



Australian Government
Bureau of Meteorology

Document 1
Severe Thunderstorm Directive
Queensland
2011/12 Season



Cumulonimbus clouds over the western suburbs of Brisbane on 30/5/11.
(image courtesy of [redacted])

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Bureau of Meteorology
Severe Weather Section,
Queensland Regional Office

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Location

The QLD Severe Thunderstorm Directive is available to all Bureau of Meteorology internal staff at: <http://www.qld.bom.gov.au>

Confidentiality

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Change Control Process

Any changes to this document must be approved by RD QLD.

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Abbreviations:

AIFS	Australian Integrated Forecasting System
ARI	Average Recurrence Interval
AWS	Automatic Weather Station
BoM	Bureau of Meteorology
BWER	Bounded Weak Echo Region
CAPPI	Constant Altitude Plan Position Indicator
EMQ	Emergency Management Queensland
EWA	Emergency Weather Alert
FAR	False Alarm Ratio
MACR	Media And Community Relations Officer
NSW	New South Wales
NT	Northern Territory
NTFGS	National Thunderstorm Forecast Guidance System
NWP	Numerical Weather Prediction
OIC	Officer In Charge
POD	Probability of Detection
PPI	Plan Position Indicator
QLD	QueensLand
RAPIC	Radar Picture
RD	Regional Director
RESM	Regional Engineering Services Manager
RFC	Regional Forecasting Centre
RFC SPOC	Regional Forecasting Centre SPOC (Supervisor)
RSWS	Regional Severe Weather Section (Queensland)
RWSM	Regional Weather Services Manager
SA	South Australia
SDCC	State Disaster Coordination Centre
SEWS	Standard Emergency Warning Signal
SMSW	Senior Meteorologist Severe Weather
SWM	Severe Weather Meteorologist
TIFS	Thunderstorm Interactive Forecast System
VIL	Vertically Integrated Liquid water content
WDSS	Warning Decision Support System
WER	Weak Echo Region
WOSH	Weather and Oceanographic Services Handbook
WSO	Weather Services Office

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1. Introduction:

Background

- 1.1.1 The purpose of this Directive is to describe the procedures for the provision of the BoM Severe Thunderstorm Warning Service in the QLD Region. The Directive should be read in conjunction with the WOSH and the QLD Severe Weather Directive. The services detailed in this Directive form part of the Disaster Mitigation Program that is the Bureau's highest priority function.
- 1.1.2 The Directive is distributed to external emergency management agencies so they are fully informed of the services and products provided before, during and after the severe weather season.
- 1.1.3 The RSWS is to annually review and, if necessary, amend this Directive. RSWS is also to annually check the AIFS warning dissemination addresses in conjunction with the MACR.

Definitions

- 1.2.1 A severe thunderstorm is defined as a deep, moist convective cell, or organised group of cells, which is/are associated with one or more of the following weather phenomena over land:
 - *Tornado (es)*;
 - *Wind gusts of 90 km/h (48 knots) or more at 10 metres above the ground*;
 - *Hail with diameter of 2 centimetres or more at the ground*;
 - *Heavy rain which may lead to flash flooding*, generally defined as the rainfall amount which has a 10% probability of being exceeded in a year over a given duration (1 hour by definition). This is often referred to as the rainfall with a 10-year Average Recurrence Interval (ARI).
- 1.2.2 The severe thunderstorm definition is meant to include those thunderstorms that have significant social or economic impact.
- 1.2.3 Often quantitative estimates of wind speeds with thunderstorms are not available, and estimated values by untrained observers are in many cases unreliable. Wind gusts may be assumed to have exceeded 48 knots if any of the following are reported:
 - Trees blown down, snapped off above ground level or uprooted;
 - Power lines blown down (not downed by lightning);
 - Large quantities of roofing material removed or damage to structures.
- 1.2.4 In operational practice, rainfall intensities over periods from 10 minutes to 6 hours should be monitored. Heavy Rainfall Guidelines (Appendix 5) have been included to give forecasters a first guess at whether observed

values have exceeded the 10 year ARI. A more precise ARI comparison can be made at [http://\[REDACTED\]](http://[REDACTED])

- 1.2.5 Flash flooding is difficult to define. In general, if an eyewitness reliably reports flash flooding, the event is recorded as a flash flood. But this can include anything from water covering a road to a major flood event that seriously affects life and property and involves major damage. The Bureau of Meteorology does not forecast flash flooding as it depends on non-meteorological factors such as topography, soil saturation from past rain, soil type, vegetation, land use and drainage. However, antecedent rainfall, together with intensity and duration of thunderstorm rainfall need to be taken into account when considering conditions that may lead to flash flooding. Urban areas are particularly susceptible to flash flooding and consideration must be given to thunderstorms moving over such areas that may not reach the above criteria.

SEWS (Standard Emergency Warning Signal)

- 1.3.1 The SEWS is a wailing siren sound used as an alerting signal. It is played on public media to alert the community to the broadcast of an urgent safety message relating to a major emergency or disaster.

- 1.3.2 The SEWS will only be used:

- To alert listeners/viewers of radio/television, or where appropriate by other means, that an official announcement is about to be made concerning an actual or potential major emergency/disaster likely to affect them; and
- When the public need to be informed to take, or be prepared to take, specific action in order to protect life, property or the environment.

- 1.3.3 As a general rule, the following factors should be present:

- Potential for loss of life and/or a major threat to a significant number of properties or the environment. Usually the threat/impact would be the lead item in local news bulletins;
- A significant number of people need to be warned;
- The impact is expected within 12 hours – or is occurring at the time; and
- One or more phenomena are classified as destructive.

- 1.3.4 A thunderstorm event which warrants the use of the SEWS should produce at least one of the following phenomena:

- *Destructive wind gusts* > 125km/h (67 knots);
- *Very large hail* > 4cm in diameter (corresponding to > golf ball size);
- *Tornado (es)*;
- *Intense rainfall which may lead to very dangerous flash flooding* (1 to 6 hour rainfall > 50 Year ARI).

1.3.5 With consideration of the above:

- The SEWS will **only be used given a reliable (and convincing) report of life threatening conditions** due to any of the above phenomena;
- A reliable report would be classified as one originating from an AWS, official rain gauge, convincing media reports, emergency services or a storm spotter. Consideration should be given to proactively contacting spotters in the affected area for visual confirmation;
- Radar data should be considered to refine or support a warning including the SEWS, but **not as an initial trigger for use of the SEWS**. Supporting radar evidence could include an intense supercell signature (see Appendix 4), near or destructive (34 m/s) Doppler radar winds below 1000m, extreme WDSS MESH values (hail size >50mm*) or persistent area of significant Rainfields accumulation values (>70 mm/hr*). A lack of supportive radar evidence, in isolation, will not be reason enough to omit the SEWS from a warning given a convincing and reliable report of life threatening conditions;
- The thunderstorm or system producing the phenomena should be of sufficient scale and / or longevity that it would be expected to affect a significant number of people, for example a town or Metro area (ie. not a single pulse thunderstorm);
- If such radar evidence is observed in the absence of a reliable visual report, AWS, or rain gauge reading, then the, **“This thunderstorm is very dangerous”** tag should be used in Metro Thunderstorm Warnings, stronger wording may be included in State Warnings and/or the wind phenomena upgraded to destructive when applicable in any warning.
- In addition to the above, if there is insufficient confidence or lack of ground truth reports to trigger SEWS, the awareness of disaster response agencies can be raised by telephoning the SDCC and alerting them using the specific phrase **“EMERGENCY WEATHER ALERT”**.
 - Notifying SDCC of an “EMERGENCY WEATHER ALERT” can be done at the forecaster’s discretion when they believe there are special circumstances requiring notification of agencies (such as QPS and Local Government) but that there is insufficient confidence or lack of ground truth reports to trigger SEWS.

* These values take into consideration operational biases observed with the MESH and Rainfields values.

- Notifying SDCC of an “EMERGENCY WEATHER ALERT” will trigger SDCC to undertake an appropriate series of phone calls.
- There is no need to invoke an “EMERGENCY WEATHER ALERT” if the SEWS or “very dangerous” terminology is already used in warnings. For example an EWA may be appropriate when there is radar evidence of large rainfall accumulations affecting or likely to affect a major population centre, but that there has been insufficient rain gauge or spotter reports to confirm if SEWS thresholds have been reached.
- Notifying SDCC of an “EMERGENCY WEATHER ALERT” should wherever possible be immediately followed by an updated warning containing the specific detail contained in the verbal advice given to SDCC in the EWA.
- The RFC should immediately notify FWC staff (and vice versa) of the issue of a “heavy rainfall” EWA to the SDCC.

1.3.6 The RFC SPOC is authorised to approve the use of the SEWS for significant severe thunderstorm events in accordance with the above criteria. If time permits, the RFC SPOC should contact RWSM or SMSW to discuss the situation.

1.3.7 If the SEWS is required, text for inclusion in Severe Thunderstorm Warnings is:

- Transmitters serving the area ..[areas affected]... are REQUESTED TO USE THE STANDARD EMERGENCY WARNING SIGNAL BEFORE BROADCASTING THIS MESSAGE.

2. The Thunderstorm Forecast:

- 2.1.1 The Thunderstorm Forecast consists of two products, “Day 1” which is the day of issue, and “Day 2” which is the following day. The preparation of both graphical products is identical using TIFS. The Thunderstorm Forecast is a pictorial forecast delineating the area of QLD likely to be affected by thunderstorms during the rest of the day. It is prepared each morning using the TIFS software by approximately 11am with “Day 1” applying for the period from the time of issue until midnight, and “Day 2” applying from midnight Day 1 until midnight on the following day.
- 2.1.2 The Thunderstorm Forecast should cover all thunderstorms, severe and non-severe, and should include comments about the potential for severe thunderstorms when possible. Explanatory notes are to be included to indicate the confidence held in the forecast, and the reasoning behind it. An example of the Thunderstorm Forecast is given in Appendix 2a.
- 2.1.3 The Thunderstorm Forecast uses the following colours:
- Green – areas where thunderstorms are a chance;
 - Orange – areas where thunderstorms are likely;
 - Red – areas where severe thunderstorms are likely.
- 2.1.4 The Thunderstorm Forecast is available to specific registered users including EMQ.
- 2.1.5 The Thunderstorm Forecast should be consistent with RFC policy as set by the RFC SPOC by around 10:00am. Some differences may arise from new data being available after RFC policy has been set (for example delayed radiosonde data). If severe thunderstorms are forecast along state border areas, effort should be made to ensure consistency with the neighbouring state. Discussions with the appropriate RFC should take place.
- 2.1.6 The Thunderstorm Forecast products are not required to be updated after issue, however if a forecaster has time then an update is recommended.
- 2.1.7 The Thunderstorm Forecast is “RFC Policy” regarding the occurrence of thunderstorms, formulated after discussion with all forecasters. Once decided upon, all other forecasts prepared by staff in the QLD region should be consistent with the Thunderstorm Forecast, unless a change in policy has been made.
- 2.1.8 If a significant proportion of Queensland or areas of high population density are assessed as likely to be affected by severe thunderstorms on either Day 1 or Day 2, the EMQ SDCC should be contacted on (07) [REDACTED] [REDACTED] as soon as this becomes apparent. This allows EMQ additional time to organise resources in anticipation of a busy event.

3. The State Severe Thunderstorm Warning:

3.1.1 The State Severe Thunderstorm Warning is issued as an alert to the public, emergency services and other organisations that severe thunderstorms are occurring, or likely to occur, in a specified area over the next few hours. The State Severe Thunderstorm Warning covers all of Queensland (Map in Appendix 1a, example in Appendix 2b). The validity time of the warning is three hours, though the warning can be updated when required.

Content of Warnings

3.2.1 The wording of State Severe Thunderstorm Warnings is automatically generated by the TIFS software, but in some cases may need editing by the forecaster.

3.2.2 State Severe Thunderstorm Warnings will describe the most likely weather phenomena (i.e. large hail, damaging or destructive winds, tornadoes or heavy rainfall that may lead to flash flooding) that will accompany thunderstorms. Indication of the confidence level and impact of severe thunderstorms can be given through careful wording of the Warning.

3.2.3 State Severe Thunderstorm Warnings include a graphic depicting areas observed or forecast to be affected by severe thunderstorms during the next three hours. The warning text will describe locations within the warned area, as well as recommended action statements from EMQ. It will also contain reference to a Metro Severe Thunderstorm Warning if one has been issued previously.

3.2.4 Reliable reports of severe weather (for example from Storm Spotters, Bureau Observers, and reliable media reports or other sources) may be included to add weight to the severity of the warning. A section within TIFS allows this to be done quickly. The forecaster still needs to fill in specifics such as location, time and phenomena reported.

Preparing a State Severe Thunderstorm Warning

3.3.1 The State Severe Thunderstorm Warning is produced using the TIFS system. Procedures for generating the State Severe Thunderstorm Warning using TIFS are contained in Appendix 8a. If TIFS is not functional then warnings should be prepared using the YABBY system, available at <http://>

3.3.2 The State Severe Thunderstorm warning should first be issued when deep convection develops in an area deemed favourable for severe thunderstorms (the red area on the Thunderstorm Forecast). A State Severe Thunderstorm Warning should also be issued when there is evidence that severe thunderstorms are occurring or are soon expected to move into Queensland.

- 3.3.3 Only one warning will be issued that will include all areas within Queensland forecast to be affected by severe thunderstorms. An exception to this is the Metro Severe Thunderstorm Warning, which can be issued for parts of southeast Queensland. If warning for separate phenomena in two different areas, separate sections can be assigned to each region, this will then be reflected in the text. The heading of the warning will include all the phenomena warned for in all the sections.
- 3.3.4 The area covered by a State Severe Thunderstorm Warning should be kept as small as possible bearing in mind the uncertainty sometimes associated with diagnosing and forecasting the extent of environment capable of sustaining severe thunderstorms. However the area should not be so small as to necessitate excessive warning updates.
- 3.3.5 Destructive winds (gusts >125km/h) should be included in severe thunderstorm warnings when forecast or observed. The presence of supercell thunderstorms in many cases will be enough evidence to include destructive winds. When the SWM becomes confident that such supercells have developed within a warning area for which the warning mentions “damaging winds” or only mentions phenomena other than winds, they should re-issue the warning with the “destructive winds” button on TIFS selected, which will generate the appropriate text. If “destructive winds” have been included in a warning the forecaster should consider whether using the SEWS will be necessary as described on section 1.3 of this Directive.
- 3.3.6 Normally State Severe Thunderstorm Warnings will not mention specific thunderstorms. Changes to this would be exceptionally severe thunderstorms such as long-lived supercells and/or thunderstorms with likely hail >4cm, tornadoes, destructive winds or intense rainfall expected to impact on a major population area. In this situation, meteorologists may provide additional information about thunderstorm movement. This enhanced service may not always be possible in times of high workload.
- 3.3.7 A number of action statements have been agreed with EMQ and are included on the warning form. TIFS automatically selects the relevant action statements for each type of severe weather associated with a severe thunderstorm. A list of these action statements is included in the example warning in Appendix 2b.
- 3.3.8 If NWP data and/or upper air observations indicate a strongly favourable environment for severe thunderstorms then, at the discretion of the RFC SPOC, the district forecasts may be updated to include the possibility of damaging winds, large hail etc.
- 3.3.9 The Zoomed State Severe Thunderstorm Warning may be used when thunderstorms are only occurring in either the broader southeast Queensland region, or in northern Queensland. Maps of these areas are provided in Appendix 1b.

