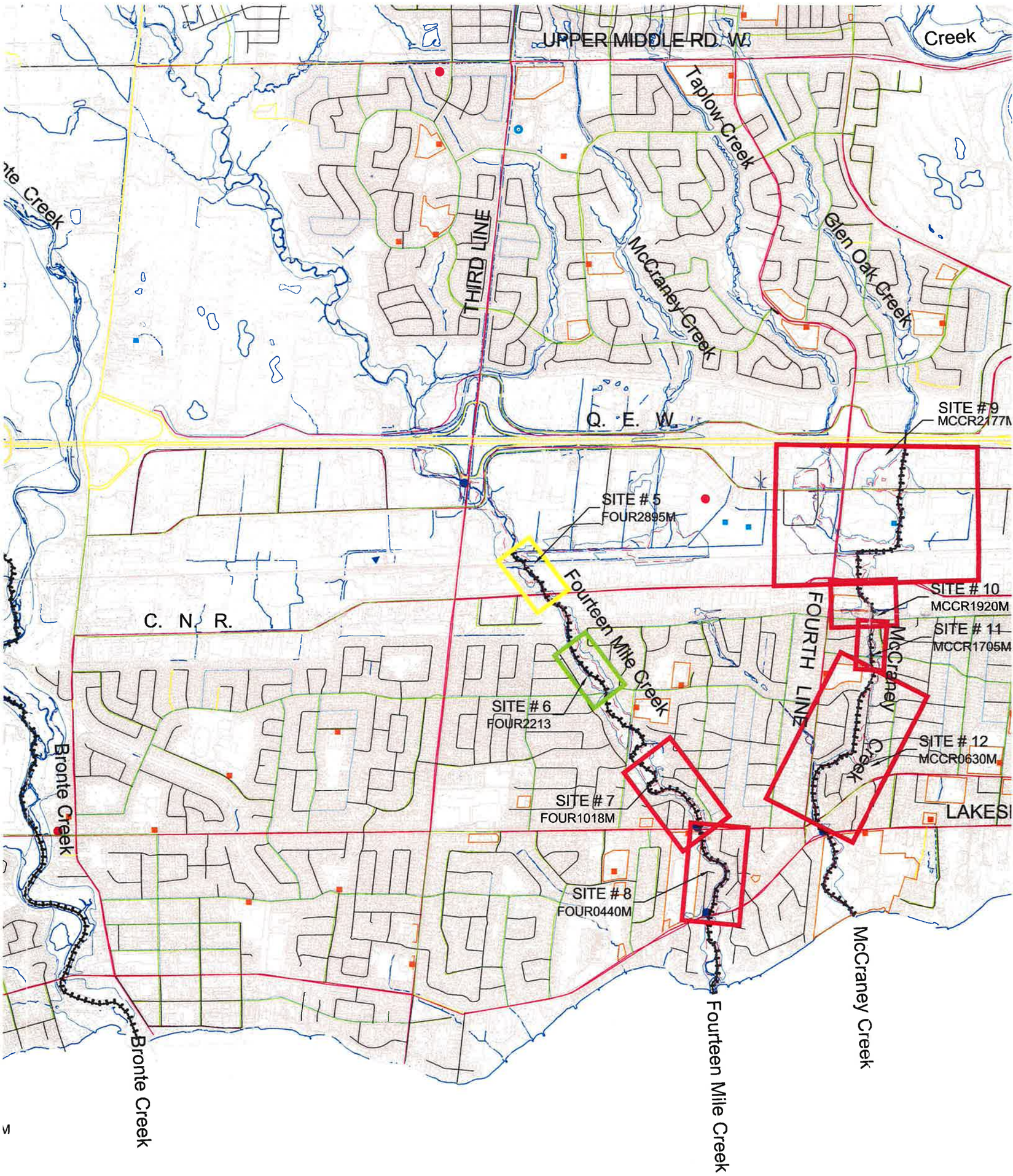
APPENDIX

C

Hydrologic Modelling and Subcatchment Parameterization



LEGEND:

- COMMUNITY CENTRE
- RIVER AND DAM WATCH
- SCHOOL
- GOVERNMENT FACILITY
- POLICE STATION
- FIRE STATION
- RECREATION CENTRE
- COLLEGE
- HOSPITAL
- GO STATION

SENSITIVE LAND BOUNDARY

TRAFFIC VOLUME RANGES:

- 0–999
- 1000–4999
- 5000–9999
- 10000–50000
- NO DATA AVAILABLE

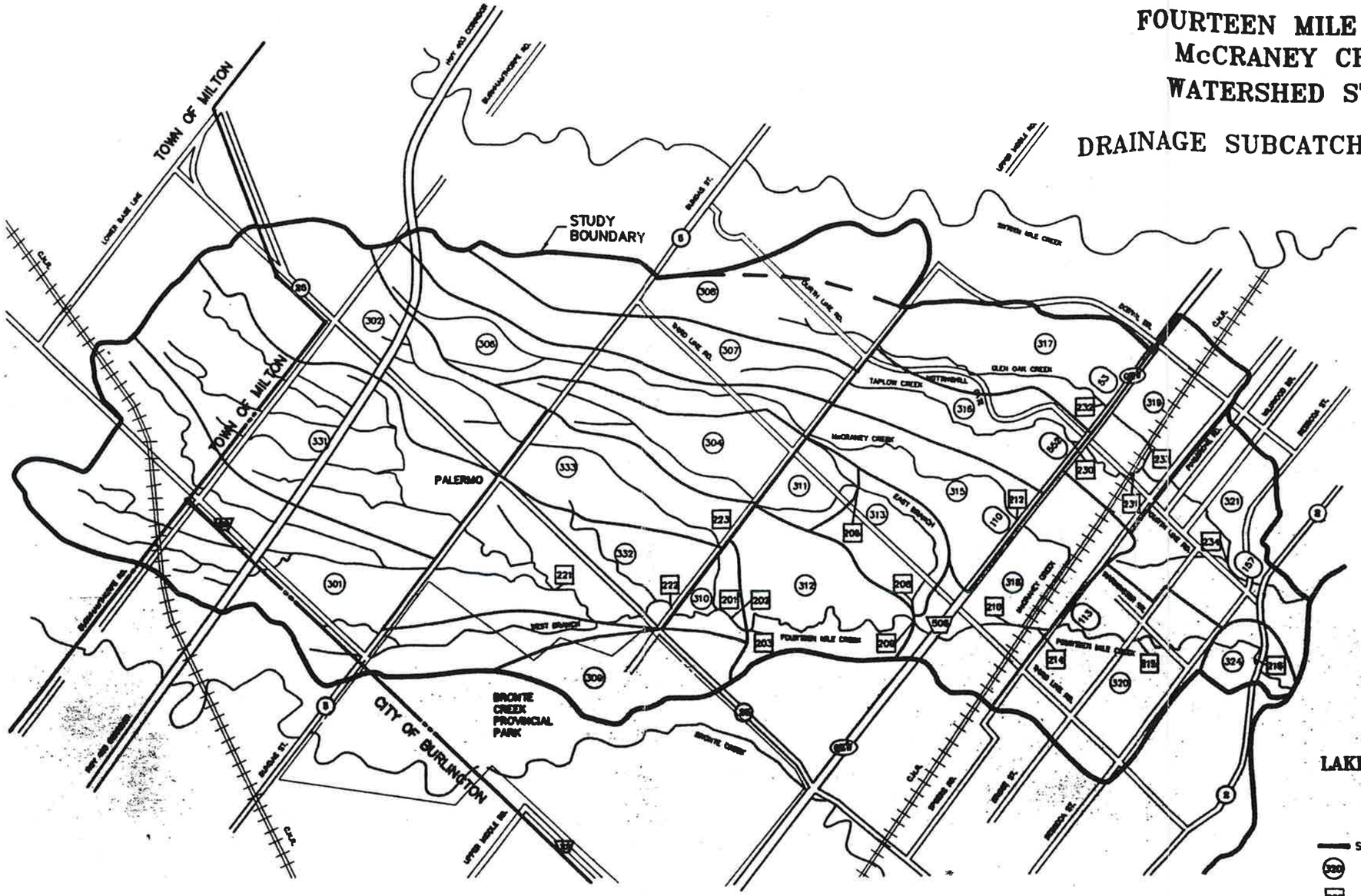
SITE RANKING

- HIGH
- MEDIUM
- LOW
- POSSIBLE FUTURE SITE

TOWN OF OAKVILLE

FOURTEEN MILE CREEK McCRANEY CREEK WATERSHED STUDY

DRAINAGE SUBCATCHMENT PLAN



LEGEND

- SUBCATCHMENT BOUNDARIES
- (320) SUBCATCHMENT
- [308] CONFLUENCE
- (308) RESERVOIR
- (110) CHANNEL

MAP: 4
N.T.S.

TRITON ENGINEERING SERVICES LIMITED
Consulting Engineers
Orangeville Fergus Georgetown Kitchener

TABLE No. 4.2c: SUMMARY OF PEAK FLOWS FOR SELECTED HYDROGRAPHS

PROJECT NAME: FOURTEEN MILE CREEK / McCRANEY CREEK WATERSHED PLANNING STUDY

DEVELOPMENT: ULTIMATE

UNITS: cu.m /sec.

HYD. No.	LOCATION	UPSTREAM AREA (sq.km.)	EVENT RETURN PERIOD (YEARS)						
			2	5	10	25	50	100	REGIONAL
302	DUNDAS ST.- 14 MILE CK., EAST	3.380	37.800	52.700	61.600	75.200	82.900	97.500	49.300
223	UPPER MIDDLE- 14 MILE E TRIB.	4.296	30.200	41.100	48.300	59.400	65.400	77.500	61.300
304	UPPER MIDDLE- 14 MILE TRIB. 2	1.570	16.600	22.500	26.100	31.600	34.800	40.700	22.900
508	14 MILE CREEK AT QEW	22.791	83.500	112.000	140.000	175.000	191.000	226.000	260.000
306	UPPER MIDDLE- McCRANEY CREEK	1.631	12.300	16.800	19.600	24.200	26.600	31.600	23.200
110	McCRANEY CREEK AT QEW	2.791	8.070	10.600	12.100	19.100	22.600	27.500	34.300
113	14 MILE CREEK AT SPEERS ROAD	27.462	88.000	119.000	141.000	180.000	193.000	231.000	294.000
114	14 MILE CREEK AT REBECCA ST.	29.782	79.700	110.000	133.000	165.000	178.000	211.000	301.000
216	14 MILE CREEK AT LAKESHORE RD.	30.172	79.200	108.000	24.700	30.400	178.000	210.000	302.000
307	UPPER MIDDLE- TAPLOW CREEK	1.540	15.200	21.100	14.400	19.400	33.500	39.500	22.400
552	TAPLOW CREEK AT QEW	3.000	9.530	11.400	18.700	23.400	21.100	26.300	33.700
308	UPPER MIDDLE- GLEN OAKS CREEK	1.710	11.900	15.900	21.000	31.200	25.800	30.700	24.100
53	GLEN OAKS CREEK AT QEW	3.210	10.600	15.700	32.800	41.700	34.400	40.000	42.100
233	EAST McCRANEY CK AT SPEERS RD.	7.760	21.400	27.600	30.400	35.500	45.300	56.400	89.700
157	EAST McCRANEY CK AT LAKESHORE	9.930	27.300	27.800	30.100	35.500	37.200	41.100	71.800

TABLE No. 4.2b: SUMMARY OF PEAK FLOWS FOR SELECTED HYDROGRAPHS

PROJECT NAME: FOURTEEN MILE CREEK / McCRANEY CREEK WATERSHED PLANNING STUDY

DEVELOPEMENT: FUTURE

UNITS: cu.m /sec.

HYD. No.	LOCATION	UPSTREAM AREA (sq.km.)	EVENT RETURN PERIOD (YEARS)						
			2	5	10	25	50	100	REGIONAL
302	DUNDAS ST.- 14 MILE CK., EAST	3.380	2.880	3.890	4.800	6.610	7.150	8.800	24.000
223	UPPER MIDDLE- 14 MILE E TRIB.	4.296	10.800	14.400	16.600	19.900	21.900	25.600	31.100
304	UPPER MIDDLE- 14 MILE TRIB. 2	1.570	16.600	22.500	26.100	31.600	34.800	40.700	22.900
508	14 MILE CREEK AT DEW	22.791	50.700	66.100	77.500	98.600	104.000	122.000	178.000
306	UPPER MIDDLE- McCRANEY CREEK	1.631	11.100	15.600	18.600	23.500	25.800	30.900	23.100
110	McCRANEY CREEK AT DEW	2.791	7.500	10.200	11.700	17.800	21.400	27.000	34.300
113	14 MILE CREEK AT SPEERS ROAD	27.462	53.200	68.900	81.500	104.000	110.000	130.000	212.000
114	14 MILE CREEK AT REBECCA ST.	29.782	47.100	60.800	77.000	99.400	106.000	128.000	234.000
216	14 MILE CREEK AT LAKESHORE RD.	30.172	47.100	60.700	76.600	99.500	106.000	127.000	238.000
307	UPPER MIDDLE- TAPLOW CREEK	1.540	14.900	20.800	24.500	30.200	33.300	39.400	22.400
552	TAPLOW CREEK AT DEW	3.000	9.410	11.200	14.200	19.200	21.000	26.200	33.700
308	UPPER MIDDLE- GLEN OAKS CREEK	1.710	11.600	15.600	18.500	23.200	25.600	30.500	24.100
53	GLEN OAKS CREEK AT DEW	3.210	10.500	15.400	20.700	31.100	34.200	39.800	42.100
233	EAST McCRANEY CK AT SPEERS RD.	7.760	21.300	27.400	32.500	41.500	45.100	56.300	89.700
157	EAST McCRANEY CK AT LAKESHORE	9.930	27.300	28.700	30.100	35.500	37.200	41.000	71.800

TABLE No. 4.2a: SUMMARY OF PEAK FLOWS FOR SELECTED HYDROGRAPHS

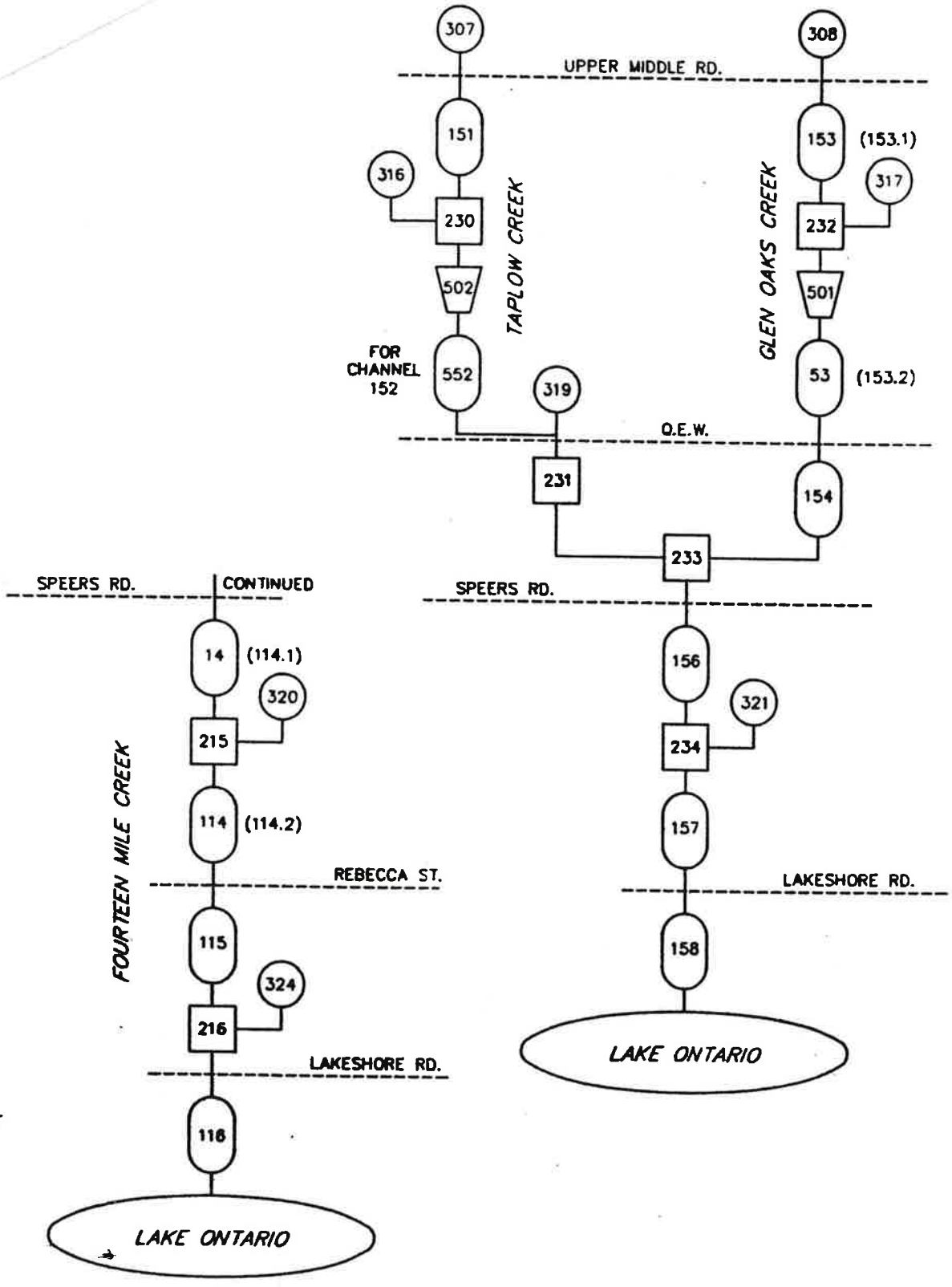
PROJECT NAME: FOURTEEN MILE CREEK / McCRANEY CREEK WATERSHED PLANNING STUDY

DEVELOPEMENT: EXISTING

UNITS: cu.m /sec.

HYD. No.	LOCATION	UPSTREAM AREA (sq.km.)	EVENT RETURN PERIOD (YEARS)						
			2	5	10	25	50	100	REGIONAL
302	DUNDAS ST.- 14 MILE CK., EAST	3.380	2.880	3.890	4.800	6.610	7.150	8.800	24.000
223	UPPER MIDDLE- 14 MILE E TRIB.	4.296	3.620	4.870	6.000	8.260	8.920	11.000	30.200
304	UPPER MIDDLE- 14 MILE TRIB. 2	1.570	2.930	3.900	4.680	6.070	6.610	8.030	14.900
508	14 MILE CREEK AT DEW	22.791	14.800	20.900	24.700	31.300	35.000	42.600	137.000
306	UPPER MIDDLE- McCRANEY CREEK	1.631	1.150	1.560	1.930	2.680	2.890	3.560	10.500
110	McCRANEY CREEK AT DEW	2.791	5.270	6.620	7.670	9.440	10.100	11.600	22.500
113	14 MILE CREEK AT SPEERS ROAD	27.462	28.100	38.300	44.800	55.300	60.900	72.400	160.000
114	14 MILE CREEK AT REBECCA ST.	29.782	24.200	31.400	37.100	47.000	51.400	73.300	169.000
216	14 MILE CREEK AT LAKESHORE RD.	30.172	24.200	31.500	37.300	47.400	51.800	74.000	171.000
307	UPPER MIDDLE- TAPLOW CREEK	1.540	1.730	2.340	2.860	3.830	4.160	5.100	12.200
552	TAPLOW CREEK AT DEW	3.000	5.110	6.350	7.420	9.300	9.920	11.200	26.000
308	UPPER MIDDLE- GLEN OAKS CREEK	1.710	1.680	2.290	2.820	3.820	4.150	5.110	13.100
53	GLEN OAKS CREEK AT DEW	3.210	4.970	6.780	8.340	10.900	12.200	16.600	29.000
233	EAST McCRANEY CK AT SPEERS RD.	7.760	18.400	24.200	28.200	34.000	37.000	43.500	69.600
157	EAST McCRANEY CK AT LAKESHORE	9.930	24.700	32.900	35.700	40.700	42.700	43.900	58.800

WATERSHED MODELLING SCHEMATIC

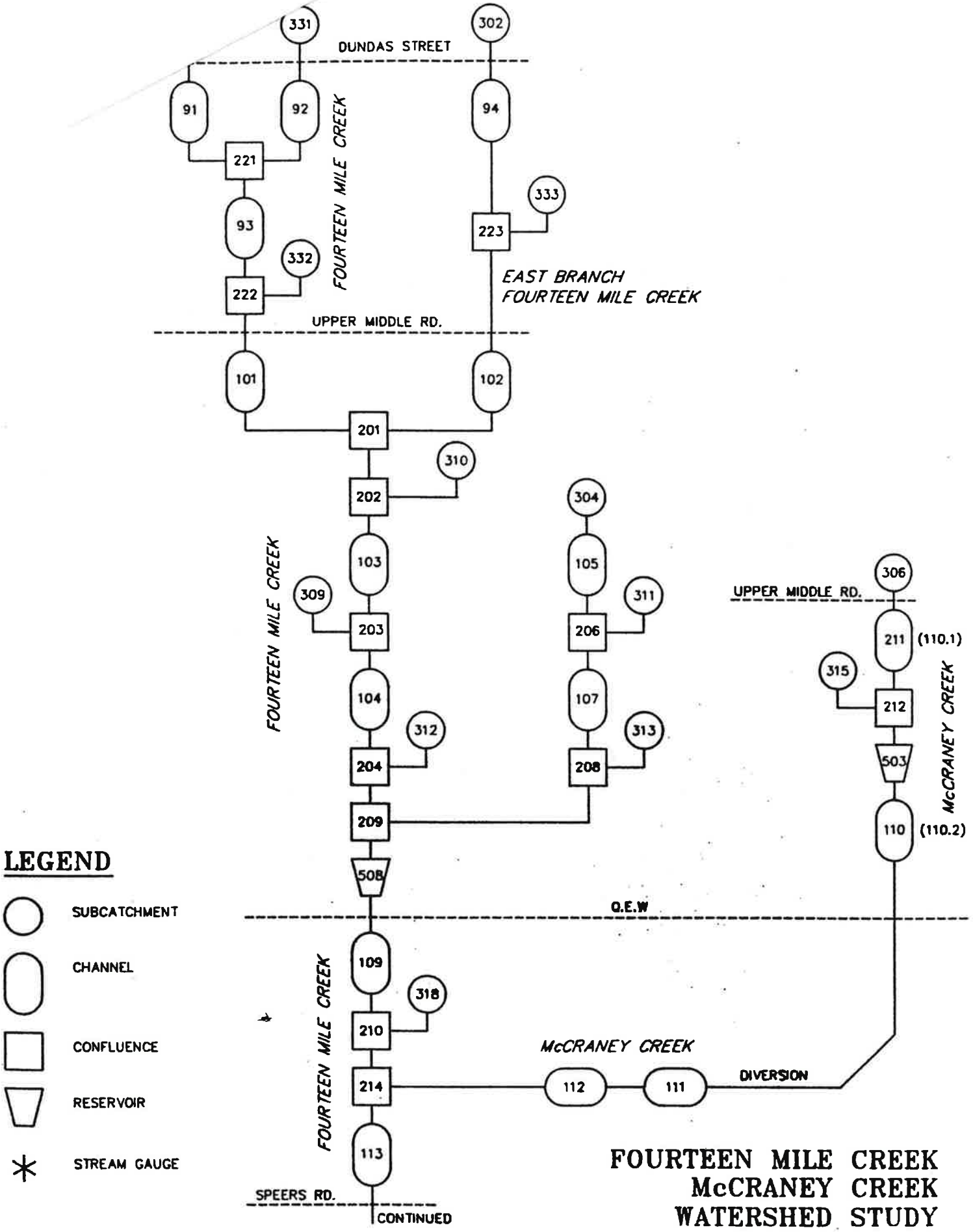


LEGEND

- SUBCATCHMENT
- CHANNEL
- CONFLUENCE
- RESERVOIR
- STREAM GAUGE

FOURTEEN MILE CREEK
McCRANEY CREEK
WATERSHED STUDY

WATERSHED MODELLING SCHEMATIC



LEGEND

- SUBCATCHMENT
- CHANNEL
- CONFLUENCE
- RESERVOIR
- STREAM GAUGE

FOURTEEN MILE CREEK
McCRANEY CREEK
WATERSHED STUDY

FIGURE 5

OAKVILLE

STAFF REPORT

Discussion
CSC Meeting
JUN 2 7 2000
ITEM # 6(A)

DATE: June 20, 2000 FILE No.: Storm Events May 12/13

TO: Chairperson and Members of Community Services Committee

FROM: R. G .Green, P. Eng., Director of Public Works

SUBJECT: **May 12/13, 2000 Storm Events- General Flooding and Damages**

Recommendations

THAT this report be received,

THAT Council concur with the actions of staff with respect to the actions taken regarding the Fourteen Mile Creek, and

THAT further staff reports be brought to Council as needed.

Origin

This report has been prepared to update Council on the major storm events that occurred over May 12 and 13, 2000. First, this report is to put into context the magnitude of the storm events that occurred over these two days. As well, this report also provides an overview of the general flooding and damages that occurred. With respect to two areas that experienced larger scale flooding, this report discusses actions to-date as well as potential future directions and issues.

Elsewhere on your agenda are three other reports. A report from the Department of Parks and Recreation on the storm damage that occurred in various parks and the two harbours. The Fire Department has provided a report on the debriefing of the members of the Emergency Operations Centre which

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Oakville, Ontario L6J 5A6
Tel 905-845-6601

was placed into operation to deal with the storm events. Finally, a confidential report from the Manager of Office Services and Insurance that provides an update on the claims received by the Town as a result of the storm.

Report

Storm Events May 12 and 13, 2000

The rain storms of May 12 and 13, 2000 were the most intense I have seen in my twenty-four year career with the Town. Attachment 'A' to this report is a copy of a memo provided by Conservation Halton that examines the rainfall intensities experienced and the resulting flood levels.

Conservation Halton operates rain gauge stations at various locations within the authority's watersheds including a station at the Fourteen Mile Creek at Warminster Drive. This station recorded two major events; one in the morning of May 12, 2000, lasting approximately one hour and a second more major event commencing at 9:00 p.m. on May 12, 2000, lasting until about 1:00 a.m. on May 13, 2000. The amount of rainfall recorded for each event was 14.2 mm and 63.7 mm respectively. Conservation Halton has correlated the data of the second storm event. Their analysis indicates that the storm had a return f equency between twenty-five and fifty years.

Notwithstanding, the major storm event had a rainfall intensity of a twenty-five to fifty year storm, the actual flood levels observed in the Fourteen Mile Creek correspond to an event closer to the one hundred year level. As explained in Conservation Halton's memo, the higher flood levels were due to the saturated ground conditions which resulted from the earlier storm on May 12, 2000. There was also a heavy thunder storm on the evening of May 11, 2000, which is not mentioned by Conservation Halton. This storm also contributed to the saturated ground conditions.

General Flooding and Damages

As a result of the intense run-off, many ditches and culverts were over topped. In some areas roadway lanes and sections of roads had to be closed including areas on Dundas Street, Upper Middle Road, QEW and Rebecca Street. In many instances roadway repairs were required and have been completed. In some instances, the over topping of ditches and culverts affected private property mostly in front and rear yards.

In addition, more significant flooding occurred along sections of the Fourteen Mile Creek and the Munn's Creek. These creeks are the subject of further discussion later in this report.

There were also many properties that experienced basement flooding through floor drains as a result of surcharging in wastewater mains. The Region of Halton is dealing directly with these issues.

To provide Council with a picture of the widespread impacts of the storm, Public Works has compiled a series of maps that are appended to this report. The maps show areas of general flooding and flooding on private properties. The maps have been compiled from calls received and inspections carried out by the department. (The Councillors' agendas include coloured maps). In some instances, the flooding of private property is as a result of wastewater surcharging. The vast majority of the flooding occurred in areas that predated our storm water management policies which have been in place since 1979.

Munn's Creek

Flooding of the Munn's Creek around the Culham/Osborne/Otter area was the subject of a report to Council on June 5, 2000. As a result of the report, Council has expanded the scope of an already approved study of the Munn's Creek. The expanded scope will undertake a review of the flooding issues and bring forward potential solutions. The study will involve public consultation and should be submitted to Council late this year or early 2001.

Fourteen Mile Creek

As you can see from the report from Conservation Halton, the flooding levels along the Fourteen Mile Creek, south of Speers Road in many areas rose to the 100 year storm event. The flooding of the Fourteen Mile Creek affected public and private property. The private property flooding was contained to rear yards impacting mostly private fences, sheds, gardens and several pools. Impacts to public property included damage to channel fencing and existing erosion protection including gabion baskets and concrete walls. Unprotected areas along the creek and in some instances even the creek bed were severely eroded. As a result of the erosion, large amounts eroded earth and shale were deposited in various areas of the creek.

The erosion protection along the Fourteen Mile Creek south of Speers Road to Lakeshore Road West was constructed by Conservation Halton in the late 1960's and early 1970's. Conservation Halton has historically been responsible

for channel maintenance. Many residents along the creek after the storm have expressed concern regarding a perceived lack of maintenance to the creek channel especially in terms of vegetation growth and the accumulation of sediment in the creek.

In response to the residents' concerns and to fully assess the impacts of the storm to the Fourteen Mile Creek in terms of hydraulic capacity and accelerated erosion, Public Works has retained Totten Sims Hubicki. This consultant is currently working on other creek erosion issues for the Town. The consultant is to examine in detail the condition of the creek channel and is to provide recommendations on what works including associated costs and timing are required in terms of sediment and vegetation removal, and erosion protection. Any recommended work must take into account Federal/Provincial regulations in terms of the creek's biological and ecological functions. This report will be submitted to Council and the public in July/August, 2000. I anticipate that some work will be required this year. Other work should be able to be referred to future budgets.

With regard to the channel fencing damaged from the storm, Public Works has installed temporary snow fencing where required and is in the process of hiring a contractor to undertake permanent repairs. The biggest challenge to the repair of the fencing is access to the repair sites which is quite difficult in many instances. Repairs to the fencing could cost between $30-50,000. While there is no budget for this work, the repairs must be carried out to ensure safety.

Conclusion

Staff will continue to deal with the issues and damages resulting from the storm events of May 12/13, 2000. It must be recognized that the storm events and the saturated ground conditions led to extensive flooding levels. While there were some instances of severe damage to private property, the Town's creek systems and stormwater infrastructure operated well in most cases. Public Works staff have some localized flooding issues still to deal with as well as the larger issues of the Munn's Creek and Fourteen Mile Creek. Further staff reports will be brought forward to Council in the months to come.

At your Committee meeting, in addition to Town staff, Conservation Halton staff will be present to answer any questions.

SUBJECT: May 12/13, 2000 Storm Events and General Flooding and Damages

Respectfully submitted,

R. G. Green, P. Eng.,
Director of Public Works

APPROVED
DEPUTY TOWN MANAGER
COMMUNITY SERVICES

cc Ray Guther, Conservation Halton

Appendix A.

DATE: May 23, 2000

TO: John Hall, Director of Watershed Management Services

FROM: Ray Guther, Manager, Watershed Engineering Services

RE: Rainfall and Reported Flooding of May 12/13, 2000
Fourteen Mile Creek and Lower Morrison and Wedgewood Creeks

Summary

The watersheds within the Conservation Halton jurisdiction were subject to severe thunderstorm activity during May 12 and 13, 2000. The thunderstorms occurred over two primary periods during May 12 and 13, with the first cell occurring between approximately 10:00 a.m. to 11:00 a.m. on May 12, 2000 and a second cell characterized by higher intensity rainfall occurring between 9:00 p.m. on May 12, 2000 and 01:00 a.m. on May 13,2000.

Based on the recorded rainfall at the Conservation Halton gauge location on Warminster Drive in Oakville this rainfall event would correspond to between the 25 year and 50 year return period rainfall event.

On May 15, Conservation Halton staff undertook site inspections of the Lower Fourteen Mile Creek and Lower Morrison and Lower Wedgewood Creeks. A subsequent inspection of the Lower Fourteen Mile Creek was undertaken with Town of Oakville staff and the Town's consultant (Ray Tufgar of Totten Sims Hubicki).

During these inspections, the peak flood levels within the Lower Fourteen Mile Creek were estimated at various locations based on observed debris deposited within the floodplain. Based on these observations the peak flood levels were observed to generally correspond to flood levels expected during a 100 year storm, and in some cases, flood levels exceeded the expected 100 year levels.

Introduction

The following provides a brief description of the rainfall of May 12 and 13, 2000 and results of staff investigation of flooding within the Lower Fourteen Mile Creek and Lower Morrision and Wedgewood Creeks.

Rainfall

On May 12 and 13 the Regions of Halton, Hamilton-Wentworth and other areas of the GTA were subject to severe thunderstorm activity. The thunderstorm followed generally an easterly direction across the watersheds within the Conservation Halton jurisdiction. The storm system was characterized by two primary storm cells the first of which, occurring at approximately 10:00-11:00 on May 12, 2000, exhibited short duration intense rainfall. The second larger cell occurred between approximately 21:00 on May 12 to 01:00 on May 13, 2000.

Table 1 provides a summary of the recorded rainfall from gauges within the Conservation Halton watersheds.

Table 1 Summary of Recorded Rainfall Volume (mm)			
Gauge Location	**First Cell Rainfall (mm) Recorded for the period of approximately 10:00-11:00 May 12, 2000**	**Second Cell Rainfall (mm) Recorded for the period of 21:00 May 12, 2000 to 02:00 May 13, 2000**	**Total Rainfall (mm) for May 12 and May 13, 2000 (48 hours)**
14 Mile Creek at Warminster Drive (Oakville)	14.2	63.7 (4 hours – 21:00 to 02:00)	83.5
Scotch Block Reservoir (Milton)	Not Available	Not Available	Not Available
Kelso Reservoir[1] (Milton)	20.6	78 (20:40 - 0:00)	132.0
Mainway (Burlington)	Less than 8.8mm (0:00-11:00)	53 (20:40-0:00)	61.8
Grindstone Creek (Burlington)	Data pending	Data pending	Data pending

1 Although rainfall gauge appears to have functioned properly the rainfall results are unconfirmed at this time.

Based on the results of the recorded rainfall the extreme rainfall corresponds to the location of the Kelso Reservoir, However, the flow response at the Kelso reservoir suggests that this significant rainfall volume may have been isolated to the local area and also reflects a longer period of low intensity rainfall earlier on May 12, 2000. The Dufferin Aggregates rainfall gauge, which is relatively close to the Kelso rainfall gauge did not receive the significant rainfall recorded at the Kelso reservoir with approximately 47.6 mm of total rainfall being recorded.

It should also be noted that rainfall gauges provide results for a point location at set time intervals only and hence may not entirely reflect the actual storm characteristics. Widely varying rainfall response across the watershed is typical for thunderstorm events, hence it is difficult to precisely characterize the return period for flood occurrences based on rainfall gauge information alone.

The recorded rainfall at each gauge has been correlated to an estimated storm return frequency based of the Municipal Intensity-Duration-Frequency (IDF) curves for the location of each gauge as summarized in Table 2.

Table 2 Summary of Rainfall Return Frequency (years) based on Municipal IDF values		
Gauge Location	**First Cell Rainfall (mm) Recorded for the period of approximately 10:00-11:00 May 12, 2000**	**Second Cell Rainfall (mm) Recorded for the period of 21:00 May 12, 2000 to 02:00 May 13, 2000**
14 Mile Creek at Warminster Drive (Oakville)	less than 2 year	Between 25 year and 50 year event
Scotch Block Reservoir (Milton)	Not Available	Not Available
Kelso Reservoir (Milton)	Data pending	Data pending
Mainway (Burlington)	less than 2 year	Between 25 and 50 year
Grindstone Creek	Data pending	Data pending

Table 2 Summary of Rainfall Return Frequency (years) based on Municipal IDF values		
Gauge Location	First Cell Rainfall (mm) Recorded for the period of approximately 10:00-11:00 May 12, 2000	Second Cell Rainfall (mm) Recorded for the period of 21:00 May 12, 2000 to 02:00 May 13, 2000
(Burlington)		

The magnitude of the rainfall return period is a function of the total rainfall as well as the duration of the rainfall hence the return frequency varies according to the selected time frame for the event.

As illustrated in Table 2 the four hour produced the most severe estimate of return period with frequencies ranging from from 25 to 50 year events.

It should also be noted that the rainfall received during the first cell (10:00- 11:00 May 12, 2000) prior to the more intense second cell (20:00 May 12, 2000 to 02:00 May 13, 2000) would have served to contribute to soil wetting and hence increased the storm flow and flood response to the second thunder storm cell.

Information received from the Hamilton Region Conservation Authority indicates a total rainfall of 40.75 mm was recorded at the rainfall gauge in Dundas for the Period of May 12 and May 13, 2000. Information provided by CRA Associates for the Dufferin Aggregates Site indicates a total rainfall of 47.6 mm for the 2 day period of May 12 and 13, 2000.

Estimation of Flood Levels within the Lower Fourteen Mile

The primary areas of flooding reported to Conservation Halton occurred in the area of west Oakville particularly in the Fourteen Mile Creek Watershed.

Conservation Halton staff under took an inspection of the Lower Fourteen Mile Creek and Lower Morrison-Wedgewood creeks and have estimated high water levels based on observed debris lines and stream flow gauge results. Table 3 provides a summary of the results of the inspection of the Fourteen Mile Creek.

Table 3 Summary of Estimated Peak Flood Levels for various locations along the Fourteen Mile Creek					
Location (Hydraulic Cross Section)	Estimated Peak Flood Elevation Based on Observed Debris Accumulation (m)	Comment	Predicted Water Surface Elevation based on 1984 FDRP Study results (m)[1]		
			Regional (Hurricane Hazel)	100 year	50 Year
Lakeshore – upstream (5)	79.0-79.5	chainlink fence damage on east bank	82.0	80.5	80.0
T.A. Blackelock School (8)	84.0	Channel invert erosion downcutting observed debris noted beyond limits of concrete channel access point	85.1	83.4	83.2
Rebecca Street downstream (9)	84.5	debris observed at top of storm sewer outfall movement/settling of concrete channel panels noted (east bank)	86.0	84.1	83.9
Rebecca Street upstream (10)	85.5	Debris noted at top of Gabion revetment (east bank)	87.1	85.6	85.4

Table 3
Summary of Estimated Peak Flood Levels for various locations along the Fourteen Mile Creek

Location (Hydraulic Cross Section)	Estimated Peak Flood Elevation Based on Observed Debris Accumulation (m)	Comment	Predicted Water Surface Elevation based on 1984 FDRP Study results (m)[1]		
			Regional (Hurricane Hazel)	100 year	50 Year
		Debris noted approximately 1.8 metres below top of road Shale accumulation noted beneath bridge (particle sizes up to 1.0m x 1.0 m x 0.2m)			
Kinoak Arena (13)	88.8	pedestrian bridge has been dislodged/damaged	89.0	87.5	87.1
Downstream of Kinoak Arena Residential Area (12)	88.1	Pools flooded Rear yard fences overtopped by flood waters and damaged Sheds and side lot line fences damaged Peak flood level within 0.3m of Building elevation	88.5	86.3	86.0
Downstream of Kinoak Arena Residential Area (11)	86.0-86.5	Scour of Material from behind gabion revetment noted	87.05	86.4	86.1
Warminster Drive downstream(16)	89.5	Estimated flood level approximate 0.5 metres below top of road with flow to low cord of structure Conservation Halton Gauge station subject to flooding and debris/sediment damage Conservation Halon streamflow gauge results indicate peak flood levels 3 metres above normal water level	90.7	89.7	89..6
Warminster Drive upstream(17)	90.5-91.0	Debris noted deposited on flood plain including TV set large propane tank, partial retaining wall and up-rooted tree approximately 0.3 0.4 m diameter Debris line note 1.1 m above elevation of flood plain	92.1	90.3	90.0
Bridge Road upstream (19)	92.0-92.5	Debris noted on flood plain elevation estimated from topographic mapping	95.0	92.6	92.1
Downstream of Speers along Warwick Avenue (21-22)	95.5	Debris noted in rear yards and lot line fence damage			
Speers Road downstream (23)	96.0-96.5	Flood level/debris line at top of gabion revetment	97.1	95.0	95.4
Speers Road upstream (24)	not estimated	progressive gabion revetment failure noted	99.6	97.7	97.1
Third Line upstream (30)	103.3	debris line noted approximately 0.3 metres below C-L of intersection	104.3	103.2	102.9
Third Line downstream (29)	102.0	based on debris line noted approximately	103.1	101.9	101.8
Wyecroft Road Upstream (N/A)	not estimated	based on debris flow depth estimated to be approximately 0.3 metres below culvert obvert/low chord	Not included in FDRP data	Not included in FDRP data	Not included in FDRP data

1. Flood Damage Reduction Study on the Fourteen Mile Creek, Philips Planning and Engineering Limited, 1984 prepared for the Halton Region Conservation Authority (Note IDF parameters used in the FDRP study vary from Town Standards)
2. Based on FDRP Study- Peak Flow rates for Regional Storm range from 220 m^3/s to 256.6 m^3/s
3. Based on FDRP Study- Peak Flow rates for 100 Year Storm range from 100 m^3/s to 109 m^3/s
4. Based on FDRP Study- Peak Flow rates for 50 Year Storm range from 79.1 m^3/s to 86.4 m^3/s

Based on the observations at the time of the Conservation Halton staff's inspection the observed flood levels in the lower Fourteen Mile Creek, at some locations appear to generally correspond to the 100 year levels and in may have exceed the expected 100 year water surface elevation at some locations.

The observed flooding on the Fourteen Mile Creek appears to correspond to higher magnitude (more severe) storm event than that indicated by the Warminster rainfall/stream flow gauge. There are a number of factors which may have contributed to this apparent difference between the rainfall and runoff/flood response including:

- The initial rainfall earlier in the day would have contributed to wetting of soils within the watershed hence increasing the runoff and flood response of the second rainfall cell
- Due to the highly variable nature of rainfall which occurs during thunderstorm events, it is possible that more intense and higher volumes of rainfall occurred in the upper portion of the watershed than rainfall recorded at the Warminster gauge.
- The direction of the storm passage across the watershed may also affect the peak flow response of the watershed

Lower Morrison and Wedgewood Creeks

Conservation Halton staff inspected a number of location along the Lower Morrison and Wedgewood Creeks and observed the following:

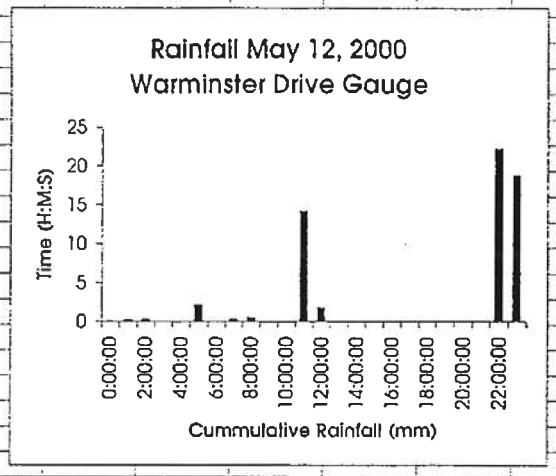
- Debris at Lower Morrison Creek at Morrison Road indicated flow to approximately the top of the bankfull channel. Morrison Road culvert peak flow approximately 2/3 of culvert depth (1.1 m)
- Debris at Lower Morrison Creek at Pinewood Park indicated flow to approximately 0.15 metre below pedestrian bridge low chord
- Debris at Lower Morrison Creek at Linbrook Road indicated peak flood depth of 0.6 metres
- Debris at Lower Morrison Creek at Chartwell Road indicated peak flood depth of 0.8-1.0 metres
- Debris at Lower Wedgewood Creek at Cornwall Road indicated peak culvert flow of approximately 50% of culvert depth (0.5m depth)
- Debris at Lower Wedgewood Creek at Duncan Road indicated peak culvert flow depth of 1.5m depth (approximately culvert full flow capacity)
- Debris at Lower Wedgewood Creek through Wedgwood Park to Alscot Drive indicated that flood depth of 0.2 to 0.4 above the channel banks, which corresponds to an approximate depth of flood of 1.0-1.5m depth from the stream invert

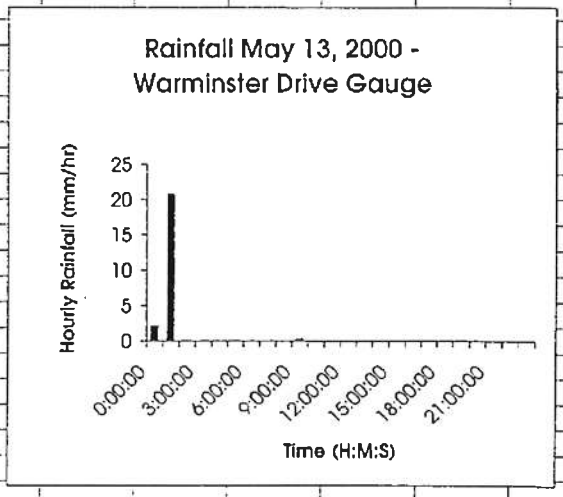
- Debris at Lower Wedgewood Creek at Wedgewood Road suggests that the peak culvert capacity at this location was attained/exceeded with the possibility of spill along the west ditch line of Wedgwood Road .

