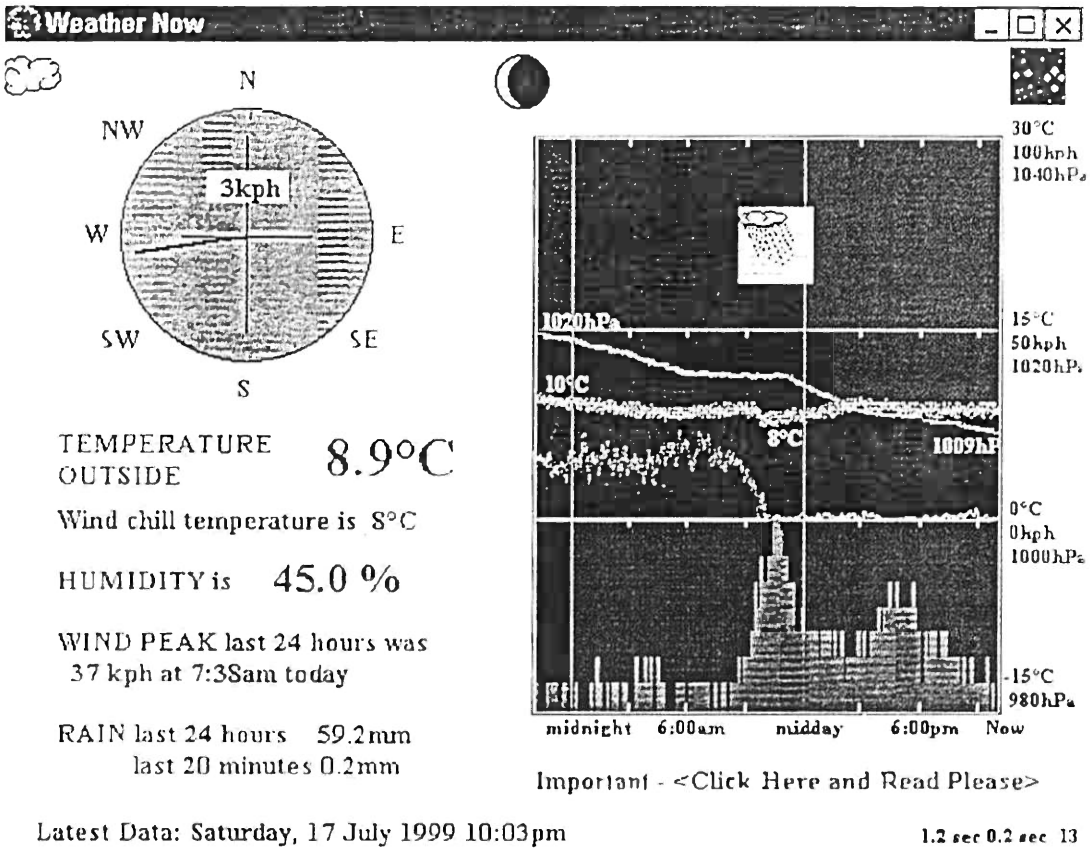
STORM REPORT

17 & 18 July 1999



Collated by Ken Couling
Water Services Unit
Christchurch City Council
September 1999

Contents

1 Executive Summary

During the period 16-19 July 1999 Christchurch experienced a long duration low intensity rainfall event. Cumulative storm rainfall increased from 70mm in the west of the city to over 120mm in the east. At the 'epicentre' of the event in the Marshlands/ Burwood area the 12-18 hour duration rainfall depth had a return period of approximately 15 years. Middle reaches of the major rivers experienced peak water levels up to approximately the five year return period level. The rivers were contained within their stopbanks through their tidal reaches thanks to a moderate maximum high tide level of approximately RL 10.5 metres.

Over 250 reports of flooding were received by telephone during 17 and 18 July. Confirmed flood damage was negligible. Water Services staff opened the Civic Offices on the evening of Saturday 17 July but the Minor Emergency Response Procedures were only partially activated. In hindsight it would have been better if the procedures had been followed more closely. However despite this the overwhelming majority of customers were happy with the level of service provided.

Overall, the drainage system coped satisfactorily with storm runoff which is to be expected for such a long duration low intensity event. Experience during the storm indicates that the opportunity exists to operate the inter-connected drainage systems of Dudley Creek and its Diversion, the No 2 Drains and Horners/Bullers drains more effectively. To do so is likely to require the installation of additional telemetry sites and a computer modelling investigation.

The experience of the storm event and opportunities for improved response to a future similar event are considered under the following sections on hydro-meteorology, response to customers, system operation, planning and investigations and key partner experience. Each chapter begins with a brief overview followed by a list of opportunities for improvement and suggested action. Many of the suggested actions have already been implemented. The intention is that appropriate members of Water Services Emergency Planning Team consider the remaining suggested actions and decide which ones need to be implemented and by whom.

An A3 map of areas where ponding was observed and photographs of some of these areas are included in the back of Section 5. Additional information about the storm event is available through Customer Services Consents Team, photographs held within the Records system and on file no PH-001-877.

Section 2

2 Hydro-meteorology

Overview

During the period 16-19 July 1999 Christchurch experienced a long duration, low intensity rainfall event. Throughout 17 and 18 July steady rainfall up to an intensity of 5mm per hour fell. Cumulative storm rainfall increased from 70mm in the west of the city to over 120mm in the east. The event was equivalent to a "ten-year storm" (ie AEP 10%) for 48 hours' duration.

The Avon (Otakaro) Heathcote (Opawaho) and Styx Rivers flowed bank full for an extended period with the Avon overtopping its banks along Avonside Drive from Robson Street to opposite Dudley Creek confluence and the Heathcote overtopping along Eastern Terrace.

The rivers were contained within their stopbanks through their tidal reaches thanks to a maximum high tide level of approximately RL 10.5m (including up to 300mm barometric lift) bearing east. This compares with mean high water spring of RL 10.35m.

	Opportunities for Improvement	Suggested Action
(a)	Improved access to Civic Offices	Check that all emergency control centre staff have swipe cards and know their PIN number. Consider whether a 'guard' needs to be posted at the after-hours door to the Civic Offices.
(b)	Trunk radio list of numbers	Issue a pocket-size weatherproof list of key trunk radio numbers.
(c)	Riverbank planting near hydrological monitoring sites	Issue an instruction to all designers involved in waterway restoration to keep planting well clear of any hydrological monitoring site.
(d)	Control room responsibilities (especially controller)	Draw up the staffing schedule of current names and positions on the whiteboard in the control room as a matter or priority once the room has been opened.
(e)	MetService weather information after hours	Arrange for Pumps control room to receive weather information faxed directly by the MetService.
(f)	Backup telemetry operator	Arrange for the backup telemetry operator to receive a one-hour refresher course regularly (say once every six months).
(g)	Remote access to telemetry information	Acquire the hardware to interrogate the Civic Offices base-station or monitoring sites directly from both Derek Rid and Derek Carver's home as a matter of priority.
(h)	Critical water levels	Check what additional critical flood levels need to be added to the Minor Emergency Procedures.
(i)	MetService Christchurch telephone number	Add the MetService local number to MERP with a note to the effect that this number should be used only if necessary after the recorded information on the 0900 number has been obtained.
(j)	Regular emergency response practice	In hand

Christchurch City Council
Water Services Unit ~ Technical Support Team

Report on Storm from 16th July to 19th July 1999
Prepared by Derek Rid

1. **Brief Overview**

During this storm event there was very little heavy rain. The rainfall was between 4 and 5 mm/hour and continued non-stop over the 17th and most of the morning of the 18th.

A considerable amount of surface flooding beside the Avon River from the Avondale Road bridge upstream to Linwood Avenue would have been caused by the very high level of the Avon River preventing the water getting in the river. The river did not drop below normal high tide level during the afternoon low tide event.

Avonside Drive

Water across the road east end of Robson St upstream to nearly opposite Dudley Creek. Water to back of footpath about 1645 hrs. Water was unable to get into the river due to its height. Water clear morning of the 18th.

Pembroke Street

Avonside Drive end flooding due to water being unable to get into river due to its height. About 1640 hrs.

2. **Successes**

The telemetry was once again able to provide information very quickly giving an overview of the whole city within 5 minutes requiring just one person to operate it. Without the system several staff would be needed to drive around the city and radio the information in.

3. **Failures/Faults**

- **Access to building.** Some staff (including me) involved in coming into the building for the storm are not frequent users of the swipe card. When we were given the cards we were given a number to enter. I have forgotten my number as it was not one that I had selected that would mean something to me and be easy to remember. We should be able to select our own number or have someone downstairs who could open the door for us.
- **Trunk Radios.** All the users of trunk radios need some pocket size weather proof cards (preferably plastic) with radio numbers/users shown on them. These along with the information loaded on them need to be updated regularly.
- **Riverbank Planting.** Due to bad light and planting at Wainoni Bridge the staff gauge was not readable. When riverbank planting is being planned consideration as to plant size and location needs to be made so that flood monitoring information can be readily obtained.
- **Emergency Staff.** There were 2 controllers in the office at the same time when the office was opened on Saturday evening. Only one should have been in.
- **Weather Information.** The weather information Faxed to us by the Met Service arrived on the office fax at 17:20 on Friday 16th, this was after the

office was closed. These should also be sent to a 24 hour operational location, possibly Pumps Control Room.

- **David Somerville's Comments.** The comments regarding problems with the telemetry system will be overcome with the new base station software. At the time I left the office it was not envisaged that there would be a need for me. I had instructed one person how to get information and I left my Cell Phone number for staff in here to call should they need me. I was quite willing to leave a function I was going to attend should I be needed.
- **Telemetry.** The water level sensors at Horseshoe Lake and one of Mona Vale's weirs had failed and we are waiting for replacements.

Ken Couling's comments responses

- **Access to Data from Home.** This is covered under the improvements section.
- **Flood Gauging.** Tony Oliver is responsible for staffing of flood gauging teams and directing them where to gauge.

3. **Improvements**

Telemetry System. The current telemetry system can not be interrogated via a portable base station since the forced change from VHF radios to UHF. We have equipment that will allow the operation of the Base Station remotely but there is a cost to get this implemented. The implementation was put on hold because our current Base Station is being upgraded for Y2K compliance. When the new system is operational it will be implemented.
When the new Base Station is fully operational a limited number of operators will have access to interrogate remote sites. Without the limitation on operators it will be impossible to maintain the integrity of the system. There will be a duty operator and this would be indicated in the register suggested for the Staffing Officers.
It is hoped that better "Windows" type, user friendly, programs will be developed by Derek Carver that will allow quick and easy displaying of data. The speed of availability will depend on what priority management set on the task for Derek Carver.
With the delays being experienced in delivery of the water level sensors it would be nice to have in stock a spare 5m and 2.5m range sensor so that when a sensor fails we can install a replacement immediately. The problem with this is that they have a 12 month warranty from date of purchase.

Controllers. Controllers need to be more familiar with water level values rather than relying on "nice" graphs to display the data. The reasoning behind this is that it takes time to prepare graphs and when water levels start changing rapidly the base station operator is busy collecting the data.
Information relating to normal water levels, starting to cause concern levels, over the adjacent road levels, etc should be part of a kit for the control room.

Minor Emergency Response Procedures Manual

The Minor Emergency Response Procedures needs input from those who are often required to respond to events that lead up to the emergency. There must be no doubling up of duties for staff. The Staffing Officers should be able to find out quickly who is available without making countless phone calls. Maybe a register on the computer that shows who is out of town, who is on leave etc. The aim is to make response to the situation outside working hours

as easy and quick as possible, it would also make the Staffing Officer's job easier.

There is a Met Service number that can be used to get special forecasts, this should be in the Minor Emergency Response Procedures book.

Staff who are usually involved in these situations should be made more aware of where everything is kept. Regular practices for setting up the emergency room should be held. In some place of the manual more detailed information is needed.

Appendices

Appendices are Avon17July99.xls
Heathcote17July99.xls
Styx17July99.xls
July171999.bmp

They are included in this file but may be viewed in more detail in "Waterdat on 'Bilbo' (G)\Storm\July99"

Codes are used to identify sites are:-

Telemetry

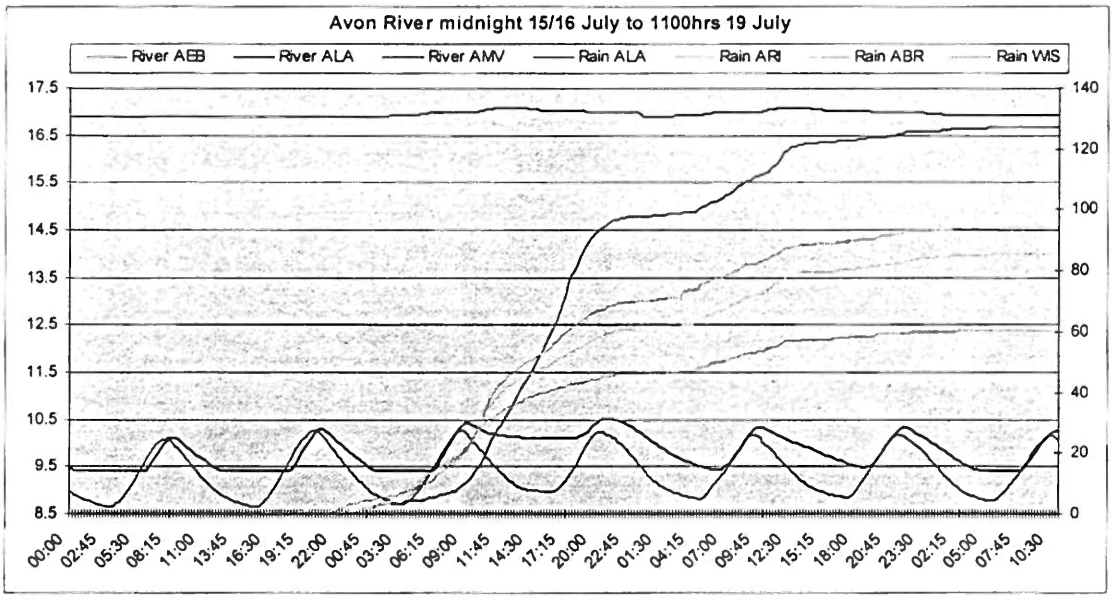
AEB	Bridge Street, Avon River
ALA	Horseshoe Lake, Avon River
AMV	Mona Vale, Avon River
ARI	College of Education, Parkstone Ave
HFM	Ferrymead Bridge, Heathcote River
HTU	Tunnel Rd Bridge, Heathcote River
HOP	Opawa Rd Bridge, Heathcote River
HFE	Ferniehurst St Bridge, Heathcote River
HSI	Bowenvale Ave, south end
HHN	Sparks Rd, opposite Gainsborough St
HWE	Wigram East Retention Basin
HHA	Halswell Junction Rd Ponding Basin
SBK	Harbour Rd Bridge, Styx River
SSP	Spencerville approx. 1.5km upstream of Heyders Rd, Styx River
SRF	Radcliffe Rd Bridge, Styx River
SBE	Tyrone Street north of Factory Rd
FBP	Belfast Oxidation Ponds
XET	Maddisons Road west of Kirk Rd

