

OTWAY WATER

Book 42 J

Comment on Barwon Water's, “Boundary Creek, Big Swamp and surrounding environment Remediation and Environmental Protection Plan”

20 December 2019



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21 January 2020, Commissioned by LAWROC Landcare Group
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Introduction

Nine reports totalling 1279 pages (see front page) makes up the documentation regarding the Remediation and Environment Protection Plan (REPP). These reports were submitted to Southern Rural Water on 20 December 2019. Otway Water Book 42 J makes comment mainly on the first of these documents, namely...

"Boundary Creek, Big Swamp and surrounding environment Remediation and Environmental Protection Plan." This REPP document contains 153 pages.

Otway water Book 42 J, Comment on REPP.

The 139 page Draft Version of the REPP was sent by email to Remediation Working Group members on the 10 December 2019 in preparation for the 10th Remediation Working Group meeting on the 12 December 2019. To adequately review the Draft and Final versions of the REPP has not been possible.

It must be stated at the very beginning that this *Boundary Creek, Big Swamp and surrounding environment Remediation and Environmental Protection Plan* (REPP), sets out extremely forward thinking and proactive actions dealing with the remediation of Boundary Creek and the Big Swamp. However.

The majority of the “comments” made in this Otway Water Book 42 J have been made numerous times before with little to no acknowledgement or reporting. If rigorous scientific and technical procedures had been followed many of the additional criticisms could have been avoided.

The Remediation and Environment Protection Plan, Pages 1-153

In one of the reports written by Jacobs⁽²⁵⁾ that was included in the Remediation and Environmental Protection Plan (REPP) sent to Southern Rural Water on 20 December 2019, it states “*The scope of works developed to meet the requirements of the Section 78 notice outlines a detailed program of works required to inform the remediation of the swamp...*” This is exactly as it should be. However, part of being “informed” is to be aware of and cover as many aspects of the “big picture” as is possible. Yes, the REPP does make mention of many of the various issues and aspects of past history but misses one crucial area. Little to nothing has been researched and or written up on the piezometric levels of the Lower Tertiary Aquifers (LTAs) pre groundwater extraction and how this extraction can be directly linked to and is the only reason for the calamity that has taken place in the Barwon Downs and upper Gellibrand River catchment areas. Nowhere has it been acknowledged that pre groundwater extraction, the water tables in the region were relatively stable. Understanding early historical facts is critical and should be recognised as having an enormous bearing on the remediation success criteria and principles driving the REPP. Recognition and acknowledgement of past events should be built into the foundations of an informed REPP.

Also, little to no recognition has been given to the impacted local landholders desire that the Lower Tertiary Aquifers be allowed to recover. At Barwon Water meetings community representation has placed this as a number one priority since 2013 and at later times through the licence application renewal and the s78 Notice process. This wish is not reflected nor placed as a remediation success criteria priority of the REPP.

It may take at least 309 years⁽⁸⁾ to remediate the depletion caused from anthropic groundwater extraction BUT shouldn't that be the number one

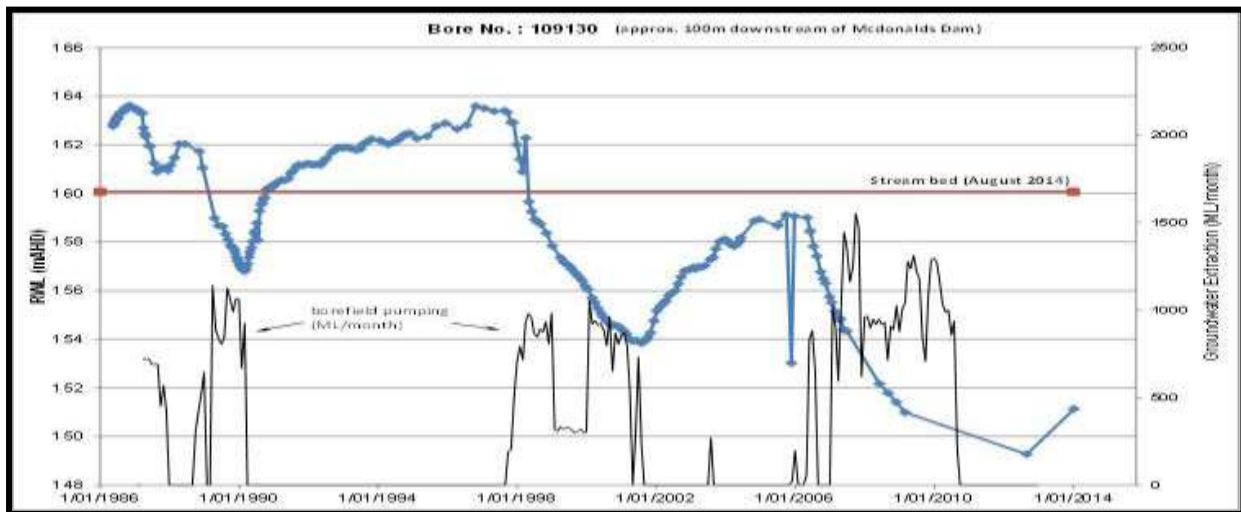
principle objective, and, be one of the remediation success criteria? Surely this is the intent portrayed by the s78 Notice,⁽²⁹⁾ that the LTA be restored to its natural and pre groundwater extraction stable level.

Why an understanding of the Pre-groundwater extraction Piezometric Water Levels is Critical to the First Principle of the REPP.

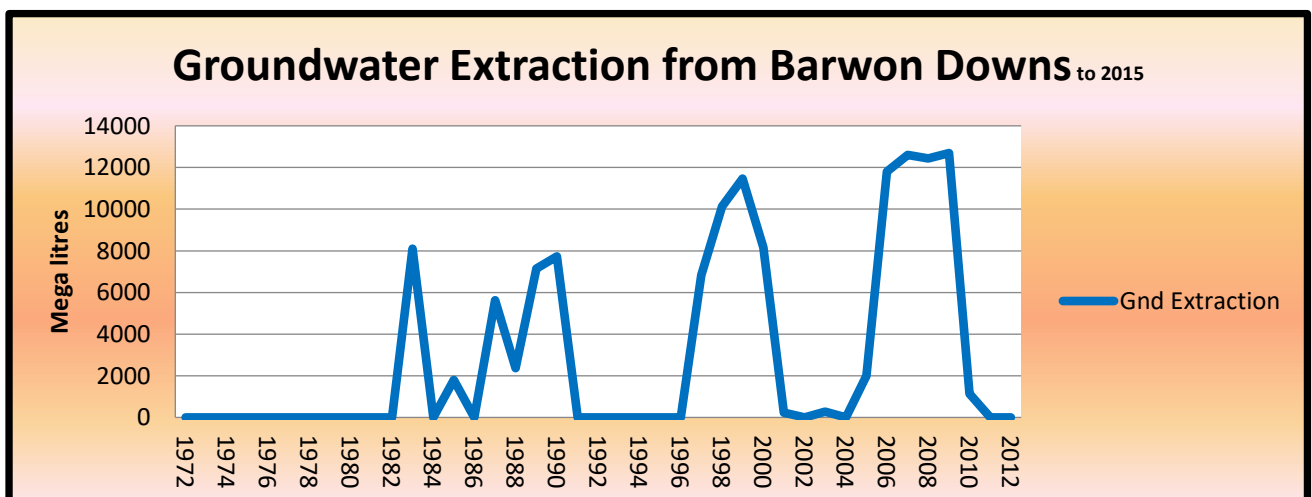
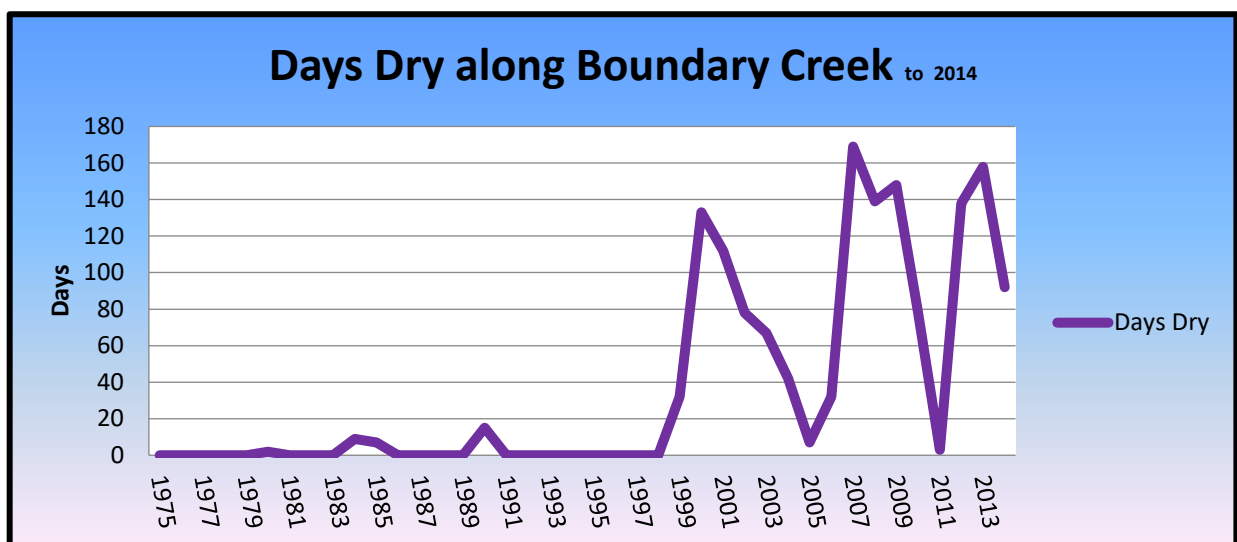
It is difficult to find any reference or answers to the following dot points in any of the REPP documentation submitted to Southern Rural Water 20 December 2019. These dot points are linked to the early historical facts and must be investigated, researched and answers sought. These dot points indicate that the multitude of detrimental impacts are directly and solely resulting from groundwater extraction at the Barwon Downs Borefield . The question needs to be asked if there had been no groundwater extraction was there ample buffering capacity within the Lower Tertiary Aquifers potentiometric levels to prevent these impacts? These dot points strongly indicate this to be the case and must be taken into consideration when determining the first Principle of the REPP.

- Local knowledge of Boundary Creek baseflows pre groundwater extraction has in large part been ignored allowing faulty assumptions to form part of historical record that is then used in the development of the REPP.
e.g. Local knowledge indicating why the Big Swamp has never been channelized, drained or turned into agricultural pasture.
- Why has the SKM's research that determined dropping the piezometric level in the LTA to 158m AHD would cause Boundary Creek to stop flowing not been followed up?
- No verification or otherwise has been undertaken to determine whether the trigger level for a Supplementary Flow release at 158.5 m AHD was appropriate.
- Why haven't the piezometric levels been graphed out and compared with the days of no flow in Boundary Creek; the pumping periods and the 158.5m trigger level, considering the level has dropped well below 158.5?
- Why was the 0.5m added to the initial determination of 158m AHD?
- Why did the piezometric levels within the Big Swamp region fall below 158.5 m AHD. And, why pre Millennium Drought, did the swamp catch fire in 1997 especially after one of the wettest periods in European rainfall record keeping? (see rainfall graph, page 15).

- How, can it be justified that during the period 1983 to 2003, climate change be held accountable for increasing the escalating number of no flow days in Boundary Creek?



Source: R. Evans presentation to Barwon Downs Groundwater Community Reference Group 2015.