In summary, the relative peak flood levels and depth of flooding along the Lower Morrison and Wedgewood Creeks were observed to increase toward the downstream limits of the system with culvert capacities typically not being exceeded, with the potential exception of the Wedgwood Drive culvert. Given the amount of Debris noted at the Wedgewood Drive Culvert it is possible that debris jamming and blockage may have contributed to flood levels at this location.

Recorded Rainfall and Waterlevel at Warminster Gauge (14 Mile Creek - Oakville)

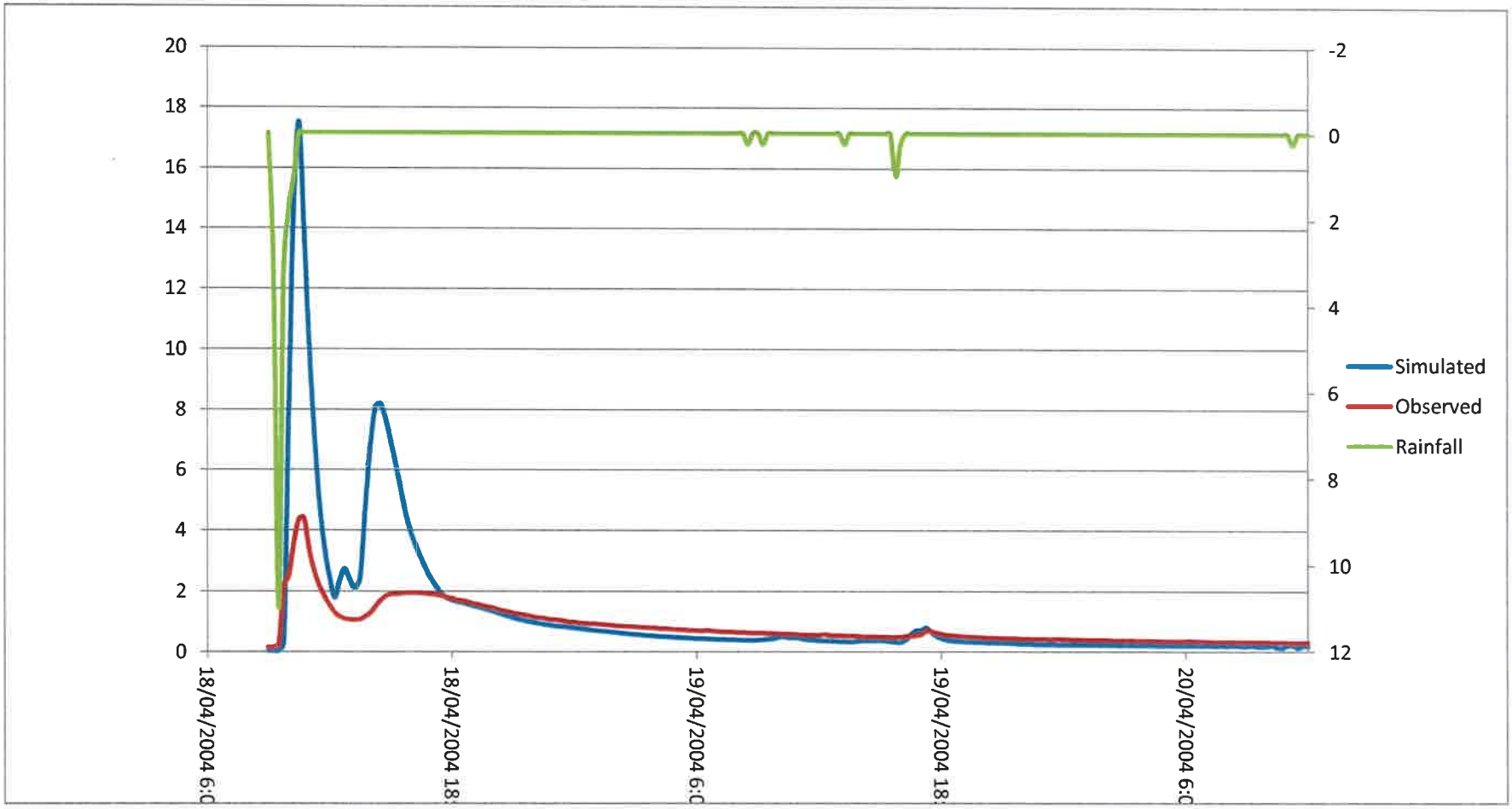
Date	Time	Cummulative Rainfall (mm)	Hourly Rainfall (mm)	Waterlevel (m)
12-May	0:00:00	552.3	0	0.326
	1:00:00	552.5	0.2	0.324
	2:00:00	552.8	0.3	0.324
	3:00:00	552.8	0	0.322
	4:00:00	552.8	0	0.32
	5:00:00	555	2.2	0.319
	6:00:00	555	0	0.319
	7:00:00	555.3	0.3	0.318
	8:00:00	555.8	0.5	0.317
	9:00:00	555.8	0	0.316
	10:00:00	555.8	0	0.315
	11:00:00	570	14.2	0.317
	12:00:00	571.8	1.8	0.753
	13:00:00	571.8	0	0.691
	14:00:00	571.8	0	0.556
	15:00:00	571.8	0	0.506
	16:00:00	571.8	0	0.469
	17:00:00	571.8	0	0.499
	18:00:00	571.8	0	0.549
	19:00:00	571.8	0	0.577
	20:00:00	571.8	0	0.573
	21:00:00	571.8	0	0.546
	22:00:00	594	22.2	0.694
	23:00:00	612.6	18.8	2.029
13-May	0:00:00	614.8	2	2.325
	1:00:00	635.5	20.7	2.912
	2:00:00	635.5	0	3.281
	3:00:00	635.5	0	3.142
	4:00:00	635.5	0	2.815
	5:00:00	635.5	0	2.529
	6:00:00	635.5	0	2.27
	7:00:00	635.5	0	2.01
	8:00:00	635.5	0	1.746
	9:00:00	635.8	0.3	1.567
	10:00:00	635.8	0	1.34
	11:00:00	635.8	0	1.141
	12:00:00	635.8	0	1.027
	13:00:00	635.8	0	0.943
	14:00:00	635.8	0	0.873
	15:00:00	635.8	0	0.811
	16:00:00	635.8	0	0.76
	17:00:00	635.8	0	0.718
	18:00:00	635.8	0	0.687
	19:00:00	635.8	0	0.67
	20:00:00	635.8	0	0.642
	21:00:00	635.8	0	0.611
	22:00:00	635.8	0	0.588
	23:00:00	635.8	0	0.57





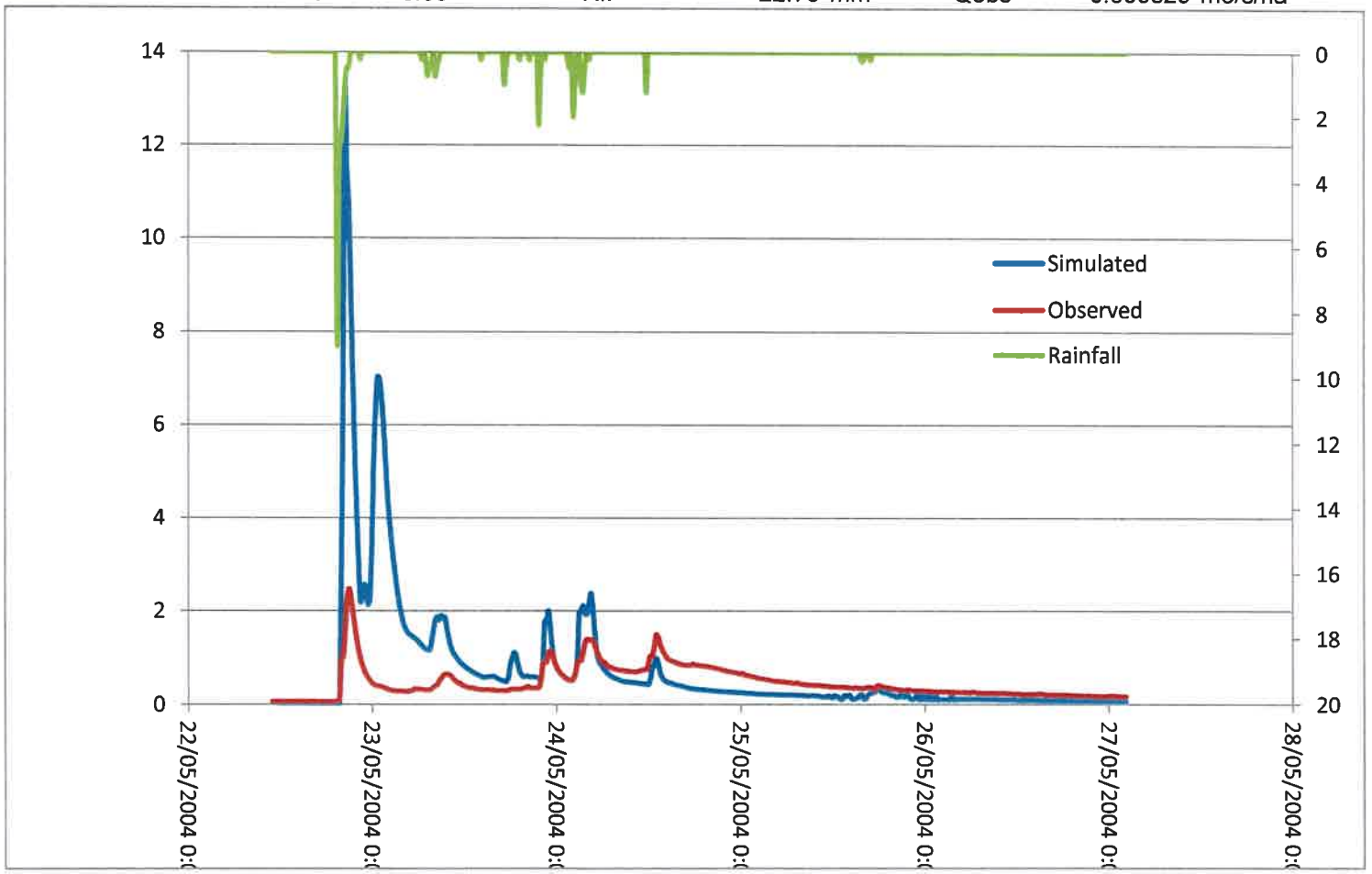
2975 ha

18/04/2004 10:30	Simulated	Observed					
C	0.31	0.13	Duration	1.25 hrs	Unitary Q		
Qp	17.51	4.39	Frequency	<2 yrs	Qsim	0.005886	m3/s/ha
Qave	2.40	1.33	R.F	20 mm	Qobs	0.001475	m3/s/ha



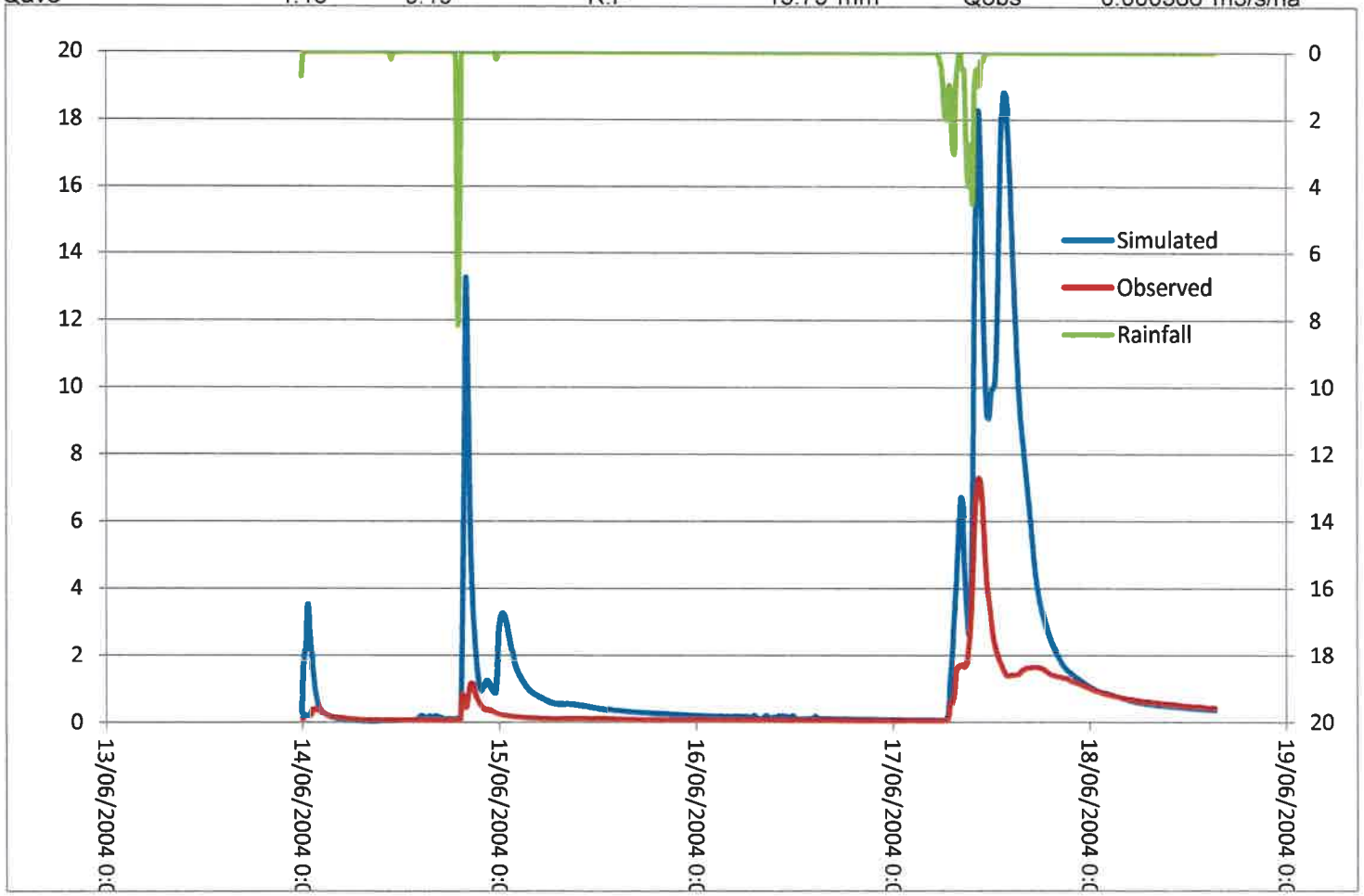
2975 ha

22/05/2004 20:30	Simulated	Observed					
C	0.36	0.08	Duration	13.5 hrs	Unitary Q		
Qp	13.08	2.47	Frequency	<2 yrs	Qsim	0.004396	m3/s/ha
Qave	1.25	0.59	R.F	22.75 mm	Qobs	0.000829	m3/s/ha



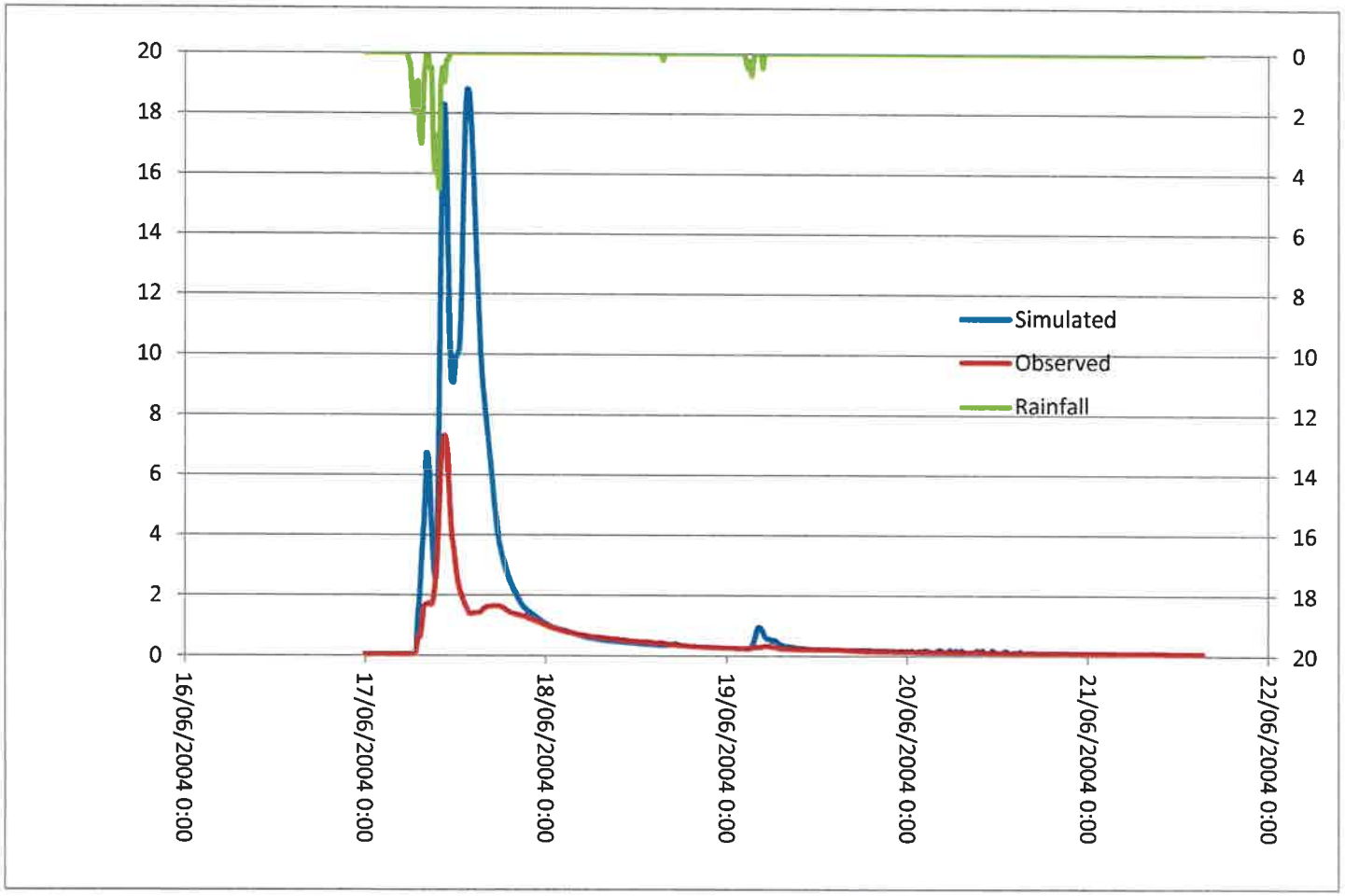
2975 ha

14/06/2004 20:00	Simulated	Observed				
C	0.23	0.03	Duration	0.75 hrs	Unitary Q	
Qp	13.24	1.15	Frequency	2 yrs	Qsim	0.004449 m3/s/ha
Qave	1.13	0.19	R.F	13.75 mm	Qobs	0.000386 m3/s/ha

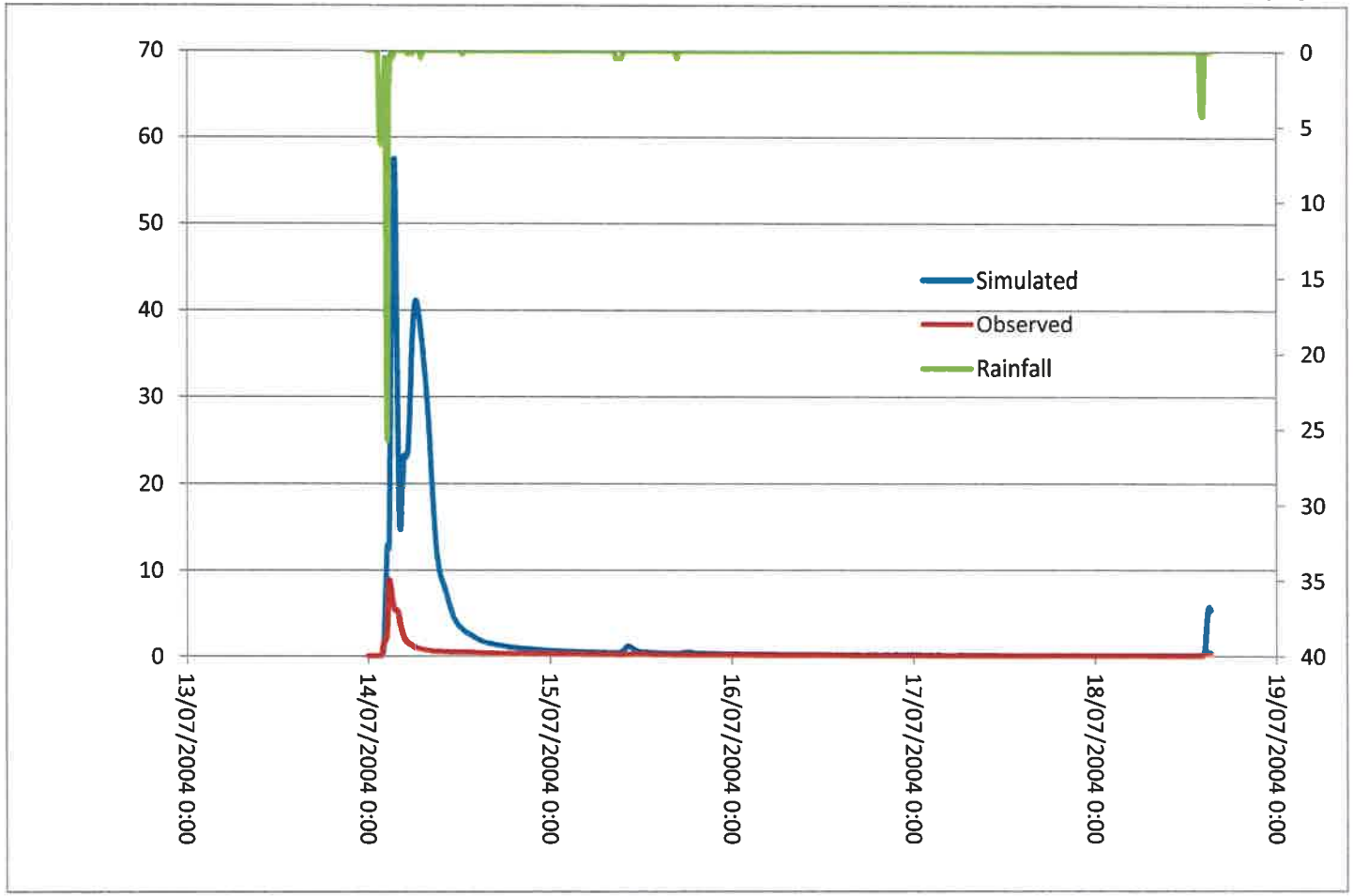


2975 ha

18/06/2004 20:00	Simulated	Observed					
C	0.44	0.13	Duration	5.5 hrs	Unitary Q		
Qp	18.78	7.29	Frequency	2 yrs	Qsim	0.006314	m3/s/ha
Qave	4.25	1.47	R.F	31.75 mm	Qobs	0.00245	m3/s/ha

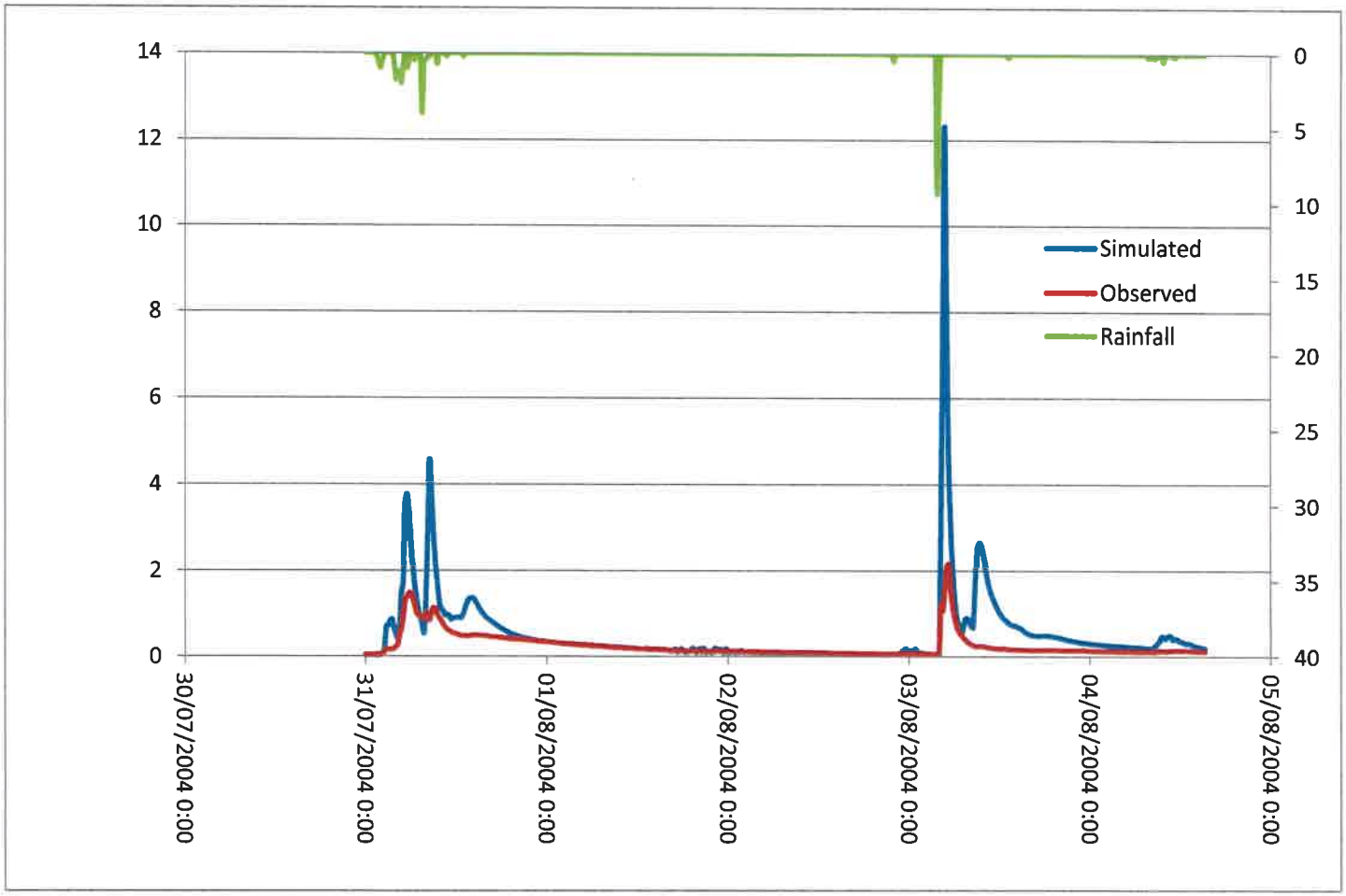


14/07/2004 3:30	Simulated	Observed					
C	0.59	0.05	Duration	4 hrs	Unitary Q		
Qp	57.22	8.76	Frequency	5-10 yrs	Qsim	0.019235	m3/s/ha
Qave	12.06	1.69	R.F	45.75 mm	Qobs	0.002944	m3/s/ha



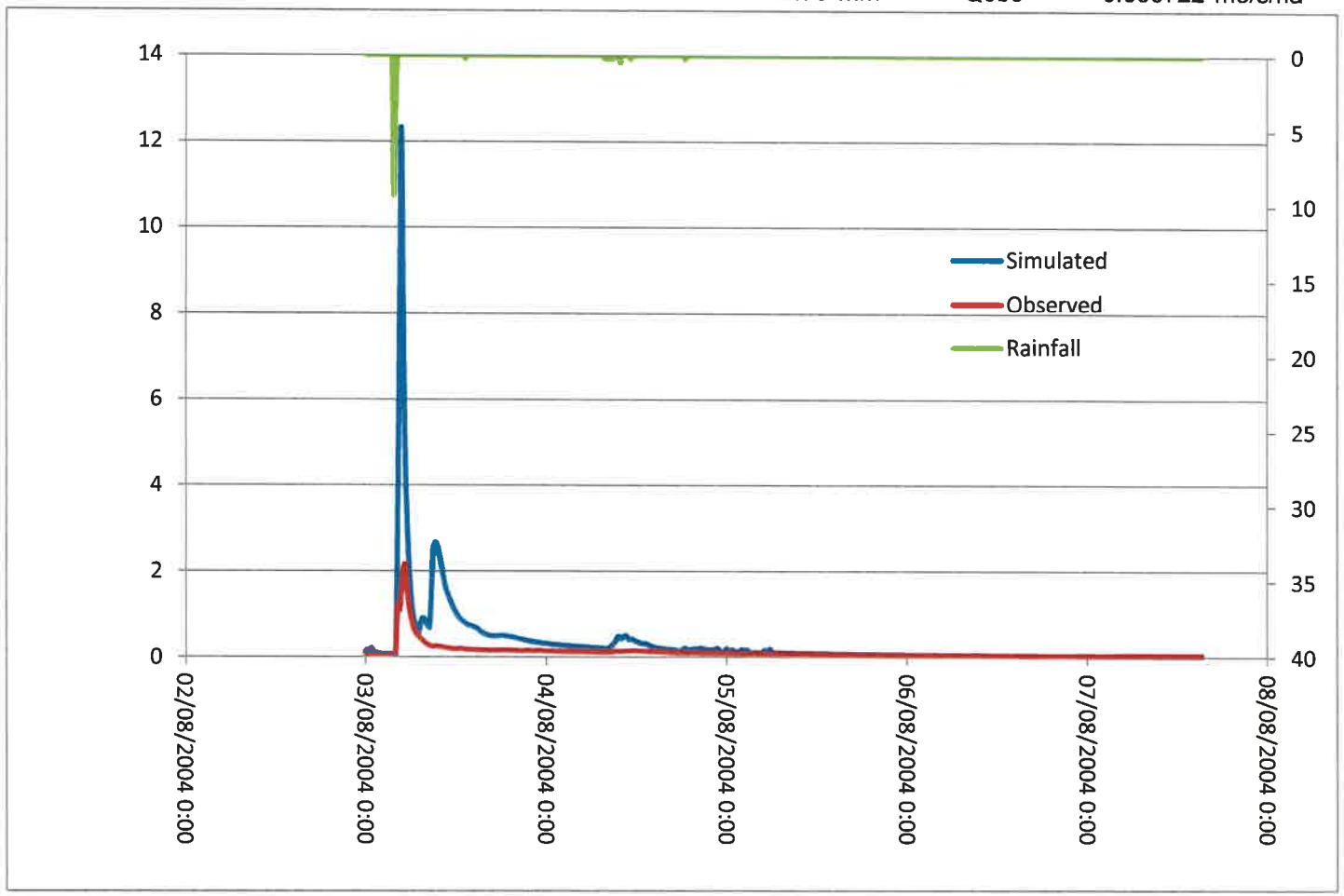
2975 ha

31/07/2004 3:30	Simulated	Observed					
C	0.12	0.04	Duration	9.5 hrs	Unitary Q		
Qp	4.56	1.47	Frequency	<2 yrs	Qsim	0.001533	m3/s/ha
Qave	1.04	0.59	R.F	18.75 mm	Qobs	0.000494	m3/s/ha



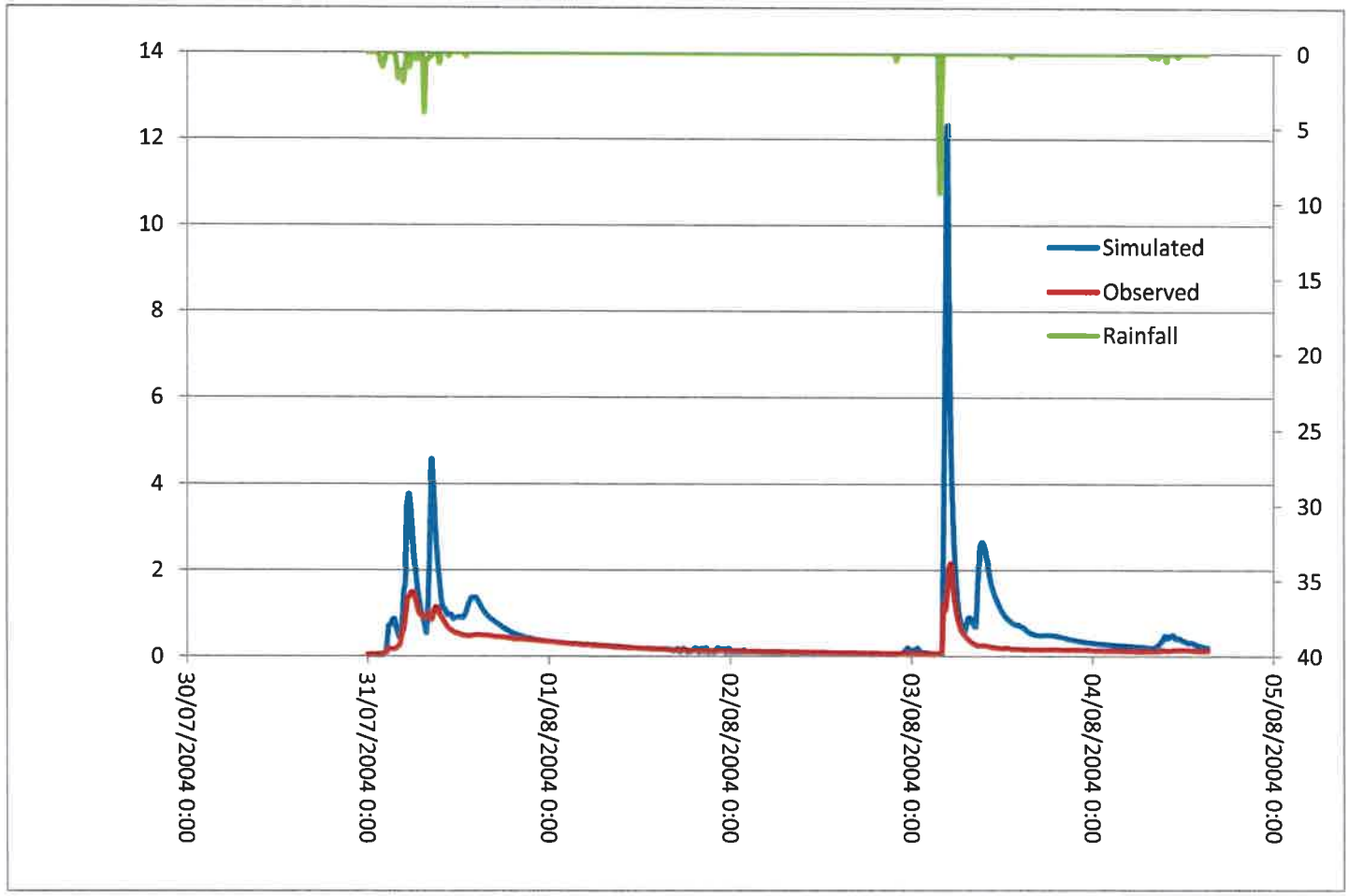
2975 ha

04/08/2004 8:15	Simulated	Observed					
C	0.15	0.04	Duration	0.5 hrs	Unitary Q		
Qp	12.33	2.15	Frequency	<2 yrs	Qsim	0.004144	m3/s/ha
Qave	0.86	0.30	R.F	12.75 mm	Qobs	0.000722	m3/s/ha

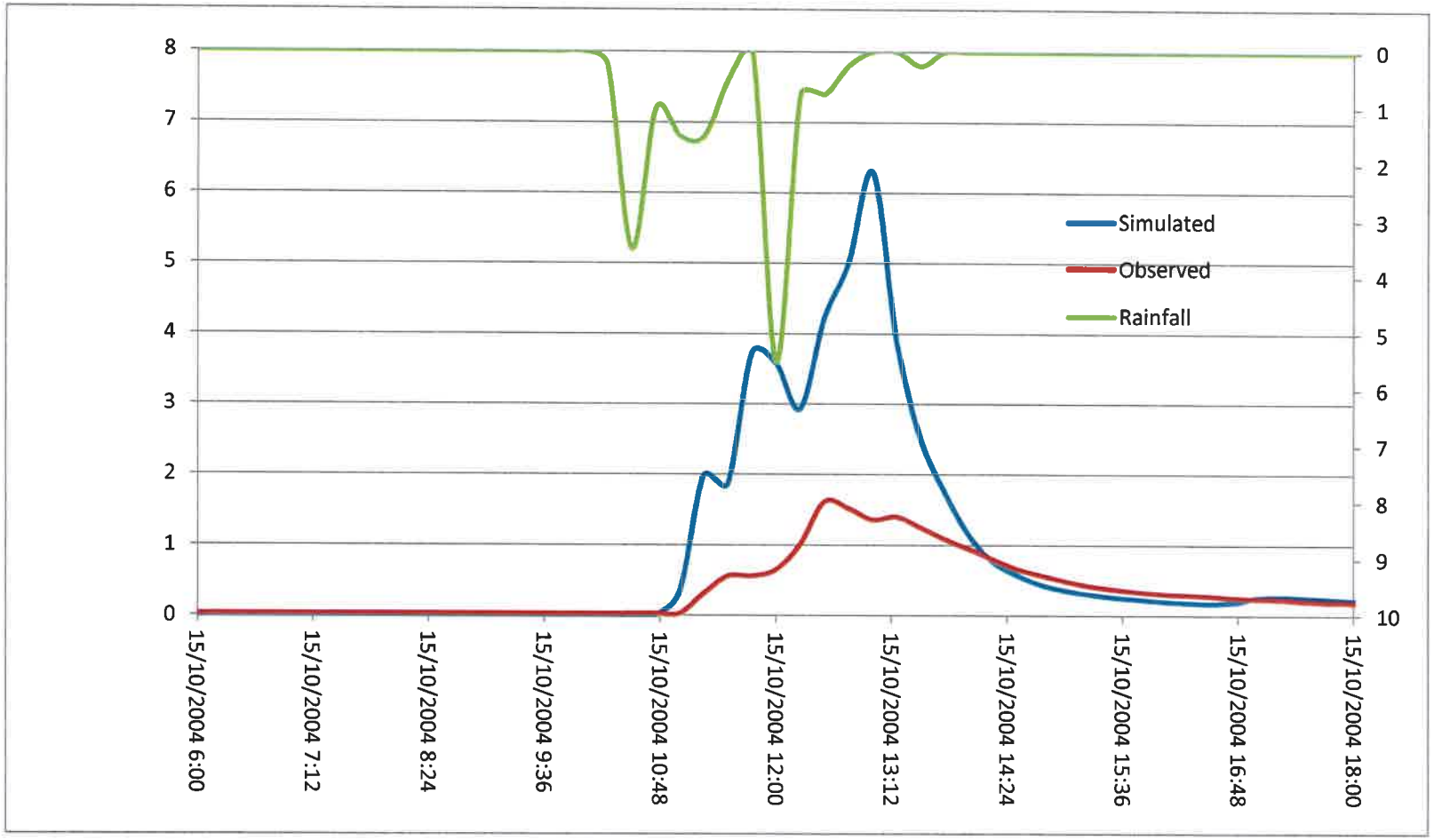


2975 ha

31/07/2004 3:30	Simulated	Observed					
C	0.12	0.04	Duration	9.5 hrs	Unitary Q		
Qp	4.56	1.47	Frequency	<2 yrs	Qsim	0.001533	m3/s/ha
Qave	1.04	0.59	R.F	18.75 mm	Qobs	0.000494	m3/s/ha

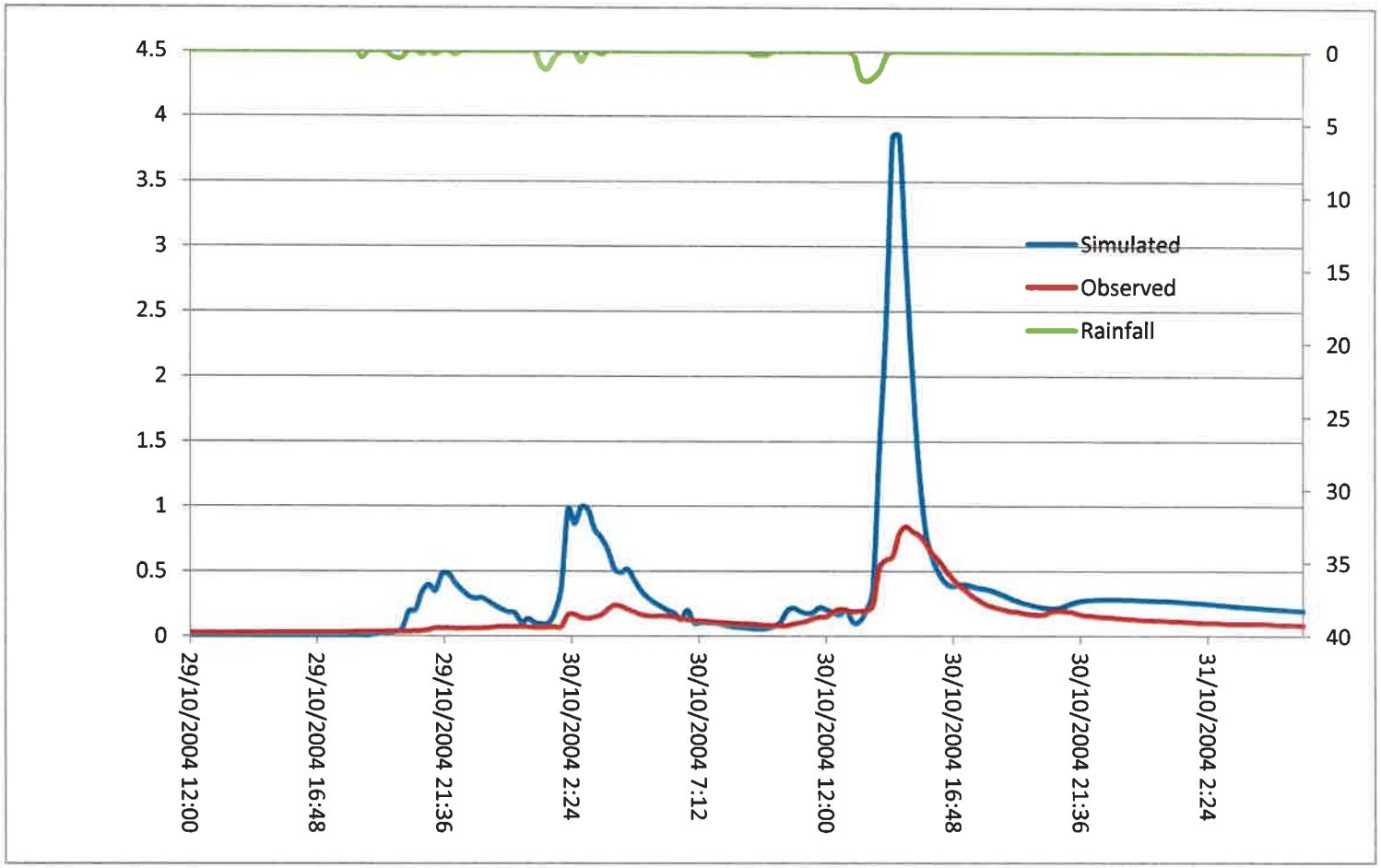


15/10/2004 13:00	Simulated	Observed					
C	0.07	0.03	Duration	3.75 hrs	Unitary Q		
Qp	6.28	1.61	Frequency	<2 yrs	Qsim	0.002112	m3/s/ha
Qave	2.24	0.63	R.F	15.75 mm	Qobs	0.000541	m3/s/ha



