Wide Bay Water Corporation

Lenthall Dam

Emergency Action Plan

October 2010

Revision 11

Comment [JAG1]: To reinsert the APPENDICES and TABLE INDEX lists if deleted, use the Shortcut Keys or Autotext

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1. Introduction

1.1 Purpose

The Emergency Action Plan (EAP) describes the coordination of necessary actions by the Wide Bay Water (WBWC) and its officers to provide timely notification to Police, Counter Disaster groups and affected persons in the event of an emergency condition at Lenthall Dam.

1.2 Format

The format of this EAP is based around the following components:

- Emergency Events and Action Procedures

1. Flooding;
2. Excessive or New Seepage Occurrence;
3. Earthquake;
4. Contamination of Catchment or Reservoir;
5. Excessive Movement of the Dam;
6. An Object Crashing into the Dam;
7. Damage to Concrete or Embankment Sections;

- Appendices

1.2.1 Wide Bay Water Incident Management Plan

This EAP is going to be the first step in order to define the communication protocol and the procedure of the declaration of those incidents and establishment of structures to manage those incidents following the existing Disaster Management Plan of Wide Bay Water. This structure includes the designation of incident managers and directors who, depending on the nature of the incident will instigate a single or multiple team response.

The function of the Lenthall Dam Emergency Action Plan is to:

- Ensure effective communication with appropriate people occurs in a timely manner
- support the site team and incident managers and/or director

In accordance with the following:

1.2.2 Counter Disaster Planning and Coordination in Queensland

The Department of Emergency Services controls counter disaster coordination and planning in Queensland. There is a tiered structure with regard to the levels of disaster coordination, initially being organised locally. Depending on the scale of the disaster, a Major Incidents Group might be formed for high level Ministerial guidance. A summary of each groups role is outlined below.

Local Disaster Management Group

This group was formerly called the Local Government Counter Disaster Committee. Local Disaster Management Groups (local groups) manage the response to a disaster at a local level. The Committees are usually chaired by the Mayor and the Local Government Chief Executive Officer is usually the Executive Officer of the committee. Local Government Management Groups develop and maintain Local Disaster Management Plans for their Shire. These Local Disaster Management Groups are best placed to decide what resources are needed, when they are needed and how best to apply such resources so as to minimise hardship and suffering. They play a key role in the Queensland Disaster Management System.

District Disaster Management Group

(Formerly called Disaster District Control Group). There are 23 Disaster Districts in Queensland, which are based on the Police Districts. The senior Police Officer in each district is designated as the Disaster District Coordinator who Chairs a District Disaster Management Group (DDMG). These DDMGs comprise representatives from regionally-based Queensland Government departments who are able to provide and coordinate whole-of-government support to disaster stricken communities. The Disaster Districts perform a 'middle' management function within the Disaster Management System by providing coordinated State Government support when requested by Local Governments.

The State Disaster Coordination Group

The State Disaster Coordination Group is the working body of the State Disaster Management Group (State Group) at State-level. SDCG members are designated liaison officers from each of the Departments represented on the State Group. This Group is the primary mechanism through which coordinated whole-of-government State-level support is provided to disaster-stricken communities.

The State Disaster Management Group.

The State Disaster Management Group (State Group) is established as the principal organisation under the new Act for the purposes of disaster management throughout the State. It replaces the State Counter-Disaster Organisation and its executive, the Central Control Group. In particular, the State Group is responsible for disaster mitigation and disaster planning and preparation at a State level and for coordinating whole-of-government response and recovery operations prior to, during and after a disaster impact. This includes accessing interstate and/or Commonwealth assistance when local and State resources are exhausted or not available.

The State Group comprises Chief Executive Officers (CEOs) from all Queensland Government Departments. The CEO of the Department of the Premier and Cabinet is the Chair, while the Executive Director of Emergency Management Queensland is the Executive Officer.

Major Incidents Group (MIG).

The Queensland Government has established a MIG to provide high level Ministerial guidance and support in the event of a significant incident with major community consequences.

1.2.3 Emergency Events and Action Procedures

A detailed set of procedures has been developed for various scenarios that may pose a risk to the dam.

Each procedure documents a series of events that trigger a decision or action. A summary of key triggers and their logic is included in Table 7, Table 8 and Table 9.

Each procedure is laid out in the form of a clear description to support the decision or required action. The description may expand on the decision but will generally refer to the appendices.

1.2.4 Flood Warning System for the BURRUM and CHERWELL Rivers

A brochure describing the flood warning system operated by the Commonwealth Bureau of Meteorology for the Burrum and Cherwell Rivers is attached as Appendix E. The classification of floods, as mentioned in the Trigger events, have been identified from this brochure upgrading the table of Flood Level for the Burrum River as shown in Table 1. This revision has been as a result of the recent raising of Lenthall Dam with the installation of crest gates that raised the Full Supply Level from RL 24.00 to RL 26.00.

Table 1 Flood Levels of Lenthall Dam after Raising

	Minor Flood Level	Moderate Flood Level	Major Flood Level
Trigger Discharges (m^3/s) based upon previous classification	140	420	840
Gate Status	Gates 2 and 3 open	All gates open	All gates open
Flood Level *	0.20	0.35	1.20
Actual Discharge (m^3/s)	179	528	861

*Height over spillway gate top (RL 26.0m)

1.2.5 Appendices

The appendices that support this EAP include:

A Access to site

B Spillway Discharge Curve and Capacity Curve

C Flood Hydrology and Hydraulic Data

D Inundation Flood Maps *(source: Sunwater Engineering "Failure Impact Assessment Report dated June, 2002)*

E Flood Warning System for the BURRUM and CHERWELL Rivers

F Lenthall Dam Safety Inspections and Condition Schedule

G Lenthall Dam : Reporting Forms

1.2.6 Limitation

The EAP covers only the situation at the Dam itself however; the effect of a dam failure on the downstream residents is included in the analysis data (Failure Impact assessment carried out by Sunwater Engineering Services in 2002) provided as part of the Data Book and partly included in EAP as Appendix D.

A separate DISASTER PLAN will be followed for the downstream response to an emergency situation at Lenthall Dam. Refer to links provided below for additional information.

http://www.frasercoast.qld.gov.au/web/guest/emergency-services

http://www.frasercoast.qld.gov.au/c/document_library/get_file?uuid=60456bff5949165bb518c8269ac612e3&groupId=12430

1.3 Roles and Responsibilities

1.3.1 Schedule of Roles and Responsibilities

The Schedule of Roles and Responsibilities nominates the position / title of each Officer responsible for given actions or roles under the EAP.

Contact details of relevant positions or agencies are included in Appendix H – *Contact List.*

In triggering the EAP (declaring an incident) it is the responsibility of the Water Treatment Supervisor to attempt to make contact with each of the nominated Officials in charge of Incidence Management in turn until successful contact is achieved.

Table 2 Schedule of Roles and Responsibilities

Position	Alternative Position	Duty
Water Treatment Supervisor	WTP Operator – On call 1	Lead the site team from Site, recording all the incidents and preparing reports, advise Treatment Manager.
WTP Operator – On call 2	WTP Operator – On call 3	Reporting from Site to the Water Treatment Supervisor, carrying out visual inspection and prepare report
Treatment Manager	General Manager – Business Services/CEO, Wide Bay Water	Act as Incident Manager/ Director on the basis of the Report received from Water Treatment Supervisor, liaise with General Manager – Business services/CEO Wide Bay Water, Police, Incident Management Agencies etc., declare an incident when necessary
CEO Wide Bay Water	General Manager – Business Services/Acting CEO Wide Bay Water	Liaise with Press at the time of incident; liaise with the Dam Regulator on the basis of the report received from the Treatment Manager.
Coordinator Asset Management		Planning Officer in charge of asset management
Engineering Specialist		Technical Support to Wide Bay Water
WBWC Chair	Deputy Chair	Provides support to staff and communicates with the Mayor of FCRC

2. General Information about Lenthall Dam

Significant parameters of Lenthall Dam are listed below.

Table 3 General Information and Dam Parameters

Parameter	Value
GENERAL	
Name of Dam	Lenthall Dam (or Burrum No.3 Dam)
Owner of Dam:	Wide Bay Water Corporation
Status of Dam:	Existing
Property Description:	Lot 21, Plan SP 134986
	Parish: Warrah
	County: Lennox
Location of Dam:	Latitude: 25°24'
	Longitude: 152° 32'
Construction Completed:	Stage 1, 1984 : Raising, 2007
Licence or development permit number:	N. A.
Date of last Failure Impact Assessment:	July 2002
Name of Water Course:	Burrum River
	± 34.2 Adopted Middle Thread Distance (AMTD)
Catchment Area	518 km^2
Description of Access	
Access description	All weather 2WD access from the Bruce Highway south of Howard via Lenthall Dam Rd and Wongi Waterholes Rd to the right abutment of the spillway. Access to the dam, outlet works and left side of the spillway from Howard is via rough 2WD dry weather roads through state forest and private property. Access to the dam would be difficult even in a 4WD during inclement weather. There is no direct access (via a bridge or road) from the right side of the spillway to the dam.
DAM DESCRIPTION	

Dam Type	Zoned earth fill dam with concrete gravity spillway
Purpose	Water supply storage
Maximum Dam Height above Foundation	29.60m Main Dam (above lowest d/s toe at RL 5.0m)
Full Supply Level	RL 26.00m[1]
Dam Crest Level	RL 34.60m
Upstream Main Embankment Slope	3.0 Horizontal on 1.0 Vertical
Downstream Main Embankment Slope	2 Horizontal on 1 Vertical
Slope Protection	Riprap (Upstream) and Grass (Downstream)
Storage at FSL	28,411 ML
Dam Crest Length	350m for Main Dam
SPILLWAY DESCRIPTION	
Spillway Type	Gated overflow spillway with an ogee crest and concrete lined chute
Spillway Crest Level	RL 26.00m crest gates have been installed
Spillway Crest Length	75.3m at crest, tapering to 46m at energy dissipator
Energy Dissipation Method	Type II USBR stilling basin
Design Head	Unknown
Control Description	5 No Flowgates Crest Gates (4 x 14.8 m and 1 x 9.8m)
Gate Arrangement	Gate 1 (right hand flank of Spillway), Gate 2 (next to Gate 1), Gate 3 (next to Gate 2, in the centre), Gate 4 (next to Gate 3) and Gate 5 (next to Gate 4 in the left hand flank of Spillway in the embankment dam side)
Sequence of Gate Opening	3, 2, 4, 5, 1
Maximum Level	Dam Crest Level 34.55m
Peak Discharge	± 5,670 m^3/s (with no gate failure)
AEP of Spillway Flood Capacity	Approx 1 in 2,000,000 Annual Exceedence Probability (AEP)

OUTLET WORKS

[1] All heights (RL) are to "Burrum No.3" datum. For Australian Height Datum (AHD), 0.18m will have to be added.

