WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Draft Report

Vegetation Management Report, Tullaroop Creek, Carisbrook

RM Consulting Group Pty Ltd

13 August 2021

Document Status

Version	Doc type	Reviewed by	Approved by	Date issued
Vv01	Draft Report	Julian Martin	Ben Tate	13 August 2021

Project Details

Project Name	Vegetation Management Report, Tullaroop Creek, Carisbrook
Client	RM Consulting Group Pty Ltd
Client Project Manager	Trent Wallis
Water Technology Project Manager	Ben Tate
Water Technology Project Director	Julian Martin
Authors	Jamie Kaye;Julian Martin;Ben Tate
Document Number	21010507 R01v01 Tullaroop Ck Veg.docx

15 Business Park Drive
Notting Hill VIC 3168
Telephone (03) 8526 0800
Fax (03) 9558 9365
ACN 093 377 283
ABN 60 093 377 283

13 August 2021

Trent Wallis
Senior Consultant
RM Consulting Group Pty Ltd
5/16 Gilbert Street
Torquay, Victoria 3228

Via email: trentw@rmcg.com.au

Dear Trent,

Thank you for the opportunity to work with RMCG and Central Goldfields Shire Council to assist the Carisbrook community with developing a clear plan for the management of Tullaroop Creek, known locally as Deep Creek, through Carisbrook.

The management of waterways through built environments requires balancing of objectives, and in this case requires consideration of impacts on the flood risk, the aesthetics and community enjoyment of the natural asset, stability of the waterway from a geomorphic perspective, and the ecological value of the riparian environment.

Should you have any questions regarding this report please contact Ben Tate, Jamie Kaye or Julian Martin of Water Technology.

Yours sincerely

Ben Tate
Regional Manager VIC
ben.tate@watertech.com.au
WATER TECHNOLOGY PTY LTD

CONTENTS

1 INTRODUCTION 4
1.1 Overview 4
1.2 Project Scope 4
2 MANAGEMENT CONTEXT 5
2.1 Overview 5
2.2 Vegetation Influence on Flooding 5
2.2.1 Overview 5
2.2.2 Role of Riparian Vegetation 5
2.2.3 Influence of vegetation removal on the hydraulic roughness 6
2.3 Historic Water Management 6
2.4 Historic Vegetation Management 7
3 CURRENT VEGETATION CONDITION 12
3.1 Overview 12
3.2 Native vegetation 12
3.2.1 Exotic vegetation 14
4 VICTORIAN PLANNING AND LEGISLATIVE REQUIREMENTS FOR VEGETATION REMOVAL 15
4.1 Overview 15
4.2 Victoria's Planning Scheme 15
4.3 Guidelines for the Removal, Destruction and Lopping of Native Vegetation 15
4.3.1 Offsets 15
5 WORKS ON WATERWAYS PERMITS 17
6 SUMMARY OF RECOMMENDED ACTIONS 18
7 REFERENCES 19

APPENDICES

Appendix A – Tullaroop Creek Stream Flow record (units ML/D)

LIST OF FIGURES

Figure 2-1 Tullaroop Creek streamflow record downstream of Tullaroop Reservoir. The streamflow record presented in five year increments is provided in Appendix A. 7
Figure 3-1 Photo comparisons showing increased shrub growth between 2016 and 2021 13
Figure 3-2 Desert Ash seedlings and parent plant near highway bridge 14

LIST OF TABLES

Table 2-1 Photo Comparison Pre and Post Vegetation Management Works 8

1 INTRODUCTION

1.1 Overview

The township of Carisbrook is located at the confluence of Tullaroop and McCallum Creeks, with the creek through town known locally as Deep Creek. The catchment flows from the northern slopes of the Great Dividing Range between Creswick and Waubra. More broadly, it is part of the Loddon River catchment in central Victoria.

Tullaroop Reservoir was constructed on Tullaroop Creek in 1958 and is a major factor in the hydrology of Deep Creek running through Carisbrook. Tullaroop Reservoir supplies water for downstream irrigation and stock and domestic purposes, with water also transferred to Laanecoorie Reservoir. Tullaroop Reservoir also supplies town water to Maryborough.

In living memory, Tullaroop Creek through Carisbrook was commonly used as a summer swimming hole, with flows being influenced by the summer bulk water releases from the upstream Tullaroop Reservoir. Over time locals have observed a change in the channel profile through town, with the channel becoming less deep associated with deposition within the creek bed. This has contributed to the establishment of reed beds within the creek for several hundred metres downstream of the highway bridge.

Following the January 2011 floods, and as a result of the community steering group led Carisbrook Flood Mitigation Plan, significant vegetation removal works were conducted to improve the flood conveyance along the creek through Carisbrook. Similar works were conducted upstream in Creswick and Clunes also.

1.2 Project Scope

RMCG has recently assisted Council in developing an Environmental Management Plan for Tullaroop Creek through Carisbrook. Water Technology has subsequently been engaged to assist in identifying recommendations for managing the natural ecological values of the riparian zone, whilst balancing the flood risk mitigation objectives.

2 MANAGEMENT CONTEXT

2.1 Overview

The waterways of Victoria have a long and well documented history of change since European colonisation. Through activities such as land clearance, removal of in-channel wood, gold mining activities in headwaters, and construction of water storages, many waterways, including Tullaroop Creek, have drastically changed in the last 200 years.

In more recent times, waterway managers have prioritised ecological values, which has seen a return of large wood and vegetation regrowth along many waterway channels. Prior to the January 2011 floods, Tullaroop Creek through Carisbrook was heavily vegetated with non-native species.

After the January 2011 floods, much of this non-native vegetation was removed, with branches of many native red gums pruned along the creek, where they were growing out into the creek water column. This work was managed by the North Central CMA, in an attempt to improve the flood conveyance through Carisbrook. These works were a part of the recommended flood mitigation plan for Carisbrook (Water Technology, 2013).

Since the post flood vegetation works, there has been some minor riparian planting and natural recruitment of certain tree species along the creek.

2.2 Vegetation Influence on Flooding

2.2.1 Overview

In most instances, the flood behaviour of a stream operates under the collective influence and response to a range of factors and events. In context of the Tullaroop Creek, the flow rate (discharge) that passes through the subject reach at any point in time will be dependent upon a number of hydrological factors including:

- Rainfall intensity, duration and distribution.
- Catchment characteristics and controls including geology, soils, topography.
- The capacity and management of Tullaroop Reservoir.
- Antecedent conditions including soil moisture, groundwater, vegetation growth etc.
- More long-term pre-existing conditions such as fire affected areas and systematic land-use change and disturbance (e.g. floodplain clearing, mining, channel modifications, floodplain constrictions, bridge crossings etc.).

2.2.2 Role of Riparian Vegetation

Both riparian vegetation and in-stream wood provide an important function and contribute to complex interactions within a waterway setting. For instance, vegetation in the channel, on the banks and on the floodplain is, in most cases, the most effective long-term positive influence on channel stability, flood resilience, aquatic habitat and water quality. These influences and interactions can occur on both a site and reach scale.

In context of flood hydraulics, the key influences of both riparian vegetation and large wood include:

- Providing frictional resistance as flows pass over/through the riparian vegetation and large wood.
- Contributing to channel stability through frictional resistance, absorption of erosive forces and sediment binding (associated with vegetation roots).

