

Article to media 31/01/11

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Weather reports and river flooding: Authoritative data, popular opinion and public response

The community is understandably now reflecting on hot topics such as dam operation, early warning, flood zoning and other flood mitigation measures in relation to the Brisbane and Ipswich floods. This raises the tension between published authoritative data (e.g. rainfall, river heights), popular opinion (e.g. how Wivenhoe was perceived to protect Brisbane), and public response (e.g. understanding flood levels on individual properties and what to do about it)

How this played out in January's floods is instructive on what data is available and how the resource authorities (BOM, SEQWATER) provide it, how the media (ABC radio, TV, newspapers) publish it, and how local authorities (BCC) and the community interpret it and respond.

I have long been interested in this issue, as an informed lay person with 40 years professional experience in water resources, river management and environmental engineering. In an era of enhanced technology, increased community awareness and instant experts, I offer the following contribution to help us deal with crisis situations such as this (and to also benefit during everyday weather conditions).

My main comments relate to vital BOM data that is already publicly available at <http://www.bom.gov.au/qld/>, but which I believe could be better interpreted by BOM / media outlets, and communicated to users. I know there are arguments about quality control of published data, packaging information for publication, and perceived competence levels of the public to interpret data. Nevertheless, the extent to which significant primary data on rainfall and river conditions is available in real-time but not packaged and published for public information, should be an area of major attention now and in forthcoming government reviews.

Like many SE Queenslanders, during that flood week in January I listened and watched intently to weather information, flood interpretations, evacuation advice and flood disasters conveyed through the media to the people of Brisbane and Ipswich. Whereas the images were visually graphic on TV, it was clear that ABC radio was the leader in authoritative, up-to-date and practical information sourced and broadcast regularly for public service and assistance.

It also became clear to me that authority representatives (BOM, SEQWATER, BCC) were struggling to convey the Brisbane and Bremer River and Wivenhoe Dam information in a meaningful way either through news bulletins or interviews. Many times I listened to ABC radio journalists and those from TV media talk to BOM hydrologists, SEQWATER managers and the Brisbane and Ipswich mayors who were exemplary in their competence, openness and grasp of the situation.

But I also listened to many interviews with the public, and experienced first-hand in discussions with others, the shortcomings of the information flow that could so easily be improved if only the rain and river data were more readily available for reasoned use by the public.

I use the BOM website data extensively for my work, but also rate it as one of the top websites for personal everyday use. Hence I am familiar with the capacity of this website and the rapidly increasing extent of valuable user friendly information available to the public. I made a case 4 years ago (article attached) when Brisbane was in the grip of a drought to have the weather story told in terms of the

meaningful quantitative data on rainfall probabilities that is already available online at <http://www.bom.gov.au/jsp/watl/rainfall/pme.jsp>, instead of the banal musings of media weather reports that are more akin to cake recipes than public advice.

This case is more critical now in time of flood. Many thousands of residents in Brisbane and parts of Ipswich would have benefited if information on river heights *throughout* the Brisbane River reaches were conveyed through the media instead of relying *almost solely* on information for the Brisbane River City Gauge in the largely tide affected lower reaches of the river where flood level fluctuations were of the order of 2 – 3 m. The Ipswich gauge on the Bremer River, where river heights fluctuate in the order of 10 – 15 m was well reported, but it was not made clear to the public how to use this information other than at these immediate locations on the Brisbane and Bremer Rivers.

Whereas the City Gauge is a valid and meaningful reference point for the City and adjoining suburbs, the western suburbs of Brisbane and much of Ipswich is affected by much greater river height fluctuation. Information that is already available for the Jindalee and Moggill Gauges on the Brisbane River was not packaged for use by the authorities or by the media. Adjoining suburbs in these Brisbane River reaches were not subject to the tidal fluctuations and the associated relatively small flood height increases experienced in lower reaches, and extensively publicised in the weather reports and through the media. These suburbs were facing flood level fluctuations of the order of 8 – 10 m, and the Jindalee and Moggill Gauge data were showing this. But this was not grasped by the authorities or the media and, during the many days of listening and watching that I did, was not conveyed meaningfully to the public

Residents of Rocklea, Graceville, Jindalee and Goodna would no doubt have benefited if they were to look out from their properties at water levels in the river or in an adjoining park and understand that these levels were expected to rise by 8 – 10 m (based on river gauges in their proximity at Jindalee and Moggill), and not by 2 – 3 m (based on the City Gauge). This information is available in real time via telemetry from the river gauges, is evident to the informed user, and is published on the BOM site at http://www.bom.gov.au/cgi-bin/wrap_fwo.pl?IDQ60286.html

