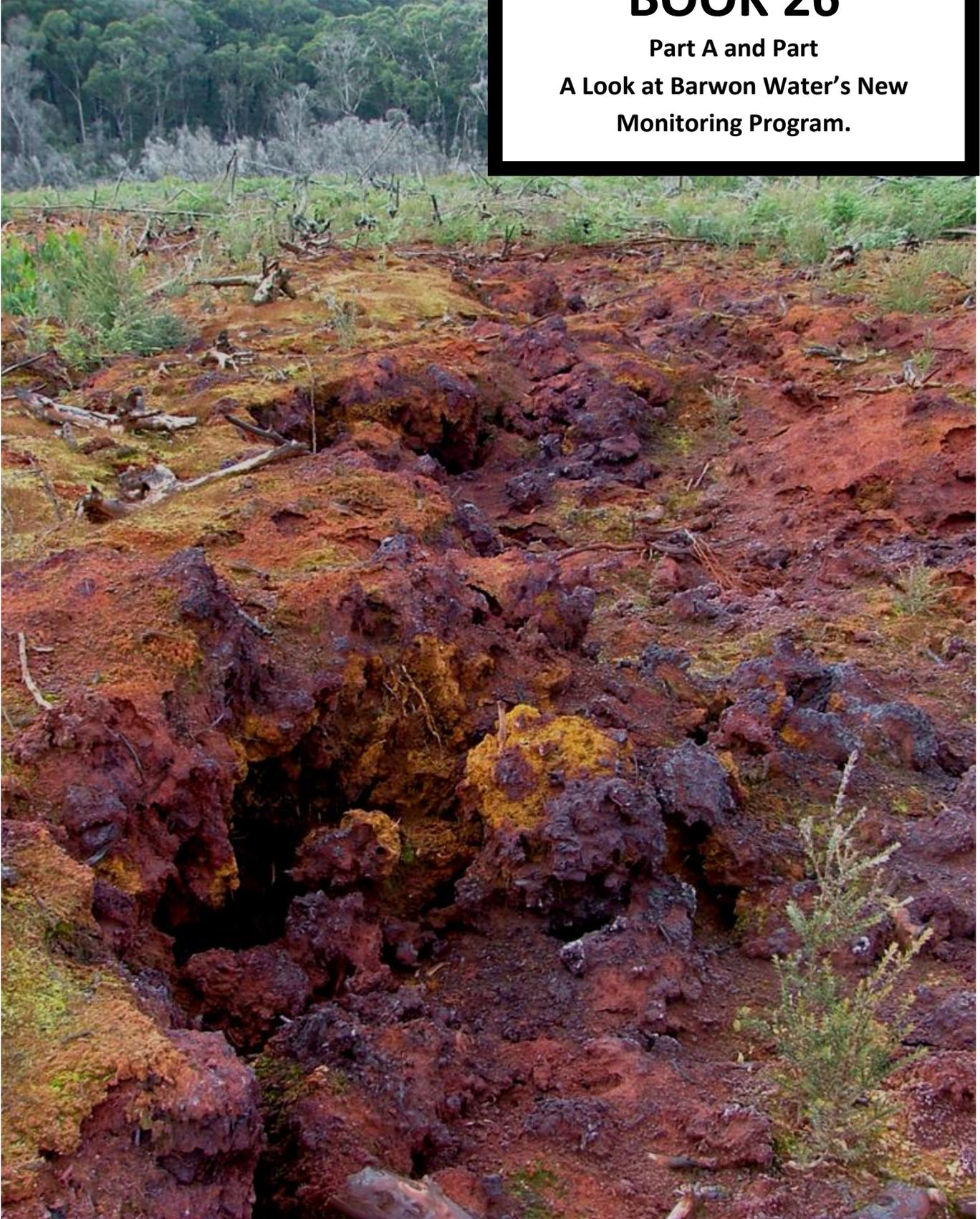

Cover photo is the Big Swamp post 2010 fire.

OTWAY WATER BOOK 26

Part A and Part
A Look at Barwon Water's New
Monitoring Program.

e | 1





Toxic water at the Stream Flow Gauging Station at Boundary Creek on the Colac to Forrest Road bridge ,2008.



Acid water of 2.5 pH in the lower section of the Big Swamp pre the 2010 fires.



Disclaimer

This publication may be of assistance to you, but there is no guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaim all liability from error, loss or other consequence that may arise from relying on any information in this publication.

This publication has been prepared, and supporting documents used, with diligence. Statements within this publication that originate from groups or individuals have not been evidentially tested. No liability is accepted from any action resulting from an interpretation of this publication or any part of it.

PART A. October 2013

PART B. April 2014

Malcolm Gardiner

Email: otwaywater@yahoo.com.au www.otwaywater.com.au

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PART A.

**Review & Comment on a
report**

**prepared for Barwon Water
by SKM, Ecology Australia &
Latrobe University, 2012.
Barwon Downs Monitoring
Program.**

An abridged version of PART A was emailed to all members of the Barwon Downs Groundwater Community Reference Group (BDGCR) on Tuesday 15 October 2013 8:04 pm, for consideration.

No feedback has been forthcoming.

PART A was placed on the website www.otwaywater.com.au as Book 26, late October 2013 and is reproduced unchanged in this book.

INTRODUCTION

The Licence to extract water from the Barwon Downs Borefield is due for review in 2019. It is Barwon Water Authority's intention to apply for a renewal of this licence. Last year, in 2012, Barwon Water began to prepare its case. The "...**overarching objective of a successful licence renewal...**" would appear to be the driving force behind all endeavours. It would also appear that this drive is aimed at the down playing of past history and as far as possible to the exclusion of all other considerations detrimental to achieving a licence renewal.

This Book 26, makes comment on the 2012 SKM, Ecology Australia & Latrobe University report that had to be acquired under the Freedom Of Information Act. This report is the first stage in this process of review and promotes a Barwon Downs Monitoring Program that best suits the overarching objective. A program that will hopefully, from Barwon Water's point of view, satisfy Southern Rural Water's acceptance as sound grounds on which to reissue the groundwater extraction licence.

Unfortunately local community stakeholders appear to have been omitted from this process up to this stage. More alarmingly there appears to be scant recognition of past data collection and experiences. If it is the intention of this monitoring program to set new benchmarks on which to evaluate future performance of the borefield impacts without recognition and or evaluation of past impacts, then this is most unsatisfactory from an environmental, social and agricultural aspect. Making a fresh start, ignoring and failing to evaluate past data and local community concerns gives a skewed impression that things are not as bad as they really are. Each successive new datum of benchmarking starts at an elevated level of impact.

What is most alarming in regard to this process of review and licence renewal, is the fact that Barwon Water sets the agenda, selects who will be involved in the process and appears only to seek consultant's advice supporting the case for renewal.

It would appear little has changed over the life of the Barwon Downs Borefield. Twenty eight years ago Quentin Farmer-Bowers⁽¹³⁾ was given the task to outline what studies were required to provide a comprehensive data base on which sound scientific and follow up managerial decisions could be based. On reflection Quentin had this to say..."***I felt that senior public servants had the perception that as professionals, they knew best what to do, how to do it and should be left to get on with it.***"⁽²⁶⁾ It would appear little has changed.

The New Barwon Water Base Case Monitoring Program.

The overall aim of the “Barwon Downs Monitoring Program, Monitoring Review, Final 1, 28 August 2013” report was to...

“Provide additional monitoring data and subsequent analysis required to support the licence renewal process.”

Page | 7

It is extremely hard to understand why Barwon Water would exclude the experience and knowledge of local community stakeholders when preparing a revised monitoring program for the Gerangamete (Barwon Downs) Borefield. In this instance local community stakeholders are defined as landholders within the area of drawdown influence from the extraction of groundwater at the Barwon Downs Borefield. As a consequence the review of the monitoring, modifications and recommendations are well established by the time local community consultation is even attempted. Is this too late? Is the agenda already set? Some would argue this is the case. Whatever the result of such a discussion it is clear that many mistakes in this 2012 report could have been avoided if local community input had been called for in the initial preparatory stages of this report.

As a follow up to the 2012 report, and sometime in early 2013, Barwon Water prepared and let out Contract No. 000534, titled. **“Barwon Downs Monitoring Program Work Package 1 Desktop Assessment, Panel Consultant Request For Proposal.”** This work was to be finalised by 17 May 2013 with *“...the overarching objective of successful licence renewal.”* The successful applicant of this contract was to review the SKM, Ecology Australia & Latrobe University 2012 report as part of the contract.

Contract No. 000534 stated, *“A review of existing Barwon Downs monitoring programme was undertaken in 2012 in preparation for licence renewal in 2019. This review (undertaken jointly by SKM, Ecology Australia and Latrobe University) highlighted gaps in the existing monitoring program that may hinder successful licence renewal.”* The contract continues... *“A detailed desktop assessment is now required to finalise the scope of the new monitoring program. It is assumed that installation of new monitoring sites/assets and major field activities will commence in the 2013/14 financial year.”*

The agenda is set; local community input not sought and the Contract report to be finalised by 17 May. Under FOI this 17 May report had been denied because it was still in draft format. It should have been finalised as per the contract, but was apparently still in draft form?

Timeline regarding these reports and contract.

- 2012 SKM, Ecology Australia & Latrobe University complete recommendations for a “Base Case,” revised Barwon Downs Monitoring Program.
- Early 2013 Contract No 000534 is let out to the successful bidder to conduct a follow up report based on the SKM, Ecology Australia & Latrobe University 2012 report.
- April 2013 site inspection done as part of Contract 000534 (See letter below).
- 01 May 2013 draft format is due for Barwon Water consideration.
- 17 May 2013 finalised report due.
- By 25 October 2013 the finalised report unavailable – still in draft form.

In March 2013 a Kawarren landholder received this letter...



25 March 2013



W F LATTA
18 School Rd
KAWARREN VIC 3249



034
1000306

Dear Resident,

Barwon Downs borefield monitoring review

Barwon Water is currently reviewing its monitoring program for the Barwon Downs borefield. This program consists of a series of monitoring bores and observation points that enable measurement of changes to the environment as a result of groundwater extraction.

The Barwon Downs borefield has been switched off since 2010 and the existing monitoring network is showing that underground water levels have been recovering at a steady rate since then. The current monitoring network is extensive, but could potentially be enhanced by installing additional monitoring facilities that would provide more comprehensive information on groundwater behaviour.

The first stage of providing better monitoring facilities involves some site inspections, which will be carried out by consultants SKM and Ecology Australia in April, 2013. This will include inspecting bore sites and taking measurements at observation bores. Up to five field workers are expected to be in the area from April 2, 2013 for about three weeks.

The monitoring program review will include investigations into water quality, stream flows, eco-systems near the borefield and groundwater recharge rates. The scope of these investigations has not yet been finalised.

The first stage of the review will help determine whether the existing monitoring is adequate or whether additional monitoring equipment is required to better understand groundwater processes.

The Barwon Downs community will be consulted and kept informed throughout the review. For more information regarding the monitoring program review or the field investigations, please contact Barwon Water on 1300 656 007 or email info@barwonwater.vic.gov.au

Yours sincerely,

Carl Bicknell
General Manager Strategy and Planning

Barwon Region Water Corporation

ABN 86 343 318 514

61-67 Ryrie Street, Geelong Victoria 3220
PO Box 659 Geelong Victoria 3220 TEL 1300 656 007 FAX +61 3 5221 8236
DX 22061 (Geelong)

www.barwonwater.vic.gov.au



It is most likely that this letter was informing residents of proposed visits to the Barwon Downs area as a result of **Task C**, as outlined in Contract No. 00534, "**Undertake site assessment.**"

Why Wayne was sent this letter is a mystery to Wayne as he lives in the adjoining Groundwater Management Area some distance from the Barwon Downs area.

Considering that the brief of Contract No. 0005634 required the finalisation of a report by 17 May 2013 a request was sent to Barwon Water asking for such a copy. As expected the request had to go through the FOI process. An FOI sent and dated 22 July 2013 included such a request. However, 45 days later the request was denied accompanied with an explanation.

"The third report requested in your application and emanating from Contract No. 00534 is currently in draft status and being finalised. Under the FOI legislation, documents in draft form on the date an FOI application is received are exempt under the Act."

"A Barwon Water employee will be in contact with you after the 1 November 2013 to advise when this document will be finalised and a copy forwarded to you." This never happened.

(Barwon Water Ref: FO79152, dated 9 September 2013.)

It would appear that **Task F** stating this report had to be finalised by 17 May 2013 has been changed. Perhaps **Task E** in the contract headed, "**Preparation of draft and recommendations**" that had to be completed by 01 May 2013, has held up the process.

To further emphasise the lack of local community involvement in the planning stages of this review process, **Task B** of the Contract No. 000534, "**Undertake information compilation and analysis**" included this...

"Compile and assess available resources (existing reports, aerial maps, hydrogeological data such as pump test analysis, bore and geophysical logs, hydrographs, overlays etc)..."

No mention of tapping into local community expertise and in fact none is known to have taken place.

17 October 2013 the Barwon Downs Groundwater Community Reference Group met for the first time. Was this the first time local community was able to have input into the process? It would appear so. It would also appear that the agenda had been set. As the following comments regarding the 2012 report unfold below, it will become apparent why it is a shame and a pity that initial local community input was not sought.

The 2012 SKM Base Case Report Barwon Downs Monitoring Program.

The following commentary on this report focuses on the material as pertinent to the Boundary Creek region including the Barongarook High recharge area.

Page 2 of the SKM 2012 Report.

On this page it mentions that “*Potential risks to the environment were identified, and, as a result, conditions in the licence (2004 licence) were put in place to mitigate any unacceptable impacts known at the time.*”

Unfortunately this is not the case. Not all known potential and actual risks were acknowledged and of those identified not all had conditions in the 2004 licence to mitigate any unacceptable impacts known at the time.

Page | 10

1. The PAV (Permissible Annual Volume) to be extracted had been recommended in 1995 and accepted in 1999 at 4000 ML/year. The licence issued in 2004 allowed 20 000 ML/year extraction.
2. Any extraction over 4000 ML/year to included artificial recharge. No provisions made.
3. Vertical leakage from layers above the EVF were determined by SKM as a major recharge of the aquifers being pumped from. No provisions were made to measure the impacts this may cause. Vertical leakage data collection recommendations had been made on numerous occasions – no conditions evident in the licence.
4. To best understand the connectivity between aquifers and recharge processes relating to salinity studies, SKM in 1995, was recommending nested bores as best practice. SKM states that nested bore hydrographs are better at revealing connectivity between shallow and deep water aquifers much better than single bores in a location. This was not reflected in the licence conditions.
5. Boundary Creek had run dry on numerous occasions coupled with,
6. the fact that SKM had determined the critical level when this would happen was when the water table level in Yeo 40 dropped below 158 mAHD. The licence did reflect this with a trigger level of 158.5 mAHD in Yeo 40 requiring the release of supplementary flows down Boundary Creek. Unfortunately, the licence conditions did not take into account a review condition if this was unsuccessful. Boundary Creek had dried up on numerous occasions and local community experience had concerns over the length of time the creek took to begin flowing after substantial rainfall. No condition applied to the licence to investigate this or revise the mitigation proposals until the licence was to be reviewed fifteen years later in 2019. The success of the supplementary flow regime has been abysmal.
7. The Upper Barwon Landcare Group warned of numerous other creeks being affected. No provision was made in the licence to study these.
8. The top end of the Big Swamp had dried out and caught fire. Only possible when the water table dropped below 158 AHD. Information at the time coupled with the creek running dry, indicated and had shown that something was seriously wrong upstream of the Stream Flow Gauging Station on Boundary Creek. No provision was made to seek the cause of this dilemma.
9. The acid level readings in Boundary Creek had dropped dramatically and were reflected in the water testing at the Stream Flow Gauging Station. This risk/happening was ignored and consequently no provision was made in the licence conditions.
10. Boundary Creek would cease flowing over the summer period unless there was substantial rainfall. The cause of this was not to be investigated and so provide a basis for better protection and provision of mitigating measures to prevent unacceptable impacts.

11. Even when Boundary Creek commenced flowing the water was not palatable to cattle until there had been considerable flushing flow through the system. Some recognition of this was reflected in the licence conditions and resulted in supplementary water being released from the Otway to Colac Pipeline into Boundary Creek. Best practice at the time would have included a review process of the suitability and success of this arrangement.
12. The peat in the Big Swamp caught fire in 1997 and again in 1998. This was identified as a risk and ignored.
13. Platypus and large fish were decimated especially in the lower reaches of Boundary Creek. This was not acknowledged or recognised and therefore no provision was made.
14. Control plots for a flora review process due in 2009 were chosen at locations inside the drawdown influence. Best practice for selection of control plots ignored.
15. The 1990 flora, fauna and fish study results conducted by Barwon Water were flawed from the outset. (1988 Tunbridge fish study overlooked. Nellie Shalley local community experience and knowledge ignored. Belcher and other researchers unaware of previous pumping history.) These and the follow up studies in the early 2000s were based on doubtful 1990 results. Best practice not employed and as a result licence conditions unable to reflect appropriate conditions.
16. Local community members on the review committee at the time, wanted a 5 year licence review. No provision made and at the time was seen as best practice but was also seen as unacceptable to Barwon Water in regard to infrastructure expense required for such a short period. Best practice compromised.
17. The SEPP for groundwater (S 107, 1997) best practice was not reflected in the licence conditions.
18. The SEPP for surface water (S 160, 2003) was also not reflected in the licence conditions. The principles including precautionary, accountability, intergenerational equity, conservation of biological diversity appeared to be given scant recognition.
 - a. Warnings that many of these principles should be taken notice of came in the form of discussions and recommendations from Smith, Stanley, Farmar-Bowers, Witebsky, Nellie Shalley, Doug Chant , the CCMA, the Upper Barwon Landcare Network and the Gerangamete Flats Landcare Group.

The provision of environmental flows as outlined in this SEPP was largely ignored, if in fact it was even referred to. The licence contained no environmental flow component.
19. Best practice local water management expertise and knowledge largely ignored.
20. Data collection and benchmarking pre 1991 largely ignored.

Page 3

Page three explicitly states that the Gerangamete Groundwater Extraction Licence issued by Southern Rural Water in 2004 covers "... **protection of stock and domestic use and protection of flows in the Barwon River and tributaries.**" **"Conditions of the licence also take into account mitigation of any unacceptable impacts."**

This 2004 licence may have had these intentions but in practice this is not the case. S & D has not been protected and flows in the tributary Boundary Creek, have been reduced to nil

during the summer and drought periods. Alarming, this 2012 document makes no mention of Stock and Domestic concerns.

This page also states that SKM, Ecology Australia and Latrobe University have addressed community interest adequately by developing a revised monitoring program. How this can be done without consulting the community is beyond belief.