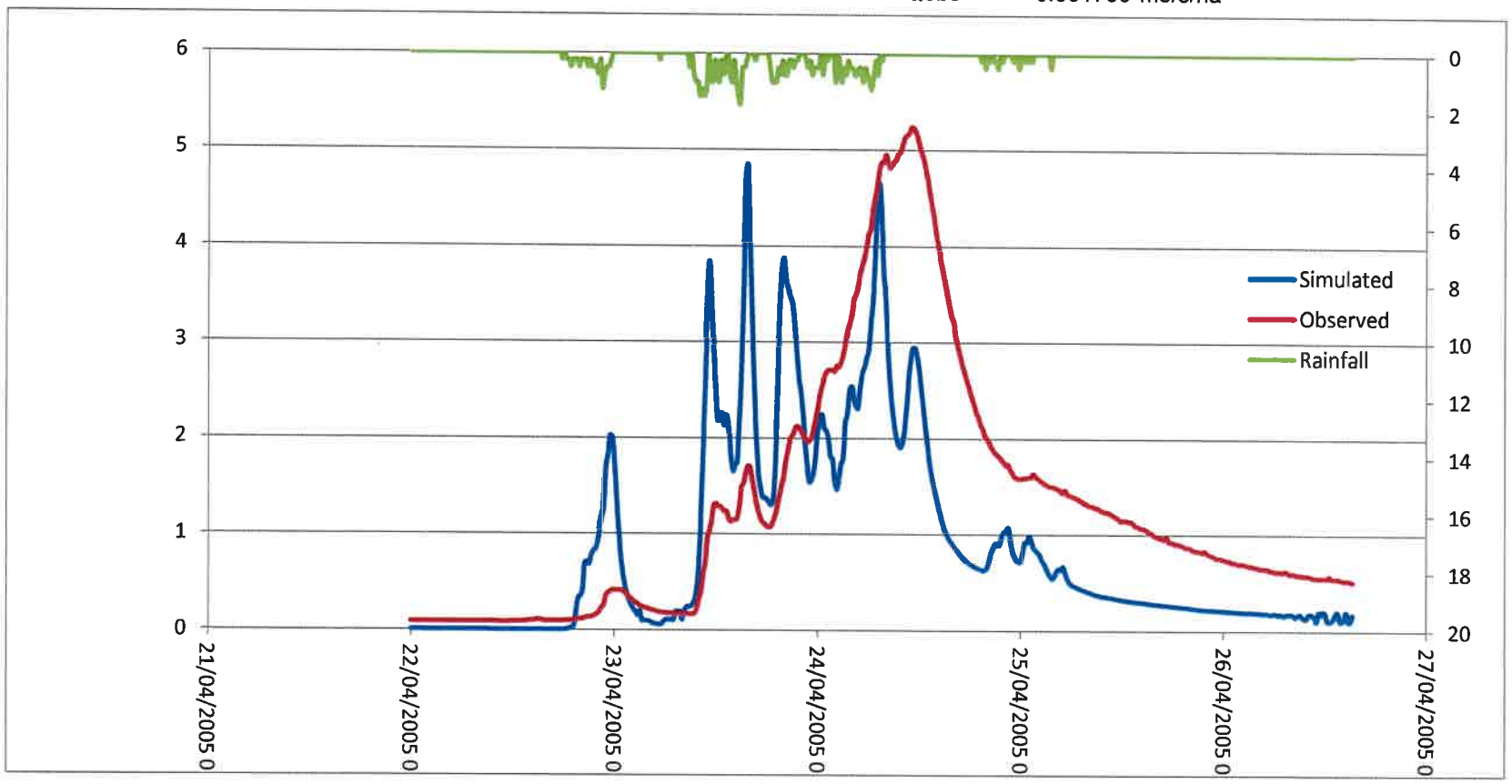
2975 ha

30/10/2004 14:45	Simulated	Observed					
C	0.06	0.02	Duration	1.25 hrs	Unitary Q		
Qp	3.85	0.84	Frequency	<2 yrs	Qsim	0.001296	m3/s/ha
Qave	0.44	0.19	R.F	14.25 mm	Qobs	0.000283	m3/s/ha



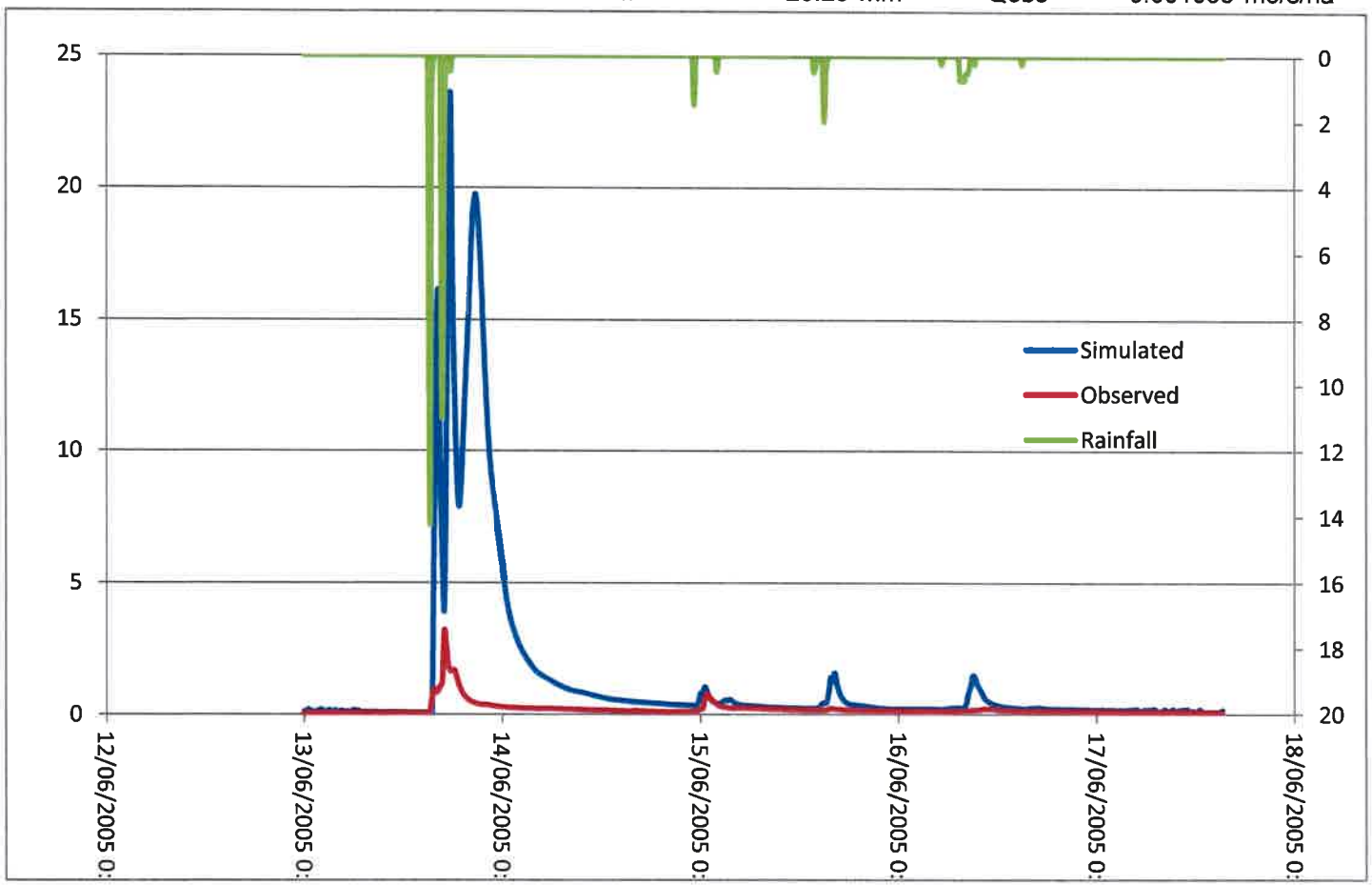
2975 ha

23/04/2005 15:45	Simulated	Observed					
C	0.17	0.19	Duration	55.75 hrs	Unitary Q		
Qp	4.83	5.23	Frequency	<2 yrs	Qsim	0.001625	m3/s/ha
Qave	1.00	1.43	R.F	62.5 mm	Qobs	0.001759	m3/s/ha



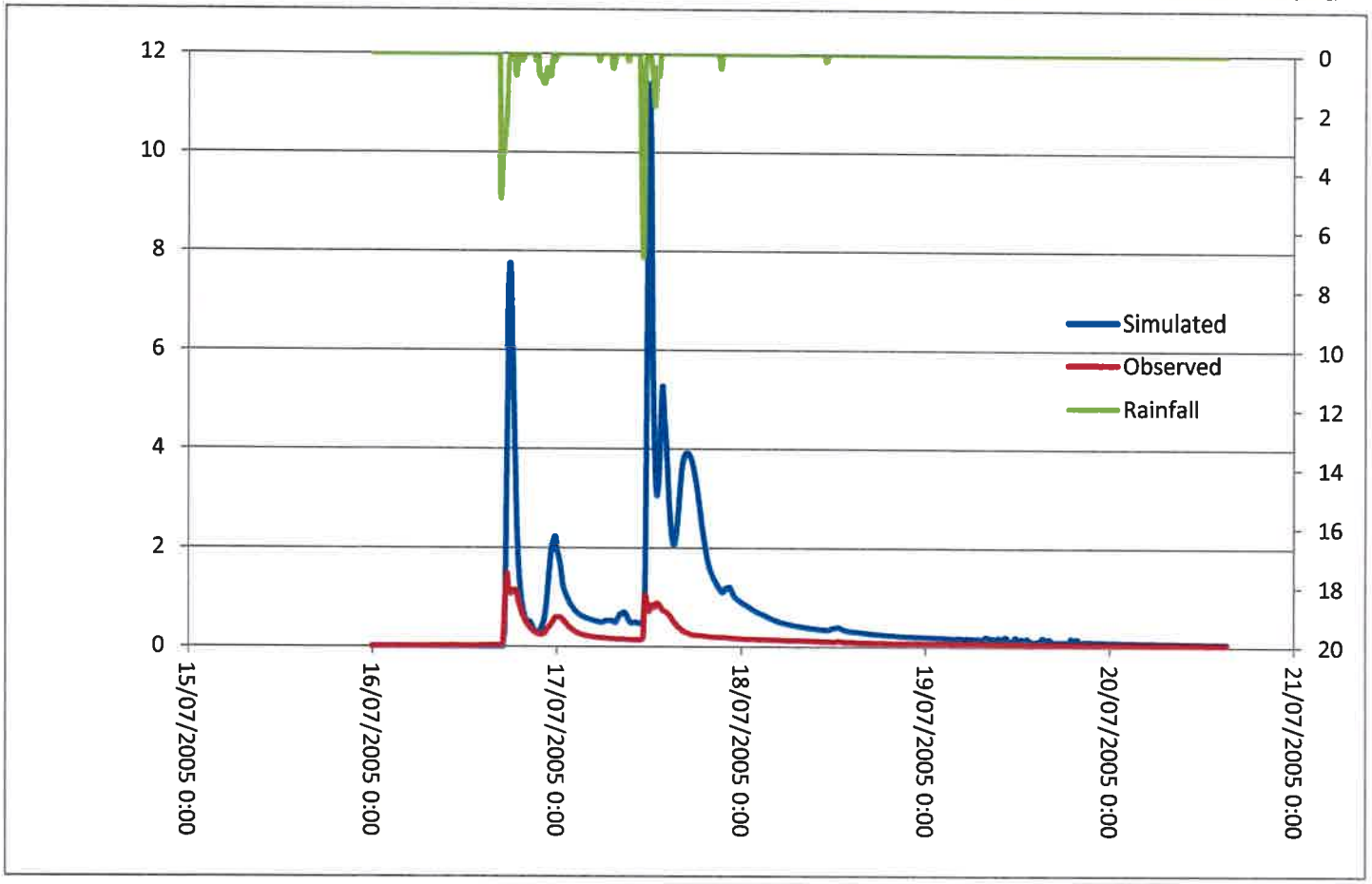
2975 ha

13/06/2005 17:45	Simulated	Observed					
C	0.48	0.02	Duration	2.75 hrs	Unitary Q		
Qp	23.56	3.17	Frequency	<2 yrs	Qsim	0.00792	m3/s/ha
Qave	5.90	0.89	R.F	29.25 mm	Qobs	0.001066	m3/s/ha



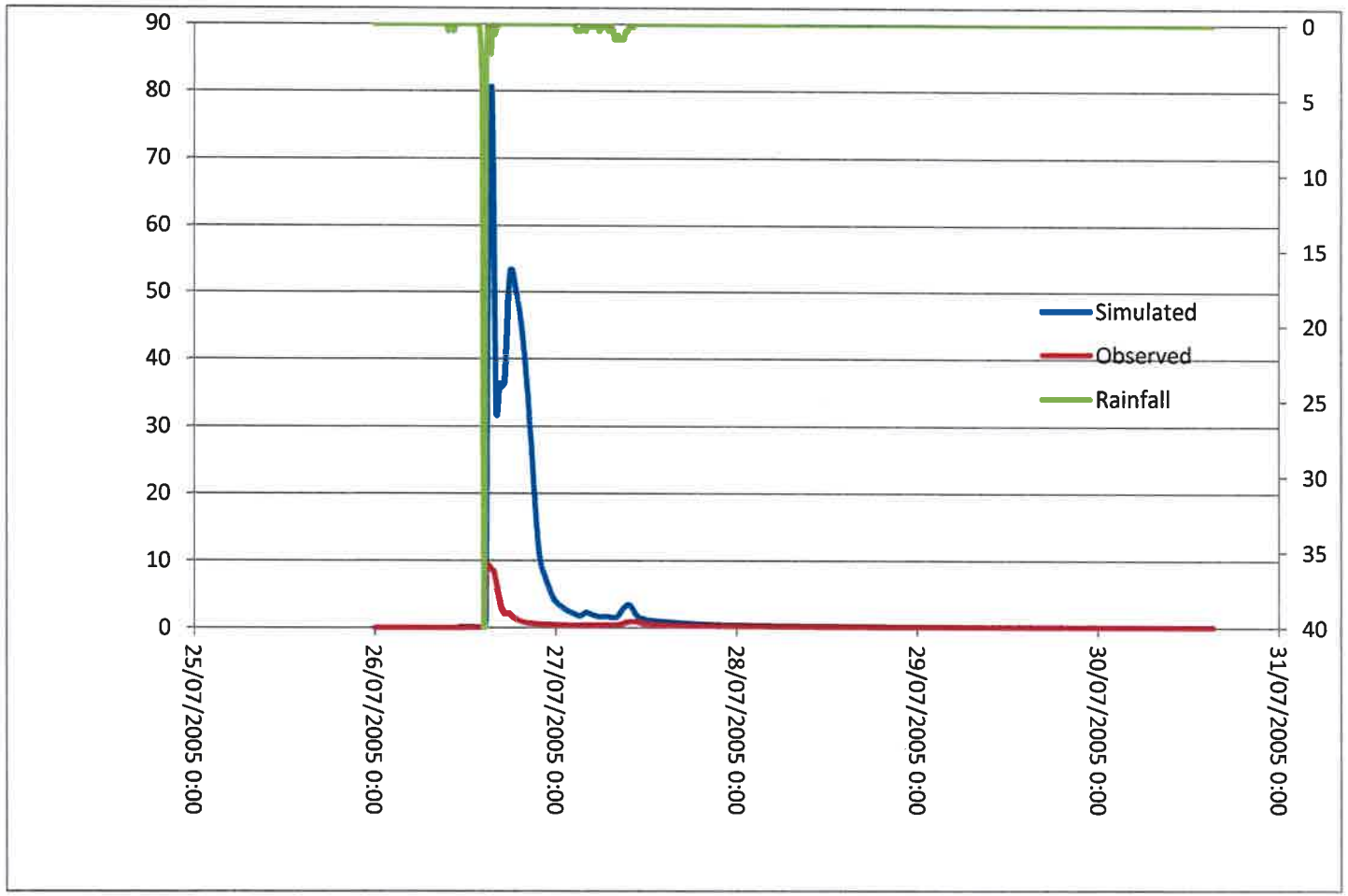
2975 ha

17/07/2005 12:00	Simulated	Observed				
C	0.15	0.03	Duration	20.75 hrs	Unitary Q	
Qp	11.30	1.47	Frequency	<2 yrs	Qsim	0.003798 m3/s/ha
Qave	1.76	0.37	R.F	38 mm	Qobs	0.000495 m3/s/ha



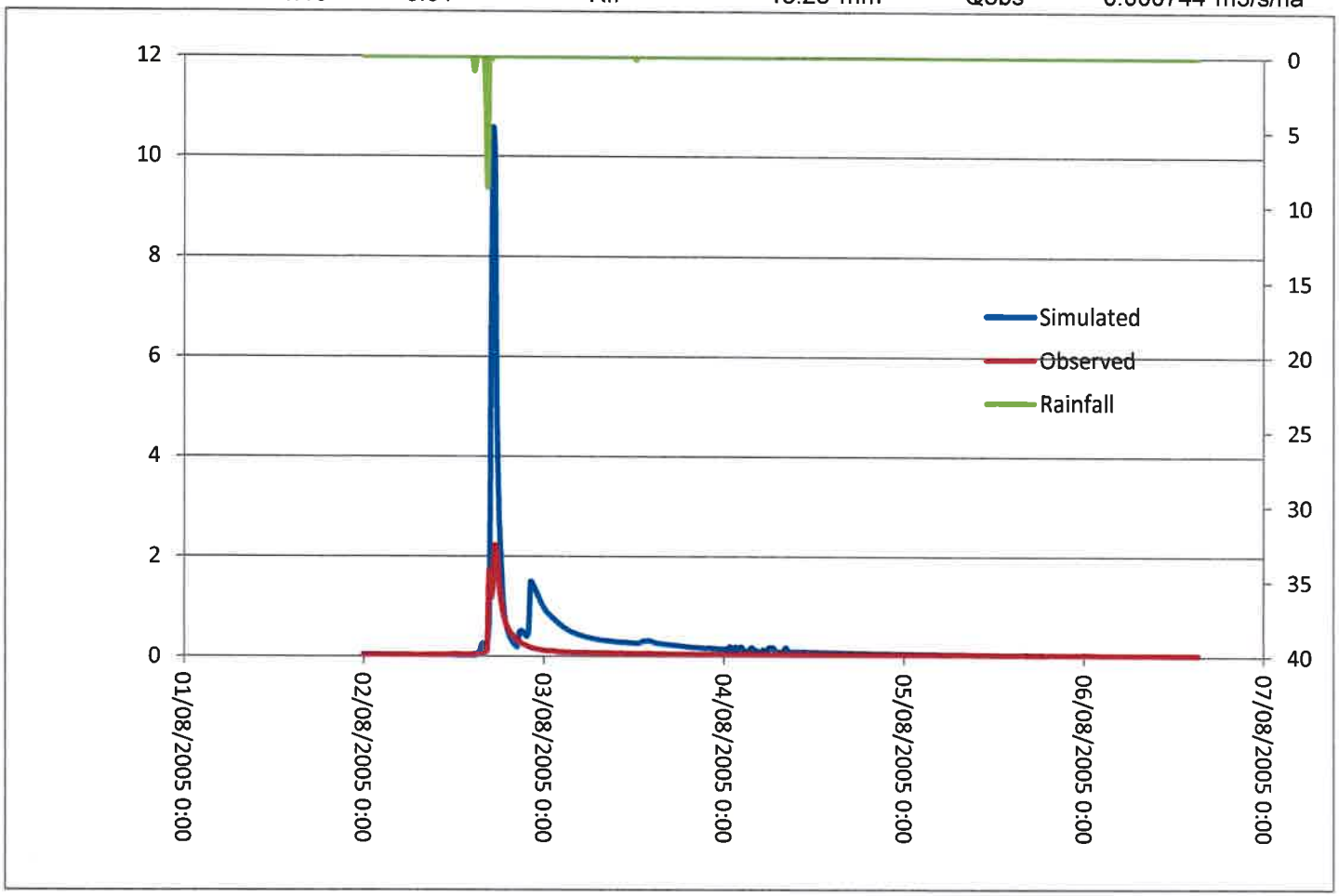
2975 ha

26/07/2005 15:30	Simulated	Observed				
C	0.51	0.03	Duration	24.75 hrs	Unitary Q	
Qp	80.66	9.36	Frequency	5-10 yrs	Qsim	0.027114 m3/s/ha
Qave	13.36	1.16	R.F	69 mm	Qobs	0.003146 m3/s/ha



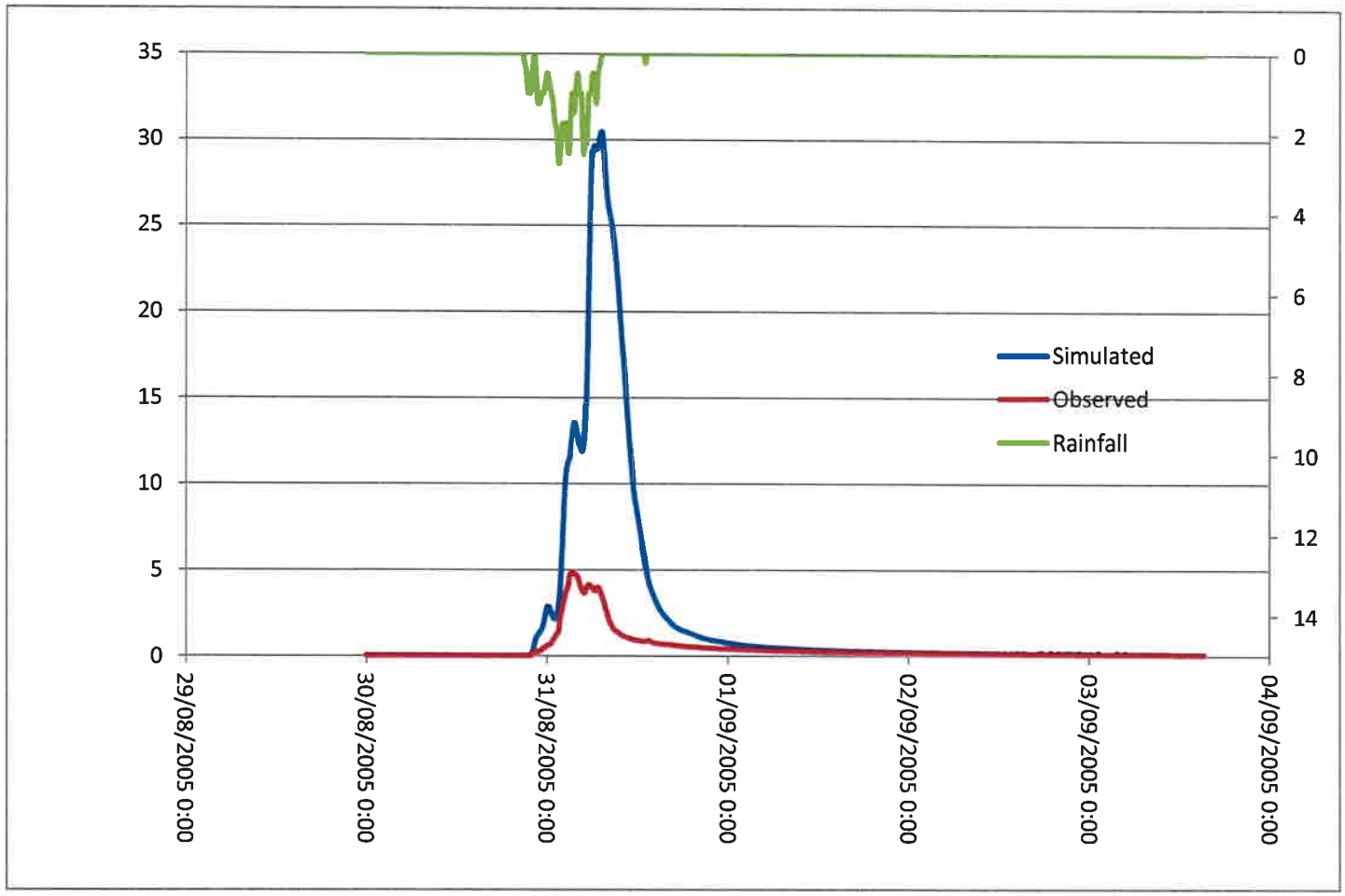
2975 ha

02/08/2005 17:15	Simulated	Observed					
C	0.14	0.04	Duration	2.5 hrs	Unitary Q		
Qp	10.54	2.21	Frequency	<2 yrs	Qsim	0.003544	m3/s/ha
Qave	1.10	0.51	R.F	13.25 mm	Qobs	0.000744	m3/s/ha



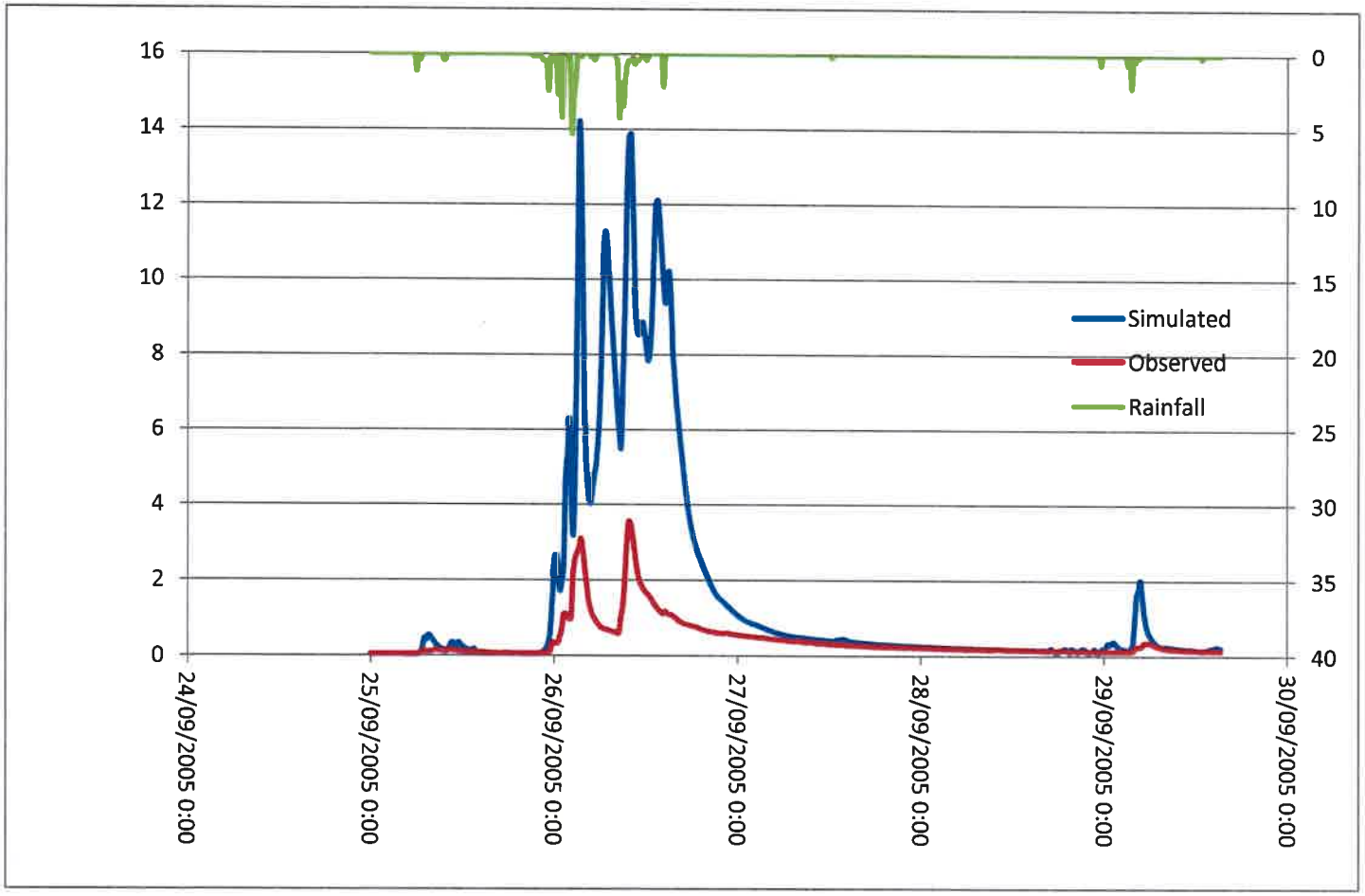
2975 ha

31/08/2005 7:15	Simulated	Observed					
C	0.49	0.06	Duration	10.25 hrs	Unitary Q		
Qp	30.45	4.82	Frequency	2-5 yrs	Qsim	0.010234	m3/s/ha
Qave	9.34	2.08	R.F	50 mm	Qobs	0.001621	m3/s/ha



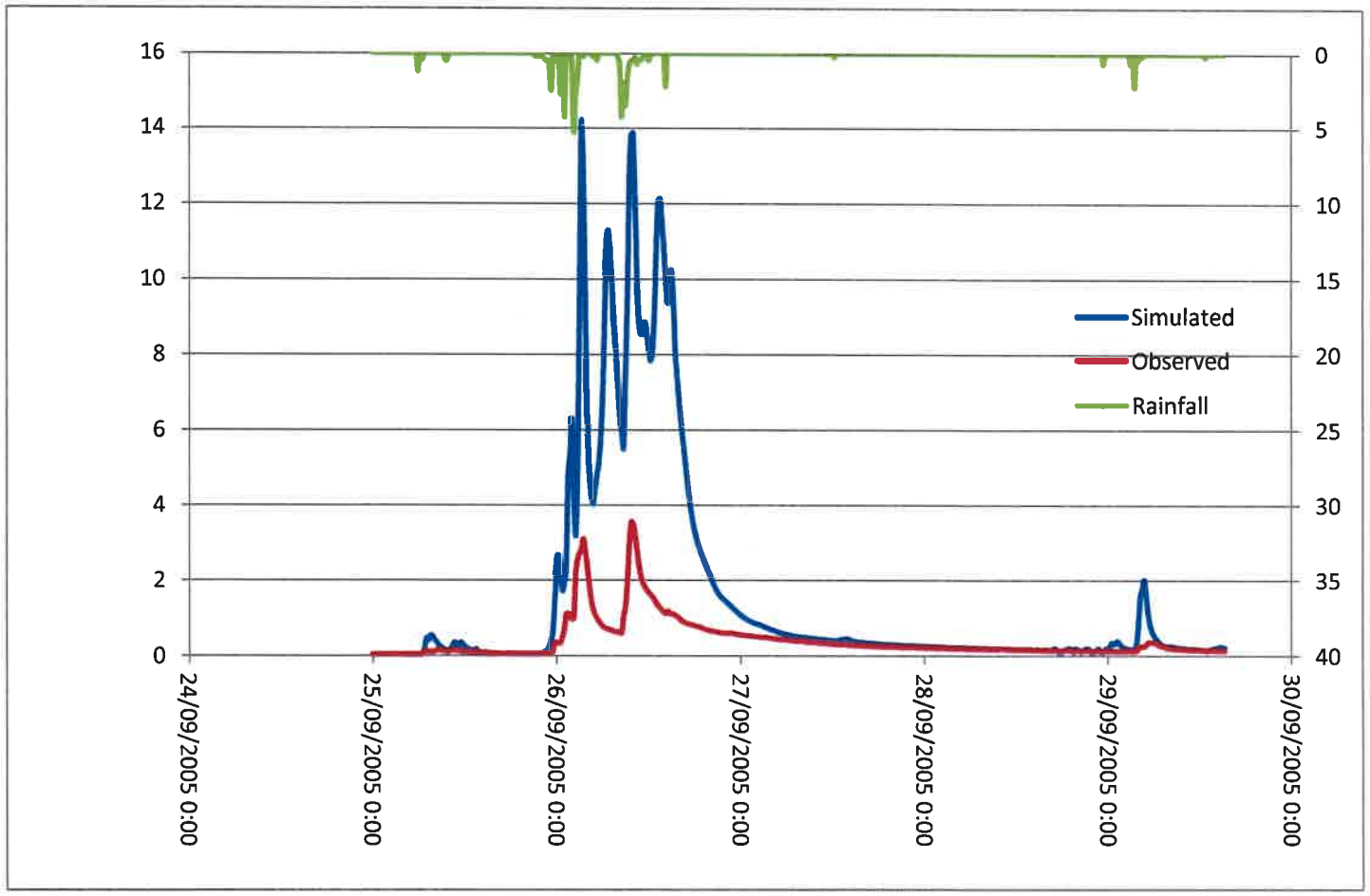
2975 ha

26/09/2005 3:15	Simulated	Observed					
C	0.36	0.05	Duration	17.25 hrs	Unitary Q		
Qp	14.08	3.56	Frequency	2 yrs	Qsim	0.004734	m3/s/ha
Qave	5.48	1.12	R.F	45.5 mm	Qobs	0.001196	m3/s/ha



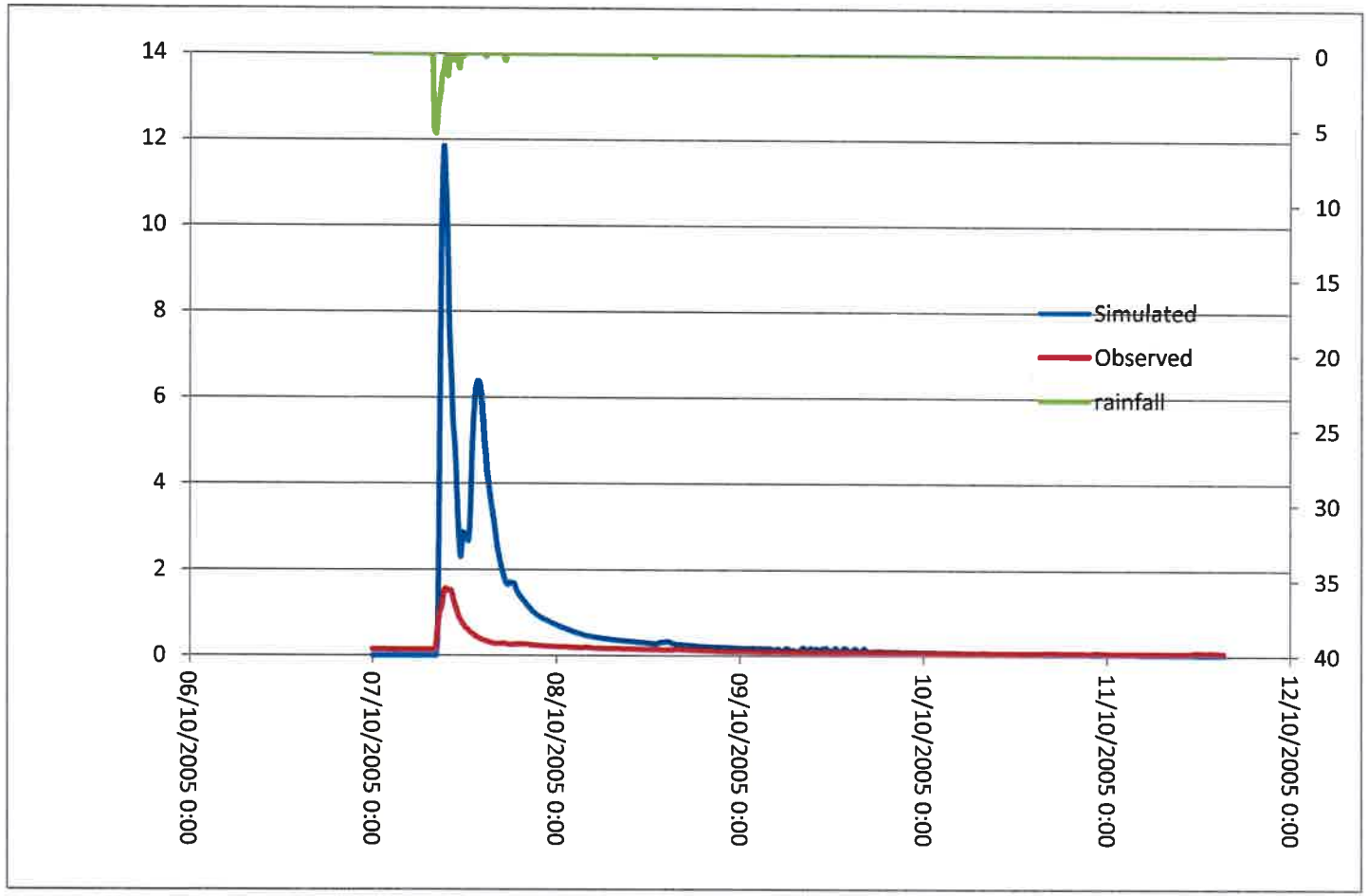
2975 ha

26/09/2005 3:15	Simulated	Observed					
C	0.36	0.05	Duration	17.25 hrs	Unitary Q		
Qp	14.08	3.56	Frequency	2 yrs	Qsim	0.004734	m3/s/ha
Qave	5.48	1.12	R.F	45.5 mm	Qobs	0.001196	m3/s/ha



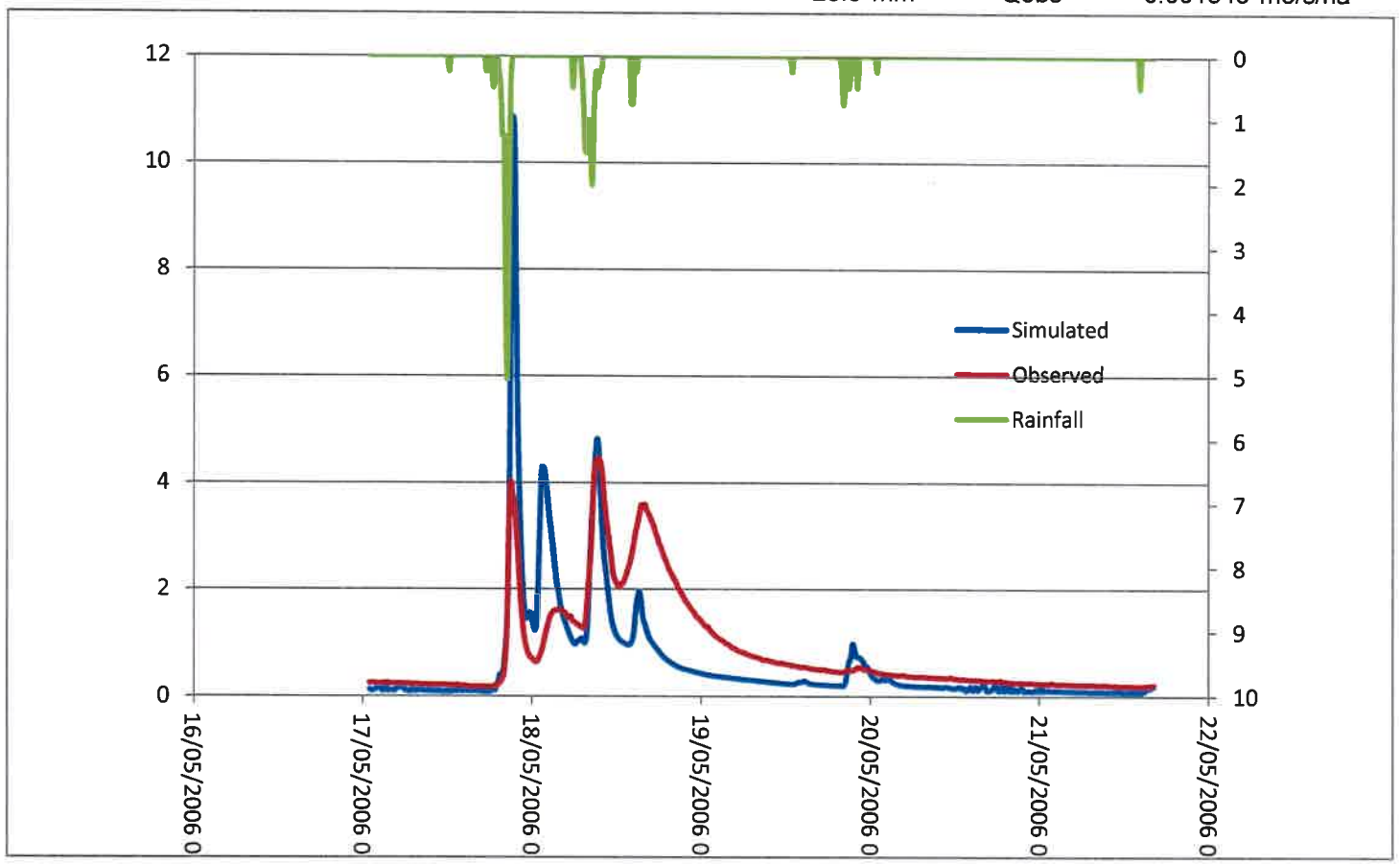
2975 ha

07/10/2005 9:15	Simulated	Observed				
C	0.27	0.03	Duration	3.75 hrs	Unitary Q	
Qp	11.84	1.56	Frequency	<2 yrs	Qsim	0.003979 m3/s/ha
Qave	2.59	0.43	R.F	22.75 mm	Qobs	0.000525 m3/s/ha



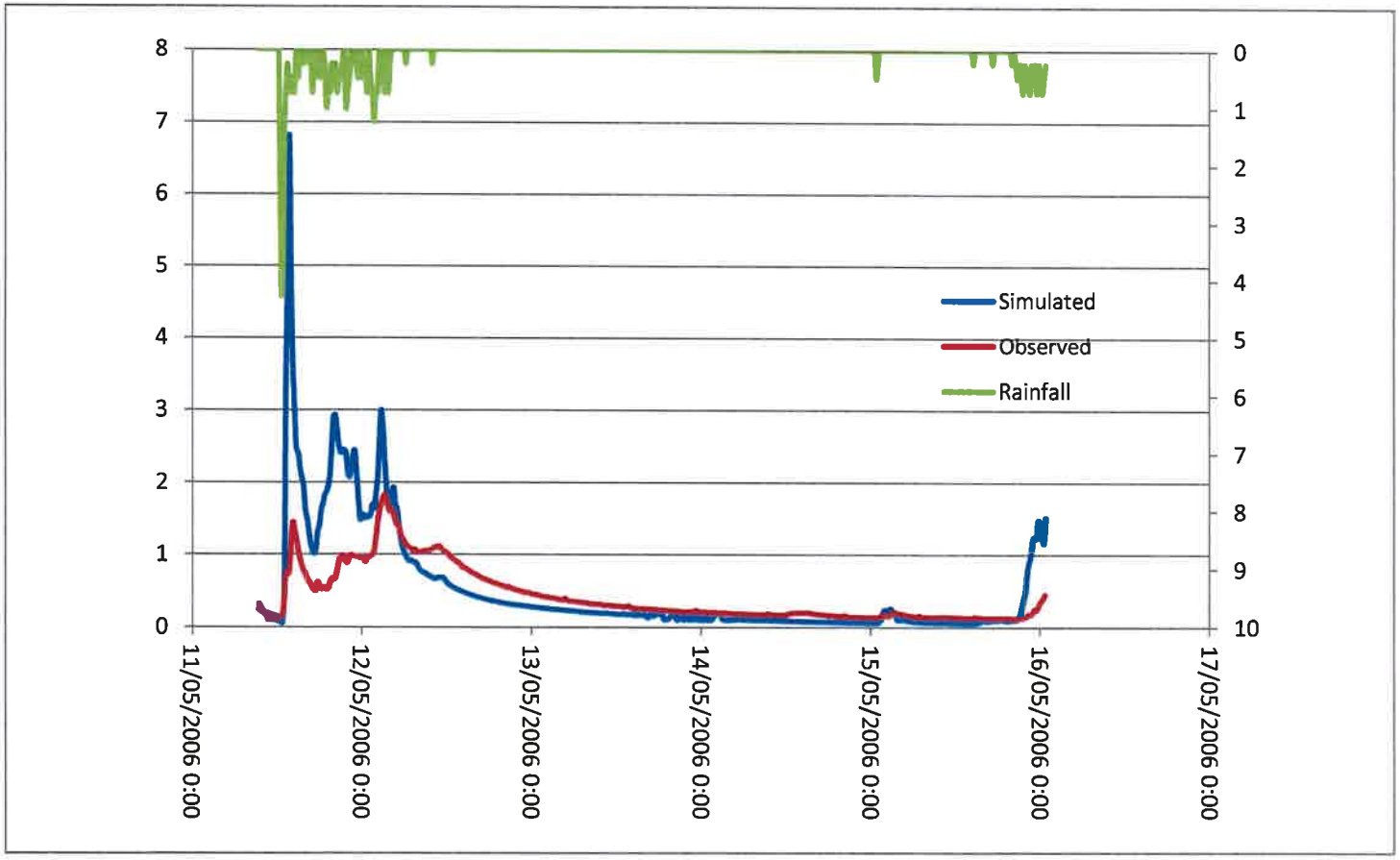
2975 ha

17/05/2006 21:15	Simulated	Observed					
C	0.20	0.25	Duration	21.5 hrs	Unitary Q		
Qp	10.82	3.99	Frequency	<2 yrs	Qsim	0.003636	m3/s/ha
Qave	1.66	1.57	R.F	28.5 mm	Qobs	0.001343	m3/s/ha



