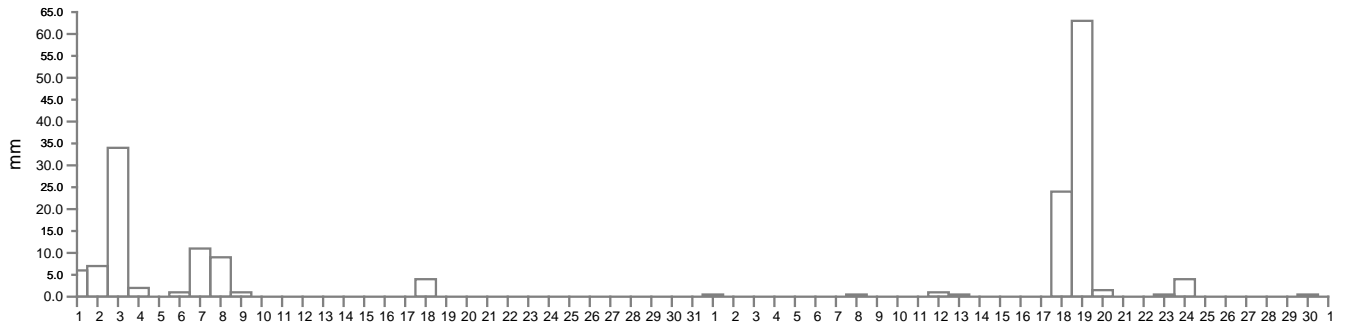
JAN -2012



JAN -2012

FEB -2012

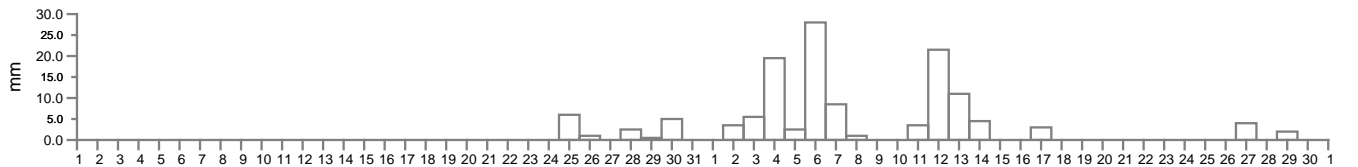
MAR -2012



MAR -2012

APR -2012

MAY -2012



MAY -2012

JUN -2012

JUL -2012

----- DATA LOSS



**Public Works**  
Manly Hydraulics Laboratory

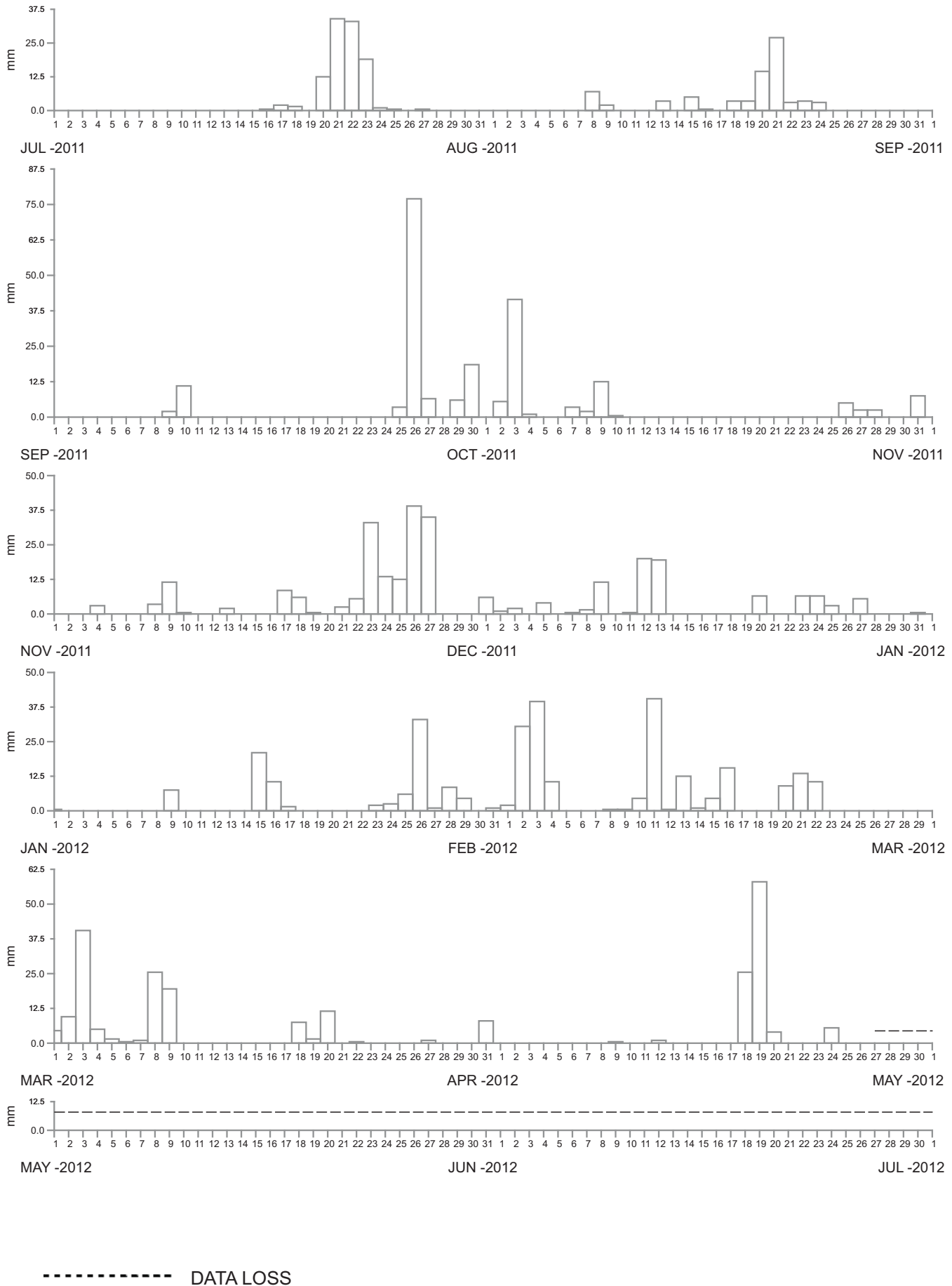
**WHITEMANS RIDGE AT WATAGANS FOREST DRIVE**  
2011-2012

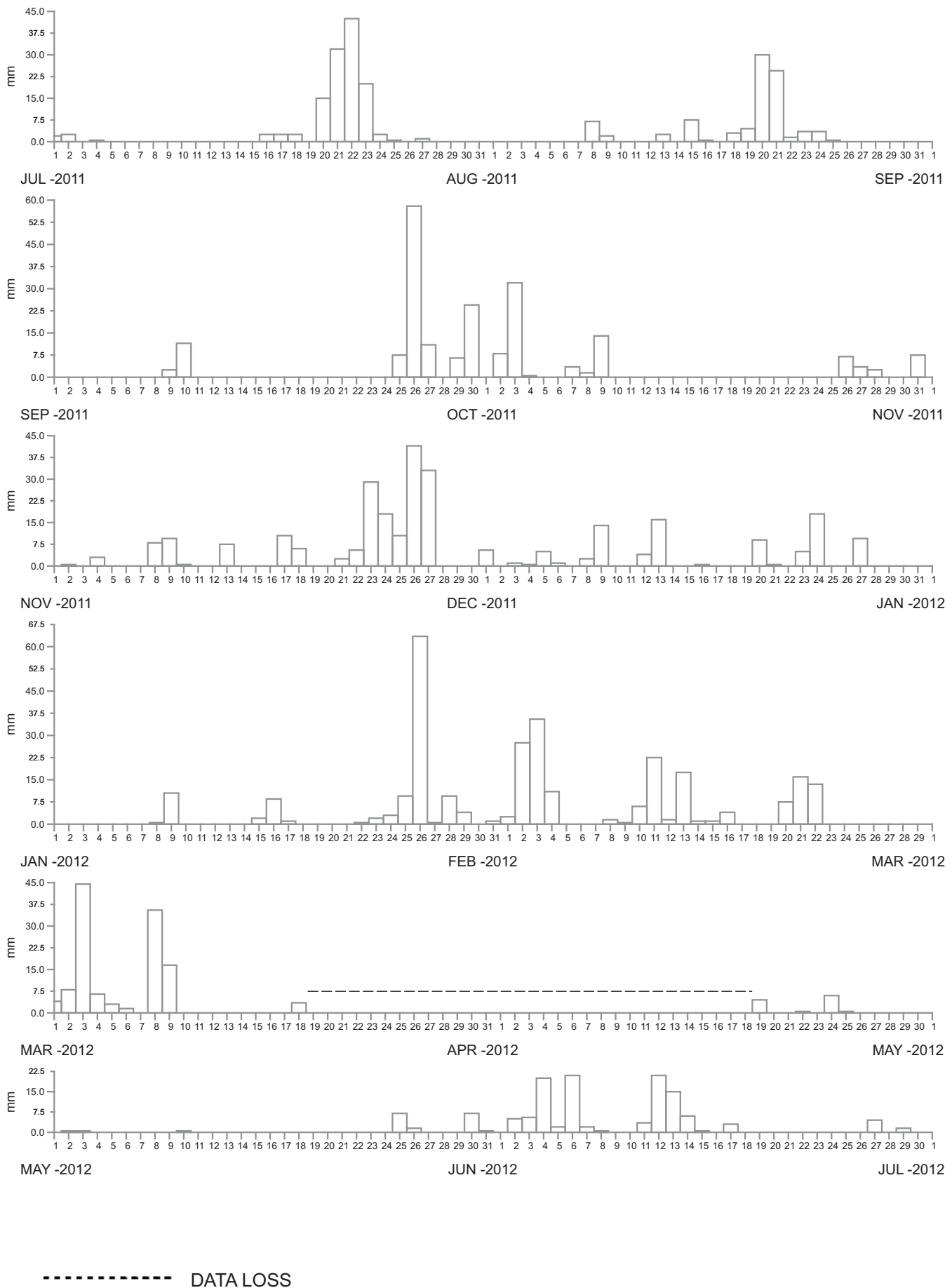
MHL  
Report 2159

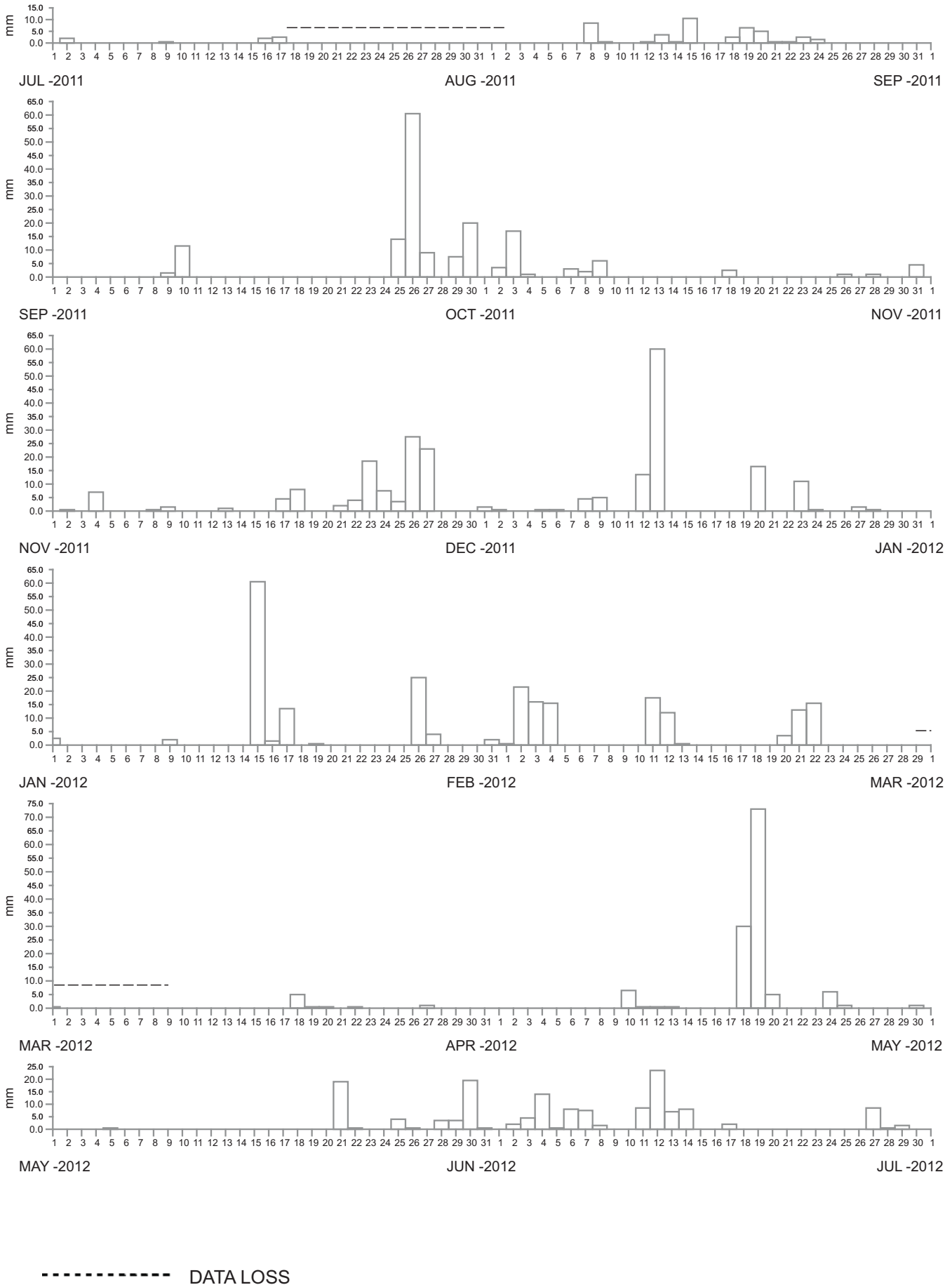
Figure

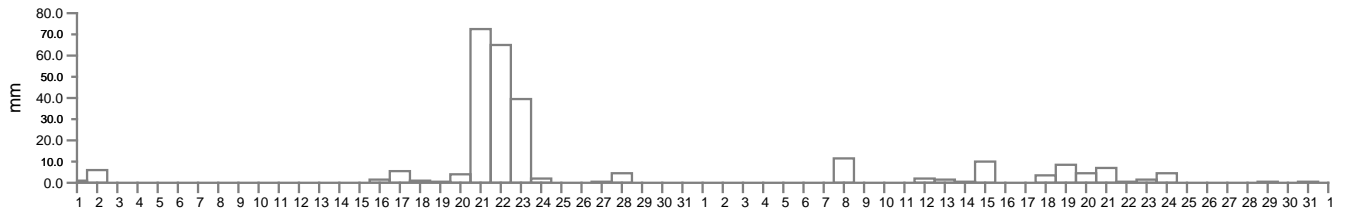
49

DRAWING 2159-49





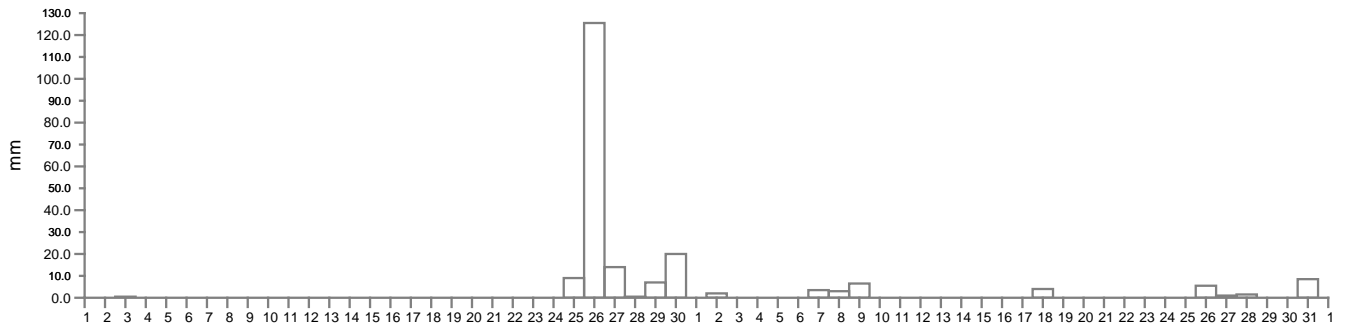




JUL -2011

AUG -2011

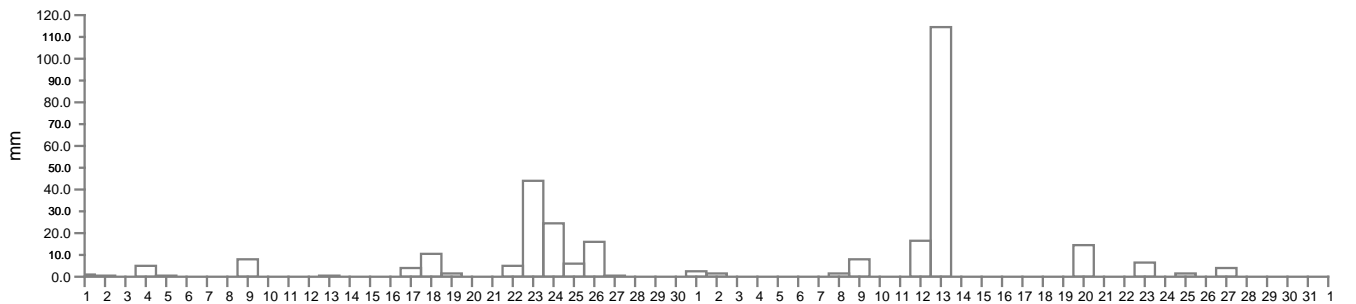
SEP -2011



SEP -2011

OCT -2011

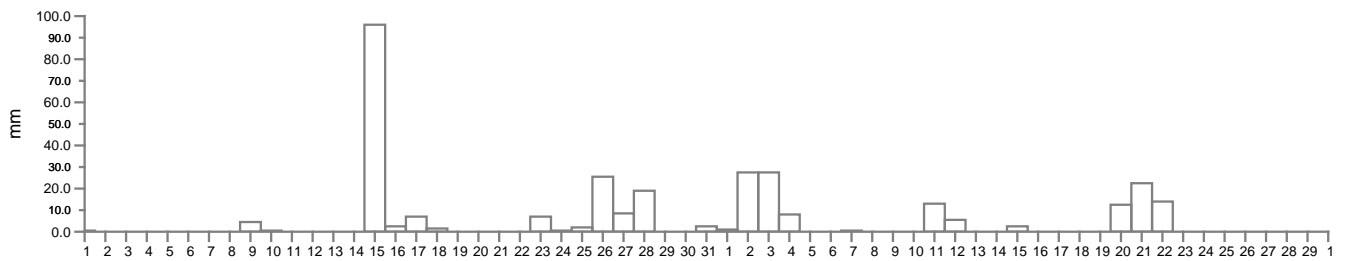
NOV -2011



NOV -2011

DEC -2011

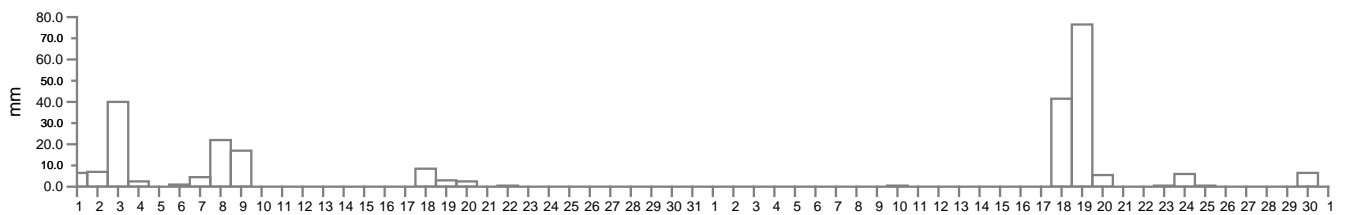
JAN -2012



JAN -2012

FEB -2012

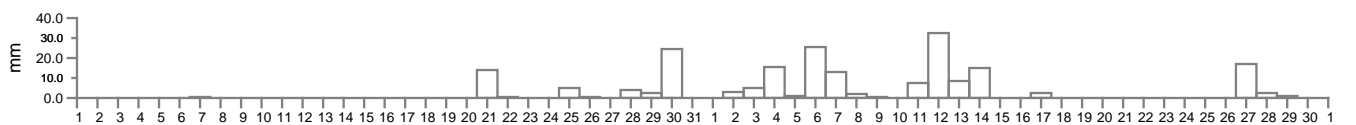
MAR -2012



MAR -2012

APR -2012

MAY -2012



MAY -2012

JUN -2012

JUL -2012

----- DATA LOSS



**Public Works**  
Manly Hydraulics Laboratory

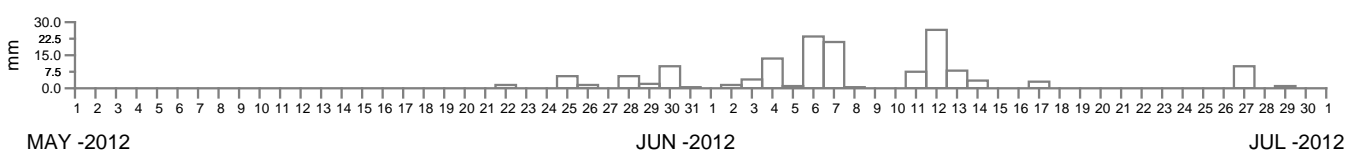
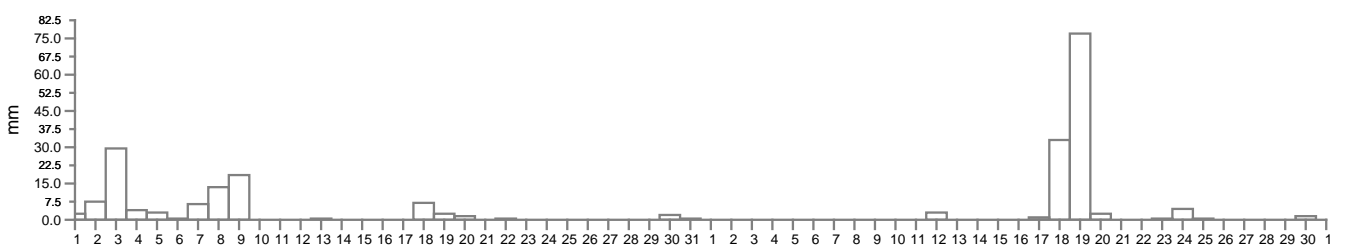
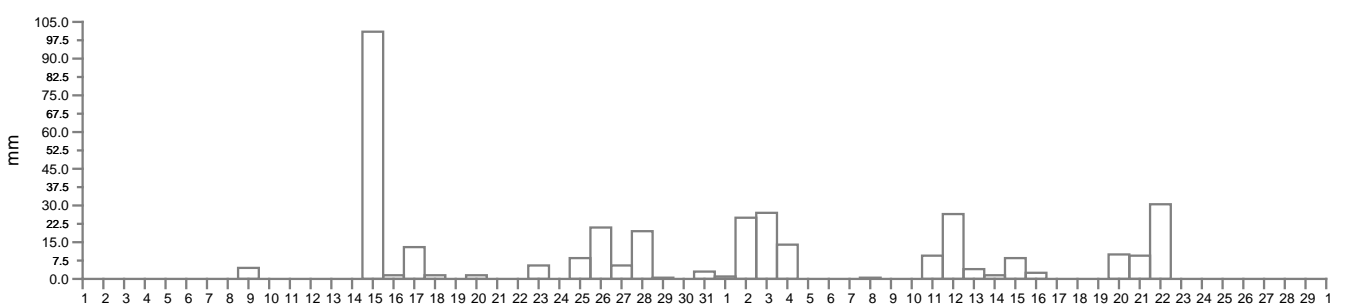
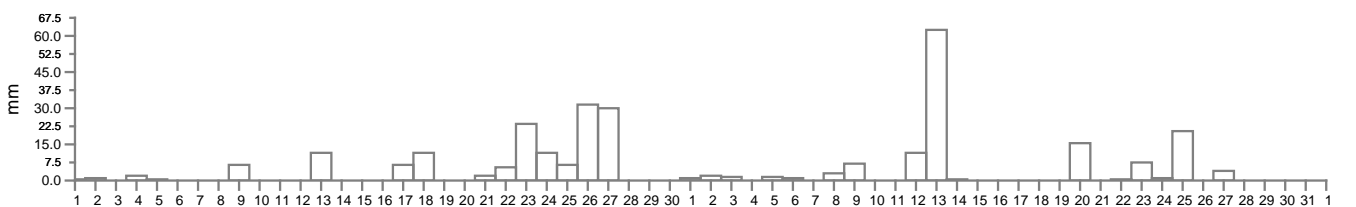
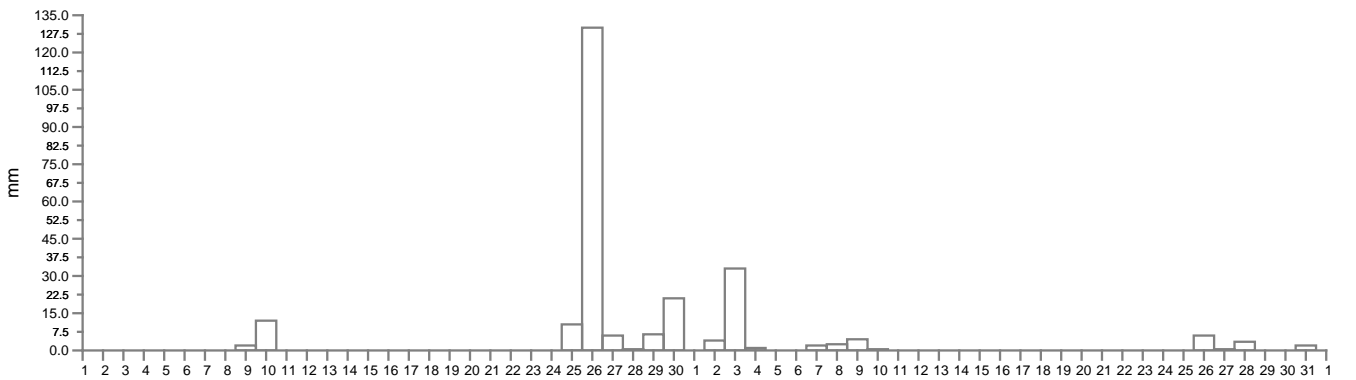
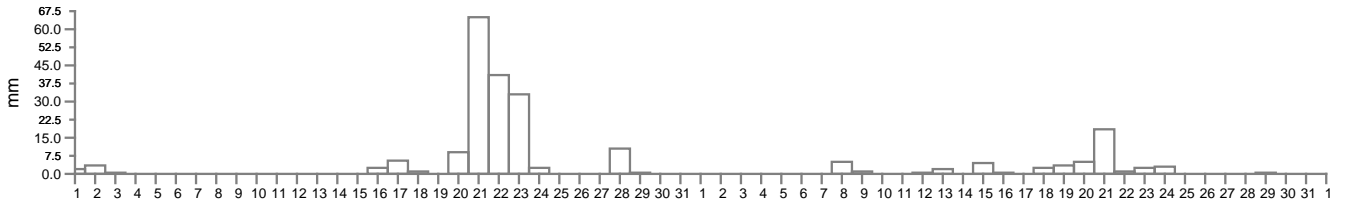
**HAMLIN TERRACE AT WARNERVALE ROAD**  
2011-2012

