

OTWAY WATER

BOOK 50

Crit. on Barwon Water's Document by
JACOBS,
"Barwon Downs Technical Works Program
Barwon Water
Groundwater Assessment Report
1/FINAL
26 November 2018."

(This 160 page Jacobs Report is part of Barwon Water's 1,300 pages of Supporting Documentation when applying for the July 2019 Renewal of the Groundwater Extraction Licence. The Licence Application was justifying the extraction of **12,000 ML/year**)

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By M Th

September 2019. Edited October 2021.

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Some Clarification on Licence Renewal & Remediation Community Groups.

In regard to the groundwater extraction licence renewal and remediation of impacts through the operation of the Barwon Downs Borefield, the following dot points may help to avoid confusion over the numerous community consultation groups that have been formed over the last few years.

- October 2013 to April 2018.
Barwon Water convened a Groundwater Licence Renewal Community Reference Group called the CRG.
- May 2018 and ongoing.
When the CRG had completed its work and submitted its report to the Barwon Water Board there was a short period before the next group was formed.
An outcome of the CRG meetings was Barwon Water agreed to a three phase plan part of which was to include the remediation of Boundary Creek and the Big Swamp.
Barwon Water convened another community group to assist with this remediation process. This group was called among other variations, the Barwon Water Community Remediation Workshop Group. This Group deals with the Remediation and Environmental Project Plan (REPP) that resulted from a Ministerial S78 Notice.
- After the August 2018, 4th Community Remediation Workshop Group meeting, the direction of remediation underwent a dramatic change. In September Southern Rural Water issued Barwon Water with a Section 78 Notice (s78). This changed the remediation process, broadening the area and making remediation efforts official and binding, hopefully. Southern Rural Water decided to convene its own CRG, and
- Late in 2018, Southern Rural Water also appointed a three member Independent Technical Review Panel (ITRP) to advise it on s78 matters.
- Early 2019 – April 2019.
Southern Rural Water convened its Community Reference Group (CRG) to assist it to deal with Barwon Water’s licence renewal application. However, this CRG was disbanded the very same day that Barwon Water withdrew its application, 14 March 2019.
- 14 March 2019.
Community outrage that the Southern Rural Water’s CRG was disbanded even before the ink had dried on the withdrawal of the licence application, Southern Rural Water convened another CRG meeting and it was found to be desirable to continue the group but in a different format.
- August 2019 – on going.

After this community protest at the cessation of the CRG, Southern Rural Water morphed this CRG group into a Community Leadership Group (CLG), which is still functioning as at September 2021.

- Throughout the above period there have been a collection of one day sessions of “Open Days” and “Workshops” conducted by Barwon Water and Southern Rural Water in Geelong, Winchelsea, Colac and Barwon Downs.
- COVIC 19 has made meetings extremely difficult and ZOOM meetings have become the order of the day.

At this point in time there are two community groups continuing to convene. The Barwon Water Community Remediation and Environmental Protection Plan (REPP) group and Southern Rural Water’s Community Leadership Group (CLG). Both groups are involved with the implementation of the s78 notice.

NOTE: Barwon Water withdrew its Licence Renewal Application early in 2019.

INTRODUCTION

The members of the Community Leadership Group (CLG) appointed by Southern Rural Water (2019) to assist with the review of Barwon Water's renewal of a groundwater extraction licence for the Barwon Downs Borefield, were faced with over 1,300 pages of background documentation connected with Barwon Water's renewal application. To read, digest and process this amount of material in anyone's terms, would be a mammoth task requiring time and much effort. Both of which were in short supply especially around Christmas time when the documentation arrived. However, from past experience unless this was done "poor" reports remain as is and too often influence future resource management decisions. Decisions based on this type of work can perpetuate an existing problem and in more cases than not compound and make a problem worse. This Otway Water Book puts on record some of the obvious things found in this one report that should not form the basis of future decisions. Book 50 B is a compilation of documentation that is applicable to Book 50.

It must also be kept in mind that the Jacobs' documentation has not been peer reviewed or validated. Unfortunately, in this case, Barwon Water has based its renewal application on sub-standard work. The validity of SKM/Jacobs work was first questioned some years ago at the Barwon Water Groundwater Community Reference meetings. It was also queried why any peer review had never been done. ***The answer given was Southern Rural Water would do this as part of the licence renewal process.*** This seemed to be an unusual way of doing things especially if mistakes, problems etc. could be remedied before the application was submitted.

Associate Professor Peter Dahlhaus as a member of Southern Rural Water's Independent Technical Review Panel, prepared a document "*Barwon Downs Borefield: review of literature and identification of issues,*" 14-12-2018. On page 5 of Dahlhaus's work he speaks about the 166 reports he reviewed and declared them to be "grey literature." In his statement below, mentioning evidentially verified work, it is not quite clear whether Dahlhaus hasn't "evidentially verified" the literature he has reviewed, or whether the authors of the literature haven't had their work "evidentially verified"... "***None of the information or data in the items has been evidentially verified for this literature review, therefore the credibility of the literature is an important consideration.***" But, there are many other criticisms made regarding gaps of information and methodology of Jacobs' work (see Appendix One, pages 37-39 for discussion points raised as a result of the Dahlhaus work). An important document.

NOTE: The **Renewal of Groundwater Extraction Licence** report prepared by Jacobs, 26 November 2018,⁽¹⁴⁾ was included as part of Barwon Water's

application for the Barwon Downs Borefield licence renewal for 12,000 ML/year extraction.

VALIDATION.

Jacobs reports required better validated. This page taken from Jacobs “*Barwon Downs Technical Works Program. Potential Impacts and risks from future operation of the Barwon Downs Borefield. 2/Final. 7 December 2018*” confirms this.

Potential impacts and risks from future operation of the Barwon Downs Borefield

JACOBS

Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to assess the impacts of the future operation of the Barwon Downs borefield beyond the existing licence, in accordance with the scope of services set out in the contract between Jacobs and Barwon Water. That scope of services, as described in this report, was developed with Barwon Water.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by Barwon Water and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs derived the data in this report from information sourced from Barwon Water and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

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This “Important note” clearly states that Jacobs has not verified the accuracy or completeness of information it has used to arrive at the conclusions and statements made in this document.

How then, was Barwon Water able to make an application with any certainty that an extraction licence for 12,000 ML/year based on Jacobs’ work is

appropriate, much less sustainable. The Department of Environment, Land, Water and Planning recommendations to the Minister for Water in 2019, indicated extraction rates between 1,100 and 1,200 ML/year would *never* see the Lower Tertiary Aquifers recover and rates above this could be regarded as mining of the resource (see Otway Water Book 55⁽¹²⁾ and 55 Appendix Book).

**JACOBS Barwon Downs Technical Works Program Barwon Water
Groundwater Assessment Report
1 / FINAL, 26 November 2018,⁽¹⁴⁾ (160 pages).**

The page numbers below in **green** refer to the pages in this Jacobs 26 November 2018 report.

Page 1.

- All levels of risk have not been included in a management plan.
- Up until 2016 the Big Swamp was not even recognised by SKM/Jacobs and Barwon Water as an area of risk.
- The extraction pumps had to be lowered another 100 m from the level as stated at ~400 m. Down to between 400 and 600 m.
- The Lower Tertiary Aquifer is recognised as three aquifers including a confining layer called the Pember Mudstone.
- Boundary Creek has not been a “*key tributary*” of the Barwon for decades.
- A reduction from 20,000 ML/year to 12,000 ML/year extraction is no concession. Extractions through the Millennium Drought averaged ~11,000 ML/year.

Page 2.

- Figure 1. This figure wrongly portrays the notion that Boundary Creek has always had dry periods when there is no extraction taking place. Pre groundwater extraction Boundary Creek never stopped flowing.
- Note:
 - The Narrawaturk Marl above the borefield is 170 m thick.
 - Observation bores do not monitor the water movement in this Marl formation.
 - Any leakage downwards from the upper level formations through the Marl would be very slow. This downwards vertical leakage impact will take ages to manifest itself at the surface.
 - Recently drilled observation bores (in 2014) are on the extremity of the formation where it is thinning and will give a very limited

indication of what is taking place in the Narrawaturk Marl confining layer across the 480 km² residual drawdown area of influence.

Jacobs and Barwon Water have little idea what is happening in this Marl.

Page 3.

- Extremely limited monitoring of the Narrawaturk Marl and Clifton Formation both in area covered and period of monitoring. There is a critical data gap of information here.
- It appears and is a notable omission that Jacobs' Acid Sulfate Soil report has not been included by Barwon Water as a background document of the application.
- Many of the Jacobs reports that have been referred to and used in this document have numerous errors (see Otway Water Books). The Jacobs PASS report is an example.⁽¹³⁾
- The vegetation monitoring network, assumptions made, and short timeframe of 6 months is well short of the minimum 10 years that is normal practice for vegetation studies. Otway Water Book 31 deals in detail with this vegetation monitoring.
- With this type of erroneous data/information etc. fed into a model will result in erroneous outputs.

Page 4.

- LAWROC has released a report disputing the statement of "... **very little groundwater flow across the faults.**" takes place. Specifically into the Loves Creek Catchment.⁽⁶⁾
- The concept of downward and upward vertical leakage should be explained and how Jacobs can claim less than 10% of the Lower Tertiary Aquifers (LTAs) recharge occurs via downward leakage. This is especially so when there is a paucity of data being collected. And, more so when the Witebsky et al.⁽¹⁾ report states that the downward vertical leakage from the Narrawaturk Marl would provide the major recharge.
- Other local rainfall measurements should be made use of. Ones closer to the recharge area not kilometres away.
- Regarding recharge rates.
 - Actually the Jacobs 2016a report stated between 8.9% and 11% of rainfall is recharge. Other SKM/Jacobs reports have recharge ranging up to 28%. It is also stated by Jacobs that 14% is a reasonable guess to use for calculation.