Data Loggers

WIS	McLeans Island Rd near Isaac's Salmon Ponds
ABR	Langdons Rd at Firestone's Factory

Chart Rainfall Sites

XKA	Kaiapoi
ABU	Burwood Hospital
ABO	Botanic Gardens
XPS	Edge of Estuary at CTW Ponds 5/6
XSU	Sumner, by School for the Deaf
HHU	Huntsbury 2 Reservoir on Huntsbury Ave
HSJ	Bowenvale Valley approx. halfway up hill to the Summit Rd
HSK	Bowenvale Valley approx. 30m vertically below the Summit Rd



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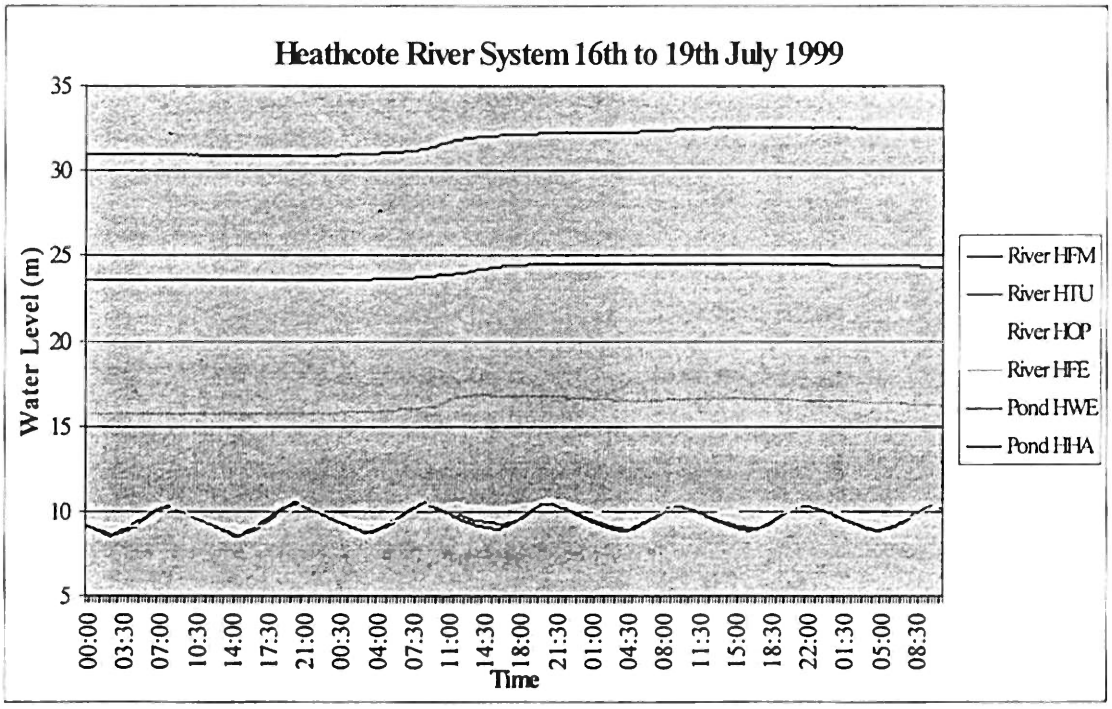
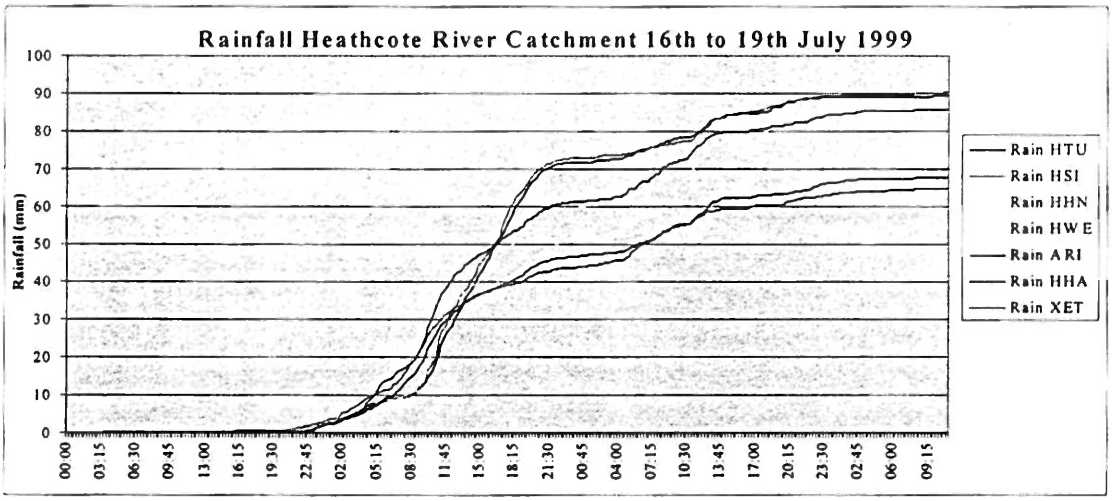
WIS	McLeans Island Rd near Isaac's Salmon Ponds





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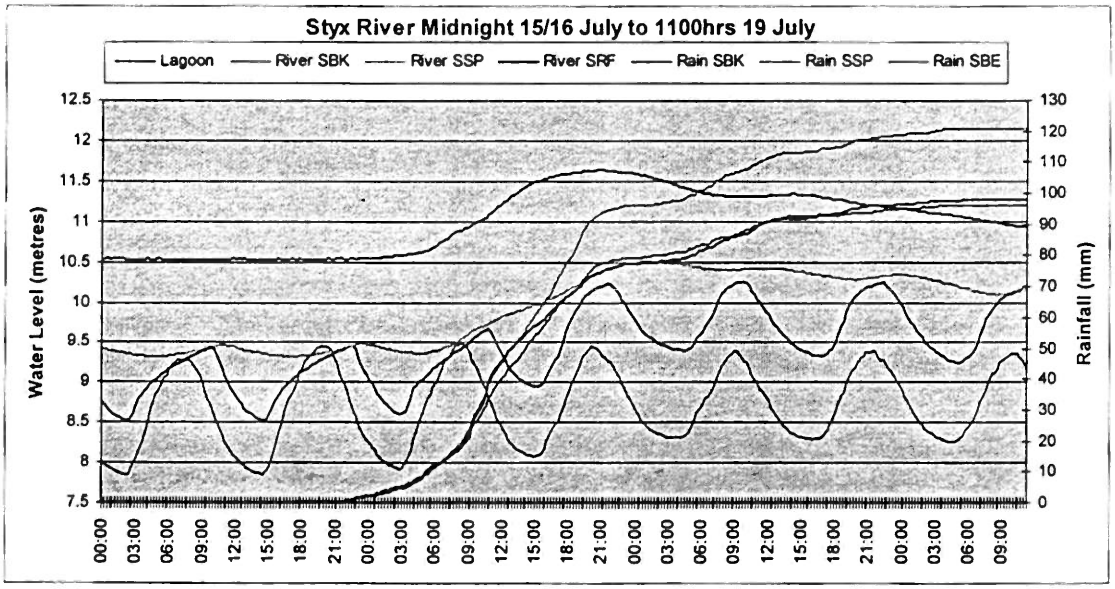

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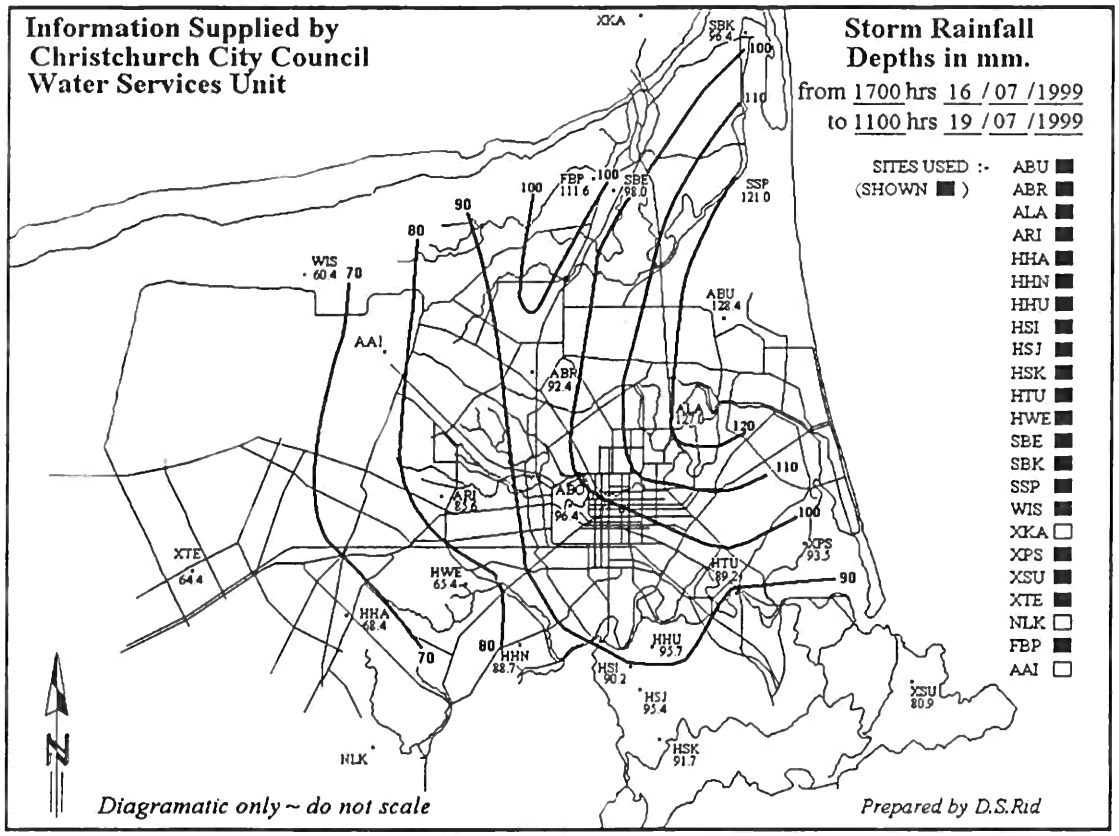
SSP	Spencerville approx. 1.5km upstream of Heyders Rd, Styx River
SRF	Radcliffe Rd Bridge, Styx River
SBE	Tyrone Street north of Factory Rd
FBP	Belfast Oxidation Ponds


Information Supplied by
Christchurch City Council
Water Services Unit
Storm Rainfall
Depths in mm.
from 1700 hrs 16 / 07 /1999
to 1100 hrs 19 / 07 /1999
SITES USED :-
(SHOWN ■)
ABU ■
ABR ■
ALA ■
ARI ■
HHA ■
HHN ■
HHU ■
HSI ■
HSJ ■
HSK ■
HTU ■
HWE ■
SBE ■
SBK ■
SSP ■
WIS ■
XKA □
XPS ■
XSU ■
XTE ■
NLK □
FBP ■
AAI □
XKA
SBK 96.4
FBP 111.6
SBE 98.0
SSP 121.0
WIS 60.4
AAI
ABR 92.4
ABU 128.4
ALA 127.0
ARI 83.6
ABO 96.4
XTE 64.4
HWE 65.4
HHA 68.4
HHN 88.7
HHU 93.7
HSI 90.2
HSJ 95.4
HSK 91.7
HTU 89.2
XPS 93.5
XSU 80.9
NLK
100
110
90
80
70
120
N
Diagramatic only ~ do not scale
Prepared by D.S.Rid