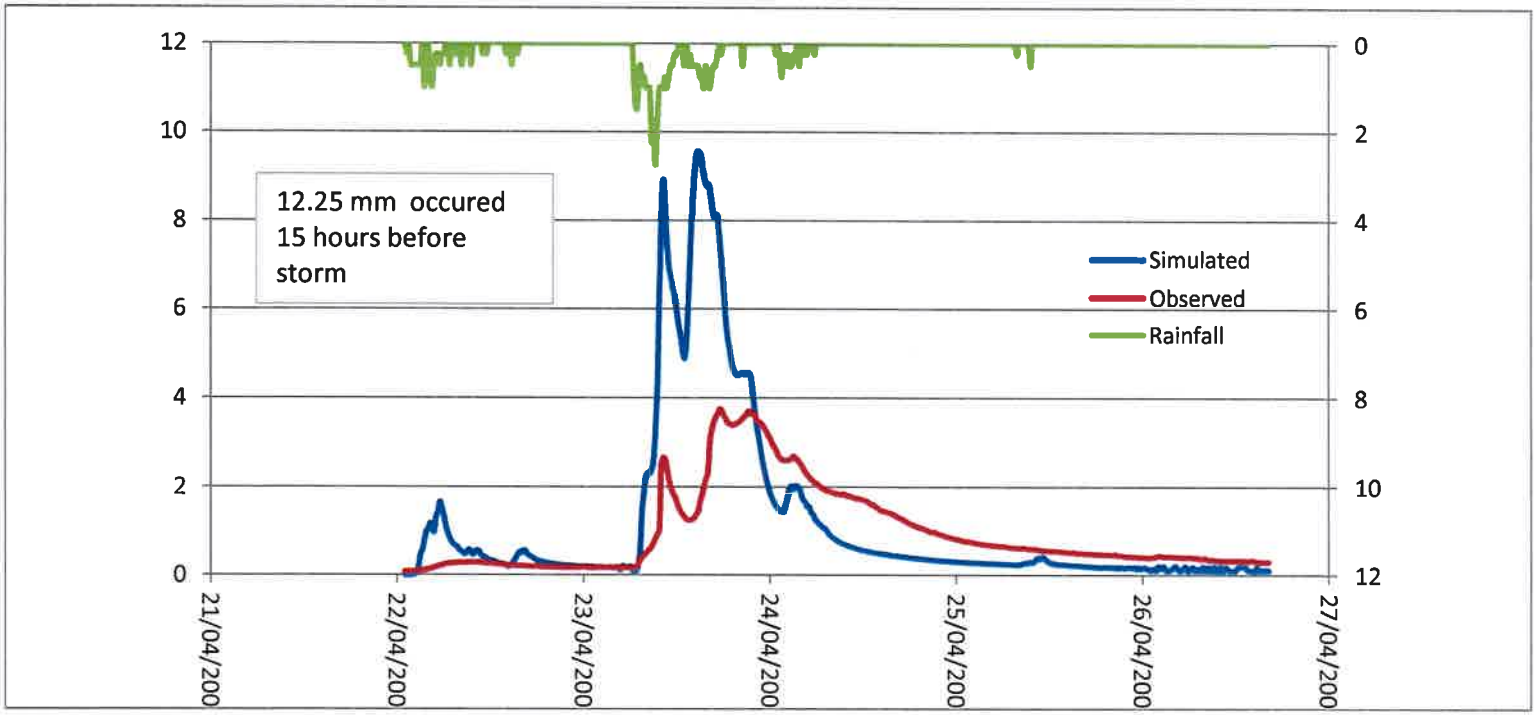
2975 ha

11/05/2006 13:45	Simulated	Observed				
C	0.15	0.08	Duration	15.75 hrs	Unitary Q	
Qp	6.82	1.83	Frequency	<2 yrs	Qsim	0.002291 m3/s/ha
Qave	1.29	0.90	R.F	32.5 mm	Qobs	0.000615 m3/s/ha



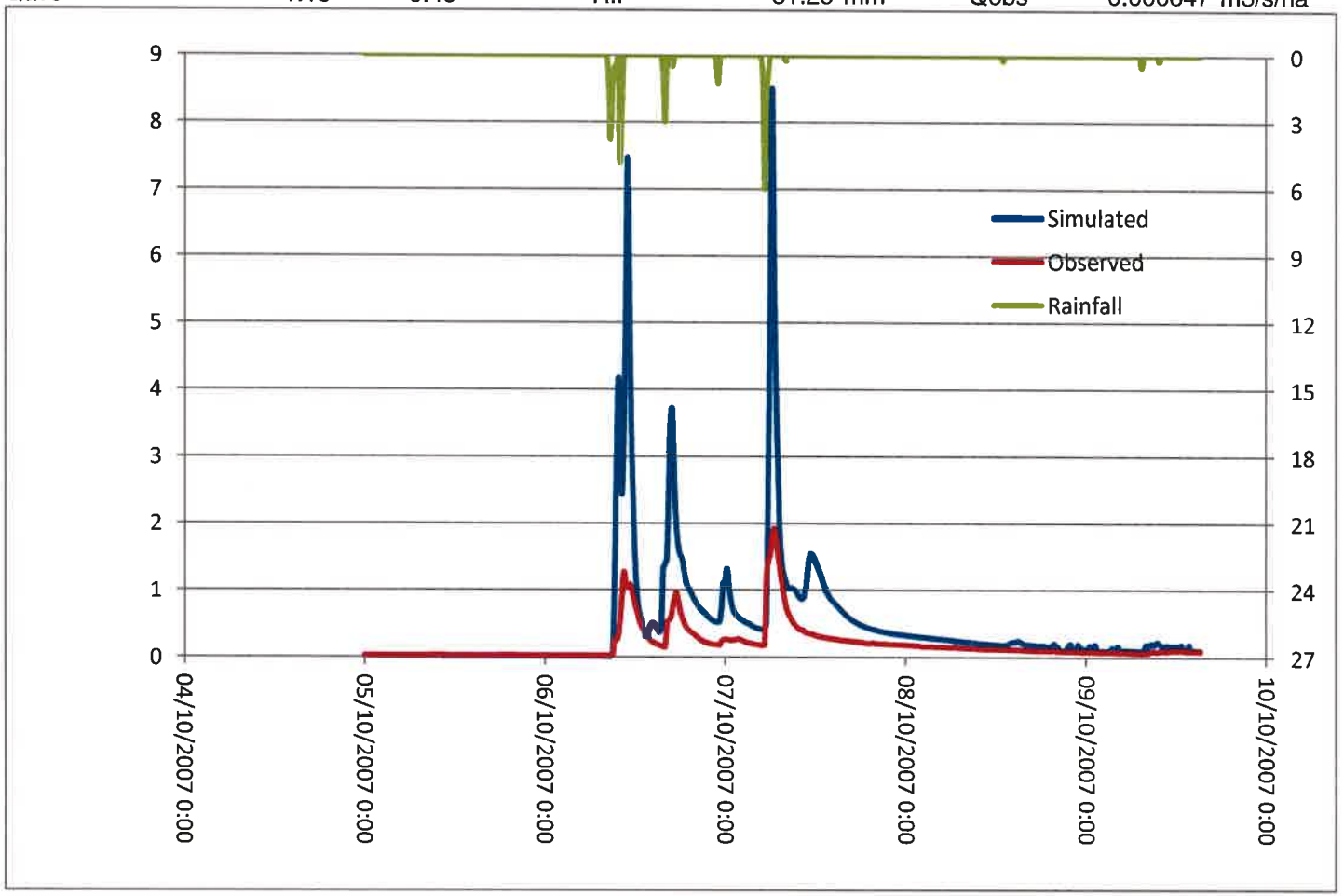
2975 ha

23/04/2006 10:15	Simulated	Observed					
C	0.32	0.21	Duration	23.5 hrs	Unitary Q		
Qp	9.56	0.28	Frequency	<2 yrs	Qsim	0.003213	m3/s/ha
Qave	2.74	1.62	R.F	40 mm	Qobs	9.45E-05	m3/s/ha



2975 ha

07/10/2007 6:15	Simulated	Observed					
C	0.15	0.04	Duration	23.75 hrs	Unitary Q		
Qp	8.52	1.93	Frequency	<2 yrs	Qsim	0.002865	m3/s/ha
Qave	1.18	0.45	R.F	31.25 mm	Qobs	0.000647	m3/s/ha



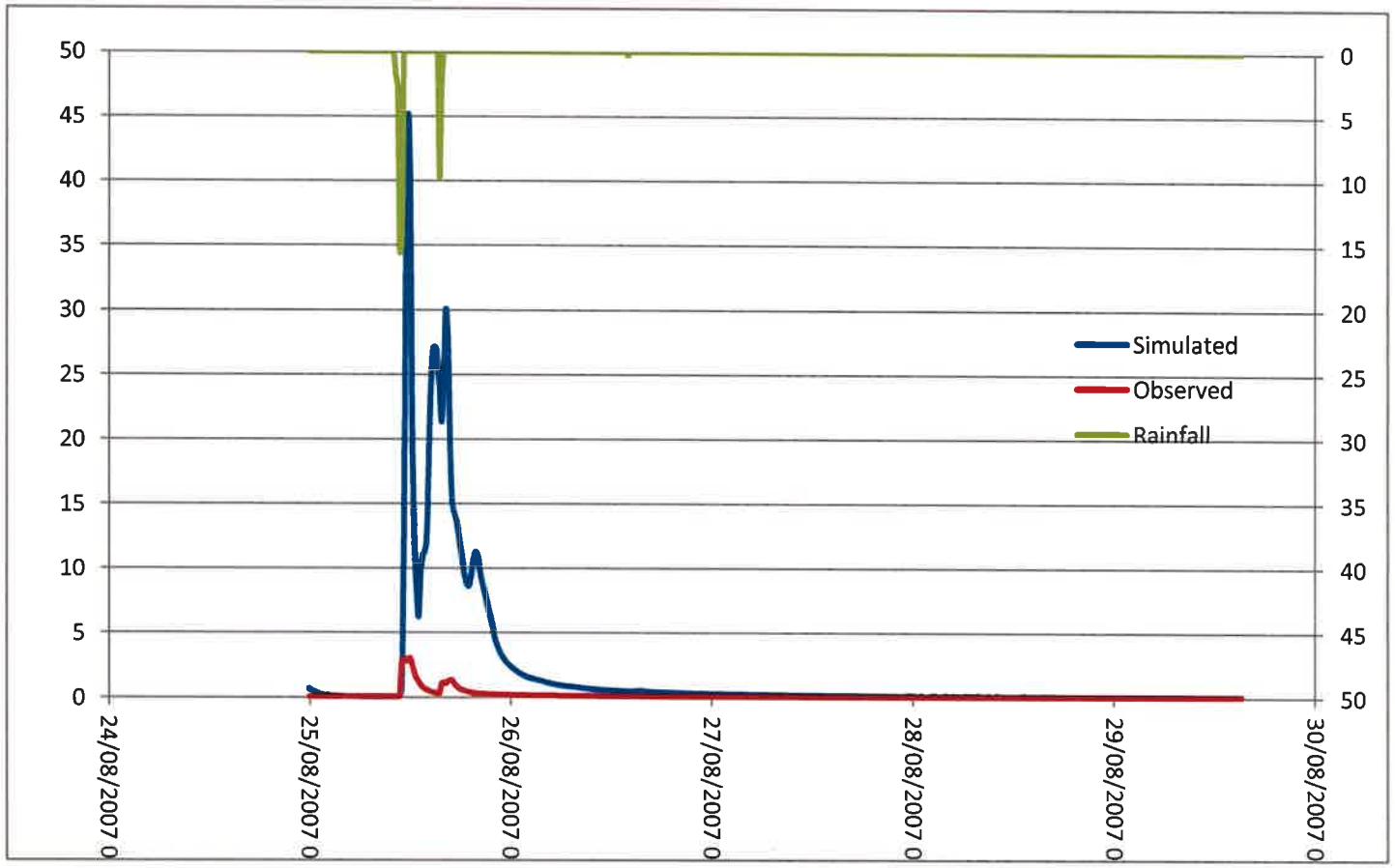
2975 ha

Note: 34.5 mm in 1.25 hrs occurs first (10-25 year storm event)

25/08/2007 11:45	Simulated	Observed
C	0.46	0.02
Qp	45.18	2.99
Qave	10.65	0.94

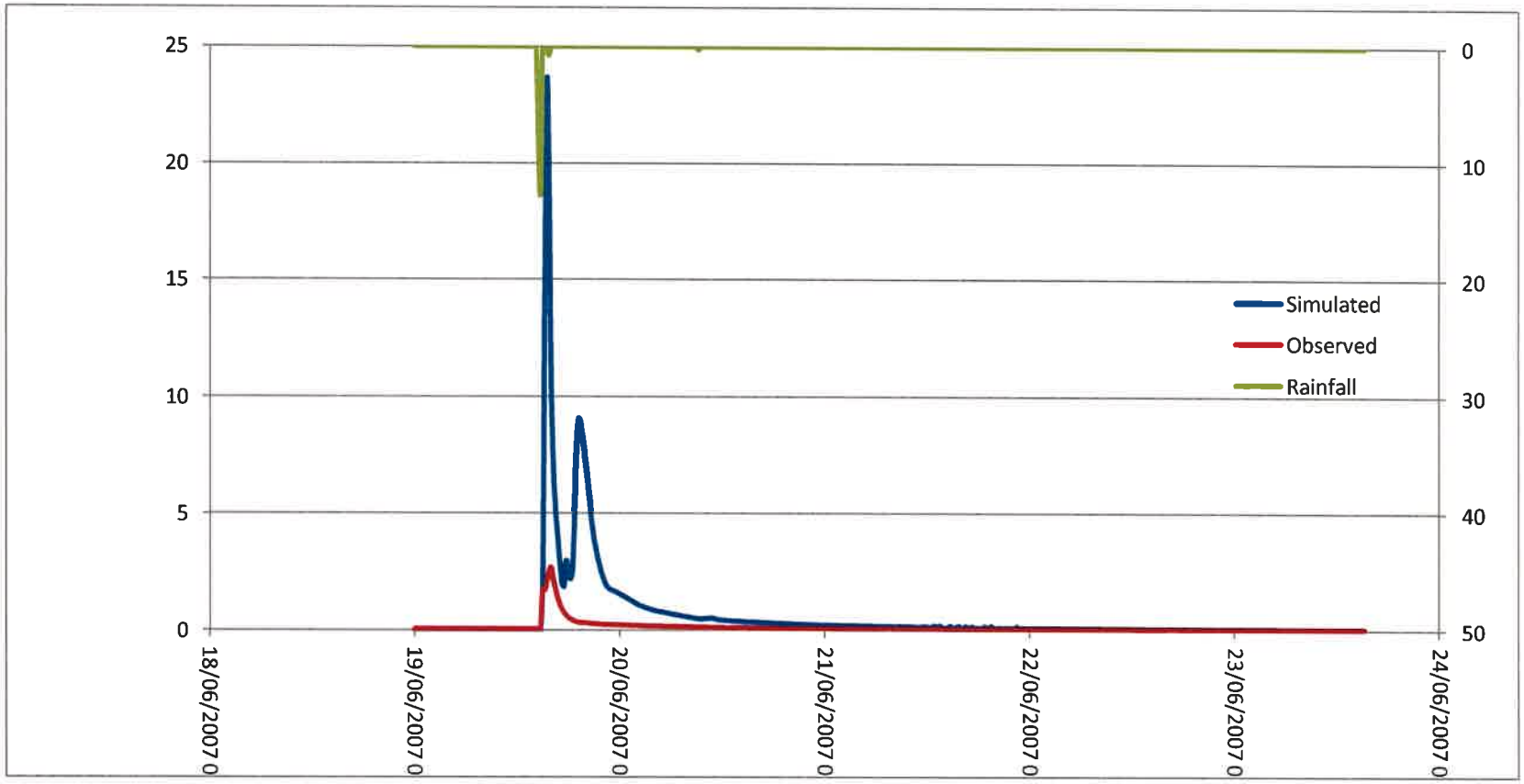
Duration	5.75	hrs
Frequency	almost 5	yrs
R.F	47	mm

Unitary Q		
Qsim	0.015187	m3/s/ha
Qobs	0.001006	m3/s/ha



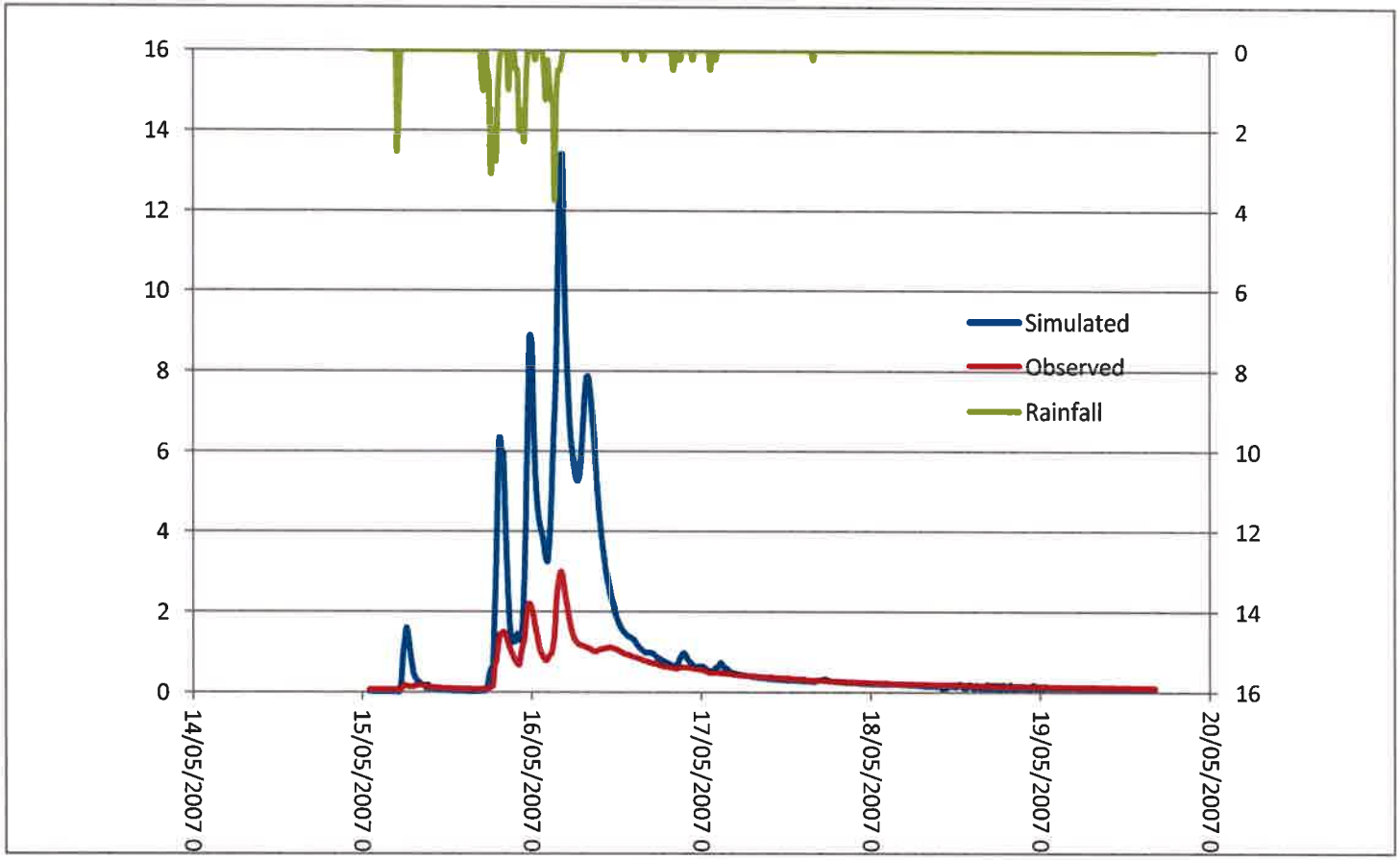
2975 ha

19/06/2007 15:30	Simulated	Observed					
C	0.28	0.03	Duration	1.5 hrs	Unitary Q		
Qp	23.55	2.66	Frequency	almost 2 yrs	Qsim	0.007916	m3/s/ha
Qave	3.22	0.88	R.F	22 mm	Qobs	0.000894	m3/s/ha



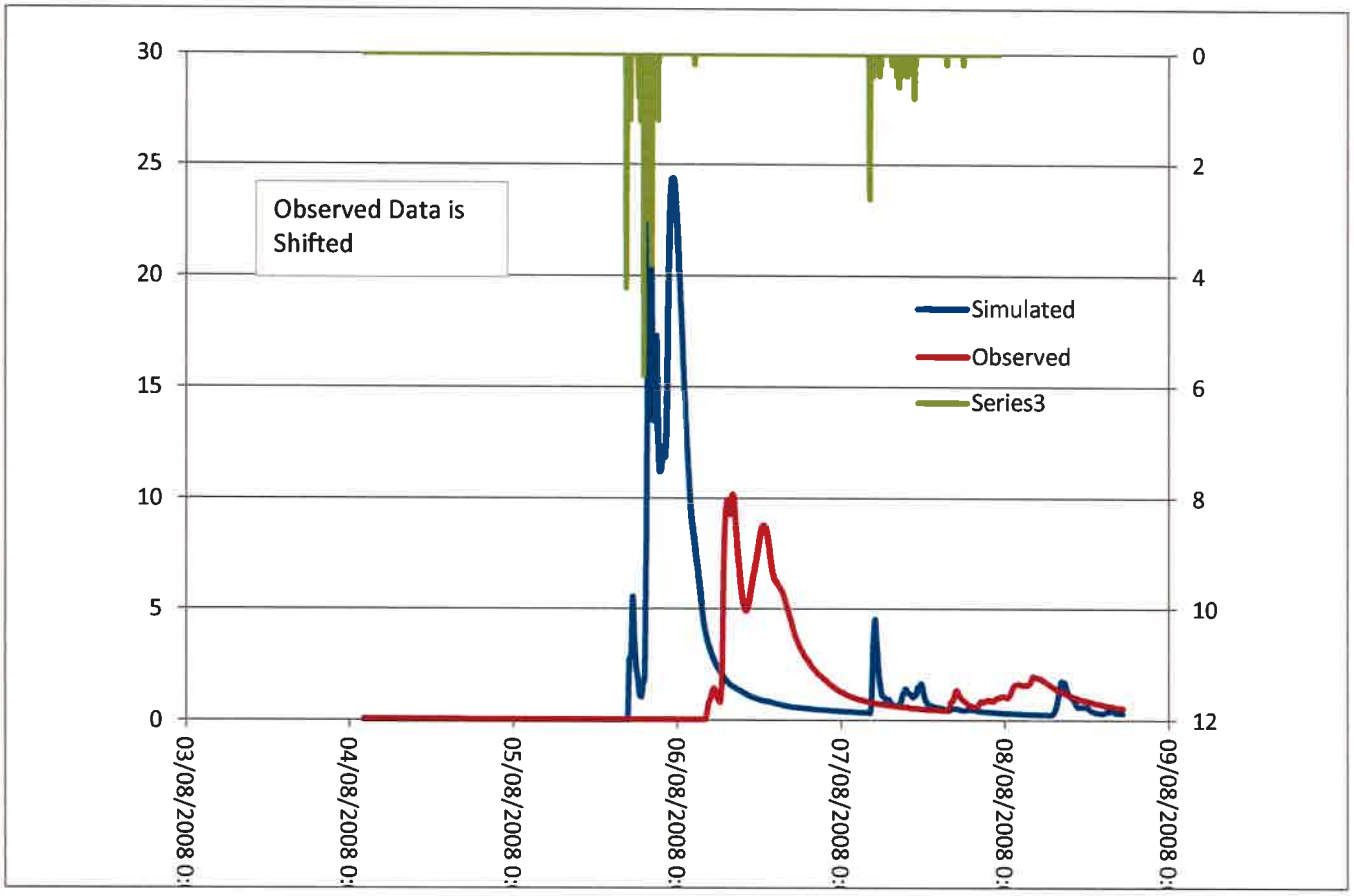
2975 ha

16/05/2007 4:30	Simulated	Observed					
C	0.32	0.08	Duration	11.5 hrs	Unitary Q		
Qp	13.41	2.19	Frequency	<2 yrs	Qsim	0.004508	m3/s/ha
Qave	2.95	0.96	R.F	36.25 mm	Qobs	0.000734	m3/s/ha



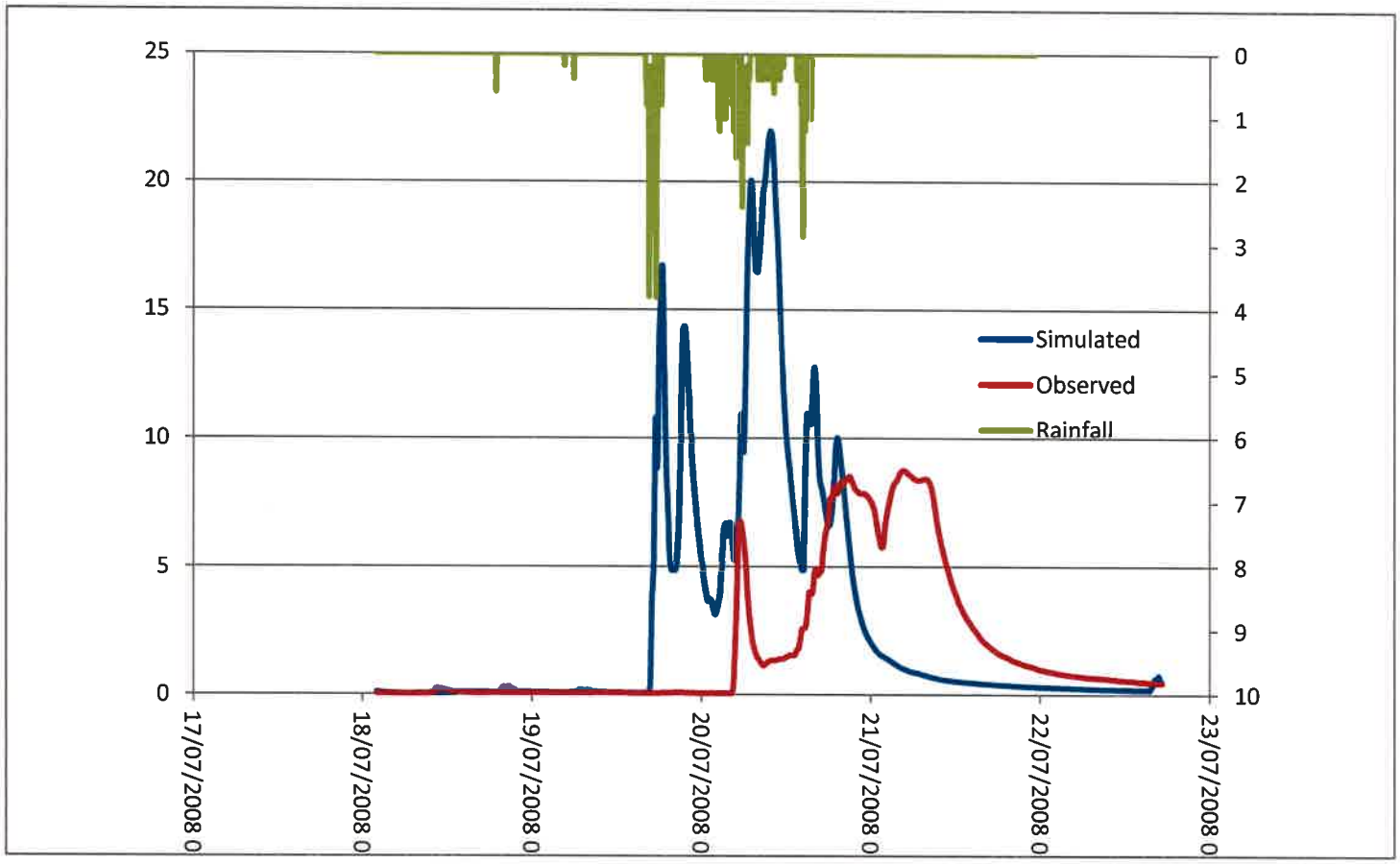
2975 ha

05/08/2008 20:00	Simulated	Observed					
C	0.48	0.28	Duration	4.92 hrs	Unitary Q		
Qp	27.74	10.17	Frequency	2-5 yrs	Qsim	0.009325	m3/s/ha
Qave	4.86	3.82	R.F	37 mm	Qobs	0.003419	m3/s/ha



2975 ha

20/07/2008 9:45	Simulated	Observed					
C	0.44	0.27	Duration	23.42 hrs	Unitary Q		
Qp	22.00	8.76	Frequency	10-25 yrs	Qsim	0.007394	m3/s/ha
Qave	7.86	4.44	R.F	76 mm	Qobs	0.002944	m3/s/ha

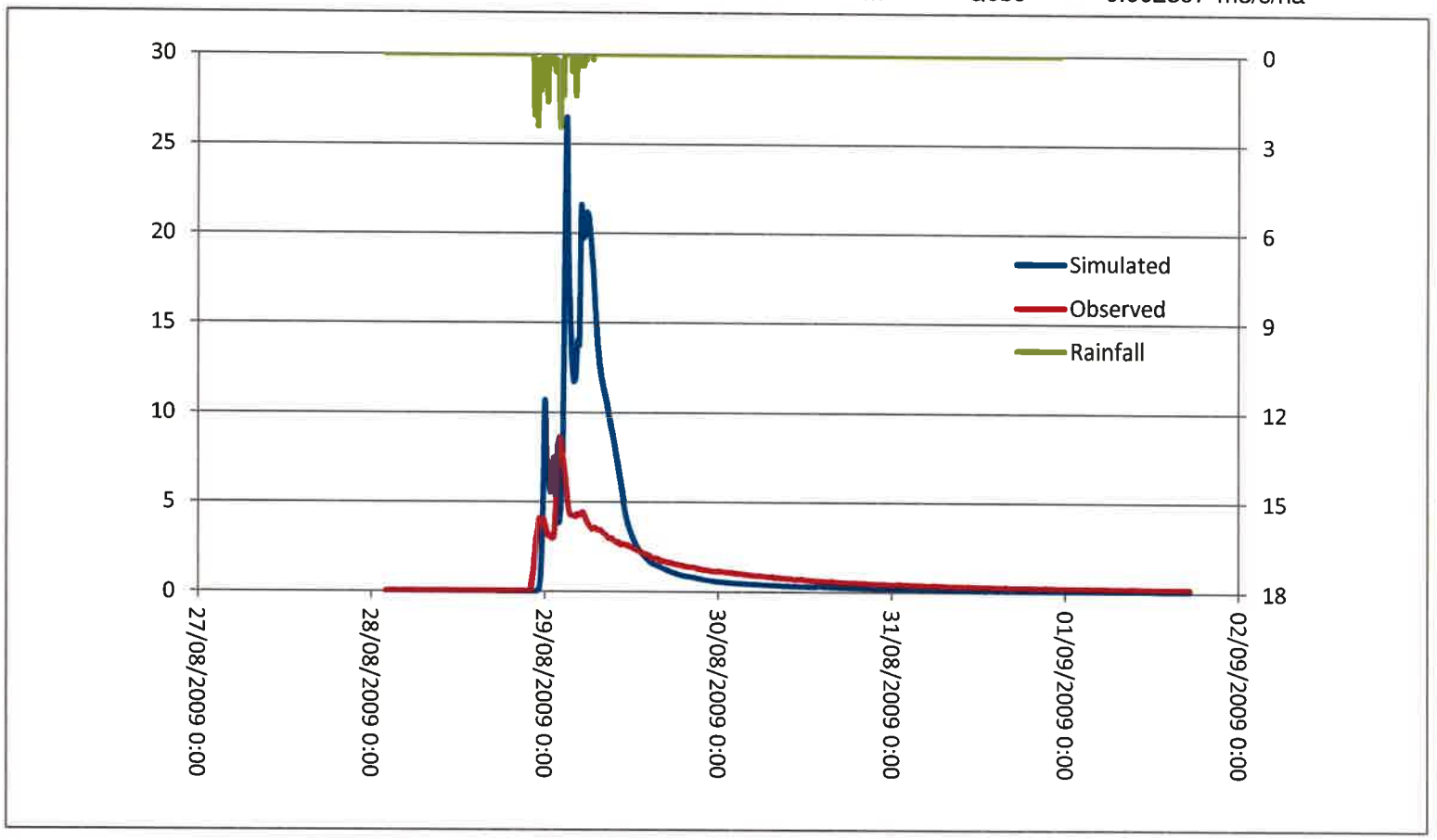


2975 ha

29/08/2009 3:00	Simulated	Observed
C	0.46	0.20
Qp	26.51	8.62
Qave	6.29	2.50

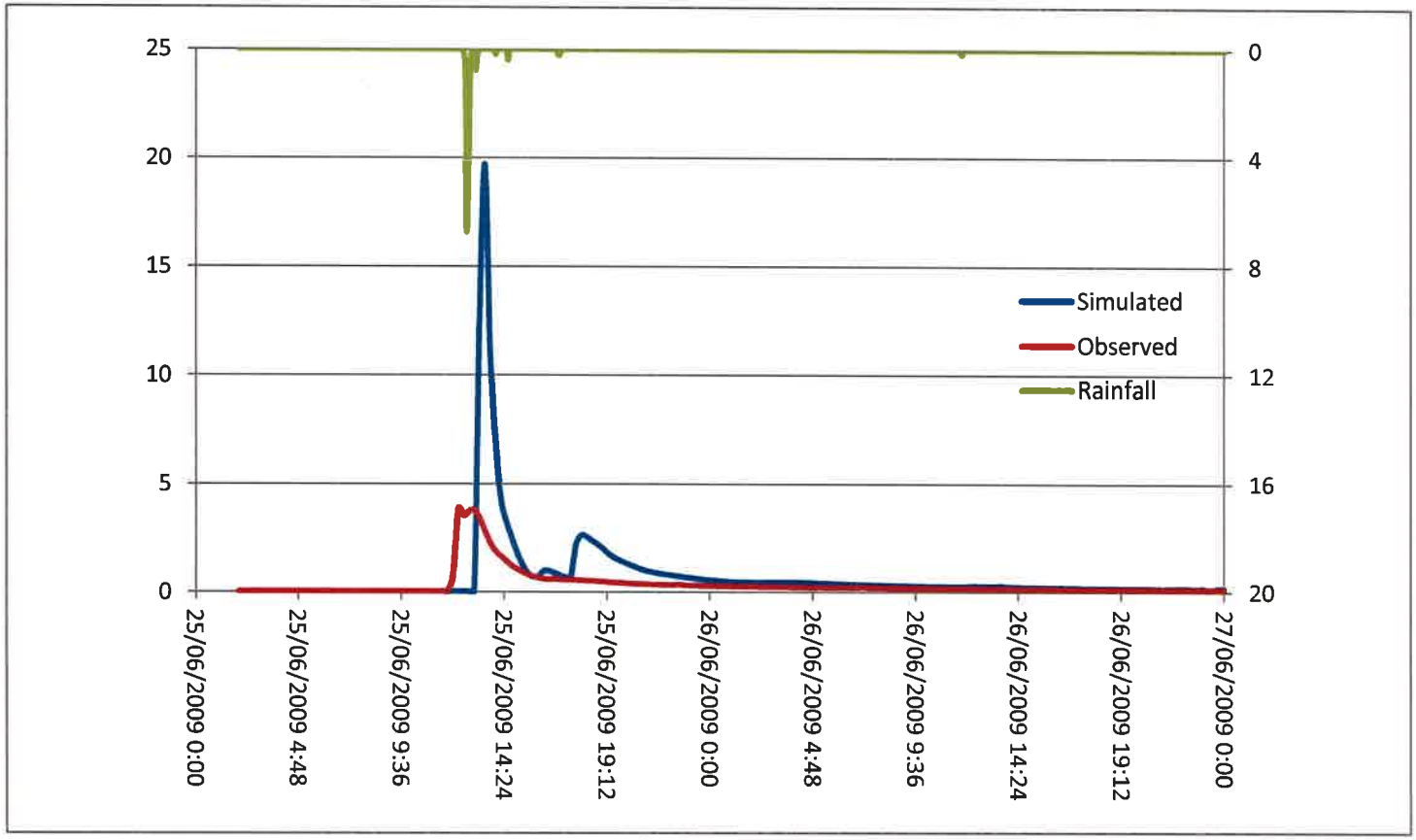
	Simulated	Observed
Duration	8.16 hrs	
Frequency	2 yrs	
R.F	38 mm	

Unitary Q	
Qsim	0.00891 m3/s/ha
Qobs	0.002897 m3/s/ha



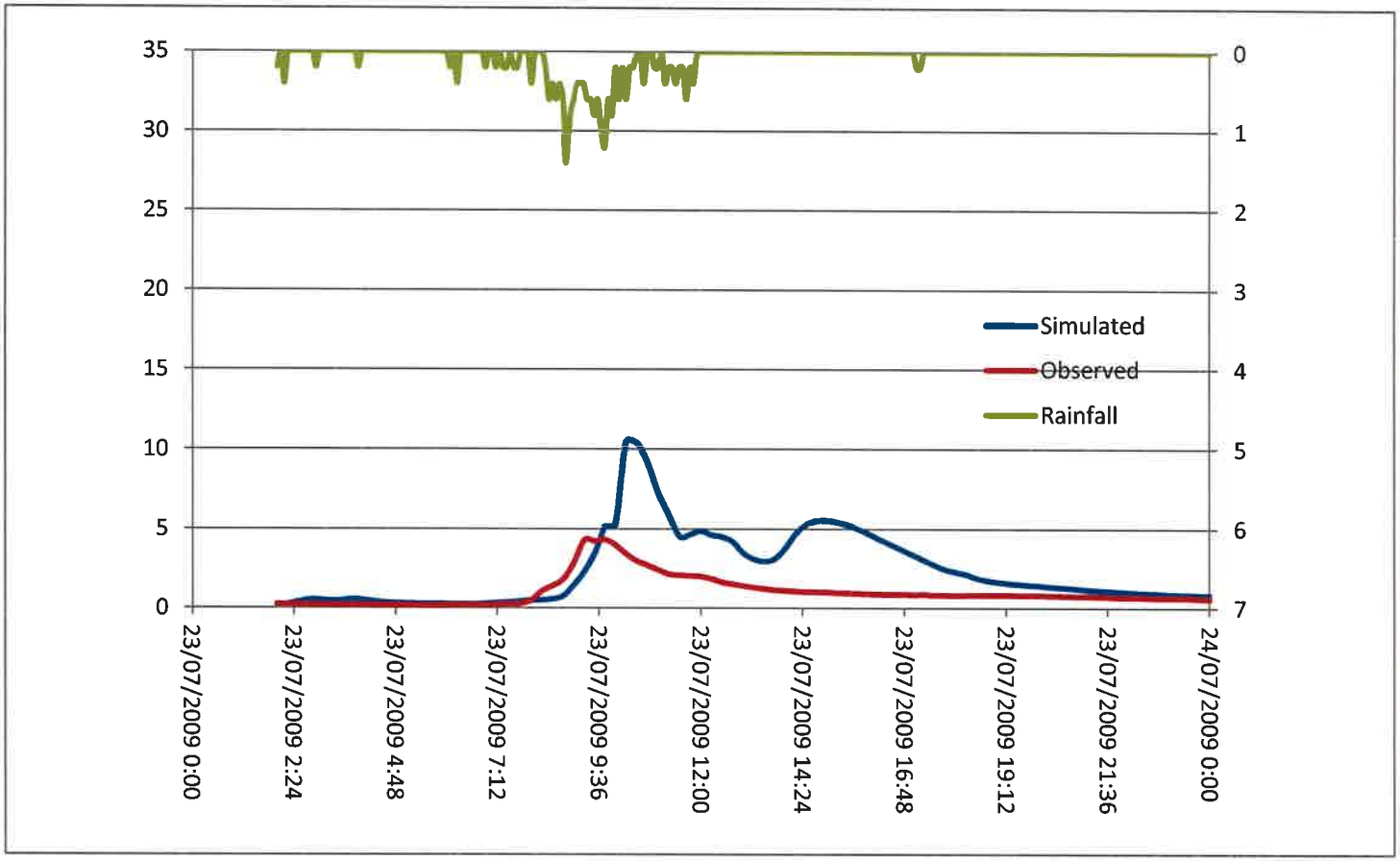
2975 ha

25/06/2009 13:30	Simulated	Observed					
C	0.14	0.07	Duration	0.66 hrs	Unitary Q		
Qp	19.70	3.85	Frequency	<2 yrs	Qsim	0.006621	m3/s/ha
Qave	3.62	1.75	R.F	13.6 mm	Qobs	0.001293	m3/s/ha



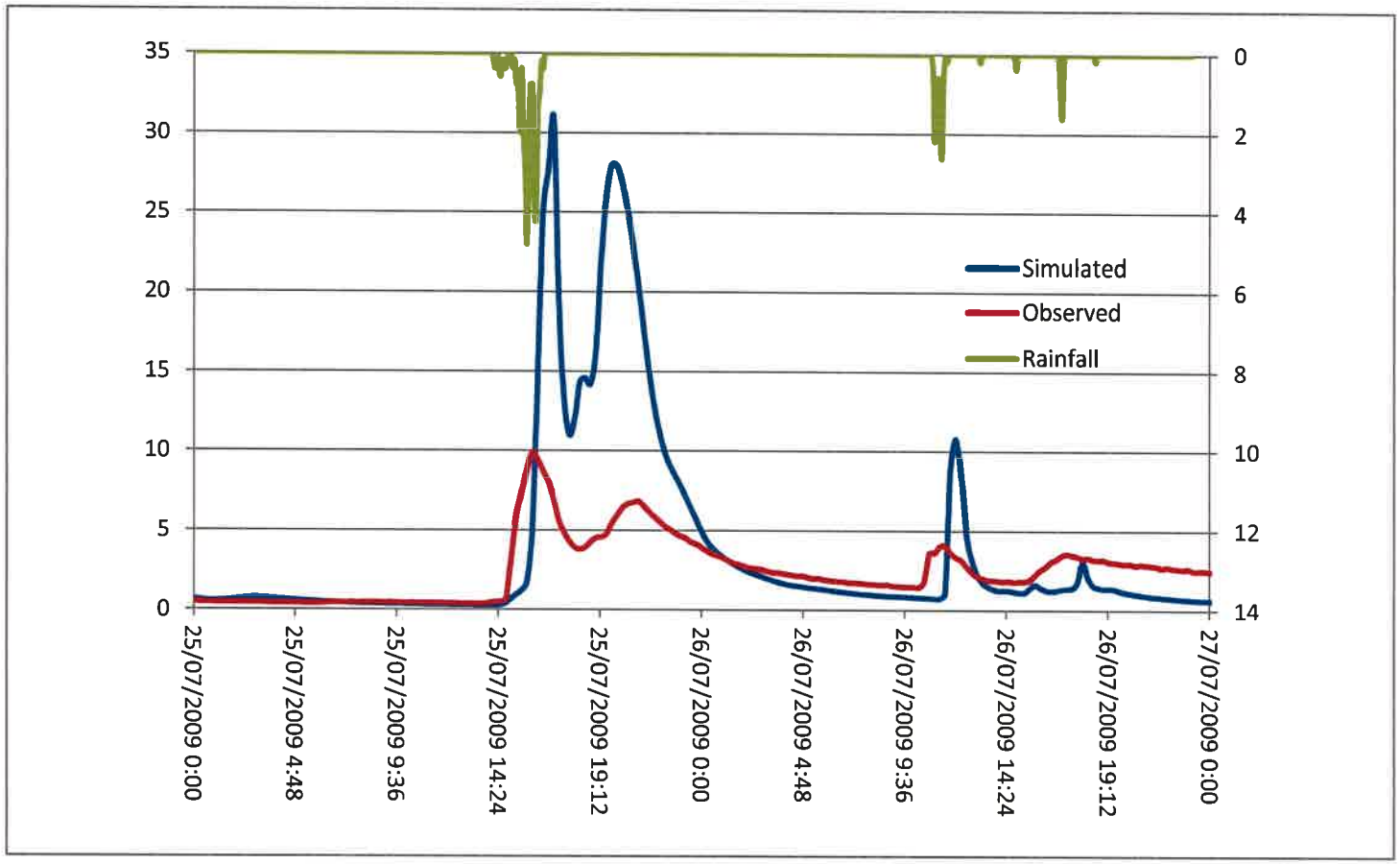
2975 ha

23/07/2009 10:30	Simulated	Observed					
C	0.21	0.07	Duration	5.83 hrs	Unitary Q		
Qp	10.40	4.32	Frequency	<2 yrs	Qsim	0.003495	m3/s/ha
Qave	3.75	1.69	R.F	20.2 mm	Qobs	0.001451	m3/s/ha