As a general rule, adding or removing riparian vegetation has limited influence on flooding, particularly during larger flood events that exceed bank full capacity. That is, the influence of the riparian vegetation on flooding

will generally decline as the flow events become larger and as the percentage of flow across the floodplain increases (DELWP, 2019) https://www.water.vic.gov.au/__data/assets/pdf_file/0019/421390/Waterway-Veg-Fact-Sheet-Riparian-vegetation-FINAL-May19.pdf).

The influence of frictional resistance associated with riparian vegetation can be analysed through an assessment of the hydraulic roughness parameter within a hydraulic model. The application of a suitable hydraulic roughness parameter (the Manning's roughness coefficient) is a subjective process and requires professional judgement from the hydraulic modeller. A technical summary regarding influence of vegetation removal on the hydraulic roughness of Tullaroop Creek is provided in Section 2.2.3.

2.2.3 Influence of vegetation removal on the hydraulic roughness

The post flood vegetation removal works completed between 2014 and 2016 were assessed and documented in (Water Technology, 2016), to determine the likely reduction in hydraulic roughness. This assessment was completed to determine if the works satisfied the requirement of a 0.02 reduction in the Manning's 'n' roughness adopted in the hydraulic modelling as part of the Carisbrook flood mitigation plan (Water Technology, 2013). The outcome of the assessment was that the works achieved that objective.

Ben Tate, the same Water Technology flood engineer who undertook the 2016 roughness review, re-walked the same reach of the creek to assess the changes to the vegetation density and the likely hydraulic roughness of today's creek condition. Since the works were completed, recruitment woody trees and shrubs such as wattle and River Red Gum has occurred. The density of the recruitment is not that significant, and this understory vegetation is unlikely to impact the flood flows. The red gum regrowth has not been significant, and from walking the reach the creek channel remains relatively open, with no dense stands of trees or logjams of woody debris. It is Ben Tate's opinion that the current condition of the creek compared to the January 2011 condition still meets the flood mitigation target of a 0.02 reduction in Manning's 'n' roughness.

It is understood that a cause of concern of the local community is the presence of the established stands of reeds within the creek bed. During an overbank flood where private properties are impacted, these reeds are fully submerged and well below the flood level. In events of this magnitude the reeds have very little impact on flood conveyance.

2.3 Historic Water Management

Tullaroop Reservoir was constructed between 1958 and 1959. The reservoir was constructed to manage flows to irrigated properties downstream and supply water for Maryborough and resulted in changes to the natural creek hydrology downstream of the reservoir. An analysis of the streamflow record between 1960 to today is summarised in Figure 2-1 and presented in five-year increments in Appendix A. The streamflow record provided in Appendix A shows a discrete change in the flow management regime downstream of the reservoir since 1995, which likely occurred due to a change in irrigation demand or requirement downstream. It is possible that this change in hydrology is also likely to have changed (reduced) the flow energy and sediment transport behaviour downstream of the reservoir. A reduction in flow energy has the potential to lead to sediment aggradation within the creek bed.

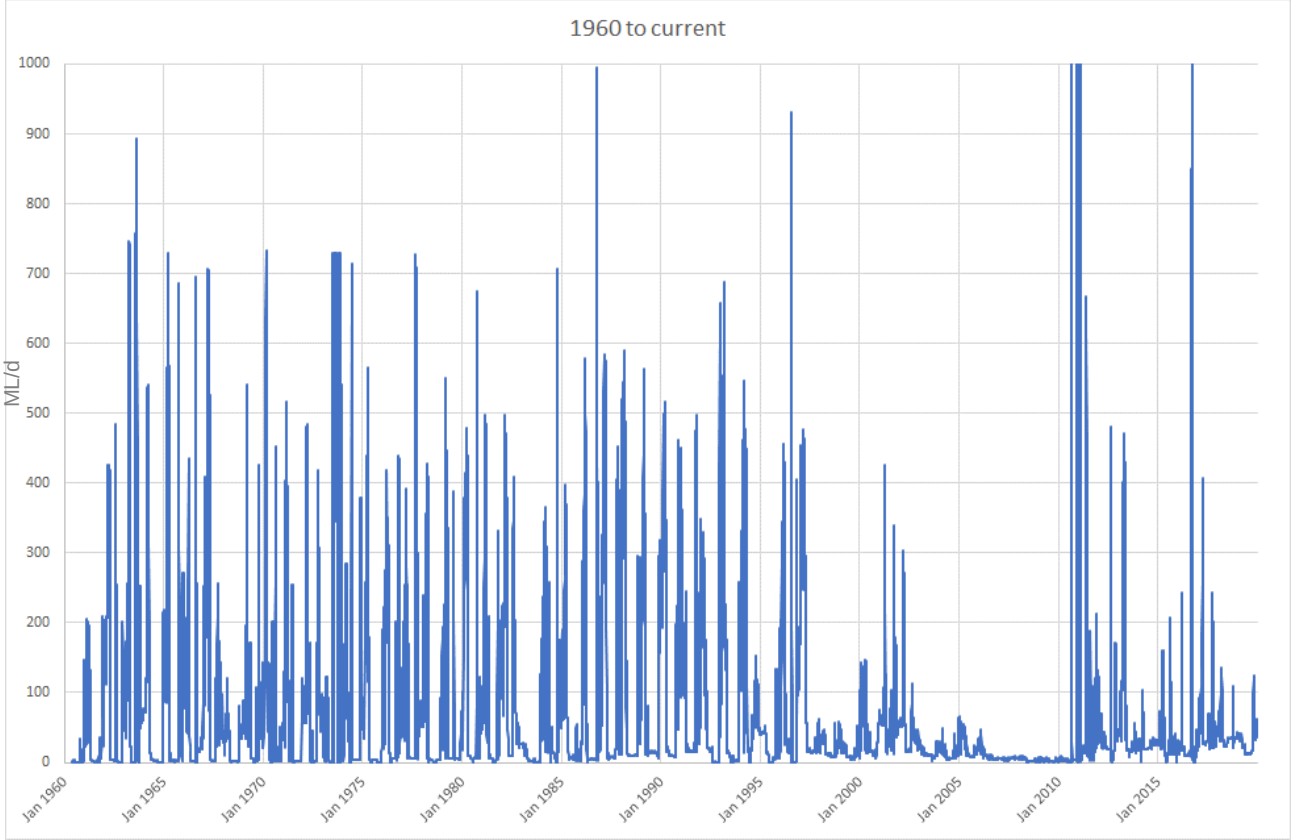


Figure 2-1 Tullaroop Creek streamflow record downstream of Tullaroop Reservoir. The streamflow record presented in five year increments is provided in Appendix A.

2.4 Historic Vegetation Management

Following the January 2011 floods, and as a result of the community steering group led Carisbrook Flood Mitigation Plan, significant vegetation removal works were conducted to improve the flood conveyance along the creek through Carisbrook. Similar works were conducted upstream in Creswick and Clunes also.

North Central CMA managed vegetation works which included the removal of exotic trees including willows and poplars, as well as selective thinning and lopping of branches of river red gums. The works were carried out by a contractor managed and overseen by North Central CMA. Prior to works starting, a community based reference group was consulted regarding the extent of the works, which included marking trees and branches for removal. The vegetation management works resulted in a very large tonnage of wood removed along the creek. This wood was stockpiled and burned. As well as living trees and branches removed, the works included the removal and sometime realignment of dead timber in the waterway. There were a number of examples of large piles of debris which were removed and some large logs were realigned to run parallel with the flow direction. On inspection, the works have made a large visual difference in opening up the waterway at levels up to a few metres above bank full.