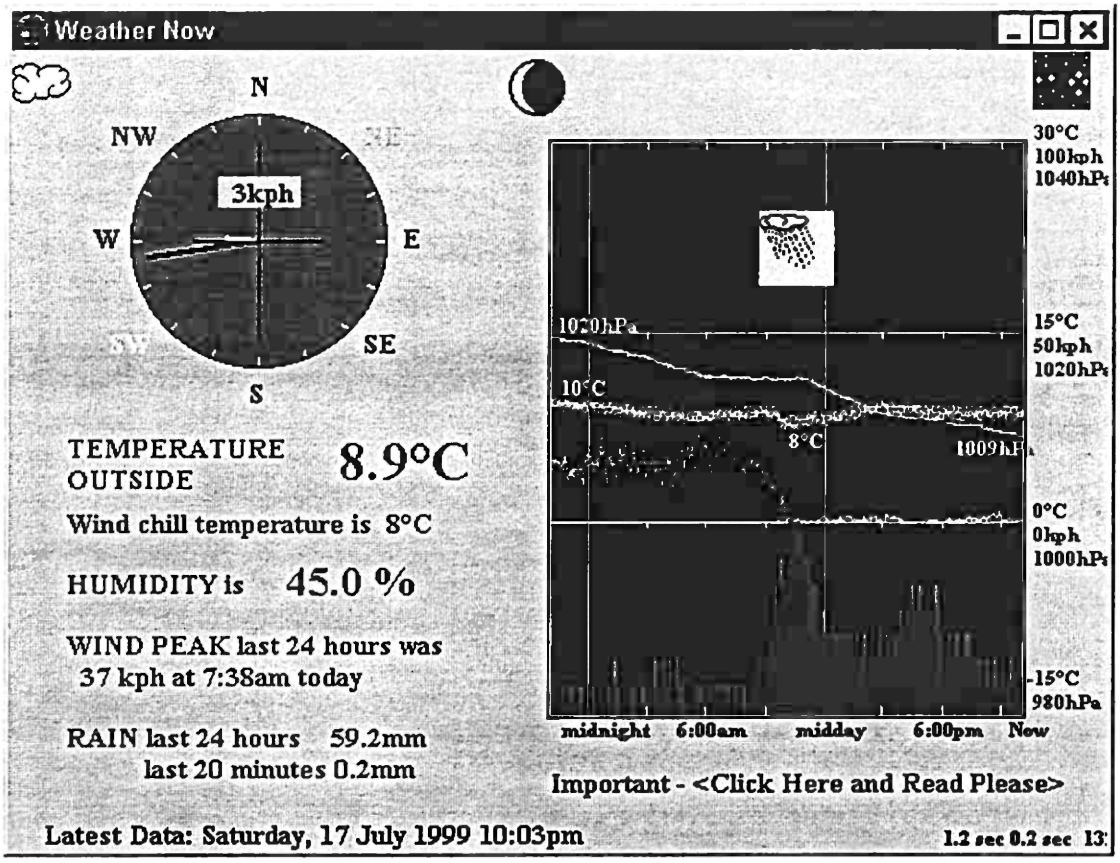
Brooklands

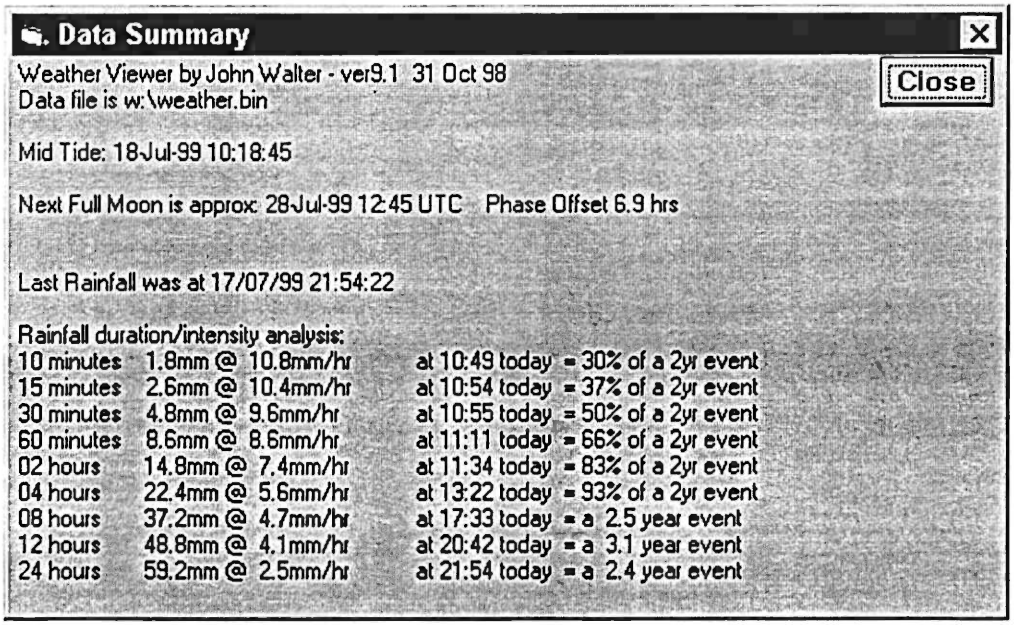
	Lagoon	Bridge	
Saturday 17	10.52	9.66	
	8.74	8.95	
	10.46	10.23	
Sunday 18	9.04	9.40	
	10.39	10.26	
	9.01	9.32	
	10.40	10.24	
Monday 19	9.00	9.24	(normal low 8.6)

Spencerville

	17th	18th	19th
midnight	9.56	10.59	10.43
0300	9.47	10.57	10.36
0600	9.49	10.52	10.25
0900	9.70	10.49	10.18 @ 0830
1200	9.91	10.52	
1500	10.06	10.46	
1800	10.24	10.40	(normal low ~ 9.4)
2100	10.47	10.39	

Weather – Civic Offices - Saturday 17 July 1999





Section 3

3 Response to Customers

Overview

Over 250 reports of flooding were received during the two critical days of the storm, 17 and 18 July.

The vast majority of customer calls regarding the flooding were received and dealt with Quick Connect, the City Council's after-hours answering service. Quick Connect transferred calls through to Pumps Colombo Street control room and to each of the three roading maintenance contractors.

Although the Civic Offices was open just before 6pm on Saturday 17 July to respond to customer calls, only those calling the Water Services number listed in the telephone book were received. In hindsight, the MERP procedures should have been envoked from the time that the Civic Offices opened and calls should have been diverted from Quick Connect to the Water Services emergency control room.

Despite this, the overwhelming majority of customers were happy with the level of service provided. Shift controllers and the Works Operations duty foreman all operating from the Pumps control room during the event made a very significant contribution in this regard.

Opportunities for Improvement		Suggested Action
(a)	Update MERP manual	In hand
(b)	Contacting staff after hours	Assign the staff officer as a matter of priority
(c)	Telemetry information	Covered in hydro-meteorology section
(d)	Division of responsibility amongst contractors in the field	Include Richard Bailey from City Streets in the emergency control room
(e)	After hours access to the Civic Offices and vehicle yard	See hydro-meteorology section. Include St Asaph Street gate combination number on the pocket trunk radio list recommended.
(f)	Equip vehicles	Assign responsibility to an emergency planning team member.
(g)	Relative priority of system operation and monitoring versus customer response	Discuss priorities
(h)	Food for staff during emergencies	Check MERP and assign responsibility for provisioning
(i)	Trunk radio availability	Discuss
(j)	City Streets contacts during emergencies	Include in our list of personnel in MERP
(k)	Availability of road signs	Write to City Streets and their contractors requesting additional road signs to be kept on hand.
5(b)	Liaison with Quick Connect	Clarify procedure in MERP and write to the manager of Quick Connect clearly setting out the procedure and Water Services contacts.
(c)	Initial emergency procedures in MERP	Provide all staff involved in the initial steps of MERP with a written reminder of what those steps are.

(d)	Availability of staff during emergencies	Discuss what additional staff, if necessary, are needed
(e)1	Elected member telephone access to control room	Dedicate an incoming line for elected members and advise them accordingly
(e)2	Answering delays with after-hours calls	See 5(b) above
(e)3	Availability of road signs	See 4(k) above
(e)4	Delayed response in the field	Discuss
(e)5	Assistance from Community Watch groups	Discuss with the police
(e)6	Home contacts for elected members	Provide senior elected members with a list of key staff after-hours contact numbers
(e)7	Reporting to senior elected members during emergencies	Include occasional reporting to senior elected members in the list of duties for the controller in MERP and include a senior elected member contact list. Write to Yvonne Palmer describing what action has been taken in response to her recommendations.
Pumps		
(a)	Emergency maintenance equipment for new roading contractors	Write to Richard Bailey recommending that it be a requirement of future City Streets maintenance contracts that contractors be equipped to deal with minor emergencies
(b)	Map of City Streets contract areas	Pumps request City Streets to provide a suitable map.
(c)	Portable whiteboard for Pumps control room	Pumps purchase a whiteboard

Customer Services Review of Storm 17 to 18 July.

1. **General Comments:**

While the storm was quite a prolonged and reasonably intense storm, the damage reported, was relatively minimal. Approximately 250 reports of flooding (including sewage overflows and roadway flooding) were recorded over the two days and probably a further 50 or more over the week following. The storm was timely in that it has given us a real live opportunity to examine the "Response Procedures" and to see where improvement can be made. A good knowledge of the MERP manual and keeping it updated **is very important.**. At the time, the storm was not initially perceived as a minor emergency. However, as it progressed, it certainly had all the makings of minor emergency and on hindsight, I believe it should have been responded to as if it was one.

2. **Quick Connect:**

With Quick Connect handling the vast majority of the calls (estimated to be in the hundreds) and forwarding them on to Pumps and/or directly to field contractors, it was not easy from the Civic Office base, to gauge the extent of the flooding in the city. Furthermore, liaison with City Streets staff was non-existent apart from using their Roading Contractors to attend callouts. The Manager of Quick Connect (Atul Ram) advised us that:-

a. Contractor response to the flooding was at times slow and that they had to field many irate calls because of peoples real or perceived danger from flooding. They had to try and calm people down.
b. At times, they couldn't get through to Pumps because the line was overloaded.
c. Road signs seemed to be at a premium. He also questioned whether or not vehicles on the road were equipped for the event eg fitted out with rodding gear, root cutters, suction gear etc.
d. The Sunday was far less intensive than the Saturday.
e. On going dialogue with Quick Connect would be appreciated – even training??

3. **What worked well**

a. Communication between Pumps and Civic Offices was good.
b. Communication between WOP's and Civic Offices was good.
c. Contact with staff in the field was good.
d. Staff called out, responded very well.
e. Interim recording process (message logging etc) worked well.
f. Advised Police that we had staff operating from the building.

g. Responded to radio, TV and media journalists in a courteous and responsible manner.

4. What didn't work so well

a. MERP manual out of date.
b. Difficulty in contacting staff on the weekend.
c. Telemetry system didn't give us the results we wanted. Main staff not available. Additional staff need to be competently trained in all aspects of the telemetry system. Limited availability of the VAX system.
d. Division of responsibility in the field has to be sorted out eg roading/stormwater/private property.
e. Gaining access into Civic Offices and use of vehicles in the yard opposite. Knowledge of appropriate swipe card codes and the number of the gate lock for getting in and out of the St Asaph Street gate.
f. Equipment – vehicles not equipped for an emergency eg towels, flooding kits, etc etc.
g. Assisting people (needing advice or help) versus in the field river monitoring.
h. Food source for staff working in the field and offices.
i. Availability of trunk radios in an emergency!! Where are they kept. Should they be kept in a special cupboard on the weekends?
j. City Street contact personnel – who and when to call them in?
k. Shortage of road signs.

5. Opportunities for improvement

a. Ensure that answers are provided for the concerns raised in 4 above.
b. Contact Quick Connect at an early stage or get them to contact one of the Section Leaders or Unit Manager when they are starting to become overloaded with calls.
c. Get Pumps to call in staff as set out in the MERP manual.
d. Ensure that staff are available from a Unit or Corporate pool. Many of those listed in the MERP manual under specific columns may not be available eg on holiday, away for the night or weekend, just not home. This creates problems if you are poaching staff from the intended second or third shift. (emergency's list may have to be increased for each shift).
e. Address Yvonne Palmer's concerns:-

    (i) "Unable to speak with any Council Staff" – Suggest that a special incoming line be made available for Community Board members and Councillors??
    (ii) "Telephone calls not being answered on 379-1660" – open up Civic Offices telephone exchange sooner.

(iii) "Police had no flooding signs" – sub-contractors actually ran out of flooding signs. Need for more signs and to know where they can be accessed from.

(iv) "Myself being told that someone would be out that afternoon and I was seeking info at 10.27am" – I presume that Yvonne was seeking or wanting someone to call her back, discuss the problem and then make the decision as to whether or not someone should investigate and/or physically do some remedial works. – training??

(v) "Community Watch Assistance" – information and equipment not readily available. Could be a welcome resource – suggest this avenue be explored further.

(vi) " Board Chairperson or even the Mayor had no after hours phone numbers of senior staff to contact" – suggest that 'Emergency & After Hours Contacts' be made available to our Community Board Members , Councillors and most importantly, the Mayor.

Tom Brien
06/08/99

Report on flooding.

Saturday 17th- 18th July 1999.

Introduction

The trigger response to calling the in the duty foreman occurred when the incoming call reached saturation for the Shift Controller. The duty foreman Geoff Williams found the number of incoming calls excessive for two to handle and subsequently called the second standby foreman.
The two foreman had access to both staff and resources and dispatched them into the field after briefing them on hot area in need of urgent attention, this also gave support to personnel already in the field. The team worked well with two manning the telephones and a foreman collating and dispatching personnel to jobs. Calls fielded for other Roading contractorswere dispatched immediately by the Shift Controller.

Fault and failings noted while dealing with this minor emergency response.

If the flooding emergency had escalated to the point where the emergency room at Civic was required then continuity from telephone calls to response in the field would have slowed considerably owing to the fact data collated and logged in the control room at the Pumping Stations was not available to the Civic Office control room. The Works Opps foreman being on the same site as incoming telephone calls meant an immediate check could determine whether other calls from the same address or location were being actioned in the field. This action prevented time being wasted in the field and determined where flooding was worst (called at the time hot spots in need of immediate action.) the above validates my reason why foreman initiating work in the field and the telephone answering and logging team should work together as an integral unit.

Roading teams other than Works Opps were ill prepared for such an emergency and lacked both the manpower and resources (plant) to either respond quickly enough to faults and when on site failed to remedy the problem owing to lack of equipment. Works Civil expected Works Opp to deal with problems that needed a rodding truck, naturally this was not possible as Works Opps had their own area to deal with. For Mr Bailey to write tenders which incorporates the need of roading contractors to have rodding equipment available is likened more to a wish list especially if rodding equipment is only likely to be used once or twice during the period of the contract. The use of rodding equipment is more likely to be incorporated in a drainage contract than roading as different skills are required and plans must be available when required.

Fault and failings noted while dealing with this minor emergency response.

The failure of a tile field drain outside a Land Drainage pumping station in Stillwater Avenue highlighted the reliance of the Waste Management unit on Works Opps to clear such drains. Basically the drain was blocked and water was flowing back into the pumping station over the plant.

Works Opps spent a considerable length of time trying to clear this drain but were unsuccessful, this was wasted time and would have been better spent in the field. Glaring failures by Waste Management:-

1. Lack of plans in the station, which should have documented the layout of field drains.
2. Lack of station maintenance, these field drains should be rodded and checked on a regular basis.
3. Waiting for Works Opps to remedy the fault rather than finding alternative solutions to the problem such as getting material to shield the motor from the falling water and getting a sludge or drainage pump of sufficient capacity to keep the station dry.

Lessons learnt and successes noted during this minor emergency response

Successes

The ability of Works Opps duty foreman and deputy to quickly access the scope of the emergency and put in place a structure that was sound and sustainable and easily expanded if the flooding response required the opening of the emergency room at Civic Offices. The local knowledge of problem areas in relation to flooding was impressive and knowing the specialised skills of personnel in the field made the whole operation very professional and successful. All personnel in the control room were busy and focused on their tasks which made the whole operation work like a well oiled machine.

Controllers lacked a large map of the demarcation areas of roading contractors, this needs addressing.

The control room requires a portable white board which can be trundled out when future minor emergencies occur, basically required to keep track of personnel and plant out in the field and contact numbers of all personnel directly involved in the minor emergency.

Conclusions

This proved response to minor emergencies can be managed in house in a professional business like manner with both the response teams and the customers getting results and satisfaction.

Norm Cumming.