- What were the piezometric levels across the Barwon Downs Graben pre groundwater extraction and why haven't they been shown in any of the presentations to community reference and consultative group meetings?
- Why hasn't there been a reassessment and analysis reviewing the work conducted by GHD in 2006 showing that deep water aquifers in the south west of Victoria are being lowered by approximately 10cm a year considering that at the Barwon Downs Borefield the drop was in excess of 55m over a 20 year period.
- Why hasn't there been any documentation and or modelling to show how far the piezometric level could be dropped from natural occurrences before the buffering capacity of the Lower Tertiary Aquifers would see the area of the Big Swamp dry out?
- It has never been clearly shown or explained how and why the artesian observation bores lost their artesianness and how this would create impacts across the Barwon Downs Graben.
The example below (see page 7) is the observation bore along Wire Lane that is situated on the top of a hill at approximately 157 m AHD and was used to irrigate adjoining pasture back in the 1970s (see Appendix One). This bore is at a similar level to the level of the Big Swamp.
- The observation Bore downstream of the Big Swamp at the Colac Forrest Road bridge, portrays a very similar hydrograph. Earliest records have this bore squirting water ~ 19 m out of the ground pre groundwater extraction. When pumping stopped in 2010 it had dropped to ~10 m below ground level. This bore is approximately one km downstream of the Big Swamp. Why hasn't this been taken into consideration? And, as importantly what are the levels now and what impact is this having in the Big Swamp remediation process?
- What was SKM hydrologist Rick Evans talking about when he stated in 2007 that Boundary Creek dried up as a result of a one year delay due to groundwater extraction at the Barwon Downs Borefield.

“Another example is from Geelong, where the predicted drying up of Boundary Creek by Barwon Downs bore field five kilometres away occurred after a lag of about one year.”⁽¹⁰⁾

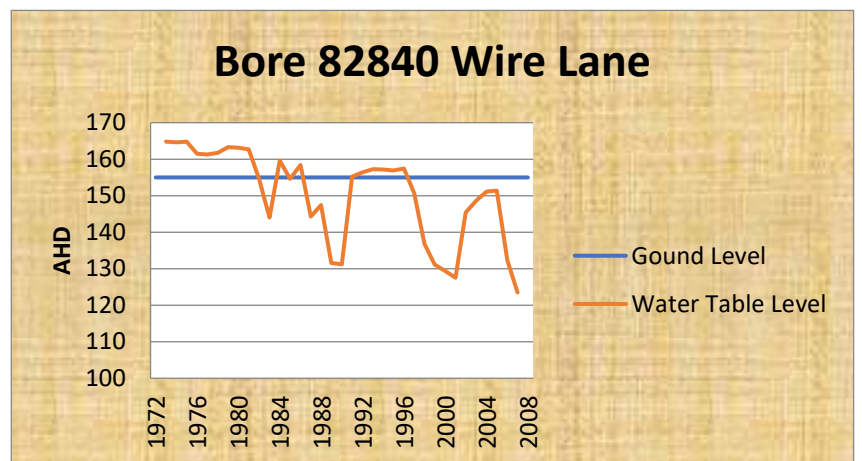
It was predicted that Boundary Creek would stop flowing due to groundwater extraction and as predicted, it actually took place (see page 20 for comment on the wording “as predicted”).

In the early 1970s when Bore 82840 was first drilled into the aquifer this was the height of the water spurting out of the ground, (8.7 metres above ground level). As at November 2007 extraction had lowered the water table at least 40 metres lower and the Millennium Drought was just beginning.



0.9 metres.

Bore Number 82840 along Wire Lane.



The piezometric level in 1972 was approximately 165 m AHD. By 2007 it had been lowered by approximately 40 m. Ground level at the Wire Lane observation bore is approximately 157 m AHD.

- **The Dynamic Equilibrium Water Level Zone (DEWLZ)**

In 1986 Farmar-Bowers⁽¹¹⁾ found that the water dynamics in the Barongarook High area had been relatively stable for some considerable time, and that under natural fluctuations of drought and wet periods the vegetation would have adapted to these conditions, changing very little. However, his research led him to believe that substantial ground water extraction would alter this natural fluctuation considerably, upsetting the natural balance. First signs of change would become apparent in groundwater dependent wetlands, springs and creeks. And oddly enough at the completion of the 1994, 2002 and 2008 vegetation surveys, these signs were becoming evident (see Carr page 19).

Farmar-Bowers included these two statements in his 1986 report that supports the notion that under conditions where there is no significant groundwater extraction the hydrologically sensitive vegetation ecosystems directly influenced by the Lower Tertiary Aquifers had and would continue to maintain a basic equilibrium.

“Current water tables appear to be quite stable and there is little movement between seasons or years. (J. Leonard Pers.Com.)”⁽¹¹⁾ Note

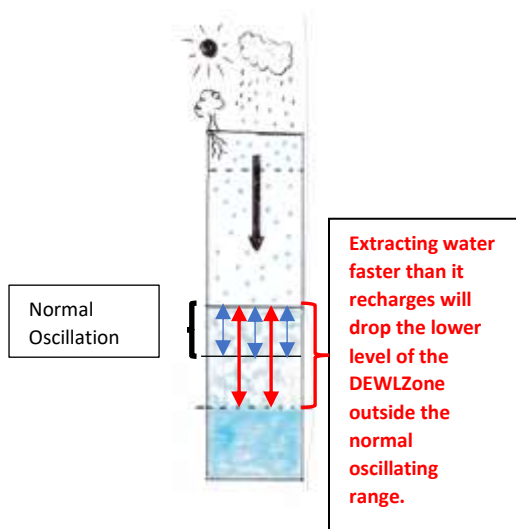
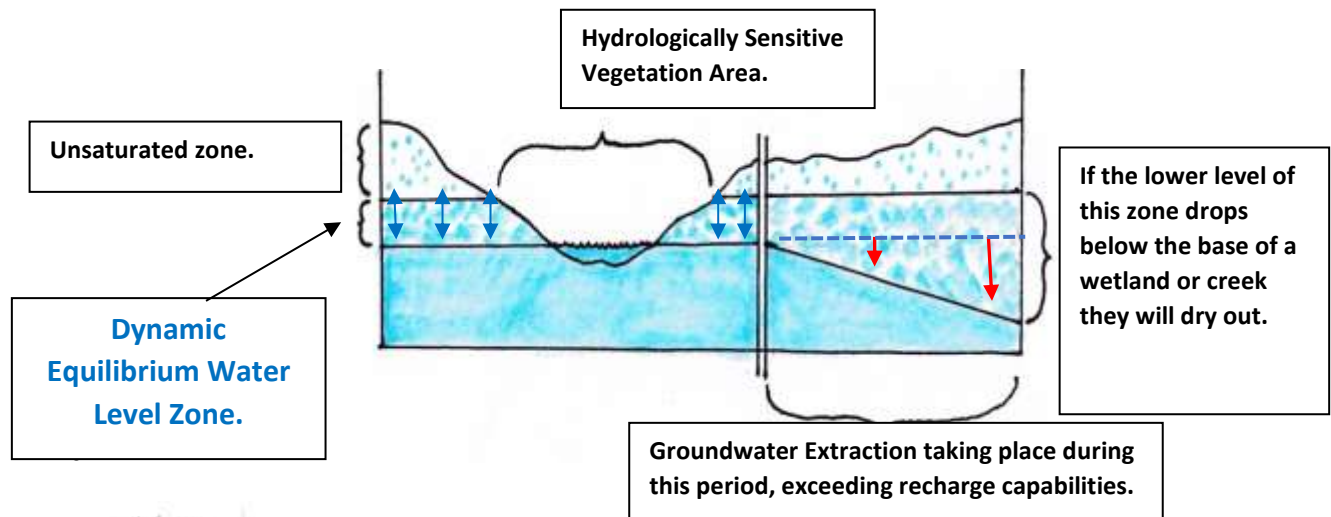
little movement between seasons or **years**. (John Leonard being a hydrogeologist with extensive experience and knowledge of the region.)

“Aquifer pumping during droughts, as is proposed, would tend to exacerbate the effects of natural variability by extending the effects of drought.”⁽¹¹⁾

By the mid 1990s and within the area of drawdown influence from the Barwon Downs Borefield, it was becoming obvious that this natural variation was changing and at an unusually fast pace; a much bigger change than would be expected under normal *“natural variability”* or *“normal undisturbed conditions.”* For the changes to be so dramatic and to happen over such a narrow timeframe is most unusual. There is much evidence of, and data available clearly showing that this natural variability has been drastically altered by ground water extraction at the Barwon Downs Borefield.

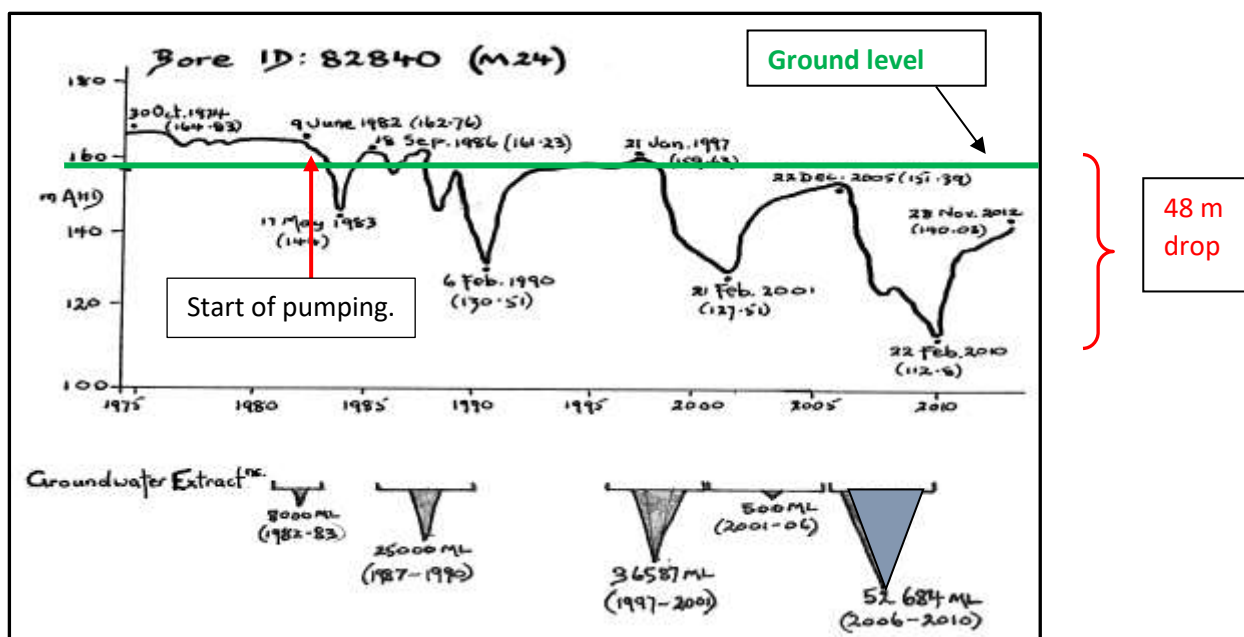
Rick Evans (SKM) speaks of this natural variability as a zone where the watertable naturally rises and falls to the “beat” of nature. Having come across this explanation of natural variability on numerous occasions I coined this zone of natural variability, the Dynamic Equilibrium Water Level Zone (DSEWLZ). During drier periods and including droughts the water pressure head drops and then recovers in wetter periods. This DSEWLZ zone is that area where there is a rise and fall of the piezometric level and is what Farmar-Bowers described as *“natural variability.”* The influencing factor across the Barwon Downs Graben allowing a natural variability to take place is an untapped Lower Tertiary Aquifer system.

Once groundwater extraction on a massive scale is placed into the equation, the lower level of the Dynamic Equilibrium Water Level Zone will drop further than can be justified as normal. A return to a natural variable state after groundwater extraction will take much longer to achieve than is normally experienced; may never happen, and, will depend on the amount of groundwater extracted. Any effect will be magnified if the water is extracted during dry or drought events.



In December 2006 the Department of Sustainability & Environment (DSE) tabled a report "Regional Groundwater Monitoring Network Review for the Deep Water Aquifer System in South West Victoria."⁽⁹⁾ This report states that in the far south west of the state groundwater is declining generally at rates less than 10 centimetres a year. That is to say besides there being a natural variability the lower level of the Dynamic Equilibrium Water Level Zone

(DEWLZ) is dropping by 10cm a year. The report goes on to say that at the current rate of decline watertables will drop in this region in the order of one metre in ten years. This report took into account climate change and present groundwater extraction in the South West. However, this study did not include the Barwon Downs Borefield area of influence where water table levels have been forcibly dropped tens of metres, in some cases at least 50m.