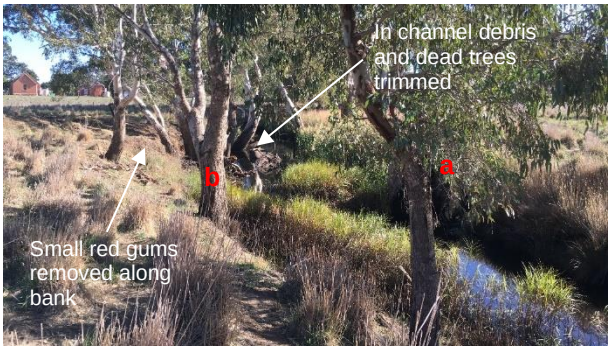
North Central CMA supplied photos taken on the 16th October 2014, which show the condition of the creek prior to any vegetation management works (Table 2-1). It must be noted that North Central CMA did carry out some post flood debris clearing and minor exotic vegetation removal works around the Pyrenees Highway bridge soon after the January 2011 flood event. Some of this exotic vegetation had regrown by 2014. Additional photos were taken on the 29th March 2016 reflecting the post works conditions.

A number of additional photos taken on various dates were also provided from the Pyrenees Highway bridge immediately after the January 2011 flood event and from after the vegetation management works. Table 2-1

shows a side by side comparison of the waterway condition pre and post vegetation management works. The order of the photos starts at McCallum Creek at Camp Street and works its way downstream to the railway bridge.

The vegetation management works are no doubt significant works, and have removed a very large tonnage of wood, both exotic and native. It is very obvious from a visual inspection how much the creek has been opened up from the bed of the channel right through to above bank full.

Table 2-1 Photo Comparison Pre and Post Vegetation Management Works

Pre Works – October 2014	Post Works – March 2016
	
	
	

Pre Works – October 2014	Post Works – March 2016
	
	
	
	

Pre Works – October 2014	Post Works – March 2016
	
	
	
	

Pre Works – October 2014	Post Works – March 2016
	
	

3 CURRENT VEGETATION CONDITION

3.1 Overview

The current vegetation condition was informed through a site assessment, undertaken by Jamie Kaye (Principal Ecologist) on the 13th May 2021. The site assessment involved walking Tullaroop between the Pyrenees Highway and the railway line, and McCallum Creek from Camp Street to the Pyrenees Highway.

3.2 Native vegetation

The creek line is dominated by an overstorey of mixed aged River Red Gum (*Eucalyptus camaldulensis*). Thinning of River Red Gums post flood has left a relatively open stand of trunks while the canopy remains mostly continuous along both banks throughout the project reach. Wirilda (*Acacia provincialis*) is the dominant shrub throughout the project reach. This shrub may have been planted post flooding but is now naturally recruiting and spreading rapidly.

Other dominant native species observed within the reach include:

- Blackwood (*Acacia melanoxylon*) – A long lived large sub-canopy tree; a few young specimens have recruited on the banks.
- Bottlebrush (*Callistemon* sp.) – A medium sized shrub; many relatively young specimens present. These plants can be long lived and River Bottlebrush (*Callistemon sieberi*) can tolerate flooding and withstand high flow velocities.
- Common Reed (Phragmites australis) – This semi-aquatic perennial reed can grow in water up to about 1.5 m deep. In the absence of grazing, this plant can dominate the creek channel and banks, as it has done in the upper section of the project reach between the highway and walk bridge. This plant is summer vigorous with new shoots growing rapidly in Spring-Summer and dying off in winter. Common Reed beds can trap sediment but are flexible and lay down under flood flow conditions.
- Cumbungi (*Typha* sp.) – This robust emergent aquatic plant will only persist where there is near permanent water present (i.e. it tends to be present in pools rather than intermittent channels and banks). This plant can persist in water up to about 2 m deep in the absence of high flow conditions. The base of Cumbungi is more sturdy than Common Reed and the base of the plant has a greater tendency to resist flow.

Following vegetation thinning and clearance post flooding, there was limited understorey remaining, however, there has been regeneration of sub-canopy and understorey species in the subsequent 5 year period. Photo comparisons between 2016 and 2021 at three locations within the project reach are presented in Figure 3-1. These photos show an increase in woody cover, particularly in the understorey shrub layer that is dominated by wattles, mostly Wirilda, (*Acacia provincialis*).

Figure 3-1 Photo comparisons showing increased shrub growth between 2016 and 2021

3.2.1 Exotic vegetation

Despite the extensive clearing of exotic vegetation post flooding, a few species continue to emerge from seed distribution. Desert Ash (*Fraxinus angustifolia*) were observed throughout the project reach, particularly at the upstream end. Poplar and Blackberry were also observed across the project area.

Figure 3-2 Desert Ash seedlings and parent plant near highway bridge

4 VICTORIAN PLANNING AND LEGISLATIVE REQUIREMENTS FOR VEGETATION REMOVAL

4.1 Overview

The removal of native regrowth less than 10 years of age, and all exotic species can be undertaken without the need for permits. Mature exotic trees within the streamside reserve may have cultural or amenity value to the community and therefore removal should be discussed prior to removal. Prior to lopping or removal of mature native species advice should be sought from Council and a permit is likely to be required (DELWP 2017a).

The following legislative requirements apply if other native vegetation is proposed to be removed.

4.2 Victoria's Planning Scheme

State planning provisions are established under the Victorian Planning and Environment Act 1987. Under Clause 52.17 of all Victorian Planning Schemes, a planning permit is required to remove, destroy or lop native vegetation, including dead native vegetation. The purpose of this clause is to ensure that there is no net loss to biodiversity as a result of the removal, destruction or lopping of native vegetation.

4.3 Guidelines for the Removal, Destruction and Lopping of Native Vegetation

Clause 52.17 is implemented through the *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP 2017b) (the Guidelines). The Guidelines outline the following three step approach to manage the removal, destruction or lopping of native vegetation to minimise land and water degradation:

1. Avoid the removal, destruction or lopping of native vegetation.

2. Minimise impacts from the removal, destruction or lopping of native vegetation that cannot be avoided.

3. Provide an offset to compensate for the biodiversity impact if a permit is granted to remove, destroy or lop native vegetation.

There are three assessment pathways for an application to remove native vegetation: basic, intermediate and detailed. These pathways are determined by the amount of native vegetation to be removed (in hectares), whether any large trees are to be removed; and the location of the vegetation.

The detailed assessment pathway requires an accredited native vegetation assessor to complete a site assessment report and assist with the permit application prior to any works. However, in the basic and intermediate pathways, the proponent can complete the application themselves using the NVIM assessment tool.

The amount of past removal (in hectares) (lawful or unlawful) that occurred on the same property or on contiguous land in the same ownership in the past five years may also influence the assessment pathway. This amount is added to the amount proposed for removal to determine the assessment pathway. However, it does not influence the vegetation offsets required (DELWP 2017b).

4.3.1 Offsets

If the application is in the basic or intermediate assessment pathway, an accredited vegetation assessor is not required. The NVIM native vegetation removal tool uses mapped information to determine the offset requirements for a proposal and only general offsets are required.

If the application is in the detailed assessment pathway, the offset requirements for the proposal will be specified in a Native Vegetation Removal (NVR) report provided by an accredited native vegetation assessor. An application in the detailed assessment pathway can have either general or species offset requirements, or both.