2975 ha

25/07/2009 17:00	Simulated	Observed					
C	0.52	0.21	Duration	2.42 hrs	Unitary Q		
Qp	30.84	9.91	Frequency	2-5 yrs	Qsim	0.010366	m3/s/ha
Qave	7.97	3.89	R.F	32.4 mm	Qobs	0.003329	m3/s/ha

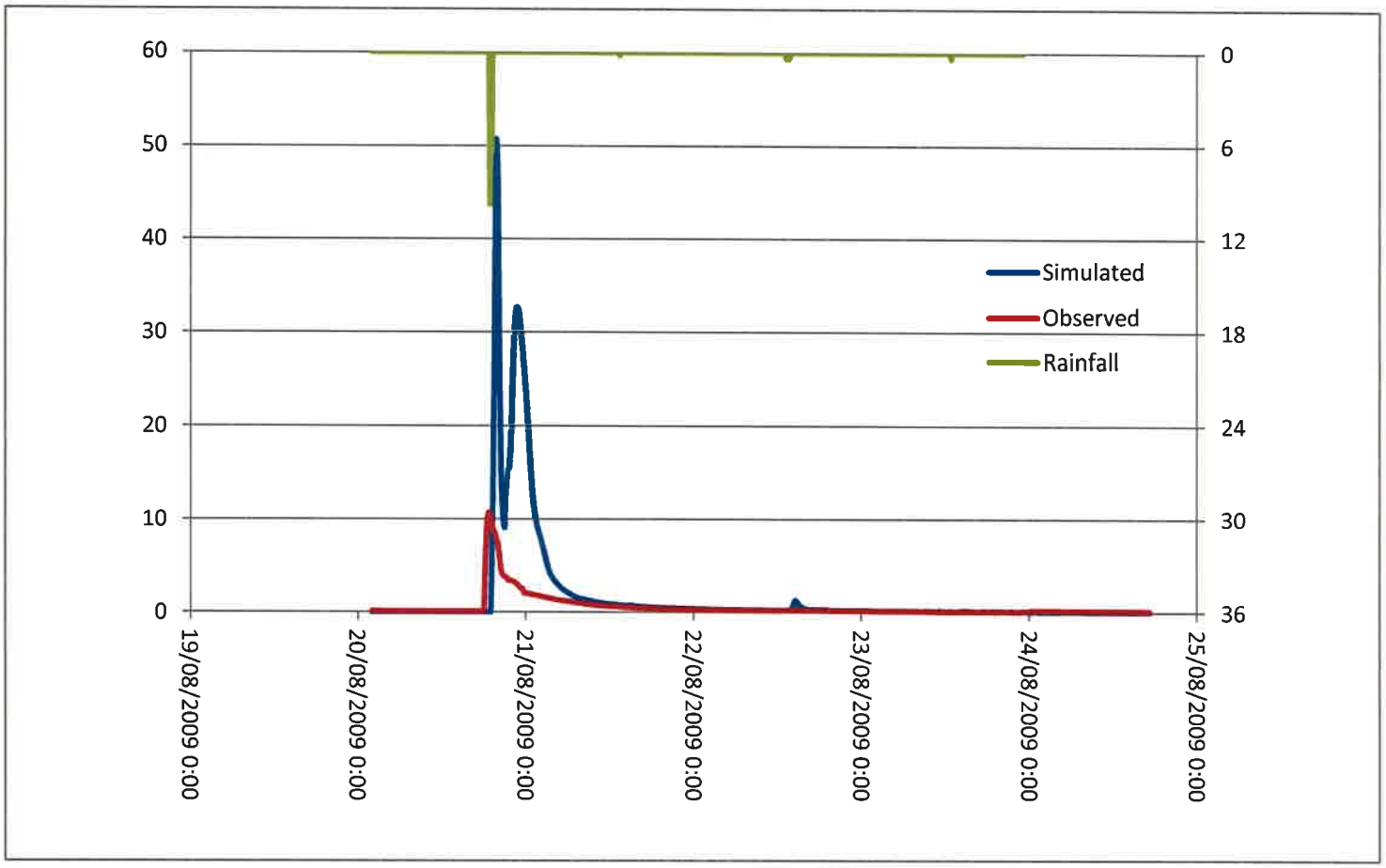


2975 ha

20/08/2009 19:45	Simulated	Observed
C	0.55	0.11
Qp	50.37	10.08
Qave	10.74	3.08

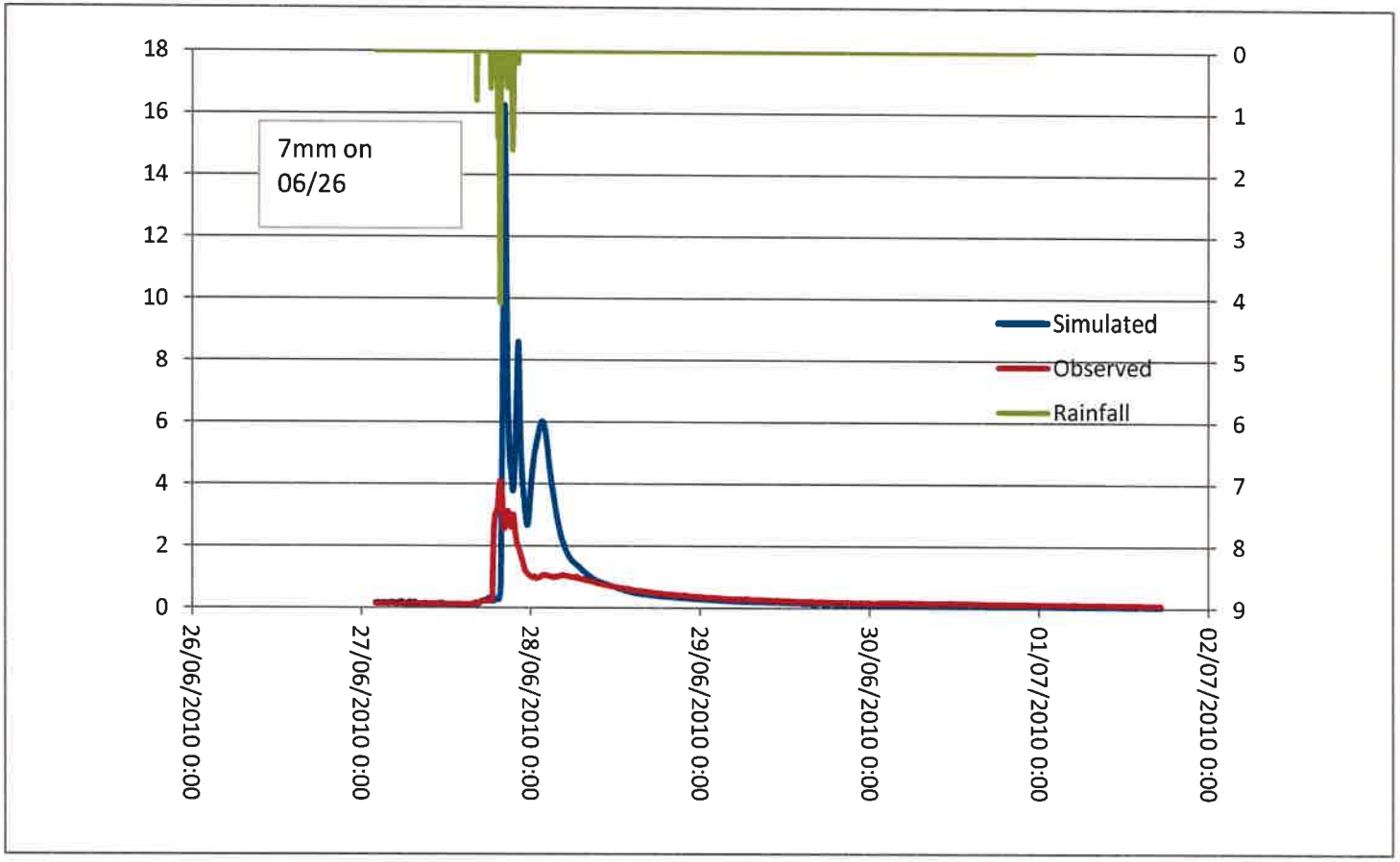
	Simulated	Observed
Duration	0.58 hrs	
Frequency	>100 yrs	
R.F	36 mm	

Unitary Q	
Qsim	0.01693 m3/s/ha
Qobs	0.003388 m3/s/ha



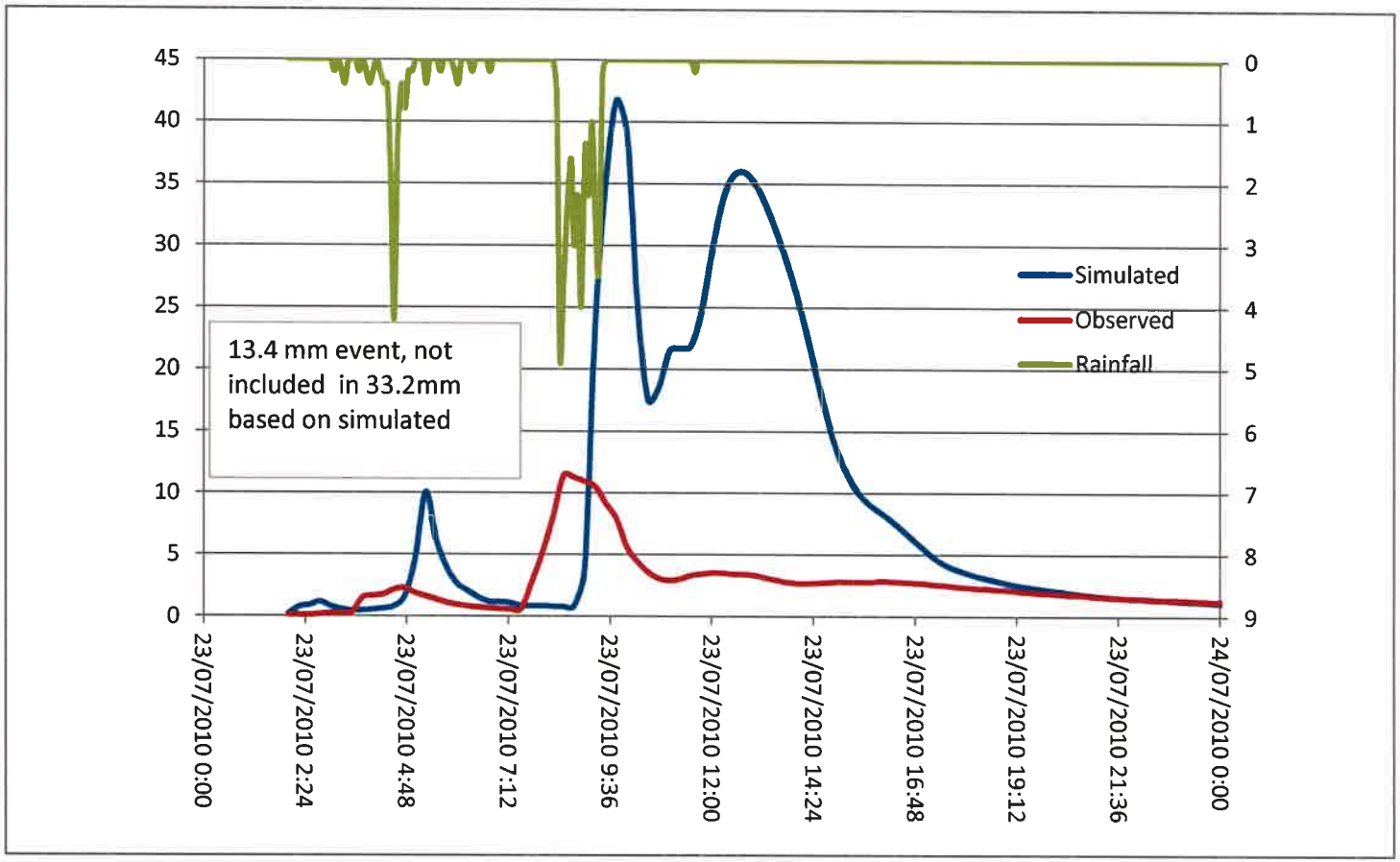
2975 ha

27/06/2010 20:15	Simulated	Observed					
C	0.30	0.11	Duration	5.92 hrs	Unitary Q		
Qp	16.14	4.09	Frequency	<2 yrs	Qsim	0.005427	m3/s/ha
Qave	2.60	1.21	R.F	19.8 mm	Qobs	0.001373	m3/s/ha



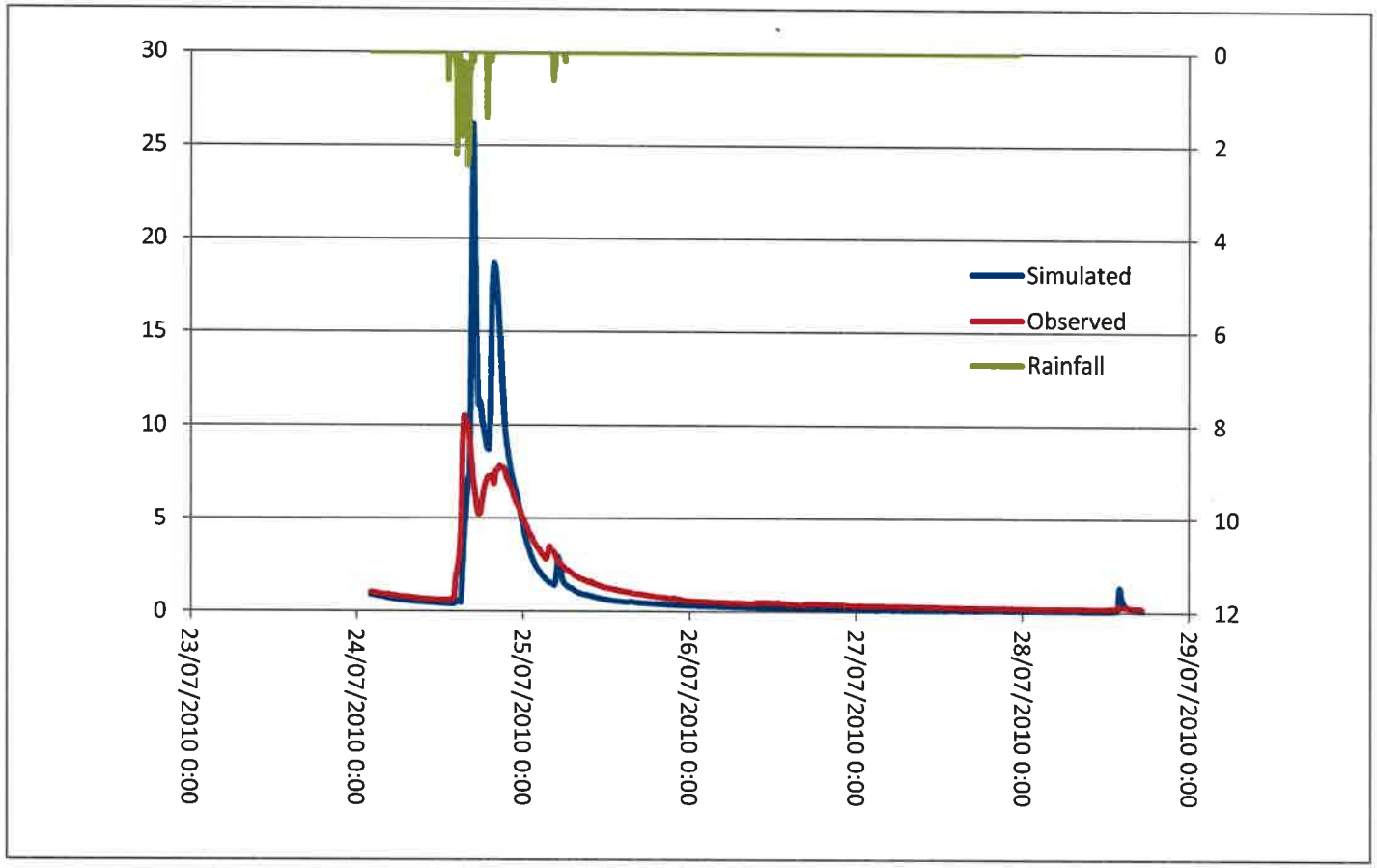
2975 ha

23/07/2010 9:45	Simulated	Observed					
C	0.61	0.11	Duration	1.16 hrs	Unitary Q		
Qp	41.76	11.38	Frequency	10-25 yrs	Qsim	0.014036	m3/s/ha
Qave	18.20	4.46	R.F	33.2 mm	Qobs	0.003826	m3/s/ha



2975 ha

24/07/2010 16:45	Simulated	Observed					
C	0.44	0.36	Duration	16.8 hrs	Unitary Q		
Qp	26.09	10.48	Frequency	<2 yrs	Qsim	0.008771	m3/s/ha
Qave	3.66	3.17	R.F	29 mm	Qobs	0.003522	m3/s/ha

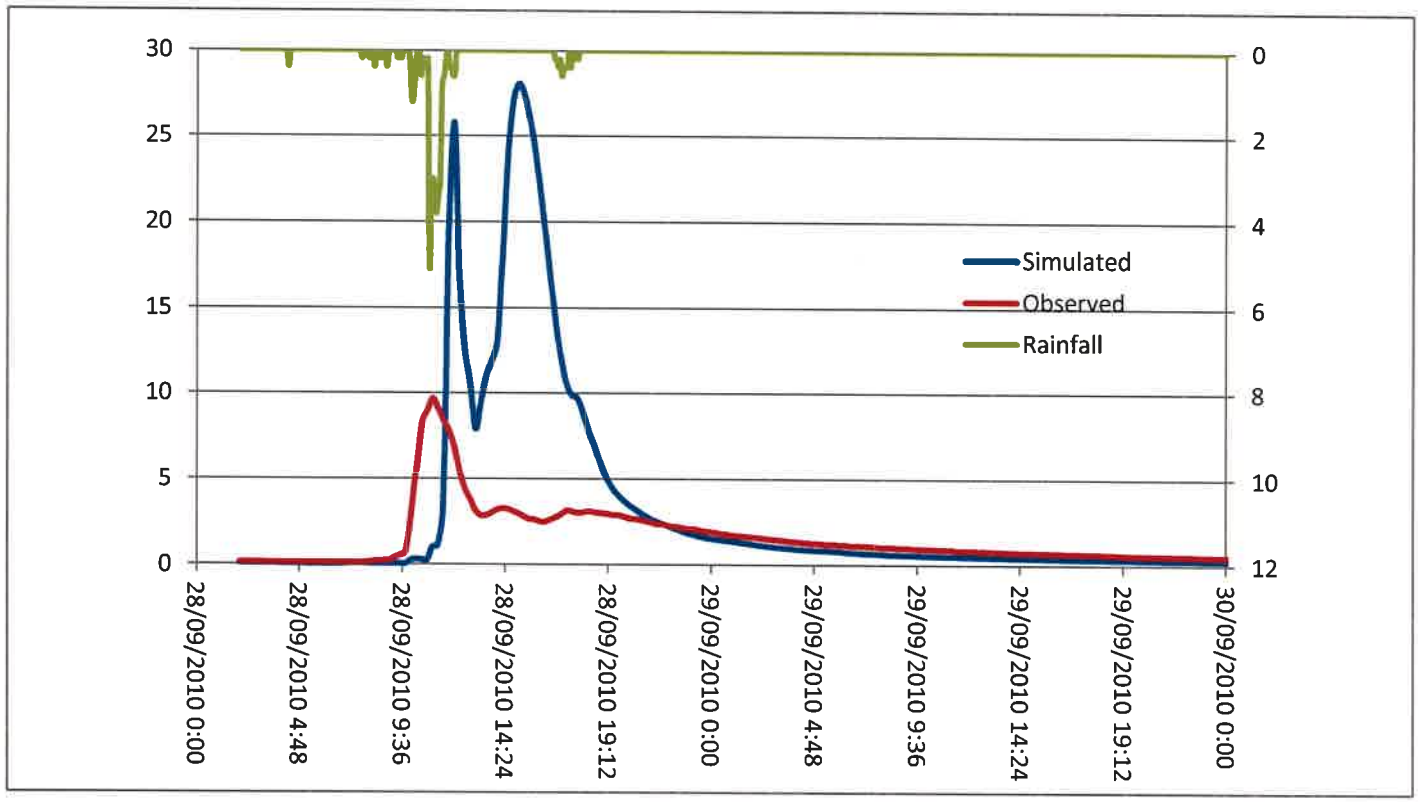


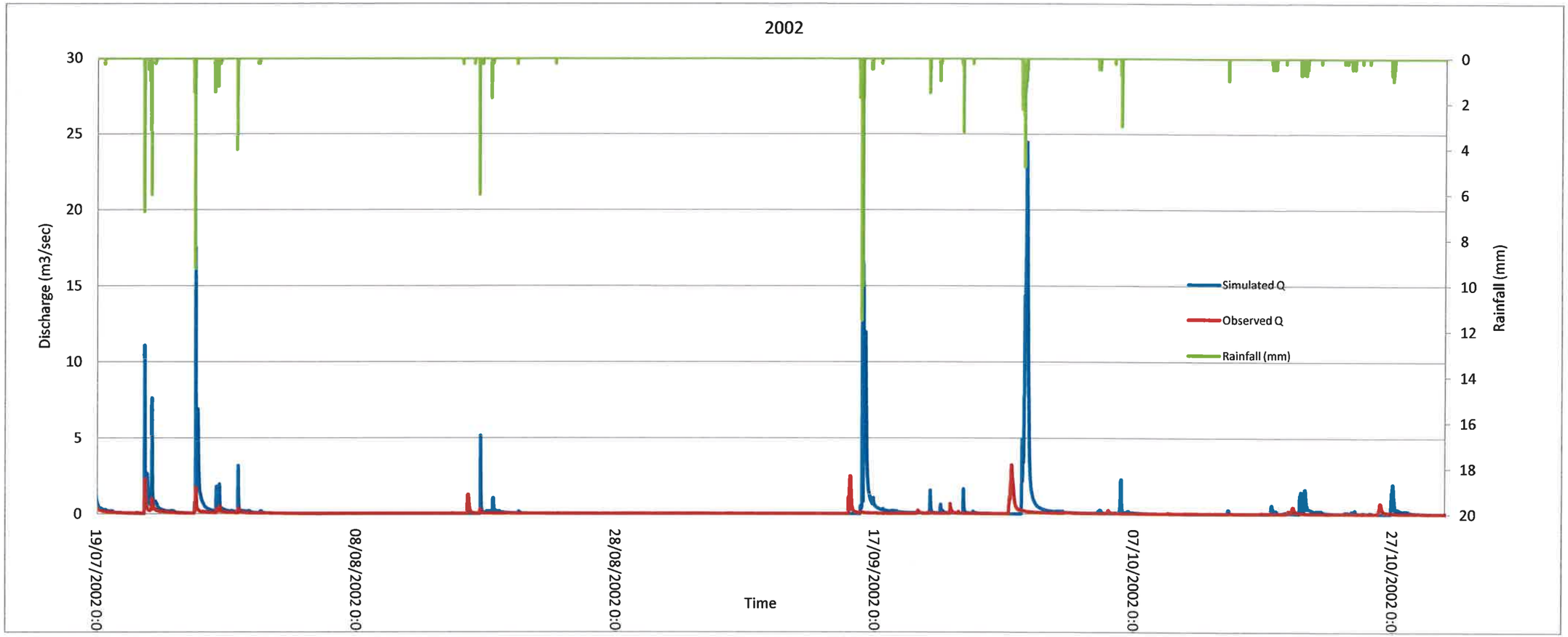
2975 ha

28/09/2010 15:00	Simulated	Observed
C	0.39	0.14
Qp	28.07	9.66
Qave	7.72	2.71

	Simulated	Observed
Duration	4.41 hrs	
Frequency	2-5 yrs	
R.F	38.8 mm	

Unitary Q	
Qsim	0.009435 m3/s/ha
Qobs	0.003248 m3/s/ha





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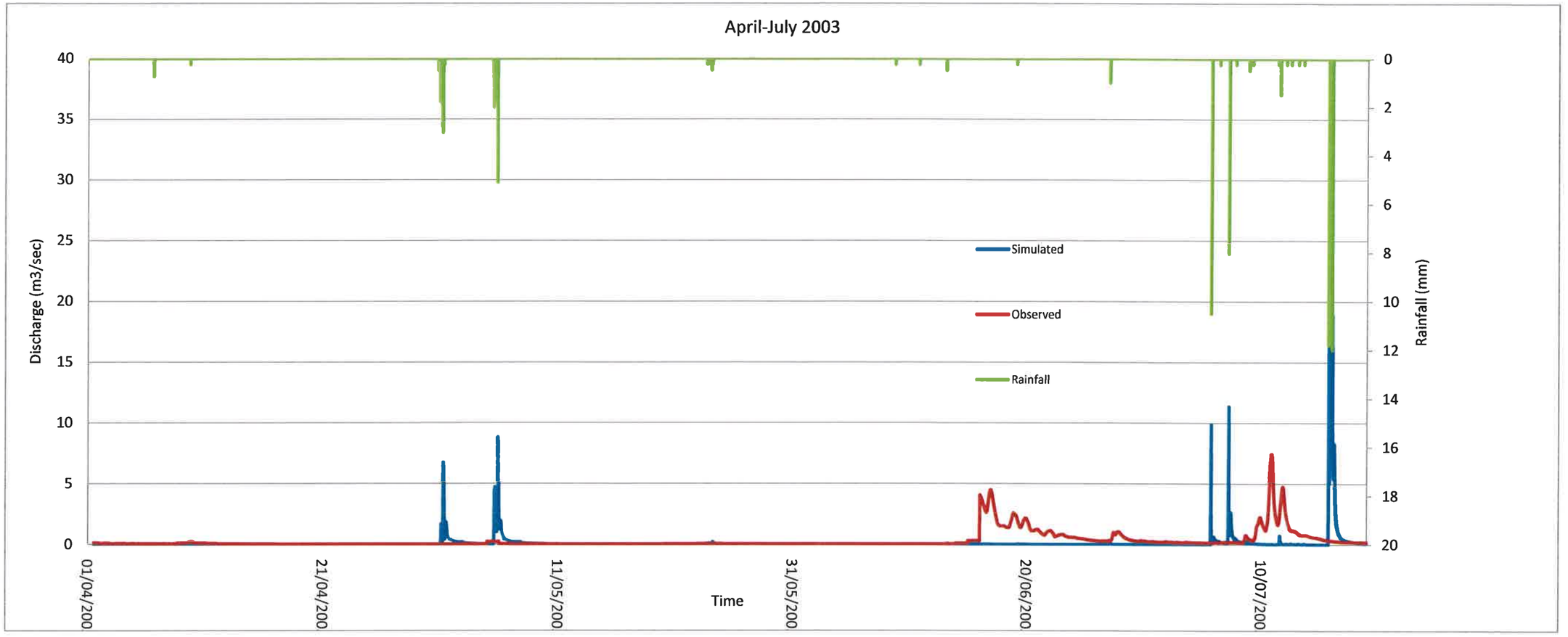

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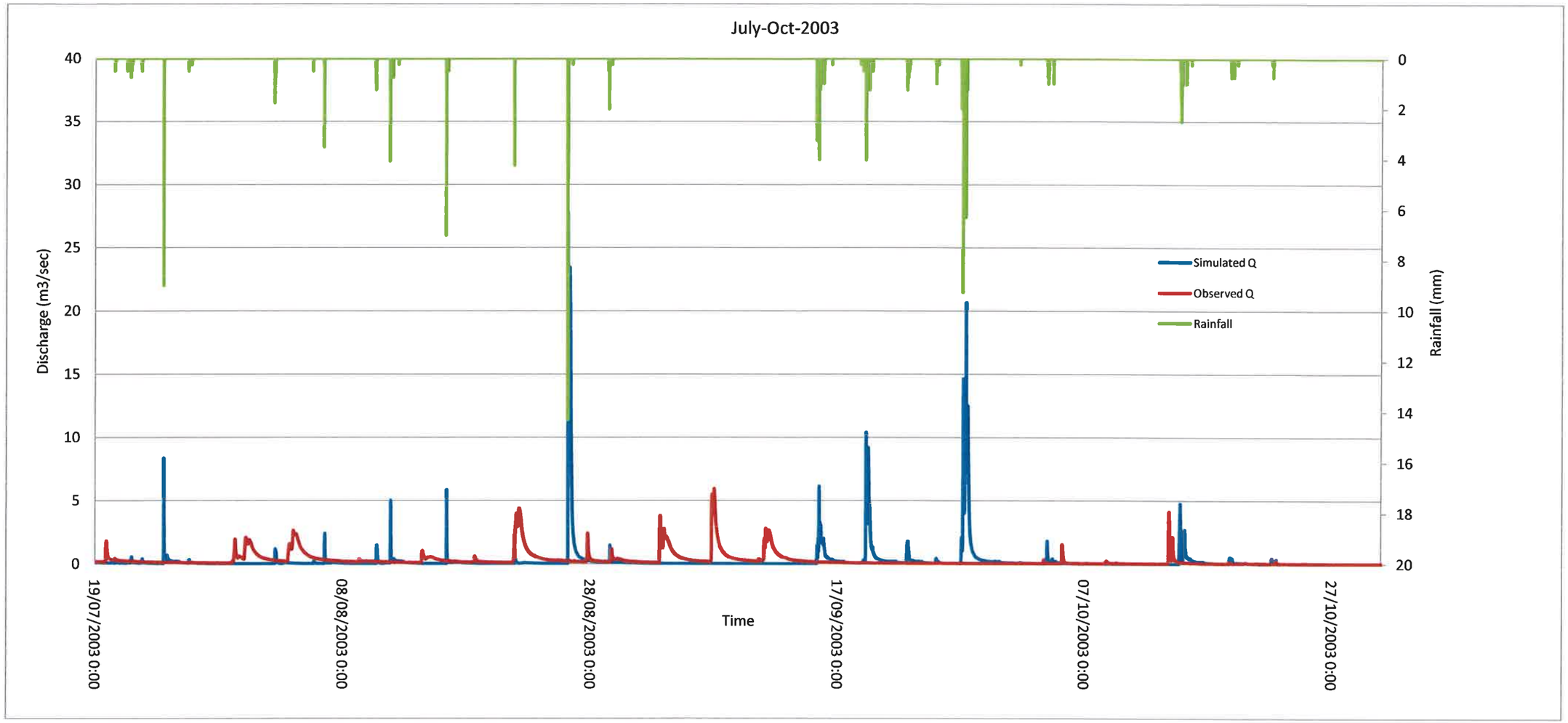
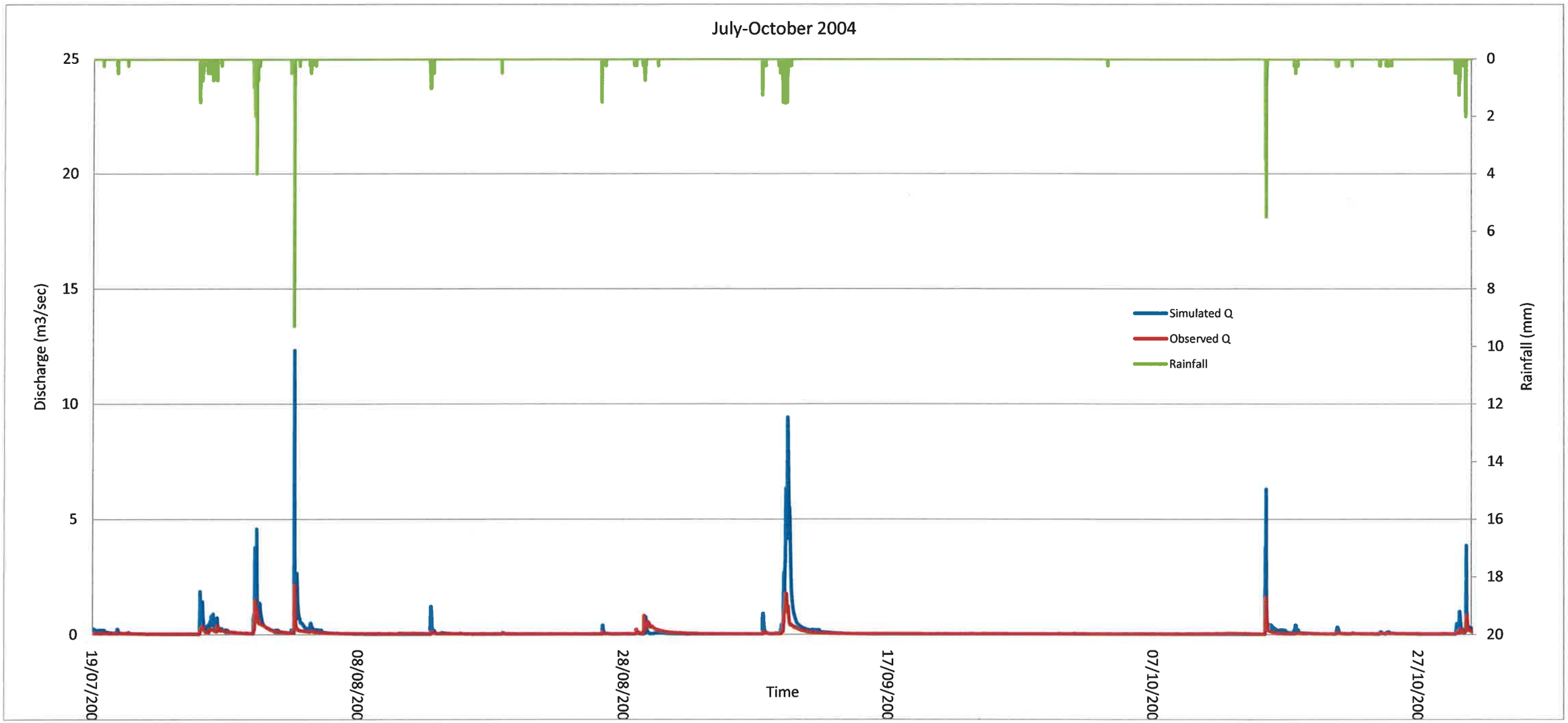

July-Oct-2003
Discharge (m3/sec)
Rainfall (mm)
Simulated Q
Observed Q
Rainfall
Time
0
5
10
15
20
25
30
35
40
0
2
4
6
8
10
12
14
16
18
20
19/07/2003 0:00
08/08/2003 0:00
28/08/2003 0:00
17/09/2003 0:00
07/10/2003 0:00
27/10/2003 0:00



