“Under the Radar”

Pesticide Detections Victorian Water Supplies 2007-2016

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What is a Pesticide?

The Food and Agriculture Organisation define a pesticide as: *"any substance or mixture of substances intended for preventing, destroying or controlling any pest, including vectors of human or animal disease, unwanted species of plants or animals causing harm during or otherwise interfering with the production, processing, storage, transport or marketing of food, agricultural commodities, wood and wood products or animal feedstuffs, or substances which may be administered to animals for the control of insects, arachnids or other pests in or on theirbodies. The term includes substances intended for use as a plant growth regulator, defoliant, desiccant or agent forthinning fruit or preventing the premature fall of fruit. Also used as substances applied to crops either before or after harvest to protect the commodity from deterioration during storage and transport." (6)* Subclasses of pesticides include: herbicides, insecticides, fungicides, rodenticides, pediculicides and biocides.

Recommendations

- **Water authorities need to be legally empowered to more accurately monitor biocide use within domestic water supply catchments. They need to know what pesticides are being used, in what volume and when spraying is occurring. At the current time, there is no agency (or agencies) in Australia that monitor biocide use.**

- **Pesticide users should submit details of all pesticide use within domestic water supplies to water authorities prior to spraying. This would allow for more accurate testing.**

- **All water authorities should test for at least 50 pesticides and more regularly than on an annual basis. Testing should also occur according to risk eg after high rainfall events.**

- **Water authorities should investigate the use of passive samplers to monitor for pesticides for longer periods of time, as well as grab samples.**

- **Water supplies are at risk from illegal dumping and even potential terrorist attacks. For some water authorities operating in Victoria, they would not know if pesticide pollution had occurred as current testing would not detect a wide range of currently registered pesticides. This includes Bendigo (Australia's largest inland city).**

- **All pesticide detections >0.1µg/L (0.1part per billion) should be investigated and the source of the pollution determined by water authorities.**

- **Notice of Contraventions should be enacted, particularly if pesticide pollution is caused by residual pesticides and if the event is ongoing. There needs to be additions to the Water Act, particularly section 169, which should specify what pesticide levels determine a Notice of Contravention for Water Supply Protection.**

- **Water authorities need to work with landholders to ensure that high risk pesticides do not enter waterways. Public education campaigns need to be implemented.**

- **All results of pesticide testing should be publicly listed.**

- **Label restrictions need to occur for Atrazine, Simazine, Triclopyr, 2,4-D, Hexazinone and MCPA further setbacks from drainage lines, increase buffers, restrictions on time of usage.**

- **Chemical Control Areas should be extended from just crops to include biocide use within domestic water supplies. Restrictions need to be placed on pesticides that are prone to pollute domestic water supplies. Particularly Atrazine, Simazine Triclopyr, 2,4-D, Hexazinone and MCPA.**

- **Drinking water guidelines should incorporate the latest research into low dose impacts of pesticide and mixture effects eg impacts on endocrine function, reproduction and development.**

- **State Environmental Protection Policies should include domestic water supplies (eg reservoirs) and be made legally enforceable, instead of being only "aspirational" goals.**

- **Pollution of waterways should be made an offence under the *Agricultural and Veterinary Chemicals (Control of Use) Act 1992*. At the moment, it would appear that many water supplies are regarded as little more than agricultural drains.**

- **Sugarloaf Reservoir in North-Eastern Melbourne should be tested for pesticides as well as the Yarra River.**

- **Victorian and Australian Pesticide legislation should be based on the precautionary principle and should be more in line with European Guidelines.**

- **Presently no Australian jurisdiction conduct pesticide air monitoring. The Victorian State Government should urgently implement pesticide monitoring of ambient air near pesticide-treated fields, (air samplers are typically placed 30–500 feet from the field boundary on each side of the field), during and after pesticide application to determine levels of the air concentration of the pesticide applied to these fields.**

- **Water authorities should also be sampling for contaminants in pesticides such as 2,4-D, which can contain dioxins.**

Introduction

In terms of risks to drinking water, water authorities strive to eliminate microorganisms and bacteria as they are the major risk factor in terms of exposing a large number of people to potentially lethal waterborne diseases.

Water authorities in Victoria also have to monitor for a range of substances that can enter water supplies and impact on health. These include chlorine disinfection byproducts, heavy metals and fluoride etc. Aesthetic parameters including colour, taste, turbidity, pH and so on are also regularly monitored.

"Further down" the list of potential contaminants are pesticides, volatile organic compounds, polyaromatic hydrocarbons, radioactive substances etc. These substances may occasionally occur in drinking water, but can occur infrequently and sporadically.

Each water authority conduct risk assessments of their water supplies and these assessments will determine levels of risk and which substances should be included in testing. Because there is no standardised risk assessment for all catchments, as land uses within water supplies are different, different water authorities can place different emphasis on pesticides risk. Some water authorities may perceive the risk higher than others, and may therefore test for a range of pesticides that other authorities may ignore.

In 2007 Friends of the Earth (FoE) tried to compile a Statewide analysis of pesticide residues in waterways covering the years 1998-2007. FoE was concerned that there was a paucity of data on what pesticides were entering waterways across the state and surmised that water authorities may have the best available data in order to better understand, what at that time, appeared to be an unquantifiable problem.

FoE also had concerns regarding the ecological and health impacts of herbicides such as Atrazine and Simazine on the freshwater environment. It was clear that there had been concerns in the past regarding runoff associated with organochlorines and new information was revealing that pesticide residues at very low levels could impact on human health as well. As a result of these concerns, FoE wrote a series of FoI applications to Victorian Water Authorities

From this process, FoE determined that over a dozen pesticides had been detected in Victorian water supplies and that there were some high risk areas, however gaps occurred in the results, due to a lack of adequate and consistent testing by water authorities across the state. At that time almost there had been 187 detections of pesticides in domestic water supplies in Victoria. (87 of these detections were by Goulburn Murray Water between 2004-6 and 39 by Barwon

Water concerning Hexazinone pollution of the Moorabool Water Supply 2004-6). Outside of these events, there had been 61 detections of pesticides in water supplies (32.6% of total).

FoE wrote in 2007: *"Some of the most serious incidents appear to be mostly related to use of 2,4-D, which is classified by the IARC (International Agency for Research on Cancer) as a Class 2B carcinogen - possibly carcinogenic to humans. …. The most at risk water supplies, according to the limited FoI information, appear to be two open aquaduct systems which flow into the Wurdee Boluc Reservoir and into the Stony Creek Reservoirs managed by Barwon Water. The Yarra is also at risk from horticultural fungicides, insecticides and herbicides, but there is scant information to back up these claims.*

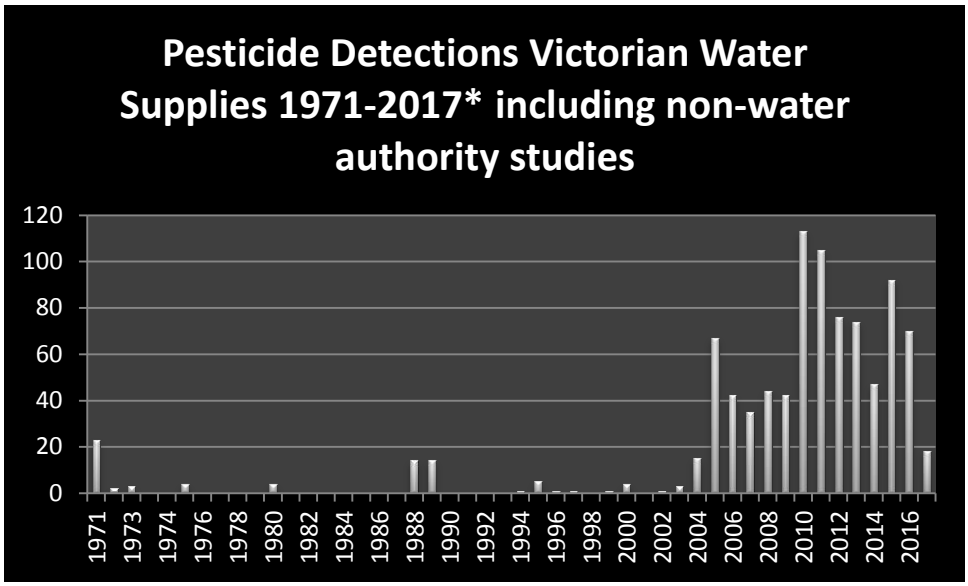
The Geelong aquaducts are at risk from cropping and grazing pesticides as the aquaducts flow through open farmland, in some places lower than surrounding farmland. The Broken Creek system managed by Goulburn Murray Water, which supplies the communities of Nathatalia and Numurkah also appears to be at some risk as do some communities relying on channel water in northern Victoria. The longest duration pollution incident reported in the past decade occurred in the Moorabool System (Barwon Water) with the herbicide Hexazinone, associated with weed control in pine plantations, leaching at low volumes for almost 3 years. The pesticide was detected 50km downstream."

"Seven water authorities were testing on average only two currently used pesticides, leaving only three (21.4%) water authorities testing for between 40-72 pesticides. This means that in late 2007, eleven (78.6%)of the fourteen water authorities were testing for less than 2 currently used pesticides."

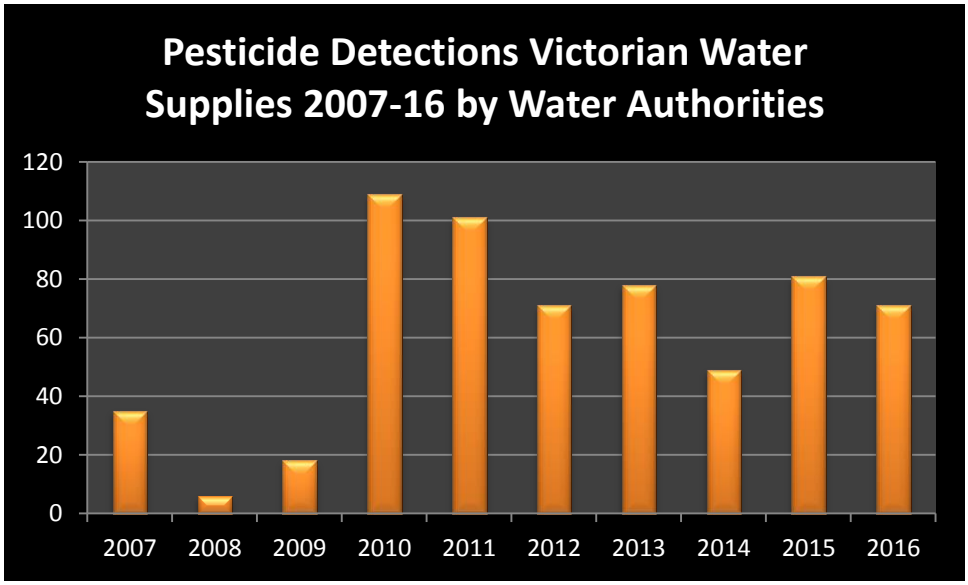
A decade later, it is now evident that more information is now at hand. It appears that in 2011/12 a number of water authorities significantly increased the amount of pesticides tested for and the laboratory's which conducted the testing appeared to be able to test at lower levels. This has meant a three* fold increase in pesticide detections in domestic water supplies. This probably represents only a fraction of what is actually coming down the catchments. It is encouraging to note that a number of independent studies looking at agricultural chemicals in domestic water supplies have also occurred in Victoria after 2007, most notably in the Yarra and Port Phillip Bay catchments. These studies are crucial at better understanding, what up to ten years ago was largely unknown (*six fold increase if 2004-6 Goulburn Murray Water study is not included).

The herbicide 2,4-D remains the most widely detected pesticide in Victorian water supply catchments, closely followed by Atrazine, Triclopyr, MCPA and Simazine. The amount of vulnerable water supplies also has increased due to more stringent testing, however potentially hundreds of pesticides are still not monitored by water authorities and there is still no legal mechanism available to

allow water authorities to know exactly what is being sprayed in their water supply catchments.

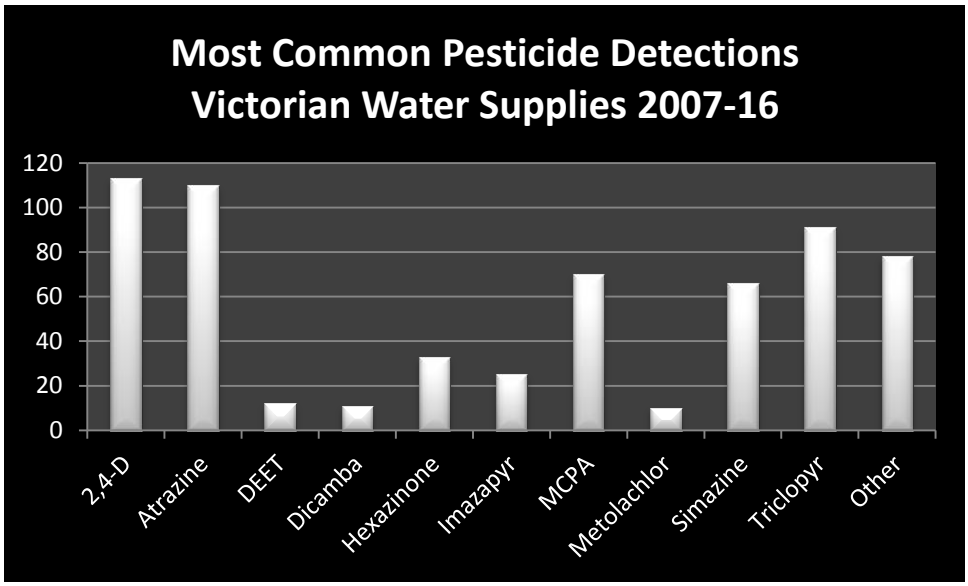


Prior to 2005, information about pesticide residues in Victorian water supplies was virtually non-existent. In the early 1970's some work was done in the Broken Creek catchment by the State Rivers and Water Supply Commission. The late 1980's saw studies done in the Ovens River catchment, yet wider scale studies did not occur until 2004 when Goulburn Murray Water assessed pesticide residues in channels and drains. Barwon Water was the first Victorian water authority to implement more stringent testing in 2004, which also explains why they were recording pesticide residues before many other authorities. (*Note that 2017 detections are incomplete.)



The highest number of detections in 2010, can be partially explained by 30 detections for 2,4-D at the small village of Girgarre in northern Victoria.

Eleven water authorites now test for more than 50 pesticides, two test for between 10-20, yet 3 still test for between 0-3 currently registered pesticides, meaning that for these authorities, it is still unclear exactly what agricultural pesticides are washing into domestic water supplies for large areas of northern and north central. The poorest pesticide "monitors" are: Coliban Water, Grampians Wimmera Mallee Water and Western Water.



From testing done by water authorities, it is clear that the most frequently detected pesticides, are the herbicides 2,4-D, Atrazine, Triclopyr, MCPA and Simazine. These 5 herbicides accounted for ~73% of all pesticide detections in Victorian drinking water supplies 2007-16

Freedom of Information (FoI) requests were sent to water authorities in December 2016 and March 2017 requesting pesticide detection data over the past decade. Once the information was received it was collated into this report.

The report is in two parts, the first part gives an overall statewide assessment with some discussion and the second part of the report focuses specifically on what pesticides have been detected by each of the water authorities. No Freedom of Information application was sent to Southern Rural Water, and as a result no information has been included from them. The information supplied by Goulburn Murray Water was the result of a FoI sent in September 2015. A response to this FoI was not sent through until May 2016.

Readers should also be aware that in September 2016 Friends of the Earth attempted to document what pesticides had been detected across Australian waterways over the years, including domestic water supply catchments. The subsequent report "*Pesticides in Australian Waterways Overview – A Jigsaw with a Billion Missing Pieces".* This document has been useful in better understanding

the extent of pesticide pollution in Australian water supplies and which are the most frequently detected on a national basis.

Tullaroop Reservoir. One source of Drinking Water supply for Maryborough and surrounding communities. Tullaroop Reservoir is managed by Goulburn Murray Water. Eight pesticides were detected in this reservoir by Central Highlands Water between 2012-16. It is highly likely that the reservoir has been receiving pesticides for decades, but testing only started in 2012. What have Maryborough residents been exposed to? Testing is only conducted in November.

Safe Drinking Water Act

If pesticides are detected above the Australian Drinking Water Guidelines, the Safe Drinking Water Act 2003 specifies that the Department of Health and Human Services (DHHS) must be notified. Because only one pesticide detection was detected above the ADWG (see Westernport Water), the DHHS was supposed to be notified once during 2007-16. All other (618) pesticide detections would not have been reported to DHHS.

"Section 18: Section 18 notifications apply when a water supplier realises that their supplied drinking water is unlikely to comply with the standard.

Section 22: Section 22 notifications apply when drinking water contamination is known or suspected. Notifications must be reported immediately to a departmental officer when:

- ***the water may be the cause of an illness***
- ***the level of a water quality standard is such that it may pose a risk to human health***
- ***the water may cause widespread complaints.***

A water business must notify the department immediately once it becomes aware of an issue, both verbally and in writing." Source: https://www2.health.vic.gov.au/public-health/water/drinking-water-in-victoria/drinking-water-notifications

Approximate number of pesticides tested in 2016 by water authorities			
Authority	**Amount**	**Time Frame**	**Testing Ranking.**
Barwon Water	~80	Quarterly	2.
Central Highlands Water	~140	Annually	5.
City West Water	-	Melbourne Water Testing	
Coliban Water	10 (3 currently registered pesticides)	Annually	11.
East Gippsland Water	~50	Annually	7.
Gippsland Water	~50	Quarterly	4.
Goulburn Murray Water*	?		
Goulburn Valley Water	~50	Quarterly	4.
Grampians Wimmera Mallee Water	18 (0 currently registered pesticides)	Annually	12.
Lower Murray Water	27 (10 currently registered pesticides)	Quarterly	9.
Melbourne Water	180 at Yarra Offtake	Every Two Months	1.
	30-60 elsewhere	3-6 Months	3.
North East Water	~50	Biannually	6.
South East Water	~50		7.
Southern Rural Water	?		
South Gippsland Water	22 (20 currently registered pesticides)	Biannually	8.
Wannon Water	~50	Annually	7.
Western Water	26 (3 currently registered pesticides)	Annually	10.
Westernport Water	~50	Quarterly	4.
Yarra Valley Water	-	Melbourne Water Testing	

Measurement: What is µg/L?

The two most common measurements used in water monitoring in this report are mg/L and µg/L.

"A gram per litre g/L is the measurement that shows how many grams of a certain substance are present in one litre of a liquid – usually water.

mg/L: Milligrams per litre. Parts per million. When measuring concentration in water, parts per million is an older expression of mg/L – one litre of water weighs one kilogram or one million milligrams.

µg/L: Micrograms per litre. In the metric weight system, a microgram is a thousandth of a milligram. Since a milligram is a millionth of a kilogram, and the microgram is a thousand times smaller, it is equivalent to a billionth of a kilogram.

Microgram is abbreviated µg. Thus, a part per billion of solid measure is equal to a ug/kg. Similarly, a part per billion of a solid in a liquid is equal to a µg/L"
http://extoxnet.orst.edu/tibs/partperm.htm

One part per billion (1 µg/L is equivalent to one drop of liquid in an Olympic size swimming pool full of water.
http://www.tceq.texas.gov/assets/public/remediation/superfund/jonesroad/ppb_chart.pdf

The supposed 'safe' dose of pesticides such as Atrazine and Simazine is 20µg/L, which is the equivalent to 20 drops of these chemicals in a body of water the size of an Olympic Sized Swimming Pool! Scientists have determined that levels of Atrazine as low as 0.1µg/L however can impact on the endocrine system of frogs, potentially meaning that similar effects could be anticipated to be seen in people.

Hormones can operate at levels as low as one part per trillion, or one thousandth of one drop in an Olympic Sized Swimming Pool.

Many of the pesticides listed in this publication are Endocrine Distruptors, meaning that they impact on the hormone system. Australian Drinking Water Guidelines are published by the National Health and Medical Research Council (NHMRC). A copy of the most recent 2011 Guidelines can be found here: https://www.nhmrc.gov.au/guidelines-publications/eh52

Findings

- **619 positive pesticide detections in Victorian domestic water supplies between 2007-16. Almost a three* fold increase on the previous decade. It would appear that almost all of these detections are for raw water, before treatment (*six fold increase if GMW Study 2004-6 is not included).**

- **46 different pesticides have been detected in Victorian water supplies between 2007-16 The most frequently detected were 2,4-D, Atrazine, Triclopyr, MCPA and Simazine. These 5 pesticides accounted for almost 73% of all detections across the state.**

- **~72% of pesticides detected are probable endocrine disruptors, meaning that there could be potential health problems at levels less than current guidelines.**

- **The highest risk land uses in terms of pesticide runoff in Victorian Domestic Water Supplies 2007-16 were: Pastures, Wheat, Barley, Triticale, Oats, Cereal Rye, Grass Seed, Canola (Triazine Tolerant), Lucerne, Seed Crops, Ryegrass, Pine and Eucalypt Plantations, Millet, potatoes, blackberry spraying.**

- **Top 10 pesticide "hotspots" 2007-16: 1) Candowie Reservoir, 2) Girgarre, 3) Wurdee Boluc system, 4) Broken Creek Numurkah, 5) Willimingongon Reservoir, 6) Maryborough supply network, 7) Broken Creek (Wunghnu), 8) Toora, 9) Moorabool system, 10) Yarra River @ Sugarloaf Offtake.**

- **Between 2007-2016 there was one breach to the Australian Drinking Water Guidelines. A detection for the deregistered pesticide Monocrotophos at Candowie Reservoir in December 2011. The level recorded was 20 times higher than the Australian Drinking Water Guideline (ADWG)2004 guideline, making this incident the most serious pesticide related incident in Victoria for possibly 40 years. The event occurred during an algal bloom. Investigation of pollution source did not apparently occur.**

- **3 pesticide detections in tap water were recorded in suburban Melbourne between 2014-6. This is the first time pesticides have been recorded in the greater Melbourne suburbs.**

- **The average pesticide detection level for all pesticides detected in Victorian Water Supplies between 2007-16 was 0.46µg/L.**

- **The average pesticide detection level for all pesticides detected in Victorian Water Supplies between 2007-16, when compared to health guidelines published in the Australian Drinking Water Guidelines, was 0.98%.**

- **The 90th percentile for all pesticide detections was 0.8µg/L and the 90th percentile in relation to detections when compared to the Australian Drinking Water Guidelines (ADWG) was 2.563%.**

- **~33% of all detections would breach European Guideline levels of 0.1µg/L which are based on Precautionary Principle. Most of these detections were for 2,4-D, Atrazine and Triclopyr.**

- **The offtake to Sugarloaf Reservoir on the Yarra River recorded the most pesticide detections of any location, 52. This location is the most regularly tested location in the state, with pesticide testing occurring every two months.**

- **The most pesticide detections were recorded by Central Highlands Water (107 detections between 2010-16), with the Maryborough water supplies recording the largest number of pesticide detections. Central Highlands Water only test for pesticides once a year, meaning that this number would be considerably higher if testing occurred on a more frequent basis.**

- **The township of Girgarre (located 40km west of Shepparton) recorded multiple 2,4-D detections extending over 3 months in 2010. The average level detected was 1.94µg/L ~6.3% of Australian Drinking Water Guideline. No tests were apparently done to screen for dioxin contamination. Dioxin is a by-product of the 2,4-D manufacturing process.**

- **The deregistered herbicide Dinoseb was detected 4 times in water supplying the Gippsland towns on Moe and Seaspray in 2009 and 2010.**

- **Willimingongon Reservoir which supplies Mount Macedon with drinking water had the second highest pesticide detection, with a detection of Pentachlorophenol at 3.8µg/L in February 2009 (38% of Australian Drinking Water Guideline).**

- **Wurdee Boluc Reservoir (Geelong) recorded a level of 1.1µg/L for the insecticide Pirimicarb in December 2011.**

- **Low levels of the herbicides Atrazine and Simazine were detected along a 250km stretch of the Murray River in November 2010 (and again in February 2017).**

- **44% of all MCPA detections occurred in the Geelong region.**

- **Barwon Water issued a Notice of Contravention for Water Protection in 2005 over an incident at Korweinguboora Reservoir regarding the forestry herbicide hexazinone, yet the levels of hexazinone were lower than many other pesticide detections that occurred elsewhere in the state between 2007-2016. Yet no other Notices of Contravention were issued.**

- **City West Water and Yarra Valley Water do not test for pesticides as they purchase water from Melbourne Water. South East Water however, also source water from Melbourne Water and have recently detected pesticides.**

- **Triclopyr dominates detections throughout the Gippsland Region. Perhaps a result of blackberry spraying by Catchment Management Authorities and farmers? 46% of all Triclopyr detections were in South Gippsland.**

- **Simazine and DEET were the most frequently detected pesticides by Melbourne Water in the Yarra River. The Yarra also recorded the state's only detections for neonicotinoid (bee killing) insecticides.**

- **Positive pesticide detections can occur from between 0%-~1% of all pesticide samples, over a given year, depending on water authority. More specific testing during pollution incidents increases detection frequency significantly.**

Candowie Reservoir which supplies drinking water to Phillip Island and surrounds. Victoria's no.1 pesticide hotspot 2007-16, due to one detection of Monocrotophos in December 2011, possibly Victoria's highest pesticide pollution incident in 40 years. The source of the pollution was never identified.

Willimingongon Reservoir (left) Mt Macedon recorded Pentachlorophenol levels of 3.8µg/L in 2009, 38% of Australian Drinking Water Guideline. This was the second highest pesticide detection in a Victorian Water Supply 2007-16.

Highest Pesticide Detections Victorian Domestic Water Supplies 2007-2016

Authority	Date	Location	Pesticide	Level Detected	Comparison to Health Guideline
Westernport Water	6/2/11	Candowie Reservoir	Monocrotophos	20µg/L	2000%
Western Water	10/2/09	Willimingongon Reservoir	Pentachlorophenol	3.8µg/L	38%
Barwon Water	5/12/11	Wurdee Boluc WTP Raw Water	Pirimicarb	1.1µg/L	15.71%
Gippsland Water	11/11/09	Moe	Dinoseb	1µg/L	14.28% (US Guideline)
Gippsland Water	11/11/09	Seaspray	Dinoseb	1µg/L	14.28% (US Guideline)
Gippsland Water	9/11/10	Seaspray	Dinoseb	1µg/L	14.28% (US Guideline)
Gippsland Water	11/11/10	Moe	Dinoseb	1µg/L	14.28% (US Guideline)
Goulburn Valley Water	10/6/10	Girgarre CG 7/12/9	2,4-D	4µg/L	13.33%
South Gippsland Water	21/4/15	Toora	Triclopyr	2.6µg/L	13%
Goulburn Valley Water	8/7/10	Girgarre CG 7/12/9	2,4-D	3.7µg/L	12.33%
Goulburn Valley Water	8/7/10	Girgarre CG 7/12/9	2,4-D	3.6µg/L	12%
Barwon Water	17/9/13	Matthews Creek	MCPA	4.6µg/L	11.5%
Goulburn Valley Water	17/6/10	Girgarre CG 7/12/9	2,4-D	3.4µg/L	11.33%
Goulburn Valley Water	17/6/10	Girgarre CG 7/12/9	2,4-D	3.3µg/L	11%
Goulburn Valley Water	29/7/10	Drinking Water Customer	2,4-D	3.3µg/L	11%
Goulburn Valley Water	17/6/10	Girgarre CG 7/12/9	2,4-D	3.2µg/L	10.67%
Goulburn Valley Water	19/7/10	Girgarre CG 7/12/9	2,4-D	2.9µg/L	9.67%
Goulburn Valley Water	22/7/10	Girgarre CG 7/12/9	2,4-D	2.9µg/L	9.67%
Goulburn Valley Water	15/7/10	Girgarre CG 7/12/9	2,4-D	2.6µg/L	8.67%
Barwon Water	17/7/07	Inlet Channel Salt Creek Lane	Glyphosate	80µg/L	8%

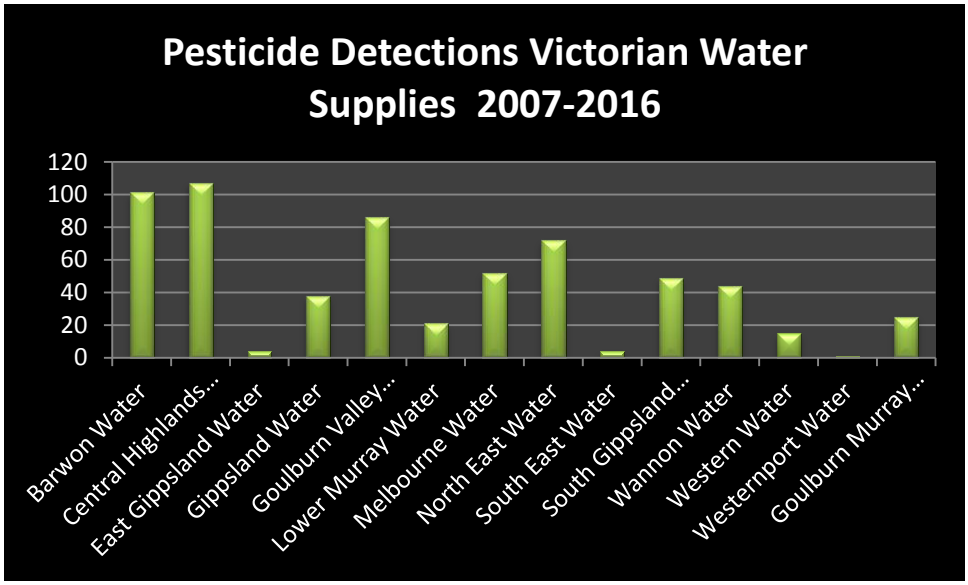
Victorian Statewide Summary Pesticide Detections 2007-16			
Authority	**Average µg/L**	**Average% of ADWG level per detection**	**Total Detections**
Statewide	**0.46µg/L**	**0.98**	**619**
Barwon Water	**0.99µg/L**	**0.83**	**101**
Central Highlands Water	**0.09µg/L**	**0.43**	**107**
City West Water	**-**	**-**	**-**
Coliban Water	**-**	**-**	**0**
East Gippsland Water	**0.1µg/L**	**0.41**	**4**
Gippsland Water	**0.23µg/L**	**0.53**	**38**
Goulburn Murray Water*	**1.5µg/L**	**0.02**	**25**
Goulburn Valley Water	**1.03µg/L**	**3.65**	**86**
Grampians Wimmera Mallee Water	**-**	**-**	**0**
Lower Murray Water	**0.03µg/L**	**0.16**	**21**
Melbourne Water	**0.08µg/L**	**0.28**	**52**
North East Water	**0.02µg/L**	**0.17**	**72**
South East Water	**0.02µg/L**	**0.04**	**4**
Southern Rural Water	**?**	**?**	**?**
South Gippsland Water	**0.14µg/L**	**0.69**	**49**
Wannon Water	**0.03µg/L**	**0.13**	**44**
Western Water	**0.28µg/L**	**2.65**	**15**
Westernport Water	**0.02µg/L**	**2000**	**1**
Yarra Valley Water	**-**	**-**	**-**

***The Goulburn Murray Water detections are based on Imazapyr detections, near the towns of Nathalia and Numurkah and were not recorded by Goulburn Valley Water, who provide drinking water to these towns.**

Average levels include only positive detections and do not include averages of all samples taken.