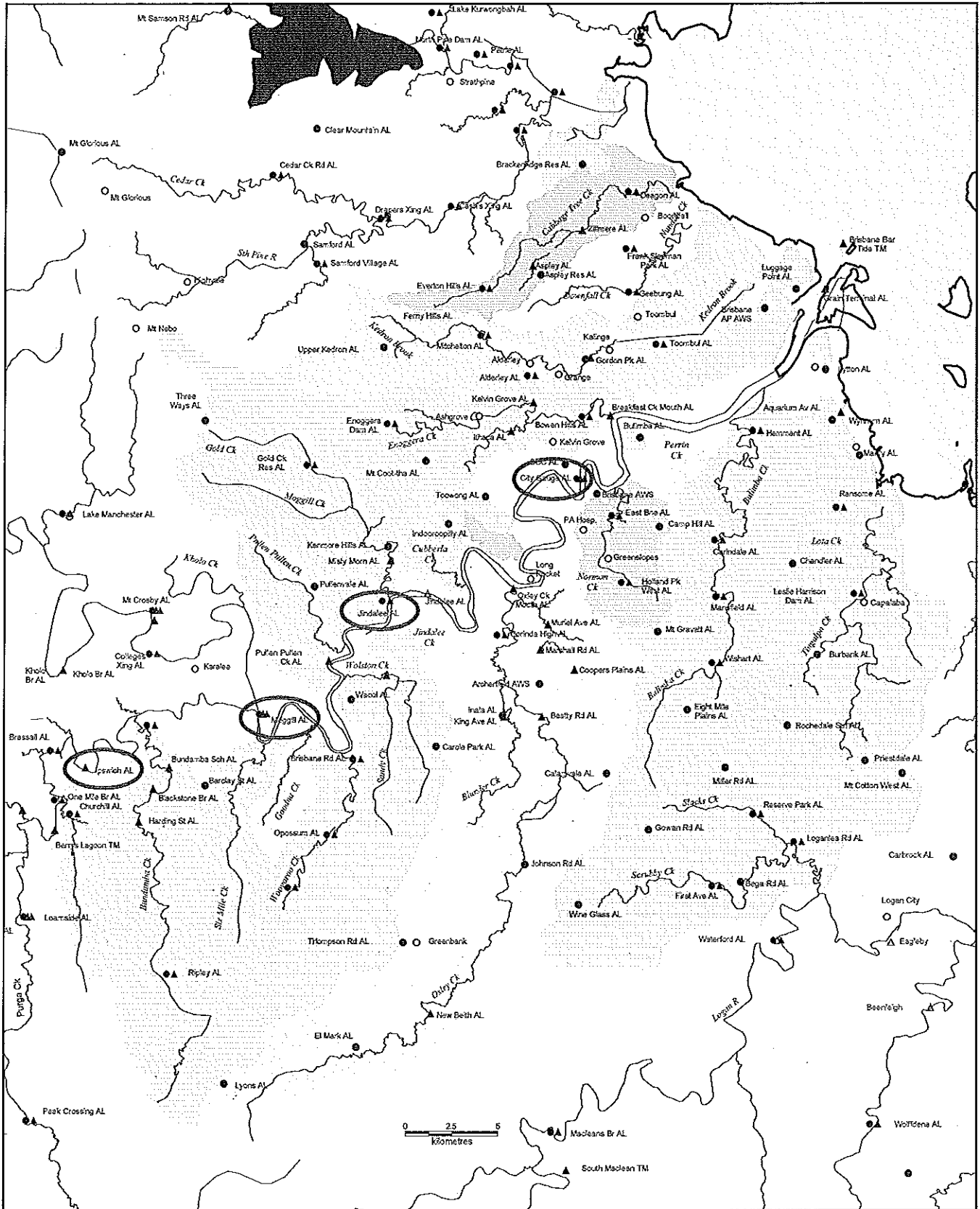
I have attached a document with extracts from the data for January's flood obtained from the BOM site (map of BOM stations with lower Brisbane and Ipswich gauges highlighted; river height plots for Ipswich, Moggill, Jindalee, City gauges; basic data for the river height / gauging stations)

Whereas information presented for future flood events will most likely be supported by enhanced technology providing graphic mapping of inundated areas, significant vital information on rain and river conditions is already publicly available on the BOM website. The case that I would like explored now and through the forthcoming government reviews is to have this information packaged and presented for use by the authorities and media to better inform a public that is mostly competent to embrace this information and benefit from it:

- real time river height data and flood level plots at http://www.bom.gov.au/cgi-bin/wrap_fwo.pl?IDQ60286.html
- rainfall forecast probability of precipitation data at <http://www.bom.gov.au/jsp/watl/rainfall/pme.jsp>