Updating a State Severe Thunderstorm Warning

- 3.4.1 State Severe Thunderstorm Warnings should be updated if not representative of the current situation, and **routinely at least every three hours**. The validity time of State Severe Thunderstorm Warnings should not exceed three hours. Where possible excessive updates (under 3 hours) should be avoided.

Cancelling a State Severe Thunderstorm Warning

- 3.5.1 State Severe Thunderstorm Warnings should be cancelled when severe thunderstorms move out of Queensland or dissipate and no further development is anticipated. This will help ensure that the public is aware that the risk of severe weather has passed. The warning should be labelled CANCELLATION and should end with the statement: "The immediate threat of severe thunderstorms has passed, but the situation will continue to be monitored and further warnings will be issued if necessary." TIFS is designed to do this automatically.
- 3.5.2 EMQ action statements should remain on the CANCELLATION warning if severe weather has been experienced in that area, these are programmed into TIFS. For example, flood waters may not have receded and powerlines may be on the ground. People may also require the appropriate emergency service phone number for assistance. They should be removed only if a warning is cancelled for conditions that did not eventuate.

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4. The Metro Severe Thunderstorm Warning:

4.1.1 The Metro Severe Thunderstorm Warning is an enhancement to the base level Severe Thunderstorm Warning service for the populated southeast corner of the state (map in Appendix 1a (dashed outline) and Appendix 1c). The validity time of the warning is up to one hour, with a desired routine update time of thirty minutes.

Content of Warnings

4.2.1 The wording of a Metro Severe Thunderstorm Warning is automatically generated by the TIFS software, but in some cases may need editing by the forecaster.

4.2.2 Metro Severe Thunderstorm Warnings will describe the most likely weather phenomena (i.e. large hail, damaging or destructive winds, tornadoes, or very heavy rainfall that may lead to flash flooding) to affect an area.

4.2.3 Metro Severe Thunderstorm Warnings are accompanied by a graphic depicting existing severe thunderstorms and their direction of movement during the next 60 minutes. In some situations, forecasters may reduce this time to 30 minutes if not confident of the longevity or movement. The warning graphic will also contain reference to a State Severe Thunderstorm Warning (if current), allowing the longer-term threat to be ascertained.

4.2.4 The graphic will include the broad State Severe Thunderstorm Warning area in yellow, and also a depiction of the areas under immediate threat from severe thunderstorms in orange (see example in Appendix 2c). The graphic transmitted to the SES will additionally show past tracks of selected storm cells.

4.2.5 Whenever destructive winds, giant hail (>4cm), intense rainfall which may lead to major flash flooding (1 to 6 hour ARI > 50 years) or tornadoes are expected from thunderstorms, the thunderstorm should also be labelled “**This thunderstorm is very dangerous**” on the graphical warning product using TIFS. This will also append enhanced wording in the text of the warning. The forecaster should consider whether using the SEWS will be necessary as described in Section 1.3 of this Directive.

4.2.6 Reliable reports of severe weather (for example from Storm Spotters, Bureau Observers, and reliable media reports or other sources) may be included to add weight to the severity of the warning. A section within TIFS allows this to be done quickly. The forecaster still needs to fill in specifics such as location, time and phenomena reported.

Area covered by the Metro Severe Thunderstorm Warning

4.3.1 The Metro Severe Thunderstorm Warning covers the following Local Government Areas (a map is provided in Appendix 1c):

- Brisbane City
- Cherbourg Shire
- Dalby (partial)
- Gold Coast City
- Gympie
- Ipswich City
- Lockyer Valley
- Logan City
- Moreton Bay
- Redland City
- Scenic Rim
- Somerset
- South Burnett
- Southern Downs (partial)
- Sunshine Coast
- Toowoomba (partial)

Preparing a Metro Severe Thunderstorm Warning

4.4.1 The Metro Severe Thunderstorm Warning is produced using the TIFS system. Procedures for generating the Metro Severe Thunderstorm Warning using TIFS are contained in Appendix 8b. If TIFS is not functional then warnings should be prepared using the YABBY system available at <http://>

4.4.2 The Metro Severe Thunderstorm warning should be issued when there is evidence that severe thunderstorms are occurring or expected to move into the Southeast Queensland metro warning area within the next hour.

4.4.3 The automatically generated text can be edited if desired in order to better convey the warning message.

4.4.4 The location of individual thunderstorms is best described in terms of major towns and suburbs or recognised geographical localities. Distances should be in kilometres not nautical miles.

4.4.5 A number of action statements have been agreed with EMQ and are included on the warning form. TIFS automatically selects the relevant action statements for each type of severe weather associated with a severe thunderstorm.

4.4.6 If NWP data and/or upper air observations indicate a strongly favourable environment for severe thunderstorms, then at the discretion of the RFC SPOC the district forecasts may be updated to include the possibility of damaging winds, large hail etc.

- 4.4.7 An example of a Queensland Metro Severe Thunderstorm Warning is shown in Appendix 2c.

Updating a Metro Severe Thunderstorm Warning

- 4.5.1 Metro Severe Thunderstorm Warnings should be updated if not representative of the current situation, and **routinely at least hourly**, with an ideal update period of thirty minutes. The validity time of Metro Severe Thunderstorm Warnings should not exceed one hour.

Cancelling a Metro Severe Thunderstorm Warning

- 4.6.1 The Metro Severe Thunderstorm Warning should be CANCELLED when severe thunderstorms move out of the warning area or dissipate. This will help ensure that the public is aware that the immediate risk has passed.
- 4.6.2 Upon cancellation of a Metro Severe Thunderstorm Warning, if a State Severe Thunderstorm Warning remains current for part of the area this should be reflected by text similar to: “Severe thunderstorms are no longer affecting the Southeast Queensland area (east of Dalby from Rainbow Beach to Stanthorpe). The immediate threat of severe thunderstorms has passed, but the situation will continue to be monitored and further warnings will be issued if necessary”. TIFS is designed to include this text automatically.


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5. Relationship Between Products:

Between Metro and State Thunderstorm Warnings

- 5.1.1 The base-level thunderstorm warning service for all of Queensland is via the State Severe Thunderstorm Warning.
- 5.1.2 A more detailed Metro Severe Thunderstorm Warning is an enhancement of the State Severe Thunderstorm Warning for southeast Queensland. The Metro Warning should be viewed as providing additional detail in high population areas to assist in the effectiveness of the warning service in these areas.
- 5.1.3 In many instances broader State Severe Thunderstorm Warnings will be issued for the Metro Warning Area prior to the requirement for a Metro Warning. In these situations, it is vital that the Metro Warning remain consistent with the State Warning. This can most easily be achieved through adequate cross-referencing between warnings, as discussed in Appendix 8, and also by **always issuing State Severe Thunderstorm Warnings first**.
- 5.1.4 There will be occasions when Severe Thunderstorm Warnings are necessary only within the Metro area. In these situations, the forecaster may choose to only issue a Metro Warning, however a State Warning can also be issued to provide greater warning lead-time. If a State Warning is current, or subsequently issued for surrounding parts of the state, these warnings must be consistent with the Metro Warning and vice-versa. If a State Severe Thunderstorm Warning is current and severe thunderstorms contract into the Metro area, the State Warning must remain current while Metro Warnings are current.
- 5.1.5 If both forms of warning are required to be issued for the Metro Warning Area, the State Warning should be issued first for the larger area, quickly followed by the Metro Warning. In this way the entire state has the same base level service and the Metro Warning becomes simply an enhanced service added to the State Warning.
- 5.1.6 When the immediate threat of severe thunderstorms has passed, forecasters will cancel the Metro Warning. If the forecaster expects the overall threat to continue, the State Warning can be referred to in the cancellation message.
- 5.1.7 If both Metro and State Warnings need to be cancelled at the same time, the State Warning should be cancelled first followed by the Metro Warning. This ensures that no warning areas are present in the cancellation messages or graphics. In this situation the SWM shouldn't cross reference the Metro Warning in the State cancellation text as it will soon be cancelled.

Cross-referencing of Warnings

- 5.2.1 If State and Metro Severe Thunderstorm Warnings are both current they should make mention of the other product. This is easily done by clicking the  icon in the text window of the TIFS State Warning screen. This will include the text, “At (time, date) a separate, more detailed Severe Thunderstorm Warning was current for the Southeast Queensland area (east of Dalby from Rainbow Beach to Stanthorpe). Refer to this product for more information”. Conversely if a Metro Warning is issued while a State Warning is current, TIFS will automatically add, “A more general severe thunderstorm warning is also current for (selected) districts”.

Between Severe Thunderstorm and Severe Weather Warnings

- 5.3.1 The Severe Thunderstorm Warning Service is separate but complementary to the Severe Weather Warning Service.
- 5.3.2 At the forecaster's discretion, a Severe Thunderstorm Warning can be issued concurrently to a Severe Weather Warning **only if additional value can be added** than through the use of the Severe Weather Warning alone.
- 5.3.3 If severe thunderstorms are forecast (or observed) and a Severe Weather Warning is current for the same area, a separate Metro Severe Thunderstorm Warning can be issued:
- if they are affecting the Metro Southeast Queensland area; and
 - are associated with different (eg. large hail) or higher impact phenomena such as destructive winds and intense rainfall; or
 - more value could be added with regard to detail of the immediate threat.

In these instances:

- A Metro Severe Thunderstorm Warning would be issued immediately, cross referencing the broader threat specified in the Severe Weather Warning. The Metro Severe Thunderstorm Warning would be updated at half hourly to hourly intervals until the threat has passed;
- An update to the Severe Weather Warning would be issued as soon as possible to cross reference the Metro Severe Thunderstorm Warning. The Severe Weather Warning would be updated at least at 3 hourly intervals while the Metro Severe Thunderstorm Warning was current;
- When the threat of Severe Thunderstorms has passed, the Metro Severe Thunderstorm Warning will be cancelled but will cross-reference the broader threat that remains in the Severe Weather Warning. The Severe Weather Warning will be updated to reflect this and also cross-reference the cancelled Metro Severe Thunderstorm Warning.

- 5.3.4 If Severe Thunderstorms affect the regional Queensland area, and a Severe Weather Warning is current for the same districts, then:
- The Severe Weather Warning would be updated immediately, ensuring that Severe Thunderstorms and the associated risk/impact is detailed thoroughly. The Severe Weather Warning would be updated at least at 3 hourly intervals while Severe Thunderstorms were affecting the same area.
 - If large hail is expected, ensure this information is clearly and predominantly detailed in the text within the Severe Weather Warning. A separate state Severe Thunderstorm Warning won't be issued.
 - When the threat of Severe Thunderstorms has passed, the Severe Weather Warning will be updated to reflect this.
- 5.3.5 If a State Based Severe Thunderstorm Warning is current and thunderstorms spread into areas of heavy rain without lightning, maintain the State Based Severe Thunderstorm Warning for that purpose as no additional value would be added by changing the warning type (and negate the possibility of Severe Thunderstorm Warnings being reissued if lightning occurs again). If this occurs with only a Metro Warning current, a separate Severe Weather Warning may be issued.

To other QLD Forecasts

- 5.4.1 Given the short-term nature of Severe Thunderstorm Warnings, both State and Metro Severe Thunderstorm Warnings are not required to be referenced in the "Warning Summary at issue time" section of the State or District forecasts.

6. Monitoring:

Sources of Information

- 6.1.1 Sources of information can be divided into two groups: the standard information received by the RFC and information received from special observers or the public.
- 6.1.2 Standard information received by the RFC includes:
- Synoptic, upper wind and temperature data;
 - AWS and rain gauge data;
 - Radar and satellite imagery;
 - Analytic fields derived from the above information;
 - Prognostic fields from computer models.
- 6.1.3 Damage reports can also be received through the media or even through online forums. While they are a valuable source of information, discretion is advised when considering reports from these external sources.

Storm Spotters

- 6.2.1 The Storm Spotter network is composed of volunteers from the community who have undertaken to report severe thunderstorm occurrences to the Bureau. Storm Spotters are asked to report either by telephoning a dedicated **freecall number (1800 [REDACTED])**, by filling in and mailing 'Severe Thunderstorm Reporting Cards', through an online reporting form available at www.bom.gov.au/storm_spotters, or email to **[REDACTED]** @bom.gov.au.
- 6.2.2 The Storm Spotter Freecall number will ring at the "radar" desk in the severe weather section. This has been diverted to the severe weather desk (extension **[REDACTED]**).
- 6.2.3 When receiving telephone reports from Storm Spotters, the following information should be noted:
- The Storm Spotter's name and/or number
 - The severe weather phenomena and/or damage observed
 - The location at which the storm occurred
 - The time at which the storm occurred
- 6.2.4 All Storm Spotter reports and any other reports indicating severe thunderstorm activity are to be passed to the RFC SPOC and RSWS. They should also be entered into the "Severe Weather Logbook" located at [http:// \[REDACTED\]](http://[REDACTED]) Spotter reports received via the online reporting form will automatically appear in AIFS Alerts and via email to **[REDACTED]** @bom.gov.au.

Responsibility for Monitoring

- 6.3.1 The overall responsibility for the Severe Thunderstorm Warning Service resides with the RFC SPOC. During the period when severe thunderstorms are climatologically common, the day-to-day provision of the Severe Thunderstorm Warning Service is delegated to the forecaster(s) at the Severe Weather Desk when it is in operation.
- 6.3.2 There is no formally defined “severe thunderstorm season” for Queensland, however a dedicated Severe Weather Desk in the RFC will be staffed from 4:45 am to 9:00 pm local time 7 days a week, generally from the beginning of October to the end of March. This may be extended depending on prevailing conditions. While the Severe Weather Desk in the RFC is staffed, the duties of the officer in that position include:
- assessment of the likelihood of severe thunderstorms;
 - monitoring of radars and other relevant meteorological observations;
 - preparation of Severe Thunderstorm Warnings;
 - answering of telephone calls on the Severe Weather Desk or media enquiries related to Severe Weather Warnings.
- 6.3.3 If heavy rainfall that may lead to flash flooding is considered likely then the Hydrology section should be consulted during normal working hours. Outside of normal working hours Hydrology staff are to be contacted as per their call-out roster at [http://\[REDACTED\]](http://[REDACTED]).
- 6.3.4 During the period when the Severe Weather Desk is not staffed, RSWS staff will aid in the assessment of severe weather risk on normal weekdays. They will also be available for call-out on weekends and public holidays if necessary. Assessments of the need for RSWS staff should ideally be made the previous afternoon and, if necessary, revised early on the day in question.
- 6.3.5 Staff should be familiar with all severe thunderstorm forecasting applications including SONDTOOL, Helindex, Convective Analyser, TIFS, NTFGS, satellite data, NWP data and use of 3D RAPIC. Useful references for severe weather forecasting/diagnosis techniques can be found in Appendices 4 to 8.
- 6.3.6 Where possible Severe Thunderstorm Warnings should only be prepared by staff who have completed the Bureau Severe Thunderstorm Competencies checklist.

7. General Information for Severe Thunderstorm Warnings:


Task Priorities

- 7.1.1 The RFC SPOC should ensure that the Severe Thunderstorm Warning Service is maintained during those periods when the Severe Weather Desk is unattended. **Routine work may be delayed or, under extreme conditions, cancelled to allow the service to continue.** At the discretion of the RFC SPOC, the severe weather shifts may be extended or severe weather trained staff on a project shift or rostered days off may be called upon to provide additional operational assistance. This is particularly the case when it appears likely that severe thunderstorms will affect the heavily populated areas of southeast Queensland covered by the Metropolitan Warning Area.
- 7.1.2 Meteorologists preparing Severe Thunderstorm Warnings are to assign priorities to tasks. The following task order should be used whenever possible:
1. Preparation of Severe Thunderstorm Warnings. Collection and monitoring of data to be included in the warnings and briefings to or phone calls from EMQ.
 2. Issuing routine forecasts. In extreme circumstances it may be necessary to delay the issue of routine forecasts.
 3. Handling telephone calls. Calls from the media should take priority over those from the general public.