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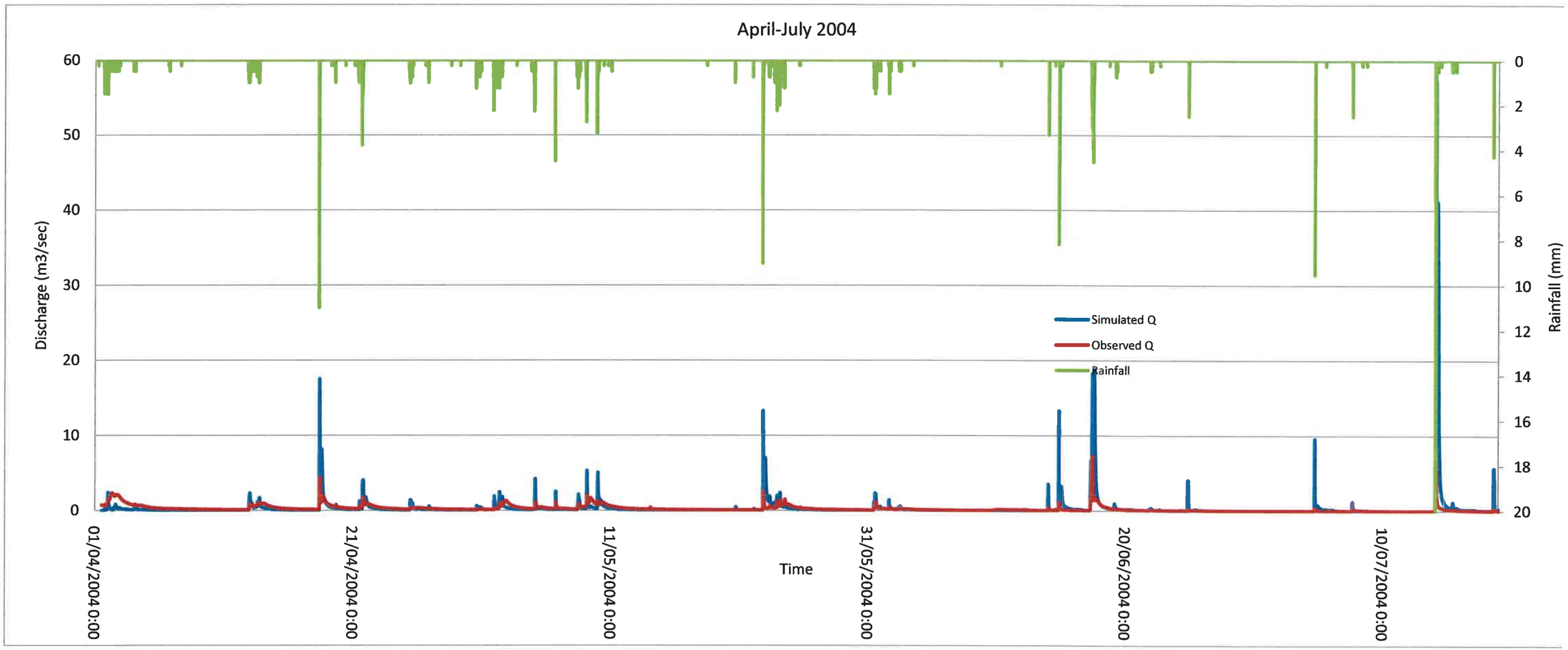
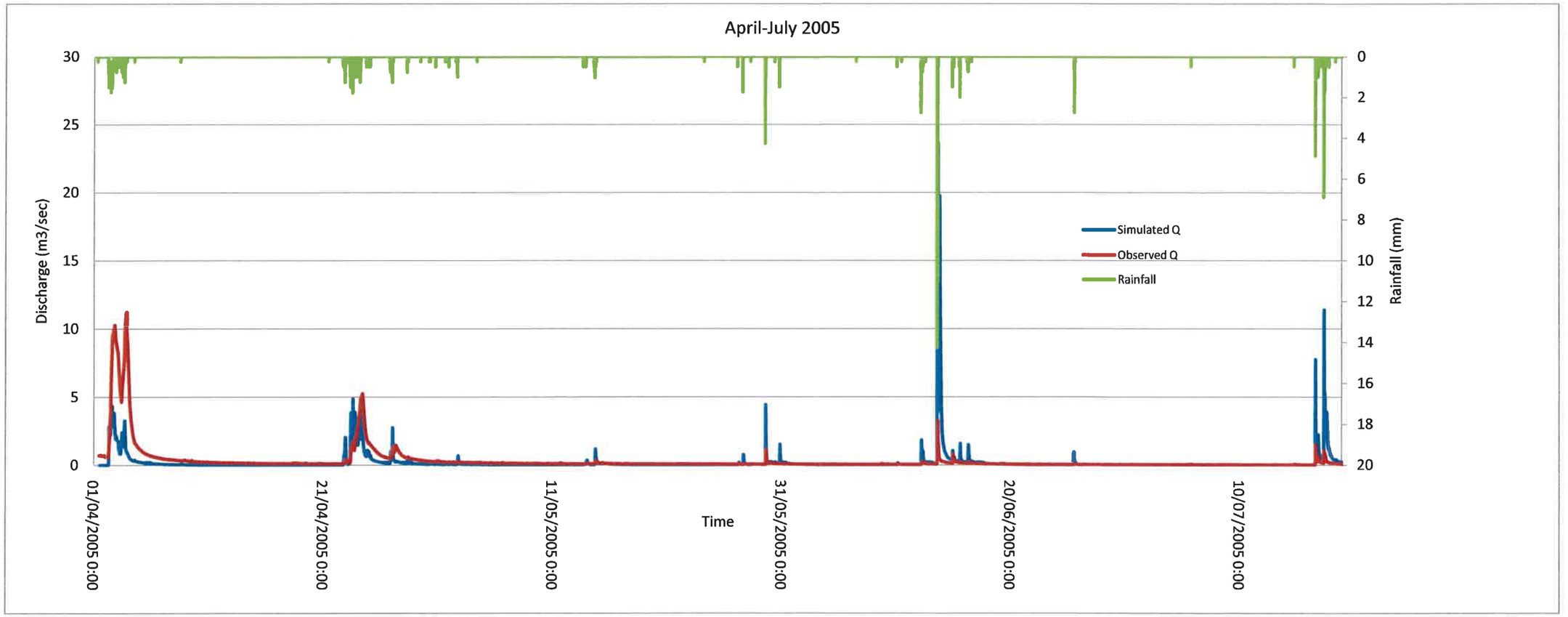
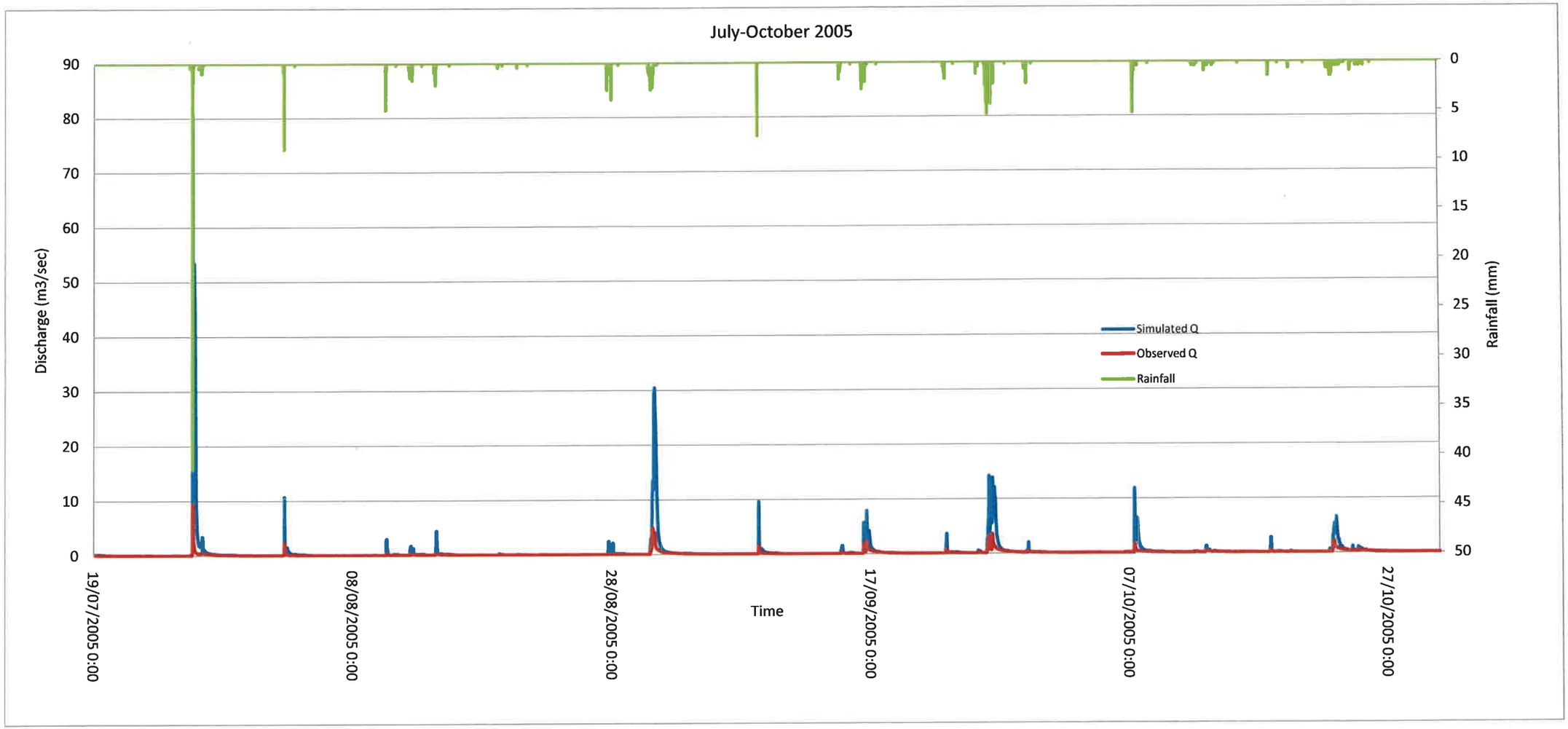
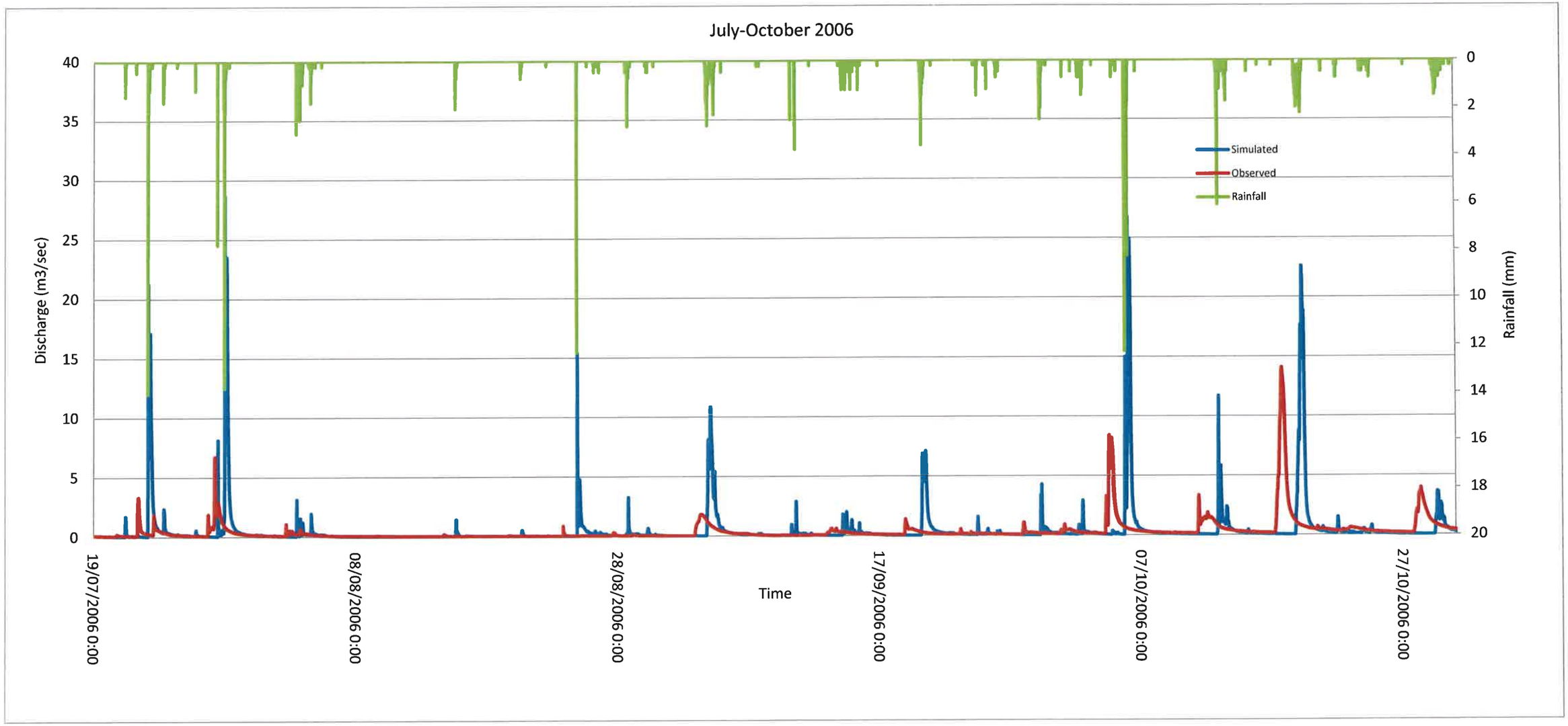
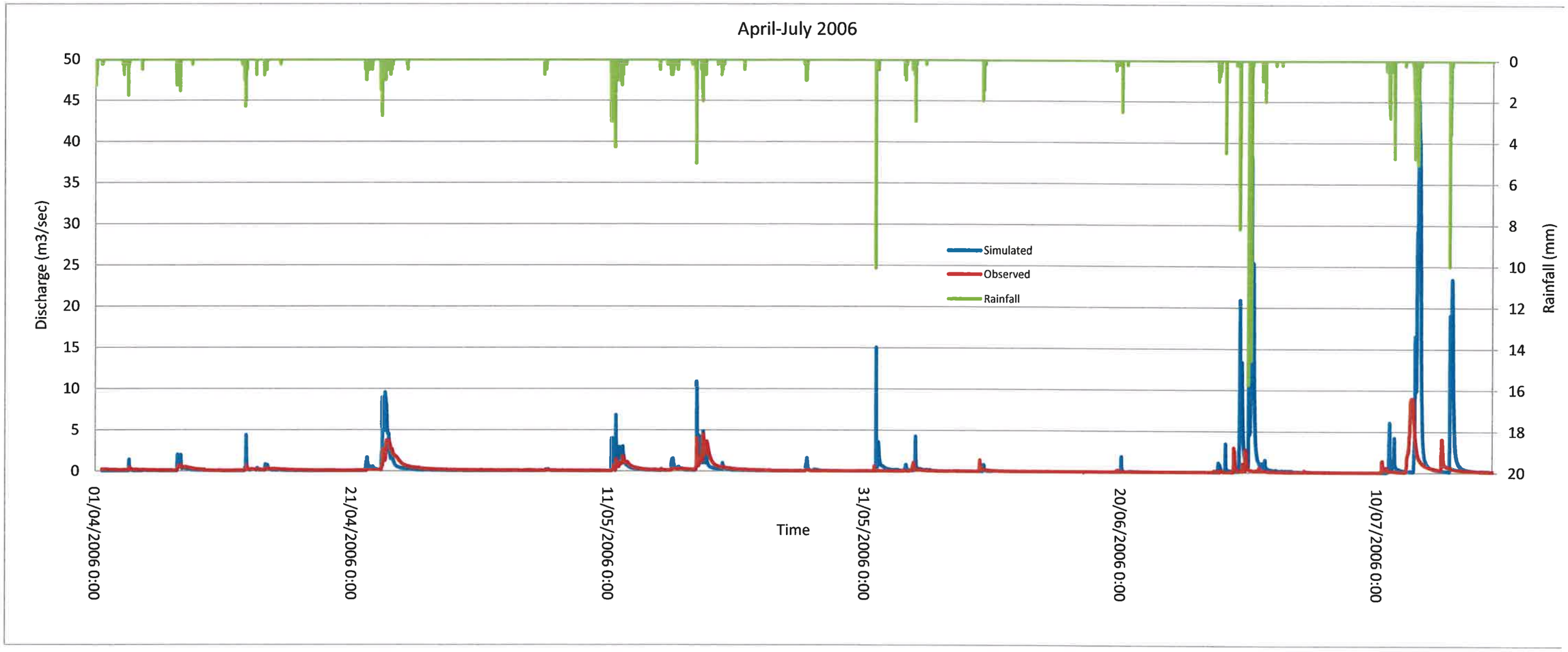
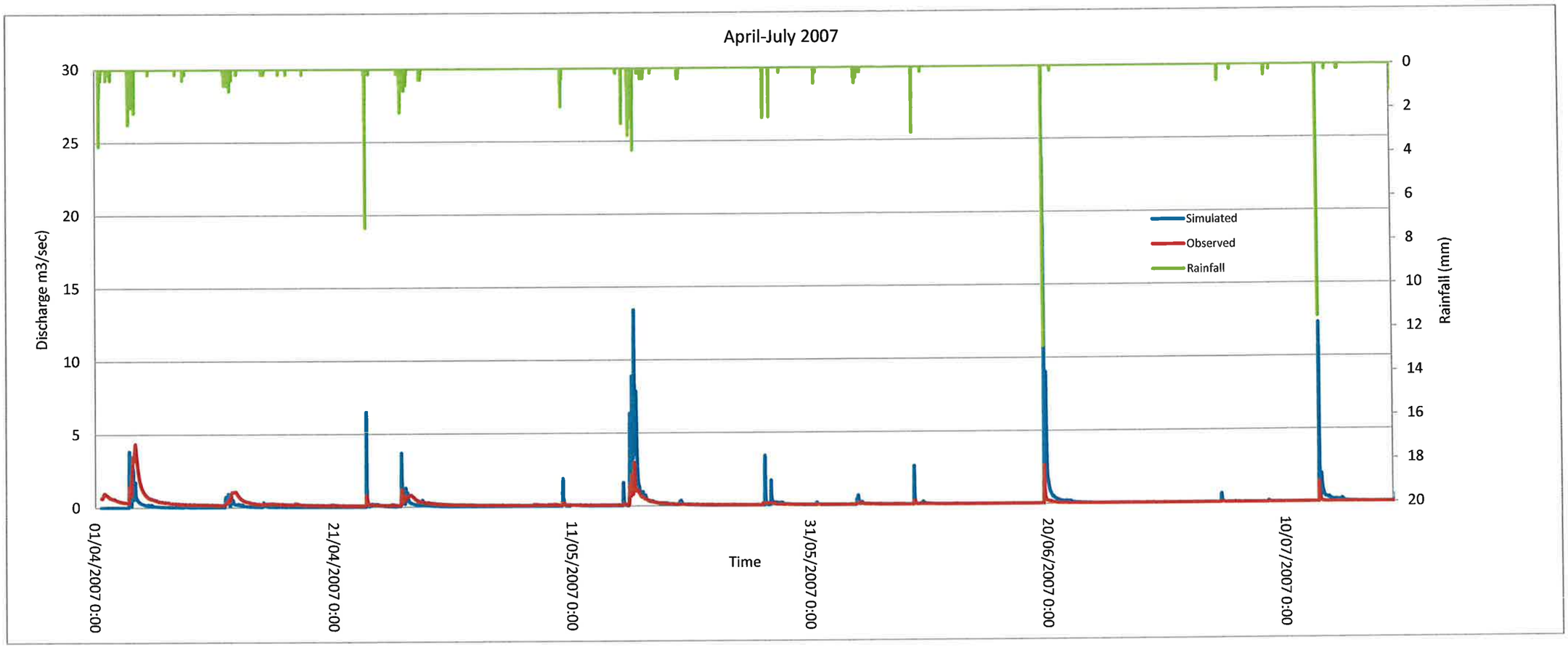

April-July 2004
Discharge (m3/sec)
Rainfall (mm)
60
50
40
30
20
10
0
0
2
4
6
8
10
12
14
16
18
20
Simulated Q
Observed Q
Rainfall
01/04/2004 0:00
21/04/2004 0:00
11/05/2004 0:00
31/05/2004 0:00
20/06/2004 0:00
10/07/2004 0:00
Time


April-July 2005
Discharge (m3/sec)
Rainfall (mm)
30
25
20
15
10
5
0
0
2
4
6
8
10
12
14
16
18
20
Simulated Q
Observed Q
Rainfall
01/04/2005 0:00
21/04/2005 0:00
11/05/2005 0:00
31/05/2005 0:00
20/06/2005 0:00
10/07/2005 0:00
Time


July-October 2005
Discharge (m3/sec)
Rainfall (mm)
90
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
30
35
40
45
50
Simulated Q
Observed Q
Rainfall
19/07/2005 0:00
08/08/2005 0:00
28/08/2005 0:00
17/09/2005 0:00
07/10/2005 0:00
27/10/2005 0:00
Time


July-October 2006
Discharge (m3/sec)
Rainfall (mm)
Simulated
Observed
Rainfall
Time
19/07/2006 0:00
08/08/2006 0:00
28/08/2006 0:00
17/09/2006 0:00
07/10/2006 0:00
27/10/2006 0:00
0
5
10
15
20
25
30
35
40
0
2
4
6
8
10
12
14
16
18
20


April-July 2006
Discharge (m3/sec)
Rainfall (mm)
Simulated
Observed
Rainfall
Time
50
45
40
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
14
16
18
20
01/04/2006 0:00
21/04/2006 0:00
11/05/2006 0:00
31/05/2006 0:00
20/06/2006 0:00
10/07/2006 0:00



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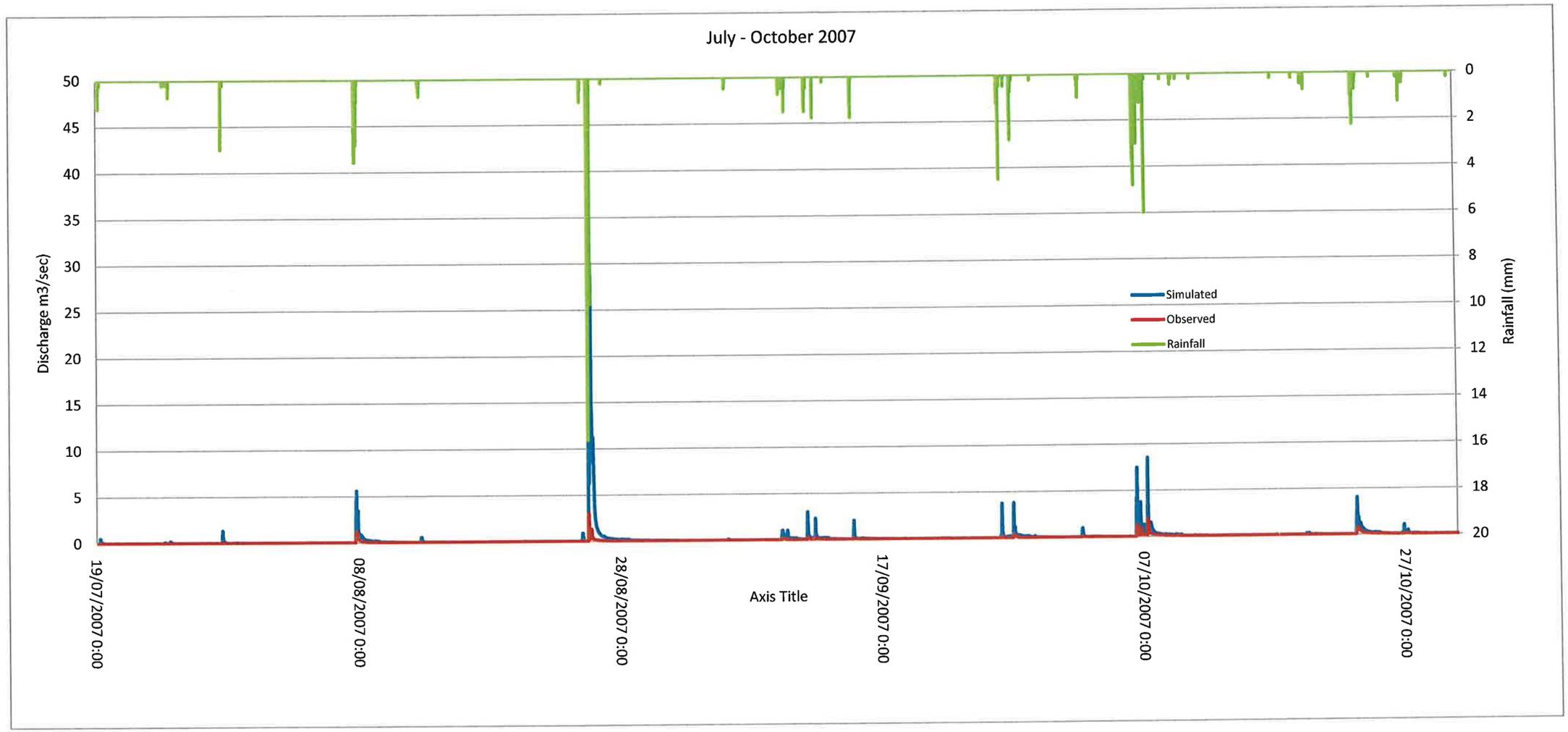
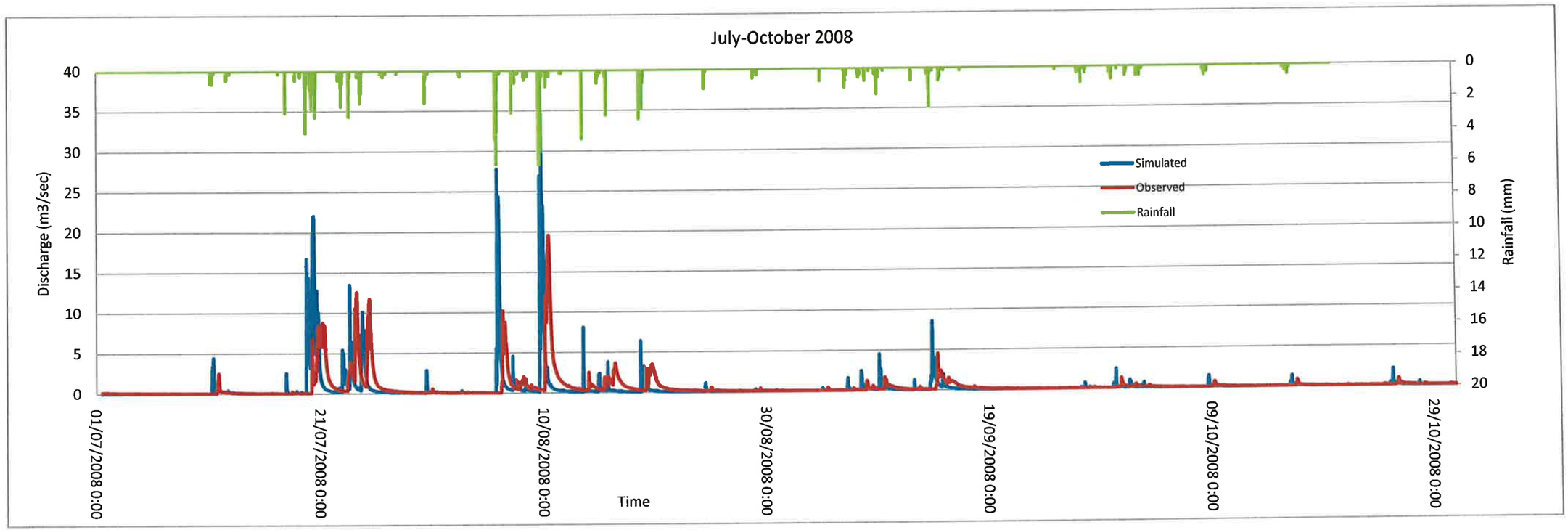
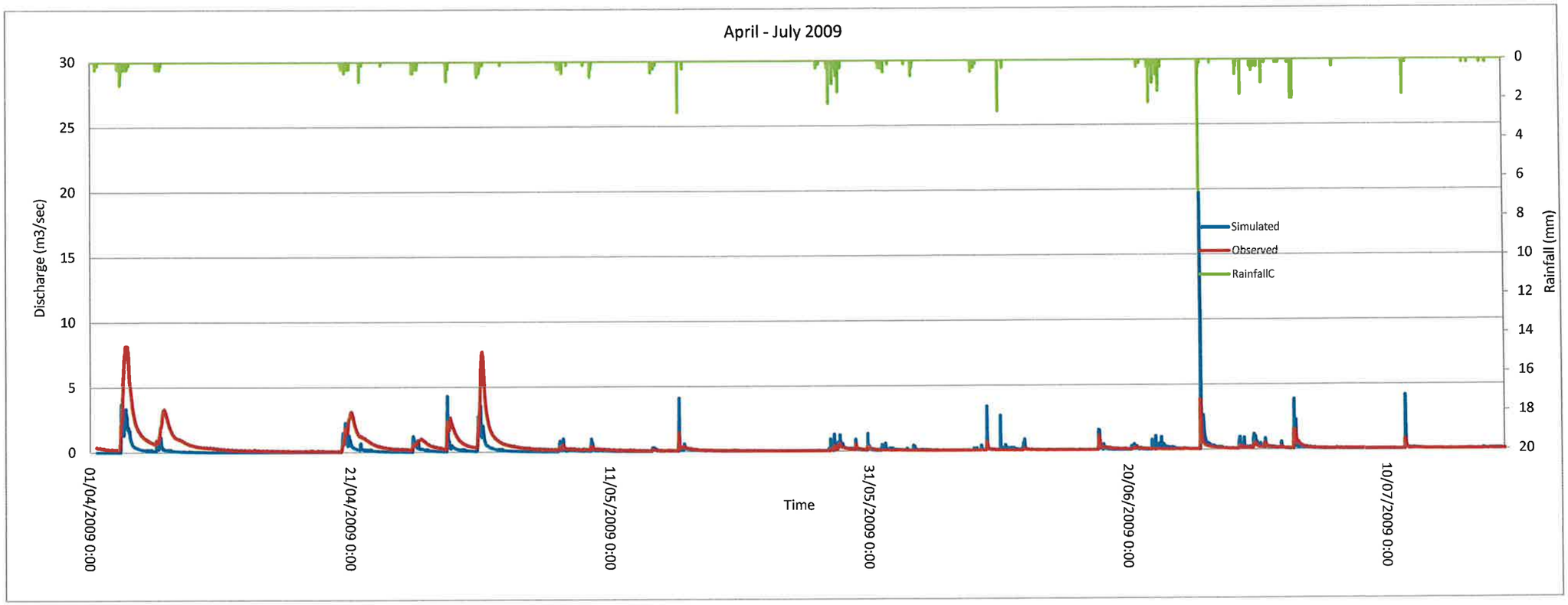
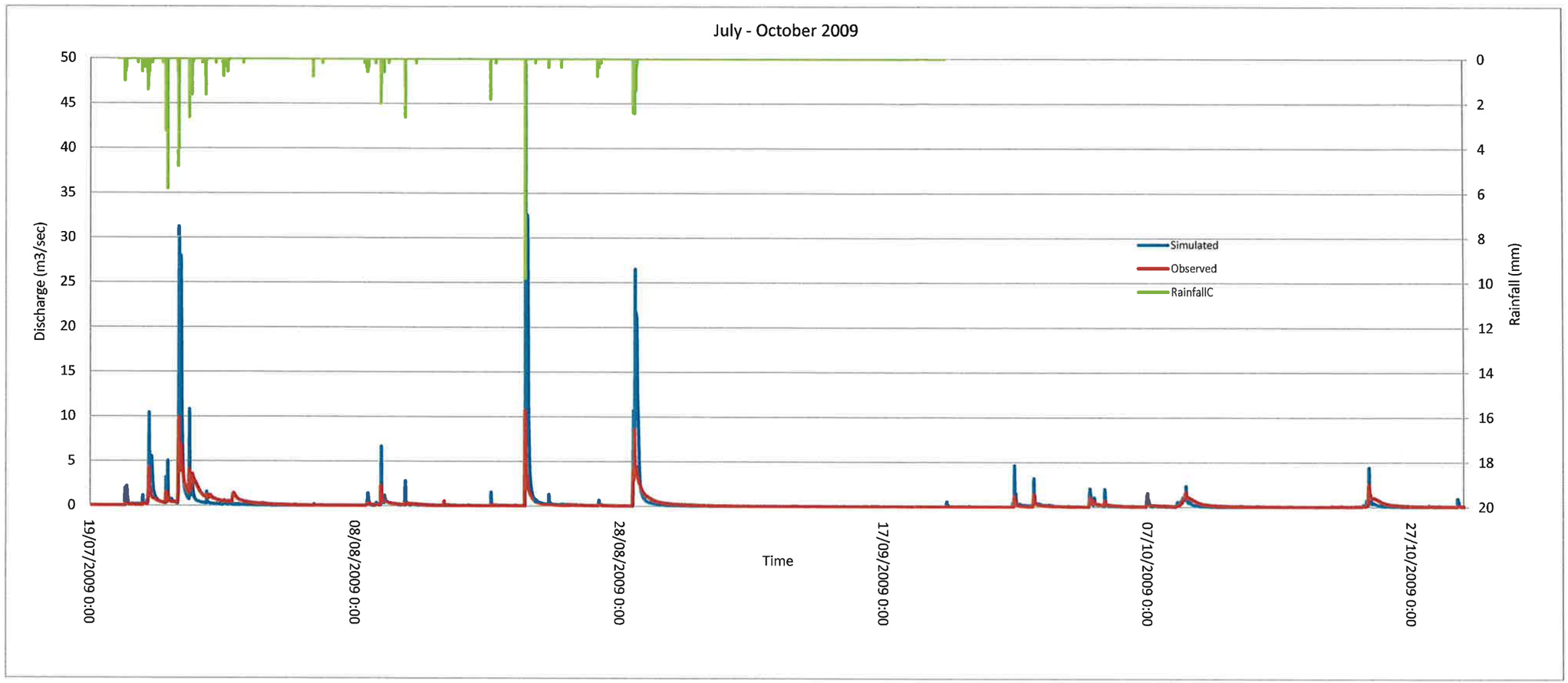
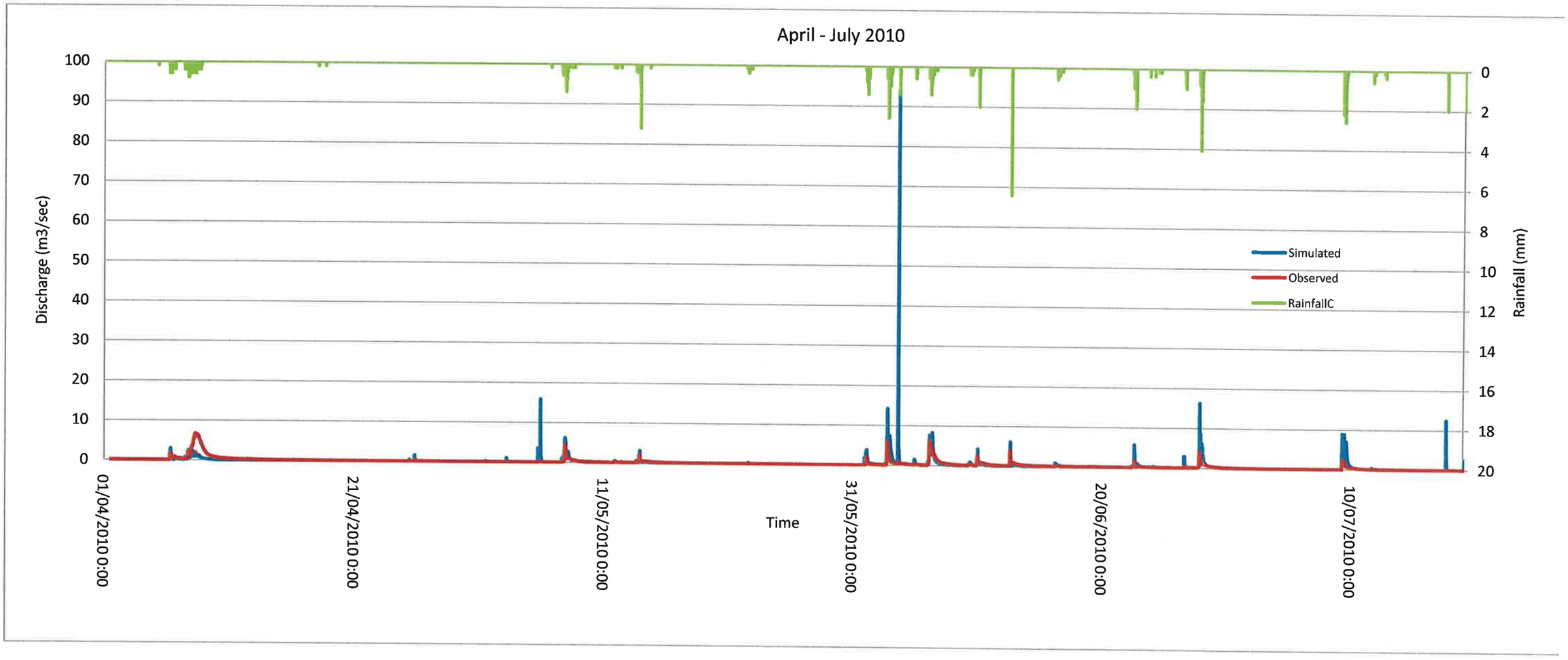
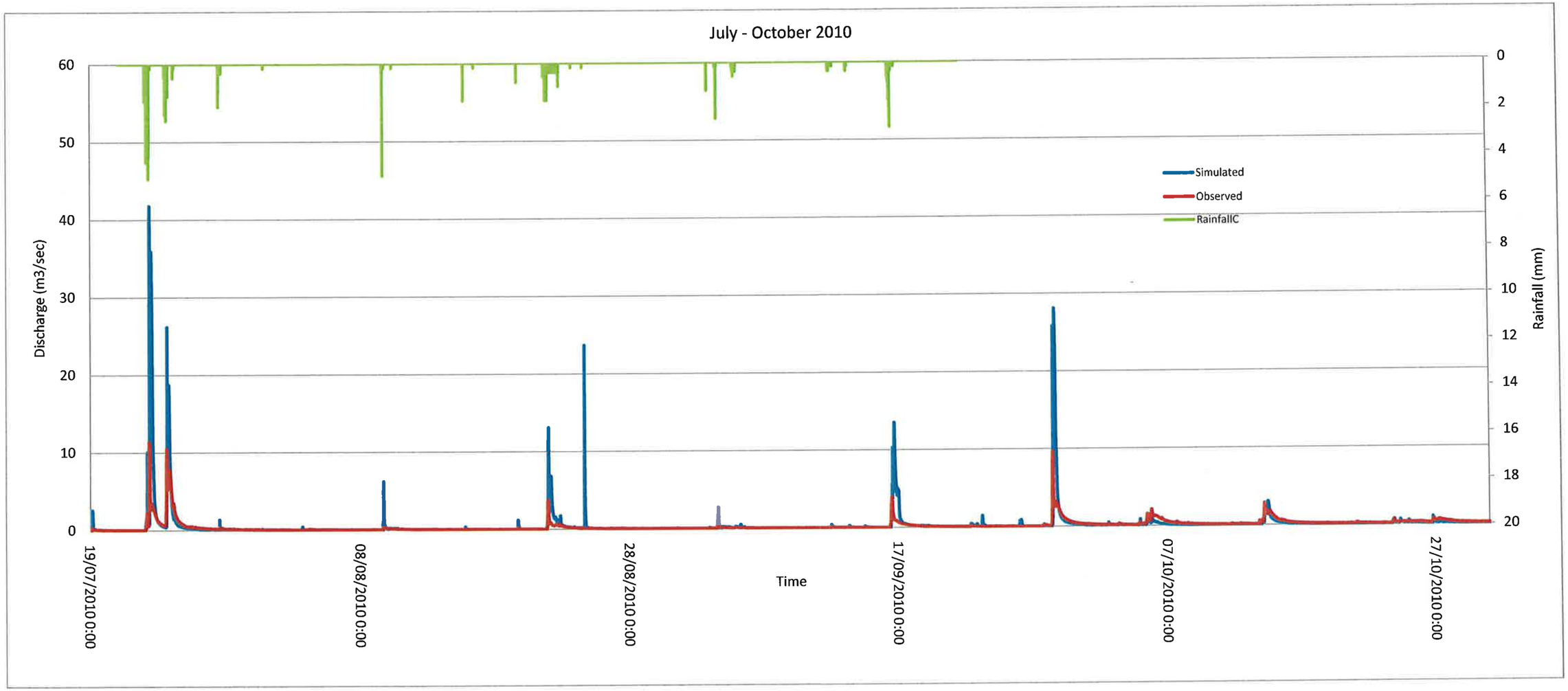

July - October 2007
Discharge m3/sec)
Rainfall (mm)
Simulated
Observed
Rainfall
0
5
10
15
20
25
30
35
40
45
50
0
2
4
6
8
10
12
14
16
18
20
19/07/2007 0:00
08/08/2007 0:00
28/08/2007 0:00
17/09/2007 0:00
07/10/2007 0:00
27/10/2007 0:00
Axis Title


July-October 2008
Discharge (m3/sec)
Rainfall (mm)
Time
Simulated
Observed
Rainfall
0
5
10
15
20
25
30
35
40
0
2
4
6
8
10
12
14
16
18
20
01/07/2008 0:00
21/07/2008 0:00
10/08/2008 0:00
30/08/2008 0:00
19/09/2008 0:00
09/10/2008 0:00
29/10/2008 0:00


April - July 2009
Discharge (m3/sec)
Rainfall (mm)
Simulated
Observed
RainfallC
Time
01/04/2009 0:00
21/04/2009 0:00
11/05/2009 0:00
31/05/2009 0:00
20/06/2009 0:00
10/07/2009 0:00


July - October 2009
Discharge (m3/sec)
Rainfall (mm)
Simulated
Observed
RainfallC
Time
19/07/2009 0:00
08/08/2009 0:00
28/08/2009 0:00
17/09/2009 0:00
07/10/2009 0:00
27/10/2009 0:00

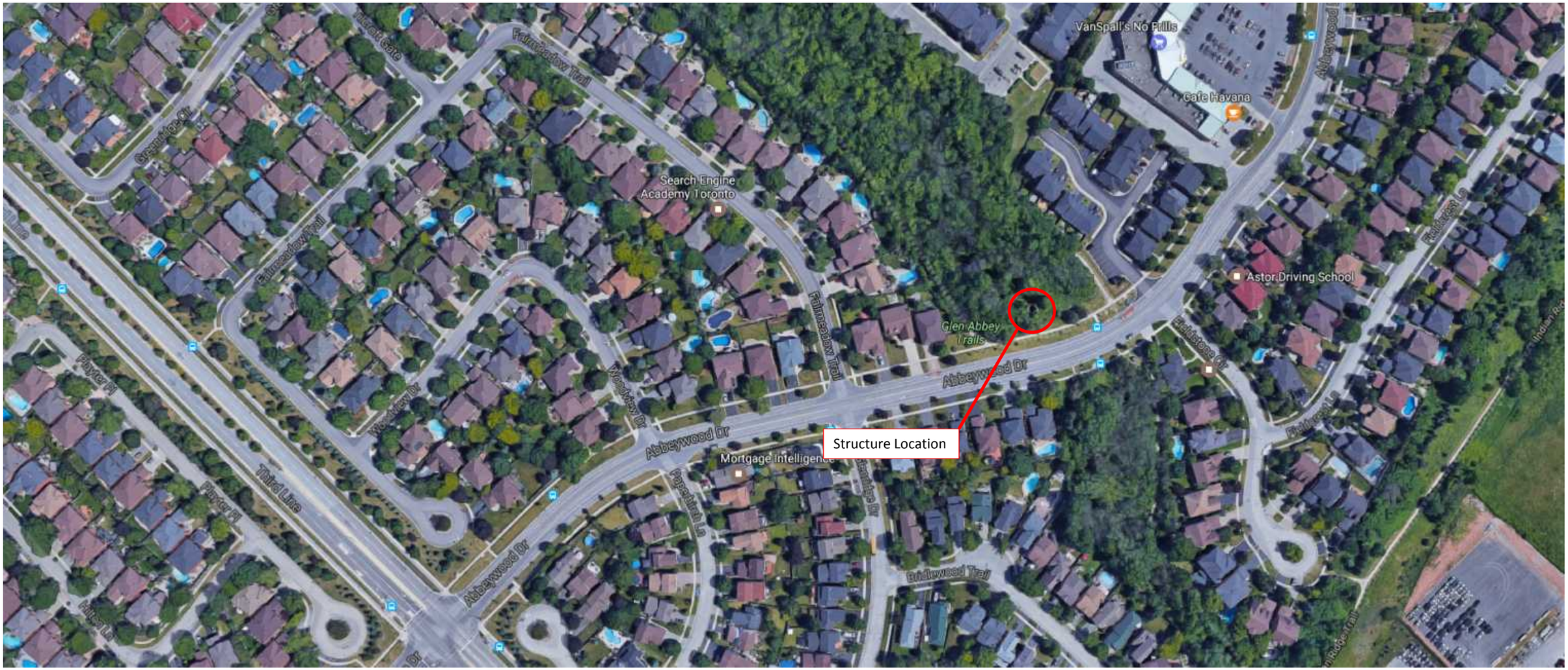

April - July 2010
Discharge (m3/sec)
Rainfall (mm)
Simulated
Observed
RainfallC
Time
100
90
80
70
60
50
40
30
20
10
0
0
2
4
6
8
10
12
14
16
18
20
01/04/2010 0:00
21/04/2010 0:00
11/05/2010 0:00
31/05/2010 0:00
20/06/2010 0:00
10/07/2010 0:00


July - October 2010
Discharge (m3/sec)
Rainfall (mm)
Simulated
Observed
RainfallC
60
50
40
30
20
10
0
0
2
4
6
8
10
12
14
16
18
20
19/07/2010 0:00
08/08/2010 0:00
28/08/2010 0:00
17/09/2010 0:00
07/10/2010 0:00
27/10/2010 0:00
Time

Appendix A

Aerial Images of On-Line Control Structures

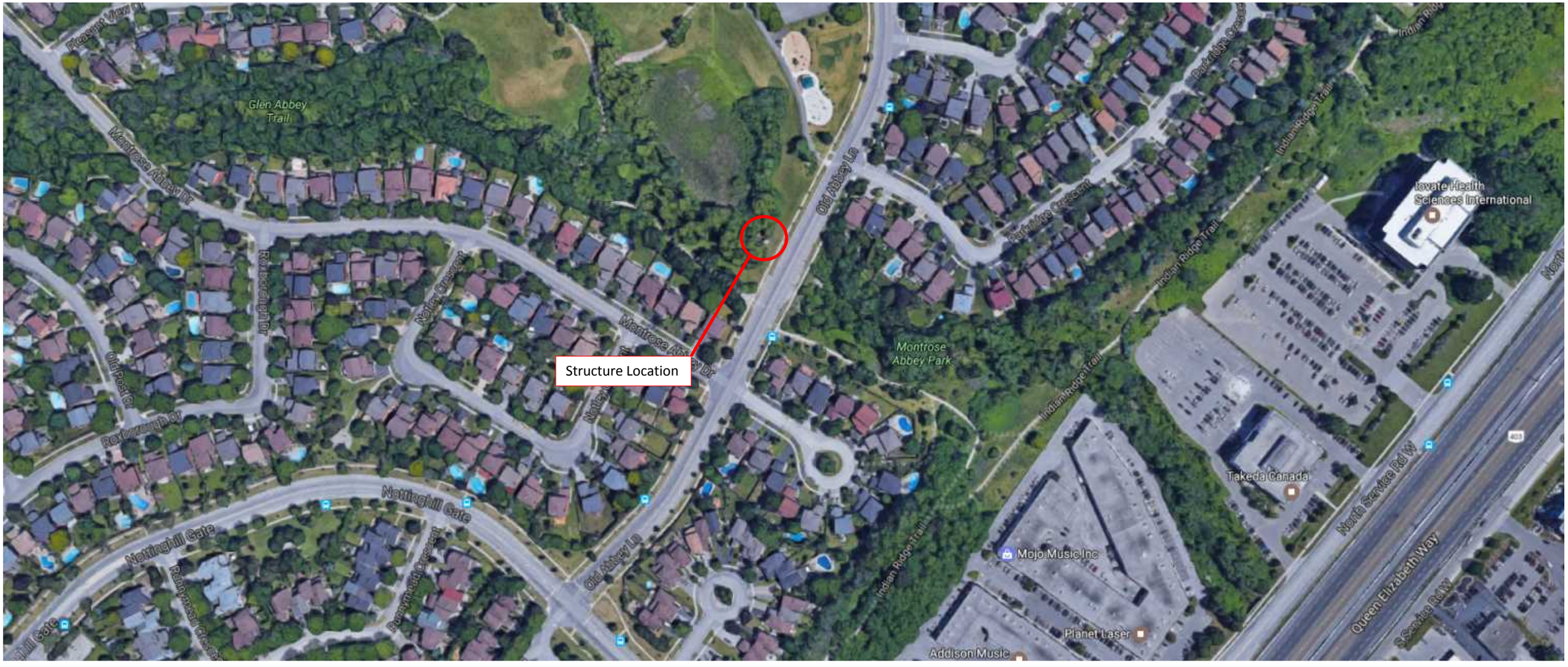
Abbeywood Drive Structure Location



Pilgrims Way Structure Location

Nottinghill Gate Structure Location

Old Abbey Lane Structure Location



Appendix B

Background Information

Andrew Brodie Associates Inc.

Consulting Engineers • Resource Development Specialists

P.O. Box 425, Thornhill, Ontario L3T 4A2 • (416) 889-6758

06 May 1986

Mr. John Jaciw, P.Eng.
UMA Engineering Limited
89 Carlingview Drive
Rexdale, Ont. M9W 5E4

Dear John:

GLEN ABBEY PHASE 3 STAGES 2 AND 3 AND PHASE 4 STAGE 1
DETENTION REQUIREMENTS ON EAST BRANCH OF FOURTEEN MILE CREEK

STUDY AREA

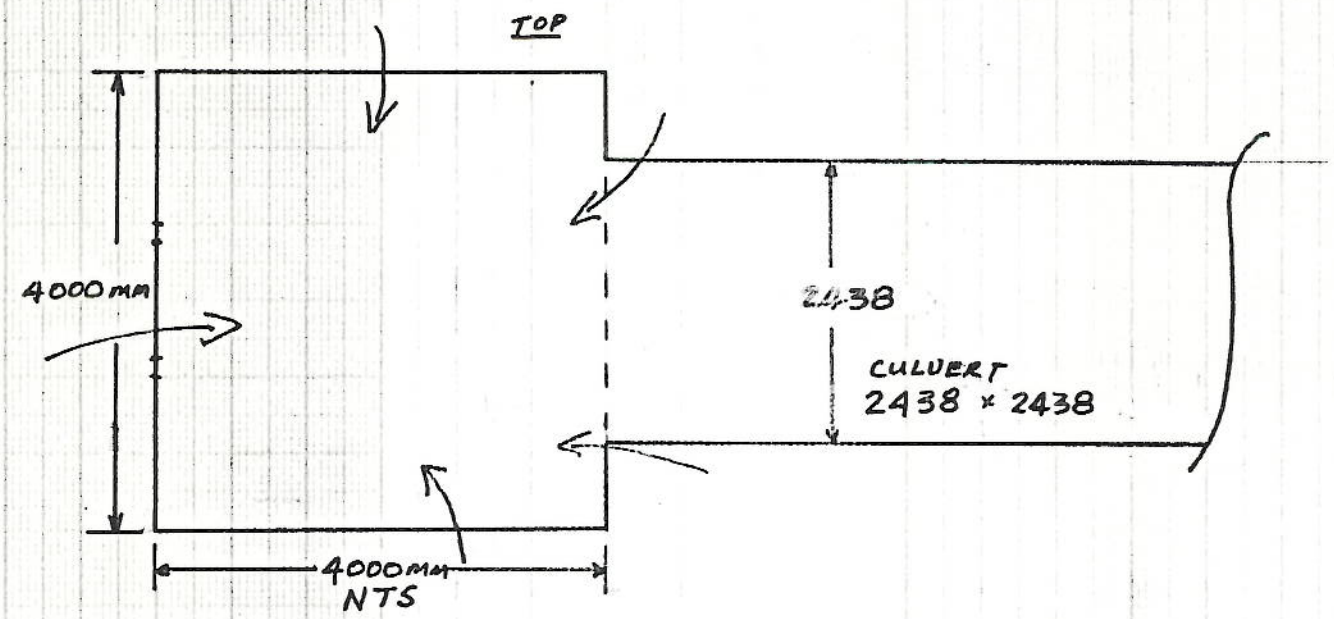
The above three parcels lie within the western portion of Glen Abbey Community in Oakville, immediately east of Third Line and north of the Iroquois Ridge. As illustrated on Figure 1, the parcels comprise:

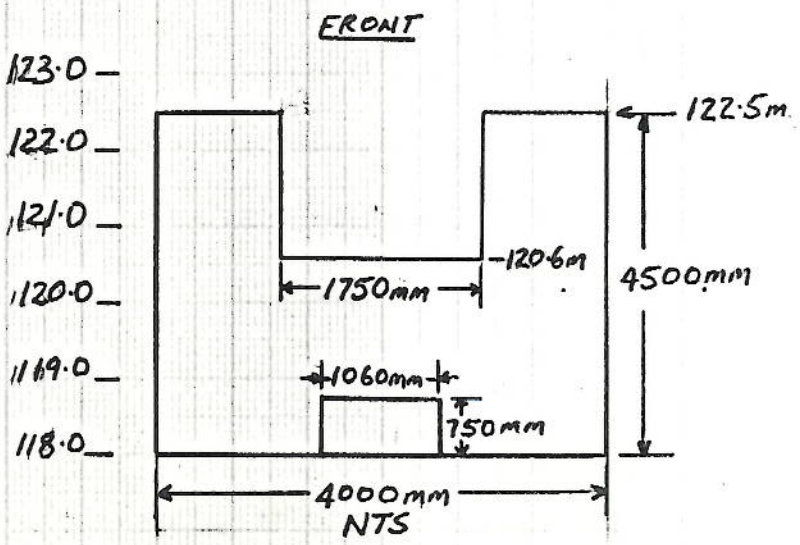
Phase 3 Stage 3 has a total area of 17.1 ha of which 5.0 ha drains naturally to the East Branch of Fourteen Mile Creek and the remaining 12.1 ha drains naturally to the west branch of McCraney Creek. To save having to cut down a number of large trees at the south-east corner of this parcel to obtain a minor system outlet to McCraney, Genstar proposes to divert the minor system flow from the 12.1 ha to the East Branch of Fourteen Mile Creek. This was discussed by myself with Halton Region Conservation Authority staff on 08 January 1986 and it was agreed that over-control would be required in the East Branch detention to compensate for this diversion. Authority staff noted that while the proposal was reasonable, they could not guarantee that the Board would approve it. It should be noted that the effect of diverting minor system flows from the 12.1 ha from McCraney Creek will be to reduce further the controlled flows emanating from the McCraney Detention.