Outlet Description	The outlet works comprises a dry intake tower with multilevel intakes, twin 1050 mmID steel pipes and a downstream valve chamber.

3. Documentation and Reporting

3.1 Documentation – Incident Log

It is essential that activities and decisions undertaken during any incident be duly recorded in chronological order in the incident log.

An incident log is to be maintained on site by the Site Team Leader (Water Treatment Supervisor) and also by the Incident Manager / Incident Director.

The incident log shall contain the following information as a minimum:

- A description of the event
- Time and date of any actions
- Regular recordings of storage level
- Regular recordings of rainfall
- Instrumentation recordings (form 2)
- Description of any observed damage
- Photographs and / or sketches
- Details of communication which took place during the emergency
- Any further comments considered necessary.

Incident logs (example forms are in Appendix G) are to be supported by other documentation such as dam safety surveillance check sheets. A pro-forma of dam safety surveillance check sheet is included in Appendix F.

A copy of the EAP, comments regarding the adequacy of the EAP and any recommendations or suggested changes to the EAP should also be included. A post event/incident debriefing session shall take place and any key recommendations/outcomes shall be included into the incident log.

3.2 Reporting

All details of the Incident and Actions are to be reported to relevant Wide Bay Water staff.

It is noted that any incident involving the dam is to be reported to the Dam Regulator in accordance with the Queensland Government Department of Natural Resources; Lenthall Dam – Dam Safety Condition Schedule. (Document available in the WBWC electronic records management system).

Reporting to the Dam Regulator shall occur in line with established organisational reporting protocols. (i.e. Manager, General Manager, CEO)

4. Emergency Events and Actions – Flooding

4.1 Critical Stability Levels

Analysis of the stability of the spillway indicates that it is stable for the probable maximum precipitation design flood (PMP DF event). This is EL 34.55m.

Critical stability levels are as per Table 4.

Table 4 Lenthall Dam Critical Stability Levels

Description	Level (m)
Dam Overtop	34.60

4.2 Flood Related Events

4.2.1 Flood Routing

The spillway rating curves (Appendix B) were used to route the inflow floods through the reservoir for various flood exceedence probabilities from a 1 in 200 Annual Exceedence Probability (AEP) event to the PMP-DF for which the results are shown in Table 5 and Table 6.

Table 5 Lenthall Dam, PMP-Design Flood Routing Results

Storm Duration (Hours)	Peak Inflow (m^3/s)	Peak Outflow (m^3/s)	Peak Water Level (m)	Storm Volume (ML)
12	7550	4620	33.22	359,000
15	8030	4920	33.92	404,000
18	8360	5160	33.61	448,000
24	8560	5490	34.34	538,000
36	7910	5670	34.57	651,000
48	6930	5190	33.97	728,000
72	5870	4210	32.65	881,000
96	5770	4150	32.58	951,000

Table 6 Summary of Peak Outflow Rates and Water Levels with Gate Failure for Various AEP Events, Lenthall Dam (Note: Gate failure is failure to open)

AEP Event (1 in Years)	Peak Outflow (m^3/s)			Peak Water Level (m)		
	No Gate Failure	One Gate Failure	All Gates Fail	No Gate Failure	One Gate Failure	All Gates Fail
200	1830	1626	1404	29.06	29.84	30.87
500	2130	1879	1653	29.55	30.38	31.42
1000	2360	2080	1853	29.95	30.80	31.86
2000	2590	2277	2010	30.30	31.20	32.18
5,000	2930	2575	2348	30.80	31.77	32.86
10,000	3180	2819	2577	31.19	32.23	33.30
50,000	3860	3432	3158	32.17	33.32	34.36
100,000	4170	3714	3424	32.52	33.80	34.83
200,000	4510	4006	3696	32.94	34.29	35.29
500,000	4960	4400	4071	33.65	34.92	35.35
1,000,000	5310	4704	4352	34.12	35.40	35.91
2,000,000 (PMP-DF)	5670	5016	4643	34.57	35.87	36.79

4.2.2 Flood Trigger Levels

The following data has been analysed in order to identify the flood trigger levels for the Lenthall Dam.

Table 7 Data controlling the Trigger Levels

Description	Level (RL m)	Q (m^3/sec)	AEP
Dam Crest	34.60	~ 5,670	2,000,000
Top of Core	32.0	~ 3,860	~ 50,000
Top of Filter	30.0	~ 2,360	1,000
Major Flooding	27.3	-	-
Historical Peak (February, 2008)	27.3	-	-
All Spillway Gates Open	26.35	528	-
Moderate Flooding	26.35	528	-

Description	Level (RL m)	Q (m^3/sec)	AEP
Minor Flooding	26.20	179	-
Spillway First Gate Open	26.15	9 to 73	-
FSL	26.0	-	-
Fixed Ogee Crest Level	24.0	-	-

The following flood trigger events were identified after due analysis of the above data and on-site situation and is used for the Emergency Action Plan for Lenthall Dam.

Table 8 Flood Trigger Events

Trigger Description	EAP Reference Number
Reservoir Level is RL 25.5m (FSL – 0.5m) and further rain is forecast	4.4
Reservoir Level continues to rise to RL 26.10m and further rain is forecast or the reservoir is rising	4.5
Reservoir Level continues to rise to RL 26.35m and further rain is forecast or the reservoir is rising	4.6
Reservoir Level continues to rise to RL 27.21m and further rain is forecast or the reservoir is rising	4.7
Reservoir Level continues to rise to RL 30.0m and further rain is forecast or the reservoir is rising	4.8
Reservoir Level continues to rise to RL 32.0m and further rain is forecast or the reservoir is rising	4.9
Reservoir Level continues to rise to RL 34.60m (Dam Crest Level) and overtopping imminent	4.10

4.3 Non-flood related events

The following non-flood related events have been identified where some Emergency Action Plan may be necessary.

Note: Non flood related trigger events are considered to be an incident and reporting to the Dam Regulator is required and shall occur in line with established organisational reporting protocols. (i.e. Manager, General Manager, CEO)

Table 9 Non-Flood Related Trigger Events

Trigger Description	EAP Reference Number
Increase in Seepage or New Area of Seepage has been observed	4.11
Earthquake felt or reported in surrounding area	4.12

Trigger Description	EAP Reference Number
Contamination of the Catchment Area or Reservoir has been reported	4.13
Movement of Dam has been observed	4.14
Object Crashes into the Dam or Reservoir	4.15
Damage to Dam has been observed	4.16

4.4 Reservoir Level is approaching RL 25.5m and Further Rain is Forecast (Reservoir is 0.5m below FSL, Spillway release and Operation of Gate is Imminent)

Although this event is not specifically an emergency event, it is included in the Emergency Action Plan (EAP) to provide advance warning of an impending event.

WATER TREATMENT SUPERVISOR	TREATMENT MANAGER (INCIDENT MANAGER)
◗ Notify Treatment Manager of dam status and rainfall.	◗ Obtain and confirm forecast from BOM (Refer EAP Appendix H for contact details) or alternatively use the BOM website, www.bom.gov.au to obtain updates.
◗ Monitor rainfall, levels and rates of rise of Dam level. ◗ Record water level and rainfall on Forms 1 and 2 of Appendix G. (Note: Form 2 has not been included).	
◗ Advise Treatment Manager of current rate of rise. ◗ Mobilise Staff for site inspection who are fully conversant with the operation of the dam. (Spillway area, catchment and Embankment Dam area) Consider the possibility of inaccessibility to the left abutment when reservoir level reaches RL 26.3m.	
◗ Perform a Dam Safety Inspection on the Spillway side including piezometer readings and seepage readings as per Lenthall Dam Standing Operating Procedure. ◗ Monitor the situation, keeping notes and photographs for the Incident Log (Appendix G) and the routine dam safety inspections (Appendix F)	◗ Inform the General Manager – Business Services/CEO, Wide Bay Water of the event and the status of the dam.
◗ If any damage is observed, advise the Treatment Manager and proceed with EAP 4.16.	◗ On receipt of damage report, proceed with EAP 4.16.
◗ Await arrival of staff and on arrival, report to Treatment Manager.	
◗ Ensure that inlet weirs for gates are clear of debris.	
◗ If Dam level exceeds RL 26.0m, advise Treatment Manager and refer EAP Section 4.5	◗ If Dam level exceeds RL 26.0m, Water Treatment Supervisor will advise the Treatment Manager and Treatment Manager shall refer EAP Section 4.5.
◗ If Dam level drops to RL 26.0m, advise Treatment Manager.	◗ If Dam level drops to RL 26.0m and no more rain is forecast, advise Water Treatment Supervisor to close incident.