MHL  
Report 2159

Figure

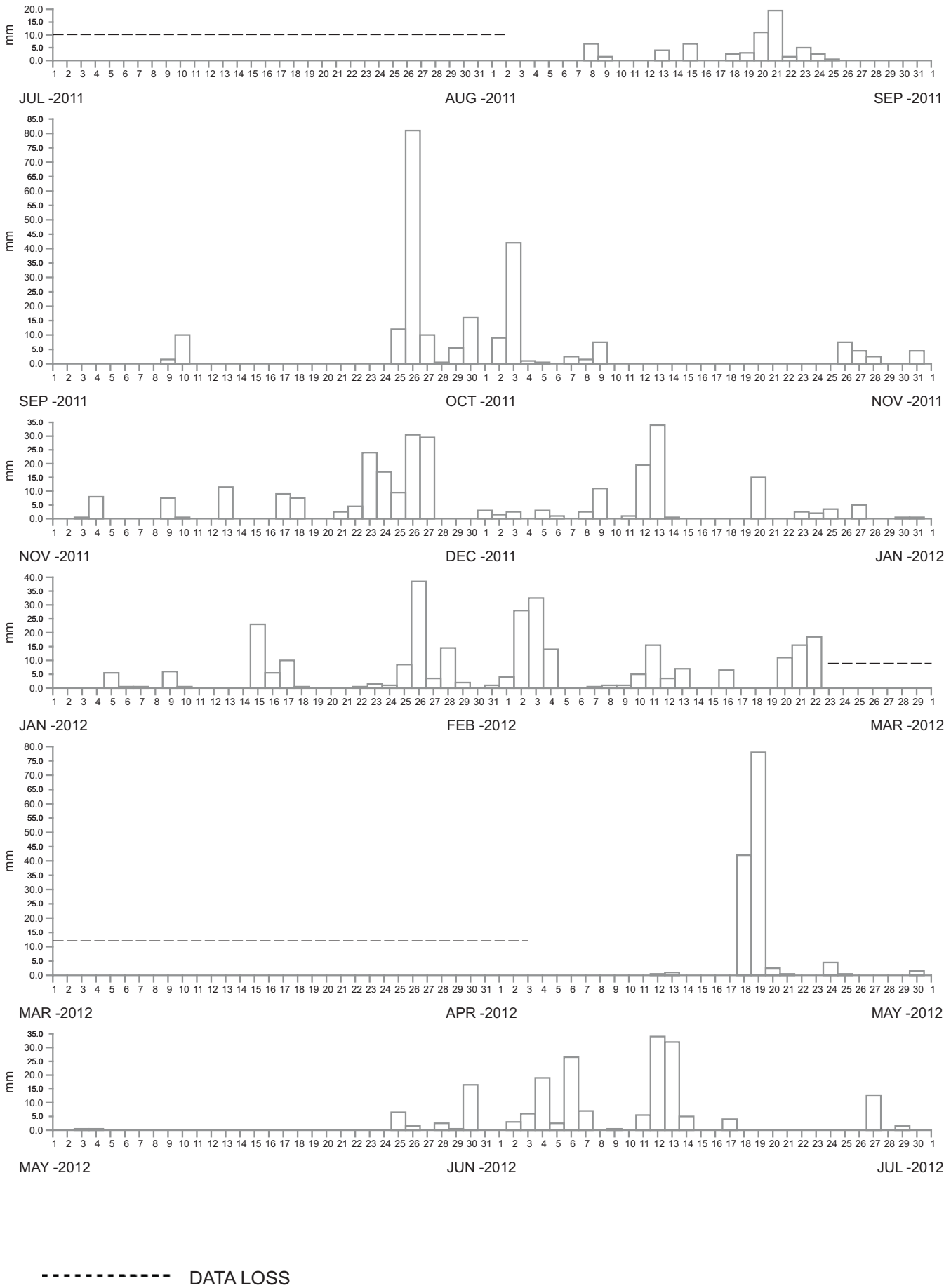
**53**

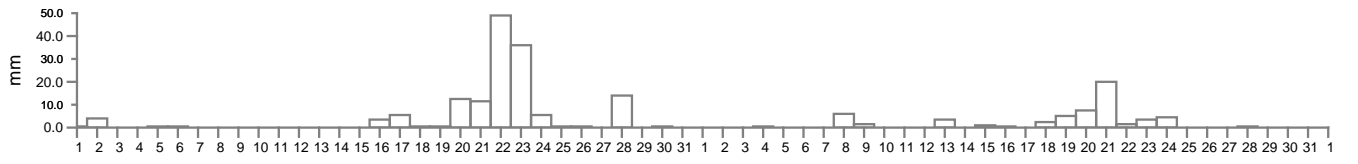
DRAWING 2159-53



----- DATA LOSS



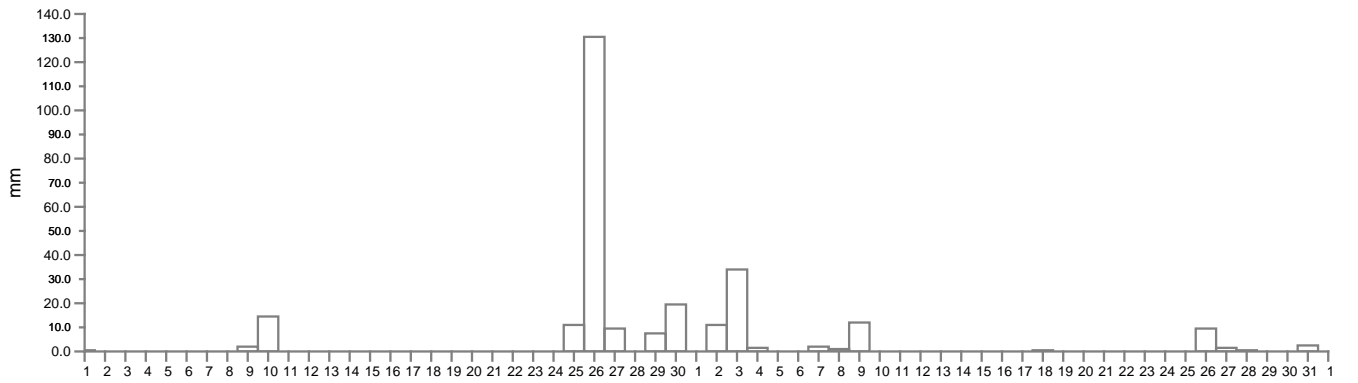




JUL -2011

AUG -2011

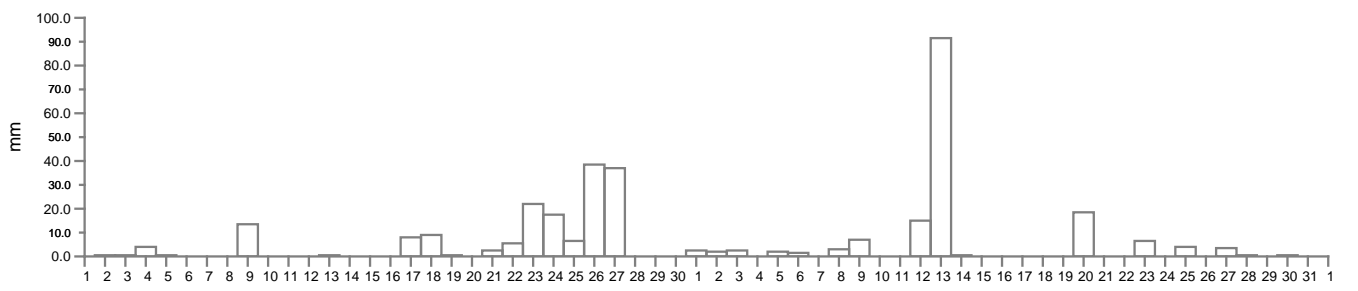
SEP -2011



SEP -2011

OCT -2011

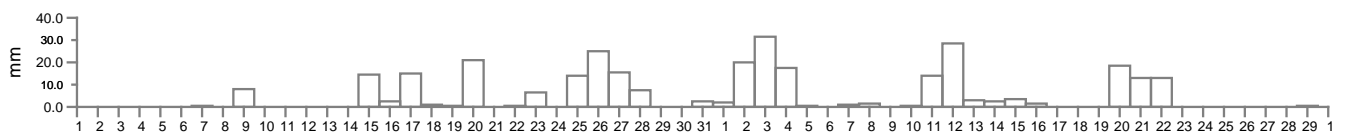
NOV -2011



NOV -2011

DEC -2011

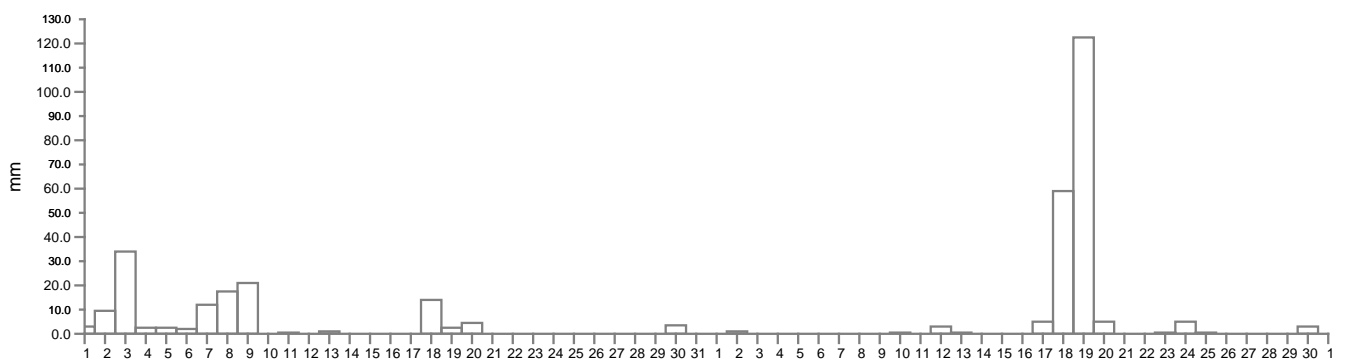
JAN -2012



JAN -2012

FEB -2012

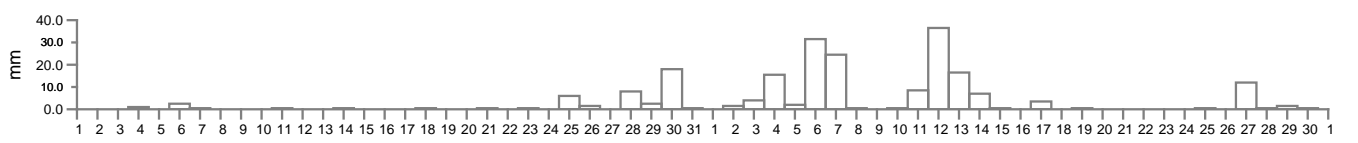
MAR -2012



MAR -2012

APR -2012

MAY -2012



MAY -2012

JUN -2012

JUL -2012

----- DATA LOSS



**Public Works**  
Manly Hydraulics Laboratory

**KANGY ANGY AT ORCHARD ROAD**  
2011-2012

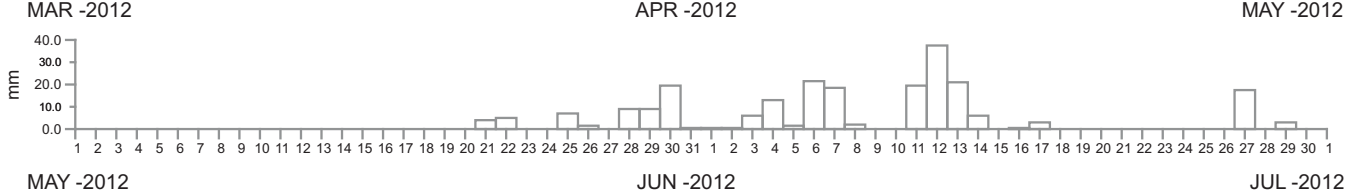
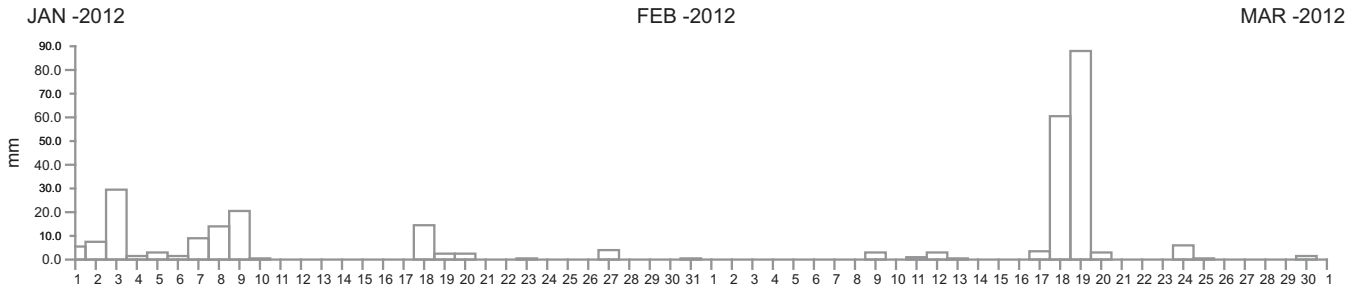
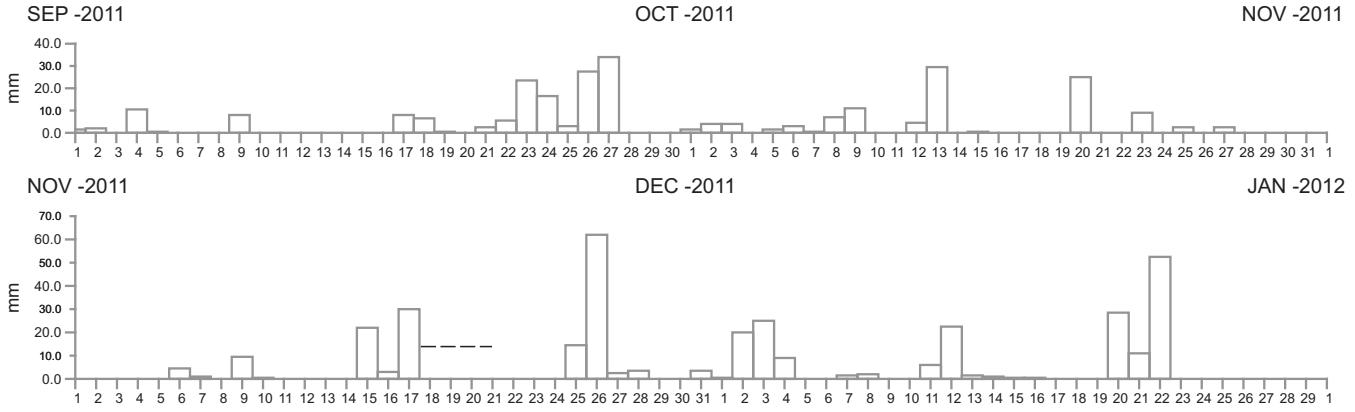
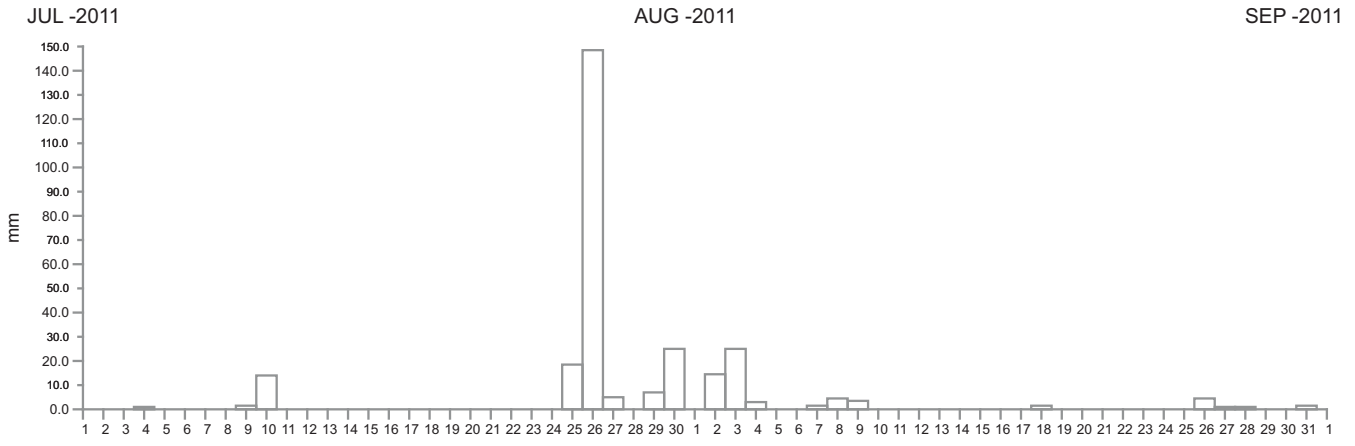
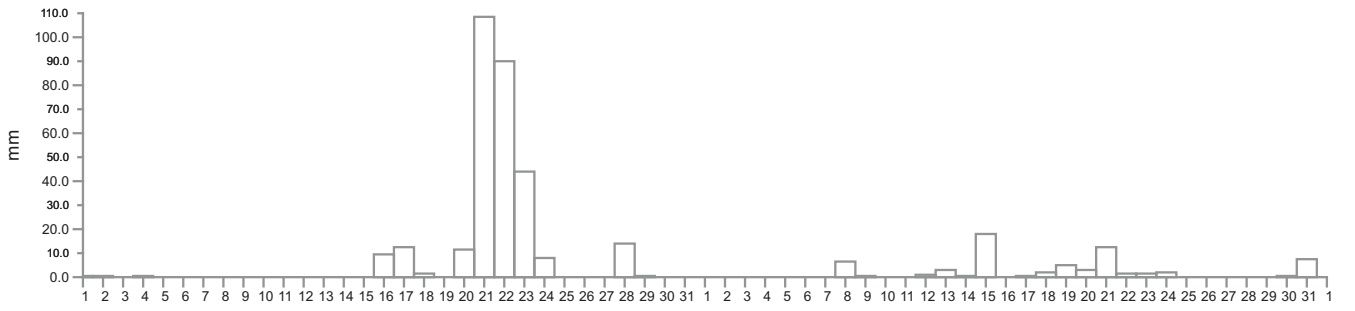
MHL  
Report 2159

Figure

**56**

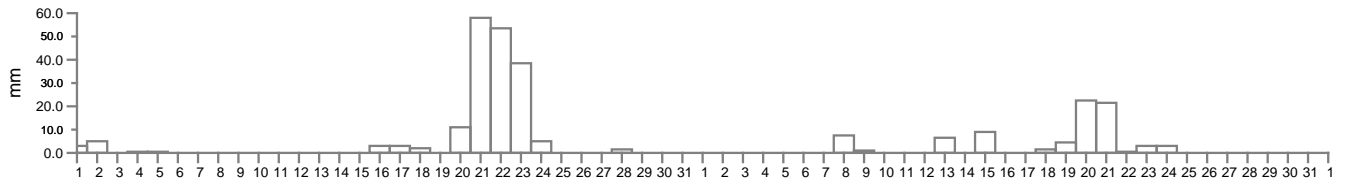
DRAWING 2159-56





----- DATA LOSS

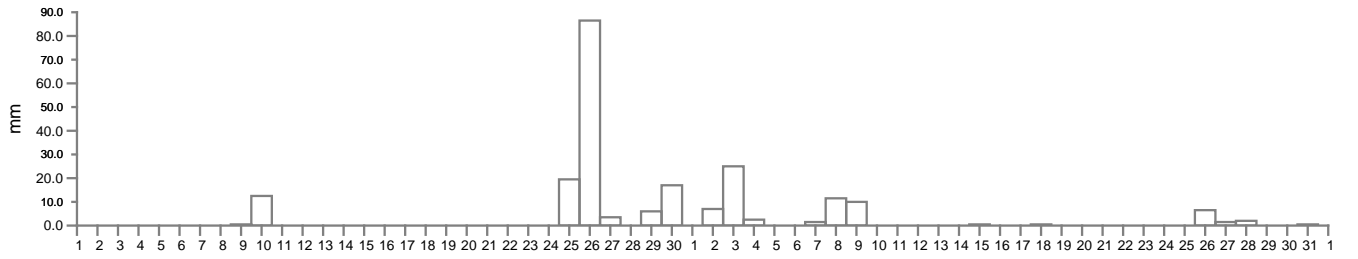




JUL -2011

AUG -2011

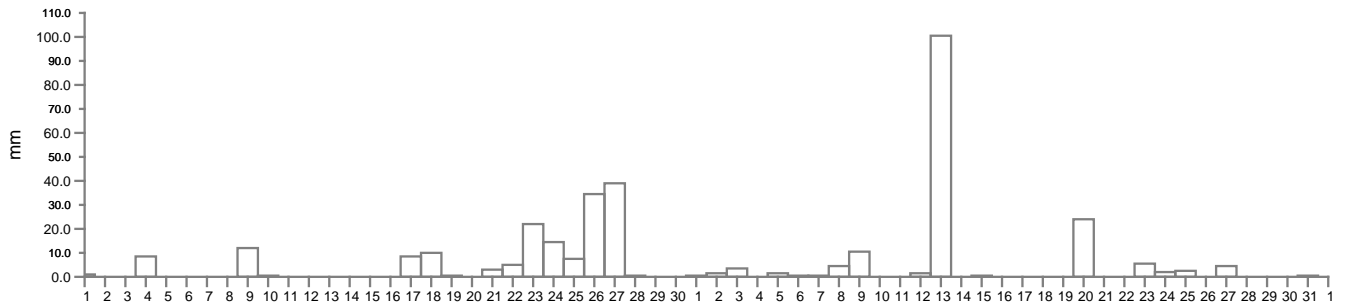
SEP -2011



SEP -2011

OCT -2011

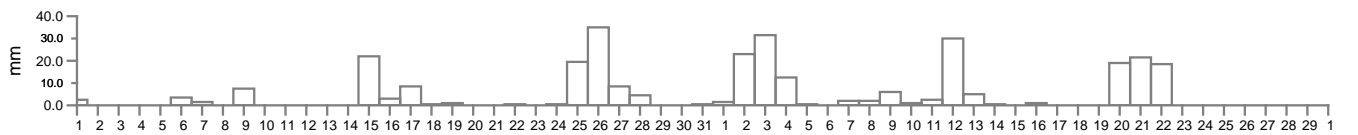
NOV -2011



NOV -2011

DEC -2011

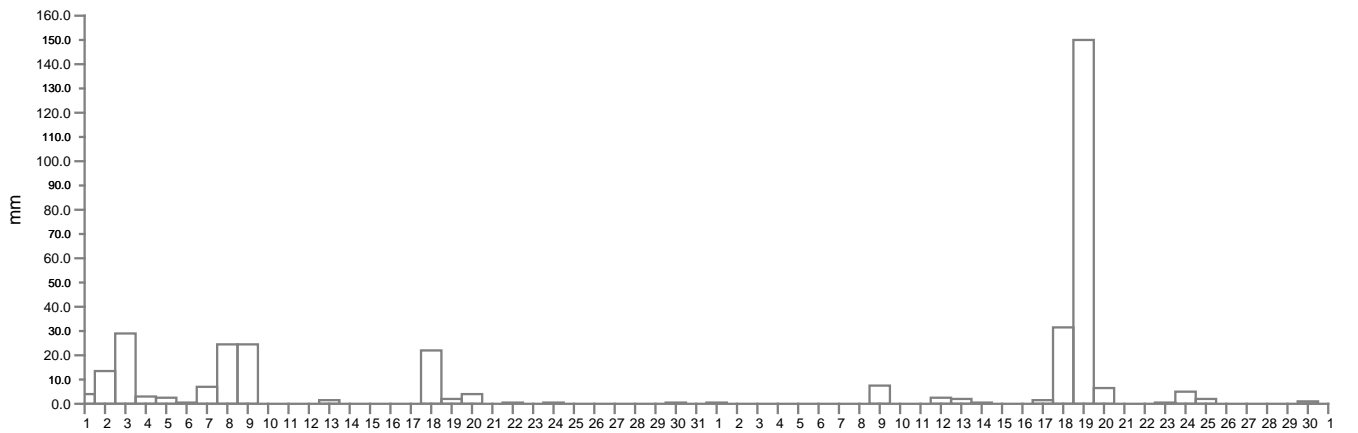
JAN -2012



JAN -2012

FEB -2012

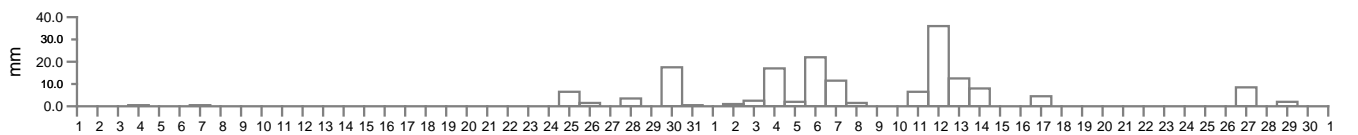
MAR -2012



MAR -2012

APR -2012

MAY -2012



MAY -2012

JUN -2012

JUL -2012

----- DATA LOSS



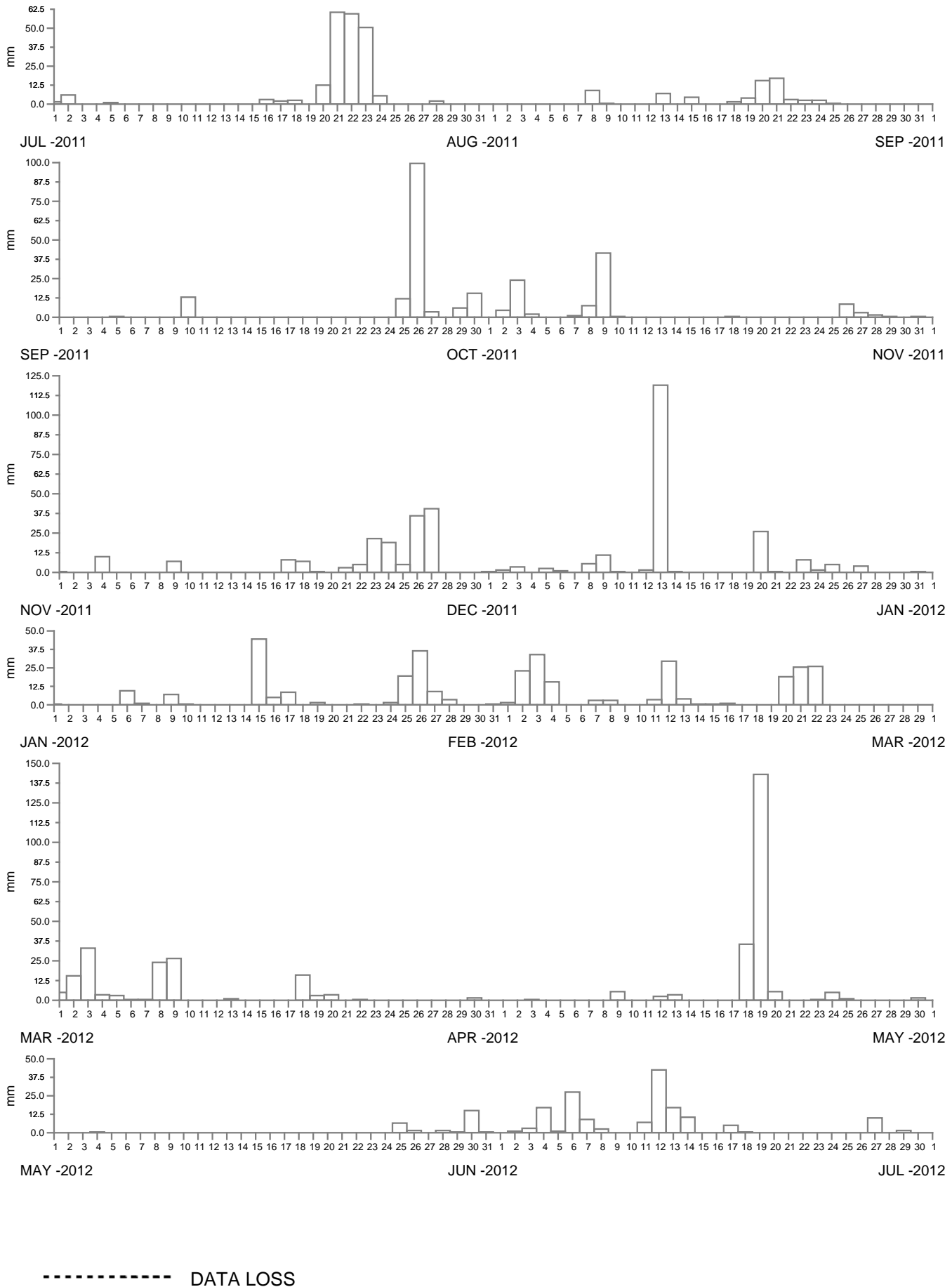
**Public Works**  
Manly Hydraulics Laboratory