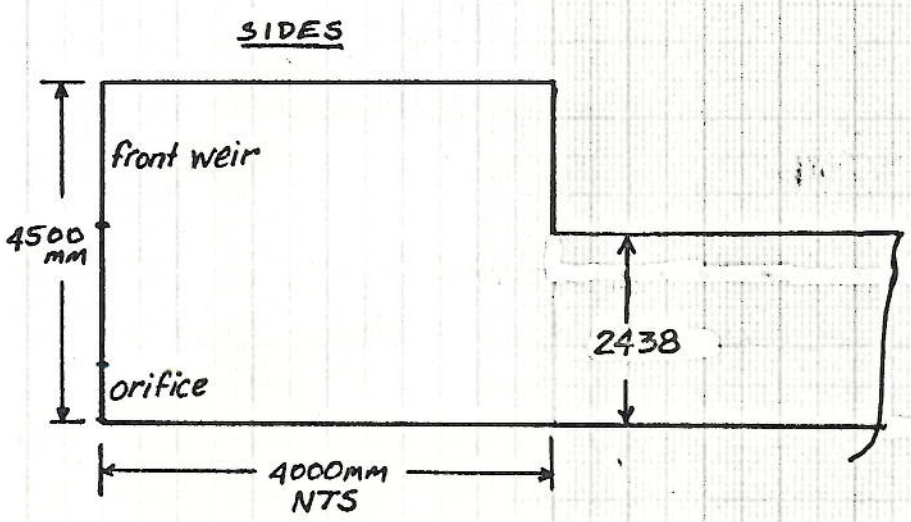
Phase 4 Stage 1 has an area of 24.3 ha that drains naturally to the East Branch of Fourteen Mile Creek.

Phase 3 Stage 2 has a total area of 18.9 ha of which 13.2 ha lies north of the Iroquois Ridge and drains to the East Branch of Fourteen Mile Creek. The remaining 5.7 ha south of the Ridge, on which a noise protection berm will be constructed, drains naturally into the Main Branch of Fourteen Mile Creek and has therefore not been modelled in this study.

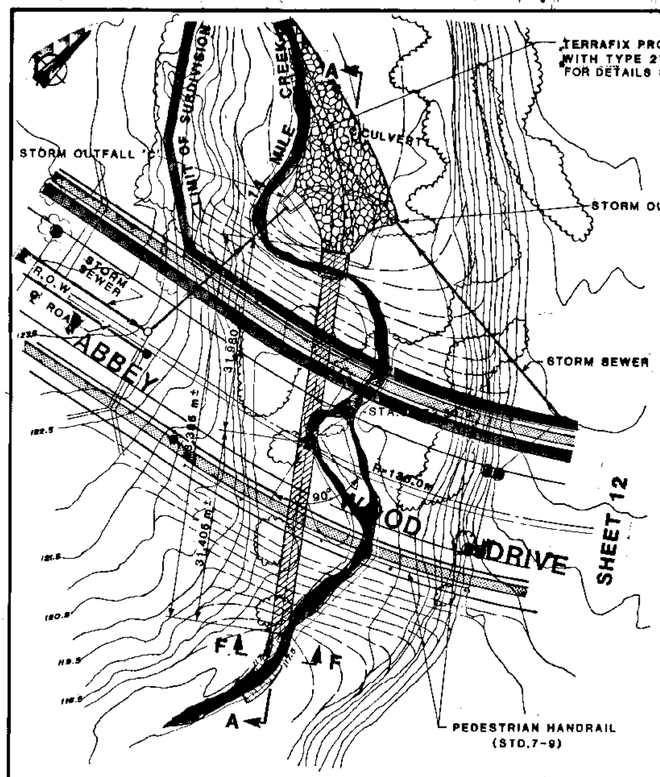
FIG. 7 PROPOSED INLET CONTROL BOX STRUCTURE



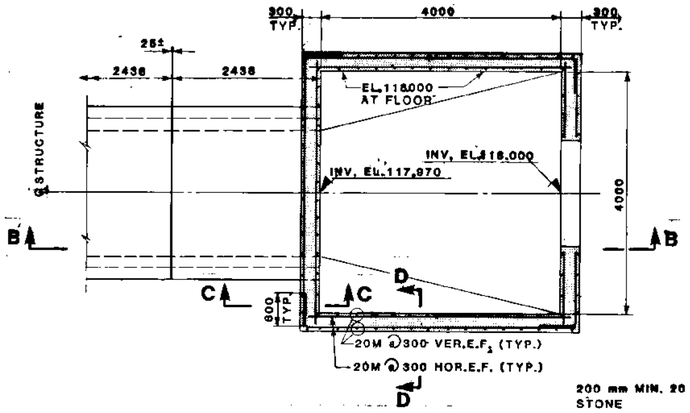




SD-3[illegible] 12
/D DR.
ABBE
CULV. & DETAIL



SITE PLAN
1:500



SECTIONAL PLAN
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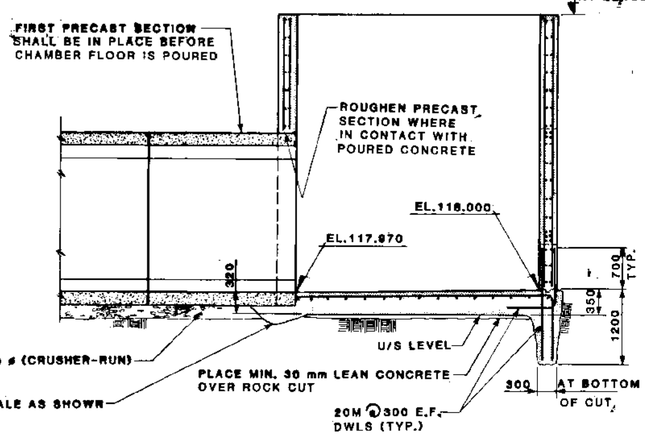

SECTION B-B
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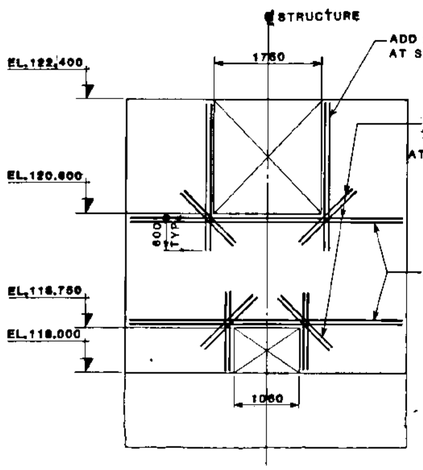

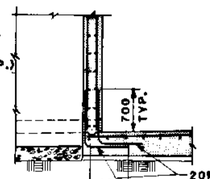

SECTION C-C
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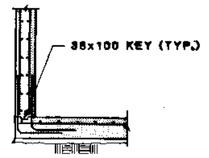

SECTION D-D
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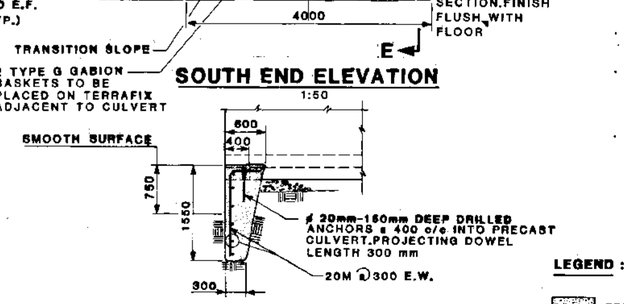
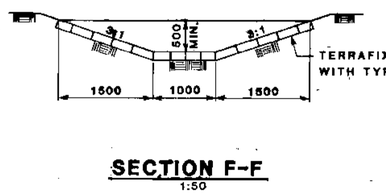


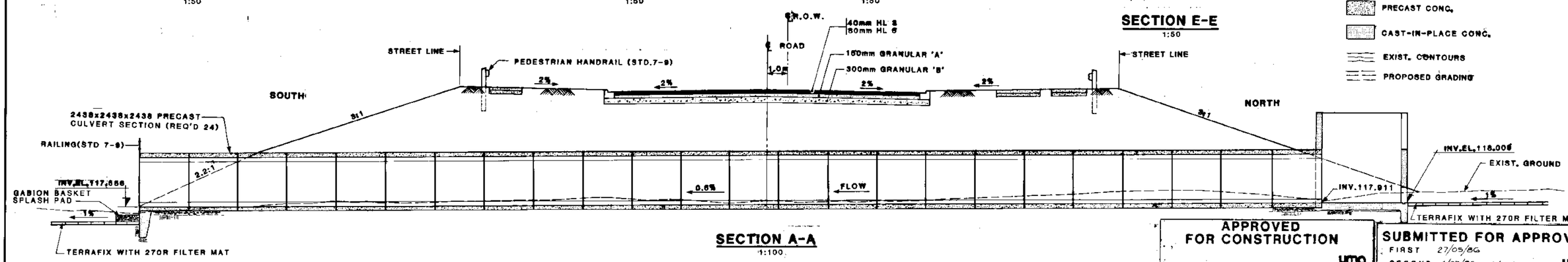
SOUTH END ELEVATION
1:50

SECTION E-E
1:50



SECTION F-F
1:50

NORTH END ELEVATION
1:50



SECTION A-A
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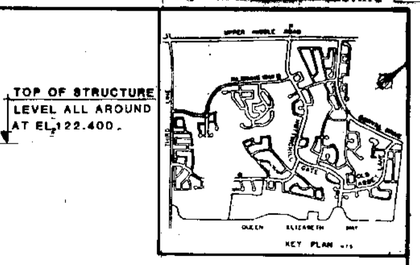


GENERAL NOTES:

Refer to Drawing 10 for grading details and to Drawing 12 for precise location of road and municipal services.

- Design loading: OHBD Truck.
- Reinforcing steel to be CSA G30.12-M1977, Grade 400.
- Concrete compressive strength at 28 days:

  Precast - 30 MPa
  Cast-in-Place - 25 MPa
- Concrete to have 6 ± 1% air entrainment.
- Clear cover to reinforcing steel:

  Precast - 45 ± 10 mm
  Cast-in-place - 50 ± 20 mm
- All exposed corners to be chamfered 38 x 38 mm.
- The base of excavation shall be inspected and approved by geotechnical engineer, prior to placing bedding or floor slab concrete.
- Place fill at both sides of precast culvert simultaneously.

LEGEND :

- PRECAST CONC.
- CAST-IN-PLACE CONC.
- EXIST. CONTOURS
- PROPOSED GRADING

APPROVED FOR CONSTRUCTION
UMA

SUBMITTED FOR APPROVAL
FIRST 27/05/86
SECOND 4/07/86 - 9/07/86
UMA

No.	Date	By	REVISIONS
2	14/01/87	J.J.	RECORD DRAWING (UNDERGROUND SERV. ONLY)
1	08/01/86	E.G.	REV. CREEK PROTECTION & PEDESTRAIN HANDRAIL

Design	K.M.P.	Checked	J.J.	Date	
Drawn	A.G.P.	Checked	J.R.S.	MAY 1986	
Scale	AS SHOWN				

GENSTAR CORPORATION
GLEN ABBEY COMMUNITY

APPROVALS

MUNICIPAL

APPROVED IN PRINCIPLE SUBJECT TO DETAIL CONSTRUCTION DESIGN CONFORMING TO TOWN OF OAKVILLE STANDARDS AND SPECIFICATIONS

Signed: [signature] 86-09-04
DIRECTOR OF PUBLIC WORKS

CONSULTANT
UMA Engineering Ltd.
Engineers & Planners

J. JACW
REGISTERED PROFESSIONAL ENGINEER
PROVINCE OF ONTARIO

MUNICIPALITY
TOWN OF OAKVILLE
THE REGIONAL MUNICIPALITY OF HALTON

TITLE
GENSTAR CORPORATION
GLEN ABBEY COMMUNITY
PHASE[illegible] STAGE[illegible]
ABBEY WOOD DRIVE
CULVERT & DETAILS

MUNICIPAL DRAWING Nº	REGIONAL DRAWING Nº
SD 328	DO
CONTRACT Nº	DWG. No.
2743-109	SHEET 22 OF 26

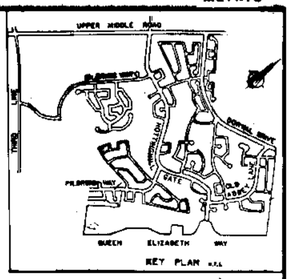
20M-400

DO 285

SD-327-12

SUBMITTED FOR APPROVAL
FIRST 26 MARCH 1986
SECOND JUNE 3, 1986 uma

APPROVED FOR CONSTRUCTION
uma



NOTES

ALL CHAINAGES ARE TO ℄ OF R.O.W.

ALL HYDRANTS TO BE LOCATED 1.5 m LEFT OF THE LOT ℄ UNLESS OTHERWISE SPECIFIED.

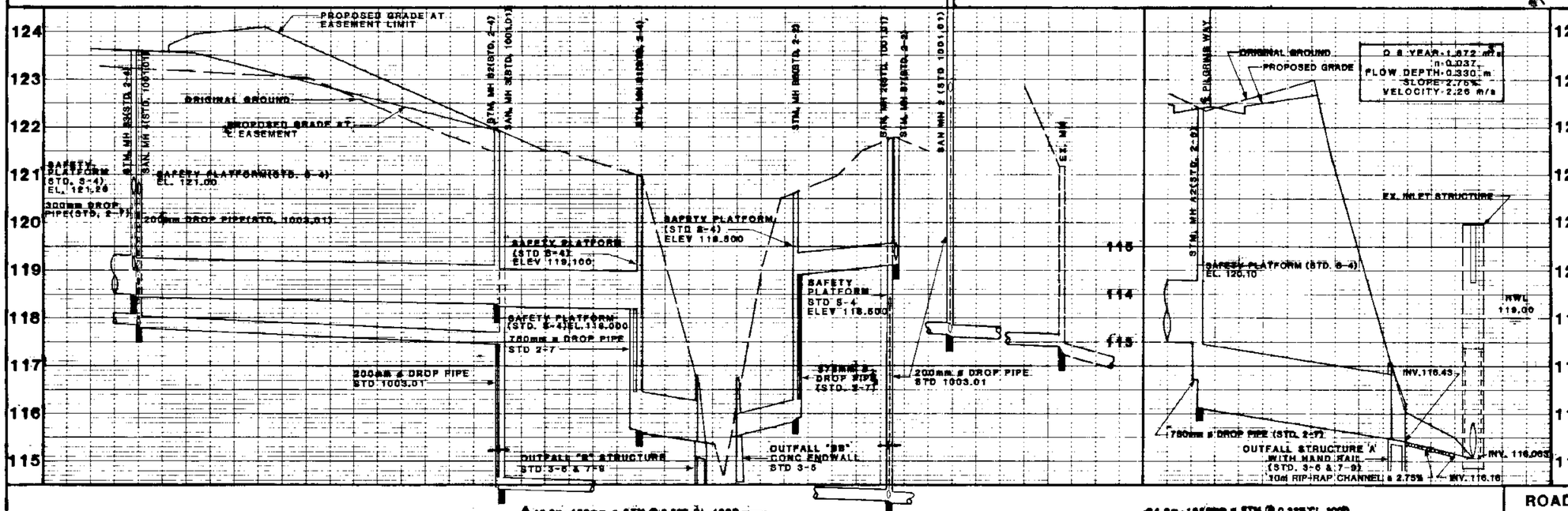
ALL STORM SEWERS SHALL BE CONCRETE PIPE.

ALL SANITARY SEWERS SHALL BE P.V.C. PIPE.

CATCHBASIN WITH INLET RESTRICTORS AT 0.028 C.M.S. ● ,AT 0.042 C.M.S. ◉

FOR SEWERS IN COMMON OR SEPARATE TRENCH REFER TO DETAILS ON SHEET 1.

LEGEND
- ○ STORM MANHOLE
- ● SANITARY MANHOLE
- ◎ MANHOLE BY OTHERS
- ■ CATCHBASIN
- ◆ HYDRANT
- ⊕ VALVE & BOX
- ⊢ PLUG
- INT INTERSECTION



ROAD GRADE			
STORM SEWER	10.0m-450mm ø STM @ 2.85% CL 100D; 15.6m-825mm ø STM @ 1.03% CL 100D; 22.0m-450mm ø STM @ 1.00% CL 100D; 84.0m-1350mm ø STM @ 0.35% CL 100D		
	825mm ø STM.	75.0m-825mm ø STM @ 0.20% CL 100D	28.2m-825mm ø STM @ 0.43% CL 1000	48.8m-1350mm ø STM. @ 1.55% CL 100D
	W120.674 E116.467	NE116.240	NW115.560 NE115.640	NE116.860 (NE.DROP 115.886) NW116.130	N117.100 S116.480
	SW116.625	SW116.820	SW116.420 SW116.610	SW116.100	SW116.480
SANITARY SEWER	200mm ø SAN.	78.2m-200mm ø SAN. @ 0.61% SDR 35	60.6m-250mm ø SAN. @ 0.29% SDR 35	39.0m-250mm ø SAN. @ 0.46% SDR 35
	W120.611 E117.822	NE113.397	(SW.DROP 115.655) NW118.200 (NW. DROP 113.240)	NW112.900 Ex. 200mm ø SAN.
	SW117.871	SW117.461	SW.119.160 SE.119.090	S112.729 EX.
CHAINAGE	SEPARATE TRENCH			

No	Date	By	REVISIONS
3	25/08/86	J.J.	RECORD DRAWING
2	16/07/86	P.T.	STM. SEWER FROM MH 86 TO OUTFALL 'BB'
1	20/06/86	P.T.	SAN. SEWER FROM MH 3 TO EX. MH

Design	P.T.	Checked	J.J.	Date MARCH 1986
Drawn	L.C.	Checked	J.R.S.	

Scale 0 5 10 15 20 METRES HOR. 1:500 VER. 1:50

REFERENCES

FIELD NOTES

APPROVALS

Municipal
APPROVED IN PRINCIPLE SUBJECT TO DETAIL CONSTRUCTION DESIGN CONFORMING TO TOWN OF OAKVILLE STANDARDS AND SPECIFICATIONS
Signed _____ Date 86-06-16
DIRECTOR OF PUBLIC WORKS

Regional
DESIGN OF SANITARY AND WATER SERVICES APPROVED SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO HALTON REGION STANDARDS AND SPECIFICATIONS AND LOCATION APPROVAL FROM AREA MUNICIPALITY
Signed _____ Date 16 JUNE 86
DIRECTOR OF PUBLIC WORKS HALTON REGION

STAMP
REGISTERED PROFESSIONAL ENGINEER J. JACIW PROVINCE OF ONTARIO

CONSULTANT

MUNICIPALITY
TOWN OF OAKVILLE
THE REGIONAL MUNICIPALITY OF HALTON

TITLE
GENSTAR CORPORATION
GLEN ABBEY COMMUNITY
PHASE 3 STAGE 4
STORM OUTFALLS

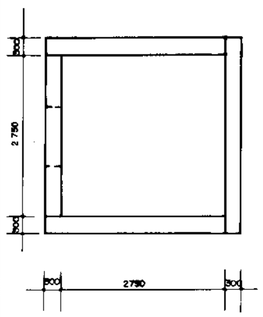
MUNICIPAL DRAWING NO SD-327
REGIONAL DRAWING NO DO
CONTRACT NO 2743-107
SHEET 12 OF 18

20M-380

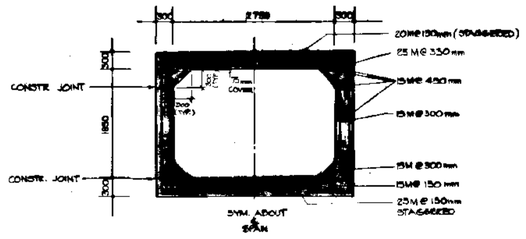
DO-280

METRIC

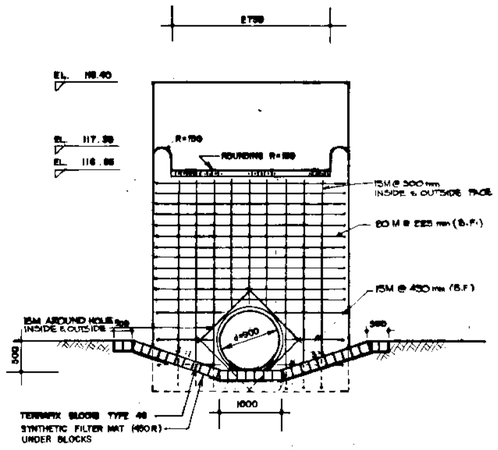
SD-1
D-6



TOP VIEW OF
INLET BOX



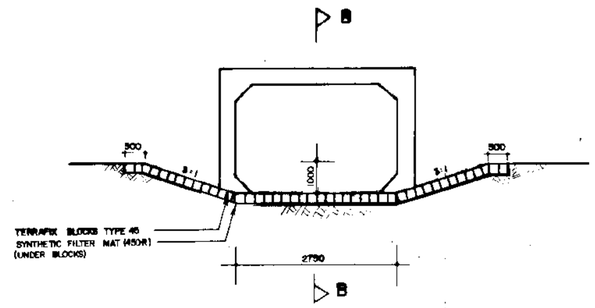
SECTION A-A



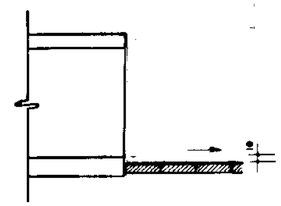
UPSTREAM END VIEW

GENERAL NOTES:

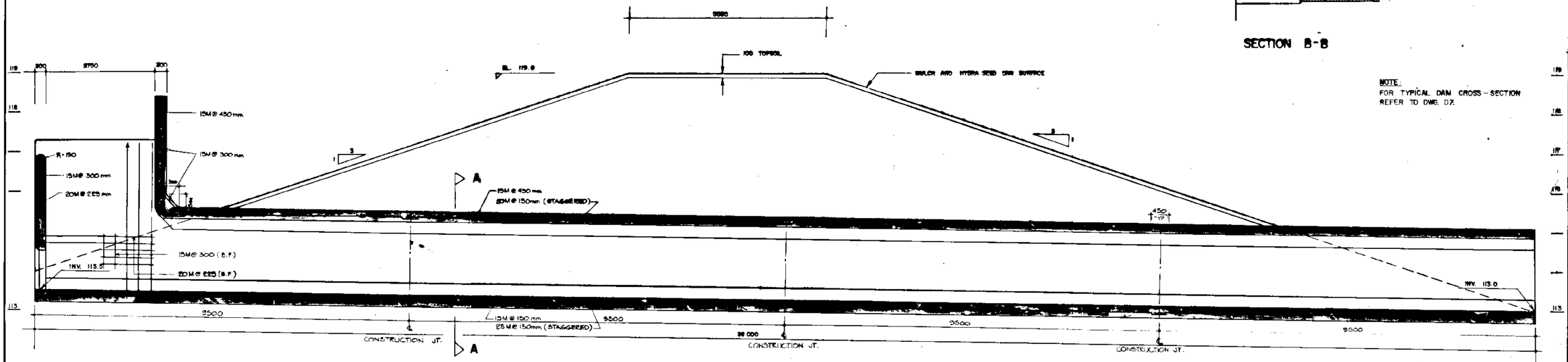
1. CLASS OF CONCRETE 30 MPA
2. CLEAR COVER TO REINFORCING STEEL 75mm EXCEPT AS NOTED
3. FILL SHALL BE PLACED ON BOTH SIDES OF CULVERT SIMULTANEOUSLY
4. REINFORCING STEEL GRADE 400



DOWN STREAM END VIEW



SECTION B-B



CROSS SECTION

NOTE:
FOR TYPICAL DAM CROSS-SECTION
REFER TO DWG. D7.

STRUCTURAL DESIGN OF CULVERTS BY UNDERWOOD McLELLAN LTD. 'URMA'
HYDRAULICS DESIGN AND DAM DESIGN BY ANDREW BRODIE ASSOCIATES INC.

No.	Date	By	REVISIONS
Design	M.G.	Checked	M.G.
Drawn		Checked	O.A.
Scale 1:50			REFERENCES

Date NOV. 1979

M-244

GENSTAR LIMITED
GLEN ABBEY COMMUNITY

APPROVALS

Municipal

APPROVED IN PRINCIPLE SUBJECT TO DETAIL CONSTRUCTION DESIGN CONFORMING TO TOWN OF OAKVILLE STANDARDS AND SPECIFICATIONS

Signed _____ Date _____
DIRECTOR OF PUBLIC WORKS

FIELD NOTES

STAMP

Regional

DESIGN OF SANITARY AND WATER SERVICES APPROVED SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO HALTON REGION STANDARDS AND SPECIFICATIONS AND LOCATION APPROVAL FROM AREA MUNICIPALITY

Signed: _____ Date: _____
DIRECTOR OF PUBLIC WORKS
HALTON REGION

FIELD NOTES

STAMP

CONSULTANT
Underwood McLellan (1977) Ltd.
Consulting Engineers & Planners

MUNICIPALITY
TOWN OF OAKVILLE
THE REGIONAL MUNICIPALITY OF HALTON

TITLE
GLEN OAKS CREEK WEST
CROSS SECTION OF DAM AND DRAINAGE STRUCTURE

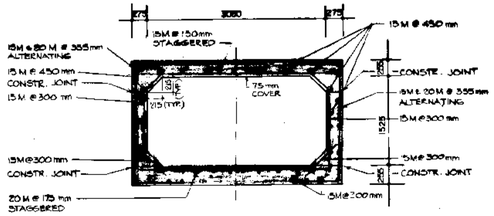
MUNICIPAL DRAWING Nº	REGIONAL DRAWING Nº
SD - 208 - 1 - 1	DO - 0121
CONTRACT Nº 2743 - 013	DWG. Nº D-6
	SHEET 2 OF 2

71 Box 1

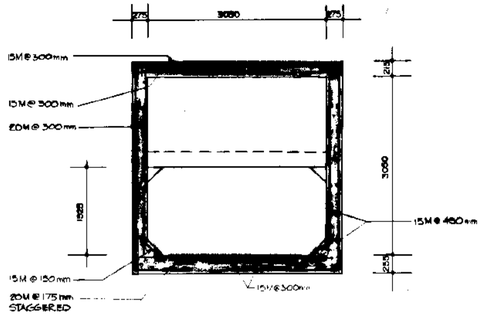
METRIC

SD-25 D-3

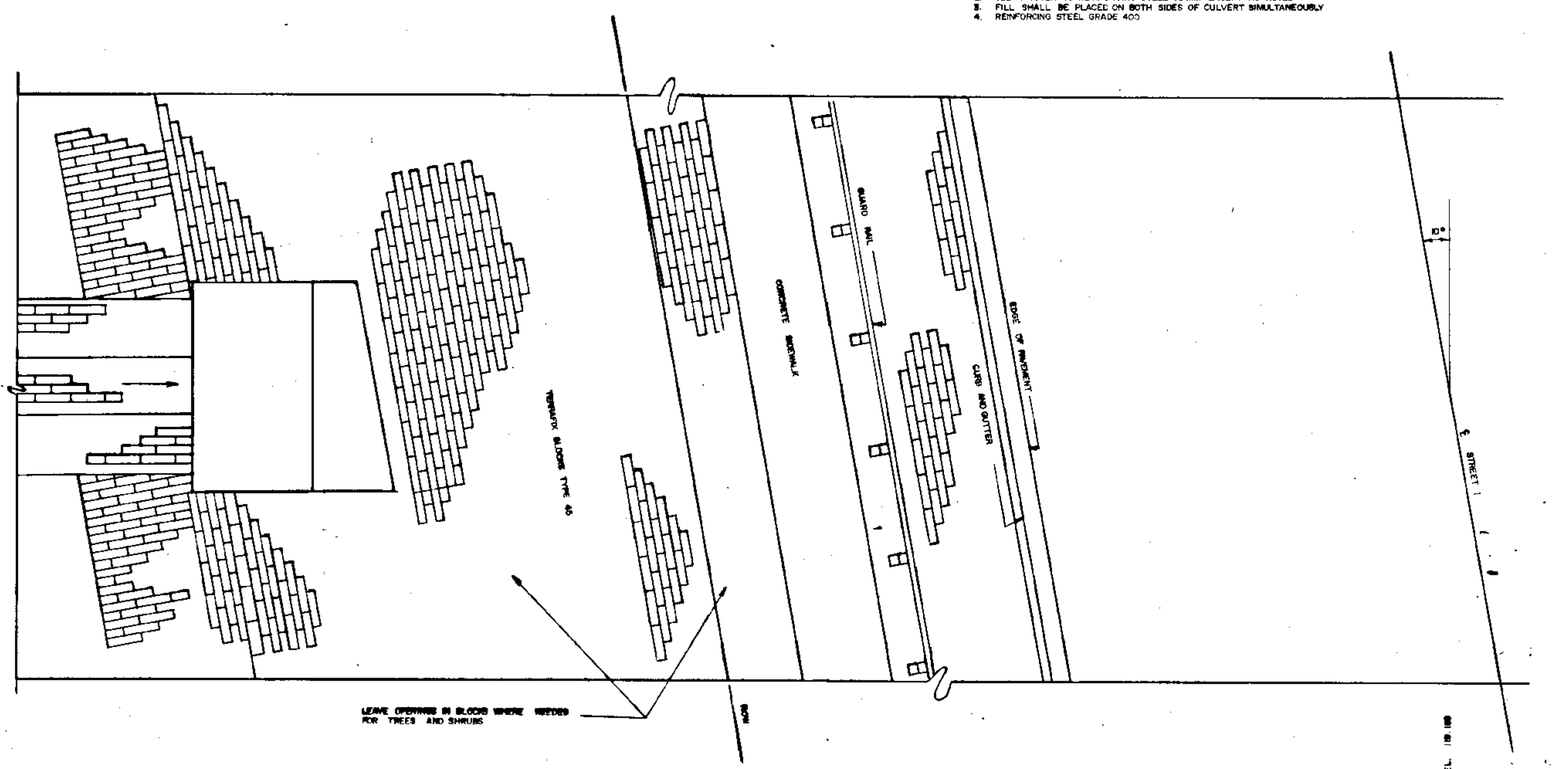
GENERAL NOTES:
1. CLASS OF CONCRETE 30MPA
2. CLEAR COVER TO REINFORCING STEEL 75 mm EXCEPT AS NOTED
3. FILL SHALL BE PLACED ON BOTH SIDES OF CULVERT SIMULTANEOUSLY
4. REINFORCING STEEL GRADE 400



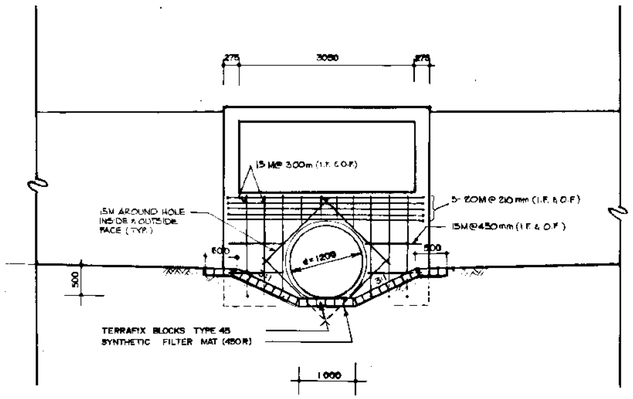
SECTION B-B



SECTION A-A

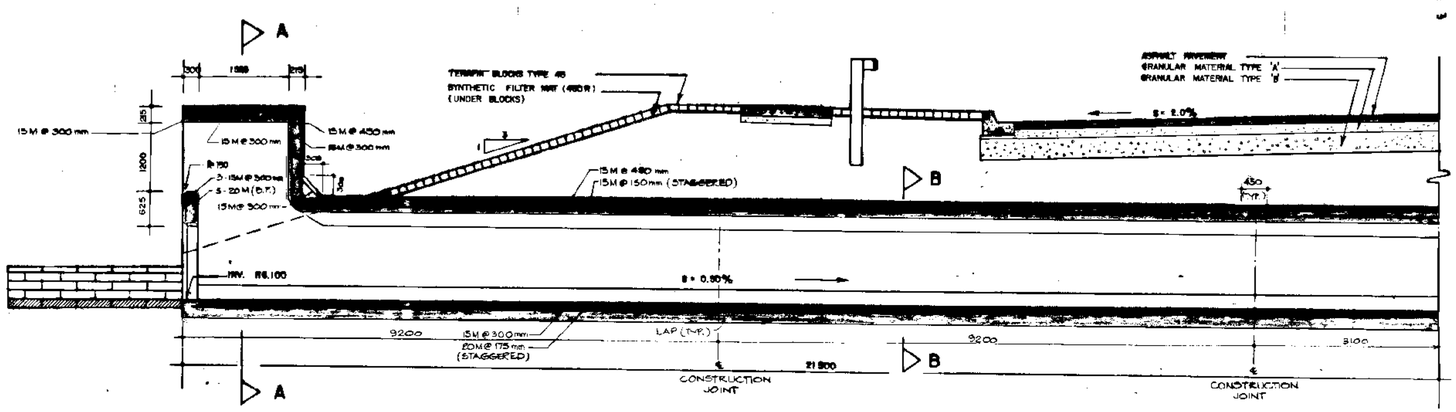


PLAN



END VIEW

NOTE:
FOR TYPICAL DAM CROSS - SECTION
REFER TO DWG. D7.



CROSS SECTION

STRUCTURAL DESIGN OF CULVERTS BY UNDERWOOD McLELLAN LTD. 'UMA'
HYDRAULICS DESIGN AND DAM DESIGN BY ANDREW BRODIE ASSOCIATES INC.

No.	Date	By	REVISIONS
Design	M.G.	Checked	M.G.
Drawn	T.B.	Checked	O.A.
Scale	1:50		

Date NOV 1979

REFERENCES

GENSTAR LIMITED
GLEN ABBEY COMMUNITY

APPROVALS

Municipal

APPROVED IN PRINCIPLE SUBJECT TO DETAIL CONSTRUCTION DESIGN CONFORMING TO TOWN OF OAKVILLE STANDARDS AND SPECIFICATIONS

Signed _____ DIRECTOR OF PUBLIC WORKS Date 30/05/80

FIELD NOTES

STAMP

Regional

DESIGN OF SANITARY AND WATER SERVICES APPROVED SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO HALTON REGION STANDARDS AND SPECIFICATIONS AND LOCATION APPROVAL FROM AREA MUNICIPALITY

Signed _____ DIRECTOR OF PUBLIC WORKS HALTON REGION Date _____

FIELD NOTES

STAMP

CONSULTANT
Underwood McLellan (1977) Ltd.
Consulting Engineers & Planners

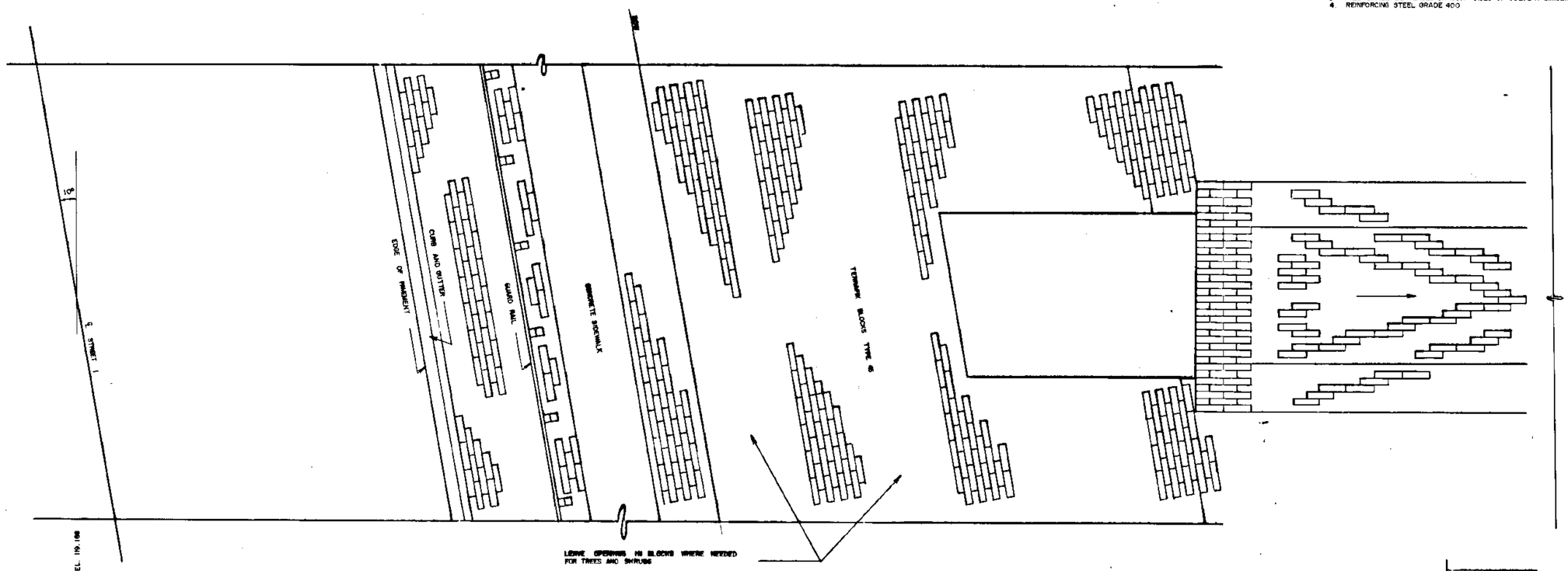
MUNICIPALITY
TOWN OF OAKVILLE
THE REGIONAL MUNICIPALITY OF HALTON

TITLE
GLEN OAKS CREEK EAST
DRAINAGE STRUCTURE
UPSTREAM SECTION

MUNICIPAL DRAWING Nº	REGIONAL DRAWING Nº
SD - 208 - 1 - 1	DO - 0121
CONTRACT Nº 2743 - 013	DWG. Nº D-3
	SHEET 2 OF 3

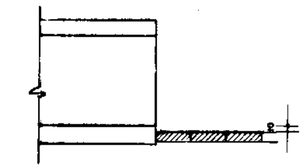
M-244

GENERAL NOTES
1. CLASS OF CONCRETE 30MPa
2. CLEAR COVER TO REINFORCING STEEL 75 mm EXCEPT AS NOTED
3. FILL SHALL BE PLACED ON BOTH SIDES OF CULVERT SIMULTANEOUSLY
4. REINFORCING STEEL GRADE 400

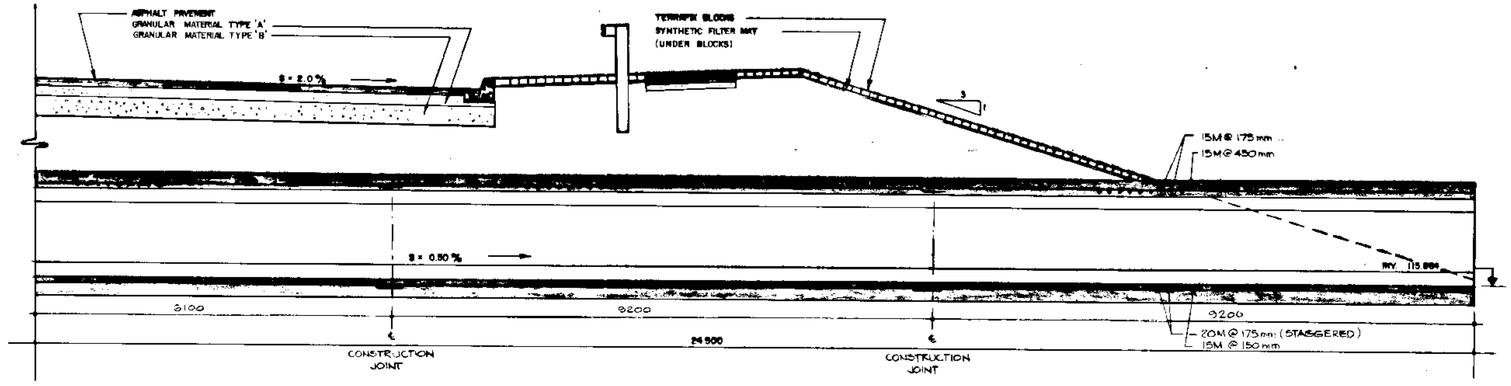


PLAN

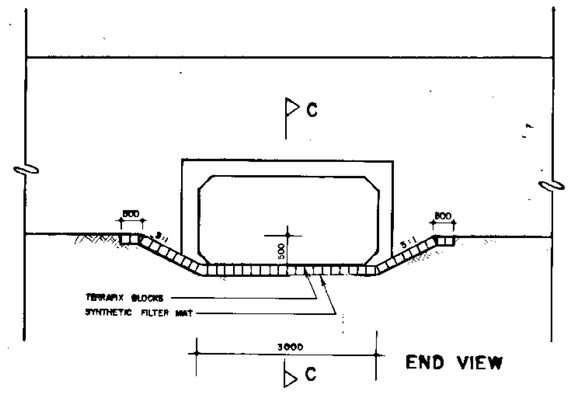
NOTE:
FOR TYPICAL DAM CROSS - SECTION
REFER TO DWG. D7.



SECTION C - C



CROSS SECTION



END VIEW

STRUCTURAL DESIGN OF CULVERTS BY UNDERWOOD McLELLAN LTD. 'UMA'
HYDRAULICS DESIGN AND DAM DESIGN BY ANDREW BRODIE ASSOCIATES INC.

