

# OTWAY WATER BOOK 49

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## The Loves Creek Catchment.



Photograph, Loves Creek barely flowing - 2019.



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Otway Water Book 57 is pertinent to the Loves Creek Catchment and may be worth a read.

## Summary of Otway Water Book 57 titled...

### **“Are the Otway Ranges, Threatened by *Wildfire* Resulting from Subterranean Water, Oil and Gas Extraction, Just Like in Gippsland?”**

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This book outlines threats to the long-term sustainability of onshore subterranean ecosystems and groundwater in Southern Victoria.

#### **Gippsland.**

Offshore Gas, Oil and Water extraction has had extreme drawdown impact on onshore groundwater reserves in the Gippsland Region. There are indications that similar impact is occurring in the Otway Ranges.

- Depressurising groundwater kilometres offshore has led to a \$5 million compensation to onshore farmers no longer able to access the dropping water table under their farms.
- Springs, wetlands and streams have been impacted.
- With dropping water tables fire risk, intensity and duration have increased.
- The 2020 Victorian Gas Program (VGP) leading to permission to continue onshore gas exploration is a farce, including:
  - Final report completed but none of the environmental studies available for scrutiny.
  - The summary of the stygofauna studies in the VGP is full of mistakes.
  - Social Engineering has influenced the Government’s decision to allow onshore gas exploration to continue.

#### **The Otway Ranges.**

In the upper regions of the Barwon and Gellibrand River Catchments of the Otway Ranges, the impacts resulting from the mining of groundwater has brought about massive economic and environmental impact.

- Creeks have dried up. No longer any summer base flow.
- A major tributary of the Gellibrand has suffered a 60% loss of baseflow.
- Wetlands have been turned into wastelands.
- Massive amounts of acid water and heavy metals threaten the Barwon River and associated tributaries and wetlands.
- A 30 km fish kill.
- Platypus colonies depleted.
- Ground level subsidence occurring.

- Area of impact at least 480 km<sup>2</sup> and still expanding years after extraction ceased.
- Impact recovery estimated to be at least 309 years.

Onshore gas extraction has the potential for this devastation to continue.



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## INTRODUCTION

Most streams and rivers in the Otway Ranges have been perennial for eons. They have received their baseflows from overflowing deep water aquifers. As a consequence of this the surface and subterranean ecosystems within the Ranges have a built in buffering capacity against drought. That is until man started to extract huge amounts of groundwater. With water tables dropping and the natural balance upset, surface impacts began to manifest. The devastation along the previously perennial Boundary Creek, a tributary of the Barwon River, is a classic example. The groundwater extraction at the Barwon Downs Borefield has caused this and the Loves Creek Catchment and upper reaches of the Gellibrand River are also experiencing a similar threat to that of Boundary Creek.

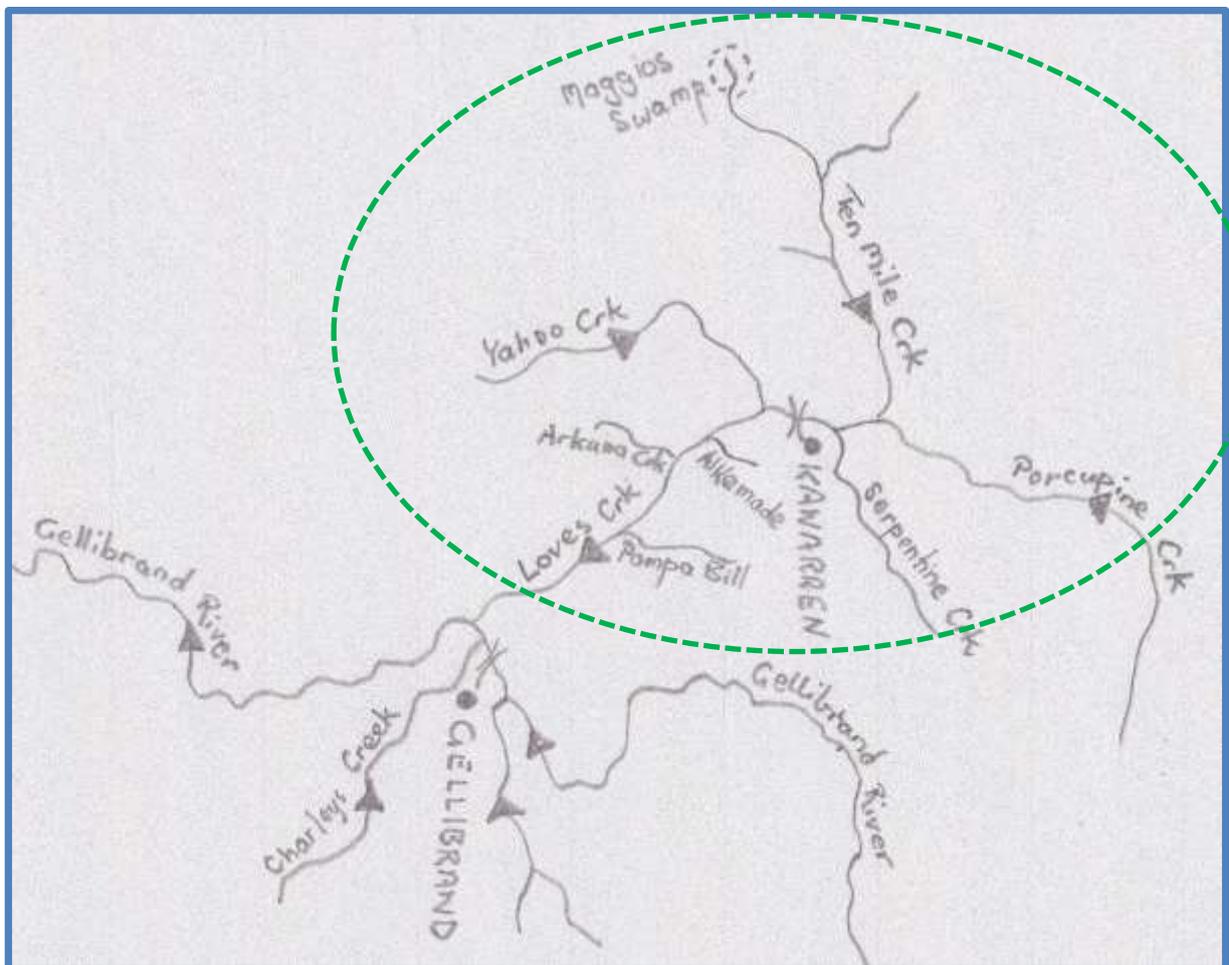
A comprehensive compilation of data and information on the Loves Creek Catchment appears to have never been undertaken. The Loves Creek Catchment has the outward appearance to the casual observer to be doing fine. Unfortunately, it always seems to be that the emphasis is given to documentation and efforts of restoration of water ecosystems that are under extreme stress or have been severely impacted. Usually this takes place long after the warning signs manifest and long after restoration becomes an expensive, long, arduous and more often than not futile exercise. Perhaps this happens when the symptoms are treated rather than the underlining cause of the problem.

Local concerns regarding the Loves Creek Catchment have been voiced as far back as the 1980s, and yes, it can be said that these concerns lead to the legislation that the Gellibrand Groundwater Management Area groundwater extraction be set at ZERO for the first time in the late 1990s. But, despite this it has not stopped two attempts to extract massive volumes of groundwater at Kawarren for use in Geelong. Extraction that would have led to kilometres of the Gellibrand River drying up during summer. Loves Creek a tributary of the Gellibrand River, would have been one of the first creeks to suffer a similar fate. The zero groundwater extraction within the Gellibrand Groundwater Management Area was not beyond reversal as seen in 2008 when at the stroke of a Minister for Water's pen the zero limit was removed giving Barwon Water permission to proceed with a borefield investigation development at Kawarren.. Even after four LAWROC commissioned studies determining that groundwater mining at the Barwon Downs Borefield had reduced the Loves Creek summer base flows by 60%, these warning signs have never been taken seriously. As part

of a Section 78 Notice placed on Barwon Water (see Otway Water Books 42-42G & 42J) the emphasis has to this stage concentrated on the remediation of Boundary Creek and the Big Swamp. Any thought, action, investigation or concern for the negative influence in the Loves Creek Catchment has been shelved to be considered at a later date. Perhaps a better way of considering this is to say the only action taken is a “swept under the carpet” motion hiding and ignoring the concerns in the Loves Creek Catchment.

Otway Water Book 49 attempts to pull together some of the “bits and pieces” that relate to the Loves Creek Catchment. Book 23 is also a valuable resource.

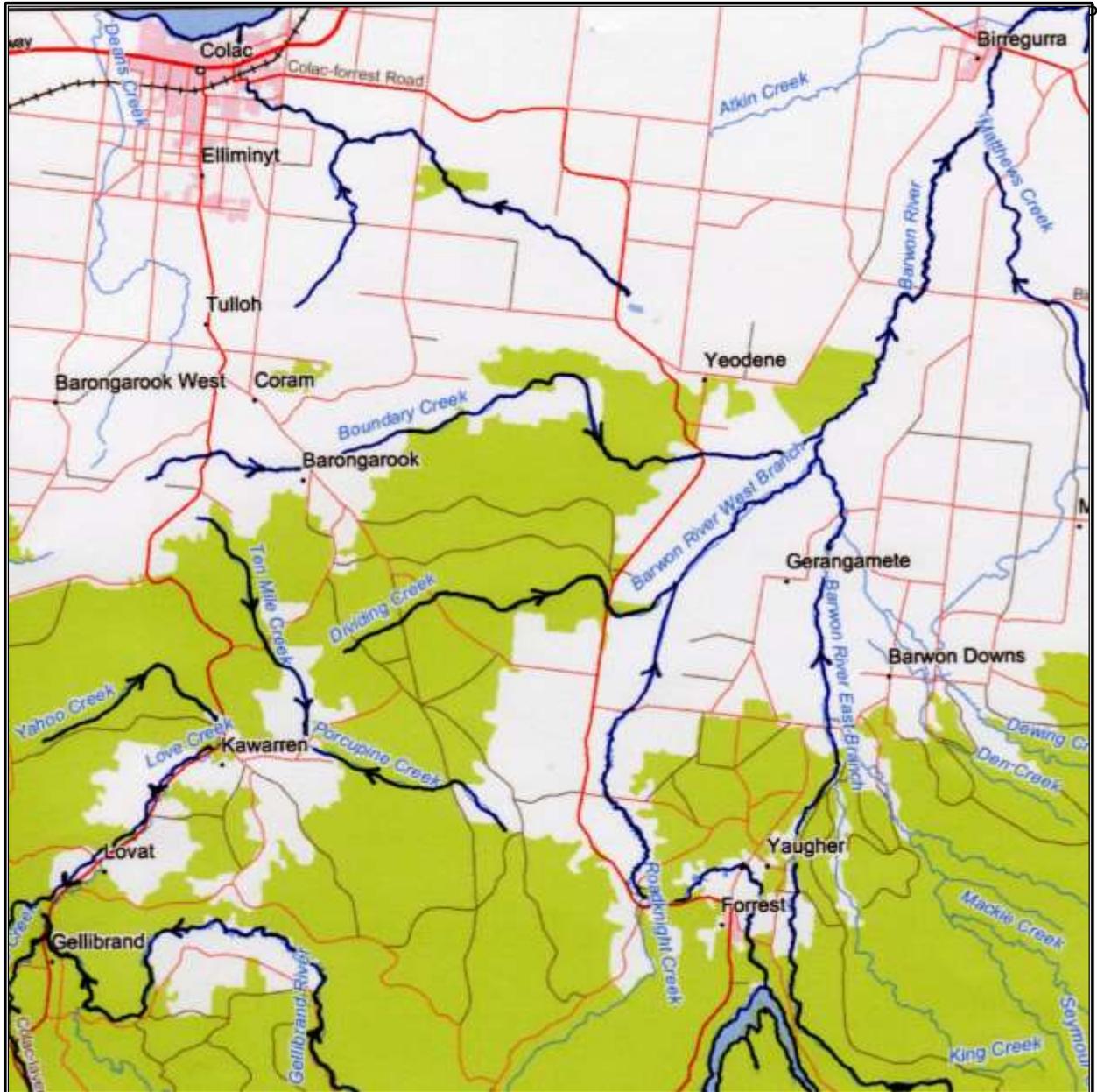
## Location Maps.



Map 1: Loves Creek Catchment.

### Perennial Tributary Creeks of the Loves Creek Catchment.

Porcupine, Ten Mile, Yahoo, Arkuna, Alkemade and Pompa Bill streams have never stopped flowing in European historical living memory. Springs, soaks and wetlands are also scattered throughout the Loves Creek Catchment.



Map2

## 1989 NREC Findings

In 1989 the Natural Resources and Environment Committee (NREC) conclude an extensive period of *“Inquiry Into Water Resources Management In Victoria”* and produced a document outlining a *“South-Western Region Water Management Strategy”*<sup>(50)</sup>

This enquiry started in 1970s and finished in 1989 when a thorough and comprehensive 253 page Strategy containing 52 recommendations, was published.

### Some of the Recommendations Made.

Many of the recommendations found in the NREC findings had a direct association with the Gellibrand River. Loves Creek is a major tributary of the Gellibrand River.

In an ideal world all of the recommendations made in this Strategy would have been implemented. The recommendations relating to the Gellibrand River system and pertinent to the Loves Creek Catchment are listed below. The dialogue marked in **blue** has not been implemented. Many of the other recommendations should be marked in various shades of blue.

#### Recommendation 2

- ❑ To provide a framework for the integrated management of all elements of the terrestrial phase of the water cycle to best serve the present and future needs of the community minimising the economic, social and environment costs.

#### Recommendation 3

- ❑ To develop a more detailed understanding of the water cycle and its interaction with the land and the environment.
- ❑ **To conserve and protect the region’s water resources and associated environmental values.**
- ❑ To regularly review predictions of future community and environmental needs for water.
- ❑ To regularly review the full range of options available to balance predicted future community needs for additional water supplies against the available resources and effects of the use of these resources.
- ❑ **To provide for future community need for water supplies of an adequate quality and level of security.**
- ❑ **To increase the level of local and regional coordination and responsibility for the management of all aspects of the water cycle.**
- ❑ To integrate the development of local and regional responsibilities within a state-wide context.

#### Recommendation 4

- ❑ The development and adoption of techniques for conserving water
- ❑ Detail of the existing rights of rural landholders
- ❑ **Establishment of environmental flows**

- ❑ **Detailed investigation of groundwater systems**
  - ❑ location of recharge areas
  - ❑ interconnection between ground and surface water systems
  - ❑ quality of the groundwater
  - ❑ magnitude of the groundwater
  - ❑ effects of using groundwater on surface and groundwater systems
  - ❑ develop economically viable groundwater resources before development of further surface water resources
  - ❑ base water quality on World Health Organization guidelines
  - ❑ develop management plans for all wetlands, water bodies and river frontages
  - ❑ investigate water quality trends
  - ❑ restore degraded rivers, streams and catchments to a stable condition
  - ❑ develop and implement appropriate land use controls
  - ❑ develop community awareness
  - ❑ develop whole of catchment management mechanism
  - ❑ develop regional organizations responsible for managing all aspects of the water cycle. These organizations should be financially self-reliant, accountable for their actions and representative of all interests affected by their activities.

### **Recommendation 8**

- ❑ Groundwater investigations strongly recommended to be completed as a matter of high priority.

### **Recommendation 9**

- ❑ *The NREC could not entertain any option which would further stress the Gellibrand River* until all groundwater investigations and findings are complete. Investigations should therefore continue to test the full feasibility of all groundwater resources before any final decision is made.

### **Recommendation 13**

- ❑ Ongoing research is needed into the range of available water supply options, especially groundwater. **The committee emphasises the need for flexibility and ongoing review based on updated comprehensive information.**

### **Recommendation 14**

- ❑ Development of surface water resources should be delayed until groundwater resources at Barwon Downs, Bamba, Kawarren, Gellibrand, Curdie Vale and *Moorbanool (now called Newlingbrook)* have been fully evaluated and, where appropriate, developed to a maximum. *The Committee especially recommends that there should be no additional extraction of water from the Gellibrand River.*

### **Recommendation 15**

- ❑ Development of the Upper Barwon storages is the next most desirable alternative to groundwater for Geelong. When available the Geelong and District Water Board should purchase the relevant land for the **Roadknight , Callahan** and Dewing Creeks' dam sites.

### **Recommendation 16**

- ❑ The Geelong and District Water Board should be free to pursue investigations but at its own cost and with no prior assurances that any commitment to additional water resources will be given. **The Board would need to have collected sufficient information to fully justify its proposal in an Environment Effects Statement.**

### **Recommendation 18 and 19**

- ❑ Water Supplies authorities to develop and implement comprehensive programs designed to encourage more efficient use of water.

**Recommendation 20**

- ❑ Geelong and District Water Board should investigate the recycling of waste water.

**Recommendation 22**

- ❑ Incentives should be offered to home owners to install water tanks.

**Recommendation 24**

- ❑ **Water authorities should keep landowners and others likely to be affected by works, proposals or the planning process, regularly informed.**

**Recommendation 25**

- ❑ **During planning periods landholders should be offered counselling and advice on their rights.**

**Recommendation 43**

- ❑ A much higher level of local involvement should be encouraged in the management of the region's rivers, lakes and streams.

**Recommendation 47**

- ❑ **Minimum environmental flows requirements be allocated.**

**Recommendation 48**

- ❑ **A condition of approval of any new water diversion or storage should be that it is designed and operated so that present levels of fish populations are maintained and where necessary improved.**
- ❑ **Measures may also need to be incorporated in new works to maintain the temperature range of the water for aquatic ecosystems.**

**Recommendation 50**

- ❑ **Undertake comprehensive studies to determine the water quality requirements of platypus, and riparian and other aquatic vegetation.**
- ❑ **Ensure that any proposed increases in environmental flows take all possible aspects of the river ecosystem into consideration.**
- ❑ **Investigate the impact of reduced water levels on the biological values of wetlands.**
- ❑ **Initiate further detailed investigations of various aspects of the groundwater systems.**
  - **Identification of groundwater recharge areas**
  - **Resolution of localised groundwater problems**
  - **Assessment of groundwater pumping impact on soaks, creeks and springs**
  - Undertake salinity investigations on the rivers, lakes and streams.

**Recommendation 52**

- ❑ The Department of Water Resources should continue to convene the SWR Task Force initially to prepare an Action Program for implementing the adopted Strategy and, at least on an annual basis, to monitor and report to the Minister for Water Resources on progress in the implementations of the adopted Strategy. Steps should be taken to ensure that adequate consultation occurs with interested parties during the preparation of the Action Program either by widening the representation on the Task Force or by other suitable means.

## 1990s Kawarren Groundwater Investigations

In a Gellibrand River Resource Evaluation<sup>(39)</sup> in 1994, it was recommended that pumping groundwater from the Gellibrand area no longer be a consideration. The government of the day had stated that if natural unregulated flow is less than the environmental survival flow, there should be no extraction of water. By 2004 the State Water Report 2003-2004<sup>(59)</sup> stated that the Gellibrand

Groundwater Management Area was to have no extraction of groundwater except for stock and domestic use.

However, Kawarren groundwater extraction investigations, with the ultimate aim of using the water in Geelong, were set in motion by Barwon Water soon after the NREC recommendations were published. Up to this time groundwater extraction focussed on the amount of water available; was it of a good drinking standard; readily accessible, and, economic to harvest. Little else was taken into consideration. From experiences with impacts created at the Barwon Downs Borefield it was becoming obvious that there was a need for a broadening of considerations. If the Barwon Downs Borefield was any example there needed to be a comprehensive rethink and investigation with data base gathering of things that could be impacted long before any pumping from the Gellibrand Groundwater Management Area was to be conducted. This would allow for comparative analysis as pumping proceeded. Whether the groundwater extraction should proceed would depend upon the findings of the investigation and data base studies.

### **Kawarren & Gellibrand Community Involvement.**

In the late 1980s and early 1990s the Kawarren and Gellibrand community was encouraged to be actively involved in this process of pre pumping data collection and investigation. As a result of co-operative engagement with Government bodies such as the Rural Water Commission, a thorough and extensive investigation was put in place. Five of the major considerations and actions taken involved the following.

1. Take heed of the impacts created at the Barwon Downs Borefield. Earlier research indicated that similar detrimental impacts could manifest themselves in the upper Loves Creek Catchment. The Barwon Downs experience could be regarded as the canary in the mine, the early warning indicator of things to come.

*“It is anticipated that large scale extraction in the Gellibrand-Kawarren region will have an influence on flow, in particular Yahoo and Ten Mile Creeks, similar to the effects noted at Boundary Creek due to pumping at the Barwon Downs wellfield.”<sup>(39)</sup>* As far back as 1984 the canary was starting to show signs of distress.

#### **Note:**

- Because of the close proximity between Gellibrand and Kawarren any groundwater extraction from either site would involve

pumping from the same water source. Any influence in the region would be felt equalling from either site.

- Yahoo and Ten Mile Creeks are tributaries of Loves Creek.
2. Conducting *“An environment audit of the significance of the wetlands and streams draining the Kawarren region be undertaken in order to establish minimum baseline conditions environmentally acceptable for these features.”*<sup>(38)</sup>
  3. Allow no extraction to take place until ...
  4. ... studies recommended by the local community had been completed.
  5. In the mean time... *“Proceed with preliminary plans for a medium to long-term aquifer test until the above recommendations have been achieved. At this time make a decision whether to proceed or abandon such a test.”*<sup>(38)</sup>

### **The Following Series of Studies Were Recommended.**

- a. Spring and Soak Monitoring
- b. Fish Studies & Environmental Flows
- c. Macro-invertebrates & Environmental Flows
- d. Aquifer/Stream Interaction
- e. Surface Water Audit

## **a. Spring and Soak Monitoring**

Even though this monitoring may have been conducted in an ad hoc fashion an attempt was made to ascertain the significance of the springs and soaks in the area. However, the main emphasis was centred on the significance of springs and soaks to landholders. The environmental aspects were poorly considered and reflected the thinking of that period. The significance of wetlands not associated with landholder domestic and agricultural interests were seldom considered.

Lakey in 1984<sup>(47)</sup> had this to say and typified the thoughts of the day regarding the importance of springs and soaks.

*“It may be that many of the springs in the area are not utilised and of no ecological significance and can therefore be considered as a waste of resource.”*

### **Spring Surveys Start.**

In the late 1980s efforts were made to routinely monitor the springs and soaks in the area. But, by May 1995 efforts were suspended. At least some effort had been undertaken to make a start.

*“Routine monitoring of these features have been suspended but will recommence prior to any extraction taking place at Kawarren.”<sup>(48)</sup>*

Nothing was done for the next 12 years.

### **The Gum Boot Test.**

However, these early spring surveying efforts weren't very refined. At a public meeting in July 1988 a Department of Water Resources spokesman is reported as stating that spring monitoring was done by someone walking into a spring and seeing how far up their gumboots the water came<sup>(11)</sup>.

(Otway Water Book 53, deals solely with springs in the area.)

## **b. 1995 and 1996 Zampatti, McGuckin. Bradshaw and Lewis<sup>(63)(64)</sup>**

Two parts of a three part fish study on Loves Creek were completed. Unfortunately, the third part of the longitudinal study was never completed. However, the work that was completed was very significant.

The two Zampatti et al. <sup>(63)(64)</sup> studies concentrated on fish populations and the appropriateness of environmental flow recommendations. In the first of these two reports Zampatti and McGuckin<sup>(63)</sup> recommended that the earlier Tunbridge et al.<sup>(57)</sup> environmental flows be adopted. But, in the second study Zampatti, Bradshaw and Lewis<sup>(64)</sup> in 1996 recommended significantly higher minimum environmental flows than those recommended in 1988 by Tunbridge and Glenane.<sup>(57)</sup> In 1998, Cameron and Vertessy<sup>(58)</sup> when conducting their macroinvertebrate studies, supported Zampatti's view recommending that higher environmental flow levels should be followed until a comprehensive study is undertaken that primarily focuses on environmental flows and aquatic invertebrates in the upper Gellibrand River Catchment. These recommendations have never been implemented. The Cameron and Vertessy report states that a significant study of environmental flow preferences of *macro invertebrates* is required as there is a paucity of published information available. Also, a ten year gap between the Tunbridge/Glenane work and

the Zampatti studies could well have seen a change in flows levels due to a variety of influences, none more so than an anthropogenic influence.

Using Tunbridge's figures<sup>(56)</sup> of 1988, the survival flow set for the Gellibrand River at Bunkers Hill was 45 megalitre a day. Unfortunately this figure was regularly not reached in summer anyway. As stated above, Zampatti et al.<sup>(64)</sup> in 1996, recommended significantly higher flows than those recommended by Tunbridge et al.<sup>(57)</sup> Despite these findings, as at 2020, no follow up work has been conducted and no environmental flows have ever been allocated.

From the 1980s to mid 1990s environmental flow studies had concentrated only on the Gellibrand River and it wasn't until 1996 that Zampatti, Bradshaw and Lewis<sup>(64)</sup> included comment on environmental flows for Loves Creek. Having basic environmental flow regimes was supported by earlier findings stating there should be no further stress placed on the Gellibrand River system especially not by extracting groundwater from the Kwarren/Gellibrand area. Extracting groundwater would be equivalent to reducing river summer base flows, thus reducing the ability to allocate the most basic of environmental flows. Under a basic environmental flow scenario many of the western district towns relying on Gellibrand River Catchment surface water extraction would run out of water (See Khouri and Duncan's work below, Point e., page 16.).

The environmental flow recommendations for Loves Creek were most likely prompted by extremely interesting fish survey results and observations. When the Loves Creek Catchment was investigated by Zampatti et al. the distribution and composition of fish assemblages was found to be significant, and, at some sites, unique in the Otway Ranges. The co-existence of certain species had not previously been recorded in the Otways and the size of the blackfish population suggested that Loves Creek should be given the same recognition, with regard to blackfish, as the Gellibrand River.<sup>(63)(64)</sup> The Gellibrand River, at the time, was regarded as the best blackfish river in Victoria. (see pages 70-72 for recent fish survey studies.)

## c. Macro-Invertebrates & Environmental Flows

Butcher, Richards and Rankin reported in 1994<sup>(51)</sup> on the first phase of the Gellibrand River catchment macro-invertebrate and environmental flows monitoring program. An integral part of this program was the ascertainment of appropriate management strategies to minimise deleterious impacts on the aquatic environment. Cameron and Vertessy followed up with the second phase of this program in February 1998 and October 1999.<sup>(7)(58)</sup> They agreed that the environmental flows levels outlined by Zampatti and his co-workers should be followed until further studies were done on macro-invertebrates and their biological needs. They reported that there was a paucity of published information available on the environmental flows preferences of macro-invertebrates.

Unfortunately, by October 1999<sup>(58)</sup> changes, perhaps those outlined by Kouri and Duncan (see below, pages 16-17), and so called economic restraints had the eleven monitoring sites of the earlier studies reduced to three. The environmental flow aspect of the study was dropped and the overall and final report of the Gellibrand programme was “lumped” in with a Thomson, Wimmera and Glenelg report.<sup>(58)</sup> No environmental flows have ever been introduced and there still remains a paucity of published information on macroinvertebrates in the Loves Creek Catchment.

## **d. Aquifer/Stream Interaction**

In 1994 in the HydroTechnology (later SKM) Gellibrand River Resource Evaluation,<sup>(39)</sup> it was recommended that pumping groundwater from the Gellibrand/Kawarren area should no longer be a consideration. Extraction at either the Gellibrand or Kawarren Borefields would impact on the flows in the Gellibrand River. At the same time the Victorian State Government's asserted that if a natural unregulated flow is less than the survival flow, there should be no extraction of water. Unfortunately because of the overallocation of the water resources in the Gellibrand River, the summer flows around this period did not achieved the most basic survival flow recommended by Tunbridge and Glenane.<sup>(57)</sup> By 2020 any thought of implementing the most basic summer survival flow recommendations could best be described as a pipe dream.

However, the most damning of reports was the one conducted by Khouri et al. in 1993.<sup>(45)</sup> This report concentrated on the Newlingbrook area (Carlisle River) and was investigating the security of water supply to the Wannon Water system. The significance of the results of this report and its impact on the Kwarren investigations was not realised for some time. However, once it was, this should have sounded the death knell for any extraction from the Kwarren and or Gellibrand borefields. This was not the case, and little else was done for years to investigate the connectedness between the aquifers and surface waters. It wasn't until another effort was mounted to extract water from the Kwarren Borefield in 2007.

The results of the Khouri et al. report was one of the major driving influences leading to the declaration of zero groundwater extraction from the Gellibrand Groundwater Management Area. However, in recent times the results of this report appeared to have been forgotten.

Khouri et al. determined that the security of the Wannon Water system could not be assured if the minimum environmental flow as described by Tunbridge and Glenane<sup>(57)</sup> was to be implemented. This very same scenario has been reported by GHD in September 2006.<sup>(14)</sup> However, Barwon Water returned to the Kwarren Borefield site with the aim of extracting 16 GL/year. Extracting this amount of groundwater before it surfaces would create havoc in the Gellibrand River Catchment.

### e. 1993 Khouri and Duncan<sup>(45)</sup>

In 1993 Khouri and Duncan of HydroTechnology (now part of Sinclair Knight Merz) reviewed the Otway System Water Supply now managed by Wannon Water. Townships supplied from this system include Warrnambool, Camperdown, Simpson, Cobden, Lismore, Derrinallum, Terang, Noorat, Glenorminston and Allansford. The Gellibrand River catchment supplies the majority of this water. The study was to identify a continuing source of water that would not further stress the Gellibrand River and the following quote taken from the section of the Khouri report headed "Reasons for the Study," is an indication of this.

*"A clear direction to examine alternative sources of water, which may have lesser environmental impacts than enlarging existing headworks and ensure that no additional water was extracted from the Gellibrand River was given to planners of future supply works."*

The principle aim of Khouri and Duncan's study was to review the water resources of the Otway System and determine appropriate timing and capacity of developing the Curdie Vale groundwater as augmentation for Warrnambool. The fourth of the seven objectives of this study was "... *To assess the impact of environmental flow in the Gellibrand River on the current and future system security of supply...*"

### **Twelve Findings from this report.**

There are twelve findings and statements from this 1993 review that were relevant to the groundwater extraction proposal at Kewarra.

1. State Government policy dictated that future allocations and water resource development proposals were to include environmental flow requirements of the Gellibrand River and should be given equal consideration with any other demand.
2. Allocating a minimum environmental flow would impact on current and future security of the Otway supply system.
3. An environmental flow requirement was likely to become a critical issue in the near future.
4. If environmental flows were allocated an alternative approach was mooted in times of reduced flows. e.g. reduce the environmental flow at the same time as imposing water restrictions and reductions on all other users. In this scenario level 4 restrictions would have the minimum environmental flow allocation reduced by four fifths.
5. The most significant factors in determining system security are the environmental flow requirements and the trigger levels for implementation of restrictions.
6. Introduction of environmental flow requirements in the Gellibrand River would have immediate and significant impact on system security. The system would operate well below acceptable security criteria.
7. It was suggested that any environmental flow allocation be flexible.
8. In 1993 the summer flows of the Gellibrand River were heavily committed.
9. In times of severe drought, river flows became very low. In 1968 the flow was 17 ML/day at Carlisle (stream flow gauging station No. 235208).
10. Both the North and the South pumping stations have the capacity to dry up the Gellibrand River if the flow in the River falls below 20 ML/day.
11. *Simpson, Camperdown, Lismore, Derrinallum and Cobden's water supply would be prone to fail in a drought if the recommended survival environmental flow was allocated in the Gellibrand River.*

12. Any proposal for implementing of environmental flow requirements would require immediate system augmentation to maintain system reliability at acceptable levels.

**Conclusions** to be drawn from the Khouri, Duncan report.

If the most basic environmental flow was allocated to the Gellibrand River, Wannon Water would have considerable trouble sourcing water for the Warrnambool system during drought conditions. Extract groundwater from the Kwarren or Gellibrand borefields would seriously compound the problems even further. Flows in the Gellibrand River would be significantly reduced. Any buffering capacity the aquifer system had on stream flows from climate change impact would be negated.

**NOTE:** It would appear that the term environmental flow may well have been replaced by Environmental Water Reserves, called EWR. If this is the case then any EWR allocation to the Gellibrand River should be allocated with a daily summer flow release – not stated as a bulk yearly allocation. At present the complete EWR allocation for the Gellibrand River flows into the sea during winter. There is no provision for keeping any water in reserve for use during summer. For summer survival for the water dependent ecosystem, this is useless. There is no environmental water that can be kept in reserve for a summer release and even though an EWR for the Gellibrand appears adequate on paper, in practise it does not achieve its aim. Up to August 2020 there has not been one summer environmental flow recommendation implemented for any part of the upper section of the Gellibrand River Catchment.

### **Result of the 1990s Kwarren Groundwater Investigations.**

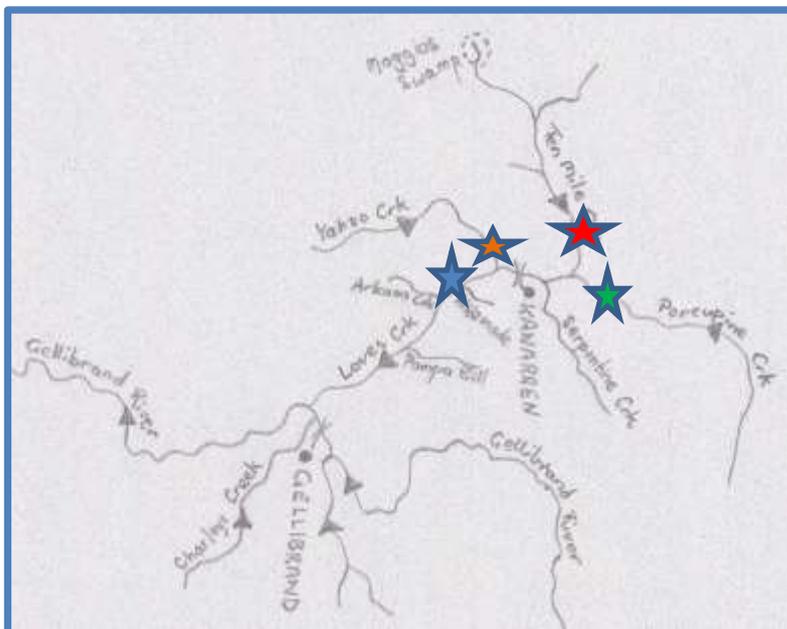
As a consequence of the over allocation findings, stream flow gauging stations on the Yahoo, Ten Mile and Porcupine Creeks were decommissioned, spring and soak monitoring ceased; the environmental flow considerations and allocations were never implemented; fish studies were not completed and macro-invertebrate studies downgraded to insignificance. Any groundwater extraction from the Kwarren borefield was not possible without incurring unacceptable consequences to the security of Wannon Water's supply and the environment. Any question of extracting groundwater from the Kwarren Borefield was abandoned or so it was thought.

### **Conclusion - Kwarren Borefield.**

The Gellibrand River summer water resources were shown to be over allocated and to extract groundwater at Kwarren would put the Gellibrand River and many of its tributaries under further and

unacceptable stress. The security of Wannon Water's water supply would be placed in jeopardy and social and environmental impact in the Kwarren/Gellibrand communities would be profound. Environmental flows required to maintain the integrity of the streams and river in the area were all but impossible to achieve. These things had been determined beyond any doubt. For the Victorian State Government to stand firm on its commitment in regard to maintaining and enhancing river health, extracting groundwater within the Gellibrand Groundwater Management Area was not an option. Groundwater extractions from the Gellibrand Groundwater Management Area were legislated at ZERO.

### 1990s Baseflows in Loves Creek Catchment Streams



Map 3.

#### Major Tributaries of Loves Creek.

The three perennial creeks of Ten Mile, Porcupine and Yahoo are the major contributors to the flows in Loves Creek. The base flow rates listed below were calculated back in the early 1990s when the stream flow gauging stations at Ten Mile, Porcupine and the Yahoo Creeks were installed. Unfortunately, all of these stations were another casualty of no further interest in groundwater extraction in the mid 1990s and were decommissioned.

#### Base Flow Rates of the 1990s.

1. **Ten Mile Creek (Red Star)**<sup>(55)(34)</sup>  
This creek had the highest summer baseflow of 1.2 ML/day.
2. **Porcupine Creek (Green Star)**<sup>(55)(34)</sup>  
Porcupine had a summer baseflow of 0.2 ML/day.

### 3. Yahoo Creek (**Brown Star**)<sup>(55)(34)</sup>

This creek had a summer base flow of 0.8 ML/day.

### 4. Loves Creek (**Blue Star**)<sup>(55)(34)</sup>

Loves had an average summer baseflow of 2.2 ML/day. The Loves Creek Stream Flow Gauging Station has never been closed down and is still in operation today not that it has anything like the passing base flows it used to have.

### 5. Other perennial streams

Other small perennial creeklets also contribute to the flows in Loves Creek before it reaches and flows into the Gellibrand River. Alkemade flows in before the Loves Creek gauging station. Arkuna and Pompa Bill flow in downstream of the gauge. Numerous springs and soaks within the catchment contribute flow to Loves Creek.

## **2008 Re-instatement of Stream Flow Gauging Stations.**

As part of the return to an interest in groundwater at Kawarren in 2007 the Ten Mile and Porcupine Creek stations were re-instated. But, the quality of the re-instatement appeared sub standard. Gauging of flows in the Yahoo Creek was conducted using a bucket and stop watch method.

### **A Decade of Data Lost.**

Overall the effort employed to catch the flow data of these three streams second time around seemed second rate, AND, over 12 years of data was lost.

### **Another Decade of Data Lost.**

The three stations at Ten Mile, Yahoo and Porcupine Creeks were pulled out in 2009. The Ten Mile Creek and Yahoo stations were re-instated in 2019, not that the Yahoo site was anymore than a few rocks put across the creek to form a very leaky barrier.

Since 2008 Porcupine Creek flows were regarded as insignificant and a stream flow gauging station was not re-instated.

Yahoo Stream Flow Gauging Station 2019



How these stones across the Yahoo Creek work must engage a new form of stream flow gauging practices.

### **Stop Start Collection of Data.**

This stop start of stream flow collecting data was dictated by efforts of Barwon Water's to justify the utilisation of a resource. These efforts took place leading up to a renewal of an extraction licence. Short term data collection throughout the history of Barwon Water's Water extraction activities is littered with similar examples. The type of on off and changes to data collection is no less apparent than in the vegetation sites investigations in the upper Ten Mile Creek and Boundary Creek areas.<sup>(48)</sup> Otway water Book 31 deals with this in some detail.<sup>(17)</sup>



By 2017 Loves Creek baseflows had dropped dramatically. By 2019 the creek was barely flowing during summer. See the Wade reports, page [38-39](#).

### **A Home Grown Loves Creek Water Audit.**

In 2009 Land And Water Resources Otway Catchments (LAWROC) Landcare Group conducted a *“Loves Creek Catchment Spring, Wetland and Stream Flow Management Water Plan”* (Unpublished). Essentially it was an effort to determine the inflow and outflow of water movement in the Loves Creek Catchment and make recommendations for future action (see Appendix One, pages [82-84](#), for a copy of these Recommendations).

The idea for an audit came about as a result of the realisation that the water resources in the Loves Creek Catchment were under threat of being unsustainably extracted as groundwater and sold for use outside the Catchment.

- It appeared that the local community was to have little say in this matter.

- This was seen as a threat to a community that relies heavily on the local water resources.
- Demand for extraction of water from the Otway Ranges for urban use was increasing and this demand did not appear to be based on sound resource management principles.
- Residents within the Catchment were becoming alarmed that the limited water resources were seen as infinite by people outside the Catchment.
- “Locals” felt that there was not enough water to service the present allocation demands within the Catchment let alone to service unfettered urban sprawl needs from outside the Catchment.
- This belief of over exploitation required supporting evidence otherwise it would not stand up to any form of scrutiny.