WATER TREATMENT SUPERVISOR	TREATMENT MANAGER (INCIDENT MANAGER)
◗ Complete Incident Log and Report and submit to Treatment Manager/ Incident Manager.	◗ Review and complete Incident Log and Report.

4.5 Reservoir Level is Approaching RL 26.10m and Further Rain is Forecast OR The Reservoir is Rising (At RL 26.10m Water begins to flow into the Inlet Weir of crest gate No.3, Onset of Minor Flooding based on BOM Classification is Estimated to be RL 26.20m)

WATER TREATMENT SUPERVISOR	TREATMENT MANAGER (INCIDENT MANAGER)
◗ Continue to monitor rainfall, levels and rates of rise of Dam level. ◗ Continue to record water level and rainfall on Forms 1 and 2 of Appendix G. ◗ Continue to record piezometer readings in spillway as per Lenthall Dam Standing Operating Procedure. ◗ Notify Treatment Manager of dam status and rainfall. ◗ If some damage is observed, advise the Incident Manager and proceed with EAP 4.16.	◗ Obtain and confirm forecast from BOM (Refer EAP Appendix H for contact details) or alternatively use the BOM website, www.bom.gov.au to obtain updates. ◗ If the dam is damaged, proceed with EAP 4.16.
◗ When water level is between 26.1m and 26.3m check inlet weirs to confirm if the water is flowing. ◗ If water is not flowing into the inlet weirs, clear the blockage if this can be done safely. ◗ Remove debris if this can be done safely. ◗ Check if the gates are opening at the required levels in the following sequence. Note: If it is observed that the crest gates are not opening on queue, this must be reported to the Water Treatment Supervisor/Treatment Manager immediately. The Treatment Supervisor/Treatment Manager are responsible for giving authorisation to commence manual operation of the gates. The opening conditions below are to be mimicked as closely as possible when in manual operation mode.	◗ Maintain contact with the Water Treatment Supervisor in order to assess the severity of the event and inform General Manager, Business Services about the situation. ◗ Authorise manual operation of gates if required ◗ Advise potentially effected upstream residents of the situation. (refer to Appendix H of this EAP – Contacts List for contact details) ◗ Incident Report. Incidents are to be reported in accordance with Condition DS 2 Items 1 and 2 of the Lenthall Dam, Dam Safety Condition Schedule.

Gate No	Inlet level	Operate level *	Manual Close (Only if reqd.)
3	26.1	26.15	26.05
2	26.15	26.20	26.10
4	26.2	26.25	26.15
5	26.25	26.30	26.20
1	26.3	26.35	26.25

* Operation shall occur within 0.2m of this level once gates have been wet commissioned.

WATER TREATMENT SUPERVISOR	TREATMENT MANAGER (INCIDENT MANAGER)
◗ Check erosion and damage, if any, in the downstream of spillway. ◗ Inform Treatment Manager of any problem in the gate operation or damage in spillway area. ◗ If damage has occurred notify Treatment Manager and refer to EAP 4.16.	◗ If the dam is damaged, proceed with EAP 4.16.
◗ Regular monitoring on the embankment side isn't necessary unless there are obvious signs of problems. ◗ In case major problems are observed, complete a dam safety inspection report immediately and inform the Treatment Manager about the problems.	◗ Maintain contact with the Water Treatment Supervisor in order to assess the severity of the event.
◗ When the water level reaches RL 26.20m inform Treatment Manager/ Incident Manager immediately. ◗ Arrange for the removal of the pump located adjacent to the boat ramp at Lenthall Dam	◗ Declare a Minor Flood Incident when Gates 3 and 2 have opened automatically. ◗ Inform General Manager - Business Services/Chief Executive Officer, Wide Bay Water of the event and the status of the dam.
◗ Relay Dam levels back to the Treatment Manager. If Dam level is approaching RL 26.35m, proceed with EAP 4.6.	◗ Calculate the current rate of change in Dam level. If the level is likely to reach above RL 26.35m (Moderate Flood Level), Refer to EAP 4.6.
◗ If reservoir level drops below RL 26.10m, proceed with EAP 4.4. ◗ Complete Incident Log and Report and submit to Treatment Manager / Incident Manager.	◗ If reservoir level drops below RL 26.10m, Monitor rate of change in reservoir levels and check rainfall forecast. If no more rain is forecast and Dam levels are dropping, proceed with EAP 4.4.

4.6 Reservoir Level is Approaching RL 26.35m and Further Rain is Forecast OR The Reservoir is Rising (Onset of Moderate Flooding based on BOM Classification is Estimated to be RL 26.35m which prompts the Evacuation in Low Lying areas)

WATER TREATMENT SUPERVISOR	TREATMENT MANAGER (INCIDENT MANAGER)
◗ Continue to monitor Dam level and rate of change in level. ◗ Undertake check on piezometers and undertake a visual inspection **if possible** - ONLY if access is safe. ◗ Note and report any anomalies to the Treatment Manager/ Incident Manager.	◗ Using the latest rates of rise, calculate the time of water level to reach RL 27.30m (Major Flood Level) and advise Fraser Coast Regional Council Local Disaster Management Group and Queensland Police Service (QPS). ◗ WBW to contact either Donna or Ester Allen and advise status of dam. FRASER COAST REGIONAL COUNCIL LOCAL DISASTER MANAGEMENT GROUP to organise evacuation of upstream residents once storage level reaches RL 26.35 and is rising. (Campers to be evacuated from Wongi Waterholes campgrounds via loop road)
◗ Check all gates are open when reservoir level reaches 26.35. ◗ If all gates have failed to open, notify Treatment Manager / Incident Manager immediately.	◗ Maintain contact with the Water Treatment Supervisor in order to assess the severity of the event. ◗ If all gates have failed to open, notify upstream residents. (Refer contact list, Appendix H of this document)

WATER TREATMENT SUPERVISOR	TREATMENT MANAGER (INCIDENT MANAGER)
◗ When the water level reaches RL 26.35m inform Treatment Manager/ Incident Manager immediately. ◗ Relay Dam levels back to Treatment Manager/ Incident Manager. ◗ Immediately perform a Dam Safety Inspection including piezometer reading, seepage measurements in the Embankment Dam area. During the inspection, note rainfall, water level, signs of slumps, erosion, springs, cracks or any deformation, which could be classified as damage to the dam. ◗ Where damage is observed, advise the Treatment Manager/ Incident Manager and proceed to EAP 4.16. ◗ In case of new area of seepage or increased seepage observed proceed to EAP 4.11.	◗ Declare a Moderate Flood Incident when all gates have opened automatically. ◗ Inform General Manager - Business Services/Chief Executive Officer, Wide Bay Water of the event and the status of the dam. Incident manager to confirm that FRASER COAST REGIONAL COUNCIL LOCAL DISASTER MANAGEMENT GROUP are prepared for pending downstream evacuation. ◗ FRASER COAST REGIONAL COUNCIL LOCAL DISASTER MANAGEMENT GROUP are to organise closure of minor public access roads and low level bridges in Lenthall Dam area and evacuate and close the public areas around Lenthall Dam. ◗ FRASER COAST REGIONAL COUNCIL LOCAL DISASTER MANAGEMENT GROUP AND QPS to establish communication with the Site Team and to confirm when the roads and public areas are closed. During the closure and evacuation process, the Treatment Manager/ Incident Manger is to relay the Dam level to FRASER COAST REGIONAL COUNCIL LOCAL DISASTER MANAGEMENT GROUP AND QPS closing the roads. ◗ If requested arrange preparation of medial briefing for General Manager - Business Services/Chief Executive Officer, Wide Bay Water. ◗ If the dam is damaged, proceed with EAP4.16. ◗ In case of new area of seepage or increased seepage observed proceed to EAP 4.11.
◗ Relay Dam levels back to the Treatment Manager / Incident Manager. If levels increase to RL 27.21m, proceed with EAP 4.7.	◗ Calculate the current rate of change in level. If the level is likely to exceed above RL 27.21m, Refer to EAP 4.7.
◗ If reservoir level drops below RL 26.35m, proceed with EAP 4.5. ◗ Complete Incident Log and Report and submit to Treatment Manager / Incident Manager.	◗ If reservoir level drops below RL 26.35m, Monitor rate of change in reservoir levels and check rainfall forecast. If no more rain is forecast and Dam levels are dropping, proceed with EAP 4.5.

4.7 Reservoir Level is Approaching RL 27.21m (assumes all gates down) and Further Rain is Forecast OR the Reservoir is Rising (Historical Peak Water Level is RL 27.3m). The access walkway to inlet weirs is at RL 27.35m. Onset of Major Flooding based on BOM Classification is estimated to be RL 27.30m. The Major Flooding may prompt the evacuation of houses and business premises. Disruptions of road and rail links, widespread flooding and inundation of large low-lying areas and farmland and isolation of towns may occur.