- A summary of this Jacobs report was presented to the Barwon Downs Community Reference Group 4 October 2016 meeting, stating the recharge was 13,000 ML/year. Another presentation suggested the recharge value was 14,000 ML/year. With no qualification what this water was recharging.
- Table 3, **page 8**, also mentions recharge but there does not appear to be any mention of the Witebsky et al. 1995 report that states the major form of recharge to the LTAs will be downward leakage out of the 170 m of the clay aquitard, the Narrawaturk Marl, that is sitting above the borefield.⁽¹⁾
- No breakdown of the 11,000, 13,000 or 14,000 ML/year recharge into various flowpaths has been done.
- The flowpath towards the Barwon Downs Borefield is only a fraction of this recharge amount.
- It has been calculated that this flowpath towards Deans Marsh has been reversed and the aquifer flows back towards the Barwon Downs Borefield.
- Confirmed drawdown now extends to the Kwararren area.
- The statements re: the levels above the LTAs are based largely on assumption, guess work and extremely limited actual data.
- Putting this into the model will give erroneous outputs.

Page 5.

- Artificial Supplementary Flows have been discounted as having an influence on observation bores and impacts in the Boundary Creek area.
- When and if Reach 2 along Boundary Creek became a losing stream, has not been proven.
- Input into a model resulting from conclusions based on terminology such as “potential,” “is likely” and “indicates” should not be done.
- In the vegetation study work, Jacobs has renamed the control sites as reference sites (Jacobs terminology). The groundwater extraction licence conditions issued for these very same sites calls them control sites. Unfortunately, all these control sites are within the residual drawdown influence from the Borefield. This negates these sites as control sites.
- The data used in regard to vegetation is post 2014 data and collected over a very short period. This is far too short a period on which to base and draw conclusions.
- The last statement on this page would appear to be an attempt at a joke – hopefully. ***“There no evidence from observed data that predicted drawdown in the regional aquifer as a result of historic pumping has***

propagated to the shallow alluvial aquifer at any other monitoring sites.” There won't be if none is looked for or investigated.

Back in 2009 SKM/Jacobs⁽⁴⁾ states *“It is not known whether leakage of the supplementary flow into the LTA is sufficient to maintain the water table at the surface and keep it connected to the regional water table, or that a perched water table (i.e. disconnected to the regional water table) immediately adjacent to the creek channel has formed.”*

Pre groundwater extraction and pre supplementary flows, the Lower Tertiary Aquifers were full and overflowing with artesian pressure heads and as a consequence perched or alluvial aquifers were not an issue.⁽⁷⁾ There is sufficient historical data available to avoid having to make such incorrect statements.

Page 6.

- Fig. 3 has much of its illustration based on epistemic guess work and assumption.
- There is no data supporting the notion that the Big Swamp is not connected to the LTAs. Local knowledge and observation suggests the Big Swamp is connected to the LTAs.
- Jacobs PASS report has numerous errors.⁽⁸⁾
- There is an alternative to the reasons for the presence of Quaternary alluvial aquifers.⁽⁷⁾ A strong case can be presented that groundwater extraction has created the need to consider alluvial aquifers.⁽⁷⁾

Pages 7/8.

- There is a lack of data being collected regarding vertical leakage. Witebsky et al. 1995,⁽¹⁾ stated the major recharge to a depleted LTA would be from the Narrawaturk Marl through downward vertical leakage. Due to the paucity of data being collected it is not known to what extent this is actually happening.
- Neither is there any indication how long this will happen for, nor is there any work being done to monitor impacts over time. Especially post groundwater extraction.
- Impact from downward vertical leakage will manifest and continue many years from now because of slow leakage from the Narrawaturk clay like material.
- Surface impacts and conclusions presented in the Jacobs documents are based on data collected since 2014. Over 30 years of impacts have been ignored.

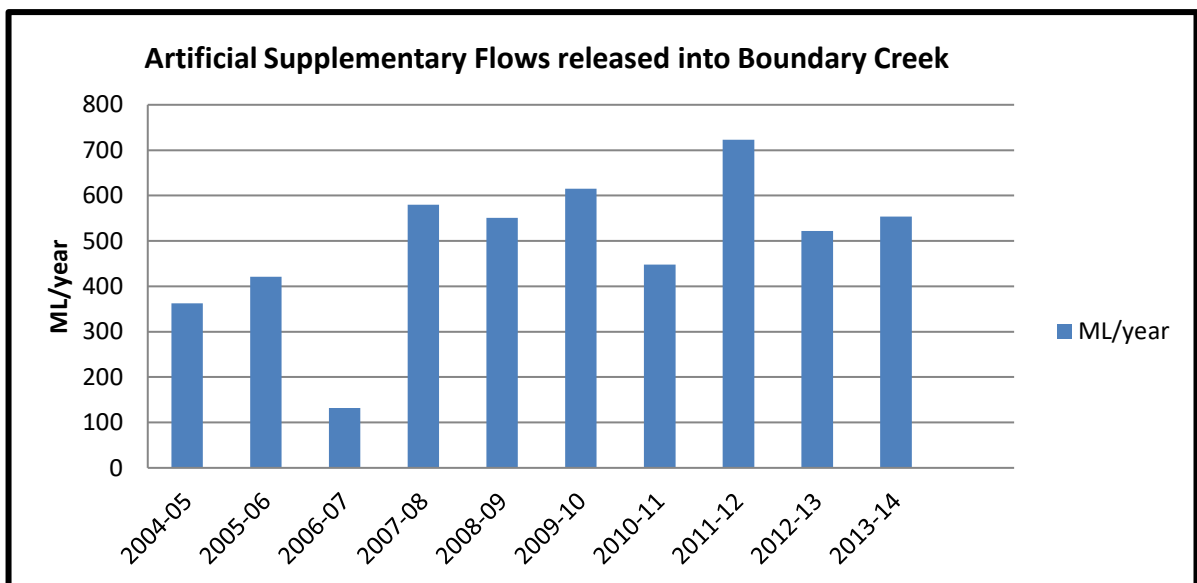
- There is a continuous dialogue on impacts BUT a comprehensive list of actual impacts has never been compiled.⁽²¹⁾⁽²²⁾⁽²³⁾⁽²⁴⁾⁽²⁵⁾⁽²⁶⁾
- Under the section headed “Potential Impacts on the LTAs,” this statement can be found on page 8.
“The technical works completed to date demonstrate that there is no adverse effect on the LTA likely to arise from the allocation or use as proposed under the licence application.” i.e. at an extraction rate of 12,000 ML/year.
 - What about contamination from downward vertical leakage from the acid and heavy metals produced in the Big Swamp?
 - What about other wetlands impacted in the area?
 - What about the Precautionary Principle and the Intergenerational Principle?
 - What about Beneficial Uses where the LTA surfaces and the overflow is no longer there?
 - What about subsidence?
 - What about the changing and reversing of flowpaths in the LTA?
 All of these things need to be considered and answers provided and included in the modelling.
- There is no mention or list of the surface impacts that are already observable.

Pages 8/9. Groundwater Mining.

- The logic displayed here is astounding and cannot be used as reasons to continue extractions as proposed.
 - A DELWP presentation to the Southern Rural Water Community Leaders Group (CLG) on 15 August 2019, confirmed that past extractions have mined the resource. The Jacobs report discounts this.
 - SKM, when assisting with the issuing of the 20,000 ML/year licence in 2002 stated that there would be no discernible impact on Boundary Creek in 100 years. It only took a fraction of this timeframe to have untold devastating impacts on Boundary Creek and adjoining wetlands. Not to mention the surrounding area.
 - During the Millennium Drought the average yearly extraction was only 11,000 ML. Imagine the impacts if 20,000 was extracted each year.
 - Even by 2002 the impacts were already evident but accredited to anything else other than groundwater extraction.

- The Big Swamp was in a deplorable state in 1997 even after one of the wettest periods on record.
- The aquifers may return to their pre-development conditions, which is encouraging, BUT that is *if* there is NO more PUMPING for some considerable time.
- At this stage the time period for full remediation and recovery of the LTAs is estimated to be between 50 and 309 years. These figures can be found in the DELWP recommendations to the Water Minister regarding the legislation of the Permissible Consumptive Volumes as legislated in June 2019. The documentation states that some areas on the extremities may take considerably longer.
- Jacobs estimates between 25 and 50 years for remediation to take place.
- And this Jacobs conclusion is a *modelled “if.”*
- The definition of mining - “*Extraction exceeds recharge,*” may be the Industry’s accepted term for mining, BUT there has to be a term that explains what has happened in the Barwon Downs Borefield scenario that causes so much damage to Beneficial Uses.
- In the “real world” it is called mining. The 2019 statement at the 15 August presentation agrees with the local community’s observations and thoughts.
- The groundwater mining definition that local community people understand is when extraction causes untold surface water problems and impacts.
- The proposed 12,000 ML/year extraction would have continued to add to the adverse impacts presently seen which is far in excess of a sustainable use.

Barwon Water releases Artificial Supplementary Flows for many months of the year. The licence stipulates 2 ML/day to be released when the flows at the Yeodene measuring station falls below 1 ML/day. These flows can be turned off when the flow at the Yeodene Stream Flow Gauging Station exceed 1 ML/day. However, the licence has now lapsed and there is some discussion that as part of the remediation work these flows may be increased during no flow periods along Boundary Creek.



SOURCE: Barwon Water Financial Year Groundwater Reports to Southern Rural Water.

Even with releases at 2 ML/day in the 2011-2012 financial year of over 700 ML, Boundary Creek still did not flow most of the year. This shows that 2 ML/day of Artificial Supplementary Flows daily flows is not enough to keep the creek flowing. These flows disappear into the depleted aquifers below.

Even when there are normal winter rains providing maximum recharge the Artificial Supplementary Flows released during many months of the year, is not sufficient to replace the amount of groundwater extracted. This is a result of Groundwater Mining.

Page 9.

- If groundwater pumping continues, the prediction that water tables will stabilise over time but at a much lower level than those of pre pumping is a frightening thought. DELWP recommendations to the Minister for Water state that the current levels would stabilise with as little as 1,000 to 1,200 ML/year extractions.⁽²⁶⁾ This is unacceptable as surface impacts would continue for several centuries.⁽²⁷⁾
- It appears to be an irrelevant statement for Jacobs to state that the aquifers will return to pre-development condition when pumping ceases, especially when advocating a 15 year licence to continue pumping at a 12,000 ML/year level. Is this an oxymoron?
- When this report states the aquifer matrix “*is not likely*” to be impacted, may be correct, but why is there no mention of what impact there will be in the aquitard matrix. Pre groundwater extraction, this

aquitard contained 170 m of water saturated material, saturated from upward vertical leakage out of the Lower Tertiary Aquifers.⁽¹⁾

- The discussion on salinity monitoring is an interesting one. The area of drawdown influence from the borefield covers a 480 km² area that has many salinity hot spots. Extensive shallow water table and salinity monitoring was being conducted in the later years of the 20th century. This has since stopped. A huge data gap.