The simple answer seemed to be to draw up a total catchment water balance. That is, compile data that shows exactly what water is available and how it is presently used and see if there is any left over for additional allocation. The success of carrying out such an ambitious plan depended on Catchment landholders’ participation and co-operation. Fifty eight Loves Creek Catchment landholders were involved in the collection of data. The task was not as simple as first thought but encouragingly a draft was drawn up with an amazing amount of local community consultation and participation.

#### **Statutory Authorities Showed No Interest to Help.**

When preparing the plan of action it was hoped that this would inspire the statutory authorities to become involved and help set the directions. No interest was shown other than to say a copy of the finished product would be appreciated. Eleven years later and still no comment from any resource management authority regarding this document.

#### **Loves Creek was Overallocated.**

There can be little doubt that on the data collected, both the surface and ground waters were at the very best fully allocated and at the worst over allocated. If every landholder entitled to a Stock and Domestic water supply exercised their rights, Loves Creek could be dried up many times over. The only possibility for any additional licence was for winter extraction from streams during high flow periods. And then the water would have to be stored in off stream storages.

#### **The Initial Concern Was Extraction at Kwarren.**

Initially and up to around 2014 the major concern was groundwater extraction in the Kwarren/Gellibrand region with the possibility that it would impact in a similar way to the devastation experienced in the Boundary Creek Catchment. In the early days it had not even been contemplated that impact from the Barwon Downs Borefield extractions could spread as far as the Kwarren and Gellibrand area.

### **A Compelling Case.**

Considering the already over allocation of water resources in the Kwarren/Gellibrand area and the local community's reliance on groundwater flows to maintain wetland and environmental integrity and summer stream base flows, there was an extremely compelling case for no groundwater extraction within the Catchment. In the 1990s the case was so strong that groundwater extraction investigation and again in 2009 determined that there should be zero extraction.

### **Community Initiative.**

Even though in 2009 a \$200 million development of the Kwarren Borefield was cancelled the local community knew that the probability there would be further attempts at extracting water from the Gellibrand Groundwater Management Area was extremely high. A valuable lesson had been learnt from the 1990s experiences. Do not assume groundwater extraction will never be proposed again. The very same type of development as was proposed in 2007 was cancelled back in the 1990's and was reported as never to be attempted again. The wording "cancelled" proved to really mean postponed to another time. As a consequence and considering that water management authorities would most likely return again some day; not heading the multitude of problems groundwater extraction creates; the LAWROC Landcare Group decided to take the initiative and prepare for the next time.

## **The New Zealand Report (Hughes).**

The link between relatively recent water resource changes in the Gellibrand River Catchment were considered by locals to be a result of excessive drawdown of groundwater at the Barwon Downs Borefield. The problems being experienced along Boundary Creek (tributary of the Barwon River) and its adjoining wetlands was viewed in Kwarren and Gellibrand as the forerunner of the fate for the Gellibrand River and tributaries in the Loves Creek region. In 2008 LAWROC conducted its first Acid Sulfate Soil test in the Boundary Creek area.<sup>(28)</sup> Water resource managements denied that there was a problem but after numerous Acid Sulfate Soil testing conducted by LAWROC and five years later, it was accepted that there was a huge problem with Actual Acid Sulfate Soils (AASS) in the Boundary Creek Catchment. A massive win for LAWROC's efforts. However, for a number of reasons 16 authorities and universities approached in Australia to go a step further, none would consider investigating the reasons **why** there was an AASS problem. An in-affective consultative group on Acid Sulfate Soils made up of Government Authorities, advised the Colac Otway Shire that to determine the reasons for this calamity would cost between \$200,000 and \$300,000 with no assurance that a result would be found.

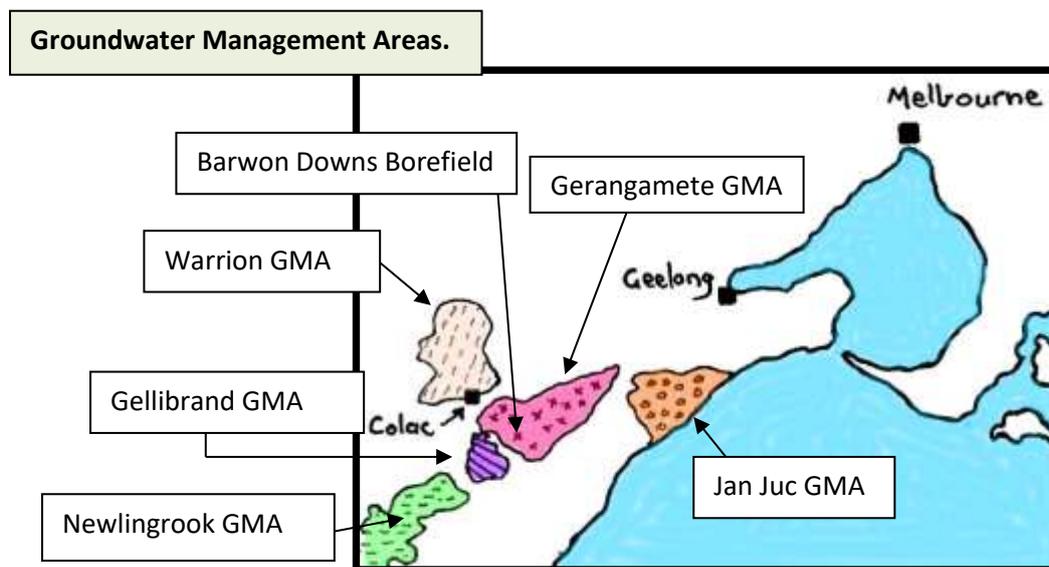
**NOTE:** LAWROC membership on this Government Consultative Group was denied.

### The Hughes Report.

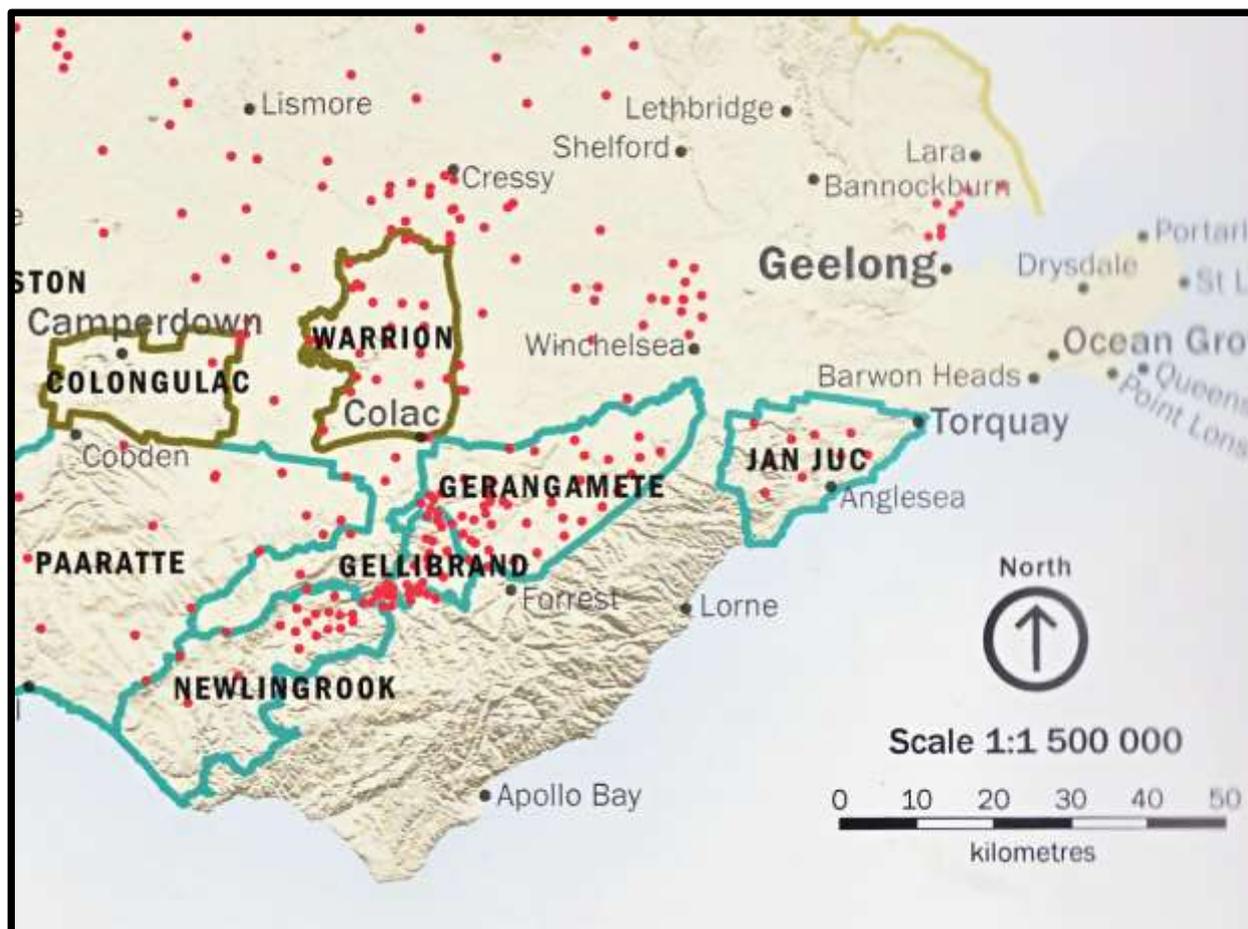
Eventually, LAWROC found a New Zealand firm with the expertise and a price tag within the resources of the LAWROC Landcare Group. The brief given to this firm was to conduct a desk top study to see if the groundwater extraction at the Barwon Downs Borefield was a cause of the environmental impacts within the region. The Hughes reports confirmed that there was a direct link between groundwater drawdown and what was taking place at the surface. This report was the first time “groundwater mining” was referred to as a definite possibility. **“Water levels have struggled to recover from the 1987 – 1990 pumping period and it is considered this is an example of groundwater mining...”** The full report can be read in APPENDIX Two, pages 85-104.

**NOTE:** The Hughes report was reviewed by Robb Potts, Principal Engineer of Lowe Environmental Impact Ltd, NZ, and Matthew Smith, Principal Consents Advisor of Environment Canterbury, NZ.

## Groundwater Management Areas



**MAP 4 SOURCE:** Our Water Our Future, June 2005 , State Water Report 2003-2004.



**MAP 5 SOURCE:** Southern Rural Water/Australian Government National Water Commission, "South West Victoria Groundwater Atlas 2012."

**Research Note as at 2013:** Official Groundwater Management Area Maps were...  
*Newlingrook Groundwater Management Area map is PLAN No. LEGL./04-153.*  
*Gellibrand GMA map is PLAN No. .LEGL./14-134, and*  
*Gerangamete GMA map is PLAN No. LEGL./04-135.*

### **Some Historical Facts regarding These Groundwater Management Areas.**

In the late 1990s the Newlingrook Groundwater Management Area (formally called the Moorbanool GMA, (see NREC Recommendation 14, page 9 above) had a Permissible Annual Volume (PAV) for groundwater extraction of approximately 2,000 ML/year; the Gellibrand Groundwater Management Area was set at zero ML/year and the Gerangamete Groundwater Management Area was set at 4,000 ML/year extraction. By 2002 the Permissible Annual Volume had been changed to a Permissible Consumptive Volume (PCV) allowing annual extractions to be averaged out over a given number of years. In 2004 the PCV for the Gerangamete Groundwater Management Area was reset at 20,000 ML/year.<sup>(20)</sup> The Newlingrook and Gellibrand Groundwater Management Area PCV's stayed as they were.

### **Tim Holding Cancels the Zero PCV for Gellibrand.**

In 2009 Tim Holding the then Minister for Water cancelled the Gellibrand GMA limit to allow Barwon Water to proceed with a stress test pump at Kawarren.<sup>(48)</sup> The pumping test never took place<sup>(33)</sup> but the zero groundwater extraction limit was not replaced until ten years later in 2019.<sup>(31)</sup> At the same time, in 2019, the Gerangamete GMA Permissible Consumptive Volume was reduced by 99% to 239 ML/year.<sup>(31)</sup>

### **In the 1980's Barwon Water wanted to secure and use the Groundwater Resources of the Gellibrand Region.**

The NREC report of 1989 stated there was to be no more stress put on the Gellibrand River.

*“The NREC could not entertain any option which would further stress the Gellibrand River...”* Recommendation 9.

Despite this Barwon Water was given the go ahead to investigate groundwater extraction in the Gellibrand Kawarren area. However, there were no assurances that this would naturally lead to a groundwater extraction licence.

*“The Geelong and District Water Board should be free to pursue investigations but at its own cost and with no prior assurances that any commitment to additional water resources will be given.”* Recommendation 16.

### **Reasons for Groundwater Investigations.**

There were three reasons why groundwater extraction investigations were allowed to go ahead.

1. The Geelong and District Water Board (Barwon Water) presented the case that Geelong was running out of water.
2. There was a strongly voiced public concern against the construction of any more large urban water supply dams.
3. Underground aquifer storages of water were utilised world wide and were seen as a safe option with little environmental impact.

*“Because the use of groundwater usually has few adverse environmental effects, it is often favoured over surface sources which can have marked effects”*<sup>(16)</sup>

This sentiment was repeated that often in the Department of Water Resources documents prepared as part of the NREC hearings, and, rather than being accepted as a generality that someone had thought up, it became an accepted truth. This urban myth type of thinking lasted well into the 21<sup>st</sup> century. What this in effect did was to allow the sanctioning of an ignorance of the connectedness between groundwater ecosystems

and surface water ecosystems in the Otway Ranges. Water resource managers and decision makers had a lot to learn. Recommendation 4 of the NREC report reflected this.

***“ Detailed investigation of groundwater systems***

- *location of recharge areas*
- *interconnection between ground and surface water systems*
- *quality of the groundwater*
- *magnitude of the groundwater*
  
- *effects of using groundwater on surface and groundwater systems*
- *develop economically viable groundwater resources before development of further surface water resources.”*

Recommendation 4, NREC Report.

The movers and shakers of the time appeared to have no knowledge of, or were prepared to overlook the facts that in the Otway Ranges, perennial surface baseflows during summer and dry periods was totally dependent on overflowing underground aquifers. An acceptance that any degree of groundwater extraction has an impact on the amount of water that flows from the aquifers into the surface water ecosystems, was sadly lacking.

## **The 2007 Kwarren Borefield Investigation**

### **2007 Back Again.**

As detailed earlier the 1990s attempt to extract groundwater from the Kwarren Borefield was abandoned. However, and despite a zero Permissible Consumptive Volume (PCV) for the Gellibrand Groundwater Management Area, Barwon Water was back at the Kwarren Borefield in 2007 looking at extracting 16 GL.

### **Service Contract 10643.**

Some-time before 2007 Barwon Water had issued a Service Contract to SKM<sup>(5)</sup> to develop a 16 GL/year extraction at the Kwarren Borefield, involving:

1. Land acquisition,
2. Setting up of extraction and pumping station pumps
3. Building of a treatment plant,
4. Piping connecting to the Geelong supply system,
5. Power line connection,
6. Roding, and
7. Easement requirements.

The project budget was set at \$200,000,000.  
(Otway Water Books 3<sup>(23)</sup> and 23<sup>(21)</sup> deal with this in some detail)

### **3 ML/year Will Stop the Gellibrand River Flowing.**

Earlier 1982 groundwater research estimated<sup>(62)</sup> that groundwater extractions at either the Gellibrand Borefield or the Kwarren Borefield of 3 ML/year, would turn the Gellibrand River from a gaining river into a losing river for the length of 17 kilometres upstream and east of the Colac to Gellibrand Road bridge. In summer this stretch of the Gellibrand River would dry up. Based on this finding a 16 GL/year extraction rate would be catastrophic.

### **Deliberate or Accidental?** (See page 136).

The 2007 groundwater extraction project in the Gellibrand Groundwater Management Area at Kwarren, was called “The Newlingrook Groundwater Investigation...” Kwarren is in the middle of the Gellibrand Groundwater Management Area and the Kwarren borefield is at least 12 kilometres away from the closest boundary of the Newlingrook Groundwater Management Area (see Map, pages 25-26). At the time the Newlingrook Groundwater Management Area PCV allowed groundwater extractions whereas the Gellibrand area had a legislated zero groundwater extraction level. The Gellibrand and Kwarren community believed the naming of the project as “Newlingrook” to be a calculated and deliberate misnaming to gain some justification that extraction investigations could be allowed at Kwarren.

The local community lodged a protest and made it quite clear to Barwon Water that a mistake had been made including Newlingrook in the project name. But to no effect. Nothing changed over six years of protest up to when the final report was released.

### **After the project was abandoned:**

- a 2009 Freedom Of Information request for a final report (Barwon Water Ref:15/260/0007C(2)) stated a report would not be completed,
- numerous follow up phone *calls*. *Such an expensive project would have demanded a final report,*
- a letter in reply to these phone calls stating any report was not a high priority. *Finally it was stated a report was imminent – sometime),*
- another FOI sent in November 2012, and

a final report was “extracted” from Barwon Water in 2013,<sup>(21)</sup> four years after the project had been abandoned.

The request for a hard copy of the report elicited the website from which the report could be downloaded. No hard copy was provided.

### **Still Called the Newlingrook Investigation.**

In the FINAL report the project was stilled named “Newlingrook Investigation.” If would appear only one conclusion can be drawn regarding the naming. That it was a deliberate and calculated act not to be reversed and to remain a historical “fact.” Perhaps another urban myth created.

### **Illegal Groundwater Extraction 2007.**

The first stage of the stress test pump at Kawarren involved an illegal extraction of 6 ML of water in July 2007. This pumping was done without Southern Rural Water permission. No licence had been granted for this exercise.

*“I am advised that SRW did not issue an approval for the pump test. However, given the small volume of groundwater extracted our attention is focused on the proposed, and far more significant, three month test.”* (Email from Dr. Martin Kent of Southern Rural Water (SRW) Friday 28 December 2008, 12:29:36 PM) (See Otway Water Book 17<sup>(20)</sup> *“Truth Honesty & Integrity or the Slippery Dance of the State Authorities,”* for a full account of this action.)

## **Southern Rural Water’s Kawarren (Newlingrook) Borefield Submissions Process - 2008.**

### **One Advertisement.**

Southern Rural Water placed one advertisement in the Colac Herald 1 February 2008 calling for submissions regarding Barwon Water’s *“Expression of Interest Regarding Pump Testing of a Groundwater Bore,”* at Kawarren.

### **Submissions to be in by 18 February 2008.**

Submissions had to be in by 18 February 2008. The address to send any submission to was *incorrect* in the advertisement.<sup>(24)</sup>

Over 30 submissions opposing the expression of interest were sent to SRW.

### **10 April 2008 Day and Night Hearing.**

Southern Rural Water decided to put aside a day and night session for these objectors to verbally present their cases. This was held on 10 April 2008 in the Colac COPAC building. Approximately 23 objectors took up this opportunity.

### **Serious Community Involvement at Last.**

Up to this stage Barwon Water’s community involvement was appalling but at long last it appeared that SRW was serious that local input was being listened to. Unfortunately, this community involvement was a tick the box exercise with little to no real commitment to listen to what the community had to say.

### **October 2008 a Decision Given.**

Eight months after Southern Rural Water began its deliberation and community involvement in the groundwater extraction project proposed by Barwon Water, the licence was given unchanged.

### **This Process Was A Farce.**

However, 14 days after the verbal submission presentations way back in April, Minister Tim Holding made it abundantly clear that there was to be no affective community involvement, no engagement or discussion of any consequence (see pages 32-33). The Southern Rural Water consultative process was simply tokenism, farcical and an elaborate window dressing kidding local communities into thinking that a democratic process was being followed. The decision to allow Barwon Water to proceed had already been made. The following letter sent to a community member was not recognised by the receiver as important until very late in the year and by then the community consultation was all but finished.



## Minister for Water

Ref: DSE048544  
File: CS#030527

121 Exhibition Street  
Melbourne, Victoria 3000  
GPO Box 4509  
Melbourne, Victoria 3001  
Telephone: (03) 8684 8000  
Facsimile: (03) 8684 8014

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Mr Charles Kohout  
125 Carlisle Gellibrand Road  
GELLIBRAND VIC 3239

24 APR 2008

Dear Mr Kohout

### TEST PUMPING OF GROUNDWATER

I refer to your letter received on 27 November 2007, to the Premier, the Hon. John Brumby MP, regarding the test pumping of groundwater at Love Creek by Barwon Water. As the issue falls within my responsibility as the Minister for Water, your correspondence has been forwarded to me for response.

In October 2006, the Victorian Government published *The Central Region Sustainable Water Strategy*, which outlines actions to secure water supplies for homes, farms, businesses, industry and the environment for the next 50 years. These actions will help improve the health of rivers and secure supplies for Melbourne, Geelong, Ballarat and the State's inner west.

The Strategy identified two options for Geelong's future water supplies: a pipeline connection to Melbourne or utilisation of groundwater resources from the Newlingbrook aquifer system. In May 2007 the Government announced that connection to Melbourne was the preferred option. However, the Newlingbrook resource appraisal program will continue, to improve our knowledge of the extent, quality and properties of groundwater in the area.

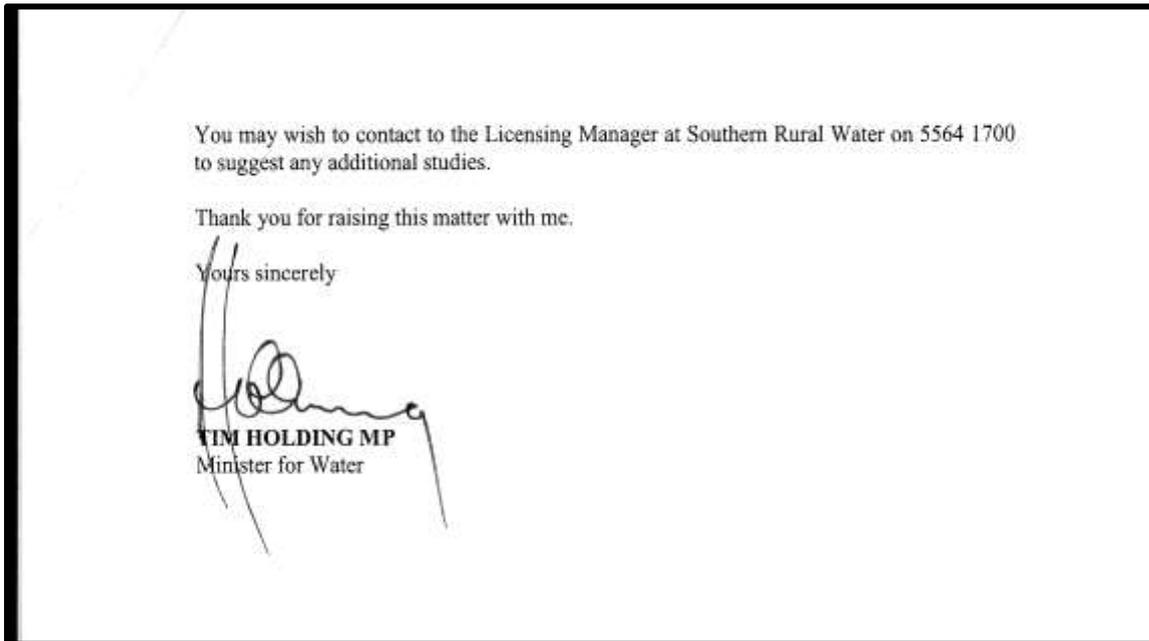
The study into the Newlingbrook aquifer system is occurring at several sites, including an existing bore in Kwarren. As is normally the case, extensive field surveys and investigations are being undertaken, and test pumping will assist in determining the aquifer's basic characteristics, including flow rates, draw down rates and recovery rates.

As you may be aware, Southern Rural Water held a meeting on 10 April 2008 with those people who lodged submissions following the advertising of Barwon Water's Section 51 licence application. **This licence will be issued for 13 months and will allow Barwon Water to pump groundwater from an existing bore in Karaween.** The water will be treated and discharged into Love Creek. Subsequent to the testing period, any long-term licence application from Barwon Water will be subject to public consultation.

#### Privacy Statement

Any personal information about you or a third party in your correspondence will be protected under the provisions of the Information Privacy Act 2000. It will only be used or disclosed to appropriate Ministerial, Statutory Authority, or departmental staff in regard to the purpose for which it was provided, unless required or authorised by law. Enquiries about access to information about you held by the Department should be directed to the Manager Privacy, Department of Sustainability & Environment, PO Box 500, East Melbourne, 3002.





In April 2008 this letter states,

*“This licence will be issued...”*

but the public consultation process regarding this licence, that Southern Rural Water had put in place in February, did not conclude until October 2008. Farcical?

Southern Rural Water’s decision in October was exactly as Minister Holding said it would be – the licence was issued allowing groundwater extraction at the Kawarren Borefield. So much for community consultation and input.

### **What a Joke!**

How ludicrous for the Minister for Water to also include in his letter, “... *any long term licence application from Barwon Water will be subject to public consultation.*”

The Minister for Water should have also added that the consultation will have no impact what so ever and participants will be wasting their time. But, go ahead anyway. Decisions will be made regardless of community input. Such a process sets a terrible example and only encourages applicants of “shoddy” groundwater extraction licences to believe that community concern and influence is of little importance.

### **Preparation Work Proceeds.**

Throughout the community consultation process regarding the granting of the actual stress test pump, licence preparation work proceeded. The extraction

bore was tested and checked; water was extracted; additional bores were drilled; spring surveys started and stream flow gauging stations reinstated.

### **Work to be Done on the Quiet.**

However, openness and transparency with this investigation was sadly lacking from the start. The stress test pump was to be done quietly with the minimum of fuss. Luckily the farmer across whose property the 6 million litres of water had to be discharged was notified and showed some concern. 6 ML of water is no small amount from a farming point of view. Nor was it acceptable to release it over private property with toxic elements.<sup>(21)</sup> Interim reports had to be obtained through the Freedom of Information process.

### **EPA Demands a Restart.**

The EPA demanded that Barwon Water restart its initial work when a community analysis of a report submitted to the EPA was shown to contain numerous faults (see Appendix Six, pages 112-129). The Barwon Water report was seeking EPA approval to proceed.

### **Off to VCAT on Appeal, 2009.**

As explained above, the community consultation process finished and Barwon Water was granted a licence to proceed with a stress test pump at Kwarren. Numerous groups lodged an appeal with VCAT objecting to the granting of a groundwater extraction licence.

Hours and hours of work went in to preparing for the VCAT appeal. However, twenty four hours before the appeal, Barwon Water withdrew its application. The Kwarren (Newlingbrook) Borefield Investigation was dead in the water for a second time. However, this meant Barwon Water could reapply at any time.

### **Champagne and Celebration in the 1990s.**

When Barwon Water abandoned and walked away from the efforts to extract groundwater from the Kwarren Borefield in the 1990s one could almost feel the ripple and hear a sigh flow throughout the Gellibrand and Kwarren community. The case had been proven that groundwater extraction would have caused untold environment damage and should never be contemplated.

### **An Unfortunate but Understandable Case of Complacency.**

In the 1990s groundwater studies and investigation in the Gellibrand Catchment were so conclusive the anti-groundwater extraction campaigners basically dropped the ball. Any future campaign was never contemplated. As a

consequence loose ends, outstanding and finished reports, investigations and data were not collected, catalogued and or stored for future reference.

It was unthinkable that any authority would want to repeat the disastrous impacts taking place along the Boundary Creek catchment just across the next valley from Kawarren.

### **Behind the 8 Ball When the 2007 Stress Test Pump Came Along.**

Not having a “library” of information proved to be a huge disadvantage when Barwon Water returned to the Kawarren valley in 2007 seeking 16 GL/year of groundwater. It took an enormous effort to get up to speed tracking down the reports from the 1990s. Some of them could not be found but many were.

### **A Lesson Well Learnt.**

The second time Barwon Water abandoned and walked away from any thought of extracting groundwater from the Kawarren Borefield in 2009, the celebration was short and brief. The community, lead by LAWROC Landcare Group knew that much work was required to prepare for the next groundwater extraction effort. An example of how difficult this task was, as outlined earlier, it took nearly 4 years to “extract” a final report on the Kawarren 2007-2009 (Newlingbrook) groundwater investigation. Forty five months after the work had been abandoned and at one stage it was quoted that there would be no final report.<sup>(21)</sup> A final report on the 2009 investigation was needed for future reference.

### **Where to From 2009?**

There were several things identified by LAWROC that needed attention. Things that were regarded as important to complete in readiness of any future groundwater extractions.

1. Collect and file as much data, reports etc. as possible.
2. Identify any loose ends that needed to be finalised. For example the reinstatement of the zero PCV for the Gellibrand Ground water Management Area.  
(This did eventually happen ten years after it was cancelled. It took to 2019 to achieve.)
3. Support the rights of landholders in the Boundary Creek Catchment.  
(This was achieved with a multi-million dollar water branch line for farmers who could no longer use Boundary Creek water.)
4. Record anecdotal evidence of impacts becoming apparent in the Gellibrand River Catchment.
5. Investigate areas of research being ignored by water resource managers in the Upper Gellibrand River and Loves Creek Catchments.

6. Identify researchers prepared to carry out independent research for LAWROC.
7. Prioritising research avenues.

## The Wade Reports.

The Wade reports were commissioned as follow up research that State Government water resource managers were not prepared to do.

Because the Gellibrand River and the Loves Creek Catchment areas gave an outward appearance of being in reasonable to good environmental health, little notice was taken of the local community's concerns that the Boundary Creek type scenario impact was starting to occur in the Gellibrand and Kwararren valley.

Alan Wade prepared four reports for LAWROC Landcare Group.

**Report One.** 2015.

*“Stage One Consideration of Impact on the Kwararren/Gellibrand Area from Groundwater Extraction at Barwon Downs.”*

**Report Two.** January 2017.<sup>(61)</sup>

*“Impacts Of Barwon Downs Extraction On Groundwater And Surface Water In The Kwararren Area.”*

**Report Three.** 5 November 2019.

*“Impacts Of Barwon Downs Extraction On Groundwater And Surface Water In The Kwararren Area – Part B (Updated).”*

**Report Four.** 19 December 2019.<sup>(60)</sup>

*“Potential Impacts Of Barwon Downs Extraction On Groundwater In Barongarook Creek Catchment.”*

**Report One** confirmed there was justification for the Kwararren and Gellibrand community to be concerned that monitoring for early warning signs of impact from the Barwon Downs Borefield was not in place. The magnitude and significance of impacts to baseflows had not been assessed and neither had the reasons for the unusual drawdown in the Kwararren area been investigated. The observable data indicated warning signs were appearing.

**Report Two** completed 7 years after the Millennium Drought, found the Loves Creek baseflow from groundwater discharge had been reduced by 50% and concluded that the only reason for this was the drawdown from the Barwon Downs Borefield.

*“As a result of extraction from Barwon Downs Borefield, it is the author’s conclusion that the minimum flow in Love Creek has been reduced by approximately 50% to date.”*

*“...the impact on Love Creek baseflow has already been significant. Before significant future extraction takes place from the Borefield, the impact of past extraction must be understood.”*

Serious pumping ceased in 2010 with a small extraction in 2016 and yet the results of the ripple effect from earlier extractions was spreading into the Kawarren region. This was despite numerous wet winters.

**Report Three.** Nearly three years after Report Two had been completed and despite continual efforts by various members of the Kawarren/Gellibrand Community on several community reference groups, still nothing had been done to address concerns, such as the 50% decline of baseflows in the Loves Creek Catchment. LAWROC Landcare Group, once again outlayed the huge cost to have a follow up report prepared on Loves Creek.

#### **Worsening Baseflow Conditions.**

In November 2019 Wade found that baseflows in Loves Creek had dropped another 10%

*“As a result of extraction from Barwon Downs Borefield, it is the author’s conclusion that the minimum flow in Love Creek has been reduced by over 60% to date.”*

*“A significant reduction in baseflow has been observed.”*

#### **Catastrophic Impacts.**

Wade feared that the Loves Creek Catchment could suffer catastrophic impact even without further extractions.

*“In August 2017, it was thought that a similar volume if extracted from the Borefield (as was extracted up to 2014), then a similar step in drawdown could be expected in the Kawarren Sub-basin. However, based on additional and more recent data and trend analysis, this author’s opinion has changed. The groundwater level may fall below the level of Ten Mile Creek in the discharge area, thereby inducing periods of no flow even if there is no further pumping at the Borefield. Data demonstrates that there are delayed impacts across the Kawarren Sub-basin years after pumping stops. Periods of no flow would cause a catastrophic impact to the aquatic ecosystem of the creek due to its dependence on perennial flow.”*

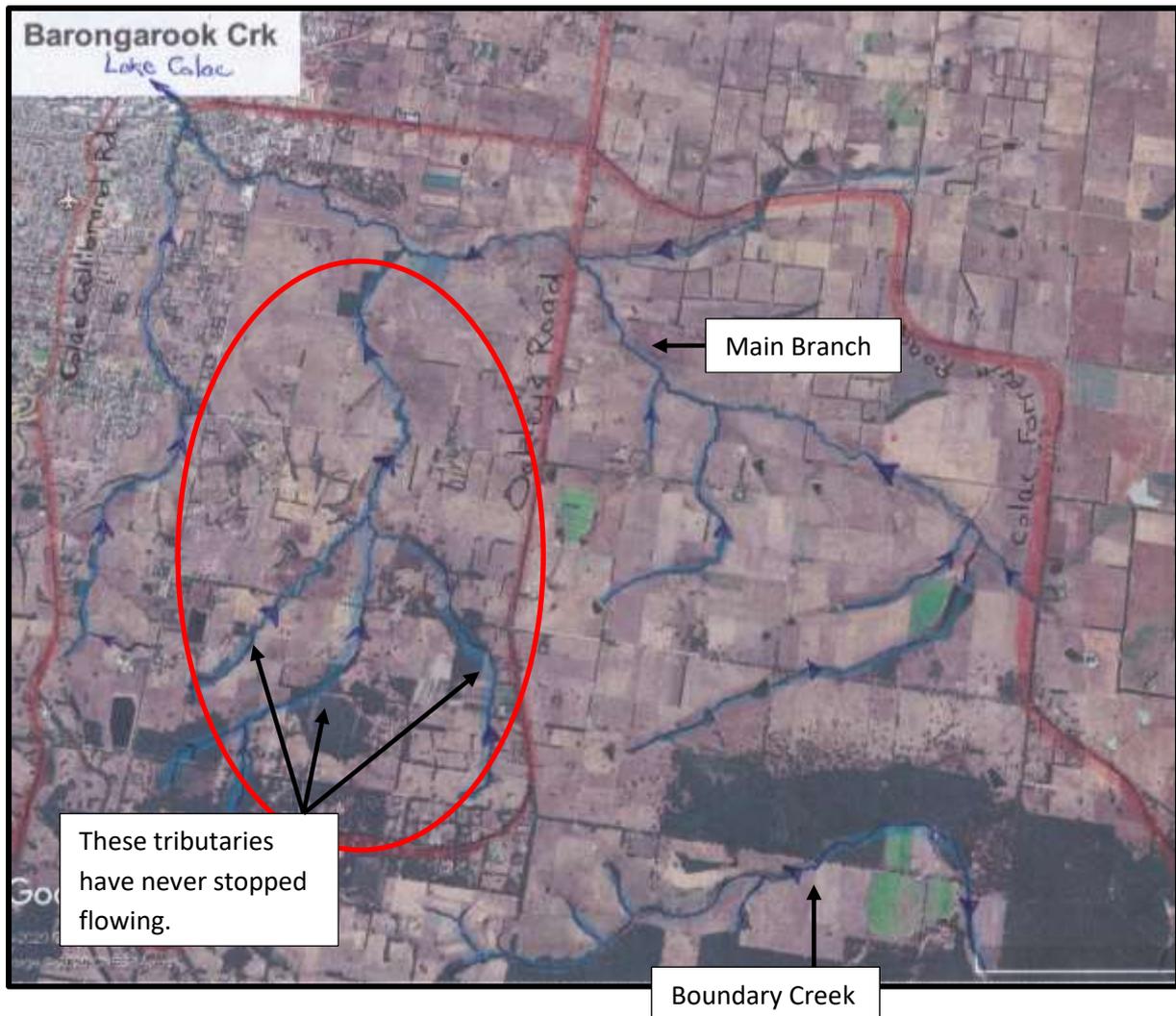
## **Report Four.**

Very little data collection or resource management comment has been done in regard to the Barongarook Creek. Local concerns included lack of no flow for months of the year in the main branch (see map page 39) and the appearance of Actual Acid Sulfate Soils.<sup>(28)</sup> As the head waters of the main branch of the creek starts well inside the area of drawdown influence from the Barwon Downs Borefield, it was seen by the LAWROC Landcare executive that a preliminary study should be conducted to assess any apparent connection between the Barwon Downs Borefield pumping history, and the drawdown in the Barongarook Creek catchment. Hopefully, this would encourage water resource managers to also look at this creek. Once again support for such an enterprise was not given. LAWROC was on its own again and Wade was commissioned to conduct the study.

### **Two Observations made by Wade in Report Four.**

1. *“There is a considerable possibility that Lake Colac water level is more influenced by the Barwon Downs Borefield pumping than rainfall. This should be investigated...”*
2. *“Herein the Barongarook Creek groundwater system is shown to be sensitive to the Barwon Downs Borefield pumping, even more so than to the upper reaches of the upper Boundary Creek stream baseflow. Rainfall has little to do with reduced baseflow. If any.”*

This Wade reports highlights the fact that there are many areas of investigation that require pursuing in the interest of water levels in Lake Colac; land holders rights to Stock and Domestic water; the creation of Actual Acid Sulfate Soils and the health of ecosystems within the Barongarook and Loves Creek catchments.



Even though the main branch of the Barongarook Creek has regularly stopped flowing during most of the year since groundwater extraction, there are tributaries to the west that have continued to flow. Otway Water Book 11, pages 78-85, discusses these tributaries that have continued to flow even during the Millennium Drought.

## In 2018 the Minister For Water Steps In.

### Remediation and Environmental Protection Plan (REPP).

Environmental problems and degradation of the Big Swamp and Boundary Creek finally came to a head in 2018. In a Media Release “Remediation Plan for Otway Waterways” from the Hon. Lisa Neville MP, she is quoted as saying...

***“Maintaining the health of these vital waterways is vital for both the Geelong community and the local environment”*** (see Appendix Three, page 105)

***“I will ensure the health of our local waterways is prioritised, and that locals are kept well informed on the development of the remediation plan.”*** (see Appendix Three, page 105)

This media release was announcing the issuing of a legally enforceable Remediation Plan under a Section 78 Notice.<sup>(29)</sup>

The Plan had to include a Remediation and Environmental Protection Plan (REPP) for Boundary Creek, the Big Swamp ***AND the surrounding area.***<sup>(29)</sup> Part of the Directive required Barwon Water to identify the area that the plan covered. It was clear that Barwon Water initially regarded the surrounding area to be in close proximity to the Big Swamp along Boundary Creek and no further. Community representatives on groups involved in the development of the Plan voiced their concern that the plan should have a much wider scope. Anywhere within the drawdown area of influence exhibiting impacts should be included. In one of the reports written by Jacobs<sup>(44)</sup> in 2019 and included as part of the Remediation and Environmental Protection Plan (REPP) sent to Southern Rural Water, it states ***“The scope of works developed to meet the requirements of the Section 78 notice outlines a detailed program of works required to inform the remediation of the swamp...”*** This was regarded as phase one of any remediation or investigation, and, problems in the “surrounding area” would be dealt with at a later stage. The excuse being that there was insufficient data available to delineate any other problem in the surrounding area.

