Dam Safety Emergency Plan for Tenterfield Creek Dam

Adopted xx xx 2021 – Res No. xx-xx

Document Control

Version	Date	Modified by	Approved by	Details
V1.0	10/02/2016		Public Works	Original
V2.0	2021	Tenterfield Council		

This plan was adopted by Council on Date – Resolution Number xxxx

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Summary information for Emergency Agencies

General Information	
Name of Dam	Tenterfield Creek Dam
Owner	Tenterfield Shire Council
Owner Address	P.O. Box 214, Tenterfield, NSW, 2372
Location	Tenterfield
Originally designed and constructed	Public Works Department
Year of completion	1931
Year dam raised (by 1.83m)	1974
Upgrade designed and constructed	2019 documents completed
Year dam upgraded	2018
Nearest town	Tenterfield
Purpose	Water supply
Sunny Day Consequence Category	High B (2014 Dambreak & PLL Study)
Flood Consequence Category	High A (2012 Dambreak & PLL Study)
Dam Data	
Original Type	Concrete gravity (post tensioned)
Upgrade type	Concrete gravity (mass concrete buttress)
Maximum height	15m to the right abutment crest
Length of dam crest	Approximately 360m
Level of dam crest	Left abutment crest @ RL 881.88m AHD Right abutment crest @ RL 881.73m AHD
Capacity of Reservoir at FSL	1,150ML (original) 1,390ML (after dredging in 2014) 1,300ML (as per survey in 2019)
Stream bed level	RL 869.0m AHD
Outlet	
Outlet	250mm diameter suction main outlet and a 600m diameter scour line
Spillway	
Type	Free overfall section at centre of the dam
Spillway width	202m
Spillway level	RL 880.05m AHD

Spillway capacity at dam crest	894m^3/s at left abutment crest (DHI, 2012)
Telemetry	
Type	SCADA telemetry automatically records rainfall and reservoir inflows
Consequence of dam failure (PMF)	
Population at Risk (PAR) – total	533
Population at Risk – incremental	150
PMF dambreak outflow (2hr)	1,197m^3/s
Hydrological information	
Catchment area	38km^2
PMF maximum flood level	RL 881.97m AHD
Probable maximum inflow flood (2hr)	1,198m^3/s
Dam crest flood outflow	893m^3/s
Alert levels for flooding	
Red alert	RL 880.87m AHD (approx.. 0.1% AEP) Provides 30-60 minutes warning time before maximum flood level is reached
Amber alert	RL 880.47m AHD (approx. 1% AEP)
White alert	RL 880.17m AHD (approx. 120mm above full supply level)
Notification protocols	
Emergency authority	Council to notify in the order as below: • NSW SES • NSW Public Works • Dam Safety NSW
Local Flood Plan	
Name	Tenterfield Shire Local Flood Plan

Executive Summary

The NSW Public Works, Dams & Civil Technologies was commissioned by Tenterfield Shire Council to prepare a Dam Safety Emergency Plan (DSEP) for Tenterfield Creek Dam.

Tenterfield Shire Council has updated this plan due to new dam wall construction in 2018, updates to the Drinking Water Management System (DWMS) in 2018, updates to the Drought Management Plan (DMP) in 2019 and upgrade to the Flood Warning System in 2021.

Tenterfield dam is located on the southern outskirts of Tenterfield town centre, approximately 120km northwest of Grafton.

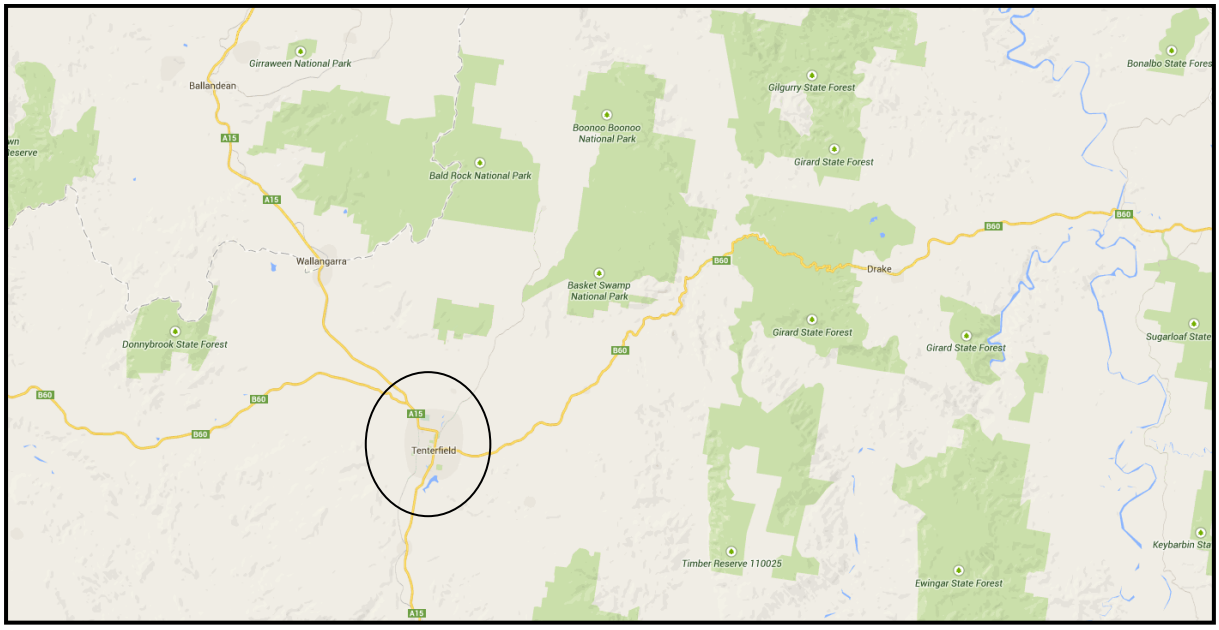

Figure 1-1 Tenterfield Creek Dam Locality Map

The dam was designed and constructed in 1931 by the Department of Public Works and was raised by 1.83m in 1974. Tenterfield dam is a 15m high concrete gravity structure with a total crest length of 360m inclusive of a 202m wide overfall spillway at its centre. The dam was reinforced with mass concrete buttress in 2018. The Dam has a "HIGH B" Sunny Day Consequence Category and a "HIGH A" Flood Consequence Category.

The responsibilities of persons and organisations involved with this emergency management are detailed in Section 2. They are identified as Tenterfield Shire Council as the dam owner, NSW SES , NSW SEOC, NSW Public Works - Dams & Civil Technologies and Dam Safety NSW.

The two major possible causes of dam failure are failure due to extreme flood levels and failure due to Sunny Day failure (rapidly deteriorating structural deficiency induced by extreme earthquake).

Emergency situations are identified through the Red, Amber and White Alert levels for a flooding event and through a Red and White Alert for an extreme earthquake event or other emergency situations.

The notification procedures for flooding, earthquake and other emergency situations outline the people/authorities to be notified by the dam owner/operator during an emergency situation. In particular, the NSW Public Works – Dams & Civil Technologies, NSW SES and Dams Safety NSW. Refer to Flow Charts for notification procedures for the above three emergency situations. Refer to Sheet 3 for Emergency Communications Directory.

A Dambreak and Probable Loss of Life Study were carried out for Tenterfield Creek Dam to simulate the failure of the dam and determine the flooding conditions in the area downstream of the dam. Tenterfield Creek Dam's flood and dambreak computer hydraulic modelling was simulated by the MIKEFLOOD 1D and 2D hydrodynamic software. DHI's (2012) MIKEFLOOD model was utilised in this Study, with the incorporation of NSW Public Work's MIKE 11 dambreak outflow hydrographs. Inundation maps are then prepared and the consequences of dam failure to assess the Consequence Category for the dam. Refer to Appendix C for flood wave arrival time/warning time available to residences.

This plan also details available surveillance, communication, monitoring and warning systems in placed at the dam. Emergency manpower requirements are identified. This plan determines where appropriate, adverse time response, alternate sources of power and communication, emergency supplies and resources. It also provides coordinating information and actions to lower the reservoir or limit inflows and outflows.

1 General Information

1.1 Introduction and statement of purpose

Dams Safety NSW (DSNSW) https://www.damsafety.nsw.gov.au/nsw.gov.au under its statutory obligations of the Dam Safety Act 2015 ensures that all dams in NSW are designed, constructed, maintained and operated to a standard to minimise the risks to the community. The DSNSW requires a quality controlled Dam Safety Emergency Plan (DSEP) for all declared dams where persons may be at risk downstream if the dam failed.

This document covers preparedness in relation to the occurrence of an emergency condition at Tenterfield Creek Dam and provides information necessary for emergency agencies to manage a downstream evacuation in the unlikely event of a potential dam failure.

The document has been prepared in line with the requirements of:

- Dams Safety Regulation 2019.
- Dams Safety Act 2015.
- Australian National Committee on Large Dam's (ANCOLD) Guidelines on Dam Safety Management, 2003; Australian National Committee on Large Dams https://www.ancold.org.au/.
- Dam Safety NSW Guidance Sheet DSNSW 2G.

This document details:

a) The type, size and location and hazard rating of the dam;
b) The Population at Risk (PAR) and downstream areas under various flood events;
c) The responsibilities of persons and organisations involved in the surveillance, maintenance, and operation of the dam, and the persons/organisations responsible for activating the Plan;
d) The persons and organisations to be notified in the event of an emergency situation;
e) The procedure for identification, evaluation, and classification of potential emergency conditions;
f) Local area communications network and alternative communications procedures to be used if the local area network fails;
g) Local area alarm systems to warn the Population at Risk (PAR)
h) Available access to the dam under normal and varying emergency conditions
i) Other necessary information to protect the Population At Risk (PAR) and mitigate flood damage;

j) Actions, Responsibilities and Communications protocols;
k) Location of materials and plant to be readily available during an emergency;
l) Preventative actions; and
m) Temporary and permanent remedial measures to be taken to maintain/return the structures to a safe operational condition.

The document identifies emergency conditions that may result in dam failure. It describes procedures to be followed to investigate and provide warning of emergency conditions to appropriate emergency managers, so that they can implement preparedness and response measures for the protection of downstream persons and property.

The document also provides direction for operating staff in the situation of unsafe or emergency conditions where dam failure is unlikely, so that the dam can be returned to a safe condition with minimal delay, this includes aspects of drought management and associated protocols.

The Dam Safety Emergency Plan is to be used to activate the Local Emergency Management Plan and Local Flood Plan as prepared by Tenterfield Shire Council. It is not intended as a replacement for the Local Emergency Management Plan or the Local Flood Plan Instead it presents a plan of procedures to complement the needs of the Local Emergency Management Plan and Local Flood Plan https://www.tenterfield.nsw.gov.au/your-council/council-documents/plans-reports/local-emergency-management-plan-emplan .

1.2 Endorsement statement

This document was originally prepared for Tenterfield Shire Council by the NSW Public Works, Dams & Civil Technologies in consultation with Tenterfield Shire Council operational personnel, the NSW State Emergency Service (NSW SES) and Dam Safety NSW (DSNSW). Revisions included in consultation with the NSW State Emergency Service (NSW SES) and Dams Safety NSW (DSNSW).

The Tenterfield Shire Council and NSW Public Works, Dams & Civil Technologies hereby endorse that the notification and responsibility details contained within this document are in accordance with the agreed protocols established between the Tenterfield Shire Council, NSW State Emergency Service, Dams Safety NSW and NSW Public Works.

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Fiona Keneally, Director Engineering

Tenterfield Shire Council

Dated:

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George Samios,

Assistant Principal Engineer, Dams & Civil

NSW Water Solutions, NSW Public Works

Dated:

1.3 Control document – distribution list

Designation/Organisation	Control Copy Number
Master Manual, «Client», «Location»	001
«Client», «Location» (for internal distribution)	002 - 004
Dams Safety NSW (DSNSW), Parramatta	006
NSW Public Works Dams and Civil Technologies Section, Sydney	005 - 006
NSW State Emergency Service (NSW SES) State Headquarters, Wollongong (For internal distribution to appropriate NSW SES Zones and Units) nswses.communityplanning@ses.nsw.gov.au	007 - 010
State Emergency Operations Centre (SEOC) (For internal distribution in accordance with the number of SEOC District Emergency Management Officers (DEMO) involved)	011

NOTES:-

1. Tenterfield Shire Council is responsible for circulating any amendments to the DSEP internally and to the NSW Public Works, NSW DSNSW, NSW SES and SEOC.
2. The NSW SES and SEOC are then responsible for circulating any amendments internally to any holders of the DSEP nominated by the NSW SES and SEOC.
3. It is the **responsibility of each Organisation to acknowledge receipt of the amendments** and advise Tenterfield Shire Council that the relevant pages have been replaced and the DSEP document has been updated accordingly.

1.4 Amendments to contact details

All future amendments to the DSEP contact details are to be entered and certified on the table below by Tenterfield Shire Council then all the relevant pages together with the amended table forwarded to ALL the Organisations on the Document Distribution List.

Contact Details						**Entered by**
Date	Organisation	Title	Name	Phone / Email	Page Number	Name (Print name)

NOTES:-

1. It is the responsibility of Tenterfield Shire Council to advise each Organisation immediately of any changes to this organisational structure, his personnel and relevant contact numbers.
2. It is the responsibility of each Organisation to advise Tenterfield Shire Council immediately of any changes to their organisational structure, their personnel and relevant contact numbers.
3. It is the responsibility of Tenterfield Shire Council to contact each Organisation annually to check that there have been no changes to their organisational structure their personnel or relevant contact numbers.
4. It is the **responsibility of each Organisation to acknowledge receipt of the amendments to the contact details** and advise Tenterfield Shire Council that the relevant pages have been replaced and the DSEP document has been updated accordingly.

1.5 Amendments to text items

Approved amendments or additions to the text of the DSEP are to be entered and certified in the table below by Tenterfield Shire Council then all the relevant pages together with the amended table forwarded to ALL the Organisations on the Document Distribution List.

Amendment		Section		Entered by	
Date	Number	Item description	Page no	Name (Print name)	Date

NOTES:-

1. It is the **responsibility of the Dam Owner to circulate all proposed amendments** to the flow charts, text pages and drawings of the DSEP to all affected organisations for approval prior to forwarding the approved amendment(s) to all the organisations on the document distribution list.
2. It is the **responsibility of each Organisation to acknowledge receipt of the amendments**, and advise Tenterfield Shire Council that the relevant pages have been replaced and the DSEP document has been updated accordingly.
3. The flow charts text pages and drawings of the original document should show the date the document was issued in the footer.
4. Any subsequent amendments to flow charts text pages and drawings should show the date of the amendment in the footer of the affected page.

2 Notification flow charts

2.1 General

The main purpose of the following notification procedures is to ensure that timely warning is provided to the responsible persons in the event of a potential dam failure or incident, and to provide information that is relevant to the emergency response. A secondary purpose is to provide communication pathways for emergencies generally and to ensure proper reporting of all emergencies.

You must report all serious incidents or injuries that occur at, or in relation to, a declared dam as soon as possible after the incident to Dams Safety NSW https://www.damsafety.nsw.gov.au/reporting by calling 0403 681 645 (24 hours/7 days a week).

You must also provide a written incident report using the online **Incident Reporting Form** no more than 72 hours after the incident, even if you have already made an oral report.

Emergency situations are categorised on the basis of severity, with each category having corresponding responses/alerts for the particular emergency condition (i.e. flooding, earthquake or other emergency).

The prime means of detecting the development of a potential emergency condition is through regular inspection of the dam by the Technical Services Director or relevant Tenterfield Shire Council Staff, and inspection and monitoring activities carried out by dam surveillance consultants.

The two major possible causes of dam failure are:

- Failure due to extreme flood levels overtopping the concrete gravity dam;
- Failure due to a rapidly deteriorating structural deficiency such as may be induced by an extreme earthquake (MMI > IV). (This is the so-called "Sunny Day" failure, i.e. not induced by an inflow flood).

Although Tenterfield Creek Dam is currently in good condition, an unsafe or emergency condition could occur at any time due to extreme natural events. Failure from a cause not related to extreme natural events is always a possibility although the probability of occurrence is extremely low.

Careful judgement is needed in reacting to emergencies. Whenever time permits, the communication pathways given in these procedures are to be followed. These ensure that decisions will be made by senior, responsible

persons and will be based on the best available specialist advice. The procedures are designed to avoid unnecessary warnings to the public.

Notification of a dam safety emergency to the public will cause alarm, anxiety, resentment, and disruption to normal activities and expense. Evacuation greatly heightens these effects.

In cases where an emergency situation is developing so rapidly that to follow the alert protocols would endanger the public, operational personnel must take any action they consider appropriate, such as alerting the Population at Risk (PAR) directly. **The Owners and Operational Personnel must at all times consider public safety as paramount.**

2.2 Notification flow charts

The procedures to be followed for each alert are summarised in the notification flow charts for flooding, earthquake and other emergency conditions (i.e. Sunny Day Failure or bomb threat). Refer to Charts 1, 2, 3, Tables I, II, III and NSW SES Flow Chart No.1 (Ref. Figure 2 1). These flow charts which provide a quick reference are found at the end of Section 2 of this document. For a descriptive outline of the notification procedures for the three emergency conditions, refer to Appendix K.

The flow charts summarise the persons/organisations to be notified and the prioritised order of notification in the event of an emergency situation. Although each emergency condition will be evaluated and responded to individually, the action for most emergencies will be similar. The notification flow charts set out the mandatory reporting that is required. Beyond these mandatory reporting(s), those involved may make any contacts they judge to be appropriate within their normal authority.

2.3 SES notification flow chart

The NSW SES Flow Chart No.1 (Refer to Figure 2 1) has been adopted from the Dam Safety NSW (DS) Guidance Sheet DSNSW2G. This flow chart provides details/protocols on notifying NSW SES State Operations Centre (SOC) and the NSW State Emergency Operations Centre (SEOC). Note however that the primary contact nominated for this DSEP, during an emergency (Refer to Notification Flow Charts 1-3):

- NSW SES State Operations Centre (SOC) or;
- Duty Officer, SEOC on the 24 hour phone number;

Dam owners should make every attempt to call the NSW SES in the first instance. Use of the protocols in the NSWSES Flow Chart No.1 must be followed if the NSW SES cannot be contacted. The NSW SES/SEOC is responsible for notifying the other emergency response agencies as per the NSW SES Flow Chart No.1.

The NSW State Emergency Service (NSW SES) is the designated Combat Agency for floods in NSW and in all local government areas where a significant riverine or flash flood threat exists; the Service has produced flood plans which are sub-plans of their respective local disaster plans (DISPLAN). Potential dam failure can best be managed through the activation of the local flood plan(s). In some cases, where dams are particularly at risk of failure (i.e. deficient flood capacity or known structural problem), special additional planning may be incorporated into the local flood plan to account for potential dam failure.

2.4 Supplementary tables and notes

****It is recommended that laminated copies of DSEP Flow Charts, Table 2 2 - Water Levels and Corresponding Alerts and Supplementary Notes (Section 2.4.2) are to be carried in the vehicles of ALL Tenterfield Shire Council Operational Personnel.**

2.4.1 Supplementary tables

The inflow hydrograph results from an extreme rainfall event referred to as the Probable Maximum Precipitation (PMP). The PMP is the greatest depth of precipitation for a given duration that is considered physically possible over a particular drainage area. WRM Water & Environment PL produced the PMF hydrographs with a range of PMP events.

Tenterfield Creek Dam's PMF inflow hydrographs produced by WRM Water & Environment PL were routed through NSW Public Work's MIKE11 flood dambreak model to obtain the critical PMF duration. That is, the duration of the PMP event that would give rise to the maximum peak flood elevation in the dam storage.

Table 2-1 summarises the dam flood routing results. It is evident from the results that the dam currently cannot cater for most PMF events. The 2 hour duration is regarded as the critical PMF.

Table 2-1 PMF Routing Results

PMP duration (hours)	Peak dam inflows (m^3/s)	Peak flood elevation (mAHD)	Max. overtopping height* (m)

0.75	892.76	881.68	-0.05
1	1,067.84	881.88	0.15
1.5	1,114.69	881.94	0.21
2	**1,198.57**	**881.97**	**0.24**
2.5	1,181.76	881.96	0.23
3	1,161.15	881.95	0.22
6	987.06	881.82	0.09

*Dam right abutment crest level = 881.73m AHD

The levels reported in this DSEP are based on the Australian Height Datum (AHD). The correlation of "Tenterfield Datum" to AHD has been determined from a recent survey of the site and is as follows:

$$AHD\ (m) =' Tenterfield\ Datum\ (ft)' x\ 0.3048 + 1.6m$$

2.4.2 Alert level assessment

The alert levels for the dam (as presented in Table 2-2) indicate the storage level/discharge level over the spillway at Tenterfield Creek Dam. These alert levels have been based on the critical PMF outflow hydrograph developed from the dambreak model, with the initial water level set at the spillway level (RL 880.05m).

These alert levels should be activated in sequence as the storage level rises during the course of a major flood event and sent to the SES as they occur.

Table 2-2 PMF water levels and corresponding alerts & time intervals

Alert	Storage level (mAHD)	Time between alerts (mins)	Time from FSL (hrs:mins)
FSL	880.05		0:00
		0:20	
White (FSL)	880.17		0:20
		0:10	
Amber	880.47		0:30
		0:10	
Red	880.87		0:40
		0:35	
DCF (right abutment)	881.73		1:15
		0:37	
MFL	881.97		1:52

NOTE: Where a situation develops too rapidly to follow the procedures, operating staff must take whatever action they consider appropriate such as alerting the ***Population at Risk (PAR)*** *directly. Any doubts should be resolved in favour of protecting public safety.* ***The Owners and Operational Personnel must at all times consider public safety as paramount.***

The Alert Level Assessment carried out for Tenterfield Creek Dam, took into consideration new Hydrology (WRM, 2012) and Dambreak & PLL Studies (NSW Public Works, 2013). It should be noted the levels referred to in the Dambreak and PLL Study are in metres and not in mAHD. This was due to new surveys carried out for the dam AFTER the Study was finalised.

The assessment involved assessing the Dam Crest Flood (DCF) and Probable Maximum Flood (PMF) event and the warning time available to evacuate downstream residents.

The DCF is considered by the NSW DSNSW, to be the first extreme flood event that could pose structural stability concerns for sound dams. The DCF is an extreme flood event with its peak flood elevation in the dam storage reaching the dam's crest level, which is considered to be the right abutment crest level of RL 881.73m AHD. The findings are provided in Table 2-3.

Table 2-3 DCF and PMF Results

Critical PMP					PMF	
Total rainfall (mm)	Storm duration (hrs)	Inflow (m^3/s)	Outflow (m^3/s)	FSL (RL mAHD)	Storage level @ Max RL (mAHD)	Time to peak (hrs:mins)
370	2	1,198	1,197	880.05	881.97	1:52
Critical PMP					**DCF**	
370	2	898.93	892.74	880.05	881.73	1:57

Outflow hydrograph for the PMF flood, generated from the dambreak model indicate that the warning times between alert levels being triggered may be very short (approximately 10 minutes).

The alert levels provided in Table 2-2 are therefore not only based on warning times. They have also been set on the following basis, to minimise the flood affected areas and maximise the warning time available:

- The **Red Alert Level** is set at RL 880.87m AHD (approximately 0.86m below the right abutment crest). This is approximately equivalent to the 1

in 1000 year AEP flood. According to the dambreak result, the Red Alert level will provide approximately 30 to 60 minutes warning time.
- The **Amber Alert** is set at RL 880.47m AHD to provide a maximum of 10 minutes warning time between the alerts. This is approximately equivalent to the 1 in 100 year AEP flood.
- The **White Alert** is set at RL 880.17 (approximately 120mm above the FSL).

Additionally monitoring storage levels at regular intervals (i.e. every 15 minutes) and the storage rate of rise allows for potential earlier notification and evacuation orders in an extreme short duration event, as this appears to be the case for Tenterfield Creek Dam. That is, if the storage level is rising rapidly, Council may proceed directly from White to Amber to Red Alert if an adequate time does not exist between the three alerts to both warn and evacuate the downstream population at risk via the NSW SES local flood plan. This decision should be made in consultation with the NSW SES and NSW Public Works.

Notes:

1. Tenterfield Creek Dam at present cannot cater for the PMF flood event.
2. The data was obtained from latest 2012 Hydrology Study (WRM) and 2013 Dambreak & PLL Study (NSW Public works).
3. It should be noted that the alert levels has been set based on the structural adequacy of the dam to withstand the above mention AEP floods. The Alert levels should be revised, if future Stability Study indicates otherwise.

Timely implementation of the **Alert Levels** is a crucial for the effectiveness of the DSEP and the effectiveness of warning systems which are imperative for minimising loss of life and property damage.

2.4.3 Supplementary notes

General

During an emergency, Tenterfield Shire Council must consult with NSW Public Works, Dams & Civil Technologies regarding any temporary repairs to the dam and appurtenant works or the requirements for additional inspections and/or monitoring.

Flood Emergency

The flood emergency 'over notification' to the NSW SES & DSNSW should not be issued until the rain has stopped, the flood is receding and the storage level has fallen below the **White Alert** level.