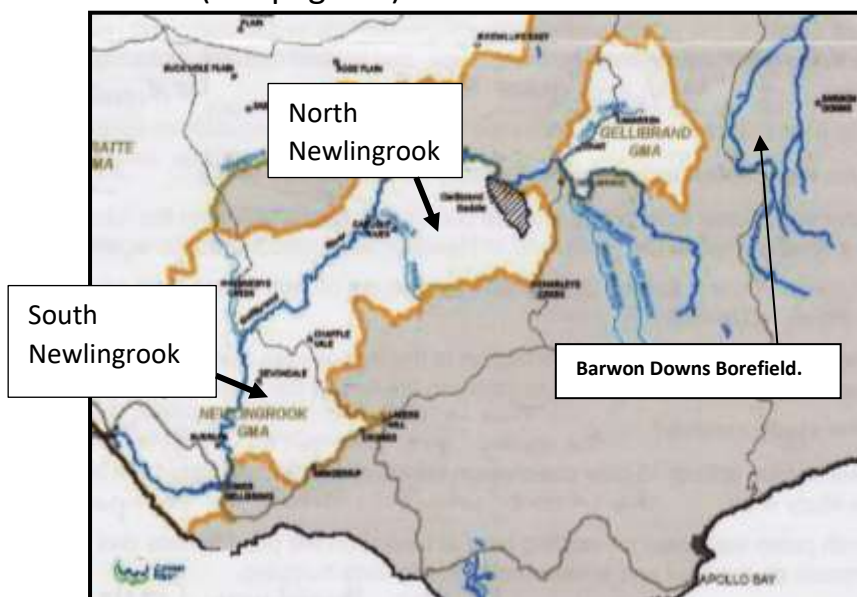
The above observation bore water table levels show how the Barwon downs Borefield extractions have skewed the DEWLZ way below the natural variability.



This observation bore hydrograph down the Kwarren groundwater flowpath shows a constant decline associated with and impacted by the Barwon downs Borefield extractions. There are no extraction bores in the Kwarren area that can account for this decline. This decline is much more than the 2006 GHD report predicted and is not a natural variability. There has been no response in the hydrographs during those wet winters since the Millennium drought. The Wade report⁽³⁹⁾ clearly accounts for this decline as a direct result of groundwater extraction from the Barwon Downs Borefield.

A 2010 SKM report titled “*Lower Tertiary Aquifer Groundwater Resource Appraisal*”⁽³²⁾ confirms that there is more at play in the Barwon Downs Borefield area of influence than a natural variation. “*...the Newlingrook South zone has not experienced falling water levels and it is likely that climate change has less impact in this area. It is unlikely that the Newlingrook North zone presents slowly falling trends as a result of climate change, because it is a similar climate to that of the southern zone. Therefore, the trends of the Newlingrook North zone are possibly associated with the faster rate of decline in the Barwon Downs Graben.*”

The Gellibrand/Kawarren groundwater flowpaths are found in the westerly section of the Barwon Downs Graben adjoining the Newlingrook Northern zone. Just as the Newlingrook Northern zone should not be showing greater groundwater decline than the Southern zone, neither should the Gellibrand/Kawarren zone be likewise declining. Under natural variation in the Dynamic Equilibrium Water Level Zone and because of a buffering discharge from the Lower Tertiary Aquifers, the groundwater levels in these three areas should be reacting in a similar fashion to whatever natural forces are at work. The Newlingrook South zone has not experienced falling water levels whereas the Newlingrook North zone is experiencing slowly falling trends. In the adjoining Groundwater Management Area to the east, the Gellibrand/Kawarren zone is experiencing extraordinary falls in the water table. Closer still to the Barwon Downs Borefield the water tables have dramatic and massive drawdown effects (see page 14).

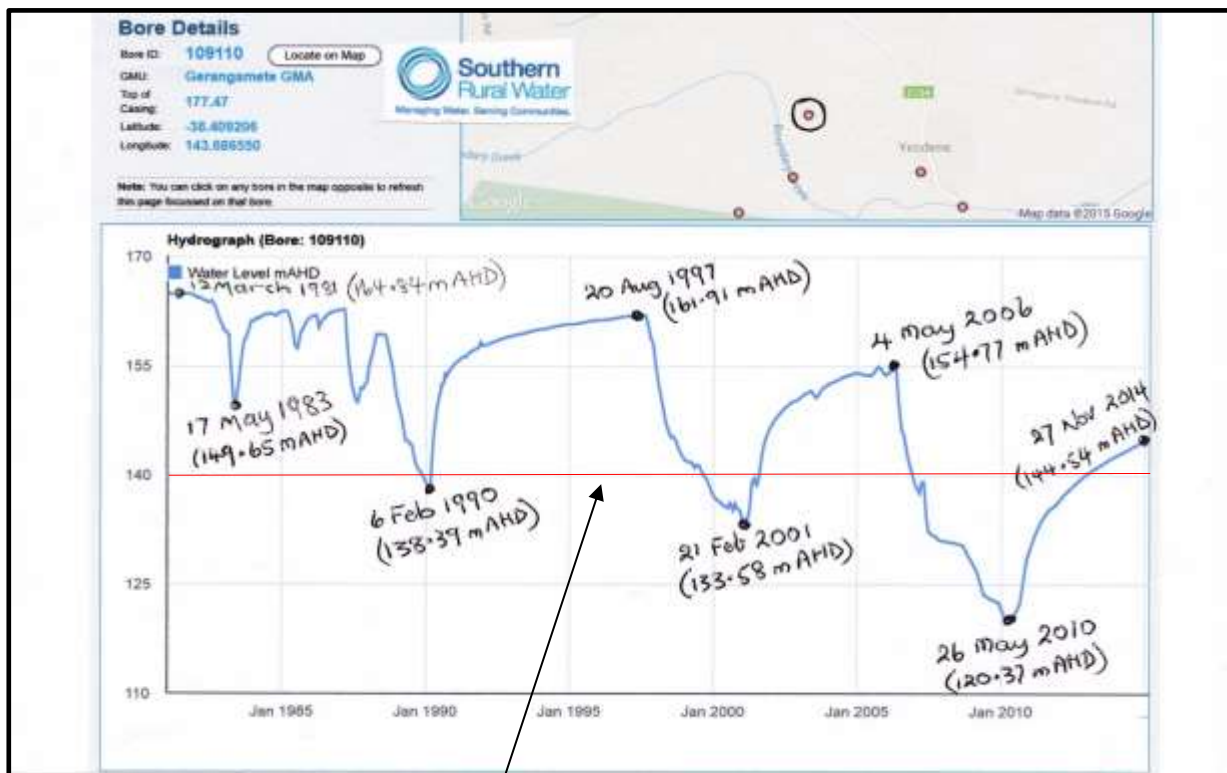


This highlights that there is a greater impact the closer one gets to the Barwon Downs Borefield. Confirmation of this is found in a quote from a Wannon Water document, “*Improving Environmental Flows in the Gellibrand River: Assessment of Water Supply Augmentation Options. May 2016.*” From

an observation bore screened in “*...the Pebble Point Formation (this is*

the largest aquifer for the proposed production bore). Water levels show seasonal fluctuations less than 20cm. A slight decline (20cm) in water levels has occurred between 1999 and 2008.”⁽⁴⁰⁾

This seasonal fluctuation is the Dynamic Equilibrium Water Level Zone. The Pebble Point formation is one of the Lower Tertiary Aquifers the Barwon Downs Borefield extracts groundwater from, and, as seen in the hydrographs in the Barwon Downs Borefield region, they suffer enormous fluctuation and drawdown impact.

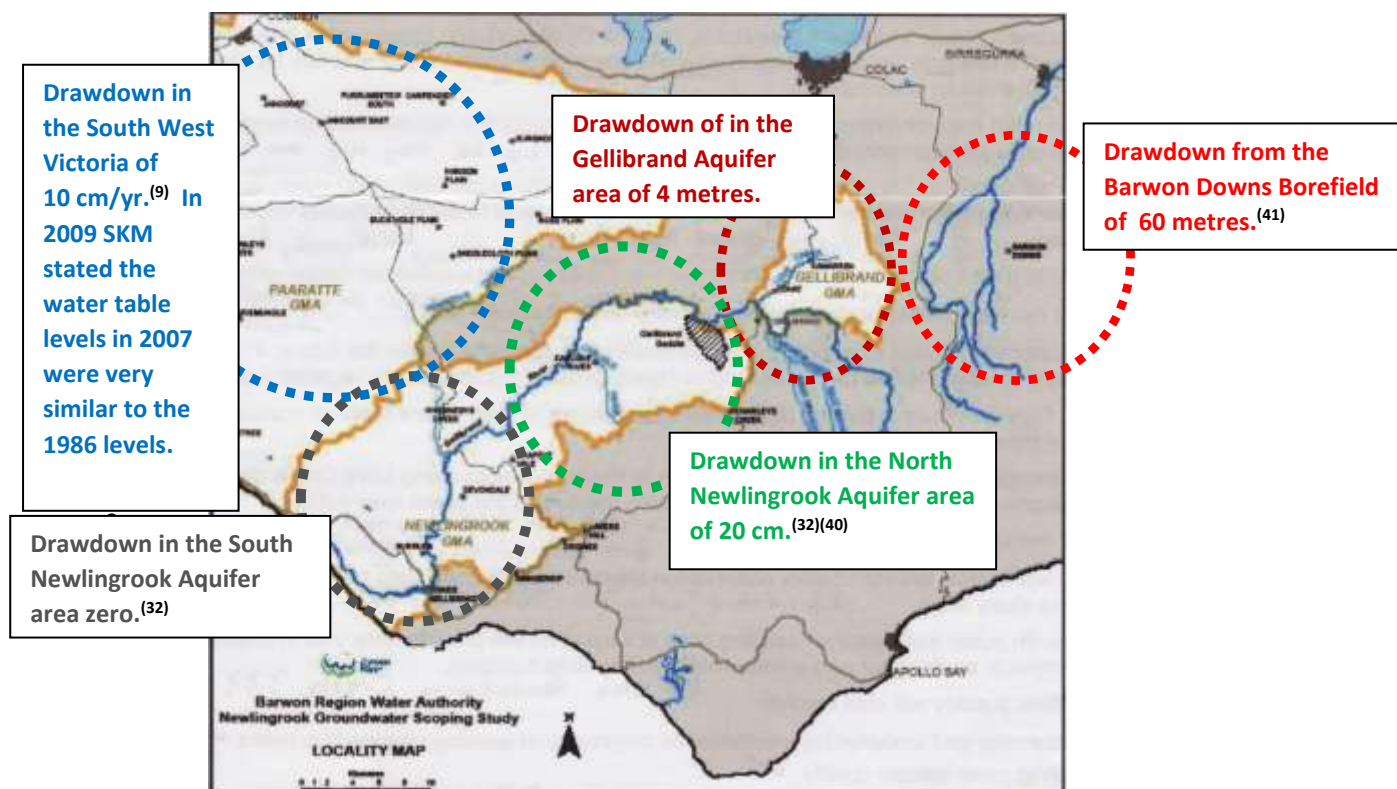


The thickness of this red line represents an approximate 20cm fluctuation.

This observation bore is situated inside the drawdown impacts from the Barwon Downs Borefield and demonstrates the enormity of the impact on natural variation from groundwater extraction. The Lower Tertiary Aquifers have been drawn down that far they no longer are able to buffer the hydrological sensitive and water dependent surface receptors.

As stated above, adjoining groundwater Dynamic Equilibrium Water Level Zones indicate that the zone in the Barwon Downs Borefield area of influence is way out of “whack.”