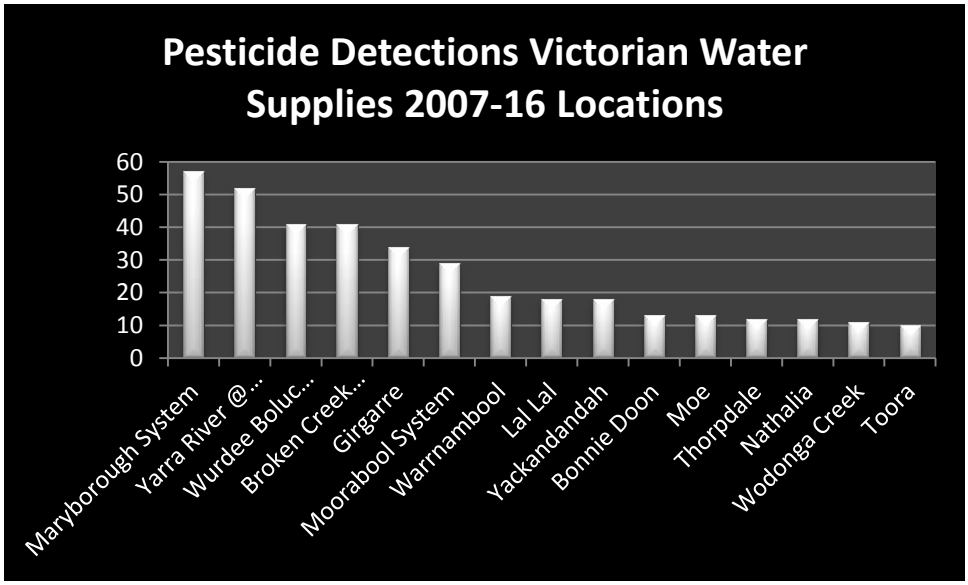
Most Frequently Detected Pesticides in Domestic Water Supplies 2007-16			
Authority	**1.**	**2.**	**3.**
Statewide	**2,4-D**	**Atrazine**	**Triclopyr**
Barwon Water	**MCPA**	**2,4-D**	**Hexazinone**
Central Highlands Water	**Simazine**	**Atrazine**	**2,4-D/Benomyl**
City West Water	**-**	**-**	**-**
Coliban Water	**-**	**-**	**-**
East Gippsland Water	**Triclopyr**	**-**	**-**
Gippsland Water	**Triclopyr**	**Dinoseb**	**MCPA**
Goulburn Murray Water*	**Imazapyr**	**-**	**-**
Goulburn Valley Water	**2,4-D**	**Atrazine**	**Simazine**
Grampians Wimmera Mallee Water	**-**	**-**	**-**
Lower Murray Water	**Atrazine**	**Simazine**	**-**
Melbourne Water	**Simazine**	**DEET**	**MCPA/Metolachlor**
North East Water	**Hexazinone**	**MCPA**	**Atrazine**
South East Water	**2,4-D**	**Dicamba**	**Thiobencarb**
Southern Rural Water	**-**	**-**	**-**
South Gippsland Water	**Triclopyr**	**2,4-D**	**Picloram**
Wannon Water	**Atrazine**	**2,4-D**	**MCPA**
Western Water	**2,4-D**	**Pentachlorophenol**	**Trans Chlordane**
Westernport Water	**Monocrotophos**	**-**	**-**
Yarra Valley Water	**-**	**-**	**-**

Highest Detections in Comparison to Health Guidelines.			
Authority	**1.**	**2.**	**3.**
Statewide	**Monocrotophos**	**2,4-D**	**Atrazine**
Barwon Water	**Pirimicarb**	**MCPA**	**Glyphosate**
Central Highlands Water	**Atrazine**	**Simazine**	**Simazine**
City West Water	**-**	**-**	**-**
Coliban Water	**-**	**-**	**-**
East Gippsland Water	**Triclopyr**	**Triclopyr**	**Triclopyr**
Gippsland Water	**Dinoseb (US Guideline)**	**Dinoseb (US Guideline)**	**Dinoseb (US Guideline)**
Goulburn Murray Water*	**Imazapyr**	**Imazapyr**	**Imazapyr**
Goulburn Valley Water	**2,4-D**	**2,4-D**	**2,4-D**
Grampians Wimmera Mallee Water	**-**	**-**	**-**
Lower Murray Water	**Simazine**	**Simazine**	**Simazine**
Melbourne Water	**Triclopyr**	**Simazine**	**Atrazine**
North East Water	**Terbufos**	**Terbufos**	**Terbufos**
South East Water	**2,4-D**	**Thiobencarb**	**Dicamba**
Southern Rural Water	**-**	**-**	**-**
South Gippsland Water	**Triclopyr**	**Triclopyr**	**Triclopyr**
Wannon Water	**Atrazine**	**Atrazine**	**Atrazine**
Western Water	**Pentachlorophenol**	**Trans Chlordane**	**2,4-D**
Westernport Water	**Monocrotophos**	**-**	**-**
Yarra Valley Water	**-**	**-**	**-**

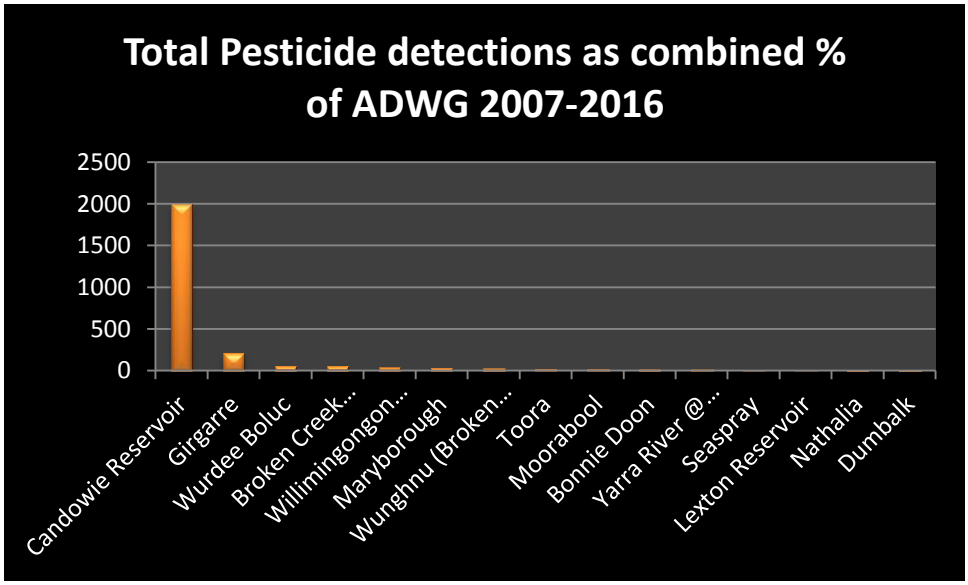


The most frequent detections amongst water authorities were: 1) Central Highlands Water, 2) Barwon Water, 3) Goulburn Valley Water and 4) North East Water

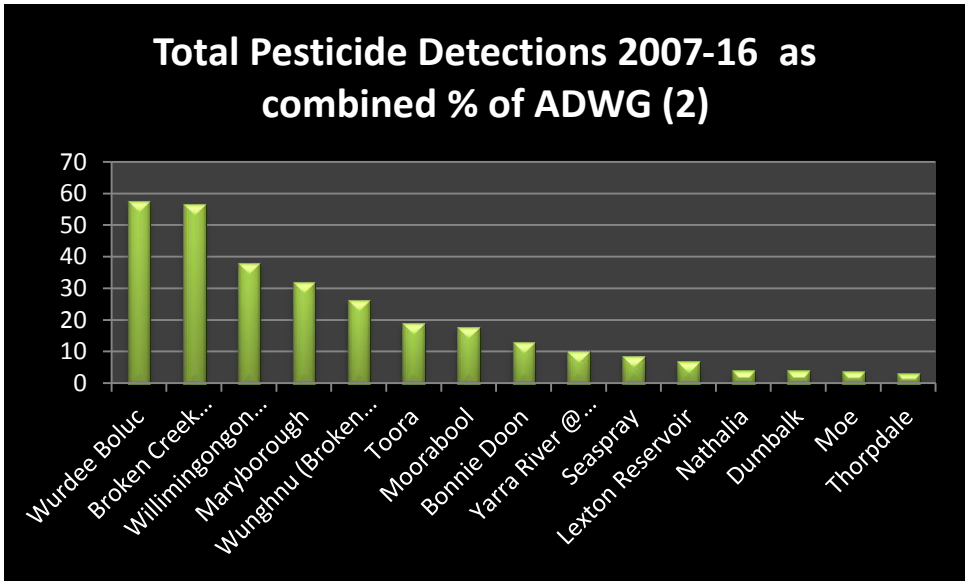
Specific Locations where samples were taken. The Yarra River offtake at Yering Gorge, pumps water into Sugarloaf Reservoir. This location had the most detections in the state, but that is a result of testing occurring every two months for a wide range of pesticides. No sampling was done in Sugarloaf Reservoir by Melbourne Water. Sugarloaf is also supplied with water from Maroondah Reservoir which would dilute the Sugarloaf water. This is probably the reason why Melbourne Water do not test at Sugarloaf.



Pesticide Detections based on actual water supplies and number of detections. Maryborough source their water from Tullaroop, Evansford and Talbot Reservoirs all of which recorded positive pesticide samples between 2012-16. Central Highlands Water currently only test on an annual basis.



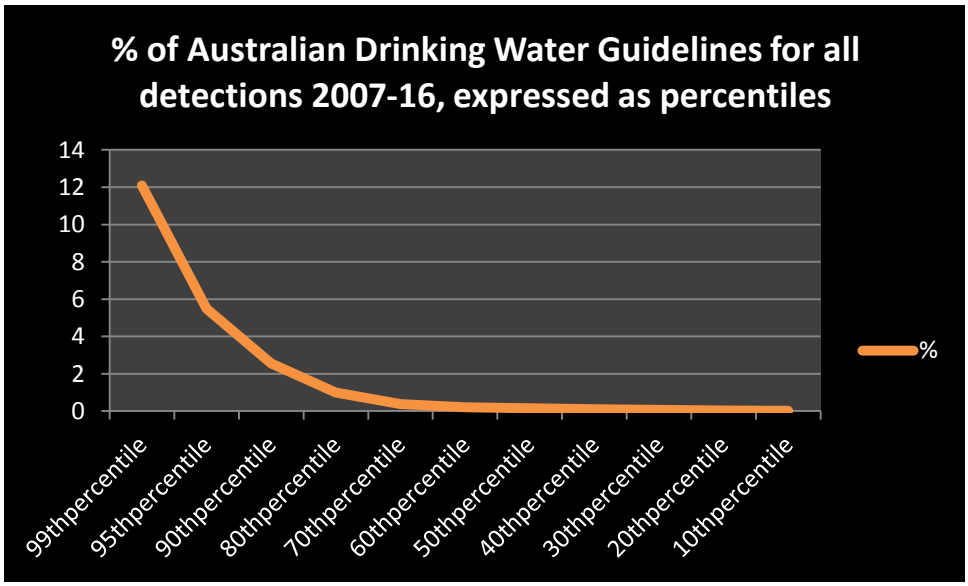
This graph is a cumulative representation of all pesticide detections as a percentage of health guideline levels over a ten year period. The graph clearly shows that Candowie Reservoir is the standout, based on one detection 2000% (20 times) higher than the 2004 guideline level for Monocrotophos.



The same graph as the preceeding graph, without the two highest combined totals, Candowie and Girgarre. This indicates that low level detections over the ten year period account for almost 100% of all detections and are well under Australian Drinking Water Guidelines. It should also be noted that several detections in the Wurdee Boluc and Moorabool systems were detected well upstream of the treatment facility.

90th Percentile

Percentiles are used in statistics to determine values below which a given percentage of observations in a group of observations fall.



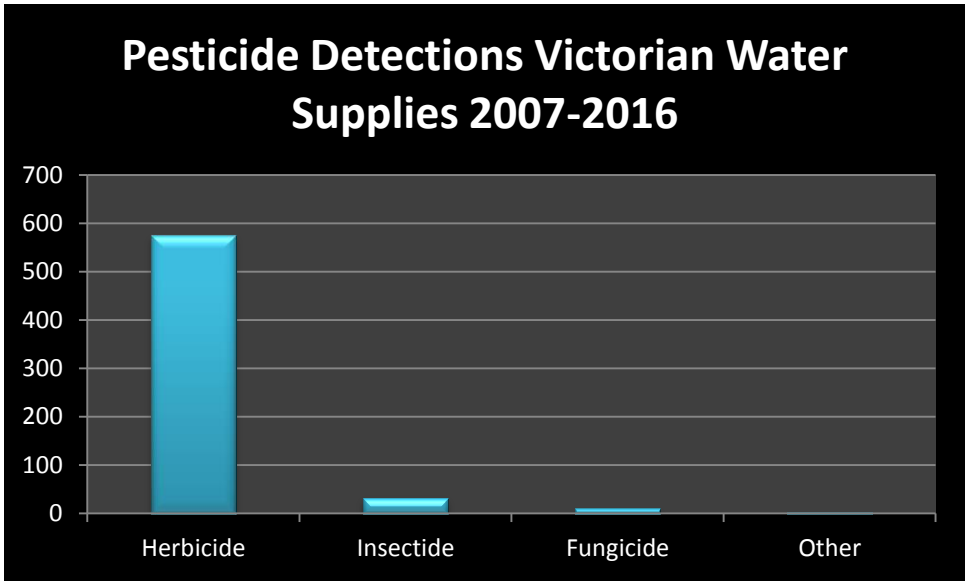
Graph above showing that 80% of all pesticide detections 2007-16 were below 1% of Australian Drinking Water Guideline for specific pesticide. Indicating that low dose exposure of drinking water supplies are the most frequent occurrence in domestic water supplies.

Percentiles for 6 most frequently detected pesticides in Victorian Water Supplies		
Pesticide	**90th Percentile µg/L**	**Percentile >0.1 µg/L**
2,4-D	**2.54**	**56**
Atrazine	**0.5**	**49**
Hexazinone	**0.07**	**0**
MCPA	**0.2**	**83**
Simazine	**0.5**	**74**
Triclopyr	**0.24**	**83**

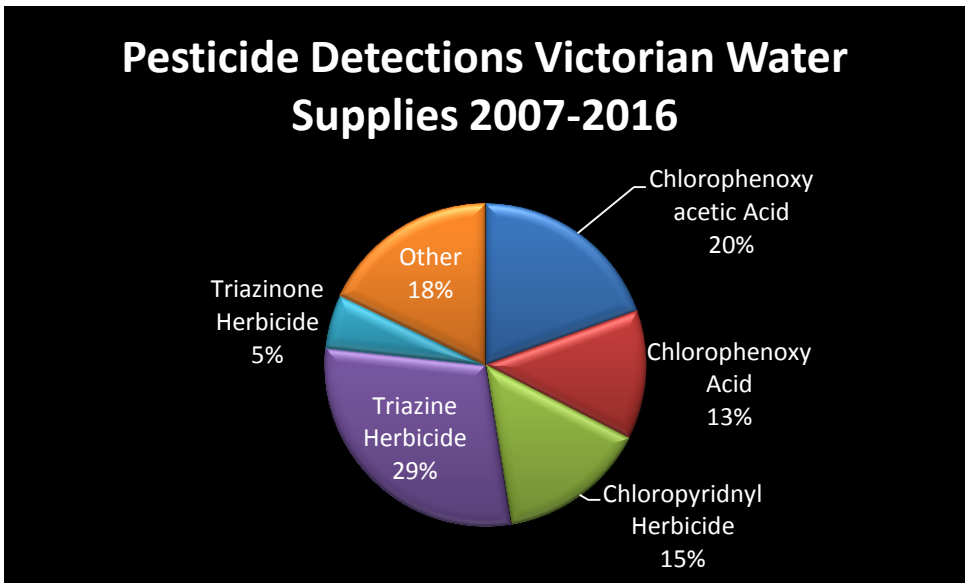
2,4-D detections have the highest 90th percentile, however Atrazine has the lowest percentile in relation to detections >0.1µg/L, which is the European Guideline based on the Precautionary Principle. More than half of Atrazine detections detected in Victorian drinking water supplies would breach the EU Guideline. Atrazine and 2,4-D should constitute the widest number of follow up investigations by water authorities.

90th Percentiles for all 619 detections, based on water authority detections		
Water Authority	***90th Percentile µg/L***	***90th Percentile Australian Drinking Water Guidelines***
Barwon Water	***0.35***	***1.28***
Central Highlands Water	***0.164***	***0.895***
East Gippsland Water	***0.076***	***0.835***
Gippsland Water	***1***	***1.05***
Goulburn Murray Water	***3.9***	***0.04***
Goulburn Valley Water	***2.95***	***9.835***
Lower Murray Water	***0.07***	***0.35***
Melbourne Water	***0.199***	***0.78***
North East Water	***0.04***	***0.25***
South East Water	***0.02***	***0.06***
South Gippsland Water	***0.27***	***1.315***
Wannon Water	***0.047***	***0.26***
Western Water	***0.056***	***0.38***

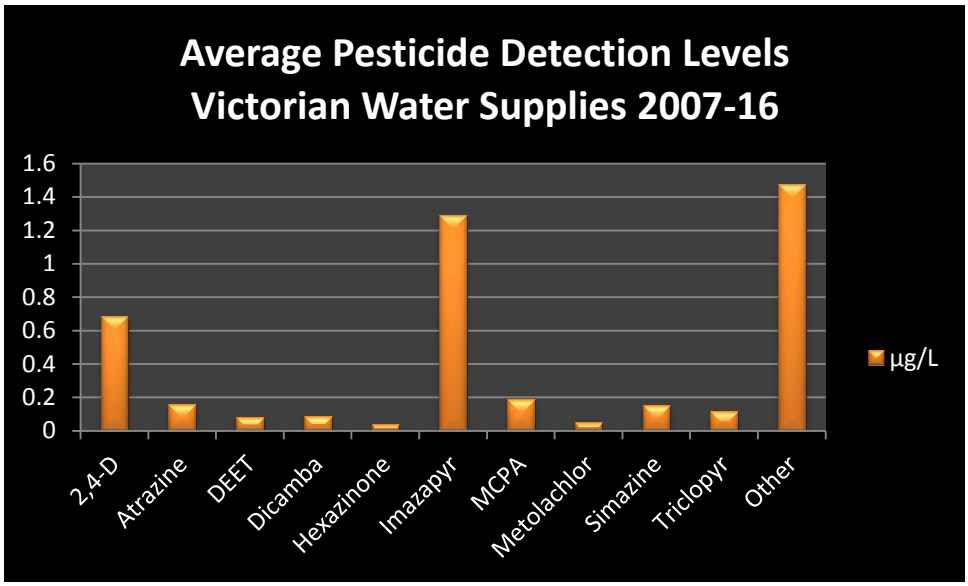
Highest 90th percentile for µg/L are Goulburn Murray Water and Goulburn Valley Water, however in terms of Australian Drinking Water Guidelines, Goulburn Valley Water are significantly higher the other water authorities. This is largely due to the 3 month 2,4-D incident at Girgarre. Note also that Westernport Water is not included in this table, due to only one very high detection.



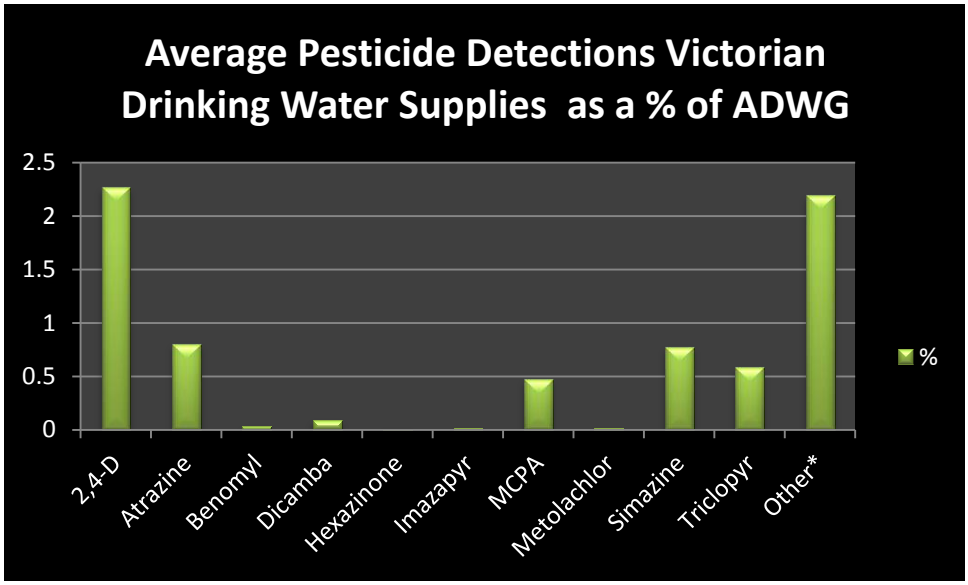
Pesticide detections are dominated by herbicides. Very few water authorities are testing for fungicides or the commonly used neonicotinoid class of insecticides.



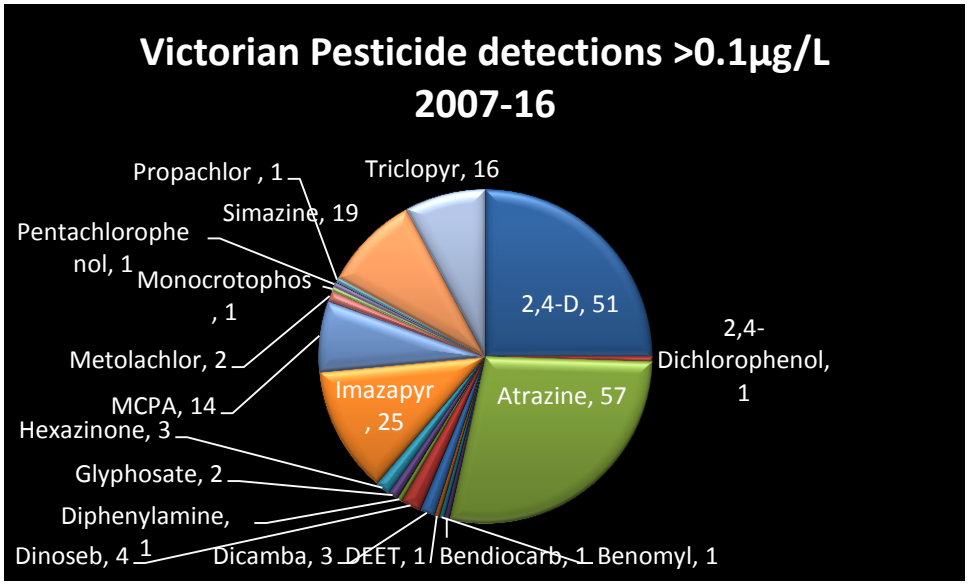
Triazine herbicides dominate the type of pesticide that are most frequently detected in domestic water supplies in Victoria. Atrazine and Simazine have long been of interest to Friends of the Earth. Both are residual in the soil and can continue to leach off sites years after application.



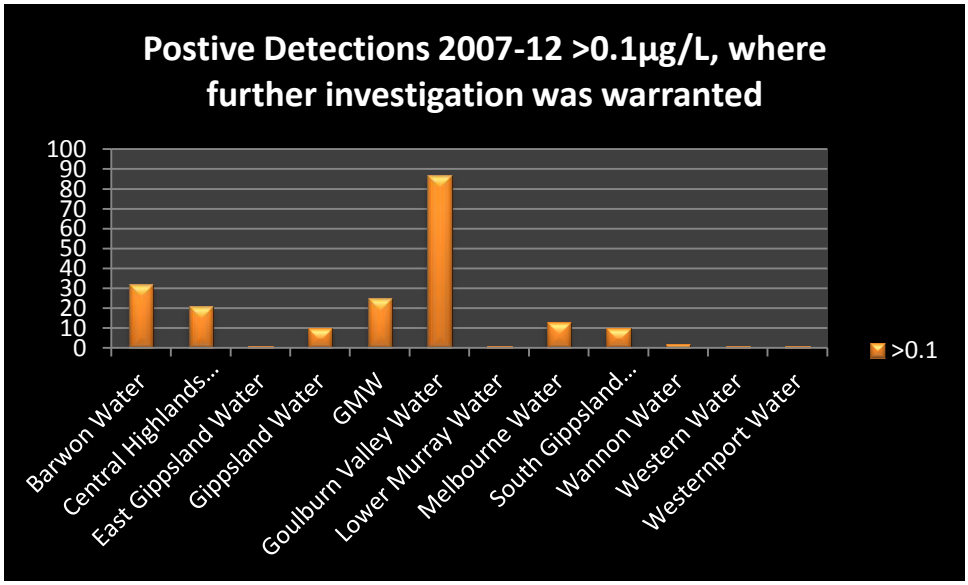
"Other Pesticides", 2,4-D and Imazapyr detected at much higher average levels than other pesticides. As graph indicates the majority of pesticide detections occur at levels <1.5µg/L. Average detection level for all pesticides is 0.46µg/L.



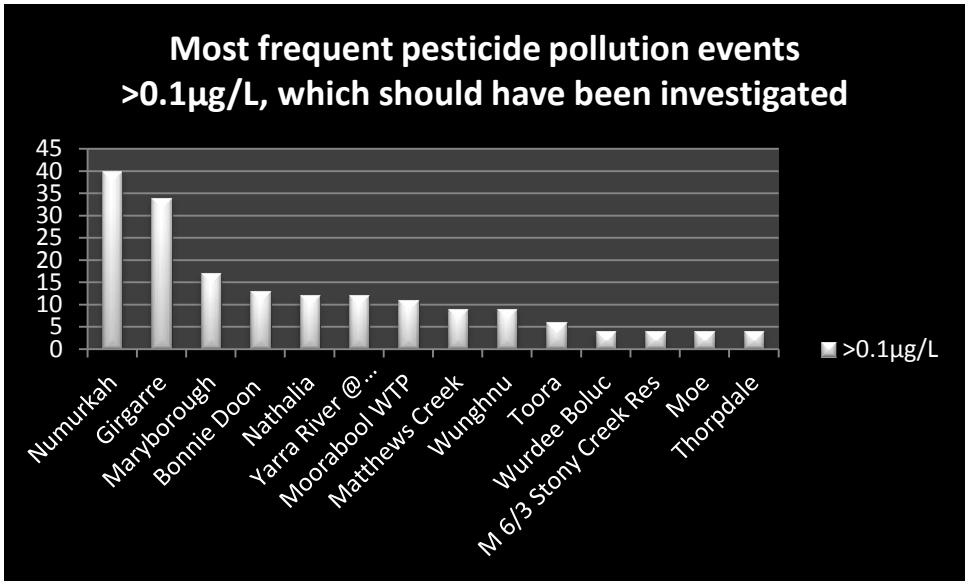
Average pesticide detections as a % of Australian Drinking Water Guideline levels. 2,4-D, Atrazine, MCPA, Simazine and Triclopyr are the most common in a drinking water supply context. "Other Pesticides" is average detection level without Candowie Reservoir Monocrotophos detection. 13 of the pesticides detected do not have guidelines under the ADWG. Average statewide detection as % of ADWG guidelines (excluding Candowie detection) is 0.98%



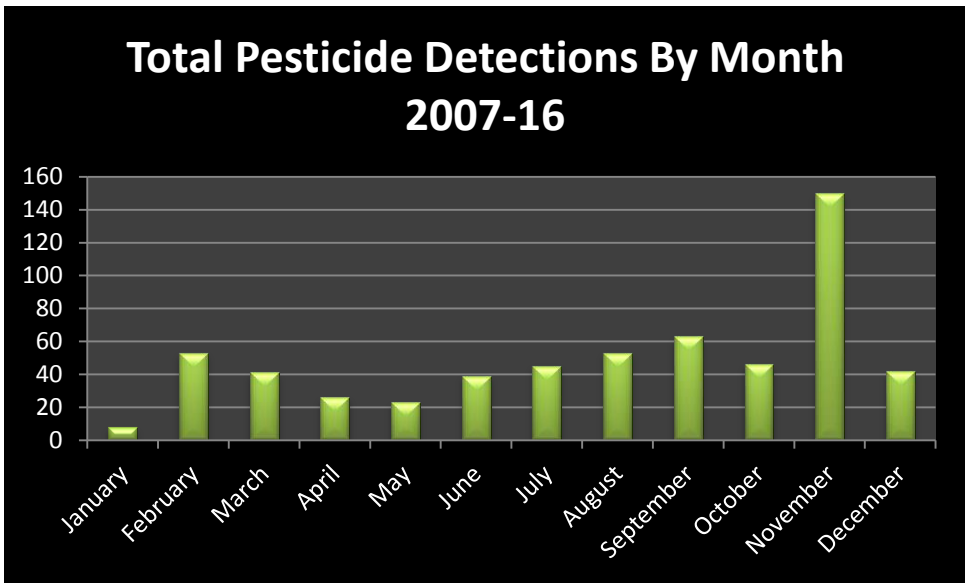
204/619 detections were greater than >0.1µg/L which is the pesticide guideline in the European Union (32.9% would warrant investigation under EU Guidelines). Most of these relate to Atrazine from numerous locations. The majority of 2,4-D detections occurred in Goulburn Valley Water supplies mainly between 2010-12.



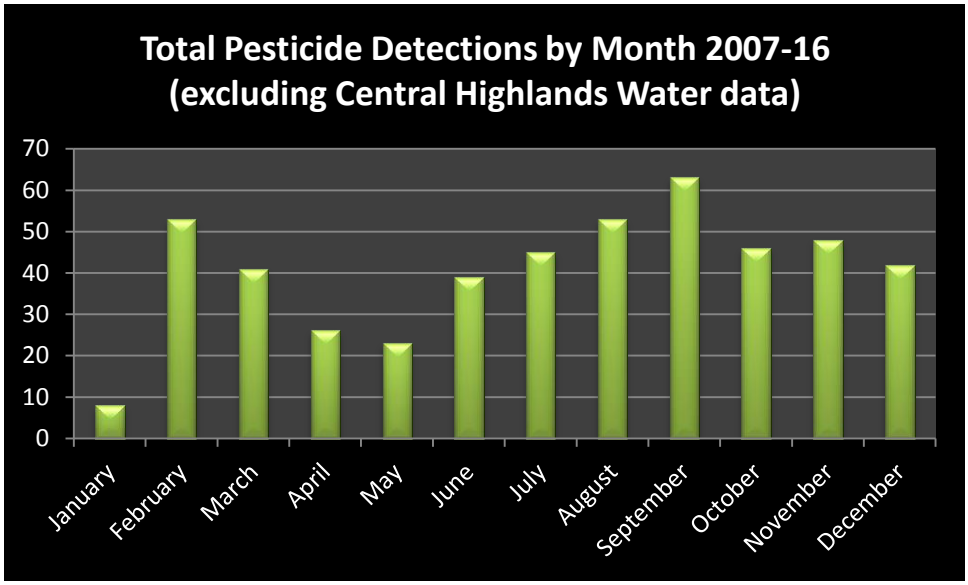
All Goulburn Murray Water detections refer to 2015 Imazapyr pollution incidents and are all based on detections near or in the towns of Nagambie and Numurkah. Imazapyr was used by Goulburn Murray Water to kill weeds in irrigation drains and channels. Some residues ended up in Broken Creek. The 30 detections for Goulburn Valley Water relate to the 2010 Girgarre 2,4-D pollution incident.