Sincerely

Ross



<ul style="list-style-type: none"> ○ Daily Reporting Rainfall Station △ Manual River Station ● Telemetry Rainfall Station ▲ Telemetry River Station 	<h2>LOWER BRISBANE RIVER FLOOD WARNING NETWORK</h2>	<ul style="list-style-type: none"> — Major Roads + + + + + Railway <p style="text-align: right;"><i>Revised: Nov 2009</i></p>
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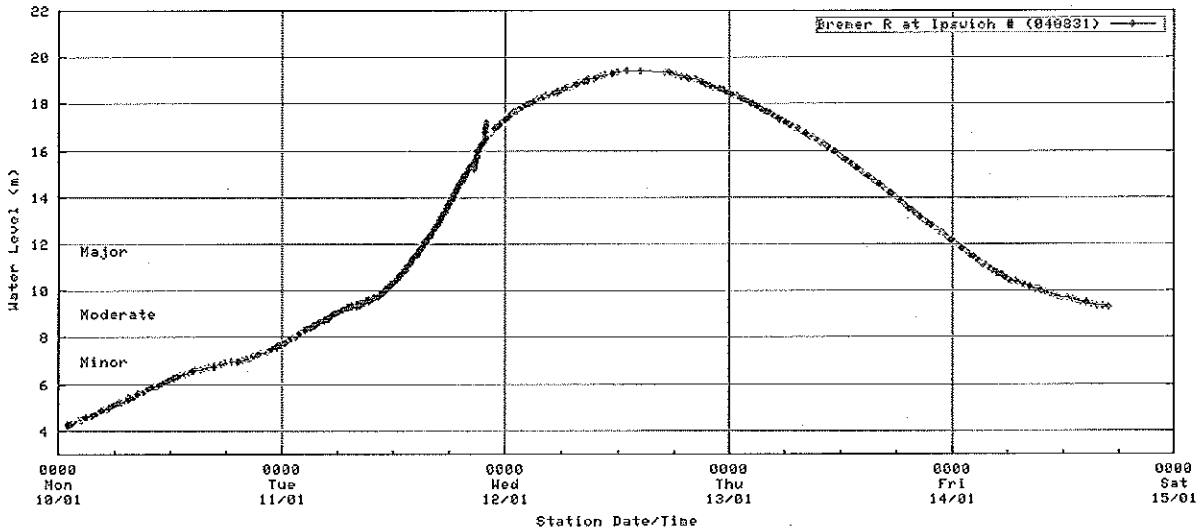
Latest River Heights for Bremer R at Ipswich

Issued at 5:15 pm EST Friday 14 January 2011

[About river heights plots](#) | [About this Plot](#)

Station details: Station Number: 040831 Name: Bremer R at Ipswich # Owner: CBM/ICC:143954
 Flood levels: Minor: 7.00 Moderate: 9.00 Major: 11.70

Data from the previous 4 days.



Australian Government Bureau of Meteorology

(Generated: 14/01/2011 17:15:17)

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About this plot

1. The river height data is the latest available operational data provided for flood warning purposes and has not been quality controlled.
2. Stations marked with * or # indicate that the data is provided from automatic equipment.
3. Stations marked with * are Telephone Telemetry Devices and are nominally polled once a day and more often during floods.
4. Stations marked with # are ALERT Radio Telemetry and report every 3 hours and more often when the water level changes.
5. All river height reports are in metres and are shown in local time.
6. Heights or depths above/below roads, bridges, dam spillways and weirs are given as a guide only. For road open/closed information, see the [RACQ](#) website.
7. This product includes data made available to the Bureau by other agencies. Separate approval may be required to use the data for other purposes. Refer to [Listing of Operating Agencies](#) for Station Ownership.
8. Where data is supplied from a Department of Environment and Resource Management (DERM) Monitoring Site, please follow this [link](#) to get advice on data use and copyright.
9. For other Station details: [Flood Classifications](#), [Road Crossings](#), [Survey/AHD Details](#), [Maps](#)