Inclusion of Tornado Warnings

- 7.2.1 Tornado Warnings are not issued separately, but incorporated with Severe Thunderstorm Warnings. Severe Thunderstorm Warnings that include mention of tornadoes should include the following statement immediately following the issue time group:

“THIS INCLUDES A TORNADO WARNING”

This text will be automatically generated when the  button in TIFS is selected.

- 7.2.2 A tornado warning will require activation of the SEWS. As such a reliable report of a tornado should be received before including this phenomenon. See section 1.3 for information about use of the SEWS.

Dissemination of Severe Thunderstorm Warnings

- 7.3.1 The warning is transmitted to media outlets in the appropriate weather districts, Weather by Fax, phone warning, the Bureau's Internet and other fire and emergency organisations that have made arrangements for transmission. Severe Thunderstorm Warnings may also be distributed to non-emergency service or non-media clients but will be charged for at a cost-recovery rate.
- 7.3.2 The officer issuing a Severe Thunderstorm Warning must check that it has reached the Bureau's external website at www.bom.gov.au.
- 7.3.3 The Warning will be automatically recorded using text-to speech technology on 1900 969 922 and 1300 659 219.
- 7.3.4 All Severe Thunderstorm Warnings are prepared using TIFS. If TIFS is not functional then the warning should be prepared using the Yabby system, available at [http://\[redacted\]/](http://[redacted]/).

Internal Liaison

- 7.4.1 Upon issuing a Warning the responsible Officer should inform all forecasters in the RFC and any WSO's likely to be affected by severe thunderstorms. RSWS staff may also contact WSO's in the nominated area to obtain damage reports. Conversely, WSO's are requested to obtain reports of any severe thunderstorms and send these to RSWS or upload them directly, including web links, photos and images, to the Severe Weather Logbook at [http://www.\[redacted\]](http://www.[redacted]).
- 7.4.2 In order to ensure consistency across the QLD/NSW, QLD/SA and QLD/NT borders, it will be necessary to consult with the NSW, SA and the NT RFC's throughout the severe thunderstorm season. It is difficult to set out a formal consultation process, however consultation should be as early as practicable in the morning and continue at regular intervals during the day as the severe thunderstorm situation and warnings change. When severe thunderstorms are likely or are occurring near the QLD/NSW, QLD/SA or QLD/NT borders, it is important that the issue of warnings be co-ordinated between the regions. Contact details are as follows:

NSW Severe Weather:	(02)	[redacted]
SA Severe Weather:	(08)	[redacted]
NT RFC SPOC:	(08)	[redacted]

External Liaison

- 7.5.1 The officer issuing the Warning is responsible for ensuring that the EMQ SDCC Watch Desk Officer is advised by telephone at the time of issue of

both the FIRST and FINAL Severe Thunderstorm Warnings, and of any significant changes in policy. The number is (07) [REDACTED] (all hours). The EMQ SDCC Watch Desk Officer can also be contacted to pass on or request significant reports of severe weather.

Call-out of Engineering Staff

- 7.6.1 After noticing or being notified of an unplanned radar outage the RFC SPOC should check for any previously logged fault reports at [http://\[REDACTED\]](http://[REDACTED]) none are present a fault report should be entered.
- 7.6.2 With consideration to prevailing weather conditions, the RESM should be contacted after the failure of any radars in QLD. The RFC SPOC will determine the need for data and request the timeframe for necessary action. If a radar goes offline, and if thunderstorms are current or expected before the next working day for the region, all efforts should be made to return the radar to service as soon as possible.
- 7.6.3 Contact numbers can also be found in Appendix 3. Out of hours, if there is any impending or expected precipitation near the affected radar, the RESM should be phoned immediately to be notified of the outage. If fine weather is expected, at the discretion of the RFC SPOC, the RESM can be sent a Short Message Service (SMS) from the GUI at [http://www.\[REDACTED\]](http://www.[REDACTED]), also found under the fault report page. If in doubt it is preferred to phone the RESM. If the RESM cannot be contacted, a period of 4 hours should be allowed, then the relevant TO 4 contacted as per the following list:

RESM:

- [REDACTED] (0407 [REDACTED])

TO 4 - Southeast QLD and Rockhampton:

- [REDACTED] (0419 [REDACTED])
- [REDACTED] (0418 [REDACTED])
- [REDACTED] (0418 [REDACTED])
- [REDACTED] (0417 [REDACTED])

TO 4 - Cairns:

- [REDACTED] (0438 [REDACTED])

TO 4 - Townsville

- [REDACTED] (0408 [REDACTED])

- 7.6.4 The RFC SPOC should also send an alert to inform the NMOC Helpdesk and technicians of the outage. This way any relevant Radar Service Interruption Notice (RSIN) can be updated. This can be done through a GUI at [http://\[REDACTED\]](http://[REDACTED]), also found under the Fault Report page. If the GUI doesn't work, an email should be sent to [QLD \[REDACTED\]@bom.gov.au](mailto:QLD@[REDACTED].bom.gov.au) including any **known information** from the list below:

Name of radar facility;
Service that will be affected;
Extent of outage;
Reason for outage;
Estimated or actual Outage start time;
Estimated Return To Service time;
Point & method of contact for further information;
Point & method of contact for BOM Staff dealing with the Outage.

Contingency Procedures during Severe Thunderstorm Events

- 7.7.1 Full contingency procedures are outlined in the QLD Forecast and Warning Continuity Procedures at:
<http://www.qld.bom> |
and the Queensland Regional Continuity Plan at:
<http://web.bom>. |

Radiosonde and Weather Watch Issues

- 7.8.1 If severe thunderstorms are considered likely then the RFC SPOC is authorised to request an additional full radiosonde flight at any WSO to provide a complete wind and temperature analysis of the pre-thunderstorm environment.
- 7.8.2 Conversely, if severe thunderstorms are occurring at the time of a scheduled wind flight, the RFC SPOC can authorise delaying or abandoning the flight in the interests of continuing radar coverage of the thunderstorms.

Media requests for Interviews

- 7.9.1 During major thunderstorm events generating considerable media interest, any available non-operational staff should be utilised in answering telephone calls and assisting with media interviews, though only after being given suitable briefing. The RFC SPOC is encouraged to call in additional staff to assist with the extra workload if needed.

8. Follow-Up Procedures

Archiving Information

- 8.1.1 RSWS is to maintain the *Severe Weather and Thunderstorm Logbook*, located under the “Disaster Mitigation” internal homepage at <http://www.qld.bom.gov>. This includes notes on any Warnings issued; telephone advice given to emergency services, the media or other interested parties (such as organisers of major outdoor functions); any weather observations or reports of severe weather received and any additional information concerning the event such as data from Automatic Weather Stations or details of equipment failures. Staff with a Wiki password are encouraged to enter damage reports, otherwise the generic Wiki login can be used or reports can be handed to RSWS staff for entry.
- 8.1.2 A summary of the Severe Thunderstorm Warnings issued per month can be accessed via the web-based services information management system (SIMS). SIMS can be accessed via a web browser at <http://s>
- 8.1.3 The responsibility for ensuring that all relevant information for a severe thunderstorm event is collected and retained lies with the Severe Weather Meteorologist on duty during the event.

Verification Statistics

- 8.2.1 RSWS is responsible for assessing all Severe Thunderstorm Warnings, and as such is to compile annual verification statistics for the Severe Thunderstorm Warning Service. The following are to be assessed for all Severe Thunderstorm Warnings:
- Occurrence of severe thunderstorm phenomena;
 - Onset;
 - Lead time;
 - Duration;
 - Area covered.
- 8.2.2 As described in Chapter 8 of the WOSH, the aim of the Severe Thunderstorm Warning Service is to provide:
- A Probability of Detection (POD) of 70% or greater;
 - A False Alarm Ratio (FAR) of 40% or less; and
 - At least thirty minutes lead time (ie. time between the issue of the Warning and the occurrence of the severe phenomena) on 70% of occasions.
- 8.2.3 When assessing Severe Thunderstorm Warnings, the following definitions are used:
- $POD = \frac{\text{No of Correctly Forecast Events}}{\text{Total No. of Events}}$
 - $FAR = \frac{\text{No. of False-Alarm Warnings}}{\text{Total No. of Warnings}}$

8.2.4 Many occurrences of severe thunderstorms are not reported in the media or to the Bureau of Meteorology. Insurance data on the occurrence of severe thunderstorms is also questionable as many people are not insured or may not claim. Hence it cannot be definitely stated that severe thunderstorms did not occur over an area where they are suspected to have occurred. This is especially true given the vast size of the Queensland warning area, and the great distances between population centres. It is acknowledged that POD and FAR statistics are therefore not a perfect representation of the accuracy of the warning service.

Reports

8.3.1 RSWS is to prepare case studies of severe thunderstorm events having significant human and/or economic impact.

8.3.2 Each year, RSWS is to prepare a report on Queensland Severe Thunderstorm activity during the year, including warning verification statistics, for inclusion in the Queensland Region Annual Report.

Major Events in QLD

8.4.1 A Severe Weather Summary is to be prepared by the SMSW or RSWS staff after significant severe weather events. It is used by WOSB staff to brief the Bureau Executive, who in turn provides briefing to the Departmental Secretary and Minister. Guidelines for issuing Severe Weather Summaries can be found in Annex 4 of the WOSH.

8.4.2 The RFC SPOC and SWM should monitor reports of damage and loss of life associated with severe weather events. The RD or other senior executive should be advised immediately an event appears to meet any of the following criteria:

- Loss of life;
- Extensive damage to property (in excess of \$5 million),
- Extensive disruption to services (affecting tens of thousands of people in a major city or more than half the population in a provincial city);
- Widespread media coverage and/or criticism of Bureau services;
- Direct interest of the Minister or another senior Minister's (this includes events affecting the Minister's own electorate).

8.4.3 On weekends and public holidays the RD can be contacted at home on the number given in Appendix 3. The RD will liaise with Head Office staff about whether a ministerial briefing is required and will implement an appropriate media strategy. The Severe Weather Summary should be prepared regardless of whether a ministerial briefing is required.

8.4.4 A Severe Weather Summary should be available in Head Office by 10:30am (Melbourne time) on the day after the event. In some circumstances the RD may request that available information be

forwarded to Head Office as soon as possible, followed by the complete Severe Weather Summary within normal time limits.

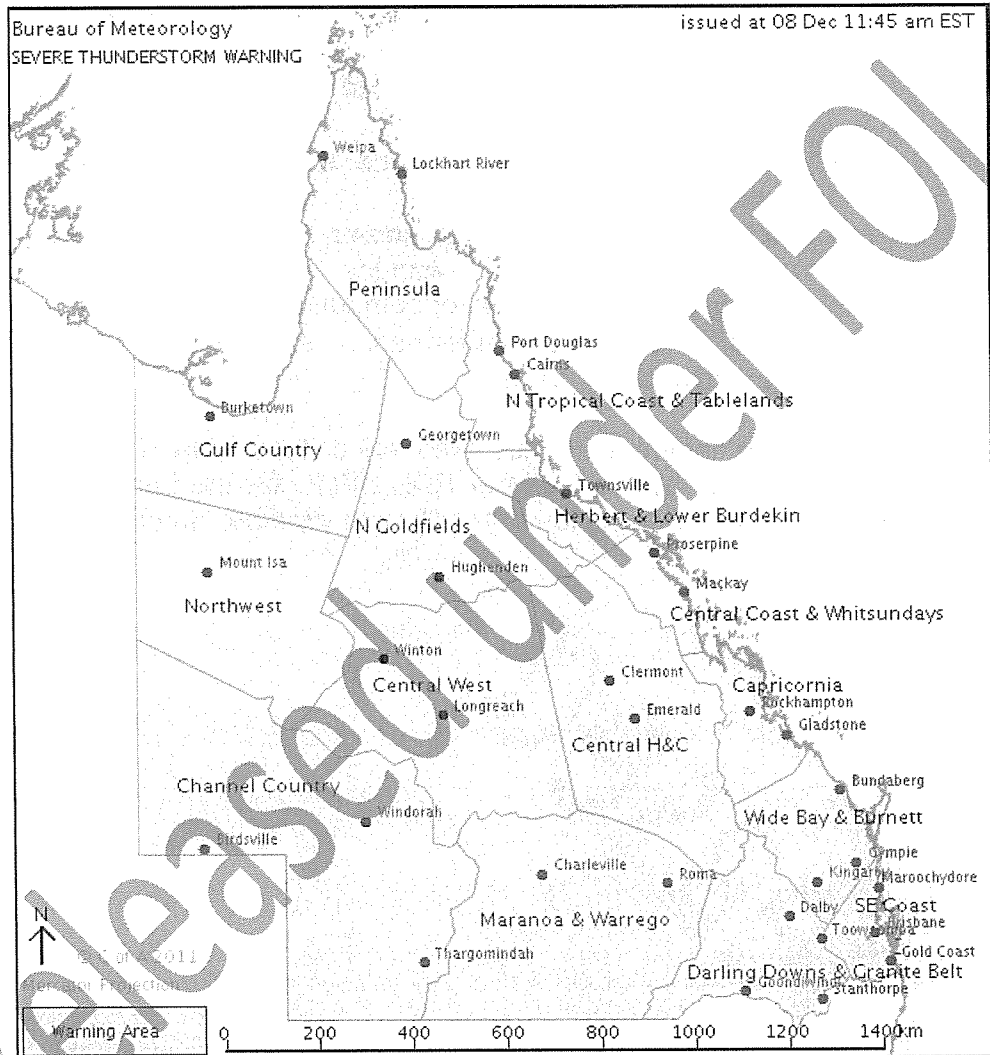
8.4.5 The Severe Weather Summary should contain the following information:

- an event summary describing what happened, where and when, the impact on life and property, and the disruption caused to services;
- time of onset and duration of severe weather (particularly important);
- warning/forecast summary: a concise summary of relevant warnings and forecasts including time of issue. This should include a candid assessment of the adequacy of forecasts and warning and their lead-time;
- media/user comments. Include extent, severity and source of criticism;
- facilities. Include any equipment failures or breakdowns which may have affected warning performance, for example communications failures or computer breakdowns;
- remarks: any further information, such as follow up action that may have been taken.