Offsets are described as either:

- First party offsets, which are on land owned by the holder of a permit to remove native vegetation. First party offsets are used to meet landowners' own offset requirements.
- Third party offsets, which are on land owned by another party. Permit holders can purchase native vegetation credits from other landowners to meet their offset requirements (DELWP 2018).

5 WORKS ON WATERWAYS PERMITS

Works on a waterway have the potential to lead to significant and widespread adverse impacts on the waterway and broader environment. As such, Catchment Management Authorities are responsible for regulating works on waterways. The regulation of works on waterways is managed through Works on Waterways Permits. To obtain a Work on Waterway Permit, an application form is to be filled in and submitted to the North Central CMA. Depending on the complexity of the works detail provided in the application, the North Central CMA may request additional information, in order to assess the application. Subject to the application and proposed works being deemed satisfactory, the North Central CMA will issue a permit. A Works on Waterway Permit will generally be valid for 12 months from the date of issuing.

6 SUMMARY OF RECOMMENDED ACTIONS

The maintenance of flow conveyance, while protecting environmental values, can be achieved by undertaking the following actions along Tullaroop Creek adjacent to the Carisbrook township:

- Continue the control of all exotic woody species. The current problem species include Desert Ash, Poplar and Blackberry. The removal of seeding parent plants should be undertaken within Crown land and encouraged on adjacent freehold property.
- Remove the majority of River Red Gum seedlings as they regenerate within the project reach. Only allow seedlings to persist in areas where mature specimens senesce, or where large gaps in canopy continuity exists. Lopping of existing trees should not be necessary.
- Manage wattle to current levels of cover. It is recommended to periodically thin wattles to ensure a mixed age of plants persist throughout the project reach, while limiting the expansion of current (Winter 2021) cover.
- Allow the maturity of current Blackwood and Bottlebrush specimens but control further recruitment of these species within the project reach.
- Given constant water presence and infrequent flooding, Cumbungi has the potential to colonise the creek low-flow channel. Being a robust perennial emergent aquatic species, this plant has the potential to fill the channel and limit the extent of open water that is usually desired by most communities. It is recommended to limit the presence of Cumbungi to current Winter 2021 levels.
- Common Reed is relatively flexible species, has negligible impact on flood levels and provides bank and bed stability during high flow events. This species does have the ability to capture sediment and colonise shallow channels and therefore may require excavation from the centre of the channel if excessive bed aggradation is occurring.
- Woody debris is a desirable habitat feature within the bed of the creek and within the streamside zone. However, should excessive accumulations occur, wood may need to be removed from the channel or floodplain. Small accumulations or individual logs within the channel should be retained, or realigned if causing flow diversion and/or erosion.