SEARCH

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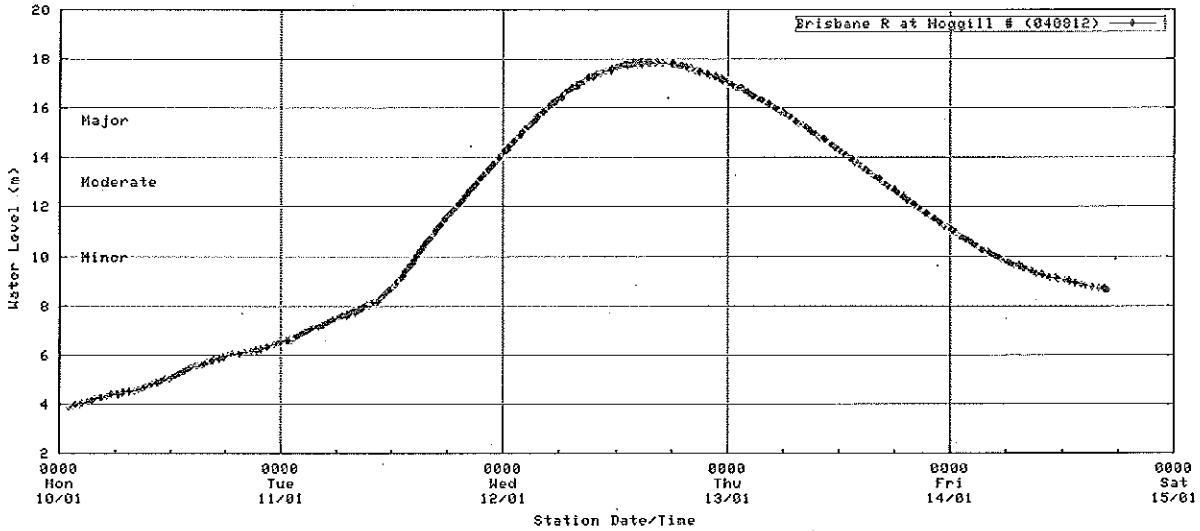
Latest River Heights for Brisbane R at Moggill

Issued at 5:15 pm EST Friday 14 January 2011

[About river heights plots](#) | [About this Plot](#)

Station details: Station Number: 040812 Name: Brisbane R at Moggill # Owner: CBM:143951
 Flood levels: Minor: 10.00 Moderate: 13.00 Major: 15.50

Data from the previous 4 days.



Australian Government Bureau of Meteorology

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About this plot

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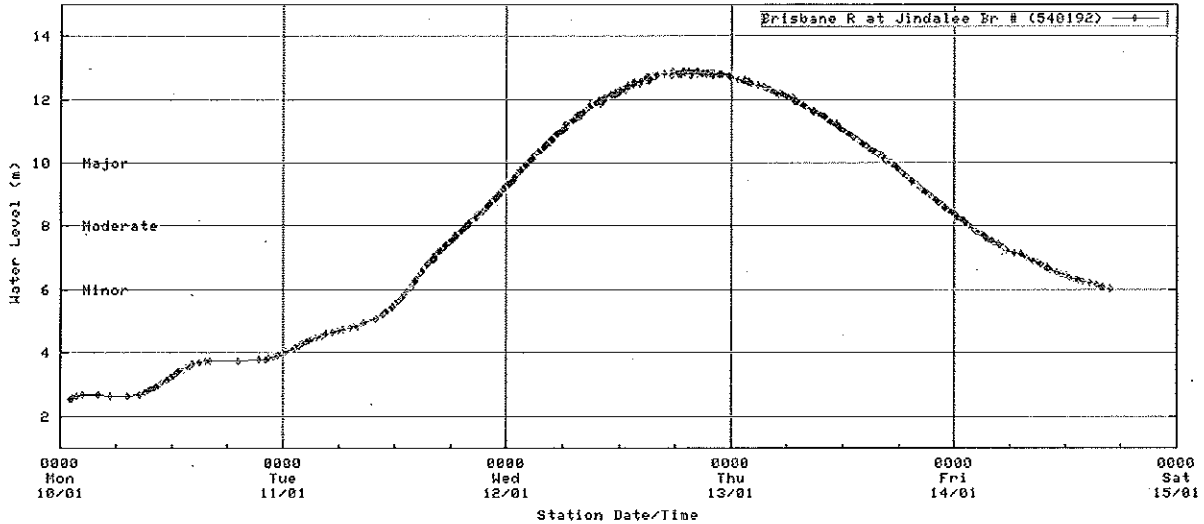
Latest River Heights for Brisbane R at Jindalee Br

Issued at 5:15 pm EST Friday 14 January 2011

[About river heights plots](#) | [About this Plot](#)

Station details: Station Number: 540192 Name: Brisbane R at Jindalee Br # Owner: SEQWCO:143832
 Flood levels: Minor: 6.00 Moderate: 8.00 Major: 10.00

Data from the previous 4 days.