Page 4

This page discusses the provision of additional monitoring data collection and subsequent analysis required to support the licence renewal process. The emphasis in the “brief” being directed towards those things required to ensure the licence is renewed. The review should be looking at all parameters to determine whether the licence should be renewed and if so by how much. A balanced review process is required.

Page 5

This page states “*The primary issues that drive community concerns can be related to environmental impacts (both perceived and real).*”

The page then goes on to list the concerns and states that these concerns are a key driver of the monitoring program. How the local community concerns can be listed when there has been miniscule consultation is beyond belief. To those farmers along the lower reaches of Boundary Creek the primary issue is the decline in a secure summer and drought water source that can no longer be relied upon.

Page 6

This page states that the concerns regarding surface waters is “*..currently expressed as an environmental concern.*”

So out of touch it is laughable. Another major concern is Stock & Domestic (S&D) supply.

Page 7

The use of the word “potential” throughout the text and linking it with issues or impacts gives the impression that past impacts cannot be proven or substantiated. This is often not the case. Many of the impacts can be substantiated with data that is already available. Additional data and expense would only confirm what is already discernible. There is sufficient data available to ascertain the cause(s) of most of the impacts.

To state that engaging with stakeholders and the local community prior to implementation of the revised monitoring is like trying to close the door after the “horse has bolted.” The stakeholders most affected in the borefield area – the landholders/locals – should have been involved pre the preparation of this 2012 SKM, Ecology Australia and Latrobe University report.

Page 8

Acknowledgement of changes in groundwater flow directions as a result of groundwater processes is interesting and involves one of the concerns that does not appear to be covered in this document or the new monitoring program. One aspect of this changing groundwater movement being affects experienced on adjoining groundwater systems.

Page 10

“...the monitoring program will need to identify criteria that define when an unacceptable impact occurs.” The impacts that have already occurred need to be confirmed and local community experience is that these impacts are unacceptable. Benchmarking and making a fresh start from 2013 is not be acceptable. Past impacts, valuable and pertinent data should not be forgotten.

“Criteria are currently available for most of the potential impacts but those that affect ecosystems are unlikely to have been developed using sufficient rigorous data and methods to be acceptable to the community and the regulators.” What has SKM been doing for 30 years of consultation over the Barwon Downs Borefield? The “on ground grass root” observable impacts that have already taken place within the area of residual drawdown are not acceptable to the local community and whether rigorous data and methods have been developed is little comfort to the landholders and environment impacted.

From page 11 on it would appear that the authors live on another planet. Not consulting with the local community has resulted in a multitude of inaccuracies or at the very best could only be described as huge differences in opinion.

Table 1, Pages 11 & 12 sets out Likelihood of unacceptable impacts occurring and availability of suitable impact criteria.

There are seven rows of Potential Impacts in Table 1.

Five of these impacts require comment and the comments are shown in red. If local community input had been called for such glaring differences may have been avoided.

Potential impact	Likelihood of impact occurring	Likelihood impact is unacceptable	Impact criteria available	Potential sources for impact criteria	Is a review of criteria required?
Reduced surface water availability for existing diverters	Mod to High	Mod to Low	No	SRW may have diversion limits for streams in the project area	Yes
	High	High	Yes	Stock & Domestic	
Reduced surface water quality for existing diverters	Low to mod	Low to mod	Partial (for ecosystems only, not for water users)	Unlikely that limits have been defined for surface water diversion	No
	High	High	Yes for both	Available	Yes
Pressure on aquatic ecosystems	Mod to high	low	Yes	EPA has general guidelines for water quality changes but these are not specific to the ecology in the	yes

				individual streams	
	High	High		Available	
Pressure on terrestrial ecosystem	Mod to High	Low	No	Sensitivity of vegetation to change in groundwater level is not defined. Unlikely that any drawdown limits based on vegetation stress will have been defined.	Yes
	High	High	Yes	Available	
Increased risk of peat fires	Mod	Mod	No	Unknown	Yes
	High	High	Yes	Known	

Page 12

Point 5.5, 1.

In this section the new monitoring program is being designed to identify the relative contribution of changes or variables that will result in impact. They are listed as land use changes, groundwater extraction and drought. It would appear that no consideration has been given to the possibility that past data is sufficient enough to ascertain impacts already occurring. The argument being, that data already collected can adequately determine the reasons for impact.

This page refers, on several occasions, to future potential impacts and the development of impact criteria, but as is true of the whole document, there does not appear to be any recognition of impacts that have already been caused. Local community knowledge can specify impact criteria without having to make a fresh start.

This page also discusses a monitoring program that will “...*characterise all groundwater processes to a sufficient standard that will enable impacts to be estimated to a reasonable level of accuracy.*”

And states, “*The monitoring program will be required to differentiate between groundwater changes, characterise groundwater process that lead to impacts, and identify criteria that define when unacceptable impacts occur.*” What about the impacts that have already taken place and the data available to determine the causes? What has Barwon Water and its advisers, SKM, been doing for 32 years in relation to developing an adequate monitoring and management program? Any proposals being made in this document are not new science.

The compiling of a Total Water Balance should have been one of the first studies to be completed decades ago and would have given managers of the water resources at Barwon Downs a clear understanding of what resources were available for allocation. A Total water Balance has never been done and is still not recommended.

Page 13

“The monitoring program should identify which rain gauge best represents rainfall in the groundwater recharge areas.” Why this has never been done is astounding and especially so when the Pennyroyal gauging station that was used in the 2008-09 Flora Survey, is some considerable distance from Barongarook High. This would have been an appropriate time to look at a better site or sites. To look for one appropriate site as suggested in this document shows a complete lack of local knowledge of rainfall patterns in the area. Perhaps, local community rain gauging abilities, data and expertise could be used to determine accurately rainfall on the recharge area(s).

Stating that land use practices past, present and future is likely to be a complex process requiring detailed analysis seems quite strange. Local community involvement would be able to adequately and accurately provide the raw data. This should not be a complex mission and surely SKM is capable of analysing the raw data with some relative ease and expertise.

Page 14**Table 2, Data Required to characterising groundwater change.**

This table contains much of the same . Some of the “Highs” should be “Lows” and some of the “Nos” should be “Ask for and tap into the local community resource.”

The last two paragraphs on this page appear to be contradictory.

“Existing hydrogeological data in the Barwon Downs region is sufficiently detailed to characterise the groundwater processes that lead to impacts on the availability of groundwater for Barwon Water and other groundwater users.”

The aquatic ecology of the Big Swamp before it was destroyed, was a groundwater user. Farmers downstream of the Big Swamp used this same water making their farms viable over summer, drought proof and a valuable source for fire fighting water. Why this same hydrogeological data cannot be used to determine aquatic, terrestrial and impacts on farming enterprises is most baffling. This next paragraph creates the dilemma.

“The processes that lead to impacts on aquatic and terrestrial ecology are understood at a conceptual level, but there is insufficient hydrogeological data to characterise the processes to a suitable standard to assess the potential impacts.”

Page 15

“The current conceptual model of groundwater flow assumes negligible groundwater flow occurs between the aquifer and the overlying aquitard. This assumes that changes to groundwater flow would have a negligible effect on stream flow where the aquifer is confined (aquitard area). Although there is a high probability that current stream flow is only slightly affected by changes to groundwater, groundwater flow is very slow in aquitards. There is a potential risk that stream flow may be affected in coming years. Measuring water levels in the aquitard is necessary to assess the risk of changes to groundwater reducing flow in streams where the aquifer is confined.”

What an amazing paragraph.

- Recommendations to measure water levels in layers above the Eastern View Formation have been made numerous times since 1986 as written by Farmar-Bowers in 1986; Barwon Water's flora and fauna studies in the early 1990s; Witebsky in 1995; Barwon Water studies done in the early 2000s leading up to the Barwon Downs groundwater extraction licence review; one of the panels reviewing the Barwon Water 2004 licence renewal; Gardiner 2007 and Barwon Water's flora survey 2008-09.
- SKM stated in one of its reports leading up to the 2004 licence renewal that the Barwon Downs Borefield was sustainable and that a major source of recharge to the EVF was from water held in the layers above the points of extraction. Some clarification is needed explaining how this 2012 conceptual model that assumes negligible flow between layers, was arrived at.
- SKM have always maintained that there will be flow effect on streams depending on the amount of extraction. Over 10 000 ML/year extraction during the latest drought is well above the 1 500 ML/year no effect level, determined by Witebsky, and indicates a major flow effect.
- Whether referring to stream flow above the confined aquifer or where stream flow crosses the unconfined aquifer it gives the wrong impression to state "...*there is a high probability that current stream flow is only slightly affected by changes to groundwater.*" Extensive data is available that places serious question upon the correctness of this statement when referring to Boundary Creek.
- Rick Evans of SKM in his fellowship in 2006 wrote that stream flow impact can be observable within hours but may take decades to manifest.
- In the same study Rick quote Boundary Creek as a creek that dried up one year after groundwater extraction. If this was in 1984, and every indication that this was the event, then the following 1000 odds days that Boundary Creek has been dry since, despite 2 ML/day of supplementary flow release, is a much more than a slight effect.
- One can only wonder what the long term holds, as the layers above the EVF vertically leak downwards and provide replenishment and sustainability to the extraction bores below.

This page throws up another interesting dilemma for Barwon Water and SKM. Boomerang Swamp, a swamp of state significance, was left to its own devices for survival on the recommendations to the 2004 review panels that it was self contained and sitting on a perched swamp. SKM are now stating that there is no data currently available to make this assertion. The Boomerang Swamp has been devastated and is now a marginal Actual Acid Sulfate Soil site.

Page 16

Table 2 continues.

Why there is very limited data currently available for subsidence raises some serious questions. What has the subsidence monitoring since the 1980s been measuring? If this section of the 2012 report is to be believed, why hasn't better monitoring and data collection been done? Why were the subsidence trigger levels included in the 2004 licence

of such low value? What does it mean that there is very limited data currently available? And, what has happened to the data that has been collected going back to the 1980s?

Page 16-17 goes on to discuss the hydrological (surface water) data.

One can only shake one's head and wonder if the Boundary Creek mentioned in this section is the same one that flows through Yeodene into the Barwon River.

To state that after 30 years of data collection that it is incorrect or at best requires correction, is an astounding statement.

Assuming the data requires correction it has not been made very clear how correction of this data will achieve what is being proposed here. Also how the supplementary flows released from the Otway to Colac Pipeline play a role in this adjustment is unclear. During summer the supplementary flows do not even reach the Yeodene Stream Flow Gauging Station. The flow disappears straight into the depleted EVF under the Big Swamp.

Page | 17

Pages 17-18, Potential Acid Sulfate Soils (PASS).

The assertions made in this section of this report may very well be correct, however, the omission of any kind in relation to **Actual** Freshwater Inland Acid Sulfate Soil having occurred in the area, is most apparent.

“The decline of groundwater levels may lead to potential acid sulfate soils (PASS) drying out if the groundwater at these sites is connected to the aquifer under stress.”

In the early 2000s SKM designated that the Big Swamp area is a discharge point for the EVF. To maintain flows in this section of Boundary Creek the water table needed to be kept at 158.5 metres AHD. The water table has been below this level for years. Supplementary flows released into the system disappear into this groundwater depleted area. The Big Swamp is a peat swamp and is now an Actual Acid Sulfate Soil Site, returning an analysis with the distinction of being one of the worst top three in Australia.

Page 18, Reduced surface water availability.

The regulator Southern Rural Water (SRW), may well want to *“protect their customer base”* but no one appears to want to protect the rights of Stock & Domestic (S&D) users. Throughout this whole document the omission of any reference to S&D is glaring.

Page 20

LAWROC Landcare Group has already commissioned a fish survey of lower reaches of Boundary Creek to confirm values and current condition of the stream. This was a low cost operation requiring a low effort to obtain the data, not a “High,” as designated in this report.

Page 20, Increased Pressure on Terrestrial Ecosystems.

“The extent to which terrestrial ecology in the Barwon Downs area is dependent on groundwater and its sensitivity to the decline in groundwater levels is unknown.”

It should be known, as Farmar-Bowers flagged the possible dependency links way back in his 1986 report. Barwon Water at the NREC hearings in the late 1980s stated that Farmar-Bowers's recommendations aimed at forming credible baseline data had been implemented. This was not the case. The 21 000 ML stress test pump commenced in 1987 without any of his recommendations being implemented.

Page 21 Reduced groundwater availability

“There are very few, if any existing groundwater users in the region. Although it is unlikely to be an issue, it is recommended that a database search be conducted.”

This is old school type thinking. In this day and age and considering State policy regarding Beneficial Uses linked with the accepted fact that there is a definite connection between perennial streams and groundwater, this statement has to be seriously challenged. Groundwater Dependent Ecosystems (GDEs) and S&D from summer streams rely on groundwater discharge. One of the reasons that there is often an over allocation of water resources is that some water has been accounted and allocated twice. Once as groundwater, and again as surface water. A Total Water Balance would clarify this.

Page 21 Reduced Groundwater Quality

The Barwon Downs area is a hot spot for surface salinity impacts and it would appear that the recommendations in this report are suggesting to examine only the aquitard layer above the EVF and no further up the profile to the surface. It would also appear that little to nothing is known about any of the layer profile above the EVF. This should have been done decades ago as recommended. Perhaps it is not too late. However, to state *“Monitoring of groundwater salinity from the pumping bores at Barwon Downs have shown a slight decline in salinity since the start of operation since 1986 indicating that the risk of reduced groundwater quality is low.”*

This statement portrays an unacceptable picture when considering:

- As mentioned earlier in the 2012 report impacts on and through the aquitard and layers above may take a considerably long time to manifest as the water in these layers leak down into the EVF. This likelihood has never been studied but recommended numerous times.
- The layers above the EVF, under normal conditions, are partly replenished from upward pressure from the EVF below.
- No salinity data collection was stipulated in the licence for the layers above the EVF,
- Any surface salinity data collection by DEPI has been downgraded and in many instances ceased.
- No testing of what the salinity levels are in the lowest section of the EVF. In other words, is the EVF sitting on a salty slug?

This section once again mentions Potential Acid Sulfate Soils and completely disregards the fact that the Big Swamp is an **Actual** Acid Sulfate Soil site producing considerable acid, heavy metals and metalloids that have to be regarded as pollutants if discharged into the outcropping EVF that the Big Swamp is sitting over. Petrides and Cartwright suggested that the groundwater extracted at Barwon Downs was something like 20 000 years old. If this is the case then the water at the borefield should maintain its quality for some considerable time to come before any pollution impacts eventuate at the borefield. No component of the revised monitoring program makes any allowance for this to be studied.

Page 22 Increased Fire Risk

No mention is made in regard to the likelihood that as the layers above the EVF leak their water into the depleted EVF below, that the surface summer influence will come earlier and stay longer.

No mention has been made of spontaneous combustion in drying peat or spotting from fires outside the peat perimeters. This 2012 report recognises that drying out peat is a hazard and that,

“This in turn, increases the risk of forest fires which can have disastrous impacts on the surrounding national parks.”

No mention of risk to humans and or infrastructure has been made except for this statement,

“Colac’s water supply will be under threat.”

If local community knowledge is to be believed it would appear that if a Big Swamp peat fire where to escape creating an uncontrollable wild fire the borefield infrastructure would be one of the first things to be burnt to the ground, shortly followed by the rest of the Barwon Water infrastructure in the area as the fire races to the coast.

Page 23 Monitoring and Evaluation Program.

The rest of the 2012 document outlines a suggested “Base Case” monitoring program and discusses its applicability and chances of securing a renewed licence. Any item or data collection that is deemed to be less likely to achieve this licence approval appears to be categorised to the lowest rating. This is not such an unusual occurrence. When attempting to achieve a goal those things that are counterproductive are naturally given less significance, if they cannot be avoided altogether. “The full detail of the monitoring program is presented as a table in Appendix B.” This is

approximately the same that Appendix B was sent. The 2012 report, under FOI, arrived as a hard copy and it is assumed that it was provided in full. However, Appendix B could only be scrutinised with a magnifying glass. No attempt was made to do this.

There are a few observations in the readable text regarding the Base Case that can be made that indicate once again that the omission of local community involvement has led to strange statements.

- Determining land use change past, present and future has been given a very high cost and is to be assessed indirectly. However, land use change will play a very important role. *“...the effect of land use change is the residual impact after groundwater extraction and drought are taken into account.”* Unless land use change is calculated directly and accurately there is always the chance that components of groundwater extraction or drought impacts could easily be incorrectly attributed to land use change. That is, any residual impact that is not attributed to groundwater extraction or drought will be automatically attributed to land use change. Local community could provide a low cost and accurate account of land use change, given the chance.

“A very preliminary estimate of costs to include all land use changes into the Base Case is in the order of \$1M.”

“Due to its high cost, complexity, and moderate to high risk of providing inconclusive results it (is) not recommended that a detailed assessment of land use change be included in the monitoring program.”

The term that comes to mind here is that land use change will be the “sacrificial lamb” for all unaccounted residual impacts.

- The tree diagram on page 25 should have TOTAL WATER BALANCE at the top of the tree. Local community assistance and cooperation with this would be crucial.

Throughout the presentation of the Base Case there is only one scant reference to local community involvement.

The SKM. Ecology Australia & Latrobe University’s report recommendations.

These recommendations appear to be based on the assumption that very little is known of impacts already created; that there is insufficient data available to make informed decisions regarding these impacts and that any impact presently apparent is acceptable because an adequate identification criteria has not been developed.

Once again it is recommended that this new Base Case monitoring program does not evaluate the historical effects of land use change but,

“The program identifies the impacts of land use change from the residual or unaccounted impacts that are attributed to extraction and drought.”

On the very last page before the referenced credits the report includes this recommendation...

“That Barwon Water communicate regularly and as early as possible with regulators and stakeholders including the community regarding the proposed monitoring plan, its objectives and overall design and scope.”

Appendix A in this 2012 SKM report is titled “Ministerial Guidelines for Licensing Groundwater for Urban Water Supply.”

Why this is included is most befuddling. On page 2 of this document it states. **“The guidelines do not apply to the renewal of groundwater licences for urban water supply purposes.”** If this is missed by the reader a similar message is repeated on page 6 of the same Ministerial Guidelines.

Also: The use of yellow for headings is most interesting. For people with failing eyesight, usually with some age attached, yellow is a very difficult colour to see and as a consequence makes reading of various parts of this document quite onerous.

No comment has been made on Appendix B due to the extreme difficulty reading this section of the report.

PART B.

Review of Barwon Water’s

“Barwon Downs Monitoring

Program,”

Stage I

SKM 2013.

(Access to this 2013 SKM Report was made available late December 2013.)

The review of the 2013 SKM Report follows on from the 2012 SKM Report commented on in PART A, pages 5-20 above.

Sometimes there is so much wool pulled over one’s eyes that it takes time to brush it away and even longer to see through it.