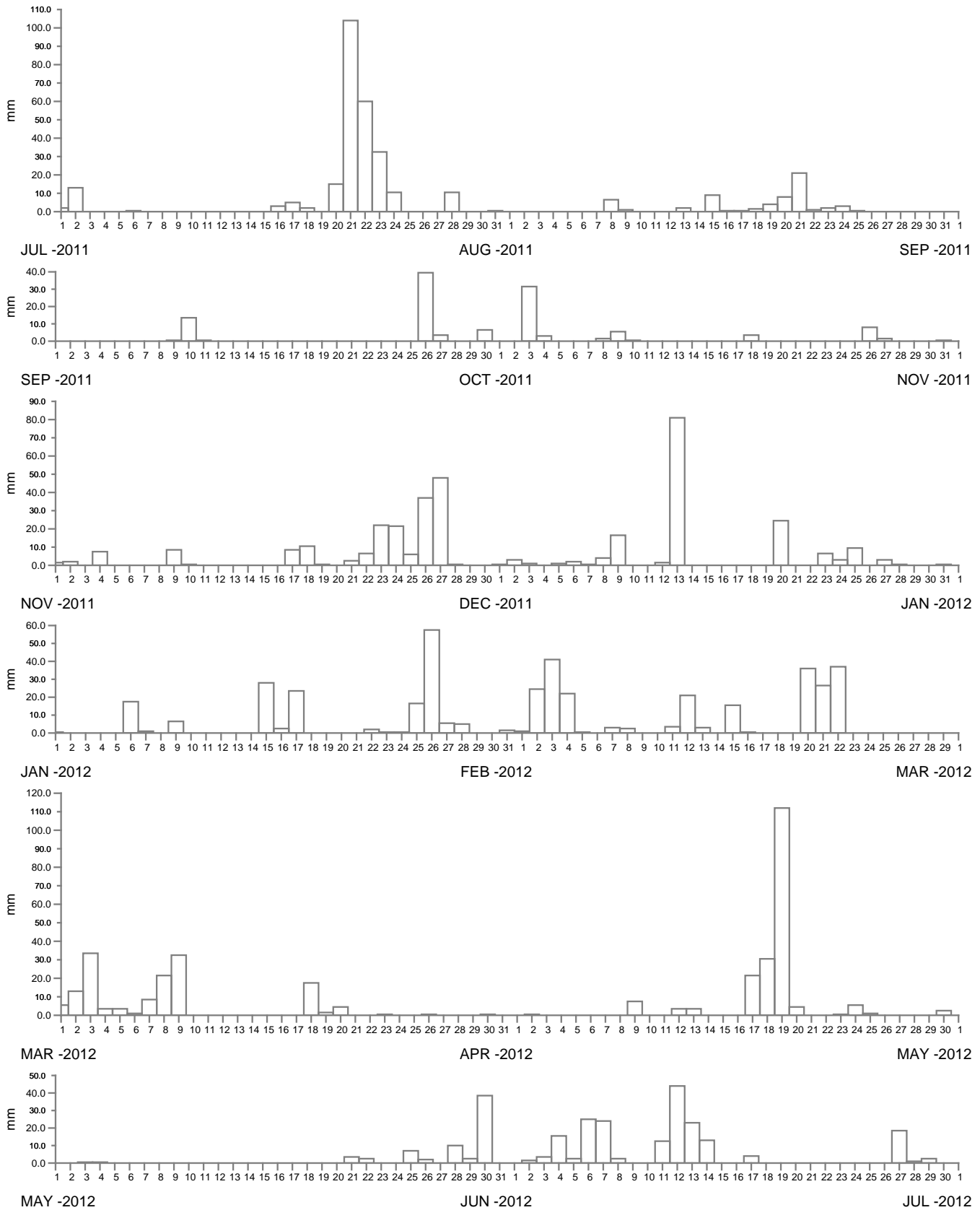
**STRICKLAND AT MANGROVE ROAD**  
2011-2012

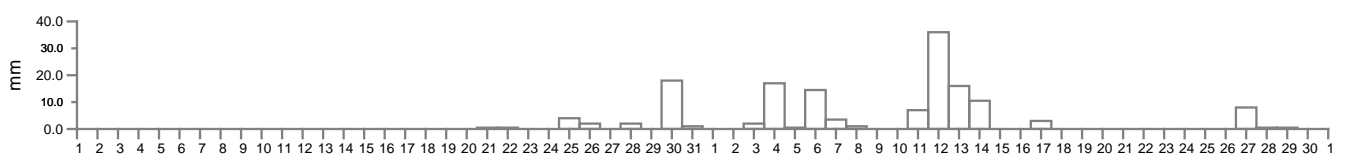
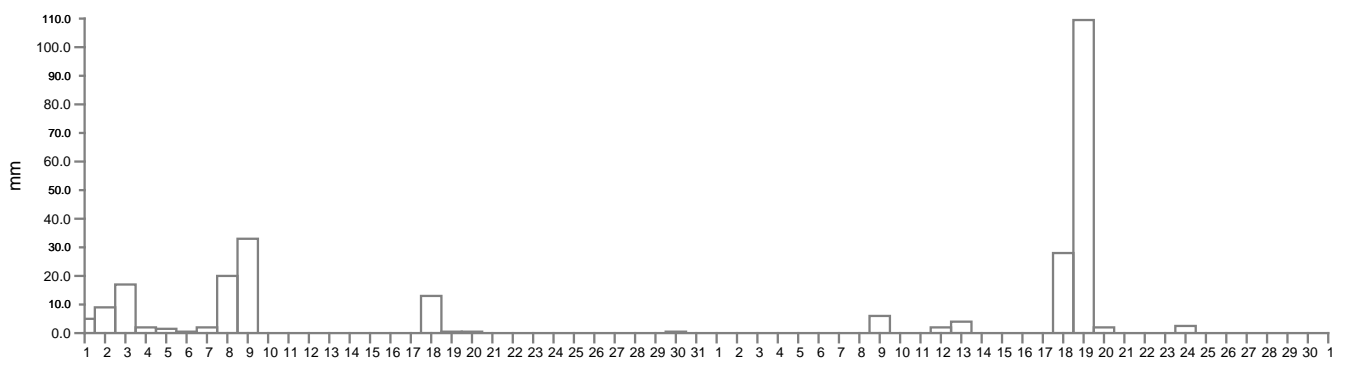
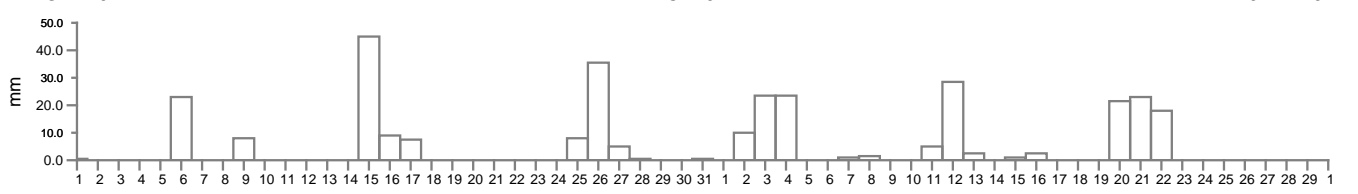
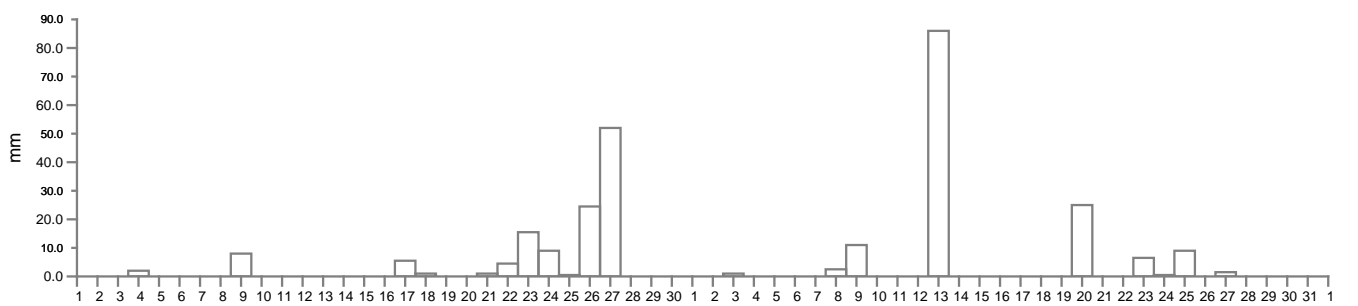
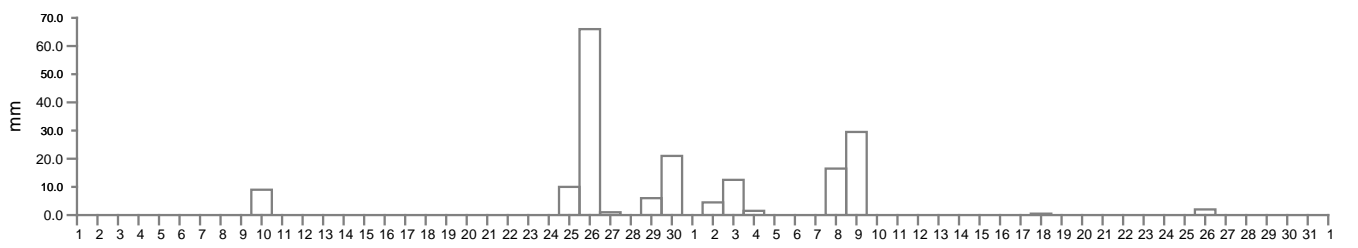
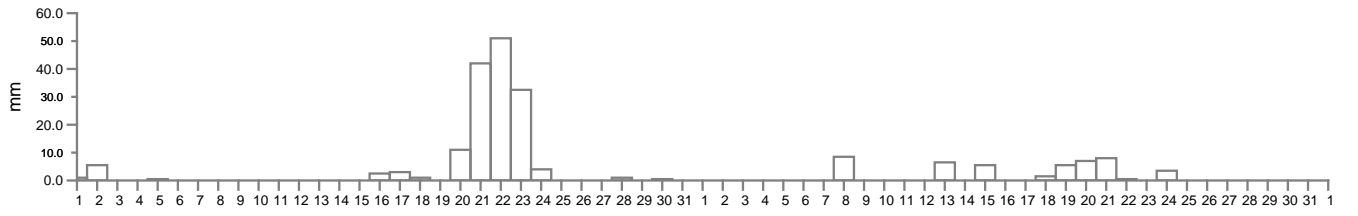
MHL  
Report 2159

Figure  
**60**

DRAWING 2159-60







----- DATA LOSS



**Public Works**  
Manly Hydraulics Laboratory

**WYOMING AT LAYCOCK STREET**  
2011-2012

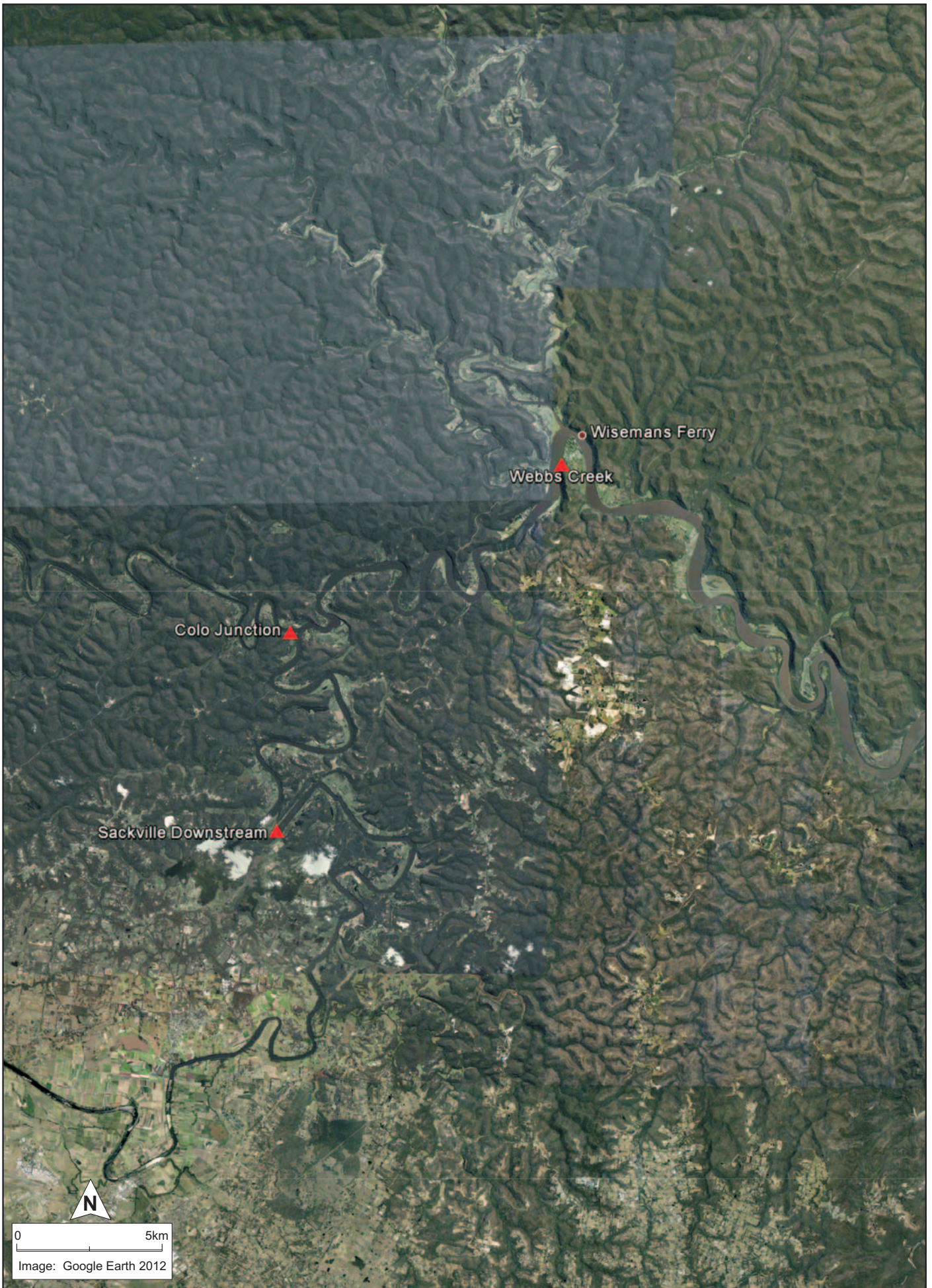
MHL  
Report 2159

Figure

**63**

DRAWING 2159-63





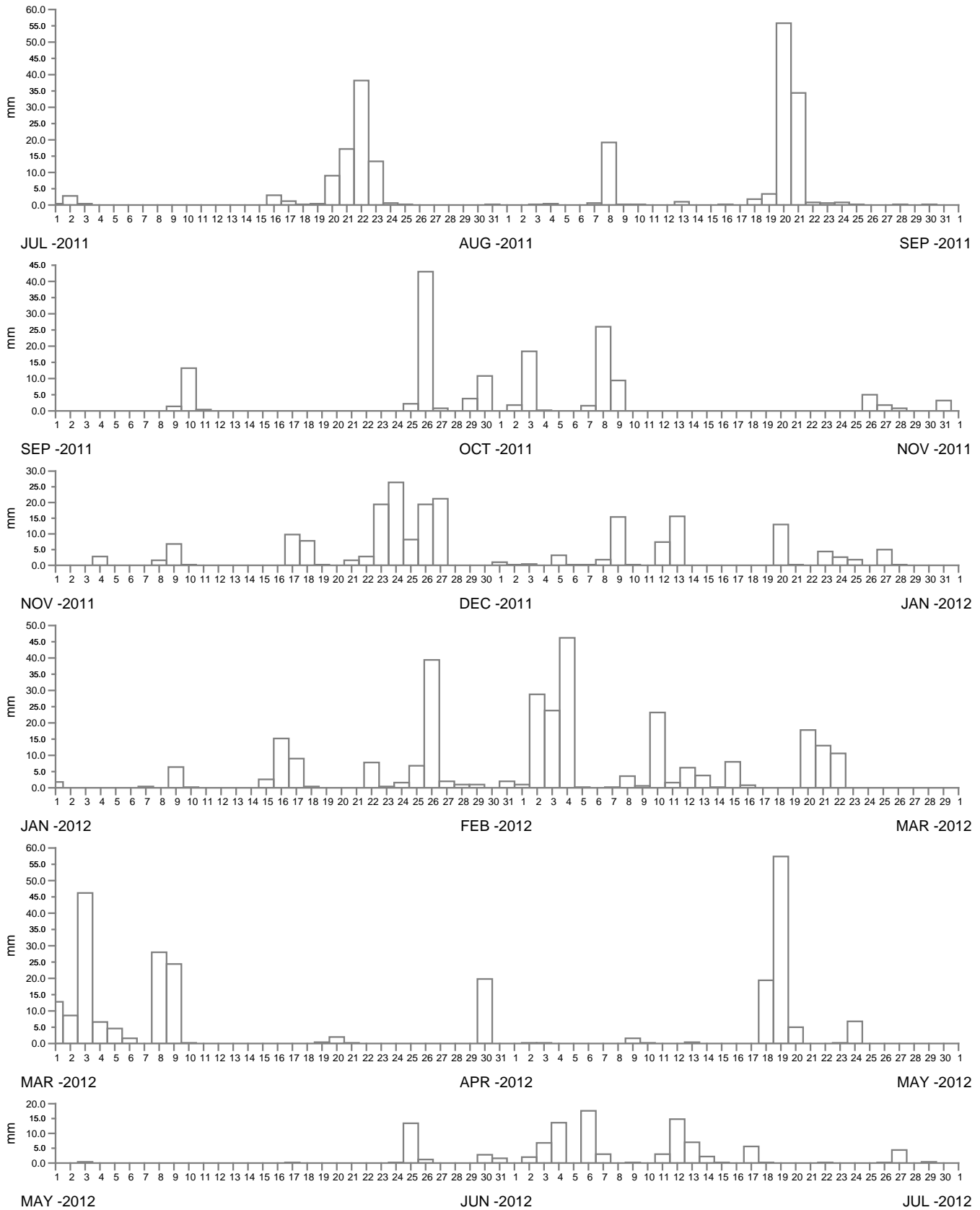
**Public Works**  
Manly Hydraulics Laboratory

### RAINFALL STATION LOCATIONS HAWKESBURY RIVER (MID) REGION

MHL  
Report 2159

Figure  
65

DRAWING 2159-65.cdr



----- DATA LOSS



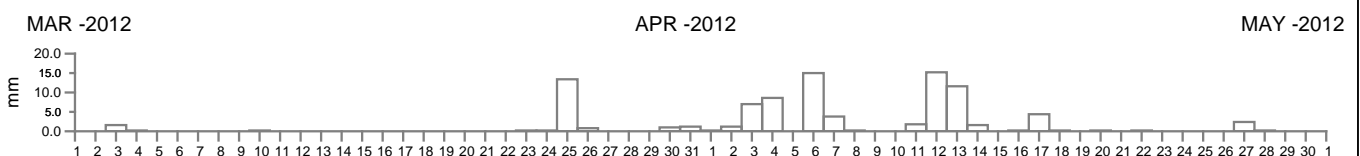
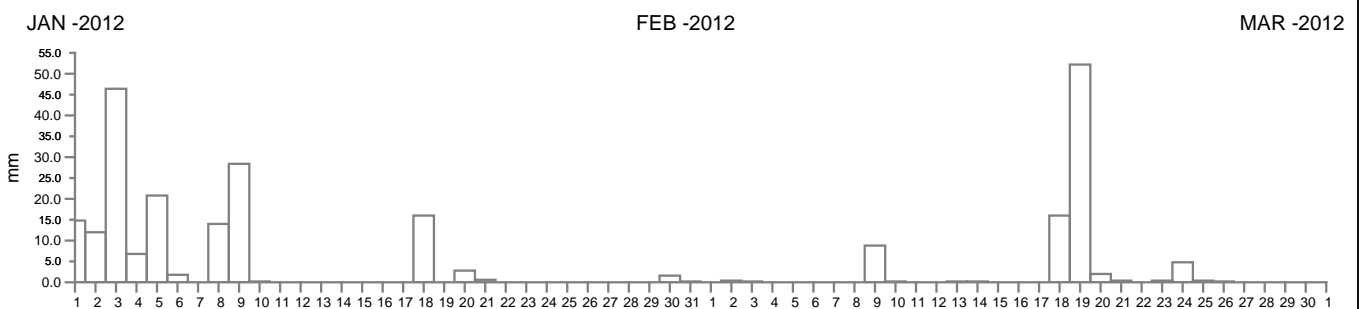
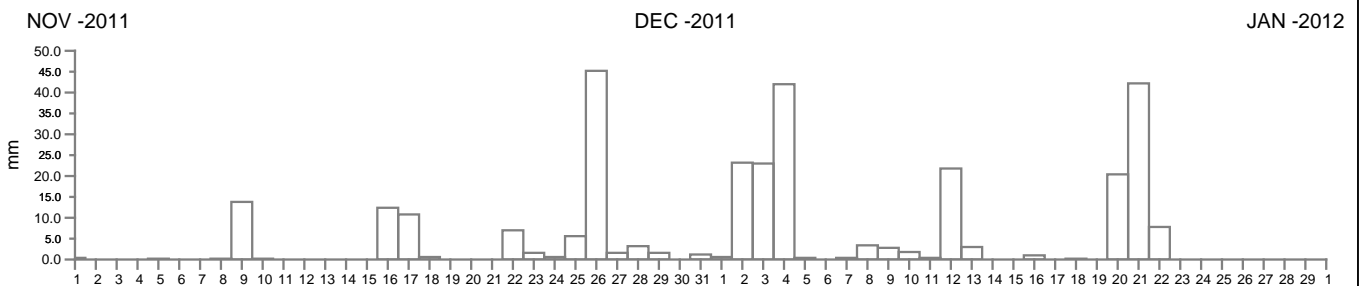
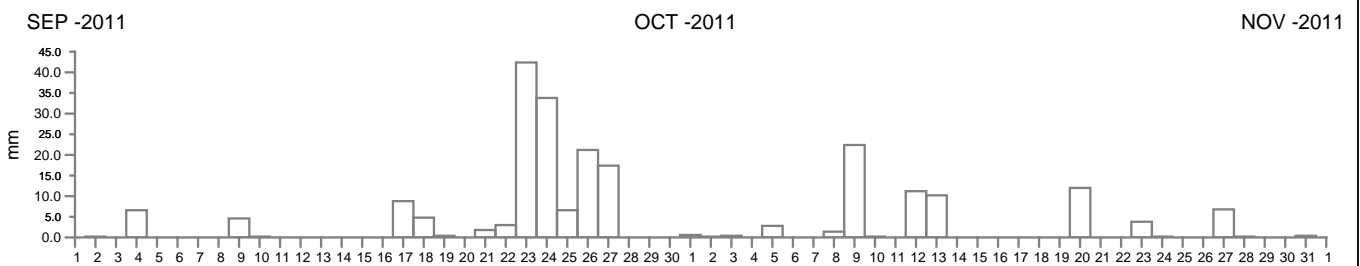
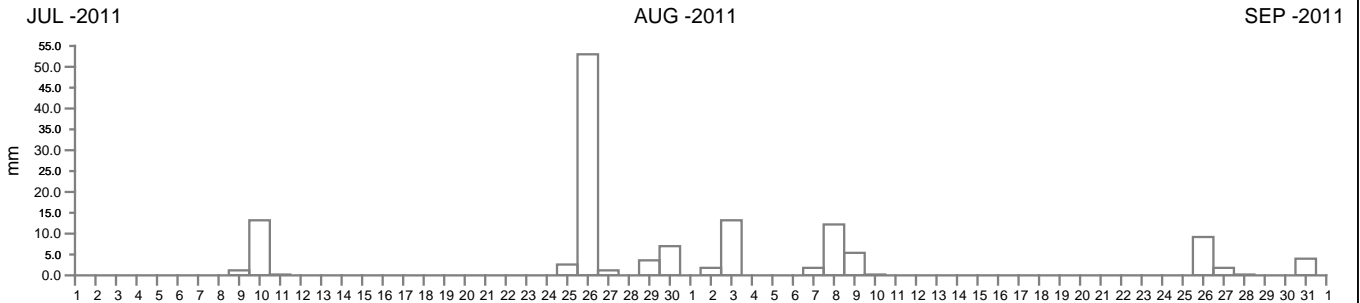
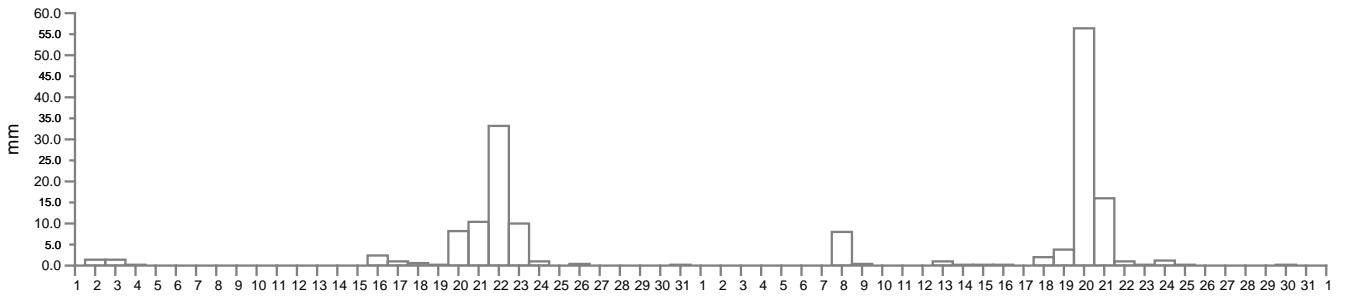
**Public Works**  
Manly Hydraulics Laboratory