Australian Government Bureau of Meteorology

<Generated: 14/01/2011 17:15:27>

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IDQ65389

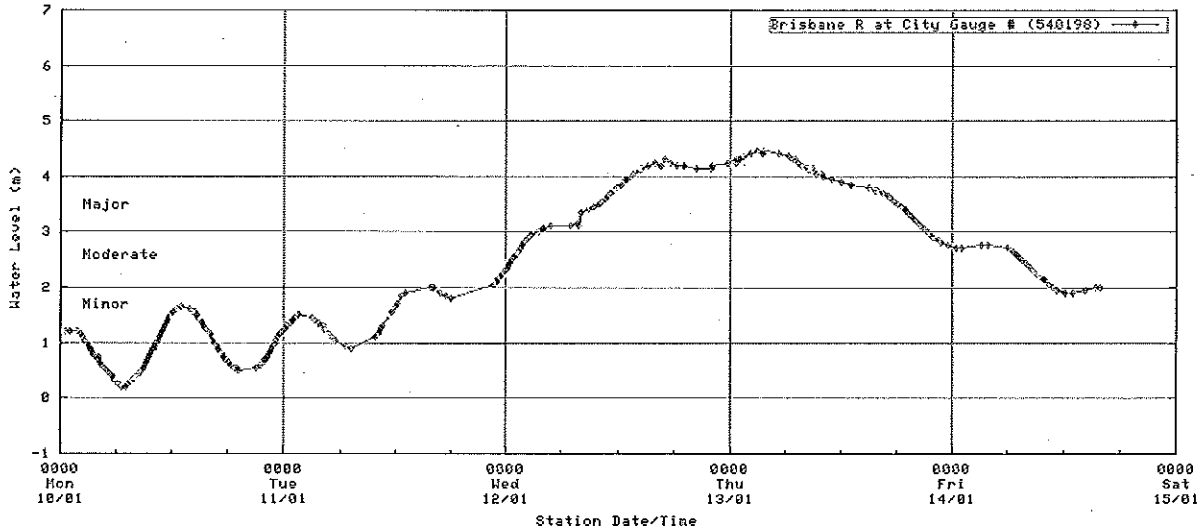
Latest River Heights for Brisbane R at City Gauge

Issued at 5:45 pm EST Friday 14 January 2011

[About river heights plots](#) | [About this Plot](#)

Station details: Station Number: 540198 Name: Brisbane R at City Gauge # Owner: SEQWCO:143838
 Flood levels: Minor: 1.70 Moderate: 2.60 Major: 3.50

Data from the previous 4 days.



Australian Government Bureau of Meteorology

(Generated: 14/01/2011 17:45:27)