**What Nonsense!** (A Case of Dumbing Down the truth).

***“There is currently insufficient monitoring data to identify if historical groundwater pumping at Barwon Downs has caused any measurable impact to sensitive environmental receptors other than Boundary Creek and Big Swamp.”*** What nonsense. This is not the case. The evidence is there.

Three years earlier in 2016 Jacobs had this to say,

***“No evidence was found that declining groundwater levels caused by groundwater extraction at Barwon downs had a negative impact on vegetation health in the catchment.”***<sup>(42)</sup> Not that this statement was nothing new. This myth has been strenuously debunked on numerous occasions.<sup>(17)</sup>

In March 2003 Barwon Water had this to say, ***“No long-term flora and fauna impacts have been detected in the Boundary Creek area resulting from the operation of the Barwon Downs wellfield.”***<sup>(4)</sup> and by...

2012 was still insistent that there was no long term environmental impact caused by the Borefield. ***“...water table drawdown occurs during pumping, but no long-term environmental impacts have been linked to borefield operation.”***<sup>(3)</sup> There is always the chance if something that is not true is repeated often enough it will eventually be accepted as true. This is especially

so if these untruths are never corrected in historical records. Another urban myth created.

### **Back to the Surrounding Areas Impacted.**

The sections of the Remediation and Environmental Protection Plan (REPP) dealing with the surrounding environment investigations has one obvious short coming. Those impacts in the surrounding environments that have already been confirmed have been ignored. Not only does the REPP states that it may take 3 years before ANY remediation in the surrounding area takes place, any remediation is also regarded as a maybe. Therefore, any impacts already confirmed will have no remediation done for at least three years and maybe not even then.

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

Principle 3 in the REPP also states that ... *“Barwon Water will consider remediation actions and controls in the area which surround Boundary Creek and Big Swamp if measurable and evidence-based scientific methodologies conclude that historical groundwater pumping at Barwon Downs Borefield has caused an environmentally significant adverse impact in the area.”* What environmentally significant adverse impact means is not defined. It is arguable that these words should not even be included in the statement. Otway Water Book 42 J lists 11 such evidence based and observable impacts present in the surrounding area (see Appendix Four, page 106, for an extract of these confirmed impacts in the surrounding area).

Many of these confirmed impacts are contained in Barwon Water’s own documentation. Even when evidence based impacts have been written up in Barwon Water’s own documentation they are not being accepted as confirmed impacts requiring the same consideration as Boundary Creek and the Big Swamp.

### **Further Dumbing Down the Intentions of the S78 Notice.**

In Barwon Water’s Scope of Works Executive Summary<sup>(2)</sup> there can be no dispute at Barwon Water’s interpretation of what “... *the surrounding environment* ...” means when the following quote is considered.

*“... to develop and implement a Remediation Plan for the Boundary Creek and Big Swamp environments.”*

However, in the same Barwon Water document one may be influenced to think the opposite... *“The purpose of the Notice is to ensure that Barwon Water successfully remediate impacts caused by historic groundwater extraction.”*<sup>(2)</sup>

Perhaps, Barwon Water is serious about wider ranging, Big Picture, impacts.

But, despite Wade's work Barwon Water's consultants, Jacobs, support the notion that the impacts requiring remediation are restricted to a very small defined area around Boundary Creek and the Big Swamp. "*The report* (Jacobs June 2017) *concluded that no other rivers or creeks have been impacted as significantly as Boundary Creek through change to baseflow by operation of the borefield.*"<sup>(43)</sup> 60% reduction of baseflows in Loves Creek is getting close to the Boundary Creek dilemma and as Wade states is getting very close to catastrophic.

### Reduced Flow in the Gellibrand River.

What little work Barwon Water has commissioned dealing with the impacts in the Gellibrand and Kwararren areas is largely based on models. Unfortunately, the Gellibrand and Kwararren region is on the extremity of the models used. The extremities of models are notoriously inaccurate. Added to this limiting factor is the poor record of the numerous models used in the past.<sup>(25)(52)</sup> (Also, see page 54 and Appendix Five, pages 107-111)

Wade recognised this and disputed an example of modelling results with the following statement...

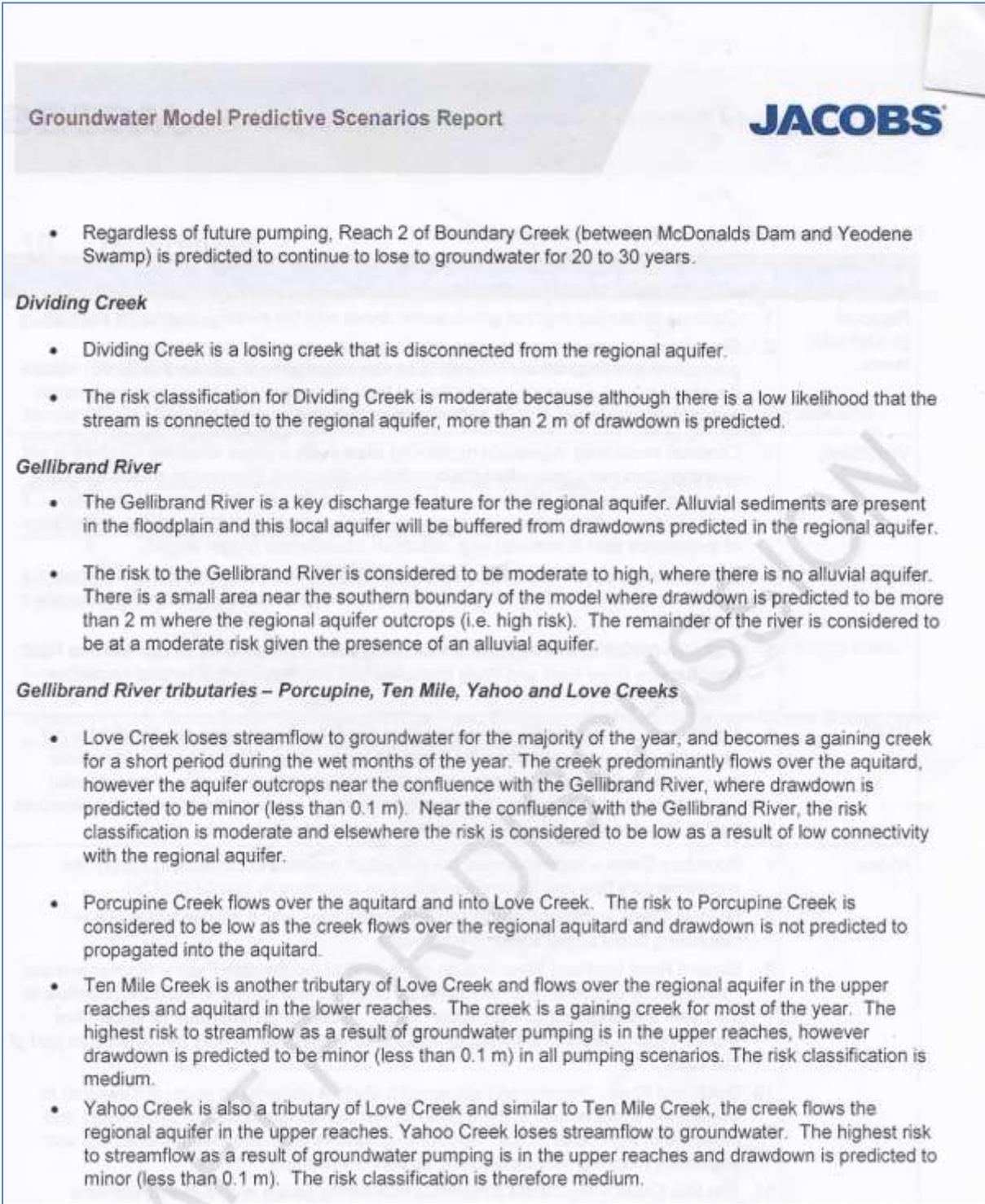
*"A quote (Executive Summary of Jacobs 2018a) "Climate conditions have caused more of reduction in a baseflow to the Gellibrand River than pumping from the bore field in this section of the River over the model time frame" is disputed. All of the hydraulic gradient reduction by approximately 10% over the last 15-20 years, and consequently the reduced flow into the Gellibrand River, is a direct result of the Barwon Downs Borefield."*



**Summer Flow in Loves Creek: bottomed out and going no-where. "No fish here!"**

## Gaining and Losing Streams in the Loves Creek Catchment.

During 2016 and 2017 Jacobs carried out hydrogeological studies refining its groundwater model and producing predictive scenarios. A draft report was released in December 2018.<sup>(41)</sup> The following extract has been taken from this report, describing modelled predictions.



**Groundwater Model Predictive Scenarios Report**

**JACOBS**

- Regardless of future pumping, Reach 2 of Boundary Creek (between McDonalds Dam and Yeodene Swamp) is predicted to continue to lose to groundwater for 20 to 30 years.

**Dividing Creek**

- Dividing Creek is a losing creek that is disconnected from the regional aquifer.
- The risk classification for Dividing Creek is moderate because although there is a low likelihood that the stream is connected to the regional aquifer, more than 2 m of drawdown is predicted.

**Gellibrand River**

- The Gellibrand River is a key discharge feature for the regional aquifer. Alluvial sediments are present in the floodplain and this local aquifer will be buffered from drawdowns predicted in the regional aquifer.
- The risk to the Gellibrand River is considered to be moderate to high, where there is no alluvial aquifer. There is a small area near the southern boundary of the model where drawdown is predicted to be more than 2 m where the regional aquifer outcrops (i.e. high risk). The remainder of the river is considered to be at a moderate risk given the presence of an alluvial aquifer.

**Gellibrand River tributaries – Porcupine, Ten Mile, Yahoo and Love Creeks**

- Love Creek loses streamflow to groundwater for the majority of the year, and becomes a gaining creek for a short period during the wet months of the year. The creek predominantly flows over the aquitard, however the aquifer outcrops near the confluence with the Gellibrand River, where drawdown is predicted to be minor (less than 0.1 m). Near the confluence with the Gellibrand River, the risk classification is moderate and elsewhere the risk is considered to be low as a result of low connectivity with the regional aquifer.
- Porcupine Creek flows over the aquitard and into Love Creek. The risk to Porcupine Creek is considered to be low as the creek flows over the regional aquitard and drawdown is not predicted to be propagated into the aquitard.
- Ten Mile Creek is another tributary of Love Creek and flows over the regional aquifer in the upper reaches and aquitard in the lower reaches. The creek is a gaining creek for most of the year. The highest risk to streamflow as a result of groundwater pumping is in the upper reaches, however drawdown is predicted to be minor (less than 0.1 m) in all pumping scenarios. The risk classification is medium.
- Yahoo Creek is also a tributary of Love Creek and similar to Ten Mile Creek, the creek flows the regional aquifer in the upper reaches. Yahoo Creek loses streamflow to groundwater. The highest risk to streamflow as a result of groundwater pumping is in the upper reaches and drawdown is predicted to be minor (less than 0.1 m). The risk classification is therefore medium.

These model generated statements and predictions require some examination.

**Loves Creek.**

The Jacobs modelled results found Loves Creek to be a losing stream for the majority of the year and a gaining stream for a short period during the wetter winter months.

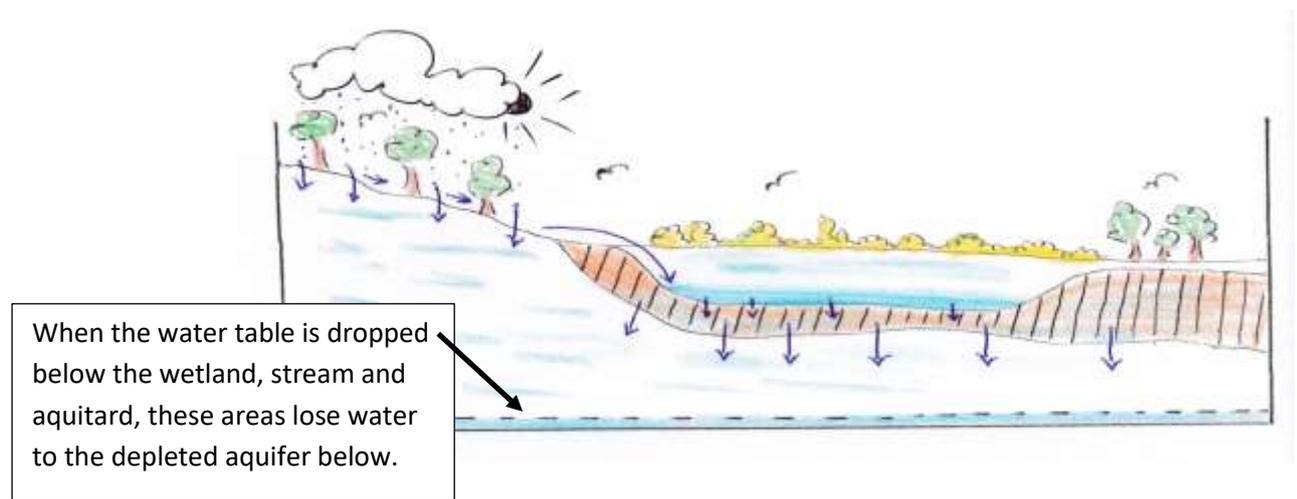
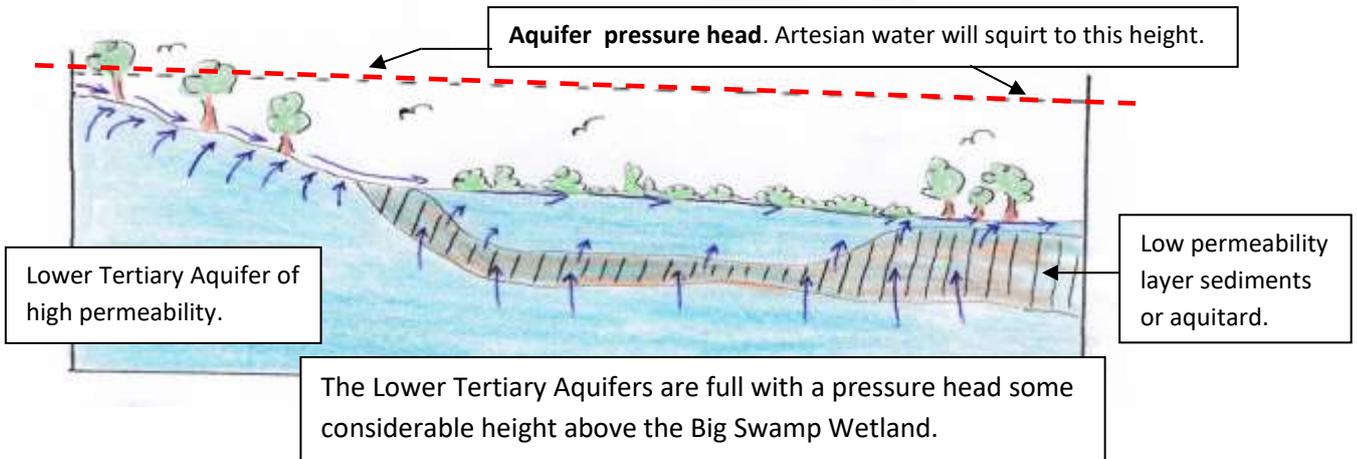
*“Love Creek loses streamflow to groundwater for the majority of the year and becomes a gaining creek for a short period during the wet months of the year.”<sup>(41)</sup>*

Questions that arise as a result of this statement are:

- What data has been put into the model to reach these conclusions?
- How was this data collected?
- Why is Loves Creek a losing stream?
- Where does the water disappear to?

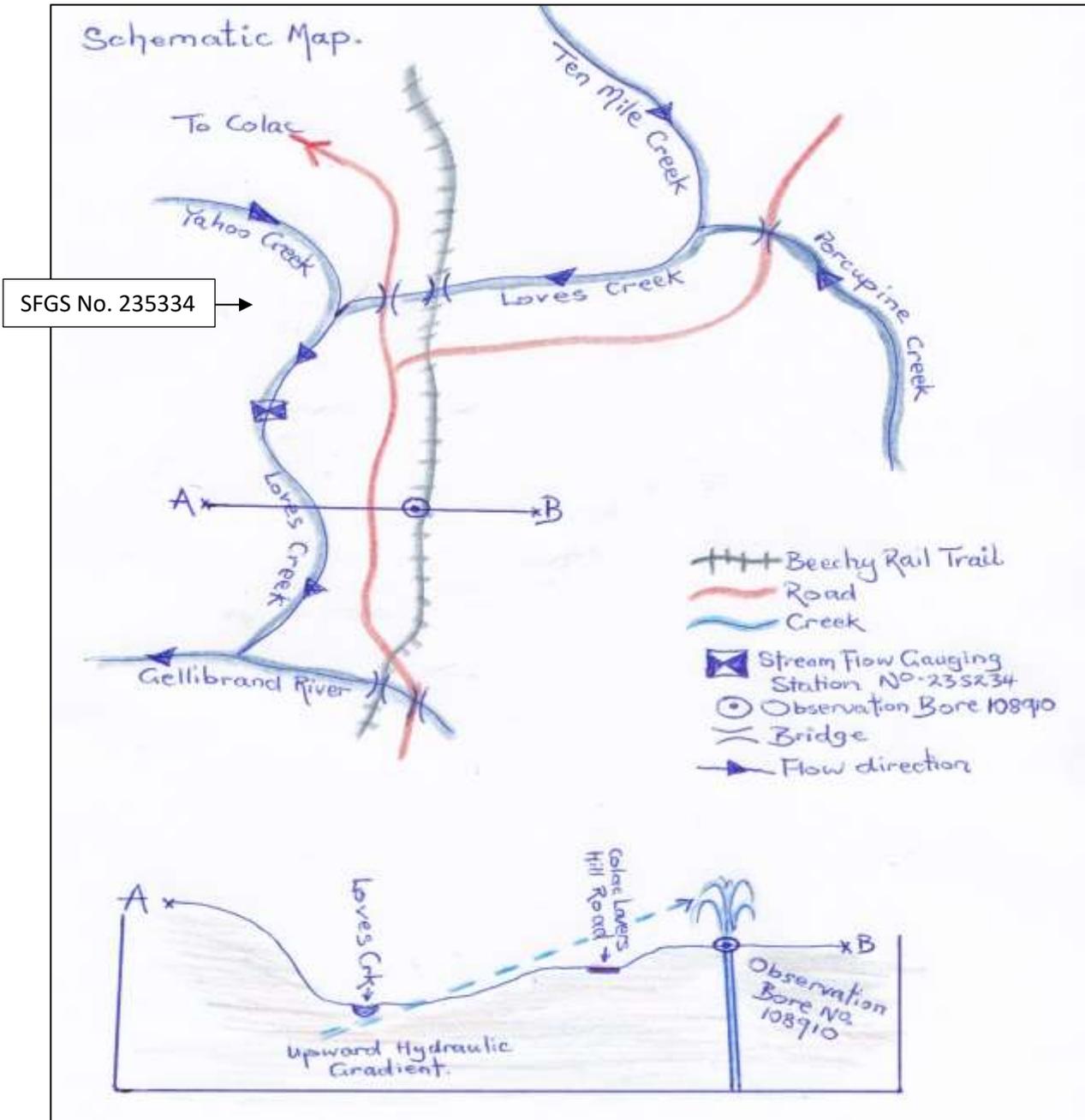
For example, Boundary Creek became a losing stream because the groundwater levels under the creek were dropped causing a “space” that needed to be replenished. Before massive groundwater extraction there was an upward hydraulic gradient into Boundary Creek from the full aquifers forcing groundwater to overflow up into the creek. In other words the pressure head below from the aquifers, was above the stream bed. Lower the upward pressure below the stream bed and a summer flowing creek dries up.

The following figures show how this is possible.



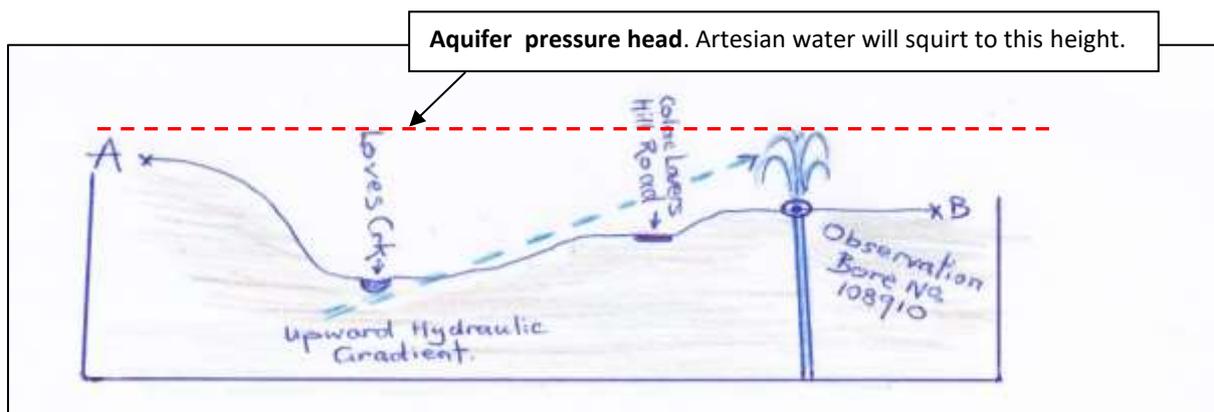
### How was it Possible for Modelling to Reduce Loves Creek as a Losing Stream?

At the time when the modelling results were being calculated there was only one Stream Flow Gauging Station (SFGS) (Number 235234) in the Loves Creek Catchment. As can be seen in the schematic drawing below this SFGS is in the middle of the Loves Creek reaches. To calculate flows along a stretch of a stream you would need to know what comes into that stream and what pours out at the other end. A SFGS in the middle would not provide the data necessary to make this calculation.



### Upward Hydraulic Gradient.

Between the stream bed of Loves Creek and State Observation Bore 108910 there is an upward hydraulic gradient. In other words there is an aquifer pressure head that is attempting to force water up to a height way in excess of the Loves Creek stream bed. If anything, this indicates Loves Creek should be a gaining stream. But most definitely not a losing one. Because Bore 108910 is always under pressure it would be a rare situation if Loves Creek is not a gaining stream all of the year created by this upward pressure head.



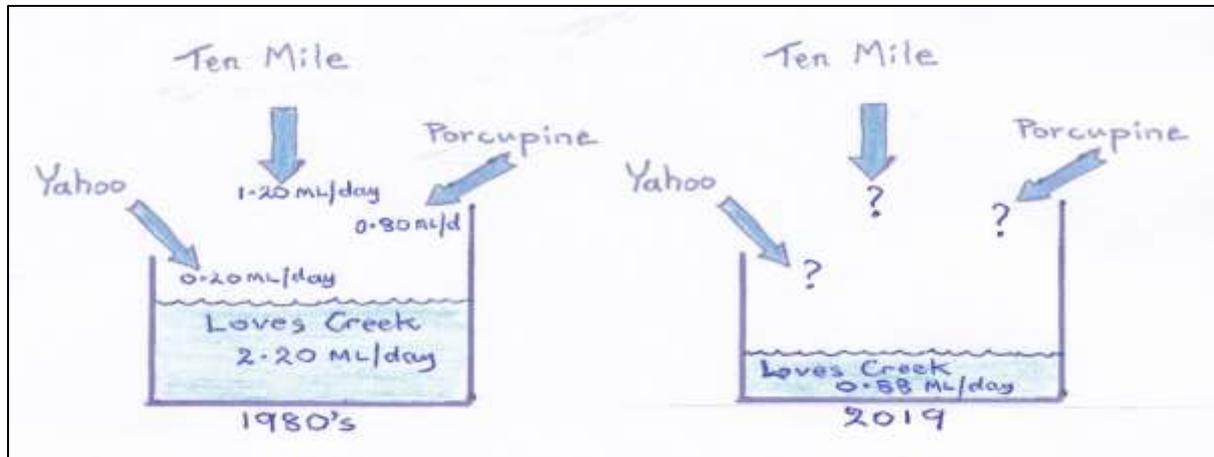
This artesian pressure head should be keeping all of the layers of earth below this head under the influence of upward vertical leakage. Any wetlands, aquitard, springs and soaks in the area below this pressure head would be under the influence of this upward pressure and there should be no void under Loves Creek into which water would leak from the creek.

### Loves Creek Flows All Year.

Loves Creek has a baseflow from groundwater all year every year due to the discharge of aquifer overflow. Wades' research shows that this baseflow at the Stream Flow Gauging Station has reduced by 60% due to the Barwon Downs Borefield extractions,<sup>(60)</sup> but still flows all year. The natural baseflow into the Loves Creek Catchment has been reduced. Impact will happen first in the highest regions of the catchment not down in the Loves Creek flats area. The tributaries to Loves Creek would be the ones being affected first. Springs and soaks in the upper areas of the catchment would start to dry up and as the water table dropped so would the impact increase downstream. As the higher regions of the catchment dry out the amount of baseflow moving down the system would decrease. Loves Creek is at the lower end of this water system and is being impacted with these lower baseflows. However, until the groundwater level dropped below all discharge points Loves Creek would continue to receive baseflows and continue to flow even through the driest periods. Loves Creek

would continue to flow as long as the hydraulic gradient was higher than all discharge points from the overflowing aquifer.

### Perennial Baseflow into Loves Creek.



In the 1980s the baseflows from the Ten Mile, Porcupine and Yahoo Creeks amounted to 2.2 ML/day<sup>(54)(34)</sup> at Stream Flow Gauging Station Number 235234. These three creeks were the only perennial creeks gauged back in the earlier days. By 2017 Wade calculated this inflow at the Loves Creek gauge 235234 had decreased by 50 %, which would mean a new baseflow of around 1.1 ML/day. By 2019 Wade determined the baseflow had reduced to 60% or 0.88 ML/day. These figures are close to the ones found in the SKM 2009 report.<sup>(52)</sup> (see page 51 for an extract from this report)

### Another Explanation for Loves Creek's Low Baseflows at SFGS No. 235234.

Jacobs is saying there is reduced water going into Loves Creek system as well as water leaking from Loves Creek into a void below. In other words, it can be likened to a bath tub being filled with water with a leak through the plug while the remainder of the water overflows (Figure Two, page 48).

Whereas, Wade is saying the water from the aquifer overflowing into the Loves Creek Catchment has been reduced and that this same amount of water passes down through the Loves Creek system to the Gellibrand River. In other words the flow rate out of the taps into the bath tub have been partly turned off, a reduced flow, with the plug in the tub remaining sealed and the water coming into the bath tub is the same as the water overflowing out of the tub (Figure Three, page 48)

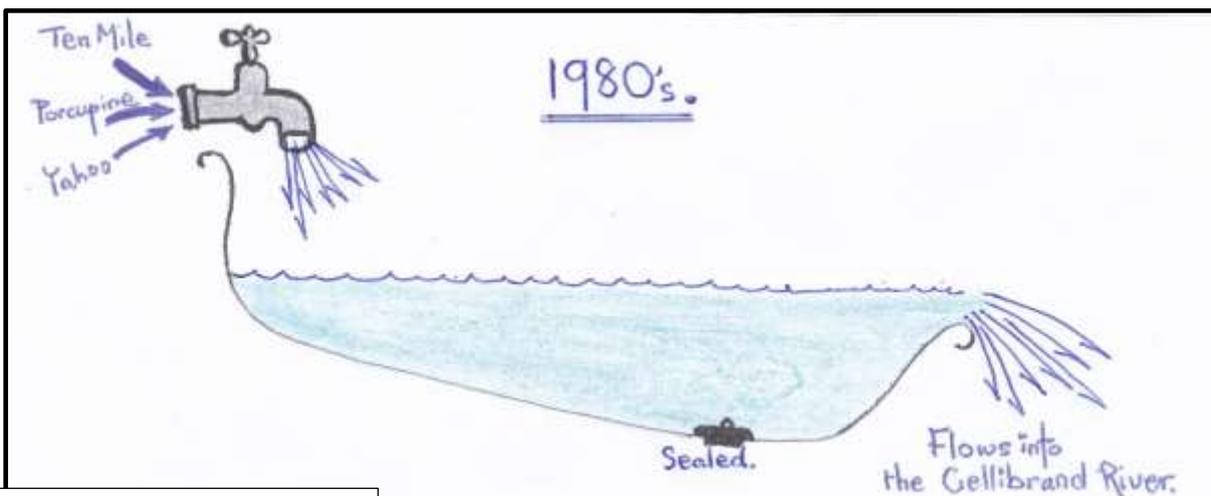


Figure One – 1980s flows.

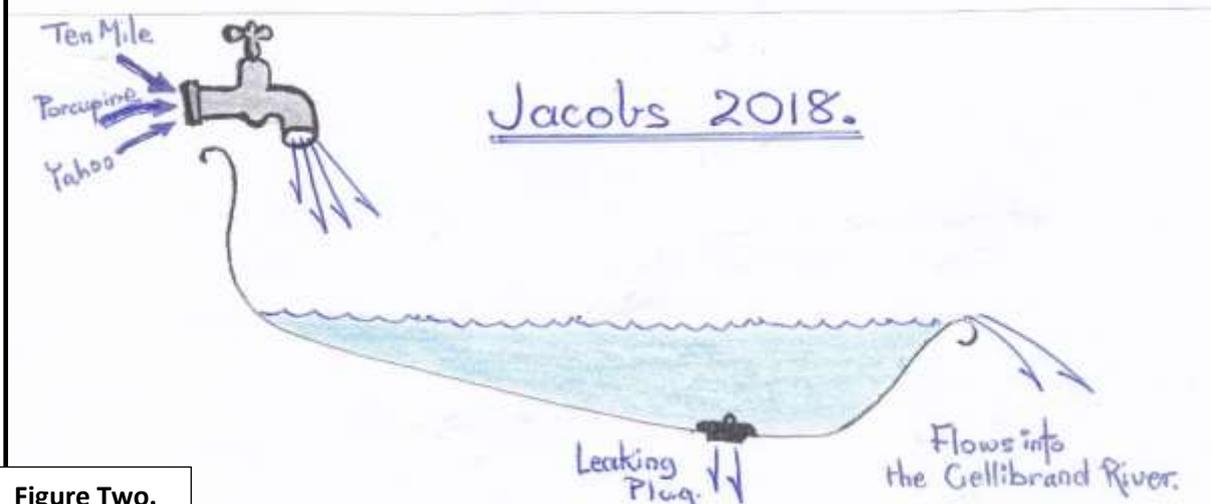


Figure Two.

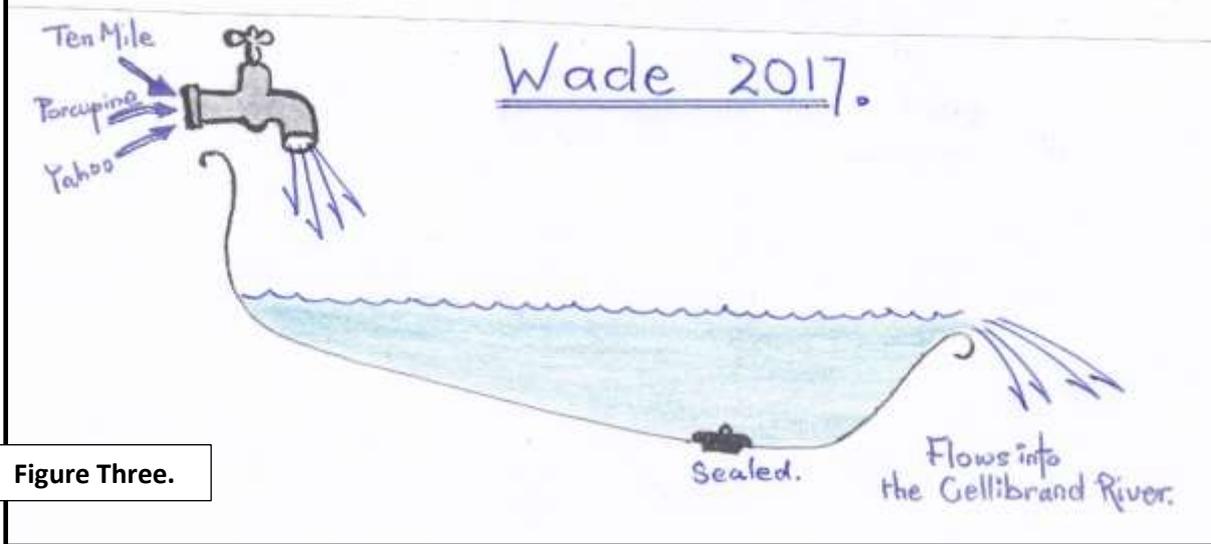


Figure Three.

### **Stream Flow Gauging Stations Decommissioned.**

Unfortunately, gauging on the Ten Mile, Yahoo and Porcupine Creeks was stopped in the middle 1990s once it was decided and concluded that there would be no groundwater extraction from Kawarren. However, when the Kawarren Borefield was once again under consideration a half-hearted attempt to gauge these streams was made for a short period around 2008 during the Kawarren (Newlingbrook ) investigation. By 2009 these gauges were once again decommissioned. Huge gaps in the amount of data collected. Then in 2018/2019 the Ten Mile and Yahoo Creeks were being gauged once more.

### **Other Perennials Streams in the Loves Creek Catchment.**

Numerous springs and soaks within the catchment contribute flow to Loves Creek. Other small perennial creeklets include Alkemade that flows in before the Loves Creek gauging station. Arkuna and Pompa Bill flow in downstream of the gauge. Pompa Bill Creek has a baseflow around 0.14 ML/day. How the Jacobs model takes into account all of these inflows and calculates that Loves Creek is a losing creek for most of the year is difficult to comprehend.

### **Ten Mile Creek** (see page 45 above).

Ten Mile Creek is the major water contributor to the flow in Loves Creek. Because Ten Mile is a perennial creek flowing all year every year. However, Jacobs states this is not the case. “[The creek is a gaining stream for most of the year.](#)” If it was not a gaining stream *all* of the year it would stop flowing, especially in situations like the Millennium Drought. Ten Mile has never stopped. Once a creek stops gaining for any length of time it dries up. Ten Mile has never done this at the Stream Flow Gauging Station. Because of a modelled prediction that this creek will have less than 0.1 m drawdown in all future pumping scenarios, the future risk given to Ten Mile Creek is medium. After considerable lobbying from the community this has been raised to high risk. However, this is based on future extractions with little comment on the impacts that have already started to happen in upper reaches of this area. Impact Ten Mile Creek and this impact is in effect transferred down through the catchment. Loves Creek flows are reduced. For example down to a flow of 40%. Jacobs modelled future impacts along Loves Creek have been determined to be moderate to low.

### **Yahoo Creek** (see page 45 above).

Yahoo Creek comments reflect a mirror image of those for Ten Mile Creek. Risk from future pumping is modelled by Jacobs at medium.

### **Porcupine Creek** (see page 45).

Porcupine Creek is regarded quite differently and is rated low risk and always seems to be placed in a class of its own. Porcupine Creek is credited with little influence by any of the impacts taking place elsewhere in the Loves Creek, Barwon River catchments. Porcupine Creek appears to be regarded as inconsequential to what else is happening in the surrounding areas. Namely, the Barwon Downs Borefield and the Loves Creek Catchment. Its importance is dismissed with the reasoning that the Porcupine Catchment sits on an aquitard and is not directly connected to the Lower Tertiary Aquifers. But, there may be more to it than that.

### **A Mysterious Discrediting of Porcupine Creek.** (See page 51)

As part of the Kwararren/Newlingrook groundwater extraction investigation the September 2008 report on stream trigger levels<sup>(52)</sup> by SKM(Jacobs) had Porcupine Creek rated as an ephemeral creek. A copy of this report was gained under FOI (Barwon Water Ref: 15/260/0007A(7)). It took seven months after the report was dated to obtain a copy. The difficulty and rigmarole to gain this report is another example of obfuscation leading to further mistrust by the community in regard to what the investigation was really about.

Below is an extract from this report and clearly shows that Porcupine Creek is reported as drying up during the dry seasons. This in itself is in complete contrast to the findings of the 1980s and historical record of adjoining landholders (see page 52).

### **Porcupine Creek runs Dry???**

Also, going from a 0.8 ML/day baseflow in the 1980 studies to zero would assuredly ring alarm bells that the Porcupine Creek is under some sort of out of the normal and catastrophic influence. However, Porcupine Creek continues to flow.

And, where the “...*anecdotal evidence*...” came from regarding the thoughts that Porcupine Creek “...*has recently displayed ephemeral flow patterns.*” has not been provided. Peter McDonald, whose family has owned land either side of the lowest reach of Porcupine Creek for decades, including the land around the Stream Flow Gauging Station, does not support the above statement. Peter’s statutory declaration can be read on page 52.



caused by pumping prior to stopping the test was 1 L/s, the lagged impact several days after stopping the test would be reduced to around 0.3 L/s, and reducing over time).

• **Table 6 - Historic minimum flows (1985-1995) for Love Creek and tributaries <sup>1</sup>**

Tributary	Minimum flow (non-drought) (ML/d)	
	Wet Season	Dry Season
Yahoo Creek	0.87	0.77
Porcupine Creek	0.88	0.00 <sup>2</sup>
Ten Mile Creek	0.93	0.78
Love Creek	4.0	1.40

1. Based on historical (ie, measured) flow data (ie, as per Table 2 plus two months of monitoring in April and May 2008. The only exception is Porcupine Creek – refer note 2)
2. Anecdotal evidence in summer/autumn 2008 has indicated that Porcupine Creek has recently displayed ephemeral flow patterns.

• **Table 7 –Minimum flows under current drought conditions (Previous 5-years) for Love Creek and tributaries**

Tributary	Minimum flow (drought) (ML/d)	
	Wet Season	Dry Season
Love Creek	1.30	0.75
Yahoo Creek	0.44	0.38
Porcupine Creek	0.44	0.00
Ten Mile Creek	0.47	0.39
Love Creek	1.30	0.75

**STATUTORY DECLARATION**

I, PETER GORDON MACDONALD,  
[full name]

of 130 MACDONALD'S ROAD KAWARRAN VIC 3249,  
[address]

DAIRY FARMER, do solemnly and sincerely declare that: -  
[occupation]

Our family first moved to Kawarren in February 1945. Grandad, Sydney MacDonald and Dad, Gordon MacDonald dairy farmed together at 195 MacDonald's road. In 1971 due to ill health, Granddad Sydney MacDonald had to leave the farm. Then I Peter MacDonald joined the dairy farming partnership with Gordon MacDonald until 1979 when I purchased 190 MacDonald's road. Since 1945 the pools in Porcupine creek have never been dry at the bridge on MacDonald's road. Since the gauging station on Porcupine creek was installed beside the bridge, the only time the flow has stopped at the gauging station was when I have been pumping (diverting) water to the dairy tank.

I acknowledge that this declaration is true and correct, and I make it with the understanding and belief that a person who makes a false declaration is liable to the penalties of perjury.

Declared at Kawarren

in the State of Victoria, this 14<sup>th</sup> day of  
January 2009

[Signature]  
.....

Signature of person making this declaration  
[to be signed in front of an authorised witness]

Before me,

[Signature]  
.....

Signature of authorised witness

L/S/C 31609  
Colac Police

The authorised witness must print or stamp his or her name, address and title under section 107A of the Evidence Act 1958 (eg. Justice of the Peace, Pharmacist, Police Officer, Court Registrar, Bank Manger, Medical Practitioner, Dentist)

I have never witnessed or heard of the Porcupine Creek ever going dry in the 50 years I have lived in the district. Such an occasion would have been big news. During the summer of January 2016 to the middle of March, I conducted some baseflow gauging and determined the minimum flow during this period was around 0.12 ML/day. That is 120, 000 litres a day, a lot of water. Even so, a huge reduction from 0.8 ML/day back in the 1980's. Why is this so?



Photograph shot at Porcupine Creek waiting for the backup of water before gauging.