The Barwon Water salinity monitoring being done as part of the licence conditions required Barwon Water to monitor the salinity levels in 3 of the extraction bores. This gives little if any indication what is happening in regard to salinity movement or impact in the layers above or around the LTA that have come under the influence of changing hydraulic gradients.

- It brings a smile to one's face when reading the use of the term "*real world*." One of the major concerns of the local community is that Jacobs's work appears to be disconnected from the real world.

Pages 10 -17.

Many of the concerns raised in these pages are discussed in other sections of Otway Water Book 50.

Pages 19-21. Rainfall.

The Shalley family has farmed the lower reach of Boundary Creek since 1912. Shalley history tells that up until the early 1980s Boundary Creek had never run dry. The farm(s) along the creek were Stock and Domestic water supply drought proof. Data quoted in this section would suggest that given the rainfall patterns over the past 104 years Boundary Creek should continue to flow all year round. Since pumping Boundary Creek has extended periods of no flow.

This following statement is extremely misleading when it fails to take into consideration pre-groundwater extraction conditions. "*These dry periods had a significant impact on surface water flows and groundwater levels across the state, and the Barwon Downs region was no exception to this.*" Many of the Otway Ranges streams have provided drought proofing through a century of varying and extreme conditions. Summer baseflows varied little⁽¹⁵⁾ until serious groundwater extraction started in 1982 at the Barwon Downs Borefield. Barwon Water states this extraction supplied Geelong with 50% of its water needs during the 1982-83 drought. During the Millennium Drought Barwon Water states Geelong relied on groundwater extraction for 70% of its

water.⁽¹⁸⁾ Under pre extraction levels the Dynamic Equilibrium Water Level Zone⁽⁷⁾ was able to buffer summer baseflows from the severest of droughts.

Page 22.

- There is a most convincing argument that the fire trenches **have not** “... **had considerable impacts on both the quantity and quality of water flowing out of the swamp.**” It is my understanding that the Geelong 6 June 2018 meeting audio recorded by Barwon Water, quite clearly recorded the acceptance by all present that these trenches **did not** impact. Extensive comment on this can be found in Otway Water Book 42.⁽²⁸⁾
- The release of the Artificial Supplementary Flows as a precautionary and mitigating measure has been a complete failure. A recognised failure since the licence conditions were implemented in 2004. However, Barwon Water would not entertain any thought to seek modification of the licence. Barwon Water officials stated no changes could be made until the licence was up for renewal in 2019. However, at the very same time Barwon Water was successfully negotiating with Southern Rural Water to modify the licence conditions changing the section on vegetation monitoring.
- The last paragraph on this page describes the layers that the Permissible Consumptive Volume refers to.
“The PCV applies to the Middle and Lower aquifer which includes all Lower Mid Tertiary (LMTA) and Lower Tertiary (LTA) Aquifers to 50 metres below the base Tertiary age formations or 200 metres from the surface, whichever is the deeper.” Is this correct?

Page 24.

- Initially the extraction bores were pumping from 400 m below ground level and were later lowered to the depths indicated in Table 3-1.
- The 1982-83 extraction may have been “**brief**” but was extensive enough to supply Geelong with 50% of its water needs.⁽¹⁸⁾
- The intermittent 1985-1990 stress test pump was massive at approximately 25,000 ML.
- A group of local community members were told that the 2016 extraction (~ 3,400 ML) was conducted because the licence allowed it. Geelong was not on water restrictions at the time. This was not taken very well by those farmers along a non flowing Barwon River. Especially when Barwon Water was holding water in the west Barwon Dam and also able

to sell 5 GL to Western Water out of Barwon Water’s reserve of water held in the Yarra Thomson system.

- Figure 3-1 would provide a quite different “look” if it showed yearly extractions. Approximately 120,000 ML over this same time period would make the daily pumping rates look insignificant.

Page 25.

12,000 ML/year extractions would allow Barwon Water to extract the very same yearly amounts that have been extracted over the life of the current licence. Not a very comforting thought.

Pages 26-29.

It is acknowledged by Jacobs that Figure 4-1 is representative only. However, numerous other representative cross sections could be drawn showing quite different aspects of the area. Consequently Figure 4-1 is not an accurate representation of all aspects and gives misleading impressions.

- The reasons given why the Quaternary Aquifers have been left out of the modelling input is curious considering that these aquifers have been explained as having a significant connection to Groundwater Dependent Ecosystem sites. In Dahlhaus’s review of this work he states that not including these in the modelling is a shortfall of the modelling.⁽²⁹⁾
- Pre groundwater extraction and where those areas with potentiometric water table levels far in excess of the surface level, the Quaternary Aquifers would have had little influence on the vegetation sites within this zone. Upward vertical leakage would have been keeping the Quaternary Aquifers full. The vegetation sites were being buffered from prevailing weather conditions and climate change by the pressure head of the LTAs.⁽¹¹⁾ This notion appears to be supported in feedback from Southern Rural Water’s Independent Technical Review Panel (ITRP) given on Barwon Water’s first effort at providing a Scope under the s78 Notice. The ITRP stated... *“Alluvium – not represented specifically, but existence of alluvium is invoked as a mitigating factor on drawdown affecting river-aquifer exchange fluxes.”*
- In fact earlier SKM/Jacobs reports (2008) stated that no Quaternary Aquifers or perched aquifers could be found at any site which had been designated to be a Groundwater Dependent Ecosystem (GDE).
- The changing of the vegetation sites; the discrediting of earlier vegetation monitoring; the starting of a new monitoring program with a baseline dated from 2014 and since groundwater extraction progressed to unprecedented levels, Quaternary Aquifers held little concern.⁽¹¹⁾

- The terms “is likely to have,” “it was concluded that” and “it could potentially” are all crammed into one sentence discussing the groundwater issues to the south west down through the Loves Creek Catchment, and, a very small section of the Gellibrand River. Feeding data based on these findings, into a model that concluded 12,000 ML/year was a sustainable extraction level, seems unbelievable.
- The section of the Gellibrand River is on the extremity of the model boundary and in Jacobs own findings requires a great deal of confirmation as to its accuracy.
- The Kwararren cone of depression is also involved in the south west flowpath and requires a little more than a one sentence of explanation as to what is taking place..

Page 30.

- The significance has not been explained why the Jacobs report wanted it noted that Technical Works Monitoring program hydraulic testing was done in the outcropping of the LTA, and not at depth within the graben.
- This also highlights another weakness with the data being fed into the model.

Pages 31-33.

- SKM’s artificial recharge attempts in the late 1980s and 1990s found that:
 - To artificially recharge the LTA would require kilometres of trenching, and
 - In a later study it was found at the time of the study one could not put any more water into an already full aquifer.
- The last 30 year recharge estimation rates of 5,900 ML/year or the 11,000 ML/year are referring to the recharge rates for the Barongarook High. These recharge rates then have to be allocated to the various flowpaths from the Barongarook High. These flowpaths head off in different directions, some away from the borefield.
 - Down to the Borefield at Barwon Downs.
 - East to Deans Marsh.
 - North East to Birregurra.
 - Possibly North West under the Deans Creek catchment.
 - West and South West to the Loves Creek and Ten Mile catchments.
 - South West to the Gellibrand Catchment

- How much of this 11,000 ML/year goes towards the borefield has not been stated? How the model copes with this is anyone's guess.
- Also, it has not been explained how much is being sucked back to the Borefield or away from the various flowpaths replenishing the depleted LTAs at the Barwon Downs Borefield.

Page 33.

The argument that evapotranspiration (ET) is a major cause of water loss from the graben is an interesting one.

- By far the greatest and major influence is the extraction of groundwater.
- Pre groundwater extraction when the pressure heads from the LTAs created artesian flows from observation bores throughout the Upper Barwon River valley, ET was not a huge contributing factor to the survival of Groundwater Dependent Ecosystems.
- A classic example being the Maggios Swamp scenario. This swamp on the outer fringes of the drawdown influence from the Barwon Downs Borefield has been benefitting indefinitely from the buffering effect of the Dynamic Equilibrium Water Level Zone (DEWLZ).⁽⁷⁾ This classic little swamp has maintained its integrity and has survived pine plantation and blue gum plantation rotations since the 1970's, where the plantings go within metres of the swamp. ET has had minor impact and will continue so, as long as the DEWLZ maintains its pressure head. The springs will continue to flow; the swamp will survive and the plantation vegetation will take its share through ET without Groundwater Dependent Ecosystem impact.

Pages 33-36. Groundwater Flow.

- Jacobs's confirmation that drawdown from the Barwon Downs Borefield has reversed flow path directions, is a little disturbing.
- The statement that the Ten Mile/Loves Creek flowpath from the borefield is separated by a groundwater divide has been challenged by LAWROC. This Group has confirmation that it is a restriction and has been called the "Pipeline Restriction."⁽⁶⁾
- The fact that the flowpath towards Gellibrand is a major one, and, that these flowpaths have been disrupted, highlights the need to apply the Precautionary Principle.
- To further emphasise the need to be wary and cautionary, is the disruption of the natural flowpaths as described in this section of the Jacobs report.

- The statement that rapid recovery in the centre of the borefield has taken place is the creation of another myth.⁽⁷⁾⁽¹⁶⁾

Pages 37-38. Vertical Leakage.

- In the Witebsky et al.⁽¹⁾ report summing up the results of the stress test pump at the Barwon Downs Borefield between 1987 and 1990, it predicted that a major supply of recharge to any depletion in the regional groundwater caused by the Barwon Downs Borefield, would come from vertical leakage downwards out of the Narrawaturk Marl aquitard.

“...Leakage from the overlaying marls is likely to be the major source of recharge under stressed conditions.”⁽¹⁾

- Vertical Leakage can be in an upwards or downwards direction. Water can be forced up from one layer to another. For example when the aquifers in the LTA are under pressure they force water up into the Narrawaturk Marl above. Lower the pressure in the LTA and the water in the Narrawaturk Marl aquitard will begin to leak down in an attempt to fill the depleted LTAquifers below.
- Leonard⁽²⁾ was discussing the certainty of vertical leakage in this very area as far back as 1984. The Witebsky et al.⁽¹⁾ report also contained this...