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About this plot

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3. Stations marked with * are Telephone Telemetry Devices and are nominally polled once a day and more often during floods.
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540050	WARREGO HIGHWAY TM	5.0	76.339	AHD	11/ 8/1990		445	4.5	5.2	5.5
540473	LAKE CLARENDON DAM ALERT									
540149	GLENGORE GROVE ALERT	51.8	67.115	AHD	1/ 1/1955		2230	8.0	11.0	13.0
040662	LYONS BRIDGE	29.1	48.528	AHD	1/ 1/1955	1/ 3/1975	2530			
							2530	10.0	11.5	13.0
540174	LYONS BRIDGE ALERT-P	29.1	47.528	AHD	1/10/1994		2530	10.0	11.5	13.0
540175	LYONS BRIDGE ALERT-B						2530	10.0	11.5	13.0
040817	RIEFLE RANGE ROAD TM	26.2	44.435	AHD	1/ 2/1988		2541	10.5	12.0	13.5
540479	ATKINSON DAM ALERT						33			
540259	BUARABA CREEK ALERT		92.504	ASSUM						
540051	O'REILLY'S WEIR TM	1.4	23.620	AHD	1/12/1948		2980	12.0	14.0	16.0
540153	O'REILLY'S WEIR ALERT	1.4	23.620	AHD	1/12/1948		2980	12.0	14.0	16.0
540183	LOWOOD PUMP STN ALERT-B		23.074	AHD	1/ 1/1992		10062			
040441	LOWOOD	140.4	23.683	AHD	1/ 9/1909		10062	8.0	18.0	15.0
540182	LOWOOD ALERT-P	139.9	22.743	STATE	1/10/1994		10062	8.6	15.9	21.2
540066	SAVAGES CROSSING TM	130.8	18.430	AHD	10/ 1/1958		10180	9.0	16.0	21.0
540150	SAVAGES CROSSING ALERT	130.8	18.430	AHD	10/ 1/1958		10180	9.0	16.0	21.0
540312	MARBURG ALERT		79.140	AHD	1/ 9/2005					
540257	BURTONS BRIDGE ALERT		15.060	AHD	30/ 7/2002					
540028	LAKE MANCHESTER ALERT									
540256	KHOLO BRIDGE ALERT		0.000	AHD	30/ 7/2002					
040142	MT CROSSBY	90.2	6.904	AHD	1/ 9/1864	1/ 1/1975	10600			
			0.000	AHD	1/ 1/1975		10600	11.0	13.0	13.0
040818	MT CROSSBY TM	90.2	0.000	AHD	7/ 2/1975		10600	11.0	13.0	13.0
540199	MT CROSSBY ALERT	90.2	0.000	AHD	1/10/1994		10600	11.0	13.0	13.0
540258	MT CROSSBY ALERT-B						10600	11.0	13.0	13.0
540063	COLLEGES CROSSING ALERT		0.000	AHD	27/ 8/1999					
540068	ADAMS BRIDGE TM	77.1	75.500	AHD	30/ 9/1968		130	4.0	5.0	6.0
540157	ADAMS BRIDGE ALERT	77.1	75.500	AHD	30/ 9/1968		130	4.0	5.0	6.0
040702	STOKES CROSSING		56.666	AHD	1/ 2/1982		180	4.0	5.0	6.0
540315	STOKES CROSSING ALERT		56.666	AHD	1/ 2/1982		180	4.0	5.0	6.0
540314	SPRESSERS BRIDGE ALERT		35.000	AHD	11/ 2/2004			4.0	4.4	4.8
540317	GREY'S PLAINS ROAD ALERT		0.000	ASSUM						
540064	GRANDCHESTER ALERT		0.000	AHD	27/ 8/1999	30/10/2002				
			82.300	AHD	30/10/2002			3.0	4.0	5.0
040701	KUSS ROAD		45.060	AHD	1/ 2/1982		200	6.0	7.0	8.0
540194	KUSS ROAD ALERT		45.060	AHD	1/ 2/1982		200	6.0	7.0	8.0
540313	ROSEWOOD WTP ALERT		35.420	AHD	15/ 2/2001			7.25	8.25	9.25
540503	ROSEWOOD DETENTION BASIN									
040549	ROSEWOOD	49.9	32.829	STATE	1/ 9/1909		543	4.0	5.0	6.0
540388	ROSEWOOD ALERT-B						543	4.0	5.0	6.0
540193	ROSEWOOD ALERT	49.9	32.829	STATE	1/10/1994		543	4.0	5.0	6.0
540147	WALLOON ALERT-P	41.0	22.970	AHD	1/10/1994		585	3.5	5.5	7.0
540196	WALLOON ALERT-B	41.0	22.970	AHD	1/10/1994		585	3.5	5.5	7.0
540081	WALLOON TM	36.9	16.400	AHD	1/10/1961		620	5.0	6.5	8.5
040838	THREE MILE BRIDGE ALERT		0.000	AHD	24/10/1990		1870	14.0	16.0	18.0
040135	MOOGERAH DAM	15.3	100.000	AHD	10/ 1/1967		225	1.0	2.0	3.0
540364	MOOGERAH DAM HW TM	15.3	154.930	AHD	1/10/1967		226			
540474	MOOGERAH DAM ALERT						228			
540365	TOOHILLS CROSSING TM									
540151	KALBAR WEIR ALERT	51.4	74.600	AHD	11/ 9/1998	15/ 8/2010	470			
			0.000	AHD	16/ 8/2010		470	76.8	77.8	78.8
540058	KALBAR WEIR HW TM	51.4	74.600	AHD	11/ 9/1998		470	76.8	77.8	78.8
540057	KALBAR WEIR TW TM	51.4	0.000	AHD	17/ 7/1997			6.0	7.5	9.0

