

# Review of the implementation of Ministerial Policy 2015/1 *Water Resource Management During Extreme Dry Conditions during 2015-16*

December 2016

## I. INTRODUCTION

Extreme dry conditions affect much of Tasmania from time to time, and are often characterised by well below average winter rainfall, followed by dry spring and summer periods and very low stream flows through spring and summer. Tasmania's water resource management system, particularly where it is implemented through water management plans, has been developed, by necessity, in relation to long-term hydrological conditions.

And specific provisions within the water management system have not been developed to manage the circumstances occurring in extreme dry years and strict implementation of these provisions during these times, particularly restrictions on the taking of water, would often result in unacceptable impacts on farming enterprises and regional communities.

Ministerial Policy 2015/1 *Water Resource Management During Extreme Dry Conditions* (the Extreme Dry Conditions Policy) was adopted as a Ministerial policy under section 8 of the *Water Management Act 1999* (WMA) on 4 November 2015 by the Minister for Primary Industries and Water. The Policy sets out water resource management procedures to be implemented in Tasmania during extreme dry conditions, ensuring an appropriate balance between consumptive water needs and environmental water needs under these circumstances. The Policy was designed to provide greater flexibility in the implementation of irrigation restrictions and the approval of Watercourse Authorities to increase access to water during periods of extreme dry.

In accordance with the Policy, on 4 November 2015 the Minister for Primary Industries and Water determined that extreme dry conditions were prevailing in Tasmania and specified that all water resources in Tasmania were subject to the implementation of the Policy until such time as extreme dry conditions no longer prevailed. On 24 July 2016 the Minister for Primary Industries and Water determined that the Policy would cease to apply following the high levels of rainfall across Tasmania during May and June.

There is a requirement that the Extreme Dry Conditions Policy be reviewed within six months after each implementation period. In the case of the 2015-16 implementation period<sup>1</sup> a review must be undertaken by February 2017.

As specified in the Policy the review must consider:

- (a) the effectiveness of the Policy in meeting its objectives;
- (b) the effectiveness of the Policy's implementation including timeliness of decision-making, efficacy of operational actions and management of water resources; and
- (c) the overall effect of the Policy's implementation, both short-term and longer-term, in regard to water resource management in Tasmania.

Separately the Department has undertaken an operational review of the 2015-16 irrigation season to assess more broadly the impacts and responses to the extreme dry conditions. Out of that review a number of recommendations were made to refine water management in Tasmania that may assist with future responses to similar conditions. Where these recommendations impact on the potential implementation of the Extreme Dry Conditions Policy these issues will be discussed.

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<sup>1</sup> The period that this Policy was in force: 4 November 2015 until 24 July 2016.

In undertaking this review feedback was sought from the Tasmanian Farmers and Graziers Association, TasWater and Tasmanian Irrigation<sup>2</sup>.

## **2. WHAT DOES THE EXTREME DRY CONDITIONS POLICY PROVIDE FOR?**

### **2.1 Objectives of the Policy**

The objectives of the Extreme Dry Conditions Policy are to:

- (a) provide a set of management procedures that ensure an appropriate balance between consumptive water needs and environmental water needs during extreme dry conditions;
- (b) provide for transparent, consistent decision-making in regard to management of water resources during extreme dry conditions;
- (c) minimise hardship for farming enterprises and regional Tasmania whilst protecting water for critical human and stock requirements and significant environmental assets during extreme dry periods.

### **2.2 Flexible Implementation of Restrictions on the Taking of Water**

Flexible implementation of restrictions on the taking of water is the main plank of the Extreme Dry Conditions Policy. To ensure an appropriate balance between consumptive water needs and environmental water needs during extreme dry conditions, the restriction regime needs to be implemented in an adaptive manner. The Policy directs, procedurally, how decisions on the implementation of restrictions are to be made during extreme dry conditions in catchments with and without a Water Management Plan.

### **2.3 Conveyance of Water**

Greater flexibility in the conveyance of water to facilitate trading during extreme dry conditions was provided to farmers under the Policy by removing the requirement to convey water to the extraction point in certain circumstances and by forgoing all, or part of, any requirement to account for conveyance losses.

The Extreme Dry Conditions Policy directs, that Watercourse Authorisations under Part 6A of the WMA may be approved with a condition permitting water to be taken from a location within 5 km upstream of where the release water is conveyed to (subject to suitable hydrological conditions). The Policy also directs that where it would not otherwise impact on other water users, Watercourse Authorisations may be approved and issued under Part 6A, without conditions requiring full conveyance losses to be accounted for.

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<sup>2</sup> TasWater provided feedback on 29 September 2016.

## 2.4 Compliance and enforcement

The Extreme Dry Conditions Policy reiterates that the compliance and enforcement activities undertaken by the Department will continue to be implemented when the Policy is implemented. There is a strong focus on education to encourage compliant behaviour and working with catchment communities to address key water management issues to support compliance.

## 3. EXTREME DRY CONDITIONS IN 2015-16

The 2015-16 irrigation season was one of the driest on record across Tasmania, and had a significant impact on agricultural production across much of the State. Following an extended period of below average rainfall that was evident from late winter 2015, extreme dry conditions prevailed across much of Tasmania during spring and early summer with rainfall across the State below or very much below average, particularly during September and October.