“The immediately overlaying Narrawaturk Marl is up to 170m in thickness and grades from silty sands to marl. It has very high storage capacity and within the borefield area is known to contain groundwater of good quality. Under undisturbed conditions an upward vertical, hydraulic gradient exists between the marl and the Lower Tertiary aquifer system and the marl is recharged with groundwater of good quality from below.”

- Under undisturbed conditions the leakage is upwards.
- In 2016 Jacobs⁽³⁾ stated that when an upward hydraulic gradient exists ***“This facilitates upward leakage from the aquifers into the overlaying aquitard and is a key discharge process for the aquifer.”*** The same Jacobs report⁽³⁾ has this to say ***“...groundwater levels in the LTA have fallen below the overlaying MTD for periods of time.”*** The MTD contains the overlaying aquitard, the Narrawaturk Marl. Once this happens the marl begins to leak downwards. Leakage out of the clay marl will be slow with impacts taking some time to manifest.

- Page 31 of the SKM/Jacobs Report 2009⁽⁴⁾ also discusses the possibility of vertical leakage and states that at this stage there is no evidence that this has occurred. The reason for this lack of evidence is that only 3 of the 61 regional observation bores used in Report 2009 were monitoring this possibility. The principle of upward and downward vertical leakage has been a reality for decades and it seems unbelievable that scant data has been collected over the 34 year period of groundwater pumping at Barwon Downs. Especially when it was stated in 1995 that vertical leakage into the depleted aquifer would be a major source of recharge.
- Other difficulties attempting to understand and make informed decisions about vertical leakage include:
 - Barwon Water has screened each extraction bores in all three aquifers being utilised. This is usually a no no thus avoiding aquifer cross interaction.
 - Each aquifer will respond differently to the extractions creating its own cone of depression pattern.
 - Is observation bore 64242 (Figure 4-6), monitoring the top, middle or lower level of the MTD? This will determine the time taken to react to drawdown in the LTAs.
 - In Figure 4-7, the same applies to observation bore 64244 as it is 200 metres above the one being compared against. The delay in response of 64244 to pumping from 2010, is going against the trend and indicates impact takes much longer to manifest at the higher level.
 - The Narraturk Marl aquitard in the MTD that sits above the LTA, is 170 metres thick at the extraction sites and will take time to leak vertically downwards into the depleted aquifers below. How this leakage is proceeding cannot be determined with the extremely limited data being collected from this marl.
 - As Evans⁽⁵⁾ reports this downward leakage could take 100s of years to manifest after extraction ceases.
- The conclusions drawn from the current conceptual understanding of the Vertical Flows Processes is based on much guess work and assumptions. This very state is reflected in a number of statements made on page 37.

Page 38. Salinity – see page 9 comments.

Pages 39-40. Groundwater Surface Water Interactions.

Gellibrand River Catchment.

- How it has been determined that there are sections of the streams in the upper Gellibrand River Catchment that are losing, has not been explained. Why is any section losing and where does it go has not been explained either? Is it from groundwater extraction at Barwon Downs?
- Statements on springs in the area seem to be contradictory...

“The underlying hydrogeology and source of water for the springs was not identified during the survey.”

The 2012 Newlingrook Investigation⁽⁹⁾ reporting on 2009 observations, contained this statement on page 6.

“A number of springs are found in the central part of the region and are derived from shallow (potentially perched) groundwater in the regional aquitard (Clifton formation).”

However, the 26 November 2018 report states that the SKM 2012 report did not identify the source of springs. *“The underlying hydrogeology and source of water for the springs was not identified during the survey.”*

Also, during the 2007 spring survey the Newlingrook investigations found that Robbie Maxwell’s property had springs sourced from the Lower Tertiary Aquifers.

Some confusion here and much to unravel.

Page 40. Boundary Creek.

Many of the statements made regarding the groundwater surface water interaction for Boundary Creek is based on guess work, estimates and assumptions. Otway Water Books 42-42H discuss the efforts to gain accurate and confirmable data on this subject. Result – nothing but guess work, estimates and assumptions – very little confirmable data.

Pages 41-43.

- At no stage throughout the discussion on Boundary Creek has there been any mention of the impact the Artificial Supplementary Flows being released out of the Otway Colac Pipeline. Consequently, the statements made at the top of page 41 are highly questionable.
- The section of the Big Swamp in Figure 4-9 has not shown that this area of the cross section cannot be accurately determined due to a data black

hole. For some reason there has been a resistance to determine where the supplementary water goes to as it disappears into the Big Swamp.

Pages 44-48.

Climate change is given an unwarranted significance in this renewal application. This only has significance as a result of the unsustainable groundwater extraction that has taken place at the Barwon Downs Borefield. Previously the Lower Tertiary Aquifers had an enormous buffering capacity against climate change impact on the water matrix pre groundwater extraction. Without groundwater extraction on such a large scale, climate change impact would have played a very minor role for some considerable time.⁽⁷⁾

Page 49. Impact on the Lower Tertiary Aquifer.

- In November 2018 Barwon Water accepted “...*the conclusion that there is no adverse effect on any aquifer likely to arise from the allocation or use as proposed under the licence application.*” Which seems quite unbelievable.
 - But by 2019 reports confirm this statement to be 100% inaccurate with the aquifers being mined.⁽¹⁰⁾
 - Barwon Water later acknowledged this in March 2019 when it withdrew its licence application for 12,000 ML/year extraction.
 - With long term vertical downward leakage, if not already doing so, this will eventually impact on the Clifton Aquifer. Page 89 has this to say “*Drawdown takes time to propagate to the surface.*”

“The maximum drawdown in the watertable is therefore experienced at different times around the study area.”

“In addition to this, some areas may continue to experience drawdown after the Borefield has been turned off.”

- This indicates there may be a considerable time delay before impacts manifest themselves. Unfortunately, subterranean impacts may never be known.
- The prospect of long term pollution and contamination of the LTAs cannot be ruled out until it has been categorially determined that there is no direct connection between a downward flowpath under the Big Swamp to the Lower Tertiary Aquifers.

Page 49 . Groundwater Mining.

- Jacobs states there would be a 25 to 70 year (CRG meeting disclosure) period needed for the LTAs to recover. This surely qualifies as long term and the extractions from the Barwon Downs Borefield can then be safely named as groundwater mining.
- The fact that past extractions have exceeded recharge **AND** have also dropped the Dynamic Equilibrium Water Level Zone so much that any buffering ability of this zone has been negated, this is groundwater mining.
- There has been much more than “*some community concern*” that the LTAs being mined. At www.stopgroundwatermining.com.au there was a link to Change.org petition with over 1,700 signatures asking that groundwater extraction be terminated. More than some concern.
- A separate petition of over 800 signatures was also tabled in State Parliament by MP Richard Riordan.
- Once again, it needs to be stated that “crap” into a model will produce “crap” results. Much of the Barwon Water calculations are “*Based on the assumptions used in the groundwater model.*”
- How it can be stated that proposed extraction rates do not exceed recharge? Historical data clearly shows that extraction rates have far exceeded recharge rates. How many times do reports have to present this fact before it is accepted?
- In the 2019 licence renewal application the maximum proposed 15 year extraction limit is 60,000 ML. This is not that dis-similar from past extraction rates that have caused so much devastation in the region. Past extractions over two 15 year periods is presented in the table below (see next page).
Even though it would appear that applying for a 12,000 ML/year extraction rate is a huge concession being made by Barwon Water, reduced from the current licence of 20,000 ML/year, this is no concession at all.

Past extractions:

Year	Total Annual	Progressive	Progressive
1. 1999-2000	11462	11462.41	
2. 2000-2001	8163	19625.72	
3. 2001-2002	229	19854.22	
4. 2002-2003	0	19854.22	
5. 2003-2004	271	20125.02	217
6. 2004-2005	0	20125.02	217
7. 2005-2006	1998	22122.75	2269
8. 2006-2007	11807	33930.04	14076
9. 2007-2008	12604	46534.04	26680
10. 2008-2009	12438	58972.78	39118
11. 2009-2010	12692.5	71665.28	51810.5
12. 2010-2011	0	71665.28	51810.5
13. 2011-2012	0	71665.28	51810.5
14. 2012-2013	0	71665.28	51810.5
15. 2013-2014	0	71665.28	51810.5
2014-2015	0		51810.5
2015-2016	1902.7		53713.2
2016-2017	1546.4		55259.6
2017-2018	0		55259.6
2018-2019	0		

SOURCE: Barwon Water Annual Reports to Southern Rural Water re: Gerangamete Groundwater Licence 893889.

Between 1999 and 2014, **71,665.28** ML were extracted.

For the 15 year period between 2003 and 2018, **55,259.6** ML were extracted.

- Witebsky et al 1995,⁽¹⁾ calculated the yearly recharge to be 1,500 ML or 22,500 ML for 15 years. The Permissible Annual Volume was calculated in 1997 to be 4,000 ML/year or 60,000 ML for 15 years. At 4,000 ML/year there would be impacts manifesting at the surface. In other words extraction would outstrip recharge and rejection from the aquifers into the surface waters would disappear. This does not take into account the impacts that would be felt throughout the subterranean cone of depression.

- Witebsky et al.⁽¹⁾ also stated, if extraction was to take place over 4,000 ML/year, then during the wet years of no extractions there **should be** artificial reinjecting of water back into the depleted aquifers.

Pages 50-55.

This section states that the Lower Tertiary Aquifers can sustain the current level of extraction as there are enormous reserves of water in the subterranean. However, the current level of extraction, although a very small fraction of the reserves, creates disastrous surface impacts. Not to mention the difficulty to ascertain the amount of subterranean impact.

Pages 56-57.

- Water level recovery has to be based on pre-groundwater extraction levels of the 1970s, not be reset with the reference point starting from 2016.
- Also, water level recovery in the LTAs has to be calculated from a three dimensional, volumetric aspect, not a one dimension hydrographic aspect. One dimension recovery gives a very skewed and inaccurate assessment of what is actually happening.