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QUEENSLAND FLOOD WARNING RIVER HEIGHT STATIONS
SURVEY DETAILS

CBM No	STATION NAME	AMTD	RL of GZ	DATUM	DATES FROM/TO	AREA km2	MIN	CROPS	MOD	TOWNS	MAJ
040440	KALBAR	49.4	66.720	AHD	1/ 9/1958	470	6.0	7.0	7.0		9.0
040445	HARRISVILLE	30.5	45.688	STATE	1/ 9/1956	725	3.0	5.0	4.0		5.0
540154	HARRISVILLE ALERT		45.688	STATE	1/10/1994	725	3.0	5.0	4.0		5.0
540387	HARRISVILLE ALERT-B		45.688	STATE	3/ 8/2006	725	3.0	5.0	4.0		5.0
540217	CHURCHBANK WEIR TM		38.611	AHD	5/ 9/1953	740	1.0		2.0		3.0
540316	CHURCHBANK WEIR ALERT		38.611	AHD	5/ 9/1953	740	1.0		2.0		3.0
540180	AMBERLEY ALERT-P	10.0	19.870	AHD	1/10/1994	850	4.0		5.5		6.5
540181	AMBERLEY ALERT-B	10.0	19.870	AHD	1/10/1994	850	4.0		5.5		6.5
040816	AMBERLEY (DNR) TM	9.0	17.608	STATE	1/10/1961	920	4.5		6.5		7.5
540195	WASHECOOL ALERT					65	2.5		3.5		4.5
540065	PEAK CROSSING ALERT		0.000	AHD	27/ 8/1999	30/10/2002					
			45.320	AHD	30/10/2002		2.0		3.5		5.0
540062	LOAMSIDE ALERT	6.8	18.385	AHD	23/11/1973	215	5.0		6.5		8.0
540210	LOAMSIDE TM	6.8	18.385	AHD	23/11/1973	215	5.0		6.5		8.0
540216	BERRY'S LAGOON TM		0.000	AHD	28/ 7/1994						
540502	BERRYS LAGOON AL										
040836	ONE MILE BRIDGE ALERT		0.000	AHD	24/10/1990		10.0		12.0		14.0
040101	IPSWICH	16.8	1.020	AHD	1/ 3/1967	1850					
			0.000	AHD	9/ 1/1975	1850	7.0	7.0	9.0	7.4	11.7
040831	IPSWICH ALERT	16.8	0.000	AHD	24/10/1990	1850	7.0	7.0	9.0	7.4	11.7
040812	MOGGILL ALERT	73.0	0.000	AHD	1/ 1/1977	12600	10.0		13.0		15.5
540200	MOGGILL ALERT-P	73.0	0.000	AHD	1/ 1/1977	12600	10.0		13.0		15.5
540192	JINDALEE ALERT		0.000	AHD	1/10/1994	12915	6.0		8.0		10.0
040713	JINDALEE BRIDGE					12915	6.0		8.0		10.0
040690	BRISBANE CITY TM		0.000	AHD	30/ 6/1992	13559	1.7		2.6		3.5
540198	BRISBANE CITY ALERT		0.000	AHD	30/ 6/1992	13559	1.7		2.6		3.5
540248	CHURCHILL ALERT						2.0		4.0		6.0
040792	RIPLEY ALERT		0.000	AHD	1/ 6/1989	35	52.0		53.0		54.0
040873	HARDING STREET ALERT		0.000	AHD	22/ 1/1993	96	24.0		25.0		26.0
040872	BLACKSTONE BRIDGE ALERT		0.000	AHD	1/ 1/1993	97	19.0		20.0		21.0
040875	BUNDAMBA SCHOOL ALERT		0.000	AHD	3/ 2/1993	102	14.5		16.0		17.5

540249	BUNDAMBA (HANLON ST) AL		0.000	AHD	29/ 8/1996							
540501	SPRINGFIELD LAKES AL					109						
040985	BELLBIRD PARK AL		43.128	AHD	25/ 7/2007							
040795	OPOSSUM ALERT		0.000	AHD	24/ 5/1989		21.0	22.0		23.0		
040874	BRISBANE ROAD ALERT	1.2	0.000	AHD	8/ 2/2005		4.0	5.0		6.0		
540378	WOLSTON CREEK ALERT											
040719	NEW BEITH TM					49	4.0	5.0		6.0		
540097	NEW BEITH ALERT		48.850	AHD	9/11/2005							
			0.000	AHD			4.0	5.0		6.0		
040796	BEATTY ROAD ALERT					155	3.5	4.5		5.5		
040789	DURACK KING AVE ALERT					28	8.0	8.7		9.4		
040791	COOPERS PLAINS ALERT					21	6.9	7.3		7.8		
540432	MARSHALL RD AL											
540071	CORINDA HIGH ALERT		0.000	AHD	6/ 4/1992		3.8	5.0		5.6		
540433	MURIEL AVE AL						5.6	6.8		7.4		
540274	OXLEY CREEK MOUTH ALERT		0.000	AHD	1/ 9/1999		2.0	2.5		3.0		
540134	HOLLAND PARK WEST ALERT						17.5	18.0		18.4		
540132	EAST BRISBANE ALERT		0.000	AHD	1/ 1/1994		2.4	3.0		3.5		
540127	WISHART (GREENWOOD ST) AL						22.5	23.0		23.5		
540126	MANSFIELD ALERT						11.5	12.0		12.3		
540128	CARINDALE ALERT						6.5	7.0		7.5		