If EU Guidelines were granted in Victoria, water authorities would have been busy determining the source of the pesticide pollution at each of these locations.



Pesticide detections occur year round, with November appearing to be the month with the most frequent detections. However, Central Highlands Water only test in November and have recorded over 100 positive samples since they implemented improved testing in 2012.



If the Central Highlands Water detections are excluded, it becomes more obvious that pesticide detections occur throughout the year, meaning that once a year sampling is inappropriate, particularly for the more residual and mobile pesticides which can leach for years after application. All detections are also based on grab samples, passive samplers which can detect pesticides for longer periods of time appear not to be used by Victorian Water Authorities.

Roadside verges and drains are commonly sprayed throughout a range of water supply catchments. What communication occurs between spray contractors and water authorities? It would not be too difficult a task for this information to be sent through to water authorities, allowing water authorities to monitor for what was actually sprayed. What happens to the pesticide residuals when it rains?

Some Pesticide Descriptions

Information in brown rows sourced from Pesticide Action Network database:
http://www.pesticideinfo.org/

2,4-D			
Chlorophenoxy Acid or ester/Herbicide Plant Growth Regulator			
Detections Victorian Water Supplies 2007-16: 113			
Control of Broadleafed weeds in fallow before direct drilling or sowing of cereals and pastures; and in cereal crops, pastures and non-agricultural areas. Wheat, Barley, Cereal Rye, Triticale, Oats, Wheat Barley, Fallow Stubble, Millet, Harvest Aid or Salvage Spray, Conservation Tillage, Pastures, Rights of Ways and Industrial Areas			
Moderate Acute Toxicity	**Possible Carcinogen**	**Potential Groundwater Contaminant**	**Suspected Endocrine Disruptor**

Atrazine			
Triazine herbicide			
Detections Victorian Water Supplies 2007-16: 110			
Selective Annual Grass and Broadleaf Weeds Control Canola (Triazine Tolerant Only), Sorghum, Broom Millet, Saccaline and Forage Sorghum, Maize, Sweet Corn, Sorghum, Lucerne, Grass Seed Crops, Seedling Ryegrass, Seed Crops, Established Rye Grass, Fallow Area Maintenance, Potatoes, Eucalypt and Pine Plantations			
Slight Acute Toxicity	**Carcinogen**	**Groundwater Contaminant**	**Suspected Endocrine Disruptor**

Benomyl			
Benzimidazole fungicide			
Detections Victorian Water Supplies 2007-16: 8			
Currently there are no products containing benomyl registered for use in Australia. It became illegal to supply or use products containing benomyl after 6 December 2006. https://apvma.gov.au/node/12391			
Slight Acute Toxicity	**Possible Carcinogen**	**Developmental and Reproductive Toxin**	**Suspected Endocrine Disruptor**

DEET
Unclassified Insect Repellent
Detections Victorian Water Supplies 2007-16: 12

Dicamba		
Benzoic Acid herbicide		
Detections Victorian Water Supplies 2007-16: 11		
Control of certain broad leafed weeds in winter cereals, pastures, conservation tillage, turf, rice and non-crop situations. Wheat, Oats, Barley, Triticale, Commercial Rye, Pinus Radiata Plantations, Grass Pastures and Perennial Grass Seed Crops, Turf, Woody Species		
Slight Acute Toxicity	Potential Groundwater Contaminant	Developmental and Reproductive Toxin

Dinoseb			
Dinitrophenol derivative herbicide, defoliant			
Detections Victorian Water Supplies 2007-16: 4			
Dinoseb is not registered or approved for use in Australia. Dinoseb is a contact herbicide used for post-emergence weed control in cereals, undersown cereals, seedling lucerne and peas. Dinoseb was also used as a corn enhancer and an insecticide and miticide.			
Acute Toxicity	Possible Carcinogen	Developmental and Reproductive Toxin	Suspected Endocrine Disruptor

Glyphosate		
Phosphonoglycine herbicide		
Detections Victorian Water Supplies 2007-16: 2		
Non-Selective Herbicide used on a wide range of annual and perennial weeds in a wide variety of situations.		
Slight Toxicity	Possible Carcinogen* *IARC	Potential Groundwater Contaminant

Hexazinone	
Triazinone herbicide	
Detections Victorian Water Supplies 2007-16: 33	
Control of certain broadleaf weeds, perennial and annual grasses, woody weeds in Pinus Radiata plantations, pasture situations and commercial and industrial areas and rights of way.	
Acute Toxicity	Potential Groundwater Contaminant

Imazapyr	
Imidazolinone herbicide	
Detections Victorian Water Supplies 2007-16: 25	
Herbicide used to control various annual and perennial weeds in non crop situations. Around agricultural buildings and other farm non-crop situations, commercial, industrial and public service areas, rights of way and waste land. Also used in irrigation channels, supply channels and tall drains leading to recirculation dams only.	
Acute Toxicity	Potential Groundwater Contaminant

MCPA	
Chlorophenoxy Acid or Ester herbicide	
Detections Victorian Water Supplies 2007-16: 70	
Selective control of broadleafed weeds in cereals, linseed, pastures and turf. Wheat, barley, oats, triticale, cereal rye, field peas, flax, grass pastures, grass seed crops, sub-clover seed crops, non-crop areas, fallow land, industrial and commercial areas and rights of way.	
Acute Toxicity	Possible Carcinogen

Mecoprop		
Chlorophenoxy Acid or Ester herbicide		
Detections Victorian Water Supplies 2007-16: 8		
Selective herbicide for broad spectrum broadleaf weed control in cereals, ryegrass seedcrops and turf grasses. Sportgrounds with MCPA, 2,4-D and Dicamba		
SlightAcute Toxicity	Possible Carcinogen	Groundwater Contaminant

Metolachor			
Chloroacetanilide herbicide			
Detections Victorian Water Supplies 2007-16: 10			
Controls certain annual grasses and broadleaf weeds in certain crops. Broccoli, brussels sprouts, cabbages, cauliflowers, canola, green beans, navy beans, maize, sweet corn, pastures, soybeans, sunflowers, sweet potatoes, tobacco, wheat, barley, oats, triclicate.			
Slight Acute Toxicity	Possible Carcinogen	Groundwater Contaminant	Suspected Endocrine Disruptor

Monocrotophos	
Organophosphorus Insecticide	
Detections Victorian Water Supplies 2007-16: 1	
Monocrotophos has not registered or approved for use in Australia since the end of the 1990's. The major uses of Monocrotophos up to the end of the 1990's were: are in cotton, lucerne, potato, sorghum, soybean, tobacco, tomatoes and commercial flower crops. (also used in Pome fruit, beans: French, millet, wheat, sorghum, sunflowers, non-crop areas, bananas, maize, panicum, soybeans, sweet corn, non-fruit bearing trees).	
Acute Toxicity	Cholinesterase Inhibitor

Pentachlorophenol		
Chorinated Phenol		
Detections Victorian Water Supplies 2007-16: 1		
Deregistered chemical used as an algaecide, fungicide, herbicide, microbiocide, molluscicide, wood preservative. "Pentachlorophenol has no active constituent approvals or registered product… This chemical is also subject to the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (PIC)…" https://archive.apvma.gov.au/archive/gazette/2006/02/gazette_2006-02-07_page_26.php		
Acute Toxicity	Carcinogen	Suspected Endocrine Disruptor

Picloram			
Pyridinecarboxylic Acid Herbicide			
Detections Victorian Water Supplies 2007-16: 4			
Selective control of woody and noxious weeds in commercial and industrial areas, public lands, fence lines and pastures, by basal bark and cut stump application. Often used in conjunction with Triclopyr. Also used in boom application with 2,4-D and Aminopyralid.			
Slight Acute Toxicity	Groundwater Contaminant	Suspected Endocrine Disruptor	

Pirimicarb		
N-Methyl Carbamate Insecticide		
Detections Victorian Water Supplies 2007-16: 1		
For control of aphids in crops. Apples, citrus, stone fruit, a range of vegetable crops, roses, chrysanthemums, canola, Lucerne, medic pastures, lupins, winter cereals.		
Moderate Acute Toxicity	Carcinogen	Cholinisterase Inhibitor

Simazine			
Triazine Herbicide			
Detections Victorian Water Supplies 2007-16: 66			
For control of weeds in a range of horticultural and broadacre crops, forestry and in non crop situations Asparagus, Berry Fruits, citrus, hops, pome fruit, apples, pears, strawberries, vines, canola (triazine tolerant only), chickpeas, faba beans, lupins, subclover, established Lucerne and perennial grass pastures, eucalyptus plantations, ornamentals, commercial, industrial, rights of way, public utility areas, road shoulders, drains, headlands driveways, railway tracks, aerodromes, gutters, footpaths, dams, tanks, troughs.			
Slight Acute Toxicity	Groundwater Contaminant	Developmental Reproductive Toxin	Suspected Endocrine Disruptor

Terbufos		
Organophosphorus Insecticide/Nematicide		
Detections Victorian Water Supplies 2007-16: 4		
For control of soil dwelling pests in multiple cropping situations. Maize, sorghum, sweet corn, sunflowers, wheat, barley (wireworms and cereal cyst nematode)		
Acute Toxicity	Cholinesterase Inhibitor	

Thiobencarb		
Thiocarbamate Herbicide		
Detections Victorian Water Supplies 2007-16: 1		
For control of barnyard grass and sedges in Rice crops.		
Moderate Acute Toxicity	Cholinesterase Inhibitor	Potential Groundwater Contaminant

Trans Chlordane
Organochlorine Insecticide
Detections Victorian Water Supplies 2007-16: 1
Deregistered: "The APVMA has identified six chemicals on the Priority Candidate Review List that no longer have any registered products and therefore can be removed from the list, as a review will not be necessary... Two of the chemicals chlordane and heptachlor are listed in the Stockholm Convention on Persistent Organic Pollutants (POPs). This means that under the Agricultural and Veterinary Chemicals (Administration) Act these chemicals are prohibited from being imported, exported, manufactured and used and thus no further active constituent approvals, product registrations or permits may be issued in respect of these chemicals." https://archive.apvma.gov.au/archive/gazette/2006/02/gazette_2006-02-07_page_26.php

Triclopyr
Chloropyridnyl Herbicide
Detections Victorian Water Supplies 2007-16: 91
For control of woody weeds and melons. Agricultural non-crop areas, forests, pastures and rights of way. (particularly Blackberries, Gorse, Broom)
Slight Acute Toxicity

Low Dose Concerns

Endocrine disruptors (EDCs) are chemicals that interact with and disrupt human and animal hormones which regulate reproduction, metabolism, development behaviour, immune function, stress and growth. An increasing body of scientific research is finding endocrine disruptors in a range of materials including pharmaceuticals, components in plastics such as bisphenyl A, Dioxins, some pesticides, Polychlorinated Biphenyls, Perflurooctanoic Acid (PFOA) and phthalates.

Everyday items such as plastic bottles, non-stick cookware, metal food cans, detergents, flame retardants, food additives, toys, cosmetics and pesticides may act as endocrine disrupters. The interference can cause problems with natural hormones in regards to synthesis, secretion, transport, activity, or elimination for natural hormones. This interference or hormone blocking/mimicking in turn can alter hormone signalling.

In June 2009 The Endocrine Society released its influential report 'An Endocrine Society Statement. Endocrine Disrupting Chemicals', (http://www.endo-society.org/journals/ScientificStatements/upload/EDC_Scientific_Statement.pdf) stating that*: "The evidence for adverse reproductive outcomes (infertility, cancers, malformations) from exposure to endocrine disrupting chemicals is strong, and there is mounting evidence for effects on other endocrine systems including thyroid, neuroendocrine, obesity and metabolism, and insulin and glucose homeostasis" and "Effects of endocrine disrupting chemicals may be transmitted to further generations through germline epigenetic modifications or from continued exposure of offspring to the environmental insult."* The American Medical Association adopted the Endocrine Society Resolution in October 2009, calling for new policies to decrease public exposure to endocrine disrupting chemicals. (http://www.newswise.com/articles/ama-adoptsendocrine-society-resolution-calling-for-new-policies-todecrease-public-exposure-to-endocrine-disrupting-chemicals)

Perhaps the most controversial herbicide over the last few years in regards to endocrine disruption is Atrazine and related Triazine herbicides such as Simazine Atrazine is one of the most commonly applied herbicides in the world. In Australia, its popularity is second only to Glyphosate. In Australia, Atrazine is registered for use primarily in many cropping situations and some tree plantations. Research conducted by many scientists is finding that Atrazine interferes *"with the hormone systems that guide development in fish, birds, rats and frogs. In many cases, the result has been "feminized" males, with behaviours or body parts more like those of females…When they were tadpoles, he put them in water tainted with 2.5 parts per billion of atrazine -- still within the EPA's drinking water standards. About 10 percent of the frogs that developed in the water became "functionally female…"* (http://www.washingtonpost.com/wp-dyn/content/article/2010/03/01/AR2010030102331_pf.html)

In 2011, the Australian Drinking Water Guideline for Atrazine was reduced from 40 parts per billion, to 20 parts per billion. As long ago as 2002 scientists were

claiming that Atrazine as low as 0.1µg/L could be causing problems. That's 200 times lower than the reputable safe level in Australia! Source: Environ Health Perspect. 2003 Apr; 111(4): 568–575. PMCID: PMC1241446 Research ArticleAtrazine-induced hermaphroditism at 0.1 ppb in American leopard frogs (Rana pipiens): laboratory and field evidence.Tyrone Hayes, Kelly Haston, Mable Tsui, Anhthu Hoang, Cathryn Haeffele, and Aaron Vonk https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1241446/

Atrazine inhibits the production of testosterone and induces estrogen production which upsets the natural balance between these hormones. Atrazine has been seen to cause immune failure in animals. *"It's been shown that it increases production of (the stress hormone) cortisol. It's been shown that it inhibits key enzymes in steroid hormone production while increasing others. It's been shown that it somehow prevents androgen from binding to its receptor." The review also consolidates the evidence that atrazine undermines immune function in a variety of animals, in part by increasing cortisol.* (http://www.newsroomamerica.com/story/195601/).

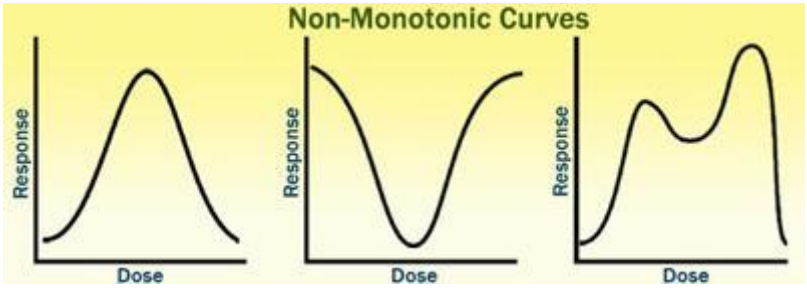


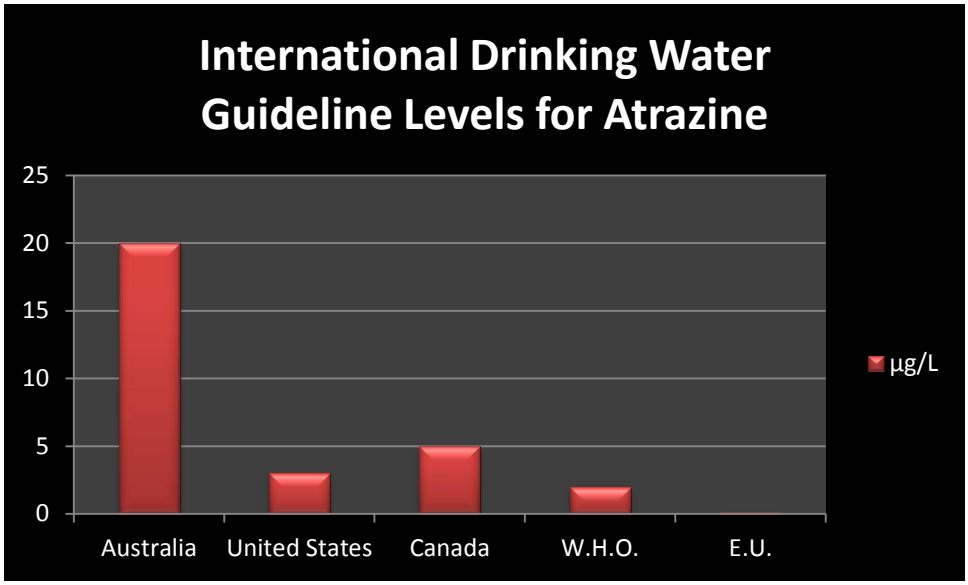
Image Source: https://www.epa.gov/chemical-research/endocrine-disruption-research-testing-potential-low-dose-effects

Scientists are now frequently finding lower doses can cause more problematic effects than the same chemical at a higher dose. These chemicals, also known as endocrine disruptors, can disrupt crucial life functions particularly in young children and foetuses. Hormones regulate body functions such as digestion, growth and sexual function, so any disruption of proper hormonal function can create health problems. The body uses very low dose effects for hormones to carry out their normal functions. It has been argued in terms of endocrine disruption that "no dose is low enough".

With 'dose makes the poison' thinking dominating toxicology, traditional toxicologists didn't pursue the possibility that there might be effects at levels far beneath those used in standard experiments. No health standards incorporated the possibility. Over the past 20 years, however, as scientists began to explore the impacts of endocrine disrupting compounds - compounds that behave like hormones or interfere with hormone actions - many examples of non-monotonic dose response began to be published in scientific journals.
(*http://www.environmentalhealthnews.org/sciencebackground/2007/2007-0415nmdrc.html*)

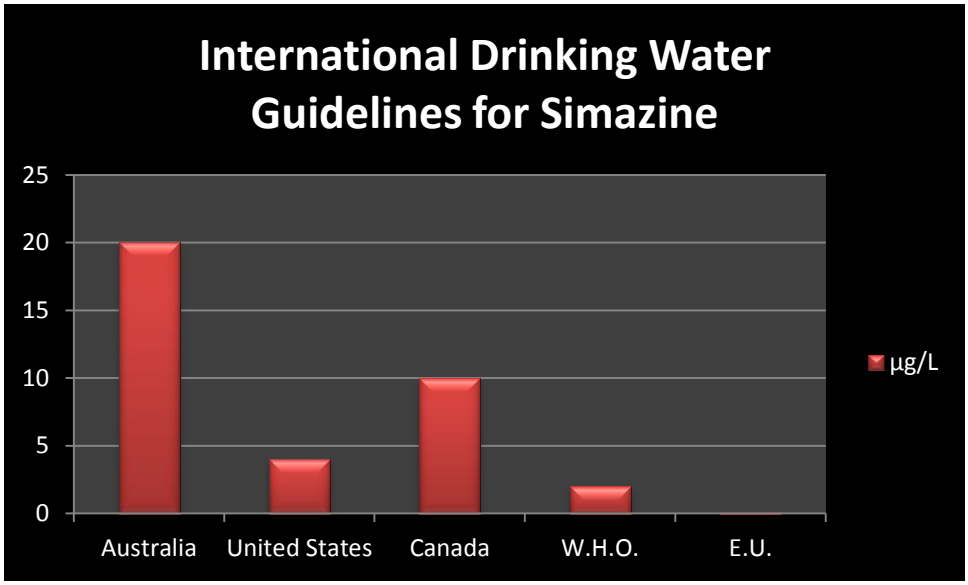
Hormones can be measured in parts per trillion, 1000 times lower than parts per billion (µg/L), well below "safety" guideline levels for most pesticides, meaning that supposed safe levels of pesticides are well above hormonal levels. Guideline levels can also increase or decrease over the years, levels which may be safe now, may not be in the future. Safe levels also vary from country to country,

confusing the issue even further. The European Union have a guideline level in drinking water for individual pesticides at 0.1µg/L (100 parts per trillion). In comparison, Australia has a "safe" guideline for Glyphosate at 1part per million, or 10,000 times higher than the European Guideline. Water authorities in Victoria rarely test for Glyphosate at <30µg/L, meaning that almost all Glyphosate detections in Victoria will be unmonitored.



Victorian Water Supply average 2007-16 for Atrazine was 0.16µg/L, which is 60% above EU guideline of 0.1µg/L. Note that the Australian drinking water for Atrazine is set at 200 times the EU guideline.

Victorian Water Supply average 2007-16 for 2,4-D was 0.68µg/L, which is 680% above EU guideline of 0.1µg/L. Note that the Australian drinking water for Atrazine is set at 300 times the EU guideline, but half that of the US Guideline.



Victorian Water Supply average 2007-16 for Simazine was 0.16µg/L, which is 60% above EU guideline of 0.1µg/L. Note that the Australian drinking water for Atrazine is set at 200 times the EU guideline.

The table below lists pesticides which are suspected to be endocrine disruptors by three reputable sources. The red shading indicates that a pesticide is an EDC. According to this table, 71.7% of the 46 pesticides (70.9% of the 619 detections are EDC pesticides) detected in Victorian waterways between 2007-16 are likely to be endocrine disruptors, possibly meaning that exposure to these pesticides at levels much lower than those regarded as being "safe" could be understated. This in turn could impact on lowering current guideline levels, meaning that levels regarded as being safe now, may not be in the future. Do tiny amounts of EDC pesticides that *"resist"* treatment actually have health consequences?

Pesticide	*Detections Vic Water Supplies 2007-16*	*Listed 1.*	*EU Cat 1 Listed 2.*	*EU Possible 3.*	*TEDX 4.*
2,4,5-TCP	*1*				
2,4,6-T	*5*				
2,4-D	*113*				
2,4-Dichlorophenol	*1*				
2,6-D	*4*				
4 Chlorophenoxy Acid	*5*				
4CPA	*1*				
Atrazine	*110*				
Bendiocarb	*1*				
Benomyl	*8*				
Bromoxynil	*1*				
Carbaryl	*1*				

Clothiandin	***1***				
Cyprodinil	***1***				
DEET	***12***				
Diazinon	***2***				
Dicamba	***11***				
Dinoseb	***4***				
Diphenylamine	***1***				
Diuron	***1***				
Fluometuron	***1***				
Fluroxypur	***1***				
Glyphosate	***2***				
Hexazinone	***33***				
Imazapyr	***25***				
Imidacloprid	***1***				
Malathion	***1***				
MCPA	***70***				
Mecoprop	***8***				
Metolachlor	***10***				
Molinate	***1***				
Monocrotophos	***1***				
Nonylphenol	***1***				
Pentachlorophenol	***1***				
Picloram	***4***				
Pirimicarb	***1***				
Propachlor	***1***				
Propazine	***1***				
Silvex	***1***				
Simazine	***66***				
Temephos	***7***				
Terbufos	***4***				
Terbutryn	***1***				
Thiobencarb	***1***				
Trans Chlordane	***1***				
Triclopyr	***91***				

References for Above Table

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3138025/

Int J Environ Res Public Health. 2011 Jun; 8(6): 2265–2303. Published online 2011 Jun 17. doi: 10.3390/ijerph8062265 PMCID: PMC3138025 Effect of Endocrine Disruptor Pesticides: A Review Wissem Mnif,[1,2] Aziza Ibn Hadj Hassine,[1] Aicha Bouaziz,[1] Aghleb Bartegi,[3] Olivier Thomas,[4] and Benoit Roig[4,*]

2. http://ec.europa.eu/environment/archives/docum/pdf/bkh_annex_15.pdf

3. http://ec.europa.eu/environment/archives/docum/pdf/bkh_annex_10.pdf

4. https://endocrinedisruption.org/interactive-tools/tedx-list-of-potential-endocrine-disruptors/search-the-tedx-list

Water Treatment Background

It appears that most of the detection results sent in from water authorities under the FoI requests, were for raw water, that is water before it goes through the treatment process. It can be expected that treatment will remove a large portion of pesticides in raw water, the exact amount will depend on the treatment process used.

Coagulation and Flocculation occurs before filtration: This process brings together particles in the raw water supply, forming floc. Coagulants such as Aluminium Sulphate and Polyelectrolytes also encourage the formation of floc. This process maximises the removal of particulates and colour later in the treatment process. Treatment of the water then removes the dosed coagulants. Substances used in this stage can include: Aluminium Sulphate (alum), Aluminium Chlorohydrate, Synthetic Organic Coagulant Polymer and Polyacrymalide (Floculant Polymer).

Filtration removes bacteria, dirt and other materials from the water: This is the key process which removes pollutants from water which may be present in the source water. Sand filters are commonly used in Australia, and some filters also contain layers of gravel and in some cases filter coal. Coagulated water is passed through a 'floc blanket' which traps suspended particles. The floc sinks to the lower levels of the sedimentation tank and is removed off as inert slurry. The remaining water is then collected usually in a series of channels and is then passed through multimedia filters, which remove smaller particles. There are several different types of filtration processes eg: 1) Dissolved Air Flotation Filtration, 2) Direct Filtration, 3) Conventional Clarification/Filtration, 4) Microfiltration, 5) Reverse Osmosis.

Disinfection: The most widely used drinking water disinfectant in Australia is Chlorine. Chlorine Gas or Sodium Hypochlorite Solution are added to the water to destroy viruses or bacteria that may cause illness. Chlorine can also be added at storage tanks or pump stations along the water distribution network. Chlorine is usually maintained at levels which are below taste and odour detection levels of people, but this can change particularly in times of increased demand for water, particularly in hot weather. Disinfection Byproducts (DBP's) are created when chlorine reacts withorganic molecules, such as algae. Some DBP's have been associated with cancer.

Varying water treatment types have differing levels of success when filtering out pesticides. A number of studies have been conducted investigating which water treatment options are best to use in filtering out pesticides.

The following quotes have been sourced from a US document: "Office of Pesticide Programs Science Policy. The Incorporation of Water Treatment Effects On Pesticide Removal And Transformations In Food Quality Protection Act (FQPA) Drinking Water Assessments. October 25, 2001. Office of Pesticide Programs

United States Environmental Protection Agency. Washington D.C. 20460"
http://www.epa.gov/oppfead1/trac/science/water_treatment.pdf

p5 ***"EPA's preliminary review of the literature indicates that conventional treatment (such as coagulation/flocculation, sedimentation, and filtration) has little or no effect on the removal of mobile (hydrophilic or lipophobic) pesticides. Disinfection and softening can facilitate alteration in the chemical structure of the pesticide, or transformation"***

p11 ***"Powdered activated carbon (PAC) filtration, granulated activated carbon (GAC) filtration, and reverse osmosis (RO) have been demonstrated to be highly effective processes at removing organic chemicals, including certain pesticides (primarily acetanilide herbicides), but specific data on removal of most pesticides are not available."***

p13 ***"Granular activated carbon (GAC) … is the best available technology (BAT) for removing synthetic organic chemicals (SOC); virtually all pesticides are SOCs. Other recommended BATs are aeration technologies for removal of dibromochloropropane and chlorination or ozonation for removal of glyphosate."***

p20 ***"Miltner et al., (1989) provide information on the possible removal of pesticides with conventional treatment … No removal of the triazine pesticides, linuron, and carbofuran was observed. The removal of alachlor and metolachlor was low and ranged from 4 to 11 % percent."***

p21 ***"The process of softening or softening-clarification was evaluated for its ability to remove pesticides from water. Data collected from the full-scale treatment plants indicated that atrazine, cyanazine, metribuzin, alachlor and metolachlor at initial concentrations in parts per billion level (µg/L) were not removed during the softening-clarification process. In contrast, parent carbofuran was reported as 100% removed."***

p24 ***"The effect of chlorination on pesticides was also evaluated at full-scale treatment plants in Ohio (Miltner et al., 1989)… For atrazine, cyanazine, simazine, alachlor, metolachlor, and linuron, the removal efficiencies were either zero or extremely low. Slight removal was observed for carbofuran. Up to 98 % removal was reported for metribuzin.***

P25 ***"Miltner et al. (1987,1989) studied the removal of atrazine and alachlor using PAC (Powder Activated Carbon)…The percent removal ranged from 28% to 87% for atrazine and 33% to 94% for alachlor. As the PAC dose increased, sorption removal efficiencies likewise increased…"***

p27 ***"The performance of GAC in removing pesticides from raw water has been demonstrated by the studies of Miltner et al. (1989) who used pesticides belonging to triazine, acetanilide, and dinitroaniline classes … Relative to the initial concentrations of the pesticides, the percent removal of the two acetanilide pesticides (72 - 98%) was higher than those of the triazine pesticides***

(47 - 62%). The highest removal efficiency (>99%) by Filtrasorb 400 was reported for pendimethalin."

Semi permeable membranes used in Reverse Osmosis Filtration appear to have the greatest capacity to filter out pesticides.

p30 ***"A short-term laboratory test conducted by Chian (1975) demonstrated that NS-100 membrane was able to remove 97.8% of atrazine compared to 84.0% removal using CA membrane. Since then, other studies by several investigators (Eisenberg and Middlebrooks, 1986; Lykins et al., 1988; Miltner et al., 1989; Fronk et al., 1990) generally indicated that thin film composite membranes have superior performance in removing pesticides compared to those of CA and polyamide membranes…"***

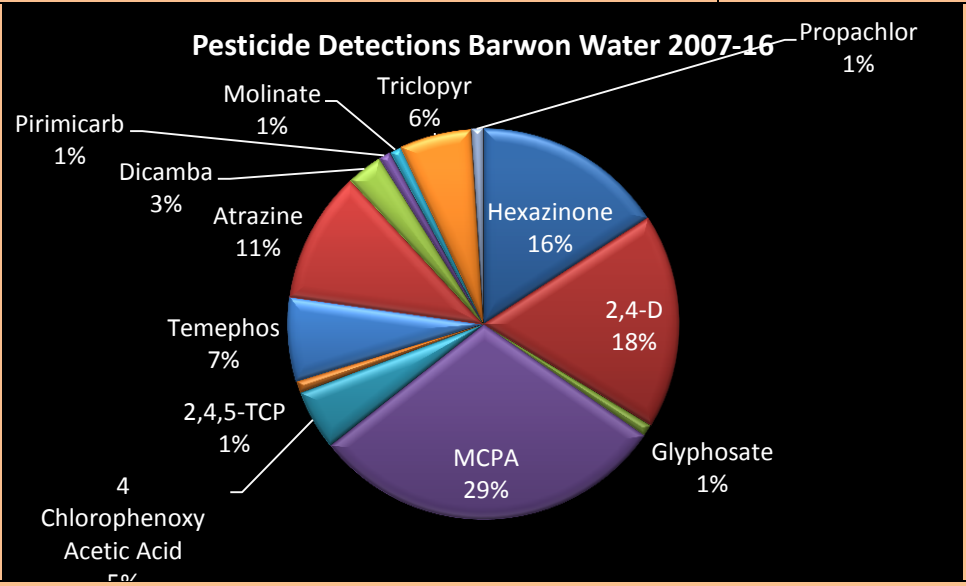
Other membranes, nanofiltration, airstripping and integrated membrane/absorbent systems all have high levels of pesticide removal.