Barwon Downs Monitoring Program, Stage 1, Field Investigations and Monitoring Program Scope, SKM 2013,⁽¹⁾

Report Readability

The voluminous 2013 SKM Report,⁽¹⁾ handed out to members at the fifth Barwon Downs Groundwater Community Reference Group meeting, has been an extremely frustrating document to review. It is a compilation of many reports. Each of these reports have their own page numbers scattered within the document. Numerous pages aren't numbered and even applying sticky tabs to the various sections, manoeuvring through the document is tedious. To facilitate ease of reading some explanation showing how this document can easily be negotiated should have been given.

(A). Review of the Aquatic Ecology Investigations section. (SKM 2013, Pages 84-102.)

ABSTRACT. *Abandoning the aquatic ecology investigations until after the artificial supplementary flows have been discontinued would allow the natural flow regime to return to Boundary Creek. This would then appear to be the most sensible time to conduct the aquatic ecology investigations..*

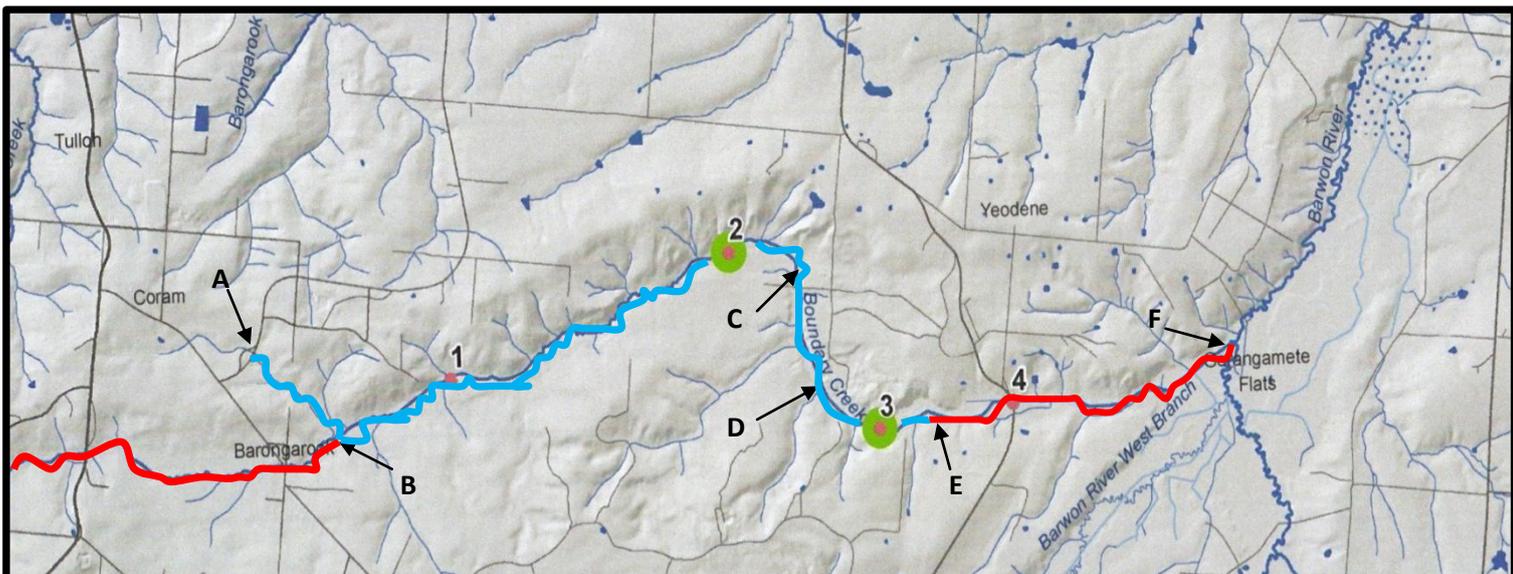


Figure 1. MAP SOURCE: Appendix F SKM 2013. Points 1-4 recommended ecological & FLOWS monitoring sites.

(Sites A, B, C, D, E and F have been added to this map.)

The 2013 SKM Report.

In April 2013 when field work was done to compile this report, Boundary Creek was dry and not flowing above Site B (red). Artificial supplementary flows from the Otway to Colac Pipeline were being released at Site A. From Site A to Site 3 there was water flowing along Boundary Creek (blue). From Site E in the Big Swamp to Site F at the confluence of Boundary Creek with the Barwon River, this section of Boundary Creek was dry with no flow (red).

Site 1 is on Boundary Creek at Langdons Road and *“...appeared to have perennial flow.”* (page 85 SKM 213) Locally this was never known as a perennial flowing section of Boundary Creek until after the artificial supplementary flows component was added to the stream flow regime in the early 2000s.

The Langdons Road Site *“...is upstream of the likely influence of any groundwater harvesting and will act as a potential reference site.”* (page 95 SKM 2013). Strangely the residual drawdown maps reported in the Barwon Water yearly reports to Southern Rural Water indicate that this site is, and continues to be some considerable distance within the drawdown cone of depression. This site is most definitely under the influence of groundwater harvesting. This should, from a scientific point of view, rule this site out as a reference site, especially if it is being used as a representative site of natural flow.

Site 2 is on Boundary Creek above McDonalds Dam. This is supposedly the site of an abandoned Stream Flow Gauging Station.

Site C is McDonalds Dam. This dam was constructed across Boundary Creek in the late 1970s.

Site D is where Boundary Creek flows out of agricultural land into a forested section downstream to Site 3. This reach from Site D to Site 3 is probable as close to the original meandering course that the Boundary Creek flows took pre European. Much of the so called Boundary Creek stream bed has been created since European settlement. In efforts to drain wetlands along the catchment, drains were constructed and these drains became known as Boundary Creek.

Just upstream of Site 3 there is no clearly defined stream bed. Water flows through many different paths and spreads out across the wetlands. In the region of Site D the McDonald family had attempted to drain the swampy area for generations and were singularly unsuccessful. Even excavating a drain through this section failed to unsaturate the area. The swamp and wetland vegetation was left to flourish, being useless for agricultural purpose. The fact that this peat swamp caught fire in 2006 was a complete surprise. The fire in this swamp took massive volumes of water to extinguish and even then a mineral earth buffer was placed around this hot spot fearing smouldering peat would cause further outbreaks of wildfire. Just downstream of this area to Site 3 the flows meander in many directions and over swampy flats finding their way to the **Big Swamp location**.

Site 3 is on Boundary creek just above the Big Swamp in a forested area. (page 96 SKM 2013)

Site E is where Boundary Creek passes through the Big Swamp. “*...flow disappears once it enters the peat Swamp.*” (page 86 SKM 2013). Since the early 1980s the days of no summer flow from Boundary Creek into the Barwon River have increased. As groundwater extraction increased so did the days of no flow in the lower sections of Boundary Creek. This was predicted as a likely scenario by SKM back in the early 2000s and by several other studies going back to 1986.⁽¹³⁾⁽¹⁴⁾

Site 4 is at the Colac to Forrest Road Bridge and Stream Flow Gauging Station.”*Boundary Creek was completely dry at Colac-Forrest Road and remained dry between that point and the confluence with the Barwon River.*” (page 91 SKM 3013). Until there is considerable rainfall this reach of Boundary Creek remains dry. This never used to be the case.

Site D is at the confluence of Boundary Creek and the Barwon River.

Water Quality

On page 96 of the 2013 SKM Report under the heading, Water Quality Surveys, the report has this to say...

“*Dissolved oxygen and water temperature are the two water quality variables that are likely to have greatest effect on ecological health in Boundary creek...*”⁽¹⁾ As a result the 2013 SKM Report recommends that data for these two parameters be collected at Site 1 and will assist in the new FLOWS study.

There can be no doubt that acidity and EC should be other water quality data sets that are collected. In other sections of the 2013 SKM Report it is recommended that EC and pH data be collected. In recent years and at various times throughout the year flows in Boundary Creek have been recorded at pH levels of 2.5 (Upper Barwon Landcare Network records; LAWROC records) and these parameters should be included in the data collection.

If the artificial supplementary flow releases are continued they should also be monitored for these parameters.

(B).The FLOWS METHOD⁽²⁾

ABSTRACT. There appears to be ample grounds supporting the notion that a re-examine of the methodology being used to determine the environmental flow recommendations be undertaken.

One cannot claim an environmental flow will be determined using the FLOWS METHOD unless the process has adopted and actually follows the FLOWS METHOD procedure. The following discussion raises considerable doubt that the 2013 SKM Report is following the FLOWS METHOD strategies and procedures.

The 2002 FLOWS METHOD is the method supposedly being adopted by SKM when determining the environmental flows for Boundary Creek. Regular references are used throughout the SKM 2103 report emphasising that the FLOWS METHOD is to be used for determining minimum environmental flows. Also, the 2013 SKM Report has chosen this method because it is the approved method...



“...the FLOWS method (DNRE 2002), which is the approved method for determining environmental flow requirements for Victorian rivers and streams,” (page 92 SKM 2013).

However, the environmental flows recommended for a reach in the lower section of Boundary Creek as determined by Lloyd Environmental et al., in 2006⁽³⁾, was not considered by the 2013 SKM Report as representative of Boundary Creek and it was... *“...recommended that a new FLOWS study be conducted to determine the minimum flows that are required to maintain aquatic habitat and aquatic biota in Boundary Creek.”* (page 92 SKM 2013).

Firstly, it is interesting to note that the FLOWS METHOD is not designed to recommend minimum flows and this point is emphasised on several occasions in the 2002 FLOWS METHOD manual.

The purpose of the FLOWS assessment scope of works is described in the 2013 SKM Report as... *“To determine the minimum flows that are required to maintain aquatic habitat and aquatic biota in Boundary Creek to be able to assess and potentially manage impacts associated with the operation of the Barwon Downs borefield if it reduces the extent to which the recommended environmental flows are met.”* (page 99 SKM 2013).

The 2013 SKM Report also outlines the risk if the FLOWS assessment is not undertaken...*“The minimum flows required to maintain aquatic habitat and aquatic biota in Boundary Creek will not be known.”*(page 100 SKM 2013).

There are numerous occasions where the people preparing the 2013 SKM Report appear not to have a clear understanding how to use the FLOWS METHOD. Even though the 2013 SKM Report often refers to this method as the preferred method of determining environmental flows it fails to have a firm grasp of the fundamentals how environmental flows should be determined by this method. In this instance the FLOWS METHOD makes it quite clear that any recommendation coming from applying the FLOWS METHOD does not recommend minimum flows.

The FLOWS METHOD manual states...*“The method developed is called the FLOWS method and is based around the philosophy of describing flow components as part of a recommendation for an environmental flow regime, rather than a minimum flow recommendation.”*⁽²⁾

Also, *“The key requirement is that recommendations should be developed to describe the entire flow regime, not solely a minimum flow over a defined period.”*⁽²⁾

Also, *“The recommendations are designed to be more than a minimum flow recommendation...”*⁽²⁾

Secondly, the FLOWS METHOD⁽²⁾ was established to develop a method for assessing the maintenance and restoration of environmental water requirements of rivers and streams in Victoria and to be used primarily for Stream Flow Management Plans (in some cases Bulk Entitlements). It is a glaring fact that Boundary creek does not have a Stream Flow Management Plan.

Thirdly, because the SKM 2013⁽¹⁾ report discounts the environmental flows determined by Llyod et al.⁽³⁾ in 2006, for the lower reaches of Boundary Creek as being unrepresentative of the stream, this statement brings into focus five points. This study was conducted on the bottom reach of Boundary Creek above Site F back to Site 4. In the Llyod et al. report this section was called Reach 7.

1. If this 2006 work of Lloyd was indeed unrepresentative then the same argument has to be applied to the way SKM plans to use the FLOWS METHOD for sites along Boundary Creek.

A key to the new FLOWS study should... “... *decide on the reaches and sites for the Environmental water requirements as they provide a representative basis for determination of Environmental water requirements for the system.*” From the FLOWS METHOD manual.⁽²⁾

The new SKM study must look at the Boundary Creek system as a whole with reaches to include sites that would provide an overall representation of the system. Including the reaches at Sites G (above the artificial supplementary flows releases if they are continued), E (on Boundary Creek in the middle reach of the Big Swamp) and H (in the agricultural land where Lloyd et al. conducted their 2006 study). These additional sites would provide this representation.

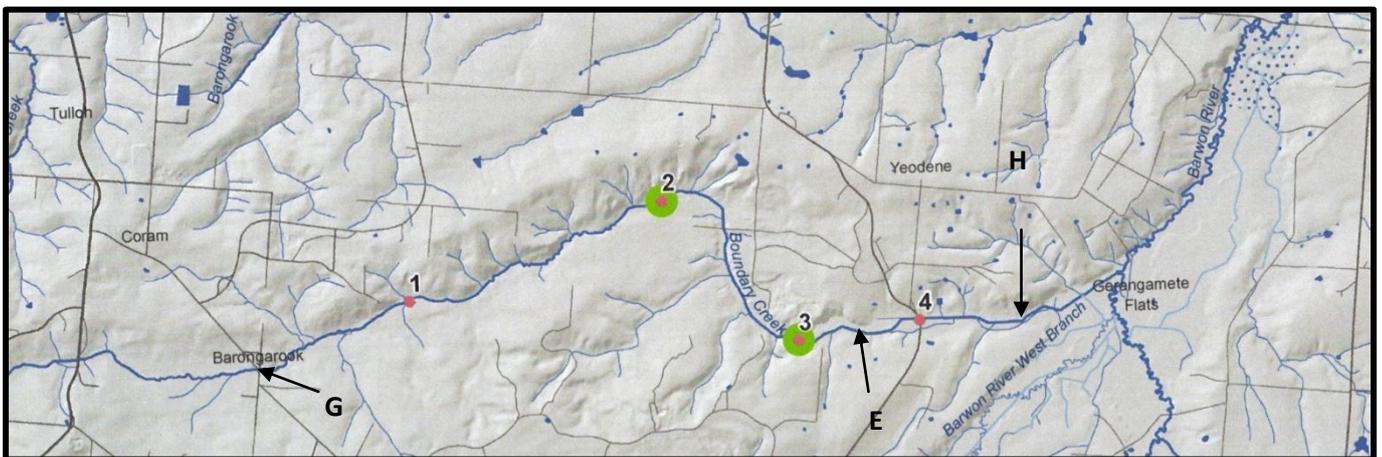


Figure 2. MAP SOURCE: Appendix F SKM 2013. Points 1-4 recommended ecological & FLOWS monitoring sites.

(Sites G, E and H have been added to this map.)

2. Three of the proposed sites are monumentally impacted from artificial supplementary flows from the Otway Colac Pipeline releases and are most definitely not representative of the natural flow of the Boundary Creek system.

3. In 2006 Lloyd Environment et al.⁽³⁾ used “...*the FLOWS method (DNRE 2002), which is the approved method for determining environmental flow requirements for Victorian rivers and streams,*”⁽²⁾ to determine the environmental flows required in Boundary Creek, Reach 7 (see point H Figure 2, page 27). This was part of a research project for the Corangamite Catchment Management Authority (CCMA) determining environmental flows for the Barwon River Catchment. Considering that Lloyd Environment helped develop the 2002 FLOWS METHOD, one would assume that Lloyd Environment would have achieved a satisfactory task of determining the environmental flows for Boundary Creek, Reach 7, using this method.
4. However, I would have to agree with the 2013 SKM Report that the environmental flows determined by Lloyd Environment in 2006 for the lower reach of Boundary Creek was poorly researched and did not follow the most basic procedure as outlined in the FLOWS METHOD. There is a strong and convincing case put forward in Otway Water Book 11⁽⁴⁾ that the Boundary Creek part of the environmental flows for the Barwon River Catchment is most unsatisfactory and poorly done.

To recommend 2 periods of a fortnight of no flow per year indicates that the FLOWS team that determined these flows in the CCMA document⁽³⁾ neglected to follow the most basic procedures outlined in the FLOWS METHOD. Then to justify one month of no flows with this comment, is difficult to understand.

Referring to the Boundary Creek reach 7 and one on the Barongarook Creek... “*If these reaches do not cease to flow, sustained flows may promote the growth of perennial emergent species such as Typha and Phragmites, which will replace other vegetation assemblages and may degrade habitat for Platypus, larger fish species, such as River Blackfish, and macroinvertebrates.*”⁽³⁾

Historically Boundary Creek, pre groundwater pumping, flowed all year and there were platypus and large fish species such as River Blackfish thriving in Reach 7 all year round. It seems strange to recommend a month of no flow. Perhaps the biggest mistake made by the Lloyd Environment team was not including local historical information.

However, considering there are now extended periods of no flow in Reach 7 since groundwater extraction, a month of a no flow period appears inconsequential. This reach no longer has aquatic habitat or

refuge spots available for the survival of instream biota during no flow periods. Added to this high acid and aluminium concentrations when flowing from the Big Swamp compound the dilemma instream biota would face.

5. A most significant point to note is that the 2002 FLOWS METHOD was researched, developed and completed by Sinclair Knight Merz (SKM), the Research Centre for Freshwater Ecology, Freshwater Ecology (NRE) and Lloyd Environment Consultants. This was completed for the Department of Natural Resources and Environment, Victorian Government.

The fact that SKM and Lloyd Environment are major players in the 2013 SKM Report one could expect that using the FLOWS METHOD for determining environmental flows for Boundary Creek, would be conducted as per the FLOWS METHOD. Serious doubt is raised that this is being done.

In the 2002 Department of Natural Resources and Environment FLOWS METHOD),⁽²⁾ it clearly states that the environmental and flow objectives should be measurable and include target statements that could sustain an ecological healthy river.

“This means that during the process of developing objectives, consideration must be given to identifying and restoring where necessary the environmental assets which would support a healthy river rather than maintaining of current condition.”⁽²⁾

In 1995. Witebsky et al.⁽¹⁴⁾ determined that Boundary Creek had a historically average daily summer flow of 3.2 ML. This would appear to be an appropriate healthy river target to aim for.

Also, the adopted definition by the FLOWS METHOD as an environmentally healthy river is: *“A river which retains the major ecological features and functioning of a river prior to European settlement and which would be able to sustain these characteristics into the future.”⁽²⁾*

However, the 2002 FLOWS METHOD document also states that it is not realistic or possible to restore a river to European conditions but in an effort to achieve this, the METHOD talks of natural flows. Natural flows are defined as... *“...flows that would exist if no diversions, storages of water occurred – accepting land use changes.”⁽²⁾*

Climate change and drought would have to be part responsible for Boundary Creek no flow days. However, this does not account for the Big Swamp catching fire in 1997 after years of above average rainfall.⁽⁶⁾ The only contributing factor drying out the top end of the Big Swamp being extensive groundwater extraction between 1986 and 1991. This cannot be termed as natural.