NSW Public Works should be advised when the spillway ceases to operate and routine inspections have resumed.

Earthquake & Other than Flood or Earthquake Emergency

Earthquakes are to be assessed in accordance with the Modified Mercalli Intensity Scale (Refer to Table 3-1) or advice/data of recent earthquakes from Geoscience Australia web site www.ga.gov.au

The NSW SES, NSW Public Works & DSNSW are to be notified by Tenterfield Shire Council that the **Red Alert** emergency is over when all the recommended remedial measures have been carried out and the danger of imminent/probable/possible failure of the structure have passed.

NSW Public Works is to be advised by Tenterfield Shire Council that the **White Alert** emergency is over when all the necessary minor repairs have been carried out and routine inspections have resumed.

NSW SES Responsibility

The NSW SES is responsible for the warning and evacuation of the downstream population at risk and notifying the other emergency response agencies as per the NSW SES Flow Chart No.1 (Refer to Figure 2-1).

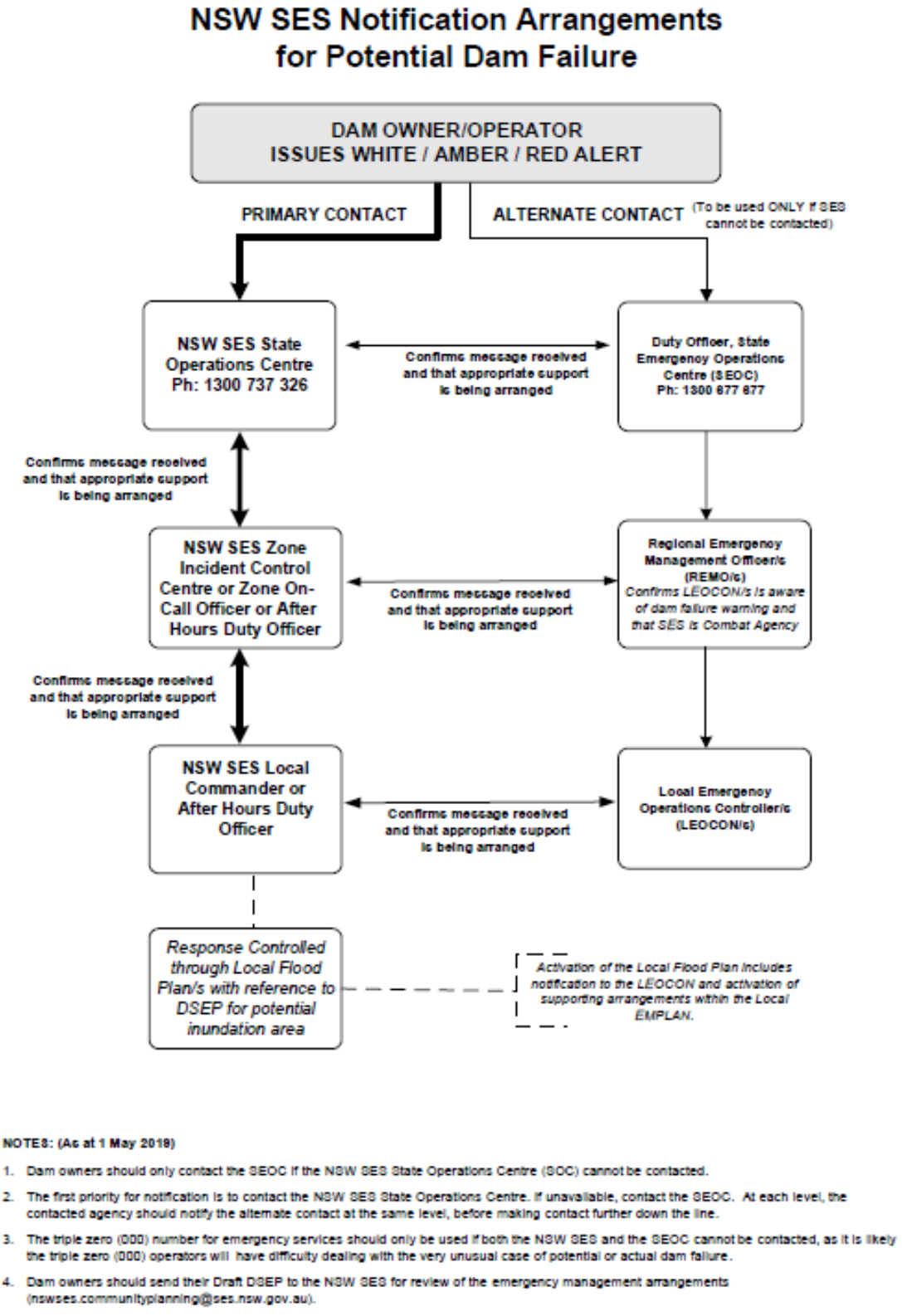


Figure 2-1 Tenterfield Creek Dam, NSW SES Flow Chart No. 1

It is recommended that laminated copies of the DSEP Flow Charts and Supplementary Notes are carried in the vehicles of ALL Operational personnel.

2.4.4 Emergency Notification Flowcharts

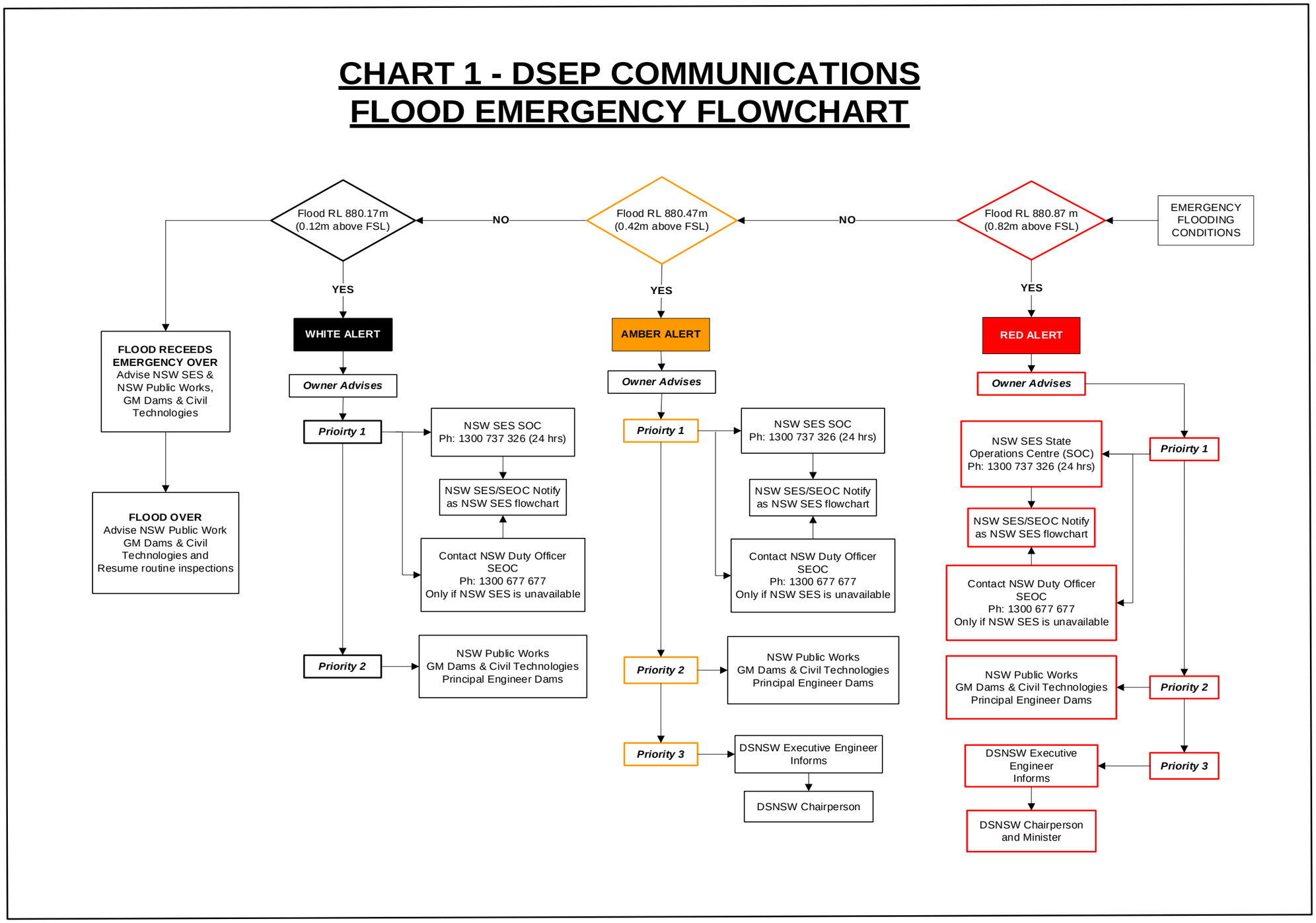


CHART 2 - DSEP COMMUNICATIONS FLOWCHART FOR EARTHQUAKE

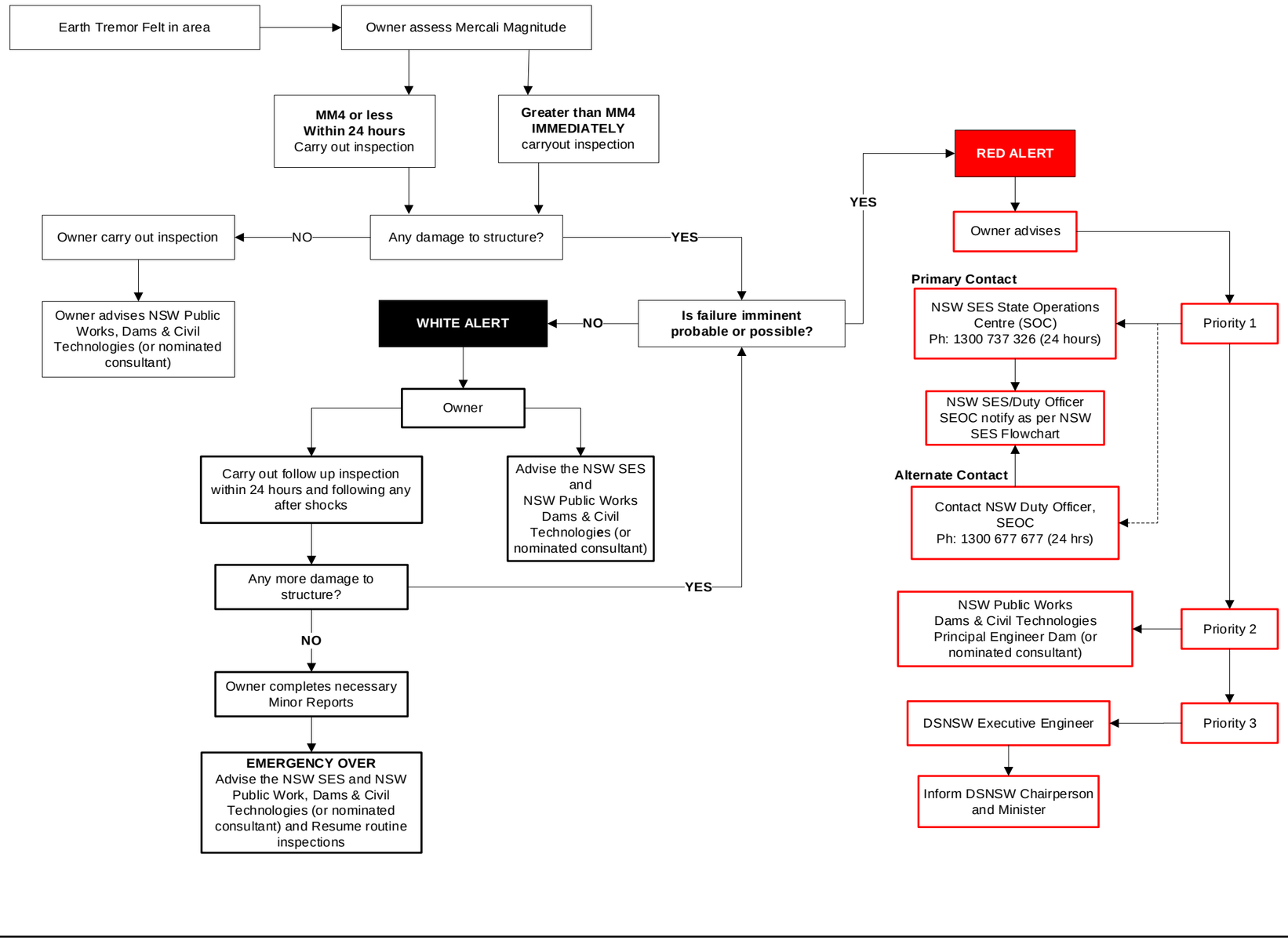
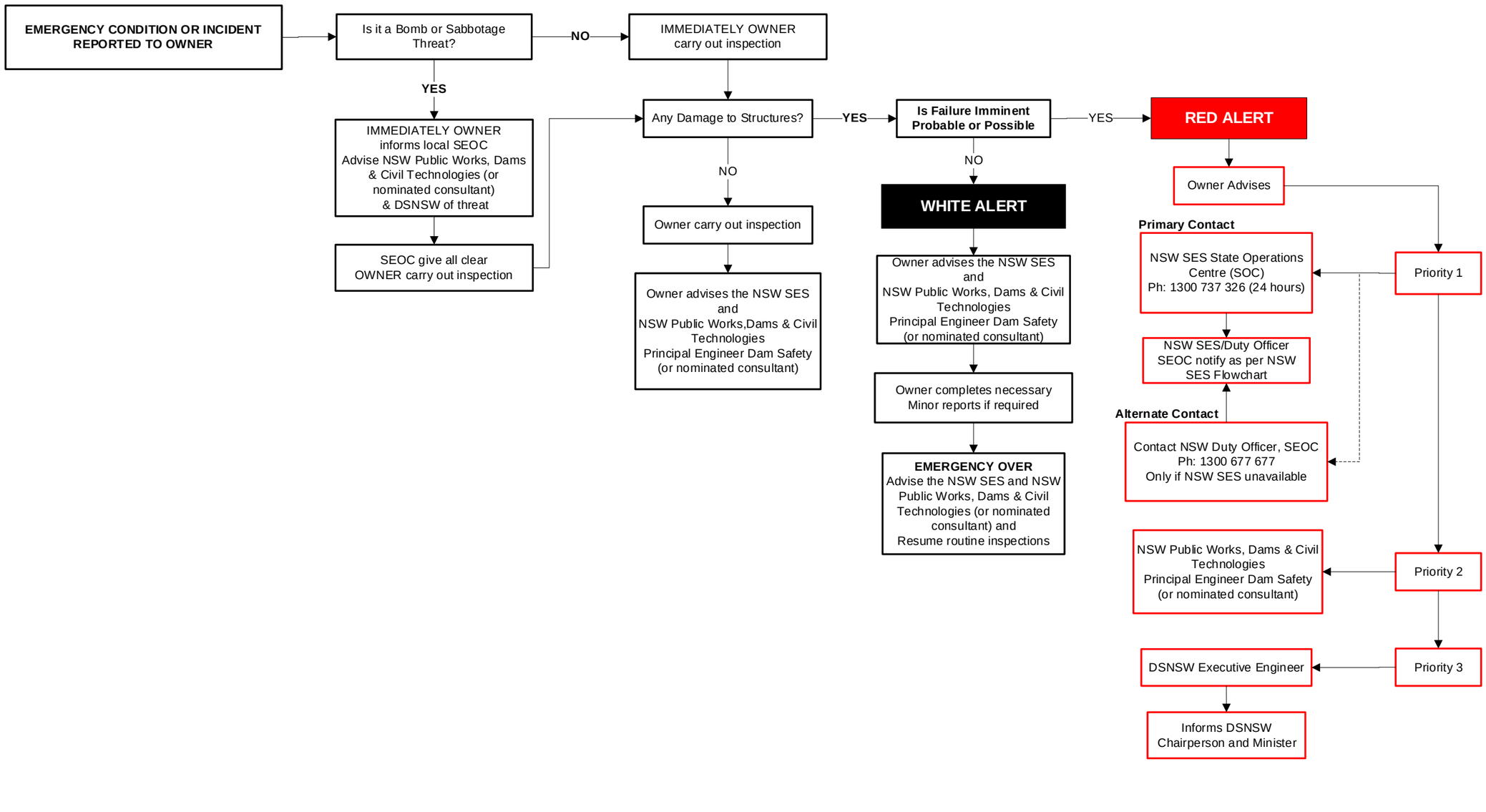


CHART 3 - DSEP COMMUNICATIONS
FLOWCHART for OTHER THAN FLOOD or EARTHQUAKE



3 Actions, responsibilities and communications directories

3.1 General

3.1.1 Notification tables

The actions and responsibilities of emergency authorities for each flooding, earthquake and other emergency conditions (i.e. sunny day or bomb threat) are summarised in the Notification Tables (Refer to Tables I, II and III). These tables provide communication pathways for emergencies and to ensure proper reporting of all emergencies to authorities. They also which provide a quick reference are found at the end of Section 3 of this document. For a descriptive outline of the notification procedures for the three emergency conditions, refer to Appendix K.

3.1.2 Emergency communications directory

The Communication Directory lists names and contact details of the responsible personnel required to be contact during a dam failure emergency. It is important that the Directory provided is maintained in a current accurate condition. As new persons take office or phone numbers or addresses change, the Directory is to be immediately updated and circulated to all manual holders, for insertion in their copy of the manual. Refer to Sheet 3 at the end of this section for the Communications Directory.

3.2 Alert status – advice protocols

When a member of Tenterfield Shire Council Staff is advising the emergency agencies by phone/radio/email in relation to the Alert status, the following communication protocol MUST be followed in the order listed:

1. "This is Name & Title of Caller from Tenterfield Shire Council".
2. "This is to advise that there is a flood/earthquake/other emergency at Tenterfield Creek Dam"
3. "This is to inform you that the current ALERT status at Tenterfield Creek Dam is Code"

"White/Amber/Red"

A "Communications Log" is included in Appendix G. The caller should log in the Communications Log the following:

- the name of the agency;
- the message recipient; and
- the date and time of the message.

Note also that after the emergency situation has passed, it should be recorded in the "Operations Log" for the Dam.

3.3 Review of communication directions

Tenterfield Shire Council must carry out an Annual Review of the Communication Directories (i.e. Table I, II and III and Sheet 3 Emergency Communications Directory) and advise ALL Organisations on the documentation distribution list of any changes.

All Organisations must advise Tenterfield Shire Council immediately of any changes to their structure, the names of their personnel and contact details. It is the responsibility of Tenterfield Shire Council to circulate these changes immediately to ALL Organisations on the document distribution list.

3.4 Emergency notification tables

The emergency notification tables are in the pages below.

Table 3-1 Action & Communication Directory – Flood evaluation – white alert

Storage (RL mAHD)	Alert	Organisation	Actions	Responsible Person	Name	Phone / Email
880.17	White	Tenterfield Shire Council	Activate alert and advise as follows: 1 NSW SES OCC or Duty Officer SEOC if NSW SES unavailable 2 NSW Public Work, Dams & Civil Technologies. Interrogate the BoM web site for all weather forecasts relevant to the catchment. Monitor the storage continuously 24 hrs/day. Provide the NSW Public Works with regular updates of inspection surveillance & monitoring data. E-mail photos of flood emergency. React to all advice provided by NSW Public Works (Note iii). Provide assistance to NSW SES if requested (Note iv). Maintain contact with NSW SES, NSW Public Works. Inform the DSNSW if the weather data indicates there is a possibility that the flood alert could escalate to AMBER. Advise any change in alert status.	Director Engineering	Fiona Keneally	BH: 02) 6736 6010 AH: 0438 576 873 f.keneally@tenterfield.nsw.gov.au
				Manager Water & Waste	Gillian Marchant	BH: 02) 6736 6122 AH: 0427 248 273 g.marchant@tenterfield.nsw.gov.au
		NSW SES	Activate procedures for flood warnings evacuation etc. as per NSW **SES Flow Chart No. 1**	State Operations Centre	State Operations Centre	1300 737 326 (24hrs)
		NSW SEOC if NSW SES unavailable		Duty Officer, SEOC	Duty officer	1300 677 677 (24hrs)
		NSW Public Works, Dams & Civil Technologies	Review monitoring & surveillance data. Monitor & assess situation and carry out inspection if considered necessary. Provide technical advice on remedial measures and additional monitoring requirements to Tenterfield Shire Council if required. Maintain contact with Tenterfield Shire Council	Principal Engineer Dam Safety	Dene Jamieson	BH: (02) 9372 7814 AH: 0428 113 272 dene.jamieson@finance.nsw.gov.au

i) The Owner must carry out an Annual Review of the Directory and advise All Organisations on the Document distribution list of any changes.

ii) All Organisations must advise the Owner immediately of any changes to their structure, the names of their personnel and contact details. The Owner must circulate these changes immediately to All Organisations on the Document distribution list.

iii) The Owner should consult only with the NSW Public Works regarding remedial measures and additional monitoring requirements.

iv) The Owner to provide assistance to the NSW SES if requested by the NSW SES.

v) The inspection details and the collection of the surveillance and monitoring data to be in accordance with the requirements of the O& M manual or as requested by the NSW Public Works.

Table 3-2 Action & Communication Directory – Flood evaluation – amber alert

Storage (RL mAHD)	Alert	Organisation	Actions	Responsible Person	Name	Phone / Email
880.47	Amber	Tenterfield Shire Council	Activate alert and advise as follows: 1 NSW SES OCC or Duty Officer SEOC if NSW SES unavailable 2 NSW Public Work, Dams & Civil Technologies. Interrogate the BoM web site for all weather forecasts relevant to the catchment. Monitor the storage continuously 24 hrs/day. Provide the NSW Public Works with regular updates of inspection surveillance & monitoring data. E-mail photos of flood emergency. React to all advice provided by NSW Public Works (Note iii). Provide assistance to NSW SES if requested (Note iv). Maintain contact with NSW SES, NSW Public Works. Inform the DSNSW if the weather data indicates there is a possibility that the flood alert could escalate to AMBER. Advise any change in alert status.	Director Engineering	Fiona Keneally	BH: (02) 6736 6010 AH: 0438 576 873 f.keneally@tenterfield.nsw.gov.au
				Manager Water & Waste	Gillian Marchant	BH: 02) 6736 6122 AH: 0427 248 273 g.marchant@tenterfield.nsw.gov.au
		NSW SES	Activate procedures for flood warnings evacuation etc. as per NSW **SES Flow Chart No. 1**	State Operations Centre	State Operations Centre	1300 737 326 (24hrs)
		NSW SEOC if NSW SES unavailable		Duty Officer, SEOC	Duty officer	1300 677 677 (24hrs)
		NSW Public Works, Dams & Civil Technologies	Review monitoring & surveillance data. Monitor & assess situation and carry out inspection if considered necessary. Provide technical advice on remedial measures and additional monitoring requirements to Tenterfield Shire Council if required. Maintain contact with Tenterfield Shire Council	Principal Engineer Dam Safety	Dene Jamieson	BH: (02) 9372 7814 AH: 0428 113 272 dene.jamieson@finance.nsw.gov.au
		DSNSW	Informs DSNSW Chairperson. Liaise with NSW Public Works.	Executive Engineer	Steve Knight	BH: (02) 9842 8070 AH: 0403 681 645 steve.knight@damsafety.nsw.gov.au

Table 3-3 Action & Communication Directory – Flood evaluation – red alert

Storage (RL mAHD)	Alert	Organisation	Actions	Responsible Person	Name	Phone / Email
880.87	Amber	Tenterfield Shire Council	Activate alert and advise as follows: 1 NSW SES OCC or Duty Officer SEOC if NSW SES unavailable 2 NSW Public Work, Dams & Civil Technologies. Interrogate the BoM web site for all weather forecasts relevant to the catchment. Monitor the storage continuously 24 hrs/day. Provide the NSW Public Works with regular updates of inspection surveillance & monitoring data. E-mail photos of flood emergency. React to all advice provided by NSW Public Works (Note iii). Provide assistance to NSW SES if requested (Note iv). Maintain contact with NSW SES, NSW Public Works. Inform the DSNSW if the weather data indicates there is a possibility that the flood alert could escalate to AMBER. Advise any change in alert status.	Director Engineering	Fiona Keneally	BH: (02) 6736 6010 AH: 0438 576 873 f.keneally@tenterfield.nsw.gov.au
				Manager Water & Waste	Gillian Marchant	BH: (02) 6736 6122 AH: 0427 248 273 g.marchant@tenterfield.nsw.gov.au
		NSW SES	Activate procedures for flood warnings evacuation etc. as per NSW **SES Flow Chart No. 1**	State Operations Centre	State Operations Centre	1300 737 326 (24hrs) nswses.communityplanning@ses.nsw.gov.au
		NSW SEOC if SES unavailable		Duty Officer, SEOC	Duty officer	1300 677 677 (24hrs)
		NSW Public Works, Dams & Civil Technologies	Review monitoring & surveillance data. Monitor & assess situation and carry out inspection if considered necessary. Provide technical advice on remedial measures and additional monitoring requirements to Tenterfield Shire Council if required. Maintain contact with Tenterfield Shire Council	Principal Engineer Dam Safety	Dene Jamieson	BH: (02) 9372 7814 AH: 0428 113 272 dene.jamieson@finance.nsw.gov.au
		DSNSW	Informs DSNSW Chairperson. Liaise with NSW Public Works.	Executive Engineer	Steve Knight	BH: (02) 9842 8070 AH: 0403 681 645 steve.knight@damsafety.nsw.gov.au
			Advise DSNSW Minister	Chairperson		

Table 3-4 Action & Communication Directory – Earthquake emergency (<MM IV)

Magnitude Damage	Alert	Organisation	Action	Responsible Position	Name	Phone / E-mail
Owner assesses Earth tremor as MM IV or less (Refer Mercalli Intensity Scale) **No visible damage to structure**		Tenterfield Shire Council	Carry out inspection within 24 hrs and assess damages. Advise NSW Public Works of results of inspection. Carry out follow up inspection after 24 hrs. Inform NSW Public Works of any change in condition of structure.	Director Engineering	Fiona Keneally	BH: (02) 6736 6010 AH: 0438 576 873 f.keneally@tenterfield.nsw.gov.au
				Manager Water & Waste	Gillian Marchant	BH: (02) 6736 6122 AH: 0427 248 273 g.marchant@tenterfield.nsw.gov.au
		NSW Public Works Dams & Civil Technologies	Review details of inspections and any surveillance data. Assess situation if there is a change in the condition of the structure. Discuss escalation to Protection alert status carry out inspection if required.	Principal Engineer Dam Safety	Dene Jamieson	BH: (02) 9372 7814 AH: 0428 113 272 dene.jamieson@finance.nsw.gov.au

i) Earthquakes to be assessed in accordance with the attached Modified Mercalli Intensity Scale or advice by the AGSO.
ii) The Owner must carry out an Annual Review of the Directory and advises All Organisations on the Document distribution list of any changes.
iii) All Organisations must advise the Owner immediately of any changes to their structure, the names of their personnel and contact details. The Owner must circulate these changes immediately to All Organisations on the Document distribution list.
iv) The Owner should consult with NSW Public Works only regarding remedial measures and additional monitoring requirements.
v) The Owner to provide assistance to the NSW SES if requested by the NSW SES.
vi) The inspection details and the collection of the surveillance and monitoring data to be in accordance with the requirements of the O&M Manual or as requested by the NSW Public Works.