### **Has the Record Been Put Straight? No!**

If mistakes remain uncorrected, such as the SKM/Jacobs report above, these mistakes can lead to resource management decisions being made on “dodgy” data. Which will perpetrate and may even exacerbate a problem. Unfortunately, this type of mistake has been a common occurrence with acceptance by Barwon Water of the scientific research documents completed by its consultants. Mistakes such as the one with the summer flows of Porcupine Creek, must not be allowed to become a record of historical fact. Especially when such mistakes have been brought to Barwon Water’s attention.

## Modelling.

Results, conclusion and predictions resulting from modelling conducted in regard to the influence and operation of the Barwon Downs Borefield has a chequered career. A model developed in 2002 to determine impacts on Boundary Creek from groundwater extraction at Barwon Downs had this to say... *“When the predicted total flows are plotted for each of the 100 year groundwater pumping scenarios, impacts due to pumping are barely discernible.”*<sup>(69)</sup> 17 years later and the impacts were so horrendous all extractions ceased.

In 2015 Jacobs used modelling when conducting a Potential Acid Sulphate Soils Field Investigation in the area of influence from the Barwon Downs Borefield. This modelling appeared to have two flaws at least.

*“The modelling used to estimate the watertable drawdown was conducted as part of SKM (2013). In turn this was based on Scenario 2 from SKM (2001).”*<sup>(40)</sup>

1. Unfortunately, this was a case of modelling based upon modelling. (Scenario 2 was a modelled result and basing the latest modelling on this seems ludicrous), and
2. it relied solely on doubtful data that was put into the model.

Modelling Scenario 2 was calculated using an average pumping rate of 4,000 ML/year, whereas during the Millennium Drought the actual pumping rate averaged over 11,000 ML/year. To state that *“The model predictions for water table drawdown in the aquitard are based on conservative model assumptions, which include (among other things) high levels of borefield operation where the pumping is assumed to be an average of 4,000 million litres annually.”*<sup>(40)</sup> is clearly showing that the data put into the model is not even close to being representative of what actually took place. As a consequence, the modelled predictions cannot be relied upon.

Even Jacobs throw some doubt on the reliability of this modelling. *“The likelihood of borefield related drawdown has uncertainty in that the estimate relies on modelled results, with associated uncertainty in input parameters and model conceptualisation.”*<sup>(40)</sup> This highlights that data being fed into the 2017 model<sup>(41)</sup> had some serious shortcomings.

### The Dahlhaus Report.<sup>(13)</sup>

In late 2018 Southern Rural Water had the responsibility to supervise and enforce the s78 Notice placed on Barwon Water to remediate the Big Swamp, Boundary Creek and surrounding environment. As part of this work Peter Dahlhaus, a Southern Rural Water Technical Review Panel member, was asked to conduct a review of literature and identify issues in relations to this s78 Notice.<sup>(13)</sup>

In 2018 Dahlhaus had these things to say in his review that are pertinent to the Jacobs modelling conducted for the Barwon Downs Borefield remediation work.

1. *“The last well-documented conceptual model is that of Witebsky et al. (1996), also partly published by Shugg and Jayatilaka (1998).”* This well documented concept model took place 20 years previous.
2. *“The construction of numerical models, or mathematical models, is based on the conceptual models.”* However, the Jacobs conceptual model appears to be flawed (See points 5 - 9, below).
3. *“The main purpose of the new numerical model is to predict future impacts for various Borefield management scenarios.”*
4. *“From the literature it appears that there have been at least six numerical models developed (by SKM/Jacobs) over the past thirty years, and the latest model meets the highest Confidence Level Classification (Class 3) in the Australian Groundwater Modelling Guidelines.” But,*
5. *“A gap in the current conceptual model of the groundwater system of the Barwon Downs Graben is that it does not yet include the broader environmental and social components, such as groundwater dependent rivers, wetlands, ecologies, aesthetics, amenity, and cultural values. As a result, the conceptual model does not yet credibly explain the potential links of cause and effect in all the monitoring trends (climate, groundwater, surface water, hydrochemistry, flora, fauna, subsidence, and water use/demand) considering the time and place of the observations in broader Barwon Downs landscape.”*
6. *“A groundwater system should be conceptualised and modelled based on all the available data: climatic, topographic, geological, geophysical, boreholes, aquifer tests (i.e. pumping tests), chemical and isotopic analyses, geomorphological features (e.g. soil profiles, rivers, springs, soaks, etc.), the regional ecologies (i.e. the groundwater dependency of the flora and fauna) and the man-made changes (i.e. pumping, irrigation, diversions, contamination, excavations, etc.)<sup>1</sup>. Therefore, in conceptualising groundwater systems there are inevitable uncertainties, as it is impossible to fully envisage, with certainty, the three-dimensional geometry of aquifers and confining beds, groundwater movement and storage, and the groundwater interactions with the surface and where and when they occur.”*
7. *“A groundwater system should be conceptualised and modelled based on all the available data: ...”*
8. *“The construction of numerical models, or mathematical models, is based on the conceptual models.”*
9. *“... the entire conceptual model remains obscure.”*

10. *“But the model is subject to both statistical uncertainty and incomplete information and the challenge is in understanding the limitations of these uncertainties, when using it to predict impacts within the entire Barwon Downs landscape.”*
11. *“While the environment concerns are obvious, there has been no rigorous study of the environmental sustainable level of groundwater extraction for the Barwon Downs Borefield.”*

Even though the model itself is regarded as being of Class 3 Classification it would appear that there are numerous input data gaps. A Class 3 accredited model will only produce output equal to the quality and appropriate amount of the data entered. In this case as with many of the previous six models, there is justification in having no confidence in the model results. Far too many critical inputs are missing.

#### **Further Reading on Modelling.**

Otway Water Book 40 contains numerous reference to Jacobs inherent problems with modelling.<sup>(26)</sup>

As a Consequence of these modelling errors **Loves Creek and the Gellibrand River have been put on the Back Burner.**

## **Platypus.**

### **The Late 1980s.**

During this period of the 20<sup>th</sup> century Barwon Water was making every attempt to gain control of the water resources in the Upper Gellibrand River Catchment. This included the groundwater resources. There was also talk of dams and one site at Bunkers Hill would have seen the Gellibrand and Kawarren townships metres under water. Needless to say this generated a great deal of community concern.

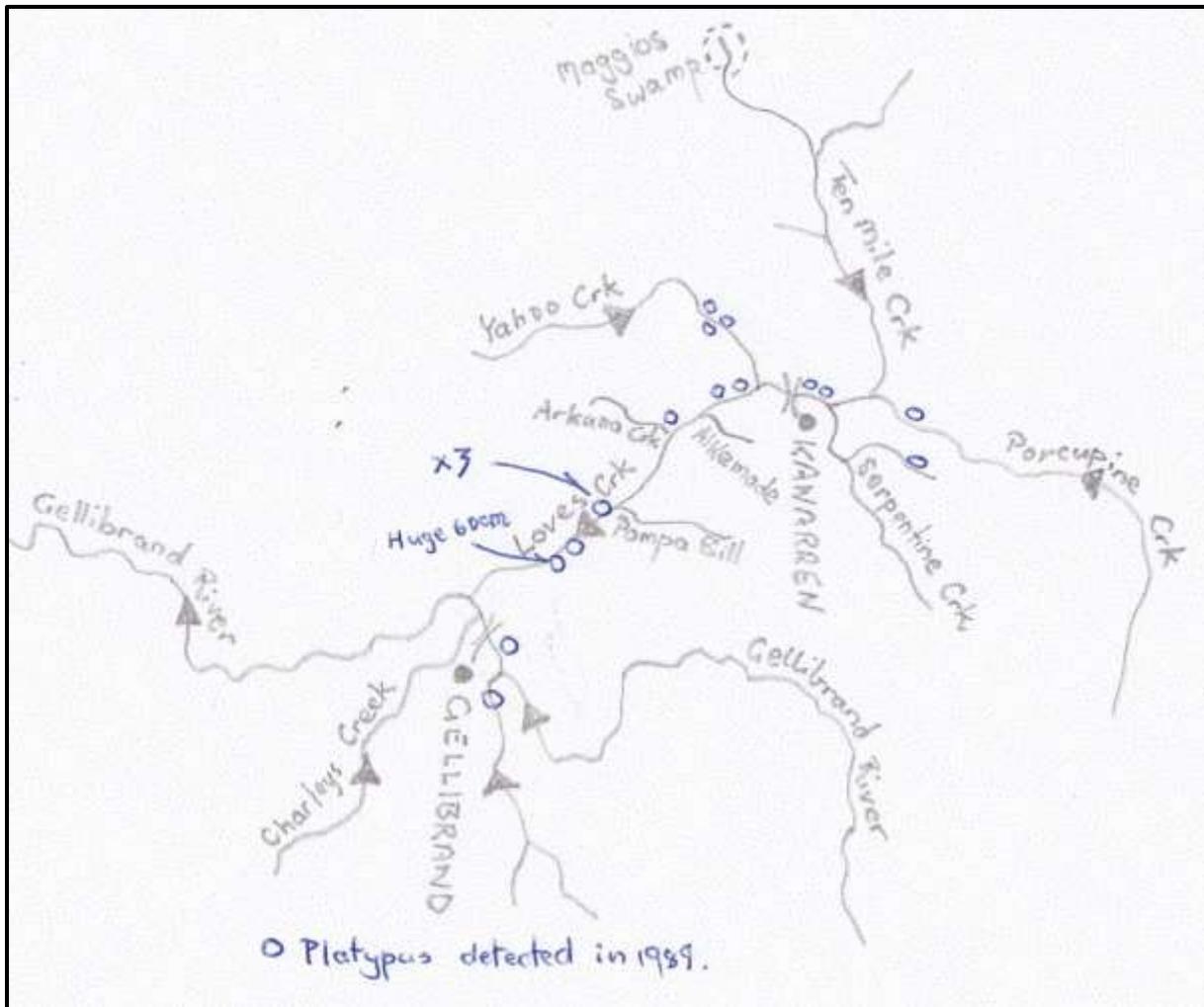
### **Platypus May Help to Save the Day.**

In an effort to raise the issues involved, the status of the platypus in the region was considered as an emotive means of doing this. However, little was known about the Otway Platypus let alone the state of platypus colonies in the immediate area. So, throughout the year of 1989, an effort was made to involve, and raise the community’s knowledge of these iconic animals.

### **Community Involvement.**

Over 70 local community members attended numerous night-time observation “expeditions” and by year’s end a total of 14 platypus were identified in the Loves Creek Catchment. Another was often seen at the Lardner’s Creek bridge and one was spotted just above the Gellibrand Colac Road bridge. Not that many animals for the length of creeks and streams canvassed.

On several occasions the “Platypus Man,” Paul Stephens, attended these observation nights (see Appendix Eight, pages 141-144). He also presented talks and carried out pyke net captures. However, during his August visit no platypus were seen or trapped. This highlighted how secretive these animals are.



Map showing location of platypus sightings in 1989.

### **In 2017. Barwon Water Conducts a Platypus Survey Along Boundary Creek.**

As part of the work being conducted by Barwon Water in the lead up to their licence renewal of the groundwater extraction at Barwon Downs, they had commissioned EnviroDNA to conduct some platypus testing of waters above the confluence of Boundary Creek with the Barwon River (See Appendix Five, pages 107-111). LAWROC Landcare member, Andrew McLennan heard of this work and approached Josh Griffiths of EnviroDNA. Over a series of phone calls and negotiations with Jim Lidgerwood, originator of the idea, a presentation by Josh was organised. Josh spoke to a packed hall in Winchelsea regarding the work his company was able to conduct. By this stage the Upper Barwon

Landcare Network had become fully involved and Jim's project was all but up and running.

### **EnviroDNA Testing.**

Testing water for DNA is a recent scientific development. Many water living species can be detected from the DNA they release into water. In this instance water was being tested for the presence of platypus. A positive result indicates there is at least one platypus in the stream at, or up to two kilometres above the sampling site.

### **At an Upper Barwon Network Landcare (UBLN) Meeting.**

Earlier before Josah spoke at Winchelsea I was invited to attend and hear Roger Blake make a presentation to the Upper Barwon Landcare Network (UBLN). At this same meeting Jim Lidgerwood asked that the UBLN support his desire to conduct a platypus survey in the UBLN district. Jim proposed a similar eDNA survey to the one commissioned by Barwon Water along Boundary Creek. His proposal was rejected.

### **LAWROC Landcare Involvement.**

As explained above, Andrew McClennan of LAWROC Landcare Group worked closely with Jim Lidgerwood (Barwon River Landcarer) encouraging Josh Griffiths to conduct the survey in the Barwon River. All of the "leg work" culminated in an eDNA testing platypus presentation in Winchelsea. The Upper Barwon Landcare Network group then took the initiative running this meeting and followed up organising and implementing an eDNA community testing workshop and survey.

### **The First UBLN Platypus Survey Is Conducted.**

A large gathering of people at Birregurra in September 2018 were involved in a platypus survey workshop after which the participants went out into the field collecting samples for testing.

### **Five Gellibrand Catchment Sites Include in the Survey.**

Because of LAWROC Landcare Group's involvement five sites were also tested in the Kawarren/Gellibrand area as part of the 2018 survey.

A total of 50 samples were collected in the Barwon River Catchment and 5 in the next valley at Kawarren and Gellibrand.

# Platypus search makes a splash

Tiny traces of DNA in river water are helping scientists and volunteers uncover the presence of platypuses in the Otways.

About 50 people have attended a Birregurra workshop to learn how to take samples from 45 different locations in the Upper Barwon catchment as part of a platypus monitoring project.

Josh Griffiths of EnviroDNA led the workshop, drawing on his decade of experience in platypus ecology and detection.

"It's the biggest turnout for platypus monitoring that I've ever seen," Mr Griffiths said of the event.

Upper Barwon Landcare Network facilitator Sarah Brien organised the workshop, and credited Mandy Baker for getting it started.

Mr Griffiths instructed the group in how to take samples of water and make them safe for laboratory analysis.

"We can detect platypus and fish from minute DNA fragments that occur in their waste products," he said.

Mr Griffiths said the project was also looking for signs of threatened fish species like dwarf

galaxias and little galaxias, as well as Yarra pygmy perch.

He said the recently discovered little galaxian was "particularly special" because of its rarity.

The group uses an "eDNA" testing method that is more cost-effective than traditional trap-and-release wildlife monitoring.

The method can only detect presence or absence of a species, not the actual numbers or frequency.

But researchers hope the method will help measure the impact of acid poisoning and no-flow events in the catchment, and discern whether streamside conditions had any impact on the presence of platypuses and fish.

Mr Griffiths also gave participants helpful insights into platypus distribution, size, behaviour, diet and habitats.

"They store fat in their tails, and they can survive cold conditions because their fur has one of the highest insulation ratings in the world," he said.

Mr Griffiths warned about the dangers of "opera house" yabby nets, which could kill platypuses.

"They are going to be banned in Victoria from next July," he said.



EXPERT: Josh Griffiths of EnviroDNA explains the sampling procedure for testing river water for DNA.

Colac Herald 3<sup>rd</sup> October 2018

## Platypus Survey Findings Presented.

Josh Griffiths presented the findings of the survey at a meeting at the Birregurra Golf Club rooms on the 22 November 2018.

The following is a media release from the Upper Barwon Landcare Network.

## Media Release by Upper Barwon Landcare Network.

### *PLATYPUS SURVEY RESULTS CONFIRM WHAT'S NEEDED*

*Media release, 30 Nov 2018, Peter Greig (President, Upper Barwon Landcare Network)*

*"These survey results appear to confirm what we had previously suspected", said Josh Griffiths from EnviroDNA to a public meeting in Birregurra in November. He should know: he's been studying platypus ecology for over 10 years. The survey was done in September this year on the Upper Barwon River and its tributaries, with help from about 50 volunteers, many of whom heard Josh's address.*

*Those volunteers went to 45 different sites throughout the catchment, and took water samples for Josh to test in the laboratory for minute traces of platypus DNA. At the same time, conditions of the river or creek at each site were*

carefully recorded by those same volunteers. It was the largest “citizen science” exercise that Josh had been involved in.

“We’re looking for not just whether platypus are present, but whether their presence (or absence) is affected by site conditions”, said Josh. “What the results appear to show is that platypus are present when two basic site conditions are met: (a) permanent water flows; and (b) good habitat”.

Of the 45 sites, only 16 had platypus definitely present, including in the Barwon around Winchelsea, **and even downstream from Boundary Creek**, which has been highly acidic for some time. Some others sites were a possibility, but several sites revealed no sign of platypus at all, even in places where they’d been previously sighted, such as the Barwon downstream of Birregurra towards Winchelsea, and in Matthews and Pennyroyal Creeks.

“Whether the negative results are permanent is unclear”, said Josh. **“It may be that the particular site is only temporarily vacant.** Future surveys will be needed to confirm that”.

Of the 16 sites with platypus definitely present, 15 were on sites classified as “fair” or “good” and only one on a site classed as “poor”, and none on “very poor” sites. That rating was based on factors known to favour platypuses: particularly adequate clean water; streamside trees for shade; stable banks for burrows; and rocky beds for the bugs and slugs that make up the platypus diet.

As further evidence of the role of site conditions, Josh linked the survey results to an independent measure: “Index of Stream Condition” (last conducted in 2010 by Corangamite Catchment Management Authority, which helped fund this survey, together with Barwon Water and Wottenhall Environment Trust). Despite the long gap from 2010 to the present, the reaches classed as having “fair” or “good” ISC were those that had the most positive results from eDNA sampling.

What this implies is that if platypuses are to be nurtured, then rivers and streams need to be cared for. The first requirement is adequate and permanent streamflow (or at least minimal “cease-to-flow” events). When waterways dry up, platypuses must disperse across land, thus becoming vulnerable to dogs and foxes.

The next requisite is tall trees on banks and fallen logs in streams – but not willows, which clog the waterways and de-oxygenate the water with falling leaves. And keeping livestock away from streams is essential, to avoid bank-erosion and water-fouling.

“Advocating for and doing such things is bread-and-butter for Upper Barwon Landcare Network”, said facilitator Sarah Brien, who organized the volunteers and funding for the survey.

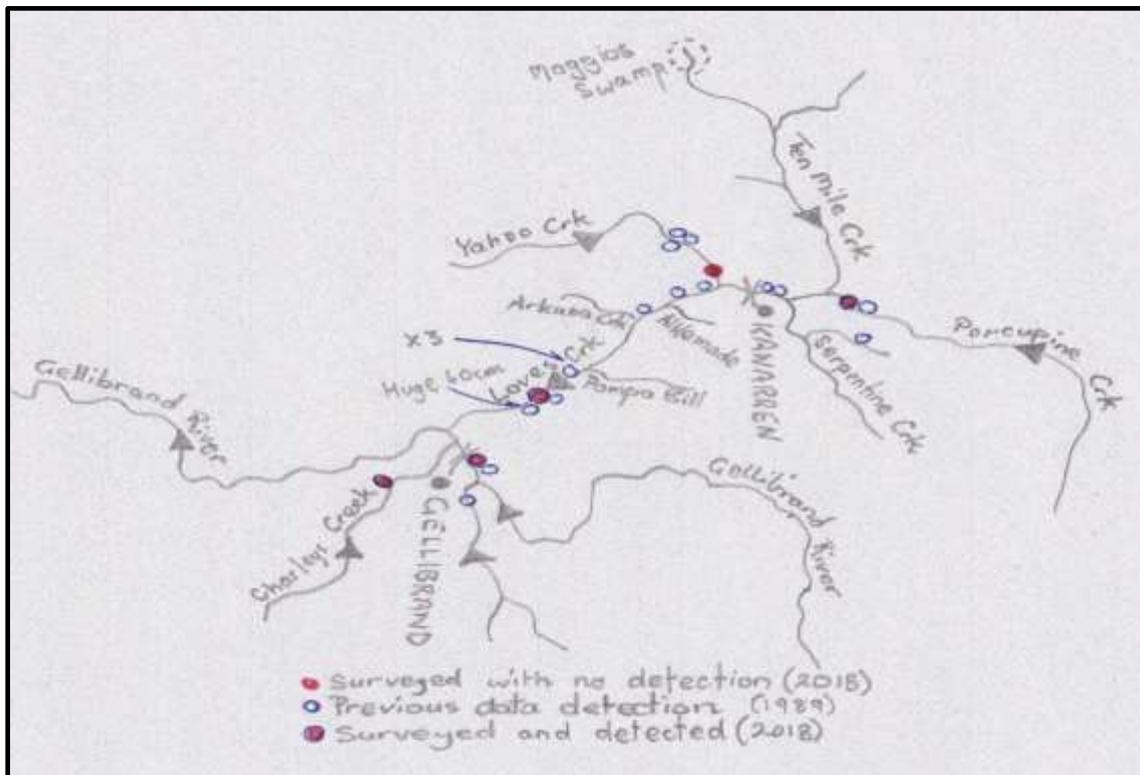
Lach Gordon from Birregurra added, “We’re hoping to extend the advocacy role further by establishing a Friends of Barwon River group”.

Josh continued, “These results indicate platypuses have almost certainly declined in the upper Barwon and this is likely to continue as demand for water increases, and more habitat disappears, and climate change progresses, the trend is not looking good. But we now have a good baseline to measure platypus populations in the future”.

Sounds like the Friends have a big job ahead of them, but a worthwhile one: after all, platypuses are very special, one of only five egg-laying mammals from around 5500 different mammal species in the world.

Further information: Sarah Brien [sarah.upperbarwonlandcare@gmail.com](mailto:sarah.upperbarwonlandcare@gmail.com); Peter Greig [petergreig45@gmail.com](mailto:petergreig45@gmail.com)

### Yahoo Creek – An Historical Platypus Colony Goes Missing.



### Four of the Kawarren/Gellibrand Sites Tested Positive.

Platypus eDNA was detected at four of the five sites tested in the Kawarren/Gellibrand area. Back in 1989 there were at least two thriving

colonies of platypus located in the Yahoo Creek. However, the 2018 eDNA testing detected nothing. This was a surprise and some what alarming. This site was the only one back in 1989 where juvenile platypus were observed. For some reason as yet unexplained the sample taken at the Yahoo site was clearer water and many times easier to process.

**A Serious Decline May Not Be Noticed for Years.**

Platypus are known to live for up to 20 years and the 1989 “Platypus Man” Paul Stephens, says that with very few juveniles being observed in the Gellibrand region this could indicate the species is in serious decline. The presence of adult platypus would give the impression that the species is doing well. However, if they are not breeding the species could be dying out before any detection is made that the animals are under duress and not breeding.

**A Year Later Upper Barwon Network Conducts a Follow Up Survey.**

As a follow up another eDNA survey was conducted in 2019 approximately a year after the initial survey. Out of the initial 50 sites surveyed in the Barwon River only 16 proved positive. Bearing in mind the testing can detect platypus up to 2 km upstream of the testing site this is not an encouraging result.

# Platypus numbers decline

A "citizen science" project has identified the presence of platypuses at 16 locations in the upper Barwon River and its tributaries.

But EnviroDNA researcher Josh Griffiths says the survey indicates a decline in the species in the region, based on what is known of platypus habitats between 50 and 100 years ago.

"There was almost certainly platypus more extensively found through the area previously," Mr Griffiths said.

The Upper Barwon Landcare Network convened 50 volunteers to take water samples from 45 sites in the upper Barwon River and its tributaries, between Forrest and Winchelsea.

Mr Griffiths then tested the water samples for tiny traces of platypus DNA in September, and found presence of the DNA at 16 of the 45 sites.

"We're looking for not just whether platypus are present, but whether their presence or absence is affected by site conditions," Mr Griffiths said.

He said that the



PHOTO SUPPLIED

**COLLECTING SAMPLES:** Volunteers Sam and Danika Brien collecting a water sample from the Barwon River to test for platypus DNA.

results showed that platypuses were present when there were permanent water flows and a good habitat.

The survey found platypuses were present in the Barwon around Winchelsea and downstream from Boundary Creek.

But platypuses were not present at several sites where they had been seen previously, such as downstream of Birregurra and in Matthews and Pennyroyal creeks.

"There are some clear spots where we didn't find them where

we expected we should do," Mr Griffiths said.

He said future surveys would need to determine whether those sites were temporarily vacant, or whether platypus numbers had decreased.

"Part of the problem is that we don't really have a lot of historical data," Mr Griffiths said.

"We now have a good baseline to measure platypus populations in the future.

"As demand for water increases, and more habitat disappears, and climate change

progresses, the trend is not looking good."

The International Union for Conservation of Nature listed the platypus's conservation status as "near threatened" in 2014.

Upper Barwon Landcare Network facilitator Sarah Brien said the survey implied a permanent stream-flow and appropriate tree planting could improve site conditions for platypuses.

Ms Brien also said keeping livestock away from streams avoided waterside erosion and fouling waterways.

## Downstream of Boundary Creek in the Barwon River.

In the 30 kilometre stretch of the Barwon River that had a fish kill in 2016 and lack of flow during preceding summers, there was one platypus detected near the Birregurra Golf Club. This was the only positive below the confluence of Boundary Creek and the Barwon River along the fish kill stretch as far as Winchelsea.

Colac Herald 13/09/2019

# Platypus team hits river

Colac district volunteers donned latex gloves and picked up their sample containers in becoming citizen scientists for the platypus.

Upper Barwon Landcare Network hosted a platypus survey on Saturday, to confirm last year's findings on platypus in the area.

EnviroDNA's Josh Griffiths instructed the 20 volunteers on how to collect water samples from 26 sites in the upper Barwon River, to test for traces of platypus DNA.

Upper Barwon Landcare Network president Peter Greig said the survey would determine if platypus populations were thriving or declining in the area.

"We're all very in-

tent on improving the condition of the rivers in our district, and the platypus are kind of a canary in the coal mine as an indicator of the health of the rivers," Mr Greig said.

"We are hoping the numbers are not declining, but we're also aware that numbers will decline unless they're in good condition."

Previous tests found platypus living at 16 locations in the upper Barwon River and surrounding tributaries.

The samples were collected and transported to the EnviroDNA laboratory for tests.

Mr Griffiths said platypus were slow breeders and primarily lived in areas where the river was in good condition.

"Their population

can decline quickly as habitat is damaged though excess water extraction, land clearing and poor bank management," he said.

Mr Griffiths encouraged people to report platypus sightings at [platypusspot.org](http://platypusspot.org)



PHOTO SUPPLIED

**CITIZEN SCIENTIST:** EnviroDNA Josh Griffiths helping young volunteer Harry Callahan in retrieving a water sample at Birregurra.

### **LAWROC Not involved.**

LAWROC Landcare Group was not aware that there was a follow up survey and for some reason was not invited to be part of this follow up survey. This was disappointing considering the initial work done by the LAWROC Landcare Group to support and get this project going.

### **Platypus Observed during a 2015 Fish Study.**

During a study at 60 sites for River Blackfish in the Gellibrand Catchment in 2015 only one platypus was sighted.<sup>(12)</sup> Probably not unusual as the fish study would have been conducted during the daylight hours and concentrated on fish observation and capture.

### **Sedimentation Affecting Platypus in the Gellibrand River.**

Appendix 11, pages 147-149, describe an episode of sedimentation affecting platypus. Also, pages 72-76 relate to this event.

# Rainfall & Natural Buffering Capacity Against Drought.

Climate change is increasing to an unacceptable level and this is mainly from human activity. There is also no doubt the natural buffering capacity of surface and subterranean ecosystems in the Otway Ranges has similarly been impacted by human activity. In the past the Otway Ranges' creeks and rivers have displayed the unique characteristics of being able to withstand the worst of droughts due to the full and overflowing aquifers within the Ranges.<sup>(22)(17)</sup> A critical part of this ability has been the high rainfall within the Otway Ranges. When regions of Victoria have undergone low rainfall the Loves Creek Catchment area has still had annual rainfall over 600 mm.

## **The Otway Ranges Have A Drought Buffering & Dampening Capacity.**

Parts of the Otway Ranges have long been regarded as a refuge against drought.

In the Statutory Declaration below, Olive Parker relates the story that back in the early 1900s during severe drought people would bring their livestock into the foothills of the Otway Ranges as a safe place to see through the drought. Interesting, Olive said this included camels, goats and sheep.

The deeper into the Otway Ranges the larger the number of permanent flowing creeks and rivers. The Otway Ranges buffering capacity and refuge from severe drought was well known and to a large degree still exists today.

STATUTORY DECLARATION

I, Olive stella Parker.
of 115 Old Friends Rd Meo
Farmer. do solemnly and sincerely declare that:-

I have lived at the above address for 59 years. When my husband and I purchased this property we were told that the creek to the west of the house was known to have never run dry as far back as 1903. Since arriving at this property in 1950 the creek has never stopped flowing and has been an invaluable water supply for our stock. During the recent dry years our dams haven't filled. Due to this the creek has been very important to us. In 1968 we purchased the O'Reillys property to the east of our property. This land also has a permanent creek on it. This creek has a large wetland area which is home to numerous birds. and This water supply is also valuable to us.

I acknowledge that this declaration is true and correct, and I make it with the understanding and belief that a person who makes a false declaration is liable to the penalties of perjury.

Declared at Colac
in the State of Victoria, this 16 day of
September 20 09.

P. S. Parker
Signature of person making this declaration
(to be signed in front of an authorised witness)

Before me,
Joseph Sakhra
Signature of authorised witness

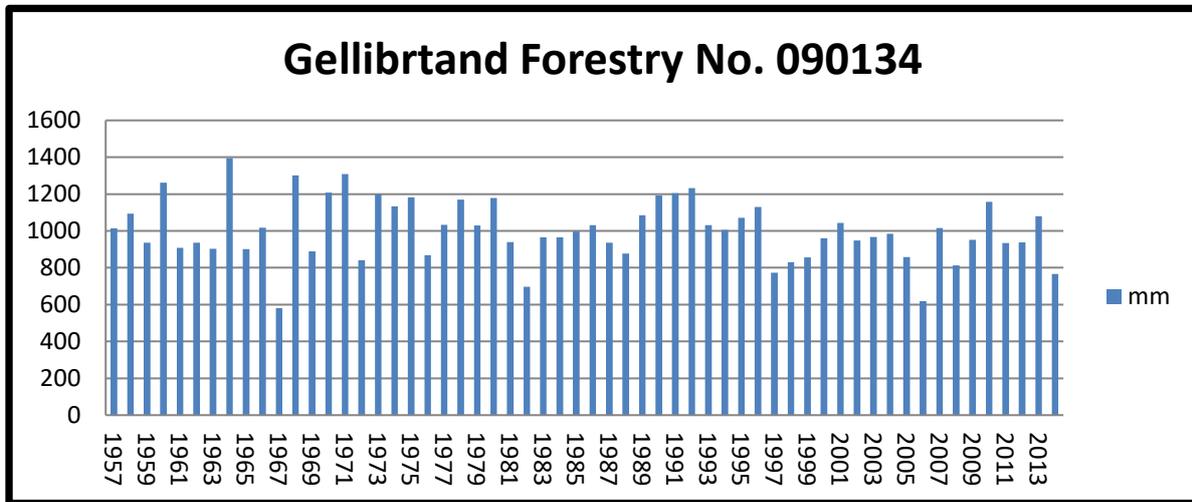
Colac HealthWise Pharmacy
Alex Pappas, B.Pharm., M.P.S.
5-7 Gateway Complex 52 Bromfield St. Colac Tel: 5231 4022
21586D

The authorised witness must print or stamp his or her name, address, and title under section 107A of the Evidence Act 1958 [Vic.] (eg. Justice of the Peace, Pharmacist, Police Officer, Court Registrar, Bank Manager, Medical Practitioner, Dentist)

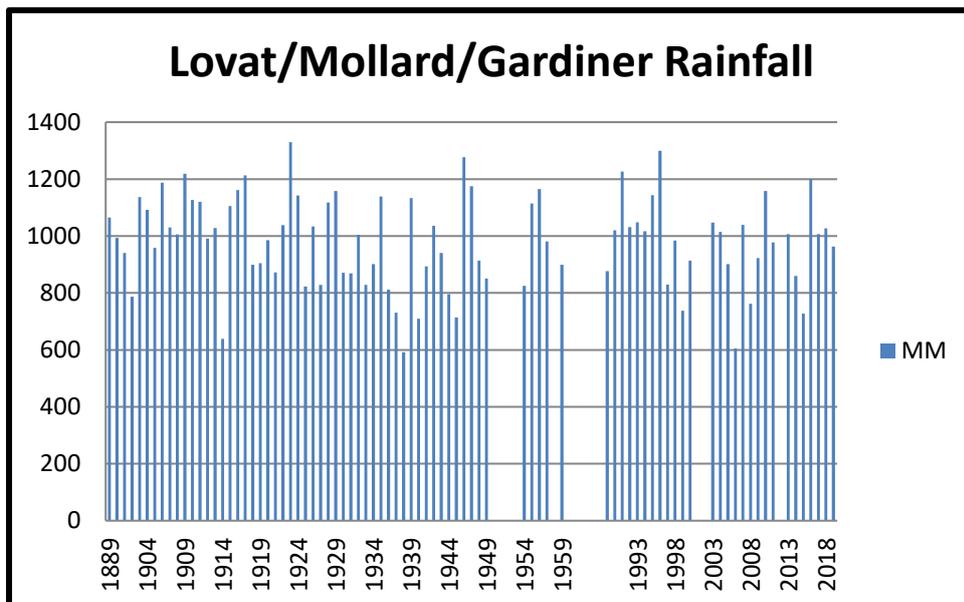
Rainfall Recharges Aquifers and Supports Perennial Streams.

The records for the Loves Creek Catchment over many years displays the ability of rainfall to replenish and recharged the aquifers in the area providing a substantial buffering capacity to the Otway Ranges to withstand drought. This

rainfall capacity and recharging of aquifers<sup>(22)</sup> also has the ability to slow down the rate of climate change impact within the region.<sup>(15)</sup>



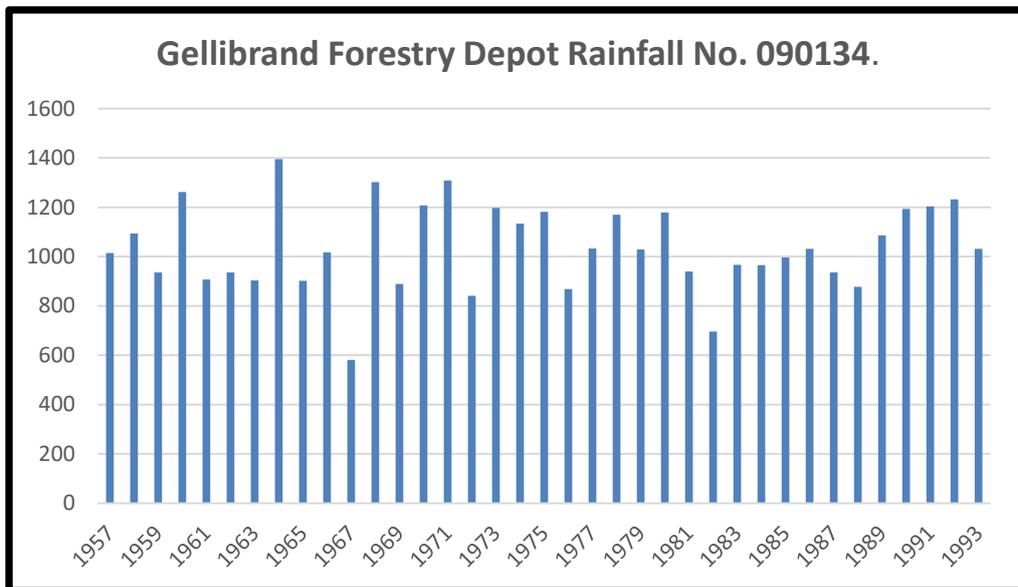
Rainfall data from the Gellibrand Forestry Depot Records.



The Lovat Rain Gauging Station long since closed, was located close to Wonga Road and is 2 km north of Gellibrand. The Mollard and Gardiner gauging is located 3 km north of Gellibrand, exactly half way between the townships of Gellibrand and Kwarren. (see page 151 for the Dawes rainfall. Very similar trend.)

The early records graphed are from the Lovat Rain Gauging Station until it closed in the 1950s. To gain some idea of the rain that fell in the period between 1959 and 1993 the Gellibrand Forestry data from two kilometres

south of Lovat indicates what rain would have fallen at Lovat during that period. The Mollard data covers up to 2017 when Gardiner’s gauging started.

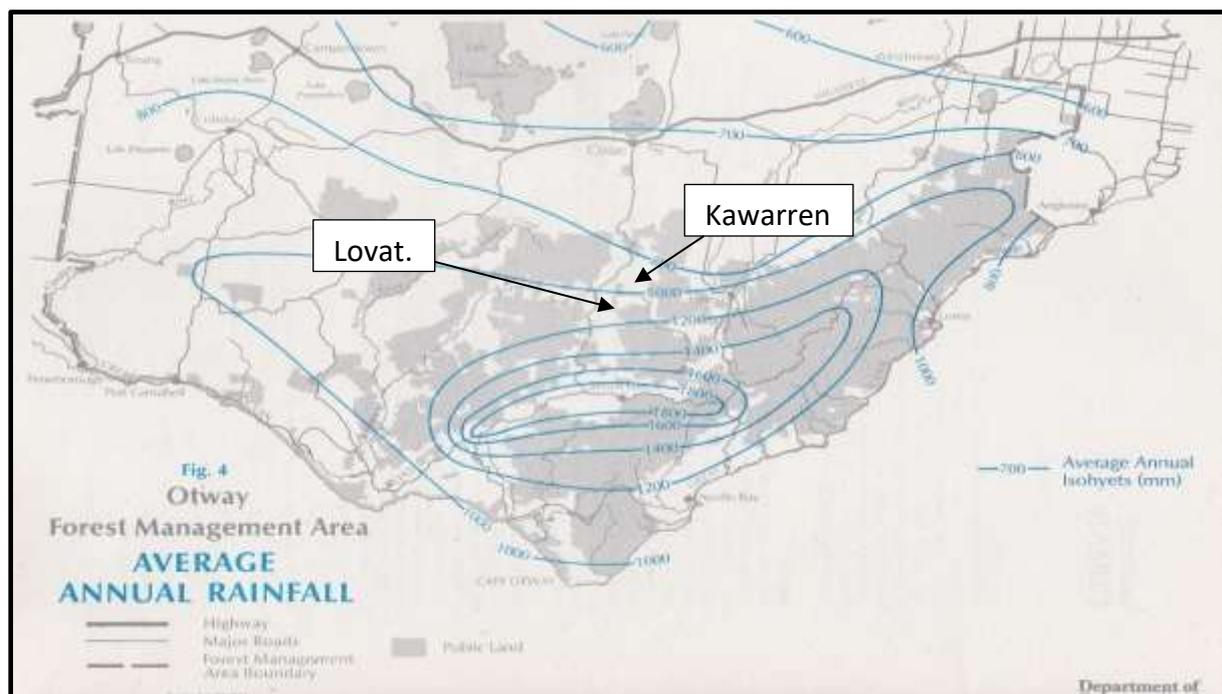


**Gellibrand Rainfall for the 1959-1993 period.**

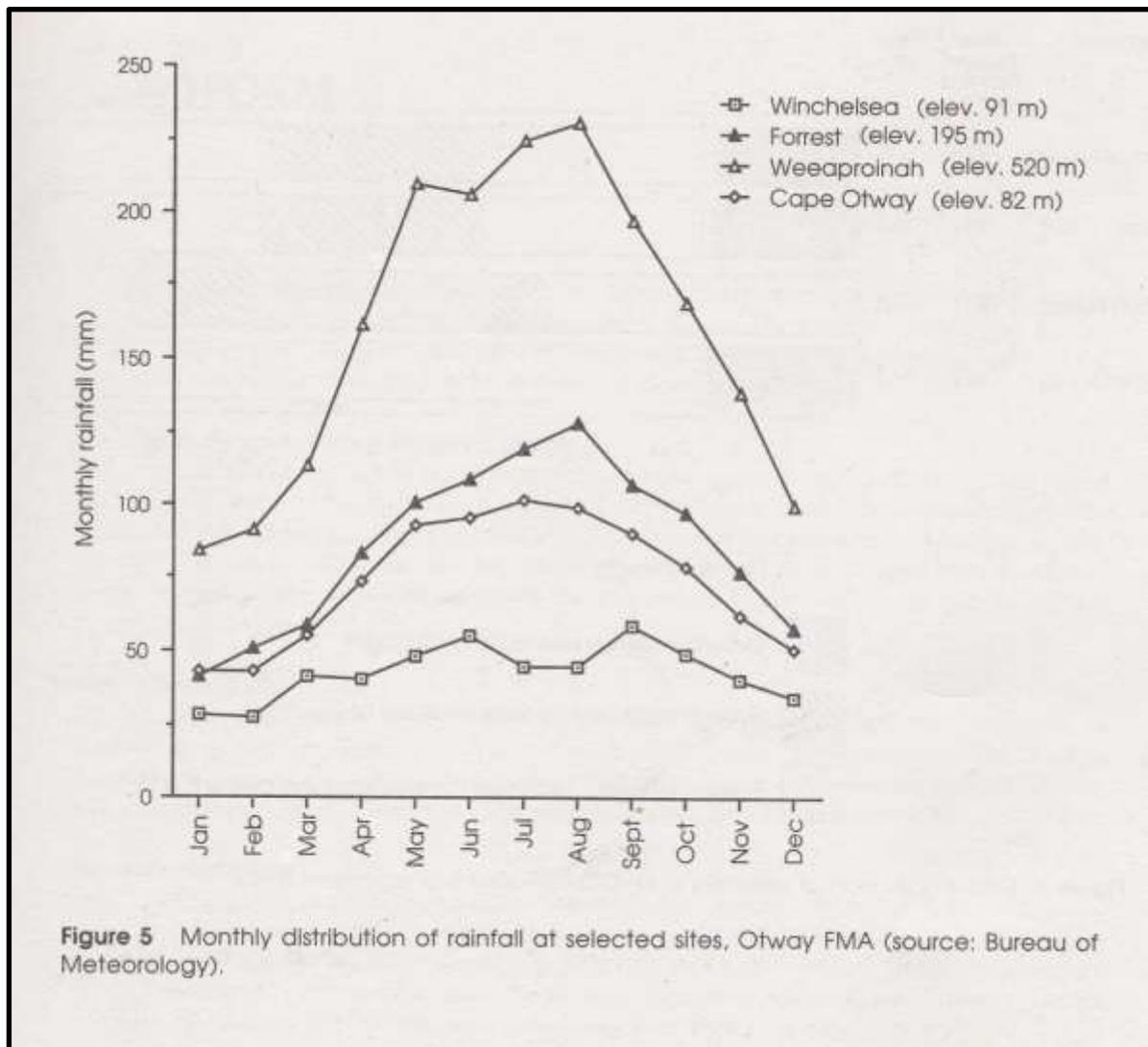
When other parts of the state are being described as having substantially lower rainfall the Loves Creek Catchment region has maintained a relatively high level of rainfall.