Otway Water Book 35⁽⁶⁾ discusses how a one dimensional 90% recovery as depicted on an observation bore hydrograph gives the casual reader the overwhelming impression that recovery is going well when in fact taken as a three dimensional volumetric measurement, the recovery is significantly so much smaller. This 90% depiction can also give the impression that this recovery is uniform across the drawdown area of influence. Bore 109130 closer to the extremity of the drawdown has been predicted to take another 20 years to reach a 90% recovery. Further out at Kawarren, bores in this location may take up to 30-40 years to recover. And, that is providing there is no more drawdown. In fact in advice to the Minister for Water regarding the Permissible Consumptive Volume legislation of June 2019, it was estimated that observation bore 64233 could take up to **309 years to recover 100%**. Also, as the cone begins to recover close to the borefield the extremity boundaries and impacts continue manifest.

As part of the of the 2019 work completed by the Department of Environment, Land, Water and Planning (DELWP) to determine the Permissible Consumptive Volumes (PCV) for the Gerangamete Groundwater Management Area, it was calculated that between 200

and 400 ML/year extraction was an appropriate level **when the aquifers fully recover**. Considering the PCV had to be set at 238 ML/year because of outstanding farmer extraction licences, there is every chance that the above years of recovery will take much longer.

- These recovery rates are given assuming there will be no more extraction.
- ***“An aquifer is typically considered to have recovered when the water levels recovers to 90% of pre-pumping level...”*** which is not what local landholders who have been impacted by drawdown would agree with. And, the remainder of the above statement ***“...as the remaining 10% of recovery can take significantly longer to realise and is a small enough proportion of the storage to overlook.”*** certainly would not be accepted by landholders. Considering the extremities of any drawdown are the last to be impacted and the last to recover should never be so easily discounted.

Pages 57-58. Effect on Groundwater quality.

- As stated earlier, extremely limited monitoring of salinity movement has been undertaken in the last 20 years.
- Monitoring salinity ***SINCE 2004*** in three bores in the LTAs, cannot lead to the conclusion that ***“...operating the borefield has not had an adverse impact on the groundwater quality with respect to salinity.”***
 - Extremely limited data has been used
 - Data has been taken from only three of the eight strata sections that could possibly be impacted
 - These three bores only measure the LTAs.
 - The data is collected from great depths
 - No data has been included in the analysis of salinity levels, movement or changes above the LTAs
 - Data is taken from one very small area of potential impact.

Pages 59-60.

If Jacobs and Barwon Water’s data is accepted it would appear that subsidence is not a problem. This was found to be the case in 2019 when Department of Environment, Land, Water and Planning (DELWP) was reviewing the Permissible Consumptive Volume for the Gellibrand and Gerangamete Groundwater Management Areas. However, if this conclusion was reached from data provided by Barwon Water then there is considerable doubt that a correct conclusion has been reached. Barwon Water’s data is dated from 2003. In actual fact subsidence data had been collected for many years previous to

2003.⁽¹⁷⁾ This data should have been fed into the model and begs the question why was it omitted?

Page 60-66. Risk Assessment Framework for *Receptors*.

- Jacobs may well be following the Ministerial Guidelines (DELWP, 2015) when presenting their arguments in this section of their report but fail to recognise critical items:
 - These guidelines are designed for new licensing not renewal of ongoing 30 year old extraction licences that have caused untold negative impacts.
 - The intent of these guidelines is to protect, enhance or rehabilitate Groundwater Dependent Ecosystems (GDEs), not to make a fresh start from a “new” baseline after untold impacts have occurred to GDEs.
 - The local community does not want the baseline for the implementation of this intent to start at 2014.
 - The local community wants the baseline to start at least from 1980.

Attempting to disregard the past impacts caused from groundwater extraction and reset with a reference point from 2014 or 2016 is totally unacceptable.

Pages 67 to 88 were not looked at in any detail except for one thing that stood out. The calculated risks for Loves Creek if further extraction was to proceed, as stated on page 85, point 8.2.8 varies markedly with a report commissioned by LAWROC Landcare Group. The Wade report⁽⁶⁾ presents impacts that dramatically contrast to the future potential risks stated in this Jacobs 26 November 2018 report.

Pages 89-94. Potential Risks to Terrestrial Vegetation.

These pages discussed **future** potential risk factors that were referenced from conditions and baseline data collected as of 2014.

- Unfortunately, all vegetation surveys and studies up to 2014 were discounted by Jacobs.
- Jacobs conducted a vegetation study in 2014 using 14 supposedly “new” sites. A new baseline or reference point for vegetation impact was established at this point in time. Groundwater Dependent Ecosystems already impacted were ruled out for various dubious reasons.⁽¹¹⁾ Site name changes, site location changes, site co-ordinates wrong, site descriptions wrong, site confusion and control sites within the area of drawdown influence altered; all added up to a very “dodgy” report.

Otway Water Book 31⁽¹¹⁾ deals with this in detail and includes Groundwater Dependent Ecosystems recognised way back in 1986.

- In 2015 Jacobs conducted a second survey at these “new” 14 sites.
- Six months is not what one would call a desirable length of time on which future predictions and modelling scenarios can be based. This statement appears to contain a slight exaggeration stating several years of monitoring. *“Vegetation across the Barwon Downs study area has been monitored over several years to determine the potential impact of extraction from the Barwon Downs Borefield on vegetation.”*
- The data presented in 2016 is the basis of the new reference point from which modelling and conforming to the DELWP 2015 guidelines have been based.
- ***The following table looks at data collected at sites since 1994 in regard to Groundwater Dependent Ecosystem dependent species.***

(Table taken from page 73 Otway Water Book 31, March 2017).

Sites Surveyed since 1993 that had a total of 47 or more groundwater dependent species identified.

Of the 100 or more sites surveyed these 13 sites had 47 or more species identified.

Site Number	47 or more Species identified in 1994	47 or more Species identified in 2002	47 or more Species identified in 2008	47 or more Species identified in 2015
6	49			
7	50			
8	55	54		
12	47			
29	49			
33	47			
38	49			
49	63			
50	68			
51	54			
52	52			
76	47			
3 (Started in 2008))	NA	NA	47	

- (Site 3 was changed to Site T7 in 2015 and was reported as being at an existing site. However, the species list fell short of 47.)

It would appear to be significant that within 8 years the only vegetation site surveyed in 1994 with 47 species was at Site 8. When Site 3 was introduced in 2008 it was the only one of the sites surveyed that had 47 species identified. By 2015 Site 3 had only 29. Water dependent species decline and a shift to vegetation species requiring drier conditions has taken place.

- It is interesting to note that Jacobs calls the control sites cited in the 2014 revised groundwater extraction licence as reference sites (Appendix C). These control sites are *all* within the area of drawdown influence from the Barwon Downs Borefield negating them as control sites.

Pages 95-99. Potential Risk to PASS (Potential Acid Sulfate Soil).

- There has been more than “...*increasing community interest about the potential environmental impacts*...” from Actual Acid Sulfate Soils (AASS), going back to 2008. The 2008 Australian Broadcasting Company (ABC) 7:30 report, with a ten minute coverage of the problems in the Big Swamp, attests to this.
- CEO Michael Malouf is on tape stating ignorance of an acid sulfate soil problem and states that it is not a Barwon Water groundwater drawdown consequence.
- It took Barwon Water to 2014 before the problem of AASS was starting to be taken seriously. Another 5 years of community concern was needed to bring the issue of Actual Acid Sulfate Soil problems to a stage of doing something about it. The Minister for Water stepped in at the end of 2019.⁽¹⁹⁾
- Figure 10-1 in the Jacobs report does not accurately represent the progressive stages of how the PASS program has evolved. Otway Water Book 40⁽¹³⁾ discusses this in detail.
- The Big Swamp, Cirillos, Boomerang Swamp and Maggios Swamp should have been included in the PASS study and future monitoring.
- Otway Water Book 40⁽¹³⁾ critically reviews the Jacobs PASS study outlining some serious concerns.

Pages 100-101. Key Findings of Impact and Risk Assessment.

The major concerns with these findings are that:

- Barwon Water and Jacobs find extraction under the intermittent pumping (as done in the past) as sustainable. This included a Permissible Consumptive Volume extraction rate of 12,000 ML/year.
- Impacts will be the same or less as in the past.
- Considering a list of past impacts has not been officially compiled makes the sustainable rate of 12,000 ML/Year a nonsense statement.
- Statements on groundwater mining, aquifer matrix and groundwater salinity are based on guess work, assumptions and huge data gaps.

- Artificial Supplementary Flows will buffer and hide the true impact from groundwater extraction in the Barongarook High region.
- The alluvial aquifers are not represented in the modelling and in the “real world” should be. Southern Rural Water’s Independent Technical Review Panel (ITRP) stated on at least two occasions that alluvial aquifer data should have been fed into the model. (see ITRP report “Barwon Downs Wellfield Groundwater Model Issues Log May 2019, page 3 under Geology & Parameters.”)
- Groundwater flowpaths across restrictions have been classified as hydrogeological barriers. Wrong in some cases (See Wade’s study⁽⁶⁾).
- Impacts on the Gellibrand River Catchment have not been resolved.
- Vegetation sites that have been drastically impacted from past extraction have been ignored or dismissed as significant.⁽¹¹⁾
- The reason that the majority of the vegetation in the study area is considered to be at low risk is because the present vegetation is opportunistic vegetation that has moved into the dried out areas created by groundwater extraction and are doing fine.
- These sites have not returned to become Groundwater Dependent Ecosystems despite several wet winters.
- The limited range of AASS and PASS monitoring has enabled the statement in point 13, page 101 to be made. The credibility of the 2015 Jacobs Potential Acid Sulfate Soils report has been challenged in Otway Water Book 40.⁽¹³⁾

Pages 102-104. Water Level Monitoring.

- The area Barwon Water monitor is approximately 480 km² and there are 89 observation bores.
- **Unfortunately**, the 480 km² area of impact only goes out to the 4 metre drawdown point. The total area of impact created by the cone of depression extends out to the point of ZERO drawdown influence.
- 31 observation bores have been drilled since 2014.
- These 31 new bores have been sunk in an effort to fill enormous data gaps recognised way back in 1986, 1994, 2002 and 2008.
- Nested bores are a rarity.
- The new 11 bores in the Narrawaturk Marl do not gather data from the 170 m clay layer above the borefield.
- Do these 11 bores gather data from different depths within the 170 m thick layer of the Marl?