Shift Controller. Main Pumping Station.

Couling, Ken

From: Couling, Ken
Sent: Friday, 23 July 1999 14:25
To: Brien, Tom
Cc: Watson, Allan
Subject: FW: lack of assistance for information on flooding

Tom

Can you please include consideration of Yvonne's points in your part of the storm report.

Thanks, Ken

-----Original Message-----
From: Couling, Ken
Sent: Tuesday, 20 July 1999 07:41
To: 'Yvonne Palmer'
Subject: RE: lack of assistance for information on flooding

Thanks, Yvonne. I will feed this information into our debriefing process and come back with some answers in 2 or 3 weeks.

Ken

-----Original Message-----
From: Yvonne Palmer [SMTP:y&bpalmer@xtra.co.nz]
Sent: Monday, 19 July 1999 19:54
To: Ken.Couling@ccc.govt.nz
Subject: lack of assistance for information on flooding

As discussed this evening Ken the following things that I along with the residents experienced were:

1 unable to speak with any council staff
2 telephone calls not being answered on the 379-1660
3 Police had no flooding signs to put out at the Main North Road/Vagues Rd
4 Myself being told that someone would be out that afternoon and I was seeking info at 10.27a.m.
5 Papanui Community Watch offered assistance to cordon areas that were bad and no one to gain information or equipment required.
6 Board Chairperson or even the Mayor had no after hours phone

numbers for senior staff to discuss
issues with.

Hope this is of some assistance for your meeting. My biggest frustration that I could not tell the ratepayers
what was happening and how long.
Maybe for the future that the board chairpersons are informed of the issues and then that Chairperson notify the
other board members and councillors in the ward, so that they can address the issues.

Thanks
Yvonne Palmer

Section 4

4 System Operation

Overview

Overall, the system coped satisfactorily with storm runoff which is to be expected for such a long duration, low intensity event.

The small Moyna Avenue stormwater pumping station proved to be particularly troublesome during the event. Maintenance staff are investigating how its operation can be improved.

All four gates of the Heathcote tidal barrage were open at the appropriate time and left open until the end of the event. A more sophisticated opening and closing regime in tune with flow reversal in the river may be much more effective. It is recommended that an improved operational regime for the gates be investigated using hydraulic modelling.

The greatest rainfall depths fell in the catchments of the inter-connected drainage systems of Dudley Creek and its Diversion, Horseshoe Lake and No 2 Drains, and Horners/Bullers Drains. While these systems coped reasonably well, the potential exists to improve performance with more sophisticated real-time monitoring.

High water levels were experienced in the tidal reaches in the Styx River. This was caused partly by closure of one of the two pair of tidegates by the Canterbury Regional Council for maintenance. However, Regional Council staff were very cooperative in removing the tidegate stoplogs temporarily on 19 July to rapidly reduce the volume of storm runoff stored temporarily upstream.

Opportunities for Improvement	Suggested Action
(a) Moyna Avenue Pumping Station No 218 operational reliability	Install longer screens in the invert at the pumping station to reduce frequency of blockages (completed). Maintenance and Renewals team to investigate the covering of the full length of the invert with mesh grating (investigation underway).
(b) Heathcote tidal barrage gate operation	Include investigation of gate opening and closing rules in the computer modelling programme in discussion with the Planning and Investigations Team Leader.
(c) Optimised operation of the Dudley Creek No 2 drains and Horners/Bullers Drains systems	Maintenance and Renewals Team Leader to discuss with Planning and Investigations Team Leader whether, and if so when, additional telemetry sites should be installed within the catchments.
(d) Winters Road retention basin operation	Maintenance and Renewals Team Leader to change operating instructions for the basin depending on the outcome of (b) above.

STORM REPORT - C L Rance

17 to 19 JULY 1999

General

Rainfall was of variable intensity – records suggest less over western side of City and heavier swathe along coastal area. Rainfall data attached. There were some very intense falls experienced in vicinity of Dudley Creek. PS 205 (Horseshoe Lake) chart shows some high peaks prior to lunch and around tea time (1800 hrs) on 17/7/99. This was borne out by very high water levels I observed in Dudley Creek at 2000 hrs and backed up ponding in the Flockton Street area and over line of piped swale from this basin. Flooding of Avon side road near Dudley Creek confluence occurred during Saturday. High Avon River levels were observed around 1700 hrs by DS Rid from Banks Avenue down to Wainoni Bridge. Below this point water levels were increasingly lower due to tide levels (Low tide Ferrymead 1524 hrs).

Tide times 17/7/99:
Ferrymead: low tide -1524hrs, high tide - 2120 hrs

Kerrs reach: low tide – 1634 hrs, high tide – 2200hrs

Operational Problems

(a) Dudley Creek/Avon River side

I was concerned that the changed harvesting regime had contributed toward the raised river levels and specifically discussed this with Derek Rid. Based on his observations he considered that the level of pumping from PS 205, which was at a maximum of 12 cu mecs for some time, lifted river levels at the Horseshoe Lake outlet and increased the back water effect in the Avon. In addition the very intense rain in the Dudley Creek catchment was unable to discharge (this rainfall was also associated with the pumping requirement from PS 205)

In my view the change in harvesting regime upstream of Gayhurst Road did not have any significant impact on the raised river levels in the lower Avon and Dudley Creek areas – it was more a matter of combination of tides, pumping and rainfall concentration.

However, I am also of the view that the planned modelling of the Cranford Street basin flow diversion and retention aspects, and its impact on flood management of the Dudley Creek system, Winters Road basin, PS 219 (Cranford Street diversion), PS205 and Horners Drain /Bullers drain will provide better system management options during storm conditions. Essentially we need to be able to refine how we shift excess water around. Typical question could be, should we divert to Bullers or to Styx or open Winters Road Basin. To do this we need to increase telemetry stations to monitor levels etc

Recommendation

That we pursue with some urgency additional telemetry sites in Cranford Street area and outfall systems. I have some information from Derek Rid on costs (copy attached) but needs discussion with Robert Watts team to clarify their needs

(b) **Styx River**

High rainfall along coastal area and North west of City (Kruses Drain etc) had some impact on the Styx River flows. There was a higher than normal amount of ponding in the lower reaches. This was due to the closure of one set of the Styx Flood gates by CRC for maintenance. This was eased to some extent by removing the stop logs on the 19 July to allow extra volumes to discharge on the outgoing tide. This was carried out by CRC staff directly. Both sets of tide gates are now fully functional (as from 9 September).

(c) **Other Operational problems**

Winters Road Retention Basin
This facility was operated in accordance with the normal operations criteria set some years ago by Murray Binnie.

This apparently contributed to some property flooding along Topps Drain when Bullers Drain flows backing up into Topps Drain through a flap valve that was wired in raised position. The owner Mr James Smith disclaimed all knowledge of this and blamed Works Operations who had overlooked maintaining this valve for some months!!

This matter has been rectified but it is my view that we need to modify the operations parameters for Winters Road basin.

Under the present operating instructions during shorter duration storms when there are short peak flows, the majority of flow appears to go down Bullers drain and little retention occurs in the Winters Road Basin or elsewhere in the system. In addition when peak flows are passed the flow in Bullers Drain tends to hold up water in Topps Drain and floods at least one driveway. I am reluctant to issue instructions for permanent operational changes until we have completed the Cranford Street flow modelling but believe we can adjust the flow rates to maintain drainage from Topps and force more discharge to the Styx via Horners Drain. This will mean more ponding on the farm land to the north of winters Road by back up into various side drains.

As a result of our experiences during the 17 July storm, I trialed some modified operations procedures for the Winters Rd sluice gate during a heavy rain period on the 27 July and this appeared to be successful in respect of Topps Drain.

This is more justification for additional telemetry sites in the area

PS 218 – Moyna Avenue
This was an ongoing problem during the 17 July storm and arose from frequent blockage of the grill intake to the pump. The station is equipped with a local alarm that awakes residents, local cats and dogs and babies!! Residents then contact the Council to rectify things.

There are only three or four properties served by the invert and pump system which historically has only become a problem since a new owner acquired the property with the pump.

I have visited site with John McKay and we have installed longer screens in the invert to reduce blockages. The owner however would like us to cover the whole invert area with mesh grating (at Council cost).

We are pursuing the matter.

Inward Complaints

The attached schedule of complaints received during the storm shows a number of parts of the system that were overwhelmed. Generally these were cleared with rodding or when water subsided. I have highlighted those that are of interest.

To Chris Rance
From Derek Rid 16th August 1999 R1 17th August 1999

Budgetary Information for Storm Monitoring
Revised to include power supply to data logger sites (*changes in italics*)

As we discussed on Friday 13th August here are the approximate costs for establishing and running a flood-monitoring site. It costs more to establish a telemetry site but time is saved once they are operating. These are the advantages in using the Telemetry System over Data Loggers.

1. Telemetry has "On-Demand" information available in the office when required,
2. Daily detection of any failure of water level transducer or logger,
3. Staff time and vehicle running savings for normal operation,
4. Staff time and vehicle running savings during floods,
5. Visits to the site can be on a "planned" basis and offer flexibility for visits over the "must visit" at the beginning of the month situation with data loggers.

Approx costs for each Flood Monitoring Site

Telemetry	**$**	**Data Logger**	**$**
Site Establishment			
QRTU	2700	Data Logger	1650
Water Level Transducer	1500	Water Level Transducer	1500
Weatherproof Cabinet	450	Weatherproof Cabinet	450
Ducting, fixings etc	100	Ducting, fixings etc	100
Radio Telephone	1250	*Battery*	*70*
Aerial and Mast	400	*230V power supply*	*1000*
230V power supply	1000		
Approx. Total	7400	*Approx. Total*	*4770*

Logger Saving = $2630

Annual Costs

Power/year	36	*Power/year*	*36*
Battery 1 per 4 years @$70	17.50	*Battery 1 per 4 years @$70*	*17.50*
Approx. Total	53.50	*Approx. Total*	*53.50*

Approx time for each Flood Monitoring Site

Telemetry	Hours	**Data Logger**	Hours
Site Establishment			
3 days – 2 people	36	2.5 days – 2 people	30
Annual Time			
	Hours		Hours
Calibration checks (6)	9	Calibration checks (6)	9
Servicing (3)	4.5	Servicing (3)	4.5
Data Processing/checking, daily	18	Data Processing/checking, monthly	12
		Data Collection	18
Annual Time	31.5	*Annual Time*	*43.5*

Telemetry Saving = 12 hours

Installation of new sites

At our meeting you named 3 sites for possible monitoring. If these were to proceed, to avoid delays, it is suggested that we employ someone under contract to collect some of our data. This would free-up Tony Pentecost and Tony McKinnon to do the installation of equipment. We have available Jan Pentecost who measured the groundwater level sites each week prior to Tony McKinnon being employed. By using her very little time would be needed for training.

With the ongoing demand for more data, staff time saving is becoming very important. *There is a 6 hour per site saving the first year and a 12 hour saving* per site per year thereafter using telemetry compared with a data logger.

Two of the sites, Dudley Creek Diversion at Cranford St and Winters Road Pond may get groundwater level monitoring added. This would save some time in the weekly round of groundwater data collection.

To aid you with planning your requirements a summary of our Hydrometric Monitoring sites follows.

Telemetry

Site	Water Level	Water Level	Rainfall	Water Temp
Styx River				
Brooklands	Lagoon	Harbour Rd	Yes	Harbour Rd
Spencerville	Yes		Yes	
Radcliffe Rd	Yes			
Belfast PS 62			Yes	
Belfast Ponds			Yes	
Avon River				
Bridge Street	Yes		Being Installed	
Horseshoe Lake	River	Lake	Yes	
Gloucester St city	Shed only			
Mona Vale	Fendalton Rd	CGHS		Yes
Riccarton			Yes	
Heathcote River				
Ferrymead	Yes			
Tunnel Road	Yes		Yes	
Catherine St	To be installed			
Opawa Road	Yes			
Buxton Tce	On hold			
Ferniehurst St	Yes			
Sparks Rd PS 42			Yes	
Wigram East	River	Pond	Yes	Yes
Halswell Junct Rd	Pond	Groundwater	Yes	
Sibleys Drain	Drain		Yes	
Templeton			Yes	

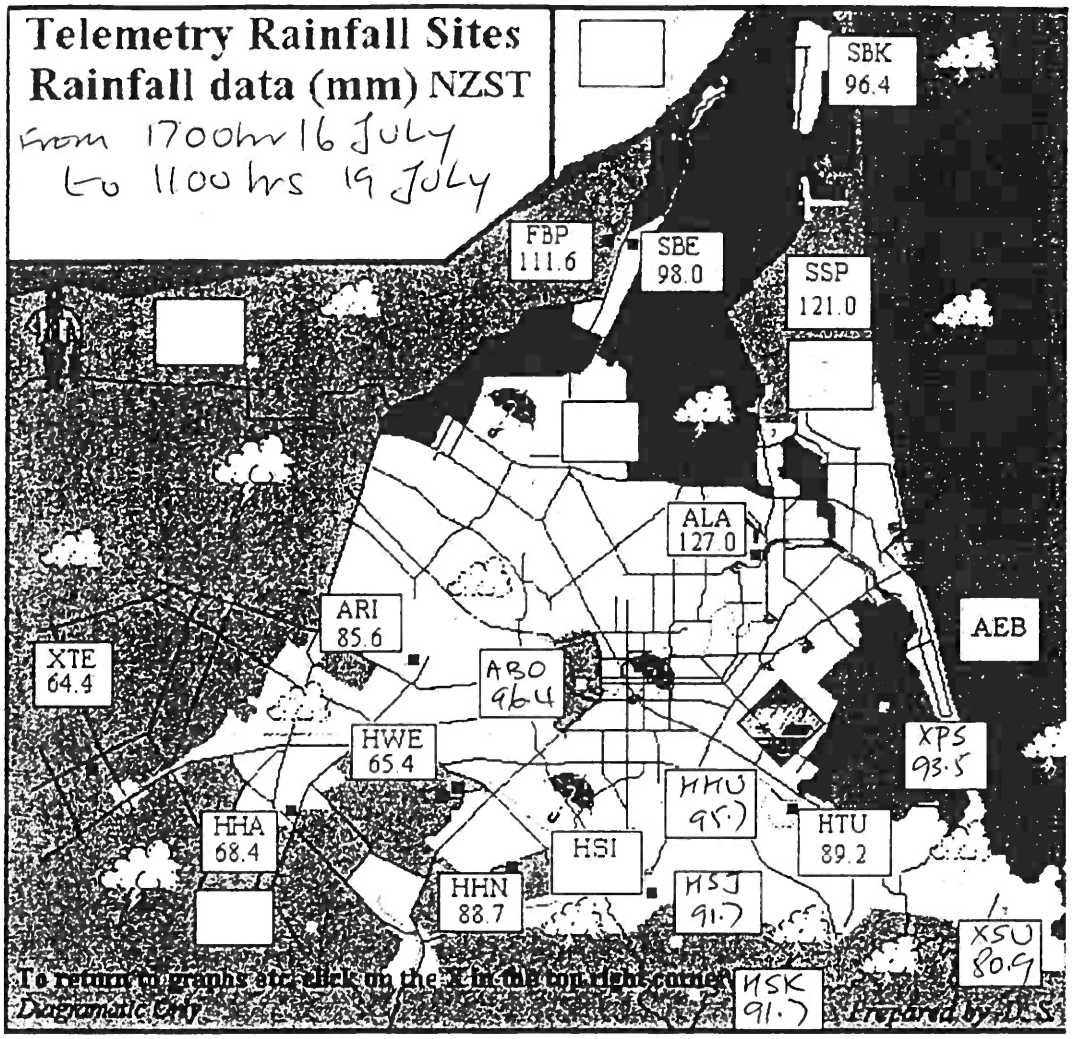
Data Loggers

TS Cornwall	Estuary			Yes
Ladbrooks			Yes	
Papanui			At Firestone	
McLeans Island Rd			At Isaacs	
Broadoaks Subdn	Yes			
CTW Pond 3			To be installed	
Old #2 Drain	At Lake Tce Rd			
Bottle Lake	Yes			
Hendersons Rd	To be re-established.			