**HAWKESBURY RIVER AT WEBBS CREEK**  
2011-2012

MHL  
Report 2159

Figure  
**66**

DRAWING 2159-66



----- DATA LOSS



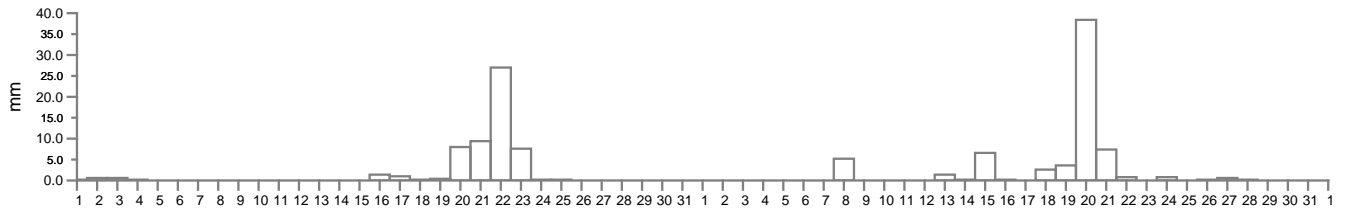
**Public Works**  
Manly Hydraulics Laboratory

**HAWKESBURY RIVER AT COLO JUNCTION**  
2011-2012

MHL  
Report 2159

Figure  
**67**

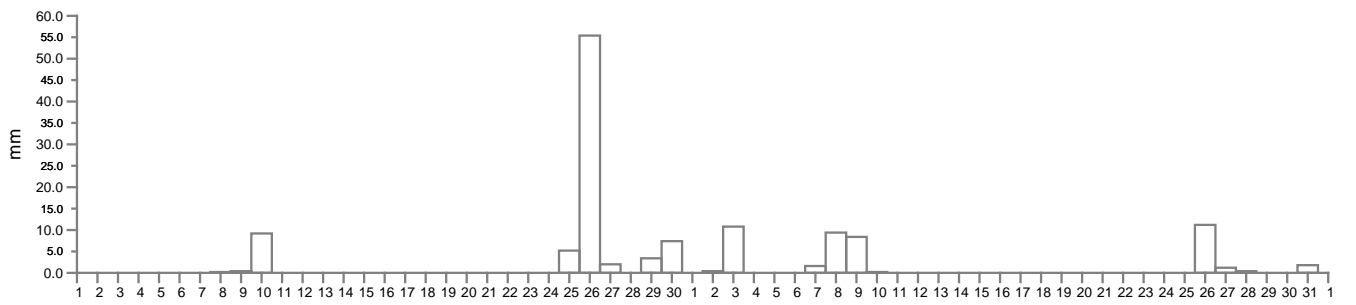
DRAWING 2159-67



JUL -2011

AUG -2011

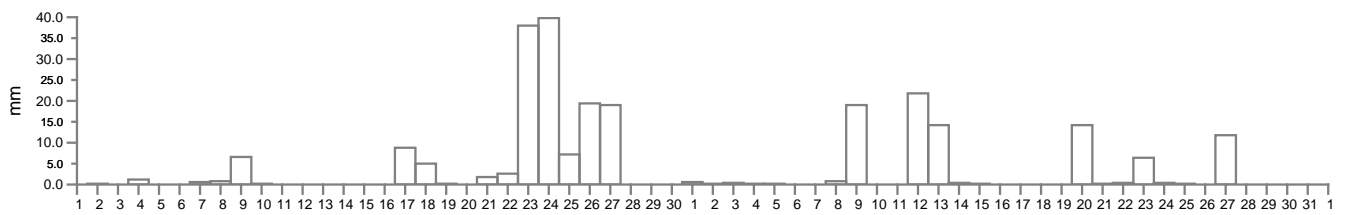
SEP -2011



SEP -2011

OCT -2011

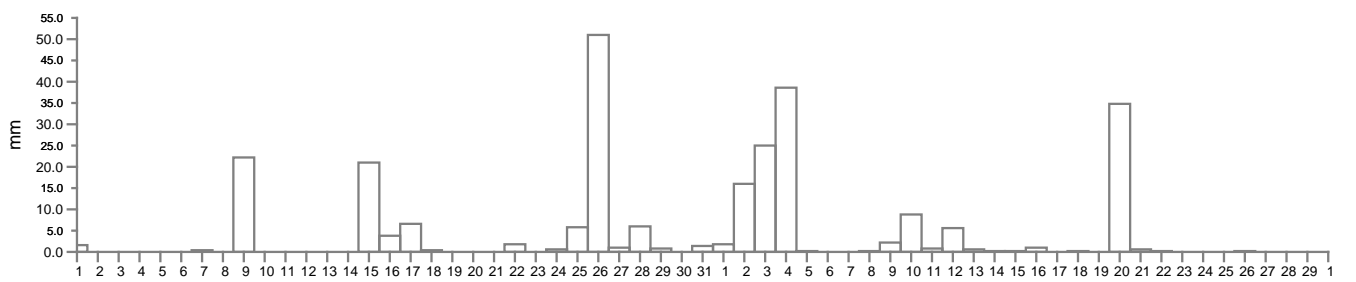
NOV -2011



NOV -2011

DEC -2011

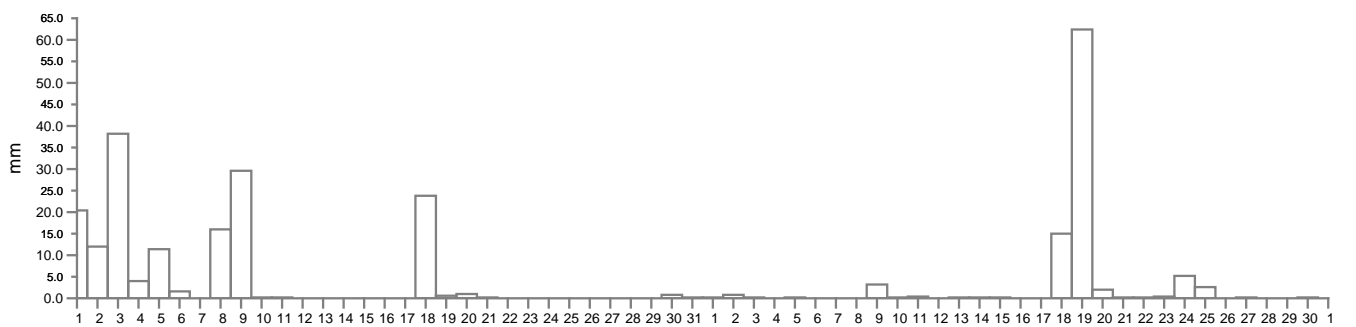
JAN -2012



JAN -2012

FEB -2012

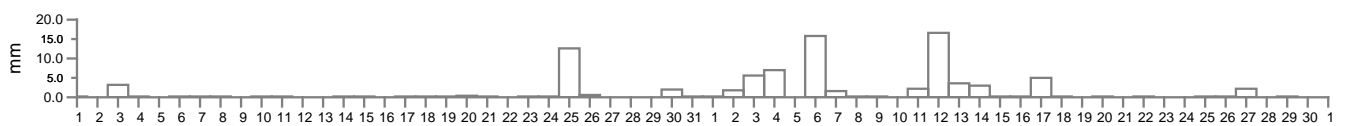
MAR -2012



MAR -2012

APR -2012

MAY -2012



MAY -2012

JUN -2012

JUL -2012

----- DATA LOSS



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Manly Hydraulics Laboratory

**HAWKESBURY RIVER AT SACKVILLE DOWNSTREAM**  
**2011-2012**

MHL  
Report 2159

Figure  
**68**

DRAWING 2159-68

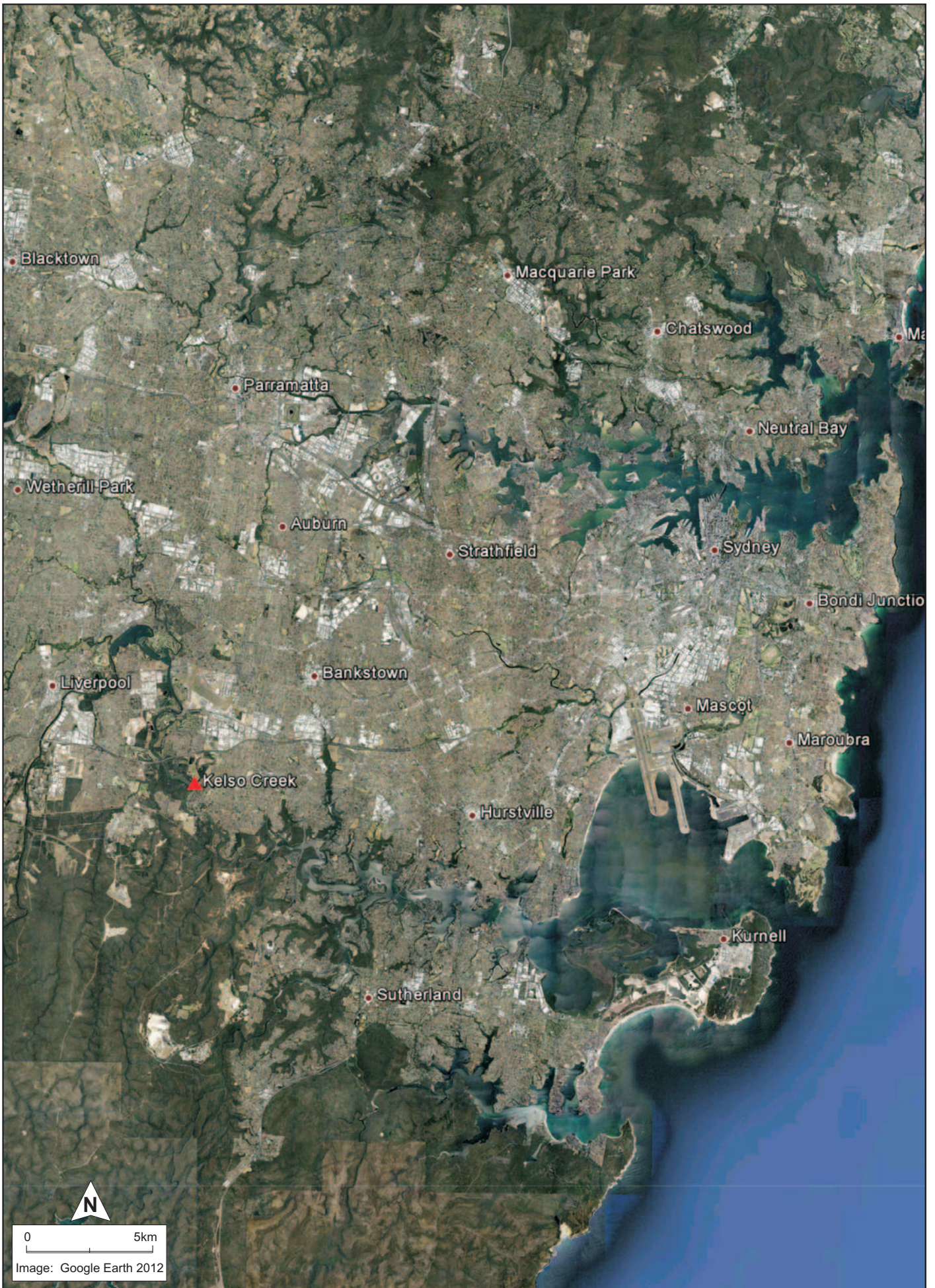


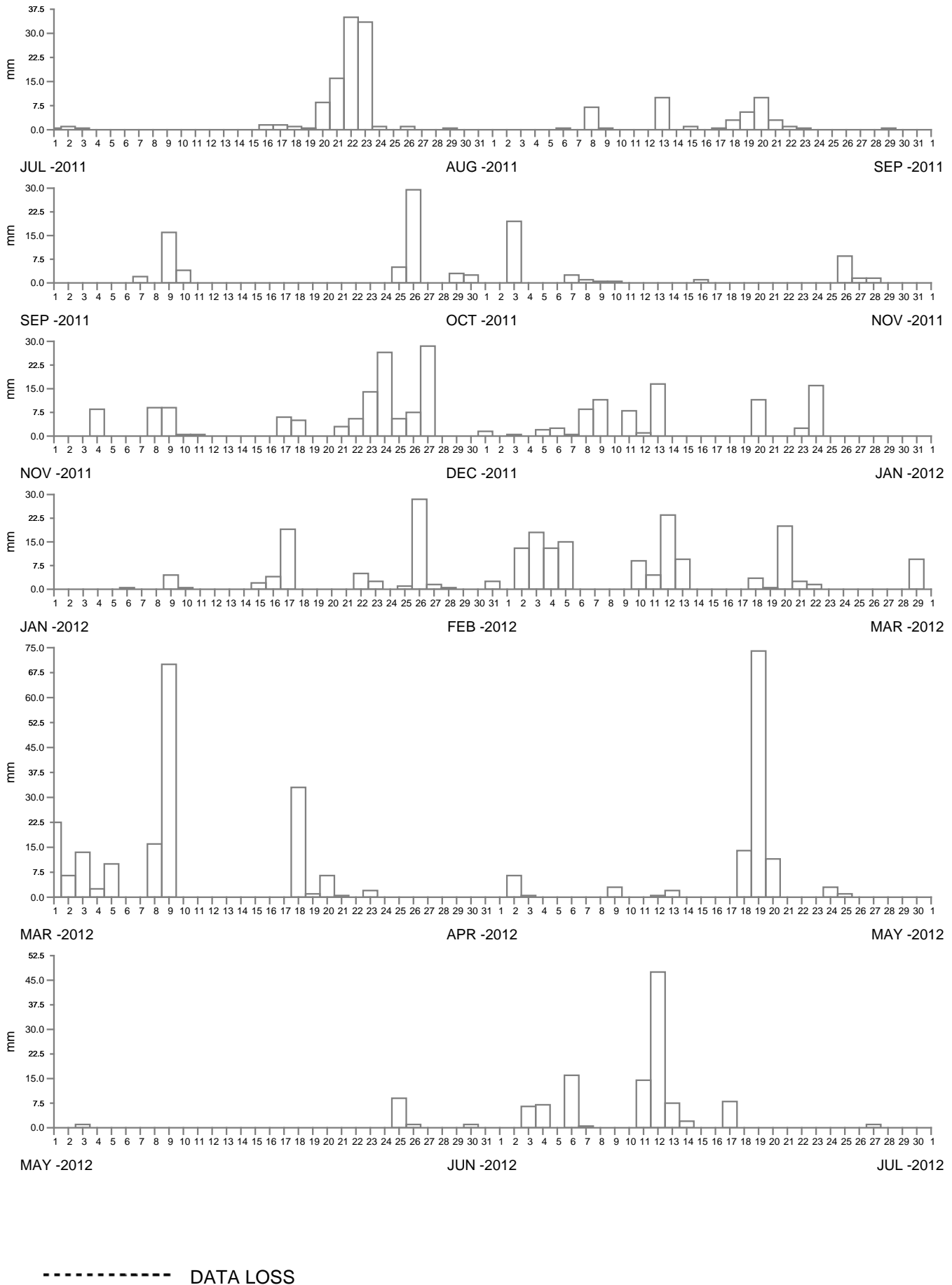
Image: Google Earth 2012

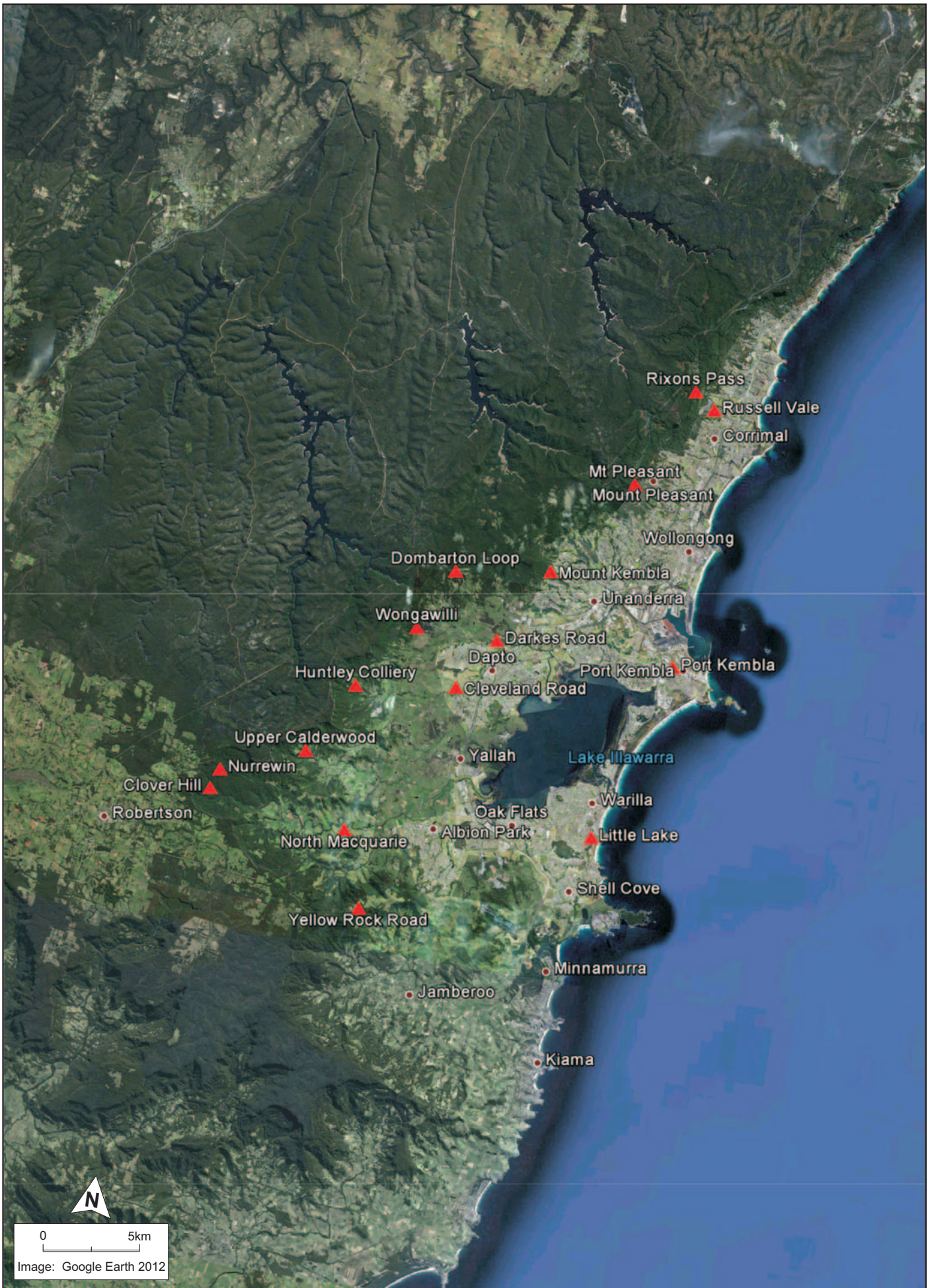


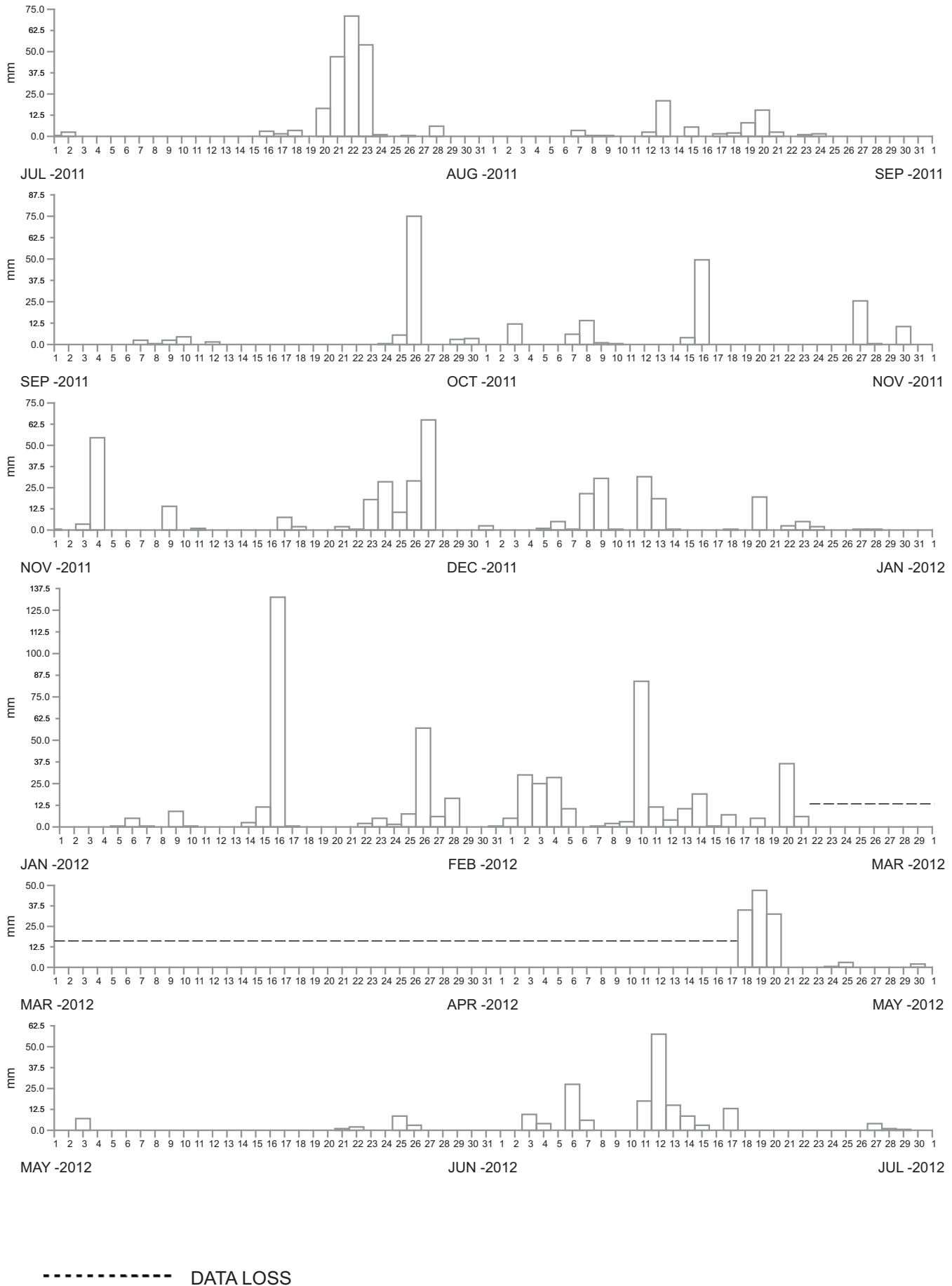
**Public Works**  
Manly Hydraulics Laboratory