Date: 15/12/2010

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QUEENSLAND FLOOD WARNING RIVER HEIGHT STATIONS
SURVEY DETAILS

CBM No	STATION NAME	AMTD	RL of GZ	DATUM	DATES FROM/TO	AREA km2	MIN	CROPS	MOD	TOWNS	MAJ
540129	HEMMANT ALERT		0.000	AHD	1/ 1/1994		1.9		2.3		2.5
540279	RANSOME ALERT						3.0		3.4		3.8
540278	WYNNUM(BYRNESIDE TCE) AL						4.0		4.5		5.0
540296	PULLEN PULLEN CREEK AL										
540107	GOLD CK RESERVOIR ALERT										
540061	MISTY MORW ALERT					62	9.6		10.1		10.6
540119	ENOGGERA DAM ALERT						75.5		77.0		79.0
540118	KELVIN GROVE ALERT						3.5		4.5		5.5
540239	ALDERLEY ALERT										
540116	ITHACA ALERT						14.0		14.5		15.0
540500	ITHACA CREEK TM					10					
540130	BOWEN HILLS ALERT		0.000	AHD	1/ 1/1994		2.3		2.9		3.5
540286	BREAKFAST CREEK MOUTH AL		0.000	AHD	1/ 9/1999		1.8		1.9		2.0
	PINE										
540111	MITCHELTON(OSBORNE RD)AL						32.6		33.4		34.0
540226	KEDRON (QUT) ALERT						9.8		10.8		11.7
540131	TOOMBUL (NUDGEE RD) ALERT		0.000	AHD	1/ 1/1994		2.5		2.9		3.3
540431	FRANK SLEEMAN PARK AL										
540120	GEEBUNG ALERT						8.5		9.0		9.8
540121	EVERTON HILLS ALERT						44.0		44.5		45.0
540113	ASPLEY (STRINGYBARK DR)AL						28.5		29.0		29.8
540122	ZILLMERE (PINEAPPLE ST)AL						12.0		12.5		13.0
540124	DEAGON ALERT		0.000	AHD	1/ 1/1994		2.0		2.5		3.0
540444	CEDAR CK RD ALERT		62.248	AHD	17/ 6/2008						
540416	SAMFORD VILLAGE ALERT		45.237	AHD	1/ 3/2007		4.76		5.26		5.76
540398	DRAPERS CROSSING TM										
540205	DRAPERS CROSSING ALERT	21.0	17.592	AHD	1/10/1965	156	4.0		5.0		6.0
540415	CASH'S CROSSING ALERT		6.525	AHD	1/ 3/2007		6.27		6.67		8.07
540414	NORMANBY WAY ALERT		0.000	AHD	1/ 3/2007		3.70		3.90		4.60
540189	BAXTERS CREEK ALERT										
540442	DAYBORO TM										
540484	DAYBORO WTP ALERT										
540483	KOBBLE CK ALERT										
540443	KOBBLE CK TM										
540202	NORTH PINE DAM ALERT										
540277	NORTH PINE DAM ALERT-B										
540204	LAKE KURWONGBAH ALERT										
540412	YOUNGS CROSSING ALERT		0.000	AHD	1/ 3/2007	53	6.00		7.50		9.50
540203	PETRIE ALERT		-2.600	AHD	1/10/1994						
			-1.070	AHD	1/ 8/2001		3.5		5.5		7.1
540439	LAWNTON ALERT		0.000	AHD	14/ 1/2008						
540413	JOHN BRAY PARK ALERT		9.006	AHD	1/ 3/2007		3.4		3.7		4.3
540417	MURRUMBA DOWNS ALERT		0.000	AHD	1/ 3/2007		2.25		2.50		4.10
540445	LIPSCOMBE RD ALERT		6.364	AHD	17/ 6/2008						
540245	BURPENGARY (ROWLEY RD) AL		0.000	AHD		20	15.0		20.0		20.5
540242	BURPENGARY (DALE ST) AL		0.000	AHD		46	8.8		9.7		10.5
540244	WAMURAN ALERT		0.000	AHD	30/ 9/1998	37	29.0		30.0		30.5
540208	UPPER CABOOLTURE TM		7.135	STATE	11/10/1965	94	8.5		10.0		12.0
540357	UPPER CABOOLTURE ALERT		7.135	STATE	11/10/1965	94	8.5		10.0		12.0
540243	CABOOLTURE WTP ALERT		0.000	AHD		187	7.0		8.0		9.5
	MAROOCHY										
540345	MOOLOOLAH ALERT	33.0	19.995	STATE	15/12/1971	39	4.5		5.0		5.8
540300	MOOLOOLAH TM	33.2	19.995	STATE	15/12/1971	39	4.5		5.0		5.8
540346	EWEN MADDOCK DAM ALERT		25.375	AHD	22/ 4/2005		0.5		1.0		1.5

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SECTION 6

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QUEENSLAND FLOOD WARNING RIVER HEIGHT STATIONS
SURVEY DETAILS

CBM No	STATION NAME	AMTD	RL of GZ	DATUM	DATES FROM/TO	AREA km2	MIN	CROPS	MOD	TOWNS	MAJ
540344	JORDAN ST ALERT		5.158	AHD	22/ 4/2005		3.0		4.0		5.0
540350	PALMVIEW ALERT		-0.014	AHD	22/ 4/2005		4.7		5.0		5.5
540351	MERIDAN WAY ALERT		0.613	AHD	22/ 4/2005		2.80		2.85		3.5