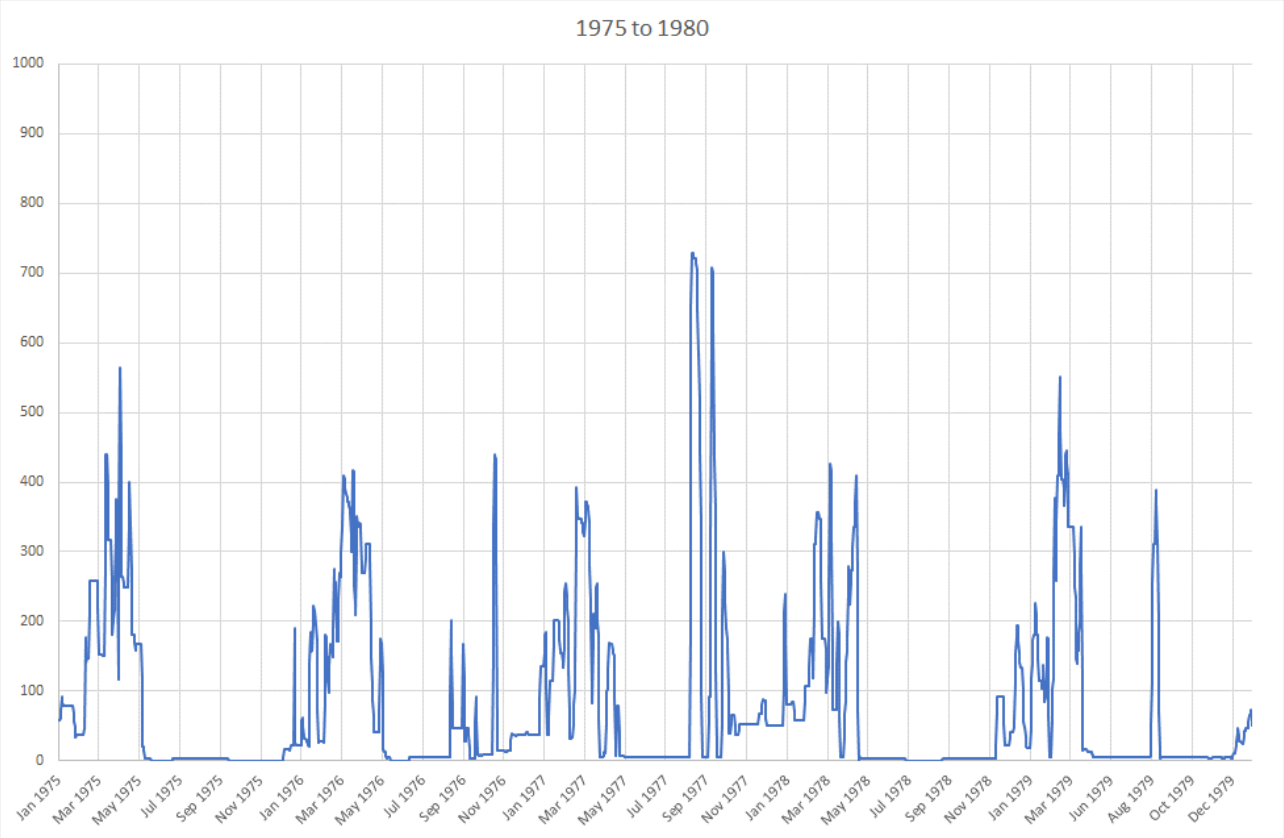
7 REFERENCES

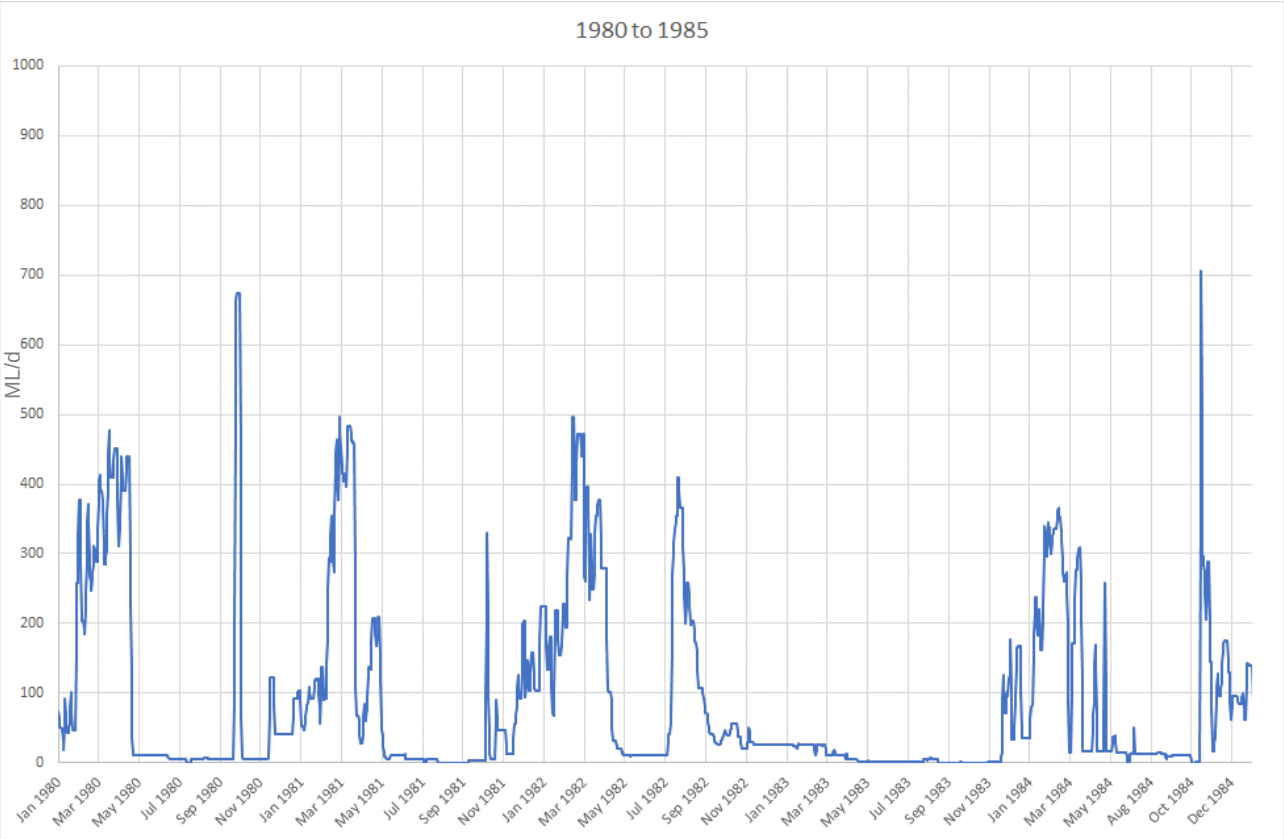
Department of Environment, Land, Water and Planning, Melbourne (DELWP) (2017a) *Exemptions from requiring a planning permit to remove, destroy or lop native vegetation: Guidance.* Victorian Department of Environment, Land, Water and Planning. Melbourne.

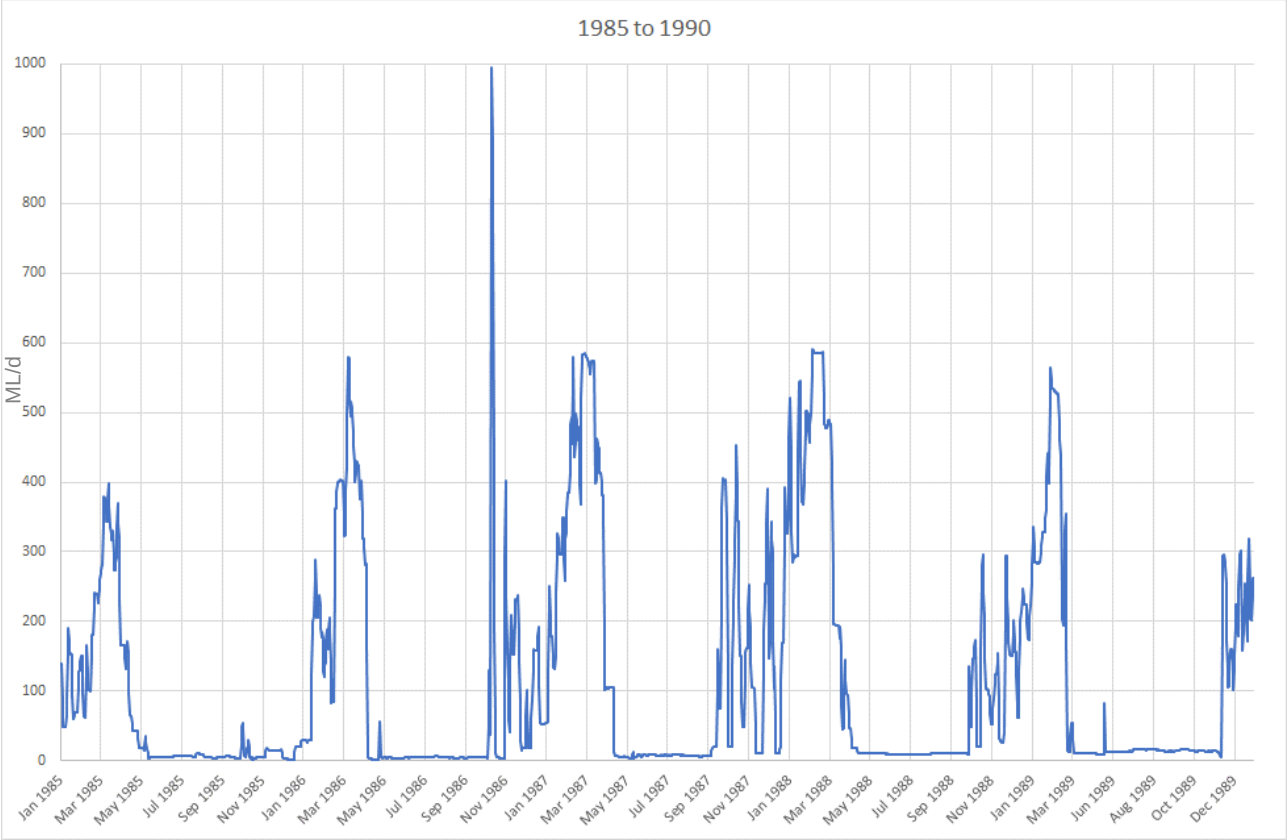
Department of Environment, Land, Water and Planning, Melbourne (DELWP) (2017b) *Guidelines for the removal, destruction or lopping of native vegetation.* Victorian Department of Environment, Land, Water and Planning, Melbourne.