Significant rainfall deficits were experienced across Tasmania during 2015, in particular in key agricultural areas in the State, and resulted in reduced flows through streams across much of Tasmania. The El Niño weather pattern experienced during 2015-16 was the strongest observed since 1997<sup>3</sup>.

These rainfall patterns had severe impacts on soil moisture levels resulting in greater demands for irrigation water earlier in the year across the north of Tasmania in particular before the traditional start of the irrigation season in December. Continued low stream flows also reduced the amount of water available for both early irrigation demands and the filling of farm dams for the summer period.

These sustained low flow periods saw continued winter restrictions on the Boobyalla and Tomahawk Rivers from July 2015, with the South Esk and St Pauls Rivers also experiencing restrictions on the filling of dams during this period. Winter Cease to Take (CTT) triggers in the Ringarooma Water Management Plan were also reached for the first time on the Ringarooma River in late September as irrigation demand started to increase.

This resulted in irrigation based enterprises in both the Ringarooma and South Esk catchments either being unable to water crops and pasture at the start of the season, or being compelled to use their on farm water storages earlier than they had planned to maintain production. With no guarantee of opportunities to replenish the water taken from those farm dams during the remaining winter period, this presented a possibility of not having access to stored water late in the season when any deficit in irrigation water for crops would result in significant reductions in yield.

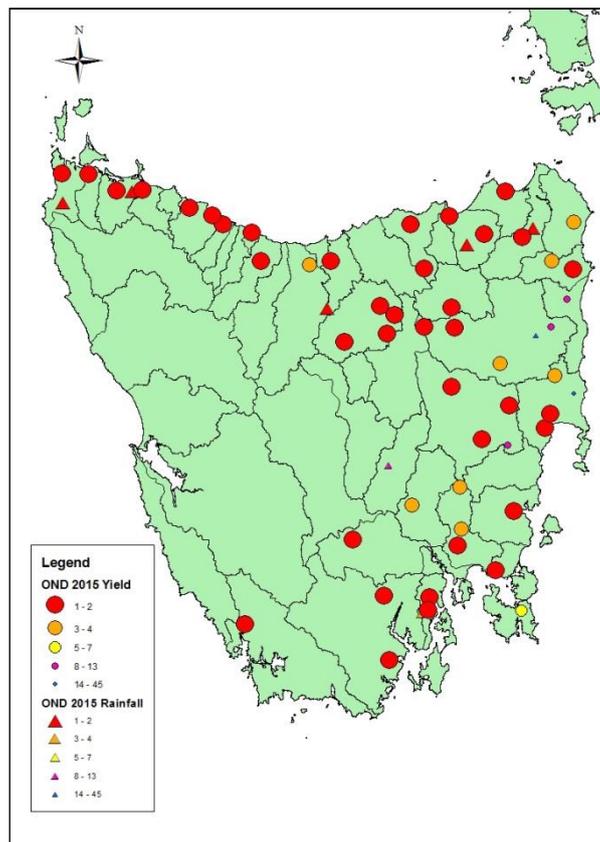
In addition to this, a number of waterways in catchments not covered by Water Management Plans started to experience early restrictions as a result of flows falling below

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<sup>3</sup> El Niño events are usually associated with below average spring rainfall over eastern Australia, and increased spring and summer daytime temperatures south of the tropics. Its counterpart in the Indian Ocean, the positive Indian Ocean Dipole, was at levels not seen since late 2006, which reinforced the drying pattern, particularly in the southeast of Australia.

existing operational trigger points for summer restrictions. Restrictions occurred up to 3 months earlier than normally expected.

An analysis of the hydrological conditions by the Department indicates that during the 2015 spring and early summer periods, conditions deteriorated rapidly across the State (DPIPWE 2016a)<sup>4</sup>. The combination of below average autumn and winter yields, minimal spring rains resulted in all sites recording below average yields. This dry pattern persisted into summer with no reprieve until late January when a storm event provided increased river flows for east coast catchments (DPIPWE 2016a). Unfortunately this rainfall did not occur state-wide and many catchments continued to experience lower than average yields (DPIPWE 2016a). Figure 1 shows the rankings of streamflow yields and rainfall during the 2015 late spring and early summer period. Rankings of 1-2 (in red) are the sites with the lowest or second lowest yields/rainfall on record for the late spring early summer period. The analysis indicated that for this period 26 sites had the lowest ranking on record and that a further 13 sites were ranked the second lowest yield and of the 52 sites assessed, 47 were ranked in the lowest 10 years on record in relation to streamflow yields for late spring early summer (DPIPWE 2016a).



**Figure 1.** Late Spring Early Summer (October, November, December) 2015 Yield (ML) Rankings (DPIPWE 2016a).

<sup>4</sup> The spring period refers to the months of September, October and November. Late spring and early summer refers to the months of October, November and December.

## **4. WHAT ACTIONS UNDER THE EXTREME DRY CONDITIONS POLICY WERE MADE IN 2015-16?**

### **4.1 Ministerial determination that extreme dry conditions prevailed**

The continued dry conditions across significant areas of the Tasmania were the impetus for the Minister to determine on 4 November 2015 that the Extreme Dry Conditions Policy would prevail across all water resources in Tasmania. Multiple lines of evidence were used to make the determination and the Minister took into consideration the following:

- the presence of El Niño and Indian Ocean Dipole climatic systems;
- seasonal rainfall and streamflow forecasts made by the Bureau of Meteorology;
- winter flow conditions;
- the geographic extent to which Tasmania, or significant parts of Tasmania, are, or are likely to be, affected;
- the likelihood of long-term restrictions on the taking of water being in place without the operation of this Policy.