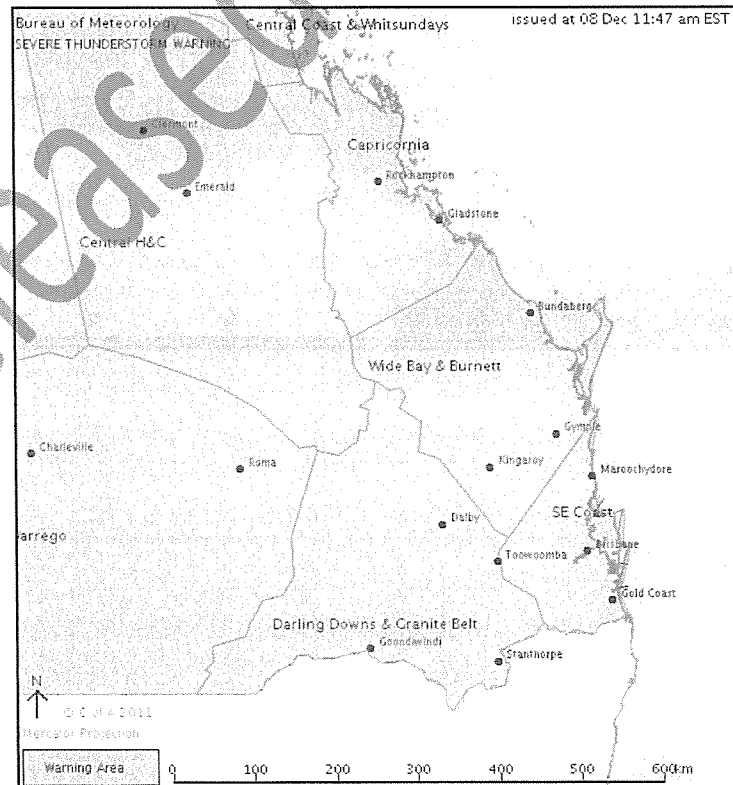
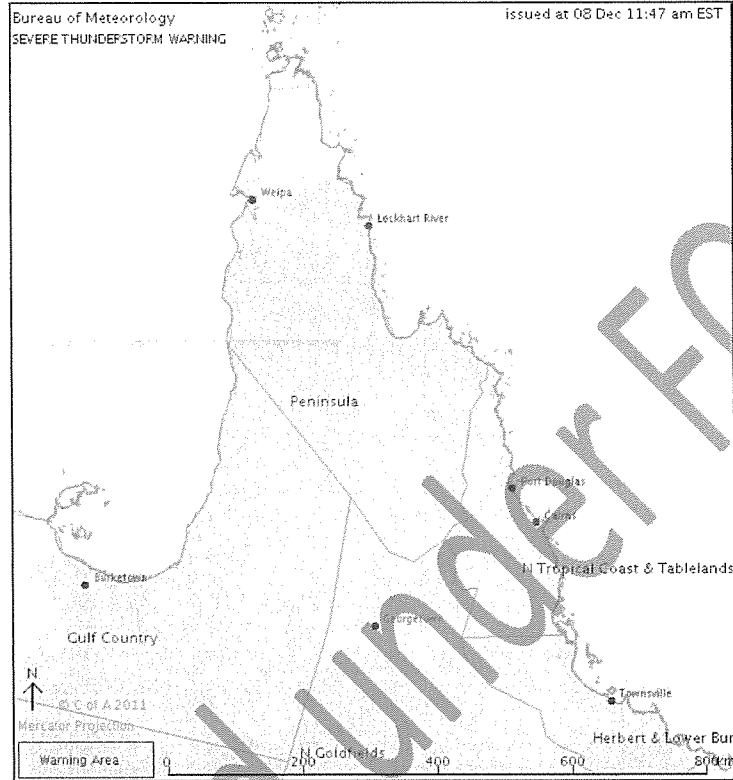
8.4.6 The above information may also be collated into a Severe Weather Talking Points by the SWM or RFC SPOC for the benefit of other RFC staff or for the preparation of the Severe Weather Summary.

Released under FOI

Appendix 1a: Qld State Severe Thunderstorm Warning Area

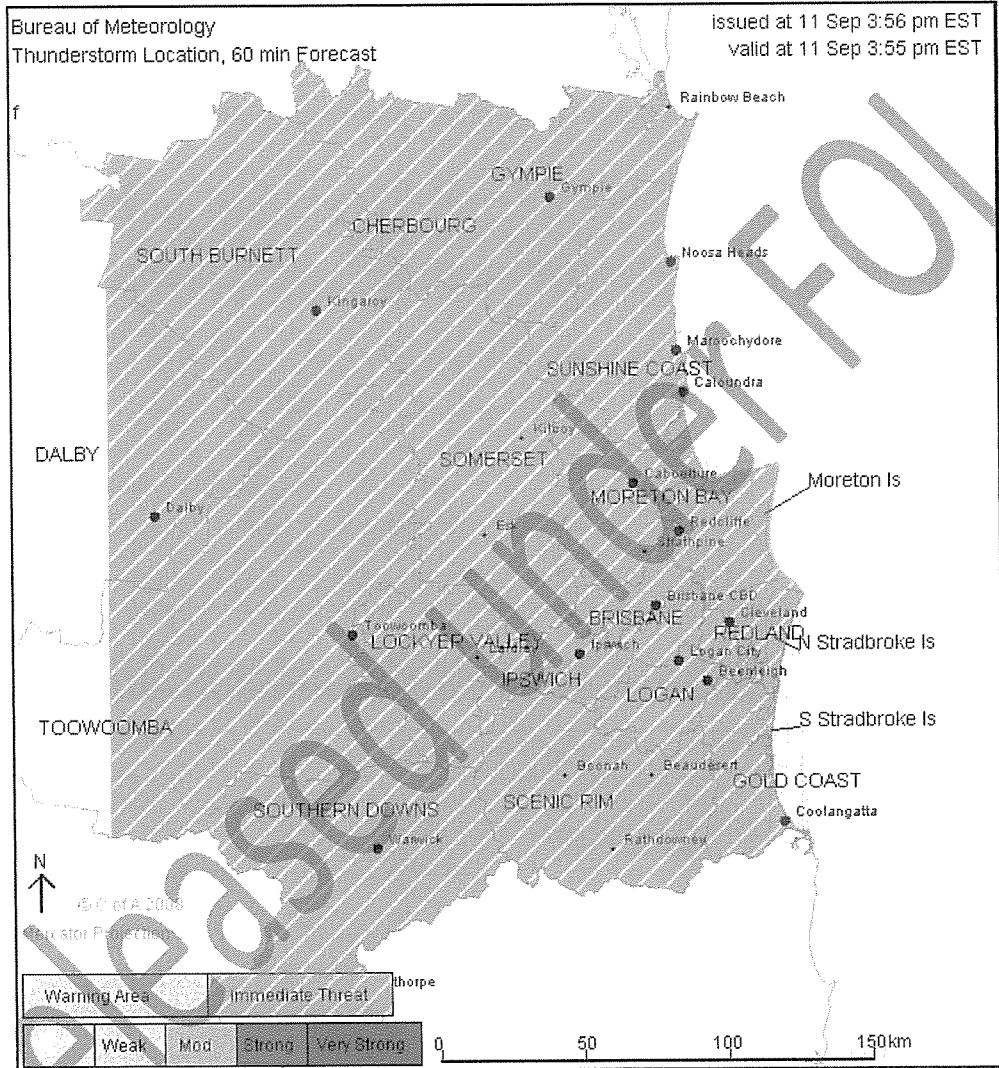


Appendix 1b: Qld State Severe Thunderstorm Warning Areas – Zoomed



Released Under FOI

Appendix 1c: Qld Metro Severe Thunderstorm Warning Area



Appendix 2a: Example of Thunderstorm Forecast:

IDQ65758

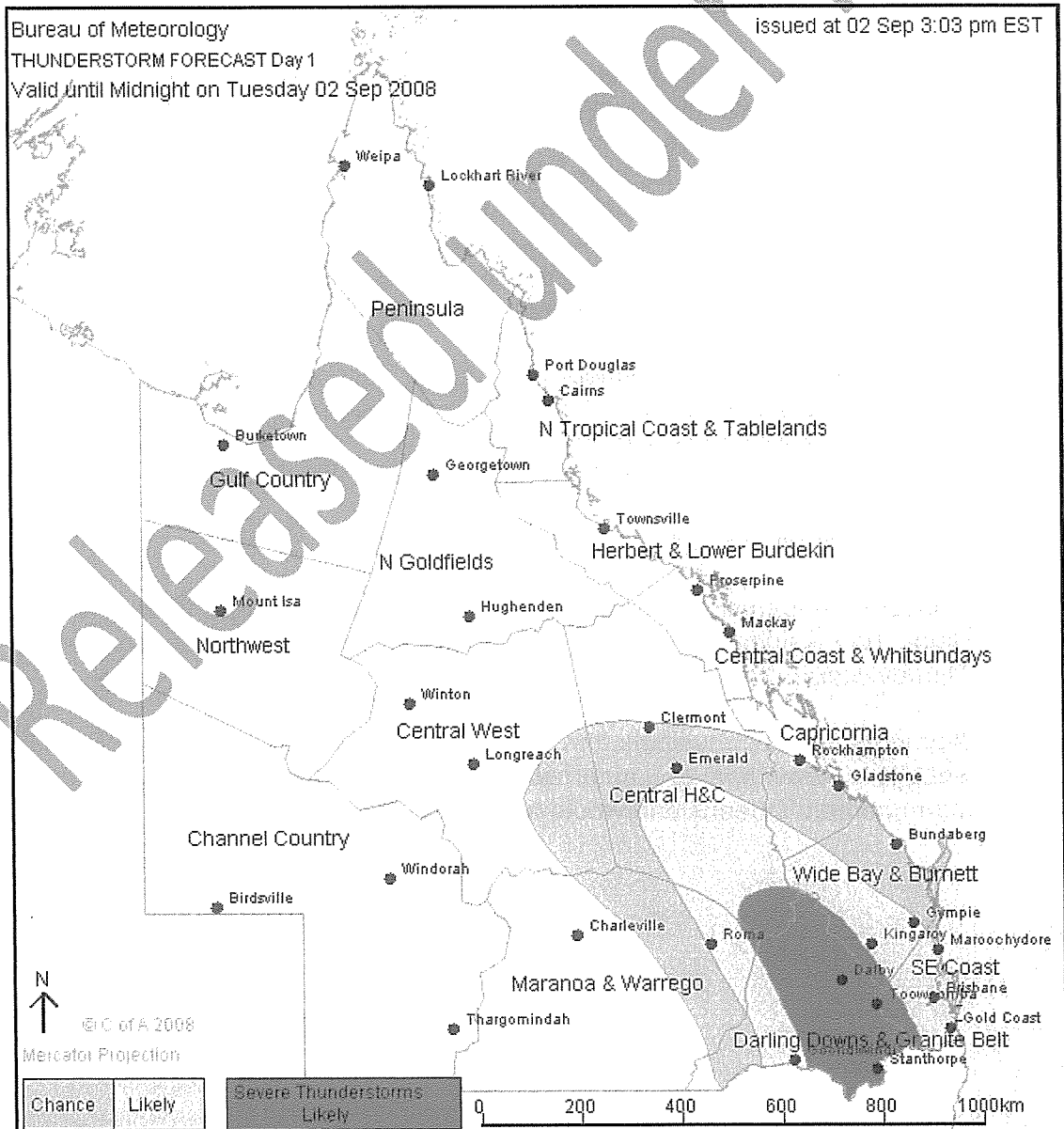
Bureau of Meteorology
Queensland Regional Office

THUNDERSTORM FORECAST

Issued at 4:43 pm Thursday, 11 September 2008,

Valid until midnight on Thursday, 11 September 2008.

A trough moving through southeast Queensland is likely to trigger scattered thunderstorms over the broader southeast of the state. Thunderstorms are expected to form inland during the afternoon with some likely to produce large hail, damaging winds and heavy rain. Isolated thunderstorms are expected to reach the Southeast Coast District later this evening.



Appendix 2b:
Example of State Severe Thunderstorm
Warning:

TOP PRIORITY FOR IMMEDIATE BROADCAST

SEVERE THUNDERSTORM WARNING

for DAMAGING WIND and LARGE HAILSTONES

For people in the Central Highlands and Coalfields, Capricornia, Wide Bay and Burnett, Darling Downs and Granite Belt, Southeast Coast and parts of the Central Coast and Whitsundays, Central West and Maranoa and Warrego Forecast Districts.

Issued at 10:12 am Thursday, 8 December 2011.

Severe thunderstorms are likely to produce damaging winds and large hailstones in the warning area over the next several hours. Locations which may be affected include Warwick, Gold Coast, Toowoomba, Brisbane, Dalby, Maroochydore, Roma, Gympie, Bundaberg, Gladstone, Emerald, Rockhampton, Clermont, Kingaroy, Stanthorpe and Goondiwindi.

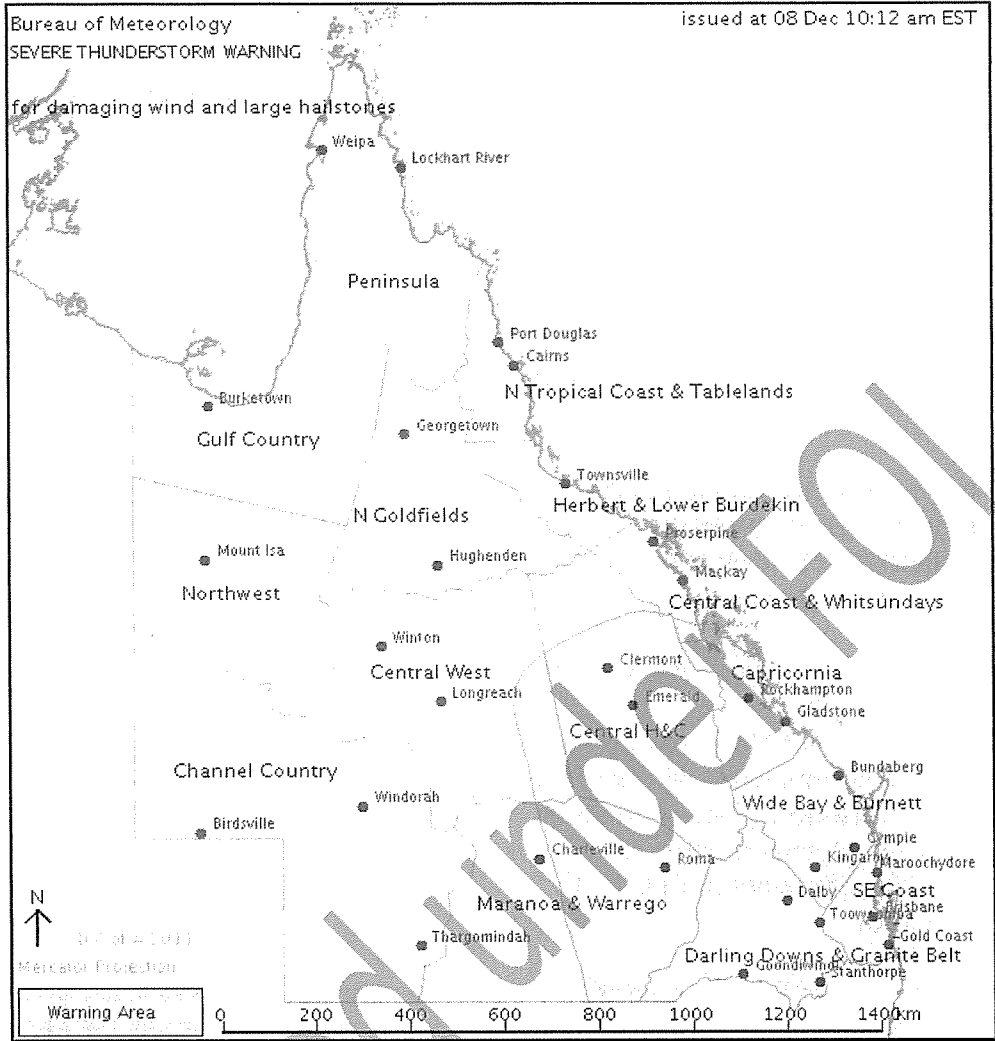
Emergency Management Queensland advises that people should:

- * Move your car under cover or away from trees.
- * Secure loose outdoor items.
- * Seek shelter, preferably indoors and never under trees.
- * Avoid using the telephone during a thunderstorm.
- * Beware of fallen trees and powerlines.
- * For emergency assistance contact the SES on 132 500.

The next warning is due to be issued by 1:15 pm.