Specific Water Authority Pesticide Detection Data

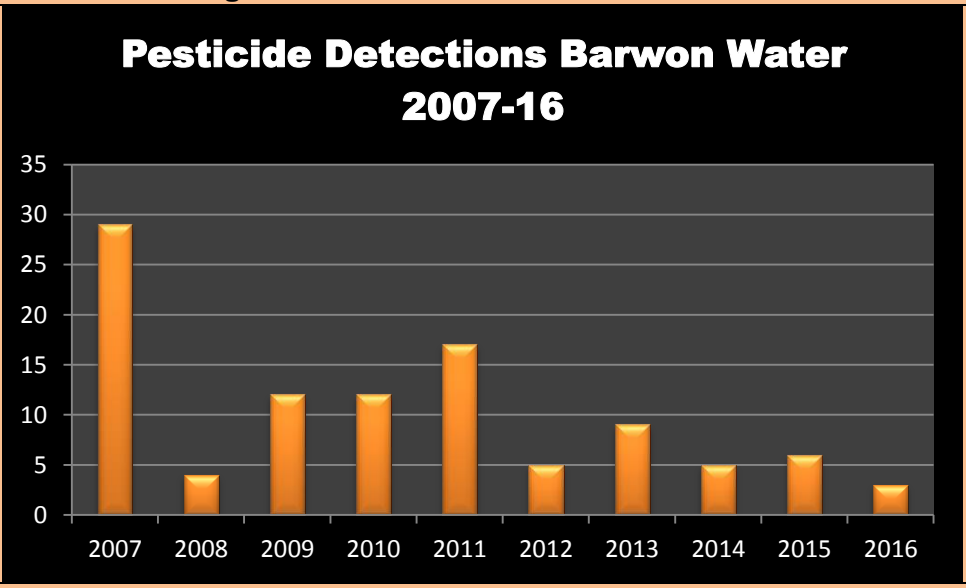
Disused 2,4-D cans North East Victorian Domestic Water Supply

Barwon Water

Total Pesticide Detections 2007-16: 101



Average Barwon Water Detection Level: 0.99µg/L
Average Statewide Detection Level: 0.46µg/L
Average Barwon Water Level as % of ADWG: 0.83%
Average Statewide Level as % of ADWG: 0.98%



"Generally", Barwon Water have tested for ~80 pesticides on a quarterly basis throughout the time period of this report. Barwon Water was the first Victorian Water Authority to implement more "rigorous" pesticide sampling in 2004. As a result they are the only water authority with a consistent testing regime over the past 13 years. Many detections in the Wurdee Boluc and Moorabool systems have

also occurred well upstream of raw water reservoirs, increasing average detection levels, particularly for MCPA.

Pesticides Types Detected: (13)

September 08: Empty Stony Creek Reservoir #3

MCPA (30)
2,4-D (18)
Hexazinone (16)
Atrazine (11)
Temephos (7)*
Triclopyr (6)
4 Chlorophenoxy Acetic Acid (5)
Dicamba (3)
Glyphosate (1)
2,4,5-TCP (1)
Pirimicarb (1)
Molinate (1)
Propachlor (1)

Most Frequent Detections

MCPA (30): Barwon Water Average: 0.37µg/L	**MCPA: State Average. 0.19µg/L**
2,4-D (18): Barwon Water Average: 0.15µg/L	**2,4-D: State Average. 0.68µg/L**
Hexazinone (16): Barwon Water Average: 0.05µg/L	**Hexazinone: State Average 0.04 µg/L**
Atrazine (11): Barwon Water Average: 0.2µg/L	**Atrazine: State Average. 0.16µg/L**
Triclopyr (6): Central Highlands Water Average: 0.05µg/L	**Triclopyr: State Average 0.12µg/L**
Dicamba (3): Central Highlands Water Average: 0.03µg/L	**Dicamba: State Average 0.09µg/L**

Five Highest Detections:

October 2008: Wurdee Boluc Aquaduct From Brickmakers Road.

1). Pirimicarb 5/12/11 Wurdee Boluc WTP 1.1µg/L. 15.71% Australian Drinking Water Guideline

2). MCPA 17/9/13 Matthews Creek 4.6 µg/L. 11.5% Australian Drinking Water Guideline

3). Glyphosate 17/7/07 Inlet Channel Salt Creek Lane 80 µg/L. 8% Australian Drinking Water Guideline

4) 2,4-D 4/6/08 Moorabool WTP 1.9 µg/L. 6.3% Australian Drinking Water Guideline

5) MCPA 19/7/11 Matthews Creek 2.4µg/L. 6% Australian Drinking Water Guideline

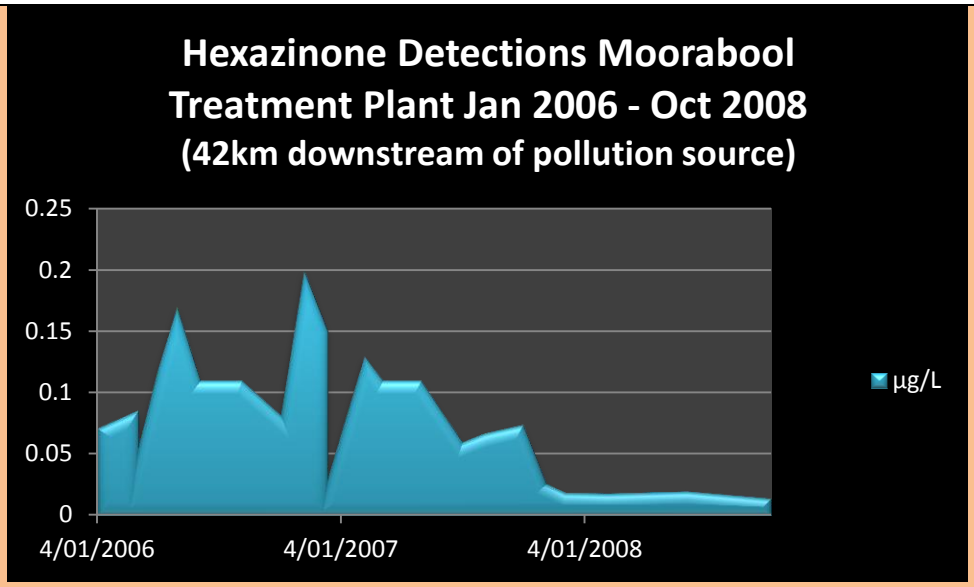
~44% of Statewide MCPA detections have occurred in Barwon Water Catchments. Three of the highest MCPA detections in Australian water supplies have been detected in Matthews Creek catchments, 4.7µg/L (17/9/13), 2.4 µg/L (19/7/11), 2.4µg/L (6/8/12). All well upstream of Wurdee Boluc Reservoir. How land is managed in the Matthews Creek catchment could have national ramifications in terms of better understanding how MCPA enters domestic drinking water supplies. This could in turn lead to strategies that lessen MCPA pollution.

All Temephos* detections are questionable and could be due to possible lab contamination.

The Propachlor detection of 1.8µg/L @ Wurdee Boluc (4/12/13) is possibly the highest in Australian water supply. Was the source investigated? Propachlor is used in some vegetable crops.

The Pirimicarb detection of 1.1µg/L @ Wurdee Boluc WTP (5/12/11) is possibly the second highest detected in Australian Water supply. Was the source investigated?

Molinate, usually used on grass weeds in rice crops, was detected at 0.3µg/L at Birregurra on 7/6/12. This is possibly the second highest detection of Molinate in a Australian water supply. Was the source investigated? Birregurra is ~350km south west of New South Wales rice cropping.



All of the Hexazinone detections post 2007 relate to an incident at Korweingaboora in 2004, when a recently logged plantation had pelletised Hexazinone applied. The highest level of Hexazinone recorded at Korweinguboora was 9.4µg/L on the 4th of March 2005. By December 2004 Hexazinone was detected at an inlet to Moorabool Treatment Plant, some 40km south.

In April 2005, Barwon Water issued Hancock Victorian Plantations with a Notice of Contravention for Water Protection *(Water Act 1989. Section 169(1): Notice of contravention for water supply protection).* The water authority then reached an agreement not to use certain herbicides in its catchment areas.

The highest level of Hexazinone detected near the water treatment plant was ~0.3% of the Australian Drinking Water Guideline. Yet between 2003-2016, at least 30 detections of pesticides occurred higher than 0.3% of the ADWG in Barwon Water catchments, most notably with the herbicides MCPA, Atrazine and 2,4-D, yet no Notice of Contravention was issued against any of the users of these pesticides. Why?

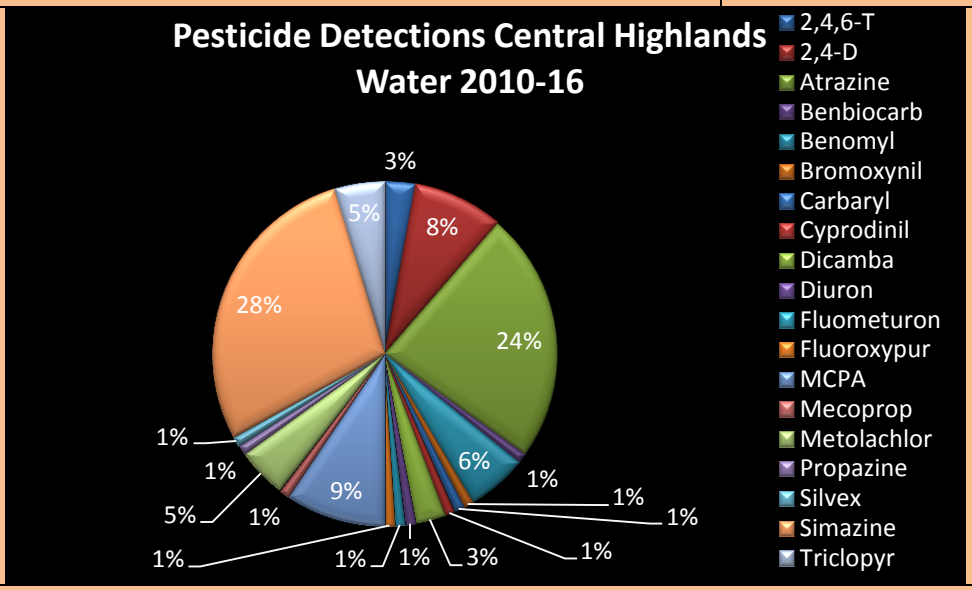
In 2004 Barwon Water implemented Victoria's most robust pesticide testing, which included approximately 80 pesticides. If they had not implemented this testing regime, the Korweinguboora Hexazinone incident would have gone by unreported because noone would have been testing for it. Hexazinone was continually detected by Barwon Water between 2004-2008. Noone will ever know what pesticides have flowed through Victorian water supplies over the past decades due to a lack of testing by water authorities. Pesticides have been widely used since the 1940's, yet it wasn't until 2012 that most water authorities in Victoria have followed Barwon Water's 2004 precedent.

Historical Data of Interest
Highest Pesticide Detections Barwon Water 1999-2017

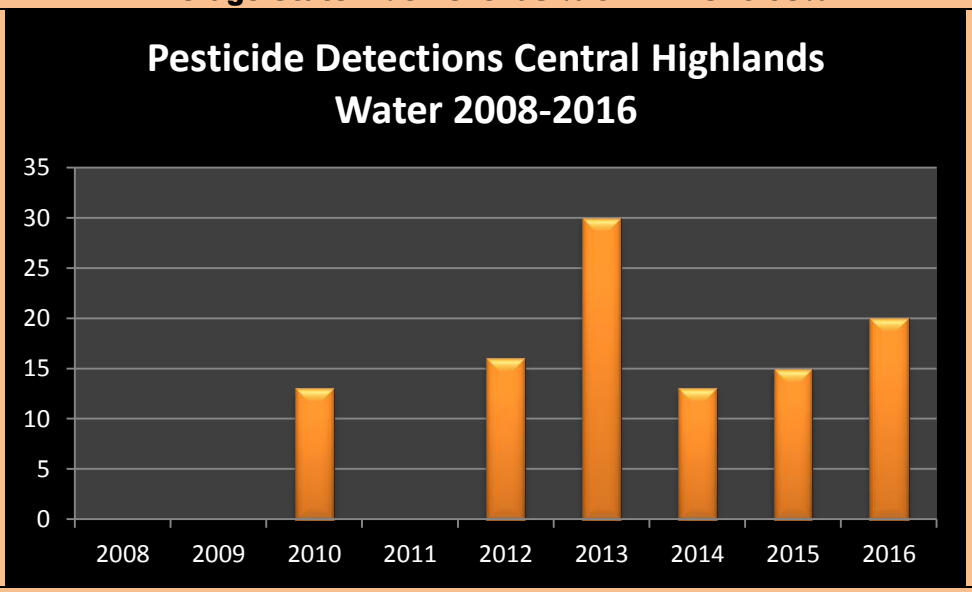
	Date	Location	Pesticide	Level Detected	Australian 2011 Guideline
1.	12/5/03	Wurdee Boluc Raw Water	2,4-D	34µg/L	30µg/L
2.	19/8/03	Wurdee Boluc Inlet Channel	2,4-D	27µg/L	30µg/L
3.	5/8/03	Stony Creek Reservoir #3	2,4-D	20µg/L	30µg/L
4.	5/12/11	Wurdee Boluc WTP Raw Water	Pirimicarb	1.1µg/L	7µg/L
5.	17/9/13	Matthews Creek	MCPA	4.6µg/L	40µg/L
6.	28/10/99	Highton Pre Disinfection	Dieldrin	0.03 µg/L	0.3µg/L
7.	17/7/07	Inlet Channel Salt Creek Lane	Glyphosate	80µg/L	1000µg/L
8.	4/6/08	Moorabool WTP	2,4-D	1.9µg/L	30µg/L
9.	19/7/11	Matthews Creek	MCPA	2.4µg/L	40µg/L
10.	6/8/12	Matthews Creek	MCPA	2.4µg/L	40µg/L
11.	4/12/13	Wurdee Boluc	Propachlor	1.8µg/L	70µg/L
12.	22/6/11	M6/3 Stony Creek Reservoir #3	Atrazine	0.5µg/L	20µg/L
13.	19/7/11	M6/3 Stony Creek Reservoir #3	Atrazine	0.5µg/L	20µg/L
14.	4/3/05	Korweinguboora Reservoir	Hexazinone	9.4µg/L	400µg/L
15.	10/9/10	Matthews Creek	MCPA	0.48µg/L	40µg/L
16.	16/12/14	Matthews Creek	Triclopyr	0.21µg/L	20µg/L
17.	24/12/10	Moorabool WTP Combined	Atrazine	0.2µg/L	20µg/L
18.	4/2/11	Moorabool WTP Combined	Atrazine	0.2µg/L	20µg/L
19.	4/3/11	Moorabool WTP Combined	Atrazine	0.2µg/L	20µg/L
20.	7/6/12	Birregurra	Molinate	0.3µg/L	4µg/L

Central Highlands Water

Total Pesticide Detections 2007-16: 107



Average CHW Detection Level: 0.09µg/L
Average Statewide Detection Level: 0.46µg/L
Average CHW Level as % of ADWG: 0.43%
Average Statewide Level as % of ADWG: 0.98%



"Generally", Central Highlands Water tested for ~40-45 pesticides at a number of locations in 2008-9. Wider testing occurred in November/December 2010. First positive detections Lal Lal Reservoir between September & December 2010. Almost all sampling since 2012 has occurred only in November for ~140-150

pesticides and metabolites. Testing also picking up lower detections since 2012.

Pesticides Types Detected: (19)

July 2017: Talbot Reservoir. Used as water supply for Maryborough and surrounds. 14 positive pesticide detections 2012-16.

Simazine (30)
Atrazine (25)
MCPA (9)
2,4-D (9)
Benomyl (6)
Triclopyr (5)
Metalochlor (5)
Dicamba (3)
2,4,6-T (3)
Bendiocarb (1)
Bromoxynil (1)
Carbaryl (1)
Cyprodinil (1)
Diuron (1)
Fluometuron (1)
Mecoprop (1)
Propazine (1)
Silvex (1)
Fluoroxypur (1)

Most Frequent Detections

Simazine (30): Central Highlands Water Average: 0.16µg/L	**Simazine: State Average. 0.16µg/L**
Atrazine (25): Central Highlands Water Average: 0.12µg/L	**Atrazine: State Average. 0.12µg/L**
MCPA (9): Central Highlands Water Average: 0.02µg/L	**MCPA: State Average 0.19 µg/L**
2,4-D (9): Central Highlands Water Average: 0.02µg/L	**2,4-D: State Average. 0.68µg/L**
Benomyl (6): Central Highlands Water Average: 0.03µg/L	**Benomyl: State Average 0.03µg/L**
Triclopyr (5): Central Highlands Water Average: 0.03µg/L	**Triclopyr: State Average 0.12µg/L**

Five Highest Detections:

July 2017 Centenary Reservoir Maryborough. Multiple low level pesticide detections

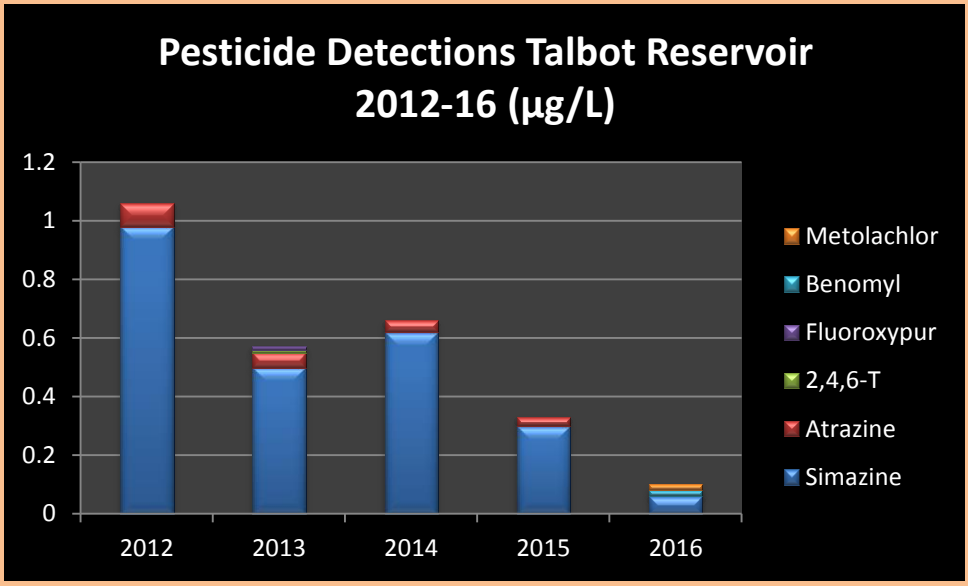
1). Atrazine 7/11/12 Lexton Reservoir 1µg/L. 5% Australian Drinking Water Guideline

2). Simazine 18/11/12 Talbot Reservoir 0.98µg/L. 4.9% Australian Drinking Water Guideline

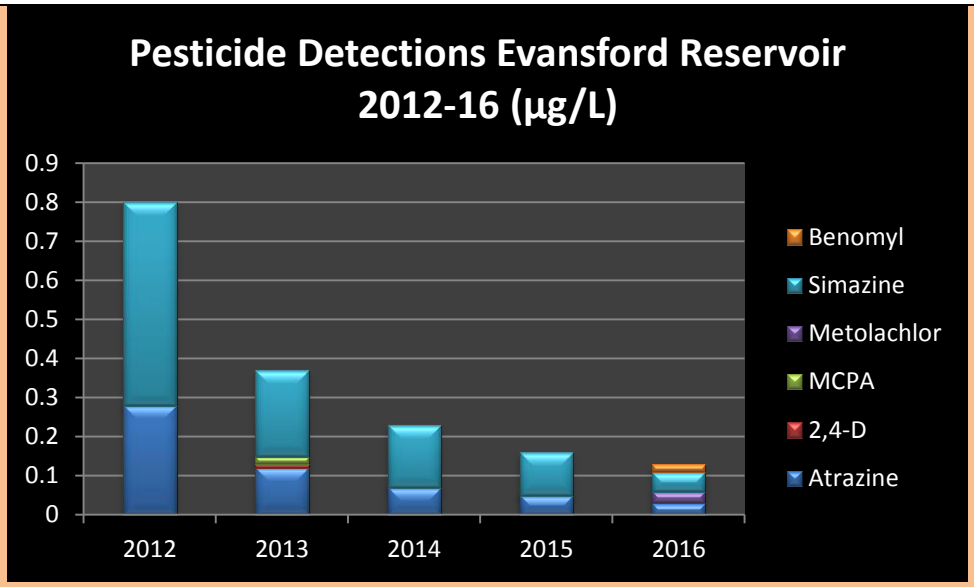
3). Simazine 13/11/14 Talbot Reservoir 0.62µg/L. 3.1% Australian Drinking Water Guideline

4) Simazine 19/11/12 Evansford Reservoir 0.52µg/L. 2.6% Australian Drinking Water Guideline

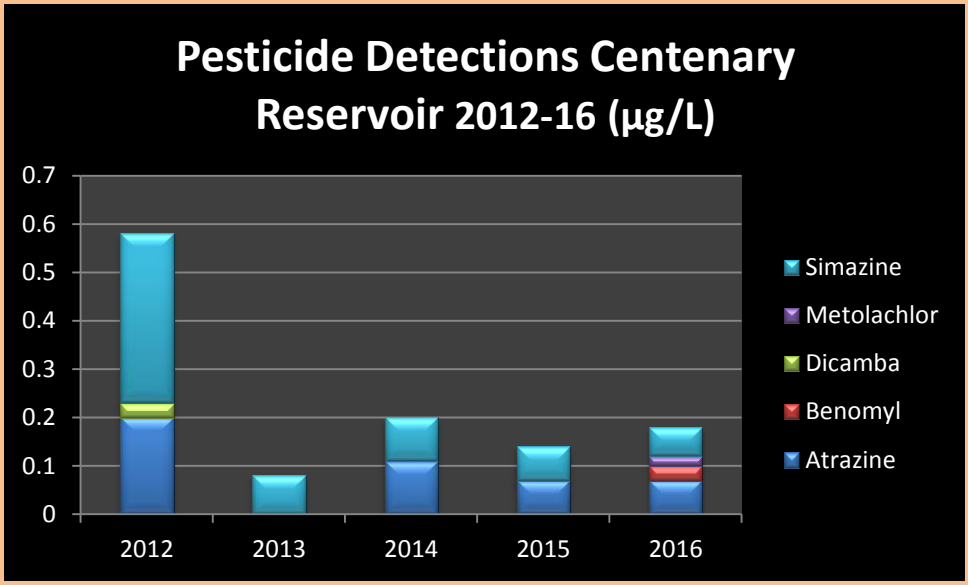
5) Simazine 14/11/13 Talbot Reservoir 0.5µg/L. 2.5% Australian Drinking Water Guideline



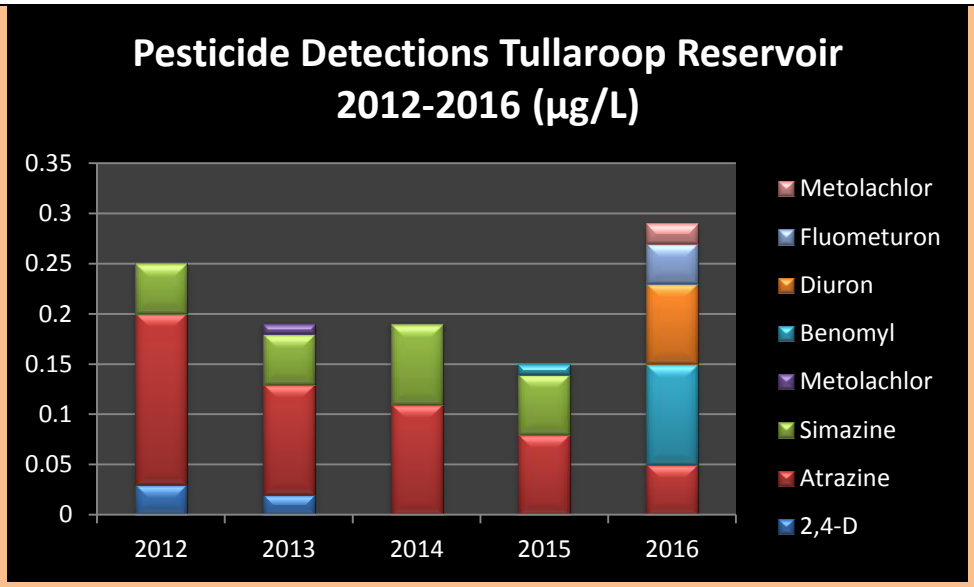
Simazine detections dominate pesticide detections in Talbot Reservoir between 2012-16. Under European Guidelines all detections of Simazine 2012-15 would warrant further investigations by water authority to determine source of the pollution.



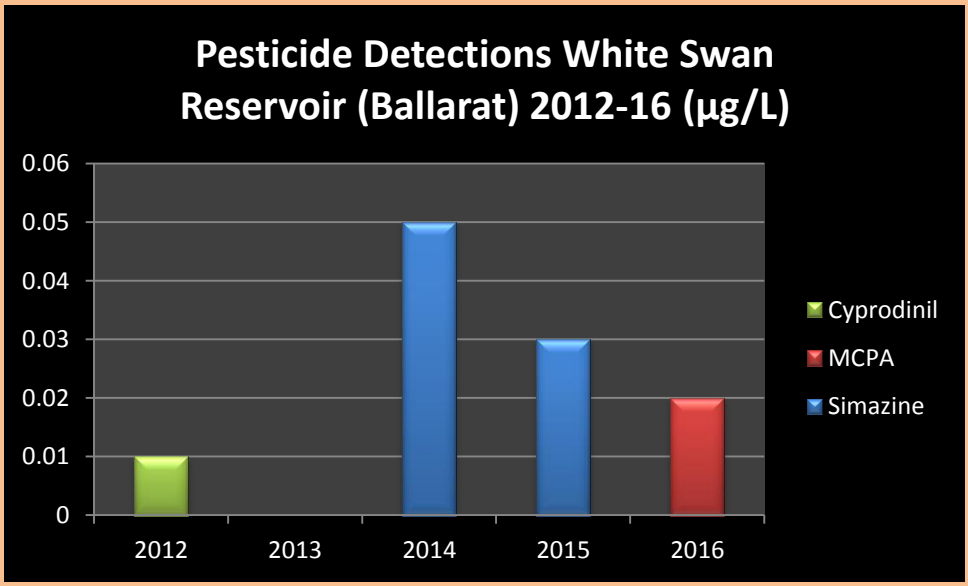
Levels of Atrazine and Simazine decreasing substantially since 2012, however this could also mean that the source of the Atrazine/Simazine pollution was sprayed in 2012 and has continually leached from the same site.



Centenary Reservoir receives water from several other reservoirs, meaning that if chemicals are found in other reservoirs in the region, they will also be likely to be detected at Centenary Reservoir.



Bucking the Trend. Tullaroop Reservoir increased its pesticide detections in 2016, including the states only detections 2007-16 for Diuron and Fluometuron. 2016 also saw Victoria's highest Benomyl detection. Atrazine consistently detected between 2012-16. Benomyl was also detected in Centenary Reservoir.



Victoria's only detection of Cyprodinil (a fungicide) in 2012 occurred in White Swan Reservoir. White Swan Reservoir supplies Ballarat with drinking water. Are the source of the low pesticide detections coming from spray drift or water coming in via the recently constructed Goldfields Superpipe?

City West Water

Total Pesticide Detections 2007-16:	0

City West Water purchase water from Melbourne Water and rely on Melbourne Water to test for pesticides.

City West Water are, in part, supplied water from the Yarra River.

For more information see the Melbourne Water page.

Also see South East Water.

Coliban Water

Total Pesticide Detections 2007-16: *"No Data No Problem?"*	0

"Generally", Coliban Water have tested for 10 pesticides, almost all of which are organochlorines which have not been used in Australia for years. Organochlorines are known to last for long periods of time and can be remobilised into the water column after rainfall. Many are highly toxic and bioaccumulate, hence the reason to test for them.

In terms of currently registered pesticides, Coliban Water test for only two. MCPA and 2,4-D. The detection limit for 2,4-D and MCPA used by the lab employed by Coliban Water is 5 parts per billion (µg/L). The "safe" drinking water guideline for 2,4-D and MCPA in Australia is 30µg/L and 40µg/L, respectively.

The detection limit that Coliban Water currently use for 2,4-D and MCPA means that almost all positive detections would not currently be detected and are set at 50 times higher than guideline levels in Europe. The average detection levels of all pesticides in Victoria 2007-16 was 0.46µg/L. Average Detection levels for 2,4-D and MCPA in Victorian Water supplies 2007-12, was 0.68µg/L and 0.19µg/L respectively, meaning these levels would not be detected by Coliban Water.

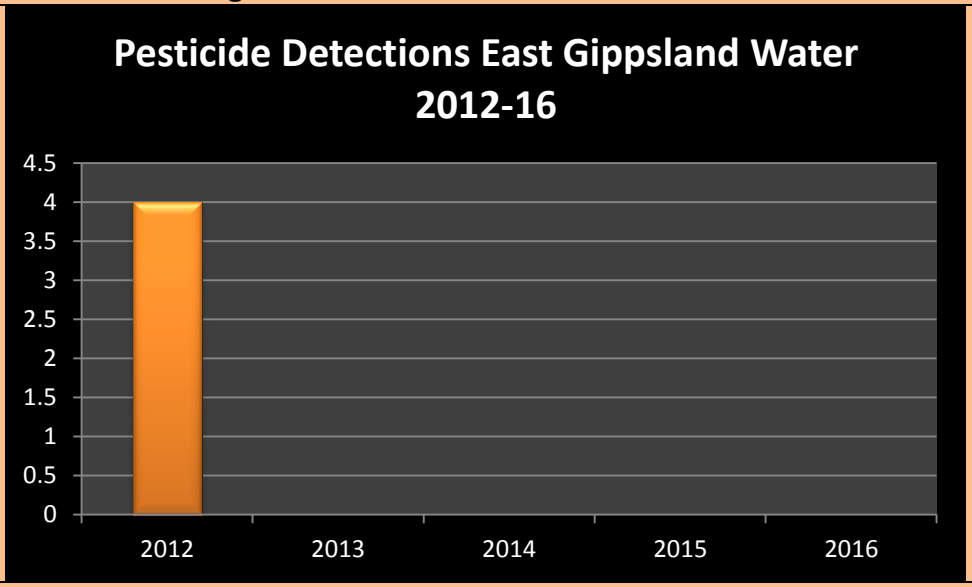
In terms of the frequency of testing, there were some variations. For instance Bendigo had annual tests 2008-9, quarterly tests 2010-14 and back to annual tests in 2015-16.