The Department's recent retrospective analysis of the hydrological conditions that prevailed at this time have reaffirmed that the lines of evidence used to make the determination were appropriate (DPIPWE 2016a). Nevertheless, consideration should be given to using hydrological triggers and other measures such as soil moisture from the Bureau of Meteorology's to provide effective real-time lines of evidence to support any future determination that extreme dry conditions are prevailing.

### **4.2 Actions during the 2015-16 implementation period**

During the 2015-16 implementation period, decisions to withhold water restrictions in the Boobyalla, Mersey, Ringarooma and South Esk River catchments were made in accordance the Extreme Dry Conditions Policy. In addition, 26 of 31 Watercourse Authorities to convey water in nine catchments were issued during the 2015-16 implementation period that had transmission losses waived or reduced in accordance with the Policy.

#### **4.2.1 Flexible Implementation of Restrictions on the Taking of Water**

During the 2015-16 implementation period, the Department issued restrictions in 27 catchments around the State. As detailed in Table I, during the 2015-16 implementation period, decisions to withhold or ease water restrictions in four catchments occurred in accordance with the Extreme Dry Conditions Policy. The four catchments were the Boobyalla, Mersey, Ringarooma and South Esk River catchments, all of which are subject to the provisions of a Water Management Plan.

All decisions to withhold restrictions took into consideration multiple lines of evidence and were endorsed by the Manager, Water Operations Branch and then subsequently approved by the General Manager, Water and Marine Resources Division. The existing templates were updated to incorporate the Policy into the restriction management standard decision making protocol used by the Department for normal catchment management decision making.

**Table I.** Actions relating to restriction management taken in accordance with the Extreme Dry Conditions Policy.

<p><b><u>Boobyalla River</u></b></p> <ul style="list-style-type: none"> <li>• <b>Extreme Dry Conditions Policy applied:</b> 6/11/15 until 2/12/15 (27 days)</li> <li>• <b>Action taken:</b> The restriction issued on 30/10/15 (total ban on the taking of surety 5 &amp; 6 water) was rescinded.</li> <li>• <b>Rationale for applying the Extreme Dry Conditions Policy:</b> crop vulnerability, limited access to alternate water, short term streamflow forecasts and forecast limited rainfall within a week to provide temporary relief on river extraction for a short time.</li> <li>• <b>What followed next?:</b> On 2/12/15 there was a total ban on the taking of surety 5 &amp; 6 water.</li> </ul>
<p><b><u>South Esk River and tributaries upstream of the Macquarie River confluence (excluding St Pauls and Nile Rivers)</u></b></p> <ul style="list-style-type: none"> <li>• <b>Extreme Dry Conditions Policy applied:</b> 6/11/15 until 13/11/15 (7 days)</li> <li>• <b>Action taken:</b> The Summer period (December to April) cease-to-take level was applied and a restriction withheld.</li> <li>• <b>Rationale for applying the Extreme Dry Conditions Policy:</b> crop vulnerability, limited access to alternate water, short term streamflow forecasts and forecast limited rainfall within a week to provide temporary relief on river extraction for a short time.</li> <li>• <b>What followed next?:</b> On 13/11/15 a flood take notice was issued for 5 days and the next restriction occurred on 8/12/15 with a total ban on the taking of surety 5 &amp; 6 water.</li> </ul>
<p><b><u>Ringarooma River and tributaries</u></b></p> <ul style="list-style-type: none"> <li>• <b>Extreme Dry Conditions Policy applied:</b> 21/12/15 until 5/1/16 (16 days)</li> <li>• <b>Action taken:</b> A restriction was withheld.</li> <li>• <b>Rationale for applying the Extreme Dry Conditions Policy:</b> crop vulnerability, limited access to alternate water, short term streamflow forecasts and forecast limited rainfall within a week to provide temp relief on river extraction for a short time.</li> <li>• <b>What followed next?:</b> On 5/1/16 there was a total ban on the taking of surety 6 water.</li> </ul>
<p><b><u>Mersey River and tributaries</u></b></p> <ul style="list-style-type: none"> <li>• <b>Extreme Dry Conditions Policy applied:</b> 16/1/16 until 28/1/16 (12 days)</li> <li>• <b>Action taken:</b> Full restriction on surety 5 water withheld, and a 50% restriction on the taking of surety 5 water, short term streamflow forecasts and 100% ban on taking of surety 6 water was implemented.</li> <li>• <b>Rationale for applying the Extreme Dry Conditions Policy:</b> critical demands and lack of alternative water.</li> <li>• <b>What followed next?:</b> On 28/1/16 the restriction notice was lifted due to rainfall.</li> </ul>

Some of the evidence used by Departmental staff to determine whether the Extreme Dry Conditions Policy would apply is part of the business as usual information that regional officers collect to support management decisions within the catchments. This includes anticipating crop data, reviewing weather observations and seasonal outlook information.

Feedback from the Inland Fisheries Advisory Council is that the Director of Inland Fisheries should be consulted prior to making a determination to withhold a water restriction. This was not done during the 2015-16 implementation period and will be considered for any future implementation of the Policy.