**The 1990’s Otway Forest Management Plan.<sup>(68)</sup>**

The following two inserts have been taken from a 1990 Otway Forest Management Plan document.<sup>(68)</sup>



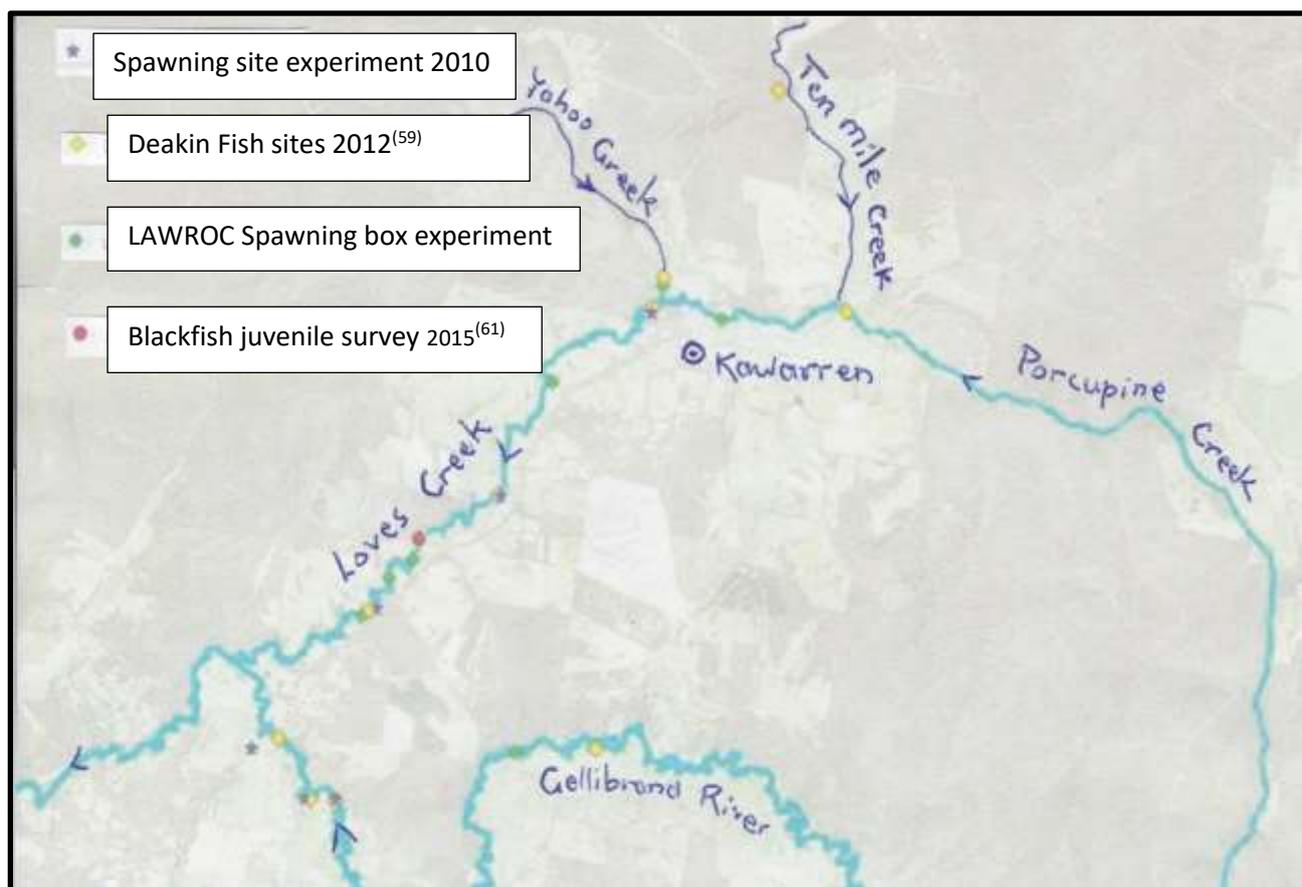
Even though the data used to draw up these two inserts is 30 years old the rainfall graph on page 67 indicates that the rainfall in the Loves Creek Catchment has varied very little since this period.



### Boggy Saturated Top Soils of the Past?

There have been times when it has been argued that the Loves Creek Catchment area does not get as boggy as it did in years past and this could very well be true. It could be argued that these observable surface changes could be due to the subsurface drying out as a result of groundwater extraction or aquifer depressurisation. The two drawings on page 44 explain how the surface ecosystems have a stronger inclination to dry out when sitting over a depleted aquifer system.

## Recent Fish Studies.



Valuable fish study reports can be easily accessed at the Corangamite Digital Library – See Appendix 9, page 145.

### Primary Influences on Stream Biota.

Koehn et al.<sup>(46)</sup> outlined biological information regarding the primary driving influences on stream biota health. These are:

1. Water quality.
2. Flow regime.
3. Nutrient sources.
4. Habitat structure. And,
5. how these influences interact.

Changes in these parameters can be dramatic with easily observable results, or, small subtle and difficult to measure changes often going unobserved. Some understanding and a watchful eye of these subtle changes should be foremost in the mind of any water watch citizen scientist.

### Some of the Subtle Changes.

- Toxic pollutants that can lead to reduced feeding; upsetting spawning ability; bioaccumulation of toxins in the food chain; loss of invertebrate food supply. Many of these happenings would be masked with the stream outwardly looking healthy.

- Changes in dissolved oxygen, water temperature, pH, suspended sediments and salinity affecting stress levels, feeding, growth rates and spawning.
- Sediments settling out on stream beds, blankets substrate reducing habitat for spawning and food supply.
- Altered natural flows will impact migration, biological triggers, spawning and reduce habitat for breeding and feeding.
- Altered riparian habitat will upset the stream health in numerous ways impacting on microbial decomposition of organic matter; reduced terrestrial and water invertebrates as a food source and disrupt the whole aquatic ecosystem.

The natural balance can so easily be disrupted. One subtle change can have a ripple effect that may take some considerable time to manifest to such a level that the effect becomes noticeable. The absence of juvenile platypus is one example. Because adults platypus can live for so long the absence of juveniles may never be of concern until all the adults die out. Also, the secretive nature of platypus rarely being observed makes their status difficult to ascertain. The platypus are an excellent example of why these subtle changes are difficult to detect and highlight why stream health observers need to be very vigilant.

### In 2011 Things Would Appear to be OK.



SITE: The rare fish was found in the Gellibrand River at Black's Bridge



## Grayling found in Otways

by Alex White

A rare fish discovery in the Otways has renewed hope that threatened fish populations in the region are resurging.

Scientists recorded an Australian grayling in the Gellibrand River at Black's Bridge, indicating the species might be returning to the area's waterways.

It's the first grayling officially recorded in the catchment since scientists started keeping records in the early 1980s and follows a Corangamite Catchment Management Authority worker taking a photo of a grayling last year.

CCMA senior river health officer Denis Lovric said the discoveries were a positive sign that efforts to boost endangered native fish populations in Corangamite's waterways were working.

In the past decade the Corangamite CMA has addressed 10 barriers impeding fish migration in the Gellibrand catchment, opening up more than 230 kilometres of the waterway, excluding its tributaries.

It has also completed more than 100 kilometres of river restoration works in the catchment, including planting native vegetation.

willow removal and fencing to help improve water quality.

The CCMA will do sampling again this summer and Mr Lovric said his team hoped there were more Australian graylings, along with other native fish.

"The one caught was a juvenile, which means they're recruiting, probably in low numbers, but we think it means they're breeding, which is really good," he said.

Scientists surveyed 60 different sites along the Gellibrand River and captured 14 fish species, 13 of which were native with the brown trout the only introduced species.

Mr Lovric said four species were common to anglers but the other 10 native species remained mostly unknown to the general public.

Australian grayling




POSITIVE: Corangamite Catchment Management Authority senior river health officer Denis Lovric says rare fish discoveries in the region are a boost for the authority.

Castlec. Herald 19/08/2011

### However...

However, things aren't always the way they seem. In a Short Summary<sup>(11)</sup> of their full report prepared for the Corangamite Catchment Management Authority on Fish Assemblages and Riparian Restoration Efforts in the Gellibrand River Catchment 2012,<sup>(37)</sup> Howson and Matthews found "***Length frequency distributions suggest that river blackfish consist of an ageing population with few recent recruits present in the Gellibrand Catchment.***" Big older river blackfish with very few young fish found. This is quite alarming and suggests that subtle changes as outlined by Koehn et al.<sup>(46)</sup> have taken place upsetting the biological health of the catchment. These results also suggest that the imbalance has been taking place for some time with very few juveniles found. Although closer to a dramatic impact the huge sediment plume sent down the Gellibrand River while Barwon Water was enlarging the Olangolah Reservoir in 2009, most probably has had long term subtle changes.



This photograph was taken at Raffertys Bridge approximately 17 kilometres downstream of the Olangolah Reservoir works (photo by Marina Lewis. See pages 147-149 for Marina's account of this event).

The sediment load is quite obvious and went on for a considerable period. The full account of this can be found in Otway Water Book 23.<sup>(21)</sup>



This photograph was taken during the same period. This crystal clear water of Loves Creek showed no indication of a sediment plume as it flowed into the Gellibrand River.

Andrew Daffy reported that Stephenson's Creek was also running clear into the sediment loaded Gellibrand River (pers com.).

Charleys Creek was also crystal clear and can be seen as clear water mixing with the sediment rich water of the Gellibrand River (see page 74).



Charleys Creek water. Sticks on the bottom of the Gellibrand River easily seen.

**But, this is only one example of a Dramatic Change with the Possibility of Causing Subtle Impact in the Longer Term.**

Even though Loves and Charleys Creek ran clear water it does not mean that other subtle changes had not been taking place in these creeks. Unfortunately, it is often regarded by some that a small impact can be overcome by nature's healing, not taking into account that numerous such minor impacts can accumulate with a catastrophic conclusion.

**Howson & Matthews' Work Done for the Corangamite CMA.<sup>(36)(37)</sup>**

Howson and Matthews conducted studies for the Corangamite Catchment Authority "...to compare fish assemblages sampled from reaches within five riparian vegetation categories: 1) willows; 2) natural native forest; 3) native revegetated; 4) thin-strip Riparian; and 5) cleared areas. Other aims included a comparison of fish assemblages across four broad catchment regions that reflected a longitudinal river gradient running from upland to downstream lowland areas and assemblages were also compared between the Gellibrand main stem versus associated tributaries." at 60 sites.

Overall, Howson and Matthews found that “... *the Gellibrand catchment still consists of a high diversity of freshwater fish, most of which consist of Australian natives and only one exotic species was captured (i.e. brown trout).*” But, between a 2008 study and this 2012 study the “... *commonly captured species (e.g. galaxiids, trout, eels, etc.) had greater numbers of juveniles than larger individuals/adults, whereas blackfish are highly skewed toward larger individuals. This length/frequency distribution suggests that blackfish represent an ageing population that is potentially beginning to decline (or already in decline).*”

#### **Spotted Galaxiids Also on the Decline.**

Howson and Matthews<sup>(37)</sup> also had this to say “*Very few spotted galaxiids were found at any of the 60 sampling locations.*”

The outward healthy appearance of things may not be a true indication of what is actually taking place in regard to river and stream health.

#### **Howson and Matthews Loves Creek Catchment Results.**

This 2012 study does not detail the fish species caught at each site. Overall, there were 14 freshwater native species captured with one introduced species – brown trout. Seven sites in the Loves Creek Catchment were included in the study. See Appendix Ten, page 146 for photographic examples of the 15 species.

#### **The Latest Fish Study Conducted in the Gellibrand River Catchment.<sup>(12)</sup>**

In 2015 O’Connor et al.<sup>(12)</sup> carried out a fish study of 60 sites in the middle and upper Gellibrand River Catchment. The aim of this study was to conduct a River Blackfish assessment for the Corangamite Catchment Authority.

*“The survey was undertaken to confirm the presence of juvenile River blackfish in the Gellibrand River catchment.”*

In total 1654 native fish, 108 Otway Spiny Crayfish, 86 brown trout and one platypus were collected.

In Loves Creek the survey collected 169 Common Galaxias, 1 Otway spiny crayfish, 3 Spotted galaxias, 22 River blackfish, 17 Short finned eel, 2 Tupong and 255 Ammocoete.

#### **Findings of this 2015 Arthur Rylah Institute Study.<sup>(12)</sup> (See pages 150-151)**

*“In tributary streams, particularly Boggy and Loves creeks, River blackfish was relatively abundant and had broader size class of fish than those collected from the Gellibrand River.”*

*“The results of this survey are consistent with studies which suggest there is a lack of juvenile River blackfish present within the Gellibrand mainstream.”*

These findings regarding the mainstream of the Gellibrand River are a direct contrast to the findings back in the 1980’s.<sup>(65)</sup>

*“...this pattern of River blackfish length structure is in contrast to a previous study conducted in the early 1980’s which found that the River Blackfish population in the Gellibrand River mainstream was the best population, both in number and size of fish, of any river in Victoria and possibly south east Australia.”<sup>(12)</sup>*

### **Sedimentation Described as One of the Most Likely Causes.**

As earlier described Koehn et al.<sup>(46)</sup> noted sediments settling out on stream beds blankets substrate reducing habitat for spawning and food supply. The O’Connor et al. study found sediment settling in the mainstream of the Gellibrand River a reality.

*“...sediments (sand) appears to have infilled deeper holes and smothered much of the instream habitat, including woody debris.”*

*“There are a number of possibilities contributing to the decline of River blackfish abundance and size structure within the main stream of the Gellibrand River including loss of habitat due to sedimentation, low river flow leading to loss of access to habitat and poor water quality and possible overfishing.”<sup>(12)</sup>*

These two statements are not surprising considering the Olangolah Reservoir upgrade was spewing sediment into the Gellibrand River between the 16 April 2008 to at least into the middle of June 2008 during a very wet period..

### **EPA investigations Regarding the Sediment Releases into the Gellibrand**

**River.** (Otway Water Book 23 deals with this in detail.<sup>(21)</sup>)(also, see Appendix 11, page 147.)

The EPA was extremely slow to react to public outcry at the state of the Gellibrand River. Not only that, it took the EPA until August 2009 to complete a report on the Olangolah Reservoir fiasco. However, that is not quite accurate as another report with the exact same title was released by Barwon Water in February 2010. Small but subtle differences between the two reports exist. How can that happen? Which report tells the real story?

Preventing sedimentation into the Gellibrand River took second consideration. The following quotes have been taken from one of the EPA Report.

- Barwon Water contractors... *“...it was not a feasible option for us to stop work and wait for dryer conditions...”*
- During the final stages of the development on 27 May 2009 when the spillway let water pass it was still turbid a long way downstream. *“...which would have included high turbidity runoff from the rainfall events around 2<sup>nd</sup> May and 18 May.”*
- There were three pages outlining how future works should be carried out so that similar problems never arise again.

- There were three pages of risk assessment of critical aspects that outlined the likelihood of re-occurrence, consequences and risk. Twelve of them were classed at High risk of reoccurring if changes in management where not carried out in future operations.

Fourteen of these issues were classified as...

*“Environmental damage or a release to the environment resulting in extensive, long term but reversible harm to a segment of the environment,*

*OR*

*Environmental damage or a release to the environment resulting in moderate harm to species habitat or ecosystems of high conservation value or special significance,*

*Or*

*Less than 5 years to recover.”*

If the lack of juvenile blackfish in the mainstream of the Gellibrand River is a result of the Olangolah Reservoir re-construction sedimentation spill, then 5 years is an enormous undercalculation.

**Loves Creek Fish Kill** – a subtle indicator??

In November 2018 what appeared to be a very minor fish kill was observed in Loves Creek. Andrew McClennan (Statutory Declaration, page 78) ) and Mike Maxwell (pers com.) observed dead fish floating in Loves Creek. The event when reported to authorities was regarded as inconsequential. One or two fish was regarded as a natural occurrence. Nothing was done.



Andrew froze this dead blackfish he found but was not aware that an autopsy needed to be done within a relatively short time. Maybe next time.



## Acid Sulfate Soils.

South of the Princes Highway into the Otway Ranges the potential for the creation of Actual Acid Sulfate Soils (AASS) is extremely high. There are numerous Potential Acid Sulfate Soils (PASS) that remain innate as long as they remain saturated. Dry out these PASS and huge problems can develop. To highlight the seriousness of this, one need go no further than a 7 hectare freshwater upland wetland of the Big Swamp along Boundary Creek. Boundary Creek is a tributary of the Barwon River.

**In 2017 Jacobs, Barwon Water's consultants tabled a report** on this wetland highlighting problems created as this swampy area dries out.<sup>(66)</sup>

- 26 out of 30 sample analysed from the wetland were in excess of the Victorian Government's Action Criteria levels of 18 moles of acid per tonne.
- If the top one metre of the wetland acid was mobilised it was estimated to amount to 134,000,000 moles of acid.
- The annual amount leaving the wetlands would be approximately 55,000 moles.
- If nothing was done and the drying out process was to continue as in the past the situation could persist for **several hundred years**.

Not a nice thing to contemplate. Just over in the next valley is the Loves Creek Catchment with PASS (Potential Acid Sulfate Soils).

### The Loves Creek PASS Sites.

In 2010 when LAWROC commissioned the Environmental Analysis Laboratory of Southern Cross University<sup>(67)</sup> to conduct soil analysis tests on the Big Swamp wetlands, LAWROC included other areas that were spot checked within the Loves Creek Catchment.

The Loves Creek Catchment sites indicated a mixed set of results. One site along the Spiny Horn Creek had high levels of potential Acid Sulfate Soil. However, the Acid Neutralising Capacity (ANC) of the soil was sufficient to neutralise any acid produced in the event the soil profile was to dry out. Sites on Yahoo Creek and Porcupine Creek had Titratable Actual Acid (TAA) levels well above the State Government Action Criteria. From this very scant check of the catchment it was obvious that the potential existed for other sites to go the same way as the Big Swamp wetlands.

### Maggios Swamp wetlands along Ten Mile Creek.<sup>(67)</sup>

At the headwaters of the Ten Mile Creek there is a magical small swampy wetland surrounded by forestry activities dating back to the 1970's (see Otway Water Book 23<sup>(21)</sup>). Soil from this wetland was collected from two depths and were analysed as part of a leaf analysis investigation. The upper level was 9.7

times the TAA Victorian State Government Action Criteria level and 1.2 times above the acceptable Reduced Organic Sulfur levels. This indicated that the area was a Potential Acid Sulfate Soil site requiring close monitoring. There are numerous other wetlands along the various reaches of the Ten Mile Creek that have never been tested for Potential Acid Sulfate Soils.

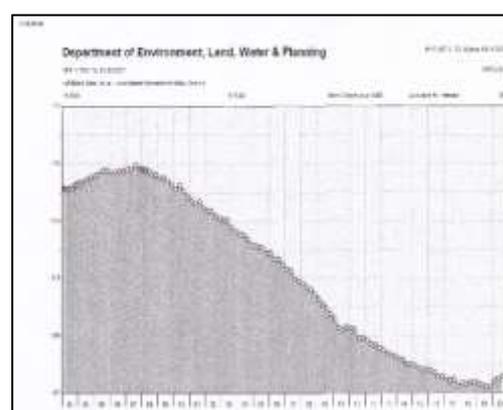
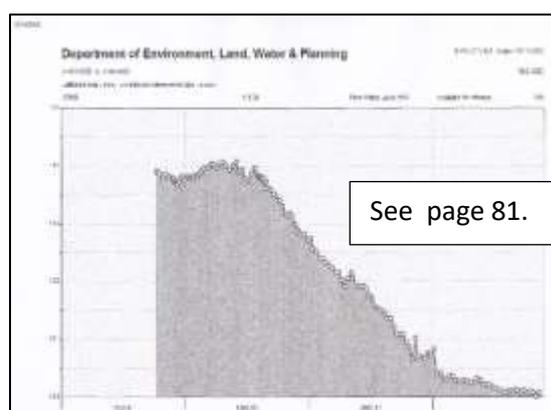
### **Porcupine Creek Wetlands and Acid Sulfate Soils.**<sup>(67)</sup>

In a similar fashion Porcupine Creek has similar analysis results as Maggios Swamp wetlands and requires close monitoring. Considering the samples at both the Ten Mile and Porcupine Creeks were taken from a very small area of the total wetlands, this is of some concern as to the overall Potential Acid Sulfate Soils condition of these wetlands. The Porcupine Creek wetlands alone cover a very large area.

### **Could There Be Another Cause of Depressurisation and or Lowering of Aquifers in the Gellibrand Groundwater Management Area?**

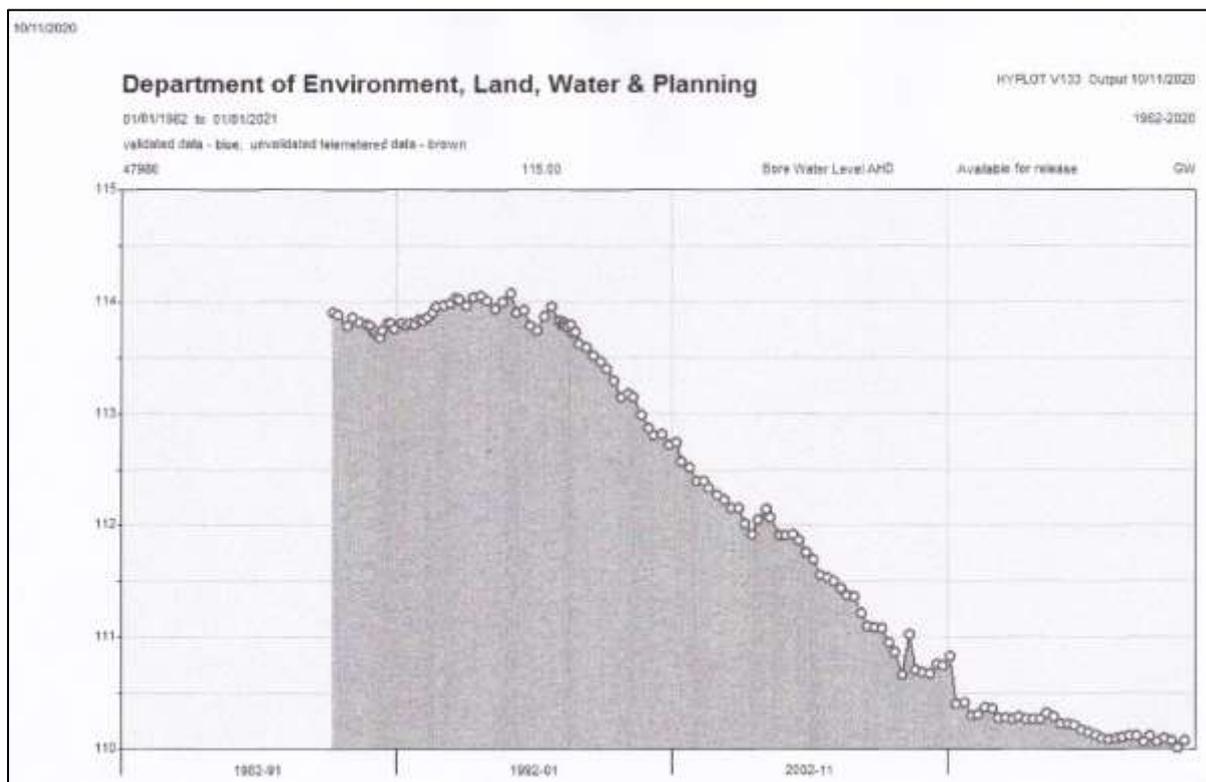
Otway Water Books 21 and 28 and the Wade reports, have focussed on many of the detrimental impacts within the Gellibrand Groundwater Management Area being a result of the spreading area of influence from the Barwon Downs Borefield extractions. Otway Water Book 57 clearly demonstrates that research documentation concludes that gas, oil and water extraction in Bass Strait off Gippsland has had a very dramatic and detrimental impact on onshore aquifers. Perhaps the extractions off Port Campbell have had a similar impact on the aquifers in the Otway Ranges.

The hydrograph on the left is from Bore 47986 at Kawarren, 1982-1/1/2020.



The hydrograph on the right is Bore 114164 at Barongarook, 1993-1/1/2020. It has been nearly 11 years since the last serious groundwater extraction at the Barwon Downs Borefield and these bores show very little sign of recovery despite many wet winters.

Reading Otway Water Book 57 certainly makes one wonder.



### What Can A Citizen Scientist Do?

It is so important that people living in the Loves Creek Catchment realise they can provide a most valuable contribution as citizen scientists. There are several things that can be done:

1. Keep the State Government resource Managers accountable.
  - a. Approach and discuss with people conducting unusual activities in the area.
  - b. Keep a record of these discussions – who, where, when and why.
  - c. Verify verbal facts provided.
  - d. Scrutinise and review written reports.
  - e. Be sure to follow up any requests made of the resource managers.
2. Record dated observations.
  - a. Change in springs, soaks and stream flow.
  - b. Fauna activity.
  - c. The “ordinary” and especially anything out of the ordinary.
3. Be involved in the Corangamite Catchment Management Authority’s “Water Watch” and other programs.

## CONCLUSION.

The health of the Loves Creek Catchment relies heavily on the activity of citizen scientists aiding the Government Resource Managers to successfully conduct their statutory responsibilities.

With limited resources at their disposal the Resource Managers' help can best be utilised applying "*the squeaky wheel gets the most attention,*" maxim.

## APPENDIX ONE. Extract from Loves Creek Water Audit.

### Recommendations for Future Action

1. Allow no further allocation of surface or groundwater in the Loves Creek Catchment.
2. Continue with the data collecting through personal visits with the intention of involving as many residents in the Loves Creek Catchment as is practical.
3. Investigate the feasibility and desirability to involve Beneficial Uses recipients from outside the catchment.
4. Continue attempts to involve Government authorities with catchment and natural water resource responsibilities.
5. While facilitating a better working relationship with regulatory bodies that influence matters within the Catchment, aim at creating "*a necessary reality check and knowledge base so that relevant ministers and other department officials can have confidence in its advice.*" (Bobbie Brazil – Chairman Landcare Council 2008)
6. Lobby the "authorities" to instigate a government funded Total Water Balance audit of the Loves Creek Catchment.
7. Conduct detailed long term studies to include both field and "desk top" information gathering on flora, birds, mammals, reptiles, amphibians, fish and freshwater macro invertebrates from the terrestrial ecosystems and the flora and fauna from the both the surface and groundwater ecosystems.  
Include the following studies...

- A. Determine an environmental flow regime for at least sixteen terrestrial indicator species that includes a mix of 4 fish, 4 water invertebrates, 4 flora species and 4 benthic algae that are groundwater dependent.
- B. Identify at least 5 fauna species that are found in the aquifer as indicators of the aquifer health.
- C. Determine the occurrence and abundance of these species including their conservation status.
- D. Compile an inventory of the habitat and biological needs of these species required to ensure their ecological survival.
- E. Plan for verification of the environmental flow requirements of these species 5 years hence.

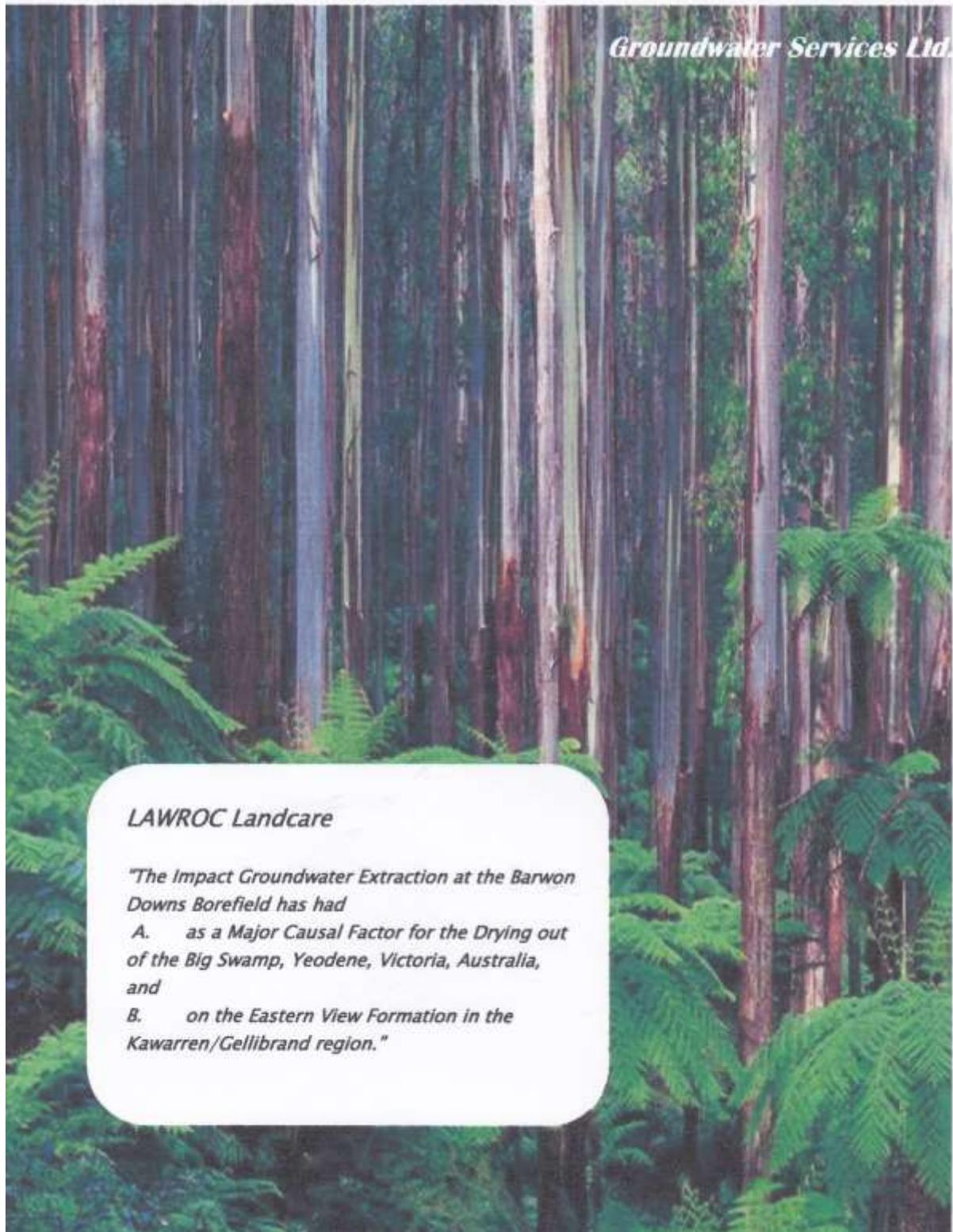
- F. Collect inventories of all other species in the study area.
- G. Assess the status of all species.
- H. Compile detailed information on the occurrence and abundance of rare, threatened and endangered species.
- I. record introduced species found in the wild.
- J. A report on the effects of human extraction of water resources from the catchment that has an influence on the environmental values of the area.
- K. Define those species studied that are partially and totally dependent on groundwater.
- L. Note the species most susceptible to change in the water regime of the area.
- M. Determine and note those species living with connectedness to water tables, springs, soaks and wetlands
- N. Set up a bore monitoring network specifically designed to monitor sites that have groundwater dependent species.
- O. Develop and provide accurate comprehensive maps that clearly mark the areas of investigation.
- P. Note on these maps the creeks, springs, soaks, wetlands and peat areas.
- Q. Indicate the creeks, springs, soaks, wetlands and peat areas being monitored.
- R. Collect data that includes seasonal and yearly fluctuations.
- S. Describe all species by scientific and common name(s).
- T. Investigate the notion that small streams act as breeding grounds for biota that in turn are flushed into and replenish depleted stocks in larger creeks and rivers.
- U. Investigate the relevance to the Loves Creek catchment of this statement made by Evans<sup>(1)</sup> that *"...most river systems in Australia are nitrogen limited, i.e. their ecological health is controlled by the availability of nutrients. Surface water is typically nutrient poor while groundwater may often be nutrient rich. Hence, the discharge of groundwater into rivers is often controlling the health of their ecology."*

An attempt to begin some of this work as outlined in point 7, has already been initiated. However, the need for closer scrutiny, scientific vigour and thoroughness will need to be applied.

- 8. Provide fish ladders at the Ten Mile, Porcupine and the Yahoo Creek stream flow gauging stations.
- 9. Survey the catchment for Potential Acid Sulfate Soils. This could be done when completing a comprehensive audit of springs and wetlands in the catchment as in point 7.P above.
- 10. Continue the work of fencing off stream frontages.
- 11. Endeavour to replace exotic species of vegetation in these stream side frontages with native species.
- 12. Facilitate environmentally friendly stock access to water resources.

13. Instigate a study aimed at ascertaining the influence and effects on the Loves Creek Catchment from drawdown influences by the Barwon Downs borefield extractions.
14. Develop a framework of accountability that is equitable to all Beneficial Uses. Up to this point the local landholder is easily held accountable for actions taken. There are sufficient regulations and authorities to enforce best practice. However, the same cannot be said for the authorities themselves. For example 6 megalitres of toxic polluted water was illegally extracted from the Kwarren borefield and released into the Loves Creek Catchment and the authority involved was not held accountable. If this same breach of the law had been done by a landholder the consequences would have been handled differently. Authorities and individuals have to be held accountable, abide by the law of the land and suffer the same retribution when the law is breached.
15. FUTURE PLANS to include LOCAL CONSULTATION. Any persons or authority making application to vary the water resource management within the Loves Creek Catchment is to consult with LAWROC or at the very least a significant number of residents in the Catchment. This would include such catchment management issues as riparian vegetation, river frontage management, fish stocking, salinity, weed control, spraying, willow removal and water resource allocation.
16. STREAM FLOW GAUGING STATIONS. Stations on Ten Mile Creek (235239), Porcupine Creek (235241), Yahoo Creek (235240) and Loves Creek (235234) should be maintained and kept in commission. The Porcupine, Ten Mile and Yahoo Creek stations were decommissioned in the mid 1990s. The Ten Mile and Porcupine Creek stations were recommissioned in 2008 in an ad hoc fashion. These stream flow measuring stations are vital data collecting points and must be calibrated and maintained, especially if accurate data is required in the future. Because of the low flow rates in these streams it is not adequate to "infill" missing data through extrapolation.
17. TRIGGER LEVELS. The above mentioned stream flow gauging stations should have trigger levels established. When reached landholders above the station should be notified and every possible attempt should be made to restrict water extraction to an absolute minimum. The only extraction past this point would be judicious use for stock and domestic.
18. DISPUTE RESOLUTION. Any disputes will be resolved in accordance with the Water Act 1989, Southern Rural Water policy and any other relevant Government policy.
19. REPORTING. Southern Rural Water to provide a yearly report on...
  - a. The full record of compliance to issued licences.
  - b. The annual amount of water diverted from the Loves creek catchment by entitled licence holders.
  - c. Any failures to comply with any licence conditions.
  - d. Actions taken with failures to comply with licence conditions.
  - e. Any significant amendments to any licence condition.
  - f. Any transfer of water from the Catchment including the place of origin and the destination.
  - g. Any water sales made from or within the Catchment.

## APPENDIX TWO.



### *LAWROC Landcare*

*"The Impact Groundwater Extraction at the Barwon Downs Borefield has had*

*A. as a Major Causal Factor for the Drying out of the Big Swamp, Yeodene, Victoria, Australia, and*

*B. on the Eastern View Formation in the Kwarren/Gellibrand region."*

**LAWROC Landcare**

**"The Impact Groundwater Extraction at the Barwon Downs Borefield has had  
A. as a Major Causal Factor for the Drying out of the Big Swamp, Yeodene,  
Victoria, Australia, and  
B. on the Eastern View Formation in the Kawarren/Gellibrand region."**

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Report prepared on: 10 March 2014

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GWJ144 LAWROC Landcare

"The Impact Groundwater Extraction at the Barwon Downs Borefield has had:  
A. as a Major Causal Factor for the Drying out of the Big Swamp, Yeodene, Victoria, Australia, and  
B. on the Eastern View Formation in the Kawarren/Gellibrand region."

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### Executive Summary

This report examines the nature and magnitude of adverse environmental effects due to groundwater abstraction in the Barwon Downs bore field (Gerangemetete Borefield), operated by Barwon Water for the purposes of drought relief for the city of Geelong, Victoria. The report is a desktop study, reviewing current and historical reports, (specifically Otway Water Books 19 and 21) on the matter, with a view to giving an opinion on whether the operation of the Barwon Downs bore field has affected the surrounding environment significantly. Effects of concern are the reduction of flows in Boundary Creek, the reduction in water levels in adjoining swamps and the reduction of groundwater levels in the abstraction aquifer and surrounding aquifers (Kawarren sub-basin). Resulting effects (water quality and ecological values) due to a reduction in flows in Boundary Creek are also reviewed.