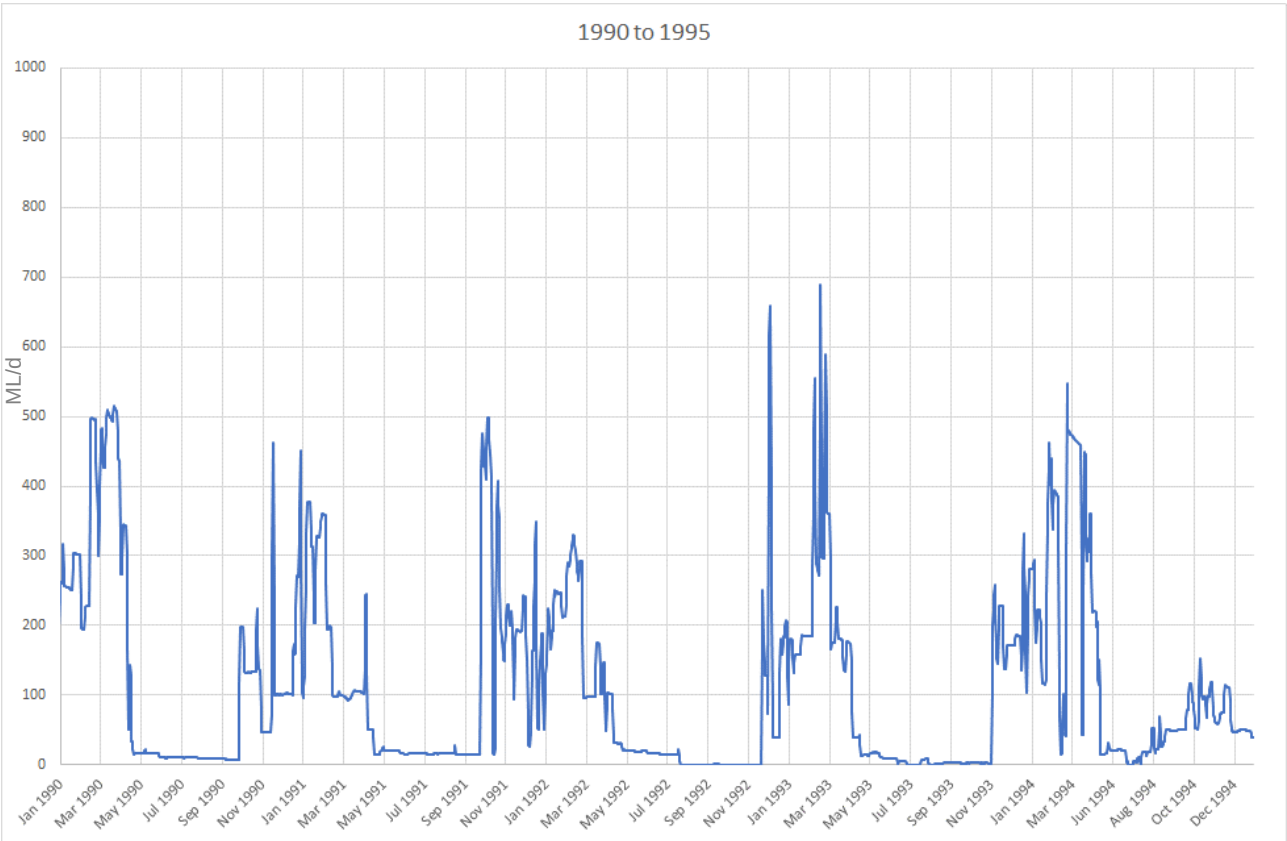
Department of Environment, Land, Water and Planning, Melbourne (DELWP) (2018) *Assessor's handbook - Applications to remove, destroy or lop native vegetation v1.1,* Department of Environment, Land, Water and Planning, Melbourne.

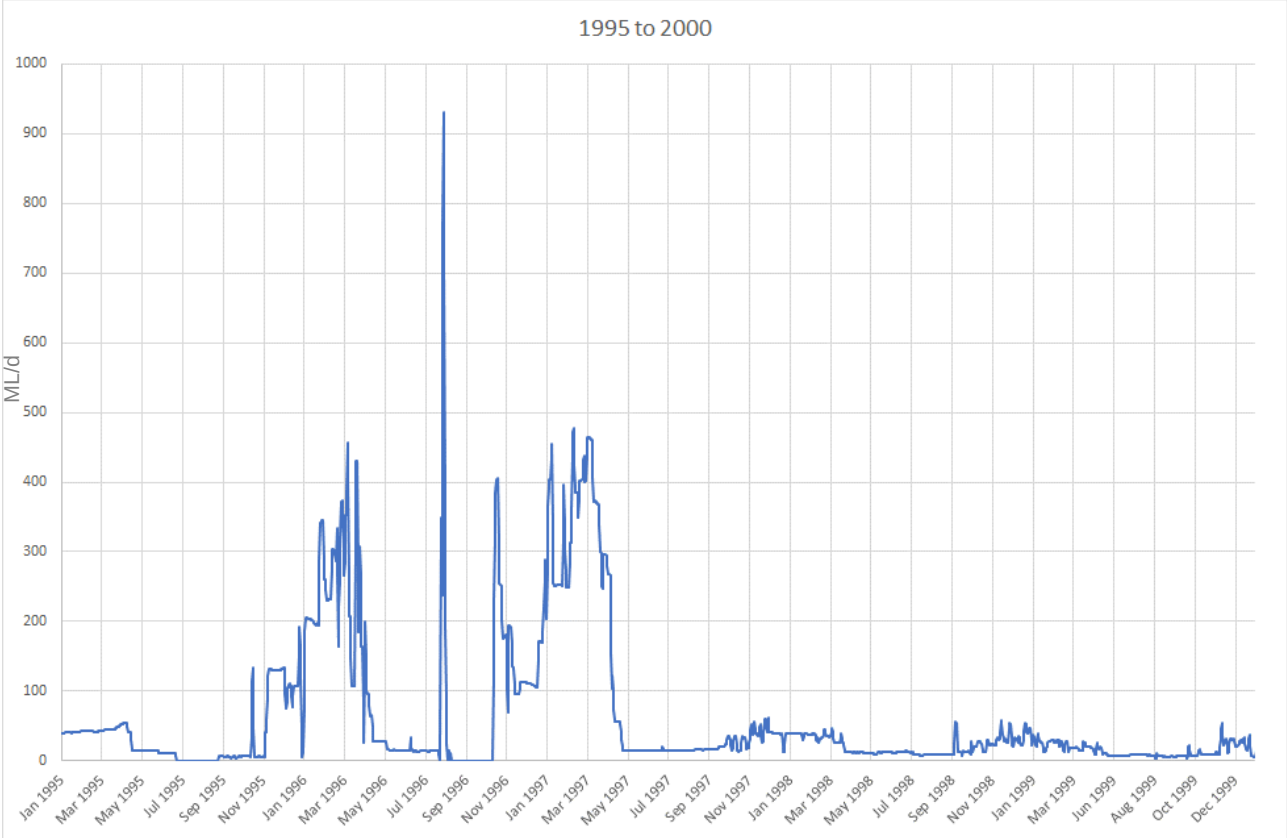
APPENDIX A – TULLAROOP CREEK STREAM FLOW RECORD (UNITS ML/D)