#### 4.2.2 Conveyance of Water

During the 2015-16 implementation period, 31 Watercourse Authorisations (WCA) were issued by the Department. Excluding one transfer for an aquaculture enterprise, the WCAs ranged in size from 5 ML to 281 ML. And the necessity to waive or reduce the conveyance loss condition associated with each authorisation was considered on a case by case basis.

Seven WCAs were issued authorising the conveyance of 670ML where water was to be taken upstream from the release point. The majority of these WCAs were for conveyance within the Ringarooma catchment, one for the Brid River and one for the Mersey River. These WCAs would not have been approved if the Extreme Dry Conditions Policy was not being implemented.

Table 2 summarises how these 31 WCAs were dealt with and shows that transmission losses associated with five WCAs were not reduced or waived in accordance with the Extreme Dry Conditions Policy as reducing those transmission losses could lead to potential impacts on critical human and stock requirements or environmental water needs. All WCAs were approved for just the current irrigation season.

**Table 2.** Watercourse Authorities issued during the 2015-16 implementation period.

Catchment	Total number of WCA issued	Transmission losses waived	Transmission losses reduced	Transmission loss conditions not waived <sup>1</sup>	Additional water potentially available (ML)
Black-Detention	3	3	0	0	5.4
Brid	5	5	0	0	201.5 <sup>2</sup>
Duck	3	0	3	0	1.9
Great Forester	1	1	0	0	2
Mersey	2	1	1	0	100
North Esk	1	0	1	0	0 <sup>3</sup>
Ringarooma	10	7	1	2	573.8
Rubicon	1	1	0	0	13.6
South Esk	5	0	2	3 <sup>3</sup>	24.4
<b>TOTAL</b>	<b>31</b>	<b>18</b>	<b>8</b>	<b>5</b>	<b>922.6</b>
<ol style="list-style-type: none"> <li>1. Transmission losses were not waived where these had already been provided for in the WCA application or where it was not considered appropriate for transmission losses to be retained.</li> <li>2. 91% of this water was for aquaculture.</li> <li>3. No additional water because the client advised the Department of the transmission losses to be applied.</li> <li>4. One of the WCA was within the same zone so there were no conveyance losses to waive.</li> </ol>					

As detailed in Table 2, the implementation of the Extreme Dry Conditions Policy allowed for an additional 922.6 ML of water to be potentially available for taking available through the reduction or waiving of conveyance losses and the approval of WCAs where water was to be taken upstream from the release point.

Overall WCAs approved during the 2015-16 implementation period authorised 4,568 ML of water to be conveyed with 4,389 ML available to be taken, after transmission losses were discounted<sup>5</sup>. If the same WCAs were issued in a year during which the Extreme Dry Conditions Policy was not being implemented and normal transmission losses applied and upstream conveyance was not allowed, then an estimated 3,898 ML would have been released with 3,466 ML been potentially available to be taken.

### 4.3 Determination that Extreme Dry Conditions no longer prevail

In July 2016 the Minister determined that extreme dry conditions no longer prevailed in Tasmania and the implementation of the Policy formally ceased. This followed substantial rainfall during May and June which resulted in major flooding across a number of northern river basins. In this instance the decision to cease the implementation of the Extreme Dry Conditions Policy was clear-cut, however, this will not always be the case and consideration should be given to what advice the Minister needs to determine that extreme dry conditions no longer prevail and the implementation of the Policy cease.

## 5. POTENTIAL EFFECTS OF THE 2015-16 IMPLEMENTATION OF THE POLICY

### 5.1 Views of Water Users

In August the Minister wrote to more than 2,500 irrigators seeking their feedback on their experiences in the 2015-16 irrigation season. One of the issues covered by the survey was whether or not irrigators were aware of the Extreme Dry Conditions Policy and whether it assisted their businesses. In relation to awareness of the Policy, a total of 571 responses to were received with 35% aware and 65% not aware of the Policy. The 35% of respondents were asked whether or not the Policy assisted their business and those responses are detailed in Table 4. Some 32% or 79 respondents agreed or strongly agreed that the Policy assisted their business

**Table 3.** Findings of the irrigation survey question regarding whether the Extreme Dry Conditions Policy assisted their business, based on 246 responses.

Survey answer	%	Number of responses
Strongly agree	11.4%	28
Agree	20.7%	51
Neither agree or disagree	45.5%	112
Disagree	12.2%	30
Strongly disagree	10.2%	25

<sup>5</sup> One WCA conveying water to an aquaculture enterprise accounted for around 40% of all the water approved for conveyance.

It is difficult to quantify more broadly the impacts of the Policy's implementation on water users to minimise hardship for farming enterprises during extreme dry conditions because there are a number of variables that influence individual decisions regarding how water would be used during any irrigation season. For instance cooperative water sharing arrangements may facilitate greater access to water in some catchments and individual business decisions leading into the 2015-16 implementation period on the risks associated with likely water availability during the irrigation season would impact on how the Policy would have provided benefits to particular businesses. Farmers with on-farm storage, access to water from an irrigation scheme, access to groundwater or a combination of these are likely to be better placed to manage extreme dry conditions compared to those entirely reliant on taking water from rivers to apply directly to pasture or crops.