Table 3-5 Action & Communication Directory – Earthquake emergency (>MM IV) – White alert

Magnitude Damage	Alert	Organisation	Action	Responsible Position	Name	Phone / E-mail
Owner assesses Earth tremor as greater than MM IV (Refer Mercalli Intensity Scale) **Some damage may be visible but not enough to cause immediate failure of the structure**	White	Tenterfield Shire Council	**IMMEDIATELY** carry out inspection and assess damages. Activate alert and Advise NSW Public Works, Dams & Civil Technologies Mark up visible damage to structure. Provide NSW Public Works with inspection, surveillance & monitoring data. E-mail photos of any structural damage. Monitor condition of structure for 24 hrs after the last 'after shock'. Take remedial action if required. React to all advice provided by NSW Public Works (Note iv). Inform NSW SES & DSNSW of assessment and advise any possible escalation in alert status.	Director Engineering	Fiona Keneally	BH: (02) 6736 6010 AH: 0438 576 873 f.keneally@tenterfield.nsw.gov.au
				Manager Water & Waste	Gillian Marchant	BH: (02) 6736 6122 AH: 0427 248 273 g.marchant@tenterfield.nsw.gov.au
		NSW Public Works Dams & Civil Technologies	Review surveillance & monitoring data. Assess situation and carry out inspection if required. Provide technical advice on remedial measures and additional monitoring requirements. Request additional technical advice if required.	Principal Engineer Dam Safety	Dene Jamieson	BH: (02) 9372 7814 AH: 0428 113 272 dene.jamieson@finance.nsw.gov.au

Table 3-6 Action & Communication Directory – Earthquake emergency (>MM IV) – Red alert

Magnitude Damage	Alert	Organisation	Action	Responsible Position	Name	Phone / E-mail
Earth tremor assessed as greater than MM IV (Refer Mercalli Intensity Scale) Major visible damage to structure. **Failure probable, imminent or in progress**	Red	Tenterfield Shire Council	**IMMEDIATELY** carry out inspection and assess damages. Activate alert and advise as follows: 1 NSW SES OCC or Duty Officer SEOC is NSW SES unavailable 2 NSW Public Works, Dams & Civil Technologies. 3 DSNSW Executive Engineer Inform NSW SES & DSNSW of damage assessment. Monitor structure 24 hrs/day. Provide the NSW Public Works with regular updates of inspection, surveillance & monitoring data. E-mail photos of structural damage. React to all advice provided by NSW Public Works (Note iv). Provide assistance to NSW SES if requested (Note v). Advise NSW SES, NSW Public Works and DSNSW of any change in alert status.	Director Engineering	Fiona Keneally	BH: (02) 6736 6010 AH: 0438 576 873 f.keneally@tenterfield.nsw.gov.au
				Manager Water & Waste	Gillian Marchant	BH: (02) 6736 6122 AH: 0427 248 273 g.marchant@tenterfield.nsw.gov.au
		NSW SES	Activate procedures for flood warnings, evacuation etc. as per NSW **SES Flow ChartNo. 1.**	State Operations Centre	State Operations Centre	1300 737 326 (24 Hours) nswses.communityplanning@ses.nsw.gov.au
		NSW SEOC if NSW SES unavailable		Duty Officer, SEOC	Duty Officer	1300 677 677 (24 hours)

Magnitude Damage	Alert	Organisation	Action	Responsible Position	Name	Phone / E-mail
		NSW Public Works Dams & Civil Technologies	Review inspection surveillance & monitoring data. Monitor & assess situation and carry out inspection. Arrange additional technical advice if required. Provide technical advice on remedial measures and additional monitoring requirements. Maintain contact with Tenterfield Shire Council and liaise with DSNSW.	Principal Engineer Dam Safety	Dene Jamieson	BH: (02) 9372 7814 AH: 0428 113 272 dene.jamieson@finance.nsw.gov.au
		DSNSW	Inform Chairperson. Liaise with NSW Public Works.	Executive Engineer	Steve Knight	BH: (02) 9842 8070 AH: 0403 681 645 steve,knight@damsafety.nsw.gov.au
			Advise DSNSW Minister.	Chairperson		

Table 3-7 Modified Mercalli Intensity Scale (FEMA)

Earthquake Intensity (MM)	Description of Earthquake	Richter Equivalent
I	People do not feel any earth movement	**0-0.43**
II	A few people might notice movement if they are at rest and/or on the upper floors of tall buildings	
III	Many people indoors feel movement. Hanging objects swing back and forth. People outdoors might not realise that and earthquake is occurring.	
IV	Most people indoors feel movement. Hanging objects swing. Dishes, windows and doors rattle. The earthquake feels like a heavy truck hitting the walls. A few people outdoors may feel movement. Parked cars rock.	**4.3-4.8**
V	Almost everyone feels movement. Sleeping people are wakened. Doors swing open or close. Dishes are broken. Pictures on the wall move. Small objects move or are turned over. Trees might shake. Liquids might spill out of open containers.	
VI	Everyone feels movement. People have trouble walking. Objects fall from shelves, pictures fall off walls furniture moves. Plaster in walls might crack. Trees and bushes shake. Some slight damage in poorly built buildings however there is no structural damage.	**4.8-6.2**
VII	People have difficulty standing. Drivers feel their cars shaking. Some furniture breaks loose. Loose bricks fall off buildings. Damage is slight to moderate in well-built buildings and considerable in poorly built buildings.	
VIII	Drivers have trouble steering. Houses that are not bolted down might shift on their foundations. Tall structures such as towers and chimneys might twist and fall. Well-built structures suffer slight damage. Poorly built structures suffer severe damage. Tree branches break. Hillsides might crack if the ground is wet. Water levels in wells might change.	**6.2-7.3**
IX	Well-built buildings suffer considerable damage. Houses that are not bolted down move off their foundations. Some underground pipes are broken. The ground cracks and reservoirs suffer serious damage.	
X	Most buildings and their foundations are destroyed. Some bigger bridges are destroyed. Dams are seriously damaged. Large landslides occur. Water is thrown on the banks of canals, rivers and lakes. The ground cracks in large areas and rail lines are bent slightly.	
XI	Most buildings collapse. Some bridges are destroyed. Large cracks appear in the ground. Underground pipe lines are destroyed and rail lines are badly bent.	**>7.3**
XII	Almost everything is destroyed. Objects are thrown into the air. The ground moves in waves or ripples. Large amounts of rock may move.	

Table 3-8 Action & Communication Directory – Other than flooding / earthquake emergency

Magnitude Damage	Alert	Organisation	Action	Responsible Position	Name	Phone / E-mail
Owner advised of Bomb threat or other incident at dam **No visible damage to structures**		Tenterfield Shire Council	**1 IMMEDIATELY** inform NSW SEOC of Threat. 2 Advises NSW SES, NSW Public Works, Dams & Civil Technologies of threat.	Director Engineering	Fiona Keneally	BH: (02) 6736 6010 AH: 0438 576 873 f.keneally@tenterfield.nsw.gov.au
				Manager Water & Waste	Gillian Marchant	BH: (02) 6736 6122 AH: 0427 248 273 g.marchant@tenterfield.nsw.gov.au
		NSW SEOC	Advise Owner dam site all clear to carry out inspection.	Duty Officer, SEOC	Duty Officer	1300 677 677 (24 Hrs)
		Tenterfield Shire Council	**IMMEDIATELY** carry out inspection and assess damages. Advise NSW SES, NSW Public Works of results of inspection. Carry out follow up inspection after 24 hrs. Inform NSW Public Works of any change in condition of structure.	Director Engineering	Fiona Keneally	As above
				Manager Water & Waste	Gillian Marchant	As above
		NSW Public Works, Dams & Civil Technologies	Review details of inspections and any surveillance data. Assess situation if there is a change in the condition of the structure. Discuss escalation to Protection alert status carry out inspection if required.	Principal Engineer Dam Safety	Dene Jamieson	BH: (02) 9372 7814 AH: 0428 113 272 dene.jamieson@finance.nsw.gov.au

i) The Owner must carry out an Annual Review of the DSEP and advise All Organisations on the Document distribution list of any changes.

ii) All Organisations must advise the Owner immediately of any changes to their structure, the names of their personnel and contact details. The Owner must circulate these changes immediately to All Organisations on the Document distribution list.

iii) The Owner should consult with NSW Public Works only regarding remedial measures and additional monitoring requirements

iv) The Owner to provide assistance to the NSW SES only if requested by the NSW SES.

v) The inspection details and the collection of the surveillance and monitoring data to be in accordance with the requirements of the O&M Manual or as requested by the NSW Public Works

Table 3-9 Action & Communication Directory – Other than flooding / earthquake emergency –White alert

Magnitude Damage	Alert	Organisation	Action	Responsible Position	Name	Phone / E-mail
Owner advised of Minor explosion or other incident at dam **Visible damage but not enough to cause immediate failure of the structure**	White	Tenterfield Shire Council	**1 IMMEDIATELY** inform NSW SEOC of Threat. 2 Advises NSW SES, NSW Public Works, Dams & Civil Technologies of threat.	Director Engineering	Fiona Keneally	BH: (02) 6736 6010 AH: 0438 576 873 f.keneally@tenterfield.nsw.gov.au
				Manager Water & Waste	Gillian Marchant	BH: (02) 6736 6122 AH: 0427 248 273 g.marchant@tenterfield.nsw.gov.au
		NSW SEOC	Advise Owner dam site all clear to carry out inspection.	Duty Officer, SEOC	Duty Officer	1300 677 677 (24 Hrs)
		Tenterfield Shire Council	**IMMEDIATELY** carry out inspection and assess damages. Activate alert and Advise NSW Public Works. Monitor condition of structure. Provide NSW Public Works with inspection, surveillance & monitoring data and E-mail photos of any structural damage. Take remedial action if required. React to all advice provided by NSW Public Works (Note iii). Inform NSW SES & DSNSW of assessment and advise any possible escalation in alert status.	Director Engineering	Fiona Keneally	As above
				Manager Water & Waste	Gillian Marchant	As above
		NSW Public Works, Dams & Civil Technologies	Review inspection, surveillance & monitoring data. Assess situation and carry out inspection if required. Provide technical advice on remedial measures and additional monitoring requirements. Arrange additional technical advice if required.	Principal Engineer Dam Safety	Dene Jamieson	BH: (02) 9372 7814 AH: 0428 113 272 dene.jamieson@finance.nsw.gov.au

Table 3-10 Action & Communication Directory – Other than flooding / earthquake emergency –Red alert

Magnitude Damage	Alert	Organisation	Action	Responsible Position	Name	Phone / E-mail
Owner advised of Major explosion or other incident at dam **Major visible damage to structure.** Failure probable, imminent or in progress	Red	Tenterfield Shire Council	**1 IMMEDIATELY** inform NSW SEOC of Threat. 2 Advises NSW SES, NSW Public Works, Dams & Civil Technologies of threat.	Director Engineering	Fiona Keneally	BH: (02) 6736 6010 AH: 0438 576 873 f.keneally@tenterfield.nsw.gov.au
				Manager Water & Waste	Gillian Marchant	BH: (02) 6736 6122 AH: 0427 248 273 g.marchant@tenterfield.nsw.gov.au
		NSW SEOC	Advise Tenterfield Shire Council no further risk of more explosions at dam. All clear to carry out inspection.	Duty Officer, SEOC	Duty Officer	1300 677 677 (24 Hrs)
		Tenterfield Shire Council	**IMMEDIATELY** carry out inspection and assess damages. Activate alert and advise as follows: 1 NSW SES SOC or Duty Officer SEOC ifNSW SES is unavailable. 2 NSW Public Works, Dams & Civil Technologies 3 DSNSW Executive Engineer Inform NSW SES, NSW Public Works & DSNSW of damage. Provide the NSW Public Works with regular updates of inspection, surveillance & monitoring data and E-mail photos of structural damage. Monitor structure 24 hrs/day. React to all advice provided by NSW Public Works (Note iii). Provide assistance to NSW SES if requested (Note iv). Advise NSW SES, NSW Public Works and DSNSW any change in alert status.	Director Engineering	Fiona Keneally	As above
				Manager Water & Waste	Gillian Marchant	As above

Magnitude Damage	Alert	Organisation	Action	Responsible Position	Name	Phone / E-mail
		NSW SES	Activate procedures for flood warnings, evacuation etc. as per NSW **SES Flow Charts No. 1.**	OCC	OCC	1300 737 326 (24 hours) nswses.communityplanning@ses.nsw.gov.au
		NSW SEOC if SES unavailable		Duty Officer, SEOC	Duty Officer	1300 677 677 (24 hours)
		NSW Public Works, Dams & Civil Technologies	Review inspection, surveillance & monitoring data. Assess situation and carry out inspection if required. Provide technical advice on remedial measures and additional monitoring requirements. Arrange additional technical advice if required.	Principal Engineer Dam Safety	Dene Jamieson	BH: (02) 9372 7814 AH: 0428 113 272 dene.jamieson@finance.nsw.gov.au
		DSNSW	Inform Chairperson. Liaise with NSW Public Works.	Executive Engineer	Steve Knight	BH: (02) 9842 8070 AH: 0403 681 645 steve.knight@damsafety.nsw.gov.au
			Advise DSNSW Minister.	Chairperson		

Table 3-11 Emergency communications directory

Organisation	Title	Business Address	Contact details	After Hours
Council				
Tenterfield Shire Council	Fiona Keneally Director Engineering	PO Box 214 Tenterfield, NSW, 2372	Ph: (02) 6736 6010 f.keneally@tenterfield.nsw.gov.au	0438 576 873
	Gillian Marchant Manager Water & Waste		Ph: (02) 6736 6122 g.marchant@tenterfield.nsw.gov.au	0427 248 273
	John Edmonds Senior Services Operator		j.edmonds@tenterfield.nsw.gov.au	0411 770 743
Emergency Services				
NSW SES State Headquarters	State Operations Centre	6-8 Regent Street Wollongong NSW 2500	Ph: 1300 737 326 (24 Hours)	
NSW SES Western Zone Headquarters	Mitchell Parker Deputy Zone Commander New England Command	160 Bultje Street Dubbo NSW 2830	Ph: 0458 012 256	
NSW SES Tenterfield Unit Headquarters	Caron Miller Unit Commander	2 Cowper Street Tenterfield NSW 2372	M: 0404 433 935 or 132 500 nswses.communityplanning@ses.nsw.gov.au	
Tenterfield Shire Council	Wes Hoffman Local Emergency Management Officer (LEMO)	PO Box 214 Tenterfield, NSW, 2372	Ph: (02) 6736 6022 w.hoffman@tenterfield.nsw.gov.au	0419 017 963

4 Location Maps/Plans of Tenterfield creek dam

4.1 General

Tenterfield Creek Dam is located on the southern outskirts of Tenterfield town centre approximately 120 kilometres northwest of Grafton, 18 kilometres south of Queensland/NSW border and 545 kilometres north of Sydney. An aerial photograph, showing the surrounding topography and a location map for Tenterfield Creek Dam is located at **Figure 8-1** and **Figure 1-1** respectively.

4.2 Access to Tenterfield creek dam

4.2.1 Access to the Dam Site

The dam site is located approximately 2 kilometres south of Tenterfield and is accessed via a sealed road that turns left off the New England Highway at Clifton Street heading east and turning right into Scrub Road then right into the water treatment plant/dam access track. The access road crosses private property on the left hand side.

Vehicles would normally be left at the water treatment plant where parking and turning of vehicles is possible. All road leading to the dam site (left hand-eastern side) are sealed and in good condition. There is no road to the right hand (western side). The right abutment of the dam can be accessed by foot up the short left bank gravel track. According to Council, access maybe available through private paddock in an emergency.

There are locked gates to the entrance of the dam.

4.2.2 Alternative Access to the Dam Site

The dam site can also be accessible via Saddlers Estate Public Park, located at the southern end of town. When flooding becomes too great and access roads to the dam site are flooded, access to the dam can be via helicopter service. The local air strip is located on the north-western side of town (Sunnyside) and potential sites for landing of helicopters are at Federation Park and Washpool Creek Road.

5 Communication & Warning Systems

5.1 Communications System for Tenterfield creek dam

In accordance with the Australian National Committee on Large Dams Guidelines on Dam Safety Management a reliable communications system for the dam is required both in normal and emergency situations.

All information is transferred between the stakeholders via mobile/landline phone systems and internet connections.

The equipment available for transmitting voice information, surveillance data and photos are listed in **Table 5-1**.

Table 5-1 Communication Equipment

System	Number	Detail	Location/s
Mobile phone (camera)	3	Director of Engineering Services Manager	On person
Digital Cameras	3	Senior Services Operator	On person and site surveillance
Laptops (wireless connection)	2	Director of Engineering Services Manager	
2-Way	1	Sewage Treatment Plant Water Treatment Plant	Located at the Tenterfield Services Department
Landline/s	3	Tenterfield Shire Chambers Water Treatment Plant	Rouse Street
SCADA	1	Tenterfield Shire Chambers	Rouse Street

The linked sites are:

- TSC base station (Tenterfield Council Office, Rouse Street Tenterfield),
- Tenterfield Dam

- NSW SES (Tenterfield Unit Headquarters at Lot 2, Cowper Street, Tenterfield)
- NSW Office of Water (formerly known as DECCW-OW)

5.1.1 Alternative Communication System and Power Sources

Severe flooding could most likely cause significant damage to roads, bridges, power lines and other infrastructure. If power supplies or communications have been interrupted, attempts should be made to repair these or make arrangements for temporary or backup systems, including portable generators, two-way radios, mobile telephones etc. Communications will need to be re-established. Note that the "Communications Log" provided at **Appendix G** should be used to record all communications that occur regarding the emergency.

Tenterfield dam power source is backed by solar power for base station and communications if original power source fails.

5.1.2 Radio Frequency and TV Channels

The dissipation of information on the dam emergency will be carried out as per NSW **SES Flow Chart No.1** (Refer to **Error! Reference source not found.**). Local media outlets shall receive Flood Bulletins from the NSW SES Western Zone Headquarters Public Information Unit. The same media organisations shall receive from this authority other information such as road information for Tenterfield and the nearby area.

5.1.3 Emergency Communications Directory

For contact names and phone numbers refer to **Sheet 3 - Emergency Communications Directory** (see end of Error! Reference source not found.), or **Table I**, **Table II** and **Table III** in Error! Reference source not found. of this document for contacts under alternative emergency circumstances.

A "Communications Log" is included in **Appendix G**. It should be used to record all discussions that take place regarding the emergency. It should include all phone calls; radio and person to person conversations with reference to the current emergency situation. Rule a line to indicate the end of the discussion after every entry.

Note also that after the emergency situation has passed, it should be recorded in the "Operations Log" for the Dam.

5.2 Warning System for Tenterfield creek dam

The Tenterfield Flood Warning system was initially commissioned in June 2000 by Greenspan Technology/Hunter Watertech. The system underwent an upgrade in 2021 through Prospect Group. Initially the system was programmed to monitor variables such as rainfall and dam level continuously. There are alert level criteria set down in the system and when these are reached; they are displayed on the SCADA Master Computer located within the Engineering Department at Tenterfield Shire Administration building. A backup system is located at the Riley Street Works Depot. Responsible staff can access the system by mobile phone link. The conditions for Alert levels are located in Flowchart 1.

5.2.1 Sirens

There are 3 sirens in the CBD which are activated when the Red alert condition develops (i.e. 820 mm above the spillway). They are located at the following sites:

- Douglas Street Bridge
- Shirley Park Sporting Grounds
- Federation Sporting Grounds

5.2.2 Instrumentation and Monitoring

An important factor in the effectiveness of the DSEP is the prompt detection and evaluation of information obtained from instrumentation and/or physical inspection and surveillance procedures. Constant monitoring of the Dam for changes will allow remedial action to be enacted quickly and effectively if changes do occur.

Details of the type of instrumentation/monitoring used at Tenterfield Creek Dam, the locations of these and their normal monitoring frequency are given in **Appendix H**. **Appendix G** provides a "Visual Inspection Report" form that is to be filled in when appropriate during and/or after an emergency. An incident report form too should be filled out in the case of an incident occurring which includes a description of the incident and details of conversation between the reporting Officer and contacted person.

The flood warning system was updated, in 2020 to 2021, installation of hardware, updated telemetry, software (SCADA) as well as provision of control through eagle eye https://eagle.io/ restricted site.

Public information available on council's website at https://public.dataonline.io/public/dash/ls80s09iw46zr9l allows for instantaneous real time viewing of flood and emergency level indicators. Provision of data links and examples of webpages figures 5-1 & 5-2.