NO	Date	By	REVISIONS
Design	M.G.	Checked	M.G.
Drawn		Checked	O.A.
Scale 1:500			Date NOV. 1979
			REFERENCES

GENSTAR LIMITED
GLEN ABBEY COMMUNITY

APPROVALS

Municipal

APPROVED IN PRINCIPLE SUBJECT TO DETAIL CONSTRUCTION DESIGN CONFORMING TO TOWN OF OAKVILLE STANDARDS AND SPECIFICATIONS

Signed: _____ Date: 80/05/20
DIRECTOR OF PUBLIC WORKS

FIELD NOTES

STAMP

Regional

DESIGN OF SANITARY AND WATER SERVICES APPROVED SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO HALTON REGION STANDARDS AND SPECIFICATIONS AND LOCATION APPROVAL FROM AREA MUNICIPALITY

Signed: _____ Date: _____
DIRECTOR OF PUBLIC WORKS
HALTON REGION

FIELD NOTES

STAMP

CONSULTANT
Underwood McLellan (1977) Ltd.
Consulting Engineers & Planners

MUNICIPALITY
TOWN OF OAKVILLE
THE REGIONAL MUNICIPALITY OF HALTON

TITLE
GLEN OAKS CREEK EAST
DRAINAGE STRUCTURE
DOWNSTREAM SECTION

MUNICIPAL DRAWING Nº	REGIONAL DRAWING Nº
SD - 208-1-1	DO - 0121
CONTRACT Nº 2743 - 013	DWG. Nº D-4
	SHEET 3 OF 3

M-244

SD-208
D-4

GOVERNING METRIC STANDARDS

CAN 5-M77 A 23.1; A 23.2; A 23.3

MATERIALS:

1. CEMENT FOR ALL CONCRETE SHALL BE TYPE 10 CAN 3-A5-M77
2. ALL REINFORCED CONCRETE SHALL BE 30 MPa AT 28 DAYS
3. ALL REINFORCING STEEL SHALL BE GRADE 400 TO 650 12M - 1977

NOTES:

REINFORCING BARS SHALL HAVE 75 MM COVER EXCEPT AS NOTED

ALL EXPOSED EDGES SHALL HAVE 25 MM x 25 MM CHAMFER

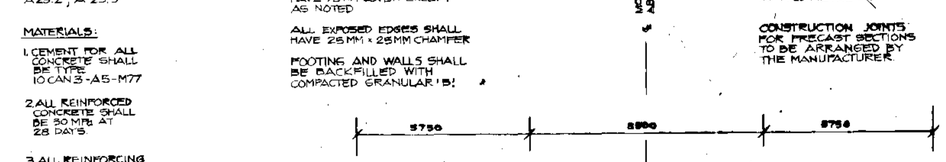
FOOTING AND WALLS SHALL BE BACKFILLED WITH COMPACTED GRANULAR 'B'

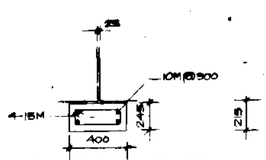
NOTES:

ALL DIMENSIONS ARE IN MILLIMETRES

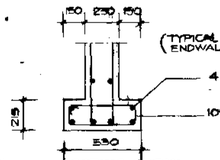
CONSTRUCTION JOINTS FOR PRECAST SECTIONS TO BE ARRANGED BY THE MANUFACTURER

MONTROSE ABBEY DRIVE

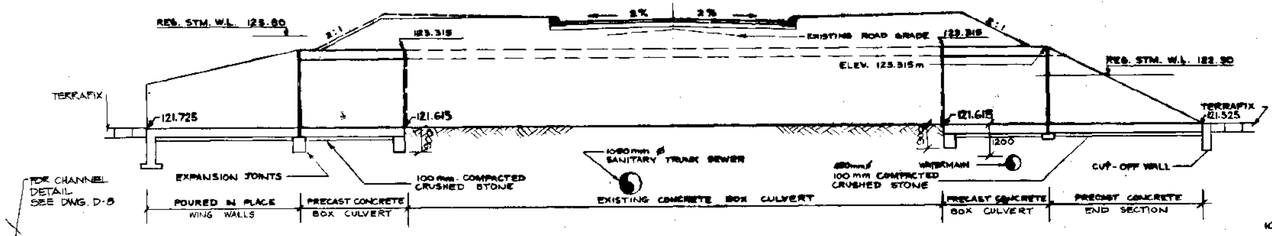




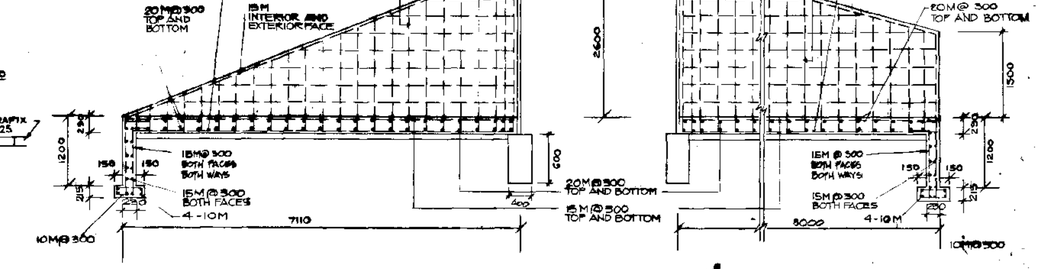
EXPANSION JOINT DETAIL
SCALE 1:20



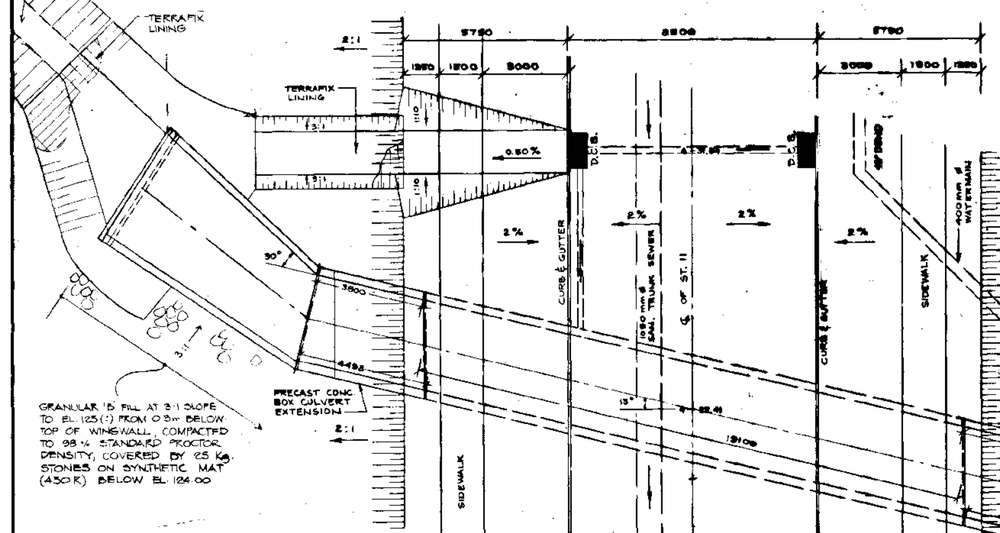
FOOTING DETAIL
SCALE 1:20



ROAD CROSS - SECTION (PERPENDICULAR TO ROAD ℄) N.T.S.

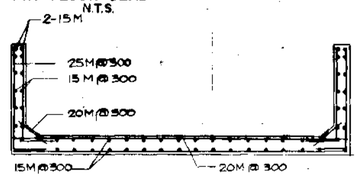


ENDWALL DETAIL N.T.S.

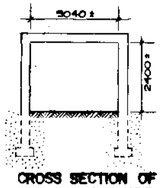


PLAN (N.T.S.)

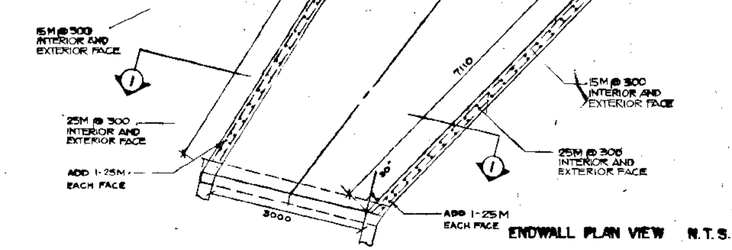
REINFORCEMENT DETAIL FOR CAST-IN-PLACE WINGWALLS AND FLOOR SLAB N.T.S.



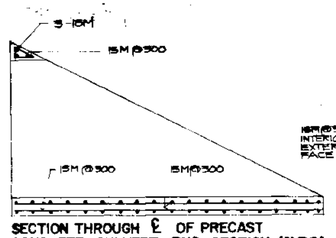
SECTION 1-1



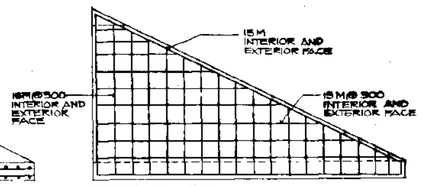
CROSS SECTION OF EXISTING CULVERT
SCALE 1:20



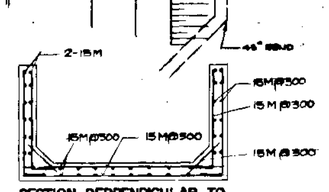
ENDWALL PLAN VIEW N.T.S.



SECTION THROUGH ℄ OF PRECAST CONCRETE CULVERT END SECTION (N.T.S.)



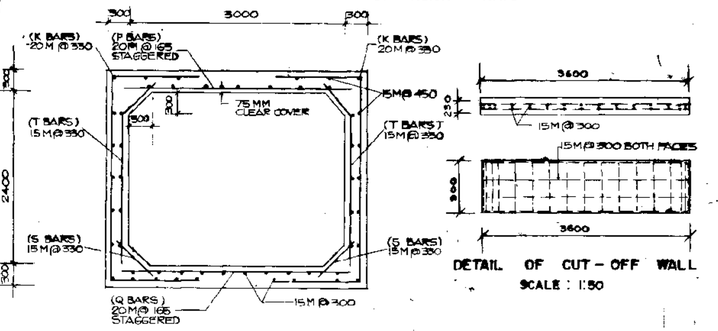
DETAIL OF TYPICAL BOTH SIDES (N.T.S)



SECTION PERPENDICULAR TO ℄ OF PRECAST CONCRETE CULVERT END SECTION (N.T.S)

PRECAST CONCRETE BOX CULVERT EXTENSION N.T.S.

P BARS - STRAIGHT; 2.50 M LONG
Q BARS - STRAIGHT; 2.70 M LONG
K BARS - 120 2.85 M 180
S BARS - STRAIGHT; 0.70 M LONG
T BARS 45° 2.10 M



PLAN

ELEVATION

DETAIL OF CUT-OFF WALL
SCALE: 1:50

Nº	Date	By	REVISIONS

Design	O.A.	Checked	J.J.	Date	DECEMBER 1979.
Drawn	P.T.	Checked	T.B.		
Scale				REFERENCES	

GENSTAR LIMITED

GLEN ABBEY COMMUNITY

APPROVALS

Municipal

APPROVED IN PRINCIPLE SUBJECT TO DETAIL CONSTRUCTION DESIGN CONFORMING TO TOWN OF OAKVILLE STANDARDS AND SPECIFICATIONS

Signed _____ Date 80/05/20

DIRECTOR OF PUBLIC WORKS

FIELD NOTES

STAMP

Regional

DESIGN OF SANITARY AND WATER SERVICES APPROVED SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO HALTON REGION STANDARDS AND SPECIFICATIONS AND LOCATION APPROVAL FROM AREA MUNICIPALITY

Signed _____ Date _____

DIRECTOR OF PUBLIC WORKS HALTON REGION

FIELD NOTES

STAMP

CONSULTANT

Underwood McLellan (1977) Ltd.

Consulting Engineers & Planners

MUNICIPALITY

TOWN OF OAKVILLE

THE REGIONAL MUNICIPALITY OF HALTON

TITLE

CONCRETE BOX CULVERT DETAILS

MONTROSE ABBEY DRIVE STA. 4 + 22

MUNICIPAL DRAWING Nº	REGIONAL DRAWING Nº
SD - 208 - 1 - 1	DO - 0121
CONTRACT Nº 2743 - 013	DWG. Nº D - 1
	SHEET 21 OF

M-244

SD-208-1-1 (D.)

Appendix C

Field Notes & Photos

DESIGN MEMORANDUM (METRIC)

amec foster wheeler

CLIENT Town of Oakville

PROJECT 14 Mile / McCraney

SUBJECT In-line Structures - Field Measurements

PROJECT NO.	PAGE
TP111031	1
PREPARED BY	FILE NO.
MB	120
CHECKED BY	DATE
	May 2/17

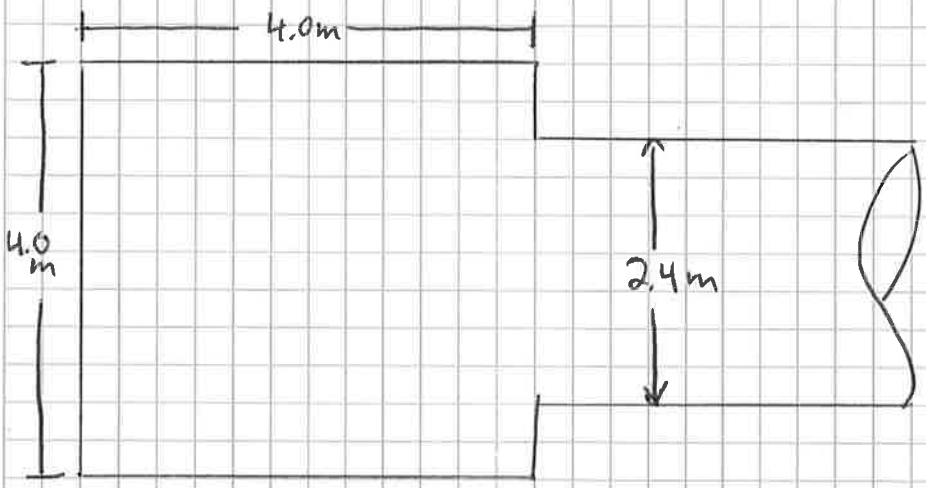
Note: This form must be used for project calculations and original to be filed in project files.

Abbeywood Drive

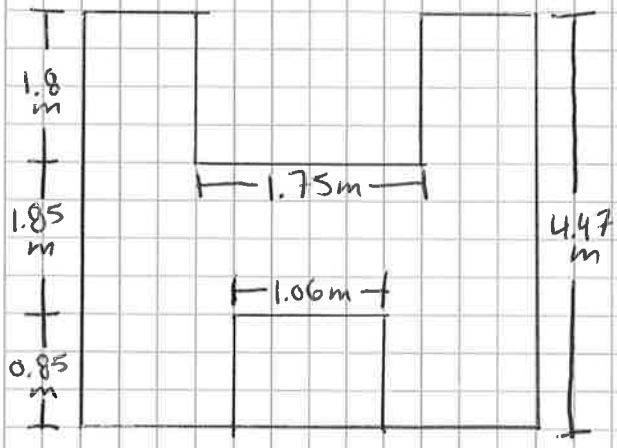
Wall thickness = 0.3m

* All dimensions are inside

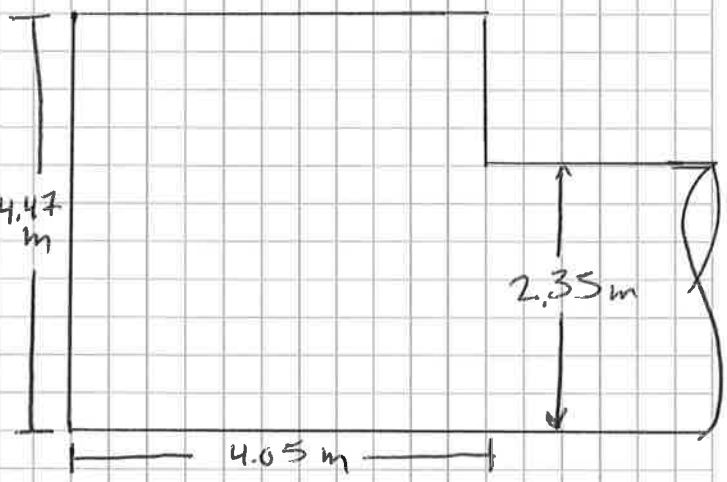
TOP



FRONT



SIDES



Abbeywood Drive Structure

1. Front View of First and Second Stage Controls

2. Front View of First & Second Stage Controls

3. View of Third Stage Control (Open Top)

4. Inside View

DESIGN MEMORANDUM (METRIC)

amec foster wheeler

CLIENT Town of Oakville

PROJECT 14 Mile / McCraney

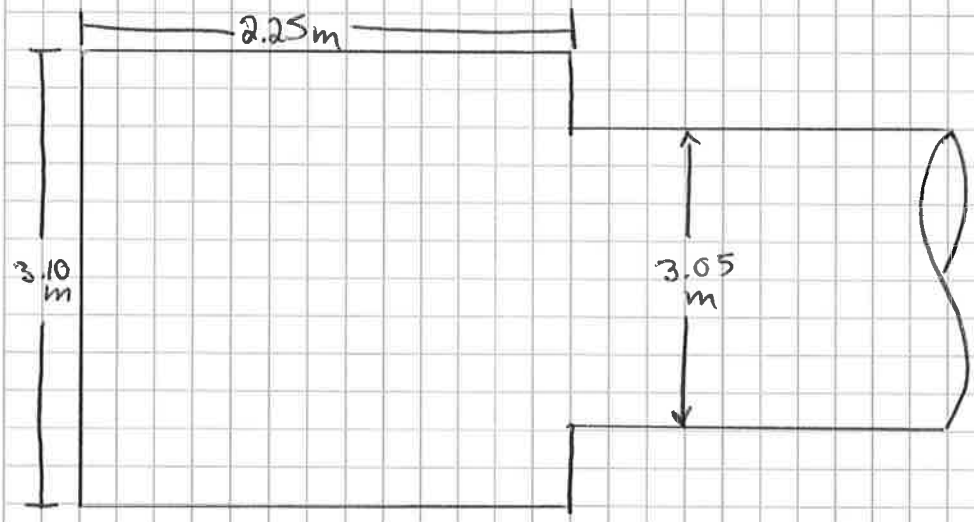
SUBJECT In-line Structures - Field Measurements

PROJECT NO.	PAGE
TP11163	2
PREPARED BY	FILE NO.
MB	120
CHECKED BY	DATE
	May 2/17

Note: This form must be used for project calculations and original to be filed in project files.

Pilgrim's Way

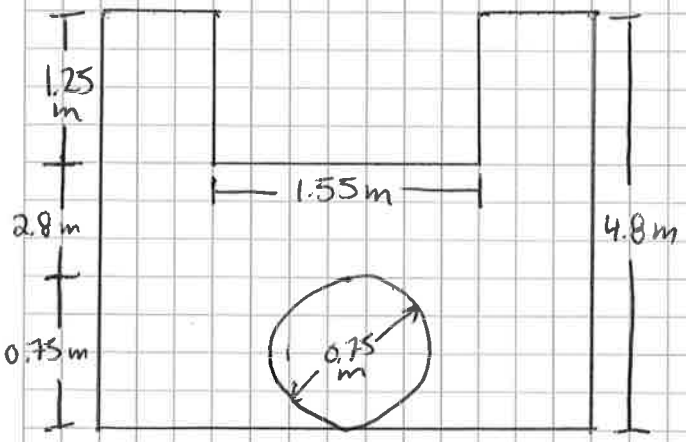
TOP



Wall Thickness = 0.3m

* All dimensions are inside

FRONT



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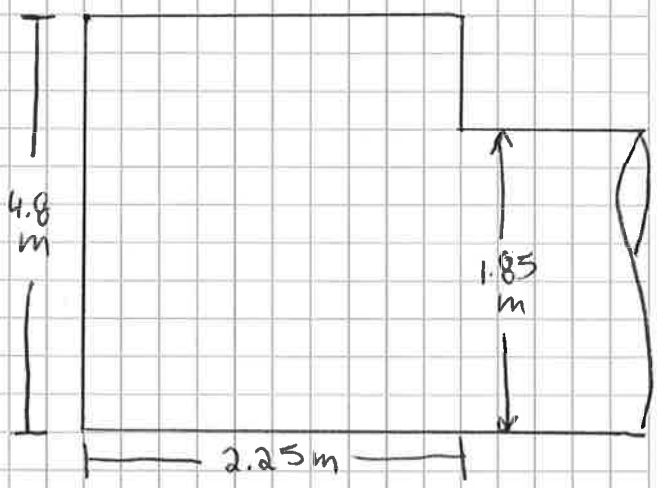


Pilgrims Way Structure

1. Front View of First, Second and Third Stage (Open Top) Controls

2. Front View of First Stage Control

3. Inside View

DESIGN MEMORANDUM (METRIC)

amec foster wheeler

CLIENT Town of Oakville

PROJECT 14 Mile / McCraney

SUBJECT In-line Structures - Field Measurements

PROJECT NO.	PAGE
TP11031	3
PREPARED BY	FILE NO.
MB	120
CHECKED BY	DATE
	May 2/17

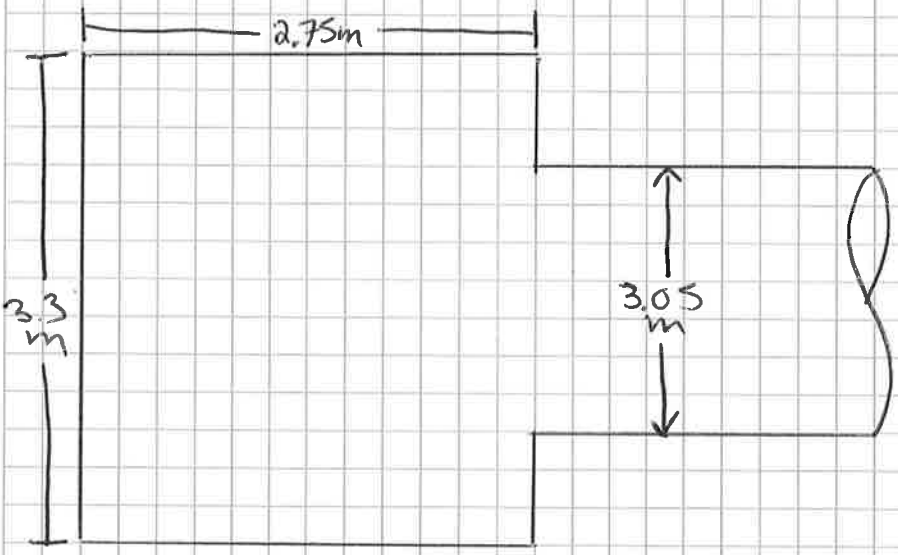
Note: This form must be used for project calculations and original to be filed in project files.

Nottinghill Gate

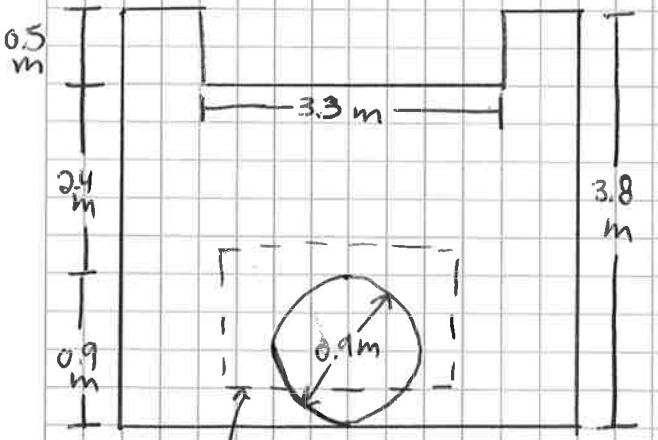
Wall thickness = 0.3m

* All dimensions are inside

TOP

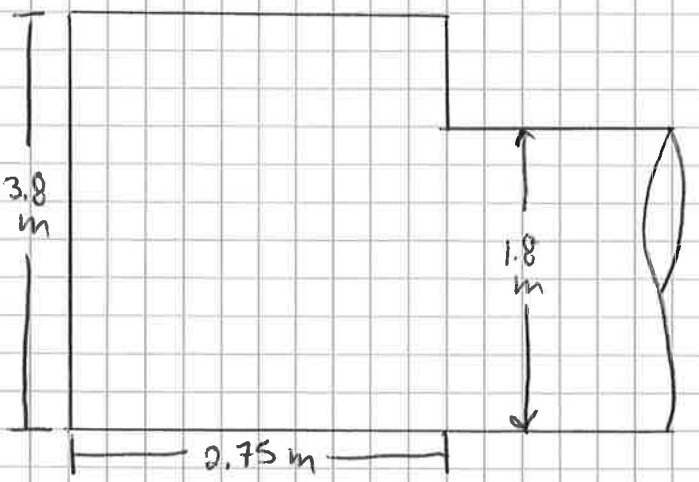


FRONT



Steel plate covering approx. $\frac{2}{3}$ of 0.9m opening. Could not measure

SIDES



Nottinghill Gate Structure

1. Front View of First, Second and Third Stage (Open Top) Controls

2. Front View of First Stage Control

3. Inside View of Orifice Plate (Covering approx. 2/3 of first stage control)

DESIGN MEMORANDUM (METRIC)

amec foster wheeler

CLIENT Town of Oakville

PROJECT 14 Mile / McCraney

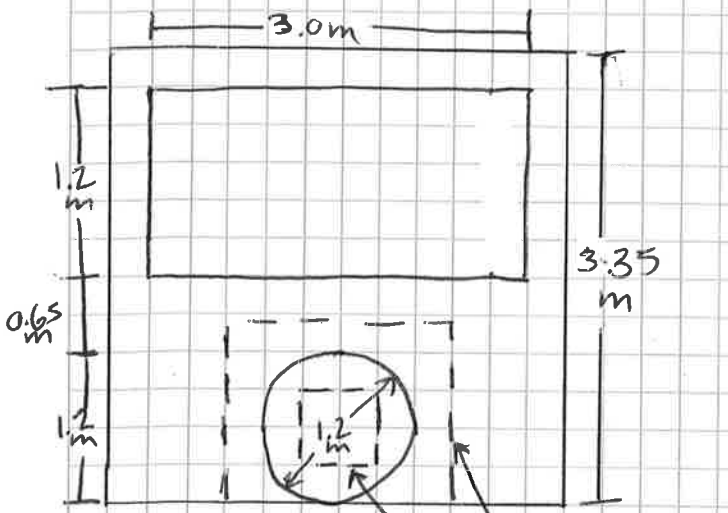
SUBJECT In-Line Structures - Field Measurements

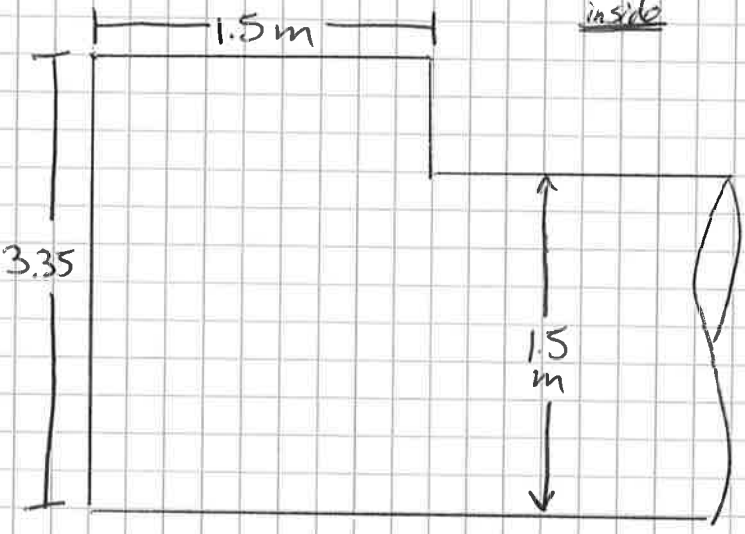
Note: This form must be used for project calculations and original to be filed in project files.

PROJECT NO.	PAGE
TP11603	4
PREPARED BY	FILE NO.
MB	~~EE~~ 120
CHECKED BY	DATE
	May 2/17

Old Abbey Lane

FRONT

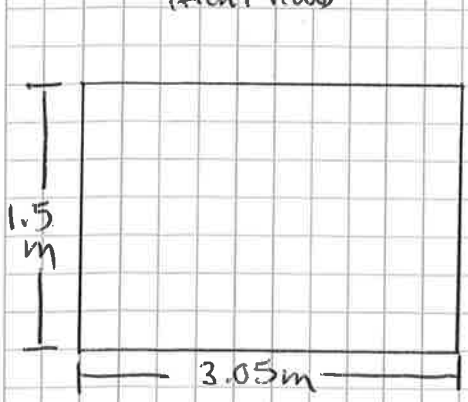


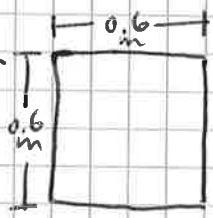


Wall Thickness = 0.3m

☆ All dimensions are inside

CULVERT
(Front View)





Steel Plate with square opening attached to inside of structure. Dimensions are approximate - could not measure.

Old Abbey Lane Structure

1. Front View of First/Second Stage Controls and Closed Top

2. Front View of First Stage Control with Square Orifice Plate Attached (approx. dimensions of 0.6 m x 0.6 m)

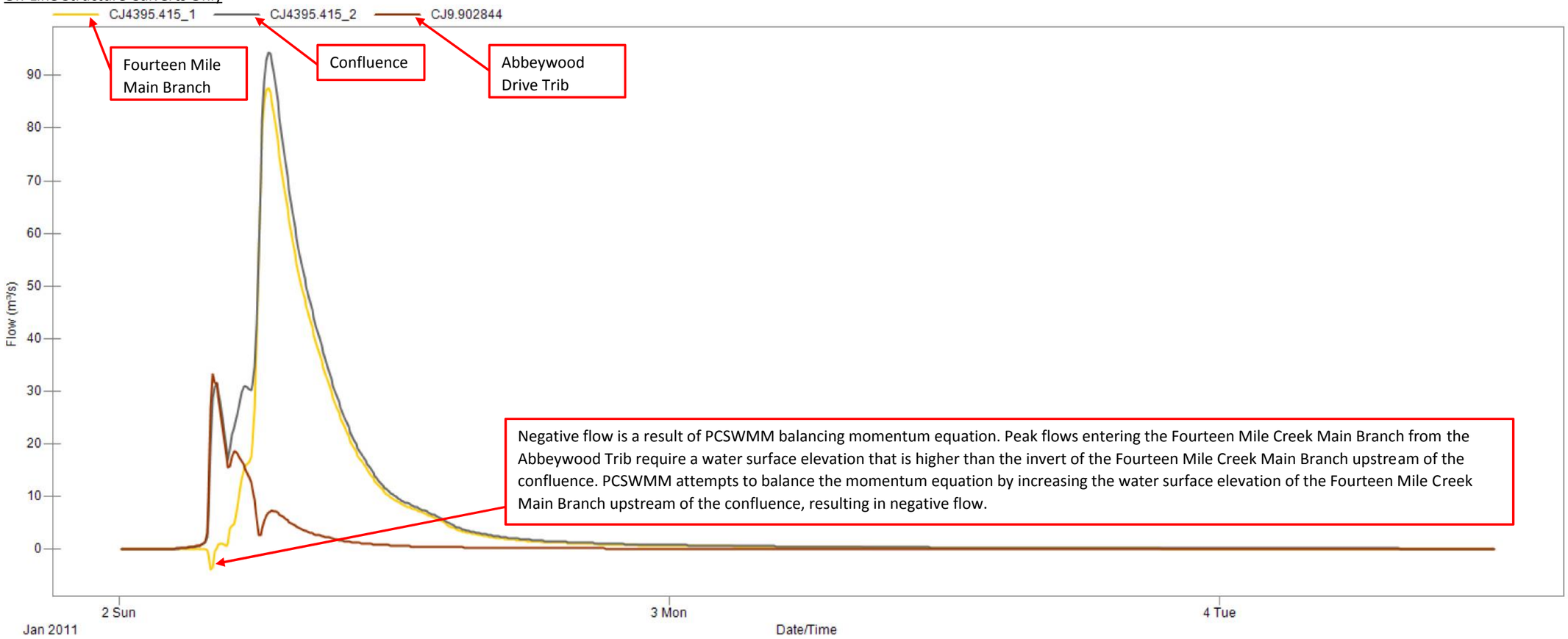
3. Inside View of First Stage Control with Square Orifice Plate Attached

Appendix D

Hydrographs

Confluence of Abbeywood Drive Tributary & Fourteen Mile Creek Main Branch – 100 Year

On-Line Structure Culverts Only



Data | Objectives | Error | Storage | Patterns | Edit | Derive | Audit | Events | Scatter | Duration

Objective functions for Flow (m³/s)

Options ?

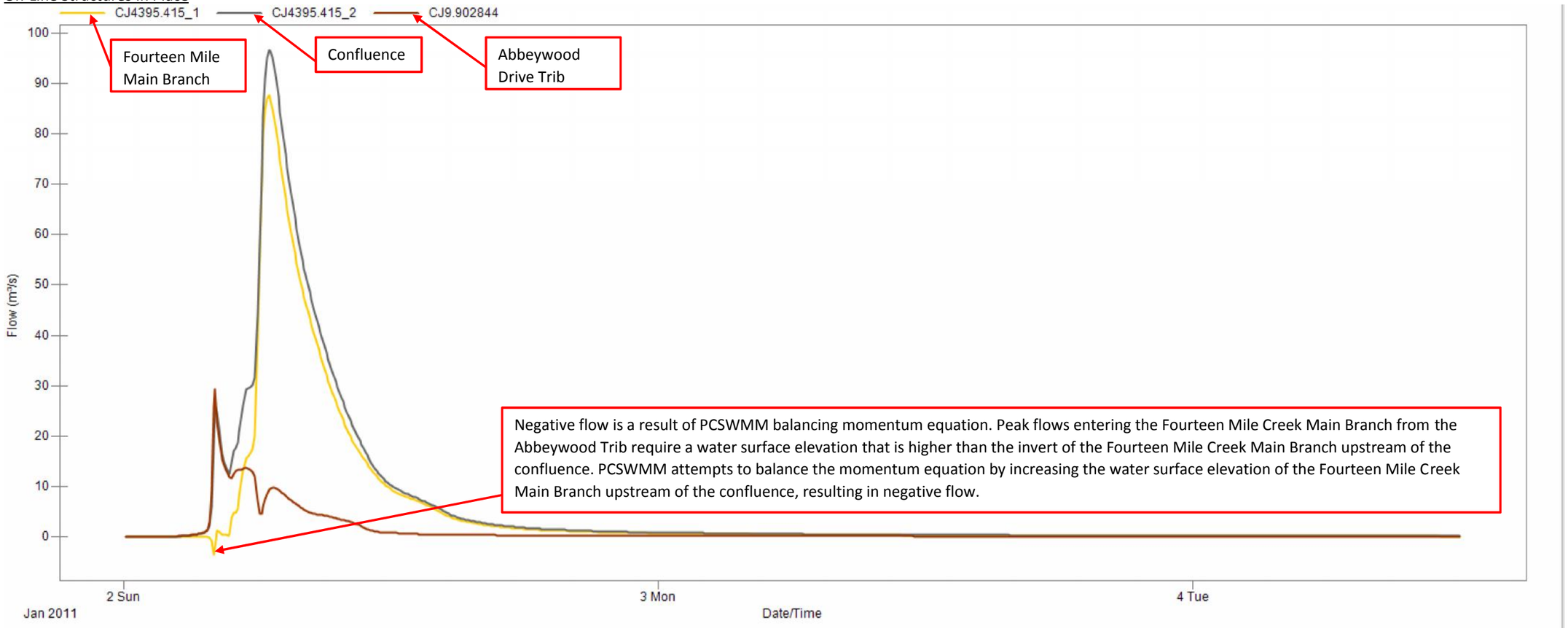
From 1/1/2011 9:05:15 PM to 1/4/2011 2:59:45 PM (65.91 hours)

	CJ4395.415_1	CJ4395.415_2	CJ9.902844
Maximum Flow (m³/s)	87.67	94.42	33.27
Minimum Flow (m³/s)	-3.888	0	0
Mean Flow (m³/s)	4.882	5.968	1.087
Duration of Exceedances (h)	59.36	59.92	59.92
Duration of Deficits (h)	4.137	1.5	0.5833
Number of Exceedances	2	1	1
Number of Deficits	1	1	1
Volume of Exceedances (m³)	1056000	1287000	234500
Volume of Deficits (m³)	2603	0	0
Total Flow (m³)	1053000	1287000	234500

Flow (m³/s) Exceedance: 0

Flow (m³/s) Deficit: 0

On-Line Structures In Place



Data | Objectives | Error | Storage | Patterns | Edit | Derive | Audit | Events | Scatter | Duration

Objective functions for Flow (m³/s)

Options ?

From 1/1/2011 9:05:15 PM to 1/4/2011 2:59:45 PM (65.91 hours)

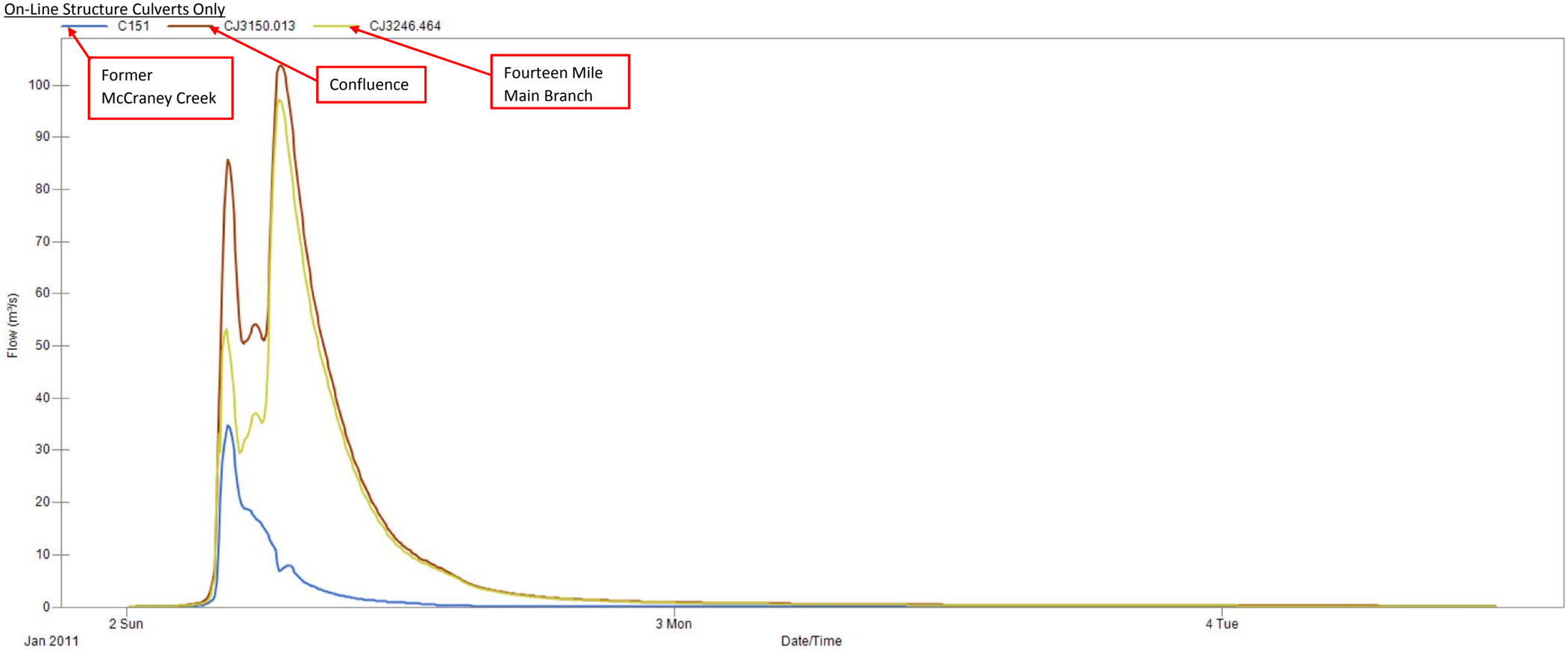
	CJ4395.415_1	CJ4395.415_2	CJ9.902844
Maximum Flow (m³/s)	87.63	96.76	29.24
Minimum Flow (m³/s)	-3.635	0	0
Mean Flow (m³/s)	4.881	5.968	1.088
Duration of Exceedances (h)	59.45	59.92	59.92
Duration of Deficits (h)	4.055	1.5	0.5833
Number of Exceedances	2	1	1
Number of Deficits	1	1	1
Volume of Exceedances (m³)	1055000	1287000	234600
Volume of Deficits (m³)	2008	0	0
Total Flow (m³)	1053000	1287000	234600

Flow (m³/s) Exceedance: 0

Flow (m³/s) Deficit: 0

Confluence of former McCraney Creek & Fourteen Mile Creek Main Branch – 100 Year

On-Line Structure Culverts Only



Data | Objectives | Error | Storage | Patterns | Edit | Derive | Audit | Events | Scatter | Duration

Objective functions for: Flow (m³/s)

Options ?

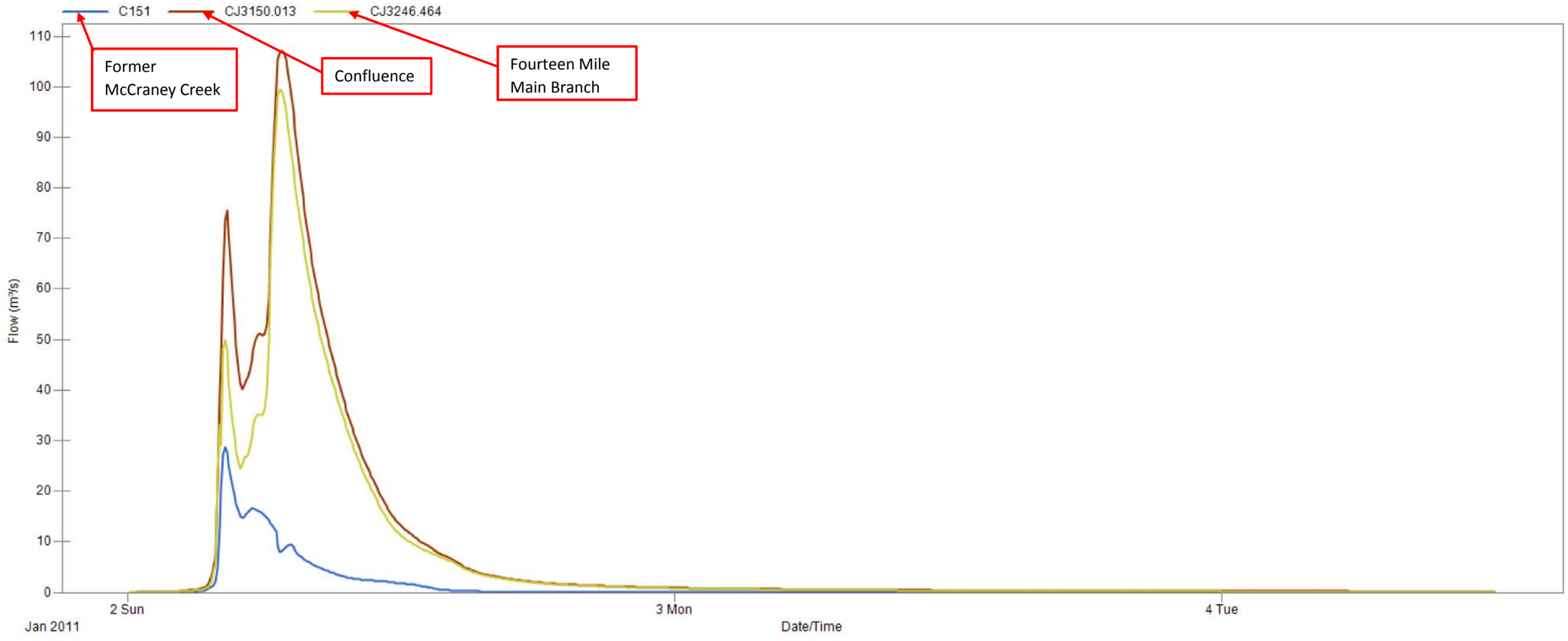
From 1/1/2011 9:05:15 PM to 1/4/2011 2:59:45 PM (65.91 hours)

	C151	CJ3150.013	CJ3246.464
Maximum Flow (m³/s)	34.83	103.9	97.15
Minimum Flow (m³/s)	0	0	1.493E-05
Mean Flow (m³/s)	1.256	7.902	6.654
Duration of Exceedances (h)	59.92	59.92	59.92
Duration of Deficits (h)	0.08333	0	0
Number of Exceedances	1	1	1
Number of Deficits	1	1	0
Volume of Exceedances (m³)	271000	1704000	1435000
Volume of Deficits (m³)	0	0	0
Total Flow (m³)	271000	1704000	1435000

Flow (m³/s) Exceedance: 0

Flow (m³/s) Deficit: 0

On-Line Structures In Place



Data | Objectives | Error | Storage | Patterns | Edit | Derive | Audit | Events | Scatter | Duration

Objective functions for Flow (m³/s)

Options ?

From 1/1/2011 9:05:15 PM to 1/4/2011 2:59:45 PM (65.91 hours)

	C151	CJ3150.013	CJ3246.464
Maximum Flow (m³/s)	28.73	107.2	99.48
Minimum Flow (m³/s)	0	0	1.493E-05
Mean Flow (m³/s)	1.255	7.902	6.654
Duration of Exceedances (h)	59.92	59.92	59.92
Duration of Deficits (h)	0.08333	0	0
Number of Exceedances	1	1	1
Number of Deficits	1	1	0
Volume of Exceedances (m³)	270800	1705000	1435000
Volume of Deficits (m³)	0	0	0
Total Flow (m³)	270800	1705000	1435000

Flow (m³/s) Exceedance: 0

Flow (m³/s) Deficit: 0