Nevertheless, providing additional water through the conveyance of water and flexible implementation of restrictions provided support to growers in a number of catchments. The goodwill generated by the Policy within the farming communities allowed in a stressful environment the opportunity for some breathing space in order to refine water sharing arrangements. Combined with existing cooperative approaches between water users in catchments such as the Flowerdale, Leven, Mersey, Liffey and Ringarooma, water users were able to work towards sharing water resources to avoid or minimise the number of days that restrictions would occur. As can be seen in Tables 1 and 2, decisions under this Policy were made in a number of catchments with water availability greatly increased in the Ringarooma with potentially an additional 574 ML available through more flexible conveyance of water.

Feedback from some water users is that the arrangements provided by the Extreme Dry Conditions Policy should be formalised in water management plans to deal with extreme dry conditions within the planning regime. This is not considered warranted because this Policy explicitly deals with extreme conditions that lay outside of the regular planning process.

## **5.2 Impact of the 2015-16 implementation on third parties**

In managing the State's water resources the Department took into consideration impacts on third parties such as stock and domestic users and town water requirements as when decisions were made under this Policy to either withhold restrictions or provide for WCAs.

Managing water to meet all needs under extreme dry conditions is challenging and will work most effectively with the involvement of water users in developing a cooperative management regime. The highest priority water is provided at surety 1 for critical stock and domestic needs, followed by the needs of the environment at surety level 2. Triggers for implementing restriction management are set at levels that aim to maintain stock and domestic and environmental water needs.

TasWater noted in their submission that the Extreme Dry Conditions Policy refers to the 'likely demand for irrigation water', but not for demand for different allocation purposes such as town supply, aquaculture and other commercial uses'. Notwithstanding that the Policy focuses on the supporting Government's vision of cultivating prosperity in agriculture, the Policy preserves access to essential town water supplies, and places non-essential town water, aquaculture and commercial uses on an equal footing with other water allocations of a similar surety level.

### **5.2.1 Essential town water and stock and domestic needs**

There were no reports of water not being available for essential town water supplies nor for stock and domestic needs when restrictions were withheld or as a result of the conveyance of water undertaken during the 2015-16 implementation period in accordance with the Extreme Dry Conditions Policy.

It is difficult to quantify the individual impacts of allowing water to be taken up to 5km upstream and the waiving of conveyance losses. Timing and duration of individual conveyance events on particular river systems and whether it causes pulsing flow events and the state of the river at the time of the conveyance would influence what impacts occurred. However transmission losses do tend to be higher than normal under low flow conditions such as those that prevailed during the 2015-16 implementation period. As noted in the *Operational Review of the 2015-16 Irrigation Season* in some systems the actual losses were estimated to have been as high as 40-50%, this combined with upstream transfers made the potential for third party impacts much greater if operations were not closely monitored (DPIPWE 2016b).

As noted in the *Operational Review of the 2015-16 Irrigation Season* the arrangements for the conveyance of water provided by the Extreme Dry Conditions Policy was critical in maintaining the ability of many irrigators to continue to operate (DPIPWE 2016b). Nevertheless, this flexibility did result in a number of issues with the on-ground management of these WCAs. This included the patterns of water releases and extraction resulting in daily fluctuations in river levels which in the case of the Black River, nearly stopped the flow in the River (DPIPWE 2016b). There was also complex management required of WCAs which enabled upstream transfers, in particular where multiple instream dams were present. This required a high level of oversight by Departmental staff and took them away from assisting the broader irrigation community in that area.

### **5.2.2 Environmental water needs and the ecological effects of low flow conditions**

The Department undertook a study of the effects of the dry climatic conditions during 2015-16 on rivers in Tasmania (DPIPWE 2016c). The primary purpose of the study was to provide information on the condition of rivers across the State between spring 2015 and autumn 2016 and to assess the ecological effects of the low flow conditions which were primarily driven by climatic conditions. This information was used to inform this review, the study did not however, examine the environmental effects of the implementation of the Extreme Dry Conditions Policy.

The effects of low flow conditions on rivers in northern, north-eastern and southern Tasmania during 2015-16 were assessed by measuring/sampling instream wetted habitat, physico-chemistry, and benthic substrate, sediment, algae and macroinvertebrate communities at 13 sites across nine rivers between early January and late April 2016<sup>6</sup>. Gauged flow records for the study rivers were also collated. In addition, broad-scale AusRivAS (Australian River Assessment System) sampling of macroinvertebrates was undertaken at approximately 90 sites across Tasmanian in spring 2015 and autumn 2016.

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<sup>6</sup> The nine study rivers represented perennial, free-stone (mostly cobble-dominated) rivers of a range of sizes that had varying degrees of agricultural land and water use in their catchments. This included one site on each of the following rivers: the Cam River, Don River, Esperance River, Mountain River and Styx River; and two sites on each of the following rivers: Leven River, North Esk River, Ringarooma River and South Esk River.

Appendix I provides an overview of the key findings of the study. Leading into the 2015-16 implementation period and throughout that period, rivers were in poor condition and stressed. River conditions were very poor during spring 2015 and there was some recovery by autumn 2016. Pulsing events and intense water extraction tended to exacerbate river health issues and cautious implementation of the Extreme Dry Conditions Policy is required in rivers that are under stress (DPIPWE 2016c).

The report noted a number of water management implications that require consideration in any future implementation of the Extreme Dry Conditions Policy, these are presented in Table 4.

**Table 4.** The ecological effects of low flow conditions that should be considered in any future implementation of the Extreme Dry Conditions Policy based on DPIPWE (2016c).