It is considered that adverse environmental effects are occurring due to groundwater abstraction in the Barwon Downs bore field. The following points summarise the adverse environmental effects:

1. An increase in groundwater abstraction over four main pumping events that have occurred since the early 1980's has resulted in an increase in no flow days along Boundary Creek;
2. An increase in groundwater abstraction over the four main pumping events has resulted in a lowering of groundwater levels within the Barwon Downs aquifer; these levels have not recovered to predevelopment conditions (prior to the 1982 pumping event). Declining levels are evident in hydrographs that display immediate drawdown signatures and do not recover to pre-pumping levels. It is also considered that pumping is responsible for a regional decline in groundwater levels in aquifers (Kawarren sub-basin) not directly connected to the pumped aquifer. These aquifers exhibit declining levels that are not indicative of rainfall (recharge) variability;
3. Subsequent to the above two points, a decrease in water levels within adjoining swamps has occurred, resulting in drying out of peat soils and an increase in fire occurrence;
4. An overall reduction in flow along Boundary Creek has resulted in a decrease in pH levels reducing the quality of water supplied to the farming industry and also affecting ecological values, possibly beyond repair.

The Otway Water Books 19 and 21 provide a good summary of evidence that supports the claim of adverse environmental effects due to abstracting groundwater in this area. The books are generally organised in a timeline fashion and one recommendation would be to group each adverse effect within its generally recognised topic for ease of reading and impact. The books include anecdotal evidence, which whilst in declaration form could be bought easily into question. It is recommended that that evidence in the form of an observational record be supplied first and then supported with the anecdotal evidence provided for each topic grouping.

The Department of Natural Resources and Environment report titled "Groundwater Developmental Options and Environmental Impact – Barwon Downs Graben

GWJ144 LAWROC Landcare

"The Impact Groundwater Extraction at the Barwon Downs Borefield has had  
A. as a Major Causal Factor for the Drying out of the Big Swamp, Yeodene, Victoria, Australia, and  
B. on the Eastern View Formation in the Kawarren/Gaillibrand region."

Southwestern Victoria\* (Witebsky et al, 1995) also provides very useful datasets, analysis and conclusions with which to assert adverse environmental effects are occurring. This report provides a robust set of baseline data in the form of borehole/hydrograph records and the pumping tests itself for which the report has been prepared for. Given that the conclusions in the report were summarised in 1995, the report provides a good test of whether environmental impacts have occurred with subsequent periods of pumping.

The Witebsky et al (1995) report asserts that 4,000 ML per year on average is what the Barwon Borefield should be licensed for and any increase on this amount should be mitigated with either a cessation of pumping until groundwater levels have recovered or that artificial recharge should be employed. Neither of these recommendations has been undertaken and the increase in pumping over and above the 4,000 ML per year (currently approximately 10,000 ML/yr) has resulted in effects that are supported by forward predictions (based on modelling) contained within the Witebsky et al (1995) report, being an increasing drop in regional groundwater levels **without recovery** and reduced flows within Boundary Creek. Of note is that the Witebsky et al (1995) report recommends that regional drawdown in residual groundwater levels (groundwater levels after pumping has ceased for some time) should not be any greater than 20 m; observed effects on the surrounding environment suggests that this figure should be very much less. The data supplied in Books 19 and 21 show that groundwater levels in a number of bores are fast approaching this 20 m reduction as of 2009 and is likely to have even surpassed this number with the addition of data from 2009 onwards.

#### Scope of this report

The brief is to:

1. Appraise, review and scrutinise each causal item presented in Otway Water Books 19 & 21 to determine which items are:
  - able to stand up to rigorous debate/scrutiny,
  - conjecture,
  - anecdotal, and
  - of little use when being used to support the reason for drying out impacts on Big Swamp.
2. Write a conclusion section that includes a clear enunciation of which data supports the argument that groundwater extraction is the major cause of the Big Swamp drying out.
3. To examine the effect groundwater abstraction at the Gerangemete bore field is having on the Kawarren/Gellibrand branch of the Eastern View Formation (EVF).
4. Make recommendations, including costing, on research that may be required to fill any shortfall that would be required to support the argument that groundwater extraction at the Barwon Downs bore field is the major cause for the drying out of Big Swamp and having impact on the Kawarren/Gellibrand section of the EVF.

It is the endeavour of this report to address these matters.

#### Nomenclature

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\*The Impact Groundwater Extraction at the Barwon Downs Borefield has had  
A. as a Major Causal Factor for the Drying out of the Big Swamp, Yeodene, Victoria, Australia, and  
B. on the Eastern View Formation in the Kawarren/Gellibrand region.\*

Throughout this report a number of descriptors are used for the same article and are interchangeable, these are but not limited to:

Barwon Downs bore field – Gerangemete bore field  
Barwon Downs Aquifer – Eastern View Formation

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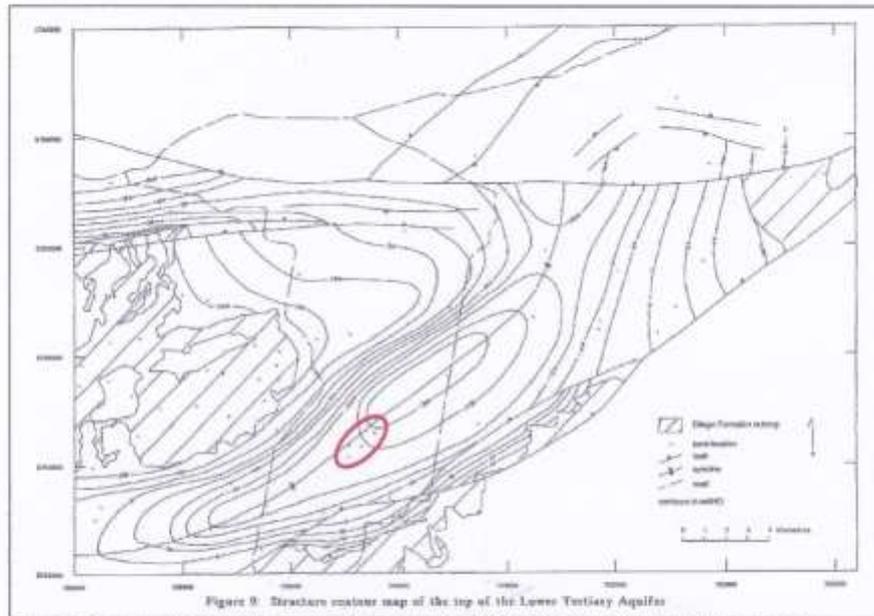


Figure 2. Structural base of the Barwon Downs aquifer (Witebsky et al, 1995). Red circle denotes bore field.

The groundwater high present in the north western section of Figure 3 is in part caused by a basement high in the underlying Otway Group. It is also the source of the main recharge zone of the Barwon Downs aquifer given that the Dilwyn Formation outcrops at this location.

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## 1 INTRODUCTION

### 1.1 Background

Water from the Gerangemete bore field (Barwon Downs Bore Field) has been abstracted since the early to mid-1970's. This water has been abstracted for water supply needs of Geelong City and outlying areas in the south western part of the state of Victoria, Australia (Figure 1). In particular, the water has been abstracted during times of drought when other water sources cannot be utilised to the same extent to meet the demands of a large population centre. As such, the Gerangemete Bore Field is an infrastructural asset of critical importance.



Figure 1. Location Plan

Since the establishment of the Gerangemete bore field development, a large amount of water has been abstracted during water-short periods. The bore field is not always utilised year-in, year-out. However, it is asserted by LAWROC that since abstraction has been occurring, adverse environmental impacts have occurred including, but not limited to, the occurrence of zero flow days in Boundary Creek, the drying up of Big Swamp, degraded water quality values in both respective water bodies and the degradation of fauna and flora.

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## 1.2 Geological and Hydrogeological Setting

The Barwon Downs aquifer (also been termed Eastern View Formation) is a sedimentary deposit that sits within a graben (extensional basin) that trend southwest to the northeast (Figures 1 and 2). This graben extends from just south west of Geelong to Cape Otway and is associated with the Otway Ranges. In simple terms, the Barwon Downs aquifer is hosted in marine sedimentary deposits of the Wangerrip Group (Witebsky et al, 1995). This is a basal Tertiary group comprised of unconsolidated sands, gravel and ligneous deposits in places. It is underlain by the Cretaceous Otway Group of very low permeability sandstones. Overlying the aquifer is a Marl of low permeability which acts as an aquitard, termed the Narrawaturk Marl.

The Barwon Downs Bore Field generally abstracts water from the Wangerrip Group (Figure 2). The Wangerrip Group sits within a small synclinal structure that trends southwest to northeast. To the northeast, the Wangerrip Group pinches out and constitutes the bulk of the water bearing material. To the southeast, the aquifer formation is truncated by the Bramba fault and is also truncated by the Birregurra fault to the north or is exposed in the Barongarook High. To the southwest the aquifer is bounded by either a pinching out of the Wangerrip Formation or there may be a groundwater divide; in any case there appears to be a hydrological boundary, beyond which pumping effects are not immediately observed (Figure 3). The aquifer does, however, extend beyond this boundary and constitutes the aquifer that sits under the Gellibrand/Kawarren areas; it also constitutes a different groundwater management zone by water authorities.

The geometry and location of the Barwon Downs aquifer is presented in Figure 2 below as a structure contour map of the Dilwyn Formation (Wangerrip Group) within which all of the Barwon Water bores abstract from. This map has been taken from the Witebsky et al (1995) report along with the piezometric contours presented in Figure 3.

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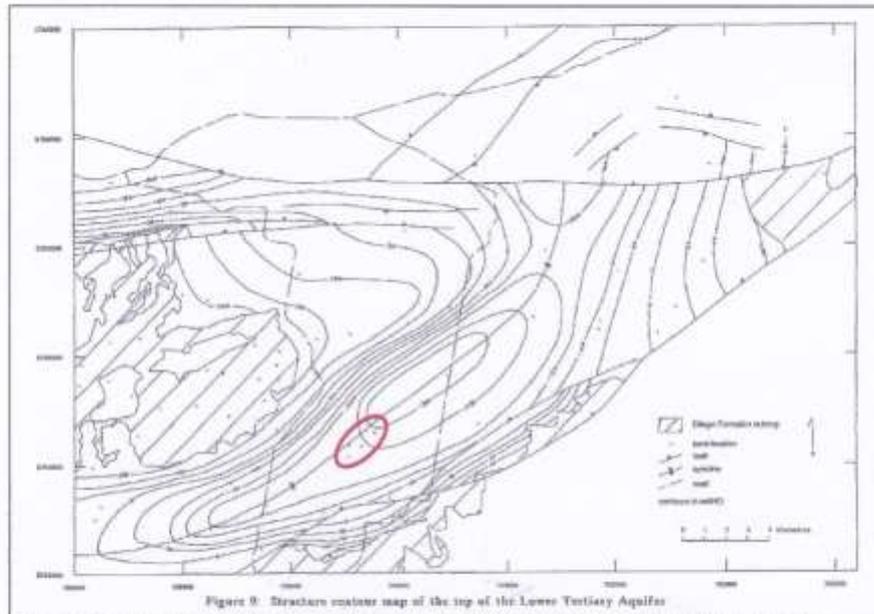


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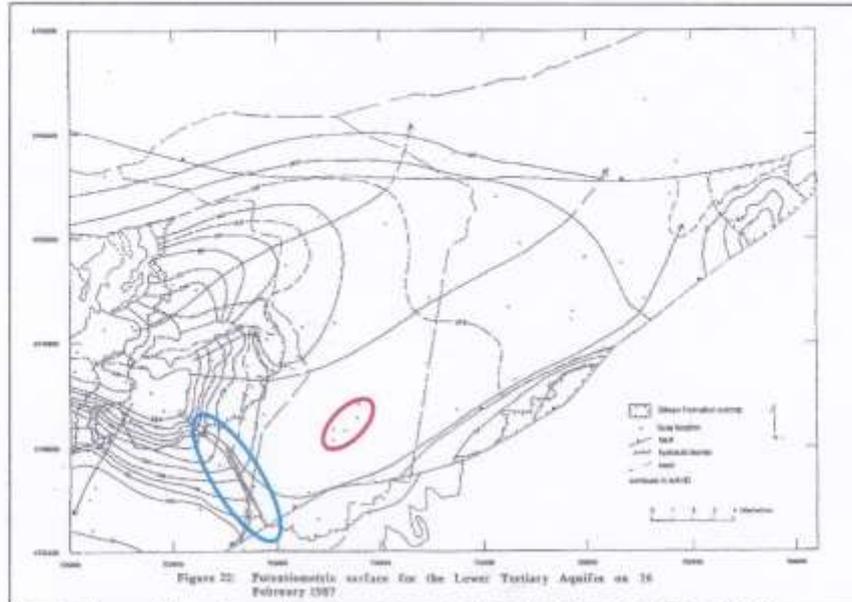


Figure 3. Piezometric contours of the Barwon Downs Aquifer (Witebsky et al, 1995). Red circle denotes bore field. Blue circle denotes location of the groundwater divide, separating the Barwon Downs Aquifer with the Kawarren sub basin.

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## 2 ENVIRONMENTAL DEGRADATION IN THE BOUNDARY CREEK AREA

Otway Water Book 19 provides compelling evidence to support the claim that environmental degradation in the Boundary Creek area is occurring. The conclusions of this report are that there is environmental degradation. The following topical points are examined and their efficacy to support the claim of environmental degradation is discussed.

### 2.1 Groundwater Levels

Groundwater storage is one of the most sensitive environmental factors to abstraction, affecting groundwater levels directly. The pumping periods undertaken in the Gerangamete bore field have contributed to considerable groundwater declines during the past 30 years of operation. Table 1 presents the overall declines considered in nearby monitoring wells. Figure 4 presents their locations. It is noted that the Gerangamete bore field abstraction accounts for at least 95% of all abstraction in the Barwon Aquifer.

**Table 1. Summary of groundwater declines – observational estimations from published graphs (Otway Water Book 19)**

Years	Volume (ML)	Overall decline in Bore 64229 (G13)	Overall decline in Bore 82840 (M24)	Overall decline in Yeo 40	Overall decline in Yeo 21
1982 – 1983	8,000	~7m	~3m	No data	No data
1987 – 1990	25,000	No decline	~3m	~1.5m	~3m
1997 – 2001	36,587	~10m	~7m	~6m	~5m
2006 – 2011	52,684	No data	No data	~2.5	~5m
Total decline		~17m	~13m	~10m	~13m

What is evident in the data records is that after each stress period, groundwater levels have not recovered to where they once were. It is therefore reasonable to assume that if the current regime of abstraction continues, groundwater levels will continue to decline and adverse environmental effects also continue and increase. In Figure 5 the observations for groundwater decline estimation is presented. Water levels have struggled to recover from the 1987 – 1990 pumping period and it is considered this is an example of groundwater mining (where average groundwater demand is greater than average groundwater recharge).

A visual analysis on groundwater rainfall recharge has been undertaken to assess impacts due to changes in rainfall. Rainfall data has been collected from the Birregurra Post Office climate station. From 1970 to 2013 there has been a slight decline of 100 mm of average annual rainfall. Given that recharge will be of the order of 10% of the 100 mm figure, the decline in average annual rainfall is not enough to account for the 10 to 13 or so metres of decline observed in the monitoring bores presented in Table 1.

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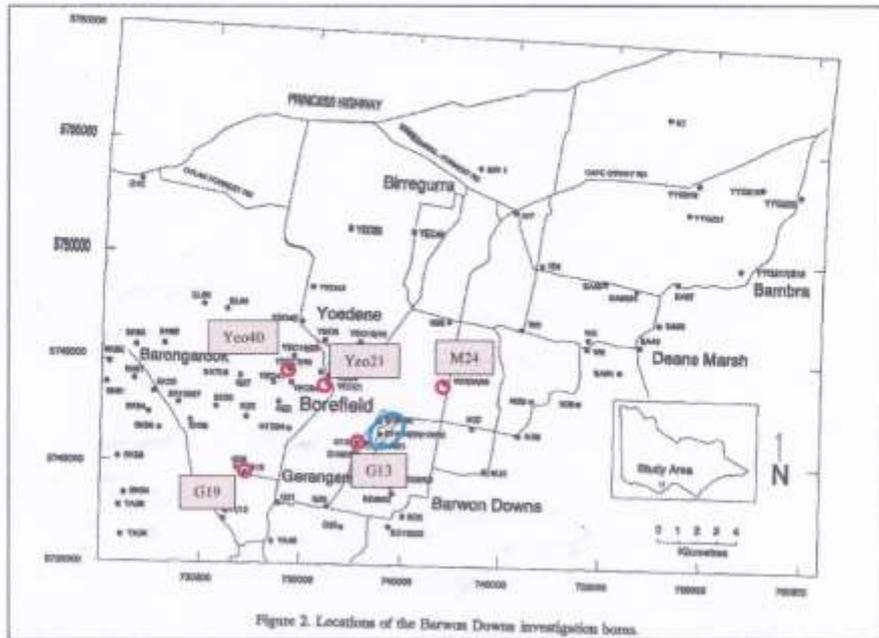


Figure 2. Locations of the Barwon Downs investigation bores.

Figure 4. Bore Location plan (Witebsky et al, 1995). Red circles denote bores listed in Table 1. Blue circle denotes location of abstraction bores.

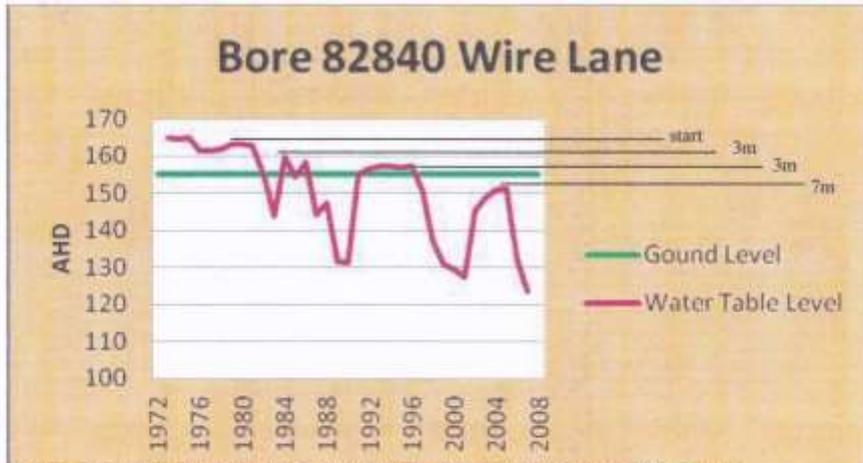


Figure 5. Groundwater declines in Bore 82840. Taken from Otway Water Book 19, page 66.

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## 2.2 Groundwater levels in the Kawarren/ Gellibrand Area

Declining groundwater levels in the Kawarren sub-basin to the west of the Barwon Downs aquifer are not so easy to explain. Water level records do show a decline in groundwater levels since pumping has begun and it is likely that this is the result of cumulative effects of pumping in the adjacent Barwon Downs aquifer. The two aquifers are separated by what is widely believed to be a groundwater divide (presented in Figure 3.) most likely created by a basement high that intersects the overlying aquitard; it could well be a no flow boundary. In any case, bores situated in the Kawarren aquifer do not show a direct drawdown response to pumping of the Barwon Downs aquifer, particularly the 1997 to 2001 pumping period (Figure 6) that shows a typical pumping signature, albeit over a long time period. It is considered that they do show an indirect cumulative effect from the Gerangemet pumping.

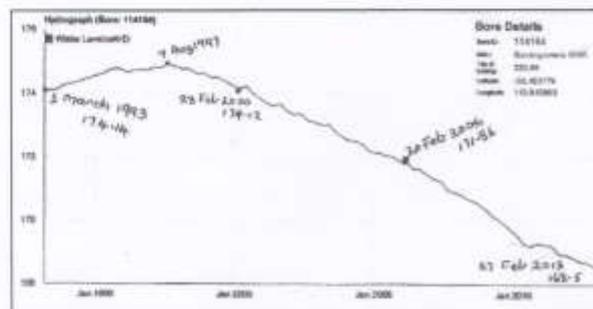


Figure 6. Groundwater decline in Bore 114164 (Bore G19 in Figure 5 above). Graph taken from Otway Water Group Book 21

Any response in groundwater levels in the Kawarren sub basin to pumping in the Barwon bore field would need to be transmitted through a low permeability zone – this would likely even out the peaks and troughs of groundwater pumping and produce an overall linear decline (decline without recovery) as seen in some of the Kawarren borehole water level records. It is therefore considered that the groundwater decline, as presented in Figure 6 is likely to be the result of pumping in the Barwon Downs bore field.

## 2.3 Boundary Creek Flows

It is asserted that flows along Boundary Creek, in the area of the Stream flow Gauging Station Number 233228, have degraded since pumping started in the Barwon Downs Bore field. This area has been designated by SKM as the "Region of Groundwater Discharge to Boundary Creek" (Otway Water Book 19, page 45), and set a trigger level of 158.5 mAHD stating that the upper section of Boundary Creek in this area would change from a discharging site to a groundwater recharging site once the water levels reached approximately 156 mAHD (Otway Water Book 21, pages 58-59). The water levels for this trigger point, after 3 years of no pumping, are still below the 150 mAHD level as described in the 2012-2013 Groundwater Licence Report Number BEE032496. This asserted degradation is supported by statutory declarations by long term residents who have observed the flows in Boundary Creek. They state that flows had not declined prior to pumping, have remained steady for the most part of the 20<sup>th</sup> Century

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and that there were no "no-flow" days also prior to pumping. One declaration covers a period from 1912 onwards (Nellie Shalley) Whilst there are a number of declarations supporting this claim, no long-term observational record is supplied with them; no flow recordings using robust and consistent flow measurement techniques. This is a problem and brings the declarations into doubt and question. However, if no such data exists, the observations of the residents cannot be discounted.

The proving of flows in Boundary Creek is central to claiming that environmental degradation, in its many forms, has occurred. Flows in Boundary Creek will affect pH levels, heavy metal concentrations, ecological state and also the state of saturation in Big Swamp itself. However, flow data has been collected since the start of pumping in the Gerangemete bore field. This data is presented in the form of no-flow days and presents a relationship of increasing no-flow days with increased pumping and stress on the abstracted aquifer. Four major periods of pumping have occurred since the installation of the borefield. Each of the four pumping events are characterised by an increase in abstracted volume (Table 2.).

**Table 2. Summary of abstracted volumes and no flow days.**

Years	Volume (ML)	Annual Averaged Volume (ML)	No. of no flow days in Boundary Creek at the Yeodene recorder site (average per year)
1982 – 1983	8,000	4,000	7 (3.5)
1987 – 1990	25,000	6,250	No data
1997 – 2001	36,587	9,147	328 (65.6)
2006 – 2011	52,684	10,536	503 (125.8)

Stream flows and numbers of no-flow days have also been recorded over the same time period (Table 2). It is clear that as abstraction volumes increase so to do the amount of no-flow days along Boundary Creek, increasing from an average annual of 3.5 days to 125.8 days. Boundary Creek flow data has been collected from the Victoria Resources Data Warehouse. At a cursory glance, there does not appear to be a strictly linear relationship between extraction numbers and flow with respect to the data presented in Table 2, however, what is apparent is that a threshold is reached with extraction above which no-flow days seem to increase significantly. It is considered that this threshold represents a lowering of the groundwater table below that of the creek bed and furthermore, the recovery of the groundwater table does not appear to have occurred between periods of pumping. The Witebsky et al (1995) report investigated and showed a flow relationship between stream flow and abstraction. This correlation appears to be more obvious when pumping volumes are increased (Witebsky, 1995, page 70) which supports the general trend of numbers presented in Table 2.

In addition to flow data, Witebsky (1995) has produced piezometric contour maps of the pumped aquifer (Barwon Downs Aquifer). It can be seen in one of these maps, presented in Figure 7, that Boundary Creek is a gaining stream and a major output of regional groundwater flow. Given this, any abstraction within the pumped aquifer will undoubtedly have an effect on Boundary Creek flows; stream depletion is likely to occur.

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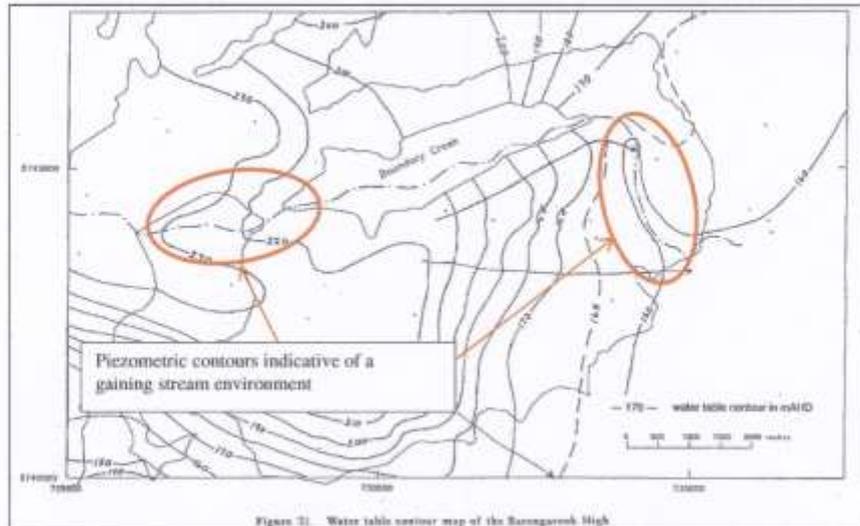


Figure 7. Piezometric contours in the Boundary Creek area for the Barwon Downs Aquifer in unstressed conditions (Witebsky, 1995).

The increase of no-flow days over time due to increased amounts of pumping supports the anecdotal evidence that prior to any groundwater abstraction from the Barwon Downs Bore Field, flow along Boundary Creek was more constant and that much fewer no-flow days would have occurred. Certainly the fact that during the first major period of pumping for drought relief in 1982 - 1983 only 7 days of no-flow were recorded in 1984 and 1985, and in contrast, during the 1997 - 2001 pumping period, 328 days of no-flow were recorded. This increase in no-flow days supports anecdotal evidence.

#### 2.4 Condition of Swamps adjoining Boundary Creek

Pumping from the Barwon Downs Bore Field could cause the drying up of Boundary Creek associated swamps, however, this assertion cannot be proven conclusively. The problem of testing this assertion arises from the lack of observational data in the form of swamp water level (and/or spring water level) observations. Although Otway Water Book 19 provides plenty of anecdotal evidence to support the assertion of Big Swamp drying up, without a long term observational data record that would include the monitoring of stream stage and swamp water levels, it is hard to define the causal link. It is possible that the swamps exist due continuous stream flow in Boundary Creek, given the base flow associated with historical groundwater highs or that the swamps are fed directly from regional groundwater flow; however, it is also equally plausible that swamp levels are due to underlying low permeability material that is not able to transmit rainfall recharge. However, in general, the lowering of groundwater and stream recharge due to abstraction does usually have an impact on neighbouring riparian wetlands/swamps. The anecdotal evidence does, however support the conclusion that the swamps are getting drier, particularly with the increased incidence of fires. The point must be made, however, that if suitable mitigation was employed to remediate groundwater levels to pre-development levels, then the causal link could be

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established if shallow groundwater levels situated near these swamps were to be monitored.

## 2.5 Acidity levels in Boundary Creek

The discussion and evidence for acidity increases in Boundary Creek provided by Otway Water in the Otway Water Book 19 is robust. Evidence in the form of a long-term observational record is supplied within the report and contrasted with a nearby stream that is also groundwater fed, but not showing signs of flow decline. Figure 7 demonstrates that there has been an acidity increase over time, however, further work needs to be undertaken to understand the causes for this. It is noted that a notable drop in pH levels do occur around the 1990 to 2000 time period, this is approximately within the same period of dry day increases.

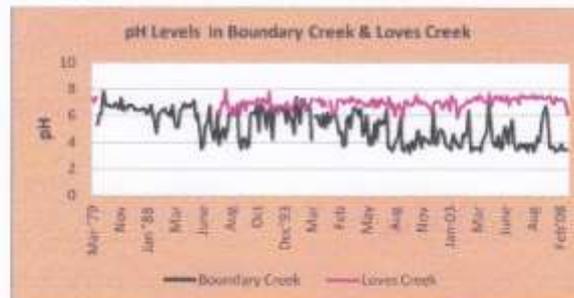


Figure 8. Increase in acidity in Boundary Creek over time. Otway Water Book 19, Page 78.

## 2.6 Ecological Indicators

Ecological indicators have not been well observed in the investigation of the Boundary Creek environment. Otway Water Book 19 mentions a study undertaken by Tunbridge, but no observational data is provided. It is understood, however, that the Tunbridge study does identify fish species which are no longer present in Boundary Creek. It is recommended that the data from this study is presented to support any ecological claims made, otherwise the report will be relying on anecdotal evidence.

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### 3 CONCLUSIONS

The following points summarise conclusions made from this desktop study:

- From evidence contained within Otway Water Book 19, it is quite clear that the groundwater resource in the Barwon Downs aquifer is reducing over time. The evidence that supports this is the series of graphs presenting groundwater levels over a 20 year time period. Each time the resource is stressed via abstraction, groundwater levels drop significantly and do not fully recover to where they were before.
- The reduction in groundwater resource is more than likely having an effect on surface water resources and much evidence, recorded observations as well as anecdotal, supports this.
- The 1995 report prepared by The Department of Natural Resources and the Environment (Witebsky 1995) clearly states that any abstraction over 4,000 ML per year from the Barwon Downs bore field will result in degraded environmental values if groundwater levels are not allowed to recover either by cessation of pumping or artificial recharge.

It is our opinion that no further work is required to be undertaken with respect to investigating the causal links from pumping to environmental degradation, because it is clear that there is a significant and strong causal link. The requirement to determine recharge rates and permeability's through the overlying aquitards (leakage) is not needed as all relevant data is contained within the water level record. That record shows that recharge is simply not occurring fast enough to recover the water level to pre 1980 conditions; that is all that is needed to be known. Relevant recharge rates should be able to be calculated using the recovery rate observed within relevant bores.

Further and continuous environmental monitoring should occur, however, monitoring will likely record further degradation if mitigation in the form of either cessation of pumping or groundwater injection is not undertaken to let the water levels recover to pre-1980 levels. To this end, the recommendations provided in 1995 by the Department of Natural Resources and the Environment still stand; that is a programme of conjunctive use to recover the storage of the Barwon Downs Aquifer must be employed to maintain environmental values. Specifically the water levels in specified monitoring bores need to recover to pre-1980 levels for the flow regime in Boundary Creek to recover, that is, the occurrence of zero no flow days and continuous groundwater supported base flow to return. Given the amount of time it will take to naturally recover groundwater levels in the Barwon Downs aquifer due to low natural recharge rates, the efficacy of injection wells to artificially recover water levels should be investigated.

It is also asserted that the declining water levels in the Kawarren/Gellibrand groundwater zone could also be mitigated with a conjunctive use strategy. Allowing water levels to recover in the Barwon Borefield area, either by cessation of pumping or by injection will likely recover the groundwater levels in the Kawarren/Gellibrand sub basin if the two groundwater zones are indirectly connected through a low permeability zone or groundwater divide. However, recover of the water levels in the

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Kawarren/Gellibrand aquifer would likely take longer to recover than in the Barwon Borefield area.

In simple terms the Eastern View Formation aquifer can be likened to an overflowing bucket, with the bucket being the aquifer and the overflow the Boundary Creek. If more water is sucked out of that bucket than what is going into that bucket then that bucket will no longer be overflowing.

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# APPENDIX Three.

## Media Release

The Hon Lisa Neville MP  
Minister for Police  
Minister for Water



Thursday, 9 August, 2018

### REMEDIATION PLAN FOR OTWAY WATERWAYS

The Andrews Labor Government is protecting the health of Otway waterways by ensuring Barwon Water repair the environmental impacts of past groundwater extraction in the region.

Minister for Water Lisa Neville has intervened through Southern Rural Water (SRW) to request a legally enforceable remediation plan, under Section 78 of the Water Act, to improve and protect the health of key waterways in the Otways.

Ms Neville said she was also requesting extra work to determine whether any further extraction is sustainable. This is in addition to the normal assessment process.

The announcement – which affects waterways such as the Big Swamp, Boundary Creek and Barwon River (between Boundary Creek and Winchelsea) and important groundwater reserves – includes the following directions to SRW:

- That Barwon Water prepare a thorough remediation plan, given findings that past groundwater extraction have affected pH conditions in Boundary Creek
- That in addition to the normal assessment process, SRW establish an independent technical review panel to assess Barwon Water's groundwater extraction license renewal application
- That SRW work with DELWP to determine whether a change to the overall permissible consumptive volume for the Gerangamete Groundwater Management Area should be reduced
- That Barwon Water discontinue any extraction activities, other than for maintenance and emergency response purposes, while the assessment is being completed and until all remediation work dictated under the remediation plan has been completed.

While groundwater extraction to supplement supply hasn't been undertaken in the borefield in two years, the environmental impact from past extraction means there needs to be a change in approach.

In addition, SRW will create a community reference group to provide input into the groundwater license renewal assessment process and a forum for issues to be raised in a formal manner.

People who wish to register interest to take part in the community reference group can contact Southern Rural Water on 1300 139 510.

The Labor Government has already invested in large-scale infrastructure projects such as the desalination plant, the Melbourne-Geelong pipeline and Anglesea borefield – which now means Geelong's water supply is future-proofed, more secure than ever before and less reliant on groundwater.

#### Quotes attributable to Minister for Water Lisa Neville

*"Maintaining the health of these vital waterways is vital for both the Geelong community and local environment."*

*"I've placed strict requirements on Barwon Water's licence renewal process and I expect them to be complied with."*

*"I will ensure the health of our local waterways is prioritised, and that locals are kept well-informed on the development of the remediation plan."*

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## APPENDIX Four. Direct extract from Otway Water Book 42J.

(Changes Made: the references have been changed to match the references in this Book)

Some of the confirmed surrounding environmental area impacts.

Page | 106

1. Base flows in Loves Creek have been reduced by at least 50%.<sup>(61)</sup> At the very least Loves Creek should be rated as a high risk area. There are contradictory elements regarding whether Loves Creek is a gaining, losing or neither of these as a flowing creek.
2. Jacobs<sup>(53)</sup> confirms a surface and LTA interaction in Ten Mile Creek that is attributable to the majority of Loves Creek base flows.
3. Beneficial Uses of the water from the Ten Mile Creek, Loves Creek and the Gellibrand River have suffered serious impact and landholders Rob Maxwell, Mike & Carol Maxwell and Neil Longmore & Marina Lewis (pers. comm) are but a few of those impacted.
4. Social and environmental impact within the Gellibrand catchment.
5. Reduced flows in Gellibrand River as stated by Jacobs<sup>(41)</sup>
6. An Actual Acid Sulfate Soil site at Cirrillo's in the Barongarook Creek Catchment is well inside the drawdown area of influence. Requests to have this site investigated resulted in Jon Fawcett (SKM at the time) collecting samples. No report was forthcoming and later requests to follow this up were ignored. LAWROC Landcare funded tests confirmed the site as an Actual Acid Sulfate Soil site.<sup>(8)(10)</sup>
7. The Barongarook Creek Catchment has been impacted.<sup>(60)</sup> This fits the Cirrillo's AASS site scenario.
8. There is an Actual Acid Sulfate Soil site at Campbell's in the Yan Yan Gurt Creek Catchment well inside the drawdown area of influence. This site was investigated as part of the Jacobs work and this has been found to be a site resulting from groundwater extraction.<sup>(8)(10)</sup>
9. A drawdown under the Kawarren township and surrounding district from the Barwon downs Borefield, has been confirmed.<sup>(14)</sup> After exhausting many avenues of possibilities, a Jacobs "Kawarren Drawdown Investigation" found that... ***"In summary, the subdued drawdown observed in Kawarren is considered to be the result of pumping from Barwon Downs."*** The drawdown is in the order of 3-4 metres.
10. The fire risk has been heightened over the 480 km<sup>2</sup> drawdown area of influence.
11. High value GDE areas within the drawdown influence have been decimated.<sup>(17)</sup>

# APPENDIX Five. Boundary Creek Platypus Study.

f(281)

## Assessing platypus presence and habitat quality in Boundary Creek


**Confidential Report**

December 21, 2017

**Prepared for:**  
Josh Hale  
**Jacobs**

**Prepared by:**  
Josh Griffiths  
**cesar**  
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Parkville, VIC 3052  
Australia

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## Summary of site assessment – Boundary Creek

Wildlife Ecologist, Josh Griffiths conducted a site visit to Boundary Creek with staff from Jacobs and Barwon Water on 12<sup>th</sup> April 2017 to visually assess the habitat quality for platypuses and collect water samples for eDNA analysis for the presence of platypuses. In general terms, the key habitat requirements of platypuses include permanent water for foraging, stable earthen banks to construct burrows, and an abundance of invertebrate prey.

The current habitat quality of the creek was considered poor to moderate. The best available habitat is in Reach 1 upstream of McDonald's dam. This reach contains a number of habitat variables considered favourable for platypuses including permanent flowing water (provided by 2ML/day supplemented through a pipeline from West Gellibrand Reservoir), some pools up to 0.5m deep, relatively steep, stable banks suitable for burrow construction, native riparian vegetation including large trees, and areas of cobbled/rocky substrate and large woody debris (Ellem *et al.* 1998; Grant 2004; Milione and Harding 2009; Serena *et al.* 1998; Serena *et al.* 2001). Reach 1 terminates in a large farm dam (McDonalds Dam) may provide suitable foraging habitat and drought refuge. Downstream of the dam, Reach 2 has less favorable habitat with areas of cleared riparian zones, channelised sections, and little bank habitat suitable for burrowing. At the downstream end of Reach 2 the channel braids and disperses to form swampy area with little apparent surface water. The most downstream reach of Boundary Creek that terminates in the Barwon River, Reach 3, contains very poor platypus habitat and appears to be seasonally dry for extended periods.

Reports from local residents indicate platypuses once occurred in Boundary Creek (Jacobs 2017) but there is little evidence to suggest platypuses currently occupy the creek. A search of the available wildlife databases (Victorian Biodiversity Atlas, Atlas of Living Australia, platypusSPOT – accessed 13/4/17) reveals no records of platypuses in Boundary Creek although the species is known to occur in the wider catchment area including the adjacent Barwon River (McKinnon and Milner 2009, APC 2002). Based on the observed conditions in Boundary Creek, platypuses inhabiting the Barwon River are unlikely to make regular use of Boundary Creek due to dry conditions in the lower reaches inhibiting dispersal upstream. The presence of an on-stream dam between Reach 1 and 2 further fragments the system. However, it is possible that Boundary Creek receives occasional use by platypuses when conditions are suitable.

We used environmental DNA (eDNA) to systematically assess the current presence of platypuses in Boundary Creek. Environmental DNA techniques detect genetic material from the target species in water samples and has proven to be highly sensitive to detect platypuses (Lugg *et al.* ; Weeks 2010). Water samples were obtained from five sites along Boundary Creek and two sites in the adjacent East Barwon River using standard techniques and assessed for the presence of platypus DNA using species specific primers (Weeks *et al.* 2015). No platypus DNA was detected at any of the sites investigated (Table 1).



Site	Waterway	Location	Easting	Northing	Test result
BC1	tributary of Boundary Ck	BC release pipe	727545	5745385	Negative
BC2	Boundary Ck	Reach 1 upstream MacDonald's dam	733558	5745986	Negative
BC3	Boundary Ck	McDonald's dam	734150	5745515	Negative
BC4	Boundary Ck	Reach 2 channel upstream damplands	734291	5744629	Negative
BC5	Boundary Ck	Reach 2 upstream Big Swamp	734655	5743987	Negative
BR1	Barwon Rv	Colac-Lorne Rd	741846	5747383	Negative
BR2	Barwon Rv East	Dewings bridge Rd	739877	5742355	Negative

Table 1: Site details and results of eDNA testing for platypuses in Boundary Creek and the adjacent Barwon River in April 2017.