If severe thunderstorms develop in the Southeast Queensland area (east of Dalby from Rainbow Beach to Stanthorpe), a more detailed Severe Thunderstorm Warning will be issued to people in this area.

Warnings are also available through TV and Radio broadcasts, the Bureau's website at www.bom.gov.au or call 1300 659 219. The Bureau and Emergency Management Queensland would appreciate warnings being broadcast regularly.



Appendix 2c:
Example of QLD Metro Severe
Thunderstorm Warning:

TOP PRIORITY FOR IMMEDIATE BROADCAST

SEVERE THUNDERSTORM WARNING - SOUTHEAST
QUEENSLAND
for DAMAGING WIND and LARGE HAILSTONES

For people in the **GOLD COAST CITY** and parts of the **LOCKYER VALLEY**, **LOGAN CITY**, **GYMPIE**, **IPSWICH CITY**, **SCENIC RIM**, **SOMERSET**, **SOUTH BURNETT**, **TOOWOOMBA**, **REDLAND CITY**, **CHERBOURG SHIRE** and **North Stradbroke Island Council Areas**.

Issued at 10:15 am Thursday, 8 December 2011.

The Bureau of Meteorology warns that, at 10:05 am, very dangerous thunderstorms were detected on weather radar near Hampton and the area north of Gatton. These thunderstorms are moving towards the east to northeast. Very dangerous thunderstorms are forecast to affect the area southwest of Esk and the area west of Esk by 10:35 am and Esk and the area south of Esk by 11:05 am.

Other severe thunderstorms were located near the area northeast of Kingaroy, Goomeri and Canungra. They are forecast to affect the ranges between Gympie and Murgon, Elgin Vale and Kilkivan by 10:35 am and the area southwest of Gympie, the area northwest of Gympie and Jacobs Well by 11:05 am.

Damaging winds and large hailstones are likely.

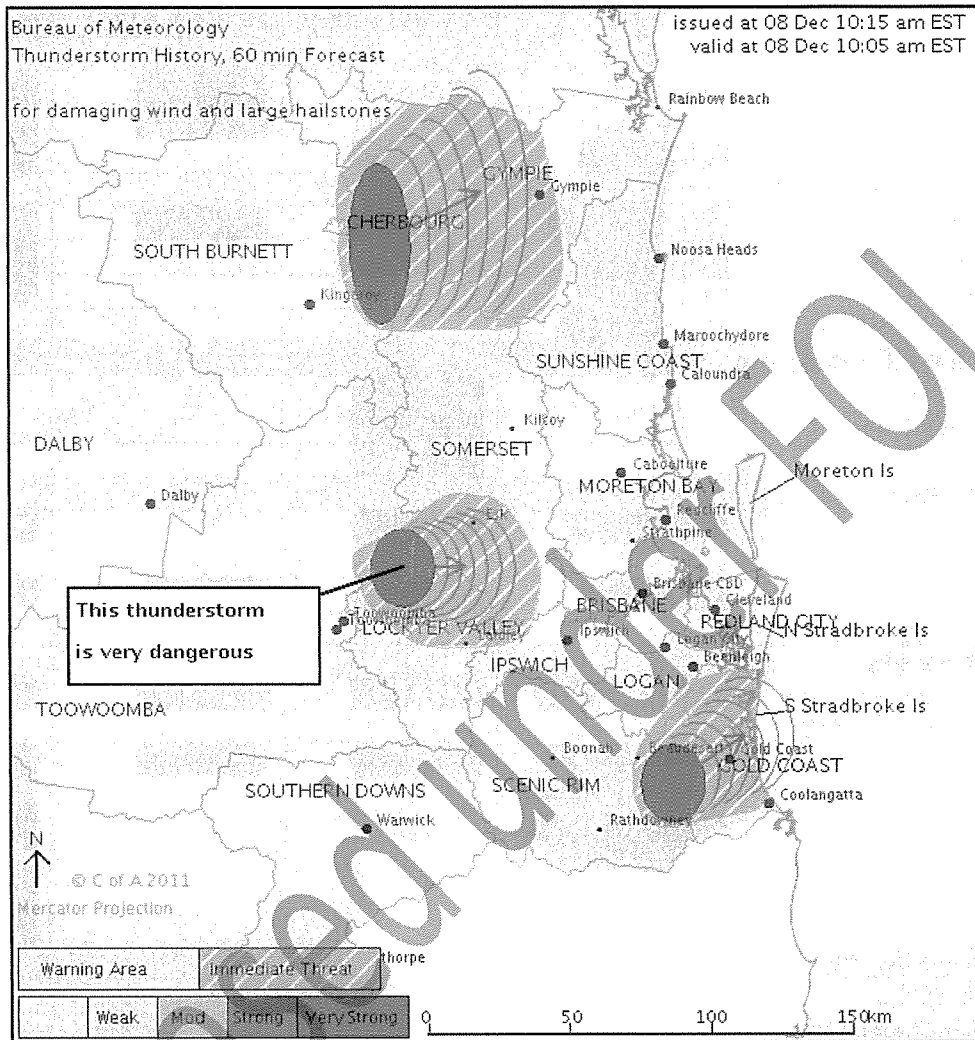
Emergency Management Queensland advises that people should:

- * Move your car under cover or away from trees.
- * Secure loose outdoor items.
- * Seek shelter, preferably indoors and never under trees.
- * Avoid using the telephone during a thunderstorm.
- * Beware of fallen trees and powerlines.
- * For emergency assistance contact the SES on 132 500.

The next warning is due to be issued by 11:15 am.

A more general severe thunderstorm warning is also current for the Central Highlands and Coalfields, Capricornia, Wide Bay and Burnett, Darling Downs and Granite Belt, Southeast Coast and parts of the Central Coast and Whitsundays, Central West and Maranoa and Warrego districts.

Warnings are also available through TV and Radio broadcasts, the Bureau's website at www.bom.gov.au or call 1300 659 219. The Bureau and Emergency Management Queensland would appreciate warnings being broadcast regularly.



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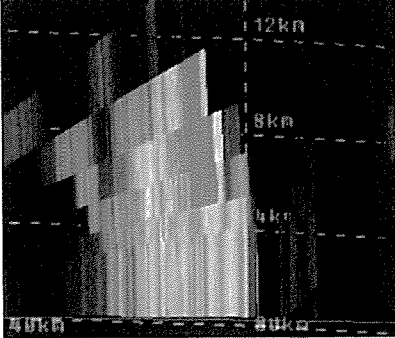

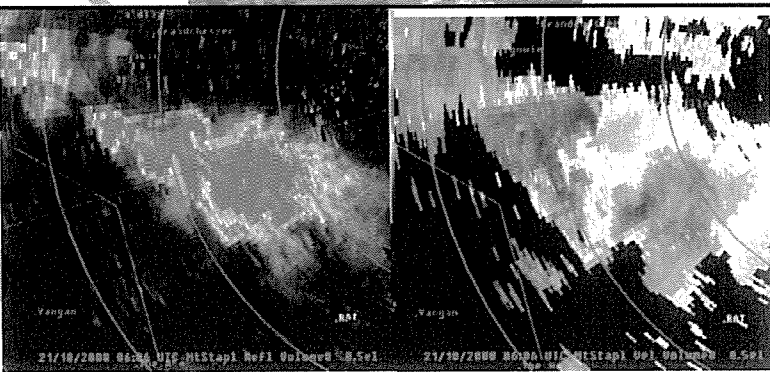
Appendix 3: Contact Details

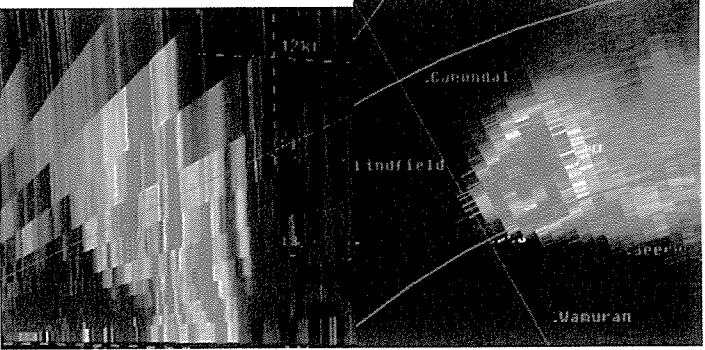
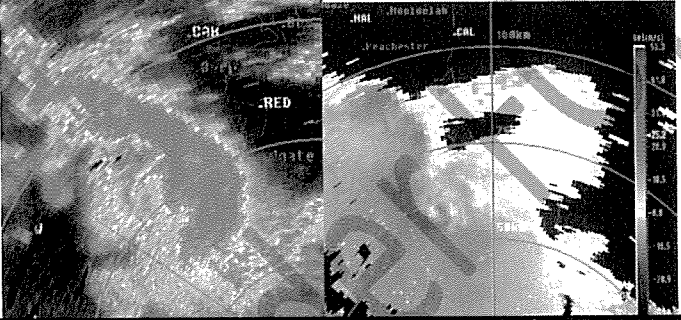
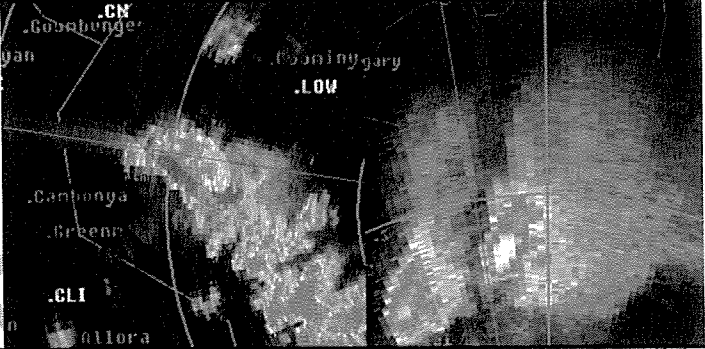
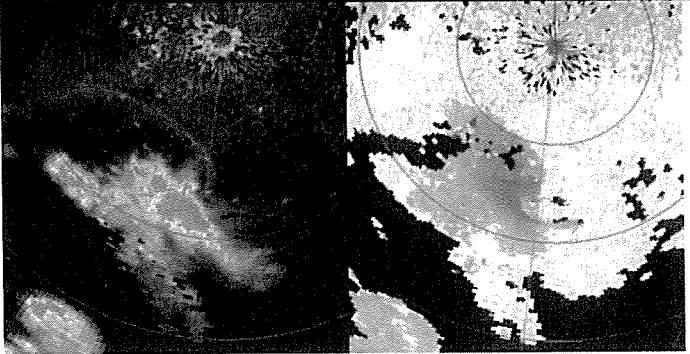
Position	Name	Work No (07)	Home No (07)	Mobile No
Executive				
RD	Jim Davidson	3239 8739	[REDACTED]	[REDACTED]
DRD	Bruce Gunn	3239 8741	[REDACTED]	[REDACTED]
RWSM	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Regional Severe Weather Section (RSWS)				
SMSW	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
SWM (PO 2)	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
SWM (PO 2)	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Storm Spotters	1800	[REDACTED]	[REDACTED]	[REDACTED]
Regional Forecasting Centre				
RFC SPOC	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Sev Wx Desk	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
RFC Fax	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Hydrology				
Hydrology Manager	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Supervising Hydrologist	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Engineering				
Regional Services Manager (RESM)	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
TO 4	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Emergency Management Queensland				
EMQ SDCC	Watch Desk	[REDACTED]	[REDACTED]	[REDACTED]
National Meteorological and Oceanographic Centre (NMOC)				
NMOC Helpdesk	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Interstate SW Sections				
NSW SW Desk	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
SA SW Desk	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
NT RFC SPOC	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
TTS Warnings				
QLD Warnings	[REDACTED]	1900 969 922	[REDACTED]	[REDACTED]

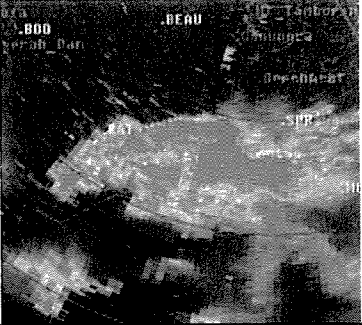
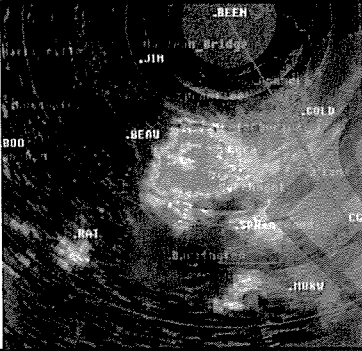
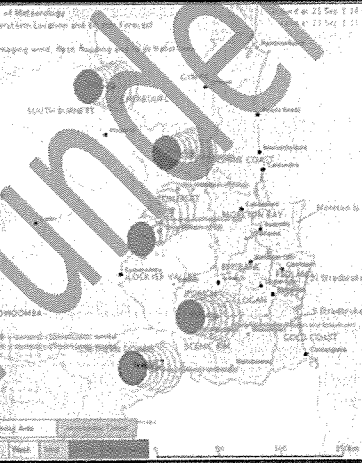
(More contacts at <http://.....>)