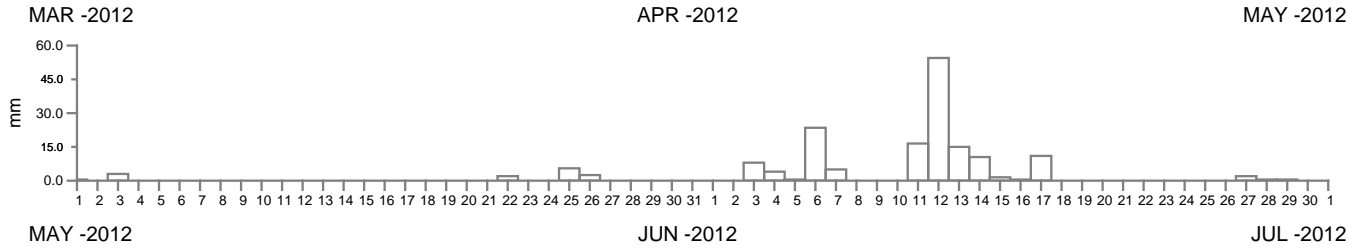
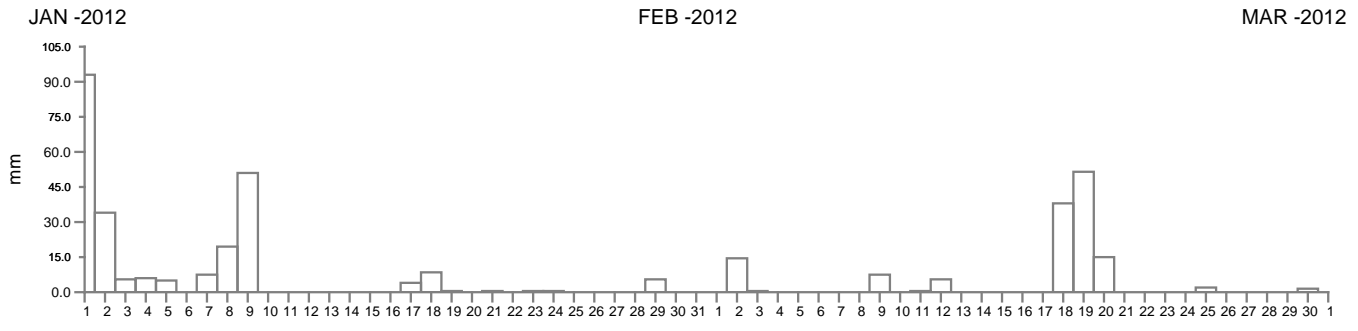
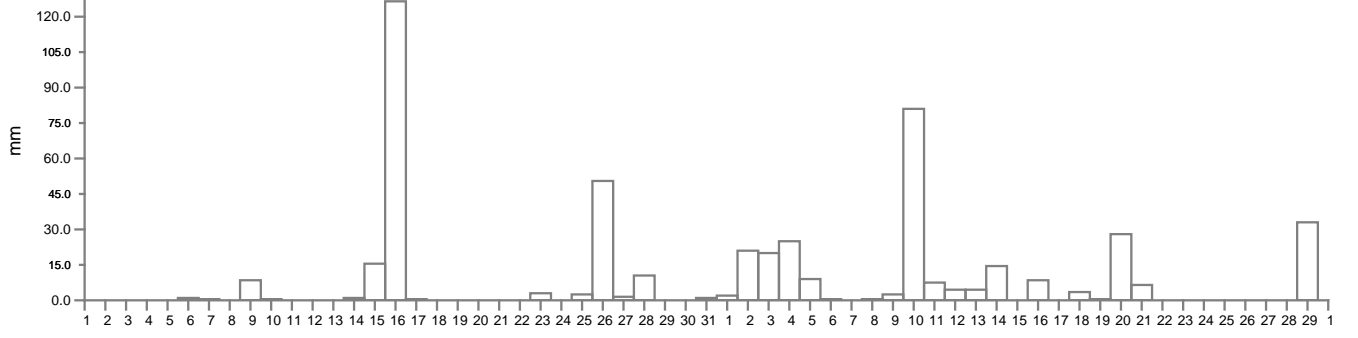
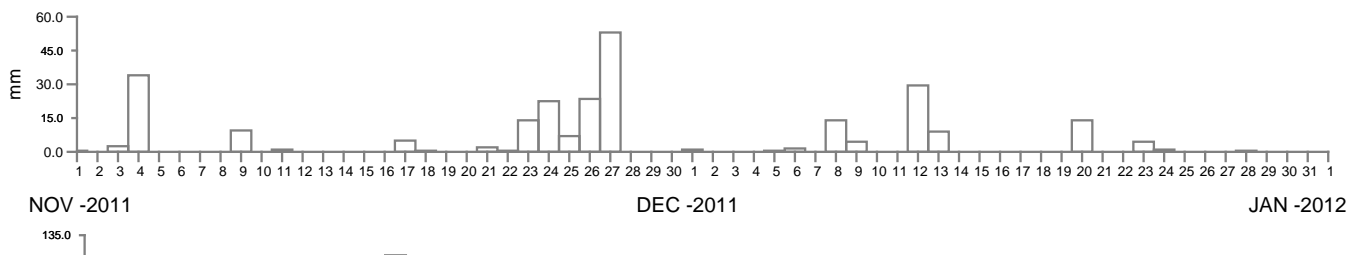
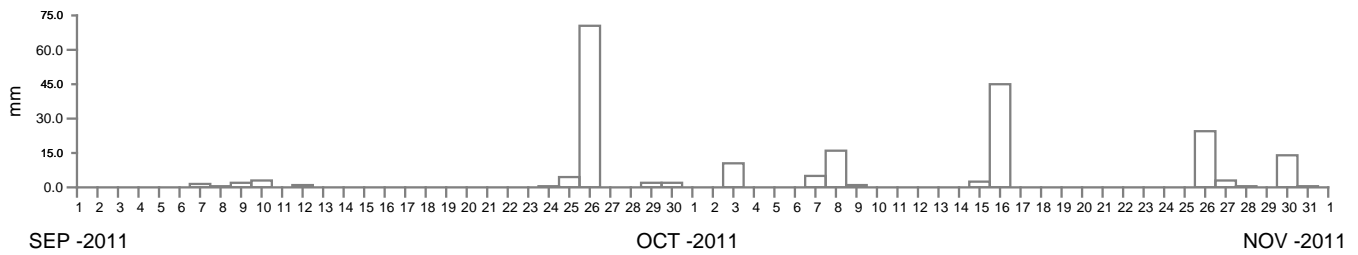
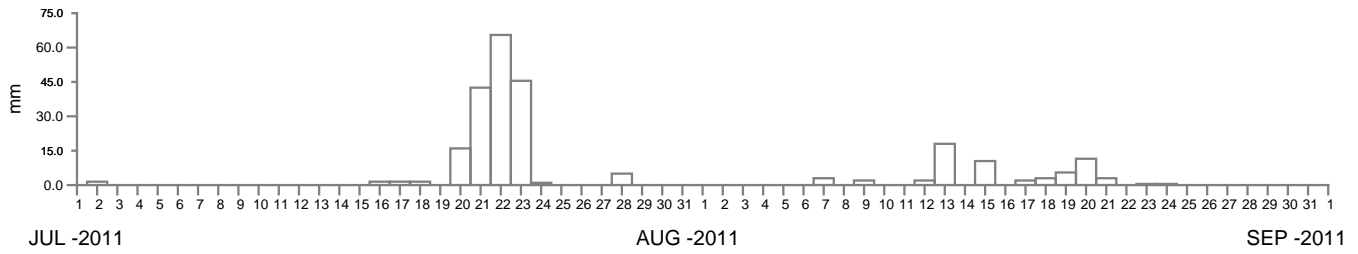
**RAINFALL STATION LOCATIONS  
SYDNEY COASTAL REGION**

MHL  
Report 2159  
**Figure  
69**  
DRAWING 2159-69.cdr









----- DATA LOSS



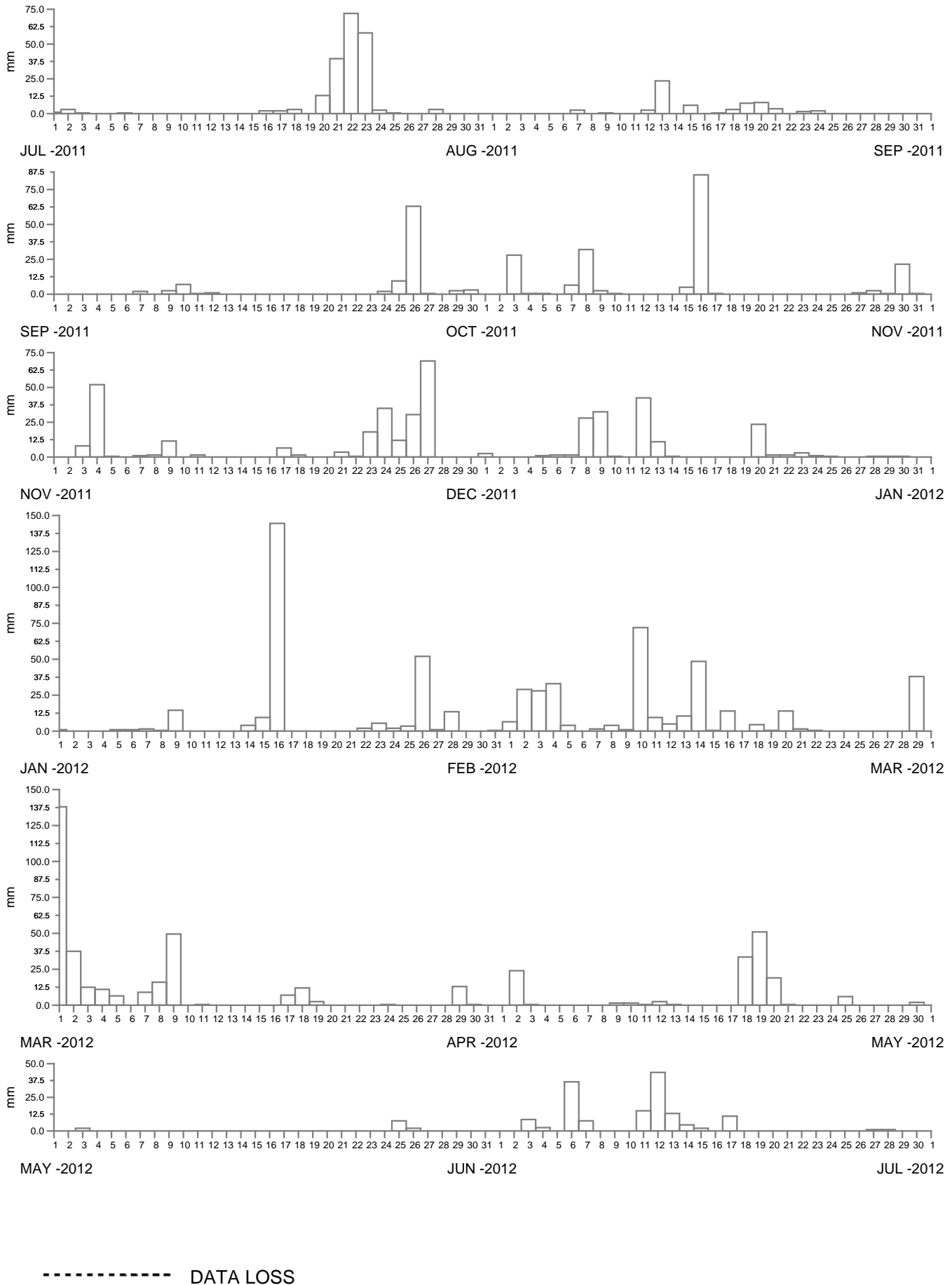
**Public Works**  
Manly Hydraulics Laboratory

**RUSSELL VALE AT WHITING CRESCENT**  
2011-2012

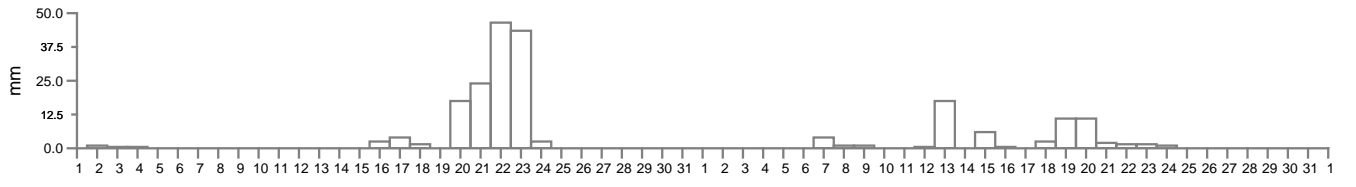
MHL  
Report 2159

Figure  
**73**

DRAWING 2159-73



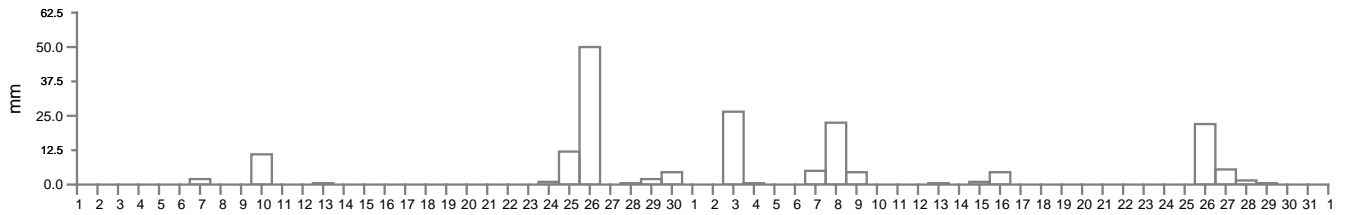




JUL -2011

AUG -2011

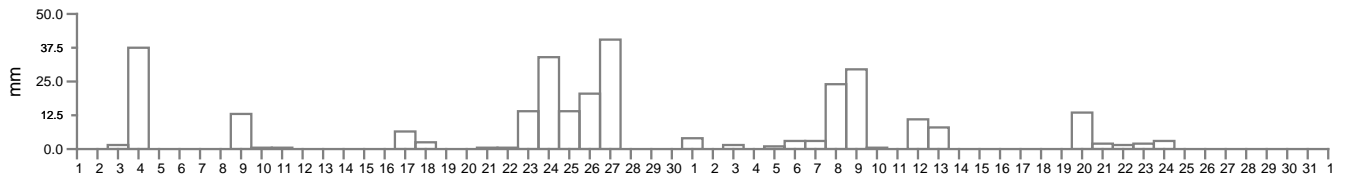
SEP -2011



SEP -2011

OCT -2011

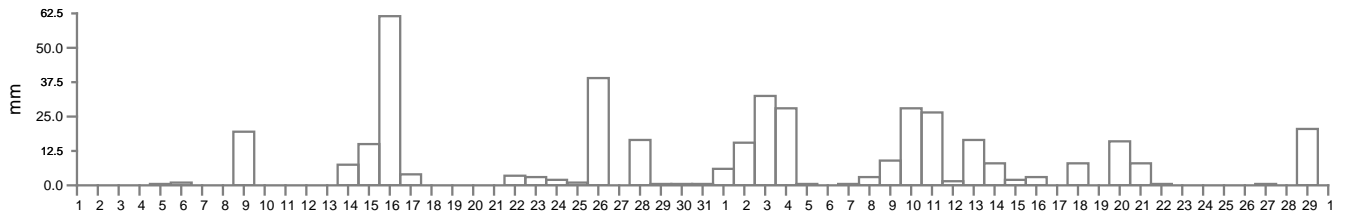
NOV -2011



NOV -2011

DEC -2011

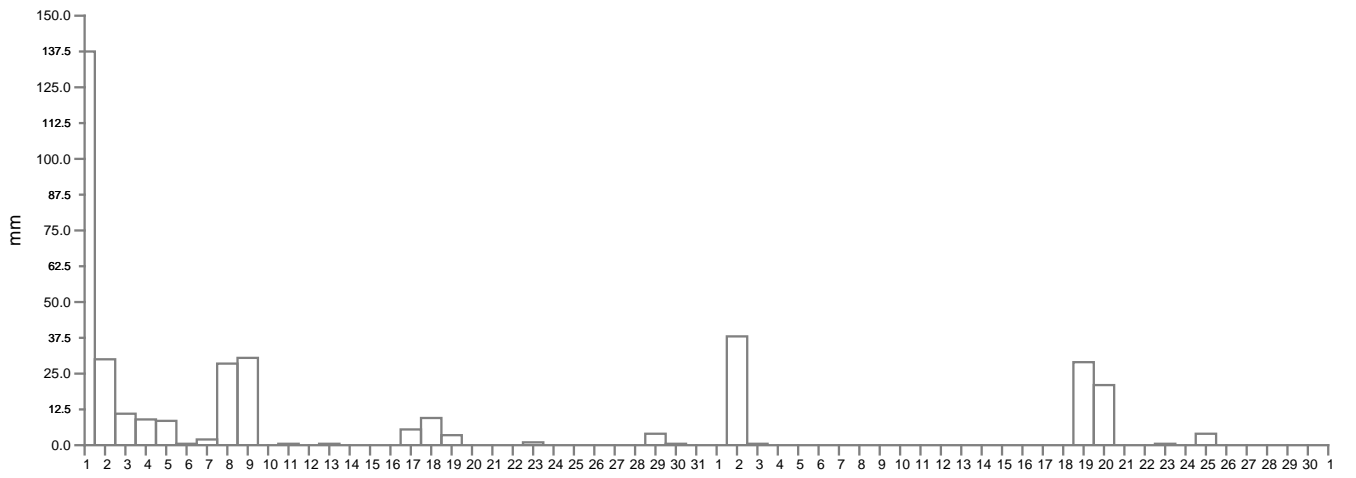
JAN -2012



JAN -2012

FEB -2012

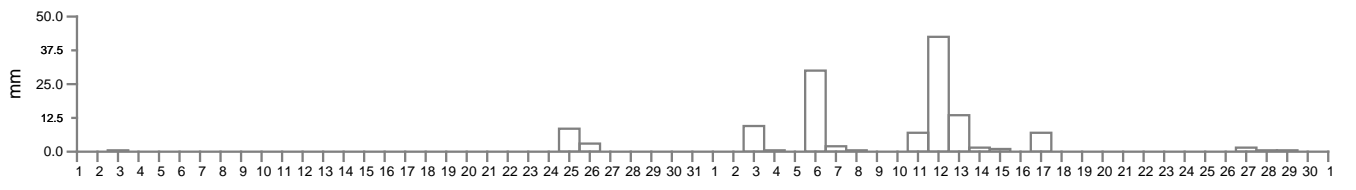
MAR -2012



MAR -2012

APR -2012

MAY -2012



MAY -2012

JUN -2012

JUL -2012

----- DATA LOSS



Public Works  
Manly Hydraulics Laboratory

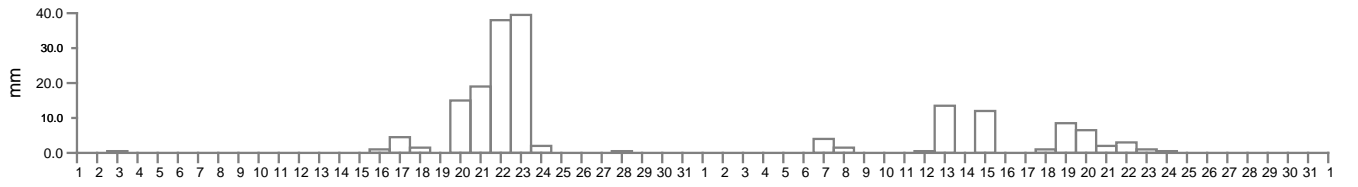
DOMBARTON LOOP AT PAYNES ROAD  
2011-2012