Charts

Botanic Gardens			Yes	
Burwood Hospital			Yes	
CTW Pond 6			Yes	
Sumner			Yes	
Huntsbury			Yes	
Bowenvale mid			Yes	
Bowenvale upper			Yes	
Kaiapoi			Yes	

FROM DEREK RID.
(colour copy available)



Bot. Gard = ABO Belfast = SBE Burwood = ABU HoonHay = HHN
Huntsbury = HHU Riccarton = ARI Sumner = XSU Woolston = HTU

Date	Time	Street Name	Numb	Caller	Details	Forwarded To
8-Jul-99	13:06	Albert	78		the road is flooding	Works Civil
7-Jul-99	18:36	Aldwins		CCC Housing	Flooding behind Aldwins Courts	Fulton Hogan
		Amstel			Flooding in Amstel off Poulton	Works Ops
8-Jul-99	10:23	Aorangi	115		Sewage	Works Ops
7-Jul-99	17:53	Arawa	77	Mr Larry Greg	Raw Sewage and Flooding	Pumping Statio
7-Jul-99	16:45	Archer	10		Flooding on 10 Archer Street	Works Ops
8-Jul-99	12:00	Arncliff	70a		Flooding in back yard	Fulton Hogan
7-Jul-99	16:18	Avonside		Public	Avonside Drive Kerrs/Wainoni Road Blocked	Fulton Hogan
7-Jul-99	16:42	Avonside	858	Garry Moore	Blocked sewer at 858 Avonside	Works Ops
8-Jul-99	09:36	Avonside	866		Sewage and water flowing through house	Fulton Hogan
8-Jul-99	11:30	Avonside	866		Flooding Detour signs required	Works Ops
		Avonside			Flooding Avonside, Kerrs Road back towards Brittan Drain	Water Services
7-Jul-99	17:07	Baker		Public	Blocked gutters and flooding between Baker Street/Palmers Rd on New Brighton ro	Fulton Hogan
7-Jul-99	21:55	Barkers		Securitas	River has burst its banks off Kate Shepherd Rest Home cnr Barkers/New Brighton	Pumping Statio
		Bellbrook			Flooding Bellbrook/Emmett	Works Ops
		Berwick			Flooding	Works Ops
7-Jul-99		Birch	23	Mrs Morris	Flooding in street not allowing s/w from property to get away, garage now flooding	Water Services
		Bishop	76		Flooding	Works Ops
7-Jul-99	16:36	Bishop	122	Quick Connect	Flooding 122 Bishop street/ roading truck required	Works Ops
7-Jul-99	09:41	Bowhill		Kaibaa	Flooding on the corner of Bowhill and Marine Pde corner	Fulton Hogan
		Breezes			Flooding	Works Ops
7-Jul-99		Bridle Path	208	Mrs Watson	Water flowing passed house, slip at front of property and road	Water Services
7-Jul-99	18:07	Briggs	125		Flooding onto property and in house	Works Ops
8-Jul-99		Briggs	125		Sewage	Works Ops
7-Jul-99	18:18	Briggs		Quick Connect	Flooding in Briggs road near Marshlands Road	Works Ops
	18:47	Briggs	54		Backyard flooded all day	Water Services
7-Jul-99	20:14	Broguham		Public	Flodding Traffic Island in left turn lane at Brougham/Opawa is flooded over	Works Civil
7-Jul-99		Bromley	44		Flooding at Ruru/Maces Rd	Fulton Hogan
		Brook	15		Flooding	Works Ops
8-Jul-99	07:50	Brougham			Roading truck required at Brougham St and Opawa Road	Works Ops
		Caledonian	119		Flooding	Works Ops
7-Jul-99	20:08	Cambridge	327	Public	Flooding in Petersbrough, Barbadoes off Bridge	Fulton Hogan

Date	Time	Street Name	Numb	Caller	Details	Forwarded To
7-Jul-99	17:08	Centaurus	118a	McInnes	Under runner in the middle of lawn with a lot of clay	Works Civil
8-Jul-99	11:36	Centennial	72	Keith Simmond	Street flooding	Works Civil
7-Jul-99	21:01	Clarendon		Works Civil	Flooding under rail bridge, Norwich and Worcester, Ferry and Mackworth	Fulton Hogan
7-Jul-99	18:55	Clive		Public	Flooding up to fence line of Clive and Wellington	Fulton Hogan
8-Jul-99	14:17	Clyde			The grate has been removed and wedged into the hole at the cnr of Clyde and Wai-	Pumping Statio
		Colenso			Flooding Colenso - Clarke	Works Ops
7-Jul-99	17:39	Colombo	54	W/S Control r	Flooding in Burwood station	Works Ops
8-Jul-99	11:05	Colombo	635		Road sign needs to be removed	Works Ops
8-Jul-99	08:29	Combs	6		Sewage overflowing	Works Ops
		Cranford	541		Sewer	Works Ops
		Cranford	543		Sewer Flat 2	Works Ops
		Cresswell	46b		Requires Roading Truck	Works Ops
7-Jul-99	17:47	Curletts	66	Kim Ringdahl	No water at 66 Curletts	Works Ops
		Dallington			Flooding	Works Ops
7-Jul-99	19:17	Dunbarton			Overflowing Sewers	Works Ops
7-Jul-99	16:36	Dunbarton	20	Quick Connect	Flooding in Dunbarton Road	Works Ops
8-Jul-99	11:00	Dunbarton	20		Sewage overflowing	Works Ops
7-Jul-99	18:06	Dyers Pass		Police	Mud Slip	Fulton Hogan
7-Jul-99	18:15	Eastern		Public	Flooding on Eastern Terrace between Tennyson and Fisher Ave also Riverlaw betw	Works Civil
8-Jul-99	07:45	Eastern			Flooding Eastern Terrace/ St Martins Road	Works Ops
		Edgeware			Flooding between Geraldine and Hills Road	Works Ops
7-Jul-99		Edgeware	562		Flooding St Albans Stream	Works Ops
		Edmonds	37		Flooding from Bells Creek	Works Ops
7-Jul-99	16:36	Edward	35	Quick Connect	Flooding in Edward ave BINGS B RAIN	Works Ops
7-Jul-99	18:41	Edward		Quick Connect	Flooding in Edward Street	Works Ops
7-Jul-99	17:12	Emmett			Flooding coming into house cnr orcades and emmett	Works Ops
8-Jul-99	11:56	Emmett	134	Jason Hall	street flooding, 134 Emmett is about the centre of the flooding	Works Ops
8-Jul-99	16:50	Emmett	129	Peter O'driscoll	Flooding street with sewage cnr of Orcades and Emmett	Water Services
7-Jul-99		Emmett	133	Jassen	Street Flooding	Works Ops
7-Jul-99	17:17	Estuary		Public	Estuary Rd outside school the road works are not properly signposted and the unse	Fulton Hogan
8-Jul-99	10:57	Ethne			Sewage overflow	Works Ops
7-Jul-99	16:42	Everard		Garry Moore	Flooding in Everard	Works Civil

Date	Time	Street Name	Numb	Caller	Details	Forwarded To
7-Jul-99	19:25	Farquhars	81	Wayne Bond	Sewage overflowing into street	Water Services
7-Jul-99	18:45	Farquhars	69	David Patterso	Sewage overflowing in Road and properties four houses effected	Water Services
7-Jul-99	09:45	Farrington	78	Woods	Flooding at the corner of Maple St/Farrington Avenue	Works Ops
7-Jul-99	21:00	Fernbrook	12	Tom Brien	Want Westminister Park Drain Checked, SW off Park area	Works Ops
7-Jul-99	19:15	Fernbrook	12	Chris Moir	Property backs onto Westminster Park, water flooding in from new porch. Has bee	Water Services
8-Jul-99	07:00	Ferndale	12	[redacted]	Flooding in Westminister park	Works Ops
8-Jul-99	00:00	Ferry			Edmonds Park Concrete channel flooding	Works Ops
7-Jul-99	19:45	Ferry		Mr Lange	Sewer blockage in Ferry rd Aldwins Rd	Works Ops
7-Jul-99	18:35	Flockton		[redacted]	Flooding in Flockton St, St Albans also Geraldine and Edward	Works Ops
7-Jul-99	18:41	Flockton		Quick Connect	Flooding in Flockton Street	Works Ops
		Forfar			Flooding	Works Ops
7-Jul-99	10:42	Forfar	79	Wilking	Flooding in Forfar and Berwick Street	Works Ops
7-Jul-99	16:03	Forfar			Flooding in Courts adjacent to 95 Forfar Street	Works Ops
7-Jul-99		Francis	14		Sewer	Works Ops
7-Jul-99	19:25	Francis	14		Water across road, road sign needed	Water Services
		Fredrick	35		Flooding	Works Ops
		Garvins			Flooding	Works Civil
7-Jul-99	18:41	Geraldine		Quick Connect	Flooding in Geraldine	Works Ops
7-Jul-99	21:30	Geraldine		Alison Duggan	Francis ave right across road is flooded. Geraldine/Edward	Water Services
		Gloucester			Flooding around Gloucester, England and Stanmore	Works Ops
7-Jul-99	17:45	Grafton	55	Public	Flooding	Fulton Hogan
		Grants	66		Flooding	Works Ops
7-Jul-99		Grants	66	Deidre Weeber	Sewer overflow	Works Ops
7-Jul-99	07:36	Greers	318	Resident	no water	Works Ops
7-Jul-99		Gunns	23		Back flooding Gunns/Holliss	Works Ops
		Harakeke	32		Sewer	Works Ops
8-Jul-99		Harewood	520		Flooding	Works Ops
8-Jul-99	12:17	Harewood	522	Mcclintons	Street Flooding	Pumping Statio
7-Jul-99	18:18	Harrison		Quick Connect	Flooding in Harrison	Works Ops
8-Jul-99		Hartley	82		Sewage	Works Ops
		Hills			Flooding Ailsa - Aylesford	Works Ops
7-Jul-99	19:27	Hills	92	Hills Road Fish	Flooding into Shop	Works Ops

FLOCK TON STREET INVERT

RELATES TO FLOCKTON/ DUDLEY

Date	Time	Street Name	Numb	Caller	Details	Forwarded To
7-Jul-99	17:59	Holliss			Flooding from up the hill	Works Civil
8-Jul-99	09:06	Holliss	55	Mrs Duurlog	Upper Holliss ave water is flowing down the road from where it should be running int	Works Civil
7-Jul-99	09:00	Holly		Quick Connect	Flooding corner of Holly and Springfield	Works Ops
7-Jul-99	09:00	Holly Road	10B	Ladd	Flooding on the cnr of Holly and Springfield Road	Works Ops
		Homer			Flooding on Homer - Roach	Works Ops
		Hunter			Sewer	Works Ops
7-Jul-99	16:42	Ian		Garry Moore	Flooding in Ian Place	Works Ops
		Innes	279		Flooding	Works Ops
		Jacobs			Flooding	Works Ops
8-Jul-99		Jamieson	37		Sewage	Works Ops
	18:18	Jennifer	21	Mrs Pooley	Flooding this morning	Water Services
7-Jul-99	19:42	Jollie			Flooding in Unlit section of Jollie Street Linwood	Fulton Hogan
8-Jul-99	17:01	Kianga		Mr Burgess	Water is right up to their doors and may flood them out. Kaianga road near the Styx	Water Services
		Kilmarnock	39b		Flooding	Works Ops
7-Jul-99	21:30	Kilmarnock			Gorged sewers and backing up	Water Services
7-Jul-99	15:36	Kilmore			Flooding on Kilmore Street between Manchester and Colombo, Elm grove on Fitzge	Fulton Hogan
		King			Flooding	Works Ops
7-Jul-99	18:00	Kingsford			Flooding on Kingsford by Mundys Rd and Mclean St	Fulton Hogan
7-Jul-99		Kirkwood	56	Julia Hardacre	Sewer overflow and flooding	Works Ops
7-Jul-99	10:50	Lancewood	33	Mr Bates	Flooding	Works Civil
8-Jul-99		Lancewood	80	Paul Brechion	Sewer blocking up	Water Services
7-Jul-99	17:02	Liggins		Public	Floodingon the corner of Liggins/Queensbury	Fulton Hogan
8-Jul-99	10:06	Lincoln			Road Works - dangerous pothole	Works Civil
6-Jul-99	17:52	Lismore St		Works Civil	Hole in road corner Lismore/Wilsons Road	Fulton Hogan
7-Jul-99		Loftus	10		Flooding	Works Ops
7-Jul-99	09:52	Longfellow	27	Colin	Flooding outside his fence	Works Civil
7-Jul-99	17:54	Lower Styx		Quick Connect	Flooding Lower styx Road near Spencerville	Works Civil
7-Jul-99	08:22	Lowry	78	Lindsay Grant	The footpath is flooded outside his property	Works Ops
8-Jul-99		Ludhaina	16		Flooding	Works Ops
7-Jul-99		Lyttelton			Flooding Lyttelton/Conway	Works Ops
		Mackworth	42		Flooding	Works Ops
7-Jul-99	19:30	Mackworth	40a	Gerry Hartley	Toilet 3/4 full and getting higher, seems strange should clear through gully trap	Water Services