Appendix 4: Radar Signatures Indicating Storm Severity

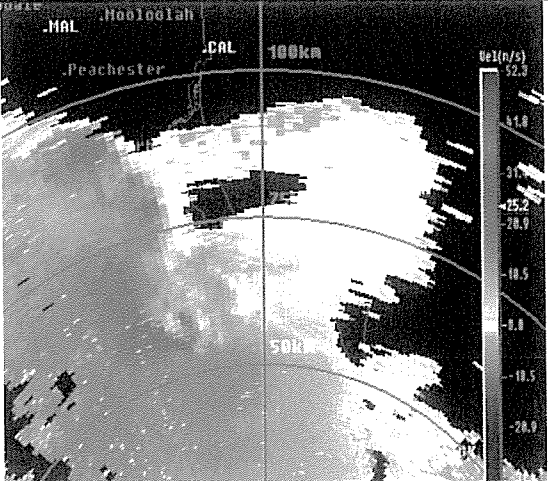
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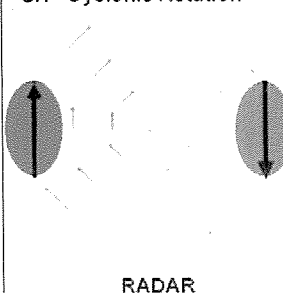
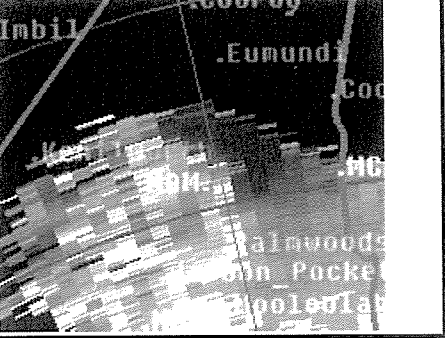
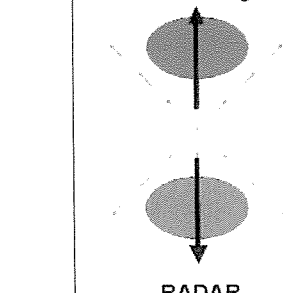
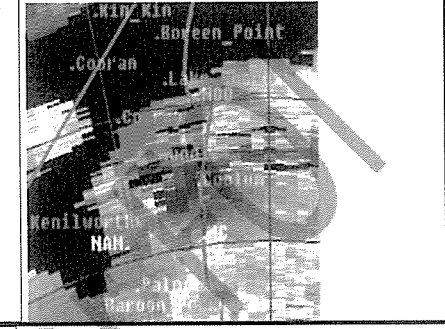
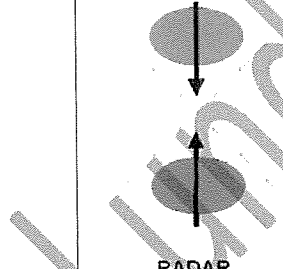
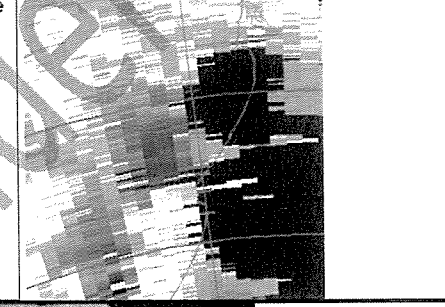
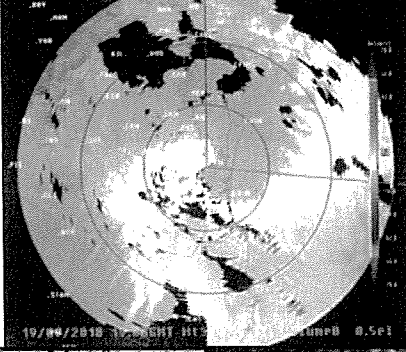
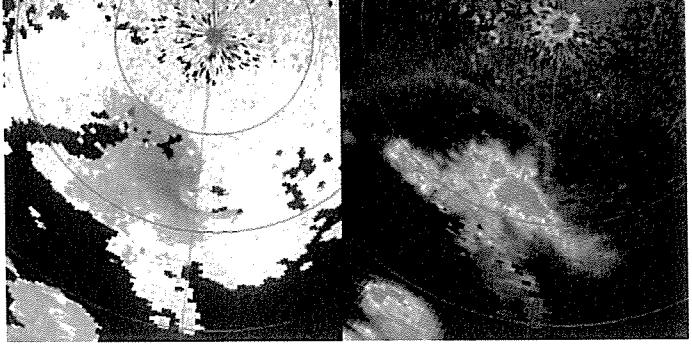
<p>High 50 dBZ echo tops</p> <p>Best viewed in a CAPPI window, will represent likelihood of hail and damaging winds. This cell wasn't visible on the web COMPEI for another half an hour but ended up dumping 4cm hail on Ipswich.</p>	
<p>High reflectivity values > 50 dBZ</p> <p>Represent likely hail and heavy rain. Damaging winds can be inferred from thunderstorm structure. This thunderstorm recorded 75.5 dBz!</p>	
<p>Hook echo or pendant on rear flank</p> <p>Best viewed in a low level scan and should continue through a couple of timesteps. Represents supercellular nature and likely destructive winds or tornadoes. Given the few reported tornadoes in Queensland discretion should be used before putting tornadoes in a warning with no previous report. Also shown with corresponding Doppler image showing a low level mesocyclone.</p>	

<p>Echo top displacement, (Bounded) weak echo region - WER/BWER</p> <p>Represents an organised rotating updraft and likelihood of supercellular structure. Likely to produce large hail. Damaging/destructive winds can be inferred from storm structure. Also note the small hail spike in the PPI view.</p>	
<p>Bow echo</p> <p>Represents likely damaging winds, also shown with corresponding Doppler image reading 25.2 ms or 91 kmh.</p>	
<p>Hail spikes (TBSS)</p> <p>Visible on the far side of a cell with respect to the radar. Verifies very well with large hail reports. Can sometime be hidden in an anvil background storm features as in the picture on the right.</p>	
<p>Locate low level boundary using reflectivity data</p> <p>Here is an example of a thunderstorm outflow on the bottom scan from the Emerald radar. Notice the boundary on the reflectivity links up nicely with the Doppler image of the outflow. This thunderstorm 'suffocated' on this outflow 20 minutes later.</p>	

<p>Tight low-level reflectivity gradient</p> <p>The tight reflectivity gradient here shows the developing side of a left moving supercell. This cell is moving to the NW in a W'ly steering flow.</p>			
<p>Single echo top</p> <p>A single well defined echo top (usually viewed in CAPPI) shows an organised vigorous updraft.</p>			
<p>Identify anomalous propagation</p> <p>Usually best viewed in a CAPPI window. Knowledge of the existing steering flow will also help here.</p>			

Velocity:

<p>Strong near surface ground-relative winds</p> <p>An squall line example from Redcliffe with several wind damage reports. 25.2ms is equal to 91kmh.</p>	
--	--

<p>Low/mid-level rotation/Mesocyclone</p> <p>A mid level rotation shows likely cell splitting or supercellular nature. A low level Mesocyclone shows a likely rear flank downdraft, or tornado and will generally be associated with damaging or destructive winds.</p>	<p>SH - Cyclonic Rotation</p>  <p>RADAR</p>	
<p>Low-level or storm top divergence</p> <p>Signifying likely strong downdraft/updraft. The radar is to the south in this image of storm top divergence.</p>	<p>SH - Pure Divergence</p>  <p>RADAR</p>	
<p>Low-level convergence below updraft (strong updraft)</p> <p>The radar is to the south in this image of low level convergence.</p>	<p>SH - Pure Convergence</p>  <p>RADAR</p>	
<p>Identify wind speed and direction variations with height, including veering and backing of wind with height</p> <p>Backing – inverted "S" pattern, veering "S" pattern.</p>		
<p>Locate boundary using velocity data</p> <p>Here is an example of a thunderstorm outflow on the bottom scan from the Emerald radar. Notice the boundary on the reflectivity links up nicely with the Doppler image of the outflow. This thunderstorm 'suffocated' on this outflow 20 minutes later. Also note the low level Mesocyclone on the Doppler image.</p>		

Appendix 5: Heavy Rainfall Guidelines and Maps

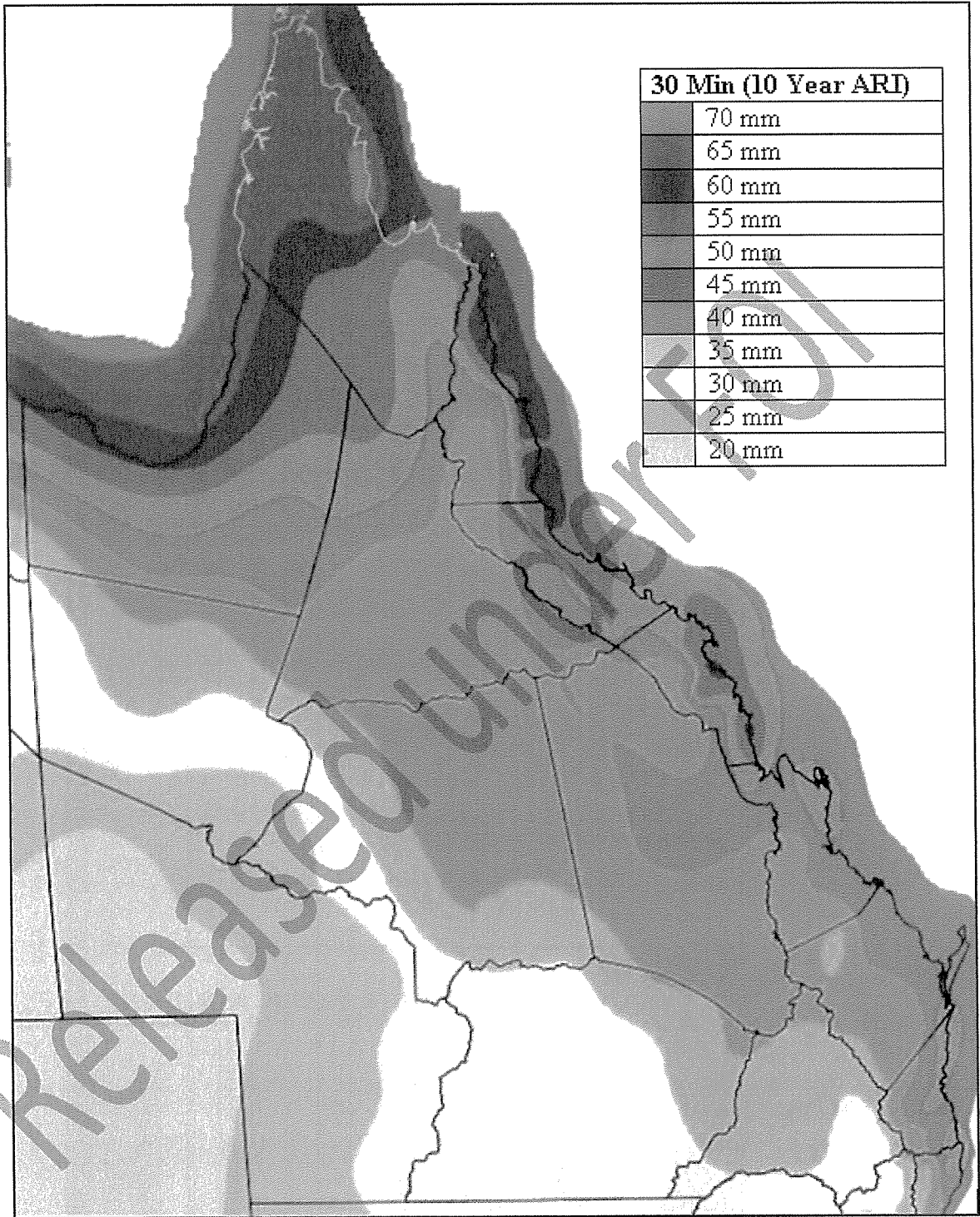
Product	Thunderstorm Warning			Severe Weather Warning			Forecasts	
	10 min	30 min	1 hour	6 hour	24 hour	24h - "Moderate"	24h - "Heavy"	
Duration	10 year ARI (SEWS - 50 year ARD)	10 year ARI (SEWS - 50 year ARD)	10 year ARI (SEWS - 50 year ARD)	10 year ARI (SEWS - 50 year ARD)	10 year ARI (SEWS - 50 year ARD)	~1 year ARI * 0.75	~1 year ARI	
District	10 year ARI (SEWS - 50 year ARD)	10 year ARI (SEWS - 50 year ARD)	10 year ARI (SEWS - 50 year ARD)	10 year ARI (SEWS - 50 year ARD)	10 year ARI (SEWS - 50 year ARD)	~1 year ARI * 0.75	~1 year ARI	
Peninsula	35	40 - 70	60 - 90 (80 - 125)	90 - 150 (135 - 200)	230 (320)	75	150	
Gulf Country	30	35 - 65	50 - 80 (70 - 110)	90 - 120 (135 - 170)	155 - 215 (240 - 300)	50	100	
Northern Goldfields & Upper Flinders	25	35 - 55	50 - 70 (70 - 100)	90 - 120 (135 - 170)	145 (195)	35	30	
North Tropical Coast	30	40 - 65	50 - 90 (70 - 125)	90 - 270 (135 - 300+)	195 - 385 (270 - 550)	75	150	
Herbert and Lower Burdekin	30	40 - 60	50 - 80 (70 - 110)	90 - 210 (135 - 290)	195 - 370 (270 - 525)	75	150	
Central Coast & Whitsundays	30	40 - 60	50 - 80 (70 - 110)	90 - 180 (135 - 260)	300 (445)	75	150	
Capricornia	25	40 - 50	50 - 70 (70 - 100)	60 - 150 (100 - 205)	160 - 200 (190 - 295)	50	100	
Central Highlands & Coalfields	25	35 - 45	50 - 60 (70 - 80)	60 - 90 (100 - 135)	140 (195)	35	70	
Central West	20	25 - 40	30 - 50 (50 - 70)	60 - 90 (100 - 135)	125 (185)	35	70	
Northwest	20	25 - 40	30 - 50 (50 - 70)	60 - 90 (100 - 135)	145 (220)	35	70	
Channel Country	15	20 - 30	30 - 40 (50 - 60)	30 - 60 (60 - 100)	100 (160)	25	50	
Maranoa & Warrego	20	30 - 40	40 - 50 (60 - 70)	60 (100)	115 (140)	25	50	
Darling Downs & Granite Belt	20	30 - 40	40 - 50 (60 - 70)	60 (100)	110 (150)	35	70	
Wide Bay & Burnett	25	35 - 50	50 - 60 (70 - 80)	60 - 120 (100 - 170)	110 - 225 (150 - 340)	50	100	
Southeast Coast	25	35 - 50	50 - 70 (70 - 100)	60 - 150 (100 - 205)	110 - 195 (150 - 280)	50	100	

ARI = Average Recurrence Interval

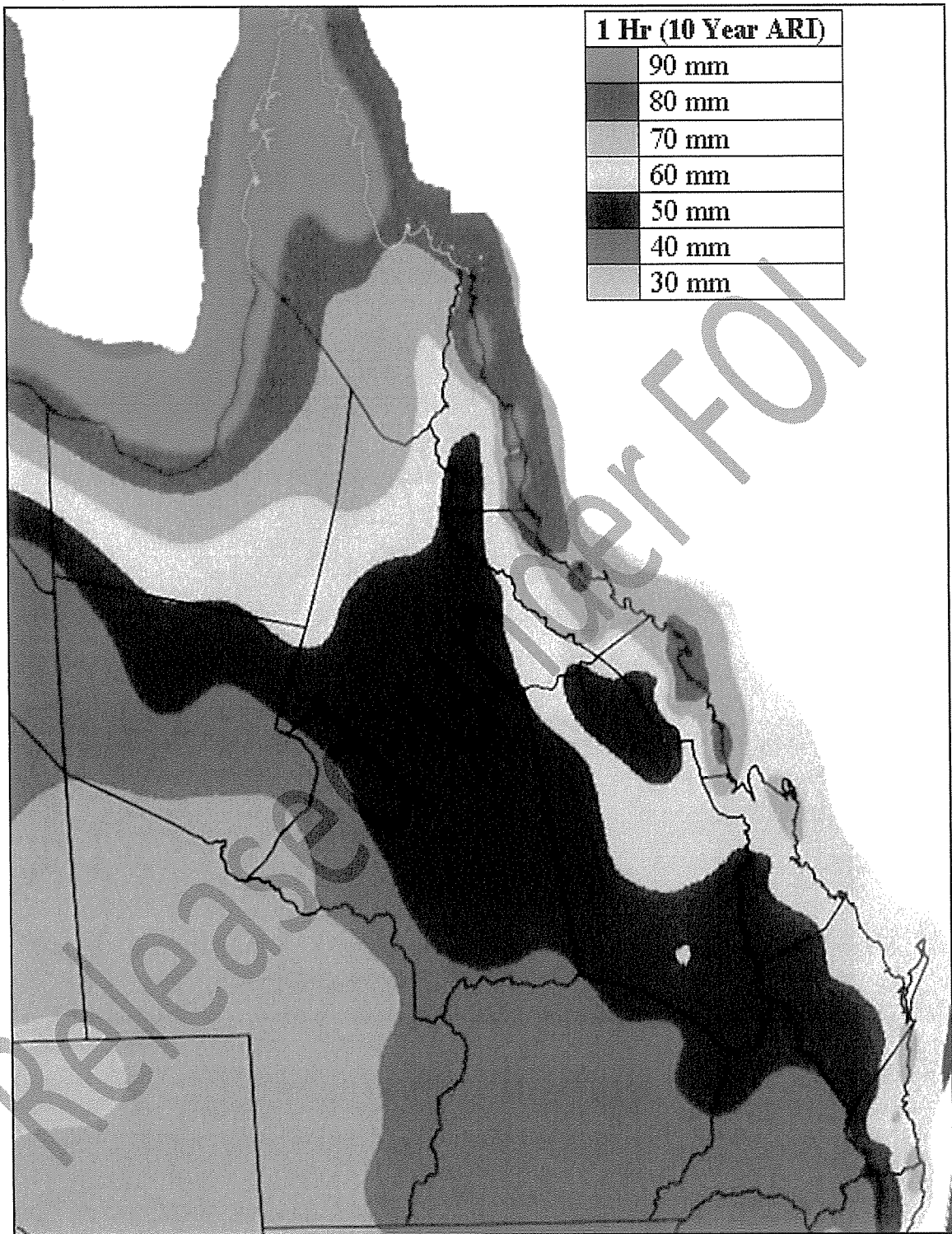
Figures show the range of values for each forecast district. More specific information for 30 minute, 1 hour, 2 hour, 3 hour and 6 hour ARI's can be found within the ARI maps. 10 minute values should generally not be considered for flash flooding unless expected to continue.