When applying Dr. Rick Evans's Response Ratio⁽¹⁵⁾ to groundwater extraction on the flows in Boundary Creek, the message is clear, groundwater extraction has been extensive enough to cease groundwater discharge into Boundary Creek.

As part of the environmental flows determination *"The data series should be for a minimum of 10 years, although a 30 year duration is desirable."*⁽²⁾ There is observable data available for a 30 year period and there is the added bonus of oral history going back as far as 1912. Examining the 2013 SKM Report it is difficult to find any indication that information from this 30 year period is to be made use of.

The FLOWS METHOD also states that... *"Data sourcing and collation should not be limited to the data sources..."* and that... *"The method is modular, where additional components may be added to allow more detailed investigation of key issues..."*⁽²⁾ A most natural addition would be the inclusion of local community input. This was one of the major omissions in the Lloyd's 2006 environmental flow determination. Nellie Shalley, whose land Reach 7 flows through, was not consulted regarding flows in Boundary Creek. Her family history goes back to 1912.

"A key issue that should be investigated would include historical information on the system. This may be in the form of data or photos or oral history that would present a picture of the original state of the system and any changes that have occurred."⁽²⁾

The 2013 SKM Report states that in this recent round of endeavours there has been local input. However, there is little evidence to support this. In fact the number of fundamental omissions and mistakes is testament to a lack of local input.

In the section discussing Cease to Flow, Low flow, Freshes, High flows, Bankfull flows and Overbank flows, the 2002 FLOWS METHOD document discusses that changes to any of these natural flows can have deleterious effects on the

ecosystem where these changes have taken place. The manipulation of flows whereby there is an increase through artificial supplementary flows being added to the flows of Boundary Creek, is most definitely an unnatural change. If new work is done then this artificial supplementary flow regime will play a significant role and requires intense consideration and must be included as an addition under the modular concept. Ideally these artificial flows should be discontinued and thus allow a better understanding of the “natural” flow components.

One aim set down by the 2013 SKM Report is...” *...to provide suitable habitat and flow conditions for the native fish that have previously been recorded or that could potentially occur in the catchment.*” In a 1988 report Tunbridge⁽⁷⁾ found that of all the tributaries of the Barwon River that he had investigated Boundary Creek was the only one containing blackfish. Historically platypus and other large species have habituated Boundary Creek, species that require flows or aquatic habitat refuge to survive periods of low flow. Reach 7 up to the Big Swamp was where Tunbridge found the blackfish species. This reach no longer contains refuge or water when there is a no flow scenario.⁽²²⁾

The 2002 FLOWS METHOD... *“Flow recommendations should be framed for individual reaches...”*⁽²⁾ and *“Overall there is recognition that the health of aquatic ecosystems will be maintained by aiming to restore the fundamentals of the natural flow regime.”*⁽²⁾ Local farmers consider the findings of Witebsky et al.^(wit) whereby Boundary Creek had an average daily flow of 3.2 ml/day, as a fairly accurate figure of a natural flow regime. And, an artificial supplementary flow cannot be regarded as a fundament of natural flow.

As Nellie Shalley and others⁽⁵⁾ attest to, Boundary Creek used to be a perennial creek in its natural state 30 odd years ago supporting a variety of large fish species and platypus in the reaches of the creek between Sites E and F (see fig. 1 page 22). Local community observation was confirmed by the fish survey and studies carried out by Tunbridge in 1986.⁽⁷⁾ Bearing these natural and historical observations in mind and the above statement regarding the FLOWS METHOD, Boundary Creek must be studied along its entire length. To choose sites within the reaches impacted from releases of the artificial supplementary flows from the Otway to Colac Pipeline, appears too restrictive, may skew the data collected and give an “artificial” bias when determining environmental flows.

Until the artificial supplementary flows are turned off there would appear to be no case for the continuation of the FLOWS study.

A thought to consider is - are the artificial supplementary flows achieving the aim of the 2004 licence conditions? If the answer is no, as it would appear, can there be any justification for maintaining these flows. Why not cease these flows and allow Boundary Creek to return to a more natural flow?

NOTE:

Why the 2013 SKM Report is using the 2002 FLOWS METHOD document is most baffling (see page 25★). A revised method, FLOWS METHOD, Edition 2,⁽¹⁹⁾ was completed in June 2013. However, if the 2002 model is used this quote from Edition 2 is reassuring.

“The major steps in the implementation of the FLOWS method have remained largely unchanged over the last ten years. However, some minor modifications have been sporadically introduced over recent years in light of the new information on the hydrological requirements of the biota (especially fish and to a lesser extent vegetation) and in some cases, an assessment of flow component performance and prioritisation.”

However, it is not reassuring when it is known that SKM was the major “player” in the development and preparation of this second 2013 edition of the FLOWS METHOD. Especially when SKM is not adopting this latest edition in Barwon Water’s 2013 new monitoring program.

Two new features of Edition 2 on page V of the manual are worth noting.

1. *“additional opportunities for engagement and consultation with local stakeholders to provide input and feedback to the process and allow a level of community ownership of the outcomes.”* Sadly the opportunities incorporating local community involvement in the 2002 edition have been lacking throughout the program inception and development stage of the suggested new monitoring program of 2013. A Project Advisory Group should have been set up including landholders, community and environmental group representatives. *“Its role is to provide input and feedback to the process from a local viewpoint.”* And, the first meeting of this group should be *“...held during the project inception...”* The inception period in 2012 did not include local input.
2. *“recognition and consideration of the potential for groundwater to provide important contributions to stream flows.”* This is an important

component especial in regard to the Boundary Creek situation. The FLOWS Method Edition 2 actually mentions groundwater extraction as an important component to be considered. Extraction issues are also recognised, as is an artificial flow release.

Edition 2 has replaced the term “natural flow” with “unimpacted flow.”
“In this manual, and future FLOWS studies, it is recommended that the term ‘unimpacted’ flow be used instead.”

In the Introduction of Edition 2, page 1, it states that the FLOWS METHOD is a scientific and transparent approach for assessing the flow requirements for the fresh water reaches of river systems including broad requirements for overbank river flows for floodplain and river fed wetlands. Floodplain and wetland situations most definitely apply to swamps along Boundary Creek.

As with Edition 1, Edition 2 is a comprehensive method for determining environmental flows. However, it is most important that developments of the last ten years be incorporated in any 2014 environmental flow recommendations for Boundary Creek. Besides the inclusion of groundwater influences, more local community involvement, and Acid Sulfate Soils considerations, the 2013 Edition mentions that more accurate modelling “... ***includes climate change modelling.***” (page 8, Edition 2 FLOWS.)

It is strikingly apparent that the 2013 SKM Report has not followed the methodology as outlined in the 2002 or the 2013 FLOWS METHOD. The environmental flow component for Boundary Creek in the 2103 SKM Report cannot claim that the FLOWS METHOD is the one being used.

“The FLOWS method was developed to provide a consistent statewide approach for assessing the flow requirements of environmental assets associated with waterways.” The environmental flow determination proposal in the 2013 SKM Report is not following manual procedure. With this in mind it seems doubtful that a claim can be made that any environmental flow arrived at in this new monitoring program is based on the FLOWS METHOD.

(C) Stream Flow Gauging Stations (SFGs) on Boundary Creek.

ABSTRACT. *Reinstate the Stream Flow Gauging Stations above McDonalds Dam, below McDonalds Dam, on the Ten Mile Creek and on the Porcupine Creek.*

The reinstatement of the Stream Flow Gauging Stations (SFGs) above and below McDonalds Dam appears to make sense. To know what is coming into the dam during low flow periods is essential so that any agreement on flows that must be allowed to continue below the dam, can be accurately regulated.

Why outlay the expense of installing the SFGS at Site 1 when just a short distance upstream the artificial supplementary flows are gauged at the point of release. In discussion below, there is some confusion whether there are perennial flows at Point 1. If the artificial flows are stopped then it can be determined one way or another whether there are in fact perennial flows at this site.

(D) Reaches of Boundary Creek.

ABSTRACT. *There needs to be clarification made regarding the actual sites and description of reaches along Boundary Creek.*

The 2013 SKM Report discusses upper, middle and lower reaches when referring to Boundary Creek. However, when reading pages 84 to 94 of the 2013 SKM Report things become quite confusing. The reaches have not been clearly defined.

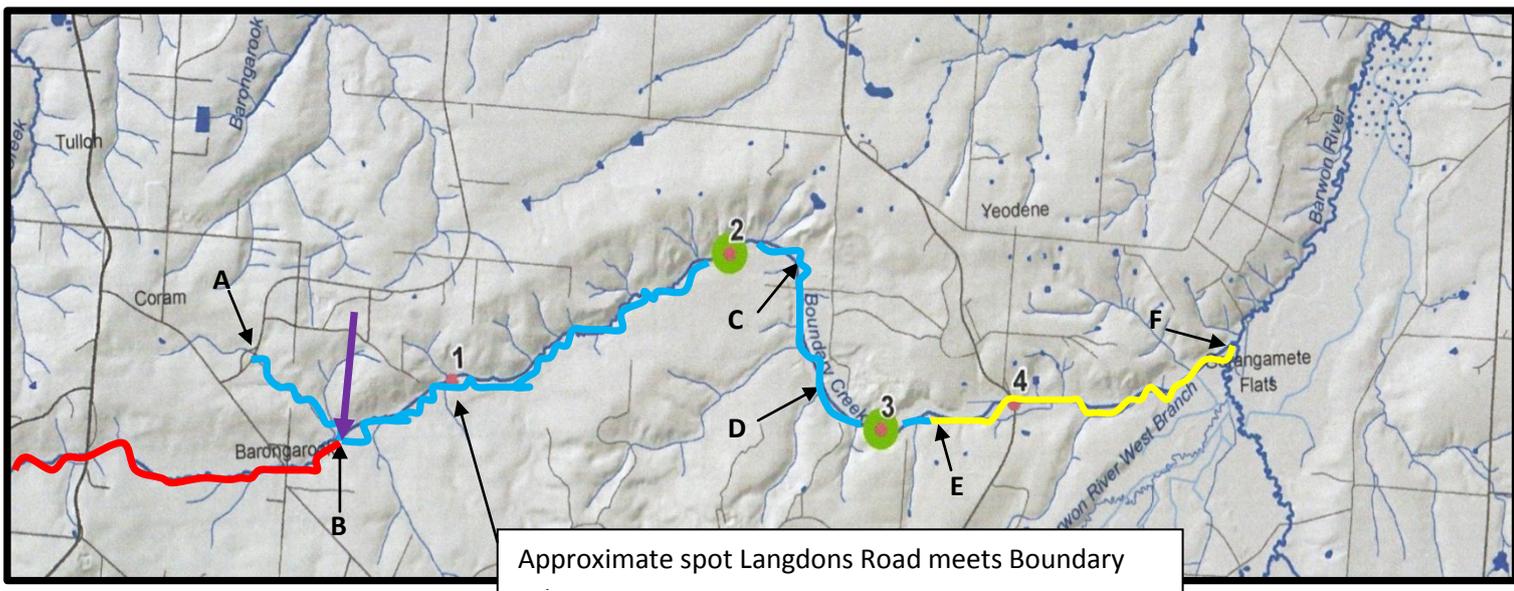


Figure 3. MAP SOURCE: Appendix F SKM 2013. Points 1-4 recommended ecological & FLOWS monitoring sites.

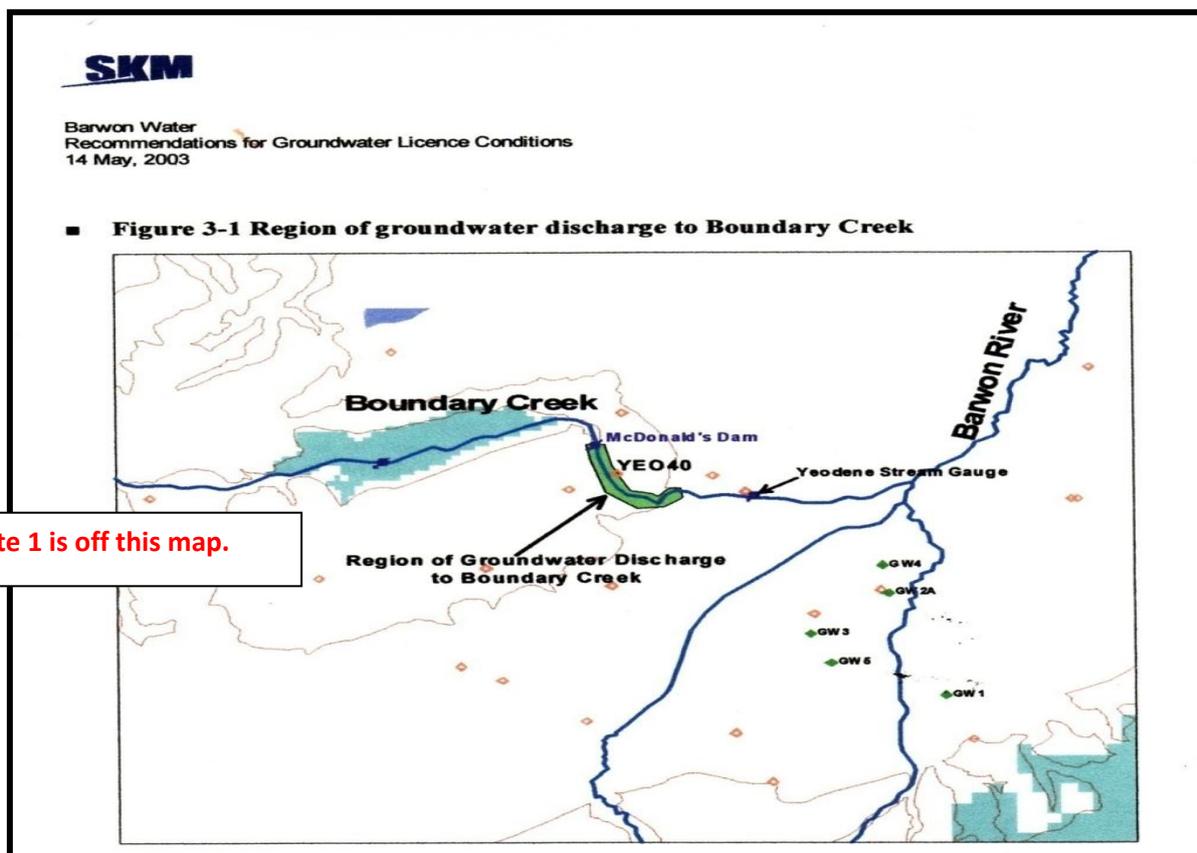
(Sites A, B, C, D, E and F have been added to this map, as have the coloured reaches)

In an effort to sort out the statements made and to clarify discussion, three coloured reaches have been superimposed on the SKM map as seen above. The upper reach being the dry section of Boundary Creek above the artificial supplementary flow releases from the Otway to Colac Pipeline. The blue reach between points B and E is called the middle reach, impacted by the artificial supplementary flows. The yellow section being the dry creek bed down to the confluence with the Barwon River.

On page 85 of the 2013 SKM Report, at Boundary Creek on Langdons Road, it is stated that this is the first part of the stream that appeared to have perennial flow. From page 139, Appendix G, of the 2013 SKM Report it appears that this point is Site 1. However, to fit in with the description of the Langdons Road site, Site 1 would fit better if it was further upstream as indicated by the purple arrow. *“The point we accessed appeared to have a main channel entering from the north that carried most of the flow. A relatively still backwater was present in the other channel upstream of that point...”* The artificial flows from the Otway to Colac Pipeline is the only source of water that would give the impression of a perennial flow and this would come from the north down Sandy Creek from Point A. The still backwater can only be the main channel of Boundary Creek.

Irrespective of this confusion this section of the creek is accurately described as providing potential habitat for fish and macroinvertebrates. But the question is what part do the artificial flows play in this? For the casual observer all of the middle reach to McDonalds Dam looks healthy and ideal for instream life forms. Of course this section is maintained by artificial supplementary flow releases, will appear to be in ideal condition and would also give the impression that this was a perennial stream. But is it natural?

Figure 4.



Not so long ago in 2003, SKM produced this map (Figure 4) that clearly defines where the groundwater discharges into Boundary Creek creating a perennial creek flow. Considering observation bore decline and the impacts that have taken place in this green zone there would appear to be little doubt that this map is still representative of the “*Region of Groundwater Discharge to Boundary Creek.*” This location falls neatly between C and E as seen in figure 3, page 34. It is nowhere near Point 1 that has been described as perennial.

Under natural flow conditions Boundary Creek could only be perennial at Langdons (Point 1) if there was groundwater discharge. With Boundary Creek dry only metres above where the tributary, Sandy Creek and the artificial supplementary flows enter (see point B figure 3), it seems most unlikely that Boundary Creek is perennial at Langdons Road in this part of the middle reach. This is another reason for ceasing the artificial flows. A true indication of what is naturally occurring is being confounded by these artificial flows.

Page 91 of the 2013 SKM Report confuses the issues further by not clearly defining the reaches being discussed. Suffice to say that the upper reach must be the one that is dry. In this reach it flows largely through agricultural land. *“The main channel of Boundary Creek upstream of that input was dry.”* The input being the artificial flows.

The middle reach must surely be the one defined by the input from the artificial supplementary flows coming down the tributary, Sandy Creek. However, this is not made clear.

Below this dry upper reach and past the artificial input downstream... *“...groundwater contributions and inflow from small tributaries appeared to increase flow in the middle reaches (i.e. from the release point down to McDonalds Dam).”* This is the first time, ever, that there has been any suggestion that there is an increase from small tributaries in this section. This is an area well upstream of that indicated on the SKM map in Figure 4, page 35.

There also needs to be some comment made regarding the iron bacteria site stated as being approximately 1 km above McDonalds Dam. The iron bacteria is described as an indication that there is a groundwater source entering Boundary Creek at this point. The 2013 SKM Report suggests this source comes from regional groundwater (EVF) or from a large perched wetland/marsh on top of the northern bank.

Firstly, any local person of the area will be able to tell the inquisitive that no such wetland/marsh exists on the top of the north bank.

Secondly, it would appear that the iron bacteria site is the same one as described as the abandoned Stream Flow Gauging Station above McDonalds Dam. But this is not clearly put.

NOTE:

The original Stream Flow Gauging Station (SFGS) above McDonalds Dam was designed to gauge the amount of water entering the dam so that the same amount of water could be released out of the dam for downstream environmental and agricultural purposes. Consequently the natural flow regime could be maintained. The SFGS below McDonalds Dam was there to ensure that any released flow was in fact accurate so that what was entering the dam was released to flow on past. From local knowledge the site of the upstream SFGS is not 1 km above the dam.

Thirdly, this site above McDonalds Dam with the iron bacteria, appears to be the same site as describe on pages 86 and 91 of the SKM 2013 Report. But is it? This confusion needs to be clarified.