Upper Coliban Reservoir catchment has cropping and improved pasture, as does the Goulburn River above Goulburn Weir. Intensive cropping and high pesticide use are also likely in the Loddon River, Coliban River, Murray River and Campaspe River. Gunbower Creek and channel water would also be prone to agricultural runoff. Atrazine, Simazine, 2,4-D, Triclopyr and MCPA runoff would be expected.

East Gippsland Water

Total Pesticide Detections 2007-16:	4

Average East Gippsland Water Detection Level: 0.103µg/L
Average Statewide Detection Level: 0.46µg/L
Average East Gippsland Water Level as % of ADWG: 0.41%
Average Statewide Level as % of ADWG: 0.98%



"Generally", East Gippsland Water test for pesticides once a year, either in July or September. Between ~40 to 60 pesticides are tested for depending on location. Eagle Point Entry Point tested Jan 2008, some other communities approximately 2009, most communities by 2010 had more extensive range of pesticide testing.

Pesticides Types Detected: (1)	Triclopyr (4)

Most Frequent Detections

Triclopyr (4): East Gippsland Water Average: 0.103µg/L	Triclopyr: State Average. 0.12µg/L

Four Highest Detections:

Buchan River Valley East Gippsland. Triclopyr detections 2012, CMA spraying the cause?

1). Triclopyr 10/2/12 Buchan River 0.2µg/L. 1% Australian Drinking Water Guideline

2). Triclopyr 13/12/12 Buchan River Entry 0.09µg/L. 0.45% Australian Drinking Water Guideline

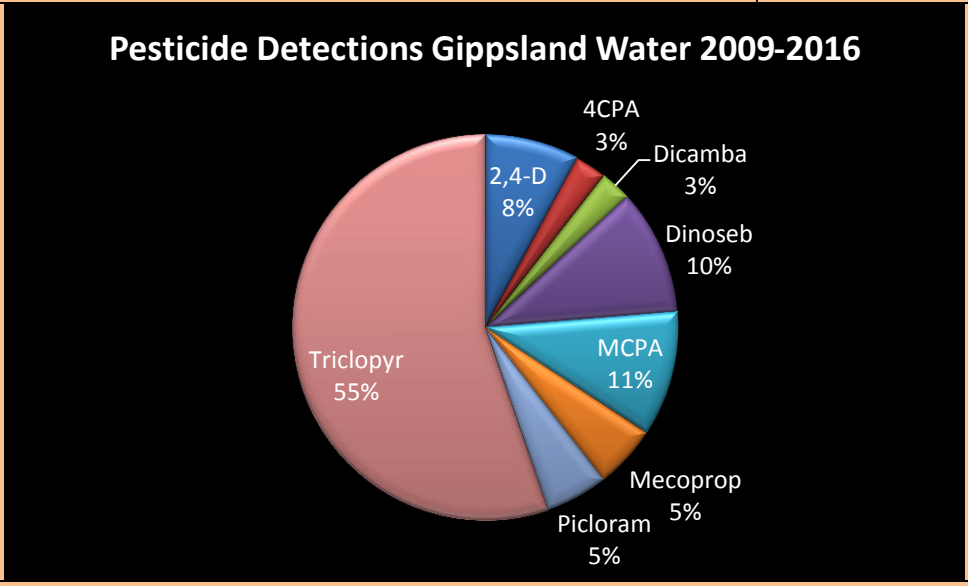
3). Triclopyr 7/3/12 65 Main Street Conorville 0.02µg/L. 0.1% Australian Drinking Water Guideline

4) Triclopyr 7/3/12 Buchan Entry Water 0.02µg/L. 0.1% Australian Drinking Water Guideline

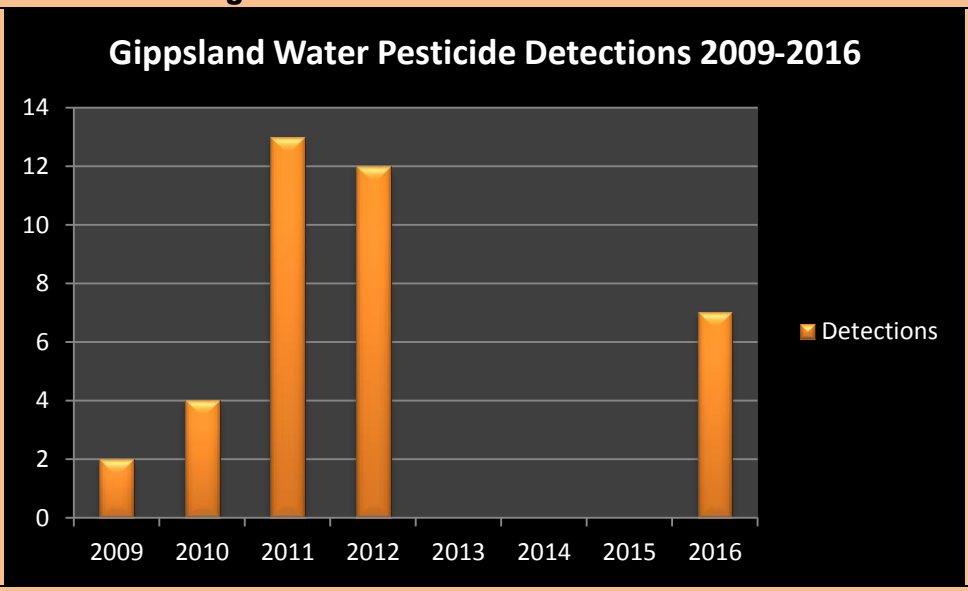
4 detections for Triclopyr, all occurring over February/March 2012 upstream or near Buchan. One possible cause of the pollution could be spraying of Triclopyr by Catchment Management Authorities for control of Blackberries. (Cann River recorded a positive Triclopyr detection in March 2017).

Gippsland Water

Total Pesticide Detections 2007-16: 38



Average Gippsland Water Detection Level: 0.23µg/L
Average Statewide Detection Level: 0.46µg/L
Average Gippsland Water Level as % of ADWG: 0.53%
Average Statewide Level as % of ADWG: 0.98%



"Generally", Gippsland Water tested for ~10-25 pesticides in raw and reticulated water at a number of locations between 2006-9 on 3-6 months or annual basis with 2,4-D and 2,4,6-T tested on a monthly basis. Testing regimes increased in June 2009 to 30 and 63 in some locations over November 2009 – December 2009. Generally 40-60 pesticides now tested for on a quarterly basis.

No detections for pesticides in reticulated system, only in raw water.

Pesticides Types Detected: (8)

Thorpdale Drinking Water Supply, dominated by potato crops

Triclopyr (21)
Dinoseb (4)
MCPA (4)
2,4-D (3)
Mecoprop (2)
Picloram (2)
4CPA (1)
Dicamba (1)

Most Frequent Detections

Triclopyr (17): Gippsland Water Average: 0.13µg/L	**Triclopyr: State Average. 0.12µg/L**
Dinoseb (4): Gippsland Water Average: 1µg/L	**Dinoseb: State Average. 1µg/L**
MCPA (3): Gippsland Water Average: 0.24µg/L	**MCPA: State Average 0.19 µg/L**
2,4-D (3): Gippsland Water Average: 0.04µg/L	**2,4-D: State Average. 0.68µg/L**
Mecoprop (2): Gippsland Water Average: 0.03µg/L	**Mecoprop: State Average 0.02µg/L**

Five Highest Detections*:

Thorpdale gets their drinking water from Easterbrook Creek, a tributary of Narracan Creek, which supplies Moe.

According to a report* published the EPA 2013 the following pesticides were detected by the EPA in Narracan Creek in December 2011 (Diazinon 0.008ug/L, Simazine 0.012ug/L, Metolachlor 0.005ug/L, 2,4-D 0.005ug/L, Azoxystrobin 0.002ug/L, Diazinon 0.002ug/L, Metribuzin 0.072ug/L, 2,4-D 0.023ug/L, MCPA 0.076ug/L, Triclopyr 0.217ug/L, Azoxystrobin 0.002ug/L, Diazinon 0.002ug/L, Atrazine 0.003ug/L, Metribuzin 0.069ug/L, 2,4-D 0.028ug/L, MCPA 0.072ug/L, Triclopyr 0.0261ug/L, Atrazine 0.003ug/L, Metalaxyl 0.002ug/L) and March 2012 (2,4-D 0.018ug/L, Triclopyr 0.022ug/L, Azoxystrobin 0.002ug/L, Metolachlor 0.011ug/L). It is likely that Gippsland Water testing would not have detected these pesticides at these levels of detection. (*Impacts of Intensive Agriculture and Plantation forestry on Water Quality in the Latrobe Catchment, Victoria April 2013)
http://www.epa.vic.gov.au/~/media/Publications/1528.pdf

1). Triclopyr 5/11/12 Seaspray 1.5µg/L. 7.5% Australian Drinking Water Guideline

2). Triclopyr 21/2/12 Thorpdale 0.25µg/L. 1.25% Australian Drinking Water Guideline

3). Triclopyr 10/2/16 Moe 0.22µg/L. 1.1% Australian Drinking Water Guideline

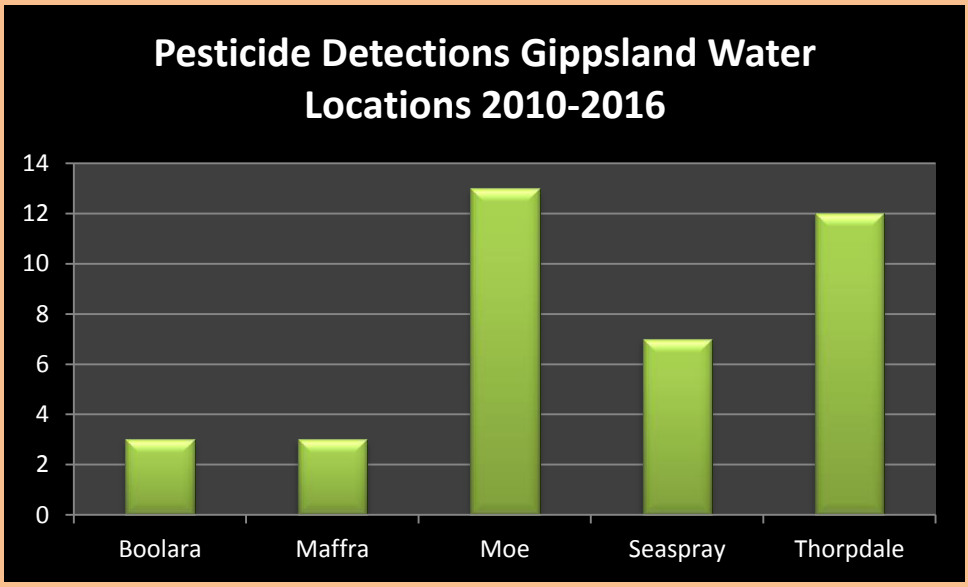
4) MCPA 8/11/11 Thorpdale 0.42µg/L. 1.05% Australian Drinking Water Guideline

5) MCPA 10/2/16 Moe 0.39µg/L. 0.975% Australian Drinking Water Guideline

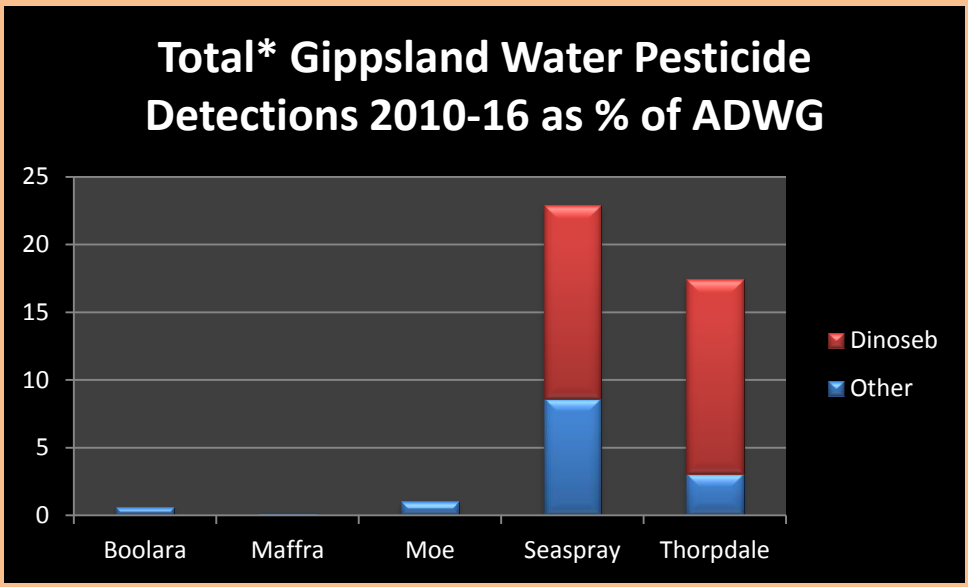
***Dinoseb has no guideline level under the Australian Drinking Water Guidelines. The U.S. Guideline for Dinoseb is 7µg/L, meaning that all 4 detections at Moe and Seaspray would be 14.28% of that Guideline.**

Dinoseb is not registered or approved for use in Australia so how was it detected in the water supplies for Moe and Seaspray in November 2009 and November 2010? Dinoseb is a contact herbicide for post-emergence weed control in cereals, undersown cereals, seedling lucerne and peas.
Dinoseb is also used as a corn enhancer and an insecticide and miticide.

"WASHINGTON, Oct. 7 1986— Asserting that the widely used pesticide dinoseb posed a "very serious risk" of birth defects, the Environmental Protection Agency issued an emergency order today barring sale or use of the chemical... Dinoseb is used as a weed killer on a wide variety of crops, including soybeans, cotton, potatoes, peanuts, alfalfa, snap beans, peas, grapes and almonds. It is made by a number of producers, including the Uniroyal Chemical Company". (New York Times October 8 1986)



66% of all Gippsland Water pesticide detections occurred in the Narracan Creek catchment over the 7 year period, but health risks appear greater in Seaspray and Thorpdale (see below) due to the Dinoseb detections.



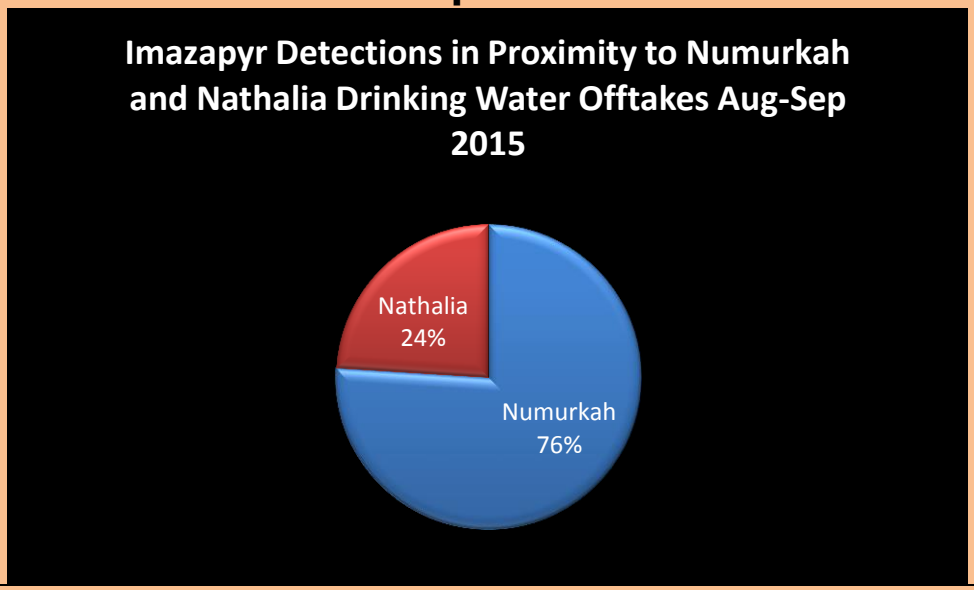
This graph shows that as a total % Australian Drinking Water Guidelines and US Guideline for Dinoseb, in terms of possible health impacts over the 8 years, Seaspray water, sourced from Merrimans Creek appears to be of most concern.

The bulk of Gippsland Water detections occur in February and November.

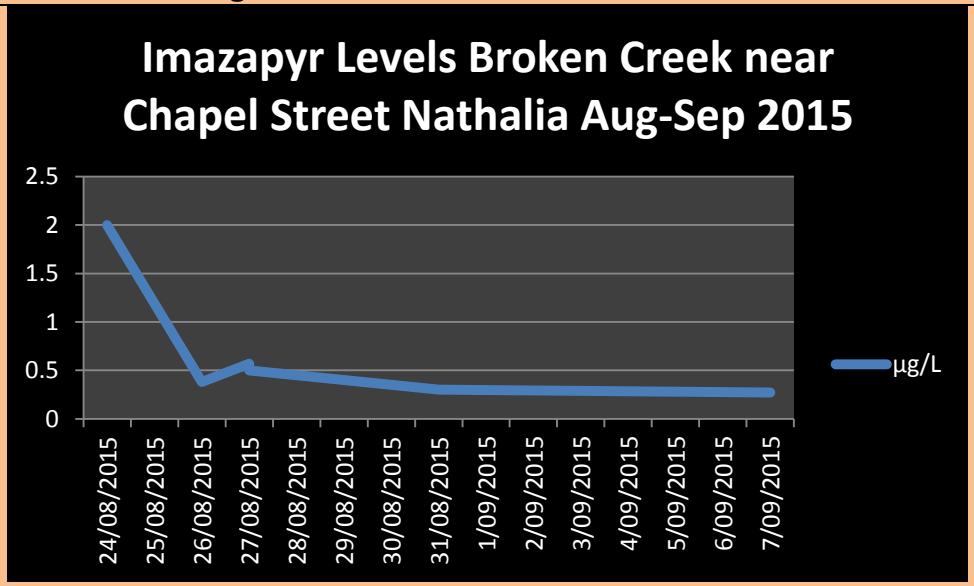
Goulburn Murray Water

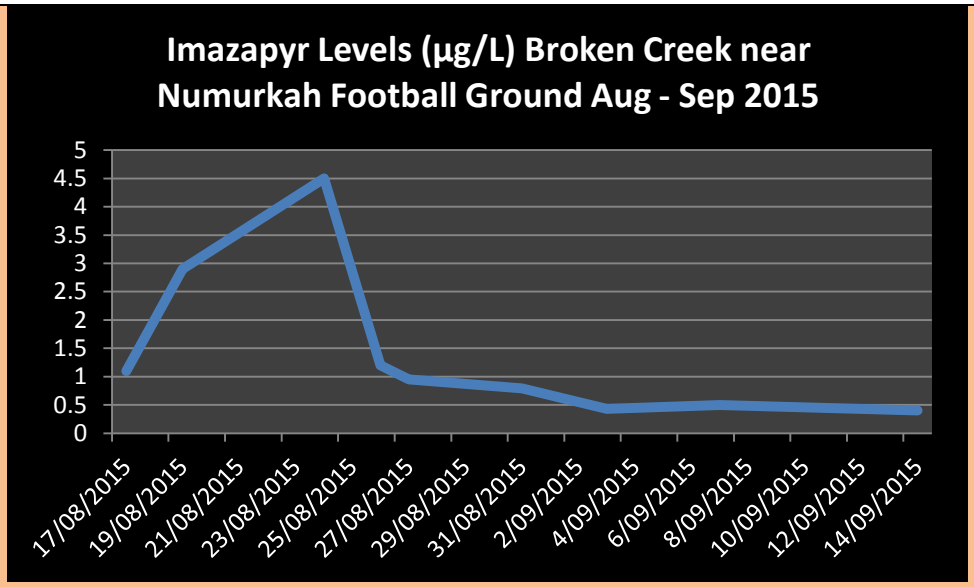
Total Pesticide Detections 2007-16: 25

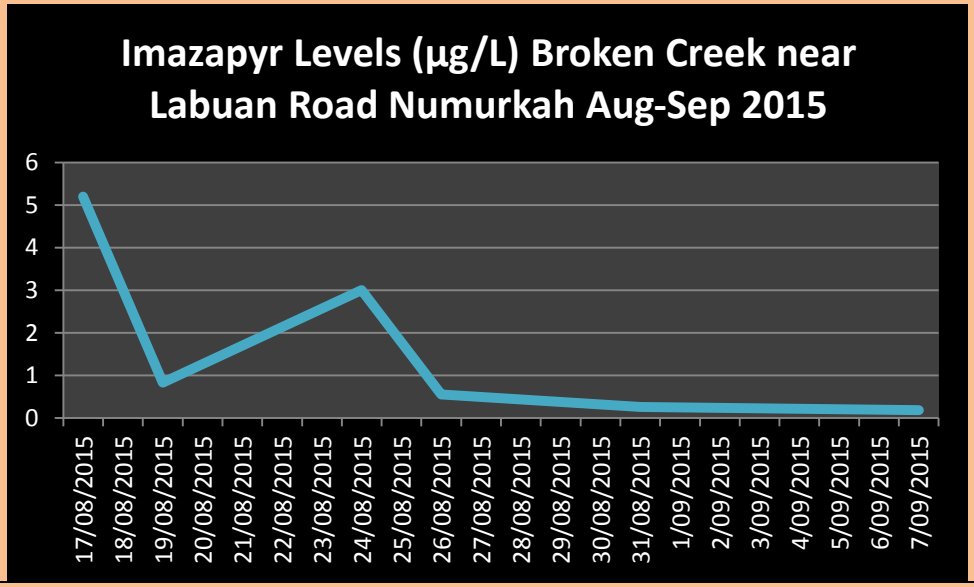
Incomplete Data



Average Goulburn Murray Water Detection Level: 1.5µg/L
Average Statewide Detection Level: 0.46µg/L
Average Goulburn Murray Water Level as % of ADWG: 0.017%
Average Statewide Level as % of ADWG: 0.98%







"Generally", Goulburn Valley Water test for pesticides used for aquatic weed control in drains, channels and waterways. Testing is conducted irregularly and can include Glyphosate, 2,4-D and Imazapyr. Positive Glyphosate samples were detected shortly after spraying for aquatic weeds, but generally well upstream from domestic water offtakes. As such, Glyphosate data was not included in this report.

Between July-October 2015 Goulburn Murray Water was involved in controversy regarding Imazapyr residues in drains and channels. The herbicide was more residual than expected and water supply to irrigators had to be delayed due to higher that anticipated residues. Imazapyr was also detected in waterways such as Broken Creek, which supplies the towns of Numrukah, Nathalia and Wunghnu with drinking water. Sample locations were generally in close proximity to water supply offtakes, 4 of which have been included in this report. Imazapyr detections further upstream in drains have not been included in this report. It should be also noted that Imazapyr has a very high guideline level 9000µg/L.

"HUNDREDS of northern Victorian farmers have missed the official start of the watering season after their channels were contaminated with chemicals. Residual traces of herbicide were found in 370km of channels in the Murray Valley, Shepparton, Central Goulburn and Rochester irrigation areas. About 400 Goulburn Murray Water customers hope to be able to use the water for irrigation, stock and even domestic use by the end of this week. GMW spokesman Daniel Irwin said the water corporation applied a herbicide to selected channels during winter with the active ingredient Imazapyr to treat the aquatic weed arrowhead." (Source Weekly Times Aug 27 2015)

Between 2004-6 Goulburn Murray Water tested for a range of pesticides in various channels and drains in Northern Victoria. Such tests have not been repeated since, even though one the highest pesticide levels recorded in Australia was detected at Kerang in 2006. (See ref: Pesticide Monitoring in Goulburn-Murray Waters Irrigation Supply Channels Covering the Six Irrigation Areas [2004 -2006 Irrigation Season Study Report] http://www.g-mwater.com.au/downloads/gmw/R_D/PESTICIDE_2004_2006_REPORT.pdf)

Goulburn Murray Water provide water to Goulburn Valley Water, who provide drinking water. A number of communities in northern Victoria rely on channel water for drinking water supplies. It should also be noted that Goulburn Valley Water do not test for Imazapyr.

Pesticides Types Detected: (1)

Broken Creek Numurkah

Imazapyr (25)

Most Frequent Detections

Imazapyr (25): Goulburn Murray Water Average*: 1.5µg/L	**Imazapyr: State Average. 1.5µg/L**

Five Highest Detections*:

Numerous small communities rely on channel water in northern Victoria. Drinking Water quality for such communities is provided by authorities such as Goulburn Valley Water. **According to GMW: "Water Resources within each supply system are allocated to various parties including urban authorities, irrigators and the Environment in accordance with the Water Act 2006 and all relevant state legislative bulk entitlement orders."**

1). Imazapyr 17/8/15 Numurkah 5.2µg/L. 0.06% Australian Drinking Water Guideline

2). Imazapyr 24/8/15 Numurkah 4.5µg/L. 0.05% Australian Drinking Water Guideline

3). Imazapyr 24/8/15 Numurkah 4.5µg/L. 0.05% Australian Drinking Water Guideline

4) Imazapyr 19/8/15 Numurkah 3µg/L. 0.03% Australian Drinking Water Guideline

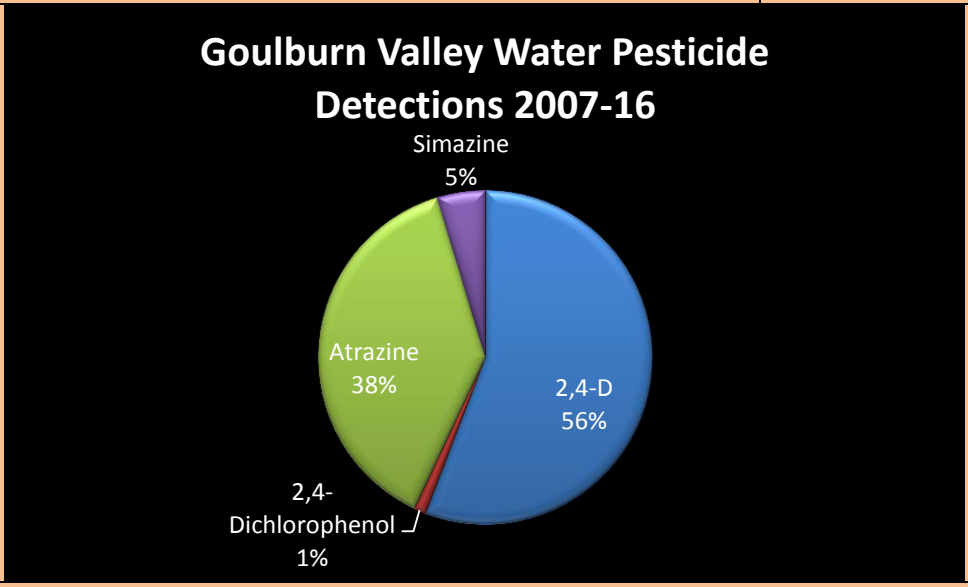
5) Imazapyr 19/8/15 Numurkah 3µg/L. 0.03% ADWG

Historical Data of Interest
Highest Pesticide Detections Goulburn Murray Water 2005-2017

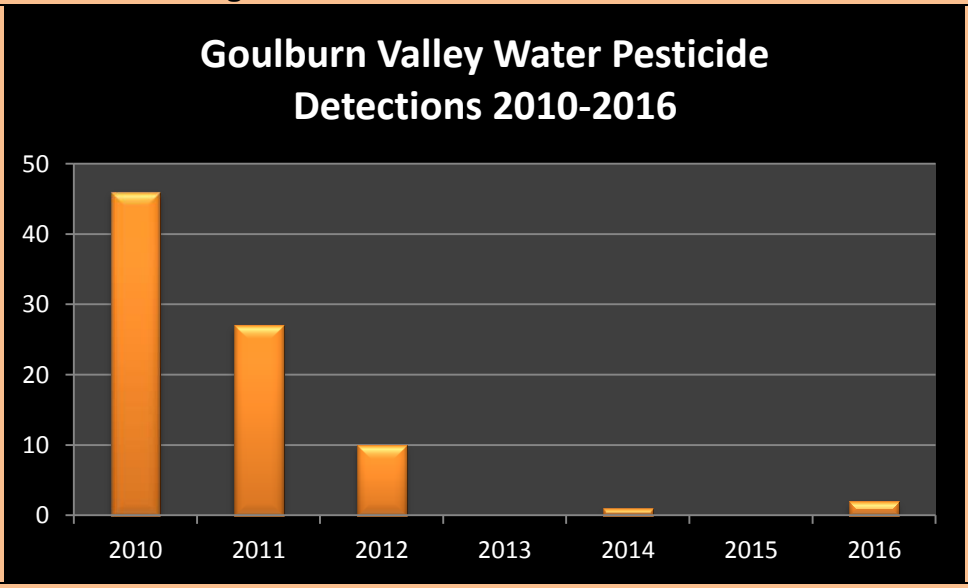
	Date	Location	Pesticide	Level Detected	Australian 2011 Guideline
1.	Oct 2005	Kerang Channel 14/2	Esfenvalerate	65µg/L	30µg/L
2.	8/5/06	Broken Creek	Glyphosate	160µg/L	1000µg/L
3.	2007	Goulburn Weir Backwater	Glyphosate	120µg/L	1000µg/L
4.	8/5/06	Broken Creek	Glyphosate	85µg/L	1000µg/L
5.	Dec 2005	Katamatite Channel 7/3	Atrazine	0.056 µg/L	20µg/L
6.	Mar 2006	Kerang Channel 14/2	Atrazine	0.05 µg/L	20µg/L
7.	Mar 2006	Goulburn Weir	Atrazine	0.048 µg/L	20µg/L
8.	Dec 2005	Katamatite Channel 7/3	Atrazine	0.045 µg/L	20µg/L
9.	Feb 2006	Goulburn Weir	Atrazine	0.044 µg/L	20µg/L
10.	April 2006	Tatura Channel 3/5	Atrazine	0.42µg/L	20µg/L
	Oct 2005	Kerang Channel 14/2	Bifenthrin	100µg/L	?
	Oct 2005	Kerang Channel 14/2	Taufalvinate	75µg/L	?