Date	Time	Street Name	Numb	Caller	Details	Forwarded To
7-Jul-99	20:03	Maidstone		Police	Flooding in Maidstone/Radbrook	Works Ops
7-Jul-99	20:05	Maidstone		Works Civil	Flooding at the corner of Maidstone and Radbrook Street	Works Ops
		Main North	131		Flooding	Works Ops
7-Jul-99	18:16	Main North	192	Tom Brien	Flooding	Works Ops
		Main North			Water Main	Works Ops
7-Jul-99	18:00	Main North	190	Mrs Peterson	Water backing up sw. garage, drainage compaines cleaded drains getting worse	Water Services
		Mansfield	14		Creek flooding	Works Ops
8-Jul-99	18:52	Marine		Police	Flooding on Marine Parade New Brighton off Thompson Park on beach side	Fulton Hogan
8-Jul-99	12:15	Marriotts	9		Flooding	Fulton Hogan
7-Jul-99	20:41	Matai	29		Stormwater Drain Blocked flooding into sewer	Works Civil
8-Jul-99	09:43	Matai	29		Sewage overflow	Works Ops
7-Jul-99		Mathias	6		Flooding	Works Ops
7-Jul-99	18:35	Matlock		mrs Nusbrigde	Road flooding corner of Matlock and Mackworth	Water Services
8-Jul-99	12:25	McBratneys	48	Carol Mcmena	Street flooding house	Fulton Hogan
7-Jul-99	17:42	Mclean	37	Swanson	Flooding in open drains	Works Ops
8-Jul-99	11:30	Memorial	279a		Sewage	Works Ops
	20:00	Milton	134	Lisa Graham	Sewer to top of toilet bowl	Water Services
7-Jul-99	20:30	Milton	134	Quick Connect	Sewage overflow	Works Ops
8-Jul-99	09:36	Moyna	14 - 1		Flooding back stream overflowing	Works Ops
8-Jul-99	11:11	Moyna	14		Stormwater Pumping station 218	Works Ops
7-Jul-99	08:53	New Brighton		Police	Before Marshlands Rd Bus stop sign has been bent and is sticking out on the road	Fulton Hogan
8-Jul-99	17:00	New Brighton			Flooding in road and paths down New Brighton road between Baker Street and Pal	Fulton Hogan
8-Jul-99	12:10	New Brighton	205		Mud Truck	Works Ops
	18:30	Newport			Overflowing sewer	Water Services
		Nikau			Flooding	Works Ops
7-Jul-99	14:12	Norrie	66	Sean Horne	Sewer overflow on road	Works Ops
7-Jul-99	12:06	Nottingham	55	Ganda	Flooding in street	Works Civil
7-Jul-99		Nottingham			Flooding Nottingham Ave/Wales Street	Works Ops
8-Jul-99	00:21	Opawa		Tessa Blackey	Mud slid Chch side of tunnel before Opawa turn off	Works Civil
8-Jul-99	12:00	Oragen	39		Flooding in Station at Stillwater Pumping Station	Works Ops
7-Jul-99		Pages	58d		Flooding	Works Ops
		Papanui	219		Flooding	Works Ops

Date	Time	Street Name	Numb	Caller	Details	Forwarded To
		Pauline			Flooding between Pauline and pamela	Works Ops
		Percival			Flooding	Works Ops
7-Jul-99		Perry	19		Flooding	Works Ops
		Philpotts			Flooding between Philpotts and QEII WINTERS RD	Works Ops
7-Jul-99	17:50	Quantock	1		Ponding on road	Water Services
7-Jul-99		Raeleigh	29		Flooding in street	
	17:55	Ranfurly			Flooding in the intersection of Ranfurly and Caledonian starting to enter property	Water Services
7-Jul-99	18:45	Retreat	69	Mrs Nichols	Concerned about water and high tide	Water Services
7-Jul-99	18:37	Rhona			Flooding in Rhona, Linwood Ave, also Avonside Dr at Linwood	Fulton Hogan
7-Jul-99	19:21	Roker	115	Public	Sewer backing up	Works Civil
7-Jul-99	10:30	Rose	6	Don	Flooding outside his property	Works Civil
7-Jul-99	14:30	Rossmore		Police	Sewer overflow	Works Ops
7-Jul-99	09:51	Royal Park	63	Mcdonald	Flooding on Barkers Road	Fulton Hogan
8-Jul-99	00:13	Roydvale Dr	126	Mrs Thompson	Road has Sunk at Clarence Street on Railway Crossing	Works Civil
8-Jul-99	10:37	Russley		Police	Russley road near the airport roundabout right down to the Harewood Crematorium	Water Services
8-Jul-99	10:36	Russley		Police	Oil spillage on Russley Road to the Harewood Roundabout	Works Ops
7-Jul-99		Sawyers Arms	4		Flooding	Works Ops
8-Jul-99	09:09	Scottson	16		Sewage overflowing	Works Ops
7-Jul-99	09:30	Sefton	70	Resident	Flooding	Works Ops
7-Jul-99	16:35	Selwyn	177	John	Sewer Blocked	Works Ops
7-Jul-99	17:46	Sewlyn			Deep Flooding	Works Civil
7-Jul-99	09:43	Shands		Police	Flooding at the corner of Shands/Edmonton	Works Civil
		Sharon			Creek flooding	Works Ops
7-Jul-99	10:01	Shore	152	Mr Keating	Flooding outside his property	Fulton Hogan
7-Jul-99	18:09	Smith	138	Mrs Hutcheson	Drain Blocked in Arran Cresent near 138 Smith street	Works Ops
7-Jul-99	20:28	Smith	61	Kirsten Smith	Sewer not getting away	Water Services
7-Jul-99	20:05	Somerfield		Works Civil	Drains at the corner of Somerfield and Selwyn need clearing	Works Ops
7-Jul-99		Sparks		Craigen	Sparks road by Waimohik Place flooding	
		Speight	27		Flooding	Works Ops
8-Jul-99		Springfield	206	Mr Moore	Flooding rear of section	Works Ops
8-Jul-99	19:27	St Martins	22b	Mr R Bruce	Flooding in St Martins Raod between no's 22 and 24	Works Civil
7-Jul-99	09:53	Swift	23	Mr Petrie	Flooding on Swift Street	Works Ops

Date	Time	Street Name	Numb	Caller	Details	Forwarded To
		Thames	65		Flooding	Works Ops
7-Jul-99	15:51	Thorrington	36		Flooding at 36 Thorrington Ave	Works Civil
7-Jul-99	15:20	Thorrington			Flooding in Thorrington Road	Works Civil
7-Jul-99	17:16	Thorrington		Nanman	Flooding on west side of thorrington road	Works Civil
8-Jul-99	11:06	Tomes	60	Leslie Drom	Sewage coming out of all her drains	Water Services
8-Jul-99	09:05	Tomes	76		Sewage overflowing on properties 76 - 60 Tomes	Works Ops
8-Jul-99	11:35	Tomes	62		Sewage	Works Ops
		Torrens	21		Flooding	Works Ops
		Tuam			Flooding around Tuam and Percy Street	Works Ops
8-Jul-99	09:24	Tui	23	Warren Harfe	Flooding on road, Fendalton, St Barnebas Church through to Chch Boys High	Pumping Statio
7-Jul-99	09:41	Vagues	1	Mr Hughes	Flooding outside his property KRUSES DRAIN	Works Ops
8-Jul-99		Varden	23		Sewage	Works Ops
		Waimairi	280		Check grates	Works Ops
8-Jul-99		Wainoni	71a		Flooding	Fulton Hogan
8-Jul-99	14:40	Wairoa	34	Mrs Hale	Flooding on her property	Fulton Hogan
7-Jul-99	15:31	Waitaki	34	Mrs mangin	Flooding corner Waitaki Street and Pages Road	Fulton Hogan
		Warden	84		Flooding	Works Ops
8-Jul-99		Warden	23		Sewage	Works Ops
7-Jul-99	09:41	Warrington	80	Mr Walker	Flooding outsdie his property	Works Ops
7-Jul-99	18:16	Warrington	99	Tom Brien	Flooding	Works Ops
7-Jul-99	18:20	Warrington	99	Mrs McIntyre	Back yard flooding - coming in from Harrison st Dudley Creek FLOCKTON ST.	Water Services
		Whaka			Water Main before 45 Whaka terrace	Works Ops
7-Jul-99	05:04	Wigram			Flooding on Wigram/Halswell Junction Cnr	Works Civil
7-Jul-99	11:20	Wigram			Flooding signs required Wigram and Haytons road	Works Ops
7-Jul-99	09:00	Wilsons		Police	Street flooding and a pothole on corner of Wilsons road and Lismore Street	Fulton Hogan
8-Jul-99	16:28	Winborne	10	Mrs Dondle	Hole in the pavement	Fulton Hogan
7-Jul-99	15:32	Winters	73		Flooding (The creek behind 22 Charon Stree, Amstel Lane, off Poulton Ave Shirley)	Works Ops
8-Jul-99	14:26	Winters	82	Mrs Elley	Sewage water is blocking the pavement at the corner of Winters and Fraser Street	Pumping Statio
8-Jul-99	10:10	Winters	74		Sewage	Works Ops
		Winton			Flooding Winton - Lindsay	Works Civil
7-Jul-99	12:09	Worcester	338	Mcmillan	Linwood Community Arts Centre Water coming from downpipes	Works Ops
8-Jul-99	10:40	Worsley	14		Flooding	Fulton Hogan

Date	Time	Street Name	Numb	Caller	Details	Forwarded To
8-Jul-99	12:18	Wyon	19	Mrs Lloydd	Street flooding affecting houses	Fulton Hogan
7-Jul-99	17:51	Yaldhurst	65	Mrs Perini	Blocked drains outside 65 Yaldhurst Road - roading truck	Works Ops
7-Jul-99	18:33	Yaldhurst Rd			Flooding at Yaldhurst/ Ludecke	Works Civil

Section 5

5 Planning and Investigations

Overview

The storm event provided the best opportunity for the last several years for obtaining valuable gauged flow information on tributary waterways such as No 2 Drain and Sumner Main Drain where advance planning studies are underway. No gauging was carried out in these catchments because the NIWA team was short of staff and a City Council team has yet to be formed and trained. It is recommended that a gauging team be formed and trained as a matter of priority.

A flooding map indicating areas where surface ponding was observed during the storm and photographs taken of some of these areas are included at the back of this section.

The greatest rainfall depths and intensities recorded during the storm of 17 and 18 July 1999 were in the Marshlands/Burwood areas. The rainfall depth return period for the Burwood rainfall site was approximately 15 years for 12-18 hours' duration.

Peak water levels in the middle reaches of the major rivers had a return period of approximately five years for the Avon River at Gloucester Street and Styx River at Radcliffe Road. The return period for peak water levels in the Heathcote River was less than five years.

Extensive shallow surface ponding was experienced in and around the Winters Road retention basin and Cranford Street 'basin' area. Opportunities exist for improving the operation of the inter-connected drainage networks in these areas. However the recent City Plan hearing decision to allow new residential development adjacent to Bullers Drain will have the opposite effect unless adequate flood mitigation measures can be implemented as a condition of any subdivision.

Opportunities for Improvement	Suggested Action
3.1 Liaison with the Canterbury Regional Council and NIWA over flood gauging	Tony Oliver to make early contact with Canterbury Regional Council and NIWA during future storm events
3.2 Equipping and training an in-house gauging team	Technical Support Team to provide equipment and training as a matter of priority
3.3 System operation in and around the Winters Road retention basin and Cranford Street 'basin' areas. Proposed residential development adjacent to Bullers Drain drainage mitigation measures.	Develop a computer model to test operation of the inter-connected drainage systems (programmed). See suggested action under Section 4 System Operation. Water Services Consents Team to recommend adequate mitigation measures as a condition of any subdivision. Waterways and Wetlands Team Leader to draw Ivan Thomson and Vil Vabulis' attention to existing flooding problems in this area.
3.4 Telemetry installation in the Cranford Street/Winters Road catchment areas	See Section 4 System Operation

3.5	Definition of level of service for rural landowners in the Cranford Street/Winters Road catchment areas	Maintenance and Renewals Team Leader to define an appropriate level of service through the review of the utility asset management plan next year.
3.6	Halswell Junction Road retention basin	Land drainage engineer to review design parameters and investigate the outlet control for the basin.

Flood Event

17 July 1999

Tony Oliver
Planning Engineer

1.0 FREQUENCY OF THE EVENT

1.1 Rainfall

As already reported, the rainfall in this event was up to 100% greater on the north-east area of the city i.e. Marshlands-Burwood areas, compared with areas to the south-east i.e. Templeton.

For the Burwood rainfall site, the following frequencies have been estimated:

Duration	Total Depth (mm)	Return Period
6 hrs	43.5	5 yrs
9 hrs	63.5	10 yrs
12 hrs	77.9	• 15 yrs
15 hrs	87.9	• 15 yrs
18 hrs	92.9	• 15 yrs
21 hrs	96.6	
24 hrs	99.2	• 10 yrs

In comparison, the Civic Offices site recorded a 24 hour depth of 59 mm. This is approximately a mean annual event.

1.2 Flood Levels

Avon River

@ Mona Vale - peak 17.1 m @ 1245 on 17 July (estimated approximately mean annual flood event)

@ Gloucester Street - peak 23.5 $m^3/_5$ on 17 July (refer attached plot) and is estimated approximately five year return period.

@ Horseshoe Lake Outlet maximum water level 10.53 m - this is not exceptionally high and could be expected to occur two to three times per year.

Styx River

@ Radcliffes Road - peak level 11.64 m @ 2030 on 17 July (maximum flow 6.3 $m^3/_5$) and is estimated as five to ten year event.

Heathcote River

@ Buxton Terrace - maximum flow 21.5 $m^3/_5$ @ 1700 on 17 July and is estimated as two to five year event.

@ Ferniehurst - 16.8 m @ 1430 on 17 July and is estimated as two to five year event.

@ Wigram East Basin - peak water level 24.5 m and is estimated as two to five year event.