Fourthly, is the location of Site 2, as seen above in Figure 3, page 34, marked in the correct spot. If it is then it would not appear to be at the SFGS site.

The questions raised here being:

1. Is the 14th May 2003 SKM document showing the discharge of groundwater still applicable? (see figure 4, page 35)
2. Is it correct, to designate a reach as having a natural perennial flow kilometres upstream of the 2003 SKM discharge area? Bearing in mind the 2003 SKM discharge points and the addition of artificial supplementary flows, this seems doubtful.
3. If there is regional discharge as now suggested above the area designated in the SKM 2003 map, how was this missed in 2003?
4. Where exactly is the site of the iron bacteria?
5. Where exactly is the site of the decommissioned Stream Flow Gauging Station above McDonalds Dam?
6. Is the iron bacteria site the same as the upstream SFGS?

To help clarify and possibly answer these questions a re-analysis of the long – term data may help... ***“...long-term groundwater data indicates that sections of Boundary Creek upstream of the peat swamp would have historically received groundwater inflows.”*** (page 91 SKM 2013). This data also needs to be made available for scrutiny.

Considering that extensive flora sites where surveyed along Boundary Creek in early 1990s and early 2000s the results of these survey should throw light on the state of the creek during this period (see figure 5, page 43). These flora survey results are particularly relevant having been carried out before any of the artificial supplementary flows were released for the first time. Some understanding of the natural flow regime can be gained from these surveys. Needless to say the middle reach as indicated in Figure 3 above (see page 34) has been significantly altered and impacted since the artificial flows began.

(E) Macroinvertebrate Studies.

ABSTRACT. *There would appear to be little point conducting macroinvertebrate studies until The artificial supplementary flows are discontinued.*

“There is little available information on the composition and condition of the macroinvertebrate communities in Boundary Creek. Therefore a new survey is recommended to inform the FLOWS Assessment.” (page 100, SKM 2013)

The 2013 SKM Report recommends that 4 sites have macroinvertebrate studies carried out (see figure 3 page 34). Three of these sites fall under the influence of artificial supplementary flows and are not anything like site representative of the natural flow. Because these 3 sites have a continual flow maintained by the artificial supplementary flows, one would anticipate that any macroinvertebrates within this section of Boundary Creek would be sustained as a result of an unnatural man made ecological state. Pre artificial supplementary flows to this middle reach of Boundary Creek, the water would stop flowing during the summer months with springs and soak flow only being enough to sustain pools and dams.

To gain a much more representative picture of the macroinvertebrate composition and condition in Boundary Creek in anything close to a natural state, the supplementary flows should be discontinued. Ceasing the artificial supplementary flows would allow Boundary Creek to return to a “natural flow” regime.

(As a matter of interest: In 1986 it was recommended that macroinvertebrate studies be carried out along Boundary Creek.⁽¹³⁾

In the Natural Resources and Environment Committee (NREC) hearings Geelong and District Water Board (now Barwon Water) officials stated that these studies were under way. In reality they have never been done let alone started.)

The fourth site is at the Colac Forrest Road Stream Flow Gauging Station and if a survey is conducted during the summer period of no flow the chances of finding instream biota appears negligible. During winter flows the high acidity and heavy metal levels would have a similar impact at this site.

Until the artificial supplementary flows influence is removed there would appear to be no justification for conducting macroinvertebrate studies.

(F). Review of the Terrestrial vegetation groundwater dependence and perched watertable assessment.

(Pages 65-73, 2013 SKM Report)

ABSTRACT. *Previous data must be taken into account and linked to the new work being proposed. The recommended investigations dealing with trees' groundwater dependency that forms the bulk of this section of work, is worthwhile and most interesting. It will provide valuable data for the future but the work must be put in context with previous work. However, up to this point in time previous work on Groundwater Dependent Ecosystems seems to have been forgotten.*

Previous Studies & How They Relate to the 2013 Recommendations.

The 2013 SKM Report, page 66, states... *"It is difficult to determine impacts of changed groundwater conditions (past or future predictions) when the conceptual understanding of the interaction of terrestrial vegetation and groundwater is poor."*

...and continues with...*"In part this is the reason why past attempts at Barwon Downs to correlate vegetation condition survey results to groundwater condition have proved inconclusive."* The evidence and data available does not support this assertion.

"There are key aspects of Stage 1 and Stage 2 assessment that have not been undertaken for potential GDEs in the study area." Once again, previous work has been ignored, evidence found in Barwon Water's own reports.

In the case of the Big Swamp the reality is that this swamp was dependent on groundwater to sustain it, pre-groundwater extraction. Any conceptual understanding is not required as it has been established that there is a direct connection between the Big Swamp and the Eastern View Formation,⁽⁵⁾ the aquifer from which the Barwon Downs Borefield extracts its water. Remove the GDEs groundwater source and the site dries up, the GDE vegetation dies and is replaced by a drier tolerant species. This is what has happened in the Big Swamp. No more *"conceptual understanding"* than this is required.

The 3 stages that the 2013 SKM Report recommends are...

Stage 1: GDE location, classification and basic conceptualisation.

Stage 2: Characterisation of groundwater reliance.

Stage 3: Characterisation of ecological response to change."

To say that these stages have not been attempted in the past is extremely misleading. It is quite confounding why the general tenure and thrust of this 2013 SKM Report is to start afresh and begin benchmarking from 2013.

Is it true that these three Stages have not been undertaken or at the very least attempted in the past? The answer is NO. It would appear earlier investigations and studies did cover these three stages but have been ignored or overlooked. If local input had been asked for at any stage in the development of this new monitoring program, these earlier studies would have been identified and not allowed to be overlooked.

In September 1992 Barwon Water issued a Contract Brief titled... ***“Inventories and Assessments of the Flora and Fauna Values of the Barwon Downs Aquifer Outcrop Areas and Streams Draining Them.”***⁽⁸⁾

In the flora section 2.2 it included this statement... *“...with emphasis placed on those species and communities which have a dependence on aquatic environments...”*⁽⁸⁾ This was in 1992.

In the PART B1 FLORA SURVEY it states this... *“The survey is to focus on areas and species that are most sensitive to changes in water table.”*

“Whilst it could be expected that a lowering of the water table will to some degree impact on all flora in the study area, there is a need to identify those areas which are considered more sensitive and may require further monitoring to evaluate response in plant communities to long term changes in the water table.”⁽⁸⁾

Does more need to be said.

Perhaps... *“As the predominant environmental effect to the development of the wellfield will be a lowering of water tables...”*⁽⁸⁾ Why isn't this data that was collected in the early 1990s relevant to 2013? That is if it was in fact collected.

In June 1994 Carr et al.⁽⁹⁾ of Ecology Australia completed the flora section of this 1992 Barwon Water Service Contract. Carr's report states...

“The study was precipitated by the investigations of Barwon Water into the potential for doubling the capacity of the Barwon Downs groundwater wellfield which would have likely effects on the water table and stream flows in the study area. An inventory and significance assessment of the flora and fauna of the study area was required with an emphasis placed upon aquatic (in-stream, riparian, wetland) environments as well as an identification of vegetation and fauna habitat sensitive to changes in the water table.”⁽⁹⁾ There can be little

doubt that Ecology Australia (EA) knew exactly what tasks had to be performed, and what needed to be included. Did EA complete this first stage?

Stage 1: GDE location, classification and basic conceptualisation. (2013)

In Ecology Australia's 1994 report it states EA surveyed and mapped the aquifer outcropping areas and associated streams and botanical significances were assessed. Surely this satisfies the 2013 Stage 1 criteria.

Stage 2: Characterisation of groundwater reliance. (2013)

In 1994 Ecology Australia (EA) reported that... *"Hydrological sensitive species and vegetation communities are identified and anticipated impacts from altered hydrology are briefly discussed."*⁽⁹⁾

Of the 82 quadrant sites visited 392 vascular plant species were identified. 34% or 134 of these were deemed hydrologically sensitive. 44 were of National or Regional significance. *"These swamp or wetland plants include a range of life forms from small herbs to trees, some of which (e.g. Scented paperbark, Melaleuca squarrosa) are vegetation dominants. They may be obligatory aquatic or amphibious, or occur in seasonally wet or waterlogged soils."*⁽⁹⁾

It would appear that the first two stages recommended in the 2013 SKM Report's new benchmarking were completed by Ecology Australia in 1994.

(It is interesting to note this quote as well... *"When drained, peats become oxidised, lose the greater part of their bulk resulting in slumping of the landscape, and are much more prone to burn..."*⁽⁹⁾ This is typical of the Big Swamp.)

In May 2002 Carr of EA⁽¹¹⁾ tabled a follow up report for Barwon Water. Ecology Australia (EA) re-sampled 24 of the 1994 hydrologically sensitive vegetation sites.

In the Summary section, this report refers back to the 1994 survey... *"The vegetation was documented to detail its significance and identify vegetation types to be hydrologically "sensitive", that is, potentially affected by water extraction by Barwon Water from the Barwon Downs groundwater wellfield."*⁽¹¹⁾

The 2002 Carr report continued with... *"Significant differences in vegetation floristic (species) composition and structure were detected at several locations..."*⁽¹¹⁾

"The observed changes in vegetation composition and structure are clearly the result of decreased moisture availability."⁽¹¹⁾

Stage3: Characterisation of ecological response to change. (2013)

Much more could be said about the new Groundwater Dependent Ecosystem studies that the 2013 SKM Report recommends, but there seems little point

other than to state these earlier studies should not be ignored and should form an integral part in setting the direction the new monitoring program takes.

In 2008-09 Barwon Water conducted a further flora survey and came up with inconclusive results. However, if further background and reading is required on this work, Otway Water Book 9⁽¹²⁾ provides a critical analysis and places considerable doubt on the veracity of the 2008-2009 findings.

If a clear understanding of the past status of Groundwater Dependent Ecosystems is to be part of the new monitoring program it would seem most appropriate that these earlier studies be re-examined. Why haven't the 24 hydrologically sensitive vegetation sites been revisited. Is it because they have undergone significant change from drying out and can no longer be regarded as Groundwater Dependent Ecosystems?

The 1992 and 2002 studies carried out along a multitude of Boundary Creek sites were completed before any artificial flows were implemented (see Figure 5 below). These studies would have been conducted when Boundary Creek was in a more natural flow regime period with moderate groundwater extraction impact and no artificial supplementary flows. Link this work with Farnar-Bowers's 1986 work and a historically accurate picture begins to emerge.

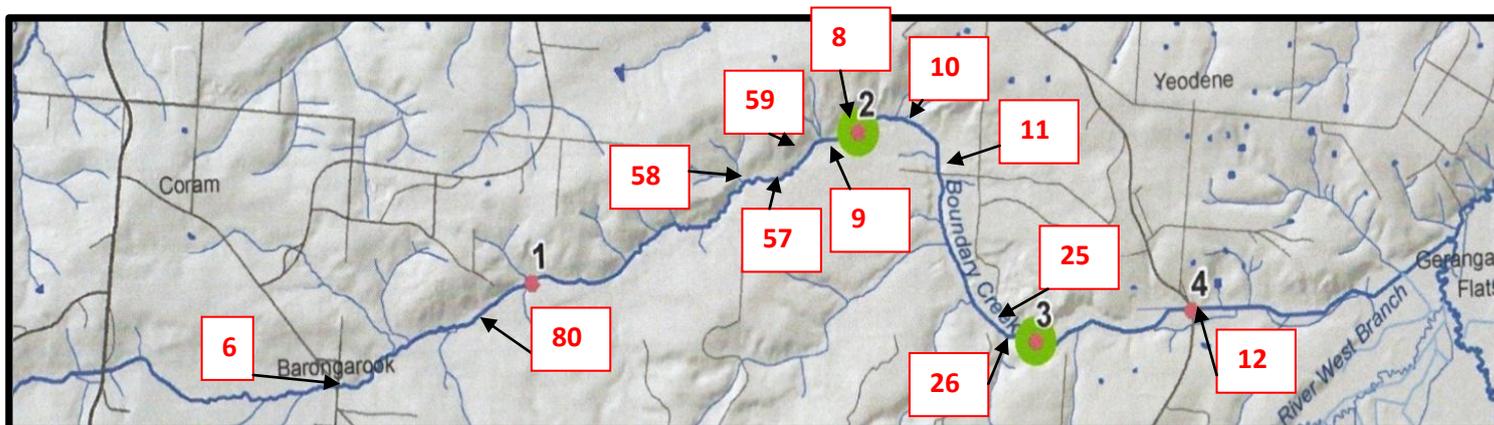


Figure 5. MAP SOURCE: Appendix F SKM 2013. (The approximate sites of the 1994 Flora survey, in red, have been added.)

It would appear that there is quite a store of recorded flora data along Boundary Creek and in the target area that has not been taken into account in the 2013 SKM Report new monitoring program. Why haven't the hydrologically sensitive vegetation sites surveyed in 1994 been included in the 2013 recommendations?

The Groundwater Dependent Ecosystems (GDE) that the 2013 SKM Report (pp 65-73) discusses are in the drier tree zone found above the hydrologically sensitive sites identified in 1994.

In 1986 Quentin Farmar-Bowers was charged with “...*identifying the environmental effects that may occur in the recharge area for the Barwon Downs groundwater project.*”⁽¹³⁾ After studying rainfall patterns and droughts Farmar-Bowers⁽¹³⁾ suggested that the vegetation on the Barongarook High was able to cope with a substantial degree of rainfall variability, but, “*This resilience may greatly delay the response of the vegetation to falling groundwater levels.*”

“*Reduced surface water and lowering of water tables as a result of aquifer pumping would be an additive effect to the natural variability. The pumping of the Barwon Downs wellfield is likely to create changes in groundwater levels of the order of 25 to 50 metres at the site and would be well beyond that exhibited naturally (L. Barrow, Pers. Com. 1986). Aquifer pumping during droughts, as is proposed, would tend to exacerbate the effect of natural variability by extending the effects of drought.*”⁽¹³⁾ L. Barrow of Barwon Water.

Farmar-Bowers found “*Lower areas in the topography are influenced by groundwater. Near Boundary Creek water is released from the water table forming springs and waterlogged areas at least during winter and spring. These areas support forms of vegetation that cope with periodically (or constantly) wet conditions. These areas would be affected by a fall in ground water level. In the extreme, the existing vegetation (and animals that use it) would be replaced by other vegetation more able to utilize the new drier conditions. This change may occur quite rapidly perhaps within a few years.*”⁽¹³⁾ There is compelling evidence that this change has taken place. And, if there are no longer any “...*species or communities which have a dependency on aquatic environments...*”⁽⁸⁾ studying the groundwater dependency of trees in the next zone is a worthwhile investigation to discover whether this zone is impacted as well.

Farmar-Bowers discussed the area above the low lying saturated zone. He breaks this area into two zones. The highest vegetation zone being “...*well above the “regional” groundwater table.*” The other, in between zone, is

“...an intermediate area where the water table comes within the rooting zone of at least some of the vegetation some of the time. This rooting zone can extend to 25 m in some circumstances (see Morris appendix A1)” It appears the trees in this higher zone are the ones the groundwater dependency recommendations in the 2013 SKM Report are going to investigate. If this is the case then it is worthwhile investigating the response and resilience of the trees in this zone to altering groundwater levels. Also, if these studies and the data collected can look back in time, as stated in the 2013 SKM Report, then this is a valuable and worthwhile aspect to be pursued.

“Further, this assessment provides the ability to “look” back across time and examine for potential changes in vegetation associated with changes in groundwater level.” (page 67, 2013 SKM Report).

(G). Perched Swamps.

ABSTRACT. *It would appear that SKM has difficulty determining whether there are perched swamps in the Barongarook High. Historical data testifies to this and perhaps SKM does not have the expertise to conduct the perched swamp investigation.*

Hoxley of SKM in the early 2000s had the panels reviewing the 2004 licence for groundwater extraction at Barwon Downs, dismiss a GDE on the evidence he provided. His work concluded that this swamp was sitting on a perched aquifer, would not be impacted from groundwater extraction and did not require any mitigation consideration. This swamp was marked Site 78 and Site 79⁽⁹⁾ in the 1994 Ecology Australia flora survey. The swamp is locally named Boomerang Swamp.⁽⁶⁾ It was tested for Acid Sulfate Soils by LAWROC in 2012 and is a border line Actual Acid Sulfate Soil site impacting on the vegetation and biota of the swamp area. The swamp that was designated a swamp of State significance in 1994 has undergone massive detrimental change since groundwater extraction began.

After Hoxley’s contribution, licence conditions to protect this swamp were omitted from the final licence.⁽⁴⁾

Four years later in 2008⁽¹⁰⁾ SKM determined that there was insufficient data to conclude that there were any perched swamps in the study area. This assertion still seems to be the case and is a complete contradiction to the conclusion and work the same company, SKM, did in the early 2000s.

The question to be asked here is why haven't nested bores been drilled and data collected in all layers of the system, surface down to the EVF, when it was first recommended decades ago? If there are any perched aquifers in the study area they will come under the influence of vertical leakage and nested bores are by far the best way to determine any impact.

Also, a perched swamp is not immune from vertical leakage though the leakage may take decades to have noticeable impact. If placed in the GDEs discovered in 1994, nested bores would have answered many questions being asked in the 2013 SKM Report.

In the lead up to the extraction licence issued in 2004, SKM believed that the EVF would receive a major amount of its recharge from leakage out of the confining layer above the EVF. Nothing has been done to study this assertion. The present recommendations in the 2013 SKM Report are now concentrating on this confining layer with the exclusion of the earth structures above. Is this history repeating itself? Hasn't anything been learnt from past experiences? Isn't it time all layers to the surface be monitored for vertical leakage, not left to another time period. (see pages 60-61 on vertical leakage)

(H). Review of the Potential Acid Sulphate Soil (PASS) investigations.

(Pages 74-83 & Appendix A, pages 65-70)

ABSTRACT. The following sites (see points A. and B. Below) should be included in the new monitoring program. This monitoring should also involve an observation bore network investigation of vertical leakage and connectedness between surface layers and the Eastern View Formation (EVF).

A. Acid Sulfate Soil sites sitting on the aquitard that display no visually obvious acidification, as proposed in the 2013 SKM Report, and

B. Actual Acid Sulfate Soil sites in recovery stage on the unconfined (exposed) Eastern View Formation. These sites have not been included in the new monitoring program recommended in the 2013 SKM Report.

Including the two distinct areas of ASS sites would allow comparative data in the event that there is a delay in impacts created via vertical leakage on sites not yet apparent (sites mentioned in section A above), and an indication of what is happening in the recovery of the Actual Acid Sulfate Soil sites on the EVF (sites mentioned in section B above).

Investigations also need to be considered into the possibility that the Actual Acid Sulfate Soil sites that sit on the exposed Eastern View Formation are a source of contamination to the EVF aquifer system.