Goulburn Valley Water

Total Pesticide Detections 2007-16: 86



Average Goulburn Valley Water Detection Level: 1.03µg/L
Average Statewide Detection Level: 0.46µg/L
Average Goulburn Valley Water Level as % of ADWG: 3.65%
Average Statewide Level as % of ADWG: 0.98%



"Generally", Goulburn Valley Water tested for ~10-25 pesticides in raw and reticulated water at a number of locations between 2006-9 on 3-6 months or annual basis with 2,4-D and 2,4,6-T tested on a monthly basis. Testing regimes increased in June 2009 to 30 and 63 in some locations over November 2009 –

December 2009. Generally 40-60 pesticides now tested for on a quarterly basis.

Pesticides Types Detected: (4)

Channel 7/12/9 Girgarre Drinking Water Supply, polluted with 2,4-D for at least 4 months in 2010.

2,4-D (48)
Atrazine (33)
Simazine (4)
2,4-Dichlorophenol (1)

Most Frequent Detections

2,4-D (48): Goulburn Valley Water Average: 1.53µg/L	**2,4-D: State Average. 0.68µg/L**
Atrazine (33): Goulburn Valley Water Average: 0.33µg/L	**Atrazine: State Average. 0.16µg/L**
Simazine (4): Goulburn Valley Water Average: 0.92µg/L	**Simazine: State Average 0.16µg/L**

Five Highest Detections:

1). 2,4-D 10/6/10 Girgarre 4µg/L. 13.3% Australian Drinking Water Guideline

2). 2,4-D 8/7/10 Girgarre 3.7µg/L. 12.3% Australian Drinking Water Guideline

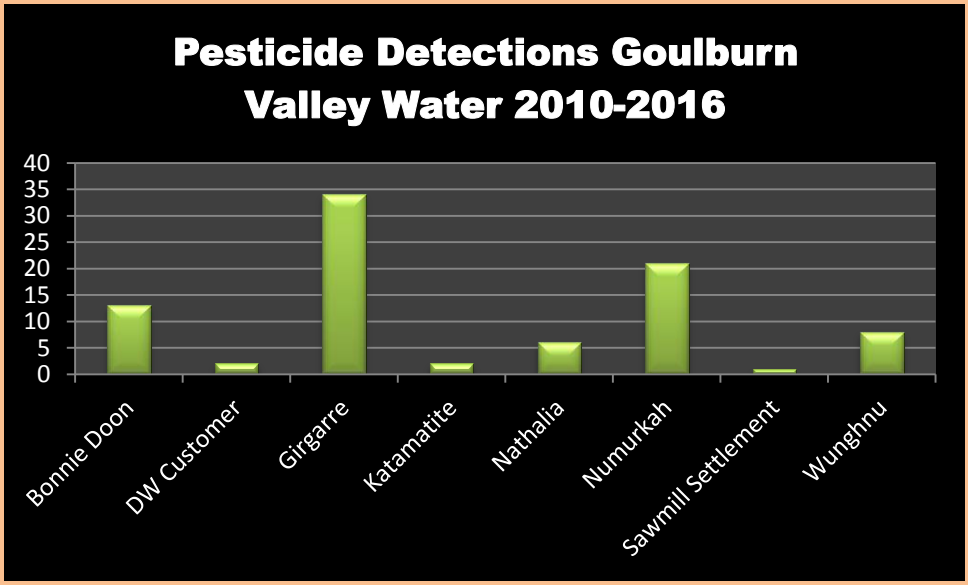
3). 2,4-D 8/7/10 Girgarre 3.6µg/L. 12% Australian Drinking Water Guideline

4) 2,4-D 17/6/10 Girgarre 3.4µg/L.

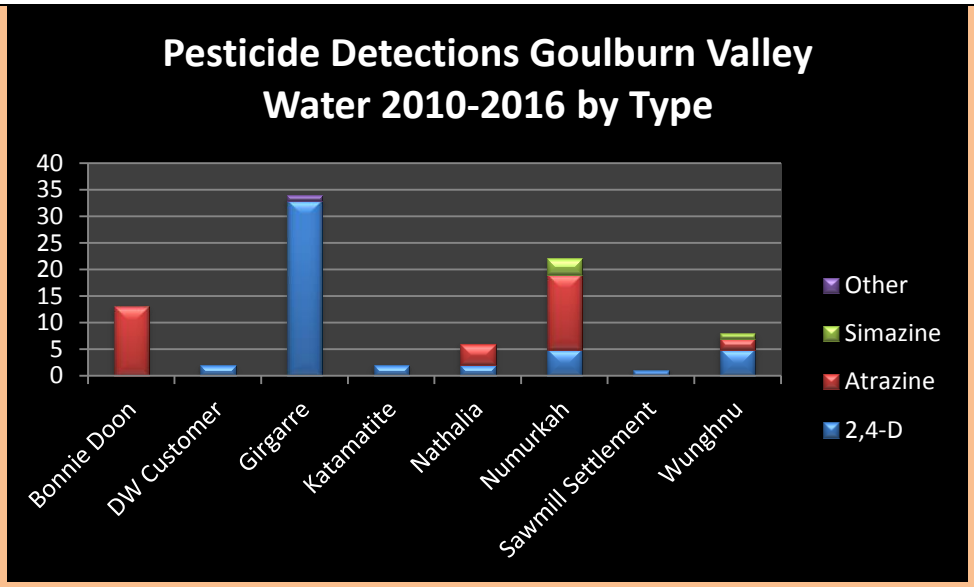
Girgarre: Channel 7/12/9, near the offtake to the Girgarre Water Treatment Facility. Were residents informed that the channel water was polluted with 2,4-D for four months in 2010? What was the source of the pollution? Was a Notice of Contravention for Water Protection *(Water Act 1989. Section 169(1): Notice of contravention for water supply protection). Was 2,4-D banned for use in this channel supply? If not, why?*

11.3% Australian Drinking Water Guideline

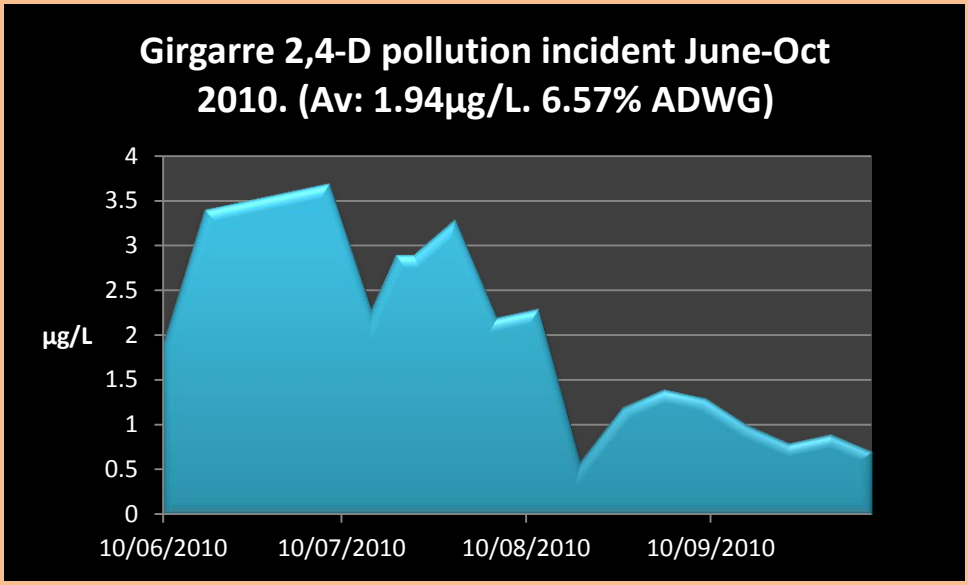
5) 2,4-D 29/7/10 DW Customer 3.3µg/L. 11% Australian Drinking Water Guideline



Girgarre easily accounted for most detections due to 2010, 2,4-D incident. However, an equivalent amount of detections occurred in water supplies from Broken Creek. Nathalia, Numurkah and Wunghnu all source their drinking water from Broken Creek.



2,4-D was detected in 7 locations, Atrazine detected in 4. Almost all detections occurred between 2010-2012.



2,4-D detections in Girgarre channel supply for approximately 4 months in 2010. The average detected levels over the four month period were 1.94µg/L (6.6% of the Australian Drinking Water Guideline for 2,4-D). It is also unclear what percentage of the 2,4-D was removed by the treatment process used at Girgarre. It appears that activated carbon was not used. It is also unclear the level of dioxins contained in the 2,4-D that came down the channel. Dioxins, some of the most toxic substances known, can be created during the 2,4-D manufacturing process. ***"An urgent review is underway after a Four Corners investigation found elevated levels of dangerous dioxins in a generic version of 2,4-D, one of Australia's most widely used herbicides. Dioxins are one of the most deadly chemical compounds in the world, but Australian authorities do not routinely test for them. One scientist said the product tested by Four Corners, which was***

imported from China, had one of the highest dioxin readings for 2,4-D in the last 10 to 20 years, and could pose potential health risks…"
http://www.abc.net.au/news/2013-07-22/four-corners-dangerous-dioxins/4833848

Nagambie Water supply – Broken Creek.

Chlorophenols

Included with the Freedom of Information request from Goulburn Valley Water were detections for 2,4,5 Trichlorophenol (8 detections) (highest level: 460 µg/L 18/10/11 Strathbogie)and 2,4-6 Trichlorophenol (96 detections) (highest level 5.2µg/L: Strathbogie 16/11/15).

Also included were 36 detections of petroleum based chemicals eg Toulene (highest level 5.6µg/L at Violet Town 5/7/10). Hundreds of detections of Dibromochloromethane, a disinfection byproduct were also included.

According to the Australian Drinking Water Guidelines

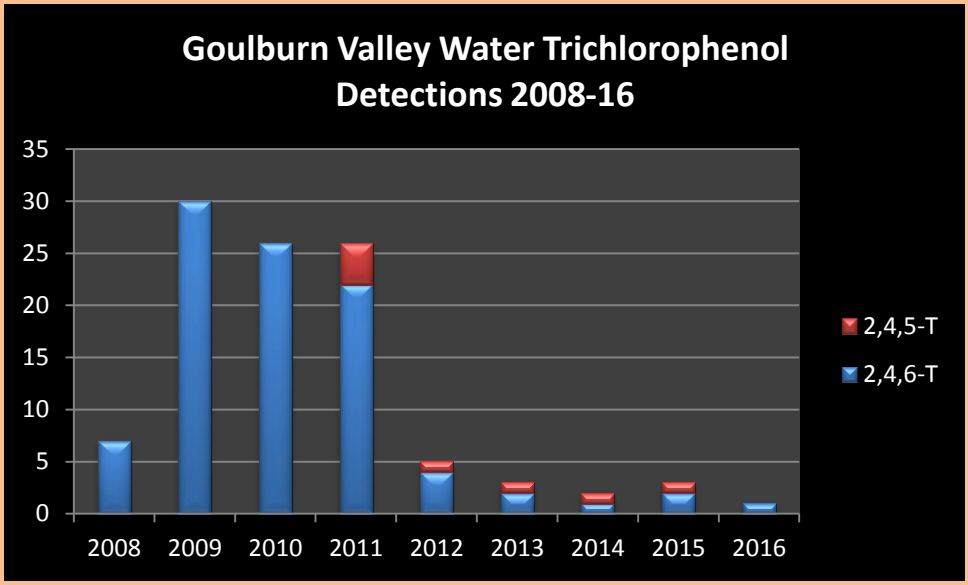
"Chlorophenols may be present in drinking water as a result of chlorination of water that contains phenol or lower chlorophenols, or from contamination of water sources. Chlorination of water containing natural organic compounds can

produce very low concentrations of chlorophenols. Degradation of phenoxy herbicides such as 2,4,5-T and 2,4-D also generates chlorophenols…

Chlorophenols are used commercially as preservatives, moth-proofing agents, germicides and anti-mildew agents…. No data are available on concentrations of chlorophenols in Australian drinking waters. If present at all, it is likely that concentrations would be extremely low."

2,4,6 Trichlorophenol is listed under the 2002-3 Goulburn Valley Water – Water Quality Annual Report as *"Health-Related Organics-Organic chemicals that can impact on the health of consumers are rarely present in drinking water supplies, but could potentially be present in raw water sources as a result of accidental spills or misuse."*

Due to the unknown source of the Trichlorophenols, these detections were not included in the final pesticide data in this report, but are assumed to be a byproduct of disinfection. Average level of 2,4,6 Trichlorophenol detected 2008-16 in 33 locations: 0.93µg/L. Average level 2,4,5-Trichlorophenol detected 2011-15 in 4 locations: 72.87µg/L.



Trichlorophenol Detections Goulburn Valley Water 2009-15		
Town	**2,4,6-Trichlorophenol**	**2,4,5-Trichlorophenol**
Avenel	**2**	**0**
Barmah	**1**	**0**
Broadford	**3**	**2**
Buxton	**1**	**0**
Cobram	**1**	**0**
Colbinabbin	**1**	**0**
Goulburn Weir	**7**	**0**
Katamatite	**1**	**0**
Katunga	**3**	**0**

Kirwans Bridge	**6**	**0**
Kyabram	**1**	**0**
Longwood	**5**	**0**
Mangalore	**1**	**0**
Mansfield	**1**	**0**
Marysville	**0**	**1**
Merrigum	**1**	**0**
Merrijig	**2**	**0**
Molesworth	**1**	**0**
Murchison	**1**	**0**
Nagambie	**6**	**0**
Numurkah	**1**	**0**
Pyalong	**9**	**1**
Sawmill Settlement	**1**	**0**
Seymour	**2**	**0**
Stanhope	**1**	**0**
Strathbogie	**24**	**4**
Strathmerton	**0**	**1**
Tallarook	**2**	**0**
Thornton	**1**	**0**
Tongala	**1**	**0**
Trawool	**1**	**0**
Waterford Park	**1**	**0**
Woods Point	**3**	**0**
Wunghnu	**1**	**0**
Yea	**2**	**0**

In early 2010, this plantation at Kilmore East was sprayed with Simazine by contractors working for Midway Plantations Pty Ltd. In August 2010, Simazine was detected at 20µg/L in a farm dam just downstream of the plantation. Subsequent testing by Goulburn Valley Water did not detect Simazine in Sunday Creek which flows into the Goulburn River near Seymour 20km downstream. This event is the highest level of Simazine detected in a Victorian waterway.

Wunghnu Water Supply, piped in from Broken Creek.

Historical Data of Interest
20 Highest Pesticide Detections
Goulburn Valley Water 1972-2016

	Date	Location	Pesticide	Level Detected	Australian 2011 Guideline
1.	1972	Nathalia Broken Creek	Amitrole *	430µg/L	0.9µg/L
2.	1974/5	Broken Creek	Amitrole *	7.3µg/L	0.9µg/L
3.	1974/5	Broken Creek	Amitrole *	6.3µg/L	0.9µg/L
4.	1974/5	Broken Creek	Amitrole *	5.5µg/L	0.9µg/L
5.	13/12/73	Broken Creek	Amitrole *	3.7µg/L	0.9µg/L
6.	1974/5	Broken Creek	Amitrole *	3.7µg/L	0.9µg/L
7.	1974/5	Broken Creek	Amitrole *	3.7µg/L	0.9µg/L
8.	29/11/73	Broken Creek	Amitrole *	2µg/L	0.9µg/L
9.	20/12/73	Broken Creek	Amitrole *	2µg/L	0.9µg/L
10.	22/6/06	Broken Creek Numurkah	2,4-D	17µg/L	30µg/L
11.	1980?	Broken Creek	Dieldrin *	0.16µg/L	0.3µg/L
12.	5/10/05	Sunday Creek Reservoir	Pentachlorophenol	2µg/L	10µg/L
13.	6/4/95	Broken Creek	Glyphosate**	170µg/L	1000µg/L
14.	8/5/06	Broken Creek	Glyphosate**	160µg/L	1000µg/L
15.	10/6/10	Girgarre CG 7/12/9	2,4-D	4µg/L	30µg/L
16.	8/7/10	Girgarre CG 7/12/9	2,4-D	3.7µg/L	30µg/L
17.	8/7/10	Girgarre CG 7/12/9	2,4-D	3.6µg/L	30µg/L
18.	17/6/10	Girgarre CG 7/12/9	2,4-D	3.4µg/L	30µg/L
19.	8/7/10	Girgarre CG 7/12/9	2,4-D	3.4µg/L	30µg/L
20.	29/7/10	DW Customer	2,4-D	3.3µg/L	30µg/L

***Sampling by State Rivers & Water Supply Commission**

****Sampling by Goulburn Murray Water**

Grampians Wimmera Mallee Water

Total Pesticide Detections 2007-16: *"No Data No Problem?"*	0

"Generally", Grampians Wimmera Mallee Water have tested for 18 pesticides and metabolites, almost all of which are organochlorines which have not been used in Australia for years. Organochlorines are known to last for long periods of time and can be remobilised into the water column after rainfall. Many are highly toxic and bioaccumulate, hence the reason to test for them.

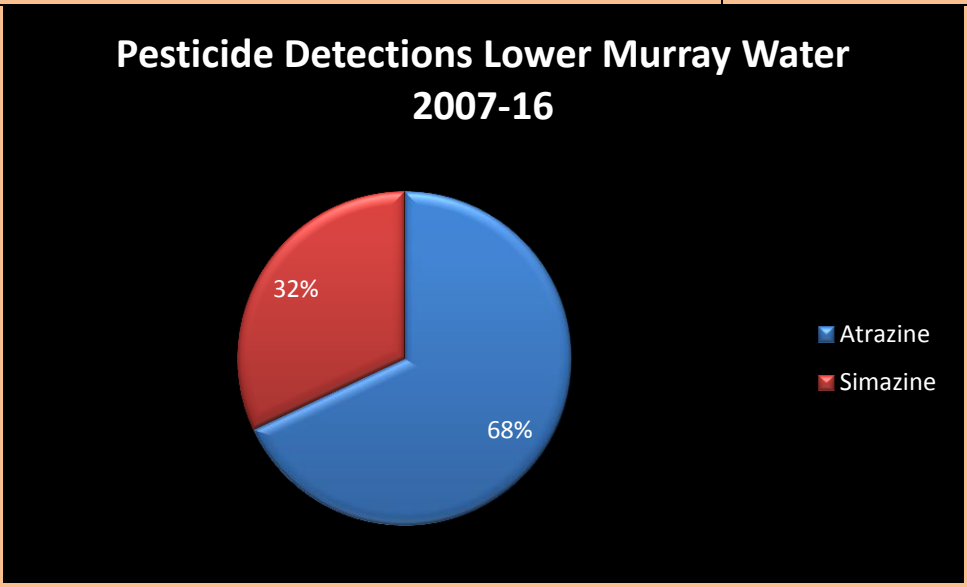
In terms of currently registered pesticides, Grampians Wimmera Water test for none.

In terms of the frequency of testing, it would appear that Grampians Wimmera Mallee Water test for pesticides at each of their locations, once a year, usually between February and April.

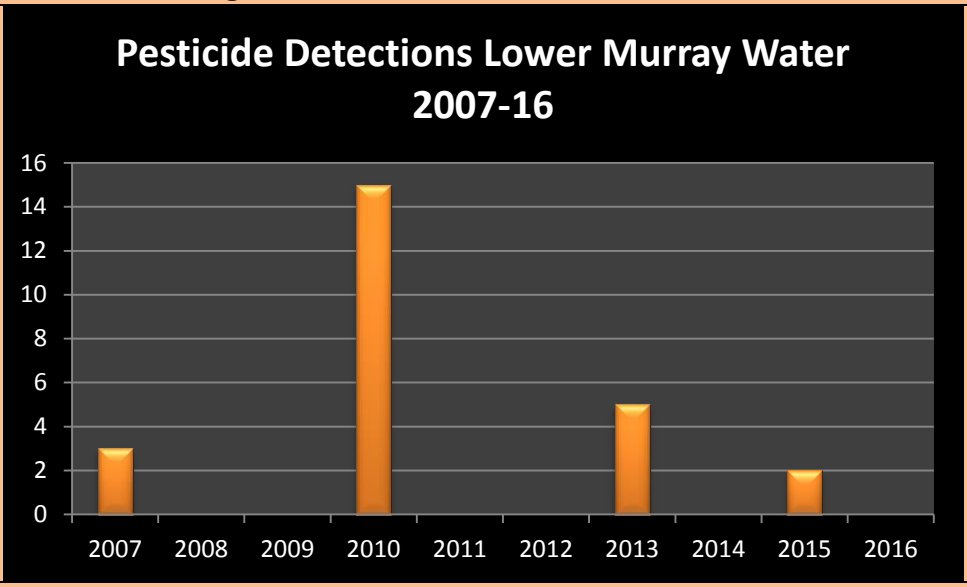
Communities are supplied water by a variety of sources including: the Wimmera Mallee Channel System, ground water, Northern Mallee Pipeline, Normanville Pipeline and Lake Bellfield. Ararat is supplied by Langi Ghiran Reservoir and Picnic Road Reservoir.

Lower Murray Water

Total Pesticide Detections 2007-16: 21



Average Lower Murray Water Detection Level: 0.04µg/L
Average Statewide Detection Level: 0.46µg/L
Average Lower Murray Water Level as % of ADWG: 0.18%
Average Statewide Level as % of ADWG: 0.98%



"Generally", Lower Murray Water test for 27 pesticides on a quarterly basis at 10 locations. Eight Currently registered pesticides include: Atrazine, Chlorothalonil, Chlorpyrifos, Chlorpyrifos-Methyl, Glyphosate, Methidathion, Oxyfluorfen and Simazine

Pesticides Types Detected: (2)	Atrazine (13) Simazine (8)

Most Frequent Detections

Atrazine (13): Lower Murray Water Average: 0.02µg/L	Atrazine: State Average. 0.16µg/L
Simazine (8): Lower Murray Water Average: 0.06µg/L	Simazine: State Average. 0.16µg/L

Four Highest Detections:

15 of the 25 detections occurred on November 3rd and 4th 2010. Simazine was detected at 8 and Atrazine 6 separate locations, 250km apart. Does this mean that Simazine had polluted a continuous 250km stretch of the Murray River on the same days? This "event" was repeated in February 2017.

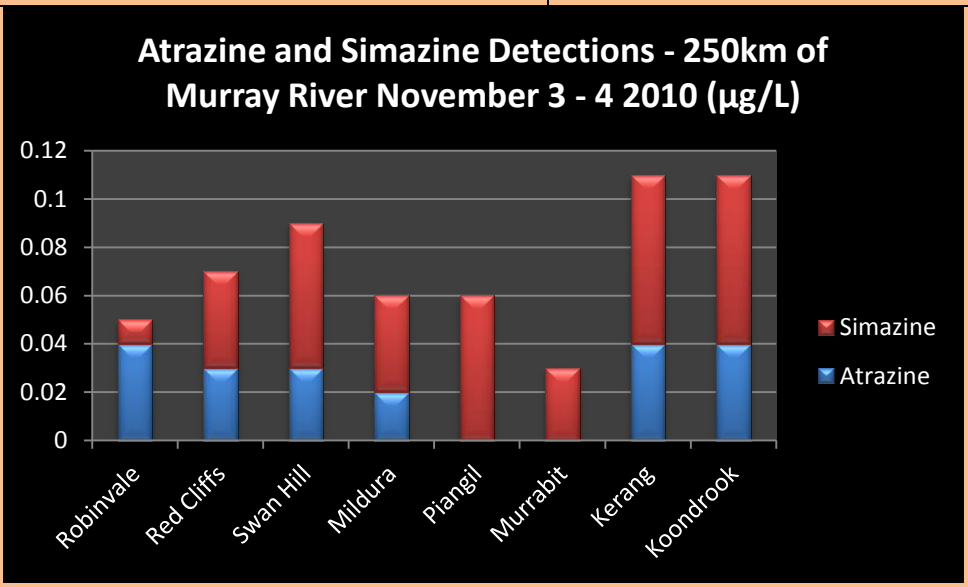
1). Simazine 3/11/10 Robinvale 0.1µg/L. 0.5% Australian Drinking Water Guideline

2). Simazine 4/11/10 Kerang 0.07µg/L. 0.35% Australian Drinking Water Guideline

3). Simazine 4/11/10 Koondrook 0.07µg/L. 0.35% Australian Drinking Water Guideline

4) Simazine 3/11/10 Swan Hill 0.06µg/L. 0.3% Australian Drinking Water Guideline

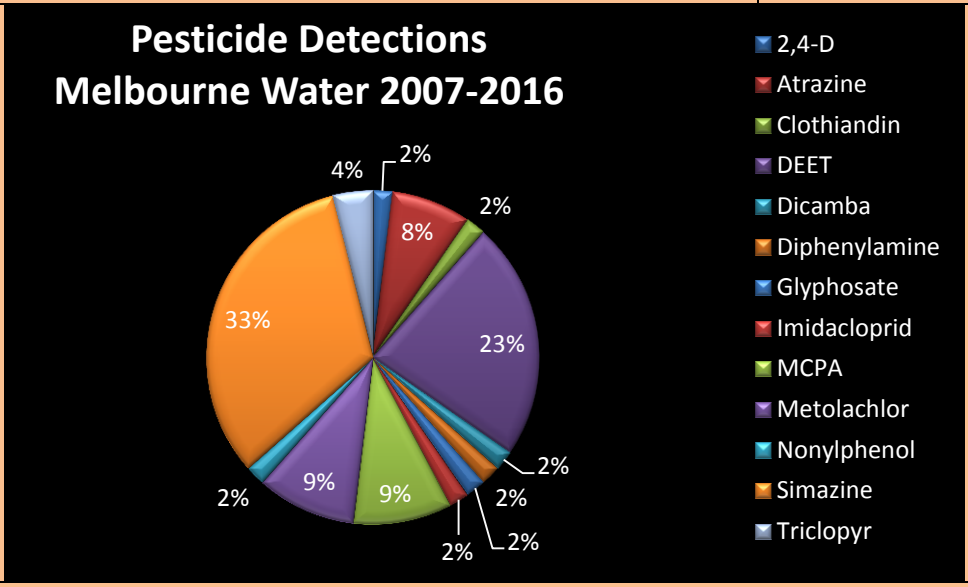
5) Simazine 3/11/10 Piangil 0.06µg/L. 0.3% Australian Drinking Water Guideline



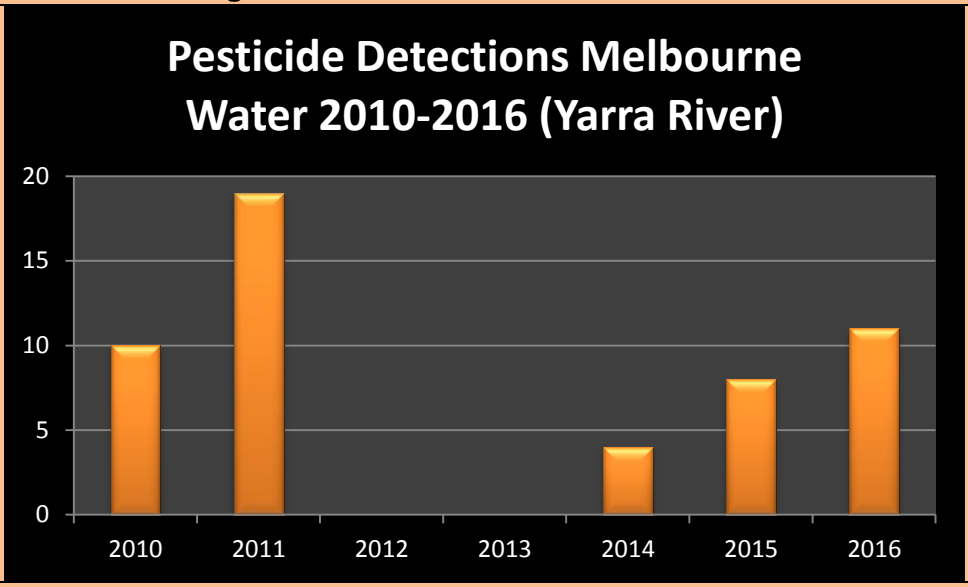
In 1972 an Amitrole level of 320µg/L was detected at Swan Hill in the Murray River. This level is 355 times above the 2011 ADWG. Goulburn Murray Water detected Esfenvalerate at 2.167 times the ADWG in October 2005 at Kerang Channel 14/2. Very high levels of Bifenthrin and Taufluvalinate also found.

Melbourne Water

Total Pesticide Detections 2007-16: 52



Average Melbourne Water Detection Level: 0.08µg/L
Average Statewide Detection Level: 0.46µg/L
Average Melbourne Water Level as % of ADWG: 0.28%
Average Statewide Level as % of ADWG: 0.98%



In terms of pesticides, from 1996 to January 2005. Melbourne Water were only testing for a range of organochlorines* and 2,4-D. Generally speaking, there were

two pesticide testing regimes per year across all their reservoirs with the tests concentrating on Aldrin, Chlordane, Lindane, DDT, Dieldrin, Heptachlor, Heptachlor Epoxide and 2,4-D. Atrazine was only included in the testing regimes from August 1 2005. In mid 2008, testing increased to 38 pesticides, which again was increased to 136 pesticides for a brief time around 2010.
Melbourne Water currently test for ~180 pesticides at the Yarra River Offtake 6 times a year (sometimes more). Other water supplies such as Silvan, Greenvale Tarago, Dromana, Greenvale etc are generally tested every 3-6 months for between 30-60 pesticides.

Pesticides Types Detected: (13)

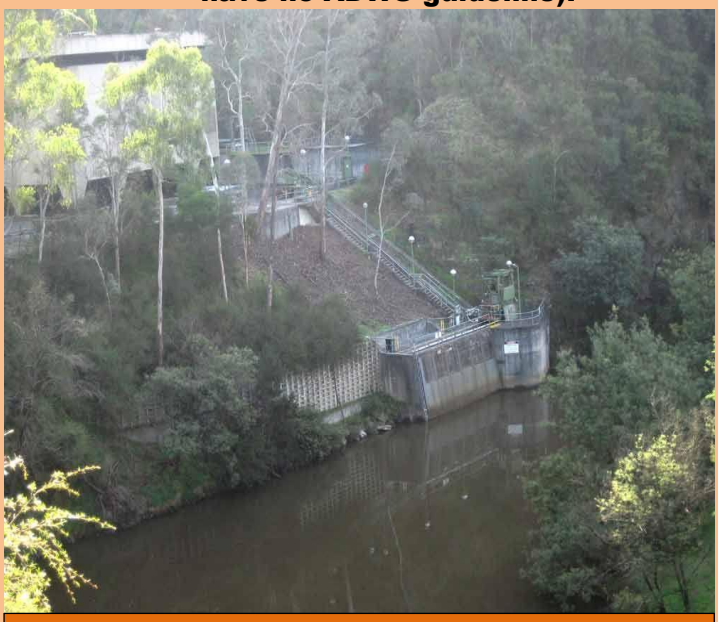
Strawberry spraying Woori Yallock Creek

Simazine (17)
DEET (12)
MCPA (5)
Metolachlor (5)
Atrazine (4)*
Triclopyr (2)
2,4-D (1)
Clothiandin (1)
Dicamba (1)
Diphenylamine (1)
Glyphosate (1)
Imidacloprid (1)
Nonylphenol (1)

Most Frequent Detections

Simazine (17): Melbourne Water Average: 0.05µg/L	**Simazine: State Average. 0.16µg/L**
DEET (12): Melbourne Water Average: 0.08µg/L	**DEET: State Average. 0.08µg/L**
MCPA (5): Melbourne Water Average: 0.08µg/L	**MCPA: State Average 0.19 µg/L**
Metalochlor (5): Melbourne Water Average: 0.08µg/L	**Metalochlor: State Average. 0.05µg/L**
Atrazine (4): Melbourne Water Average: 0.11µg/L	**Atrazine: State Average 0.16µg/L**

Five Highest Detections (31% of MW detections have no ADWG guideline):



Pumps at Yering Gorge. Water is pumped out of the Yarra at this location into Sugarloaf Reservoir.