- 3 observation bores in the Clifton Formation is totally inadequate if a comprehensive understanding of how the Clifton is reacting to groundwater extraction over such a wide 480 km² area.

Pages 105-107.

- The following statement is so true. *“There is very limited data to demonstrate if and how salinity may have changed over time.”* Yes, the salinity data gathering in the extraction bores is important but as stated earlier and repeated in the statement above, no one has any idea how groundwater extraction has or has not impacted on salinity movement in the upper structures above the LTAs. Or, in the wider area of drawdown impact.
- Taking salinity samples from three of the extraction bores and reporting the results of this testing **does not** gain a comprehensive understanding of what is happening throughout the extensive area of the Lower Tertiary Aquifers. To claim otherwise is quite extraordinary.
- No explanation has been given why the Porcupine Stream Flow Gauging Station has not been recommended for re-instatement. Both the Yahoo and Ten Mile Creeks stations have been re-instated. Sort of.
- The Ten Mile Creek Station is very much as it was originally constructed. However, the original Yahoo one was completely removed as water had undermined it and was in very poor condition. The re-instated station pool has been created with loose stones made into a barrier.



Yahoo Creek Stream Flow Gauging Barrier.

Pages 108-110.

- Both the vegetation and PASS work presented by Barwon Water is extremely questionable.⁽¹¹⁾⁽¹³⁾

Pages 111-124. Triggers/Subsidence/Flows.

Triggers are designed to act just as described at the top of page 111, but Jacobs needs to get it right.

- One cannot set Groundwater Dependent Ecosystems (GDEs) triggers based on post 2014 data and not consider pre 2014 GDE impacts.
- It would appear when reviewing the 2004 licence conditions it was recommended that all subsidence pre 2003 be forgotten (see Appendix Four, page 42).
- It would also appear, that the extensive data collected from subsidence monitoring points scattered throughout the area going back many years, have been discounted, lost or overlooked. When these early subsidence sites were replaced with satellite referenced points perhaps it was decided to make a fresh start and forget any subsidence that had already taken place.
- However, there is no excuse for this data to be discounted and not fed into the latest model calculations and predictions. At one of the early Barwon Water Barwon Downs Groundwater Licence Renewal Community Reference Group (CRG) meetings in 2014, the fact that subsidence data pre 2003 existed was raised. Amazingly neither the Barwon Water officials or the SKM/Jacobs specialists were aware of the early data collecting system. Incomplete data into a model will produce unreliable outputs.
- Pre 2014 triggers for vegetation impact , if set, would have been passed long ago, e.g. the Big Swamp., e.g. the Boomerang Swamp⁽²⁰⁾ etc.⁽¹¹⁾
- The 2004 licence stipulated the flow at the Yeodene Stream Flow Gauging Station had to be 1.0 ML/day, **NOT** 0.5ML/day.
- The trigger levels in observation bores 64229, 64236 and 82844 relate to subsidence. If the water table dropped below the set levels then subsidence level checking is activated. ***“On going monitoring of land subsidence is recommended, and existing trigger levels are recommended for the future licence.”*** (page 59)
- Observation bore 109131 has two trigger levels. One for subsidence and one for environmental flows..
- To state that the ***“...borefield has been operated historically within the required trigger levels (as per the licence)...”*** is nonsense. At the best this could be claimed as half the truth/story.

- The water table trigger level in observation bore 109131 (Yeo 40) has been below the environmental flow trigger for a least 10 years. ***This is an example of the “real world”*** but appears to have been overlooked by SKM/Jacobs and Barwon water.
- Extensive and comprehensive studies were carried out when determining the Boundary Creek environmental flow trigger for the 109131 observation bore back in 2004.
 - It was found that if the water level in 109131 dropped to 158 m AHD, Boundary Creek would turn from a gaining stream to a losing stream. Thus the 158.5 m trigger level.
 - Baseflows in Boundary Creek would stop and Boundary Creek would dry up during a normal summer.
 - To ensure that this would never happen the trigger was set with a **0.5** m buffer.
 - If the water level dropped to 158.5 m AHD then supplementary flows had to be released into Boundary Creek to ensure Boundary Creek kept flowing. Totally unsuccessful.
 - Unfortunately five things became apparent.
 - A 2 ML/day supplementary flow was not enough to maintain flows.
 - Extraction and short recovery periods failed to allow the Lower Tertiary Aquifers to recover through Artificial Supplementary Flows of 2 ML/day.
 - As time and pumping progressed the water level continued to drop further and further below the 158.5 AHD trigger.
 - The days of no baseflow in Boundary Creek neatly match the period that the water level in 109131 has stayed below the 158.5 m AHD trigger, confirming the inadequacy of the the Supplementary Flows once the trigger level was exceeded.
 - As of today the water level in observation bore 109131 is still way below the trigger level of 158.5 m AHD.

No other trigger level proposed in Jacobs’ 26 November document was reviewed.

Pages 125-126. References.

It is interesting to note that none of the Otway Water Books reviewing many of the Jacobs documents presented to the Barwon Downs Groundwater Community Reference Group (CRG), have been included in the references. Many of these books critically review SKM/Jacobs work. Most Otway Water Books

referred to are easily accessed (www.otwaywater.com.au) and present one view of community concern.

CONCLUSION.

Disturbingly, even though Otway Water Books reveal mistakes in the SKM/Jacobs documentation that cannot be disputed, the SKM/Jacobs work continues to be referenced, mistakes and all, in documents as late as June 2019. Consequently, water resource management decisions continue to be made based on faulty material.

As disturbingly, alternative explanation or conclusions that could be drawn from the multitude of assumptions, guesswork and limited data is not presented in any of the SKM/Jacobs work.

As with so many of the SKM/Jacobs reports a problem arises when decisions are made at an epistemic level. Basing groundwater resource management decisions on guesswork, assumptions and generalities can too often lead to catastrophic results. The Barwon Downs Borefield experience is a classic example. The destruction caused during the 15 years of the past licence when the average yearly extraction during the Millennium Drought was 11,000 ML, was bad enough. But, to justify and apply for a renewal of the groundwater licence at an extraction rate of 12,000 ML/year shows how badly groundwater resource management decisions can be.

The Jacobs report reviewed in this Otway Water Book shows how this can come about. The report by JACOBS, "*Barwon Downs Technical Works Program Barwon Water Groundwater Assessment Report 1/FINAL* 26 November 2018," was included in the volume of reports and documentation submitted by Barwon Water supporting the 12,000 ML/year licence renewal proposal.

The Appendices included in this Otway Water book outline many of the concerns and problems facing the appropriate Otway Ranges groundwater resource management decisions pre and post withdrawal of Barwon Water's groundwater extraction licence.

APPENDIX ONE – The Dahlhaus Review.

Some Key Quotes from Peter Dahlhaus’s document: “Barwon Downs Borefield: Review of literature and identification of issues.” 14-12-2018. Final.

(The Dahlhaus Review is found in OB 50 file.)

As a lead up to Barwon Water presenting their renewal of the groundwater extraction licence for the Barwon Downs Borefield an Independent Technical Review Panel was appointed by Southern Rural in 2019, to assist with the scrutiny of this licence. The 15 year old licence was due for renewal in June 2019. As part of this process Peter Dahlhaus reviewed 166 documents written on the Barwon Downs Borefield subject. The review (Final, 14-12-2018) was finalised around the same time that Barwon water submitted its licence renewal application, December 2018. Following are some of the issues dealt with in the Dahlhaus review.

The impression gained from this review of issues and identification of issues is that there is an abundance of things that indicate issuing a licence under the present level of knowledge would be going against the Principles of:

- A. precaution,
- B. intergenerational equity,
- C. accountability, and
- D. the Integration of Economic, Social and Environmental Considerations.

The appropriateness of this is reflected in the numerous Key Questions That Arise from the Literature as indicated on pages 19, 20, 26 & 27 of the review. But, perhaps the one statement that is most relevant highlighting the lack of surface environment concern is...

“While the environment concerns are obvious, there has been no rigorous study of the environmental sustainable level of groundwater extraction for the Barwon Downs Borefield.” Page 26.

1. Recent local community concern has been the lack of interest shown in regard to past surface impacts with an emphasis on predicting what could happen in the future based on environmental conditions of the day, 2014.

“The main purpose of the new numerical model is to predict future impacts for various Borefield management scenarios.” Page 19.

2. There are a few concerns with the conceptual model:

- a. ***“... the entire conceptual model remains obscure.”*** Page 19.
 - b. ***“A groundwater system should be conceptualised and modelled based on all the available data: ...”*** The rest of this quote on page 18, paragraph 3, highlights how easy it is to overlook inevitable uncertainties.
A local community concern is this very thing and little economic, surface environmental, social or cultural values have been fed into the conceptualisation.
 - c. ***“The construction of numerical models, or mathematical models, is based on the conceptual models.”*** Page 19.
If the conceptual model is based on doubtful and or unvalidated data then the numerical model output has to be regarded with some scepticism.
3. Regarding the numerical model. ***“But the model is subject to both statistical uncertainty and incomplete information and the challenge is in understanding the limitations of these uncertainties, when using it to predict impacts within the entire Barwon Downs landscape.”*** Page 20. Not to mention the impact now manifesting in the Gellibrand River Catchment.
 4. ***“Significant effort has been made in recent years by Barwon Water to engage with the community on the issues relating to the impact of the Barwon Downs Borefield.”*** Page 27. Unfortunately, since the last Remediation Workshop 3 in August 2018, the level of community engagement has dropped off to zero. During these later months the s78 Notice was issued, the ground rules changed, the goal post moved, the Scope was developed and submitted.
 5. The local community would welcome the inclusion of social values. ***“In the literature reviewed, independent studies on the social values of the Barwon Downs waterways, wetlands and springs, such as their historical and recreational value, relationship to catchment management values and their landscape amenity values have not been found.”***

Some other points of clarification need to be made.