(http://...)

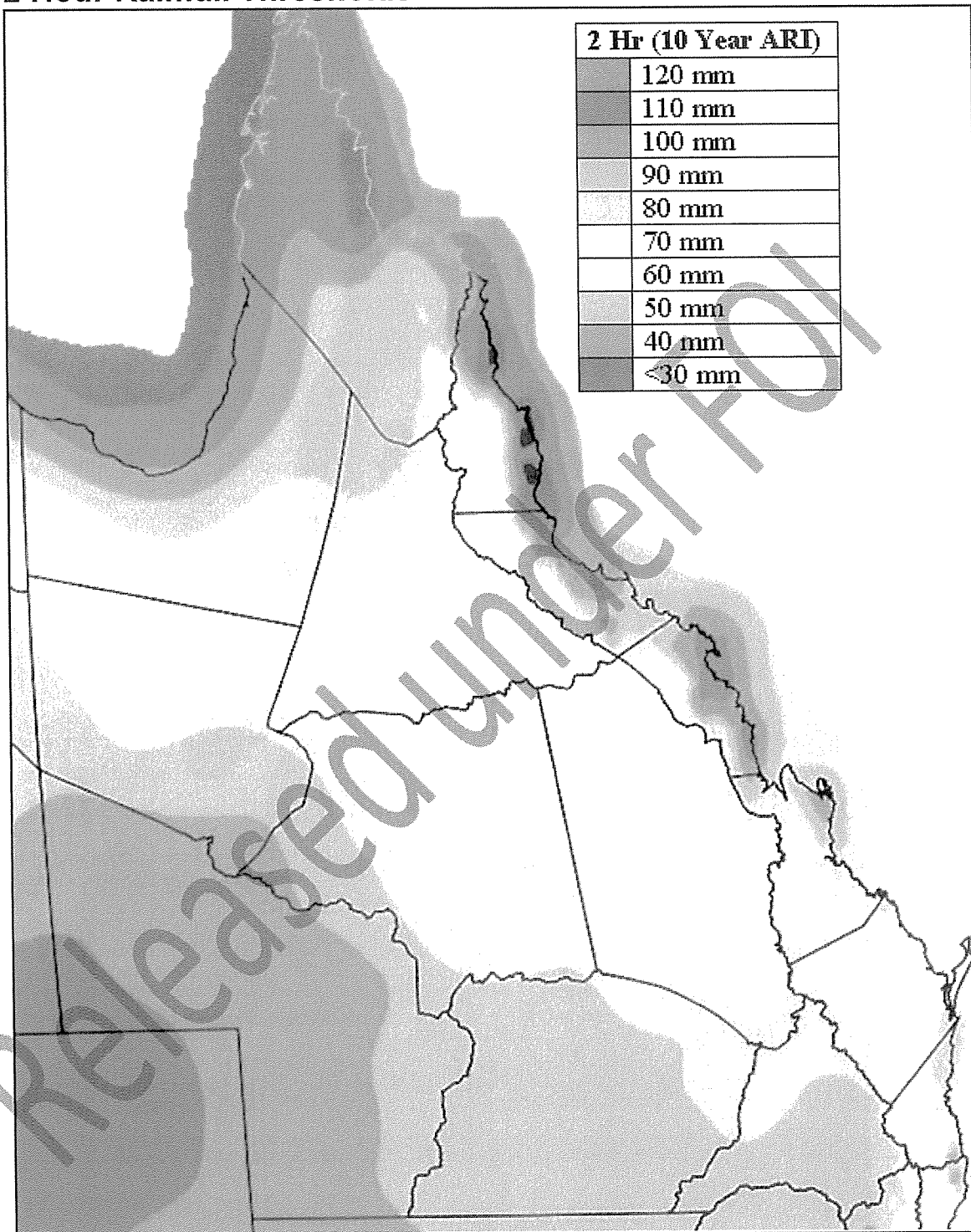
30 Minute Rainfall Thresholds



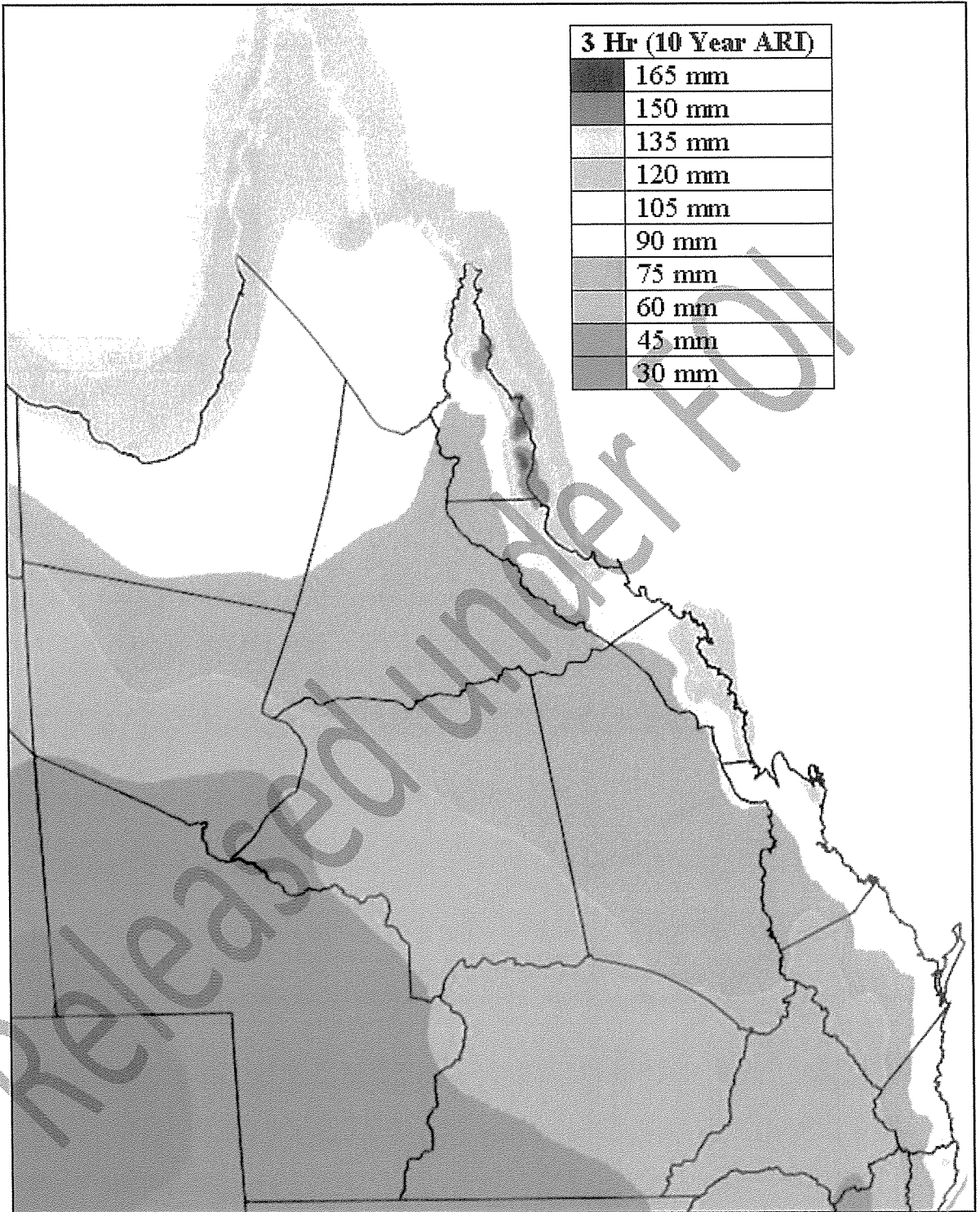
1 Hour Rainfall Thresholds



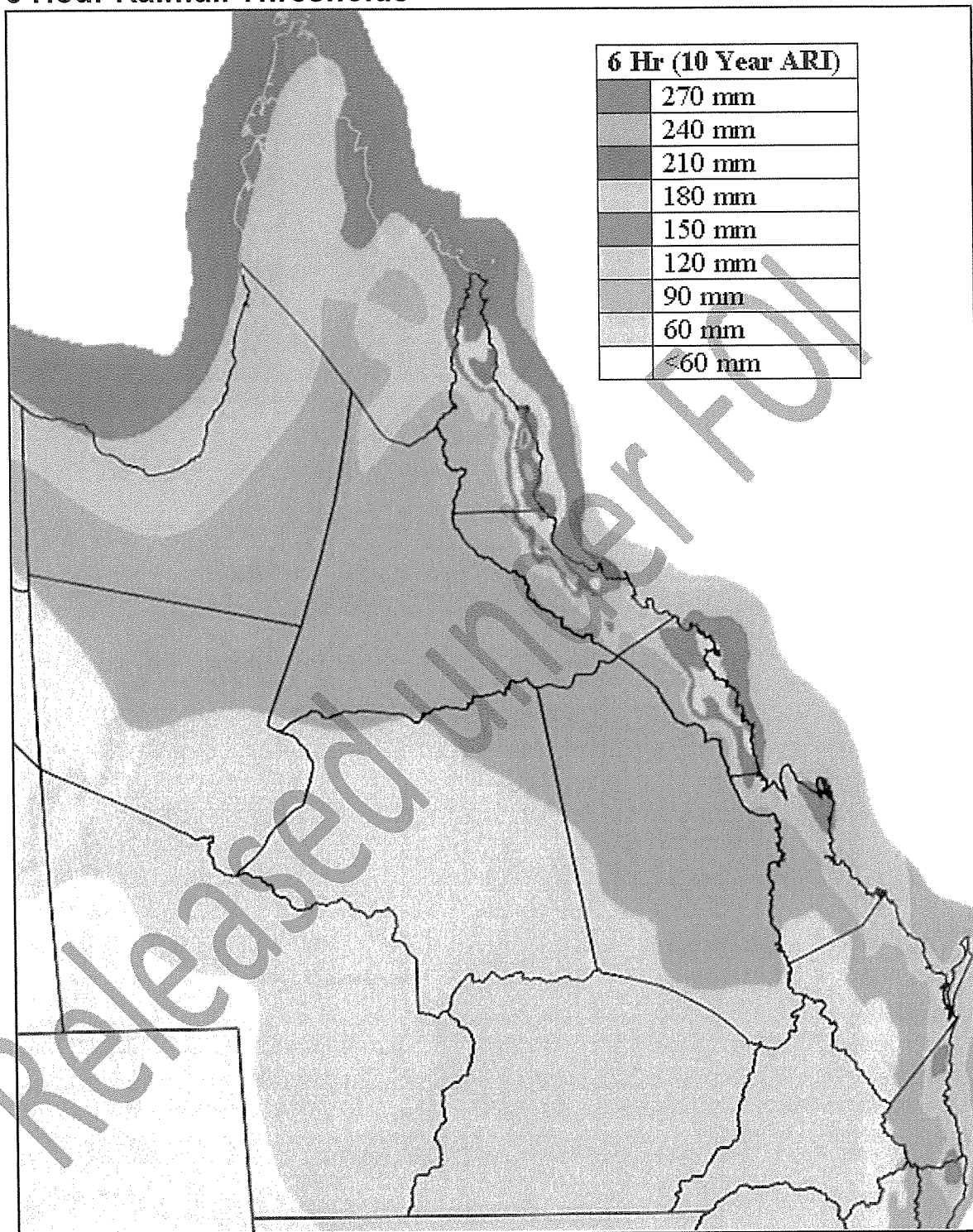
2 Hour Rainfall Thresholds



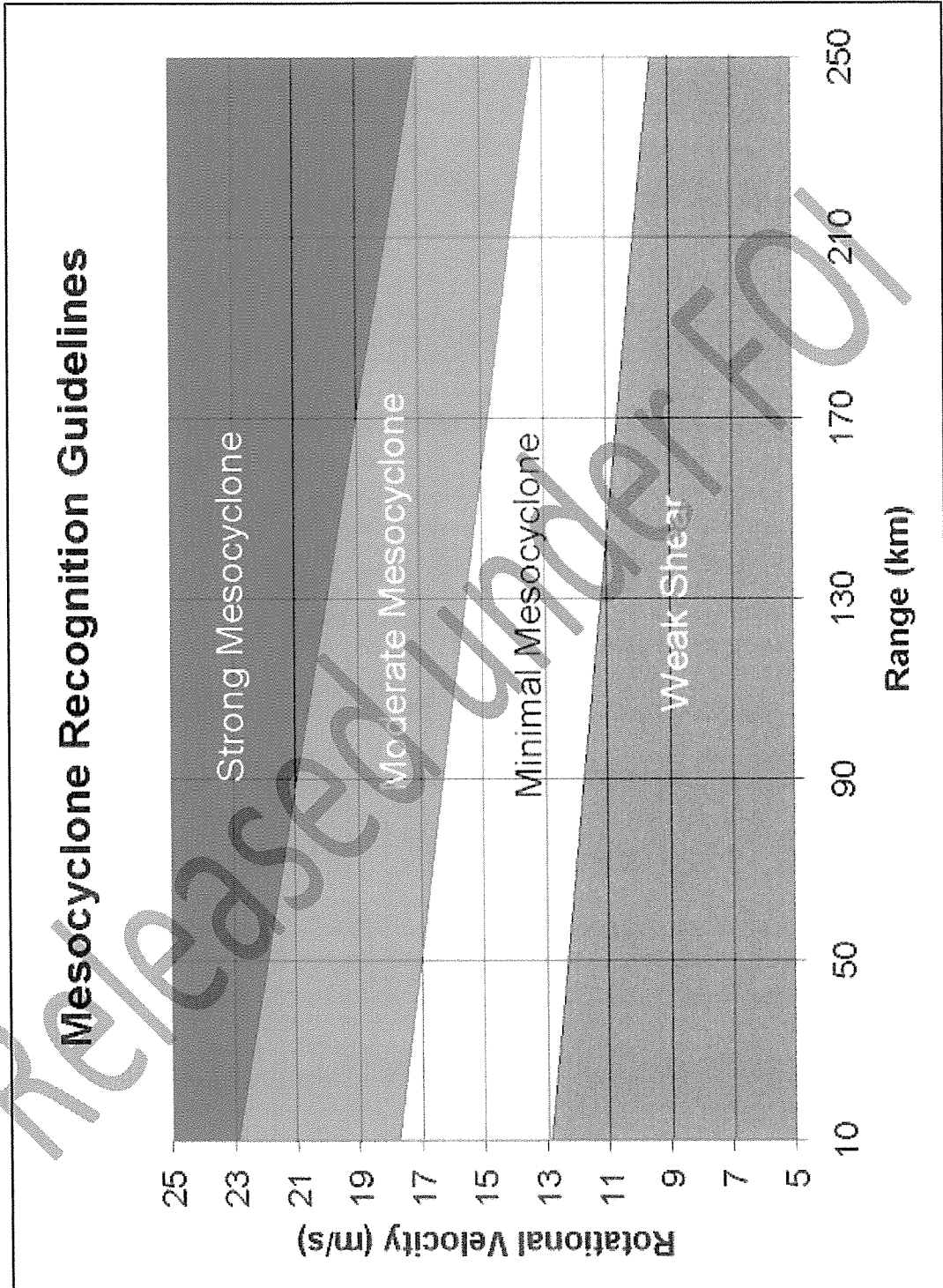
3 Hour Rainfall Thresholds



6 Hour Rainfall Thresholds

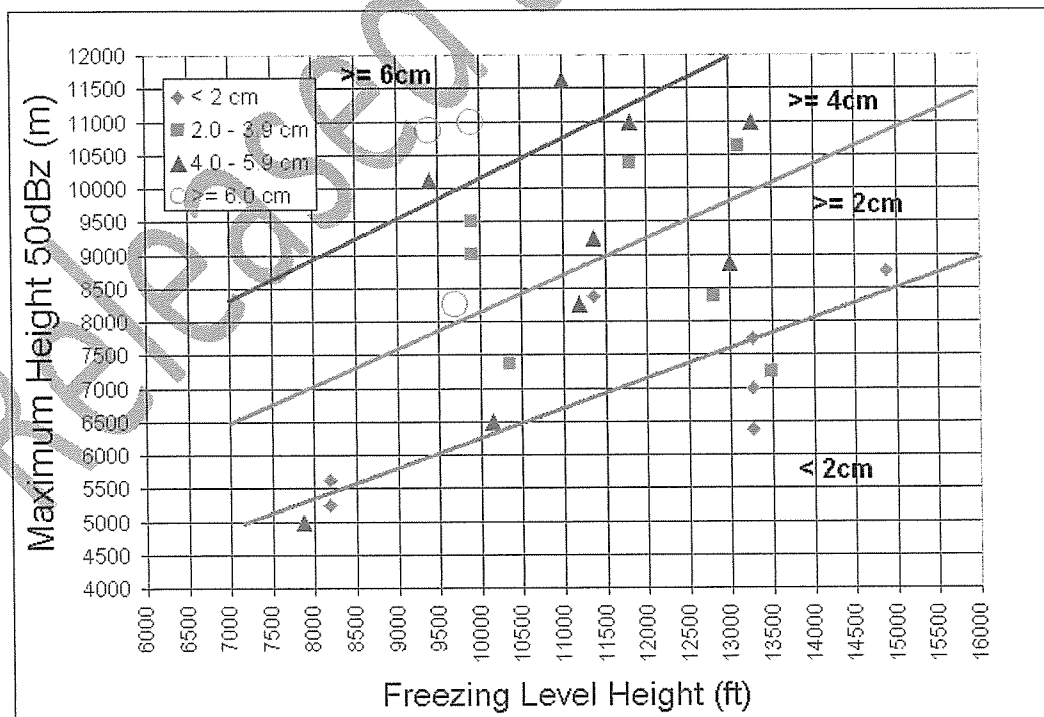
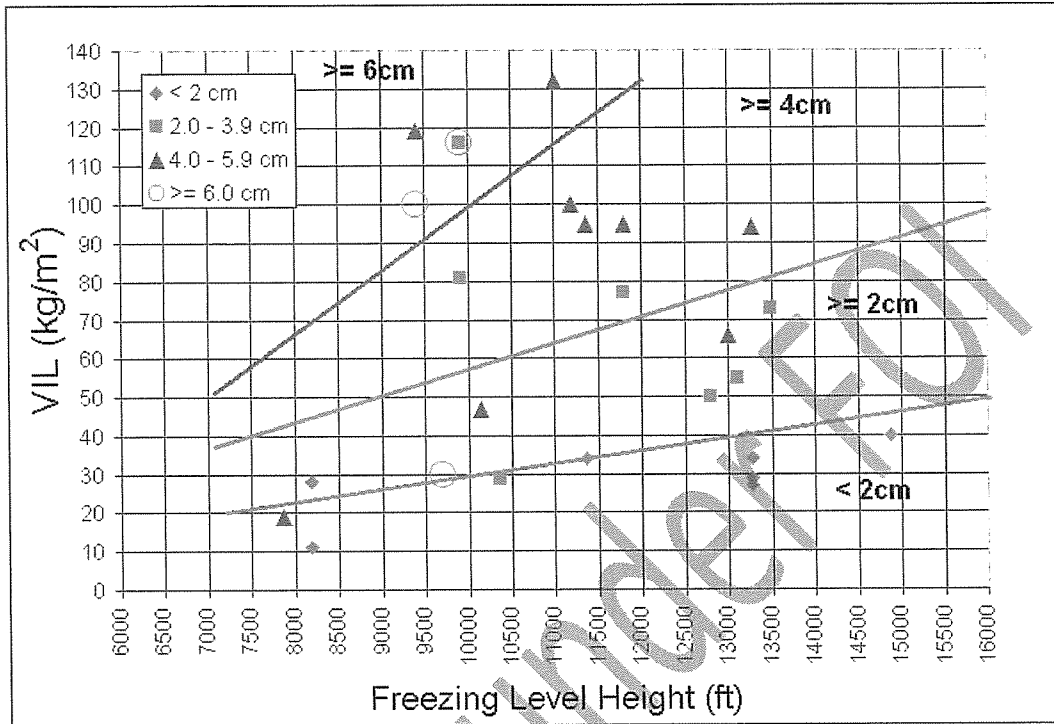


Appendix 6: Mesocyclone Nomogram



(Courtesy NSW Severe Weather, at <http://...>)

Appendix 7: Large Hail Nomograms



(Courtesy NSW Severe Weather, at <http://www.nsw.gov.au/...>)

Appendix 8a: Guide for issuing State Severe Thunderstorm Warnings using TIFS

This guide can be found online at
<http://www...>

Step 1: Turn "Auto Refresh" off



On



Off

Turning "**Auto Refresh**" off switches from monitoring into warning mode.

Step 2: Draw a warning area



Press "**Add Area**" button and click/hold to draw a warning area.



Use the "**Edit Area**" button to add to, or remove from an area you are not happy with.



Alternatively use the "**Rubbish bin**" button to delete it and start again.



GPATS data can be viewed by selecting the overlay in the top left of screen but please remember to press "**refresh**" to get the latest data.

Warning Section (1-3)

A second warning area can be added by changing the number in the Warning Section tab of the **Area Editor**. For example a warning with heavy rain in northern Queensland and a warning for large hail, heavy rain and damaging winds in southeast Queensland at the same time.

Step 3: Add severe phenomena



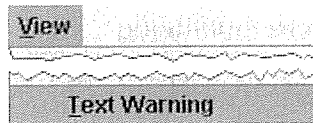
These "phenomena" are damaging winds ($\geq 90\text{kmh}$), destructive winds ($\geq 125\text{kmh}$), large hail ($\geq 2\text{cm}$), heavy rainf (**10 year ARI**) and/or tornadoes.

Step 4: Cross-Reference any Metro Warnings



In the text editor click the "**Skyscraper**" button to include a statement referring to a Metro Warning being current. Do this if a Metro Warning is current or just about to be issued.

Step 5: Choose text detail level and edit text



Bring up the text part of the warning using **View -> Text Warning**.

The detail level of the automatically generated text can be set with the detail buttons. Once engaged in this step, the graphical part of TIFS should not be touched as that would refresh the text and wipe out any changes made to the text.

Step 6: Issue



Click the "**Issue**" button and double check the pre-selected address zones. Ring the EMQ SDCC on (07) [redacted] ring any interstate RFC's with a border affected by the warning and check that products have reached the external website.

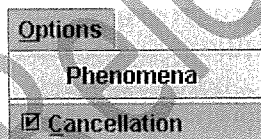
Step 7: Turn "Auto Refresh" on



On

Turn "**Auto Refresh**" on to keep monitoring the situation.

Cancellation of a State-Based Warning in TIFS



Tick the **Cancellation** box under the **Options** menu.

Make sure all graphics are deleted from the display. This is quickly achieved using **Tools --> Clear Areas**.

Appendix 8b: Guide for issuing Metro Severe Thunderstorm Warnings using TIFS

This guide can be found online at
[http://\[REDACTED\]](http://[REDACTED])

Step 1: Turn "Auto Refresh" off



On



Off

Turning "Auto Refresh" off switches from monitoring into warning mode.

Step 2: Get rid of unwanted cells

These cells are storms that you do not intend to warn for. There are three ways of deleting cells:



Visible



Any VIL

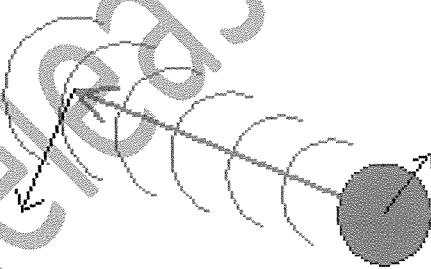
- rubbish bin
- "visibility" button in the cell editor
- VIL/Height filtering (VIL usually set to 40 or 50)

Step 3: Reshape and resize the cell(s) I want to warn for



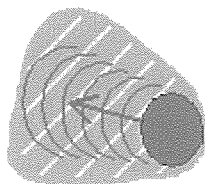
Use the "reshape" and "resize" tools

Step 4: Adjust the cell positions and cell motion vectors



Manual motion assessments can deviate substantially from the automated motion assessment by TITAN/WDSS. Drag the cell and the tip of the cell motion vector to an adjusted position while holding the left mouse button in **General Mode**.

Step 5: Draw the immediate threat area

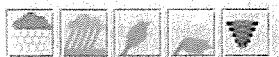


Add the immediate threat area using the **Add Area** button.

Any point location in the immediate threat area should be likely to experience severe convective weather over the next 60 min (for a 60 minute warning duration). Note that locations "behind" the cell should not be in the immediate threat area, and that the threat area should

fan out away from the cell due to increasing uncertainty in the cell location with increasing forecast lead time.

Step 6: Add severe phenomena or "Very Dangerous" tag

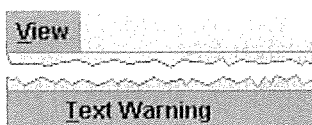


These "phenomena" are damaging winds ($\geq 90\text{kmh}$), destructive winds ($\geq 125\text{kmh}$), hail ($\geq 2\text{cm}$), heavy rain (**10 year ARI**) and/or tornadoes.



Add a "This Thunderstorm is Very Dangerous" tag from the cell editor if very large hail ($>4\text{cm}$), destructive winds ($>125\text{kph}$) or very heavy rainfall (>50 year ARI).

Step 7: Choose text detail level and edit text



Bring up the text part of the warning using **View -> Text Warning**.