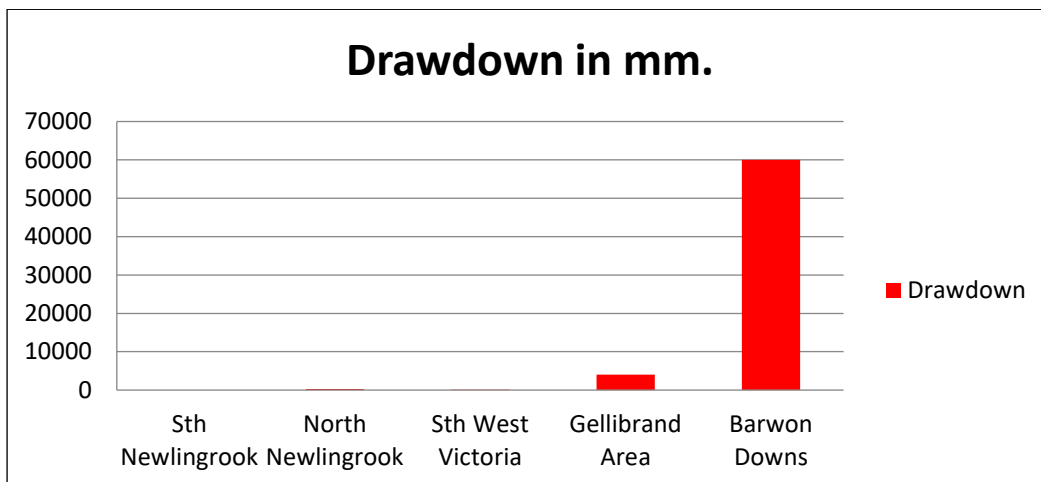
Otway water Book 42 J, Comment on REPP.



As stated earlier, in 2010 SKM had this to say *“As anticipated, the Newlingbrook South Zone has not experienced falling water levels and it is likely that climate change has less impact in this area. It is unlikely that the Newlingbrook North zone presents slowly falling trends as a result of climate change, because it has similar climate to that of the southern zone. Therefore, the trends of the Newlingbrook North zone are possibly associated with the faster rate of decline in the Barwon Downs Graben.”*⁽³²⁾

SKM in 2011 also stated in their “Climate Change Modelling for the Barwon Downs Aquifer” report, *“Future groundwater responses are not expected to be significantly impacted by future climate assumptions.”*⁽³³⁾ In the immediate future, Climate Change would have little impact on the natural buffering capacity from the Lower Tertiary Aquifers, just as Climate Change is having little impact on the systems further to the west.

The Department of Sustainability and Environment in a 2006 report, “State Observation Bore Network Program, Regional Groundwater Monitoring Network review for Deep Aquifer System in the South West Victoria” that groundwater is declining at rates less than 10 centimetres a year.⁽⁹⁾



This data strongly indicates that the closer one gets to the influence of the Barwon Downs Borefield drawdown the greater the impact. The further away from this impact the smaller the range of oscillation with the Dynamic Equilibrium Water Level Zone fluctuations.

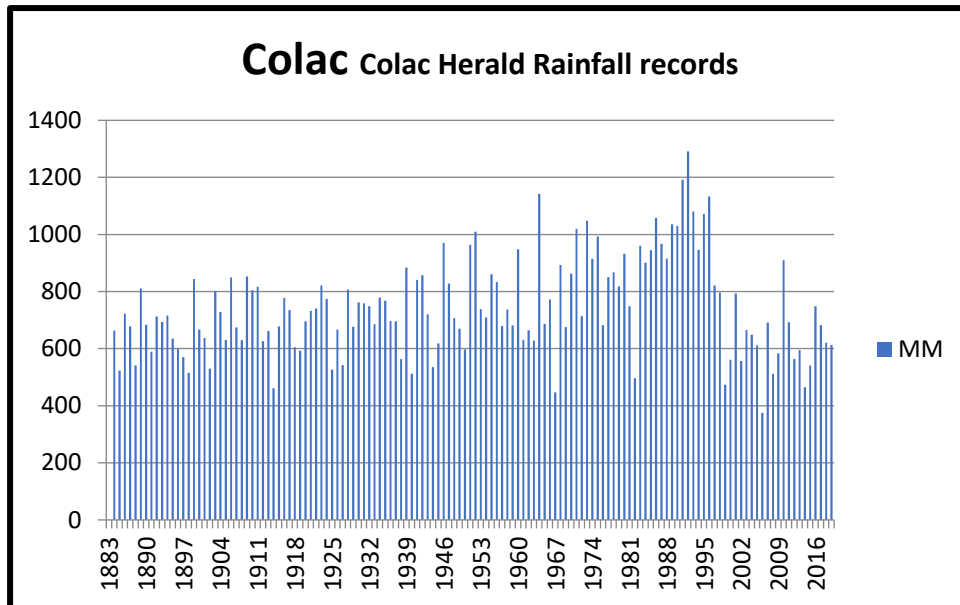
Impact on the Boundary Creek region had been evaluated and accepted as far back as 1991, and if, as stated in this article, “*...the creek’s recent dryness had*

probably been caused by test groundwater pumping...”

and considering the rainfall records for this period there seems to be an extremely strong case justifying the omission of the word “*probably.*”



The circumstances surrounding this report and the times Boundary Creek had run dry during the last few years must be compared against the rainfall events during the same period.



It most certainly was an extremely wet period right through to 1998 which brings into play how did the top end of the Big Swamp catch fire in 1997 with such earlier wet winters. A groundwater stress test pump took place between 1986 and 1990 and its impact has been recorded on observation bore hydrographs. Impact way and beyond the natural variation of the Dynamic Equilibrium Water Level Zone is observable during this wet period with obvious consequences.

- However, in 2002 SKM described how baseflow does not respond rapidly to rainfall...

"The baseflow component generally does not respond rapidly to rainfall and often represents a relatively stable and constant streamflow component."⁽³⁷⁾ What this means and what the implications are, needs to be fleshed out.

Barwon Water confirms impact of bore pumping

Barwon Water has confirmed that pumping groundwater from a Barwon Downs borefield has impacted the water flow to Boundary Creek.

The results come after water campaigner Malcolm Gardiner raised his concerns for more than 10 years about the effect that pumping the Barwon Downs borefield would have on the region's waterways.

Yeodene's Nellie Shalley has previously expressed her concerns to the *Colac Herald* about Boundary Creek, which flows through her property south-east of Colac, drying up in summer.

She said that she believed groundwater pumping at a borefield near her property had depleted the creek's flow.

A Barwon Water spokeswoman said the study was a comprehensive groundwater monitoring program that launched in 2013 to help inform Barwon Water's Barwon Downs borefield renewal application, which the corporation is due to submit in late 2017.

Barwon Water general manager strategy and partnerships Carl Bicknell said

the data was a result of a major update to the groundwater model for the Barwon Downs area.

The study found that use of the borefield over the past 30 years was responsible for two thirds of the reduction in base flow from the aquifer into Boundary Creek, while the dry climate during the same time accounted for the remaining third.

The spokeswoman said the model showed the lower sections of Boundary Creek "would likely have" no-flow periods during summer regardless of groundwater pumping, but pumping had increased the frequency and duration of no-flow periods in lower reaches of Boundary Creek.

The data confirmed there was no predicted impact to vegetation outside the Boundary Creek catchment as a result of groundwater pumping.

Mr Bicknell said it had been known for some time that borefield pumping was connected to flows in Boundary Creek, but the level of interaction had not been fully understood.

"As a condition of our current groundwater licence we



IMPACT: Nellie Shalley inspects a dry Boundary Creek in 2007.

have released supplementary flows into Boundary Creek," he said.

"However, we know these flows have not always made their way to the lower reaches of the waterway.

"We now have results of a thorough scientific study that provides answers we can be confident in, allowing us to examine ways to restore flows that will compensate for the operation of the borefield."

The spokeswoman said the borefield was a "crucial" supplementary water source for Geelong, the Surf Coast, Bellarine Peninsula and parts of Golden Plains Shire when surface storages were low.

She said that in 2007,

at the height of the worst drought on record, the borefield provided up to 70 per cent of the Geelong's daily water supplies.

Mr Bicknell said further technical studies were underway to assess the effect of a range of alternative borefield operating regimes on flows in Boundary Creek and measures to address the issue of acid water release from Big Swamp into Boundary Creek.

The outcomes of these studies, as well as planned community engagement in the coming months, will provide information for Barwon Water's licence application.

Colac Herald. Wednesday, June 28, 2017

To those not knowing any better this 2017 article gives an impression that sound management decisions have and are being made and that it is important that the groundwater extraction licence be renewed in 2019. No mention is made of the 26 years since the **"Board accepts blame for dry creek"** in 1991, of the disastrous impacts from the groundwater extraction at the Barwon Downs Borefield. Surface water resources and receptors dependent on these resources have suffered enormously. This article clearly demonstrates how earlier historical facts, local knowledge and data have not informed the present REPP.

- It has taken until 2019 for hydrologically sensitive vegetation in the Ten Mile, Loves Creek and the Gellibrand Catchments to start to show signs of being impacted from an ever expanding area of drawdown from the Barwon Downs Borefield. Until recently these three catchments, even during and the millennium drought showed little observable impact. The Lower Tertiary Aquifer discharge was acting as a buffer against drought in these three areas. Similarly, aquifer discharge sites in the Barwon Downs Borefield area should have also experienced the same form of buffering, but haven't. As the area of drawdown impact has spread these three

catchments are beginning to suffer. This should be included in the compilation of information on which the REPP is based.

- An analysis of SKM's 2010 work suggesting that the Southern Section of the Newlingbrook Aquifer had shown little to no impact from extractions or climate change because of its buffering capacity has already been raised and needs to be included in the REPP discussion paper.
- Hatton (CSIRO) and Evans⁽²⁰⁾ wrote in 1998, "*It is clear that long term and permanent use at the Barwon Downs borefield would have a significant impact on ecosystems in Boundary Creek and adjacent vegetation.*" Why hasn't this research been included in the formulation of REPP information base?
- Below is part of a document presented during the 2000-2004 development of the renewal process for the Barwon Downs Borefield Licence. The highlighted section is quite specific ***that groundwater extraction from the Barwon Downs Borefield dries up Boundary Creek.*** This extract from the renewal panel's draft report in 2003 formed part of the work leading up to the preparation of the conditions that were to be placed in the final licence, and, is also one of the reasons that a Supplementary Flow had to be released into Boundary Creek with the aim of ensuring flows continued.

LICENCE CONDITION:

Maintenance of Flow in Boundary Creek

Background

Groundwater extraction at the borefield reduces groundwater levels beneath Boundary Creek such that groundwater discharge ceases and the creek stops flowing in summer. Groundwater levels are drawn down quickly during pumping and recover more slowly when pumping ceases.

To maintain flow in the creek BW will need to supply water to the creek to compensate for the loss of baseflow until groundwater levels recover sufficiently.

A minimum flow needs to be provided along the creek to Yeodene, for environmental and D&S purposes.

To achieve a minimum flow at Yeodene will require a greater input flow in the headwaters of the creek.

Stream gauging at Yeodene is undertaken by DSE and information is currently obtained by BW quarterly.

Water is taken from the creek above the Yeodene gauge for domestic and stock use and there is an on stream dam on the creek.

It is considered unreasonable for BW to have to guarantee a flow at the Yeodene gauge as BW has no control over the amount of water taken from the creek.

1. Setting Objectives and Prescribing Limits

Objective :

To maintain a minimum flow in Boundary Creek for the environment and D&S users.

Limits:

A flow of 2 ML/d must be provided at the head waters of the creek unless:

- groundwater levels the bores x, y and z have recovered to within ? m of full recovery level, or
- flow at the Yeodene gauge exceeds 1 ML/d between the 1st May and 31st November of each year.

Reporting and Review of Monitoring

Reporting:

BW must fit a meter at the point of water inflow at the head of the creek.

The meter must be read weekly by BW.

The metered data must be provided quarterly to the Authority.