MHL  
Report 2159

Figure

76

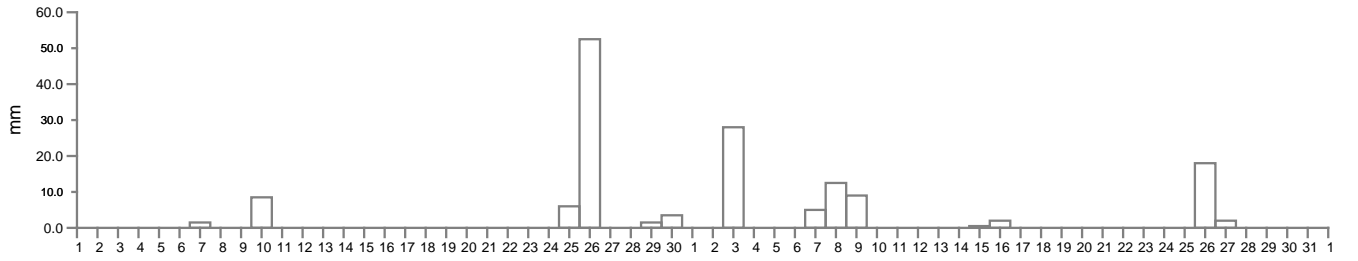
DRAWING 2159-76



JUL -2011

AUG -2011

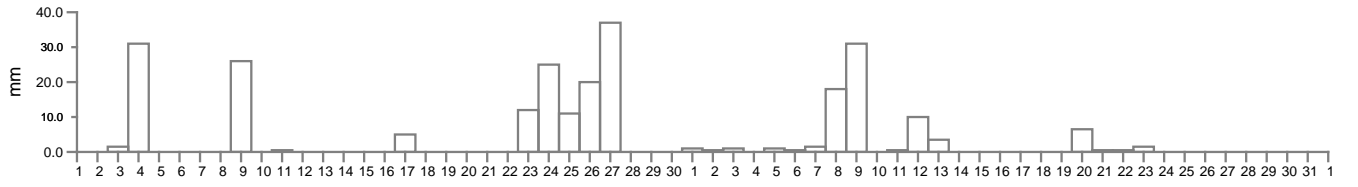
SEP -2011



SEP -2011

OCT -2011

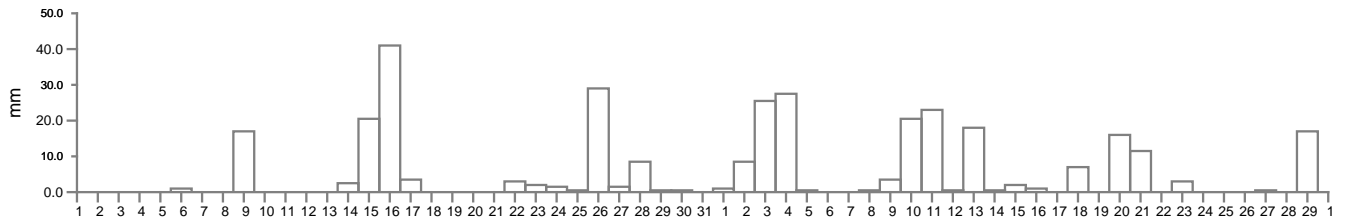
NOV -2011



NOV -2011

DEC -2011

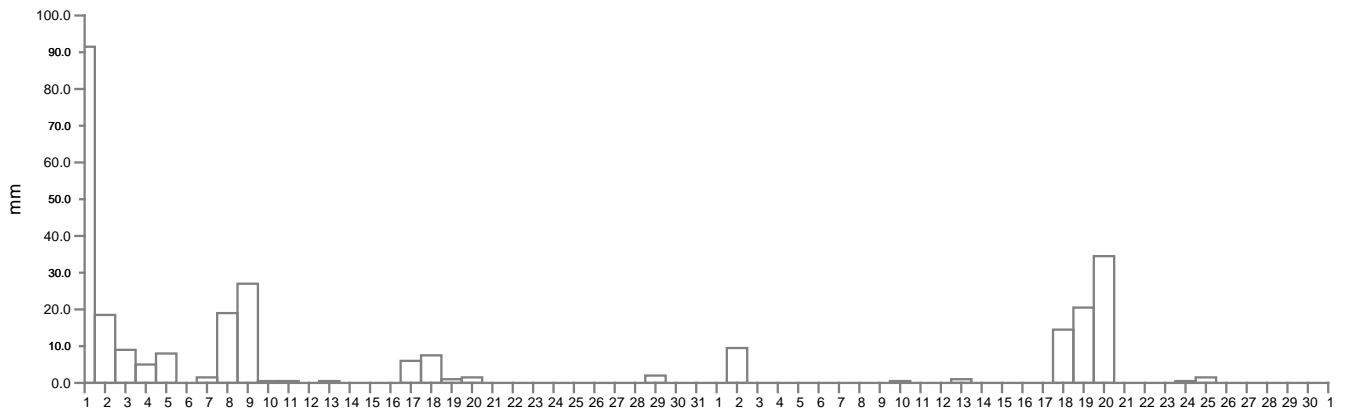
JAN -2012



JAN -2012

FEB -2012

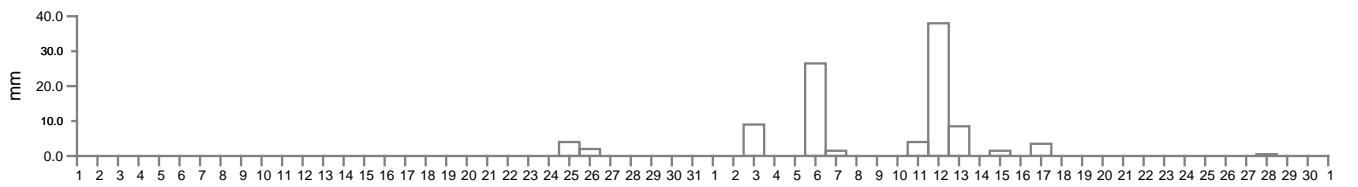
MAR -2012



MAR -2012

APR -2012

MAY -2012



MAY -2012

JUN -2012

JUL -2012

----- DATA LOSS



**Public Works**  
Manly Hydraulics Laboratory

**WONGAWILLI AT JERSEY FARM ROAD**  
2011-2012

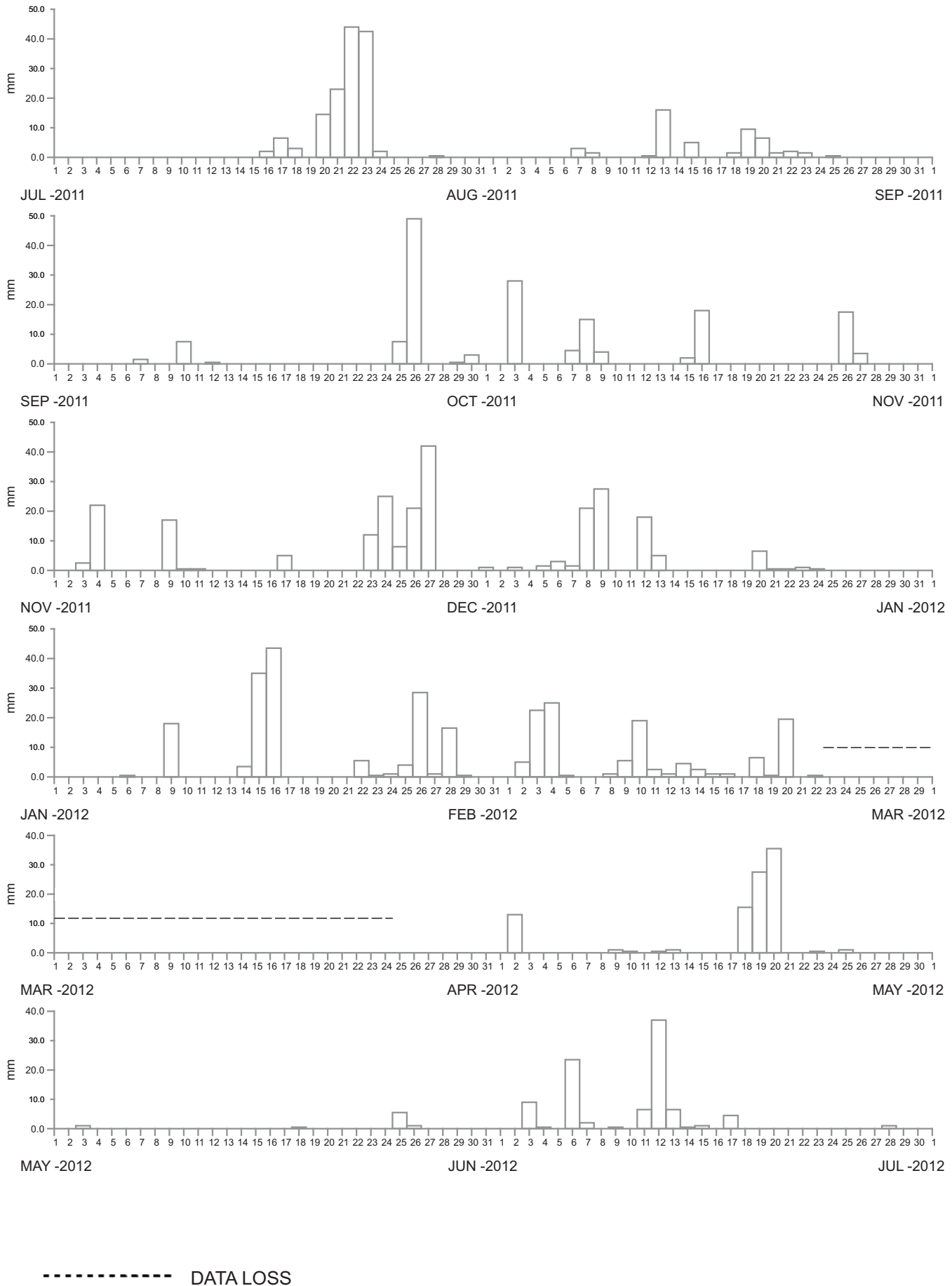
MHL  
Report 2159

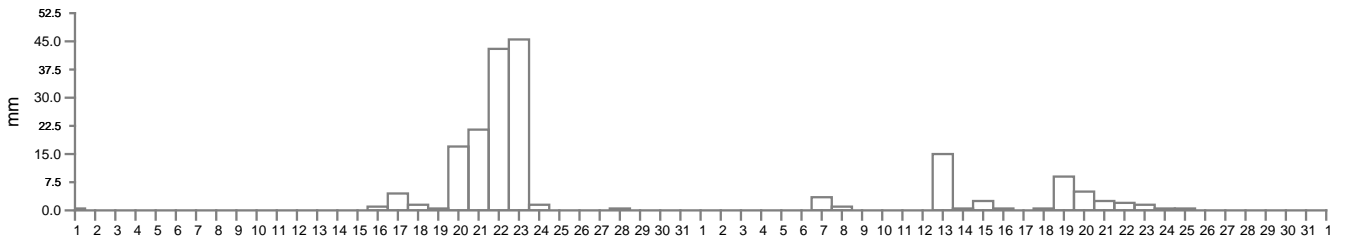
Figure

77

DRAWING 2159-77



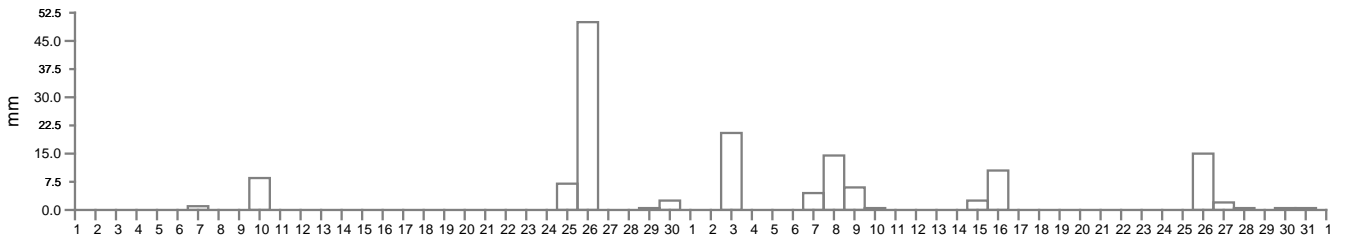




JUL -2011

AUG -2011

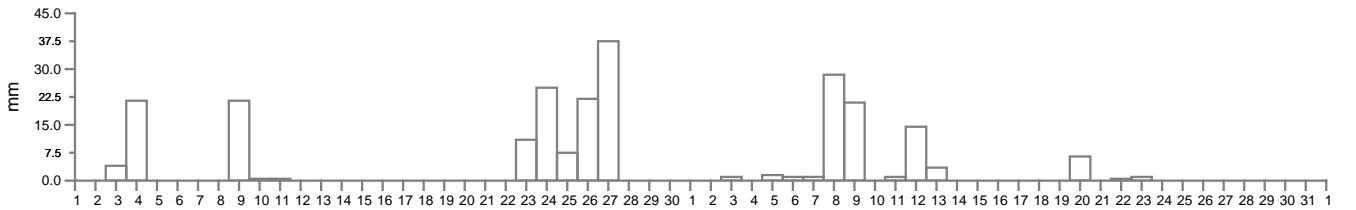
SEP -2011



SEP -2011

OCT -2011

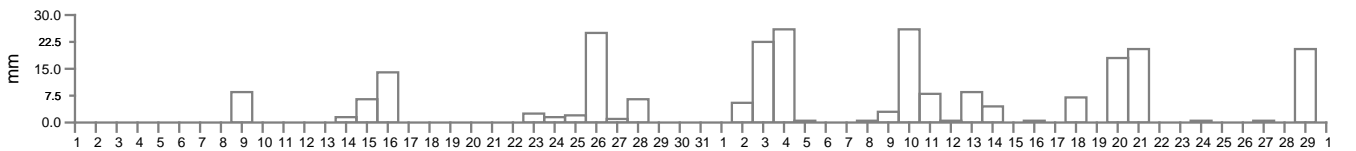
NOV -2011



NOV -2011

DEC -2011

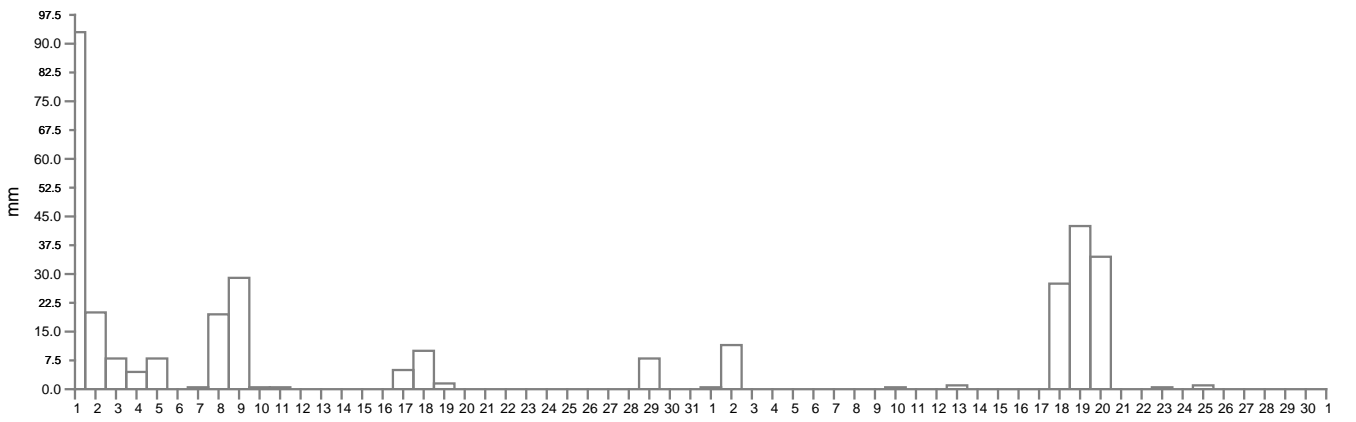
JAN -2012



JAN -2012

FEB -2012

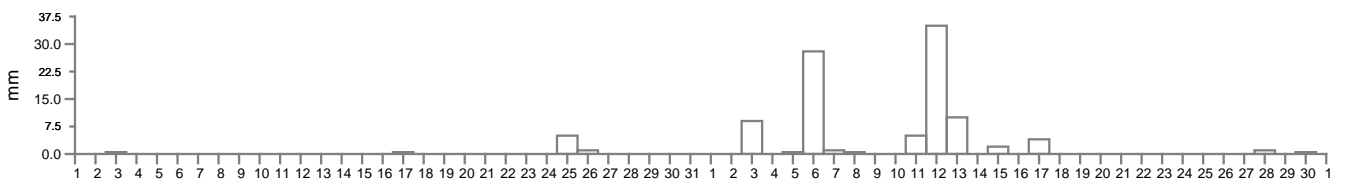
MAR -2012



MAR -2012

APR -2012

MAY -2012



MAY -2012

JUN -2012

JUL -2012

----- DATA LOSS



**Public Works**  
Manly Hydraulics Laboratory

**CLEVELAND ROAD AT CLEVELAND ROAD**  
2011-2012

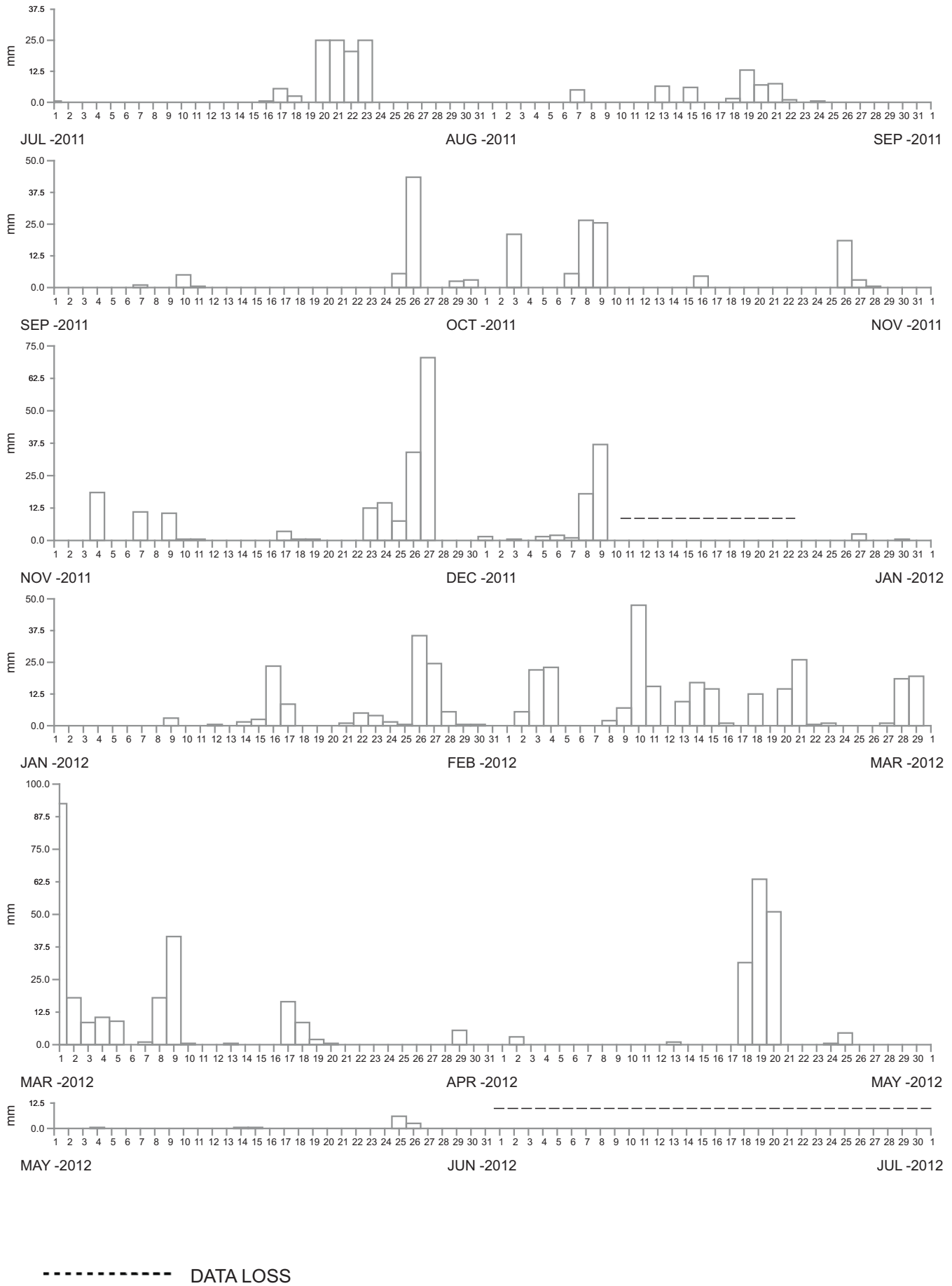
MHL  
Report 2159

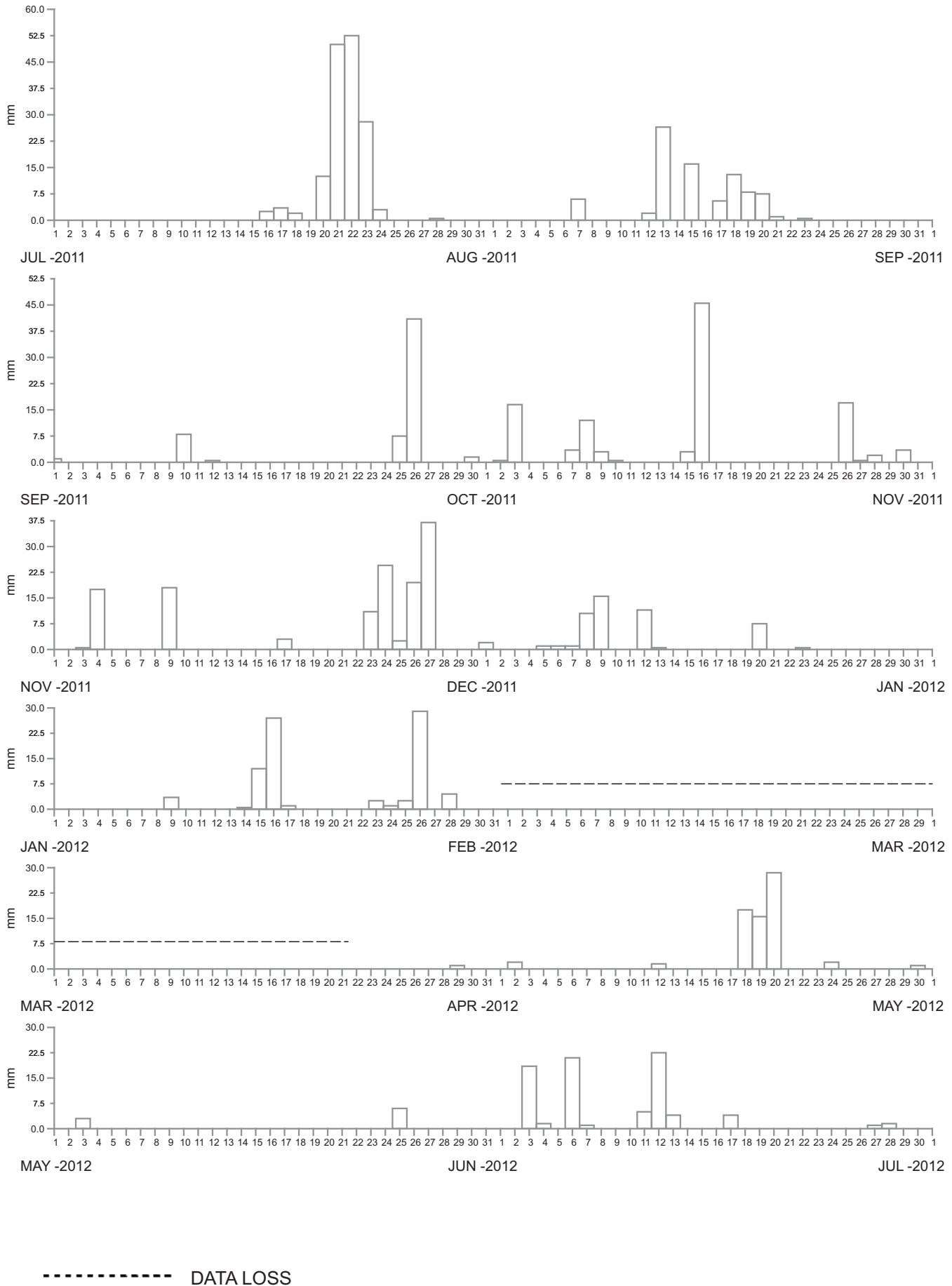
Figure

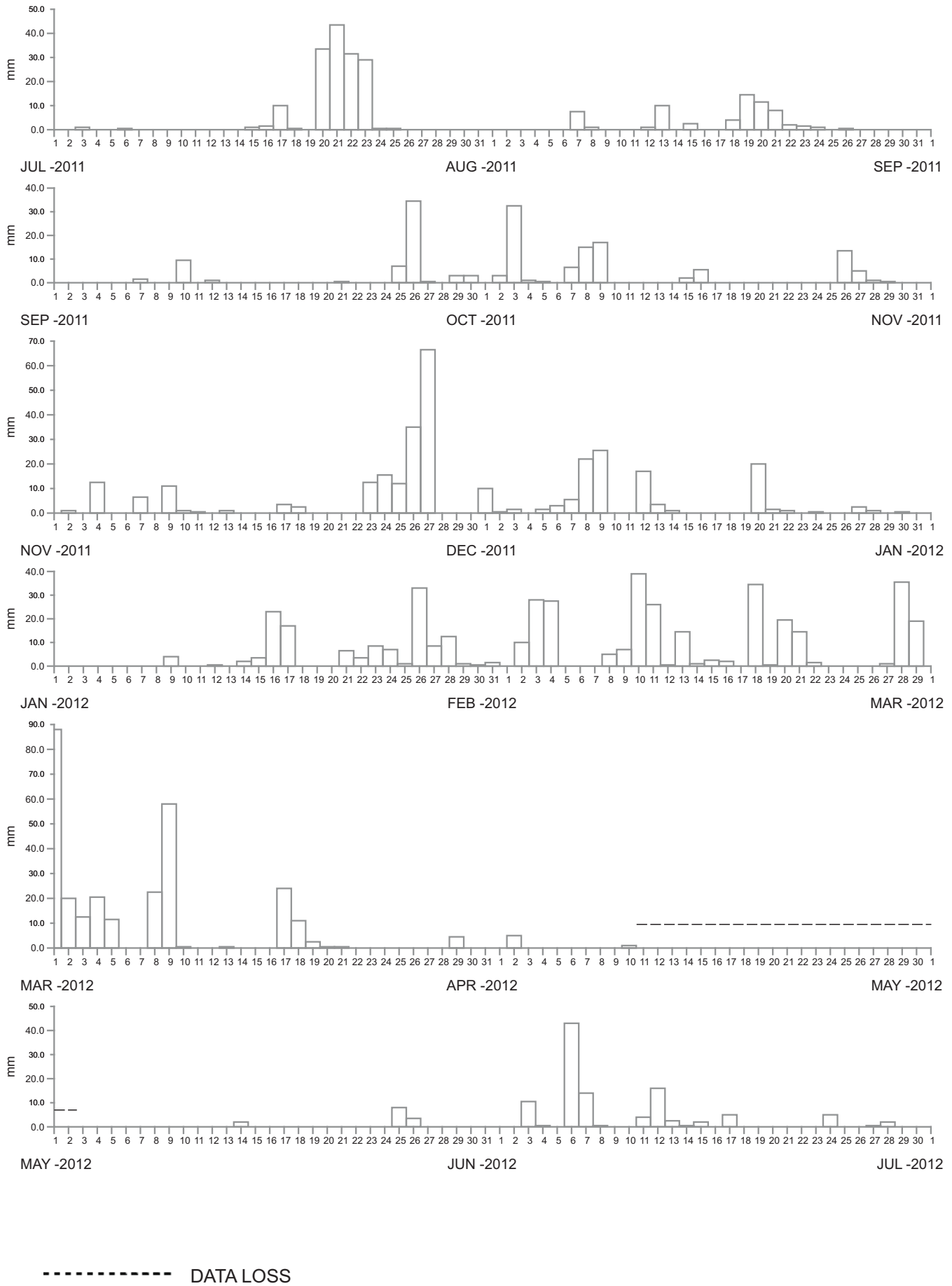
80

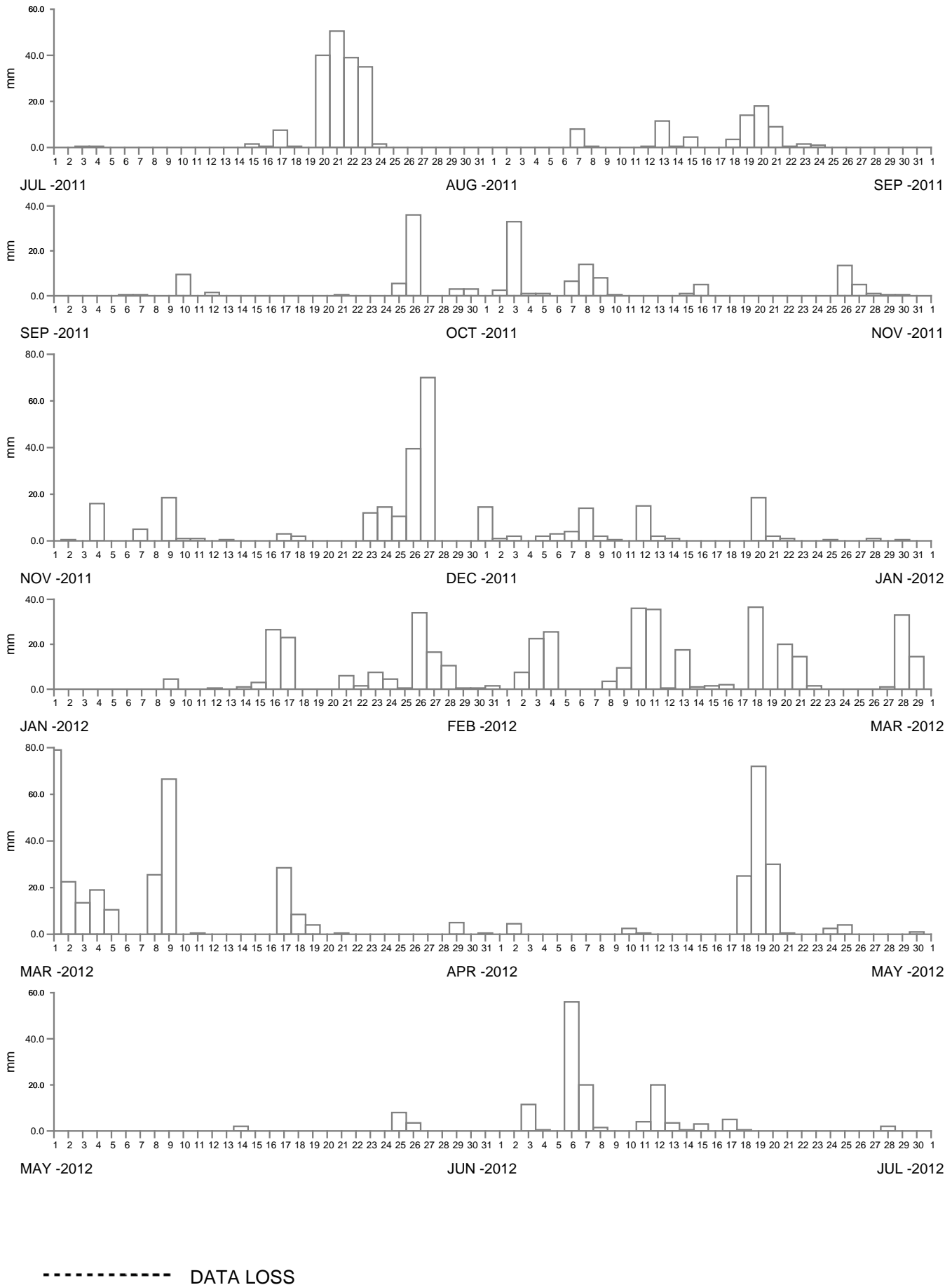
DRAWING 2159-80

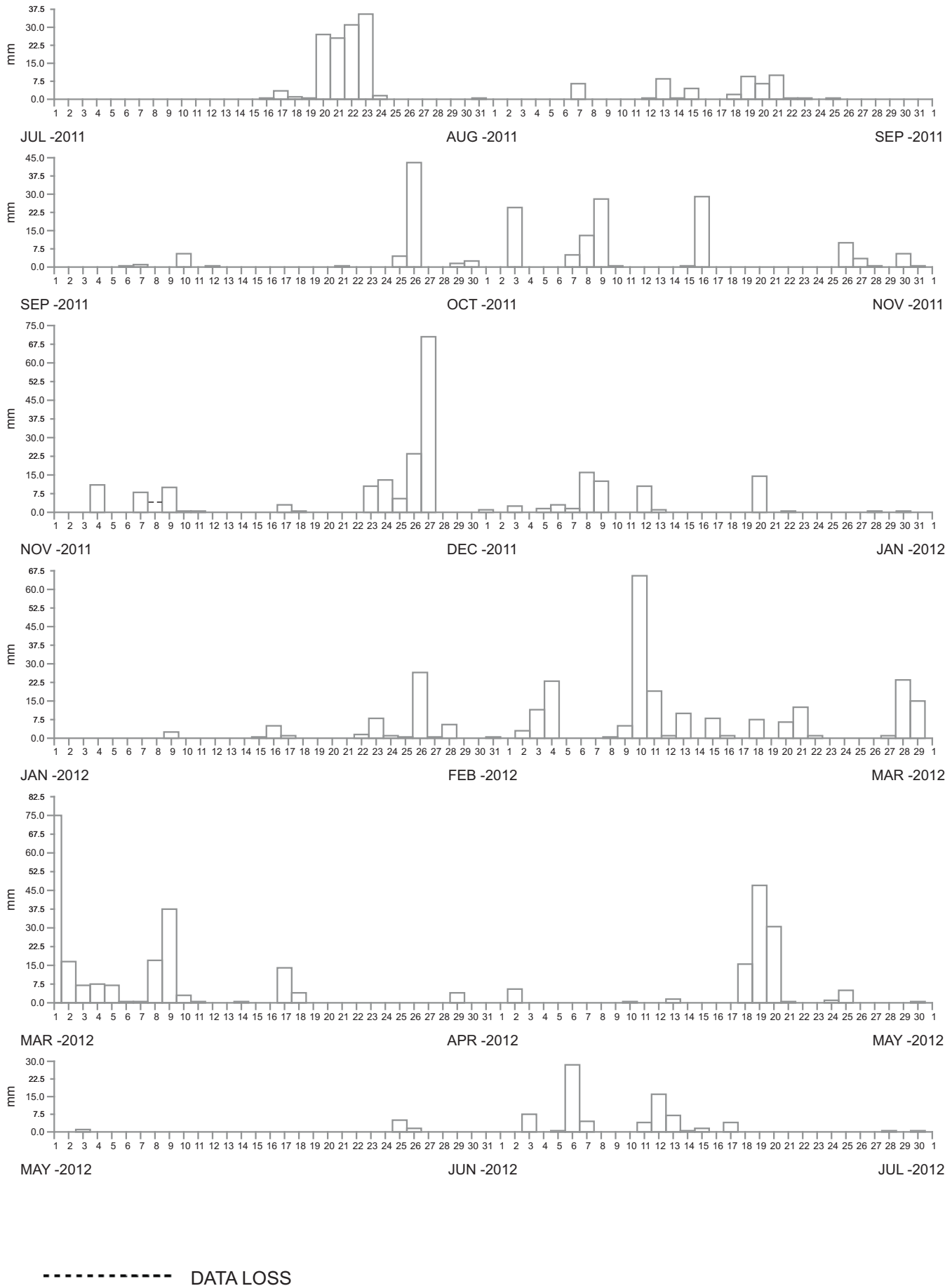
















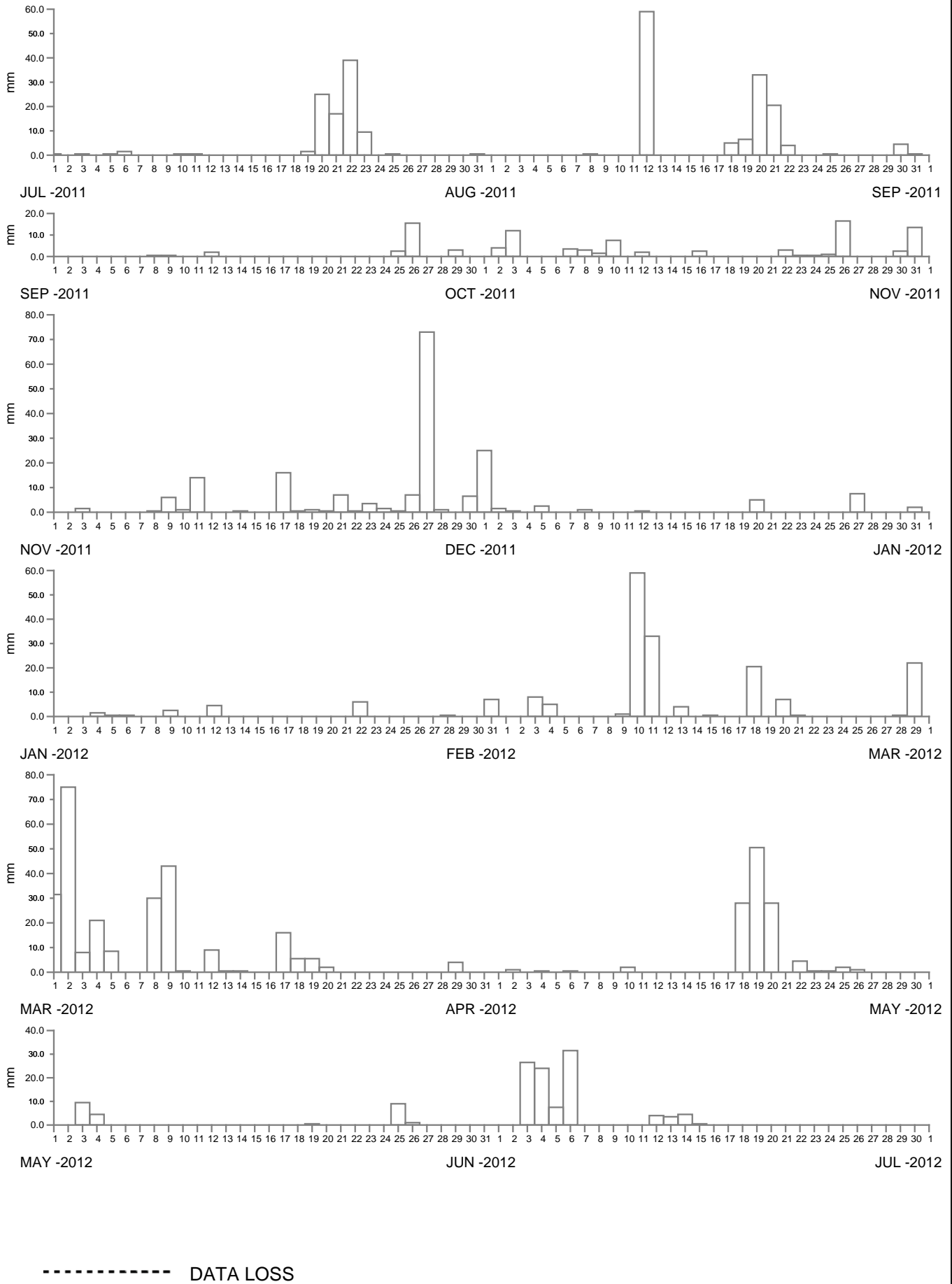
**Public Works**  
Manly Hydraulics Laboratory

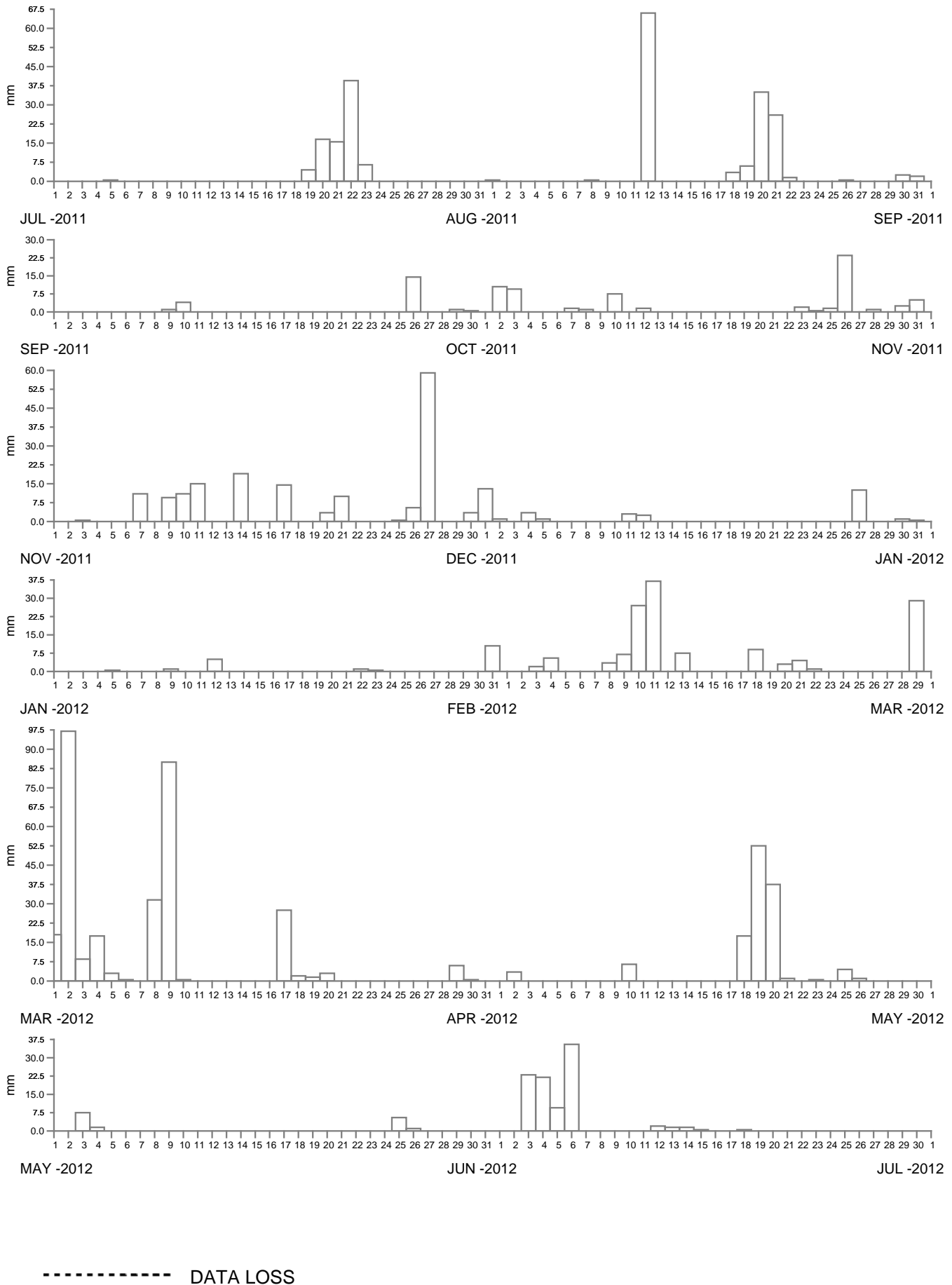
**RAINFALL STATION LOCATIONS  
SOUTH COAST (MID) REGION**

MHL  
Report 2159

Figure  
**88**

DRAWING 2159-88.cdr





**Appendix A**

**Data On-Line**

**Table A1 Data On-line**

<b>Region</b>	<b>Station</b>	<b>Period of Data</b>
Tweed	Cudgera	Aug 1983 -Ongoing
Brunswick	Main Arm	Sep 1983 - Ongoing
Brunswick	Huonbrook	May 1986 - Ongoing
Brunswick	Myocum	Feb 1986 - Ongoing
Richmond	Lake Ainsworth	Oct 1994 - Ongoing
Richmond	Empire Vale	May 1998 - Jul 2000
Richmond	Wollongbar	Jul 1992 - Jul 1994
Clarence	Yamba	Apr 2002 - Ongoing
Clarence	Wyndora	Jan 1990 - Jun 1991
Clarence	Roberts Creek	May 1994 - Jun 1996
Clarence	Shannon Creek	Nov 2000 - May 2008
Bellinger	Wooli Caravan Park	Jun 1997 - Ongoing
Bellinger	Perry Drive	Dec 1998 - Ongoing
Bellinger	Shepards Lane	Dec 1998 - Ongoing
Bellinger	Red Hill	Nov 1998 - Ongoing
Bellinger	Newports Creek	Dec 1990 - Ongoing
Bellinger	Middle Boambee	Dec 1990 - Ongoing
Bellinger	South Boambee	Apr 1991 - Ongoing
Bellinger	North Bonville	Dec 1990 - Ongoing
Bellinger	Gleniffer	Aug 1993 - Feb 2007
Bellinger	Bellinger Council	Apr 1993 - Jun 2001
Bellinger	Kooroowi	May 1991 - Ongoing
Bellinger	Thora	Feb 1993 - Ongoing
Nambucca	Bowraville	Jun 1993 - Oct 2001
Nambucca	Utungun	Dec 1991 - Ongoing
Macleay	Euroka U/S	Jul 1990 – June 2011
Macleay	Aldavilla Downstream	Dec 2011 - Ongoing
Maria	Green Valley	Sep 1994 - Ongoing
Hastings	Telegraph Point	Nov 1990 - Ongoing
Hastings	Lake Cathie	Aug 1993 - Jun 2001
Hastings	Ellenborough	Jun 1991 - Sep 1999
Camden Haven	Logans Crossing	Dec 1989 - Ongoing
Manning	Mount George	Mar 1991 - Ongoing
Karuah	Nabiac	Jun 1984 - Ongoing
Karuah	Tuncurry	Aug 2002 - Ongoing
Karuah	Tiona	Jun 2002 - Ongoing
Karuah	Tarbuck Bay	May 1996 - Ongoing
Karuah	Bulahdelah	Aug 1996 - Ongoing
Hunter	Gostwyck	Oct 1999 - Ongoing
Hunter	Seaham	Sep 1999 - Ongoing
Hunter	Hexham Bridge	May 1998 - Ongoing
Hunter	Belmore Bridge	Sep 1995 - Ongoing
Hunter	Cardiff	Mar 1991 - Sept 1996
Macquarie-Tuggerah Lakes	Barnsley	Jan 1988 - Ongoing
Macquarie-Tuggerah Lakes	Fassifern	Jan 1992 - Dec 1997
Macquarie-Tuggerah Lakes	Dora Creek	May 1992 - Jul 1999
Macquarie-Tuggerah Lakes	Martinsville	Mar 1988 - Ongoing
Macquarie-Tuggerah Lakes	Mandalong	Dec 1988 - Ongoing

Region	Station	Period of Data
Macquarie-Tuggerah Lakes	Wyee	May 1992 - Ongoing
Macquarie-Tuggerah Lakes	Whitemans Ridge	Apr 1989 - Ongoing
Macquarie-Tuggerah Lakes	Yarralong	Feb 1987 - Ongoing
Macquarie-Tuggerah Lakes	Kulnura	Mar 1989 - Ongoing