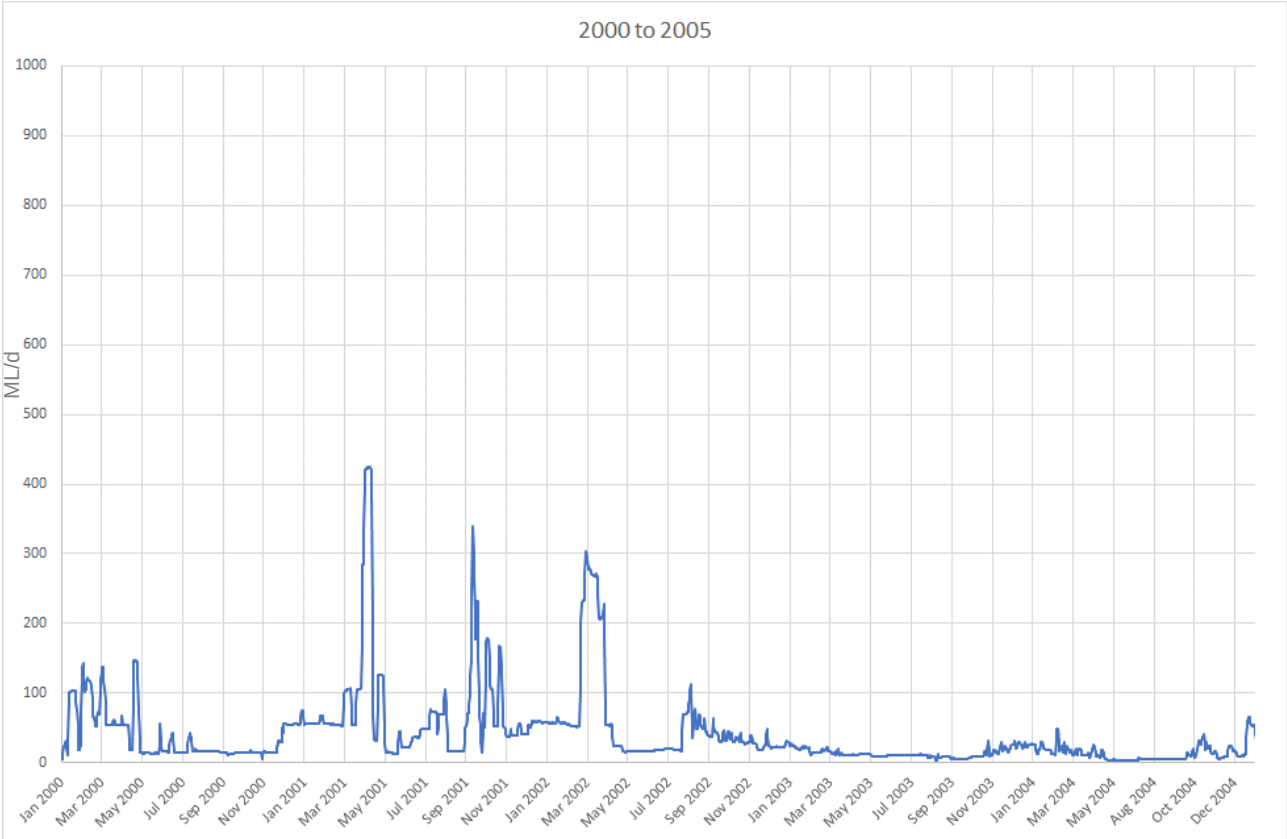

1975 to 1980
1000
900
800
700
600
500
400
300
200
100
0
Jan 1975
Mar 1975
May 1975
Jul 1975
Sep 1975
Nov 1975
Jan 1976
Mar 1976
May 1976
Jul 1976
Sep 1976
Nov 1976
Jan 1977
Mar 1977
May 1977
Jul 1977
Sep 1977
Nov 1977
Jan 1978
Mar 1978
May 1978
Jul 1978
Sep 1978
Nov 1978
Jan 1979
Mar 1979
Jun 1979
Aug 1979
Oct 1979
Dec 1979

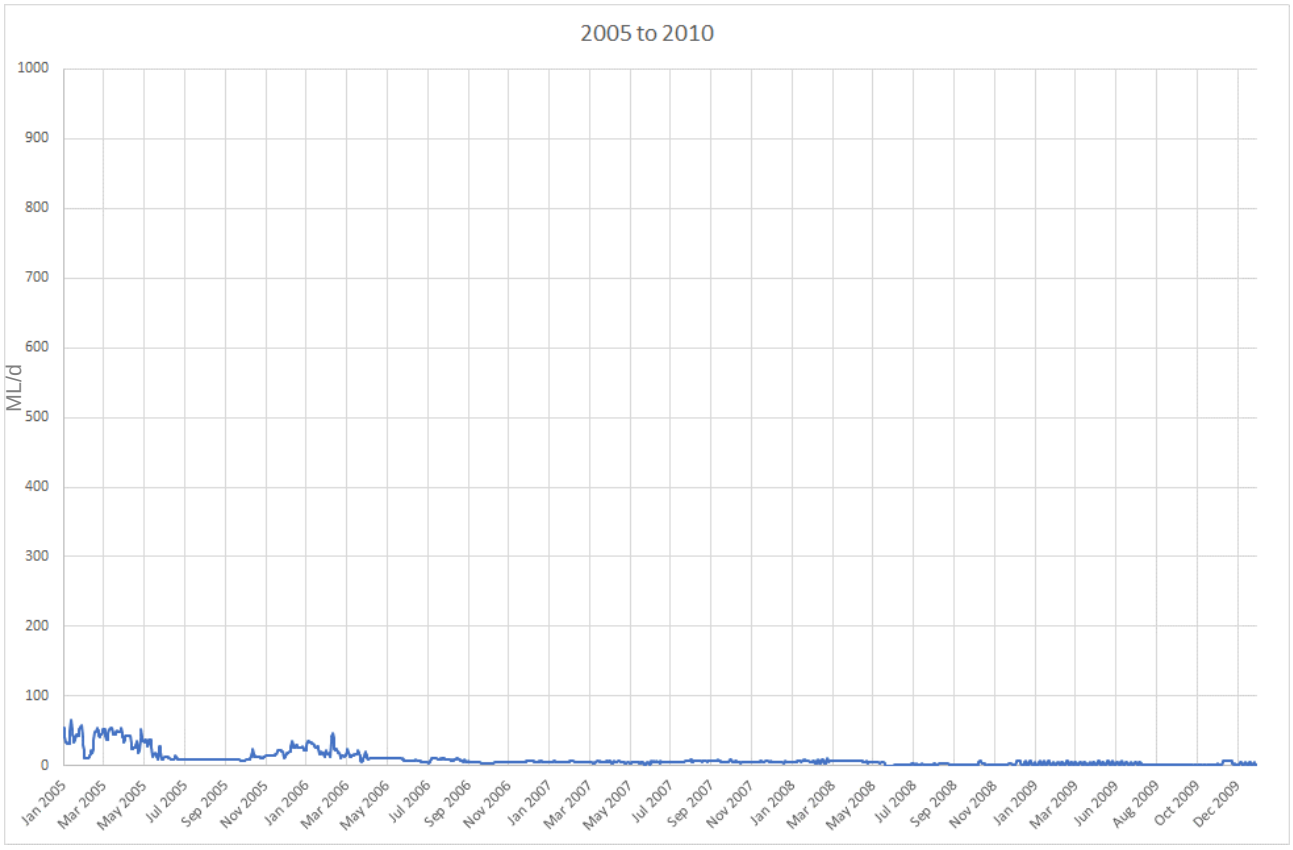

1980 to 1985
ML/d
1000
900
800
700
600
500
400
300
200
100
0
Jan 1980
Mar 1980
May 1980
Jul 1980
Sep 1980
Nov 1980
Jan 1981
Mar 1981
May 1981
Jul 1981
Sep 1981
Nov 1981
Jan 1982
Mar 1982
May 1982
Jul 1982
Sep 1982
Nov 1982
Jan 1983
Mar 1983
May 1983
Jul 1983
Sep 1983
Nov 1983
Jan 1984
Mar 1984
May 1984
Aug 1984
Oct 1984
Dec 1984