Stream gauging data from the Yeodene gauge (233228) must be obtained from the monitoring contractor at least at monthly intervals and provided to the Authority quarterly.

3. Compliance

Notification of exceedance:

If the flow provided to Boundary Creek by BW falls below 2ML/d and the bores have not recovered sufficiently, or there is insufficient flow at the Yeodene gauge as described above, the Authority must be notified within 7 days of this occurrence.

- SKM in 2002⁽³⁷⁾ has this to say...

"It has been noted that during periods of significant pumping from the aquifer, the flow in Boundary Creek is reduced and in some instances it has ceased flowing altogether." This was in 2002, pre-millennium drought times when the extractions averaged over 11,000 ML/year.

- In 2007 Evans⁽³⁶⁾ reported in his Land & Water Senior Research Fellowship Report that one way to understand the relationship between groundwater and surface water is to calculate the response ratio. Why wasn't this ratio applied to the earlier calculation of impacts from extractions at the Barwon Downs Borefield considering Evans has been closely involved in SKM's consultative work for Barwon Water? This ratio calculation should be an automatic inclusion in any compilation of information needed to arrive at an informed decision for remediation.
- A 2008 Flora Survey⁽³⁵⁾ undertaken as part of the Barwon downs licence conditions by SKM for Barwon Water states, ***"This reversal of groundwater flow has caused this reach of Boundary Creek to change***

from a gaining stream to a losing stream.” Right up to 2017 there had never been any consideration that anything other than groundwater extraction was responsible for no flow days in Boundary Creek. Working from an informed basis this is important to understand and especially so when the section on morphication is considered (see page 20).

- Science for Decision Makers, “Managing Connected Surface Water and Groundwater Resources,” Commonwealth of Australia, February 2006, is quoted as writing, *“In Australia, the development of the Barwon Downs bore-field in south western Victoria resulted in the drying up of Boundary Creek within a year.”*⁽³⁰⁾ Why hasn’t this piece of research been included in any of the multitude of Barwon Downs Borefield reference material?
- As far back as 1984 Lakey⁽²⁸⁾ recognised the importance of carrying out a comprehensive spring survey of the numerous natural springs in the areas of the townships of Barongarook and Kawarren. Lakey surmised that, *“...springs towards the Barongarook township would almost certainly disappear as a consequence of groundwater pumping.”* No mention of climate change back in 1984. And, these springs support and maintain wetlands or Groundwater Dependent Ecosystems that have since been decimated.⁽¹⁵⁾
Lakey also had this to say *“...flows in both Ten Mile and Yahoo Creeks will very likely be significantly reduced and quite possibly eliminated.”* This possibility is now a reality.⁽³⁹⁾
- Carr and Muir in 1994 reported that... *“Hydrological sensitive species and vegetation communities are identified and anticipated impacts from altered hydrology are briefly discussed.”*⁽⁵⁾
- In a follow up Carr and May reported in 2002... *“Significant differences in vegetation floristic (species) composition and structure were detected at several locations...”*⁽⁴⁾ SKM dismissed this significant work of Carr and Muir, and Carr and May, out of hand.⁽¹⁵⁾
- Blake, Gardiner and Lidgerwood met with Barwon Water officials in 2017 discussing a document⁽²⁾ that covered a stress test pump conducted during the late 1980s and the paper included that *“...after four years of pumping the water table had dropped 25 metres below the level of the original groundwater surface that outcropped along the Boundary Creek and “Big Swamp”. The Boundary Creek which was always a “gaining stream” over this section, would have become a “losing stream” due to*

the drop in the groundwater table.”⁽²⁾ Is this statement right or wrong? This statement challenges present thinking and acceptance in the REPP that climate is responsible for one third of dry days in Boundary Creek and this challenge has never been addressed. If the above statement is correct then present thinking is based on flawed information and a rethink of the REPP is required, especially the first Principle.

Until a comprehensive pulling together; analysis and assessment of these pre and post groundwater extraction happenings has been undertaken it cannot be claimed that the REPP’s first Principle has evolved from an informed basis. In fact there is every indication as asked for by the local community, that the return of the Lower Tertiary Aquifer pressure heads should be regarded as the number one remediation success criteria.

Page 14. “As Predicted.”

“As predicted, groundwater pumping reduced groundwater contributions to flows into Boundary Creek. Technical studies in 2017 confirmed that the historical management of groundwater extraction from the Barwon Downs Borefield over the past 30 years was responsible for two thirds of the reduction of groundwater base flow into Boundary Creek, increasing the frequency and duration of no flow periods in the lower reaches of Boundary Creek. The dry climate experience during the same period accounts for the remaining one third reduction.”

This was written in the 20 December 2019 Remediation and Environmental Protection Plan (REPP).

This acceptance as a definitive fact of a 2/3 reduction of flows in Boundary Creek due to groundwater pumping and the 1/3 from climate, has been raised on several occasions as a mistake. Also, Otway Water Book 42F (2018) deals with this in some detail.⁽¹⁴⁾

The technical studies in 2017 as mentioned above, can be traced back to Jacobs 16 June 2017: Barwon Downs Hydrogeological Studies 2016-2017, Numerical Model-Calibration and Historical Impacts. Barwon Water, and states...

*“The model **indicates** that the operation of the borefield over the past 30 years is **most likely** responsible for two thirds reduction of base flows into Boundary Creek.”*

The definitive statement made above has been...

1. based on assumptions and guesswork,
2. wrongly used in the modelling,
3. been repeated numerous times, and
4. has significantly influenced the REPP process.

And, if the dot points on pages 4-19 are taken into account the “*indicates*” and the “*most likely*” are figments of imagination. This must be recognized so that mistakes such as seen in this statement do not continue to be made.

“A further report commissioned by Barwon Water titled “Barwon Downs Geological Studies 2016-2017: Numerical model calibration and historical impacts” (Jacobs June 2017) found that: operation of the borefield over the past 30 years is responsible for two thirds of the reduction of groundwater base flow into Boundary Creek...”

This quote can be found in the Ministerial Notice Section 78 of the Water Act 1989 issued to Barwon Water 11-09-2018 and demonstrates how an assumption can morph into being accepted as a fact and forms part of historical record.

This mis-information was also used at presentations to the communities of Birregurra, Winchelsea and Colac during 2019.

How an assumption can turn into an accepted fact is further emphasised in Draft Version of the REPP (10-12-2019), pages 18 and 42 that included...

“Hydrogeological investigations found that operation of the Borefield over the past 30 years is responsible for two thirds of the reduction of base flow into Boundary Creek’ (Jacobs, 2018a).”

The myth appears to have now gone to a new level and is also accepted as a fact by the perpetrators of the myth, as demonstrated in this quote from a **2018** Jacobs report.

Page 49 of the latest version of the REPP contains this direct quote attributed to a Jacobs report of 2018a.

“operation of the Borefield over the last 30 years is responsible for two thirds of the reduction in base flow into Boundary Creek” (Jacobs, 2018a).”

Page 14. A New Myth in the Making?

The notion being presented in this quote from the 20 December 2019 REPP was repeated several times in the Draft Version of the REPP.

“...was responsible for two thirds of the reduction of groundwater base flow into Boundary Creek, increasing the frequency and duration of no flow periods in the lower reaches of Boundary Creek.”

- a) Does it mean the no flow periods before any pumping took place have increased in frequency and duration once pumping started up, or ...
- b) does this mean that the latest pumping has caused the earlier pumping periods of no flow to increase in frequency and duration?

Until pumping started flows in Boundary Creek were continuous. Disruption of flows did occur in the late 1970s when McDonalds Dam was being constructed. This ambiguity needs to be clarified.

Page 14, 52. Flow releases Through McDonald's Dam.

Page 14.

The REPP reports that Supplementary Flows are not effectively being passed through McDonald's Dam.

"...investigations confirmed that the ineffective regulation of passing flow conditions, including the supplementary flow released by Barwon Water to counter the expected losses in the creek, was not effectively reaching downstream reaches of Boundary Creek."

This statement has been based on an extremely limited data base post 2014.

The topic was discussed at the tenth meeting of the Remediation working Group, 12/12/2019. The data collected by way of these investigations covers a very short period post 2014 and involves quite a lot of guesswork regarding the period pre 2014. Nellie Shalley volunteered to discuss this topic giving a 40 year perspective on the flow releases. Unfortunately, Nellie had not been approached regarding this before the 12-12-2019 meeting and still has not been approached. Her knowledge could be valuable gaining a broader perspective.

To gain another historical perspective on how effective the flows have been passed on would be to analyze the data collected from the three stream flow gauging stations above McDonald's Dam; *in McDonald's Dam* and directly below McDonald's Dam, that operated from 1989 to 1994 before being decommissioned (2 of these gauges were recommissioned around 2014 – a 20 year data gap). These three gauges were specifically installed to ensure the summer flows into the dam were being released from the dam. Also, this data, if compared with the next downstream Stream Flow Gauging Station may provide some insight into the gaining or losing of baseflow in reaches 2 and 3 before significant groundwater extraction.

To follow on from the quote above with this statement *"The reduction in flows (flows through the dam) was the main contributor that caused the drying of Big Swamp..."* is one jump in guesswork too much to accept as correct. A contributor to the lower flows perhaps, but to what degree and over what period is far from being established. An added complication is that McDonald's dam has undergone a landholder change in recent times and regulation of the flows has been a problem. Too many assumptions and data gaps to make an informed conclusion.

Page 52.

The comment on passing flows on this page can give an impression that not all flows have been passed on. If based on the patchy data collected since 2014 then giving this impression is wrong. Passing flows have been released since at

least 1980 and the best source on information on this topic would come from talking with Nellie Shalley.

Notorious Failure of Band-Aide Fixes & Advice Given.

What can be learnt from the efforts and attempts by man to manipulate the Barwon Downs Graben is that despite a well researched knowledge base far too many poor management decisions have been made. The above example dealing with the on, off, on of the Stream Flow Gauging Stations along Boundary Creek immediately comes to mind. These situations are compounded by unavoidable circumstances.

Examples include:

- a. breakdown and repairs to piping systems and other infrastructure, e.g. Otway Colac pipeline flow stopped affecting supplementary flows.
- b. Mistakes made in record keeping. (e.g. Section F of Groundwater Reports to SRW)
- c. Non acceptance and implementation of the Precautionary Principle through disbelief or rejection of predictions made in the 1980s and 1990s reports that stated any extraction over 1,500-16,000 ML/year would have serious impacts. Ignoring of this most current information at the time, lead to the granting of extraction licences for 12,600 (1995) and 20,000 ML/year (2004).
- d. Fire trenches wrongly attributed to swamp drainage.
- e. Remediation that relies on an adaptive process which in itself indicates a “suck it and see and adapt” approach. This manipulation of nature with a try this band aide and if it does not work then rip it off and try another, is fraught with the possibility of other problems. It must be added here that this is not a reflection of the remediation being undertaken along Boundary Creek and the Big Swamp as it is based on extremely sound scientific advice and expertise. But, it has been made very clear by the expert advice that the adaptive approach is basically a “suck it and see” approach and is the best that can be applied until... and the until should be, until the LTA returns to a pre groundwater extraction level. A critical thing here ensuring success is that constant monitoring and adaption to a changing situation is done. But, this means reliance on human manipulation that is dictated by this definition of what is to be done...***Remediation refers to controls and actions that could be practicably carried out to improve the ecological condition and function of areas confirmed to have been impacted by historical management of groundwater pumping at Barwon Downs, noting that this is likely to be different to the original condition due to the extent of change since***

European settlement.” The success of a Boundary Creek and Big Swamp remediation plan using this definition relies heavily on the persistence, willingness, monies available and no further groundwater extraction demands being placed on the LTA. The cheapest and most significant way to ensure long term successful remediation would be to allow the LTA to recover.

- f. Work conducted by SKM/Jacobs is often sketchy, inaccurate and lacking scientific and technical rigour. Also, outcomes and conclusions are too often based on assumptions and guess work (see Appendix Two).