As outlined in the 2013 SKM Report, the aim of the ASS testing is to determine the presence of any sites and potential impacts that groundwater may be having. (2013 SKM Report page 81). If the 2013 Edition 2 of the FLOWS METHOD is adopted then ASS studies should form an integral part of the methodology to be adopted determining environmental flows for Boundary Creek.

Of 9 sites flagged in the 2013 SKM Report, 5 have been recommended for study. Except for Site 4 these five sites have been described as sitting on the aquitard. Site 7 was not accessed for examination as the landholder had not given permission. Site 4 is also entirely contained within private property. When approached both landholders were not aware that a site on their property had been recommended to be studied for PASS. Strange. Another example where local involvement in the planning stages had not been sought.

How these 5 sites were chosen is also very interesting. *“The desktop level assessment for PASS across the study area was initially informed by the review of previous work undertaken in the area and then complimented by consideration of a number of other datasets that can inform likely areas of PASS.”*⁽¹⁾ What this statement means is quite obscure. If previous work refers to the LAWROC and Glover investigations, as referred to in the 2103 SKM Report, then this work was restricted to very limited locations and could not be construed as covering a significant section of the 2013 SKM study area. Also Glover was unable to conduct her soil sampling in the Big Swamp due to Occupational Health and Safety concerns. The issue being that there could have been smouldering pits of burning peat just under the surface with the likelihood of falling into one of these. Consequently, samples were taken from the verges of the swamp. LAWROC sampling was comprehensive and done throughout the swamp.

Once again the fundamental mistake of not “tapping” into local community knowledge has led to a poorly constructed Acid Sulfate Soil monitoring program. Significant PASS and AASS have been missed, sites known to the “locals.”

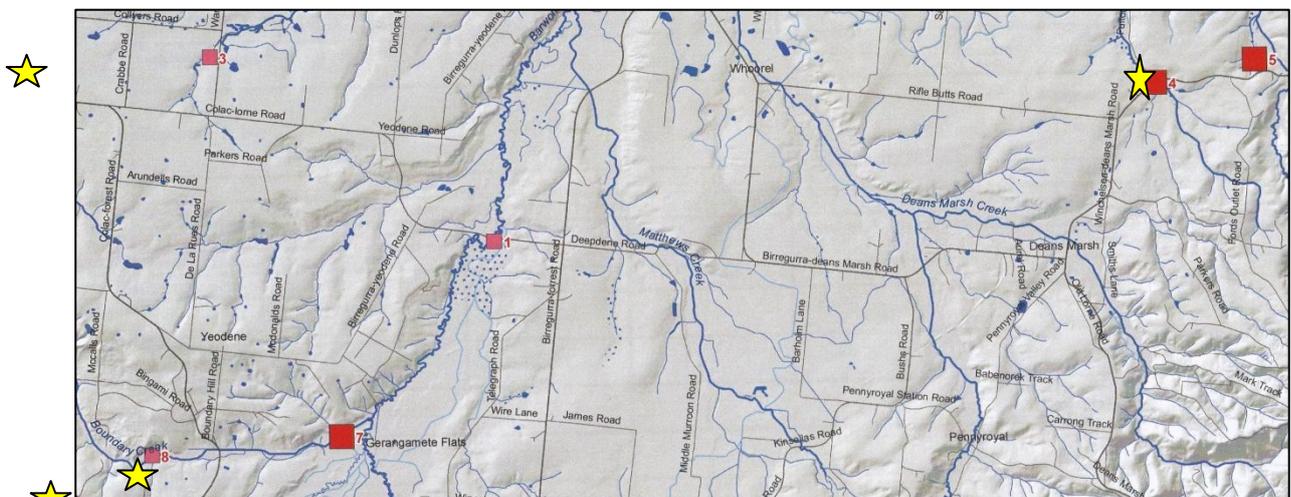


Figure 6. MAP SOURCE: Appendix E 2013 SKM Report. (Additions are the yellow stars. Two are off the map but are well within the residual drawdown influence from the Barwon Downs Borefield.)

Not only are these sites known (indicated with a yellow star), they have already been tested for Acid Sulfate Soils. LAWROC has these results.

If Acid Sulfate Soil (ASS) monitoring is not undertaken the 2013 SKM Report states that... *“...the potential magnitude of acid generation at these sites will not be known. If such sites do exist and the borefield causes drawdown in*

these areas, acidification of these areas (and downstream may occur.)” (2013 SKM Report, page 82.)

The 5 sites chosen for study have, up to this stage, shown no visually manifested acidification. However, they may be under the influence from vertical leakage of groundwater downwards into the depleted layers below and for this reason should be monitored.

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Considering...

- a. The sites chosen show no visual sign of acidification,
- b. From 1997 to 2009 this target area experienced one of the worst droughts since European settlement, and
- c. During this period there had been extensive groundwater extraction,

it would be expected that they would have already turned to Actual Acid Sulfate Soil sites in a similar manner that the Big Swamp and Campbell’s site have. However, being chosen in the areas they are, sitting on the aquitard, it is more than feasible that any impact will take considerably longer to manifest. Impacts from groundwater extraction in these situations can manifest decades after groundwater extraction ceases. Therefore it is sensible and prudent that they are monitored to gain a robust and comparative data set if in the future acidification takes place. If these sites are slowly being dewatered as a result of vertical leakage it would be wise to collect data before the fact.

The four Actual Acid Sulfate Soil (AASS) sites identified by the LAWROC studies and not included in the 2013 SKM Report recommendations, all fall within the influence of the residual drawdown and are situated on the outcropping Eastern View Formation. All of these sites require investigation. It would be interesting to canvas local knowledge in an attempt to gain a clearer picture of the extent of ASS in the target area.

The Campbell’s site is two paddocks downstream of the SKM’s Site 4. This Site 4 is described on pages 77-78 of the 2013 SKM Report, as... *“ASS may be present but most likely confined to the drainage line and likely to have been exposed (if present) in past very dry periods.”* Interestingly, the Campbell’s site is not confined to the drainage line, is a seriously bad Actual Acid Sulfate Soil site and is well inside the influence of the residual drawn from the Barwon Downs Borefield.

The 2013 SKM Report continues to describe Site 4... *“Groundwater will be sourced from the aquitard and/or the aquifer.”* This statement clearly indicates that the groundwater source in this area is either directly connected

to the aquifer or is sitting on the aquitard just above the Eastern View Formation.

As the Campbell's site is so close to Site 4, being approximately 500 metres downstream and is adjacent to the same creek, it would be extremely valuable to compare and study both sites. Why has one changed from a Potential Acid Sulfate Soil site into an Actual site when the other appears not to be affected. Add to this, spring fed dams on the Campbell's property have been experiencing uncharacteristic difficulties maintaining water levels despite the previous 4 wet winters. Subsidence is apparent as are other symptoms of acute problems on the farm. Whatever the cause(s) the farming viability of this property is compromised and the reasons why need to be ascertained.

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If the 2013 SKM Report is so concern with "...*the potential magnitude of acid generation...*" in those sites yet to be identified, then the magnitude of acid generation presently taking place in the sites already proven to be Actual Acid Sulfate Soil sites, should be part of the investigations, not ignored.

Surely these confirmed Actual Acid Sulfate Soil sites need to be included in the monitoring program in an effort to determine what has taken place and what is still taking place at these sites. It would also be extremely valuable to know how these sites are behaving or recovering in relation to the recovery being experienced in the Eastern View Formation since groundwater ceased.

POLLUTION???

An aspect that LAWROC Landcare Group has been unsuccessfully pursuing with government authorities, is the possibility that the acid and heavy metals and metalloids that are produced and released within the Actual Acid Sulfate Soil sites are leaching into the aquifer. The likelihood of this happening is extremely high and if happening will be contaminating and polluting the aquifer. The logic of this is quite robust and as a consequence should be given a high priority to be investigated.

NOTE: The FLOWS METHOD, Edition 2, when discussing the composition of members of the Environmental Flow Technical Panel (EFTP) states that if there is a presence of Acid Sulfate Soils then there should be a member on the panel with ASS specialist skills.

(I). Review of investigations South-West Boundary (Ten Mile Creek – Porcupine Creek area and the Southern Boundary.) (Appendix A, page 71)

ABSTRACT. It would appear that a genuine attempt to ascertain the impact upon the Kawarren/Gellibrand catchment from groundwater extraction at Barwon Downs, is not to be undertaken.

The south-west and southern boundaries are of particular interest to the residents of the Kawarren/Gellibrand area. The concern being that the drawdown from the Barwon Downs Borefield is having a significant impact on the EVF discharge that maintains the perennial streams in the Loves Creek and Gellibrand River Catchments.

The South-West Boundary.

On page 71, Appendix A, of the 2013 SKM Report it states that... ***“The significance of this area is that it connects the Barwon Downs and Gellibrand groundwater systems, so it is important for identifying effects of pumping on the Gellibrand groundwater system including the Gellibrand River.”*** However, it is not important enough to do anything other than develop a 2014 conceptualisation of the situation. In Appendix A of the 2013 SKM Report it is recommended that drilling 4 extra bores would clarify a conceptual model. It is also stated that drilling any less than 4 observation bores would be unlikely to provide any significant improvement on what can already be determined. Unfortunately, the 2013 SKM Report ignores these recommendations, stating the decision has been made not to drill any of these 4 extra bores. That is a worry. Perhaps the saving grace can be found in a comment of an SKM officer who mentioned in the third meeting of the Barwon Water Community Reference Group meeting that there was already enough observation bore data to determine the impacts that groundwater extraction at Gerangamete is having on the Kawarren/Gellibrand area.

However, if this is the case why does it state in Appendix A there is a need to develop a conceptual model? And hasn't this been done before?

Looking back upon earlier models it would appear that this similar conceptual modelling has already been done. Much of this work was carried out in the early 2000s. In addition, there is documentation that dates back even further to the early 1990s. This 1990s work provides some background into the way in which the Kawarren/Gellibrand stream of the Eastern View Formation can be

influenced from groundwater extraction at the Barwon Downs Borefield and must not be forgotten or ignored.

A Hydro Technology report⁽¹⁸⁾ includes the following statements:

“The results from drilling undertaken in this program has provided sufficient data to accurately delineate the areas providing recharge to each sub-region.”

Further...*“The southern and more prominent hydrogeological divide separates groundwater flow towards the Barwon Downs sub-basin from that moving into the Kawarren sub-basin.”*

In another Hydro Technology report⁽¹⁷⁾ this was stated:

“The hydrogeological setting in the Kawarren region has been well established following recent investigations.” (1994)

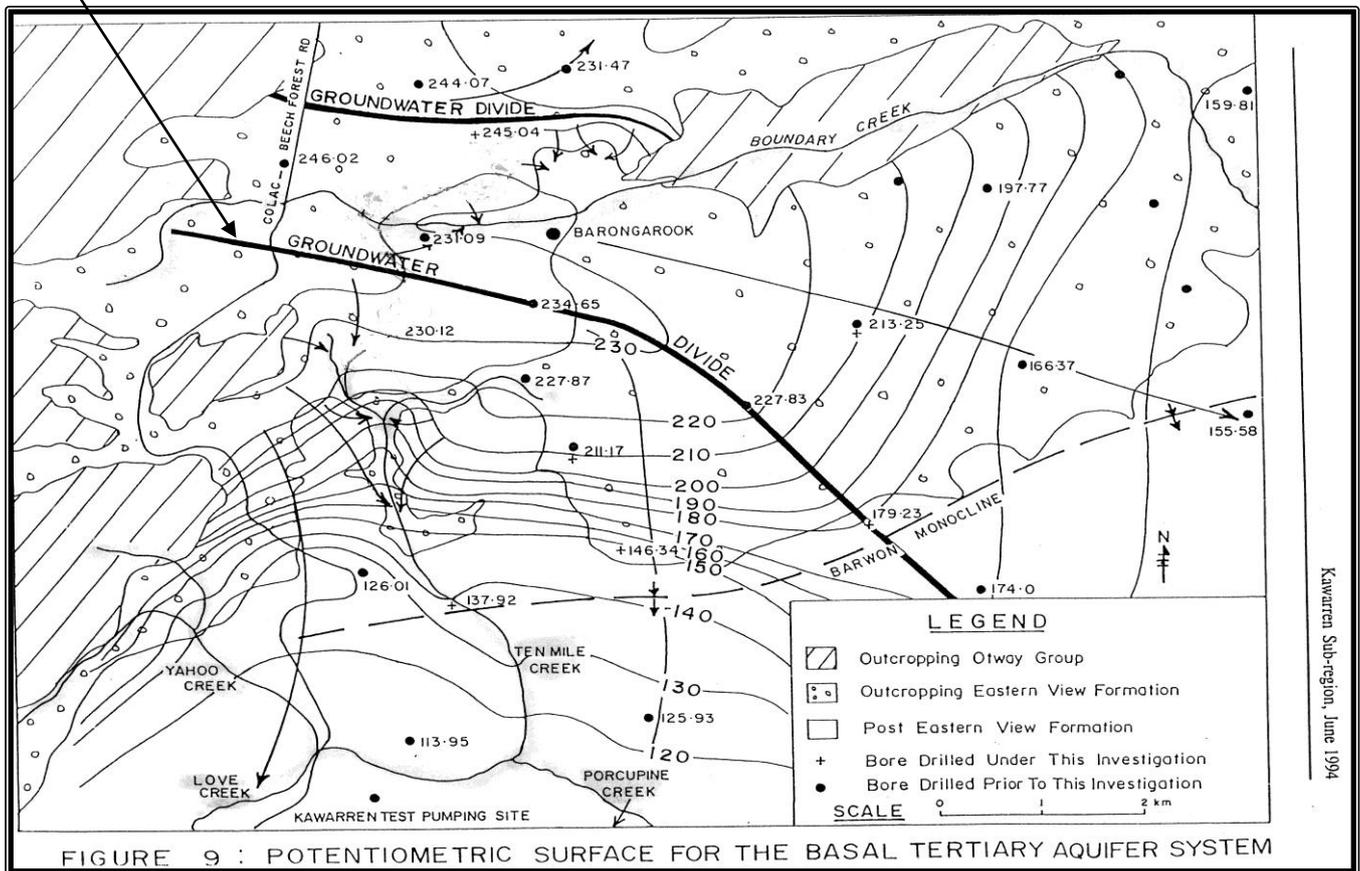


Figure 7. SOURCE: Hydro Technology⁽⁷⁾

Years before Leonard⁽⁸⁾ found a similar delineation of the groundwater flows in the EVF.

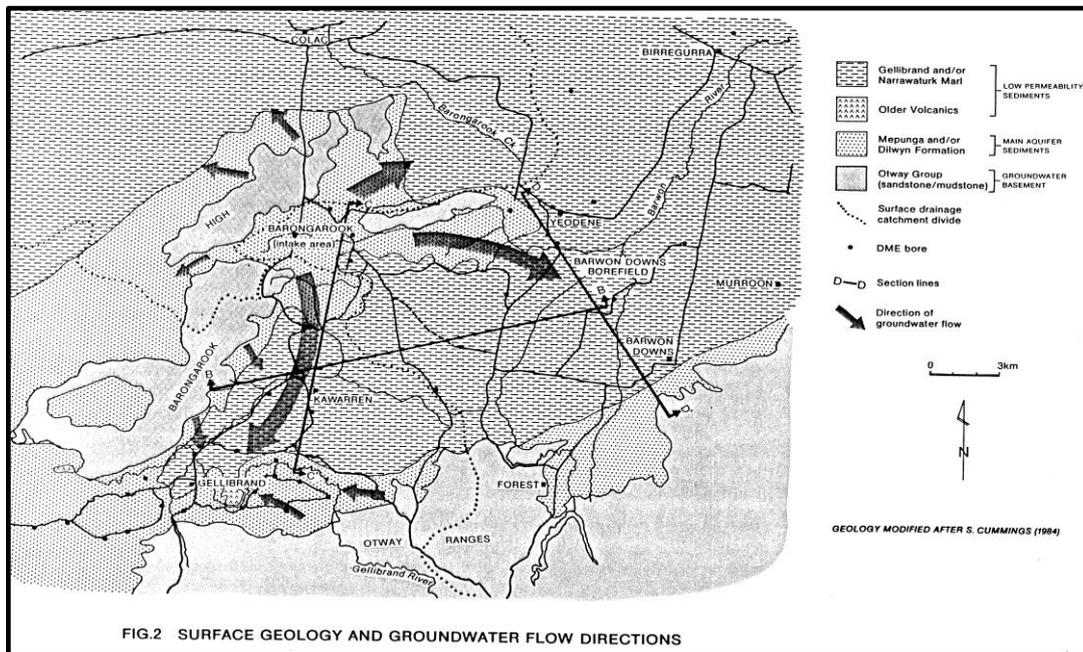


Figure 8. SOURCE: Leonard⁽⁸⁾

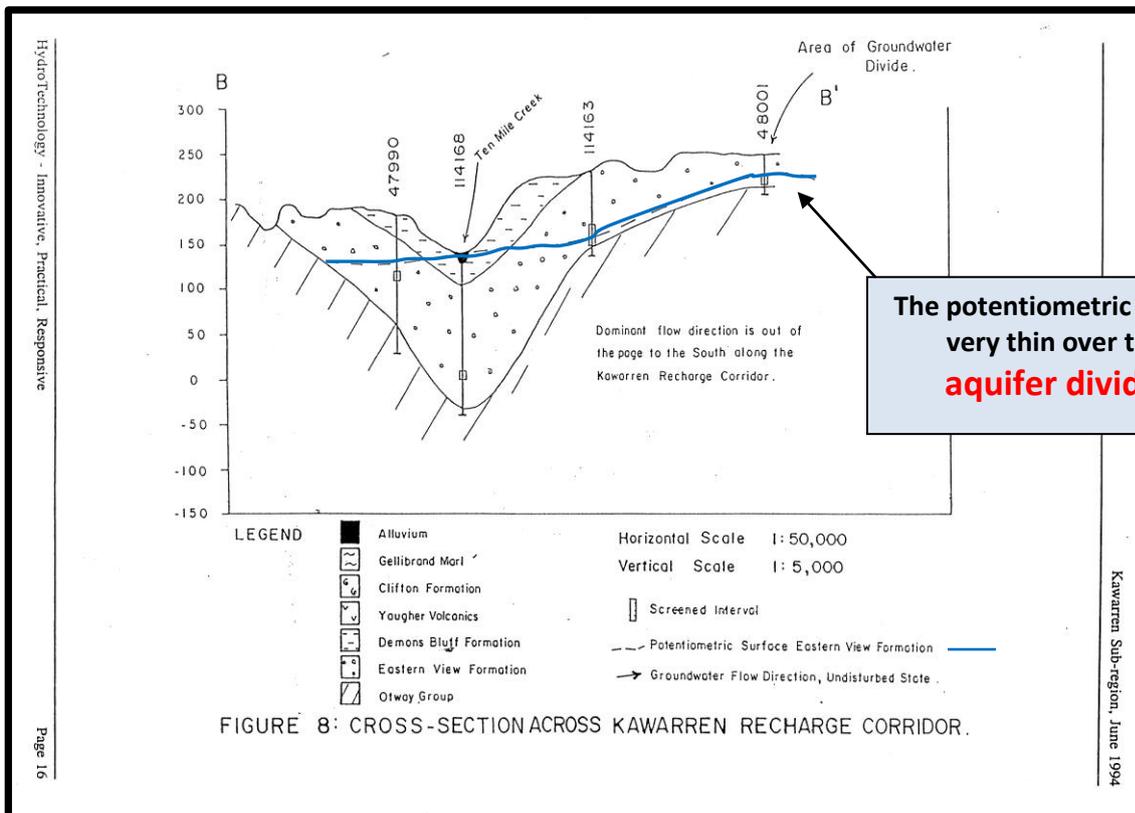


Figure 9. SOURCE: Hydro Technology.