- a. The early pages discuss “grey literature” and the credibility of literature and the fact that none of the literature reviewed has

- been evidentially verified. Will this be done and is probably a question that needs to be asked of Southern Rural Water?
- b. It would be fair to say that the statement *“In reviewing the literature, it is apparent that environmental issues related to the management of the Barwon Downs Borefield have been growing in importance through time.”* Page 6, is referring to water resource managers’ acceptance and perception of the issues. The local community has been voicing the importance of these issues for over 3 decades.
 - c. This statement is close to the truth. *“While the environment concerns are now obvious, a clear gap in the literature is that there has been no rigorous study of the environmentally sustainable level of groundwater extraction for the Barwon Downs Borefield.”* Page 6. However, there is substantial data available that Barwon Water has chosen to discount as unimportant. And, recent vegetation Jacobs’ studies have failed to apply scientific and technical rigor. This throws considerable doubt on the veracity of input to the conceptual model.
 - d. On page 7 the Take and Use Licence amount of 8,000 ML/year perhaps should be 12,000 ML/year.
6. It is not quite clear whether Dahlhaus hasn’t “evidentially verified” the literature he has reviewed, or whether the authors of the literature have had their work “evidentially verified” when Dahlhaus states... *“None of the information or data in the items has been evidentially verified for this literature review, therefore the credibility of the literature is an important consideration.”* Page 5.

Questions to the SRW's Independent Technical Review Panel re: BW's Groundwater Licence Renewal.¹⁴⁻⁰²⁻²⁰¹⁹

1. Is the Technical Panel aware that there has been no local consultation since Remediation of the Big Swamp Workshop 3, August 2018? This was before the s78Notice was given.
2. Is Southern Rural Water aware of this?
3. Is the Minister aware of this?
4. Why hasn't Barwon Water had the work presented as justification for its renewal application validated, evidentially verified or peer reviewed?
5. Will the Technical Panel be conducting a validation of, and evidentially verifying SKM and Jacob's work?
6. Will the findings of any validation process be made public?
7. What Recovery Plans are going to be built into the conditions if a licence is issued for:
 - a. EPBC listed species
 - b. F&FG listed species
 - c. Australian Grayling
 - d. Burrowing Crayfish
 - e. Spiny Crayfish
 - f. Bi-valve mussels
 - g. Platypus
 - h. Water Rat
 - i. Southern Pigmy Perch
 - j. Growling Grass Frog
 - k. Flora species as presented to the Federal Environment Minister.
8. Why hasn't impacts from acid and heavy metal pollution of stygofauna been considered?
9. Which streams/rivers will these recovery plans cover?
10. Will pumping be allowed before these species recovery plans have been implemented and or successful?
11. Who will be responsible to carry out this work and who will ensure the licence conditions are followed?
12. What plan will be included in the licence to cater for instantaneous combustion of any drying peat?

13. Because the Gellibrand River Catchment is now being impacted when will and who will conduct a comprehensive survey of peat swamps in this catchment?
14. Will the survey be done with the same high level of competence as the 1992 vegetation survey was done targeting Groundwater Dependent Ecosystems?
15. Why haven't Barwon Water included its PASS report to be reviewed by SRW?
16. Why hasn't Barwon Water included the other AASS sites to be monitored?
17. Has Barwon Water presented any proposal to reverse the carbon negative activities impacting within the drawdown influence area?
18. Why weren't the minutes of the three Community Workshops attached to the licence application as promised by Tracey Slatter?
19. Why hasn't Barwon Water shown the impact area of the drawdown out to the point of zero?
20. Shouldn't the application include a plan to better monitor the change and impact of salinity movement within the drawdown area and earth structures above the LTAs?
21. Why hasn't the application included how both downward and upward vertical leakage into/out of the Clifton Formation and the Narrawaturk Marl, is occurring as a result of extraction?
22. Has SRW a list of the breaches of the current licence?
23. Why hasn't SRW asked the EPA to visit and assess the Big Swamp site?
24. Will the Technical Panel ask the EPA to be involved?
25. Has the Technical Panel analysed the recharge figures and compared them to historical data and reports?
26. What provisions has Barwon Water included in the application to cover Stock and Domestic rights of landholders?
27. Has the Technical Panel considered the impacts redirection of Gellibrand River Catchment base flows is having or will have on the Wannon Water System?
28. Why doesn't the application discuss and provide plans to cover the pollution and contamination of acid and heavy metals that is seeping into the ground? (At a stream bed and aquifer level)
29. Does the Technical Panel know what reserves Barwon Water has in storage in the Yarra Thompson system?
30. Does the Technical Panel agree with the recharge rates of from 5900 ML/year to 11,000 ML/year Jacobs claims can be tapped into and extracted sustainably?

31. Has the Technical Panel asked SRW whether the Supplementary Flows can be turned off?
 32. Has the Technical Panel investigated why there is no analysis of impacts/effects resulting from the release of Supplementary Flows?
 33. Has the Technical Panel or SRW analysed any of the Supplementary Flow data presented in the Barwon Water annual reports sent to SRW?
 34. Will The Technical Panel be reviewing and validating the following reports as part of the renewal process? Reports not included in the Peter Dahlhaus “**Barwon Downs Borefield: Review of literature and identification of issues**, 14 /12/2018”:
- Jacobs, 5 August 2016: 2016-2017 Field Investigations Report, Installations of new monitoring assets. FINAL..
 - Jacobs 28 August 2015: Barwon Downs Monitoring Program, review of Conceptual Model at Numerical Model Boundaries. VW07575_CM_R01 Final, Barwon Water. Tabled at Barwon Downs Groundwater CRG meeting 03-12-2015.
 - Jacobs 16 June 2017: Barwon Downs Hydrogeological Studies 2016-2017, Numerical Model-Calibration and Historical Impacts. Draft for Barwon Water.
 - Jacobs 14 September 2015: Barwon Downs Stage 1 Field Works, Potential Acid Sulphate Soils Field Investigations report. Barwon Water. Final.
 - Jacobs 18 December 2017: Barwon Downs Hydrogeological Studies 2016-2017, Groundwater Model Predictive Scenarios Report. Draft. Barwon Water. (Prep. by 2)
 - Sinclair Knight Merz, 14 April 2009: Barwon Downs Flora Study 2008. Final 1. Barwon Water, Victoria Australia.
 - Jacobs 7 July 2015 Barwon Downs Vegetation Monitoring Report 2014/15 . Unpublished report for Barwon Water prepared by Jacobs Australia.
 - Jacobs 2016 Barwon Downs Vegetation Survey 2016 Final V2, 19 December 2016. Unpublished report for Barwon Water
 - SKM 2012: Ecology Australia & La Trobe University. Barwon Downs Monitoring Program- Monitoring Review. SKM reference VW06692.
 - SKM 19 May 2015: Barwon Downs Recharge and Climate Change Presentation to May Meeting of the Community Reference Group.
 - Jacobs 11 July 2018: Low Flow Recommendations for Boundary Creek. FINAL Draft – 04. Barwon Water

- Jacobs 5 August: Field Investigations Report, Installations of new monitoring assets. FIANL.
- Kohout C., 2018: Assumptions document provided to Barwon Water during Workshop deliberations.

35. When conducting the expert reviewing process of this report “*Sinclair Knight Merz, 14 April 2009: Barwon Downs Flora Study 2008. Final 1. Barwon Water, Victoria Australia,*” will the Technical Panel also validate the contents and provide a written report? That is, evidentially verify the work presented in this report.

36. Is the Technical Panel aware the Barwon Water Groundwater Community Reference Group recommendations to the Barwon Water Board contained substantial conditions when supporting the licence renewal?

The statement in the “Barwon Downs Borefield: Review of literature and identification of issues” “...***the Community Reference Group’s report to Barwon Water clearly supports the licence renewal.***”, gives a false impression and may lead the reader to believe the CRG agrees with latest developments.

37. Is the Technical Panel aware that the “goal posts” have been moved since the conclusion of the CRG deliberations?

38. When will the Peter Dahlhaus review of literature and identification of issues be made for general distribution?

39. Will the Technical Panel be investigating Barwon Water’s alternative and presently available sources and reserves of water?

40. Will the costings of not using the groundwater from the Barwon Downs Borefield be made available?

41. Will the Technical Panel be considering the Precautionary, Intergenerational Equity, Accountability and the Integration of Economic, Social and Environmental Considerations Principles?

APPENDIX THREE.

Southern Rural Water
Barwon Downs Licence Submission
PO BOX 729
WARRNAMABOOL
Vic 3280



February 20, 2019

Southern Rural Water,

It would appear to be inevitable that the outcome of Barwon Water's application to renew its groundwater extraction licence from the Barwon Downs Borefield will finish up in VCAT. If SRW gives an extraction licence I will be appealing to VCAT against the decision. If SRW refuse a licence and if Barwon Water then go to VCAT, I will be supporting the SRW decision. Either way there are a multitude of reasons why the licence should not be allowed to go ahead.

- 1. Barwon Water cannot be trusted to abide by the intent and conditions of a licence. Past experience is littered with examples of non compliance.*
- 2. The Barwon Downs Groundwater Community Reference Group (BDGCRG) recommendations have been misrepresented.*
- 3. The BWGCRG recommendation supporting a licence renewal also had very stringent conditions accompanying this recommendation.*
 - 100 ML/year to maintain infrastructure.*
 - No extraction for urban use, until*
 - Remediation of impacts successful*
 - Implementation of programs to fill data gaps, and*
 - During this process and at the conclusion of remediation provide an accurate sustainable level of extraction.*

(This included a complete revision of the definition of sustainable to include not only sustainability of things at a deep level but also right through the stratification to the surface)
- 4. However, the BWGCRG recommendations no longer apply as the Section 78 Notice changed the ground rules and moved the goal posts.*
- 5. No community consultation with the local community has been undertaken since this Notice was issued, regarding these changes brought about by the s78 Notice.*
- 6. The Scope was prepared and submitted to SRW without any local community involvement during the 4 months the Scope was being prepared.*
- 7. Lies or at the very best gross mistakes, were presented as part of the Scope.*