The only sure way to ensure that in time remediation will be complete is to allow nature to return the LTAs to pre groundwater extraction levels. This REPP should have this as the highest priority under the principles and remediation success criteria. The adaptive approach measures being undertaken should be aimed at assisting nature to return to a state of relative equilibrium.

Pages 2, 10, 16 & 35.

Success Criteria.

Page 2.

“Barwon Water fully supports this aquifer recovery and incorporates this into the principles.”

Support is far from good enough unless this sentiment is incorporated into the criteria for successful remediation and successful remediation must include the groundwater levels in the LTAs returning to pre groundwater extraction levels across the whole 480mk² area of drawdown influence.

The remediation success criteria must include *“The Lower Tertiary Aquifer pressure head returning to pre groundwater levels as a measure of successful remediation.”*

Page 10.

Bearing in mind the dot points covered in pages 1-19 in this Book 42 J, it is considered that ***“The Remediation Working Group’s independent nominated experts have advised that the recovery of the LTA to pre-pumping groundwater levels is not a suitable target as it is dependent on factors such as third party users and climate.”*** is not acceptable. Perhaps if Barwon Water had been forthcoming with background information during the REPP process and had disclosed all of the dot point facts as described above, to the experts, then a suitably recommended target may have reflected one closer to the local communities expectations, aspirations and the early factual history.

Page 16.

Irrespective of the definition of what is meant by “remediation” no reason has been put to say that the LTA pre-pumping groundwater levels cannot be attained.

Page 35.

A success target of a “*Recovery trend for groundwater levels in the LTA*” is also totally unacceptable.

Any realistic recovery of groundwater levels close to community expectations has already been dashed as this target set by the REPP has already been achieved. This target can be ticked off and any realistic aim of returning the LTA to pre groundwater extraction levels will no longer need to be taken into consideration by Barwon Water. Jacobs’s report to Barwon Water in 2017⁽²²⁾ included these statements claiming recovery trends having already been achieved...

“*Groundwater levels close to the borefield have recovered approximately 80% since 2010 when the borefield was last used.*”

“*Groundwater levels are predicted to reach 90% recovery within 10 years if there was no future pumping.*” By 2017 this report predicts that the LTA will be 90% recovered. An upward trend has been established.

Though trending upwards the values attributed to recovery fall well short of what is exactly taking place. A three dimensional cone of depression recovery does not reflect these values stated above. Neither does it take into consideration the recovery in the outer reaches of drawdown influence.

Pages 11, 13-15, 39-42, 136-145.

Surrounding environmental investigations.

This statement found on page 15 of the REPP has to be modified to address the impacts that have already been confirmed in the surrounding environments. Under the conditions of the s78 Notice remediation action or protection plans must be drawn up catering for these impacts.

“*There is currently insufficient monitoring data to identify if historical groundwater pumping at Barwon Downs has caused any measurable impact to sensitive environmental receptors other than Boundary Creek and Big Swamp.*” There is no mention that Beneficial Uses impacts should be considered or investigated .

The sections of the REPP dealing with the surrounding environment investigations has one obvious short coming. Those impacts in the surrounding environments that have already been confirmed have not been recognised. Not only that...

Page 41.

... on page 41 of the REPP it states that it may take 3 years under Principle 3 before ANY remediation in the surrounding area MAY take place. Therefore any

impacts already confirmed will have no remediation done for at least three years..

“The entire process to confirm if further remediation is required is expected to conclude by July 2023.”

Page 11.

Principle 3 on this page¹¹ states that *“Barwon Water will consider remediation actions and controls in the area which surround Boundary Creek and Big Swamp if measurable and evidence-based scientific methodologies conclude that historical groundwater pumping at Barwon Downs Borefield has caused an environmentally significant adverse impact in the area.”* What environmentally significant adverse impact means is not defined. It is arguable that these words should even be included in the statement. But, let’s look at some of the confirmed surrounding environmental area impacts.

1. Base flows in Loves Creek have been reduced by at least 50%.⁽³⁹⁾ At the very least Loves Creek should be rated as a high risk area. There are contradictory elements regarding whether Loves Creek is a gaining, losing or neither of these as a flowing creek.
2. Jacobs⁽³⁴⁾ confirms a surface and LTA interaction in Ten Mile Creek that is attributable to the majority of Loves Creek base flows.
3. Beneficial Uses of the water from the Ten Mile Creek, Loves Creek and the Gellibrand River have suffered serious impact and landholders Rob Maxwell, Mike & Carol Maxwell and Neil Longmore & Marina Lewis (pers. comm) are but a few of those impacted.
4. Social and environmental impact within the Gellibrand catchment.
5. Reduced flows in Gellibrand River as stated by Jacobs⁽²³⁾
6. An Actual Acid Sulfate Soil site at Cirrillo’s in the Barongarook Creek Catchment is well inside the drawdown area of influence. Requests to have this site investigated resulted in Jon Fawcett (SKM at the time) collecting samples. No report was forthcoming and later requests to follow this up were ignored. LAWROC Landcare funded tests confirmed the site as an Actual Acid Sulfate Soil site.⁽³⁾⁽⁶⁾
7. The Barongarook Creek Catchment has been impacted.⁽³⁸⁾ This fits the Cirrillo’s AASS site scenario.
8. There is an Actual Acid Sulfate Soil site at Campbell’s in the Yan Yan Gurt Creek Catchment well inside the drawdown area of influence. This site was investigated as part of the Jacobs work and this has been found to be a site resulting from groundwater extraction.⁽³⁾⁽⁶⁾
9. A drawdown under the Kawarren township and surrounding district from the Barwon downs Borefield, has been confirmed.⁽²⁴⁾ After exhausting

many avenues of possibilities, a Jacobs “Kawarren Drawdown Investigation” found that... *“In summary, the subdued drawdown observed in Kawarren is considered to be the result of pumping from Barwon Downs.”* The drawdown is in the order of 3-4 metres.

10. The fire risk has been heightened over the 480 km² drawdown area of influence.

11. High value GDE areas within the drawdown influence have been decimated.⁽¹⁵⁾

The answer to this question found on page 40 of the REPP has already been answered for areas of the surrounding environment... *“Has historic groundwater pumping caused a decline in watertable in areas where there are high value GDEs and if so, how much and is it significant?”* And, the answer has to be a resounding, yes. Otway Water Book 31⁽¹⁵⁾ covers this topic in detail.

Each of these confirmed impacts require a remediation plan prepared in a similar and thorough way that the Big Swamp plan has been developed. The plans should also be based on the Adaptive Management Approach as outlined on page 18 of the REPP.

Page 42.

When the above 11 points are taken into consideration it would appear that the statements made on page 42 of the REPP are nothing other than mother-hood statements, including...

- Continue to monitor
- To refine and update
- As required
- Fed back into
- To reassess risks and ensure that
- Captured for investigation
- Will engage with community and stakeholders
- To consider insights and other available technical or scientific information
- Robust process
- Well resourced
- Quality controlled
- Appropriate project management protocols are followed

What is required is action rather than words for those impacts already confirmed within the surrounding environment. Results affected from groundwater extraction at the Barwon Downs Borefield.

Page 136. Modelling.

The regional groundwater model used to determine risk areas in the surrounding environment also has to be questioned. The list of 11 confirmed impacts above, or parts thereof, suggest that the model needs considerable modification, not to mention things like the omission of Quaternary alluvial aquifers from the modelling. *“...where Quaternary aquifers have been confirmed to be present but have not been included in the model.”* From this point alone, unless these aquifers are included the model falls short of being acceptable just as many earlier models have proven to be wanting.

Also, to state that the Quaternary alluvial aquifers are not influenced by the LTA may be true in 2019 but this has not always been the case and must be reflected in the modelling, but isn't. If post 2013 conditions are the only data input into the model, the model has to be challenged from many additional directions.

“The Technical Works Monitoring Program (SKM, 2013) undertaken by Barwon Water to inform the Barwon Downs licence application confirmed the presence of many Quaternary alluvial aquifers which are not influenced by pumping (Jacobs, 2017).”

1. The LTA water table levels originally had a hydraulic upward gradient way above the Quaternary aquifers under discussion. This upward gradient would have...
 - Maintained an overflow discharging from the LTA through springs, creeks and rivers.
 - Kept any hydrogeological unit (alluvial aquifer/aquitard/perched aquifer) in Boundary Creek and the Big Swamp Wetland region, saturated by way of an upward vertical leakage/pressure and over flow of discharging groundwater.
 - Prevented the creation of perched and alluvial aquifers and the drying out of ground water dependent wetlands.
 - Provided a buffering capacity on impacts to springs, creeks and wetlands from drought and climate change.
2. Draft Version 1 of the REPP on page 128 includes the objective of determining in the surrounding environment those Quaternary aquifers that are saturated as a result of upward vertical leakage and influence from the LTAs, just as was the case in the Big Swamp scenario pre 1980s. *“Is pressure in the regional groundwater system (the LTA) maintaining an upward gradient to keep overlying local alluvial/aquifers saturated.”* This is the precise argument being put, namely that pre groundwater extraction at the Barwon Downs Borefield the upward gradient from the LTAs was keeping the overlaying local alluvial aquifers saturated and therefore made any discussion about water depletion in perched or

Quaternary alluvial aquifers a non-argument pre groundwater extraction. Also this has to be included in any modelling scenario, not excluded.

3. Unfortunately, in 2002 Greg Hoxley (SKM) when involved with lead up investigations to the Barwon Water groundwater extraction licence renewal, determined a swamp of State significance to be sitting on a perched aquifer. Locally this swamp is called Boomerang Swamp because of its shape. As a result of this perched swamp finding, any consideration for this swamp's preservation in the groundwater licence conditions were dropped. Boomerang Swamp was henceforth accepted as sitting on a perched aquifer. Result - one perched swamp was said to exist in the drawdown area and has since turned into a borderline Actual Acid Sulfate Soil site with resulting ecological impacts.

4. Six years later in 2008 SKM's Barwon Downs Flora Study⁽³⁶⁾ defines a perched aquifer as an aquifer isolated from a regional groundwater system such as the LTA.

"A perched water table by definition is hydraulically isolated (i.e. is independent) from regional groundwater systems and as such, are not impacted by pumping stresses applied to a regional water table system (such as the LTA)."

5. Hoxley claimed there was such an aquifer in the study area. However, SKM in 2008⁽³⁶⁾ was not so sure. SKM felt there was insufficient information available in 2008 to determine whether perched aquifers were actually present in the area.

"It is likely there are perched water tables in the study area, but their location cannot be reliably predicted with the hydrogeological data currently available."⁽³⁶⁾ None present let alone how to predict likely sites. All but a few observation bores in the Gellibrand and Gerangamete Groundwater Management Areas were monitoring the regional groundwater. *"The water table elevation data obtained from observation bores on the Barongarook High is not suitable for predicting the location of perched water tables because these bores monitor the regional groundwater system."*⁽³⁶⁾

6. To add to the misinformation and confusion caused over perched aquifers in a 2015 Jacobs report,⁽²⁶⁾ the perched aquifer miraculously re-appeared. *"... Site T3 was found to be unconnected to groundwater sources used by the Barwon Downs Borefield (i.e. is a perched swamp)."*

The Jacobs's summary⁽²⁶⁾ also includes this statement that there is a *"...possibility of highly localised perched water tables..."* Considering this study was done years after massive groundwater extraction had taken place it would be little wonder if perched aquifers had materialised.

7. Then by 2017 all new Jacobs reports made no mention of perched aquifers but started discussing Quaternary alluvial aquifers that were isolated from the LTA as though they were a different aquifer to a perched aquifer. It cannot be avoided that things are amiss here, at least confusing. However, it can be shown that the Quaternary alluvial aquifers or perched aquifers in the Boundary Creek and Big Swamp remediation discussions were in fact saturated from upward vertical pressure from the LTAs pre groundwater extraction from the LTA.

This very point is supported in the 2019 GHD report⁽¹⁸⁾ that was submitted by Barwon Water as part of the REPP.

Some quotes from this report include...