PART A. Comment on the Barwon Water Report prepared by SKM, Ecology Australia & Latrobe University, conducted in 2012, Barwon Downs Monitoring Program. PART B. Review of Barwon Water's "Barwon Downs Monitoring Program" Stage 1, August 2013.

The Hydro technology report⁽¹⁸⁾ also has this to say:

“A prominent ground water divide controls the direction of flow across the Barongarook High and into the Barwon Downs Graben. Flow is generally to the east towards Yeodene and to the south towards Kwarren and Gellibrand.”

“... the groundwater divide will shift in response to extraction and the degree of rejected recharge to the surface water systems, streams and springs will decrease.”

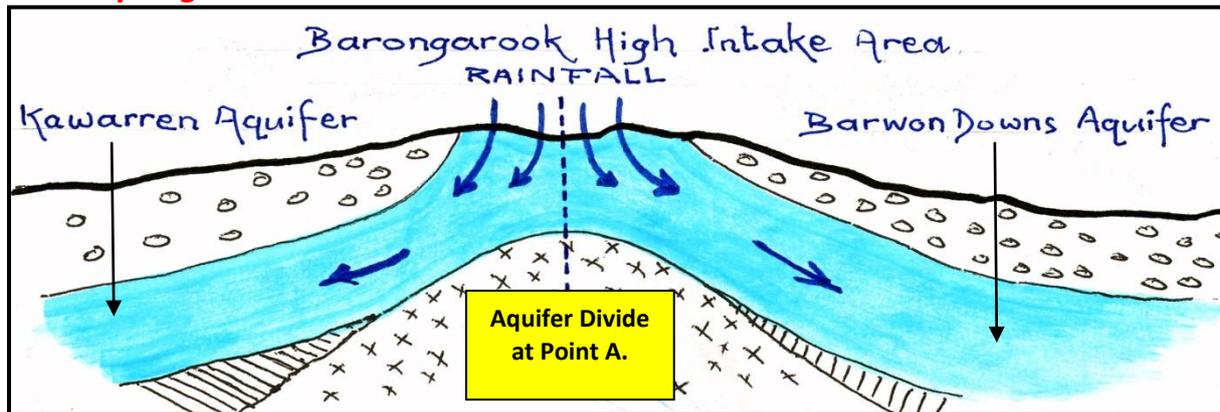


Figure 10. Conceptual Diagram.

This diagram represents the position of the aquifer divide between the Barwon Downs Borefield and the Kwarren/Gellibrand area, pre groundwater extraction. Figure 9 on page 53 clearly shows this divide.

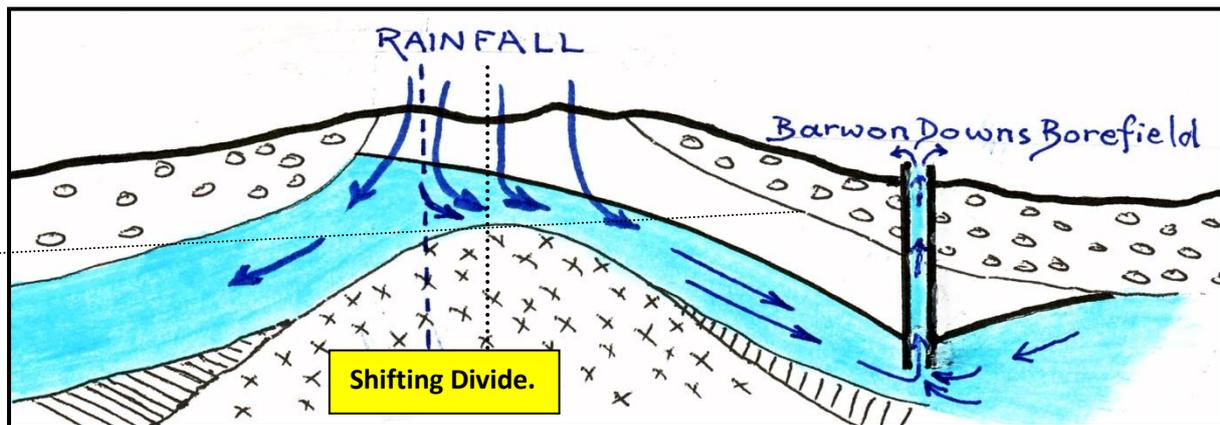


Figure 11. Conceptual Diagram.

This diagram illustrates how the extraction of groundwater at the Barwon Downs Borefield draws water towards the extraction bores that would normally flow in the Kwarren direction. This shifting of the aquifer divide closer to Kwarren in the Ten Mile Creek Catchment lessens the amount of recharge going into the Kwarren region of the EVF aquifer and could explain

why the Kwarren/Gellibrand observation bores hydrographs are continuing to decline even after 4 wet winters. (see Chart 2 page 56)

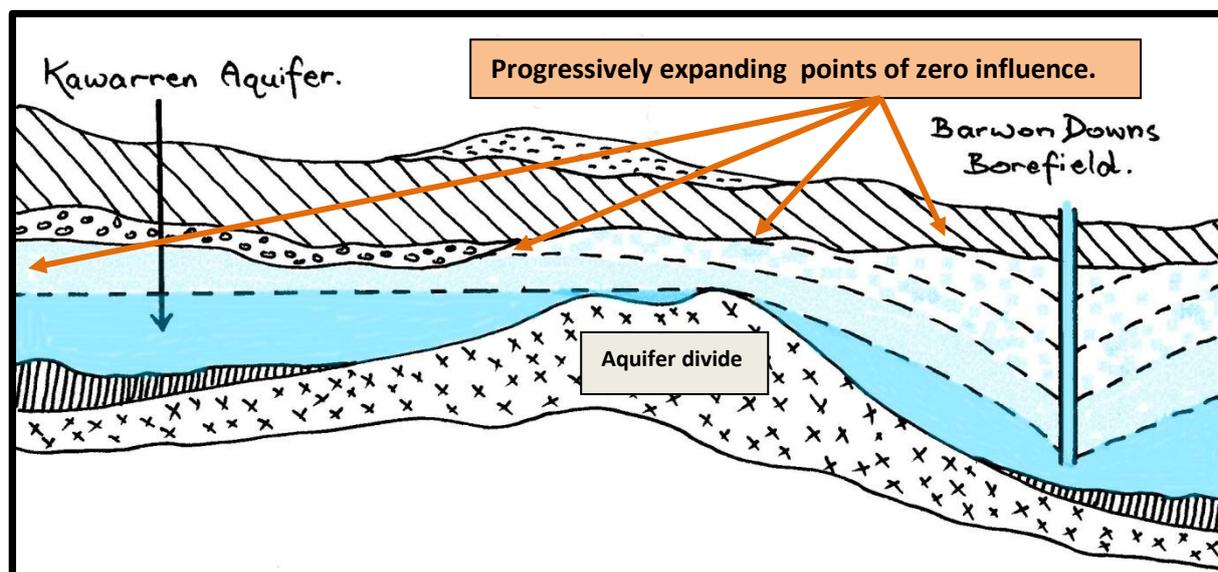


Figure 12. Conceptual Diagram.

Not only does this shifting aquifer divide have an impact on the recharging of the Kwarren EVF but once groundwater extraction ceases, the cone of depression begins to fill, drawing water from further and further away.

The hydrographs from the Kwarren/Gellibrand Region (see Chart 2, page 56) show little to no response to four reasonably wet winters whereas during the same period the hydrographs in the Barwon Downs Borefield area of influence have shown considerable recovery (see Chart 1, page 56). The aquifer storage and recharge that normally affects the Kwarren observation bores appears to be drawn away.

The fact that ***“The borefield was taken off-line in 2010 and has shown significant signs of recovery”*** (Extract from Barwon Water media release issued Thursday 21 June 2012) needs considerable clarification and explanation as to what is exactly taking place and why there are signs of a significant recovery, especially when, during the same period the neighbouring Gellibrand Groundwater Management Area hydrographs have continued to fall.

Besides having a profound effect on the water tables in the Gerangamete Groundwater Management Area there is every indication that the groundwater extraction at the Barwon Downs Borefield has also been impacting on the recharge and storage capacity of the Eastern View Formation in the Gellibrand Groundwater Management Area. Irrespective of the planned

conceptual model it seems imperative the 4 new observation bores recommended in Appendix A, page 71, should go ahead. Especially if they can help clarify what is taking place on this south-western boundary.

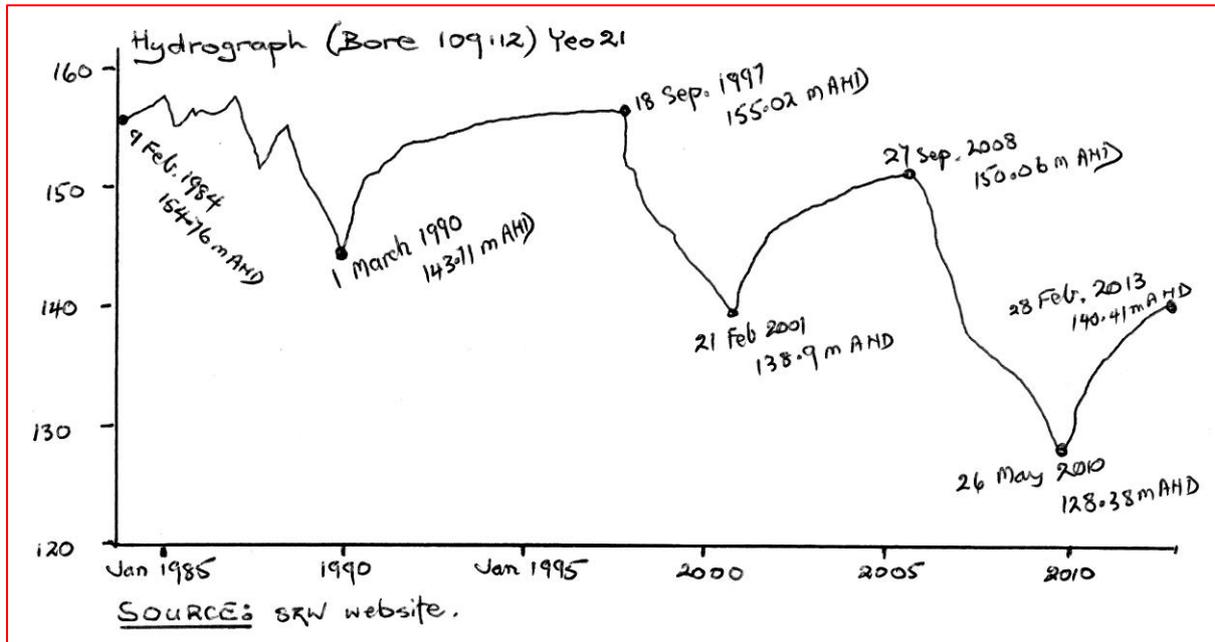


CHART 1. Chart source: Southern Rural Water. Observation bore at the Colac Forrest Road Bridge adjacent to Boundary Creek under direct influence from the Barwon Downs Borefield.

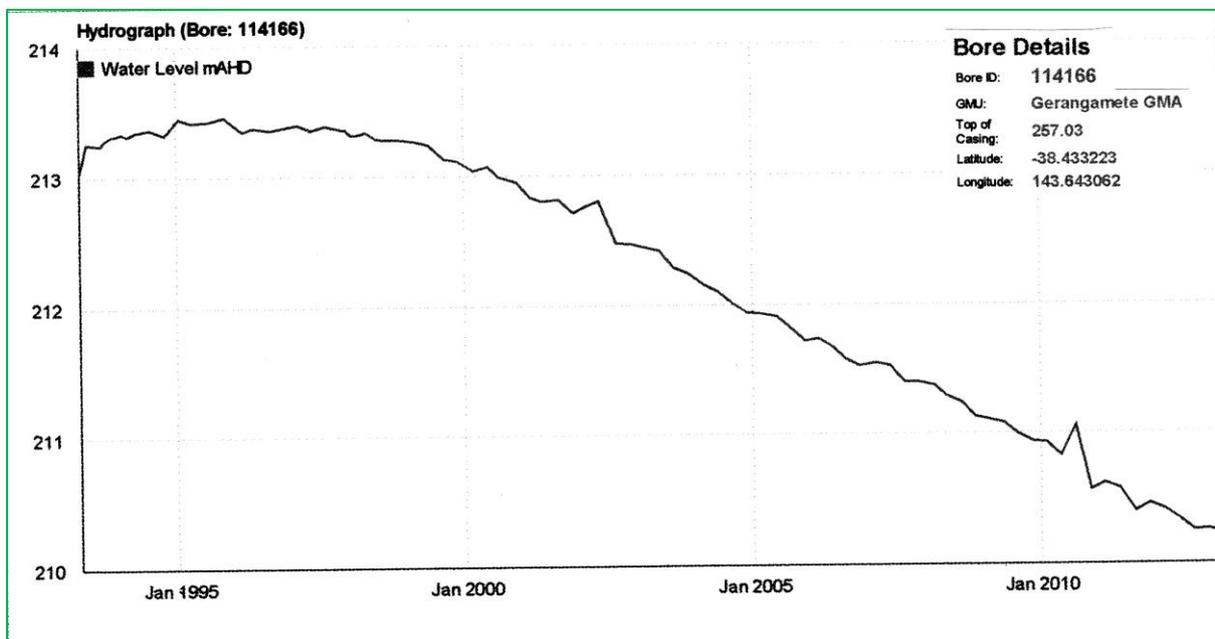


CHART 2. Chart Source: Southern Rural Water. Observation bore south west of the Aquifer divide in the Kawarren/Gellibrand area.

In 2003 SKM reiterated that there was a divide as noted in earlier studies as seen in figure 13 below.

■ **Figure 4-2 Flow Net for Dilwyn Formation to the South of the Modelled Area**

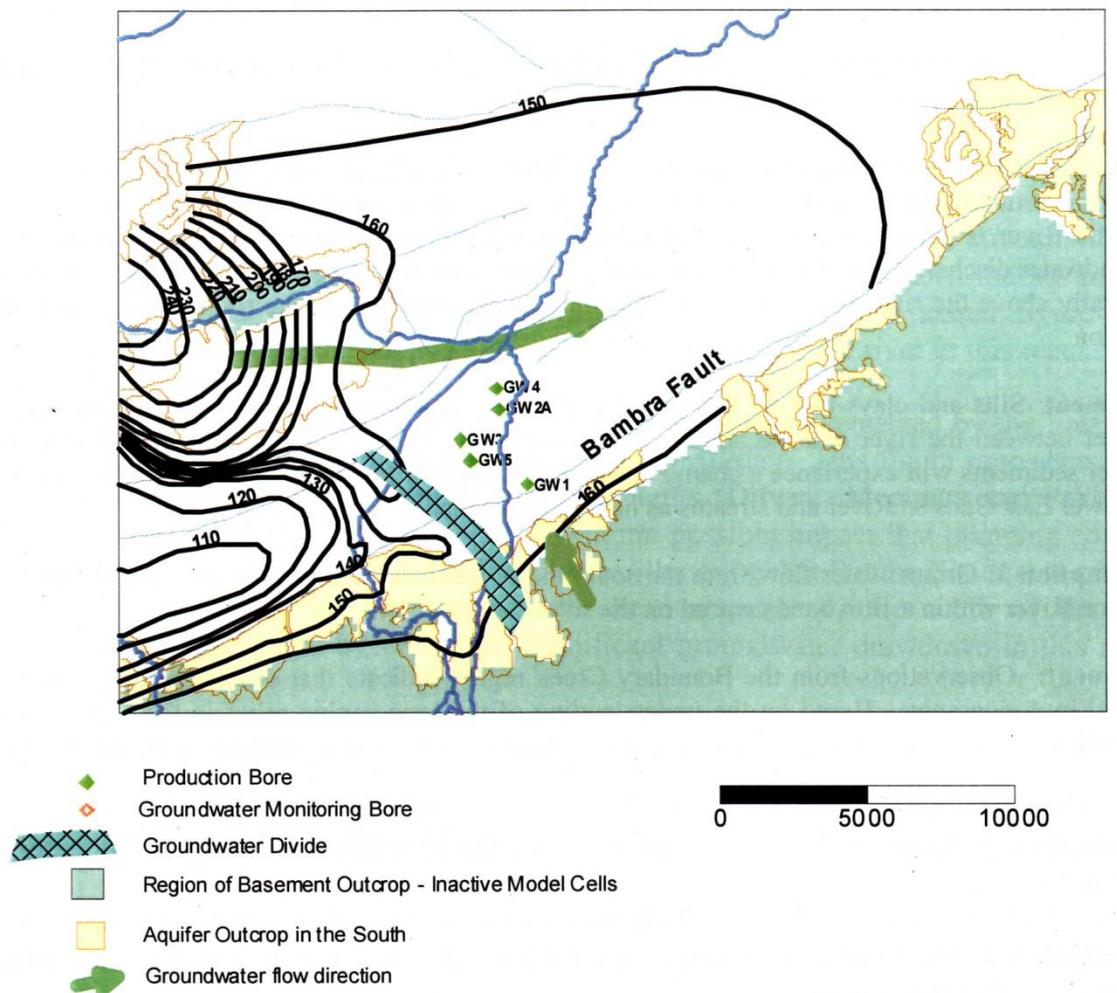


Figure 13.

In the early 2000s SKM modelled seven Barwon Downs groundwater pumping scenarios. These included conceptual models on the possible effects on the Kawarren area. The scoping study leading up to formulation of these scenarios is most interesting.⁽¹⁶⁾

The scoping study was based around Nine Keys Issues identified by Barwon Water and the Department of Natural Resources and Environment. The fourth

issue was... ***“Groundwater Divide. Use of a GHB condition for the model is recommended to enable interaction with the adjacent aquifer system to be simulated.”*** (GHB - Groundwater High Boundary).