Figure 5-1 Restricted Flood warning system data

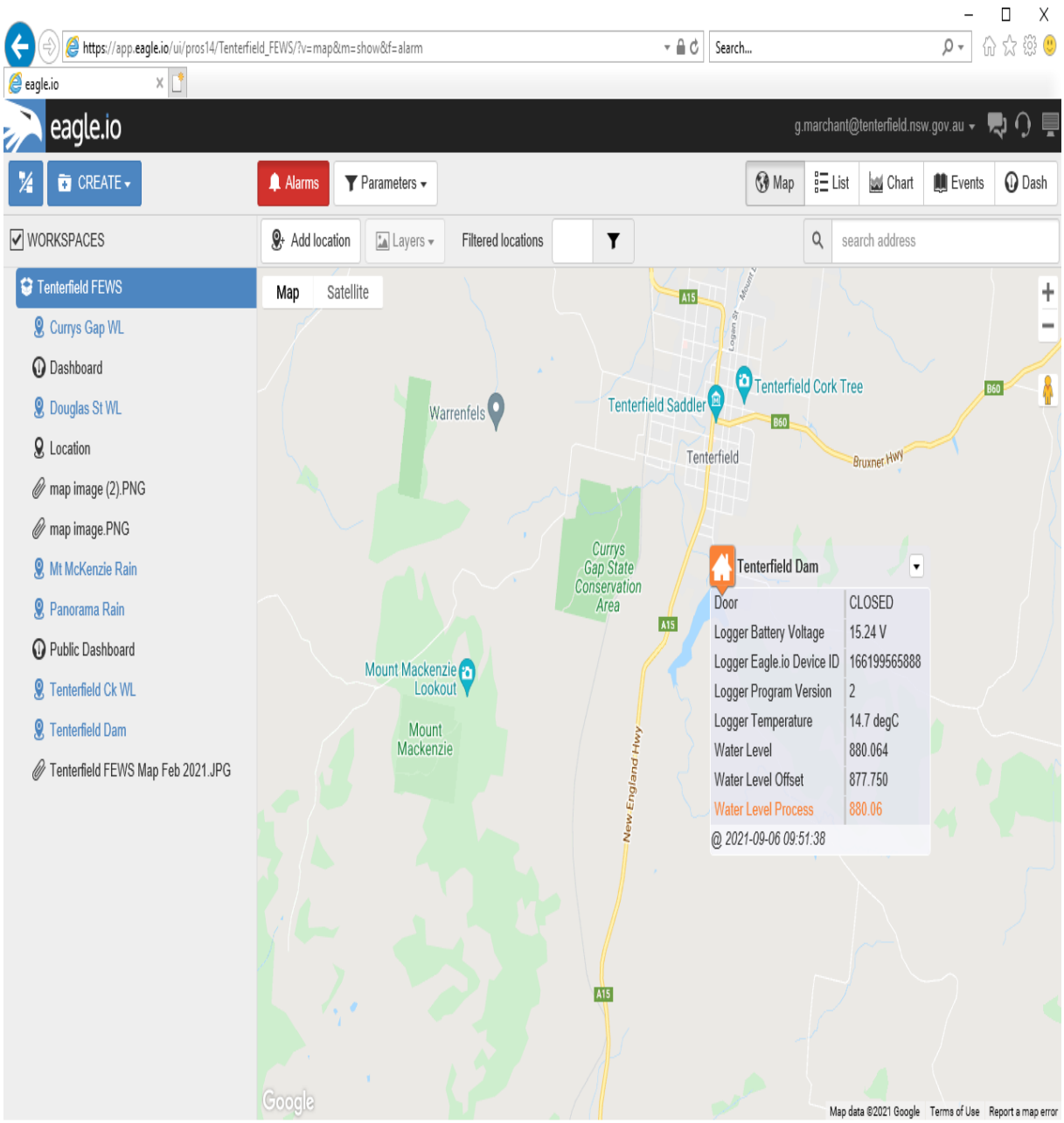
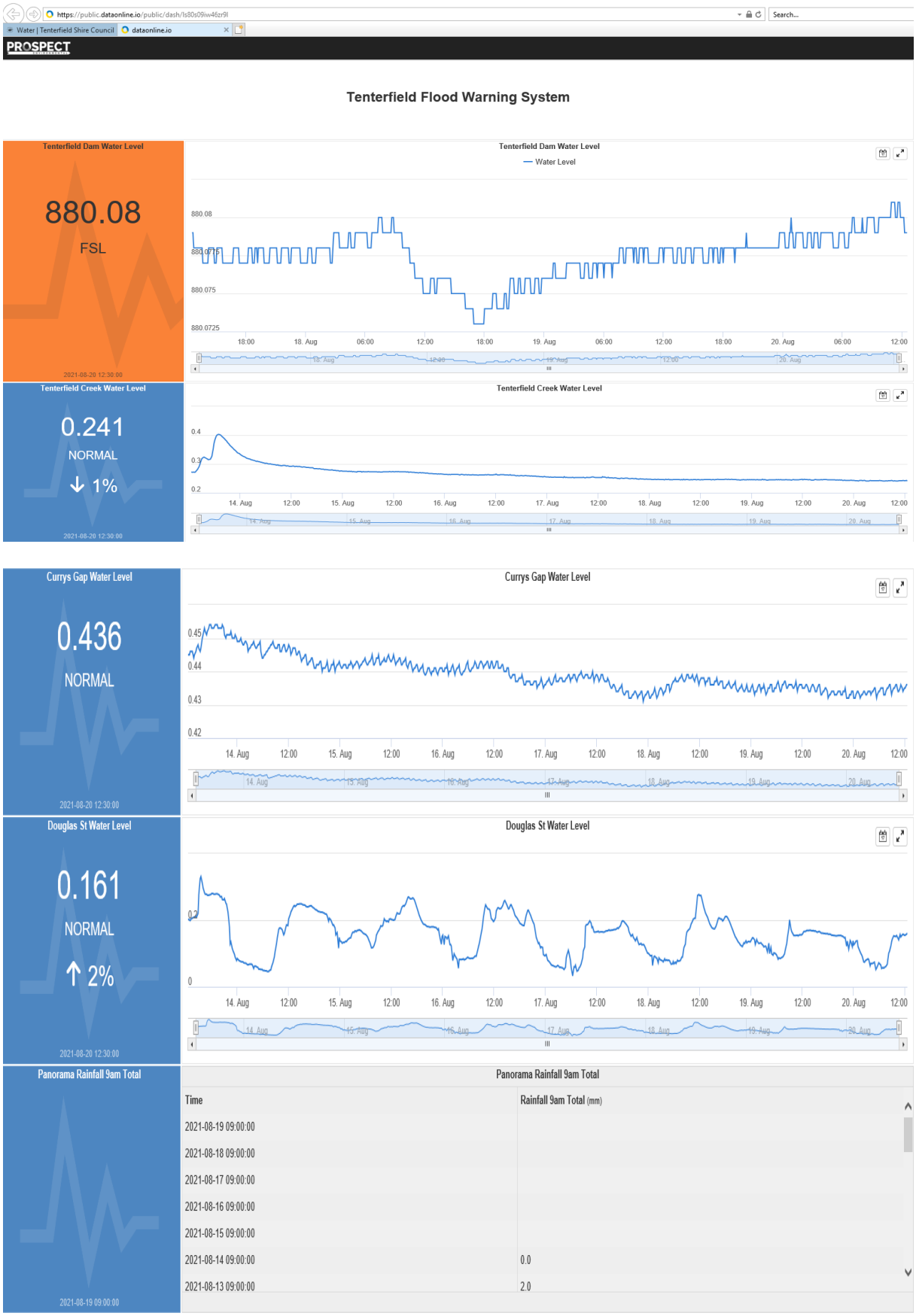
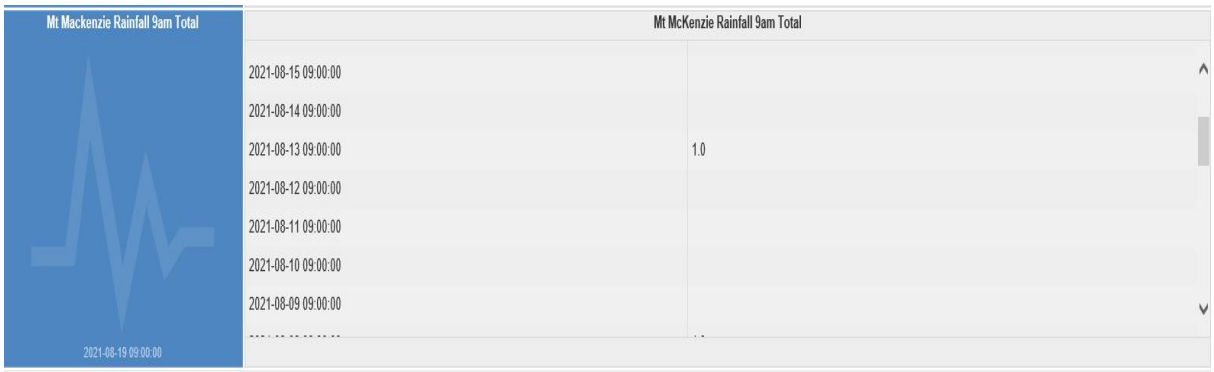
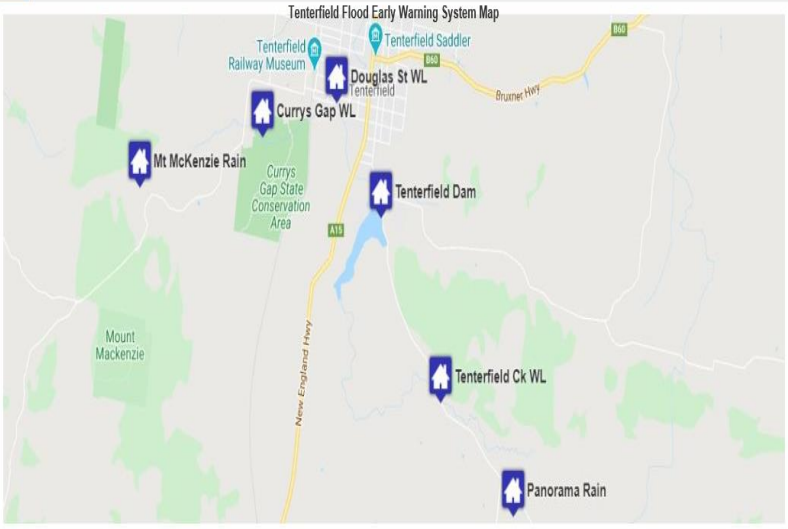


Figure 5-2 Public available Flood warning system data







5.2.3 Stream Gauging Stations

Stream gauging stations are located in the Tenterfield Creek Dam area. These provide valuable information on the catchment yield and response rate and more accurate estimation of flood magnitude. They are of benefit to any future flood warning system. Refer to **Appendix L** for information on the location of these stream gauging stations.

6 Emergency Manpower Requirements

6.1 General

This section details the labour force requirements during an emergency situation at Tenterfield Creek Dam for:

- Operating the Base Station;
- Inspection of Tenterfield Creek Dam;
- Collection of surveillance and monitoring data for Tenterfield Creek Dam.

6.2 Emergency Situation Manpower Resources

Duty rosters to cover the manpower requirements for manning the base station, inspecting the dam and collecting surveillance and monitoring data during a 'round the clock' emergency operation are required during an emergency situation. Refer to **Table 6-1** for this Schedule.

If there are insufficient operational Council personnel to cover the manpower requirements for a 'round the clock' duty roster, a secondment of personnel should be appointed by Council. The seconded personnel appointed, is require to have suitable prior training.

Table 6-1 DSEP DUTY ROSTER

Council Personnel	Time	Duty
Chief Operating Officer Manager Water & Waste	Rostered as necessary	Manning Base Station
Senior Operators (if possible)	Rostered as necessary	Inspecting the dam and collecting surveillance and monitoring data
Dam Operators (if possible)		Carrying out emergency communications to relevant authorities.

6.3 Emergency Supplies and Resources

Appendix F contains a recommended list containing the type and quantity of materials that should be stored at the dam site and the suppliers from which they may be obtained. Furthermore, the location of plant/equipment during an emergency condition is specified in this Appendix.

7 Organisational Responsibilities

Emergency Management of Tenterfield Creek Dam is conducted in accordance with **Charts 1**, **2**, **3** and NSW **SES Flow Chart No.1** (See **Error! Reference source not found.**).

When the NSW Public Works is notified of an unsafe or potential emergency condition at the dam, they will assess the situation, and if convinced that a dam failure is imminent, will confirm that opinion to Technical Services Director.

The NSW SES and NSW SEOC, when notified of an imminent dam failure will initiate appropriate emergency action in accordance with the Tenterfield Shire Council, Local Emergency Management Plan, to safeguard persons in downstream areas.

NSW Public Works will monitor the situation until the danger is over and will notify their assessment to, or issue advice to the Technical Services Director, on measures to ameliorate the situation.

The DSNSW requires all incidents to be reported via an incident form Incident Reporting Form (office.com) The purpose of this form is to enable dam owners to provide a written report of an incident to Dams Safety NSW as per Clause 19 of the Dams Safety Regulation 2019. The incident types which are listed in the form below under (a) through (f) also require an oral report as soon as possible after the incident. If this applies to your incident and you have not made an oral report in relation to the incident, please call 0403 681 645.

The responsibilities of persons and organisations involved with this emergency management are detailed further in Error! Reference source not found..

8 Drought Response Strategy

The response strategy consists of implementing appropriate actions to control, contain or minimise the impacts of droughts. The implementation of the DMP including identifying and reviewing situations, overseeing the implementation of supply and demand actions, approving media releases and reviewing operations will be the responsibility of the Drought Management Team.

The following sections describe the response strategy during drought incidents, with the focus on the township of Tenterfield, for information on the other villages please see entire Drought Management Plan [Drought Management Plan | Tenterfield Shire Council (nsw.gov.au)]

8.1 Drought Strategy Activation Plan

8.1.1 Overview

The drought response strategy will be activated in an event when the water supply is affected due to natural climate conditions.

The main scenario that would activate a drought management response, including the introduction of supply restrictions, is water scarcity. Scarcity is defined in Table 8-1.

8.1.2 Drought Triggers

Triggers are situation that will activate the response strategy plan. The triggers are based on progressive reductions in water availability. The triggers from implementing drought restrictions are provided in Table 8-1.

These triggers initiate demand-side actions which are expected to reduce the demand to a target daily demand (refer to Table 8-3). If the demand reduction is not achieved by the introductions of the restrictions for each level, the next level should be applied.

Table 8-1 lists water supply system drought trigger levels. The Relax column indicates the mark where the level can be relaxed and the status changed to a lower level.

Table 8-1 Proposed Water Restrictions Triggers

Level	Trigger		Relax	
	Storage Condition	Other	Storage Condition	Other
Permanent water conservation	>70% Dam: <1m below spillway Weir: <0.45m below weir	• Seasonal conditions (hot, cold, holiday periods) • Climatic trend (e.g. low rainfall over a period)	N/A	
Level 1 Low	70% Dam: 1.0m below spillway Weir: 0.45m below weir	• Authoritative advice on an adverse climatic forecast • Critical loss of pumping capacity • Water source deterioration in capacity. The supply will last 9 months. • Reduction in water allocation by regulatory authority.	75% Dam: 0.76m below spillway Weir: 0.8m below weir	• Supply is not restricted • Storage is 12 months or more

Level	Trigger		Relax	
	Storage Condition	Other	Storage Condition	Other
Level 2 Moderate	60% Dam: 1.3m below spillway Weir: 0.6m below weir	• System failure affecting the ability to supply. • Demand exceeding capacity of the system to supply. • Water source deterioration in capacity. The supply will last 6 months. • Rainwater dependent communities without water. • Consumption target of previous level not achieved for 1 week.	65% Dam: 1.1m below spillway Weir: 0.52 below weir	• System is operational. • Storage is 9 months or more
Level 3 High	50% Dam: 1.7m below spillway Weir: 0.75m below weir	• Widespread contamination of water source or supply. • Water source deterioration in capacity. The supply will last 5 months. • Consumption target of previous level not achieved for 1 week.	55% Dam: 1.5m below spillway Weir: 0.67m below weir	• Source water is within WWTP raw water parameters • Storage is 6 months or more

Level	Trigger		Relax	
	Storage Condition	Other	Storage Condition	Other
Level 4 Very High	40% Dam: 2.2m below spillway Weir: 0.9m below weir	• Water source deterioration in capacity. The supply will last 3 months. • Consumption target of previous level not achieved for 1 week.	45% Dam: 1.9m below spillway Weir: 0.82m below weir	• Source water is back to normal • Storage is 5 months or more
Level 5 Emergency	15% Dam: 3.9m below spillway Weir: 1.25m below weir	• Water source deterioration in capacity. The supply will last 2 months. • Consumption target of previous level not achieved for 1 week.	35% Dam: 2.3m below spillway Weir: 0.97m below weir	Storage is 3 months or more

8.2 Drought Management Team Roles and Responsibilities

8.2.1 Activation and Setting Restriction Levels

Council's Chief Executive (CE) in consultation with the Mayor, can proclaim this drought management plan to be in force once the CE determines that Trigger has been reached.

The Chief Executive with the Mayor have the authority to change the restriction levels on the advice from the Drought Management Team.

8.2.2 Drought Management Team

The CE will appoint the drought management team (DMT). The roles and responsibilities are outlined in Table 8-2.

Table 8-2 DMT Roles and Preliminary Responsibilities

Role	Position in Council	Responsibilities
Chair	Levels 1-2: Water & Waste Manager Level 3-4: Director Infrastructure Level 5: Chief Executive	• Coordinate the activities of the team • Communication with Council • Communicate with Government agencies – high level • Provide media interviews, if required
Incident Manager	Level 1-2: Projects Engineer (Water) Levels 3 and above: Water & Waste Manager	• Monitor and assess data • Provide an assessment of the situation. • Brief the DMT Chair and Council • Allocated roles to team members, including stand-ins • Prioritise tasks and develop response actions • Ensure adequate facilities and resources – both specialist and support • Communicate with stakeholders, neighbouring LWUs, Government agencies and major customers – action level • Hold regular team meetings • Monitor the use of actions and their effectiveness • Monitor team member performance and action if required • Determine completion of the response phase and commence recovery • Post include – coordinate review of incident and update DMP

Role	Position in Council	Responsibilities
Communication Manager	All levels: Incident Manager	• Support the DMT Chair with communication • Prepare communication material as appropriate • Issue media statements • Maintain media databased including social networks
Administrative Support	Water & Waste Admin	• Record keeping • Prepare progress reports as required for distribution to DMT members • Provide administrative support, answer telephones, email first review and general office duties • Attend and minute meetings

8.3 Demand-Side Action Plan

8.3.1 Water Restrictions

Water restrictions aim to reduce water demand by customers through regulating the type and duration of water-using activities. If not specifically mentioned otherwise, the restrictions of each level apply to all the higher levels. For example, if fixed hoses are prohibited for Level 2, fixed hoses are also prohibited for all the higher levels.

The restrictions are shown in Table 8-3 and apply to any consumer accessing Tenterfield Shire Council's potable water supply.

It should be noted that Jennings sources their water from Southern Downs Regional Council (SDRC), and restrictions from SDRC will apply to this township. Refer to 0 for details.

0 provides the water exemption form and 0 provides the water carters registration form.

8.3.2 Demand Targets

Level 1 (Low)

This restriction strategy will aim to reduce normal average daily household consumption by 10% to a target level of 280L per person per day (L/P/d).

Businesses are not being strongly targeted at this level, but are encouraged to reduce consumption.

Level 2 (Moderate)

The second level of restrictions will aim to reduce normal average daily household consumption by 10-20% to a level of 280-250L per person per day. An increase in the advertising campaign for a reduction in water usage will be implemented.

Businesses are encouraged to review their water consumption and use tools such as the Water wise checklist to identify areas where they may be able to save water. The checklist can be found in 0.

Level 3 (High)

The third level of restrictions will aim to reduce normal average daily household consumption by 20-30% to a level of 250-220L per person per day.

During this stage, policing is implemented with the increased monitoring of water usage throughout the community. Households and businesses with excess consumption levels will receive warning letters informing them of the possible fines that may be incurred if consumption within the dwelling or business is not decreased. During this stage, alternate water sources, such as the Tenterfield bore field, will be investigated and plans for implementation developed.

Businesses are encouraged to try to reduce water use. They are encouraged to discuss with Council if they are having issues reducing water consumption.

Level 4 (Severe)

The fourth level of restrictions will aim to reduce normal average daily household consumption by 30-40% to a level of 220-190L per person per day.

Plans for implementing alternate water sources will be finalised.

Level 5 (Emergency)

Level five restrictions will aim to reduce normal average daily household consumption by 50% to a target level of 190-160 litres per person per day (L/P/d). During this stage all non-essential water related activities are banned. Alternative water supply plans including the carting of water to the supply system, intermittent closing of the reticulation system, etc. may be implemented.

8.3.3 Demand Side Activities

In combination with water restrictions, Council will also undertake the following activities to assist in managing the demand on the water supply:

- Public education, information and awareness campaigns;
- Provide information on storage levels and water use;
- Provide tools and resources to assist people in managing their water use and adhering to restrictions;
- Implement Emergency Procedures: Provision for fire-fighting; and
- Intermittent closing of the reticulation system.

Table 8-3 Water Restrictions Table

Type of Consumer	Permanent water conservation	Level 1 Restrictions	Level 2 Restrictions	Level 3 Restrictions	Level 4 Restrictions	Level 5 Restrictions
Target reduction		10% reduction	10-20% reduction	20-30% reduction	30-40% reduction	40-50% reduction
Domestic						
Fixed hoses / sprinklers	No unattended hoses. No watering between the hours of 9am and 4pm. Vehicles should only be washed on grassed or permeable surfaces. Washing of hard surfaces with hand held hose is not permitted at any time.	Maximum 15 minutes per day between 4:00pm and 9:00am	Maximum 15 minutes per day between 4:00pm and 9:00am	Not permitted. Bucket watering permitted.	All external use of potable water is banned. Grey water use only	All external use of potable water is banned. Grey water use only
Micro sprays / drippers / subsurface						
Hand held hoses		Maximum 1 hour per day between 4:00pm and 9:00am. One hose per property.	Maximum ½ hour per day between 4:00pm and 9:00am. One hose per property.	Maximum 10 minutes per day between 4:00pm and 9:00am. One hose per property.		
Swimming Pools and Spas		Filling permitted – no unattended hoses	Filling of new or existing pools is banned. Topping up of pools is allowed by handheld hose 1hr/day outside of the hours of 8am and 4pm	Filling of new or existing pools is banned. Topping up of pools is allowed by handheld hose 1hr/day outside of the hours of 8am and 4pm	Filling of new or existing pools is banned. Topping up of existing pools to 300mm below skimmer box by one hand held only, 1hr/week on Wednesdays.	Filling and topping up of pools banned.
Car Washing		No restrictions – no unattended hoses	Buckets only	Buckets only	Cleaning of windows, windscreens, lights and mirrors with buckets.	Cleaning of windows, windscreens, lights and mirrors with grey water.
Washing Hard Surfaces					Banned	Banned
Business / Commercial Premises etc.						
Public gardens, sports grounds & community facilities	No unattended hoses. No watering between the hours of 9am and 4pm.	As per residential restrictions. Exception: sprinklers or micro sprays may be used up to 2hrs/ day for essential businesses (e.g. nurseries) or	As per residential restrictions. Exception: sprinkler may be used up to 2hrs/day for essential businesses (e.g.	Hand held hoses allowed for 1 hour per day outside the hours of 8am and 4pm	Buckets or watering cans only	Use of town water is banned

Type of Consumer	Permanent water conservation	Level 1 Restrictions	Level 2 Restrictions	Level 3 Restrictions	Level 4 Restrictions	Level 5 Restrictions
Nurseries		where business hours dictate water use, e.g. schools	nurseries) or where business hours dictate water use, e.g. schools	Sprinklers and hand held hoses allowed for 2hrs/day. Application for times.	Sprinklers/hand held hoses 1hr/day – application for times.	Use of town water is banned
Bowling Greens				Hand held hoses allowed for 1 hour per day outside the hours of 8am and 4pm	Buckets or watering cans only	Use of town water is banned
New turf / landscaping	Newly laid turf may be watered with water conserving equipment for a period of up to six (6) weeks from the installation of the turf.			Water in – then hand held hoses 1 hour per day outside hours of 8am and 4pm		Use of town water is banned
Public pools	No unattended hoses between the hours of 9am and 4pm	Filling permitted – no unattended hoses	Filling of pools is banned. Topping up of pools is allowed by handheld hose 1hr/day outside of the hours of 8am and 4pm	Topping up allowed	Topping up with alternative water supply permitted. Town water use not permitted.	Topping up with alternative water supply permitted. Town water use not permitted.
Washing motor vehicles[1] – cars, taxies, food transport, commercial etc.		No restrictions – no unattended hoses	Buckets only on grassed areas. Exemption may be granted if proof of water efficient devices provided	Buckets only on grassed areas. Exemption may be granted if proof of water efficient devices provided	Buckets only on grassed areas. Exemption may be granted if proof of water efficient devices provided	Use of town water is banned
Building construction			No restrictions – no unattended hoses	No restriction on essential business use	Restricted to essential business use.	Use of town water is banned
Paved public areas; where food is prepared or consumed or for health reasons				Hand held hoses 1hr/day – eating / preparation areas for health reasons only	Buckets or watering cans – eating / preparation areas for health reasons only	Buckets or watering cans – eating / preparation areas for health reasons only

Type of Consumer	Permanent water conservation	Level 1 Restrictions	Level 2 Restrictions	Level 3 Restrictions	Level 4 Restrictions	Level 5 Restrictions
Water cartage – potable supply				Filling of domestic tanks only – private carriers must be registered.	Council approved private water carters only	Use of town water is banned
Auto flush urinals / public toilets				On timers – banned On Demand - ok	On timers – banned On Demand - ok	On timers – banned On Demand – ok Public toilets closed
Industrial						
Ready mix concrete & other industrial operations	No unattended hoses between the hours of 9am and 4pm	No restriction on water usage for essential business activities	No restriction on water usage for essential business activities	Restricted to 8 hours / day operations	Council Approved	Use of town water is banned
Rural						
Stock watering	No restriction	No restriction	Council Approved	Council Approved	Council Approved	Use of town water is banned
[1]Emergency vehicles are exempt, but are encouraged to be water wise						

8.4 Supply-Side Action Plan

When drought occurs, actions must be taken to mitigate the effects of water shortage and to ensure that a reliable water supply is available to meet the health and safety needs of the community. Supply-side actions are actions taken by Council aimed to supporting the restrictions as well as preparing for worsening situations.

8.4.1 Staged Action-Plan

Drought management supply-side actions should be implemented while the community, guided by Council, takes action to reduce water demand using water restrictions. The supply actions are proposed to be implemented within a timeframe so that water supply is sufficient to sustain the estimated water demand at the particular water restriction level. The supply-side actions are actions that Council will undertake to continually supply water to its customers during drought. Alternative water supply options are described in Section 10.2.2.

Table 8-4 lays out how supply actions are implemented as restriction levels are increased.