WATER TREATMENT SUPERVISOR	TREATMENT MANAGER (INCIDENT MANAGER)
◗ Monitor Dam level and rate of change in level. ◗ Relay Dam levels back to Treatment Manager. ◗ Note and report any anomalies to the Treatment Manager / Incident Manager.	◗ Using the latest rates of rise, calculate the time to RL 34.55m (overtopping of embankment) and advise FRASER COAST REGIONAL COUNCIL LOCAL DISASTER MANAGEMENT GROUP AND QPS
◗ When the water level reaches RL 27.21m, inform Treatment Manager/ Incident Manager immediately. ◗ Relay Dam levels back to Treatment Manager/ Incident Manager.	◗ Advise General Manager – Business Services/CEO, WBW of status and evacuation process. ◗ FRASER COAST REGIONAL COUNCIL LOCAL DISASTER MANAGEMENT GROUP AND QPS shall review flood maps and prepare for pending downstream evacuation. ◗ During the evacuation process, the Treatment Manager/ Incident Manager is to relay the Dam level to FRASER COAST REGIONAL COUNCIL LOCAL DISASTER MANAGEMENT GROUP AND QPS officers who are closing the roads. ◗ If requested arrange preparation of media briefing for General Manager – Business Services / Chief Executive Officer, WBW.
◗ Undertake inspection every 3 hours to monitor structural performance of the dam. Look for any signs of stress such as excessive seepage, deformations, slumping, erosion or damage to dam. ◗ If damage has occurred notify Treatment Manager/ Incident Manager and proceed to EAP 4.16. ◗ In case of new area of seepage or increased seepage observed proceed to EAP 4.11.	◗ If the dam is damaged, proceed with EAP4.16. ◗ In case of new area of seepage or increased seepage observed proceed to EAP 4.11.

WATER TREATMENT SUPERVISOR	TREATMENT MANAGER (INCIDENT MANAGER)
◗ Continue monitoring condition of the dam, but do not enter structure. ◗ Continue to monitor Dam level and rates of change in level. ◗ Regularly report to Treatment Manager/ Incident Manager and note readings and reports in Incident Log.	◗ Maintain contact with the Water Treatment Supervisor and relay the Dam level to RASER COAST REGIONAL COUNCIL LOCAL DISASTER MANAGEMENT GROUP AND QPS
◗ Allocate Operational Staff to support as required.	◗ Provide updates to the General Manager-Business Services / Chief Executive Officer, WBW regarding evacuation requirements and progress.
◗ If reservoir level drops below RL 26.5m, proceed with EAP 4.6.	◗ If reservoir level drops below RL 26.5m, proceed with EAP 4.6.
◗ If reservoir level is rising, toward RL 30.0m, proceed with EAP 4.8.	◗ If reservoir level increases to RL 30.0m, proceed with EAP 4.8.

4.8 Reservoir Level is at RL 30.0m and Rising (on the onset of water level reaching the top of filter zone in the embankment dam)

WATER TREATMENT SUPERVISOR	TREATMENT MANAGER (INCIDENT MANAGER)
◗ Monitor Dam level and rate of change in level. ◗ Relay Dam levels back to Treatment Manager/ Incident Manager. ◗ Note and report any anomalies to Treatment Manager/ Incident Manager.	◗ Using the latest rates of rise, calculate the time to RL 34.60m (overtopping of embankment) and advise FRASER COAST REGIONAL COUNCIL LOCAL DISASTER MANAGEMENT GROUP AND QPS ◗ Advise General Manager-Business Services / Chief Executive Officer, WBW of status. FRASER COAST REGIONAL COUNCIL LOCAL DISASTER MANAGEMENT GROUP AND QPS are to evaluate evacuation requirements based on actions required under Section 4.7 of this EAP and assessment of flood map information.
◗ When the water level reaches RL 30.0m inform Treatment Manager/ Incident Manager immediately.	◗ Maintain contact with the Water Treatment Supervisor and relay the Dam level to FRASER COAST REGIONAL COUNCIL LOCAL DISASTER MANAGEMENT GROUP AND QPS .
◗ Continue monitoring of the dam but do not enter structure. ◗ Look for any signs of stress such as excessive seepage, deformations, slumping, erosion or damage to dam. ◗ If damage has occurred notify Treatment Manager/ Incident Manager and proceed to EAP4.16. ◗ In case of new area of seepage or increased seepage observed proceed to EAP 4.11.	◗ If the dam is damaged, proceed with EAP 4.16. ◗ In case of new area of seepage or increased seepage observed proceed to EAP 4.11. ◗ Assess need for carrying out a visual inspection of the left abutment. Arrange access to left abutment if required.
◗ Allocate Operational Staff to support as required.	◗ Advise the General Manager-Business Services / Chief Executive Officer, WBW of EAP status.
◗ If reservoir level drops below RL 30.0m, proceed with EAP 4.7.	◗ If reservoir level drops below RL 30.0m, proceed with EAP 4.7.
◗ If reservoir level is rising, toward RL 32.0m, proceed with EAP 4.9.	◗ If reservoir level increases to RL 32.0m, proceed with EAP 4.9.

Note:

Spillway wall overtopping commences as the water level reaches RL 30.80. At water levels higher than this, some damage to the spillway chute is anticipated.

4.9 Reservoir Level is at RL 32.0m and Rising (on the onset of water level reaching the top of core zone in the embankment dam)

WATER TREATMENT SUPERVISOR	TREATMENT MANAGER (INCIDENT MANAGER)
◗ **WARNING: Wave overtopping of spillway chute is occurring. DANGEROUS AREA. No personnel are to approach the spillway chute wall backfill.** ◗ Monitor Dam level and rate of change in level.	◗ Using the latest rates of rise, calculate the time to RL 34.60m (overtopping of embankment) and advise FRASER COAST REGIONAL COUNCIL LOCAL DISASTER MANAGEMENT GROUP AND QPS
◗ Relay Dam levels back to the Treatment Manager/ Incident Manager. ◗ Note and report any anomalies to Treatment Manager/ Incident Manager.	◗ Advise General Manager-Business Services / Chief Executive Officer, WBW of status. FRASER COAST REGIONAL COUNCIL LOCAL DISASTER MANAGEMENT GROUP AND QPS are to evaluate evacuation requirements based on actions required under Section 4.7 of this EAP and assessment of flood map information.
◗ When the water level reaches RL 32.0m inform Treatment Manager/ Incident Manager immediately.	◗ Maintain contact with the Water Treatment Supervisor and relay the Dam level to FRASER COAST REGIONAL COUNCIL LOCAL DISASTER MANAGEMENT GROUP AND QPS.
◗ Continue monitoring of the dam but do not enter structure. ◗ Look for any signs of stress such as excessive seepage, deformations, slumping, erosion or damage to dam. ◗ If damage has occurred notify Treatment Manager/ Incident Manager and proceed to EAP 4.16. ◗ In case of new area of seepage or increased seepage observed proceed to EAP 4.11.	◗ If the dam is damaged, proceed with EAP 4.16. ◗ In case of new area of seepage or increased seepage observed proceed to EAP 4.11.
◗ Allocate Operational Staff to support as required.	◗ Continue to advise the General Manager – Business Services / Chief Executive Officer, WBW of EAP status
◗ If reservoir level drops below RL 32.0m, proceed with EAP 4.8	◗ If reservoir level drops below RL 30.0m, proceed with EAP 4.8.
◗ If reservoir level is rising further and reaching RL 34.60 proceed with EAP 4.10.	◗ If reservoir level increases to RL 34.60m, proceed with EAP 4.10.

Note:

Spillway chute walls will be overtopped as dam level approaches RL 32.5, Damage of Reno mattress protection, backfill and chute walls may occur.

4.10 Reservoir Level continues to rise to RL 34.60m(Dam Top Level) and Overtopping imminent

WATER TREATMENT SUPERVISOR	TREATMENT MANAGER (INCIDENT MANAGER)
◗ All operational staff that were checking / repairing the dam are to be removed from the dam. ◗ Each member is to be accounted for and allocated a safe position upstream of the dam.	◗ Using the latest rates of reservoir rise, calculate the time to dam overtopping level (RL 34.60m) and FRASER COAST REGIONAL COUNCIL LOCAL DISASTER MANAGEMENT GROUP AND QPS ◗ Advise General Manager-Business Services / Chief Executive Officer, WBW of status. FRASER COAST REGIONAL COUNCIL LOCAL DISASTER MANAGEMENT GROUP AND QPS are to evaluate evacuation requirements based on actions required under Section 4.7 of this EAP and assessment of flood map information. ◗ If requested arrange preparation of media briefing for General Manager – Business Services / Chief Executive Officer, WBW.
◗ Note and report any anomalies to the Treatment Manager/ Incident Manager. ◗ Continue to monitor Dam level and rates of change in level, IF POSSIBLE, but do not enter structure. ◗ Regularly report to Treatment Manager/ Incident Manager and note readings and reports in Incident Log.	◗ Refer to EAP 4.16 if there are any signs of structural defects.
◗ If Dam level exceeds RL 34.25m (i.e. 0.3m below the dam crest level) advise Treatment Manager/ Incident Manager.	◗ Advise FRASER COAST REGIONAL COUNCIL LOCAL DISASTER MANAGEMENT GROUP AND QPS as applicable of Dam level and the possibility of overtopping of the dam.
◗ If reservoir level drops below RL 32.0m, proceed with EAP 4.9.	◗ If reservoir level drops below RL 32.0m, proceed with EAP 4.9.