Water management issue	Issues to consider
<p>Prolonged periods of low flows between winter 2015 and autumn 2016 appeared to negatively affect the condition of many rivers across Tasmania, and impacted reaches in agricultural areas did not recover with the occurrence of increased baseflows and freshes in late summer – autumn 2016.</p> <p>Impacted reaches (i.e. those affected by agriculture in the their upstream catchments) are not as resilient to the effects of stressors associated with low flows and are likely to take several months (or years) to recover. Furthermore, long-term temporal declines in condition in some rivers suggest that some rivers may not recover. Recovery of rivers across Tasmania from the effects of 2015/16 is subject to ongoing monitoring; however, given these findings, the Policy should only be implemented when absolutely necessary as providing further access to water from rivers at this time is likely to exacerbate the impacts of low flows.</p>	<ul style="list-style-type: none"> <li>• Continue to monitor the recovery of rivers in Tasmania from the effects of the dry climatic conditions in 2015/16.</li> <li>• Implement the Policy only when absolutely necessary as providing further access to water from rivers in agricultural catchments when flows are less than monthly cease-to-take thresholds is likely to exacerbate the impacts of low flows.</li> </ul>
<p>During autumn 2016, river reaches with high levels of agricultural land use (and water use) in their upstream catchments were in poorer condition (e.g. higher sediment and algal loads, altered macroinvertebrate communities) than those with minimal agriculture.</p> <p>As the Policy applies primarily to agricultural catchments, its implementation should recognise that many rivers in agricultural landscapes in Tasmania are impaired to varying extents. Therefore, the Policy should be implemented with caution following well-defined guidelines that relate to climate and streamflow conditions to help determine when it begins and ceases to apply.</p>	<ul style="list-style-type: none"> <li>• Implement the Policy with caution following well-defined guidelines that relate to climate and streamflow conditions to help determine when it begins and ceases to apply.</li> </ul>
<p>Substantial diel (within-day) flow variability was evident in several of the study rivers and this type of flow variability is likely to increase under low flow conditions and high levels of water extraction.</p> <p>Recent work in the Ringarooma River catchment in Tasmania, and scientific literature relating to the ecological effects of unnatural sub-daily flow variability, suggest that pronounced diel flow variability can have significant impacts on riverine ecosystems. Implementation of the Policy should seek to mitigate the influence of direct water extraction on baseflow variability where it is likely to cause negative environmental impacts.</p>	<ul style="list-style-type: none"> <li>• Implementation of the Policy should seek to mitigate the influence of direct water extraction on baseflow variability where it is likely to cause negative environmental impacts.</li> </ul>

<b>Water management issue</b>	<b>Issues to consider</b>
<p>During prolonged periods of low baseflows, benthic loads of sediment and algae are likely to increase, and water quality may deteriorate in rivers in agricultural landscapes. Freshes and high flow events reduce benthic loads of sediment and algae, and they may alleviate poor water quality.</p> <p>Because of this, implementation of the Policy should consider protecting the occurrence, magnitude and duration of rainfall-driven freshes and high flow events. In particular, operation of dams on tributaries should ensure that these events are not substantially impacted and are able to pass through river systems.</p>	<ul style="list-style-type: none"> <li>• Implementation of the Policy should consider protecting the occurrence, magnitude and duration of rainfall-driven freshes and high flow events to ensure that these events are not substantially impacted and are able to pass through river systems.</li> </ul>
<p>The monitoring undertaken in this study has provided valuable information about: (1) the condition of rivers during a period when the Policy was implemented, and (2) the ecological effects of low flows on rivers in Tasmania.</p> <p>To adaptively manage water resources while the Policy is implemented and inform future reviews of the Policy, ecological monitoring should be conducted when it is implemented.</p>	<ul style="list-style-type: none"> <li>• Conduct ecological monitoring when the Policy is implemented and stipulate that this will be done in the Policy.</li> </ul>

## 6. REVIEW FINDINGS

The findings of this review of the implementation of the Extreme Dry Conditions Policy in 2015-16 are that:

- The retrospective hydrological review of the 2015-16 season validated that it was appropriate for the Minister to declare that extreme dry conditions prevailed in November 2015.
- The Policy explicitly dealt with extreme conditions that lay outside of the State's water management planning regime.
- The Policy supported the Department's effective management of water during the extreme dry conditions that prevailed in 2015-16.
- The Policy provided effective and transparent decision making in relation to water management during extreme dry periods.
- The aim of minimising hardship for some farming enterprises was facilitated through the increased availability of water in certain catchments at periods when crops were highly vulnerable to stress as a result of low water availability.
- Cooperative water sharing arrangements in some catchments helped to facilitate access to water outside of the implementation of this Policy.
- Experience gained through the 2015-16 implementation period provides a basis for improving any future implementation of the Policy (e.g. staged triggers for turning the Policy on/off and the complexities associated with compliance of WCAs where water may be taken upstream). The Department's scientific findings regarding hydrological condition will also assist the development of guidelines to determine that extreme dry conditions are likely and this will allow the Policy to be implemented on the basis of robust hydrological indicators.
- Notwithstanding that the 2015-16 implementation of the Extreme Dry Conditions Policy was on a Statewide basis, the fact that restrictions were only withheld on four instances means that due consideration was given to a range of factors identified in the Policy before a restriction notice was issued or withheld<sup>7</sup>.
- Regardless of whether this Policy is implemented or not, prolonged periods of low flow negatively affects the condition of many rivers and river reaches, with agricultural catchments being less resilient to stress.
- During very low flow conditions, enabling the conveyance of water up to 5km upstream can be problematic where water passes through multiple dams and involves third parties. This can result in highly complex management with a high level of oversight by Departmental staff required and may take staff away from assisting the broader irrigation community in that area.