Macquarie-Tuggerah Lakes	Toukley	Dec 1985 - Ongoing
Macquarie-Tuggerah Lakes	Warnervale	Jan 1986 - Apr 2010
Macquarie-Tuggerah lakes	Hamlyn Terrace	Mar 2010 - Ongoing
Macquarie-Tuggerah Lakes	Wyong Weir	Jan 1986 - Apr 2008
Macquarie-Tuggerah Lakes	Wyong	Jan 1986 - Apr 1991
Macquarie-Tuggerah Lakes	Kangy Angy	Aug 2010 - Ongoing
Macquarie-Tuggerah Lakes	Chittaway	May 1989 - Aug 2010
Macquarie-Tuggerah Lakes	Berkeley Vale	Jun 1988 - Ongoing
Macquarie-Tuggerah Lakes	Mardi Dam	Jun 1988 - Ongoing
Macquarie-Tuggerah Lakes	Sterland	Apr 1989 - Ongoing
Macquarie-Tuggerah Lakes	Long Jetty	Sept 1992 - Sept 1998
Macquarie-Tuggerah Lakes	Bateau Bay	Jan 1980 - Ongoing
Macquarie-Tuggerah Lakes	Lisarow	Mar 1989 - Ongoing
Hawkesbury	Strickland	Dec 1985 - Ongoing
Hawkesbury	Narara	Apr 1989 - Ongoing
Hawkesbury	Mount Elliot	Dec 1985 - Ongoing
Hawkesbury	Wyoming	Aug 1988 - Ongoing
Hawkesbury	Kincumber	May 1987 - Ongoing
Hawkesbury	Webbs Creek	Jul 1999 - Ongoing
Hawkesbury	Colo Junction	Jul 1999 - Ongoing
Hawkesbury	Sackville Downstream	Jun 1999 - Ongoing
Hawkesbury	Woy Woy	Jul 1991 - Jul 1996
Hawkesbury	Brooklyn	Apr 1991 - Jul 1996
Hawkesbury	Cowan	Jun 1991 - Jul 1996
Hawkesbury	Penrith	Nov 1990 - Ongoing
Hawkesbury	Narellan Creek	Jan 1994 - Sep 1996
Hawkesbury	Camden Life Centre	Mar 1994 - Sep 1996
Hawkesbury	Mt Annan School	Feb 1994 - Sep 1996
Blue Mountains	Mount Boyce	Nov 1992 - Feb 1995
Blue Mountains	Clarence	Nov 1992 - Feb 1995
Blue Mountains	Zig Zag	Nov 1992 - Feb 1995
Sydney Coastal	Kuringai	Jan 1991 - Sep 1996
Sydney Coastal	Wahroonga	Nov 1990 - Jul 1996
Sydney Coastal	Beecroft	Sep 1992 - Jul 1996
Sydney Coastal	Avalon	Jun 1994 - Ongoing
Sydney Coastal	Mona Vale	Jun 1994 - Ongoing
Sydney Coastal	Narrabeen Creek	May 1998 - Ongoing
Sydney Coastal	Middle Creek	Apr 1995 - Ongoing
Sydney Coastal	Cromer	Mar 1994 - Ongoing
Sydney Coastal	Belrose	May 1994 - Ongoing
Sydney Coastal	Allambie	Jun 1999 - Ongoing
Sydney Coastal	Balgowlah	Aug 1999 - May 2005
Sydney Coastal	North Manly	May 1995 - Ongoing
Sydney Coastal	Manly Dam	Nov 1995 - Ongoing
Sydney Coastal	Chatswood	Sep 1992 - Jul 1996
Sydney Coastal	Denistone	Jan 1990 - Jun 1996

<b>Region</b>	<b>Station</b>	<b>Period of Data</b>
Sydney Coastal	M4 Motorway	Jun 1993 - Sep 1996
Sydney Coastal	Homebush Bay	Feb 1993 - Mar 1994
Sydney Coastal	Kelso Creek	Nov 1996 - Ongoing
Wollongong Coastal	Bulli Pass	Sep 1982 - Oct 1998
Wollongong Coastal	Rixons Pass	Jun 1985 - Ongoing
Wollongong Coastal	Russell Vale	Jul 1982 - Ongoing
Wollongong Coastal	Corrimal Colliery	Jun 1985 - Dec 1993
Wollongong Coastal	Mount Pleasant	Jun 1997 - Ongoing
Wollongong Coastal	Mount Nebo	Sep 1982 - Feb 1997
Wollongong Coastal	Mount Kembla	Jun 1985 - Ongoing
Wollongong Coastal	Dombarton Loop	Jun 1985 - Ongoing
Wollongong Coastal	Wongawilli	Sep 1982 - Ongoing
Wollongong Coastal	Port Kembla BHP	Jan 1993 - Ongoing
Wollongong Coastal	Port Kembla	Sep 1982 - Ongoing
Wollongong Coastal	Darkes Road	Feb 1994 - Ongoing
Wollongong Coastal	Cleveland Road	Jun 1985 - Ongoing
Wollongong Coastal	Huntley Colliery	Jun 1982 - Ongoing
Wollongong Coastal	Calderwood	Jan 1983 - Jun 1985
Wollongong Coastal	Upper Calderwood	Jun 1985 - Ongoing
Wollongong Coastal	Little Lake	May 1991 - Ongoing
Wollongong Coastal	Airport	Jun 1991 - Mar 1995
Wollongong Coastal	North Macquarie	Jul 1985 - Ongoing
Wollongong Coastal	Clover Hill	Aug 1985 - Ongoing
Wollongong Coastal	Nurrewin	May 2005 - Ongoing
Wollongong Coastal	Yellow Rock Road	Jun 1982 - Ongoing
Wollongong Coastal	Balgownie	Jul 1982 - Jun 1987
Wollongong Coastal	Woonona	Jul 1982 - Jun 1985
South Coast	Lake Wollumboula	Feb 1999 - Oct 2000
South Coast	Barlows Bay (Narooma)	Jul 1999 - Ongoing
South Coast	Regatta Point	Jan 1999 - Ongoing
South Coast	Merimbula Wharf	Aug 1997 - Sep 2001
South Coast	Agnew Wharf	Aug 1997 - Jun 2000

## **Appendix B**

### **Sample Rainfall Data Outputs**

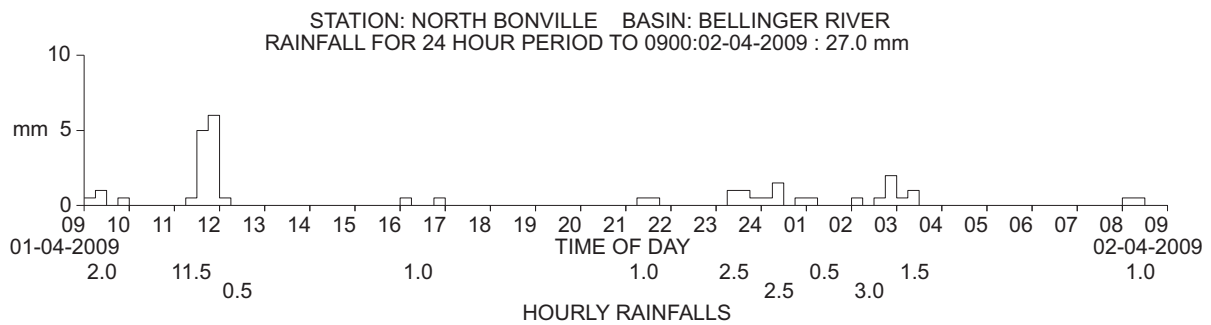
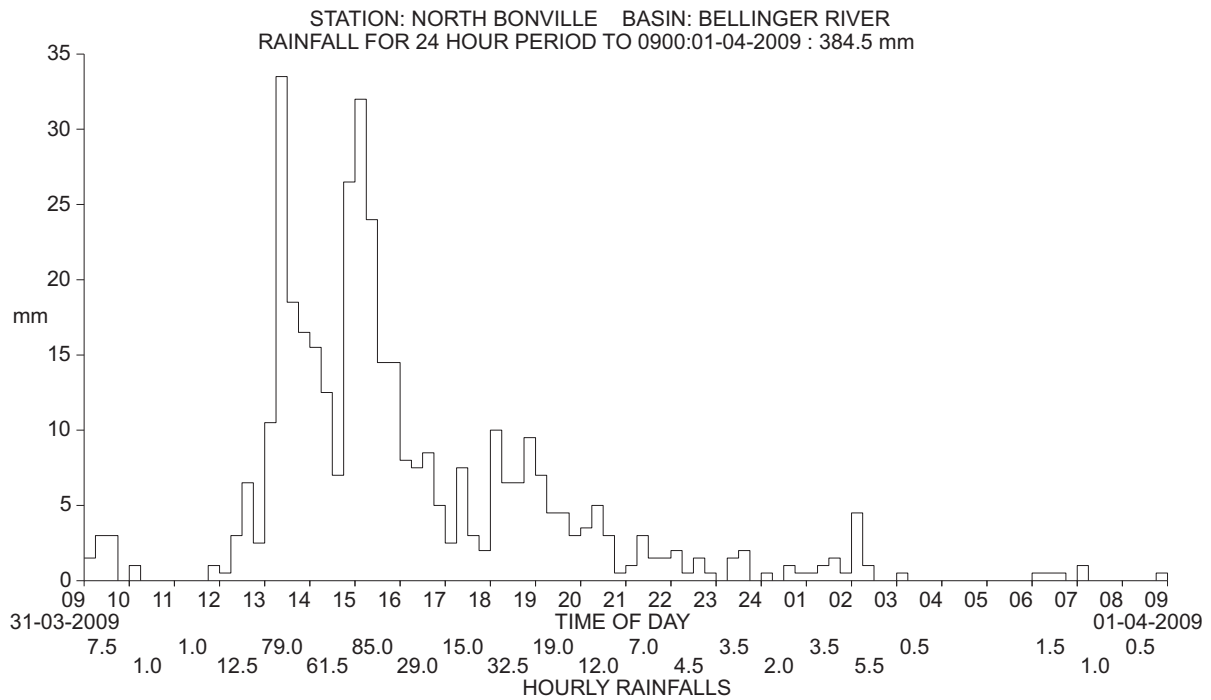
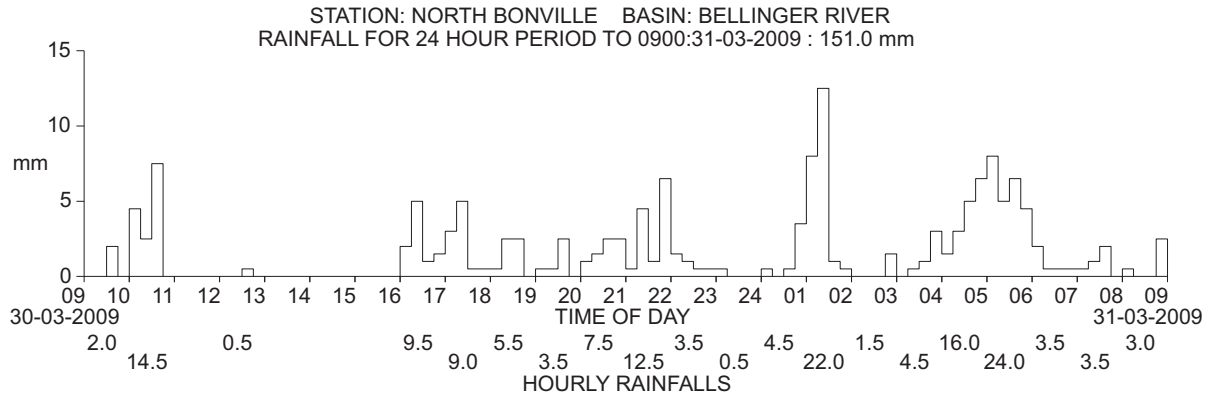
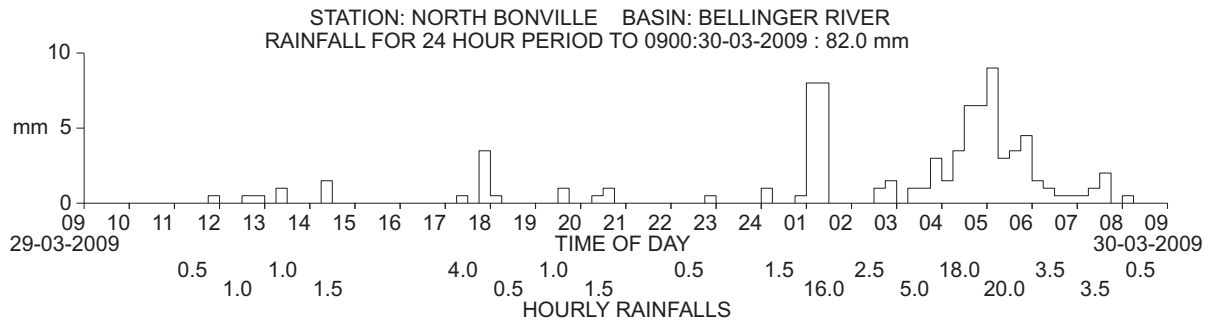
DAILY RAINFALLS FOR STATION NORTH BONVILLE  
START YEAR 2008