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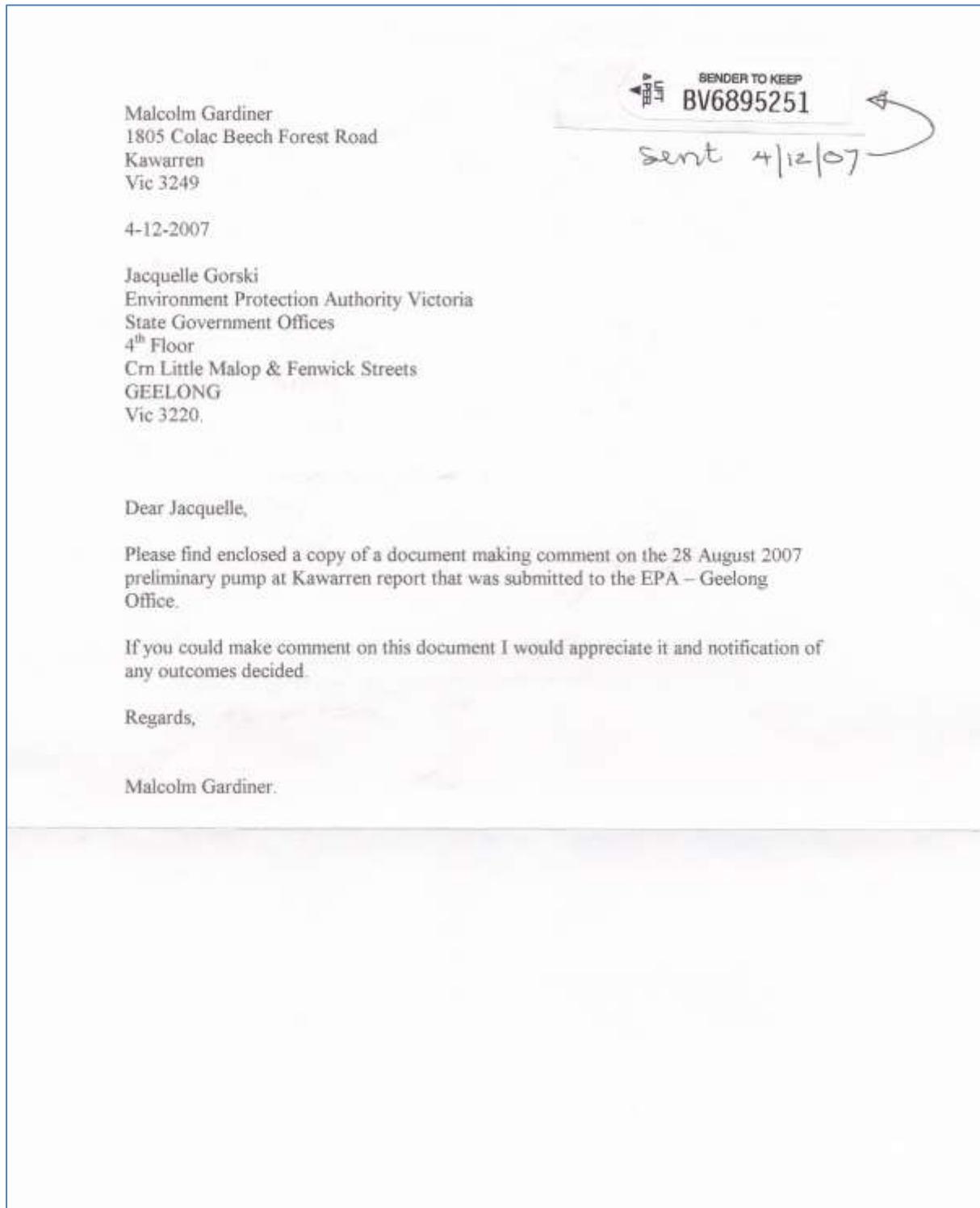
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## APPENDIX Six. Letter to EPA. Criticism on Test Pump.



# Comment to the Environment Protection Authority, Geelong Branch, on the ..

Newlingrook and Gellibrand Groundwater Investigation – Kawarren Pumping Bore Assessment Report

Page | 113

(Draft, 28 August 2007, organised and reported by SKM on behalf of Barwon Water.)



Ten Mile Creek (under threat of being dried up by groundwater extraction at Kawarren), a tributary of Loves Creek at the Decommissioned Stream Flow Gauging Station,. May 2007.

Draft  
28 August 2007

Access to this report was promised at the 25 October 2007 meeting Barwon Water ran at the Gellibrand Hall for the Kawarren/Gellibrand community. Following a letter from Paul Northey (Appendix One) access to the above mentioned report was gained through Barwon Water's web site once it was placed on the web some time after 7 November 2007. (However Scott Dennis did provide a hard copy on Wednesday 7 November 2007.)

(Unless otherwise indicated the page numbers and figures referred to in this document are directly related to the page numbers and figures of the SKM 28 August 2007 Report.)

### **STATE GOVERNMENT POLICY**

Gazetted State of Victoria Government Policies:

- a. "State Environment Protection Policy – Waters of Victoria," and
- b. "State Environment Protection Policy – Groundwaters of Victoria,"

have been used as references.

It is the intention of this document to demonstrate to the Environment Protection Authority (EPA), Geelong, that to proceed with the test pump at Kawarren will seriously and adversely compromise Beneficial Uses of the surface and ground waters in the Kawarren/Gellibrand district if additional studies and provisions are not implemented. The Beneficial Uses affected being:

- a. the natural aquatic ecosystems and associated wildlife
- b. water based recreational and aesthetic enjoyment,
- c. agricultural water supply of irrigation, stock and domestic, and
- d. recreational use of edible fish.

As pointed out by SKM at the Gellibrand Hall meeting on the 25<sup>th</sup>, SKM may be carrying out "standard procedure" in regard to this test pump BUT "...the level of environmental protection expected by the community..." has increased and better technology has also made some advances apparently not taken into consideration by SKM. SKM's definition of "Standard Procedure" appears to be in need of significant upgrade.

No environmental flows have been established for the Ten Mile, Yahoo, Porcupine, Serpentine, Arkuna, Pompa Bill and Loves Creeks or the Gellibrand River. Therefore it is most difficult to maintain appropriate flow regimes of an appropriate quality, quantity and seasonally accepted patterns as dictated in the Waters of Victoria Policies. The State Government insists on maintaining river health and if possible to enhance it. If Environmental Water Reserves (EWR) have replaced environmental flows then minimum daily EWR should be allocated to the streams in the test pump area before any test pumping is commenced – as a matter of priority.

SKM not having recognised nor studied the wetlands in the headwaters of Ten Mile Creek make the management of these wetlands extremely difficult. The above policies describe wetlands as an integral part of the water systems that must be maintained. Effects of pumping at Kawarren will first be noticed in the wetlands at the headwaters of Ten Mile Creek yet these wetlands have not been studied.

The Waters of Victoria Policy also mentions Public Education and Participation whereby the encouragement of an active, well informed public is to be sought. A Protection Agency needs to take Barwon Water to task over the lack of commitment to this issue. Perhaps one or more of the Protection Agencies are falling down on their responsibilities in this regard as well.

The overall goal of these Environment Protection Policies is to maintain and where necessary improve the surface and groundwater resources for the Beneficial Uses in the State of Victoria.

Any granting of works approval, licence, licence amendment or notice must ensure that Barwon Water carries out its proposed works in accordance with the State Environment and Protection Policies on surface and ground waters. This is a responsibility of the State Government to see that the groundwater extraction proposal at Kawarren is conducted according to State Government law and conditions.

## DISCUSSION

**1.** In the Introduction, page one, it is stated that the Bore 108912 (Yaugher 37/Yaugher 51) was last used in 1984 and since then there has been no ongoing monitoring of water levels or chemistry.

In November 1991 D. R. Stanley of the Rural Water Commission of Victoria had this to say on page 47 of his report <sup>(1)</sup> titled "Preliminary Groundwater Resource Evaluation of the Kawarren Sub – Basin of the Barwon Downs Graben."

*"... a short term extraction of water from the bore was initiated in mid 1991."*

Then in 1993 another short term test was undertaken.

At both the 1991 and 1993 short term pumps the water was chemically tested. To assert that this bore was last used and monitored in 1984 is an extreme error and the following discussion will highlight the significance of this mistake.

**2.** In the Middle of Winter.

When discussing dissolved oxygen (DO), temperature, hydrogen sulphide, ph, iron concentrates etc. it must be taken into consideration that in the middle of summer Serpentine Creek will be a trickle, if flowing, and Loves Creek will have a "Typical summer flow..." (page 23) of one ML/day. At the time of the July 2007 preliminary pump Serpentine Creek was estimated to be flowing between 1.7 and 3.4 ML/day. To collect data during the middle of winter and then apply it to summer conditions is fraught with imponderables.

To gain anything close to an accurate assessment of the ambient conditions of Loves Creek in regard to the above mentioned parameters, they should be recorded at a similar time to when the test pump is planned – not in the middle of winter. This is a most compelling argument for delaying the test pump for at least 12 months while these parameters are accurately determined.

It would also appear that very little consideration was given to the environmental impacts the releasing of 5 ML of groundwater, during the preliminary pump in July, might have on the instream biota. Any further preliminary testing must take this into consideration.

**3.** Hydrogen Sulphide (H<sub>2</sub>S).

3.1. The State Water Laboratory put the sulphide level at less than 200 ug/l in 1991 (Appendix Four).

3.2. Interestingly to note that the SKM July 2007 test results for hydrogen sulphide came in at less than 100 ug/l.

3.3. It is difficult to ascertain from the report but it appears that the “sniff test,” using the nose as the instrument of measurement, was used to determine the level of hydrogen sulphide at the test site.

3.4. Five things are alarmingly apparent:

3.4.1 SKM reports that the ANZECC (2000) guidelines say 1.0 ug/l levels are required to protect 95% of species. There is no indication that the groundwater levels of hydrogen sulphide come remotely close to this desirable level.

3.4.2. SKM reports that hydrogen sulphide levels have not been tested below 100 ug/l and horrifyingly it would appear that this level was also an educated guess. At 100ug/l it is one hundred times worse than the 95% protection of species level.

3.4.3. The SKM report states equipment necessary to test the hydrogen sulphide levels at the ANZECC tolerances was not used.

3.4.4. The releases in excess of 5 million litres of water into the stream system in July was most likely well outside tolerable levels. An assessment on the environmental impacts on the streams will never be determined as pre pumping data had not been collected for comparative analysis.

3.4.5 The hydrogen sulphide levels in Loves Creek were not tested.

As page 25 of the August report points out the hydrogen sulphide levels in regard to environmental impact are not known. This report makes it quite clear there is still much to be learnt about the hydrogen sulphide levels.

(It is also very interesting to note on page 25 that the SKM report states *“It is very likely that concentrations in the Gellibrand River are above these levels, given the significant contribution of groundwater to the river.”* One parameter of the planned test pump at Kawarren in December is to ascertain the significance of groundwater contribution to the Gellibrand River. There appears to be some confusion on someone’s part, either the significance of groundwater is known or it isn’t.)

#### 4. Water Temperature.

4.1 It is important that the source of the figures for the graph of temperatures in Loves Creek, page 21 Figure 14, be disclosed. SKM states this establishes the temperature in Loves Creek over summer to be between 16 and 18°C.

Vertessy et al.<sup>(2)</sup> found that the temperature between November 1993 and November 1998 never reached higher than 16 degrees at the Loves Creek stream flow gauging station on the occasions that the temperature was measured.

Stanley did some continuous temperature stream gauging between October 1991 and May 1992 in Loves Creek and found the summer temperatures to fluctuate between 11 and 19 degrees.

These sets of figures tend to suggest that there is a great deal of work yet to be done to accurately determine the temperature regime that exists in Loves Creek.

4.2 The range of daily variation in temperature patterns must also be established so that the extracted groundwater temperature can be regulated to match the 24 hour ambient fluctuations of Loves Creek.

4.3 As different reaches of the Loves Creek stream may also vary a study needs to be undertaken to ascertain the importance of any variation to instream species.

- 4.4 Page 6 says the groundwater temperature ranged from 16.7 degrees to 17.7 with a statement on page 22 quoting the average groundwater temperature was 16.7 degrees. The averaging of a set of figures between 16.7 and 17.7 to average 16.7 does seem improbable and needs to be clarified.
- 4.5 The groundwater temperature reported by SKM to be at an average of 16.7°C is somewhat confounding when one studies earlier reports. Stanley<sup>(1)</sup> mentions that the average reading of the groundwater temperature back in the late 1980s was found to be 18.5°C. This was obtained by a bottom hole maximum reading thermometer measurement at a depth of 202.4 metres. Stanley decided to check the reliability of this reading and conducted a short term extraction in August 1991. After approximately two casing volumes had been removed from the bore, temperature measurements were undertaken as the groundwater came to the surface. The extracted water temperature was tested for a period of two hours at the surface. It was found that the water temperature remained relatively constant throughout this test and in fact also averaged 18.5°C. The average temperature of the groundwater at 202.4 metres below ground level in 1984 was exactly the same temperature at the surface level in the 1991 test. The huge discrepancy between the 1984/1991 temperatures and the July 2007 readings of an average of 16.7°C must be clarified.
- 4.6 The August 1991 short term pump by Stanley was most likely prompted as a result of the February 1991 estimates regarding the huge costs required to cool the groundwater to an acceptable limit for disposal into Loves Creek (Appendix Two). The groundwater temperature needed to be unquestionably established. As stated it was found in 1991 to be an average of 18.5°C at the bore head.
- 4.7 Back in the early 1990s little to no consideration was given to the daily fluctuations of a stream's ambient temperature. The consensus at that time was that an average temperature was thought to be appropriate. This is no longer the case and to stay within the legal temperature limits a great deal of thought, testing and provision will need to be made.
- 4.8 As stated on page 13 the impact on Loves Creek was in the order of 3 degrees at the higher pumping rate. This is well outside the permissible effect any discharging water can have on the ambient temperature of an accepting stream. How this scenario will work out in summer is difficult to determine but the natural lowering of stream flow in Loves Creek and the discharging of this heated water could have profound effects even when offset with rises in summer air temperature. The effect on the temperatures in the Serpentine during the July pump was profound (page 12). With the possibility of the groundwater comprising up to 9 times (page 19) the volume of the Loves Creek natural summer stream flow during the test, a similar effect is possible on the temperatures in Loves Creek as was experienced in the Serpentine in July.
- 4.9 In February 1991 J McDonald states in a letter (Appendix Three) that the groundwater is some 3 to 4°C above ambient summer stream temperature. Considering Stanley's findings as stated in 4.5 above, the variation could be considerably more significant. If Loves Creek were to reach 19°C the groundwater would in fact be cooling the stream's water and at 11°C the groundwater would be 7.5°C warmer.
- 4.10 To further compound the temperature problems the groundwater temperature regime cannot vary as much from ambient stream temperature as originally thought. Temperature variations from background shall not affect beneficial uses and shall not exceed 2°C in general surface waters. For some reason SKM has not been informed that Loves Creek actually flows through the Otway Forest Park in close proximity to the bore site (Appendix Five). For parks and

forests the variation can only be 1°C (Victorian Government Gazette S 13 26 February 1988 Page 13 Schedule B). This necessitates that the temperature variation of the groundwater to ambient stream temperature can only be plus or minus one degree. If read literally the Gazette states that there shall be NO detrimental effects on beneficial uses allowed even if the variation is less than the one degree as stated, and causes detrimental effects.

- 4.11 Not fully understanding the biological needs of the beneficial use by the instream biota, further compounds the problem Barwon Water has. The effects on beneficial use cannot be determined if the beneficial uses requirements are not understood.
- 4.12 Added to that the Barwon Water Authority is obliged to work within the Statement of Obligations that the State Government gazetted this year, 2007. The conditions set down in Part 6 titled, "Environmental Management" and the section in Schedule A titled, "Sustainable Management Principles," clearly indicate that if this test continues to be conducted in the manner it is, it will be in breach of the obligations in this document.
- 4.13 It also needs to be explained why there was an initial decrease in groundwater temperature (Figure 4).
- 4.14 The temperatures at Loves Creek, near the Colac to Beech Forest bridge, have not been included in the report nor have the pre pump temperatures. Was the location above or below the confluence of the Yahoo Creek? These figures are significant. Why weren't temperatures taken further down the Loves Creek system?
- 4.15 To state on page 22 that the temperature of the groundwater is not expected to be an issue for discharging groundwater during the summer and autumn months appears to be a gross understatement and requires a complete rethink.

## 5. Dissolved Oxygen (DO)

Groundwater leaving the bore head at a DO level of 0.2 mg/l and then to be placed in a stream, that by SKM's own admission should be around 9 mg/l (ANZECC 2000), would require an enormous amount of oxygenating. SKM states that DO levels in Loves Creek during summer and autumn are typically in the range of 7-9mg/L (pages 20-21). The assurances that this can be achieved while pumping 5-6 ML/day into the Loves Creek system running at a "Typical summer flow" (page 23) of one ML/day is somewhat doubtful.

## 6. pH Levels.

It was stated that "*the process of aeration causes an increase in pH*". The report does not state what the levels of the pH were after aeration in the 48 hour test pump. No data or graphs have been included to present the pH of the groundwater entering Serpentine Creek nor what change was incurred in Loves Creek. The laboratory analysis of a groundwater sample indicated the pH at 6.3. The pH in Loves Creek has not become more acidic than approximately pH 7.3 since the start of 2006. SKM have indicated that the three month test pump "*target range is up to pH 6.5.*" The target range must surely be between 7.3 and 7.7, currently existing in Loves Creek for the past 23 months (as indicated by Figure 17).

## 7. Iron content

Aerating the groundwater in an attempt to raise the DO and pH levels could well bring on another problem that has been most apparent at the Barwon Downs borefield when the groundwater has

been aerated. There is the possibility of an iron oxide flocculant sludge oxidising out of the groundwater. This possibility requires further investigation and should be done as a matter of course. Figure 17, page 26 represents iron levels in the Gellibrand River between 1978 and 1991. Surely the iron levels in Loves Creek should also be included. Also the decrease in iron concentrations over the period of the 48 hour pump (table 6) have not been explained

## 8. Electrical Conductivity (EC)

No explanation was given why the EC decreased during the 48 hour pump test. It is a concern that there is no representation of EC measurements in the years 2005, 2006 and 2007 (Figure 13). There is an obvious omission of testing for sodium concentrations nor any comment on the implications of other inorganic anion and cation concentrations.

**9.** The methodology/operating procedure behind the proposed treatment “*spray air diffusion aeration*” for the three month test has not been explained. It has stated on several occasions in the report that “*the proposed treatment*” is expected to treat the groundwater to “*acceptable levels.*”

**10.** No table has been made to present the (ANZECC or EPA) allowable discharge concentrations in comparison to the laboratory results and field results for each of the groundwater chemistry components. This would appear to make it extremely difficult for the EPA to analyse whether or not the discharge groundwater components were above/below the allowable discharge concentrations for adequate protection of existing aquatic organisms. It would also appear to be most difficult to observe which of the groundwater components have room for fluctuation and still be within the allowable concentrations, and which groundwater components are exceeding allowable discharge concentrations (i.e. of which require treatment).

## 11. Measurements Procedures.

It has not been stated whether the three month test will be using the same type of measurement procedures as was used in the 48 hour test. Will the “bucket method” be used in conjunction with the visual observations to determine flows from the bore and along the creeks? It is also hoped that H<sub>2</sub>S measurement will be done on site using something other than the human nose.

## 12. Earlier Reports.

The flow rates of the streams in the catchment did not reflect the accuracy that is possible with a determine analysis. SKM have extensive data available to them but this is not reflected in this report.

**13.** The methodology used to determine the water quality parameters needs to be stated. Some confusion may be explained if it is made known where the measurements were conducted, insitu, upon initial discharge from the bore or back in the laboratory.

**14.** It is somewhat curious and puzzling why the weather station at Mt. Gellibrand was referred to (page 10) when it is approximately 30 kilometres from the pumping site. There are much closer weather gauging stations that would be more indicative of the prevailing weather conditions in the Loves Creek catchment. Farmer records in the locality would be much more indicative of rain patterns at the time.

**15.** The questions and comment made in Appendix Six may not fall within the EPA’s area of jurisdiction. However they have been included in this report for the EPA’s information.

*CONCLUSION*

Barwon Water must inform SKM that the Kawarren test must be conducted within the Statement of Obligations set down for Barwon Water 2007; comply with the State Environment Protection Policies and adhere to Government Gazette S13.

It is imperative that SKM implement the Contingency Planning part of their recommendations and include additional work on the water temperature and iron content problems. The redox anomaly (page 6) should also be clarified.

When this additional preliminary testing is done there must be provisions made so that the groundwater is not discharged to the creek system until permissible and tolerable levels are consistently obtained.

It is not a convincing or defensible argument to proceed or ignore responsible behaviour on the grounds that a detrimental effect is "... *very unlikely*..." to take place. This is covered in the Statement of Obligations. Any discharge of water to the streams must not be polluted.

The shut down procedure to be developed for the pumping test should the treatment system fail, as mentioned in the Contingency Planning must be fail safe and immediate. The delaying of 24 hours plus, as suggested in the Monitoring of the Pumping Test Discharge section, would not be adequate to safeguard detrimental environmental impact.

Although it is not apparently the jurisdiction of the EPA it must be noted that there are serious concerns relating to the pre pumping spring, soak and wetland monitoring and the establishment of environmental trigger indicator species for both the surface and groundwater dependent ecosystems. If headwater wetlands are affected then this does appear to fall within the terms of the State Environment Protection Policies. If this parameter of the test pump is deemed not to be an EPA area of responsibility then at the very least this must be made known to the appropriate Protection Agency.

The first priority that must be dealt with is ensuring that the integrity of the streams and river of the area is maintained. The most critical factor that will achieve this is the allocation of a daily Environmental Water Reserve flow or environmental flow for the Loves Creek catchment streams and the Gellibrand River. If this is not the responsibility of the EPA then this matter must also be referred on to the appropriate Protection Agency.

\* \* \* \* \*

It would be appreciated if acknowledgement of this document and outcomes of rulings made on Barwon Water's "Kawarren Pumping Bore Assessment Report, Draft, 28 August 2007" are forthcoming.

Malcolm Gardiner  
1805 Colac Beech Forest Road  
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Vic 3249.

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APPENDIX ONE



Our Ref: 40/220/0031G  
Your Ref:  
Enquiries To: Scott Dennis

November 7, 2007

Mal Gardiner  
1805 Colac Beech Forest Road  
Kawarren Vic 3249

Dear Sir/Madam

**Re: Newlingrook and Gellibrand Groundwater Management Areas Investigations – Information about the study available on the Barwon Water website**

During the public information session at the Gellibrand Community Hall on October 25, a number of documents were requested to be provided to the community for information. The information requested included:

- Newlingrook & Gellibrand Groundwater Investigation - Kawarren Pumping Bore Assessment Report
- Consultants brief for the investigations
- DSE acknowledgement that the Gellibrand GMA should be included in the study

Given the difficulty in distributing large documents to a large number of people who have registered their interest with Barwon Water, these documents have been made available on the Barwon Water website and can be accessed from the front page under Community Consultation.

The address for the website is [www.barwonwater.vic.gov.au](http://www.barwonwater.vic.gov.au).

Acknowledging that not all people have access to the internet, Barwon Water will provide printed copies to those requesting it.

This site will be kept up to date with developments on the study and also additional information to be provided to the community.

If you have any questions regarding the study or the information provided please contact Scott Dennis on 03 5273 4436.

Yours faithfully,

A handwritten signature in black ink, appearing to read "Paul Northey".

Paul Northey  
Manager Strategic Planning & Sustainability

Barwon Region Water Corporation  
ARN 96 248 316 514

61-67 Bryd Street, Geelong, Victoria  
P.O. Box 456, Geelong, Victoria, 3220  
03 52061 0000  
[www.barwonwater.vic.gov.au](http://www.barwonwater.vic.gov.au)

Telephone: 1300 654 331  
Facsimile: 03 5271 9228

APPENDIX TWO

& HOUSING

TEL No. 03-6285132

8 Mar 91 11:14 No. 005 P.05

ENVA

C43755C 28



**Rural Water Commission of Victoria**

599 Orong Road Armadale Victoria Australia 3143  
Telephone (03) 508 2222

Direct Dial (03) 508 2280

22 February, 1991

Mr John Littlejohn  
Environment Assessment Branch  
Department of Planning and Housing  
477 Collins Street  
MELBOURNE VIC 3000



Dear Mr Littlejohn

re **South-Western Region Water Management Strategy  
Kawarren Groundwater Investigations**

Please find enclosed copies of the proposed RWC and GDWB investigations and associated studies to be undertaken in the Kawarren Region. These activities will be carried out in order to quantify the groundwater resource potential of the region and to provide the necessary data required in order to assess the regional environmental impact of sustained pumping.

Also enclosed is a copy of the letter sent to the DCE and EPA officers in charge of the area in question and a general project description of the RWC Kawarren Groundwater Investigation and the broader groundwater input into the South-Western Region Water Management Strategy.

The major thrust of the Kawarren investigation is centred around a short to medium term aquifer test planned to be undertaken in early 1992. As stated in almost all accompanying documents this test is designed to significantly stress the system so that the regional resource and environmental effects of sustained long term pumping from the Kawarren region can be assessed with any surety.

The test is designed to occur during the period of low surface water flow, late summer, and will be conducted over a one to three month duration. The extracted water, some 15-20 ML/day, will be piped or channelled into Serpentine or Loves Creek. The quality of the water is very good, around the 120 mg/l total dissolved salt, however the temperature of the water; being around the 18°C mark; lies outside the 2°C variation from ambient stream temperature allowed by the EPA.

The RWC in conjunction with the GDWB is presently seeking a relaxation of the disposal guidelines in this instance on the grounds of the short term nature of the test, the closeness in the disposal temperature to the ambient stream temperature and on economic grounds. The cost of cooling the

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Telex WATERCO AA 30739 Facsimile (03) 508 2886 Ausdoc DX 21

29

extracted water by 2-3°C has been estimated at between \$50,000 and \$100,000. These costs would make the test almost uneconomic.

It must be stressed that without the data obtained from a test of this nature the determination of safe yield and the environmental effects due to sustained pumping may never be confidently predicted.

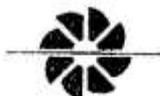
If any further information is required relating to the Kwarren investigations please do not hesitate to contact myself or David Stanley of the Investigations Branch (telephone 508 2688).

Yours faithfully,



J. McDONALD  
Regional Manager  
Southern Region

dgal6mh1



Rural Water Commission of Victoria

180 Ormsby Road, Ararat, Victoria Australia 3443  
Telephone (03) 6483322

Direct Dial (03) 508 2280

GRSC 8/3/91  
30  
Received.

22 February, 1991

Mr R. Leivers  
Regional Manager  
Colac Region  
Dept Conservation and Environment  
83 Gellibrand Street  
COLAC VIC 3250

Dear Mr Leivers

re: South-Western Region Water Management Strategy  
Kawarren Groundwater Development

For some years now the groundwater development options in the Barwon Downs, Kawarren and Gellibrand River area have been under investigation by the DITR, DWR, GDWB and the RWC. In recent times considerable effort has been devoted to the Barwon Downs Graben. Attention is now beginning to be focused on the Kawarren Area.

Over the next few months the RWC in consultation with the GDWB and DWR will be developing an investigation program to enable an assessment of the groundwater resources of the area. One of the key issues to be considered is the question of the interaction of a possible borefield with the nearby streams. These streams are tributaries of the Gellibrand River. The November 1989 Natural Resources and Environment Committee report to Parliament on the South-Western Region Water Management Strategy recommended that further groundwater investigations be undertaken in the Kawarren Region as a priority.

Based on our current state of knowledge of the hydrogeology of the area the issues concerning the relative contributions of streambed infiltration, that is the magnitude of interaction with the streams, and throughflow from the postulated recharge area known as the Barongarook High need to be addressed before any assessment of the regional environmental impact of sustained pumping can be presented.

As part of the overall investigation program the RWC in conjunction with the GDWB are preparing to carry out a short to medium term, minimum of one month and maximum of three months duration, aquifer test during the early months of 1992 near the township of Kawarren.

The site in question, located on the rail reserve some 750 metres east of the Colac-Beech Forest Road off Jasper Road (see attached plan) was the subject of a short term low rate test conducted in early 1984. In the

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T 508 2280 FAX 508 2281 Free phone 1800 609 2280 Ausdial 1322

Analysis of the test both Lakey (DME) and an independent consultant Hancock of Australian Groundwater Consultants agreed that the test did not sufficiently stress the aquifer system in order to quantify the magnitude of the aquifer - stream interaction and the determination of the regional recharge area.

As mentioned above the proposed test will be conducted for a period of one to three months during the period of low surface water flow. This will enable the maximum effect, if any, to be observed on the streams in the Kwarren-Gellibrand Region. The bore will be pumped continuously at maximum flow rates obtainable, in the order of 15-20 ML/day. The pumped water, which has a salinity of some 120 mg/l total soluble salts, will be disposed of by either a pipe network or open drain into the lower reaches of Serpentine Creek, a feeder stream of Loves Creek, or directly to Loves Creek.

The temperature of the extracted water will be in the order of 18°C. This temperature is some 3 to 4°C above the ambient stream temperatures for that period of the year. This figure exceeds that of the 2°C variation for general surface waters as recommended on Page 13 of the State Environment Protection Policy, Waters of Victoria. However due to the short term nature of the test, the closeness of temperature of the disposal water to the recommended limit and the exceedingly high cost of cooling this water by 2°C (in the order of \$100,000) the RWC and GDWB is currently seeking a relaxation of the guidelines in this instance from the EPA.

Any future correspondence regarding the proposed pumping at Kwarren can be directed to myself or David Stanley of the Investigations Branch (Telephone 03 508 2688).

Your endorsement of this proposed course of action is sought.

Yours faithfully,



J. McDONALD  
Regional Manager  
Southern Region

dfa13mh1

APPENDIX FOUR

STATE WATER LABORATORY

Page 1

A BRANCH OF THE RURAL WATER COMMISSION OF VICTORIA

ANALYSIS REPORT

LAB-NO	4039
DATE RCD	19/08/91

AUTHORITY: Rural Water Commission - State Groundwater Monitoring  
PROJECT : G55 - South West Groundwater

SAMPLER: M.Kenna

SITE-DESCRIPTION	SITE-NO	SAMPLED	
		DATE	TIME
1 Water running into Serpentine Creek Parish: Yaughter	SJ4691519515	15/08/91	11:30
2 Bore (After 1hr pumping) Parish: Yaughter	D397836	15/08/91	11:00

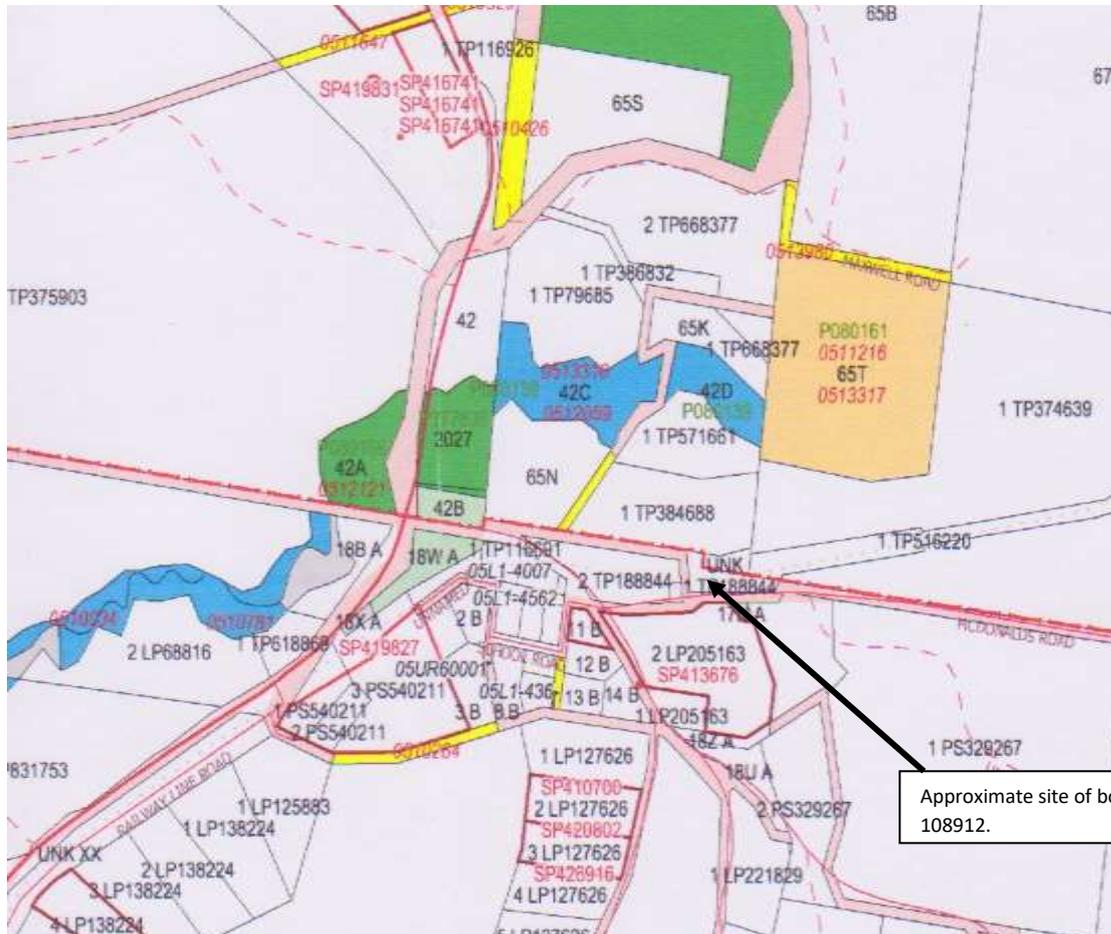
DETERMINATION	1	2
Sulphide as S (spot test).	<0.2	<0.2

<< Results in MILLIGRAM per LITRE (mg/l) unless otherwise stated.>>  
<< The above analyses were performed on the samples as received. >>  
<< Where applicable, comments on the analyses are attached. >>

DISTRIBUTION  
Sampler(MIV), File(MIV), File

P. TeHennepe  
Reported 26/08/91

## APPENDIX FIVE



The green, blue and brown areas marked 42A, 2027, 42C, 42D and 65T are all part of the Otway Forest Park. Loves Creek runs through this part of the Otway Forest Park. As a consequence the ambient temperature of the creek water can only be affected by minus or plus one degree.

## APPENDIX SIX

### Comment & Queries on the Production and Observation Bores

#### Page 3, observed draw down, Figure 1.

- ❑ Both the production bore and the observation bore had not recovered to initial groundwater level within the 2 hours of observed recovery phase (after the 48 hours). What does this imply? OR... why did both the production bore and observation bore both recover to the same draw down level after the 2 hour recovery phase?
- ❑ What was the initial groundwater level in the observation bore?

#### Page 4, aquifer parameter test, Figure 2 & 3

- ❑ Why did the production bore and observation bore have different storage coefficients?
- ❑ Why did the production bore and observation bore have different transmissivity values?
- ❑ Were the conditions of a 'leaky aquifer' applied to the data? What are the results if tested under this condition?

- Why did the production bore and observation bore have the same draw down and recovery rates (in figure 1) but did not have the same change in displacement/time rate (in figures 2 & 3)?

**Page 5, comparison with previous test and potential bore corrosion**

- Why was transmissivity in the observation bore 23 years ago higher than this year's transmissivity? This was briefly discussed in relation to potential bore inefficiency effect.

1984: 968 m<sup>2</sup>/d

2007: 825 m<sup>2</sup>/d

- Why was storativity in the observation bore 23 years ago lower than this year's storativity? This difference was not discussed.

1984: 0.0003

2007: 0.00047

- Generally higher storativity results reflect higher aquifer transmissivity. This is not so for the above results (both taken from the observation bore). Change in draw down has not been discussed in terms of aquifer material transmissivity, groundwater chemical components or storativity values.
- Aquifer transmissivity has not been discussed as a separate issue to the ability of the production bore screening to yield water.
- An accurate value for aquifer transmissivity was not undertaken during the July 2007 pump test. Was there not an insitu test (such as the slug test) completed to find out more accurately the transmissivity of aquifer material at the two bores more accurately? If not, why was this not undertaken? If accurate aquifer transmissivity value/range of transmissivity values have not been found for each bore, then the model for the 3 month pump test could be inaccurate. The modelled draw down for the 3 month pump test has been based on aquifer material transmissivity, yet the chosen transmissivity value of '250m<sup>2</sup>/day' used to produce this model has not been accurately justified.
- The assumption of "*an additional 3m draw down after a 3 month test pump*" has not been given reason? If reduction in bore inefficiency is insignificant, why go on to say that the inefficiency will impact on the draw down by "3 meters." What does this mean?
- If 3m +6.48m =9.48m draw down after 3 month pump test reflects 3% of the available draw down, does this mean that the aquifer thickness is 316m? Available draw down has not been discussed.
- The aquifer having a "*large available draw down,*" does not give appropriate reasoning to suggest that the reduction in "*bore efficiency*" is an "*insignificant issue.*" Once again, the "*reduction in bore efficiency*" (as discussed in the geophysical assessment) is a separate issue to available draw down and aquifer transmissivity.

## **APPENDIX Seven.** Criticism on another SKM Report sent to the EPA.

Mistakes made by and Crits of the Barwon Water report prepared by SKM.

# **“Newlingrook Groundwater Investigation – Stream Trigger Levels for 90 Day Pumping Test.”**

9 September 2008

Draft 4

### **Introduction (DRAFT)**

This report was noted whilst browsing the Barwon Water web site on the 7 December 2008. The blurb that accompanied this report is most interesting and must be commented upon.

1. The blurb states it is agreed that Newlingrook is the area identified in the Central Water Strategy, NOT Kawarren or Gellibrand.
2. Barwon Water has no intention of taking water from the Kawarren area for 20 years. (Service Contract says otherwise.)
3. The Gellibrand GMA has subsequently been included in the Newlingrook studies. (The major study now being in the Kawarren area NOT Newlingrook.)
4. No evidence to support this addition of Kawarren in the study is forthcoming other than to say present data on the aquifers does not exist. (There are a multitude of studies in the Gellibrand area, not being recognised or acknowledged – Newlingrook is a different matter, very few studies done.)
5. The Kawarren test pump has been included because insufficient information about the Kawarren aquifer is known. (This is totally incorrect.)
6. 470 ML over three months to be extracted. (Was to be 2000 in the 1990s, 650 in the summer of 2007-08, the Water Minister gave permission to 645 in July 2008.)
7. The extracted and then treated groundwater to be dumped into the Loves Creek catchment. (No indication how it will be treated.)
8. An assurance that the test pump will not cause any unacceptable impacts on the surface water flow or the environment. (Nothing has been provided that gives this assertion credit.)
9. Seven new observation bores will be tested for 24 hours only. (What does this mean?)
10. The current study will assess impacts on...
  - groundwater resource
  - surface water
  - groundwater dependent ecosystems
  - other aquifers
  - the environment

11. Barwon Water has developed...

- A water level
- Water quality
- Ecological monitoring program
- A stream trigger level monitoring system to ensure any potential impacts are detected early
- A program that will scale back or stop the test completely if these trigger levels are reached.

This all reads extremely well and should instil confidence that the test pump is being run and managed in the best possible way.