The detail level of the automatically generated text can be set with the detail buttons. Once engaged in this step, the graphical part of TIFS should not be touched as that would refresh the text and wipe out any changes made to the text.

Step 8: Issue



Click the "**Issue**" button and double check the pre-selected address zones. Ring the EMQ SDCC on (07) [redacted], ring the NSW RFC if the warning reaches the border and check that products have reached the external website.

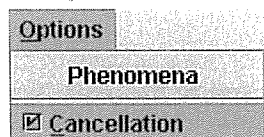
Step 9: Turn "Auto Refresh" on



On

Turn "Auto Refresh" on to keep monitoring the situation.

Cancellation of a Cell-Based Warning in TIFS



Tick the **Cancellation** box under the **Options** menu. Make sure all graphics (cells and areas) are deleted from the display. This is quickly achieved using **Tools --> Clear Areas** and VIL filtering (see Step2 above).

From: [REDACTED]
Sent: Sunday, 22 January 2012 15:52
To: QLD Severe Weather; QLD RFC SPOCs
Cc: [REDACTED]; QLD Forecasters; [REDACTED]
Subject: Update to the TS Directive [SEC=UNCLASSIFIED]

Security Classification: UNCLASSIFIED

Hi All,

A couple of updates to the Thunderstorm Directive as listed below. The new version is on the web.

The first change is with respect to the "**Emergency Weather Alert**", used when a SEWS-like event is suspected of occurring but without a confirming report.

If there is insufficient confidence or lack of ground truth reports to trigger SEWS, the awareness of disaster response agencies can be raised by telephoning the SDCC and alerting them using the specific phrase "EMERGENCY WEATHER ALERT".

- Notifying SDCC of an "EMERGENCY WEATHER ALERT" can be done at the forecaster's discretion when they believe there are special circumstances requiring notification of agencies (such as QPS and Local Government) but that there is insufficient confidence or lack of ground truth reports to trigger SEWS.

- Notifying SDCC of an "EMERGENCY WEATHER ALERT" will trigger SDCC to undertake an appropriate series of phone calls.

- There is no need to invoke an "EMERGENCY WEATHER ALERT" if the SEWS or "very dangerous" terminology is already used in warnings. For example an EWA may be appropriate when there is radar evidence of large rainfall accumulations affecting or likely to affect a major population centre, but that there has been insufficient rain gauge or spotter reports to confirm if SEWS thresholds have been reached.

- Notifying SDCC of an "EMERGENCY WEATHER ALERT" should wherever possible be immediately followed by an updated warning containing the specific detail contained in the verbal advice given to SDCC in the EWA.

- The RFC should immediately notify FWC staff (and vice versa) of the issue of a "heavy rainfall" EWA to the SDCC.

The second change is to the **radar fault reporting** process:

After noticing or being notified of an unplanned radar outage the RFC SPOC should check for any previously logged fault reports at

[http://\[REDACTED\]](http://[REDACTED])

If none are present a fault report should be entered.

With consideration to prevailing weather conditions, the RESM should be contacted after the failure of any radars in QLD. The RFC SPOC will determine the need for data and request the timeframe for necessary action. If a radar goes offline, and if thunderstorms are current or expected before the next working day for the region, all efforts should be made to return the radar to service as soon as possible.

Contact numbers can also be found in Appendix 3. Out of hours, if there is any impending or expected precipitation near the affected radar, the RESM should be phoned immediately to be notified of the outage. If fine weather is expected, at the discretion

Doc 3

of the RFC SPOC, the RESM can be sent a Short Message Service (SMS) from the GUI at http: [redacted] also found under the fault report page. If in doubt it is preferred to phone the RESM. If the RESM cannot be contacted, a period of 4 hours should be allowed, then the relevant TO 4 contacted as per the following list:

RESM:
- [redacted] (04 [redacted]).

TO 4 - Southeast QLD and Rockhampton:
- [redacted] 04 [redacted])
- [redacted] (04 [redacted])
- [redacted] (04 [redacted])
- [redacted] (04 [redacted])

TO 4 - Cairns:
- [redacted] (04 [redacted])

TO 4 - Townsville
- [redacted] (04 [redacted])

The RFC SPOC should also send an alert to inform the NMOC Helpdesk and technicians of the outage. This way any relevant Radar Service Interruption Notice (RSIN) can be updated. This can be done through a GUI at http [redacted] also found under the Fault Report page. If the GUI doesn't work, an email should be sent to QLD [redacted]@bom.gov.au including any **known information** from the list below:

- Name of radar facility;
- Service that will be affected;
- Extent of outage;
- Reason for outage;
- Estimated or actual Outage start time;
- Estimated Return To Service time;
- Point & method of contact for further information;
- Point & method of contact for BOM Staff dealing with the Outage.

Please make note of these changes as they will both be important from time to time.

Cheers,

[redacted] Meteorologist
Queensland Regional Office
Bureau of Meteorology, Brisbane
Tel: +61 7

www.bom.gov.au

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