Table 8-4 Staged Drought Supply-Side Actions

Level	Supply Side Activity
Permanent	• Investigate the availability of additional water allocations • Increase the effectiveness of extraction of water at existing locations
Level 1 Low	• Investigate use of treated effluent to replace drinking water for external watering of Council assets, sporting fields etc. • Commence procedure to acquire allocations

Level 2
Moderate
	• Negotiate access to water with owners of alternative water sources
	• Investigate water delivery by pipeline(s) from alternative sources within and outside the service area
	• Investigate groundwater sources including water quality testing (Urbenville)
	• Design and prioritise engineering projects:
	  ○ Pipelines
	  ○ Bores
	  ○ Recycled water systems

Level 3 High	Construction of long lead time projects

Level 4 Very High	Construction of short lead time projects
Level 5 Extreme	Water carting

8.4.2 Water Carting

In the event of Tenterfield water supply needing a supplement water source to be carted into the reservoir the use of an appropriately ample water supply would be commissioned. With a normal period usage of 1.2 ML/day from the system with a stage five restriction target of 50% reduction of daily volumes this will see a new daily needed volume of 0.6 ML/day. This would be possible from the carting of thirty (30) 20,000L water tankers/day. There may be a need for an additional load of water to be transported intermittently to cope with any over usage by the community.

In the event that water storages are depleted to the point where water needs to be imported from other water supplies, the use of Lismore's water supply (Rous County Council) would be most likely to be commissioned for the UMMWWS. Within a normal/daily water demand of 0.7 ML/day and a level 5 restriction target of a 50% reduction of daily use this will see a system demand of 0.35 ML/day. Twenty (20) tanker loads of 20,000L per day would suffice the demand requirements for the system.

Water carting requirements for the Jennings water supply would be mostly conducted by Southern Downs Regional Council. Depending on the drought situation, water would either come from Warwick or further afield. Council would work with Southern Downs Regional Council to ensure adequate supply.

Cost of carting

The 2019/2020 charge for bulk water from Rous County Council is $5.75/KL. Water cartage is estimated at $7.40/km, based on figures from 2019/2020.

Therefore, the cost of water and cartage for 1 month would equate to:

- $1,091,160.00 for Tenterfield; and
- $561,680.00 for Urbenville.

8.5 Monitoring During Drought

The following monitoring will be carried out during drought. Some of the items below are recorded on a regular basis as part of the water business requirements:

- Daily water demand
- Daily supply from each source (including non-drinking water)
- Daily monitoring of water sources
- Daily temperature and rainfall
- Impact of restrictions on water consumption
- Comprehensive testing of water quality from any emergency water supply, such as new bores, before commencing supply. Assistance is available from NSW Health.
- Ongoing water source quality:
    - Electrical conductivity (monthly)
    - Total dissolved solids (monthly)
    - pH (daily)
    - Alkalinity (monthly)
    - Algae levels (daily)
    - Taste and odour (on complaint)
    - Chemical analysis (monthly)
    - Microbial analysis (monthly)

A chart showing the daily demand, restriction level, temperature and rainfall is to be prepared and updates at least fortnightly.

Monitoring is intended to provide effective management of the incident. Some or all of the data may be used as part of the communication campaign. Council will continue to present the water health card for Tenterfield and Urbenville.

8.6 Communications Strategy

8.6.1 Community

Purpose

The purpose of the communication strategy is to:

- Communicate the restriction levels and expected behaviour
- Provide general information to the community and enlist its support and understanding to the actions undertaken by Council.

Channels

Some of the communication channels that may be used:

- Advertisements on radio and newspapers
- Press releases
- Information in newsletters and Councils website
- Presentation to community groups
- Signs in key locations and major roadways

- Place copies of the restriction notice and posters on community noticeboards around town and in the Cinema
- School visits to explain the restrictions to children
- Letterbox drop / mail-out of the notice and information brochure to go to all residents and businesses. This is particularly important for Urbenville.
- Rangers carrying additional brochures to be passed out where they initially warn residents
- Announcement by high profile persons (e.g. Mayor)
- Work with accommodation providers to develop a program to make hotel and motel guests aware of the restrictions in place
- Online question and answer sessions
- Presentation at community forums / drop-in sessions
- Presentation at business breakfast
- Information stalls at local markets
- Use of Council's Facebook page, if obtained in the future

Messages

Examples of messaging for posters is shown in 0. The information included in the posters is what level water restriction is current, the start date of the restrictions, a summary of the key restrictions, contact details of registered water carters and where to get more information.

Comments from the community about the drought messaging indicated that people are interested in more information, particularly about dam levels, estimates of length of time remaining in the storage and actions Council are taking to secure supply. This messaging needs to come from Council, and not be found through newspapers or other forums. During the 2018 drought, the community often heard news, often alarming, from newspapers or on television, which caused additional and unnecessary angst. Council needs to ensure that messaging is getting out to the community in a timely manner and in easy to understand language. If the message isn't getting across, i.e. through reduced water consumption, then alternative messaging or forums (such as letterbox drop) may need to be considered.

It is proposed to have a dedicated drought page on the Tenterfield Shire Council's website during drought times, with a range of information, including current water supply capacities, restriction levels and water saving tips.

Contact List

Different types of information are required for different media channels. Information such as water restrictions and water saving tips should be shared with the local media – the contacts are listed in Table 8-5.

Local community groups may also be able to assist with the distribution of this information.

Table 8-6 provides the relevant contact details. Details are provided for both areas connected to Council's potable water supply and those who are not. Both are provided as during severe drought, those who usually rely on their own water sources may need to access Council's potable water supply.

Council may also decide to share new stories about what is happening in our area with the region. The contact details of the regional media outlets are listed in Table 8-7.

Table 8-5 Local Media Contact List

Organisation	Contact Details
2 Ten FM	info@tenfm.org.au
Tenterfield Star	tenterfieldstar@austcommunitymedia.com.au
Tenterfield in Touch	news@tenterfield.nsw.gov.au
Drake Village Voice	editordvv@gmail.com
Rebel FM	admin@rebelfm.com.au
Stanthorpe Border Post	editor@borderpost.com.au
Southern Free Times	newsdesk@freetimes.com.au
Northern Star	news@northernstar.com.au
Warwick Daily News	editor@warwickdailynews.com.au

Table 8-6 Local Community Groups Contact List

Community Group	Contact Person	Contact Details
Areas connected to the potable water network		
Urbenville Progress Association	Sharyn Russ	02) 6634 1440 or 0428 666 398 secretaryofupa@gmail.com
Tenterfield Chamber of Tourism Industry Business	Mr Vince Sherry	tctib@outlook.com

Community Group	Contact Person	Contact Details
Wallangarra/Jennings Progress Association	Mrs Liz Mikkelson (President)	lizmikkelson@yahoo.com.au
Woodenbong Progress Association	Mrs Christine Reid (President)	reidsonthecreek@hotmail.com
Areas connected to private water sources		
Bolivia Progress Association	Mrs Fay McCowen	bolivia1@bigpond.com
Drake School of Arts & Progress Association	Roger Turner (President)	ezwood3@bigpond.com
Drake Hall Committee	Mr Ray Woodward	ezwood3@bigpond.com
Legume Progress Association	Mrs Val Flint (Secretary)	lambgc135@gmail.com
Legume Hall Committee	Mrs Val Flint	07) 4666 4161
Liston Hall Committee Inc	Laura Simpson (Secretary)	liston.hall@gmail.com
Liston & District Progress Association	Trish Crome (Secretary)	tandtcrome@activ8.net.au
Mingoola Hall Committee	Christine Dennis	0419 441 422
Mingoola Progress Association	Mr Simon Capper (Secretary)	capper.simon@gmail.com
Sunnyside Hall Committee	Mrs Emily Smith	0432 791 754 kyarnee2@gmail.com
Steinbrook Progress Association	Marisa Lyons (Secretary)	steinbrookhall@gmail.com
Torrington Memorial Hall Fund Inc	Jan Styles (President)	torringtonhall@gmail.com

Table 8-7 Regional Media Contact List

Organisation	Contact Details
ABC North Coast	news.lismore@abc.net.au

Organisation	Contact Details
ABC Radio Tamworth	nenw@your.abc.net.au
Glen Innes Examiner	laurie.bullock@fairfaxmedia.com.au
Janelle Saffin MP	Lismore@parliament.nsw.gov.au
The Hon Barnaby Joyce MP	barnaby.joyce.mp@aph.gov.au
NBN TV Tamworth	tamnews@nbntv.com.au
Northern Daily Leader	mail.ndl@fairfaxmedia.com.au
Northern Star	news@northernstar.com.au
Prime 7 Tamworth	Tamworth.news@prime7.com.au
Ten Network Tamworth	enquire@mcn.com.au

8.6.2 Agencies

Purpose

The separate communication strategy is required for regulators, other government agencies, water managers and neighbouring Councils in order to:

- Share resources for managing the drought
- Apply for regulatory and financial support as required
- Obtain access to alternative water sources.

A list of relevant contacts are provided in Table 8-8.

Table 8-8 Agencies Contact List

Organisation	Name	Phone	Email
DPIE	Mark Watson	0409 114 384	mark.watson@dpi.nsw.gov.au
EPA	Daniel Stokes	0499 000 729	daniel.stokes@epa.nsw.gov.au
NSW Health	Glenn Pearce	0429 100 391	glenn.pearce@health.nsw.gov.au
Kyogle Council	Tony Lickiss	02) 6632 1611	Tony.Lickiss@kyogle.nsw.gov.au

Organisation	Name	Phone	Email
Southern Downs Regional Council	Jill Yeaman	0439 394 464	Jill.Yeaman@sdrc.qld.gov.au
Glen Innes Severn Council	Keith Appleby	0408 144 251	kappleby@gisc.nsw.gov.au
Rural Support Service	Jodie Magner	0429 995 189	jodie.magner@dpi.nsw.gov.au
Hunter New England Local Health Unit	Kelly Foran	0402 292 005	Kelly.Foran@health.nsw.gov.au
Critical Customers - Tenterfield			
Tenterfield Hospital	Tony Roberts	02) 6739 5200	
Haddington Nursing Home	Fiona Murphy	02) 6736 4713	ceo@tenterfieldcarecentre.org.au
Millrace Hostel			
Tenterfield Preschool	Chloe Daly	02 6736 1616	admin@tenterfieldpreschool.com.au
Tenterfield Childcare Centre	Carly Fitzgerald	02) 6736 1387	director.tentccc@outlook.com
Sir Henry Parkes Memorial Primary School	Anna Starcevic	02) 6736 1401	sirhparkes-p.school@det.nsw.edu.au
St Joseph Primary School	Cherie Yates	02) 6736 1786	tenadmin@arm.catholic.edu.au
Tenterfield High School	Stephanie Scott	02) 6736 1200	tenterfiel-h.school@det.nsw.edu.au
TAFE			

Organisation	Name	Phone	Email
Tenterfield Fire and Rescue	John Gray	02) 6736 3835	
Tenterfield NSW RFS	Chris Walbridge	0428 657 647	northern.tablelands@rfs.nsw.gov.au
Critical Customers - Urbenville			
Urbenville Hospital	Dr Katherine Willis-Sullivan	02) 6620 2353	
Urbenville Public School	Christopher Sifko	02) 6634 1333	urbenville-p.school@det.nsw.edu.au
Urbenville NSW RFS			urbenvillerfs@gmail.com
Woodenbong Central School	Greg Wilson	02) 6635 1281 0429 684 212	woodenbong-c.school@det.nsw.edu.au
Woodenbong NSW RFS	Greg Gulliver	0476 152 252	
Critical Customers - Jennings			
Jennings Public School	Shannon Booby	07) 4684 3273	jennings-p.school@det.nsw.edu.au

9 Drought Recovery Strategy

The recovery process will commence at the end of the response operations. The end of the drought should start with the Chief Executive revoking drought conditions. The DMT will cease operation, but members will still be available to assist the Recovery Coordinator, mainly debriefing and assessing the response.

A Recovery Coordinator will be appointed by the DMT to oversee the recovery process. The Recovery Coordinator will be responsible for:

- Preparing a response report and recommending actions based on the experience. The report will be submitted to the Chief Executive within 4 weeks of revoking the drought condition and to Council within 8 weeks. Once endorsed by

Council, the report will become the main component of the preparedness stage.

- Assessing the remaining drought impact and determining the appropriate personnel to coordinate the recovery activities. This will be based on the drought recovery survey described below.

A drought recovery survey will be developed to evaluate the recovery process needed to restore the physical infrastructure and the restoration of emotional, social, economic and physical wellbeing. The drought recovery survey will assess the following criteria in order to determine the recovery actions required:

- **Ownership:** Determine the ownership of private or public asset and the source of assistance that might be available
- **Severity of impact:** Develop a scale to determine the severity of social, economic and financial impact to be based upon
- **Time to recover:** evaluate a timeframe required to recover from the drought
- **Cost of impacts:** the financial loss due to the drought impact
- **Resources required:** resources (financial and others) required to complete the recovery process.

With the outcomes of the drought recovery survey, Council will be able to seek the appropriate resources to address the recovery needs. The recovery process will involve restoring the community to the point where normal social and economic activities may resume.

Council will not compensate private customers for costs or financial losses caused by the drought. Council, along with other agencies, will assist customers and coordinate activities associated with seeking compensation from other sources such as government and insurance companies.

When the drought period is considered over and the conditions return to normal, the following actions are to be considered:

- Reviewing the Drought Management Plan and actions in the light of experience
- Insurance compensation
- Government assistance
- Liaise with tax office to provide tax relief (reduction or delay of payment deadlines)
- Develop rehabilitation/recover programs based on the drought recovery survey
- Ensure fire control programs are in place
- Assist the community in resolving conflicts.

10 Tenterfield Water Supply Scheme

10.1 Existing Water Supply Scheme

The Tenterfield water supply consists of the Tenterfield Dam (Figure 10-1) with a water treatment facility located adjacent to the dam wall. The water is treated via chemical coagulation and sedimentation, with a deep bed filtration system. It is then sterilised using UV and a chlorine residual. The filtered water is then pumped to the reticulation system with one water storage reservoir located at each end of the town on hills. The dam has a capacity of 1,300 ML[1] with an average daily demand of 1.2 ML/day supplied to the community. Figure 10-2 shows the revised water depth–storage curve for Tenterfield Dam. Further information on the Tenterfield Dam capacity can be found in 0. Bulk water can be purchased through an automatic filling station that was installed in August 2018.

The town water system is also supplemented with a series of bores. The original bores were installed in 1994 with a production bore at Shirley Park and a livestock bore at Apex Park. During the 2018 drought, seven new bores were installed as production bores, which will feed through a pre-treatment before entering the treatment plant. A map of the bore network is shown in Figure 10-3.

Figure 10-4 shows a schematic of how the Tenterfield water supply system operates. Apex Park bore is not included on this diagram, as it provides non-potable water only, which is available through an isolated system.

[1] The capacity of the dam was assessed in February 2020 with bathymetric and sediment survey's undertaken of the dam by Water Modelling Solutions.

Figure 10-1 Tenterfield Creek Dam

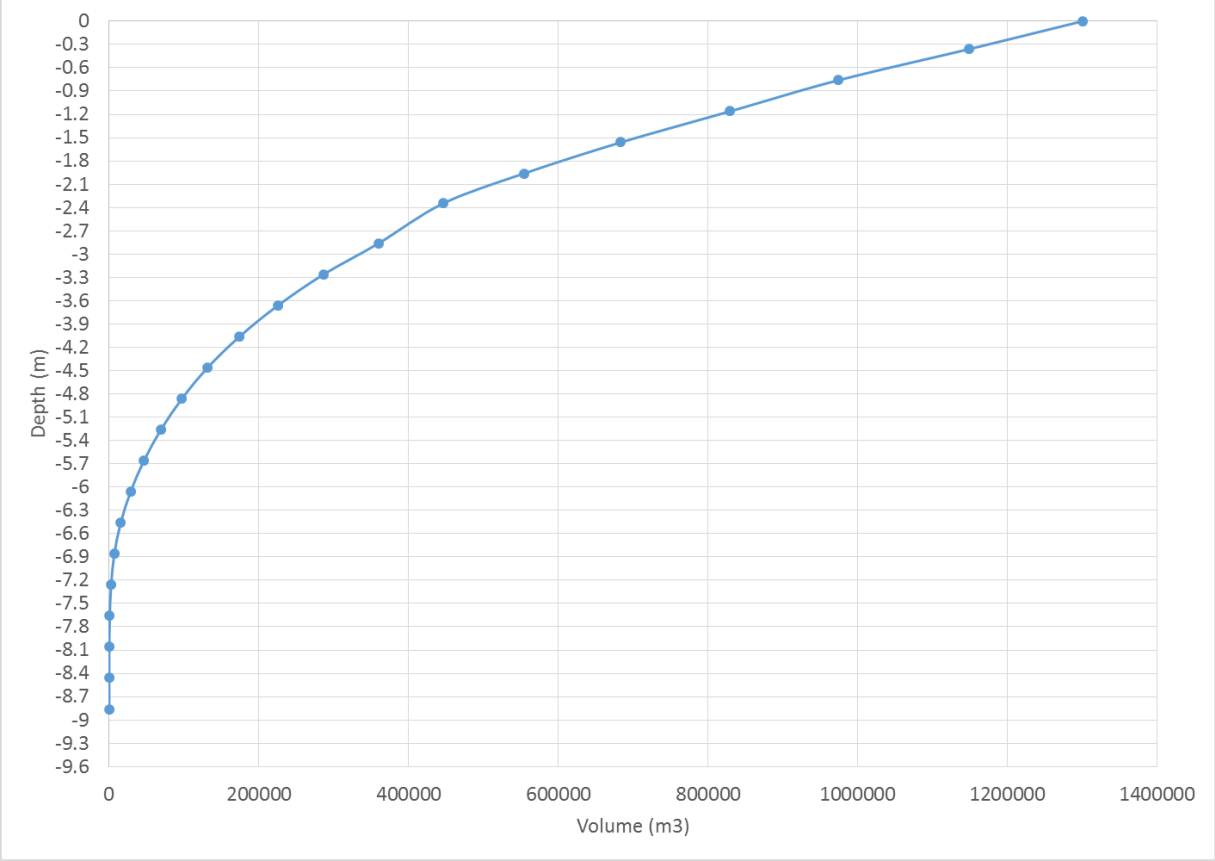


Figure 10-2 Water Depth-Storage Curve for Tenterfield Dam

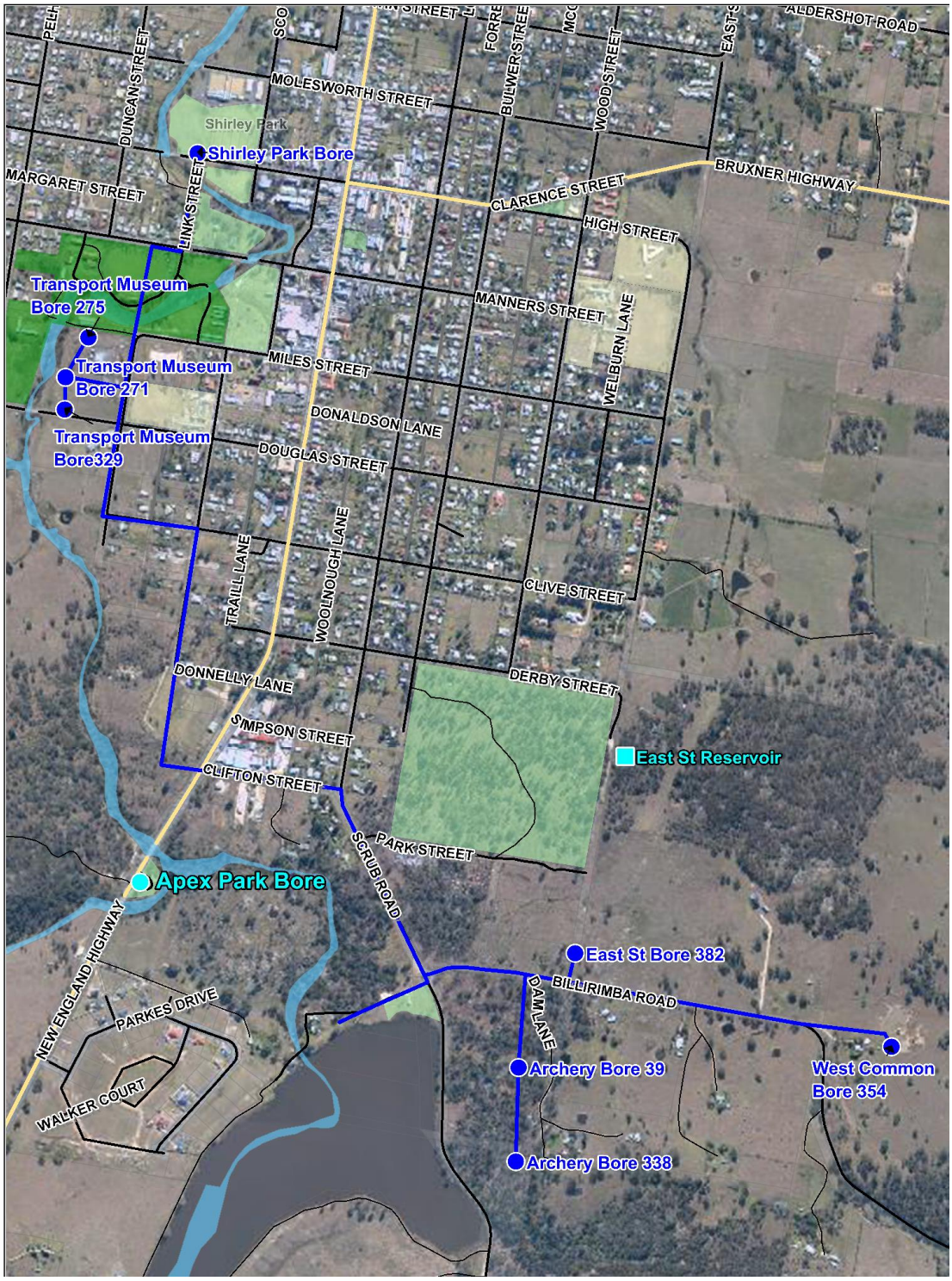


Figure 10-3 Tenterfield Bore Network

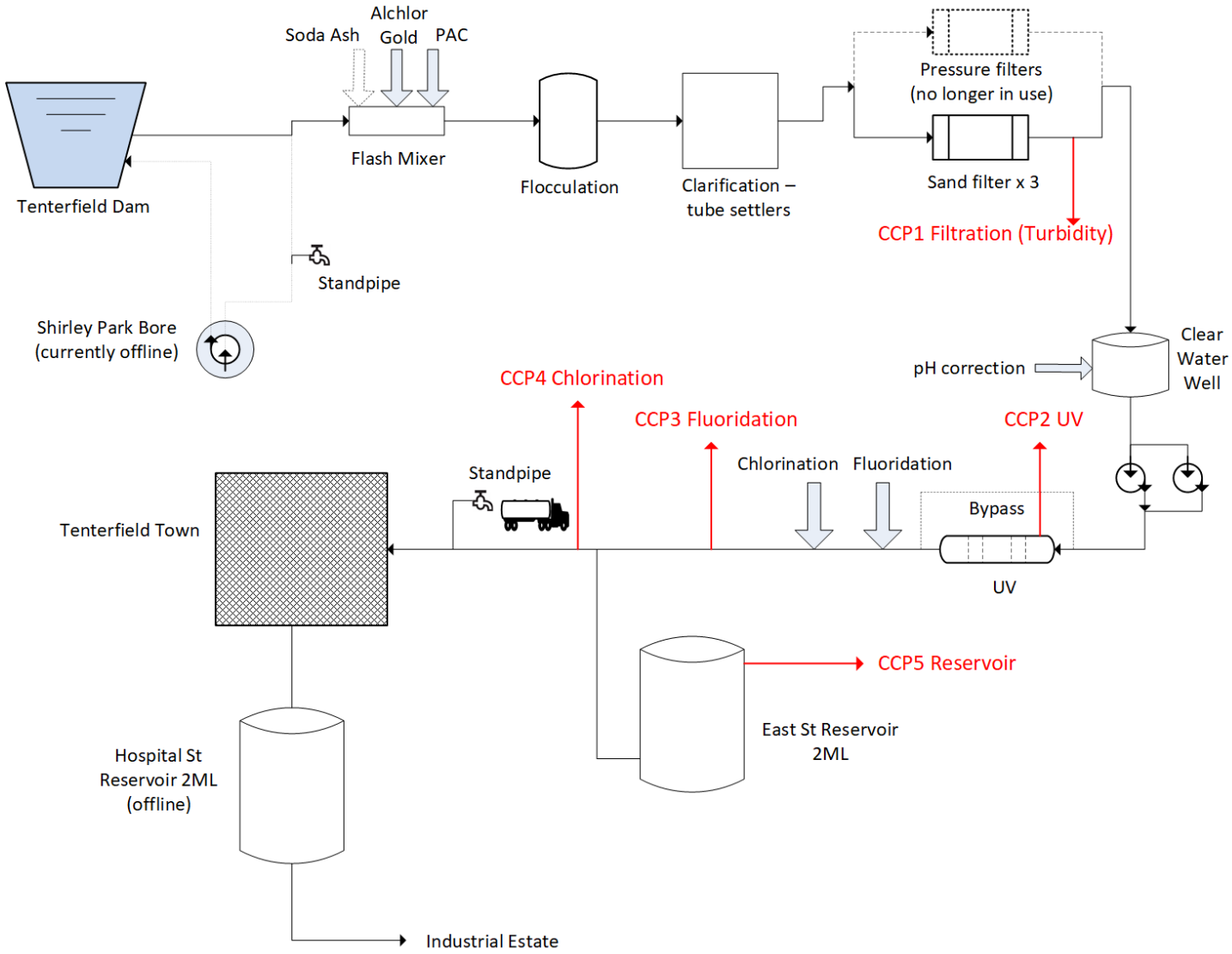


Figure 10-4 Tenterfield Water Supply Schematic (Viridis, 2018)

10.2 Water Sources

10.2.1Existing Sources

Council has a licence for **Tenterfield Dam** (WAL 6491), issued through the NSW Department of Industry as part of the NSW Border Rivers Unregulated and Alluvial Water Sources 2012 Water Sharing Plan. This provides Council with the ability to extract up to 824 Mega litres (ML) per year from the Dam for the purpose of Town Water Supply. The average yearly consumption between 2009 and 2019 is 340ML.