- a. In 2019 there were perched aquifers present and were possibly leaking downwards.

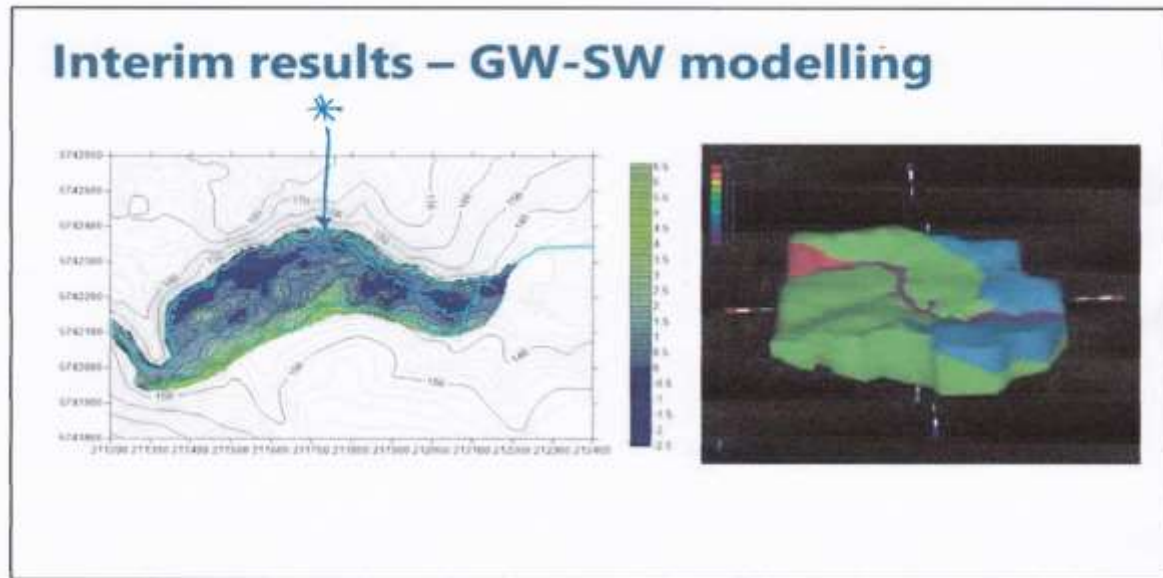
“With groundwater seepage occurring from the surface water system to the perched aquifer in the shallow alluvials, and subsequently there is a downward hydraulic gradient for groundwater flows from the perched water table aquifer towards the regional LTA system. The downward hydraulic gradient has developed due to the drawdown in the LTA associated with Barwon Water extraction.”

- b. The perched aquifers are back and appear to be closely aligned with the alluvial aquifers caused from groundwater extraction, *“...which indicates that prior to 1997 there was a general upward hydraulic gradient from the regional aquifer to Boundary Creek, and the surface water system would have been gaining groundwater baseflow. However, due to the Borefield extraction, the hydraulic gradient has been reversed...”*

- c. And later in the GHD report *“The swampland is supported by a perched water table aquifer in the alluvial sediments, which are expected to overlay both the LTA aquifer at the upper end and the MTD aquifer at the lower end.”*

- d. The pressure head of the LTA at the upper end of the swampland was metres above the surface level of the swampland pre groundwater extraction times.

This fits neatly in with a report given by Jon Fawcett at Barwon Water’s 8th Remediation Workshop Meeting when he indicated the LTA directly underlays the Big Swamp to the spot marked in on his overhead (see page 31). This being exactly where local knowledge has maintained the supplementary flows disappeared from Boundary Creek during dry periods.



Overhead of the Big Swamp as part of the Jon Fawcett presentation October 2019.

Despite this revelation, at Barwon Water's 10th Remediation Workshop Group meeting (Jon Fawcett not present), it was stated that location where the LTA surfaces under the Big swamp is still not known. Interesting, because Jon was asked to repeat his statement regarding where the LTA underlay the Big Swamp. Vindicated. This spot was the same one often quoted as the spot where the Boundary Creek flows ceased during dry periods. Filling this data gap has been one of the top priorities the Remediation Working Group set from the very first meeting, and, apparently still has not been filled. Is the investigation and the work of Jon's consulting firm not to be believed let alone what local knowledge has observed?

And, can it be believed the justification stated below provides reasonable explanation why this data gap still exists...

"The swamp is located at the transition where the LTA and the MTD aquitard outcrop. However, due to the presence of overlying alluvial sediments and access limitations, the nature and location of this contact has not been able to be clearly delineated." (Page 64 Final REPP)

Pages 67-69

It is astounding that a Forrest and District Historical Society Inc (Jennings 2008⁽²⁷⁾) can be used and referenced yet Otway Water Books and LAWROC Landcare Group scientific reports have at no stage been acknowledged nor referenced. From many aspects this is extremely demeaning and offensive. Credible local effort and knowledge unrecognised. This section of the REPP reinforces these sentiments.

In 2008 LAWROC commissioned Warrnambool University to carry out water testing that conclusively proved beyond any doubt that the Big

Swamp was releasing toxic heavy metals and highly acidic water. No recognition of this research has been given in any Barwon Water report. In fact right up to 2016, toxic water and heavy metal contamination as a result of groundwater extraction has been hotly denied.

Back in 2008

In an ABC Stateline production 10 October 2008 that included a ten minute segment *specifically* on the Actual Acid Sulfate Soil created in the Big Swamp at Yeodene, Victoria; Michael Malouf, Managing Director of Barwon Water, stated that up to this time Barwon Water was not aware of the Big Swamp situation and the accusations that its demise was linked to the Barwon Downs Borefield. Mr. Malouf did say in regard to the extraction licence ***"It is clearly monitored by a number of parties including Southern Rural Water, who issue the licence. The Corangamite Catchment Authority have a major interest in the catchment area and the Department of Sustainability and Environment from the State Government. All of these parties are involved in different ways and they've all given us a very good bill of health, if you like, in terms of how this aquifer is being managed and how it is being made to be sustainable."***

The reason the ABC became involved was due to the lack of concern or proactive efforts by the very same ***"...number of parties..."*** failing to visit and investigate local claims that the Big Swamp was in a very poor state. Earlier in the year local LAWROC Landcare Group frustrated by this lack of action, had collected and had water samples from the site tested by a NATA approved laboratory in Warrnambool.⁽¹³⁾

Up until LAWROC, at huge expense, commissioned scientists from Southern Cross University to come and carry out an Acid Sulfate Soil investigation⁽³¹⁾, not one of the nine State Government Authorities approached would have anything to do with this issue. It was after this Southern Cross report that Glover was commissioned to conduct an Acid Sulfate Soil report. The Glover report has been referenced and referred to often.

Despite all of this in 2012 Barwon Water was still in denial.

"...water table drawdown occurs during pumping, but no long-term environmental impacts have been linked to borefield operation."

(Barwon Water, February 2012: Water Supply Demand Strategy 2012-2062, Draft.)

Amplly backed up in 2016 by SKM/Jacobs reports...

“No evidence was found that declining groundwater levels caused by groundwater extraction at Barwon Downs had a negative impact on vegetation health in the catchment.”

(Jacobs 2016)

By the start of 2017 a comprehensive investigation still had not been done on the Big Swamp. ***“The purpose of this study is to assess the aquatic ecosystems of Boundary Creek and therefore it is beyond the scope to complete a comprehensive investigation of Big Swamp. Big Swamp will be the focus of a future, stand-alone study.”***⁽¹⁾

A Few examples of Non Referenced Material.

1. The poor quality of the water, going back decades, and reported by local landholders has never been officially accepted except in Otway Water Books.
2. In 2014 a LAWROC commissioned report had this to say regarding the groundwater extraction from the Barwon Downs Borefield.
“...and it is considered this is an example of groundwater mining...”⁽²¹⁾
3. If it was not for the pursuit of LAWROC’s endeavours to have the above issues recognised the Glover (2014) investigation⁽¹⁹⁾ would not have taken place. On several occasions LAWROC assisted with Glover’s background work on the Big Swamp. No recognition.
4. Interestingly enough it appeared that the reason Glover only sampled around the margins of the Big Swamp, was due to Glover not being able to access the swamp because of OH&S issues. These issues have never been a problem of access to myself and other members of the local community, during which time an intimate knowledge of the swamp has been gained. This knowledge has been captured in the Otway Water Books but has been ignored.
5. It took Barwon Water until 2013 to even contemplate that there was a possibility there was an Actual Acid Sulfate Soil problem in the drawdown area of influence.

“In 2013, a desktop review was undertaken to identify potential areas with ASS.”

LAWROC had already established that there were three confirmed Actual Acid Sulfate Soil sites within the 480 km² drawdown area of influence. And, the one in the head waters of Barongarook Creek (Cirrillos) still has not been officially recognised. LAWROC’s reports and efforts going back to the early 2000s ignored.

6. Barwon Water has chosen not to address the concerns expressed in Otway Water Book 40 regarding Jacobs's 2017 PASS Baseline Assessment report. And, unfortunately this Jacobs report is still being quoted "warts and all."

A Few Odds and Sods in the Name of Accuracy.

Page 10.

The "P" in PCV stands for Permissible not Permissive.

Page 25.

- The 1992-1999 dot point should have made it very clear that this was an extremely wet period and accounts for the close to normal pH readings recorded during this period.
- This page should have included that the lowest reading of pH in the Big Swamp was in the order of 1.5 pH. This information, may have been contained somewhere in the volume of work and if so was not found or hard to interpret.
- Farmers have not been able to rely on flows in Boundary Creek for stock water since 1984, **NOT** 1999. Local knowledge ignored.

Page 50.

- The use of a multitude of local landholder rainfall records would have given a much more thorough account of the rainfall in the regional groundwater area under investigation.
- Unfortunately, the uniqueness of various parts of the Otway Ranges is not accepted. Consequently, regional and or state wide generalities are applied across the Otway Ranges.

Page 51.

Boundary Creek has been highly modified over the last century but has seen little change since the 1960s. This has not been taken into account and in the 2013-2017 licence renewal process Barwon Water, in the earliest stages of this process, chose not to conduct a land use change study of recent times as it was considered too costly and time consuming. Otway Water Book 28⁽¹⁷⁾ reports on a recent study concluding little has changed for some considerable time.

Page 52.

- There is an east-west fire trench and a north-south trench of different dimensions.
- The east west trench was dug until mineral earth type soil was reached.
- The north south trench was dug until moist peat was reached.
- It is my understanding that neither of these trenches can be held accountable for the lowering of the water table. These trenches had no water in them 5 months after they were dug. The argument supporting

the point that the trenches had little to no impact on swamp drainage can be found in detail in Otway Water Book 42.⁽¹⁶⁾

- The licence conditions for supplementary flows was set in 2004. No data has been provided to support the case that flows were started prior to this as has been stated in the REPP.

Page 53.

- There is no reference indicating where the statement of a minimum 30% stream reduction in some parts of the Otway Ranges. Neither is there an indication of which parts of the Otway Ranges. Are they within the area of interest?
- Local knowledge would have been able to provide credible data regarding stream flow in Boundary Creek decades before 1979. When a farm relies on a permanent stream flow for stock and domestic purposes it becomes blatantly obvious when there is no flow, no water. The data that could have been sought and fed into the modelling exercise wasn't. A data gap not filled, giving a skewed modelling output.

Page 59.

- Between 2010 and 2017 the southern fire trench has never been observed to contain water even during wet winters (personal observation).
- Local knowledge has made it known that “*...flows are predominantly contained within channels located along the northern portion of the Big Swamp.*” This has been known from at least 2008 and it did not take modelling in 2019 to confirm that the supplementary flows followed the northern creek bed.
- Also, since 2008 it was well known that the supplementary flows only made it halfway along the Big Swamp perimeter during dry periods.
- However, local knowledge has become aware of changing dynamics of the flowpaths of water around and through the Big Swamp. Since 2018 the flow-path of water in the Boundary Creek on the north boundary of the Big Swamp, has altered sometimes being dry around the swamp but flowing downstream of the swamp. Up until this time this was never known to happen. The dynamics of passage of water around and through the Big Swamp is changing.