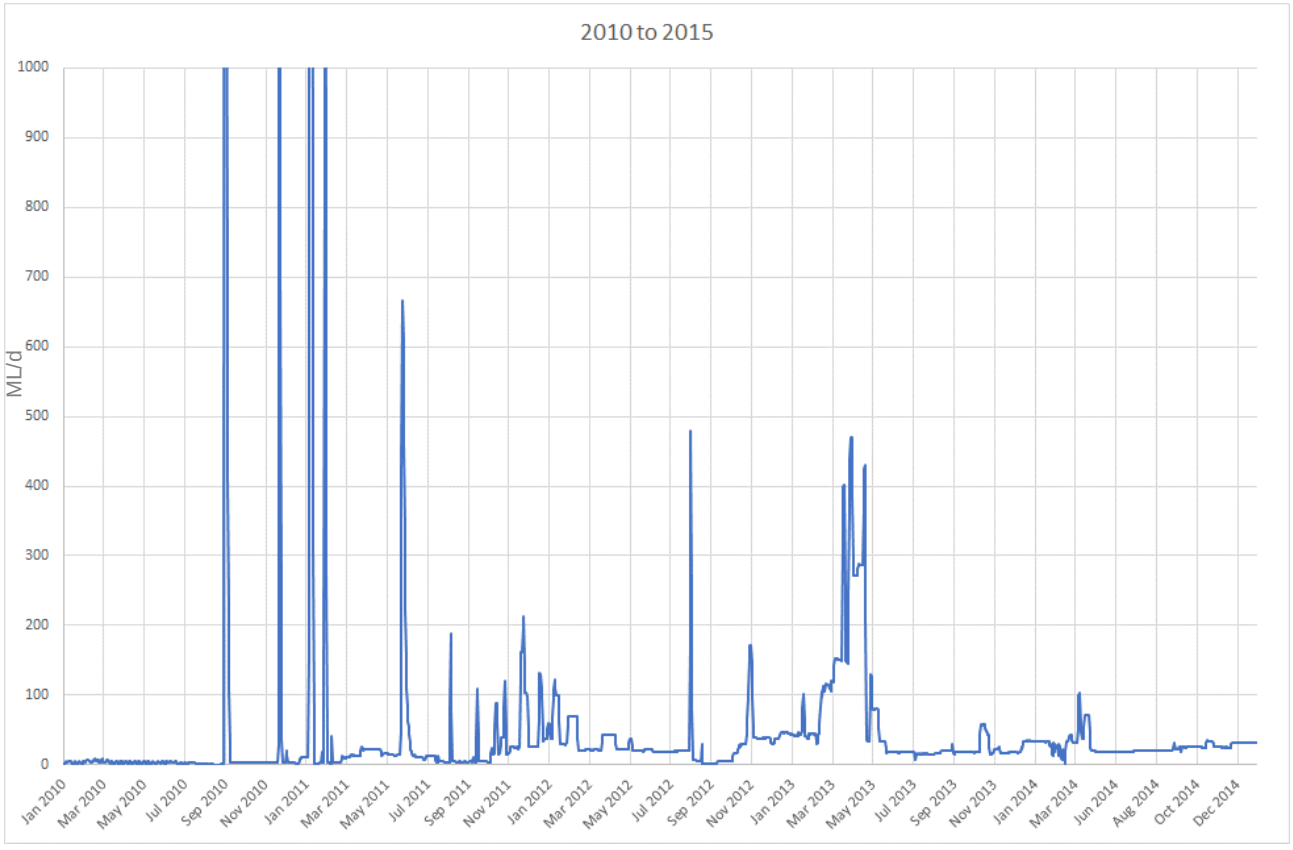

1985 to 1990
ML/d
1000
900
800
700
600
500
400
300
200
100
0
Jan 1985
Mar 1985
May 1985
Jul 1985
Sep 1985
Nov 1985
Jan 1986
Mar 1986
May 1986
Jul 1986
Sep 1986
Nov 1986
Jan 1987
Mar 1987
May 1987
Jul 1987
Sep 1987
Nov 1987
Jan 1988
Mar 1988
May 1988
Jul 1988
Sep 1988
Nov 1988
Jan 1989
Mar 1989
Jun 1989
Aug 1989
Oct 1989
Dec 1989


1990 to 1995
ML/d
1000
900
800
700
600
500
400
300
200
100
0
Jan 1990
Mar 1990
May 1990
Jul 1990
Sep 1990
Nov 1990
Jan 1991
Mar 1991
May 1991
Jul 1991
Sep 1991
Nov 1991
Jan 1992
Mar 1992
May 1992
Jul 1992
Sep 1992
Nov 1992
Jan 1993
Mar 1993
May 1993
Jul 1993
Sep 1993
Nov 1993
Jan 1994
Mar 1994
Jun 1994
Aug 1994
Oct 1994
Dec 1994


1995 to 2000
ML/d
1000
900
800
700
600
500
400
300
200
100
0
Jan 1995
Mar 1995
May 1995
Jul 1995
Sep 1995
Nov 1995
Jan 1996
Mar 1996
May 1996
Jul 1996
Sep 1996
Nov 1996
Jan 1997
Mar 1997
May 1997
Jul 1997
Sep 1997
Nov 1997
Jan 1998
Mar 1998
May 1998
Jul 1998
Sep 1998
Nov 1998
Jan 1999
Mar 1999
Jun 1999
Aug 1999
Oct 1999
Dec 1999


2000 to 2005
ML/d
1000
900
800
700
600
500
400
300
200
100
0
Jan 2000
Mar 2000
May 2000
Jul 2000
Sep 2000
Nov 2000
Jan 2001
Mar 2001
May 2001
Jul 2001
Sep 2001
Nov 2001
Jan 2002
Mar 2002
May 2002
Jul 2002
Sep 2002
Nov 2002
Jan 2003
Mar 2003
May 2003
Jul 2003
Sep 2003
Nov 2003
Jan 2004
Mar 2004
May 2004
Aug 2004
Oct 2004
Dec 2004


2005 to 2010
ML/d
1000
900
800
700
600
500
400
300
200
100
0
Jan 2005
Mar 2005
May 2005
Jul 2005
Sep 2005
Nov 2005
Jan 2006
Mar 2006
May 2006
Jul 2006
Sep 2006
Nov 2006
Jan 2007
Mar 2007
May 2007
Jul 2007
Sep 2007
Nov 2007
Jan 2008
Mar 2008
May 2008
Jul 2008
Sep 2008
Nov 2008
Jan 2009
Mar 2009
Jun 2009
Aug 2009
Oct 2009
Dec 2009


2010 to 2015
ML/d
1000
900
800
700
600
500
400
300
200
100
0
Jan 2010
Mar 2010
May 2010
Jul 2010
Sep 2010
Nov 2010
Jan 2011
Mar 2011
May 2011
Jul 2011
Sep 2011
Nov 2011
Jan 2012
Mar 2012
May 2012
Jul 2012
Sep 2012
Nov 2012
Jan 2013
Mar 2013
May 2013
Jul 2013
Sep 2013
Nov 2013
Jan 2014
Mar 2014
Jun 2014
Aug 2014
Oct 2014
Dec 2014

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Melbourne

15 Business Park Drive
Notting Hill VIC 3168
Telephone (03) 8526 0800

Sydney

Suite 3, Level 1, 20 Wentworth Street
Parramatta NSW 2150
Telephone (02) 8080 7346

Brisbane

Level 5, 43 Peel Street
South Brisbane QLD 4101
Telephone (07) 3105 1460

Adelaide

1/198 Greenhill Road
Eastwood SA 5063
Telephone (08) 8378 8000

Perth

Ground Floor, 430 Roberts Road
Subiaco WA 6008
Telephone (08) 6555 0105

New Zealand

7/3 Empire Street
Cambridge New Zealand 3434
Telephone +64 27 777 0989

Wangaratta

First Floor, 40 Rowan Street
Wangaratta VIC 3677
Telephone (03) 5721 2650

Geelong

51 Little Fyans Street
Geelong VIC 3220
Telephone (03) 8526 0800

Wimmera

597 Joel South Road
Stawell VIC 3380
Telephone 0438 510 240

Gold Coast

Suite 37, Level 4, 194 Varsity Parade
Varsity Lakes QLD 4227
Telephone (07) 5676 7602

watertech.com.au