Halswell Retention Basin

Peak water level 32.57 m is based on Montgomery Watson's modelling. This would be equivalent to a 2% AEP (50 year event).

Obviously this is not the case - see further comments under 2.2

Miscellaneous Flood Levels

Numerous other levels, particularly in the north east, were observed both during the event and from flood marks, generally identified 36 hours later. These are appended. Many of these are also indicated on photos.

2.0 ISSUES

2.1 Flood Gaugings

The Canterbury Regional Council did manage some gaugings. The Avon River at Gloucester Street and the Styx at Radcliffes Road I understand, but on the recession of the flood.

NIWA managed some gaugings on Sumner Main Drain only. In hindsight, we should have contacted NIWA.

Unfortunately, no gaugings were made by our staff. While Council staff have been identified for flood gaugings, Derek Reid has yet to provide training and arrange all the necessary equipment. This should be addressed as soon as possible.

2.2 Areas Flooded

Areas flooded are shown on the attached plan.

Heathcote Catchment

In the Heathcote catchment, flooding was mainly restricted to low lying roads adjacent to the Heathcote River and the ponding basins.

Avon Catchment

Flooding in the Lower Avon appeared to be associated with blocked sumps and pipes. The river levels were not unusually high and no bank overtopping was observed.

Lower Dudley Creek

Lower Dudley Creek was high as was its tributary, the Philpotts/Shirley Road Drain along Aylesford Street and resulted in some surface flooding in the Flockton Street area. Landowners reported peak flooding occurring after 6:00pm on 17 July.

Rainfall at the Horseshoe Lake site shows a peak intensity of approximately 9 mm in the hour between 6:00 and 7:00 pm. This also co-incided with an incoming tide in the river and when levels in Dudley Creek were already high from the previous heavy rain during the day.

Shirley Stream

Flooding in the Shirley Stream area e.g. Emmett Street seemed to be related to pipe blockages. The stream itself was not particularly high.

Winters Road/Cranford Street Basins

Significant surface flooding occurred in the Winters Road area, with the Winters Road Retention Basin being reasonably full, although no discharge occurred over the outlet weir. Alan Beard reported the control valve in Winter Road Drain wasn't closed until 8:00 pm. In hindsight, this was probably too late. High discharge into the Dudley Creek Diversion, via Ballers Drain, could have been reduced if the storage within Winters Road Basin was utilised earlier. Significant flooding also occurred in Horners Drain, probably due to high levels in the Styx River and Kruses Drain. Very little surface flooding occurred in the Cranford Street Basin area, possibly due to the very efficient pumping of Tyson's Drain pumping station.

The proposed investigation and modelling of the whole drainage system in the area will help to get a better understanding of how this integrated system operates and help to optimise storage within the system. As discussed in Chris Rance's report, telemetry in this area will promote optimisation of the system.

The residential re-zoning of land adjacent to Buller's Drain will also exacerbate future flooding due to a loss of storage volume and increased run off. Unfortunately, despite City Plan evidence, no provision has been made for appropriate mitigation.

Rural landowners appear to have unrealistic expectations regarding flooding on their land. We don't appear to have a stated level of service for such areas. I think this is an area which needs addressing.

Halswell Road Retention Basin

As previously indicated, the level in this basin was much higher than would normally be expected for the rainfall in this catchment (about a mean annual event). This could be due to the outlet control, or catchment inflows being much greater than designed for. This warrants further investigation.

3.0 RECOMMENDATIONS

3.1 Improve liaison with the Canterbury Regional Council and NIWA to maximise flood gaugings.

3.2 Request the Technical Support Team to put some priority into training gauging teams and providing appropriate equipment.

3.3 Investigate functioning of stormwater system within the Cranford Street/Winter Road Basins for future operation and identification of flood storage needs, including measures to mitigate residential development adjacent to Bullers Drain.

3.4 Investigate the use of telemetry in the Cranford Street/Winters Road systems to optimise operation.

3.5 Investigate an appropriate level of service for rural landowners.

3.6 Investigate operation and design parameters of the Halswell Retention Basin.

APPENDIX

Flood Event

17 July 1999

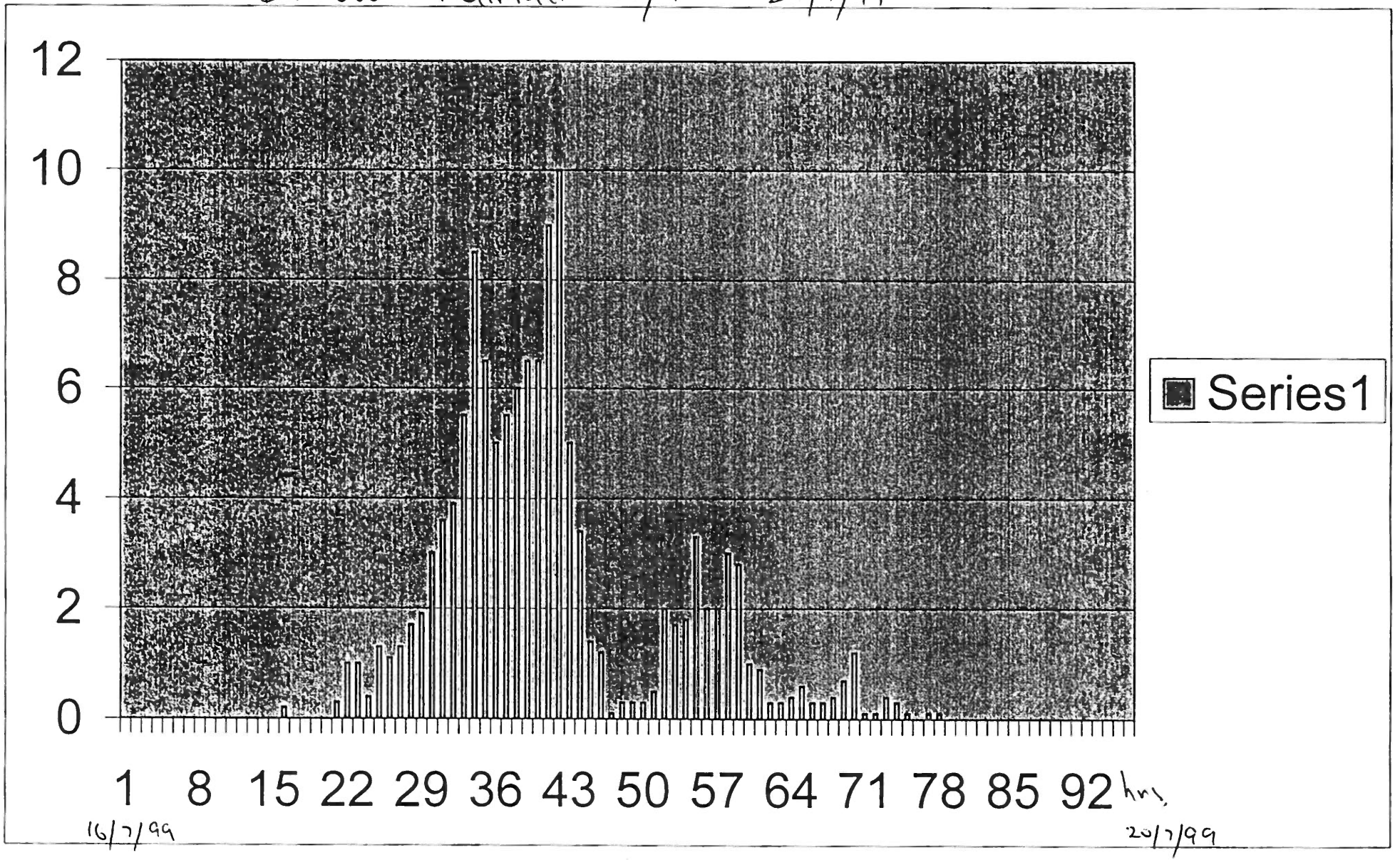
Miscellaneous Flood Levels

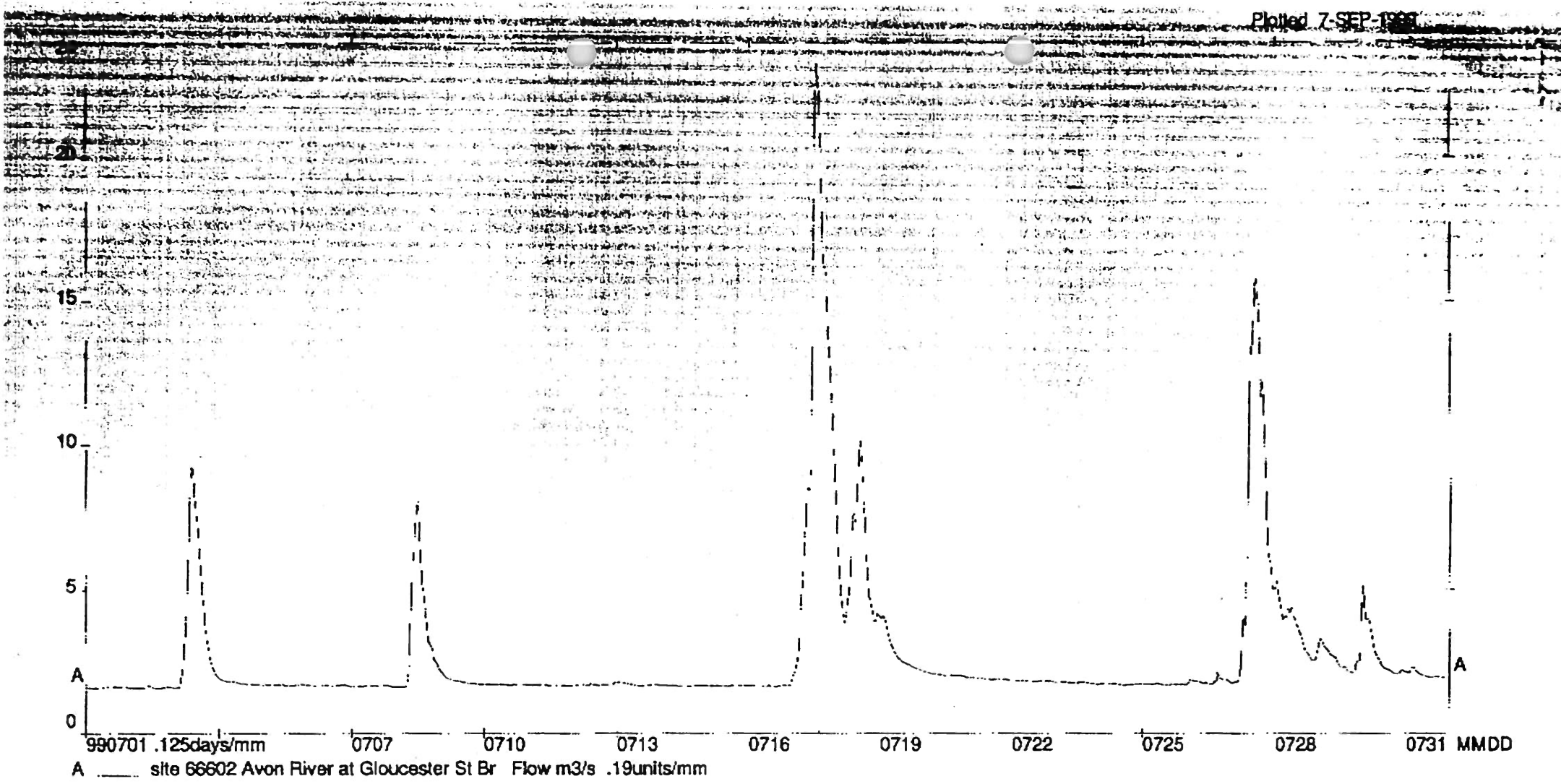
(some of these also indicated on photos)

Old No. 2 Drain @ Recorder Lake Terrace Road	peak 695 mm i.e. 10.2 m @1945 17 July
No. 2 Drain @ Mairehau Road	peak water level from flood marks 12.14 m (photo)
No. 2 Drain @ Mairehau Road	12.06 m @ 1450 18 July
Old 2 Drain @ Diversion Weir	peak SG 11.7 @ 17 July (record by local John Eade)
No. 2 Drain @ QEII Druve	Flood marks estimate 11.15 m (photo)
Snellings Drain @ Alpine View	Flood marks estimate 12.75 m (up to road) (photo)
No. 2 Snellings Drain/No 2 confluence	U/s flood marks estimate 10.55 m d/s flood marks estimate 10.49 m (photo)
Styx River @ Trelevans	SG reading 10.56 @ 1514 18 July
Styx River @ Spencervile	SG reading 10.46 @ 1515 18 July
Shepherd's Drain	U/s Lower Styx Road 11.18 m (photo)
Winters Road Retention Basin	Flood marks basin 14.22 m 17/7 14.12 m@ 1200 19 July (photo)
Winters Road Basin Inlet Weir	Flood mark estimate 14.65 m (photo)
Winters Road Drain Staff Gauge d/s Control Gate	Flood mark estimate 14.1 m (photo) SG reading 13.72 m @ 1210 19 July
Philpotts Road Drain @ Winters Road junction (staff gauge)	Flood mark estimate 14.10 m SG reading 13.75 m @ 1240 19 July
Bullers Drain @ Winters Road	Estimated flood level 14.09 m

Topps Drain @ 224 Winters Road	Estimated flood level 14.08m @17 July (see photographs taken by Mr Smith (landowner))
Horners Drain d/s Winters Road	Flood mark 14.79 m (photo)
Shirley Storm @ Quinns Road/Orion Street	Flood marks u/s Orion Street 13.40 m Flood marks d/s Orion Street 13.26 m (photo)
Dudley Creek @ Hills Road (u/s)	Flood marks estimate behind butcher shop 12.97 m (photo)
Philpotts/Shirley Road Drain (outside No. 1 Aylesford Street)	Flood marks estimate 13.32 m peaked @ approximately 1500 hrs (photo_
Shirley Road/\Emmett Street	Estimated flood levels from property owners • 13.10 m (levelled).
Flockton Street/Carrick Street/Thornton Street	Estimated flood levels from property owners • 13.3 m.
Jacksons Court u/s Huxley Street 4 Burlington Street	Flood marks levelled 15.74 m (not particularly high)
Upper Heathcote @ 15a Coppell Place	Flood marks estimated from property owner 21.19 m (levelled) 30 mm above ground - not particularly high
Heathcote River @ Ferniehurst Street	16.607 m @ 1600 18 July
Heathcote River @ Buxton Terrace	12.142 m @ 2100 17 July