Page 60.

Monthly checking of the pH levels could have missed many an acid and heavy metal flush.

Page 61.

Table 8 presents a summary of water quality monitoring on Boundary Creek since 2018. Why wasn't the records of LAWROC and the Upper Barwon Landcare Network going back many years, included?

Page 62.

- The last paragraph describes the present situation in Reach 3 (2018) – groundwater levels are above the stream bed. However, historically what have the levels been? Were the groundwater levels above the streambed pre groundwater extraction? Did they drop below the streambed level during extraction and have the levels only just recovered?

In Reach 3 at the bridge, the observation bore with ~ 19 metre artesian groundwater levels was dropped to ~ 10 metres below ground level at the height of pumping and have since recovered to artesian levels. Graphing out the hydrograph to this observation bore would answer the above questions and it would be seen that the groundwater levels had fallen way below many sections of the stream bed.

Presenting half the story gives the wrong impression.

- There is still a great deal to know about the hydrogeology of Boundary Creek. Just because a lot more is known about this creek when compared to other creeks in the Barwon Downs Graben should not be seen as a "great deal". For example assumptions and guesswork highlight the scant little bit that has been written or researched regarding what the flow situation was in Reach 1 pre supplementary flow releases, or what would happen if the flows were completely stopped. How these supplementary flows are impacting on various observation bores in the whole Boundary Creek Catchment is lacking. Lots to learn.

Page 77.

- Up to 2018 there has been no evidence of... *"...increased erosion of the swamp plain..."*
- The primary channel that now bisects the swamp plain has only become apparent since slumping, subsidence or burning of the soil has lowered this area. Up to mid 2018 the north channel of Boundary creek was always the common flow path around the swamp during non flood flow periods.
- *"The fires have had the greatest direct impact on vegetation.."* is not correct. The production of acid and heavy metals spreading down through the Big Swamp killed everything as it went, leaving, by 2010, a massive tinder dry fuel bank of dead vegetation that burnt intensely when the peat reignited in 2010.

Page 117.

The idea of returning the swamp to braided channels and other recommendations brings to mind that there seems to be little work or investigation done regarding the changing topography of the Big Swamp. How has fire, oxidation and groundwater drawdown affected the swamp's profile? See the comments above, page 34, re changing dynamics.

GHD Report⁽¹⁸⁾

In GHD's Basic Conceptual Geochemical Modelling for Big Swamp⁽¹⁸⁾ there are some background shortcomings found in this document that come from a lack of local knowledge; unfortunately ignored or not sought by Jacobs or Barwon Water. Some of GHD's background information comes from Jacobs and Barwon Water and no responsibility is accepted for these mistakes as explained in the GHD document on pages 2, 3 and 79.

- Figures 2, 4 and 8 have inaccuracies.
- Section 4.7.1 Key Processes under natural flow conditions contains contradictory information to that of local knowledge.
- The natural flow pH conditions in Boundary Creek pre groundwater extraction requires justification if pH data pre 1982 is taken into consideration.

However, the few background shortcomings do not detract or have little bearing on the core work completed in the GHD document. This report supplements a very sound remediation plan for the Big Swamp.

CONCLUSION

The biggest problem with the believability of this REPP is the inaccurate and half truth statements that have been presented to the reader and used as input to any modelling program.

By far the most positive aspect of this REPP is the excellent plan set out for the remediation of the Big Swamp.

The most disappointing and unacceptable aspects of the Plan are...

1. the insipid first principle,
2. the omission of a remediation success criteria for the LTA groundwater pressure heads returning to 1970 levels, and
3. that there is no acceptance of confirmed impacts in the surrounding environments.

APPENDIX ONE

M J Freshwater
519 St Michael St
Deniliquin NSW 2710

June 11, 2008

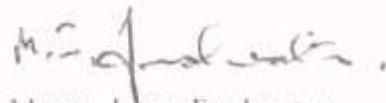
To whom it may concern:

From the early 1970s until 1988 our family owned and operated a property on the corner of Wire Lane and Barwon Downs Road at Murroon, Victoria. Observation bores were drilled in the early 1970s on Wire Lane, adjacent to that property.

When bore 82839 and bore 82840 were drilled they were observed by me to be artesian with streams of free flowing water. These bores were capped and fitted with gate valves. For many years (until the gate valves were locked in the mid 1980s) opening the gate valves resulted in water escaping under considerable pressure, with no obvious loss of pressure over time.


It is still my belief that these bores remained artesian in nature at least until I left the district in 1989.

Yours sincerely,



Murray James Freshwater

Witnessed by:

 J.P. 12/6/08

Kathy M Henderson JP 137876

APPENDIX TWO

Jacobs 12 December 2019 002/Final report to Barwon Water “Yeodene (Big) Swamp, Groundwater and surface water modelling,” that was included as part of the REPP makes interesting reading where it discusses the supplementary flows.

Pages i and 53-54 of the REPP.

“The modelling results indicate that a supplementary flow of 2 ML/d with no other interventions is not effective in increasing the inundated area or raising groundwater levels above those typically experienced at the end of winter (normally September) in recent years. However, the hydraulic modelling suggests that this level of flow release will ensure flows through the swamp through all seasons and hence represents an improvement in historic groundwater levels throughout the swamp.”

If the last sentence of this quote is compared with observable experiences the model appears to have given the wrong impression or suggestion. Over the last eleven summer periods the 2 ML/d supplementary flow has never ensured flows through the swamp. And historical, pre groundwater extraction by Barwon Water, the flows through the Big Swamp area was ~ 3.2 ML/d.⁽⁴¹⁾

Around Christmas time 2019 Boundary Creek stopped flowing at Nellie Shalley’s property despite these releases of a supplementary flow (20 December 2019).



On 13 January 2020 these photographs were taken of Boundary Creek flows.

Supplementary Flows being released into a tributary of Boundary Creek.



These Artificial Supplementary flows disappear as they pass through the Big Swamp area and as can be seen in the next photograph by the time any flow leaves the Big Swamp area into Reach 3 is just a dribble. At Nellie Shalley's property further downstream the flow has stopped completely.

From these observations it would appear Jacobs model that suggests these supplementary flows will ensure flows through the Big Swamp through all seasons, is wrong. And, from observations up to 2017 the supplementary flows during the summer periods never went through the swamp at any stage but around the northern edge of the swamp along the Boundary Creek bed.

Flows downstream of the Big Swamp at the Colac Forrest road Bridge.



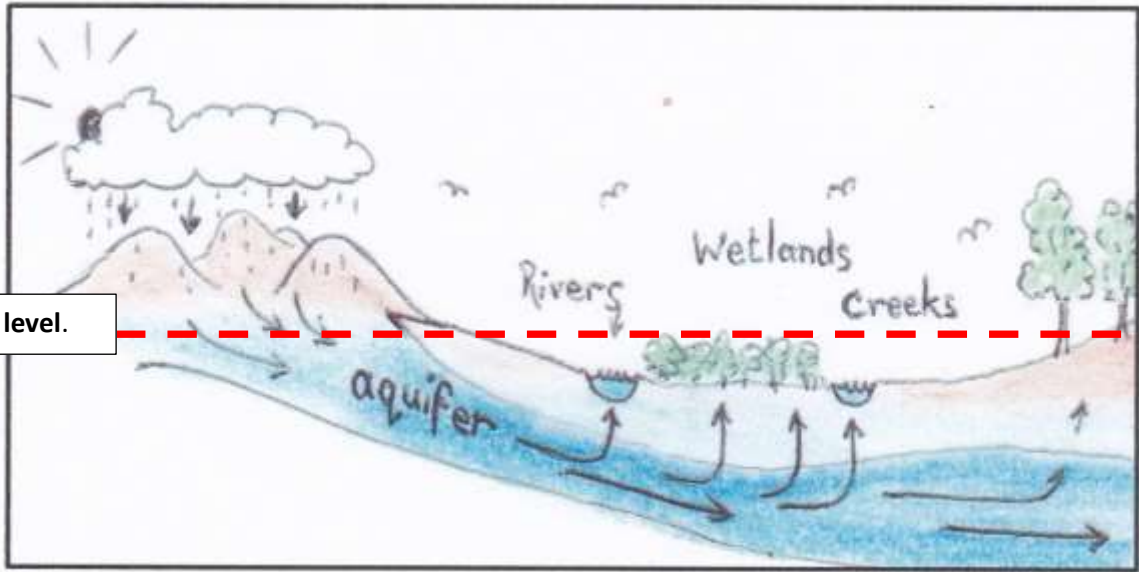
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LTA pressure level.



Email 24/01/20

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24 January 2020

The Honourable Lisa Neville
Water Minister
Level 17, 8 Nicholson Street
EAST MELBOURNE VIC 3000

Dear Minister,

**Non-negotiable matters required in Remediation and Environment Protection Plan
prepared by Barwon Water in response to Section 78 Notice**

We continue to act on the instructions of the Land and Water Resources Otway Catchment ("LAWROC") in this matter.

Local communities are increasingly being impacted by the 480 km² drawdown area of influence from the Barwon Downs borefield extraction. The impacts include reduced streamflows, drying wetlands, dying wetland vegetation and increased bushfire dangers. These are all impacts occurring in an otherwise average rainfall season in the Otways. They are impacts that were predicted before pumping began in the 1980s. Since you served the section 78 Notice on Barwon Water on 11 September 2018, local communities have spent an enormous amount of effort, money and resources to ensure that a satisfactory and accountable remediation plan for Boundary Creek, the Big Swamp and surrounding environment is developed..

In the intervening 16 months, the communities affected have continually requested that Barwon Water expand the scope of the remediation plan to investigating the impacts in the whole drawdown area. Barwon Water has so far shown little appetite to venture beyond remediating the Big Swamp. Close and impartial observers of Barwon Water's response over the last 16 months are increasingly inclined to conclude that, despite being well-funded, Barwon Water is simply not competent in investigating the 480 sq km drawdown area and is dragging its feet in carrying out remediation on the broad landscape scale required.

The communities are not happy with many sections of the REPP and the following issues are regarded as essential to bring about a semblance of successful remediation. The following 8 items must be included and are not negotiable if you expect your s.78 process to retain some shreds of credibility in the affected communities.

25 Raffertys Road, GELLIBRAND RIVER VIC 3239 ph: 52 358 254 mob: 0477 931188 nlongmore@netspace.net.au

1. The number one priority for successful remediation has to be the return of the piezometric pressure heads of the Lower Tertiary Aquifers back to pre-groundwater extraction levels. This must be made explicit in the REPP by the inclusion of numerical targets for water level recovery in a representative number of agreed State Observation Bore Network bores in the 480 sq km drawdown area.
2. Confirmed impacts experienced in the surrounding environment must be recognised by Barwon Water and form part of the REPP. (For more information please see: *Otway Water Book 42 J* by Malcolm Gardiner, pages 25-27)
3. Confirmed impact sites such as the Loves Creek and Gellibrand must have action plans prepared and implemented along the same lines as the Boundary Creek and Big Swamp plan. These things cannot be left until 2023 as suggested in the REPP.
4. The action plans must protect EPBC listed species and must be consistent with EPBC procedures and guidelines.
5. Increased fire risk within the 480 km² Otway foothills area of drawdown influence must be assessed.
6. The other three Actual Acid Sulfate Soil sites outside the Big Swamp but within the 480 km² drawdown area have to be managed to ameliorate any negative impacts as per the National Acid Sulfate Soils guidelines.
7. PASS and AASS sites to be mapped and included in the Environmental Significance Overlay in the Colac Otway Shire's Planning Scheme to reduce the risk of these areas becoming another Big Swamp type scenario.
8. Stock and domestic water entitlements of Boundary Creek farmers must be restored to pre-pumping quantities and qualities.

Please let us have your reply as a matter of priority.

Yours faithfully,

Neil Longmore.

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