1). Triclopyr 4/6/16 Yarra River Offtake 0.4µg/L. 2% Australian Drinking Water Guideline

2). Simazine 8/5/15 Yarra River Offtake 0.21µg/L. 1.05% Australian Drinking Water Guideline

3). Atrazine 11/8/11 Yarra River Offtake 0.188µg/L. 0.94% Australian Drinking Water Guideline

4) Atrazine14/7/11 Yarra River Offtake 0.173µg/L. 0.865% Australian Drinking Water Guideline

5) Simazine 11/2/15 Yarra River Offtake 0.14µg/L. 0.7% Australian Drinking Water Guideline

The Yarra River offtake to Sugarloaf had the most pesticide detections of any location in Victoria between 2007-16. All of these detections occurred after 2010.

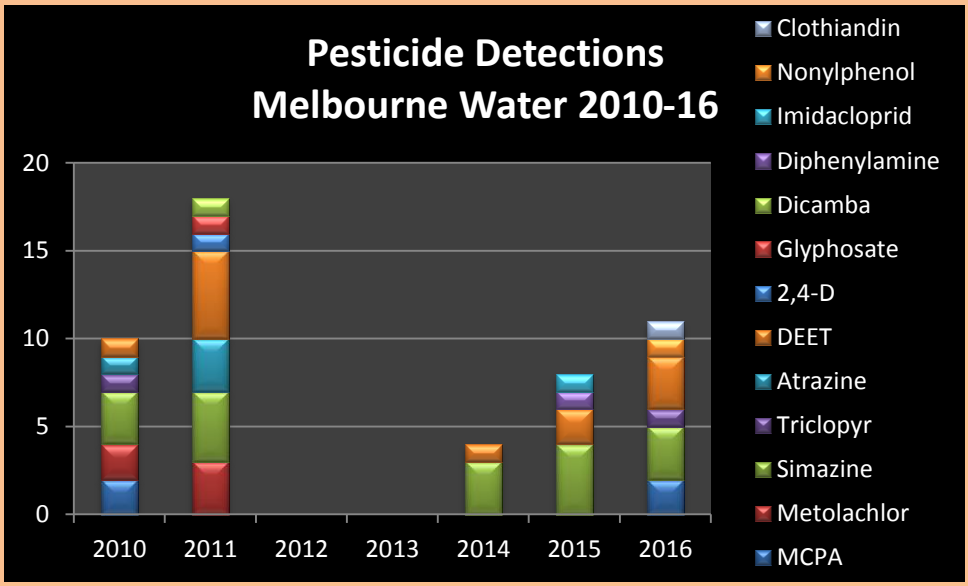
A quarter of all Victorian detections of Simazine (2007-16) occurred at the Yarra River offtake. 9% of all pesticide detections 2007-16 were detected at the Yarra River Sugarloaf offtake.

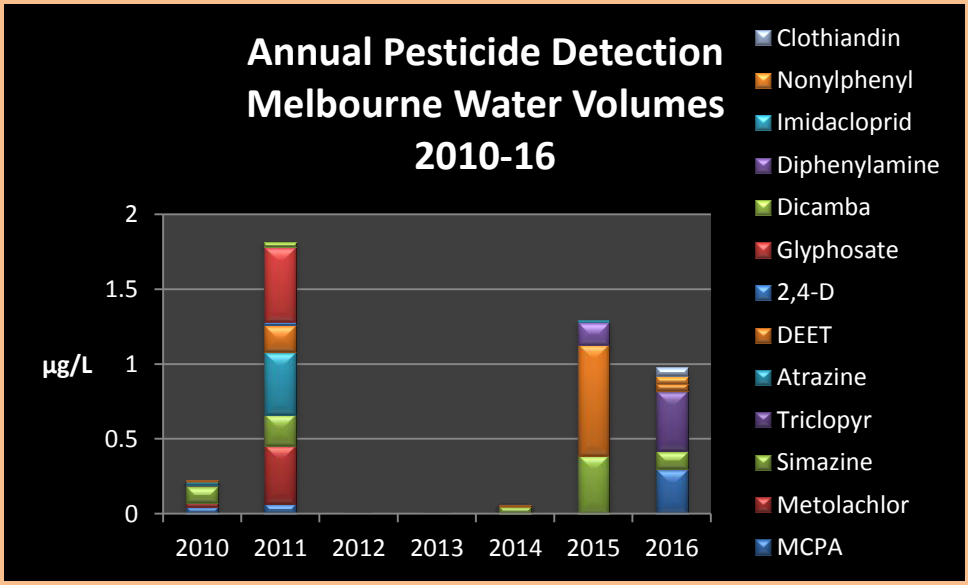
All DEET detections for Victoria are in Yarra River catchment. Highest DEET detection 0.73µg/L (12/10/15), possibly highest level recorded in a domestic water supply in Australia.

The state's only detections for Neonicotinoids, Imidacloprid and Clothiandin also at the Yarra River offtake. The Clothiandin detection 0.06 µg/L (6/12/16), possibly highest level recorded in Australian drinking water supply.

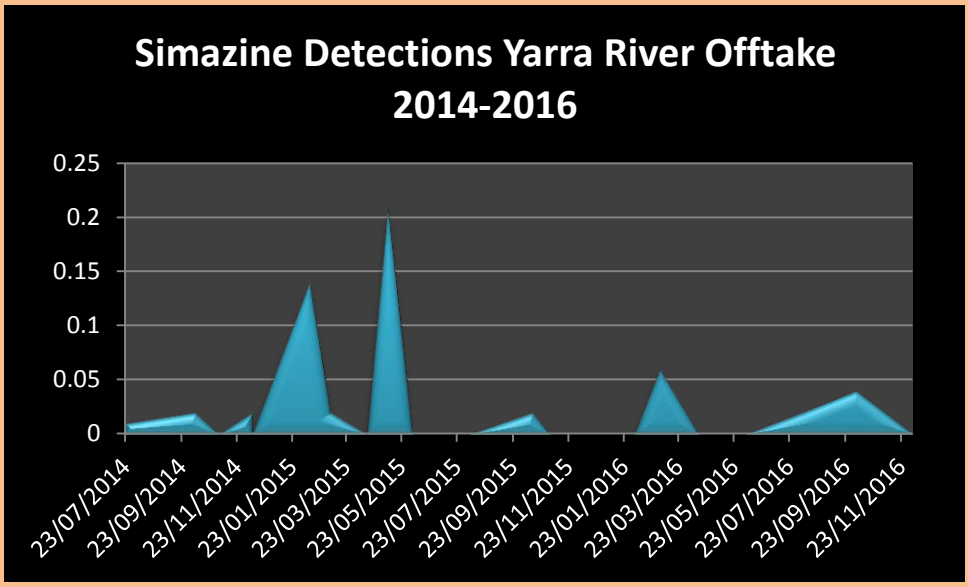
Diphenylamine detection 0.15µg/L (11/2/15) possibly highest level recorded in an Australian water supply. Nonylphenol detection 0.05 µg/L also possibly highest level recorded in Australian water supply.

Sugarloaf Reservoir. Water is pumped from the Yarra into Sugarloaf. Sugarloaf is also supplied from Maroondah Dam. Water from Sugarloaf is then treated at Winneke Treatment Plant. Melbourne Water does not test water stored in Sugarloaf for pesticides.

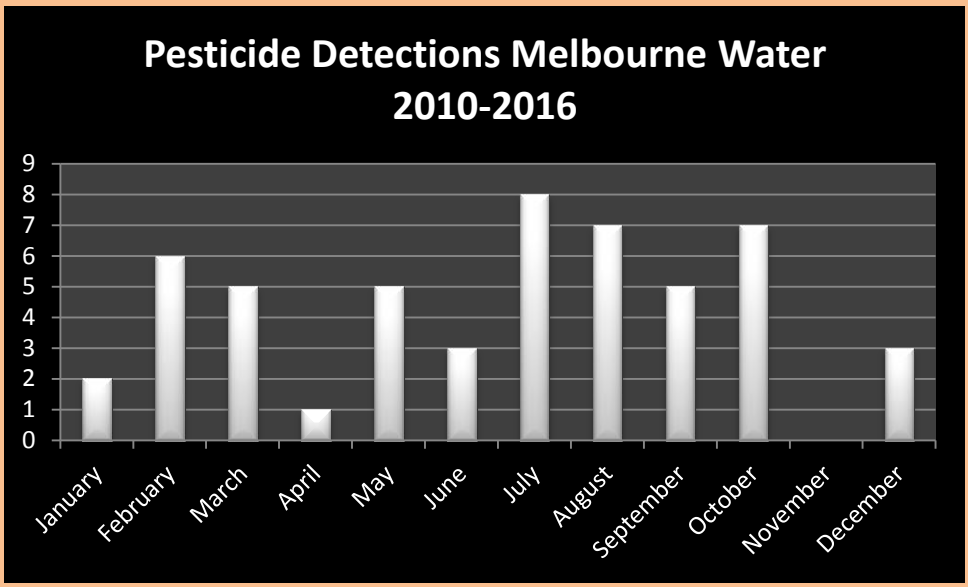




13 different pesticides have been detected at the offtake to Sugarloaf Reservoir, between 2010-16, highlighting the myriad of farming practices upstream.



Simazine detections <0.1µg/L should be investigated by Melbourne Water. Simazine is frequently detected in the Yarra River and throughout the Melbourne region, highlighting the high runoff properties of this herbicide.



Pesticide Detections in the Yarra appear to peak slightly between July to October.

Melbourne Water have implemented more strenuous pesticide monitoring since 2010. Two studies previous and during this time highlighted the number of pesticides detected in waterways upstream of the offtake to Sugarloaf Reservoir. Over 40 pesticides were detected in these studies.

The key studies were: ***Effects of Pesticides Monitored with Three Sampling Methods in 24 Sites on Macroinvertebrates and Microorganisms Environ. Sci.***

Technol., 2011, 45 (4), pp 1665–1672)+ (Supporting Information for the paper: Effects of Pesticides Monitored With three Sampling Methods in 24 Sites on Macroinvertebrates and Microorganisms' published in Environmental Science and Technology (January 2011) and Melbourne Water and DPI Agrochemicals in Port Phillip Catchment Project Report 2009-10

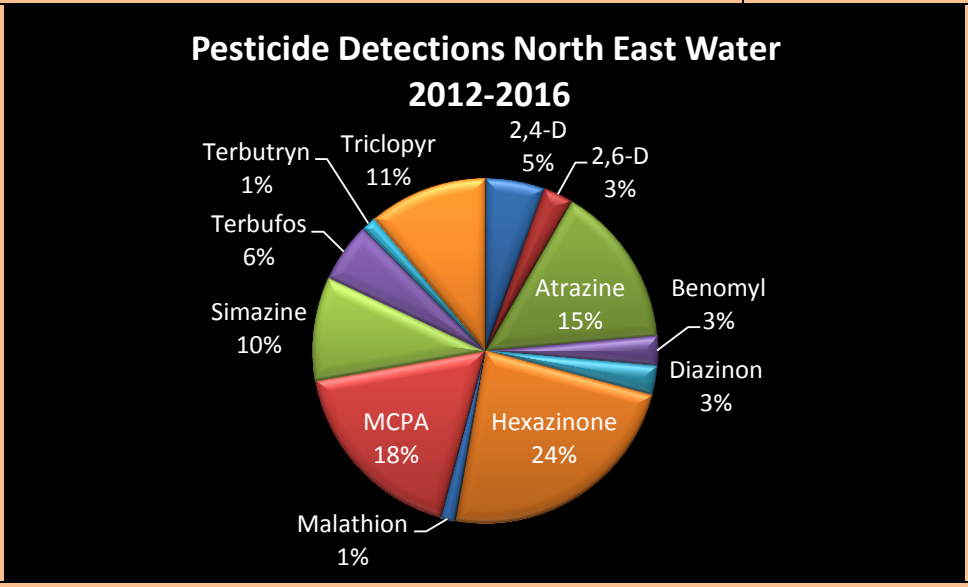
The following list shows the twenty highest pesticide detections upstream or at the Sugarloaf Offtake and other locations within the Melbourne Water network. Only FIVE were detected by Melbourne Water. ****refers to data collected in 2008 (published in 2011) Effects of Pesticides Monitored with Three Sampling Methods in 24 Sites on Macroinvertebrates and Microorganisms. **Refers to DPI Port Phillip Catchment Project***

Historical Data of Interest
Highest Pesticide Detections Melbourne Water 2000-2017

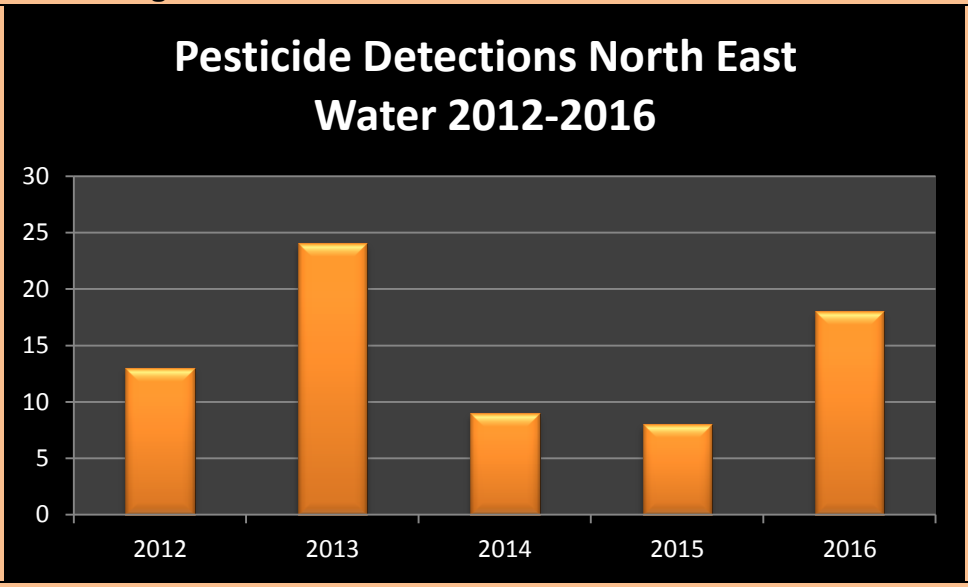
	Date	Location	Pesticide	Level Detected	Australian 2011 Guideline
1.	2008/2011*	Yarra River u/s Sugarloaf Reservoir	Simazine	15µg/L	20µg/L
2.	2008/2011*	Yarra River u/s Sugarloaf Reservoir	Fipronil	0.22µg/L	0.7µg/L
3.	2008/2011*	Sheep Station Creek	Pirimicarb	1.4µg/L	7µg/L
4.	2008/2011*	Yarra River u/s Sugarloaf Reservoir	Methiocarb	1.2µg/L	7µg/L
5.	7/2/00	Johns Hill Plant	Aldrin	0.02µg/L	0.3µg/L
6.	7/2/00	Kallista	Heptachlor	0.013 µg/L	0.3µg/L
7.	2008/2011*	Stringybark Creek	Simazine	0.67µg/L	20µg/L
8.	2008/2011*	Sheep Station Creek	Iprodione	3µg/L	100µg/L
9.	2008/2011*	Woori Yallock Creek	Propargite	0.15µg/L	7µg/L
10.	4/10/16	Yarra River @ Sugarloaf Offtake	Triclopyr	0.4µg/L	20µg/L
11.	2008/2011*	Yarra River u/s Sugarloaf Reservoir	Atrazine	0.31µg/L	20µg/L
12.	2008/2011*	Yarra River u/s Sugarloaf Reservoir	Endosulfan	0.3µg/L	20µg/L
13.	2008/2011*	Cockatoo Creek	Propargite	0.1µg/L	7µg/L
14.	2008/2011*	Yarra River u/s Sugarloaf Reservoir	Dimethoate	0.094µg/L	7µg/L
15.	8/5/15	Yarra River @ Sugarloaf Reservoir	Simazine	0.14µg/L	20µg/L
16.	2008/2011*	Watts River	Dieldrin	0.003µg/L	3µg/L
17.	2008/2011*	Yarra River @ Sugarloaf Reservoir	Atrazine	0.188µg/L	20µg/L
18.	10/12/09**	Spadonis Reserve	Dimethoate	0.061µg/L	7µg/L
19.	14/7/11	Yarra River @ Sugarloaf Offtake	Atrazine	0.173µg/L	20µg/L
20.	22/10/09**	Little Yarra River	Simazine	0.16µg/L	20µg/L

North East Water

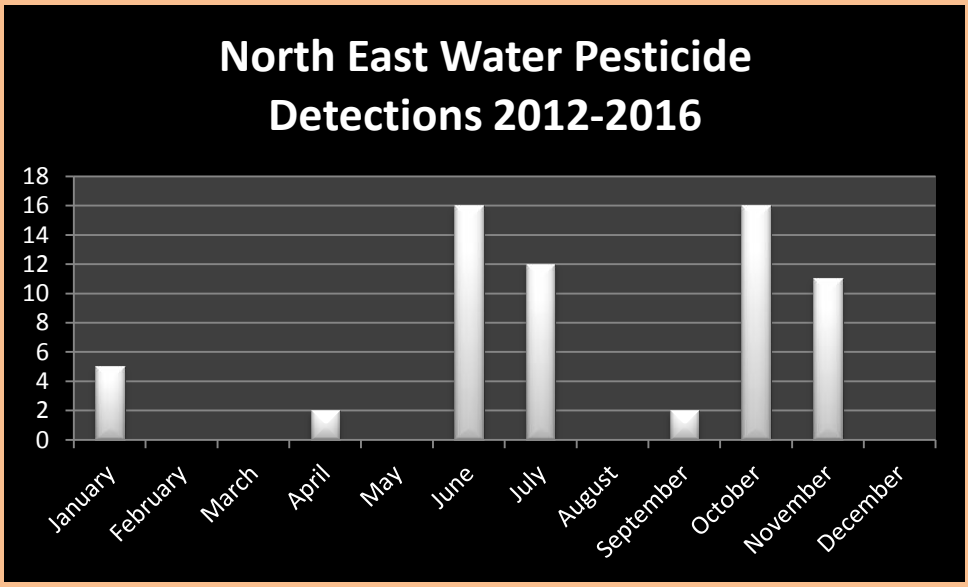
Total Pesticide Detections 2007-16:	72



Average North East Water Detection Level: 0.02µg/L
Average Statewide Detection Level: 0.46µg/L
Average North East Water Level as % of ADWG: 0.17%
Average Statewide Detection Level as % of ADWG: 0.98%



North East Water test for a wide range of pesticides usually twice a year, but quarterly at Yackandandah and annually at Eskvale and Harrietville.



Pesticides Types Detected: (12)

April 2006, Stanley Range pine plantation logging, followed by application of Hexazinone

Hexazinone (17)
MCPA (13)
Atrazine (11)
Triclopyr (8)
Simazine (7)*
2,4-D (4)
Terbufos (4)
2,6-D (2)
Benomyl (2)
Diazinon (2)
Malathion (1)
Terbutryn (1)

Most Frequent Detections

Hexazinone (17): North East Water Average: 0.03µg/L	**Hexazinone: State av. 0.04µg/L**
MCPA (13): North East Water Average: 0.02µg/L	**MCPA: State av. 0.19µg/L**
Atrazine (11): North East Water Average: 0.02µg/L	**Atrazine: State av 0.16 µg/L**
Triclopyr (8): North East Water Average: 0.02µg/L	**Triclopyr: State av. 0.12µg/L**
Simazine (7): North East Water Average: 0.04µg/L	**Simazine: State average 0.16µg/L**

Five Highest Detections:

"Terbufos is an extremely toxic organophosphate insecticide...

It also is suspected of having chronic effects as well. #EXTOXNET states "slow thinking, memory loss, irritability, delayed reaction times, and anxiety have been noted in workers chronically exposed to organophosphates like terbufos (#EXTOXNET). Animal studies do not show negative developmental, carcinogenic, or reproductive effects (#EXTOXNET)." http://www.toxipedia.org/display/toxipedia/Terbufos

1). Terbufos 24/10/16 Corryong WTP 0.02µg/L. 2.22% Australian Drinking Water Guideline

2). Terbufos 24/10/16 Tawonga Basin 0.02µg/L. 2.22% Australian Drinking Water Guideline

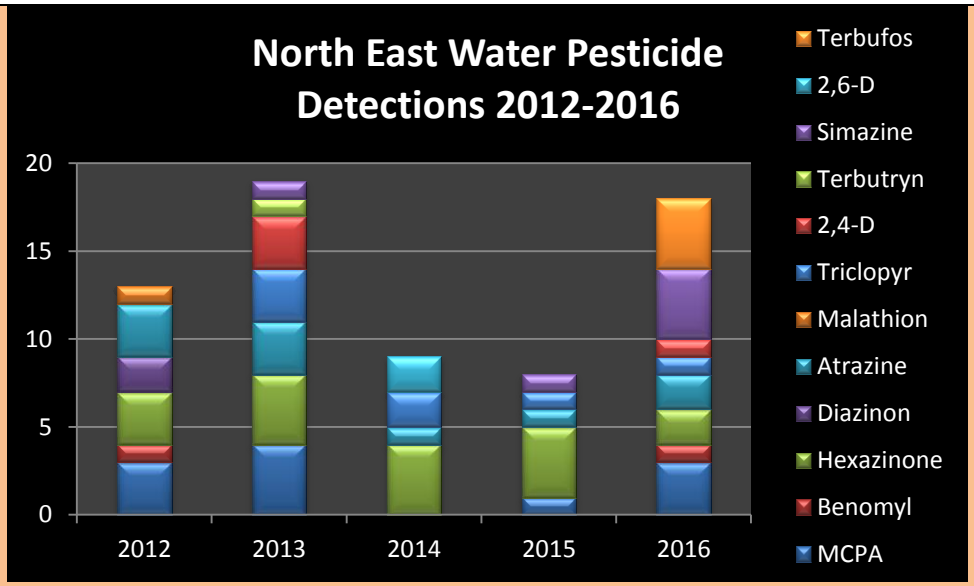
3). Terbufos 12/10/16 Reserve Basin Beechworth 0.01µg/L. 1.11% Australian Drinking Water Guideline

4) Terbufos 28/7/16 Lake Mulwala Yarrawonga 0.01µg/L. 1.11% Australian Drinking Water Guideline

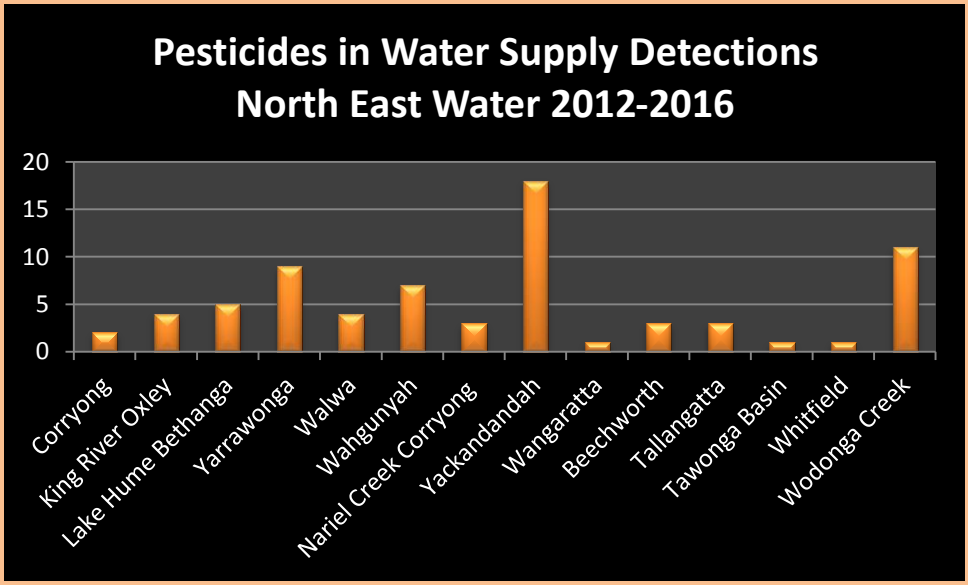
5) Diazinon 8/11/12 Wodonga Creek 0.01µg/L. 0.25% Australian Drinking Water Guideline

Victoria's only detections for Terbufos have all occurred in North East Water catchments in 2016. According to Friends of the Earth, these may also be the only detections of Terbufos in an Australian domestic water supply. It appears strange that 4 of these detections occurred in 4 separate locations. Terbufos is an insecticide used in cropping situations such as maize, sorghum, sweet corn, sunflowers, wheat, barley. It is used to kill wireworms and cereal cyst worm. It's "safe level" in drinking water is 0.9µg/L (that's less than one drop in an Olympic sized swimming pool).

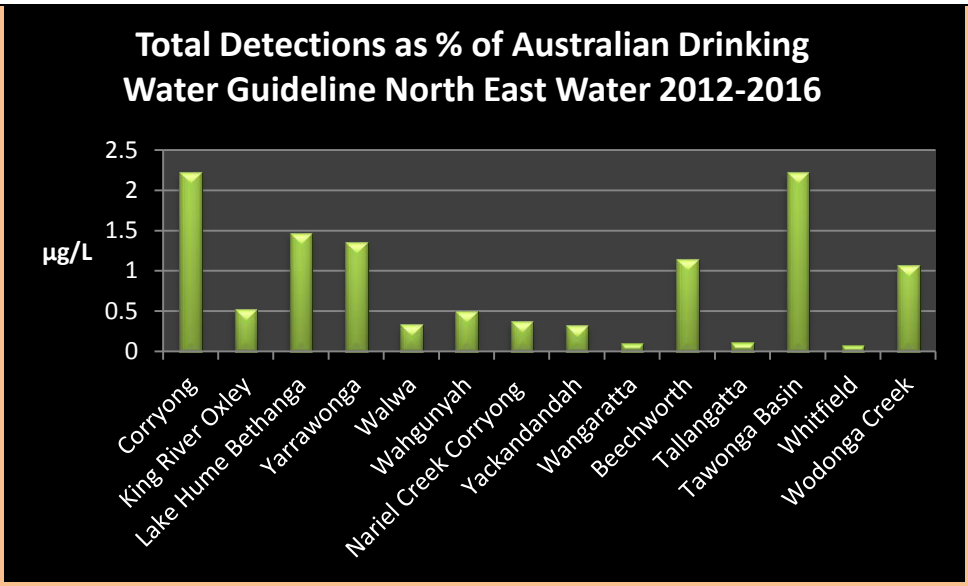
The Diazinon detection is also likely to be one the highest levels recorded in a domestic water supply in Australia.



A dozen different pesticides have been detected in North East Water drinking water supplies since they implemented more stringent testing in 2012.



The highest number of pesticide detections have occurred in Yackandandah's water supply. All of these consist of low levels of the pine plantation herbicide, Hexazinone, most likely leaching from plantations on the Stanley Plateau. Many of these plantations would have been sprayed up to a decade ago, possibly meaning that ground water has been impacted.



As a percentage of Australian Drinking Water Guidelines however, the main problem appears to be detections in the Tawonga Basin and Corryong, relating to Terbufos. Wangaratta (Ovens River) drinking water appears to be improving probably due to the ceasation of tobacco farming upstream.