4.11 Increase in Seepage or New Area of Seepage (Increase of Seepage is observed in the downstream of embankment dam or spillway/ new area of seepage has been located)

WATER TREATMENT SUPERVISOR	TREATMENT MANAGER (INCIDENT MANAGER)
◗ Notify the Treatment Manager of noticeable increase or changes to seepage (seepage rate or colour) from the embankment, the toe of the embankment, the spillway, downstream of the dam or slumps.	◗ Declare an Incident. ◗ Inform General Manger – Business Services / Chief Executive Officer Wide Bay Water of the event and status of dam. ◗ Assemble and activate Incident Management Team.
◗ Monitor the situation by measuring the rate of seepage flow and observe the clarity of the seepage flow, keeping notes and photographs for the Incident Log and the routine dam safety inspections.	
◗ Where seepage or turbidity increases, advise the Treatment Manager / Incident Manager and proceed with EAP4.16.	Proceed with EAP 4.16.
◗ After the event, immediately submit records and reports to the Treatment Manager/ Incident Manager for review.	◗ Review records and reports from Water Treatment Supervisor and compile Emergency Event Report in accordance with Condition DS 13 Item 12 of the Lenthall Dam, Dam Safety Condition Schedule. ◗ Contact the Dam Safety Consultant to undertake a special inspection within 72 hours of the incident. ◗ Stand down the incident team and close the incident.

4.12 Earthquake (when earthquake is reported in the vicinity of the dam)

WATER TREATMENT SUPERVISOR	TREATMENT MANAGER (INCIDENT MANAGER)
◗ Inform the Treatment Manager/ Incident Manager that an earthquake was felt in the area.	◗ Declare an incident ◗ Inform General Manger – Business Services / Chief Executive Officer Wide Bay Water of the event and status of dam. ◗ Assemble and activate Incident Management Team.
◗ Immediately perform a Dam Safety Inspection. During the inspection, note signs of slumps, erosion, springs/seepage, cracks, or deformation, which could be classified as damage to the dam. ◗ Monitor the situation, keeping notes and photographs for the Incident Log and the routine dam safety inspection.	
◗ Where damage is observed, advise the Treatment Manager/ Incident Manager and proceed with EAP 4.16.	◗ On receipt of the damage report, proceed with EAP 4.16.
◗ After the event, immediately submit records and reports to the Treatment Manager/ Incident Manager for review.	◗ Review records and reports from Water Treatment Supervisor and compile Emergency Event Report. (Form 1 Appendix G) ◗ Contact the Dam Safety Consultant to undertake a special Inspection within 72 hours of the incident. ◗ Stand down the Incident Team and close the incident.

4.13 Contamination of the Catchment Area or Reservoir

Note: Contamination is defined as the presence of particles, chemicals, and other undesirable substances that may have an adverse impact on Dam infrastructure/operational performance or water quality. (refer to Wide Bay Water Corporation, Catchment Management Plan, Lake Lenthall, Burrum Weirs and Cassava Dams for detailed risk analysis. Document is available in HACCP Manuals and in the WBWC electronic records management system).

WATER TREATMENT SUPERVISOR	TREATMENT MANAGER (INCIDENT MANAGER)
◗ On receipt of information regarding contamination of the catchment area or reservoir.	◗ Declare an incident. ◗ Assemble and activate Incident Management Team. ◗ Inform the General Manager - Business Services/Chief Executive Officer, Wide Bay Water of the event and the status of the dam.
◗ Advise residents surrounding the lake of the incident.	◗ Inform the WBW Environmental Services Manager and the Counter Disaster Co-ordinator of the incident.
◗ Monitor the situation, keeping notes and photographs for the Incident Log and the routine dam safety inspection.	◗ Advise Incident Management Team of status.
◗ After the event immediately submit records and reports to the Treatment Manager/ Incident Manager for review	◗ Review records and reports from Water Treatment Supervisor and compile Emergency Event Report. (Form 2, Appendix G) Emergency Event to be reported in accordance with Condition DS 13 Item 12 of the Lenthall Dam, Dam Safety Condition Schedule. ◗ Stand down the Incident Team and close the incident.

4.14 Movement of Dam

WATER TREATMENT SUPERVISOR	TREATMENT MANAGER (INCIDENT MANAGER)
◗ Inform Treatment Manager/ Incident Manager that movement of the concrete wall or the embankment has been noticed.	◗ Declare an incident. ◗ Assemble and activate Incident Management Team.
◗ Immediately perform a Dam Safety Inspection. During the inspection, note any signs of slumps, erosion, springs, cracks or any deformation, which could be classified as damage to the dam. ◗ Monitor the situation, keeping notes and photographs for the Incident Log and the routine dam safety inspections.	◗ Inform the General Manager - Business Services/Chief Executive Officer, Wide Bay Water of the event and the status of the dam.
◗ Where damage is observed, advise the Incident Manager and proceed with 4.16.	◗ On receipt of the damage report, proceed with EAP 4.16.
◗ After the event immediately submit records and reports to the Treatment Manager/ Incident manager for review.	◗ Review records and reports from Water Treatment Supervisor and compile Emergency Event Report. Emergency Event to be reported in accordance with Condition DS 13 Item 12 of the Lenthall Dam, Dam Safety Condition Schedule. ◗ Contact Dam Safety Engineer to undertake a special inspection within 72 hours of the incident. ◗ Stand down the Incident Team and close the incident.

4.15 Object Crashes into the Dam or Reservoir

WATER TREATMENT SUPERVISOR	TREATMENT MANAGER (INCIDENT MANAGER)
◗ Inform the Treatment Manager/ Incident Manager that a report has been received of an object crashing into the dam or reservoir.	◗ Declare an incident. ◗ Assemble and activate Incident Management Team.
◗ Immediately perform a safety inspection. During the inspection, note any signs of slumps, erosion, springs, cracks or any deformation, which could be classified as damage to the dam or of potential contamination from fuel or other substances. ◗ Monitor the situation, keeping notes and photographs for the Incident Log.	◗ Inform the General Manager - Business Services/Chief Executive Officer, Wide Bay Water of the event and the status of the dam.
◗ Where damage is observed, advise the Treatment Manager / Incident Manager and proceed with EAP 4.16.	◗ On receipt of the damage report, proceed with EAP 4.16.
◗ Note that the structural integrity of the dam is to remain the priority for the site Incident Team.	
◗ Where contamination only is observed, proceed with EAP 4.13 as required.	◗ Inform the General Manager - Business Services/Chief Executive Officer, Wide Bay Water of the event and the status of the dam and the potential contamination. ◗ Where contamination only is observed, proceed with EAP 4.13 as required.
◗ Where contamination and damage are observed, stabilise the damage (EAP4.16) and then proceed with EAP 4.13 as required.	◗ Inform the General Manager - Business Services/Chief Executive Officer, Wide Bay Water of the event and the status of the dam and the potential contamination.
◗ After the event immediately submit records and reports to the Treatment Manager/ Incident manager for review.	◗ Review records and reports from Water Treatment Supervisor and compile Emergency Event Report. Emergency Event to be reported in accordance with Condition DS 13 Item 12 of the Lenthall Dam, Dam Safety Condition Schedule. ◗ Stand down the Incident Team and close the incident.

4.16 Damage to Dam

WATER TREATMENT SUPERVISOR	TREATMENT MANAGER (INCIDENT MANAGER)
◗ If damage is not caused by an existing event such as flooding, it is likely to have been identified during a routine inspection. ◗ If damage to the embankment, spillway or other appurtenant structures is identified, report immediately to Treatment Manager / Incident Manager.	◗ Declare an Incident. ◗ Assemble Incident Management Team. ◗ Attend site and inspect the damage. ◗ Inform the General Manager - Business Services/Chief Executive Officer, Wide Bay Water, of the situation.
◗ Assess and report extent of damage	◗ Relay details of the damage to the Dam Safety Consultant. Information that should be relayed includes: – The type of damage; – The location of damage (i.e. chainage or block area); – Dam level; – Weather forecast; – Specific details of damage, that is, flow and colour of seepage, size of cracks (length, width, orientation), or any associated damage such as sink holes. ◗ If necessary, the Dam Safety Consultant should inspect the damage and any repairs.
◗ Monitor the situation and continually relay the situation back to the Treatment Manager/ Incident Manager. Note any changes in the nature of the damage. ◗ If instructed by the Treatment Manager/ Incident Manager or Wide Bay Water Authorised Representative, support any evacuations as required.	◗ A decision is to be made to undertake immediate repairs or not. – If repairs are not undertaken, the damage is to remain monitored. – If the situation is considered serious enough, evacuations are to commence before the incident escalated to a Major Incident.

WATER TREATMENT SUPERVISOR	TREATMENT MANAGER (INCIDENT MANAGER)
◗ Coordinate repairs on site in accordance with instruction from the Treatment Manager/ Incident Manager. ◗ Regularly update the Treatment Manager/ Incident Manager with progress and record all relevant events in the Incident Log. ◗ On completion of the repairs, monitor and report to the Treatment Manager/ Incident Manager.	◗ If repairs are to be undertaken, the Dam Safety Consultant is to specify the repairs. Materials and/or services may be obtained through Wide Bay Water (WBW) existing suppliers or as decided by the Treatment Manager/ Incident Manager. ◗ If repairs appear to have stabilised, monitor the situation and confirm with the Dam Safety Consultant and close the incident. ◗ The Dam Safety Consultant is to confirm the closure of any incident associated with damage to the dam and to undertake a special inspection within 72 hours of the incident.
	◗ The Dam Safety Consultant is to identify any follow up repairs or works. These works are to be documented in the Incident Closure Report.
◗ After the event, immediately submit records, photographs and reports to Treatment Manager/ Incident Manager for review.	◗ Review records and reports from Water Treatment Supervisor and compile Emergency Event Report.

Table 10 Potential Damage or Indicators of Damage

Problem	General Characteristic	When and What to Check
Overtopping Imminent	Storage full and water level rising	During periods of excessive rainfall – check reservoir levels.
Rapid increases or cloudy appearance of seepage	Seepage flow through storage embankment is cloudy and increasing (piping failure has potentially started)	After detection of cloudy water look for source in embankment.
Seepage erosion or piping	Progressive internal erosion of the embankment or foundation to form an open conduit or pipe (piping failure)	During routine inspections or after unaccountable increases in seepage flows, look for an emission point.
Foundation Failure	Sliding, rotation, or settlement of part of or entire dam.	During routine inspection or immediately after earthquakes – inspect for evidence of foundation movement or displacement immediately adjacent to the dam.
Slide in downstream slope	Slide in the downstream face.	During routine inspection or following heavy periods of rainfall – look for cracks or scarps near the crest and bulges at the toe.