8. *The Scope has dumbed down the intent of the s78. Restricting the area of impacts and impacts to the Boundary Creek/Big Swamp area. The multitude of other impacts within the drawdown area of influence have been excluded.*
9. *The s78 Notice and the intentions of Minister Neville is that no extractions happen until remediation of impacts is completed. By Barwon Water's own calculations this would take at least 25-70 years. And, that is if there was no further extraction. This alone says no licence should be granted until this remediation has been concluded.*
10. *The majority if not all, of the studies, surveys and work on which the extraction application has been based has not been validate, evidentially verified or externally reviewed.*
11. *The multitude of basic errors that I have been able to find in SKM/Jacobs work - confirms, as is my belief, that the work is neither scientifically or technically sound or rigorous.*
12. *To submit an application full of "flaws" with an understanding that SRW will do the validation and evidential verification is fraught with uncertainties.*
13. *The conceptual model on which the numerical model is based, contains many areas of contention with the components of the model's input being drastically flawed.*
 - *Scientifically and technically sound procedures have not been followed. The majority of the studies from which the data being fed into the 2016-2017 groundwater model, have not followed the most basic processes normally followed when conducting scientific investigations.*
 - *An understanding that rigorous scientific procedure insists that before any analysis of data is attempted the data is registered with an independent body including the name(s) of the researcher and the date data was collected. There is no evidence since 2008, in any of the SKM/Jacobs studies indicating that this procedure has been followed.*
 - *Poor literature search excluding key studies.*
 - *Omission of key variables.*
 - *Existing problems and or dangers downgraded, excluded or ignored.*
 - *Existing data unjustifiably excluded.*
 - *Existing data corrupted.*
 - *Existing data replaced with assumptions.*
 - *State Government Policy ignored until 2015, and then, objectives are pursued following the letter of the "law," not the intent of the "law."*
 - *Limitations of recommendations and proposals not clearly defined.*
 - *Making assumptions, drawing conclusions and making predictions from faulty and limited data.*
 - *Presenting half truths and prevarication.*
 - *Using limited data gained starting at a 2014 baseline with the exclusion of data collected pre 2014.*

- *Reluctance to admit errors.*
 - *Failure to correct errors.*
 - *Failure to modify/amend studies with corrections.*
 - *Failure to recognise contradictory statements.*
 - *Failure to have studies peer reviewed from outside the Jacobs regime.*
 - *In other instances failure by Jacobs peer reviewers to adequately scrutinise their work.*
 - *“old” vegetation studies incorrectly dumbed down, dismissed incorrectly and or completely rejected on dubious grounds.*
 - *Local input poorly done.*
 - *Historical impacts overlooked.*
 - *Present vegetation studies based on recent data long after severe impacts have taken their course.*
 - *Recent vegetation studies with numerous gross mistakes.*
 - *18 months to 2 years data collections and observations insufficient.*
14. *Feed “crap” into any model and “crap” will be the results coming from this model, no matter how good the model is.*
 15. *Therefore, the recommendations coming from the numerical model have to be viewed with some scepticism.*
 16. *The model may have been O.K.ed as a top model but it will only be as good as the data fed into it.*
 17. *I have no confidence in the present model being any better than outcomes of earlier SKM/Jacobs models proven to be close to totally useless.*
 18. *There has been no rigorous study of the environmental sustainable level of groundwater extraction for the Barwon Downs Borefield.*
 19. *Contamination/pollution of any aquifer under the influence of the drawdown has not been done. Especially, long term risks.*
 20. **NO** *study has ever been undertaken regarding stygofauna even though this possibility was drawn to Barwon Water’s attention as far back as the 2007 attempt to extract at Kawarren.*
 21. *No consideration in the licence application has been given to future risks and past impacts on the flora and fauna listed on the Flora & Fauna Guarantee or the EPBC Act.*
 22. *Impacts in the Gellibrand River Catchment have been dismissed as “trivial.” At this stage this may be the case, BUT, LAWROC studies present a contrary picture. Even without further extraction it is my belief that the impacts now showing in the Gellibrand valley are a mirror image of the impacts happening in the Barwon River valley some 20-30 years ago. A belief backed up with substantial data.*
 23. *The absence of comment/studies/risks/impact etc. on social, cultural and other Beneficial Uses is another reason on its own merits, to deny this licence.*
 24. *No justification has been provided in the application that contradicts or disproves the comprehensive work conducted by Witebsky et al.*

25. *Considering the extractions that have been allowed over and above those made by Witebsky et al., the Witebsky extraction volumes recommended need to be revised. Will the Witebsky recos. be applicable today? Most definitely not. In the meantime, zero extraction until the aquifers recover, and the surface impacts have been remediated.*
26. *Witebsky recommended that any extraction over 4,000 MNL/year would need to be injected back into the aquifers through Artificial Storage, during the “good” times. This has never been done. Thus, unsustainable extractions have been allowed - groundwater mining, .*
27. *Despite Jacobs assertions that no groundwater mining has taken place, or is taking place, a convincing argument can be mounted that groundwater mining is the current practice.*
28. *Beneficial Uses, guiding principles and the intent of the Water Act are not reflected in Barwon Water’s renewal application as little regard has been given to the Principles of:*
- *Precaution.*
 - *Intergenerational considerations, and*
 - *The Principle of Environmental, Social and Economic Considerations.*

It is my wish and recommendation that Southern Rural Water reject this application of Barwon Water until the remediation within the area of residual drawdown from the Barwon Downs Borefield is complete and the aquifer has return to something close to its original pressure head levels.

Malcolm Gardiner.

1805 Colac Lavers Hill Road
KAWARREN
Vic 3249
M: 0475 358 747
Landline: 52 358 325.



Barwon Water
Recommendations for Groundwater Licence Conditions
14 May, 2003

2. Setting Subsidence Trigger Levels

2.1 Background

One dimensional subsidence modelling has been used to predict likely levels of subsidence as a result of future pumping from the borefield. Three sites (bores G13, YEO22 and W7) were used for detailed modelling and the results suggest that under the proposed pumping regime the maximum levels of future subsidence would vary between 80mm and 125mm.

The estimates are based on the groundwater model predictions of drawdown in groundwater head and assumed soil compression parameters for the compressible materials present within the region. There are significant levels of uncertainty associated with the estimates due to uncertainties in these key parameters. While model calibration has been attempted by matching model results to estimates of subsidence that have occurred between 1987 and 2000, it is recognised that matching a subsidence history at a single point in time results in a non-unique determination of the key parameters.

In setting a trigger for measured subsidence it is important to take account of the predicted subsidence results, the likely errors or inaccuracies included in the estimates and the likely impacts associated with subsidence. It is also necessary to acknowledge that subsidence will vary across the region according to the soil compression characteristics and the drawdown caused by pumping from the borefield. In light of the fact that subsidence has not been estimated at all of the installed benchmarks it is proposed that a single subsidence trigger be applied to all benchmarks. It is proposed that this limit be based on the maximum predicted subsidence with an allowance for estimation error. The trigger must also be set at a level that is considered to be below the threshold at which adverse impacts are likely to occur.

2.2 Recommended Subsidence Trigger Level

It is recommended that the subsidence trigger level be set at a measured subsidence of 200mm relative to levels measured in 2003, at any point within the network of subsidence monitoring benchmarks. It is proposed that if the subsidence trigger is reached then the Barwon Water will be required to investigate the cause of the subsidence, to review and update all subsidence predictions and to investigate the potential impacts of continued water extraction.

APPENDIX FIVE. – Copy of an attachment to an email sent to all Southern Rural Water Community Reference Group members just after Barwon Water Withdrew its Licence Application, April 2019.

What a great effort every one has done at informing the public about the problems with groundwater extraction from the Barwon Downs Borefield.

And, what a surprising and welcomed result with Barwon Water withdrawing their licence renewal application.

However, there is still much to be accomplished.

- Making sure the remediation efforts extend to “ALL” (Lisa Neville’s take of the situation) impacts over the 500 square kilometres under the drawdown influence.
- Does Minister Lisa Neville mean ALL impacts or does this get dumbed down to something less. Something along the lines of Barwon Water’s definition of ALL – Boundary Creek and the Big Swamp 7 hectares.
- A realistic list of impacts throughout this 500 square km area needs to be drawn up.
- Better definition of the term “remediation” and clarified what this means in relation to Minister Neville’s intent. One of the community’s understanding of remediation is restoration of continued baseflows in the creeks being impacted.
- E.g. does remediation include Boundary Creek returning to a gaining creek with baseflows under pressure from a pressure head back to the height way above the stream bed as it was pre groundwater extraction?

It would appear we are involved in a very complex chess game. No sooner had the king problem of extraction been removed from the game Southern Rural Water wiped out the community consultation CRG process even before yesterday’s press release had dried. Collusion? Hope not.

Barwon Water is now fully in charge of community consultation. SRW have stepped aside from any public consultation, or, at the very least chopped its previous efforts off at the head. No CRG. No planned meetings. What about the independent Technical Review Panel? Have they been dismissed also?

Barwon Water’s ability to take the community along with it in regard to the s78 Notice is appalling. Is this what SRW thinks is appropriate?

The Scope was prepared, presented (20 December 2018), reviewed by Southern Rural Water (by 24 January 2019), received by Barwon Water (7 February 2019), BUT was ONLY made available to Remediation Workshop members weeks after the 4th workshop in March 2019. No mention was made of the SRW review at the 4th meeting. That is, 6 months of NO community consultation regarding the SCOPE. No input to its development. No contact with the Remediation Workshops nominated experts. No idea what was taking place. And, at this 4th meeting the next Remediation Workshop was set for September 2019. It would appear from the dumbing down of things in the Scope, that the Remediation Workshop members nominated experts, have been hijacked by Jacobs and or Barwon Water. No community input into any aspect of the Scope, preparation, review and new directions to be taken. What a farce. And amazingly some of the Technical Review Panel critical notes of the Scope echo the very same concerns that the community has. The Scope should have involved the local community members. Was SRW, the policepersons, aware of how bad the consultation had been conducted? No or they would have done something about it. How then can one have confidence that the policing will be any better in the future.

The minutes of the 4th Remediation Workshop that accompanied Southern Rural Water's review of the Scope, in my opinion, is not a very accurate representation of what took place. However.

Thankfully Tracey Slatter has agreed that she will organise the Remediation Workshop members to meet with their nominated experts without either Barwon Water or Jacobs staff being present.

At this stagehave indicated they would like this to be organised as soon as possible.

Do you wish to be involved in such a meeting?

Also, for your information:

Considering what has been taking place regarding the s78 Notice, LAWROC executive are investigating with the intention of initiating declaration proceedings through the Victorian Civil and Administrative Tribunal aimed at the manner in which the Section 78 Notice is being conducted. At this stage the intention is to seek an injunction.

You may wish to make comment regarding this initiative of LAWROC's.

Hoping to hear from you soon.

Kind regards,

Malcolm.

References.

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