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<sup>7</sup> This includes the matters specified in Schedules 1 and 2 of the Extreme Dry Conditions Policy.

- If extreme dry conditions prevail in future, the Department will be better positioned to rapidly put in place mechanisms to appropriately balance consumptive water needs and environmental water needs.

## **7. RECOMMENDATIONS**

The following recommendations cover a number of mechanisms to support future implementation of the Extreme Dry Conditions Policy as well as potential amendments to the Policy.

### ***Triggers for the Policy's future implementation***

1. Develop a process that will allow the Department and the Minister to consider whether or not deteriorating conditions will lead to an Extreme Dry Conditions determination thus enabling a rapid response if a declaration is made.
2. The Department develops a set of hydrological triggers to be used in conjunction with other lines of evidence to determine whether extreme dry conditions are prevailing.
3. Implement the Extreme Dry Conditions Policy with caution following well-defined guidelines that relate to climate and streamflow conditions to help determine when the Policy begins and ceases to apply.

### ***Supporting future implementation with internal guidelines and procedures***

4. The Department consider developing procedures and guidelines to support the implementation of the Policy, including:
  - i. Strategies to enable rapid response when it is clear that extreme dry conditions are likely to prevail (for example, the collection of crop information to support any withholding of restrictions).
  - ii. How decisions to approve WCAs authorising water was to be taken upstream from the release point will ensure that suitable hydrological conditions prevail and no third party impacts occur.
  - iii. How waiving or reducing transmission losses associated with WCAs are considered in terms of their potential impact on other water users. And how to minimise third party impacts that potentially could result in substantial fluctuations in river levels as a result of the release patterns and the downstream taking pattern.
  - iv. The circumstances for not adhering to the Water Management Procedures set out in the Policy (such as mitigating the influence of direct water extraction on baseflow variability where it is likely to cause negative environmental impacts).
  - v. Improving the knowledge of water users regarding the Policy, including how water licence and access rules to water apply in extreme dry conditions.

### ***Further review and potential amendments to the Policy***

5. Amend the Policy to ensure in catchments that the Inland Fisheries Service have an interest in, that the Director of Inland Fisheries is consulted in relation to any decision to withhold a water restriction.

6. The provision in the Policy relating to the conveyance of water up to 5km upstream be reviewed to determine the appropriateness of the 5km limitation and amended if necessary.
7. Amend the Policy to state that no upstream transfers will be approved if there are potential third party impacts that cannot be adequately managed.
8. Amend the Policy to include a mechanism for turning the Policy off, including the need for partial turning-off, where the Policy has been applied to the whole State.
9. Take into consideration the fact that some rivers are more stressed than others and the Policy, once implemented, needs to reflect that certain management arrangements may be necessary (e.g. letting flushing flows pass).
10. Consider how the Policy can be amended to allow for the water managers to protect the occurrence, magnitude and duration of rainfall-driven freshes and high flow events to ensure that these events are not substantially impacted and are able to pass through river systems.
11. Stipulate in the Policy that ecological monitoring be conducted when the Policy is implemented.

#### ***Impacts of low flow conditions***

12. Continue to monitor the recovery of rivers in Tasmania from the effects of the dry climatic conditions in 2015-16.
13. Implement the Policy only when absolutely necessary as providing further access to water from rivers in agricultural catchments when flows are less than monthly cease-to-take thresholds is likely to exacerbate the impacts of low flows.

## **8. REFERENCES**

DPIPWE (2016a). *2015/2016 State-wide Dry Season Hydrology Review Water Assessment Hydrology Report Series, Report No. WA 16/05* Water and Marine Resources Division, Department of Primary Industries, Parks, Water and Environment.

DPIPWE (2016b) *Operational Review of the 2015-16 Irrigation Season*. Water and Marine Resources Division, Department of Primary Industries, Parks, Water and Environment.

DPIPWE (2016c) *Effects of dry climatic conditions during 2015/16 on rivers in Tasmania*. Water Assessment Aquatic Ecology Report Series, Report No. WA 16/04. Water and Marine Resources Division, Department of Primary Industries, Parks, Water and Environment

## APPENDIX I

Key findings of the study of the effects of the dry climatic conditions during 2015-16 on rivers in Tasmania (DPIPWE 2016c).