Problem	General Characteristic	When and What to Check
Flow slide	Collapse and flow of soil around the storage periphery.	During routine inspections, after heavy or long periods of rainfall.
New springs, seeps or boggy areas	Evidence of internal changes in seepage control (could be initial signs of piping failure)	During routine inspection, look for 'evergreen' spots, boggy ground or pools of water.
Gullying	No rock protection or vegetation cover on embankment batters or poor drainage.	During and after large rainfalls – inspect embankment and saddle dam batters for damage to rock protection or vegetation cover
Increase in gallery seepage	Increase in the normal rate of gallery seepage	After detection – check for differential movement or cracking in concrete components of spillway and retaining walls
Landslide	Mass movement of soil or rock from slopes and valley walls around the storage.	During routine inspections or following earthquakes – look for material displacement.
Damage to structural concrete	Movement or cracking of structural concrete.	During routine inspections or when mechanical problems such as burst pipe occur – look for any movement or cracking of structural concrete.
Failure of appurtenant structures or operating equipment	Loss of ability to supply water or discharge floods safely.	After detecting an operational anomaly – identify and investigation cause.
Loss of storage contents	Excessive loss from the storage and / or occasionally increased seepage or increased groundwater levels near the storage	During routine monitoring – look for environmental changes such as vegetation damage, salt scalds, etc
Toe erosion	Erosion of embankment toe by spillway discharge or diversion flows	During and after large rainfalls – inspect embankment toe
Wave erosion	Beaching or notching of the upstream face of the embankment by waves generated over long periods of strong wind	During or after periods of strong wind – inspect upstream face of embankment.
Abnormal instrument reading	A sudden change in the values of instrument reading	On detection – check for equipment malfunction and investigate the cause

Problem	General Characteristic	When and What to Check
Chemical spills	Dead fish and other aquatic life in storage, or a strange odour or colour	On detection- identify and investigate the cause

Appendix A

Access to Site

Figure 1 Locality Plan of Lenthall Dam

Source: Google Earth, accessed 1 June 2007.

Figure 2 Plan of Lenthall Dam showing Access Roads

See over page.

Wide Bay Water

Replace this page with google map of access to Lenthall Dam

Appendix B

Spillway Discharge Rating Curve / Height-Volume Relationship Curve

Figure 3 Lenthall Dam: Spillway Discharge Rating Curve

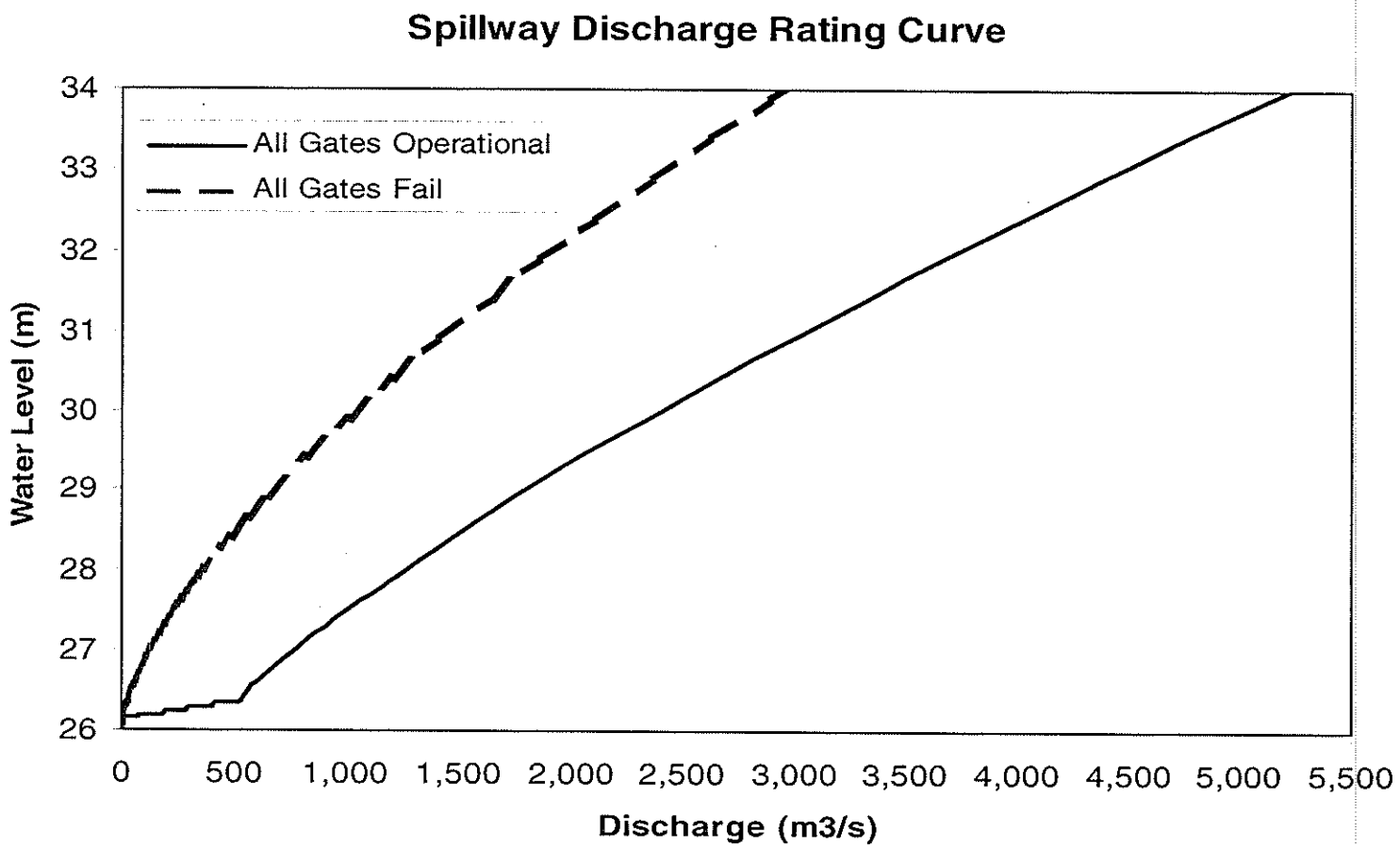


Figure 4 **Lenthall Dam: Spillway Discharge Rating Curve (Snapshot of Lower Discharges)**