Council also has an allocation for the **Shirley Park Bore** (WAL 31091). This licence is part of the NSW Murray Darling Basin Fractured Rock Groundwater Sources Water Sharing Plan. Council has an allocation of 160ML per year to extract for the purpose of Town Water Supply. Until 2019, the bore had not been utilised, 143ML was extracted in 2019.

Council has been granted an allocation for six bores, as part of the 2019 bore field project, including **Apex Park, Bore 39 (Archery Site), Bore 338 (Archery site 2), Bores 271, 275 and 329 (Transport Museum)** (WAL 43156). This licence is part of the NSW Murray Darling Basin Fractured Rock Groundwater Sources Water Sharing Plan. Council has an allocation of 330ML per year to extract for the purpose of Town Water Supply. Apex Park is limited to 15ML/year, Bores 271, 275 and 329 are limited to 100ML/year and Bore 39 is limited to 100ML/year.

Historical drought periods (1994-1996; 2002-2005; 2006-2008 and 2018-2020) saw stress placed upon the Tenterfield Water Network. Level 4 restrictions were imposed in 2003 which created minor levels of social and economic stress for the community. The drought period 2006-2008 was much less intense with a level 2 restrictions only enforced for a short period with little effect on the community. The 2018-2020 drought was significant and widespread. The dam reached a level of 22% and the community entered level 4.7 restrictions. The town was in water restrictions for 22 months.

Figure 10-5 shows the average daily demand consumption per person and the average monthly dam capacity for the 2018 drought event. It is overlaid with the timing of when water restrictions were introduced and the response in relation to the consumption. During this drought, the average consumption was 214L/person/day or 0.87ML per day for the township. During non-drought conditions, the average daily consumption for the town is 1.3ML.

There were many fires in the region during 2019, with a bushfire threatening Tenterfield township in September 2019. There were also fires in Drake in March 2019 and October 2019. These fires required water to be taken from the Tenterfield reticulation system, either from hydrants for water trucks attending the fire sites, donations of water to the evacuation centre or directly from the Tenterfield Dam. Farm dams and private water supplies were also utilised, meaning that some residents in the area might have had to purchase additional water. Residents were also purchasing additional water to ensure that there was enough water on-site to manage the fire risk. All of these put additional strain on our water supply system.

Figure 10-6 shows the average monthly rainfall and dam capacity, showing the response of the catchment to rainfall for the 2018 drought.

Figure 10-7 shows the bulk water purchases during the drought period. Figure 10-8 shows the water use from Apex Park bore during its operation. This shows that 3,015 KL of potable water was offset through the use of non-potable water from Apex Park. This facility would be made available earlier during the next drought, potentially having a larger impact on reducing potable water use.

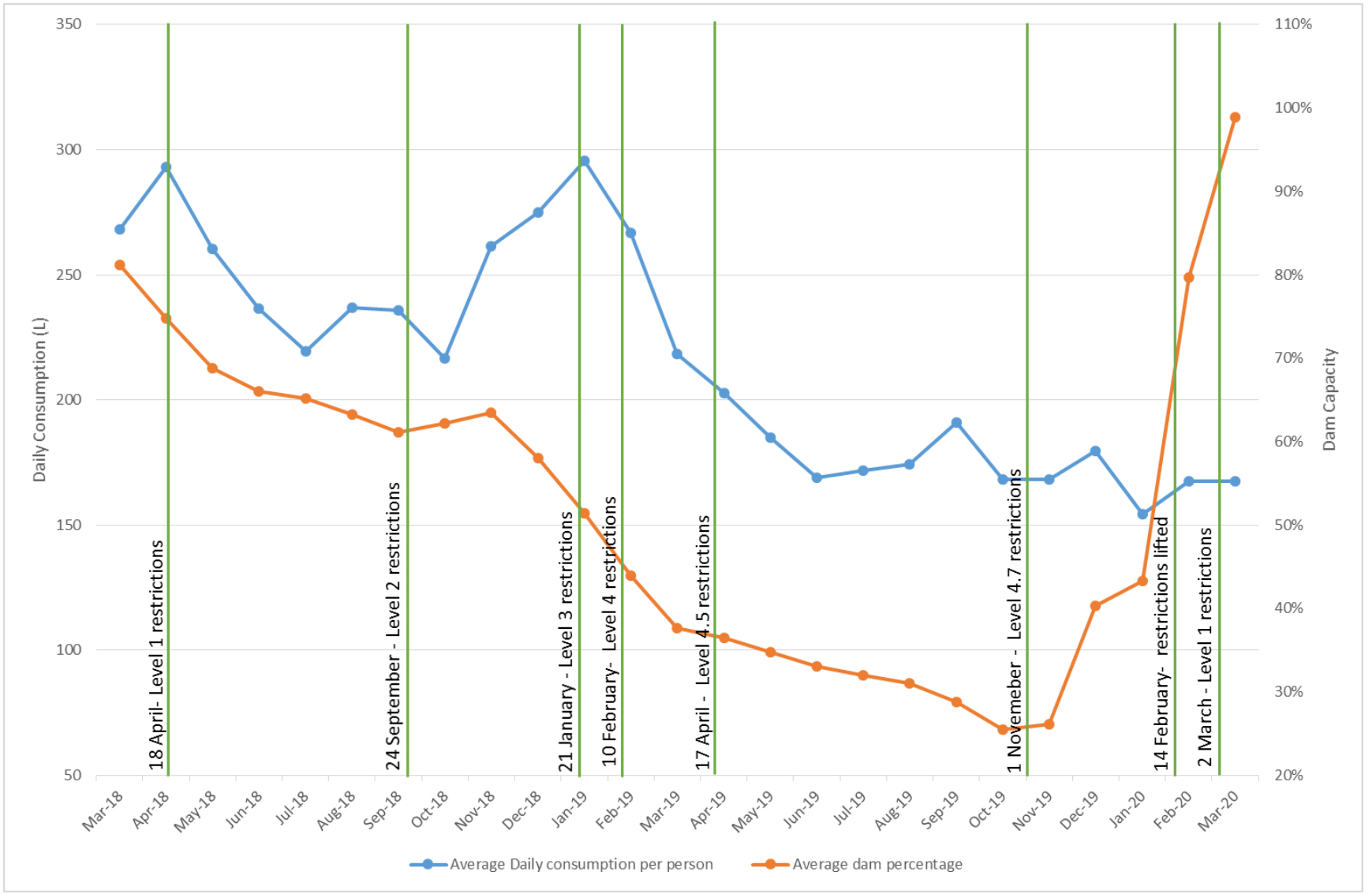


Figure 10-5 Average Consumption Vs Dam Level 2018 Drought

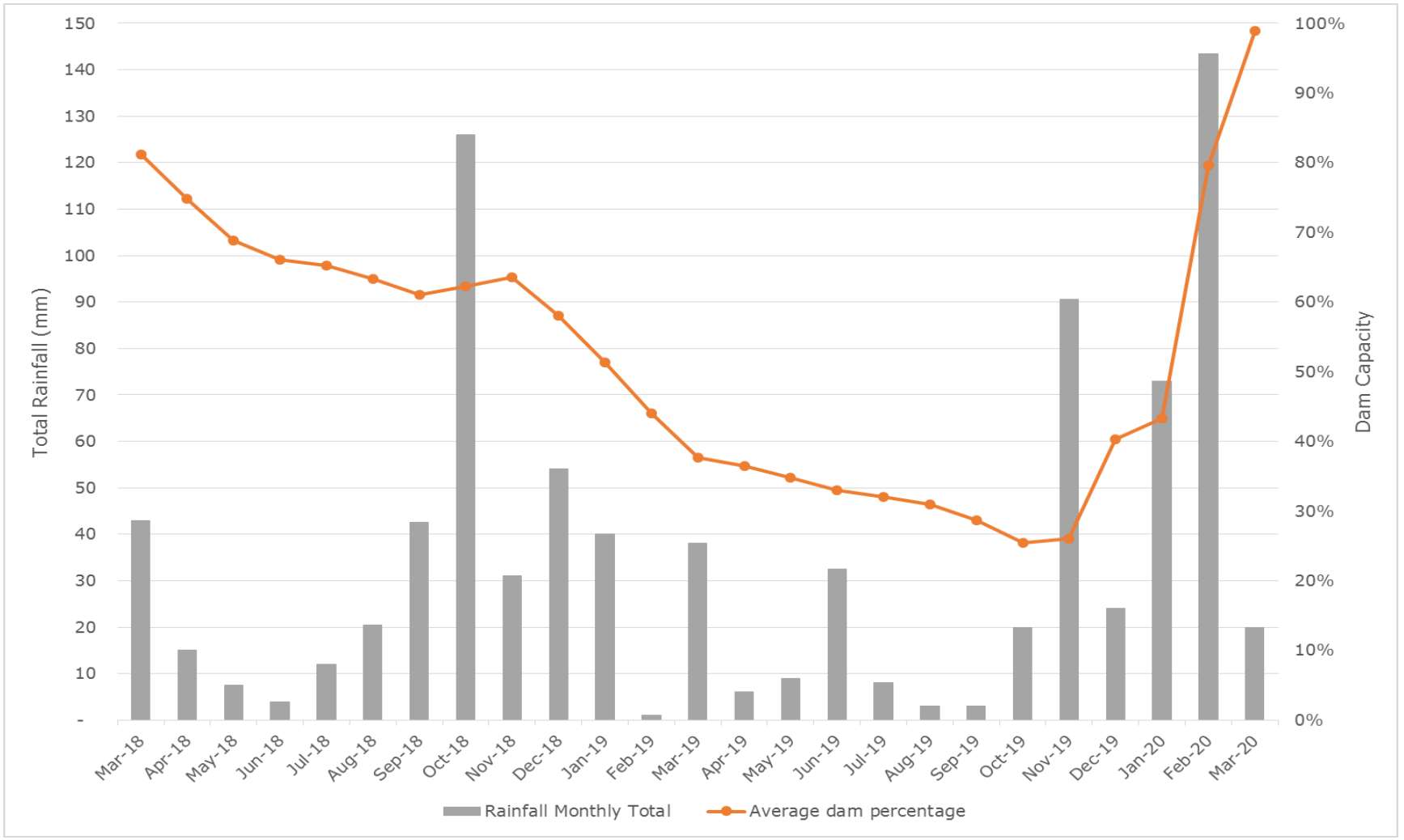


Figure 10-6 Average Monthly Rainfall Vs Dam Capacity 2018 Drought

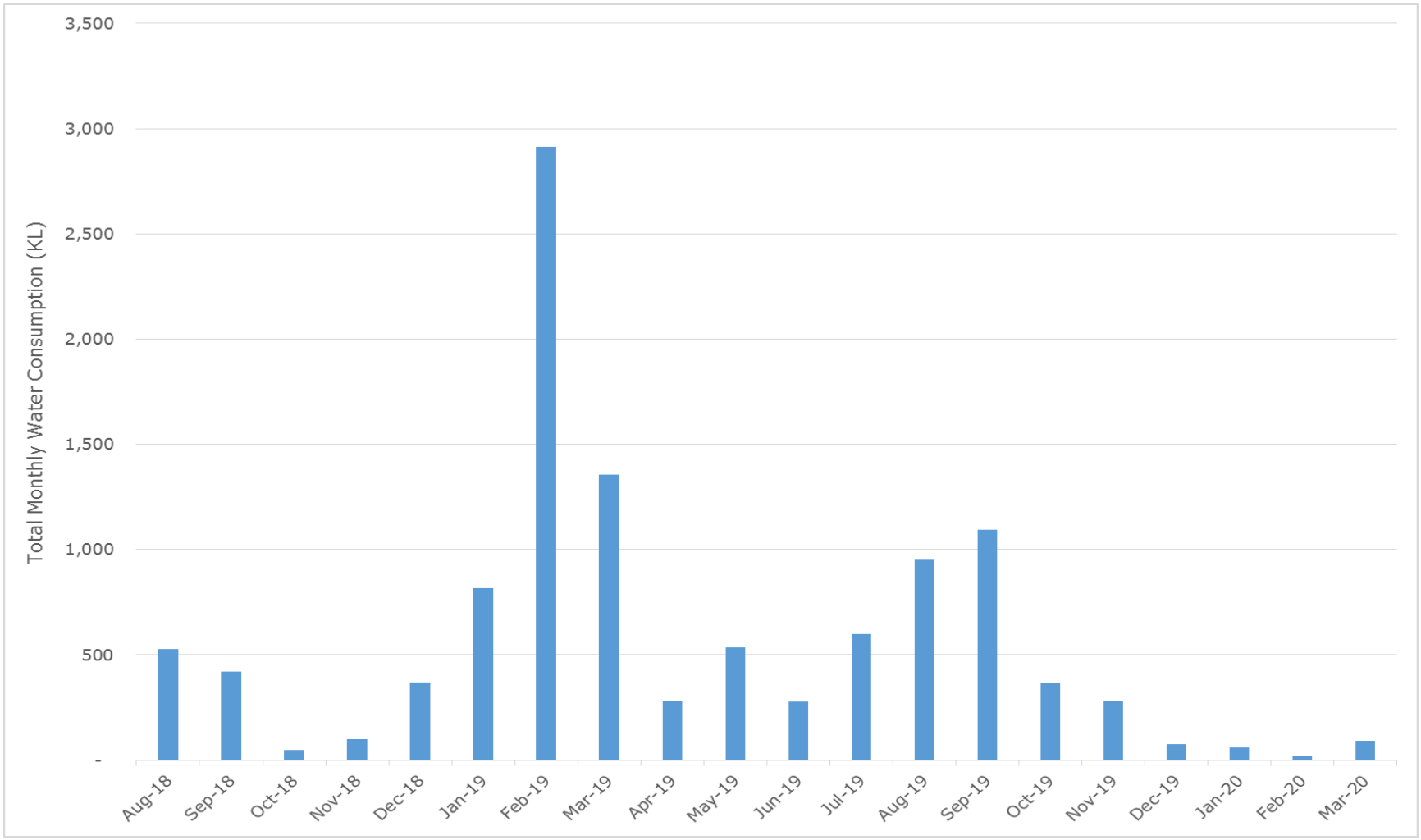


Figure 10-7 Bulk water purchases during drought period

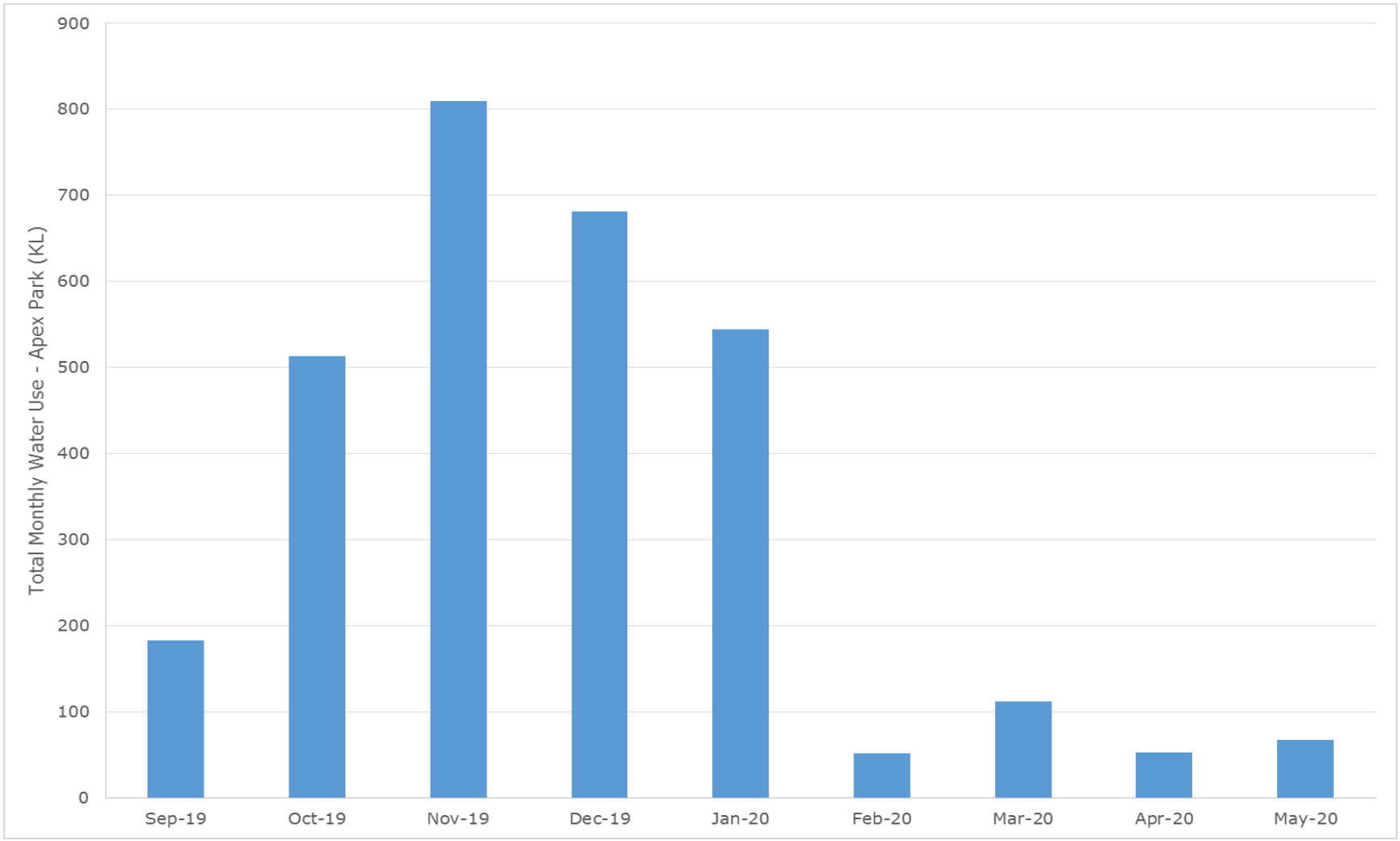


Figure 10-8 Consumption of non-potable water from Apex Park during drought period

10.2.2Potential Sources

During the bore drilling program in 2019, a number of alternative bore sites were identified. These were not drilled for a number of reasons, including depth of bore, distance to treatment plant, site restraints and political issues. These sites have been surveyed and have the potential to be reassessed in the future if required.

Recycled water from the Tenterfield Sewer Treatment Plant (STP) is currently being used by the Tenterfield Golf Club for watering their facility. This arrangement was put in place in 1980's and allows them access to half of the water produced by the plant. The other half was allocated to Gungel Farm, but they have not extracted water since 2011, when their pumps were damaged. The reminder of the water is discharged into Tenterfield Creek. On average, there is 270ML[2] per year available in the tertiary ponds. During the 2018 drought, this dropped to an average of 240ML / year. Historically, the Golf Club uses an average of 54ML / year, but during drought conditions, this increased to a maximum of 120ML / year. Discussions with the Golf Club during the 2018 drought indicated that they require a minimum of 1.5 ML/week (78 ML/year) to ensure that the greens and trees survive. Some of the STP wastewater is also used around the plant, which account for approximately 1.3ML/week (70ML/year) – this includes the evaporation from the ponds. Therefore, assuming Gungel continue to not use the water, there is potentially a surplus of between 0.1ML/day to 0.3ML/day (50ML/year to 122ML/year) that could potentially be used during drought conditions for non-potable uses. It should be noted, that depending on the use, additional treatment may be required. A potential option is to use the excess water (treated) to inject into the underground water system. However, the volumes available versus the cost to do so may not be viable. Additional research into this option would be required if it is to proceed.

Water from the sediment pond at the Tenterfield Water Treatment Plant (WTP) has been used in the past for road building and maintenance activities during times of drought. This water has also been used to assist with public tree watering during times of drought. This source of water cannot be used as a potable drinking supplement, but it can take some burden off the drinking water system through the uses described above. The new WTP that is being built is going to have a water efficiency of ≥ 95%. This is much more efficient than the

[2] Based on data from 2010 to 2019

existing plant, meaning that there will be less water available for use during drought times.

11 Water Demand

11.1 Water Pricing

Council's water supply needs to achieve cost recovery, meaning that the water income needs to support both the operating and capital expenditure.

During the 2018/2020 drought, Council's water supply was not achieving cost recovery and was operating at an average 20% deficit. This has resulted in an increase in water price after the drought to ensure cost recovery in the future, while the water usage remains low. The pricing will return to the pre-drought costings when the usage increases by 10% or more, as this will ensure full cost recovery.

Historically, water pricing has not been required to be used as a price signal to communicate the seriousness of the drought. The communities have adequately responded to water restrictions, curbing their water use to ensure the longevity of the water sources.

11.2 Water Users

Tenterfield Shire has three areas that are supplied with potable water: Tenterfield, Urbenville and Jennings. The other towns in the Shire are typically self-reliant, relying on rain, creek and bore water. Details of each town are provided in Table 11-1. There are many smaller townships in our region that have not been included in the table below. These areas account for 13% of the Shire's population.

Table 11-1 Water Demand for the Shire Townships

Township	Population Demand	Number of Connections	Average Daily Demand (ML/d)	Water Sources
Tenterfield	4,040	1,897	1.20	Tenterfield Dam Bores
Urbenville / Muli Muli / Woodenbong	787	357	0.70	Tooloom Creek

Township	Population Demand	Number of Connections	Average Daily Demand (ML/d)	Water Sources
Jennings	160	93	0.02	Beehive Dam, the Soak, the Wells, Cusack's Dam
Drake	345	217*	0.10+	**Private** – rain, creek, bore **Bulk** – Potable water from Tenterfield, Urbenville, Kyogle & Stanthorpe
Legume	152	98*	0.04+	
Liston	133	85*	0.04+	
Torrington	81	59*	0.02+	
Mingoola	18	8*	0.01+	
***Number of private dwellings +Based on 282L / person / day from ABS data. It is acknowledged that this is likely higher than actual consumption**				

Details of the Shire's critical customers and their water use is provided in Section please see Drought Management Plan [Drought Management Plan | Tenterfield Shire Council (nsw.gov.au)]

Non-residential water consumption equates to approximately 33% of the total consumption. The biggest category of water users in this section is accommodation providers (including combined accommodation and restaurant), accounting for 35% of the non-residential water use. This is followed by the medical industry (20%) and Council facilities (14%). Note: Council facilities includes the water and sewer treatment plants, chambers, depots and parks. Service stations and retail both use 6% of the total non-residential water use.

11.3 Water Usage

In the 2018/2019 financial year, residential water demand contributed 67% of the water use in the Shire (Figure 11-1), with Tenterfield using 90% of the total reticulated water in the Shire.

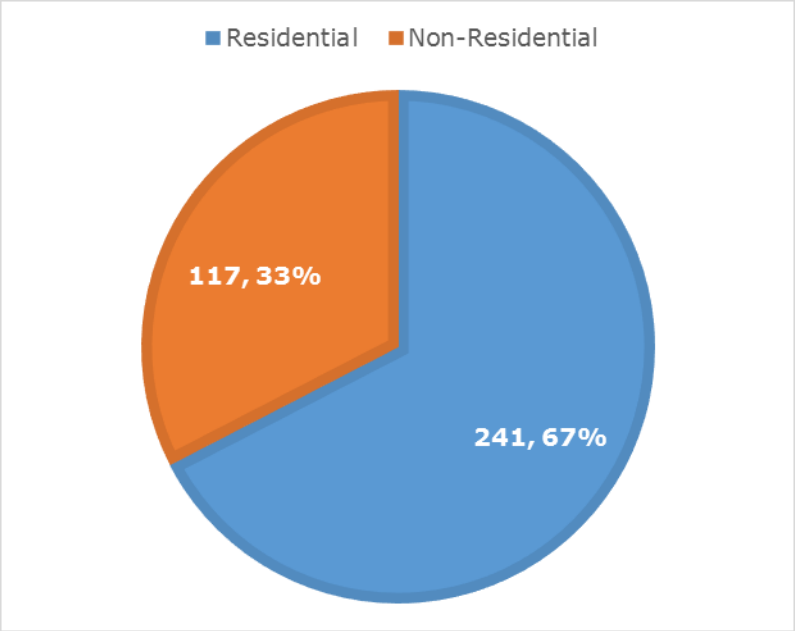


Figure 11-1 Contribution to Water Demand 2018/2019

11.3.1Tenterfield

Figure 11-2 shows the average daily water consumption (KL) for the Tenterfield township and the dam capacity (%) from 1990 to now (excluding 2006, as this data was corrupt). The overall trend has been towards the town using less water over this period. This is significant, as the ABS Census data shows that there has been a 6% increase in population from 2001 to 2019. There is also a clear correlation between drought conditions and a decrease in water use.