And the scoping study went on to state that... ***“... the proposed model will be designed to realistically model the groundwater behaviour in the vicinity of the divide.”*** Also, when discussing the migration of the divide it states... ***“...the western boundary is well into the Kwarren area and hence the groundwater divide can be modelled...”***

There can be no doubt that the potential impacts from the Barwon Downs Borefield on the aquifer divide, have already been modelled. The scoping study made it quite clear that this modelling would be done.

“The following ‘objectives’ were agreed to be addressed in a groundwater modelling study of the Barwon Downs borefield.”⁽¹⁶⁾ One of these objectives being the groundwater divide.

“Groundwater divide – Determine the potential for migration of the groundwater divide at the boundary of the recharge area possibly causing reduced groundwater flow to the Kwarren area that may result in reduced baseflows in that region.”⁽¹⁶⁾

During the deliberations of the Barwon Downs Groundwater Community Reference Group, a request was made 21 January 2014 for a copy of these modelled scenarios. It would appear that it would have been quicker, though costlier, to ask for these reports through the Freedom of Information system. They still have not been provided and a Freedom of Information request was submitted to Barwon Water 16 April 2014.

The 26 July 2000 SKM scoping study⁽¹⁶⁾ also stated that it was... ***“ ... considered quite likely that the drawdown cone has not yet reached the groundwater divide.”*** However, this same SKM report⁽¹⁶⁾ made it quite clear that the modelling would realistically give an indication of how the divide would be affected as groundwater extraction proceeded. ***“...the proposed model will be designed to realistically model the groundwater behaviour in the vicinity of the divide.”***

It would be most interesting to know what the 2000s models determined and see how relevant they are to today’s proposed conceptualisation. However, these reports are not being released by Barwon Water, at this stage. There is considerable data that is yet to be made available and could have significant influence on the direction to be taken regarding this south-western corridor. And, is this another case of “old” data being ignored or overlooked? It would appear so.

After ten years of groundwater extraction through the last drought, and since this modelling was done, the drawdown cone has most likely reached the divide mentioned above. Asking that Barwon Water provides data out to this point of zero drawdown, would seem to be a reasonable request.

Also, in later SKM report⁽²⁵⁾ dated May 2001, it reaffirms that *“The extent to which groundwater may be harvested from the Kawarren area can be determined by the model from examination of flux across this boundary.”* Why the modelling report showing this is not being released is most baffling.

The Southern Boundary.

Little consideration has been given to the groundwater inflows into the upper part of the middle reaches of the Gellibrand River (see Figure 14 below). Has there been any work in regard to the sources of the groundwater that flows into this reach of the Gellibrand River? The question being does groundwater sourced from the Barongarook High flow under the Barwon Downs Borefield in a southerly direction and flow into this part of the Gellibrand River? Or is the area marked by the red circle the inflow that comes through the Loves Creek/Kawarren corridor?

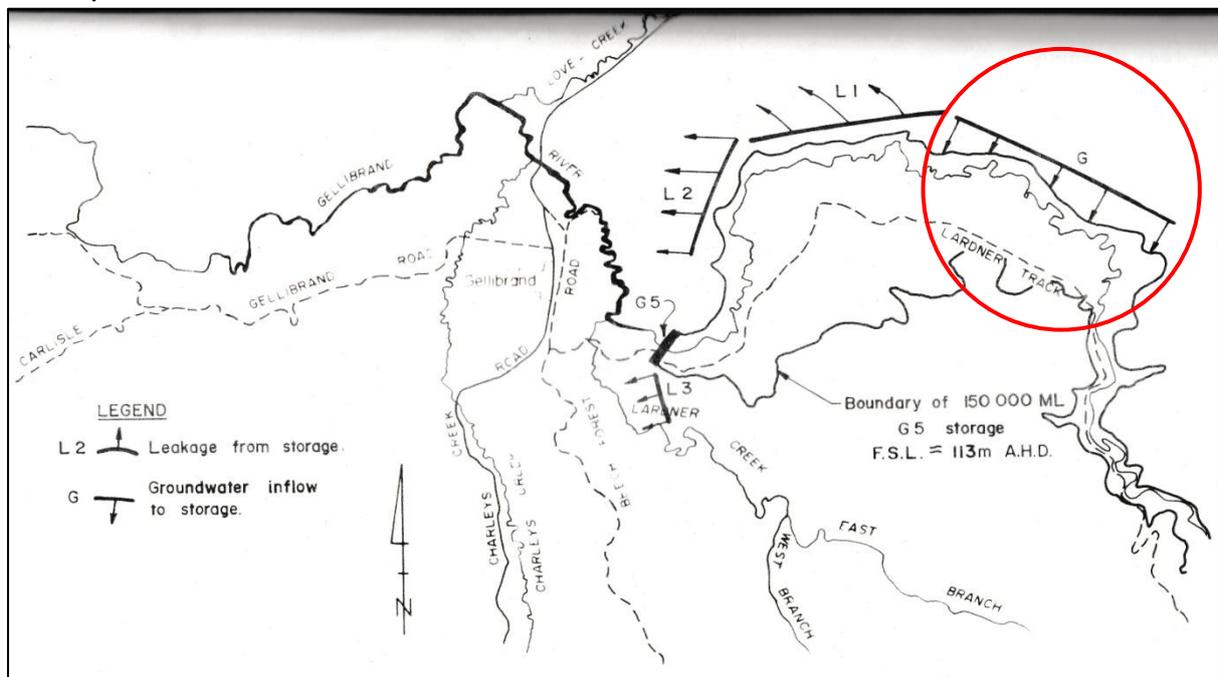


Figure 14. MAP SOURCE: State Rivers and water Supply, Victoria.⁽²⁰⁾

Considering the reluctance encountered to provide access to data known to exist, attempting to answer these questions when there is no obvious data trail, could prove most difficult.

(J). Vertical Leakage

ABSTRACT. *Attempts to determine what is happening at all layers above the Eastern View Formation appear to be half hearted.*

Vertical leakage was identified as another of the Key Issues stated in the 26 July scoping study conducted by SKM.⁽¹⁶⁾ The importance of inter layer leakage was agreed to be investigated. ***“Vertical Leakage. MODFLOW is the recommended software platform and the standard procedures contained in this model deal with vertical leakage adequately for the Barwon Downs wellfield.”***

This same scoping study states that ***“...overlying aquifers/aquitards...will be de-watered by vertical leakage.”*** (Page 16 SKM 2000 scoping study⁽¹⁶⁾) ***“Previous models of Barwon Downs have not paid particular attention to quantification of vertical leakage between the layers. This model will need to make explicit all leakage assumptions and how this will affect the results.”*** This was in 2000 and the numerous recommendations to do this years before was never done. It now appears in 2013 that any work done as a follow up to this 2000 scoping study is to be ignored.

Much has been written in Otway Water Book 18⁽⁶⁾ regarding the lack of vertical leakage studies. In a SKMs report done in the early 2000s it states that a significant recharge of the depleted EVF will be recharged from the aquitard above, by way of vertical leakage. The 2013 SKM Report is recommending that studies now begin to determine what leakage is actually taking place in this aquitard. Interestingly, the Coranganmite Catchment Management Authority 2012-2018 document⁽²¹⁾ states... ***“The lower aquifers are mainly recharged from leakage from the overlying aquifers.”*** But no data source supporting this was given and none appears to have been collected. Even though vertical leakage monitoring has been recommended for decades little has been instigated. In July 2000 Barwon Water under Assessment of Issues, it states... ***“Little monitoring is available to confirm vertical leakage.”*** In fact Barwon Water only monitors 2 bores that are above the EVF. The 2000 SKM document⁽¹⁶⁾ supports the lack of data collection ... ***“Little monitoring is available to confirm vertical leakage.”*** Did the MODFLOW ***“...deal with vertical leakage adequately...”*** as stated in 2000? It would appear not.

The general consensus is that vertical leakage is happening but at the same time little to no monitoring of it has been done. At least this new monitoring program is suggesting that the next layer up from the EVF is monitored.

However, this is not enough. All layers above the EVF to the surface should be monitored and done using nested bores.

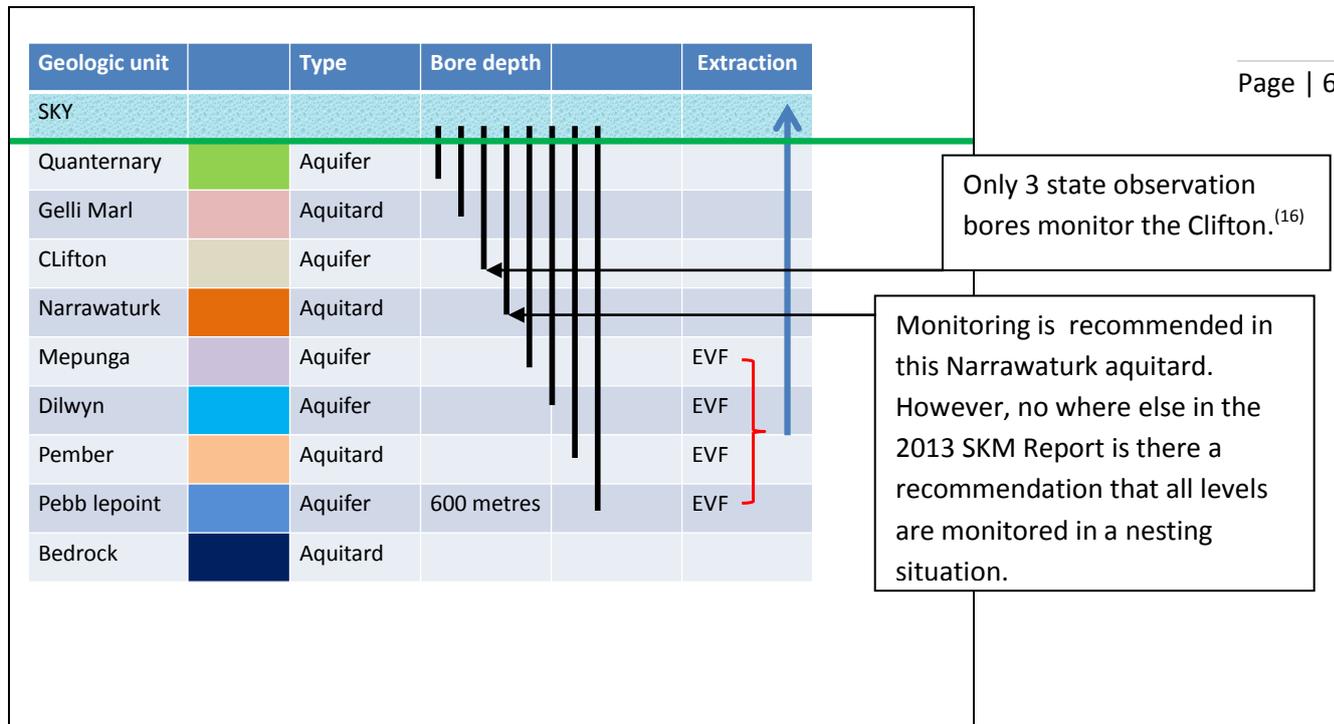


Figure 15. Black lines depicting the depth of nested bores.

The effects and impacts from vertical leakage is poorly understood and will continue to be so until nested bores are drilled into all geological units from the EVF to the surface. This should be a priority and data collected should include previous modelling. Assurances that this would be done were made at the 7th meeting of the Barwon Downs Groundwater Community reference Group, 25th March 2014.

(K). Social Considerations.

ABSTRACT. *As has been the case since groundwater extraction commenced a robust social studies investigation looks doubtful.*

With motherhood statements written in government documents and policy there always seems to be reference given to economic, social and environmental considerations. There is no doubt that the economic factors driving the New Monitoring Program in the 2013 SKM Report are given full consideration. An example of this being the pruning of the budget for the New Monitoring Program down from 2.9 million dollars to 1.57 million. Numerous reference is made to environmental considerations and this is repeatedly stated in the 2013 SKM Report, as the only concerns that the community has.

Where does the social aspect fit into the New Monitoring Scene? The answer is simple. There doesn't seem to be any.

The only mention that could be found on social considerations in the 2013 SKM Report is on page 19. It states this...

“In preparation for licence renewal in 2018-19, Barwon Water wishes to put in place a robust monitoring program which takes into account both technical and social aspects.” Robust social monitoring may be the intention, whatever that means, but in reality there is nothing in the new monitoring proposal to support this assertion. Also, the development of this new monitoring plan was started over a year ago and little to no community engagement has taken place let alone social monitoring. However, this is not surprising as similar assertions have been made for decades with little to show for them.

One of the many social impacts that should be taken into consideration is social impact from loss of Stock and Domestic water supply and use. Page 12 of the 2013 SKM Report states that the licence conditions under which Barwon Water operates, protects stock and domestic use. ***“Barwon water undertakes monitoring in the Barwon Downs borefield area in accordance with licence conditions which require monitoring of groundwater levels and water quality, subsidence, flow in Boundary Creek, as well as the protection of riparian vegetation (flora survey undertaken every five years), protection of stock and domestic use and protection of flows in the Barwon River and tributaries.”***

If the licence conditions are designed to protect Stock and Domestic use and flows in the lower reaches of Boundary Creek then why is it that a group of landholders are in dispute with Barwon Water over stock and domestic rights. Even if for no other social consideration is to be considered, then at least, the resulting social impacts from depleted Stock and Domestic water supply requires *“robust”* investigation.

(L). Local Community Involvement.

ABSTRACT. *The inclusion of local community participation takes many forms as demonstrated in this new monitoring program, 2013 SKM Report.*

In the 2012 SKM, Ecology Australia and the La Trobe University report it states that... *“The primary issues that drive community concerns can be related to environmental impacts (both perceived and real).”*

How this statement was arrived at has not been explained. There is nothing in this 2012 report indicating that local community participation in the development of this report was called for.

As a matter of interest neither does the report itemise the environmental concerns that are perceived or real. In fact the 2013 SKM Report also fails to itemise these things. Also, how this could be done without involving the local community is difficult to understand.

Local community involvement appears to follow this timeline.

- 2012 no local community involvement at the inception and first development stage of the new monitoring program conducted by SKM, Ecology Australia and La Trobe University.
- 22 January 2013 Barwon Water announces tenders for Contract No. 000534 as a follow up to the 2012 study. In the 11 page document no mention of local community involvement is mentioned.
- October 2013 the Community Reference Group meets for the first time.
- At this meeting it was asked why there had been no local community input into the preparation of the 2012 report. The answer was that there had been local participation. However, no specifics were given.
- At the 5th meeting, December 2013, the 2013 SKM Report is tabled and made available to the Reference Group members for the first time.
- Figure 1, page 13 of this 2013 SKM Report, states that in 2012 there was initial stakeholder consultation.
- Also on this page under the heading “2013” it states that “**Community Reference Group (CRG) established.**” giving the impression that this group was established first. Page 13 continues with...
“Stage 1 (WP !) – review/design of assets to refine monitoring program scope.
A-workshop Review of SKM, EA and Latrobe University, 2012
B-Desktop study

***C-Field assessment
D-Scope and cost monitoring program”***

However, Step 1 was undertaken and completed before the Community Reference Group was set up. The agenda was set and processes put in place before any local community input. It would appear that the Community Reference Group has been the first effort to involve some local community input.

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Having been told that there had been local input from the inception stages of the new monitoring program, a request was made for the actual involvement and degree of this local input.

Email sent to Barwon Water officer 3 January 2014, 23:54.

“At one of the earlier meetings of the Groundwater Reference Group I was critical that the 2012 SKM, Ecology Australia and La Trobe University appeared to lack any local representation, contribution or involvement, as I thought there was a great deal that locals could have provided making the suggested new monitoring program so much better. You stated that there had been local community participation. My query is could you provide me with the names of the local community people that were involved in this process.

I noticed that the 2013 SKM report also states that there had been local involvement at this very initial stage. It would be appreciated if you would provide details on what and who was involved.”

This request was placed on the actions still to be completed list that is presented at the Barwon Water Groundwater Community Reference Group meetings. It has been given a medium rating to be completed and has been outstanding ever since. Repeated requests for this information has fallen on “deaf ears.”

It is interesting to note that one of the findings from the disastrous fires of Black Saturday findings was the failure of authorities to make the best use of local knowledge and participation. One of the recommendations made, is to ensure that this never happens again. Although a totally different situation the point is made that ignoring local knowledge does not have a very satisfactory outcome. Eamus et al.⁽²³⁾ states that estimations of water regimes required by an ecosystem are developed through strategic scientific research and through the application of local knowledge based on many years of observation. MacKay⁽²⁴⁾ writes about cutting edge science needing to recognise that the lay

person can identify simple but precise indicators of the status of the environment in which they live.

A most glaring aspect of the new monitoring program outlined in the 2012 and 2013 SKM Reports is the omission of local community knowledge.

You chaps aren't the ones planning the new groundwater extraction monitoring program are you?



Aspects worth Pursuing as outlined in the 2013 SKM Report on the New Monitoring Program.

1. Find and monitor PASS sites within the area of drawdown influence. Sites on both the unconfined EVF and the aquitard..
2. Stream Flow Gauging Station above and below McDonalds Dam.
3. Observation bores placed in the Big Swamp (T1, T2) and Boomerang Swamp (T3).
4. Investigate the reasons for the EVF aquifers becoming less salty.
5. Investigate vertical leakage from the aquitard.
6. Investigate the dependency of the trees in the intermediate zone as described by Quentin Farmar-Bowers.

To be included in the New Monitoring Program.

1. The connectedness between the Barwon Downs and Kawarren/Gellibrand EVF aquifers and impacts occurring.
2. Investigate whether there is a shift in the aquifer divide.
3. Put in the 4 observation bores in the aquifer divide area as recommended on page 71 of Appendix A.
4. Investigate the source of groundwater inflow into the Gellibrand River through the area designated in figure 14.
5. Turn off the artificial supplementary flows.
6. Determine the recovery time needed to have constant flows return to Boundary Creek and saturation of the Big Swamp.
7. Conduct a social impact study.
8. Ascertain whether the Witebsky report figures for yearly extraction still stand.
9. Determine whether the Witebsky figures were optimistic or conservative regarding the environmental impacts i.e. what extraction rates are sustainable without environmental impacts?
10. Investigate Artificial Storage and Recovery as per Witebsky's recommendations. Look at using injection bores.
11. Re-instate the Ten Mile and Porcupine Creek Stream Flow Gauging Stations.
12. Include the investigation of all levels above the EVF for vertical leakage by way of nested bores.
13. Investigate the possibility of pollution of the EVF from AASS sites found on the unconfined aquifer.
14. Monitor the physical and chemical qualities of the artificial flows.
15. Conduct a stygofauna study.

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