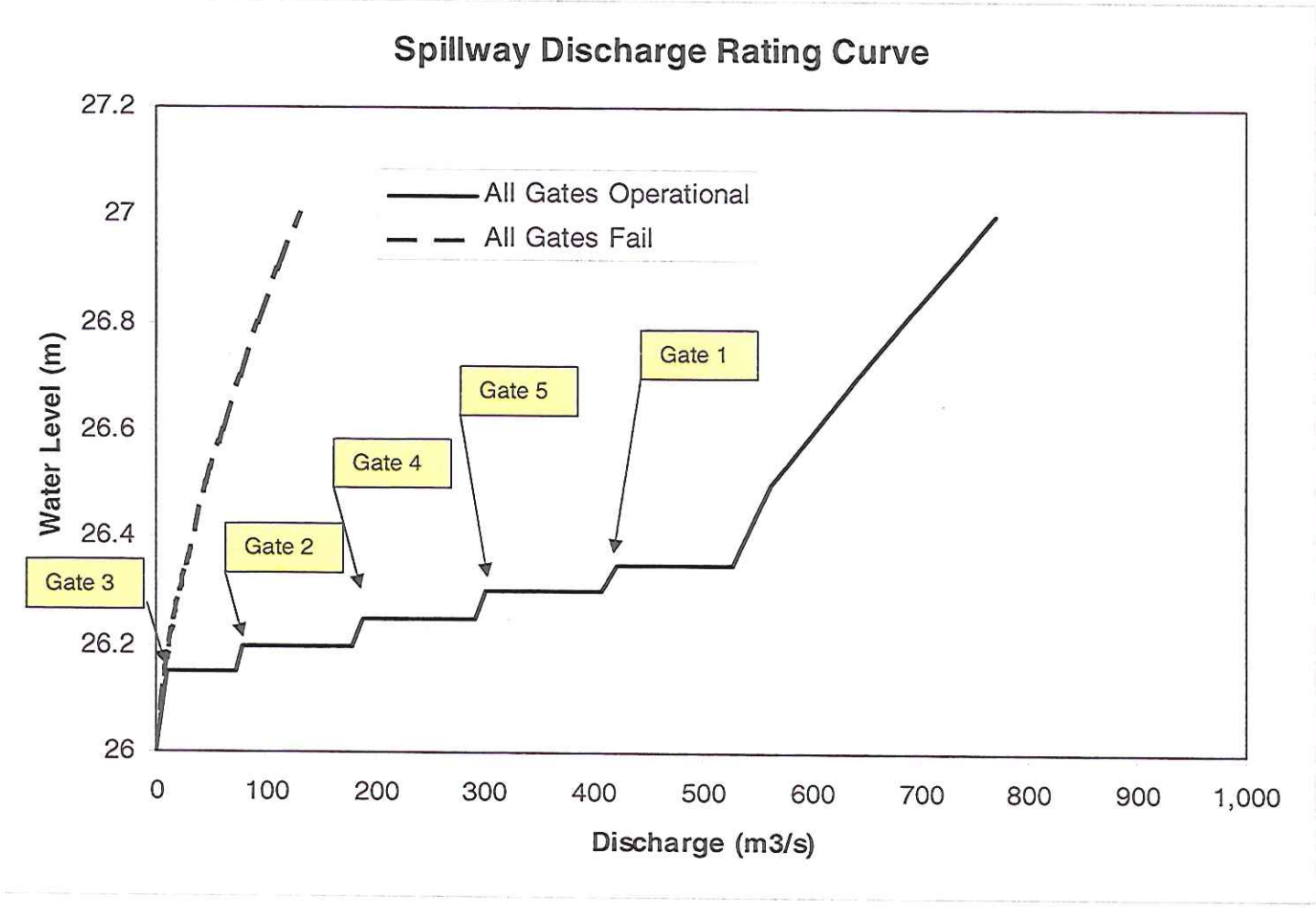


Table 11 Lenthall Dam: Data for Spillway Discharge Rating Curve

Water Level (m)	Discharge (m^3/s)	
	All Gates Operational	All Gates Fail
26.00	0	0
26.15	9	8
26.15	73	8
26.20	79	12
26.20	179	12
26.25	188	16
26.25	291	16
26.30	302	21
26.30	407	21
26.35	421	27
26.35	528	27
26.50	563	46
26.60	602	61
26.70	642	76
26.80	683	93
26.90	726	111
27.00	770	131
27.10	815	151
27.20	861	172
27.30	908	193
27.40	957	216
27.50	1007	240
27.60	1058	264
27.70	1110	289
27.80	1164	315
27.90	1219	342

Gate 3 Opening

Gate 2 Opening

Gate 4 Opening

Gate 5 Opening

Gate 1 Opening

Water Level (m)	Discharge (m^3/s)	
	All Gates Operational	All Gates Fail
28.40	1471	485
28.90	1741	644
29.40	2028	818
29.90	2332	1005
30.40	2653	1204
30.90	2991	1415
31.40	3321	1638
31.90	3664	1870
32.40	4017	2113
32.90	4381	2365
33.40	4755	2627
33.90	5140	2898
34.40	5534	3177

Note C_d of 1.8 used for gate failure scenarios, all levels

Figure 5 Lenthall Dam: Height-Volume Relationship Curve

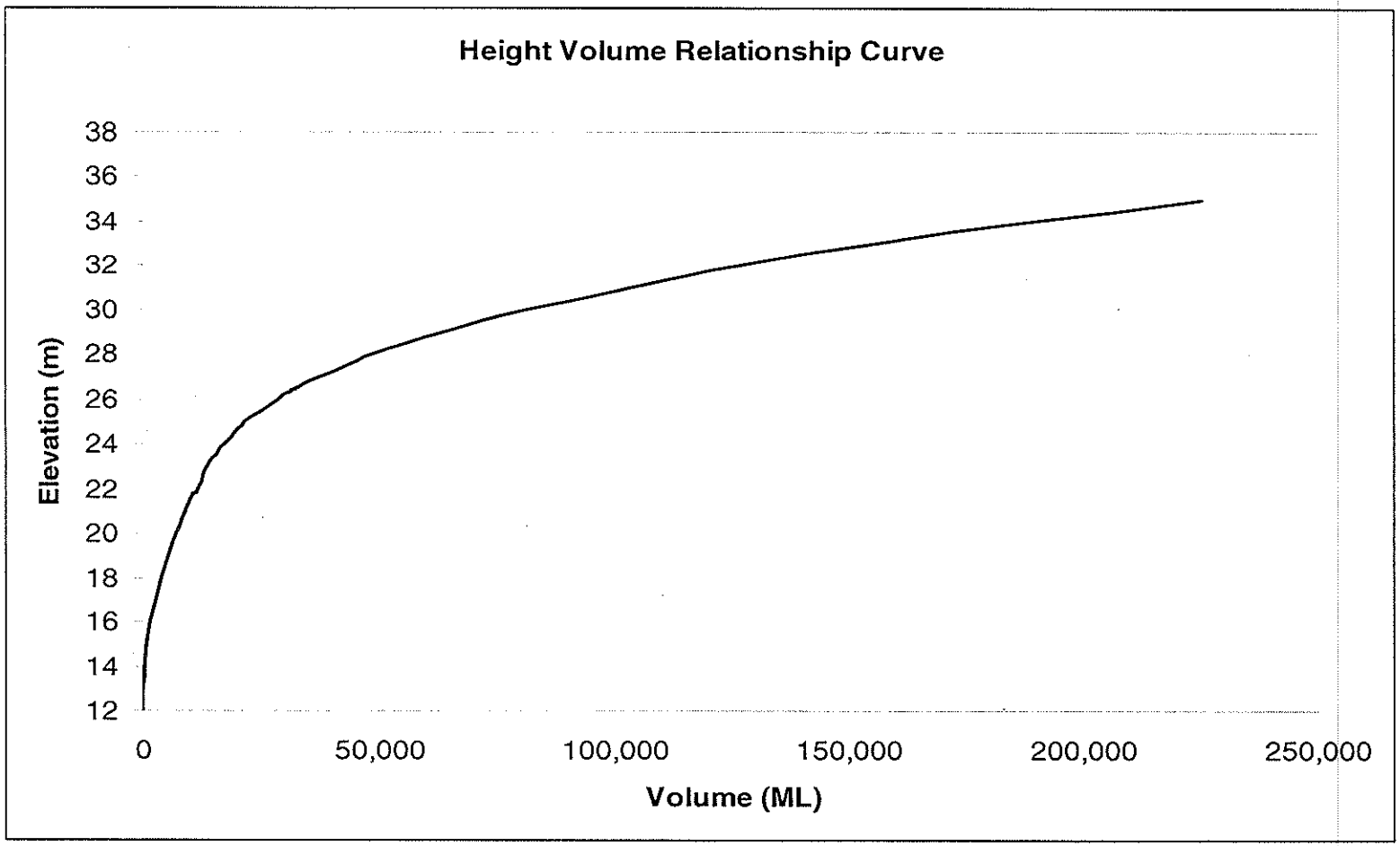


Table 12 Height-Volume Relationship, Lenthall Dam

Elevation	Volume (ML)
12.00	0
12.20	1
14.00	513
16.00	1650
18.00	3801
20.00	6951
21.00	8938
21.40	9823
21.80	10764
21.80	11258
23.00	13990
24.00	17256
24.20	18028
24.80	20771
25.00	21838
26.00	28631
26.30	30906
26.31	30998
26.35	31365
26.36	31457
26.40	31824
26.41	31915
26.45	32282
26.46	32374
26.50	32741
26.51	32833

Elevation	Volume (ML)
27.00	37328
27.50	43210
28.00	49092
29.00	63720
30.00	81375
31.00	102394
32.00	127076
33.00	155657
34.00	188294
35.00	225347

Flooding

The following significant flows have occurred at Lenthall Dam.

Table 13 Recorded Yearly Maximum Reservoir Level at Lenthall Dam pre-gates

Year	Month	Peak Level (m AHD)	Rank
1984#	Dec	24.001 (approx)	20
1985	June	24.954	8
1986	Jan	24.086	18
1987	Mar	24.146	16
1988	Dec	25.43	3
1989	April	25.142	5
1990	June	24.265	12
1991	February	23.982	21
1992	February	26.908	1
1993	February	23.491	22
1994	March	24.332	11
1995	February	25.151	4
1996	January	26.627	2
1997	March	23.363	23
1998	February	24.24	13
1999	January	24.468	10
2000	January	24.097	17
2001	February	24.497	9
2002	March	24.072	19
2003	February	24.776	7
2004	February	24.996	6
2005	December	24.211	15
2006	January	24.214	24
2007 ^	January	22.267	2

Data starts from October

^ Data ends in May

Table 14 Recorded Yearly Maximum Reservoir Level at Lenthall Dam post-gates

Year	Month	Peak Level (m AHD)	Rank
2008	February	27.41	1
2008	May		

Appendix C

Flood Hydrology and Hydraulic Data

Table 15 Flood Routing Results, PMP-Design Flood, Lenthall Dam

Storm Duration (Hours)	Peak Inflow (m^3/s)	Peak Outflow (m^3/s)	Peak Water Level (m)	Storm Volume (ML)
12	7550	4620	33.22	359,000
15	8030	4920	33.92	404,000
18	8360	5160	33.61	448,000
24	8560	5490	34.34	538,000
36	7910	5670	34.57	651,000
48	6930	5190	33.97	728,000
72	5870	4210	32.65	881,000
96	5770	4150	32.58	951,000

Table 16 PMF Flood Routing Results, Lenthall Dam

Storm Duration (h)	1893 Storm Pattern			1898 Storm Pattern			1956 Storm Pattern			1963 Storm Pattern		
	Q_{in} (m^3/s)	Q_{out} (m^3/s)	Peak WL (m)	Q_{in} (m^3/s)	Q_{out} (m^3/s)	Peak WL (m)	Q_{in} (m^3/s)	Q_{out} (m^3/s)	Peak WL (m)	Q_{in} (m^3/s)	Q_{out} (m^3/s)	Peak WL (m)
12	**7220**	4500	33.06	**8700**	4750	33.39	8590	4640	33.24	7570	4610	33.20
15	6670	4700	33.32	8650	5090	33.83	**8640**	4940	33.63	7560	4850	33.52
18	6310	4820	33.48	8340	5370	34.19	8570	5180	33.95	8110	5000	33.72
24	6300	**4900**	**33.50**	7830	**5760**	**34.68**	8270	**5550**	**34.42**	**8600**	5140	33.90
36	5240	4400	32.92	6880	5290	34.01	7090	5490	34.35	7780	**5450**	**34.30**
48	4900	4020	32.39	6210	5070	33.81	6400	5190	33.96	7300	5360	34.18