As outlined in Section 10.2.1, the Tenterfield Township is currently using approximately 214L/person/day or 0.87ML/day. During non-drought periods, the average daily consumption for the town is 1.2ML.

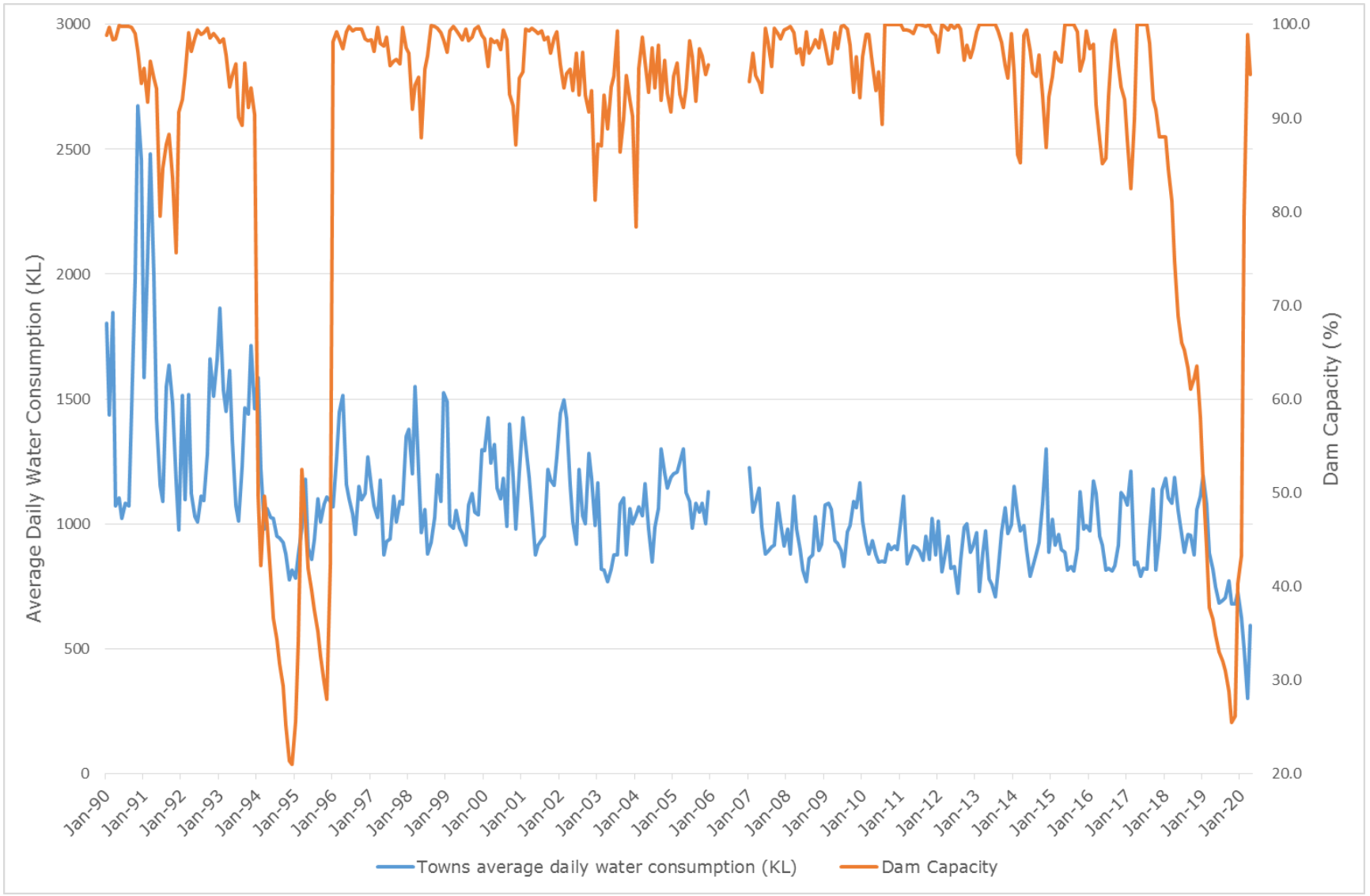


Figure 11-2 Long Term Consumption and Dam Levels for Tenterfield

11.4 Top Water Consumers

Tenterfield Shire Council does not have commercial or industrial water users that are considered significant (using more than 10ML per annum). It should also be noted that the residential sector consumes approximately 70% of the water produced within the Shire (refer to Figure 11-1). Therefore, water savings from the commercial sector have not been focused on in the restrictions, as more impact will be gained from water savings in the residential sector. However, it is proposed to work with the top (commercial) water users within the Shire to see if any water savings can be achieved.

Figure 11-3 shows the percentage of water use for the top 20 commercial/industrial water users within the Shire, broken into broad categories. For confidentiality reasons, the top 20 water users will not be listed. As is shown below, the Accommodation (including accommodation with attached restaurants) comprise most of the water use through the Shire.

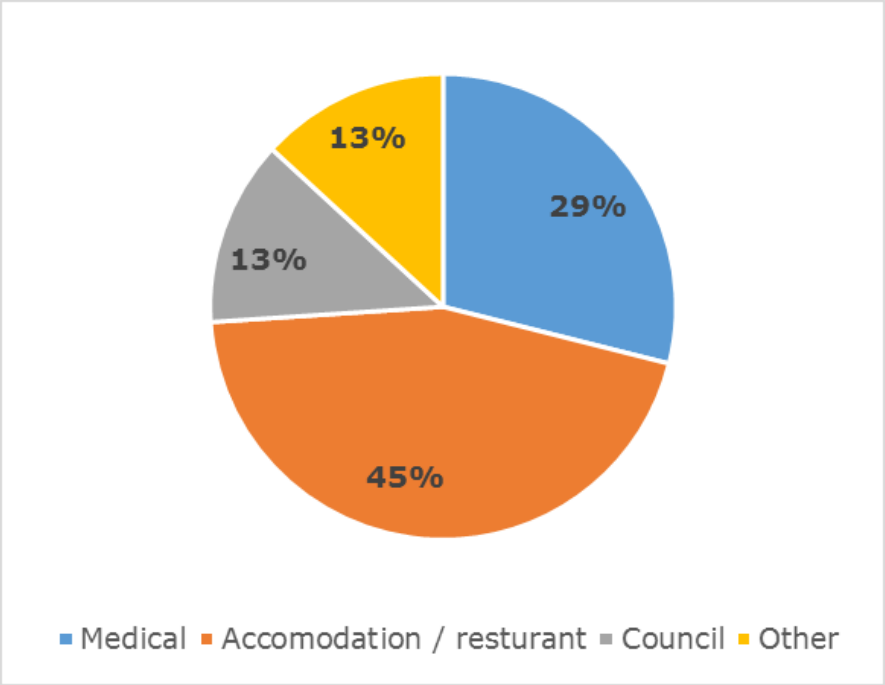


Figure 11-3Top water users

12 Climate

12.1 Rainfall, Evaporation and Temperature

Evaporation data is not explicitly recorded by BoM in our region. Based on BoM's average pan evaporation maps, evaporation in our region ranges from 200 - 175mm in January and December to 80 - 60mm in May, June and July.

12.1.1Tenterfield

BoM have a weather station at Tenterfield that has been recording rainfall data since 1870 and temperature data from 1965. Figure 12-1 shows the monthly rainfall and temperature trends for those time periods. As shown, we typically get our highest rainfall between October and March, with the maximum rainfall typically occurring in January. The temperature ranges from a maximum of 39.9◦C (February) to a minimum of -10.6◦C (July).

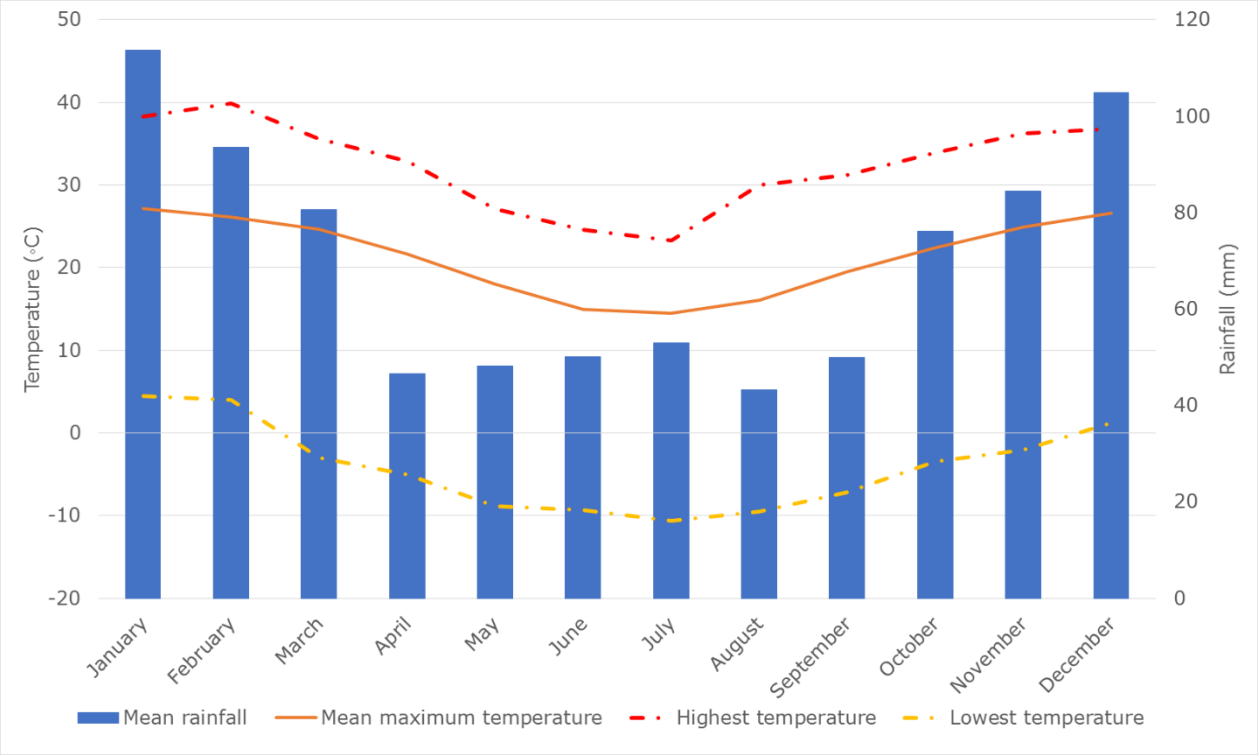


Figure 12-1 Tenterfield Climate Data

12.2 Drought Restrictions History

As mentioned in Sections 10-11, there have been numerous droughts within the Shire. Council have records of water level restrictions going back to 2002, which are outlined in Table 12-1 for Tenterfield. Records of years prior to 2018 are incomplete, and are based on newspaper articles.

Table 12-1 Tenterfield Drought restrictions history

Date Implemented	Restriction Level
25/11/1993	No fixed hoses or sprinklers
27/01/1994	No fixed hoses or sprinklers. Handheld hoses permitted between 6:00am – 8:00am and 6:00pm – 8:00pm
28/02/1994	Level 4 (numbered restriction levels introduced)
31/03/1994	Level 3
19/05/1994	Modified level 3
15/11/1994	Level 5
20/02/1995	Level 2
01/08/2002	Level 1
17/10/2002	Level 2
28/11/2002	Level 3
26/12/2002	Level 4
24/11/2003	Level 3
01/02/2004	Level 1
13/11/2005	Level 2
16/01/2006	Level 1
01/07/2011	Restrictions lifted – permanent water conservation measures
11/04/2018	Level 1
24/09/2018	Level 2
21/01/2019	Level 3
11/02/2019	Level 4
17/04/2019	Level 4.5
29/10/2019	Level 4.7
14/02/2020	Restrictions lifted – permanent water conservation measures
02/03/2020	Level 1

12.3 Effects of Restrictions on Water Demand

Figure 12-2 below shows Tenterfield's response to the 2002 drought. This graph shows that water consumption typically decreased as a result of the introduction of water restrictions. It also shows that average water use does have a tendency to increase again once the restrictions have been in place for about a month. This is despite the fact that the current restriction levels were advertised fortnightly in the local newspapers and on the radio.

Figure 10-5 shows Tenterfield's response to the 2018 drought. This graph shows that typically there is a decrease in water usage as a result of the introduction of water restrictions. After a few months of restrictions, we do tend to see an increase in water usage. There is a small increase in water consumption around September 2019, but can be attributed to the bush fires that were threatening the town.

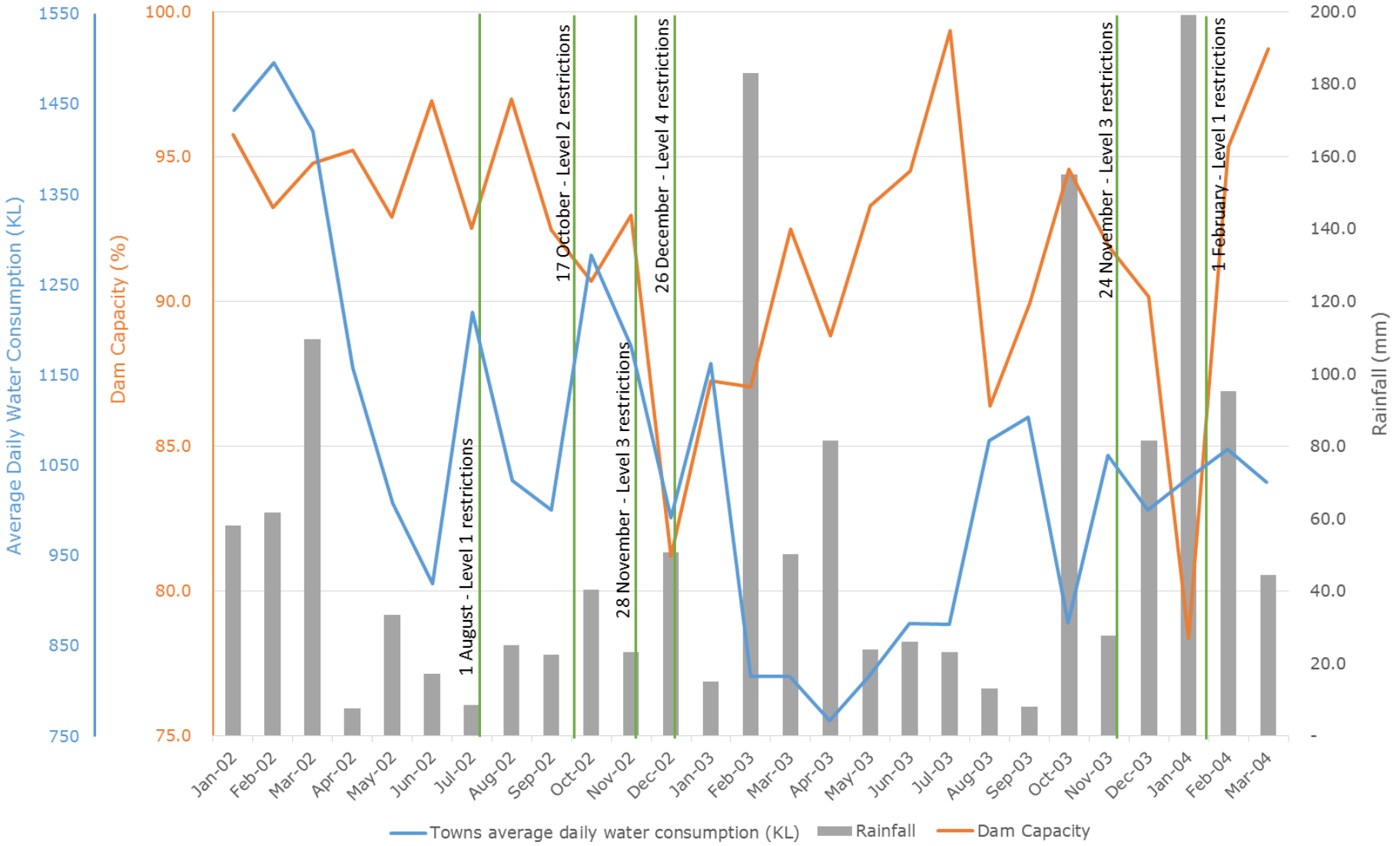


Figure 12-2 Tenterfield's response to water restrictions 2002-2004

12.4 Supply-Side Historical Actions

12.4.1Tenterfield

As part of the emergency measures undertaken for the 1994 drought, Council undertook a bore investigation. This resulted in 1 production bore: Shirley Park and 1 livestock bore: Apex Park. The Shirley Park Bore was connected directly into the Tenterfield Dam. Apex Park Bore was capped.

In 2003 Council petitioned the State Government for the Shire to be included in the rainwater tank rebate program. This was unsuccessful until 2007/2008, when Council in conjunction with the State Government, were able to offer a rainwater tank rebate.

In the most recent drought, the following actions were undertaken:

- sediment around the edge of the dam were excavated
- a survey of the bathymetry of the dam to get a revised estimate of dam capacity
- new bores were installed making a secondary bore field supply
- water quality improvements in the dam, including improved monitoring and an aeration system.

13 Regulatory Framework

13.1 Local Water Utility

Council delivers water under the provisions of the NSW Local Government Act 1993. Some aspects of the water business are carried out under provisions under the NSW Water Management Act 2000. Council is empowered to restrict water supply (e.g. by public notice published in a newspaper circulating within Council area) under the Local Government (General) Regulation 2005.

The Local Government Act 1993 Section 637 read: "a person who wilfully or negligently wastes or misuses water from a public water supply, or causes any such water to be wasted, is guilty off an offence". The maximum penalty which can apply is:

- Maximum penalty: 20 penalty units
- Current (as per 1 July 2020) penalty unit: $133.45

Consumers who are identified breaching water restrictions in place may have their supply restricted by Council in accordance with Clause 144 of the Local Government (General) Regulation 2005.

This plan is administered by Council. During drought, this plan will be overseen by the Drought Management Team (see Section 8.2). The implementation of this Drought Management Plan will be the responsibility of the Drought Incident Manager.

13.2 DPIE Water

13.2.1General

Department of Planning, Infrastructure and Environment (DPIE) Water works with partner agencies and the community to provide a reliable, sustainable supply of water for households, irrigators, farmers, industry and the environment.

Available water determinations are made for each water source generally at the start of a water year (on 1 July). The licenced volume or the percentage of the share component is defined by DPIE Water. Since the introduction of the Water Management Act 2000, DPIE Water has prepared water sharing plans for rivers and groundwater systems across NSW.

13.2.2Water Sharing Plans

By setting the rules for how water is allocated for the next 10 years, a water sharing plan provides a decade of security for the environment and water users. This not only ensures that water is specifically provided for the environment through a legally binding plan, but also allows licence holders, such as irrigators, who require large volumes of water, to plan their business activities.

13.3 Fire Fighting Requirements

In spite of water restriction actions, preference will be provided to accommodating firefighting requirements.

In the event that the emergency (level 5 restrictions) conditions last for more than 3 days, fire services will be directed to arrange alternate water source (e.g. water tankers) if appropriate. Council will work with the relevant Fire Departments to ensure adequate fire-fighting supply.

Note: at the time of writing, more information about the fire-fighting requirements for the RFS was not available. More information is being sought through the RFS and will be updated when available.

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Danish Hydraulic Institute, 15 June, 1995.

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Hydrological Modelling for Tenterfield Creek Dam Upgrade Design, September 2013.

NSW Department of Primary Industries, Office of Water
Tenterfield Dam, Tenterfield Shire Council, 2013 Dam Safety Inspection Report.

Appendix 1. SDRC Water Restrictions

Table 13-1 SDRC Water Use Targets

Restriction Level	Water Use Target
Permanent	230 L/person/day
Medium	200 L/person/day
High	170 L/person/day
Extreme	120 L/person/day
Critical	100 L/person/day
Emergency Target	80 L/person/day

Table 13-2 SDRC Water Restrictions - High

Outdoor Use activity	Allowed any time	Allowed on allocated days and times
High		
Sprinklers & fixed irrigation systems	×	×
Hand held hosing of gardens and laws	×	✓ (lawn not allowed)
Garden water using buckets	×	✓
Washing vehicles with a trigger hose or bucket	×	✓ (on grassed area only)
Cleaning vehicle windows, mirrors or lights using a bucket	✓	✓
Topping up fountains, ponds, pools or spas	×	×
Cleaning paved areas using a bucket or high pressure water unit	×	× (exceptions for health or safety reasons only)
Cleaning building using a trigger hose or high pressure water unit	×	×
Cleaning windows with a bucket	×	✓

Odd house number or no numbers: odd number calendar date

Even house numbers: even number calendar date

Outdoor water use times: May to September: allocated days 5pm-6pm

October to April: allocated day 6pm-7pm

The following tables are applied to Extreme, Critical and Emergency Restriction Levels. Water restrictions apply to residents who access drinking water supplied by Southern Downs Regional Council. This includes those accessing the town water supply via a reticulated system or rural residents who purchase water supplied via the bulk water supply standpipes.

The tables below offer additional guidance for residents, commercial operators and community groups. Penalties may apply for non-compliance.

Table 13-3 SDRC Conditional Use: Water Restrictions - Residential

RESIDENTIAL WATER USE ACTIVITY	CONDITIONS APPLY Note: Any water used for these purposes forms part of an individual's daily water allowance
General outdoor cleaning (includes: solar panels, buildings, landscaping, entertainment areas, outdoor furniture and paved surfaces)	General outdoor cleaning for health and safety only is permitted at any time using water efficient measures. Use of drinking water is not permitted to remove loose items that could be easily removed by a broom, blower or similar device.
Cleaning of residential vehicles (cars, boats, caravans, trailers and bikes)	Drinking water may be used from a bucket filled directly from a tap to: (1) spot clean a surface to remove potentially paint damaging marks; (2) clean only vehicle mirrors, vehicle lights, glass and number plates to maintain safe operation and visibility requirements; (3) clean other such parts of a vehicle as required to comply with statutory or regulatory obligations or (4) to flush an inboard or outboard motor or vehicle brakes to prevent corrosion and maintain safe operation.
Cleaning of rubbish bins, tools and related equipment as well as animal enclosures/kennels	Cleaning for health and safety is permitted at any time using water efficient measures.

RESIDENTIAL WATER USE ACTIVITY	CONDITIONS APPLY Note: Any water used for these purposes forms part of an individual's daily water allowance
Ornamental fish ponds, frog pongs and outdoor aquariums	Drinking water may be used only if it is collected in a bucket filled directly from a tap and is requirement for the health and safety of the fish, frogs and other aquarium life. Measures must be taken to reduce evaporation where possible.
Building construction – exposed aggregate driveways, laying of turf	Use of drinking water is not permitted.
Building construction - brick laying, tile cutting etc.	Alternative water sources can be used as appropriate.
Cleaning when vacating a rental property	Drinking water is permitted to be used for building construction where: (1) the site is attended; (2) hoses and equipment are in good order with no leaks and (3) water is not running to waste.
General renovations & property maintenance e.g. timber decks, driveways, pathways, house and roof painting preparation	Drinking water may be used for internal house cleaning activities that are required prior to vacating a rental property. External cleaning (windows, outdoor areas) can only be done using a bucket filled from a tap. Use of drinking water is not permitted to remove loose items that could be easily removed by a broom, blower or similar device such as dust and cobwebs.
Topping up of swimming pools	Use of drinking water is not permitted. Alternative water sources can be used as appropriate.

Table 13-4 SDRC Conditional Use: Water Restrictions - Commercial

COMMERCIAL WATER USE ACTIVITY	CONDITIONS APPLY Note: Businesses are expected to reduce their water consumption by an additional 10%
Cleaning of commercial vehicles (cars, boats, caravans, trailers, bikes, buses and trucks)	Drinking water may be used from a bucket filled directly from a tap to: (1) spot clean a surface to remove potentially paint damaging marks; (2) clean only vehicle mirrors, vehicle lights, glass and number plates to maintain safe operation and visibility requirements; (3) clean other such parts of a vehicle as required to comply with statutory or regulatory obligations or (4) to flush an inboard or outboard motor or vehicle brakes to prevent corrosion and maintain safe operation.
Cleaning of rubbish bins, tools and related equipment as well as animal enclosures/kennels	Cleaning for health and safety only is permitted at any time using water efficient measures.
Building Construction – dust suppression	Use of drinking water is not permitted for dust suppression on construction sites.
Building Construction (brick laying, tile cutting etc.)	Drinking water is permitted to be used for building construction where: (1) the site is attended; (2) hoses and equipment are in good order with no leaks and (3) water is not running to waste.
Ornamental fountains	Use of drinking water is not permitted. Alternative water sources can be used as appropriate.
Council and state government parks and road reserves	Use of drinking water is not permitted. Alternative water sources can be used as appropriate.
Active playing surface irrigation	Use of drinking water is not permitted. Alternative water sources can be used as appropriate.
Topping up of swimming pools	Use of drinking water is not permitted.