Aim of the study	Findings
<p>1. Flow conditions in rivers in northern, north-eastern and southern Tasmania between winter 2015 and autumn 2016, and how they compared to historical flow conditions.</p>	<ul style="list-style-type: none"> <li>• In comparison to long-term gauged flow records, flows in rivers in northern, north-eastern and south-eastern Tasmania were quite low and less variable in winter 2015, and particularly low (e.g. regional averages of median flows were 49-77% less than long-term averages) and less variable in spring 2015 and summer 2015/16. In autumn 2016, low flows generally persisted, but freshes and brief high flow events occurred in some of the study rivers.</li> <li>• In comparison to long-term gauged flow records, in some rivers (e.g. Cam River) low flow spells in December-April 2015/16 persisted longer than had previously been recorded, while in other rivers (e.g. North Esk River) the duration of low spells was similar to recent dry summer-autumn periods (e.g. 2006/07).</li> <li>• Diel (within-day) flow variability (that is likely to have been caused by water extraction practices) featured in most of the rivers that were examined, and was particularly pronounced in the mid Ringarooma River, lower Esperance River and lower Mountain River, and to a lesser extent in the lower Don River, lower Cam River and mid Leven River.</li> </ul>
<p>2. Macroinvertebrate community composition in rivers across Tasmania (based on AusRivAS sampling) during spring 2015 and autumn 2016, and how the status of communities compared to the results of long-term monitoring</p>	<ul style="list-style-type: none"> <li>• The results of AusRivAS monitoring indicated that many rivers across Tasmania were in a poor state (based on macroinvertebrate community structure) in spring 2015, and to a lesser extent, in autumn 2016.</li> <li>• In spring 2015, 53% of the 60 long-term monitoring sites had O/E scores which were less than the lower bound of the 95% confidence interval (CI) of historical records, while in autumn 2016, 38% of the sites had O/E scores which were less than the lower bound of their 95% CI. In addition, 11 of the sites recorded their lowest O/E score during sampling in 2015/16.</li> <li>• Most sites that had substantially higher O/E scores in autumn 2016 (cf. spring 2015) had long-term mean O/E scores of greater than ~1.0 (i.e. band A or X sites, rated as equivalent to or above reference condition). This indicates that “healthier” sites were more resilient to the effects of the low flow conditions in 2015 – early 2016 and better able to respond to increased baseflows and the occurrence of freshes (and in some cases moderate floods, e.g. South Esk River) in late summer – autumn 2016.</li> <li>• Many impacted sites (long-term mean O/E scores of less than ~1.0, band B or C sites, rated as significantly or severely impaired) had similar or lower O/E scores in autumn 2016 (cf. spring</li> </ul>

	<p>2015), and thus were still in a particularly poor state in autumn 2016.</p> <ul style="list-style-type: none"> <li>• Long-term monitoring at sites in agricultural areas (e.g. Ringarooma River, Duck River, Cam River, Emu River) indicates that the condition of some rivers (based on O/E scores) has declined substantially since c. 1994-1998, and the results for spring 2015 and autumn 2016 aligned with these trends.</li> </ul>
<ul style="list-style-type: none"> <li>• Spatiotemporal patterns in instream wetted habitat, physico-chemistry, and benthic sediment, algae and macroinvertebrates in rivers in Tasmania between January and April 2016, and relationships between these parameters and environment variables.</li> </ul>	<ul style="list-style-type: none"> <li>• Generally, reasonable amounts of wetted habitats were evident in the study rivers between January and April 2016; however, wetted habitat was substantially reduced in terms of area and/or riffle depth for prolonged periods in the lower Don River between January and April 2016, and in the upper South Esk River and lower Mountain River in early January.</li> <li>• Water quality in the study rivers was within the ranges that typically occur in Tasmanian rivers, and unlikely to be stressful to aquatic biota. However, water temperature and dissolved oxygen (DO) measurements suggest that poor water quality (high water temperatures and low DO concentrations) may have occurred in some reaches (especially lower reaches) of the study rivers for short periods during summer 2015/16.</li> <li>• Algal and sediment covers had similar spatiotemporal patterns and indicated that the study rivers can be grouped as those with consistently low covers (e.g. Leven River), those with consistently high covers (e.g. Cam River, Don River, lower Ringarooma River), and those with moderate and variable covers (e.g. North Esk River, upper Esperance River).</li> <li>• Ten of the study sites recorded their highest total suspended sediment (TSS) value in early to mid-January 2016 following a prolonged period of low flows at most sites. The increase in flow at all sites in late January (due to substantial rainfall across Tasmania) is thought to have contributed to the reduction in suspended sediment loads at most sites from February to April 2016.</li> <li>• Agricultural land use (and water use) in the upstream catchments of study sites was positively correlated with benthic covers and loads of sediment and algae. In addition, univariate factorial analyses showed that algal and sediment cover was greater at sites with high levels of upstream agricultural land use compared to sites with low levels of agricultural land use.</li> <li>• Agricultural land use (and water use) in the upstream catchments of study sites was correlated with several macroinvertebrate metrics (%EPT, O/E score, %Obligates, %Avoiders) from qualitative and quantitative samples.</li> <li>• Univariate factorial analyses showed that differences in several macroinvertebrate metrics from qualitative and quantitative samples were related to high levels of upstream agricultural land use (and water use). Compared to sites with low levels of agriculture in their catchments,</li> </ul>

	<p>macroinvertebrate communities at the sites with high levels of agriculture had less taxa that were predicted to occur at the site, less EPT taxa, less flow obligate taxa, more flow avoiding taxa, and overall higher densities (possibly due to enrichment).</p> <ul style="list-style-type: none"><li>• The results of multivariate analyses of macroinvertebrate data supported the findings of the univariate analyses. Overall, qualitative and quantitative samples revealed similar differences in the structure of macroinvertebrate communities between sites with different levels of upstream agricultural land (and water use). Several environmental variables, including some relating to elevated levels of benthic sediment and algae, were correlated with the structure of the communities at the more agricultural sites.</li></ul>
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