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
1	0.0	0.0	1.0	0.5	0.0	0.0	0.0	0.0	0.0	384.5	0.0	6.0
2	0.0	0.0	0.0	0.0	5.5	0.0	0.0	4.5	0.0	27.0	0.0	4.5
3	0.0	0.0	0.0	0.0	9.5	0.0	20.5	0.0	1.5	10.5	1.0	4.0
4	0.0	0.0	40.5	0.0	0.5	0.0	0.5	2.0	0.0	9.5	5.5	0.5
5	10.0	0.0	77.5	0.0	0.0	0.0	0.0	0.0	12.0	14.5	1.0	0.5
6	0.5	0.5	52.0	0.0	1.5	0.0	0.0	0.0	0.0	6.0	12.0	4.5
7	0.0	0.0	0.0	0.0	0.5	1.5	0.0	0.0	0.0	0.0	9.5	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	0.0	0.5
9	2.0	0.0	0.0	0.0	17.5	10.5	5.0	0.0	2.0	2.0	0.0	0.0
10	0.0	0.0	0.0	0.0	13.0	0.0	3.0	0.0	26.5	0.5	0.0	0.0
11	0.0	0.0	0.0	0.0	2.5	29.5	0.0	0.0	4.5	0.0	0.5	0.0
12	0.0	0.0	0.0	0.0	4.0	18.5	0.0	30.0	11.0	2.5	0.0	0.0
13	0.0	0.0	0.0	1.5	10.5	3.5	0.0	75.5	0.0	9.0	0.5	0.0
14	0.0	0.0	0.0	0.0	2.0	0.0	0.0	53.0	0.0	16.5	0.0	0.0
15	1.5	0.0	4.5	23.0	0.0	0.0	0.0	72.5	4.5	19.0	0.0	0.0
16	0.0	0.0	0.0	17.0	5.0	0.0	0.0	72.0	2.5	0.0	0.0	3.0
17	0.5	0.0	0.0	2.0	39.5	0.0	8.0	262.0	0.5	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	4.5	0.0	13.0	22.0	1.5	0.0	0.0	22.5
19	0.0	0.0	0.0	0.0	19.0	0.5	0.0	1.0	0.0	0.0	15.0	44.5
20	0.0	0.0	0.0	0.0	21.5	5.5	0.0	2.5	0.0	1.5	8.0	123.0
21	0.0	0.0	8.5	0.0	0.5	10.5	0.0	1.0	4.0	63.5	64.5	25.0
22	0.0	0.5	0.5	30.0	0.0	0.0	0.0	31.0	2.5	10.0	131.0	140.5
23	0.0	5.0	0.0	7.5	0.0	0.0	0.0	0.0	8.5	18.5	58.0	1.0
24	9.0	0.0	19.0	0.0	0.0	1.0	0.0	0.0	0.0	0.5	12.5	0.5
25	80.0	0.0	4.5	0.0	0.0	5.0	0.5	0.0	0.0	0.0	1.5	0.0
26	2.5	0.0	0.5	0.0	29.5	0.0	24.0	9.0	0.0	2.5	0.0	1.0
27	0.0	1.0	0.0	0.0	10.5	0.0	10.5	0.0	0.0	0.0	0.5	0.0
28	0.0	2.0	0.0	0.0	0.0	3.5	1.0	0.0	31.0	0.0	0.0	0.5
29	0.0	11.5	0.0	0.0	8.5	0.0	0.0		0.0	0.0	4.0	0.0
30	0.0	4.0	0.5	0.0	0.0	27.0	1.5		82.0	0.0	0.0	0.0
31	0.0	1.0		0.0		0.5	0.0		151.0		2.5	
TM	106.0	25.5	209.0	81.5	205.5	117.0	87.5	638.0	345.5	602.5	327.5	382.0
TY	106.0	131.5	340.5	422.0	627.5	744.5	832.0	1470.0	1815.5	2418.0	2745.5	3127.5

DAILY TOTALS ARE FOR 24 HOUR PERIOD TO 0900 HOURS ON THAT DAY

TM - INDICATES MONTHLY TOTALS  
TY - INDICATES ACCUMULATIVE MONTHLY TOTALS





\*\*\*\*\*PUBLIC WORKS DEPARTMENT OF N.S.W., MANLY HYDRAULICS  
 LABORATORY\*\*\*\*\*  
 \*\*110B KING STREET, MANLY VALE N.S.W. 2093, AUSTRALIA. TELEPHONE (02)949-  
 0200\*\*

-----STANDARD RAINFALL FILE-----  
 ----

!!STANDARD ADMINISTRATIVE DATA

FILE NAME : BNE.LIS  
 TIME OF FILE CREATION : 1145:02/10/2009  
 STATION NAME : NEWPORTS CREEK  
 BASIN : BELLINGER RIVER  
 LOCATION : N.S.W. AUSTRALIA  
 LATITUDE : 30 DEG 18.82 MIN SOUTH  
 LONGITUDE : 153 DEG 03.58 MIN EAST  
 TIME STANDARD : AUSTRALIAN EASTERN STANDARD TIME  
 TIME ZONE : 1000  
 START TIME : 0900:28/03/2009  
 END TIME : 0859:04/04/2009  
 RECORDER TYPE : HYDROLOGICAL SERVICES RRDL3  
 BUCKET SIZE (MM) : 0.5  
 TIME INCREMENT (MIN) : 1.0  
 CONTACT : P.DAVIDSON

!!COMMENTS

THE STATISTICS APPLY FOR THE TIME PERIOD AS SPECIFIED IN THE HEADER

!!STATISTICS

TOTAL RAINFALL RECORDED : 556.0 mm  
 TOTAL RAINFALL STORED : NOT AVAILABLE  
 Maximum in 24 hrs to 0900 : 419.5 mm on 01/04/2009  
 Maximum in 1 min : 3.5 mm at 1310:31/03/2009 (210.0 mm/hr)  
 Maximum in 2 min : 6.5 mm at 1309:31/03/2009 (195.0 mm/hr)  
 Maximum in 4 min : 12.0 mm at 1309:31/03/2009 (180.0 mm/hr)  
 Maximum in 4 min : 12.0 mm at 1310:31/03/2009 (180.0 mm/hr)  
 Maximum in 5 min : 15.0 mm at 1309:31/03/2009 (180.0 mm/hr)  
 Maximum in 10 min : 27.0 mm at 1304:31/03/2009 (162.0 mm/hr)  
 Maximum in 10 min : 27.0 mm at 1305:31/03/2009 (162.0 mm/hr)  
 Maximum in 15 min : 39.0 mm at 1259:31/03/2009 (156.0 mm/hr)  
 Maximum in 20 min : 49.0 mm at 1255:31/03/2009 (147.0 mm/hr)  
 Maximum in 30 min : 66.5 mm at 1252:31/03/2009 (133.0 mm/hr)  
 Maximum in 60 min : 106.0 mm at 1258:31/03/2009 (106.0 mm/hr)  
 Maximum in 60 min : 106.0 mm at 1259:31/03/2009 (106.0 mm/hr)  
 Maximum in 2 hrs : 195.5 mm at 1256:31/03/2009 ( 97.8 mm/hr)  
 Maximum in 3 hrs : 266.5 mm at 1249:31/03/2009 ( 88.8 mm/hr)  
 Maximum in 4 hrs : 308.5 mm at 1246:31/03/2009 ( 77.1 mm/hr)  
 Maximum in 4 hrs : 308.5 mm at 1247:31/03/2009 ( 77.1 mm/hr)  
 Maximum in 4 hrs : 308.5 mm at 1249:31/03/2009 ( 77.1 mm/hr)  
 Maximum in 5 hrs : 324.0 mm at 1155:31/03/2009 ( 64.8 mm/hr)  
 Maximum in 5 hrs : 324.0 mm at 1208:31/03/2009 ( 64.8 mm/hr)  
 Maximum in 6 hrs : 345.0 mm at 1249:31/03/2009 ( 57.5 mm/hr)  
 Maximum in 9 hrs : 390.5 mm at 1150:31/03/2009 ( 43.4 mm/hr)  
 Maximum in 9 hrs : 390.5 mm at 1155:31/03/2009 ( 43.4 mm/hr)  
 Maximum in 12 hrs : 407.0 mm at 1146:31/03/2009 ( 33.9 mm/hr)  
 Maximum in 15 hrs : 413.0 mm at 1146:31/03/2009 ( 27.5 mm/hr)  
 Maximum in 18 hrs : 435.0 mm at 0334:31/03/2009 ( 24.2 mm/hr)  
 Maximum in 18 hrs : 435.0 mm at 0342:31/03/2009 ( 24.2 mm/hr)  
 Maximum in 18 hrs : 435.0 mm at 0347:31/03/2009 ( 24.2 mm/hr)  
 Maximum in 18 hrs : 435.0 mm at 0353:31/03/2009 ( 24.2 mm/hr)  
 Maximum in 18 hrs : 435.0 mm at 0357:31/03/2009 ( 24.2 mm/hr)  
 Maximum in 21 hrs : 447.5 mm at 0045:31/03/2009 ( 21.3 mm/hr)  
 Maximum in 21 hrs : 447.5 mm at 0250:31/03/2009 ( 21.3 mm/hr)  
 Maximum in 24 hrs : 460.0 mm at 2112:30/03/2009 ( 19.2 mm/hr)  
 Maximum in 48 hrs : 518.0 mm at 0310:30/03/2009 ( 10.8 mm/hr)  
 Maximum in 72 hrs : 533.5 mm at 0310:30/03/2009 ( 7.4 mm/hr)  
 Maximum in 96 hrs : 539.0 mm at 0117:30/03/2009 ( 5.6 mm/hr)



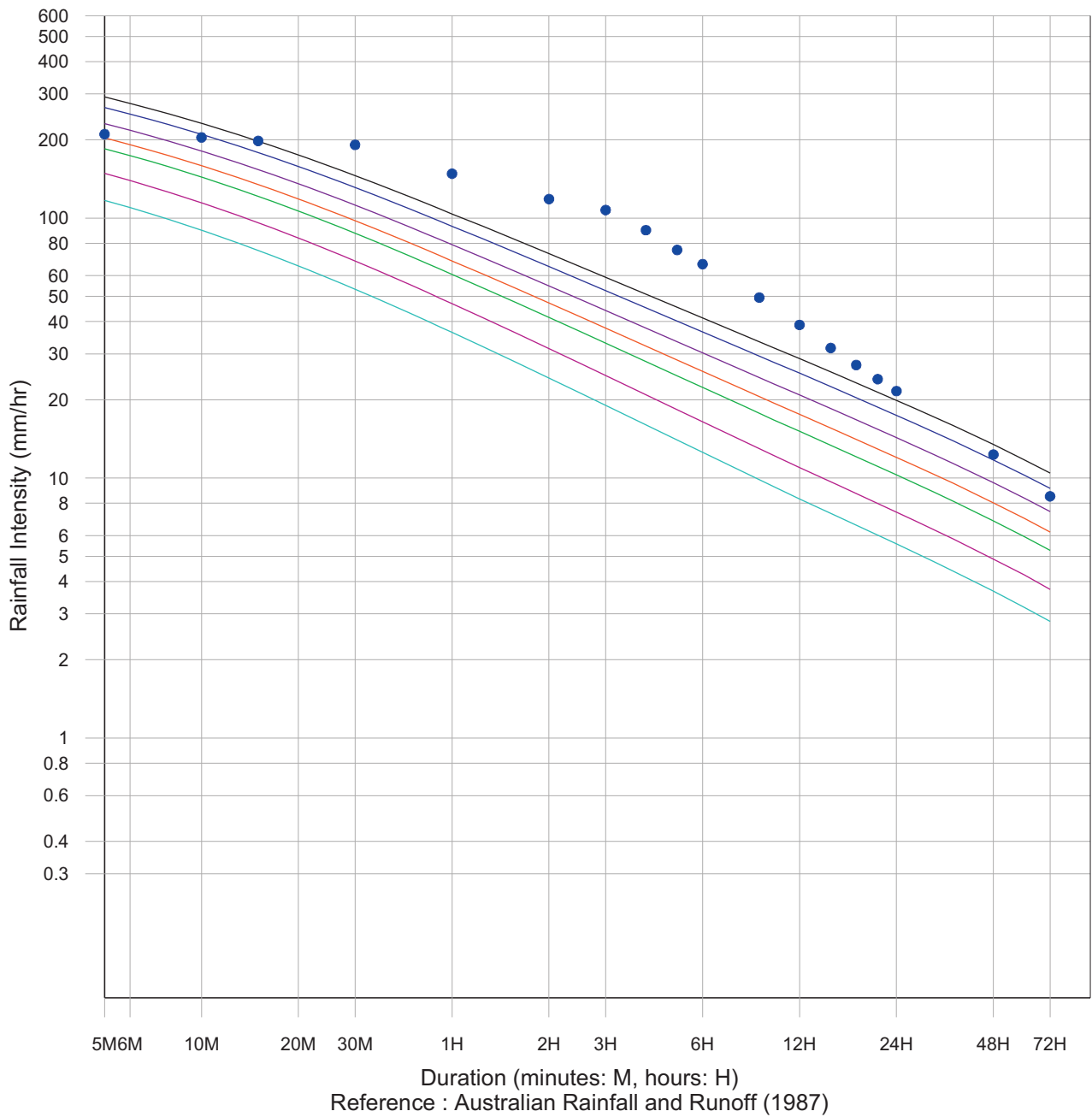
### Rainfall Intensity (mm/hr) for South Boambee

Duration (Minutes:M, hours:H)	Annual Exceedance Probability (%)						
	63	39	18	10	5	2	1
5	116.97	148.54	184.77	203.54	230.79	266.09	292.72
6	109.64	139.36	173.74	191.62	217.5	251.05	276.39
7	103.52	131.69	164.52	181.64	206.36	238.43	262.67
8	98.3	125.14	156.62	173.09	196.8	227.59	250.88
9	93.77	119.44	149.73	165.63	188.46	218.13	240.59
10	89.77	114.42	143.66	159.04	181.08	209.75	231.47
11	86.21	109.94	138.24	153.16	174.5	202.27	223.32
12	83.02	105.92	133.37	147.86	168.56	195.52	215.96
13	80.13	102.28	128.95	143.05	163.17	189.39	209.27
14	77.49	98.96	124.91	138.66	158.25	183.78	203.16
15	75.08	95.92	121.21	134.63	153.72	178.63	197.54
16	72.86	93.12	117.79	130.92	149.55	173.87	192.34
17	70.8	90.53	114.63	127.47	145.68	169.45	187.52
18	68.89	88.12	111.69	124.27	142.08	165.34	183.03
20	65.46	83.78	106.39	118.48	135.56	157.91	174.91
25	58.53	75.03	95.65	106.74	122.35	142.8	158.38
30	53.24	68.34	87.41	97.72	112.18	131.14	145.62
35	49.04	63.01	80.84	90.51	104.03	121.8	135.38
40	45.6	58.65	75.44	84.58	97.33	114.1	126.93
45	42.72	55	70.91	79.6	91.69	107.61	119.8
50	40.27	51.89	67.04	75.34	86.86	102.05	113.69
55	38.16	49.2	63.68	71.64	82.67	97.22	108.37
60	36.31	46.85	60.74	68.4	78.99	92.97	103.7
75	31.82	41.13	53.58	60.49	70	82.59	92.27
90	28.52	36.92	48.29	54.63	63.33	74.86	83.75
2	23.94	31.07	40.89	46.42	53.96	63.99	71.74
3	18.66	24.29	32.27	36.8	42.96	51.17	57.54
4	15.62	20.39	27.26	31.19	36.51	43.63	49.17
5	13.61	17.79	23.91	27.44	32.18	38.56	43.52
6	12.16	15.93	21.49	24.71	29.04	34.86	39.4
8	10.19	13.37	18.16	20.95	24.69	29.74	33.69
10	8.88	11.68	15.94	18.44	21.78	26.3	29.84
12	7.94	10.46	14.33	16.62	19.66	23.79	27.03
14	7.26	9.57	13.14	15.25	18.05	21.86	24.84
16	6.72	8.87	12.18	14.15	16.76	20.3	23.09
18	6.28	8.28	11.39	13.24	15.69	19.02	21.64
20	5.9	7.79	10.73	12.47	14.79	17.94	20.42
22	5.58	7.37	10.16	11.82	14.02	17.01	19.36
24	5.3	7	9.66	11.24	13.34	16.2	18.44
36	4.15	5.49	7.61	8.87	10.55	12.83	14.63
48	3.46	4.58	6.37	7.44	8.85	10.79	12.32
60	2.98	3.95	5.51	6.44	7.68	9.37	10.71
72	2.63	3.49	4.87	5.7	6.8	8.31	9.5



Annual Exceedance Probability

- 63% AEP
- 39% AEP
- 18% AEP
- 10% AEP
- 5% AEP
- 2% AEP
- 1% AEP



\*\*\*\*\*PUBLIC WORKS DEPARTMENT OF N.S.W., MANLY HYDRAULICS LABORATORY\*\*\*\*\*  
 \*\*110B KING STREET, MANLY VALE N.S.W. 2093, AUSTRALIA. TELEPHONE (02) 949-0200\*\*  
 -----STANDARD RAINFALL FILE-----

!!STANDARD ADMINISTRATIVE DATA

FILE NAME : BNE.LIS  
 TIME OF FILE CREATION : 1651:01/10/2009  
 STATION NAME : NEWPORTS CREEK  
 BASIN : BELLINGER RIVER  
 LOCATION : N.S.W. AUSTRALIA  
 LATITUDE : 30 DEG 18.82 MIN SOUTH  
 LONGITUDE : 153 DEG 03.58 MIN EAST  
 TIME STANDARD : AUSTRALIAN EASTERN STANDARD TIME  
 TIME ZONE : 1000  
 START TIME : 0900:03/05/2009  
 END TIME : 0859:07/05/2009  
 RECORDER TYPE : HYDROLOGICAL SERVICES RRDL3  
 BUCKET SIZE (MM) : 0.5  
 TIME INCREMENT (MIN) : 1.0  
 CONTACT : P.DAVIDSON

!!COMMENTS

THE STATISTICS APPLY FOR THE TIME PERIOD AS SPECIFIED IN THE HEADER

!!STATISTICS

TOTAL RAINFALL RECORDED : 28.0 mm  
 TOTAL RAINFALL STORED : NOT AVAILABLE  
 Maximum in 24 hrs to 0900 : 15.5 mm on 06/05/2009  
 Maximum in 1 min : 1.0 mm at 1758:03/05/2009 ( 60.0 mm/hr)  
 Maximum in 2 min : 2.0 mm at 1758:03/05/2009 ( 60.0 mm/hr)  
 Maximum in 4 min : 3.0 mm at 1757:03/05/2009 ( 45.0 mm/hr)  
 Maximum in 4 min : 3.0 mm at 1758:03/05/2009 ( 45.0 mm/hr)  
 Maximum in 5 min : 3.5 mm at 1757:03/05/2009 ( 42.0 mm/hr)  
 Maximum in 10 min : 5.0 mm at 1757:03/05/2009 ( 30.0 mm/hr)  
 Maximum in 15 min : 6.5 mm at 1757:03/05/2009 ( 26.0 mm/hr)  
 Maximum in 20 min : 6.5 mm at 1758:03/05/2009 ( 19.5 mm/hr)  
 Maximum in 30 min : 7.0 mm at 1757:03/05/2009 ( 14.0 mm/hr)  
 Maximum in 60 min : 8.0 mm at 1757:03/05/2009 ( 8.0 mm/hr)  
 Maximum in 2 hrs : 9.0 mm at 1757:03/05/2009 ( 4.5 mm/hr)  
 Maximum in 3 hrs : 10.5 mm at 2329:05/05/2009 ( 3.5 mm/hr)  
 Maximum in 4 hrs : 11.5 mm at 2344:05/05/2009 ( 2.9 mm/hr)  
 Maximum in 5 hrs : 12.5 mm at 2329:05/05/2009 ( 2.5 mm/hr)  
 Maximum in 6 hrs : 13.0 mm at 2329:05/05/2009 ( 2.2 mm/hr)  
 Maximum in 9 hrs : 15.0 mm at 2225:05/05/2009 ( 1.7 mm/hr)  
 Maximum in 12 hrs : 15.5 mm at 2151:05/05/2009 ( 1.3 mm/hr)  
 Maximum in 15 hrs : 16.0 mm at 2151:05/05/2009 ( 1.1 mm/hr)  
 Maximum in 18 hrs : 16.5 mm at 2151:05/05/2009 ( 0.9 mm/hr)  
 Maximum in 18 hrs : 16.5 mm at 2225:05/05/2009 ( 0.9 mm/hr)  
 Maximum in 21 hrs : 17.0 mm at 2151:05/05/2009 ( 0.8 mm/hr)  
 Maximum in 24 hrs : 17.0 mm at 2151:05/05/2009 ( 0.7 mm/hr)  
 Maximum in 48 hrs : 18.5 mm at 0040:05/05/2009 ( 0.4 mm/hr)  
 Maximum in 72 hrs : 27.5 mm at 1757:03/05/2009 ( 0.4 mm/hr)  
 Maximum in 96 hrs : 28.0 mm at 1757:03/05/2009 ( 0.3 mm/hr)

!!-----RAINFALL DATA IN STANDARD FORMAT-----

DATE	TIME	mm	
03/05/2009	1757	0.5	
	1758	1.0	
	1759	1.0	
	1800	0.5	
	1801	0.5	
	1803	1.0	
	1805	0.5	
	1807	0.5	
	1808	0.5	
	1811	0.5	
	1817	0.5	
	1830	0.5	
	1854	0.5	
	1920	0.5	
	1941	0.5	
04/05/2009	TOTAL	9.0	TO 0900 FROM 0900 ON 03/05/2009 ONLY
05/05/2009	0040	0.5	
	0045	0.5	
	0102	0.5	
05/05/2009	TOTAL	1.5	TO 0900



**Appendix C**  
**Publications of Interest**

## Appendix C Publications of Interest

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### Data Reports

MHL Annual Coastal Rainfall Summaries available:

MHL Report Nos. 610 (90-91), 624 (91-92), 660 (92-93), 699 (93-94), 730 (94-95), 776 (95-96), 874 (96-97), 946 (97-98), 1015 (98-99), 1071 (99-00), 1131 (00-01), 1207 (01-02), 1278 (02-03), 1348 (03-04), 1424 (04-05), 1513 (05-06), 1765 (06-07), 1849 (07-08), 1934 (08-09), 2011 (09-10), 2090 (10-11).

MHL Annual Estuary and River Water Levels Summaries available:

MHL Report Nos. 555 (87-88), 564 (88-89), 582 (89-90), 601 (90-91), 625 (91-92), 659 (92-93), 698 (93-94), 731 (94-95), 778 (95-96), 875 (96-97), 947 (97-98), 1014 (98-99), 1070 (99-00), 1130 (00-01), 1206 (01-02), 1276 (02-03), 1346 (03-04), 1422 (04-05), 1511 (05-06), 1763 (06-07), 1847 (07-08), 1932 (08-09), 2009 (09-10), 2088 (10-11).

MHL Annual Ocean Tide Levels Summaries available:

MHL Report Nos. 515 (86-87), 544 (87-88), 563 (88-89), 585 (89-90), 602 (90-91), 628 (91-92), 658 (92-93), 697 (93-94), 732 (94-95), 777 (95-96), 876 (96-97), 947 (97-98), 1013 (98-99), 1069 (99-00), 1129 (00-01), 1205 (01-02), 1277 (02-03), 1347 (03-04), 1423 (04-05), 1512 (05-06), 1764 (06-07), 1848 (07-08), 1933 (08-09), 2010 (09-10), 2089 (10-11).

MHL Annual Wave Climate and Coastal Air Pressure Summaries available:

MHL Report Nos. 547 (87-88), 560 (88-89), 581 (89-90), 600 (90-91), 627 (91-92), 655 (92-93), 695 (93-94), 733 (94-95), 779 (95-96), 877 (96-97), 948 (97-98), 1016 (98-99), 1072 (99-00), 1132 (00-01), 1208 (01-02), 1279 (02-03), 1349 (03-04), 1425 (04-05), 1514 (05-06), 1766 (06-07), 1850 (07-08), 1935 (08-09), 2012 (09-10), 2091 (10-11)

### Flood Reports

Manly Hydraulics Laboratory Flood Reports:

- *Northern Rivers May 2009 Flood Report*, MHL Report No. 1965
- *NSW Coffs Harbour and Bellinger River Regions April 2009 Flood Summary*, MHL Report No. 1913
- *NSW Coffs Harbour, Bellinger and Nambucca Rivers Region February 2009 Flood Summary*, MHL Report No. 1908
- *Bellinger and Coffs Harbour Regions January 2008 Flood Summary*, MHL Report No. 1804

- *Clarence River January 2008 Flood Summary*, MHL Report No. 1803
- *Richmond River January 2008 Flood Summary*, MHL Report No. 1802
- *Tweed and Brunswick Rivers January 2008 Flood Summary*, MHL Report No. 1802
- *NSW Hawkesbury and Nepean June 2007 Flood Summary*, MHL Report No. 1756
- *NSW Hunter Valley, Wallamba River and Myall River June 2007 Flood Summary*, MHL Report No. 1755
- *NSW Central Coast June 2007 Flood Summary*, MHL Report No. 1754
- *NSW North Coast March 2006 Flood Summary*, MHL Report No. 1482
- *NSW North Coast January 2007 Flood Summary*, MHL Report No. 1469
- *NSW North Coast Flood Summary June 2005*, MHL Report No. 1426

## Other References

Bureau of Meteorology 2002, 'Climate Glossary – Southern Oscillation Index' *Australian Government*. Retrieved from <http://www.bom.gov.au/climate/glossary/soi.shtml>

The Institution of Engineers 1987, *Australian Rainfall and Runoff*

**Appendix D**  
**Station Location Maps**



0 500m  
Image: Google Earth 2012



**Public Works**  
Manly Hydraulics Laboratory

110B King Street  
Manly Vale NSW 2093  
T 02 9949 0200  
F 02 9948 6185  
TTY 1300 301 181  
[www.mhl.nsw.gov.au](http://www.mhl.nsw.gov.au)