This is not the case. This crit concentrates on the Stream Trigger Levels report and is quite scathing in its content. The final draft of the ecological study format has not been critted as yet.

Perhaps one of the reasons this trigger level report is so poorly done is that Barwon Water maintain a secretive, closed to scrutiny and failure to involve the Kawarren and Gellibrand communities in its endeavours.

**Page One**

1. This report does not answer the multitude of specific issues raised in public submissions.
2. Ground water baseflow is significant and is not an "if" as described.
3. No evidence of the spring monitoring regime has been made available for scrutiny.
4. Having streamflow act as a surrogate trigger for springs has to be shown as sound practice and backed up with scientific data/reports.
5. The Yahoo gauging station decommissioned in the mid 1990s has not been re-instated and there is no accurate way to gauge the flow from this stream. Proof can be provided.

**Page Two**

1. To say Loves Creek are the least likely to be impacted is ludicrous. Then Mile, Yahoo and the Porcupine Creeks are tributaries and combine to form Loves Creek. Loves Creek is an accepting stream below the extraction groundwater point and above the Loves Creek stream flow gauging station. Also Loves Creek will have an extra 6 ML/day being dumped into it and there is the possibility of a multitude of small discrepancies that can occur with pumping rates. Small discrepancies in the flows of these creeks will not seem significant and may well not be discernable but constitutes a major factor in their flow regimes. The Porcupine Creek is lucky to have 0.1 ML/day flow.
2. Which springs to the north could be impacted. No map provided and it is apparent that significant wetlands are in this area and are not to be monitored.
3. The area of unconfined aquifer of EVF is not provided.

**Page Three**

1. This page mentions Appendix A to prove a point. Appendix A (both pages – comprising 4 somethings) are completely BLACK. They cannot be read. It would be good to see the full range of possible impacts under varying inputs into the modelling program.
2. Potential flow losses up to 7% in Ten Mile and up to 12% in Yahoo Creeks for such small summer flows is significant.
3. As this page states the impacts demonstrated are wide ranging depending on the MODEL inputs. These inputs are also based on a degree of guess work.

#### Page Four

1. To say that the selecting of one proxy indicator (Ten Mile Creek) of impacts on all surface water system is deplorable and not good enough. Scientific proof that this is sound practice needs to be provided quoting studies that mimic the situation at found at Kawarren.

#### Page Five

1. Pompa Bill Creek is spelt this way.
2. Selecting two springs for observation is ludicrous in the extreme. If this test is designed to investigate the environmental effects then it needs to be clearly shown that choosing two such springs is appropriate.
3. Baseflow springs feeding the streams in the area high in the catchments should be monitored, being the first to dry.
4. Nested bores at these sites should be established.
5. If the spring surveys were not suspended in the 1990s perhaps the necessary data would be available.
6. No pumping should occur until a comprehensive spring monitoring program is implemented and maintained for at least 5 years. Given that Barwon Water will not be needing water from this area for 20 years this is not unreasonable.
7. No mention is made anywhere in this report regarding ongoing monitoring after the test pump ceases. The full extent of any impact could take place anytime after a test pump. This needs to be accounted for.

#### Page Six

1. To assume that one stream flow gauging station will indicate spring depletion is beyond words. This highlights the complete lack of a comprehensive study, responsible management and neglect and disregard to the Statement of Obligations set down as law that Barwon Water is obliged to follow.

#### Page Seven

1. This report can talk about percentiles and the like and refer to average annual stream flow reductions and the like but the fact will remain that the flows in the Loves Creek catchment are fully allocated if not well and truly overallocated.
2. If we accept the EarthTech (2006) report that the minimum summer environmental flows in Loves Creek should be 6 ML/day, then this would in the strongest terms indicate that there should be ZERO groundwater extraction from the Kawarren borefield.

3. This report states that this EarthTech recommendation has relied “... upon a field assessment and expert knowledge of a technical panel representing the fields of geomorphology, hydraulics, vegetation and macroinvertebrate and fish ecology.” This would appear to clearly demonstrate the quality of the work done to establish an ideal 6 ML/day environmental flow.
4. The Barwon Water report goes on to say that this summer environmental flow is not met 46% of the time AND still wish to extract groundwater before it reaches the surface placing an added burden on the streams in the district. Illogical behaviour.
5. This report then goes on to state that... “As the environmental flow recommendations do not apply to the current flow conditions in the Loves Creek Catchment, these recommendations are not suitable trigger levels for the pumping test.” This report then goes on to set triggers level way below these environmental flows of 6 ML/day during summer.
6. This report states expert knowledge has been used to develop an environmental flow regime BUT because it has not been adopted it can be disregarded.

#### Page Eight

1. To assume that the recent range of flows is satisfactory for maintaining ecological health and function is not a sound scientific basis on which to draw important conclusions.
2. The macroinvertebrate studies mentioned have not been made available for scrutiny.
3. The fish studies done in the mid 1990s have been disregarded.
4. Conducting comparative fish studies should be conducted to clarify “... whether fish communities are experiencing flow stress...”
5. This report recommends that “... the pumping test should not cause flows in Loves Creek to drop below levels that are currently experienced.” Yet this report then sets trigger levels well below current average levels.
6. Because the stream flow gauging stations at Ten Mile, Yahoo and Serpentine were decommissioned in the mid 1990s a lot of guess work and modelling had to be used to fill in the 13 year gap of non recording. Not at all satisfactory and no reason has been given for these stations being decommissioned.

#### Page Nine

1. From personal experience over 20 years I find this graph difficult to read and difficult to accept what I believe is being represented. Loves has to have a higher graph at all stages as it is a combination of the other three tributaries. In non overflow conditions Ten Mile is always the next highest, then the Yahoo and finally the Porcupine.

#### Page Ten

1. “Infilling” is an interesting term for lack of data that is replaced with guesswork. No consideration has been given to the drawdown affect on these tributaries from the Barwon Downs borefield, extra extractions for stock and domestic use etc.
2. Based on “infill” the calculations are made.

### Page Eleven

1. It is most interesting that Table 5 shows the dry season flow in the Porcupine Creek as zero.
2. The Amber trigger level is calculated on the “infill” data and is set within the natural range of the creeks and is stated as “... *therefore any short term impacts to the ecology of the creek as a result of flow reductions will be minimal.*” if taken over a two week period. A concern with this theory is that an effect may not be immediately apparent. Also if Ten Mile Creek is the only trigger stream why is the 10<sup>th</sup> percentile applied to Loves Creek. As explained earlier the gauging station at Loves Creek is all but impossible to determine effects.

### Page Twelve

1. Let’s consider this.
  - EarthTech recommend an environmental flow of 6 ML/day in the dry season for Loves Creek.
  - This report recommends that “... *the pumping test should not cause flows in Loves Creek to drop below levels that are currently experienced.*” (See Page8.)
  - SKM have set the Amber One trigger level at 1.46 ML/day.
  - The Amber two level at 1.40 ML/day independent of the recent drought conditions, and
  - The Red Level at 0.75 ML/day which is 5.25 ML/day below the recommended environmental flow. **AND** this Red Level may constitute a significant reduction in pumping or the pumping test to be stopped, **BUT** in consultation with an ecologist.
2. The reversal of any impact is based on guess work and modelling as well. Proof by way of similar groundwater investigations needs to be provided supporting this theorising.

### Page Thirteen

1. In the middle of this page under point 2 is a clear example of the inaccurate and poor work done compiling critical information. The Statutory Declaration found on page 8888 clearly demonstrates that Porcupine Creek does not display ephemeral flow patterns.
2. This report sadly lacks credibility and nowhere can it be found the influence that the drawdown from the adjoining Barwon Downs borefield has had on the Gellibrand GMA. Impacts that may be apparent on streams in the Gellibrand GMA and Kawarren area.

### Page Fourteen

1. If I was to recommend the actions as set out on this page in regard to monitoring to be done for Yahoo Creek I would be laughed out of the country and ridiculed for lack of stringent scientific procedure.

2. I assume where it refers to Table 6 it really means Table 8.

#### Page Fifteen

1. Besides this Table being based on assumptions and doubtful data, it would appear to the uninformed that the implementation of any of these recommendations should take or require a 76 hours window to be completed.

#### Page Sixteen/Seventeen

1. I take exception to the comment that the veracity of my data collecting for Pompa Bill Creek needs to be checked.
2. I also take exception to the fact that my data collecting is also referred to as “semi-reliable.”
3. Considering the statement that Barwon Water does not plan any extraction within 20 years it is more than reasonable to delay any test pump until “semi-reliable” data is replaced with years of “accurate” and “reliable” data. This applies to the spring monitoring and stream flow gauging monitoring so that any assumptions, guesswork and modelling based on “infills” and incomplete data can be irradiated.
4. As can be seen in the Statutory Declarations on pages 99999, this report has another piece of poorly reported information. At no stage would I have ever said Pompa Bill Creek had never ceased to flow in the last 15-20 years. There is a distinct difference between 15-20 and over 40 years.

#### Page Eighteen

1. These Trigger levels for the springs are completely unacceptable. If any of these springs cease to flow for any period of time the test pump should be terminated immediately. These springs have continued to flow through the worst drought on record and require a thorough investigation period in a wide ranging spring monitoring program as spoken about in earlier comments.
2. The Belsar Road spring being in the unconfined aquifer area requires the most attention as this will be the area first to experience any drawdown affect. This area as well as the permanent headwater springs on the Yahoo and Porcupine Creeks require ecological monitoring stations established.

#### Page Nineteen

1. Surely as the test pump progresses the frequency of monitoring should increase NOT decrease.
2. In actuality a trigger level could be passed for 13-14 days before being detected and then another 76 hours before completion of any remedial work. Not good enough.

#### CONCLUSION

This project is ill conceived, poorly researched, based on doubtful assumptions and modelling with gaping data blackholes. All of these shortcomings, given time and research can be overcome. The environmental integrity of this area will then be assured. Considering the lack of emergency to finish this project there is ample time to manage a thorough and competent research project before any test pumping. The first part of this research project should be a desk top study collating the multitude of data and reports already conducted on the Kwarren and Gellibrand aquifers.

**This text box has been placed on this page as there was a blank gap that could be filled.**

The contents of this box are relevant to the Newlingrook/Kwarren groundwater extraction proposal.

In the October 2006, Our Water Our Future, Stage Government document, *“Sustainable Water Strategy – Central Region, Action Plan to 2055,”* Action 4.14, page 78, stated...

*“Barwon water will undertake a detailed feasibility and design study of accessing a new groundwater water source at Newlingrook aquifer and the possible connection from Melbourne to Geelong.”*

The timing of when ground waters would flow from Newlingrook were...

By 2015 - 5,000 ML.

By 2030 – 10,000 ML, and by

2055 - **16,000 ML.**

This 16,000 ML is the very same amount that Barwon Water planned to take from the Kwarren Borefield and could well explain why the Kwarren Borefield development was called the Newlingrook Groundwater Investigation. Kwarren is kilometres from the Newlingrook Groundwater Management Area. Kwarren is also in the middle of the Gellibrand Groundwater Management Area and legislated at the time to have ZERO groundwater extraction permitted.

### STATUTORY DECLARATION

I, MALCOLM JOHN GARDINER  
[full name]  
 of 1805 COLAC LAVERS HILL ROAD  
[address] KAWARREN VIC 3249  
Retired.  
[occupation], do solemnly and sincerely declare that:-

**In regard to:**

*Draft 4, 9 September 2008 "Stream Trigger Levels For 90 Day Pumping Test"  
 Newlingrook Groundwater Investigation.  
 Prepared by Sinclair Knight Merz for Barwon Water.*

**And in regard to:**

*Pompa Bill Creek that has many of its source springs originating on the property of "Kersbrooke"  
 1805 Colac Lavers Hill Road, Kawarren, Victoria 3249, 22A Lot 2 Parish of Yaughter.*

This property was purchased in the early 1960s in partnership with my parents. One of the features of this property was its permanent supply of running water that had never been known to cease flowing. This creek partly originating from springs in this property has since been named Pompa Bill Creek.

Since "Kersbrooke" was purchased I can testify that Pompa Bill Creek has never dried up and has always had a steady flow throughout the year, including summer flows. This record of uninterrupted flow has been the case for over 40 years.

A measuring device was installed on Pompa Bill Creek in 1989.

The two sheets, marked "*Pompa Bill Creek Records*," summarises the height data collected.

I acknowledge that this declaration is true and correct, and I make it with the understanding and belief that a person who makes a false declaration is liable to the penalties of perjury.

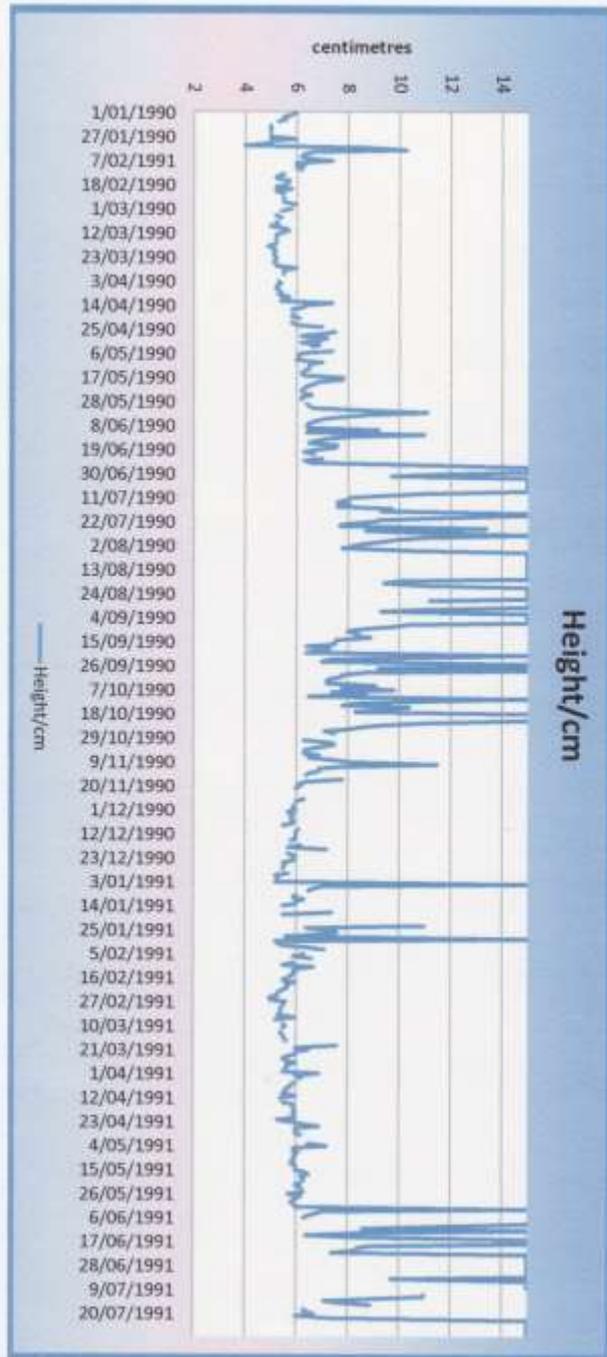
Declared at COLAC  
 in the State of Victoria, this 18<sup>th</sup> day of  
DECEMBER 20    

  
 Signature of person making this declaration  
(to be signed in front of an authorised witness)

Before me, Alan J. Halloran  
Signature of authorised witness  
PRINCIPAL COLAC P.S.

The authorised witness must print or stamp his or her name, address, and title under section 107A of the Evidence Act 1958 [Vic.]  
 (eg. Justice of the Peace, Pharmacist, Police Officer, Court Registrar, Bank Manager, Medical Practitioner, Dentist)

POMPA BILL CREEK RECORDS



*Allen Williams*  
12/12/08

**POMPA BILL CREEK RECORDS**



Any height over 15 cm not recorded.

*[Signature]*  
*Mark Holloway*  
 18/12/08

### STATUTORY DECLARATION

I, PETER GORDON MACDONALD,  
[full name]

of 130 MACDONALD'S ROAD KAWARRAN VIC 3249,  
[address]

DAIRY FARMER, do solemnly and sincerely declare that: -  
[occupation]

Our family first moved to Kawarren in February 1945. Grandad, Sydney MacDonald and Dad, Gordon MacDonald dairy farmed together at 195 MacDonald's road. In 1971 due to ill health, Granddad Sydney MacDonald had to leave the farm. Then I Peter MacDonald joined the dairy farming partnership with Gordon MacDonald until 1979 when I purchased 190 MacDonald's road. Since 1945 the pools in Porcupine creek have never been dry at the bridge on MacDonald's road. Since the gauging station on Porcupine creek was installed beside the bridge, the only time the flow has stopped at the gauging station was when I have been pumping (diverting) water to the dairy tank.

I acknowledge that this declaration is true and correct, and I make it with the understanding and belief that a person who makes a false declaration is liable to the penalties of perjury.

Declared at Kawarren  
in the State of Victoria, this 14<sup>th</sup> day of  
January 2009

[Signature]  
.....  
Signature of person making this declaration  
[to be signed in front of an authorised witness]

Before me, [Signature]  
.....  
Signature of authorised witness  
L/S/K 31609  
Colac Police

The authorised witness must print or stamp his or her name, address and title under section 107A of the Evidence Act 1958 (eg. Justice of the Peace, Pharmacist, Police Officer, Court Registrar, Bank Manger, Medical Practitioner, Dentist)

## APPENDIX Eight.

PAGE 2 — THE COLAC HERALD, MONDAY, JUNE 26, 1989

# The art of platypus spotting



A platypus spotting night will be held in the rivers near Kawarren on Wednesday night.

"Platypus man" Paul Stephens will conduct the search for the elusive animals to give adults and children a chance to see a platypus close-up in its natural habitat.

The night has been organised by Lindsay Riches, of the Gellibrand River Systems Committee, as part of the committee's platypus study.

This study is to ascertain the number of platypus in Loves Creek, a tributary of the Gellibrand River and part of the system which the committee says could be dried up by proposed groundwater pumping.

The study has been running since January, led by the popular BTV 6 platypus expert Paul Stephens, with support from the Ballarat College of Advanced Education.

Other platypus-spotting nights have been held in

the region in the past, with great success. Seventy people attended the last one.

The search starts from the Kawarren school at 5 pm, weather permitting. Mr Stephens will put a gill net in the river, watch it and try to catch a platypus or two. The animals will be carefully handled and returned to the river after observation.

Spectators are asked to wear dark clothes, carry a strong torch and be prepared to be quiet and patient.

The GRSC is also holding a talk on platypus, presented by Mr Stephens, on Tuesday night. The talk will start at 8 pm and is, once again, open to the public.

Platypus are difficult to spot unless you know the signs to look for, GRSC secretary, Malcolm Gardiner, said last week. He said he had lived in Kawarren for 20 years but never seen a platypus there until Mr Stephens pointed one out.

# No cigars for the platypus hunters

By ROBYN RADBOURN

SCHOOL holidays have sent the people of Gellibrand platypus hunting ... but with little success.

We took up watch with members of the Gellibrand River Systems Committee and a researcher from the Australian Conservation Foundation on the banks of the river last week in very cold conditions.

While we stood in the pitch black waiting for a platypus to swim into a net draped across the Gellibrand River, kids and parents from Karwarren and Gellibrand waited at Kawarren Primary for us to return.

At one time about 50 people were gathered at the school and the more adventurous staked out along the river banks to record platypus sightings.

Researcher Paul Stephens came from Ballarat to educate the locals on the life cycle of the platypus.

"Unfortunately most of my job is waiting," said Paul in the dark.

"Most winter nights it takes five layers of clothes and I'm quite comfortable," he said as a mist began to fall.

The plan was to catch a platypus in the net in the two or so hours after dusk when they come out of their burrows to feed.

GRSC secretary Malcolm Gardiner said residents had been out recor-

ding where they saw platypus along the river.

He explained this was to back up arguments against the Geelong and District Water Board damming the Gellibrand or extracting more ground water from its Kawarren bore field.

Mr Gardiner said the GRSC hoped to receive funding so Paul could do more platypus-catching and monitoring on the Gellibrand River.

Paul said the first thing to do when catching a platypus was to check under the tail for poisonous spurs.

"That's the only way you can tell if they are male.

"Those spurs, you keep well and truly away from them.

"They wouldn't kill you, but would make you very ill and sore."

An interesting point that came up was that the only way researchers can tell if a platypus is nursing young is to inject them with oxytocin.

"Once they are injected the milk just oozes out," he said.

Two hours later we had not caught a platypus and were forced to pull in the nets and settle for a pair of frozen specimens.

"It was not because the river was flowing too fast, it was just one of those things," Paul said when

he presented the frozen samples to those still waiting at the school.

The imaginations of every child had been caught.

They eagerly crowded round the platypus specimens for a good look and to stroke the soft fur.

One of our frozen samples, Paul said, was a

juvenile female which was found dead at the bottom of Erskine falls and donated courtesy of the Colac branch of the Department of Conservation, Forests and Lands.

"The smaller one would be about four months old, just out of the nest, when it died.

Paul said he was worried because he had not seen a juvenile platypus since he started catching them for a living.

# PLATYPI SEEN AT KAWARREN



Almost 50 people rolled up to spot a platypus last Wednesday night around the Kawarren creeks area as part of observing and studying the species.

Platypus researcher, Paul Stephens headed the group and placed people along creeks in search of the illusive platypus.

The observation and trapping night was one of four successful evenings in which 10 to 11 platypi were spotted.

Last Wednesday two platypi were observed and future observation nights are expected to become a regular event.

**Licensed trapper, Paul Stephens holds up what most people have never seen in its natural environment, a platypus.**

Colin Harold  
7/7/89  
P.4.

# Long, lonely hours of a platypus researcher

The fascination of Coleraine's Paul Stephens, 35, with the platypus sometimes leaves him shivering on a creek's wet, cold bank in darkness.

In the water, a modified, unweighted gill net lies in wait for one of Australia's strangest animals.

If his quest is successful, a platypus will swim into the net, become entangled, and rise to the surface.

Paul will be ready to nab it quickly and limit its stress, study it, tag it and later release it back into the wild.

There is no guarantee that Paul's hours of lonely vigil on the creek bank will produce results.

His record is 30 platypuses from Mt Emu Creek, near Skipton. All 30 have been adults. That worries him. Why no juveniles? Are they no longer breeding in the creek?

His 1½-year-old role as a part-time researcher means he must also trap platypuses from another Skipton area watercourse, Baillie's Creek.

From it, he has trapped no platypuses. That also worries him. Does it confirm the worst scenario suggested by fewer and fewer platypus sightings along the stream?

Paul is fascinated by the platypus.

While a different role has brought the Englishman to Coleraine, he shares enthusiastically the latest news about the platypus whose range today in eastern Australia is no longer clear.

Platypuses are still believed to inhabit the Grange Burn, Wannon and Glenelg River network, but Paul believes these watercourses are probably the western edge of the animal's range.

"It's only been learnt in the last two years that a platypus uses the front of its bill to detect tiny, electric charges emitted by shrimps, insect larvae, worms and yabbies.

Previously, people thought the bill merely found prey in the mud by sense of touch."

Paul, married with three children, flew from west England to New Zealand as a 17-year-old adventurer embarking on the "traditional world tour".

The Australian "leg" of that tour has so far lasted 18 years, and his Australian life has

included work as a trade assistant on the West Gate Bridge, Melbourne; as a Bailarat College of Advanced Education student who graduated with a degree of applied science in biological resources management, including ecology, vegetation management, soil conservation and soil chemistry; and as a technical assistant at the Victorian School of Forestry.

He became involved with the platypus when he took over from a colleague who had assisted a subsidised land degradation project instigated by a Skipton area landholder.

While studying the platypus, he was also able to provide landholders with information about other aspects of the two creeks' catchment, including soil erosion, water quality and stream-bank revegetation.

"Until then, I'd only seen a platypus in a zoo," he said.

The project has two more years to run, and Paul, a landholder himself, will continue his research as a sideline to his major role.

He is a consultant with Greening Australia, the commercial arm of the Federal Government's National Tree Program.

He will help others shape proposals for development and management of disused rail reserves when they pass out of V-Line control in future. He has already talked to community groups, landholders, councils, the Country Fire Authority, the Victorian Farmers Federation and other interested people.

Meanwhile, he continues to commute to Skipton for one of Australia's rare in-the-wild studies of the platypus.



Great imitation! Paul produces from his business case a model platypus. With the creek scene behind him, our picture could have passed the model off as the real McCoy—but it hasn't.

## APPENDIX Nine. Two valuable sites for information – CCMA & Native Fish Report Card.

<https://ccma.vic.gov.au/#knowledge>

Evaluation of the ecological response to large-scale river restoration in the Gellibrand and Carlisle Rivers, western Victoria.

Becker, A (School of Life and Environmental Sciences, Deakin University,Warrnambool), Robson, B.J (School of Life and Environmental Sciences, Deakin University,Warrnambool)

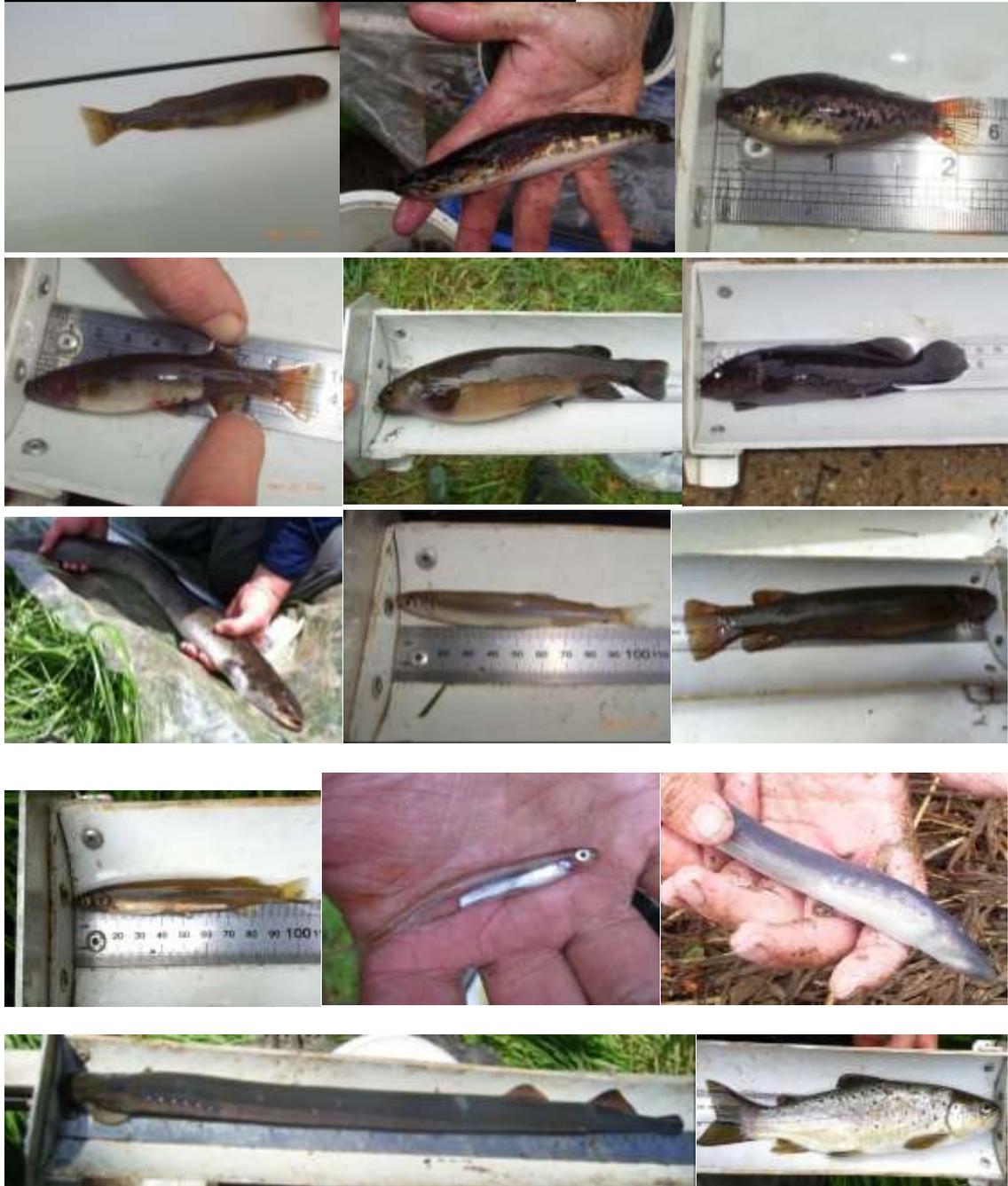
The screenshot shows a search interface for the CCMA Knowledgebase. The search query is "Gellibrand River Blackfish population". The results are sorted by Relevance, showing 10 results per page. The search was conducted within the entire page, and all words were used. The results returned 3 items:

- Fish Population and Environmental Flows in the Gellibrand River and Love Creek outh Western Victoria**  
https://www.ccmaknowledgebase.vic.gov.au/ib\_resource\_details.php?resource\_id=2088  
Office: Author: Zampatti, B. (Water ECOscience), Bradshaw, E. (Water ECOscience), Lewin, K. (Water ECOscience).  
This report examines fish populations, habitat availability, and environmental water requirements in the Gellibrand River and Love Creek Catchment. It aims to find a baseline flow, for the summer months, because it is believed that the Love Creek Catchment supplies a relatively large proportion of this flow from the Kawarren aquifer. Proposals to extract groundwater could reduce annual and summer flows by 20 and 28% respectively. Key findings were that fish assemblage in the Gellibrand above Stevenson's Falls is more diverse than previous study had found. Brown Trout exclude or reduce the population levels of Mountain and Broad-finned Galaxiids (*Galaxias brevifinnis*) in Upper Gellibrand Catchment and Love Creek Catchment. Eastern Gambusia (*Gambusia holbrooki*) species may also decline...
- Gellibrand River: a valuable recreational fishery**  
https://www.ccmaknowledgebase.vic.gov.au/ib\_resource\_details.php?resource\_id=558  
Office: Author: Koehn J (Arthur Rylah Institute for Environmental Research) 1985  
The Gellibrand River, in Victoria's Otway region, has the best population of freshwater blackfish (*Gadopsis marmoratus*) of any river in the state. It is classified of high value in supporting a sport fishery and is a conservation area for native fish. A survey showed that 9500 angling days were spent on the river during the 1982-83 freshwater blackfish season, and it attracted other recreational activities such as camping, sightseeing, picnicking, horse riding and swimming. Because of its popularity for sport fishing and other recreation, the Gellibrand River should be managed as a valuable tourist attraction within the Otway region.
- Distribution of freshwater fish in the Otway Region, south western Victoria**  
https://www.ccmaknowledgebase.vic.gov.au/ib\_resource\_details.php?resource\_id=307  
Office: Author: Koehn, J.D., O'Connor, W.G. (Arthur Rylah Institute for Environmental Research). 1988  
The distribution of freshwater fishes in the Otway region of southwestern Victoria was determined with 18 species being recorded. Distribution of native fish appears to be related to geomorphological conditions existing during and after the last glaciation 20000-5000 years ago. The short coastal streams east of Cape Otway may have formed after the Bass Strait land bridge was submerged, or may have been subjected to dessication during an ensuing

<https://nativefishreportcard.org.au/>

# APPENDIX Ten. Extract from 2011 Study<sup>(36)</sup>

## Appendix 2. Examples of fish species captured.



Fish species in order from top left to bottom right. Mountain galaxiid, Tupong, Southern Pygmy Perch, Spotted galaxiid (without spots), Spotted galaxiid (with spots), River Blackfish, Short-finned eel, Australian Grayling, Climbing galaxiid, Common galaxiid, Australian smelt, Short-headed lamprey and Pouched lamprey and Brown trout.

# APPENDIX Eleven.

State of Victoria - Evidence Act 1958  
[JP/DOJ.1/2000]

## STATUTORY DECLARATION

I, Marina Lewis

(full name)

of 25 Raffertys Rd Gellibrand River Victoria 3239

(address)

Welfare Worker

(occupation)

do solemnly and sincerely believe that:

I have lived at 25 Raffertys Rd, a property 3 kms east of Gellibrand River township with a 1 km Gellibrand River frontage, since August ~~1965~~ <sup>1976</sup>, and to the best of my knowledge:

1 On Saturday 31<sup>st</sup> May 2008 I noted that the Gellibrand River was flowing continuously with a creamy, opaque muddy sludge. This was noteworthy as the river is clear unless there has been an extremely heavy downpour upstream which to my knowledge had not occurred; besides the amount of mud in the river were such that I had not seen before. I recall that the river opacity continued for several days at least.

Please note the attached photos of the river taken on 31<sup>st</sup> May 2008.

2 At this time Dr Jennifer Gall, a friend who is a regular visitor from Canberra, and I observed that the platypus remained as much as possible on the surface of the muddy water, with frequent brief forays into the water below in search of food. This was unprecedented in my time at Gellibrand River as most platypus activity is under the surface of the water where they forage for food, with periodic very brief spells on the surface. It is rare to see them for long periods on the surface. It was apparent to both of us that the platypus may have been in some distress, with its food supply likely to have <sup>been</sup> less detectable given the high level of mud in the water, and the mud itself making it difficult for the animal to remain underwater for the extensive periods usual to ensure its nutritional needs were met.

3 My husband Neil Longmore and I were concerned that some event had occurred that had entailed significant pollution of the river. Neil phoned the Environment Protection Authority on the Sunday 1<sup>st</sup> June to report the mud sludge event.

**I acknowledge that this declaration is true and correct, and I make it with the understanding and belief that a person who makes a false declaration is liable to the penalties of perjury.**

Declared at GELLIBRAND RIVER

in the State of Victoria this 14<sup>th</sup> day of FEBRUARY 2009

Ms. J Lewis  
Signature of person making this declaration [to be signed in front of an authorized witness]

before me Neil Longmore

Signature of authorized witness.  
The authorized witness must print or stamp his or her name, address, and title under section 107A of the Evidence Act 1958 (Vic).  
(e.g. Justice of the Peace, Pharmacist, Police Officer, Court Registrar, Bank Manager, Medical Practitioner, Dentist)

**NEIL L. LONGMORE**  
**73 Pakington Street, Geelong West 3218**  
**An Australian Legal Practitioner within**  
**the meaning of the Legal Profession Act 2004**



Gellibrand River at the Rafferty's Rd Bridge 31.5.09  
UPSTREAM DOWNSTREAM



Gellibrand River at the gate of property 25 Rafferty's Rd  
31.5.09 photos taken by Marina Lewis.

## Appendix Twelve.

### Extract from 2015 Arthur Rylah Institute Fish Survey.<sup>(12)</sup>

No age class of fish under approximately 300mm length were collected from the Gellibrand River

while there were at least two age classes of fish less than this collected from Boggy Creek (Figure 5).



Figure 5. River blackfish collected in Boggy Creek.

**This is part of the Discussion section...**

## Discussion

The results of this survey are consistent with recent studies which suggest there is a lack of juvenile

River blackfish present within the Gellibrand River mainstem (Saddler et al. 2005; Australian Private

Fisheries Resources 2008; Howson and Matthews 2013). This pattern of River blackfish length

structure is in contrast to the findings of a much earlier study (Tunbridge and Glenane 1988) which

found that the River blackfish population in the Gellibrand River was the best population, both in

number and size of fish, of any river in Victoria and possibly south east Australia. Of the 413 fish they

collected from the mainstem of the Gellibrand River (from Burrupa to Dandos camping area), 55% were <220 mm long (Figure 5). In the current study, River blackfish in the Gellibrand River were all > 262 mm long, indicating that since the 1988 survey, there has been a change in the age structure of River blackfish with fewer juvenile River blackfish.

## Appendix Thirteen.

Bernadette Dawes rainfall yearly totals taken from 2009.

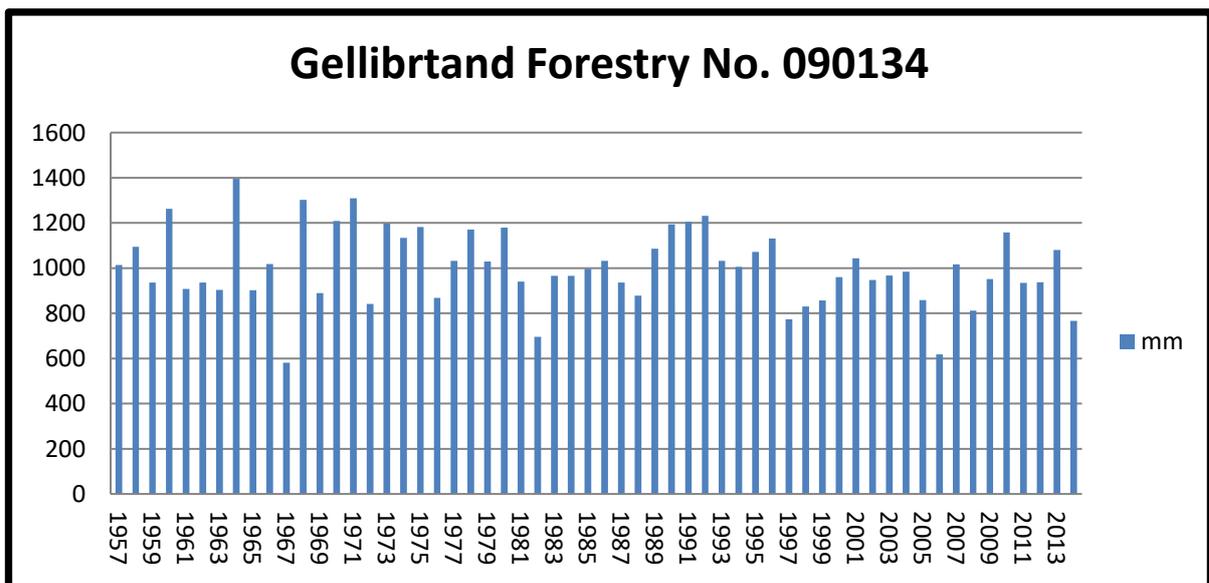
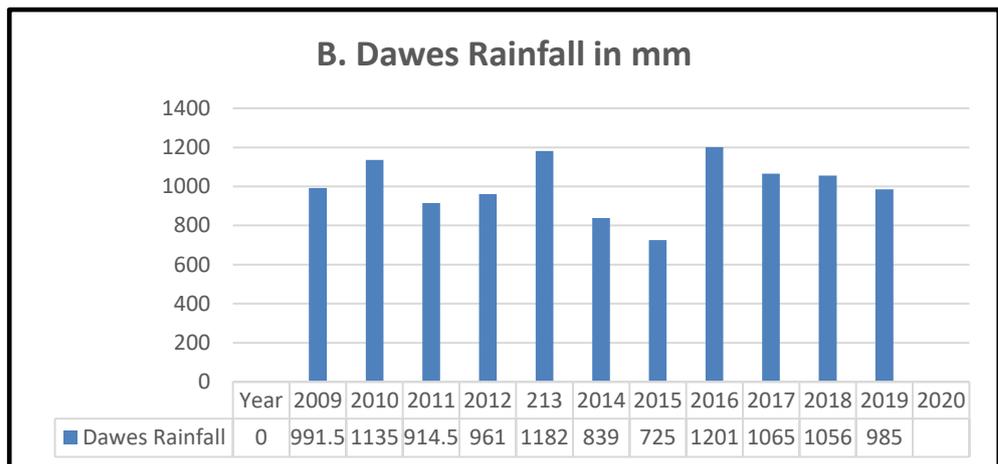
Bernadette lives at the corner of Fry’s Road and Ridge Road Kawarren.

*“When I first met the Dawes Family in the mid 1970’s they said they had an average rainfall around 40 inches....well it looks pretty much the same now.”*

*“I only took an interest in weather/climate when I noticed this area never reflected what I was seeing and hearing on the news and mainstream media.*

*Yet our area supports so many towns with water.”*(personal quotes from Bernadette).

40”=1016 mm



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