Appendix D

Lenthall Dam Flood Inundation Maps

(Source: Report on Lenthall Dam Dam Break Analysis Burrum River AMTD 34.2km by Sunwater Engineering Services, June 2002)

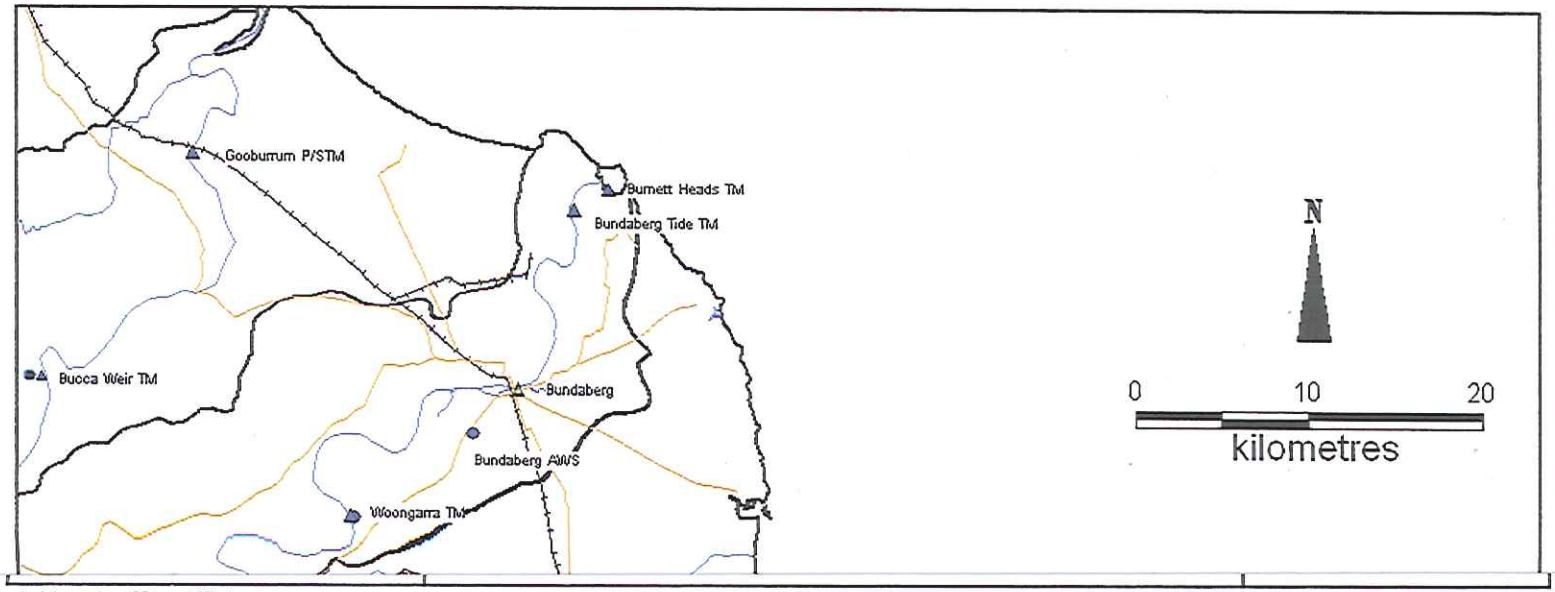
Appendix E

Lenthall Dam – Flood Warning System for the Burrum and Cherwell River

(Source: Australian Government Bureau of Meteorology website, 2008)

Australian Government

Bureau of Meteorology



r:/pub/maps/map06/map137_1.wor

Appendix F

Lenthall Dam Safety Inspections

Schedule of Dam Inspections

Routine Dam Safety Inspection Sheet. (Refer to dataworks for most current version of this documentation)

Schedule of Dam Inspections

Inspection Type	Responsible Officer	Purpose	Required Frequency
Routine Visual	Water Treatment Supervisor	Identification and reporting of deficiencies by visual observation of the dam by operating personnel as part of their duties at the dam.	Twice - Weekly generally and daily or on site continuous during significant rain/flood events
Routine Dam Safety	Water Treatment Supervisor/ Treatment Manager	Identification and reporting of deficiencies, by structured observation of the dam and surrounds, with recommendations for corrective actions.	Monthly
Annual Dam Safety	Engineering Specialist	The identification of deficiencies by visual examination of the dam and review of surveillance data against prevailing knowledge with recommendations for corrective actions. Equipment is inspected but not necessarily operated.	Annually
Comprehensive Inspection	Engineering Specialist	The identification of deficiencies by a thorough onsite inspection; by evaluating surveillance data; and by applying current criteria and prevailing knowledge. Equipment should be test operated to identify deficiencies. For a Safety Review consider: ◗ Draining of outlet works for internal inspection. ◗ Diver inspection of submerged structures.	Five-yearly
Special Inspection	Engineering Specialist	Examination of a particular feature of a dam for some special reason (eg. after earthquakes, heavy floods, rapid drawdown, emergency situation) to determine the need for pre-emptive or corrective actions.	As required

Wide Bay Water

Note:

According to Table 5.2 "Frequency of Inspections" of the ANCOLD "Guidelines on Dam Safety" routine visual inspections of "High A" hazard rating dams should be daily to tri-weekly, however it is recommended that following the installation of the Emergency Action Plan twice-weekly visual inspections will be sufficient, with daily or site continuous inspection during flood or heavy rainfall periods.

Appendix G

Lenthall Dam Incident Log Forms

Form 1: Incident Log

Form 2: Data Collection for Piezometers, (Refer to dataworks for most current version of this documentation)

Form 1 : Incident Log

Site / Location:	Lenthall Dam
Date of Incident:	
Time of Incident:	
Incident Reported by:	
Time of Incident Notification	

Description of Incident (attach extra pages if required). Include comment on adequacy of the EAP and recommended changes to the EAP.
Description of any damage, harm or nuisance caused (attached extra pages if required).

☒

Incident Log (Continued)						
Communications and Actions during the incident (attach extra pages, photos and sketches if required):						
No.	Date	Time	Reservoir Level	Rain (mm)	Photo Number	Action Taken
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

Signed		Date	

Forward copies of the completed form to the Treatment Manager/ Incident Manager, Wide Bay Water for further necessary action


Wide Boy Water

Appendix H

Contacts List

Contact List

The following table contains a list of contact names and telephone numbers that can be used to contact each person during an emergency.

Table 17 List of Contact Names and Telephone Number

Position	Name	Telephone (07 area code)	Facsimile (07 area code)	Radio [2]
SITE STAFF				
Water Treatment Supervisor	[redacted]	[redacted]		
WTP Operator – On Call 3	[redacted]			
WTP Operator – On Call 1	[redacted]			
WTP Operator – On Call 2	[redacted]			
GHD Dam Engineer	[redacted]			
OFFICE STAFF AT WIDE BAY WATER CORPORATION				
Chief Executive Officer	[redacted]	[redacted]		
General Manager – Business Services	[redacted]			
Treatment Manager	[redacted]			

[2] Wide Bay Water Corporation have their own radio frequency for communication with staff with call groups (Grp) and call numbers (call) as listed above.

Position	Name	Telephone (07 area code)	Facsimile (07 area code)	Radio [3]
Environmental Services Manager	[redacted]	[redacted]		
Wide Bay Water	24 hr Operations Centre	[redacted]		

Fraser Coast Regional Council Local Disaster Management Group

[redacted]
CEO Fraser Coast Regional Council and XO of LDMG
ph: [redacted]
mob: [redacted]

[redacted]
Disaster Planning Coordinator Fraser Coast Regional Council
Ph: [redacted]
Mob: [redacted]

[redacted]
Fraser Coast Regional Council (Road Closures)
Mob: [redacted]

[redacted]
Inundation Planning Manager Fraser Coast Regional Council
ph: [redacted]
mob: [redacted]

[redacted]
Executive Manager Business Operations
ph: [redacted]
mob: [redacted]

EMERGENCY SERVICES

Police	000
Ambulance	000

[3] Wide Bay Water Corporation have their own radio frequency for communication with staff with call groups (Grp) and call numbers (call) as listed above.

	Fire Brigade	000
COUNTER DISASTER		
Emergency Management Queensland	North Coast Region Duty Officer	[redacted]
National SES Telephone Network	N/A	(all Hrs) 132 500
DEPARTMENT OF NATURAL RESOURCES AND WATER		
Director Dam Safety	[redacted]	[redacted] [redacted]
BUREAU OF METEOROLOGY		
Duty Meteorologist Duty Engineer at Flood Warning Centre Tropical Cyclone Warning Centre	Bureau of Meteorology	[redacted]
AFFECTED RESIDENTS		
[redacted]		[redacted]

Contact details shall be reviewed annually and the updated version shall be distributed as per the Approved Controlled Document Register at the front of this Emergency Action Plan (EAP).

The entire EAP shall be reviewed and reissued in its entirety at least every 5 years.

Amendment Register

DATE	PERSON	DETAILS
14/04/10	[redacted]	**Rev. update** **WBW Env. Services Manager contact details update** **Added [redacted] to effected residents** **Added [redacted] (FCRC road closure coordinator)** **Review and update operator contact details**

08/10/10	[redacted]	Updated WBWC CEO contact details. Added reference section 4.6 – requirement to evacuate campers from Wongi Waterholes campgrounds. Added GHD Dam Engineer contact details to contacts list.