Table 13-5 SDRC Conditional Use: Water Restrictions - Community

COMMUNITY GROUP WATER USE ACTIVITY	CONDITIONS APPLY Note: Groups must upgrade facilities where possible using waterwise products and actively display waterwise information in canteens and bathrooms.
Community group clubhouses and facilities – general cleaning	Cleaning for health and safety only is permitted at any time using water efficient measures.
Cleaning of rubbish bins, tools and related equipment	Cleaning for health and safety only is permitted at any time using water efficient measures.
When hosting events	Use of drinking water is permitted for domestic use only. Drinking water is not to be used for: • Washing down of vehicles or animals • the cleaning of storage areas or animal pens
Ornamental fountains	Use of drinking water is not permitted. Alternative water sources can be used as appropriate.
Maintenance of grounds	Use of drinking water is not permitted. Alternative water sources can be used as appropriate.
Active playing surface irrigation	Use of drinking water is not permitted. Alternative water sources can be used as appropriate.

Appendix 2. Water Exemption Application Form

The form below is to be used to apply for a water use exemption.

Forms can be emailed to council@tenterfield.nsw.gov.au, posted to PO Box 214, Tenterfield, NSW, 2372, or returned in person to Council's Administration Centre.

Please note that watering during the hottest part of the day (middle of the day) will *NOT* be permitted under any circumstance.

Exemptions will expire when a certain water restriction level is reached, which will be outlined on your permit.

Submitting a permit does not guarantee approval. Permits can take up to 10 working days for approval.

Water Restriction Exemption Request Form

Please note: watering of gardens will *NOT* be permitted under any circumstances in the middle of the day.

Customer/ Business		
Property address		
Contact phone numbers	B:	M:
Email address		

Category of restriction to which the permit request applies (tick ONE box only)	
☐ Private Gardens ☐ Public Gardens ☐ Ponds and Lakes ☐ Fountains ☐ Cleaning Windows/ Building Roofs ☐ Farm Dams ☐ Swimming Pools ☐ Cleaning Paved Areas	☐ Construction Activities ☐ Sports Grounds / Recreation Areas ☐ Retail / Wholesale / Market Gardens ☐ Nursery ☐ Vehicles, Boats or Aircraft ☐ Other (please list)

Exemption request details		
Time:	Days:	Dates:

Reason of which exemption should be granted	
☐ Adverse financial impact ☐ Request results in less water being used ☐ Special needs	☐ Physical damage to a building or structure ☐ Public health or safety ☐ Filling swimming pool or spa

Please indicate the expected volumes of water required and details of how water will be used

Please indicate the measures in place to reduce the amount of water that will be used

Applicant Declaration

I/we agree to:

- Authorise Tenterfield Shire Council (Council) to publically disclose any relevant details of the permit;
- Adhere to ALL the specific requirements contained within the permit;
- Provide appropriate access to enable Council to assess adherence to the permit conditions;
- Complete al sections of this form;
- Acknowledge that the exemption, if approved, is not transferable to any other party or location and is the responsibility of the permit holder;
- Ensure that every effort will be made to conserve water at all times;
- The permit is relevant only to the current water restriction level. Upon increase of water restrictions, this permit will be void unless otherwise stated within the approval;
- Any violation of the terms of the permit will result in the immediate disqualification of the permit.

Signature of Applicant	
Date	

Forms can be emailed to council@tenterfield.nsw.gov.au, posted to PO Box 214, Tenterfield, NSW, 2372, or returned in person to Council's Administration Centre.

Office use only

Date form received	

Exemption Request: ☐ Approved ☐ Denied

Reason for decision	
Permit Number	
Date of commencement	
Date of expiry	
Water restriction level permit expires at	
Name of Authorising Officer	
Signature of authorising officer	
Date	

Appendix 3. Water Carters Registration Form

During times of drought, any water carters taking potable water from Council's standpipes need to be registered.

Once approved, access to Council's standpipes will be granted, either in Tenterfield, Urbenville or both.

Water carters are expected to keep records of date, volume of water taken, property that water is being supplied to and intended use. Council can ask to see these records at any time. Once Level 3 water restrictions are reached, water can only be taken for filling of domestic tanks.

Water taken from Council's dispensers can only be supplied to properties within the Tenterfield Shire Council Local Government Boundary, unless specific approval is granted in writing from Council.

Water Carter Registration Form

Business name:		
ABN		
Proprietor/s		
Business/office address		
Mailing address (if different from above)		
Contact phone numbers	B:	M:
Email address		
Is your business registered with the Australian Charities and Not-for-profits Commission?		
☐ Yes ☐ No		

Legislative Requirements		
Requirements	*Documents Required*	*Document Attached*
Quality Assurance Program has been developed and submitted to NSW Health to meet the requirements of NSW Water Carters Guidelines	Yes	
The vehicles(s) are fitted with a backflow prevention device or registered air gap that complies with the Plumbing Code of Australia	Yes	
The device or air gap has been tested in the past 12 months by a qualified person	Yes	
The vehicle has public liability insurance for not less than $20 million dollars indemnifying Tenterfield Shire Council against any claims that may arise from the operation of the water carter business	Yes	

Vehicle(s) Information	
Number of vehicles used for carting	
Registration number of above vehicles	
Tanker dimensions	
Tanker Volume	
Location of where water is drawn	
☐ Tenterfield ☐ Urbenville	

Applicant Declaration

I/we agree to:

- Authorise Tenterfield Shire Council (Council) to publically disclose any relevant details of the permit;
- Complete al sections of this form;
- Ensure that every effort will be made to conserve water at all times;
- Confirm that records will be kept of date, volumes taken and delivery address. Council may request this data at any time;
- Confirm that water taken from Councils' dispensers will be delivered to properties within the Tenterfield Shire Local Government Boundary only;
- Confirm that water taken from Councils' dispensers will be supplied for domestic use only (no filling of dams);
- When the dispenser key is issued, confirm that it will be used for the vehicles registered above only. The key cannot be loaned to other vehicles or companies. Failure to comply with this will result in the key being returned and removal from the Council's registered water carter list;

Signature of Applicant	
Date	

Forms can be emailed to council@tenterfield.nsw.gov.au, posted to PO Box 214, Tenterfield, NSW, 2372, or returned in person to Council's Administration Centre.

Office use only

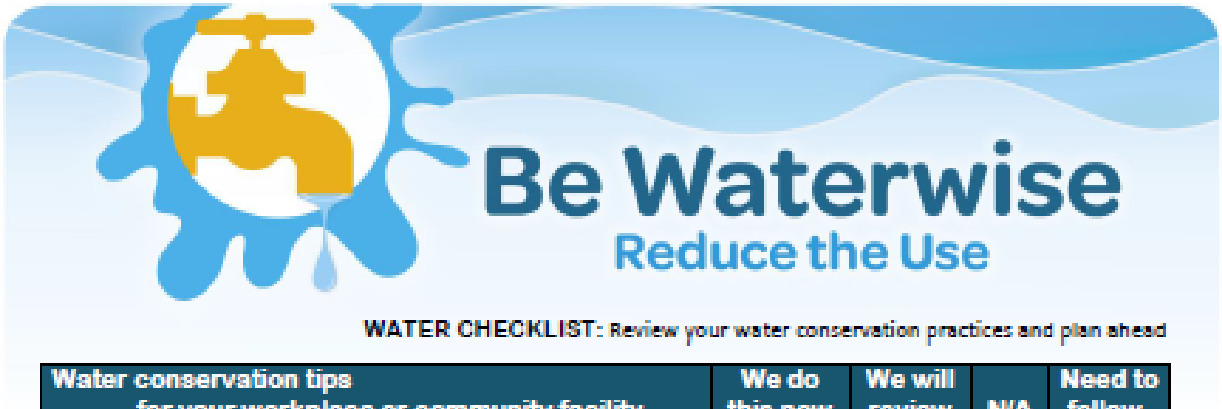
Date form received	

Registration Request: ☐ Approved ☐ Denied

Reason for decision	
Registration Number	
Date of commencement	
Date of expiry	
Name of Authorising Officer	
Signature of authorising officer	
Date	

Appendix 4. Waterwise Checklist

The Waterwise checklist is a two page document – page 1 focuses on identifying where immediate water savings can be made and page 2 focuses on identifying how additional water savings can be made in the future.

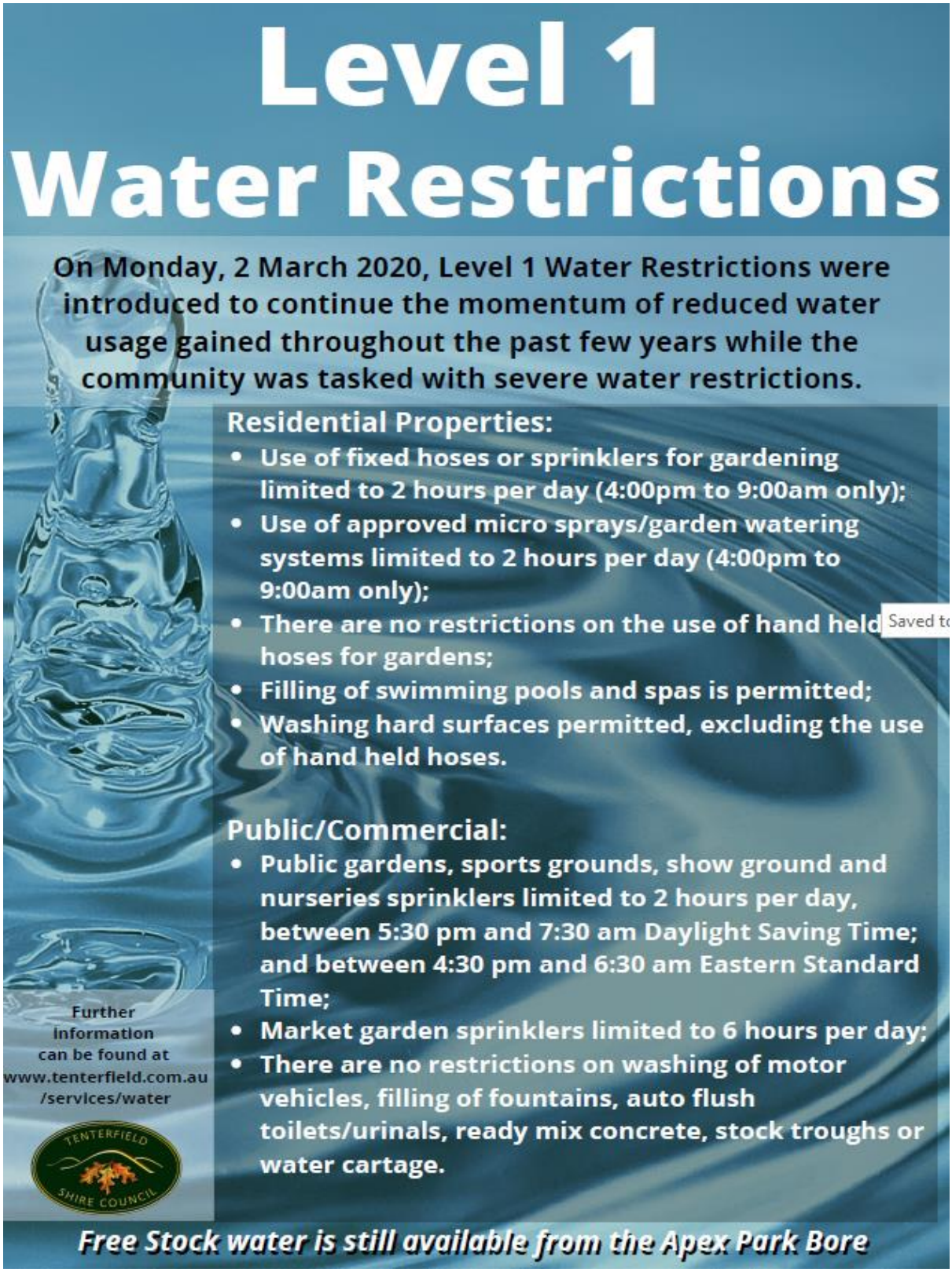


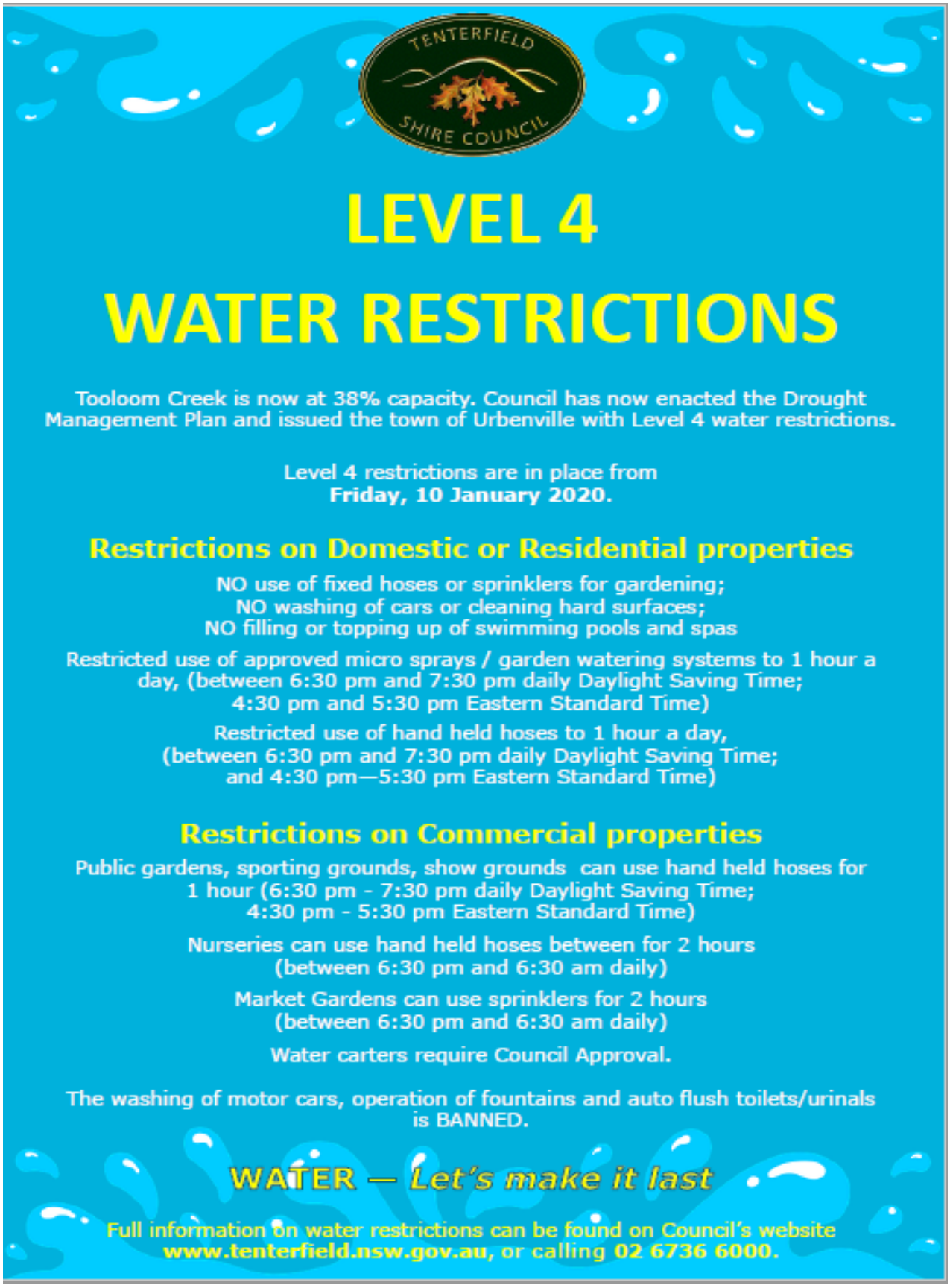
WATER CHECKLIST: Review your water conservation practices and plan ahead

Water conservation tips for your workplace or community facility	We do this now	We will review	N/A	Need to follow-up
ACTIONS – What can I do now?				
General review				
Check water meters are working properly and monitor use	O	O	O	O
Install signage to encourage water conservation	O	O	O	O
Ensure fire water hoses are not used for general activities	O	O	O	O
Amenity areas				
Check toilet cisterns for leaks and repair as required	O	O	O	O
Use cistern weights to reduce volume in single flush toilets	O	O	O	O
Adjust timings and volumes of automatic flush urinals	O	O	O	O
Install tap aerators or tap flow control valves	O	O	O	O
Install water efficient showerheads or shower control valves	O	O	O	O
Heating and cooling systems				
Turn off air conditioner cooling systems when not required	O	O	O	O
Check blowdown/bleed-off control on boilers and cooling towers	O	O	O	O
Increase concentration cycles for air conditioning cooling towers	O	O	O	O
Check the seal and float valve unit for wear. Review settings.	O	O	O	O
Check the cooling system pump for leaks	O	O	O	O
Outdoor water use				
Install signage to increase awareness of water restrictions	O	O	O	O
Inspect, repair or replace any leaking pipes and outdoor taps	O	O	O	O
Sweep or use garden blowers on paved areas instead of hosing *(unless required to meet occupational health and safety standards)*	O	O	O	O
Attach trigger nozzles to all hoses *(permissible uses only)*	O	O	O	O
Use high pressure cleaning units in place of hoses *(permissible uses only)*	O	O	O	O
Review options to meet plant water needs when maintaining gardens	O	O	O	O
Use mulch around ground covers, trees and shrubs	O	O	O	O
Adjust times for automatic irrigation equipment (e.g. sporting fields). Turn off timers when water is not required	O	O	O	O
Ensure hard surfaces are not being watered	O	O	O	O
Pool and spa areas				
Use a pool cover to reduce water loss due to evaporation	O	O	O	O
Check for and repair any leaks	O	O	O	O
Check the filter backwash schedule and adjust if possible	O	O	O	O
Keep heated pools to a minimum temp to reduce evaporation	O	O	O	O
Vehicle washing				
Limit the number of spray nozzles, their flow rate and pressure	O	O	O	O
Place timers and shut-off valves on vehicle washers	O	O	O	O
Use rainwater to wash vehicles where required	O	O	O	O

Water conservation tips for your workplace or community facility	We do this now	We report to staff	N/A	Listed in asset register
How can I plan for the future?				
General review				
Schedule daily or weekly water meter reads and share information with staff and management to monitor trends	O	O	O	O
Maintain signage to encourage water conservation *(e.g. turn off the tap)*	O	O	O	O
Schedule fire water hose testing dates	O	O	O	O
Develop a roster for checking leaks and undertaking repairs	O	O	O	O
Gauge interest in staff being "water champions" to assist water monitoring and sharing of information	O	O	O	O
Amenity areas				
Install sensor activated taps where appropriate	O	O	O	O
Retrofit toilet cisterns with more water efficient models	O	O	O	O
Review capacity to collect rainwater for the purpose of toilet flushing	O	O	O	O
Replace automatic flush urinals and low flush valve operated urinals, waterless urinals or manual operated urinals	O	O	O	O
Schedule appliance replacement e.g. dishwashers and washing machines and identify best products using the Water Efficiency Labelling Scheme (WELS)	O	O	O	O
Heating and cooling systems				
Investigate recycling water flow to cooling tower or replacing with air-cooled equipment to eliminate 'once through' cooling of equipment processes	O	O	O	O
Insulate water pipes to reduce water use while waiting for it to heat up	O	O	O	O
Schedule regular inspections of cooling system pumps and seals	O	O	O	O
Outdoor water use				
Install automatic shut-off valves on manual hoses	O	O	O	O
Collect rainwater and water from cooling tower bleed-off for re-use on landscaping	O	O	O	O
Review garden design and layout – group plants with similar water needs, and reduce lawn areas	O	O	O	O
Pool and spa areas				
Collect, treat and re-use backwash water where possible	O	O	O	O
Collect rainwater to top up swimming pools	O	O	O	O
General and vehicle washing				
Install a recycling system that allows wash water to be reused	O	O	O	O
Retrofit existing car washes with filters, storage tanks and high pressure pumps to recycle water on-site	O	O	O	O
Install rainwater tanks to provide water for washing vehicles	O	O	O	O

Appendix 5. Example Water Restrictions Poster




TENTERFIELD SHIRE COUNCIL
LEVEL 4
WATER RESTRICTIONS
Tooloom Creek is now at 38% capacity. Council has now enacted the Drought Management Plan and issued the town of Urbenville with Level 4 water restrictions.
Level 4 restrictions are in place from
Friday, 10 January 2020.
Restrictions on Domestic or Residential properties
NO use of fixed hoses or sprinklers for gardening;
NO washing of cars or cleaning hard surfaces;
NO filling or topping up of swimming pools and spas
Restricted use of approved micro sprays / garden watering systems to 1 hour a day, (between 6:30 pm and 7:30 pm daily Daylight Saving Time;
4:30 pm and 5:30 pm Eastern Standard Time)
Restricted use of hand held hoses to 1 hour a day,
(between 6:30 pm and 7:30 pm daily Daylight Saving Time;
and 4:30 pm—5:30 pm Eastern Standard Time)
Restrictions on Commercial properties
Public gardens, sporting grounds, show grounds can use hand held hoses for 1 hour (6:30 pm - 7:30 pm daily Daylight Saving Time;
4:30 pm - 5:30 pm Eastern Standard Time)
Nurseries can use hand held hoses between for 2 hours
(between 6:30 pm and 6:30 am daily)
Market Gardens can use sprinklers for 2 hours
(between 6:30 pm and 6:30 am daily)
Water carters require Council Approval.
The washing of motor cars, operation of fountains and auto flush toilets/urinals is BANNED.
WATER — Let's make it last
Full information on water restrictions can be found on Council's website
www.tenterfield.nsw.gov.au, or calling 02 6736 6000.

Appendix 6. Tenterfield Water Supply and Restriction Levels

Water Restrictions	RL (AHD)	Below Spillway (m)	Current Capacity (ML)	Capacity Percent
None	878.36	0	1300.4	100%
	878.31	0.05	1279.3	98%
	878.26	0.1	1258.2	97%
	878.21	0.15	1237.1	95%
	878.16	0.2	1216.0	94%
	878.11	0.25	1194.9	92%
	878.06	0.3	1173.8	90%
	878.00	0.36	1148.5	88%
	877.96	0.4	1131.1	87%
	877.91	0.45	1109.3	85%
	877.86	0.5	1087.5	84%
	877.81	0.55	1065.8	82%
	877.76	0.6	1044.0	80%
	877.71	0.65	1022.2	79%
	877.66	0.7	1000.4	77%
	877.60	0.76	974.3	75%
	877.56	0.8	959.8	74%
	877.50	0.86	938.2	72%
	877.46	0.9	923.7	71%
Level 1	877.41	0.95	905.6	70%
	877.36	1	887.5	68%
	877.30	1.06	865.9	67%

Water Restrictions	RL (AHD)	Below Spillway (m)	Current Capacity (ML)	Capacity Percent
	876.48	1.88	580.3	45%
	876.40	1.96	554.5	43%
	876.30	2.06	526.7	41%
Level 4	876.20	2.16	499.0	38%
	876.10	2.26	471.2	36%
	876.01	2.35	446.2	34%
	875.90	2.46	427.6	33%
	875.80	2.56	410.7	32%
	875.70	2.66	393.9	30%
	875.60	2.76	377.0	29%
	875.50	2.86	360.1	28%
	875.40	2.96	341.7	26%
	875.30	3.06	323.4	25%
	875.20	3.16	305.0	23%
	875.10	3.26	286.6	22%
	875.00	3.36	271.4	21%
	874.90	3.46	256.1	20%
	874.80	3.56	240.9	19%
	874.70	3.66	225.6	17%
	874.60	3.76	212.8	16%
Level 5	874.50	3.86	200.0	15%
	874.30	4.06	174.4	13%

	877.26	1.1	851.4	65%
	877.20	1.16	829.7	64%
	877.16	1.2	815.1	63%
	877.11	1.25	796.9	61%
Level 2	877.06	1.3	778.6	60%
	877.00	1.36	756.7	58%
	876.90	1.46	720.2	55%
	876.80	1.56	683.7	53%
Level 3	876.70	1.66	651.4	50%
	876.60	1.76	619.1	48%
	876.50	1.86	586.8	45%
	873.90	4.46	131.7	10%
	873.50	4.86	97.3	7%
	873.10	5.26	69.1	5%
	872.70	5.66	46.5	4%
	872.30	6.06	28.6	2%
	871.90	6.46	15.4	1%
	871.50	6.86	6.8	1%
	871.10	7.26	2.6	0.2%
	870.70	7.66	0.7	0.1%
Dam Empty	870.30	8.06	0	0%