Burwood Rainfall 16/7 – 20/7/99



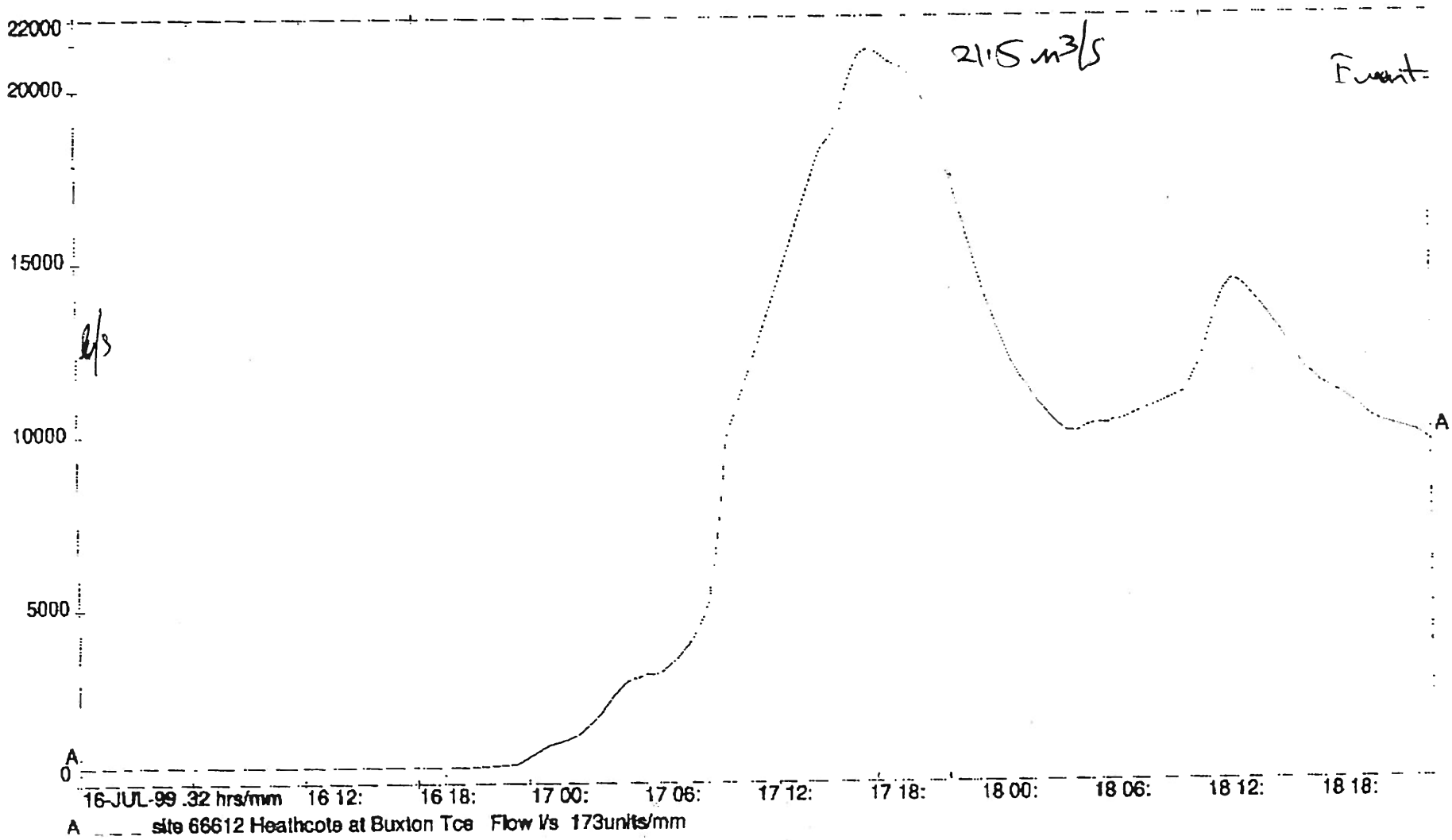


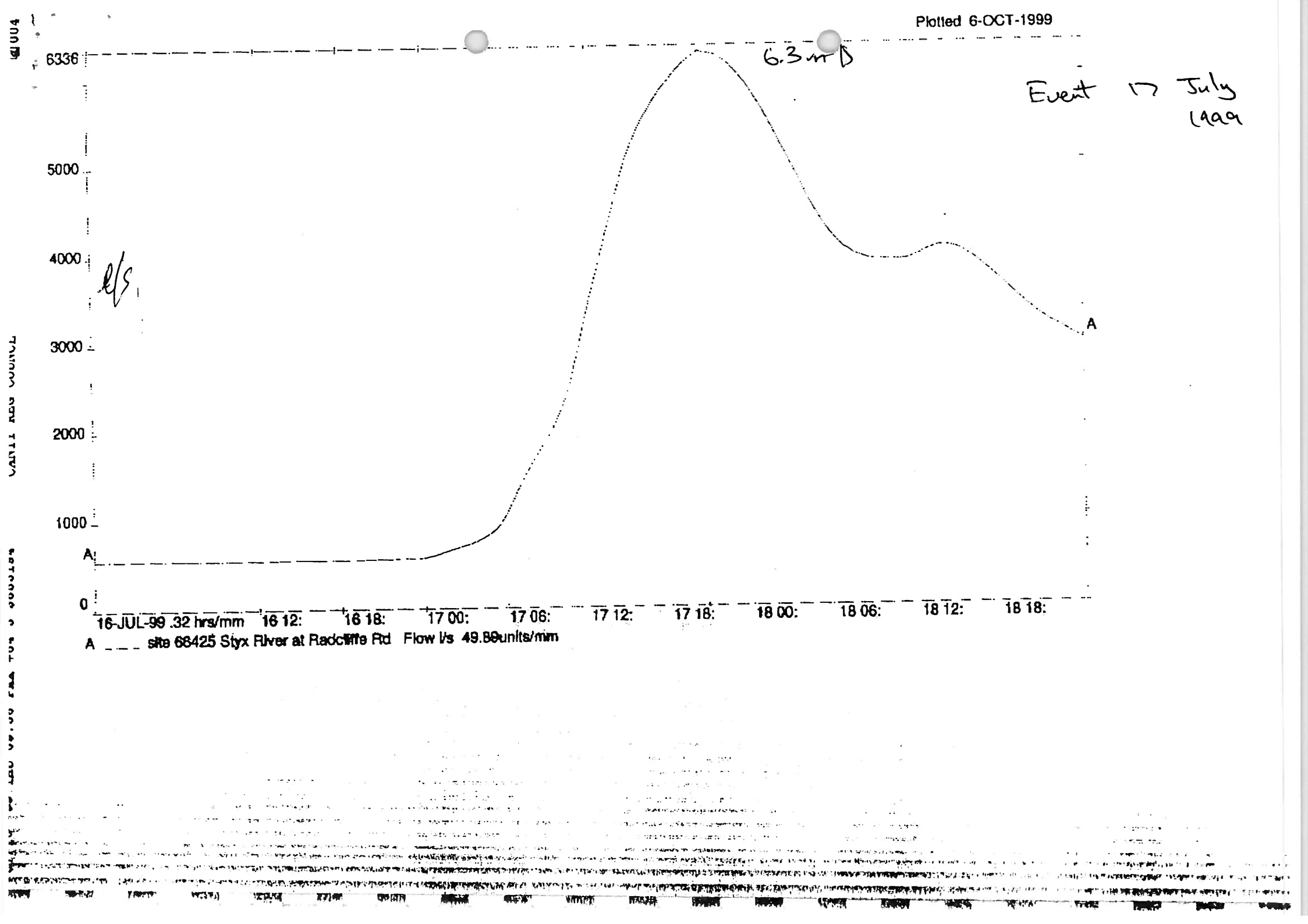
Avon @ Gloucester St.

$Q_p \simeq 23.5 m^3/s$ 17/7/99

$\simeq$ 5 yr. return period event

Plotted 6-OCT-1999




Plotted 6-OCT-1999
6.3m³/s
Event 17 July 1999
l/s
6336
5000
4000
3000
2000
1000
0
A
A
16-JUL-99 .32 hrs/mm
16 12:
16 18:
17 00:
17 06:
17 12:
17 18:
18 00:
18 06:
18 12:
18 18:
A ___ site 66425 Styx River at Radcliffe Rd Flow l/s 49.89units/mm

Winters Road Ponding Basin
19 July 1999
Flood Level 14.12m
Maximum Flood Level 14.22m

Ponding north side Winters Road
Rossiters/Horners Drains
19 July 1999

Winters Road/Horners Drain
19 July 1999

Topps Drain and Winters Road
17 July 1999

Ponding south side Winters Road
towards Buller's Drain
17 July 1999

Section 6

6 Key Partner Experience

Overview

Reports are not available from City Streets nor Works Operations. A report on the performance of the liquid waste system during the storm follows.

Sewer overflows did occur during the storm but overall the system performed satisfactorily given the magnitude and duration of the event. Approximately 40 private properties were adversely affected by sewer overflows. Liquid Waste staff are investigating ways of reducing the occurrence of similar situations during future storm events.

Suggested Action

Consider if and when a Liquid Waste representative needs to be in the control room during minor emergencies.

STORM 17-18 JULY 1999
WASTEWATER

General

Sewer problems were mainly confined to the north-west sector of the City. The usual "barometers" of the sewer performance,ie, the overflow points at Grassmere Street in Papanui and Eastern Terrace did overflow but at considerably less volume than would be expected given the rainfall depth.

This is the first storm event in which the benefits of the house to house inspections for faults have been obvious. The sewer flow monitoring equipment which had been in place for some 16 months without recording a major storm had been removed prior to this storm so accurate comparisons are not possible.

A feature of catchments in the south-west of the City was the prolonged high flows extending to some days after the storm, indicating that storm induced infiltration is the main driver of sewer overloads. This indication was later reinforced with the following snow and rain event of 3 and 4 August which maintained high sewer flows for some 5 days after the event.

Approximately 40 private properties were affected with gully traps or loo problems.

Customer service

The response of Work Operations staff was very good.
One lapse of service occurred in Briggs Road where the complaint was thought to concern the roadway and not the property where the real problem existed. This confusion can occur if insufficient information is sought from the complainant or is abbreviated too much on the record sheet.

Another unfortunate lapse of service to residents at 858-866 Avonside Drive occurred with ponded road flooding extending well into properties which was not cleared until midday Sunday 18 August. A main sewer overflow at the same location caused by a partial pump blockage at the nearby PS28 compounded the misery of the residents

One of the new breed of complaints is "my loo fills up to the brim. I have to go next door to use their loo". It appears to affect only new houses or recent new upgrades of loos. Strangely the gully traps at a lower level than loos invariably did not overflow. The reasons seem to be associated with the change in venting from the former use of back vents on pans to the new BIA approved air inlet valves.

Blocked sewers can be confused as gorged sewers. Eleven houses on Tomes Road had overflowing gully traps for 3 days caused by a blocked sewer unrelated to the storm. This is likely to be one of the hazards during a severe storm as no time is available to check a whole catchment for an individual block when high sewage levels are the norm for most of the area.

Summary

The sewer system performed reasonably well given the severity of the storm.
The house to house exercise seems be giving results
The only operational hiccup from the sewer customer service response seems to be the clarity of messages.
The matter of house venting standards will need to be addressed to avoid air locking of loos.

The assistance of the road maintenance contractors to clear sump to river or drain outfalls as part of their contractual duties would be worth considering.

Appendix

)wnpour

/7/99

e '10-year' rain

The Fire Service was kept busy with llouts from the public to deal with)oding around houses and backyards.

A Fire Service spokesman said that in ost cases it could do little to alleviate the roblem because surface water had covered rge areas and there was nowhere to pump e water.

However, no serious flooding was ported, and no houses were inundated. ooding was subsiding yesterday. Motorists ere asked by police not to travel in flooded eas unless necessary, and to keep their)eed down.

The Canterbury Regional Council re-)rted that river levels in Canterbury were gh but subsiding, with the Hurunui and 'aiau rivers both reaching peak flow levels. s rainfall eases, water levels are expected) continue falling.

North Canterbury provincial president of ederated Farmers Noel Dalley said the pe of rain, although heavy in some areas, as expected for the time of year. It had not aused any particular problems for farmers ecause the winter so far had been vourable.

"The feed situation for most farmers is retty good. There are a few people with arly lambs, but they will be prepared," he aid.

A senior vice-president of Federated armers who farms at Pigeon Bay, Pam ichardson, said rainfall had varied rastically from one part of Banks Peninsula o another, from 7.3mm to 150mm over 24 ours. Farmers welcomed it. The 150mm igure was recorded at Le Bons Bay and was he most rain in the area since 1986.

"It's much-appreciated rain," Ms Richardson said. "We can see a good growth)eriod ahead. It's like money in the bank."

No problems were reported in Banks Peninsula apart from surface water and a ew minor slips, she said.

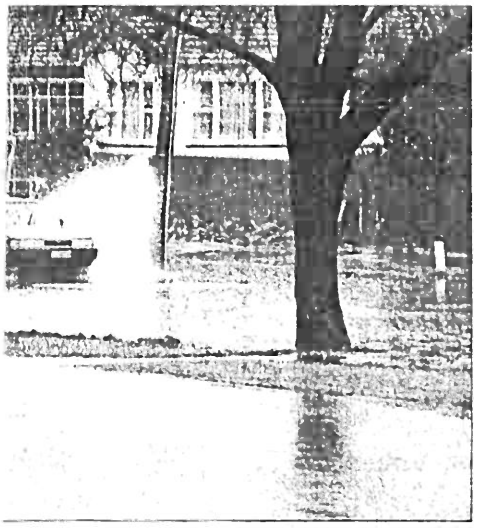


PHOTO: ANNETTE TURNBULL-DEW

ve.

CITY PLAN WATERWAYS

17 July 1999
Flood Event

Main areas flooded.

LEGEND:

- COASTAL MARINE AREA BOUNDARY
- MAJOR ROADS
- MINOR ROADS
- RAILWAY LINE
- CCC BOUNDARY
- ENVIRONMENTAL ASSET WATERWAY
- UTILITY WATERWAY - OPEN UTILITY
- UTILITY WATERWAY - UTILITY FOR IMPROVEMENT
- CRC WATERWAY
- RIVERS UPSTREAM
- RIVERS DOWNSTREAM
- HILL WATERWAY
- NEW ASSET WATERWAY

N

1 0 1 2 3Km

SCALE 1:30000