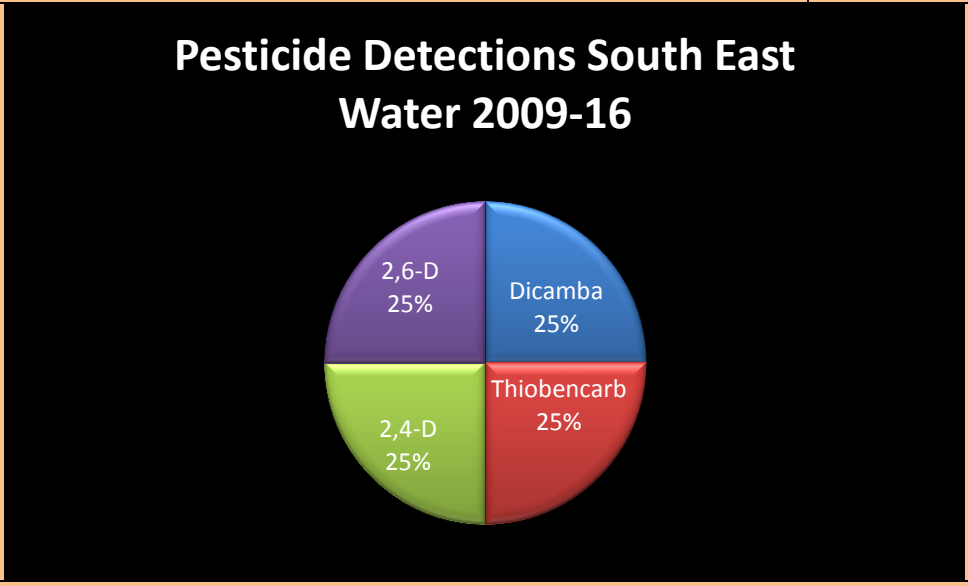
Historical Data of Interest Highest Pesticide Detections North East Water 1988-2017

	Date	Location	Pesticide	Level Detected	Australian 2011 Guideline
1.	21/4/89	Wangaratta (Raw)	Heptachlor	0.22µg/L	0.3µg/L
2.	21/1/89	Wangaratta (Raw)	Dieldrin	0.06µg/L	0.3µg/L
3.	21/1/89	Wangaratta (Treated)	Dieldrin	0.06µg/L	0.3µg/L
4.	29/9/88	Wangaratta (Raw)	Heptachlor	0.028µg/L	0.3µg/L
5.	21/4/89	Wangaratta (Raw)	Heptachlor	0.02µg/L	0.3µg/L
6.	1/2/89	Wangaratta (Treated)	Heptachlor	0.018 µg/L	0.3µg/L
7.	29/9/88	Wangaratta (Treated)	Heptachlor	0.017µg/L	0.3µg/L
8.	21/12/88	Wangaratta (Raw)	Heptachlor	0.16µg/L	0.3µg/L
9.	1/2/89	Wangaratta (Raw)	Dieldrin	0.015µg/L	0.3µg/L
10.	21/12/88	Wangaratta (Treated)	Heptachlor	0.013µg/L	0.3µg/L
11.	29/9/88	Wangaratta (Raw)	Aldrin	0.011µg/L	0.3µg/L
12.	20/5/89	Wangaratta (Raw)	Heptachlor	0.009µg/L	0.3µg/L
13.	26/10/88	Wangaratta (Treated)	Heptachlor	0.011µg/L	0.3/µg L

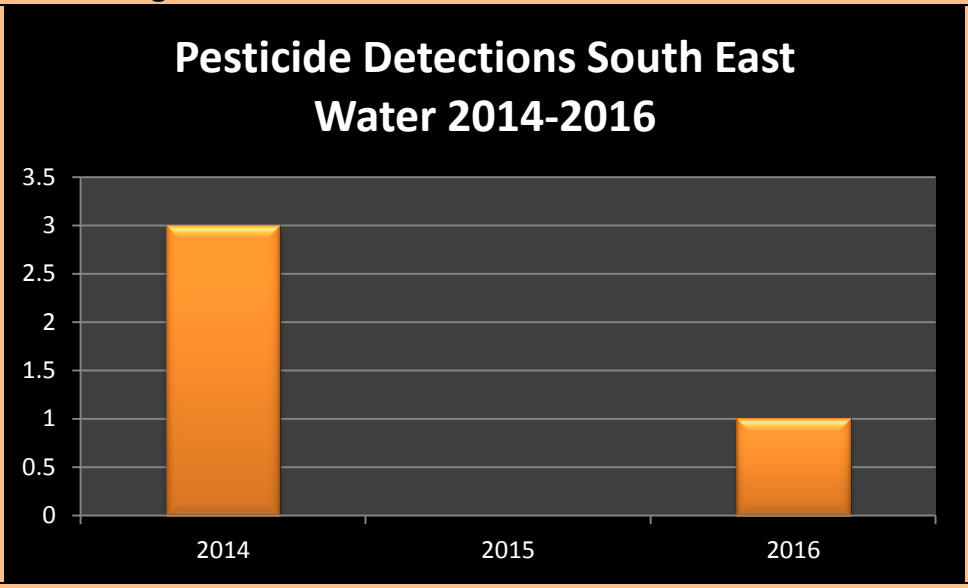
14.	**26/10/88**	**Wangaratta (Raw)**	**Heptachlor**	**0.007µg/L**	**0.3µg/L**
15.	**21/12/88**	**Wangaratta (Raw)**	**Dieldrin**	**0.007µg/L**	**0.3µg/L**
16.	**21/12/88**	**Wangaratta (Raw)**	**Aldrin**	**0.007µg/L**	**0.3µg/L**
17.	**20/5/89**	**Wangaratta (Raw)**	**Dieldrin**	**0.007µg/L**	**0.3µg/L**
18.	**24/10/16**	**Corryong WTP (Raw)**	**Terbufos**	**0.02µg/L**	**0.9µg/L**
19.	**24/10/16**	**Tawonga Basin**	**Terbufos**	**0.02µg/L**	**0.9µg/L**
20.	**29/9/88**	**Wangaratta (Raw)**	**Dieldrin**	**0.005µg/L**	**0.3µg/L**

South East Water

Total Pesticide Detections 2009-16: 4



Average South East Water Detection Level: 0.02µg/L
Average Statewide Detection Level: 0.46µg/L
Average South East Water Level as % of ADWG: 0.04%
Average Statewide Detection Level as % of ADWG: 0.98%



In terms of pesticides, from 2009- 2013 December. South East Water were only testing for eight organochlorines and 2,4-D at a number of locations. In January 2014, this increased to approximately 150 pesticides at a number of locations, reducing to 50-60 pesticides in late 2015. Testing is conducted at a range of different locations

Pesticides Types Detected: (4)

How did Dicamba end up coming out of taps in Wantirna in 2016?

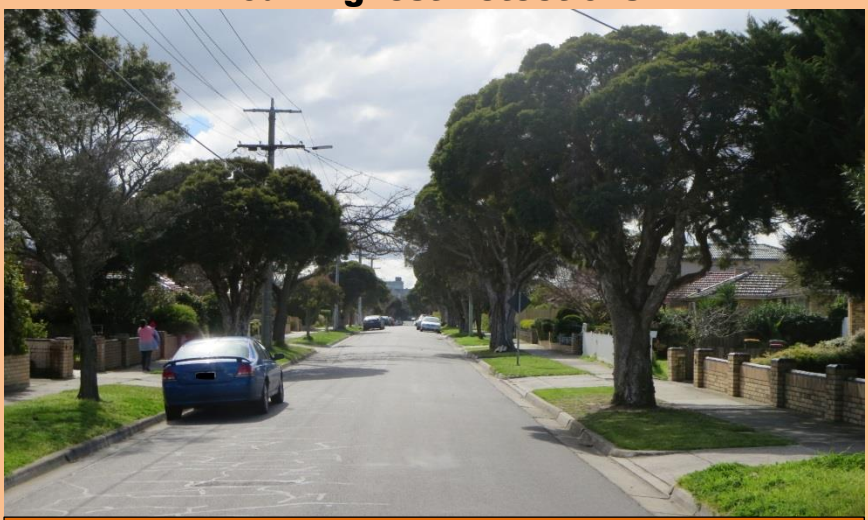
Dicamba (1)
Thiobencarb (1)
2,4-D (1)
2,6-D (1)

Most Frequent Detections

Dicamba (1)
South East Water Average: 0.03µg/L
Thiobencarb (1)
South East Water Average: 0.02µg/L
2,4-D (1)
South East Water Average: 0.02µg/L
2,6-D (1)
South East Water Average: 0.02µg/L

State Dicamba average 0.09µg/L
State Thiobencarb av. 0.02µg/L
State 2,4-D av. 0.68µg/L
State 2,6-D av. 0.01µg/L

Four Highest Detections:



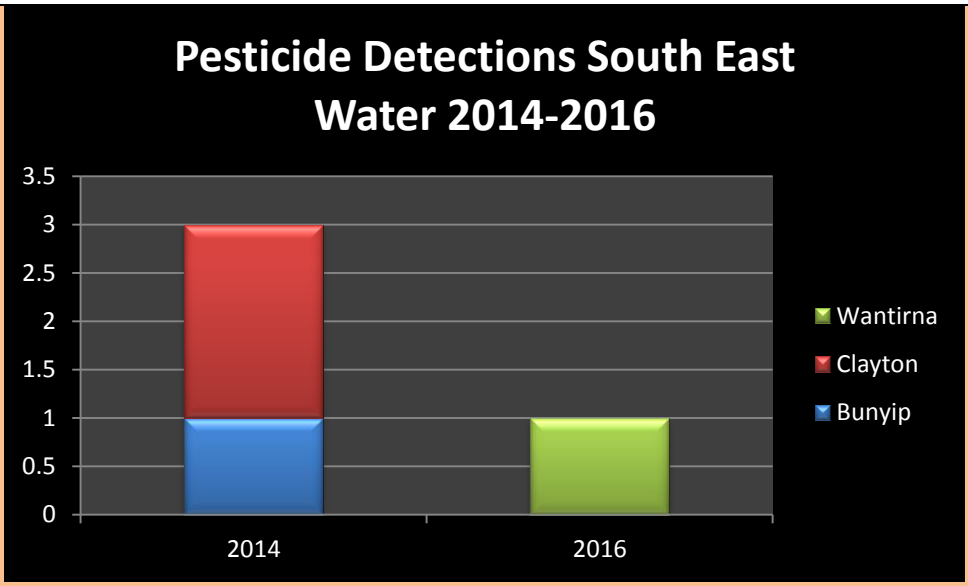
How did traces of the herbicides 2,4-D and 2,6-D end up in tap water in Clayton in 2014?

1). 2,4-D 15/8/14 Jaguar Drive Clayton 0.02µg/L. 0.067% Australian Drinking Water Guideline

2). Thiobencarb 4/2/14 Webb Street, Bunyip 0.02µg/L. 0.05% Australian Drinking Water Guideline

3). Dicamba 18/4/16 Merryn Grove Wantirna 0.01µg/L. 0.01% Australian Drinking Water Guideline

4) 2,6-D 15/8/14 Jaguar Drive Clayton 0.01µg/L. No Australian Drinking Water Guideline for this chemical.



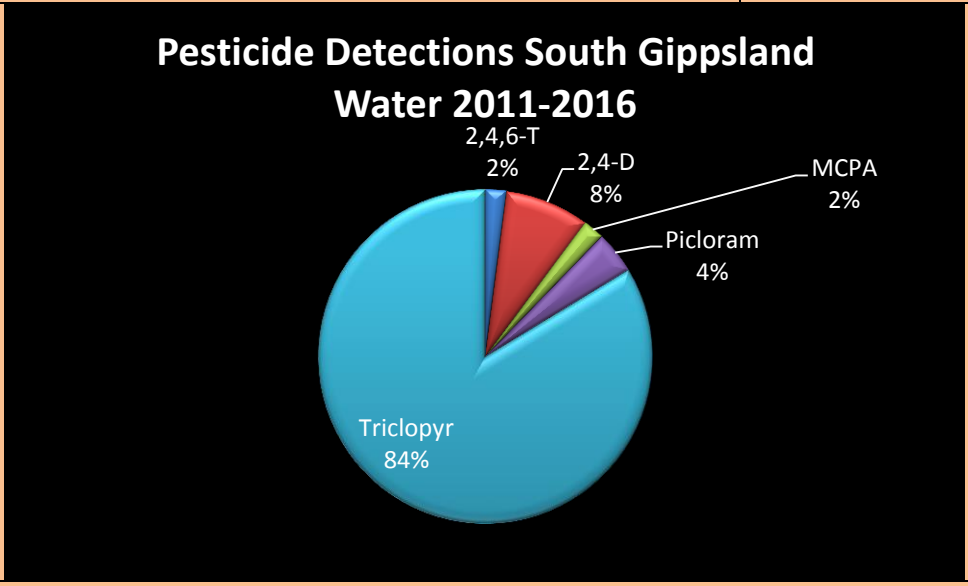
Victoria's only detection for Thiobencarb occurred at Bunyip in 2014. Thiobencarb is registered for use in rice crops and weed control in barnyard grass. According to Friends of the Earth, this could be the first time that this herbicide has been detected in an Australian water supply. As such it would be useful to know the source of the pollution.

Also of concern is that none of these detections appear to have been picked up by Melbourne Water, meaning that the pesticides could be coming through South East Water's distribution system.

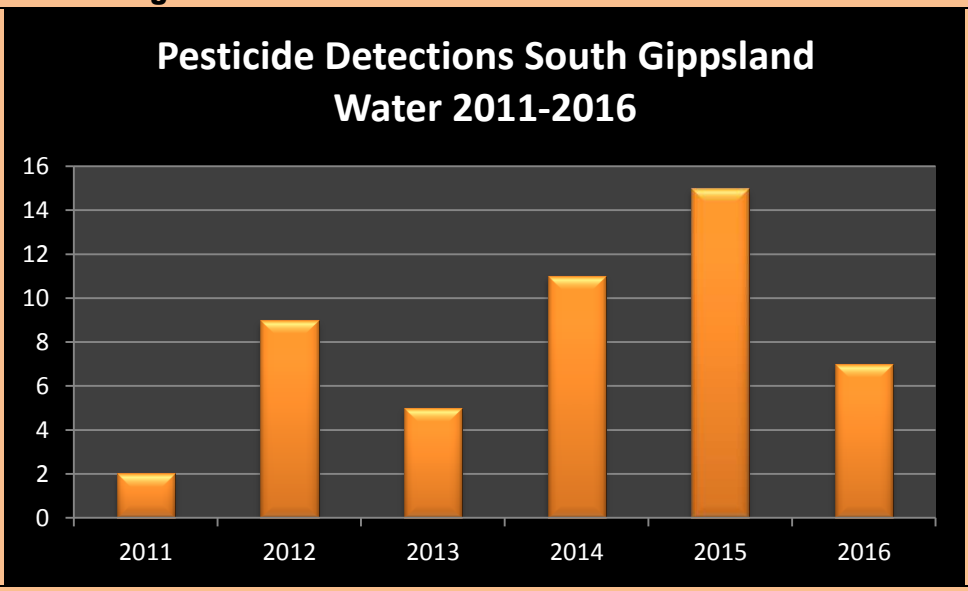
Bunyip is supplied with water from Tarago Reservoir, Clayton sources their drinking water from Cardinia and Silvan Reservoirs and Wantirna sources their drinking water from Silvan Reservoir. Are the pesticides getting through the treatment processes used at Tarago, Cardinia and Silvan or is there a contamination issue further down the system?

South Gippsland Water

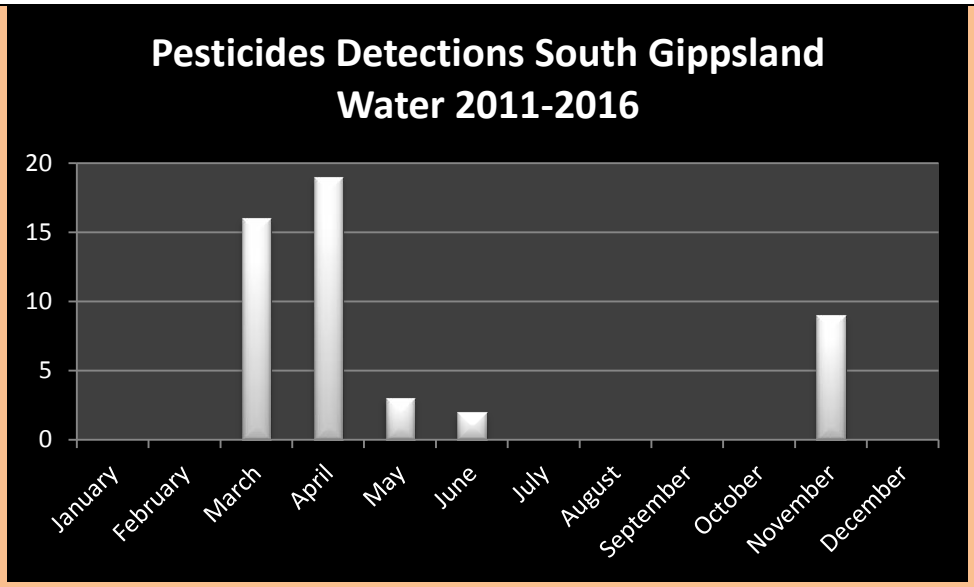
Total Pesticide Detections 2007-16: 49



Average South Gippsland Water Detection Level: 0.14µg/L
Average Statewide Detection Level: 0.46µg/L
Average South Gippsland Water Level as % of ADWG: 0.69%
Average Statewide Detection Level as % of ADWG: 0.98%



South Gippsland Water test biannually for 20 pesticides at a number of locations.



Pesticides Types Detected: (5)

Turtons Creek Headwaters

Triclopyr (41)
2,4-D (4)
Picloram (2)
2,4,6-T (1)
MCPA (1)

Most Frequent Detections	
Triclopyr (41): South Gippsland Water Average: 0.15µg/L	**Triclopyr: State average 0.12µg/L**
2,4-D (4): South Gippsland Water Average: 0.04µg/L	**2,4-D: State av. 0.68µg/L**
Picloram (2): South Gippsland Water Average: 0.17µg/L	**Picloram: State av. 0.25µg/L**
2,4,6-T (1):South Gippsland Water Average: 0.01µg/L	**2,4,6-T: State av. 0.03µg/L**
MCPA (1):South Gippsland Water Average: 0.03µg/L	**MCPA: State av 0.19 µg/L**

Five Highest Detections:

Upstream of Leongatha Water Supply

1). Triclopyr 21/4/15 Toora 2.6µg/L. 13% Australian Drinking Water Guideline

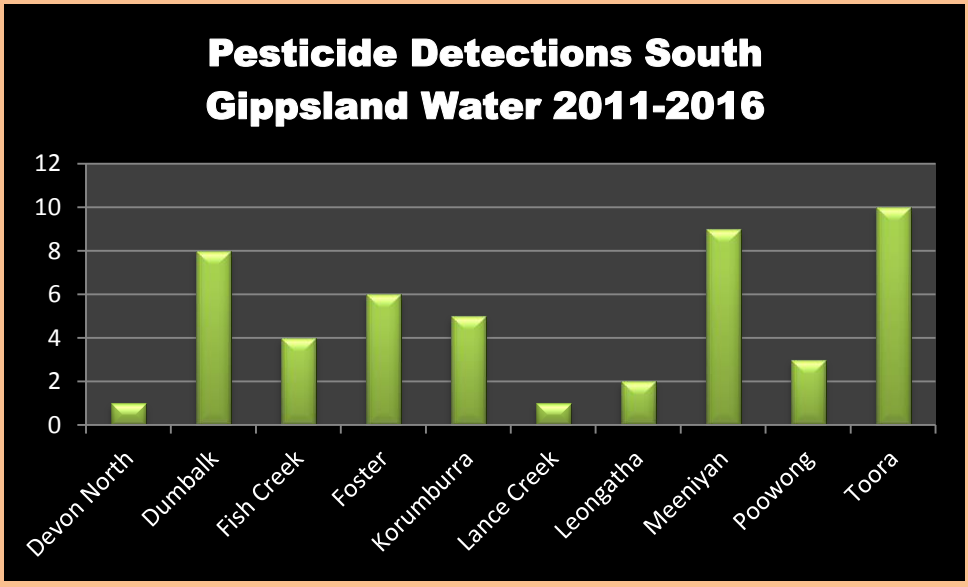
2). Triclopyr 18/4/16 Leongatha 0.58µg/L. 2.9% Australian Drinking Water Guideline

3). Triclopyr 12/5/15 Toora 0.53µg/L. 2.67% Australian Drinking Water Guideline

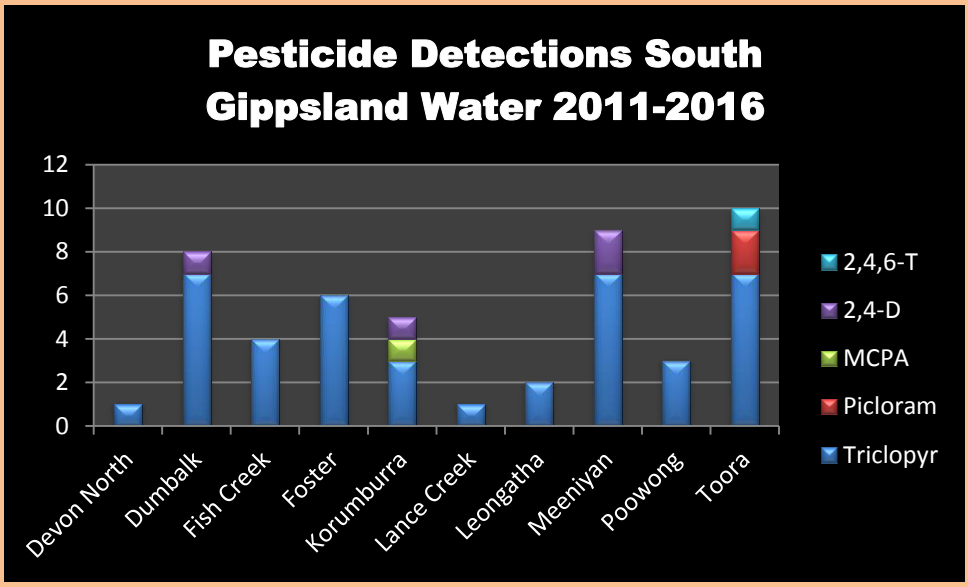
4) Triclopyr 19/4/16 Dumbalk 0.52µg/L. 2.6% Australian Drinking Water Guideline

5) Triclopyr 12/5/15 Toora 0.27µg/L. 1.35% Australian Drinking Water Guideline

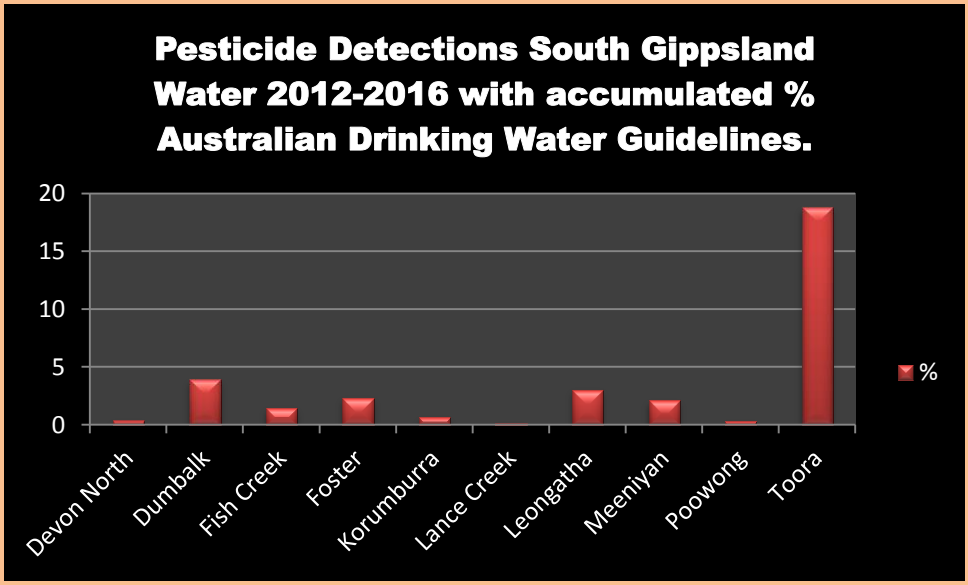
45% of all detections of Triclopyr in domestic water supplies in Victoria occurred in the South Gippsland region.



Trilopyr is used to kill blackberry infestations along waterways. Is it likely that the source of the Triclopyr entering domestic water supplies in the region is from local farmers or the Catchment Management Authority?



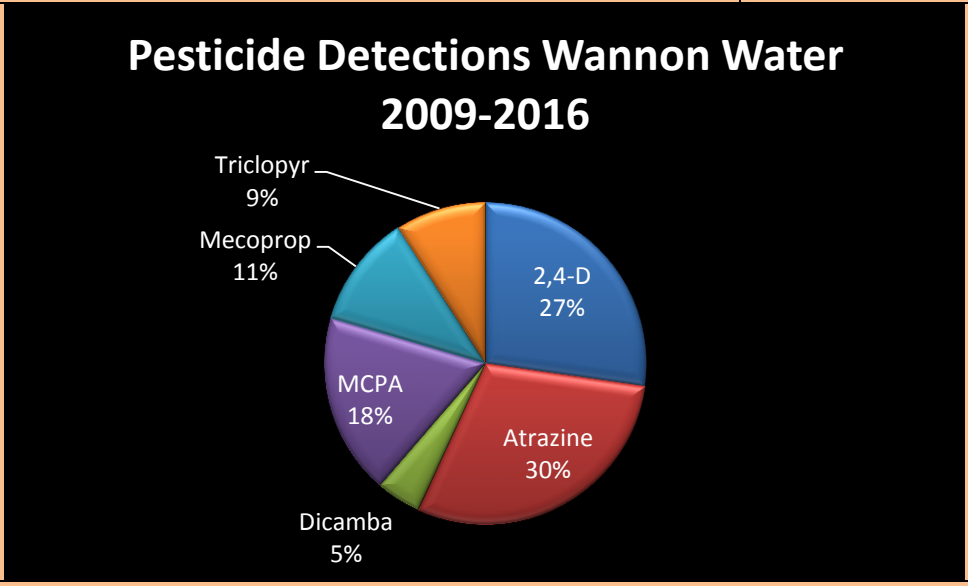
Triclopyr was detected in 10 separate South Gippsland water supplies between 2011-16. Was the source of the pollution investigated?



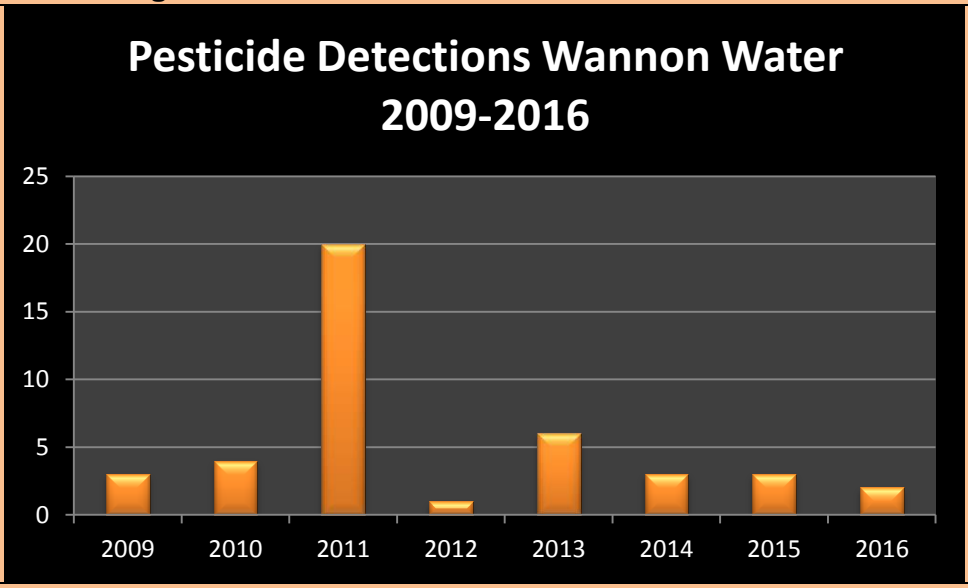
According to Friends of the Earth records, the level of Triclopyr detected at Toora on 21/4/15 is the third highest level recorded in a domestic water supply in the country. This event was clearly of national significance.

Wannon Water

Total Pesticide Detections 2007-16: 44



Average Wannon Water Detection Level: 0.03µg/L
Average Statewide Detection Level: 0.46µg/L
Average Wannon Water Level as % of ADWG: 0.13%
Average Statewide Detection Level as % of ADWG: 0.98%



In 2015-16, Wannon Water tested for approximately 50 pesticides at a number of locations once a year. It appears that there was more frequent testing several years earlier.

Pesticides Types Detected: (6)

Atrazine (13)
2,4-D (12)
MCPA (8)
Mecoprop (5)
Triclopyr (4)
Dicamba (2)

Most Frequent Detections	
Atrazine (13): Wannon Water Average: 0.05µg/L	**Atrazine: State av. 0.16µg/L**
2,4-D (12): Wannon Water Average: 0.02µg/L	**2,4-D: State av. 0.68µg/L**
MCPA (8): Wannon Water Average: 0.02µg/L	**MCPA: State av 0.19 µg/L**
Mecoprop (5): Wannon Water Average: 0.02µg/L	**Mecoprop: State av. 0.02µg/L**
Triclopyr (4): Wannon Water Average: 0.03µg/L	**Triclopyr: State average 0.12µg/L**

Five Highest Detections:

Glenthompson Water Supply

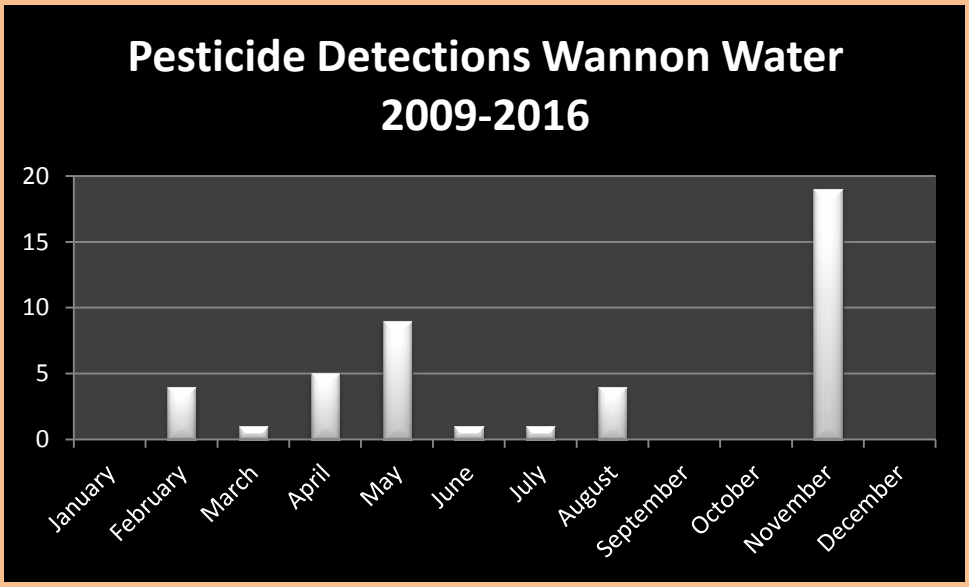
1). Atrazine 9/11/11 Warrnambool Headworks and Storages 0.19µg/L. 0.95% Australian Drinking Water Guideline

2). Atrazine 2/6/13 Glenthompson 0.13µg/L. 0.65% Australian Drinking Water Guideline

3). Atrazine 10/11/11 Hamilton 0.07µg/L. 0.35% Australian Drinking Water Guideline

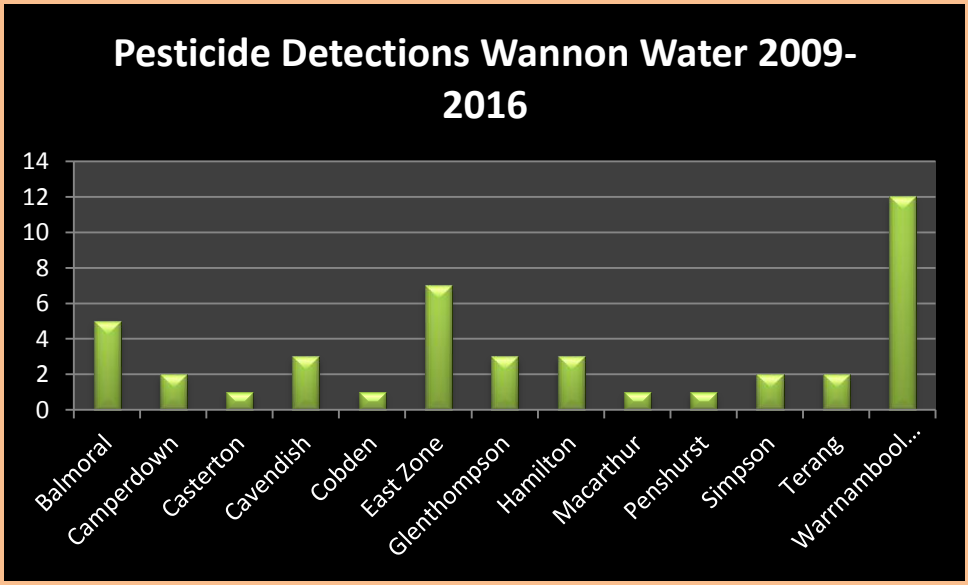
4) Atrazine 27/5/14 Balmoral 0.06µg/L. 0.3% Australian Drinking Water Guideline

5) Atrazine 19/2/15 Balmoral 0.05µg/L. 0.25% Australian Drinking Water Guideline

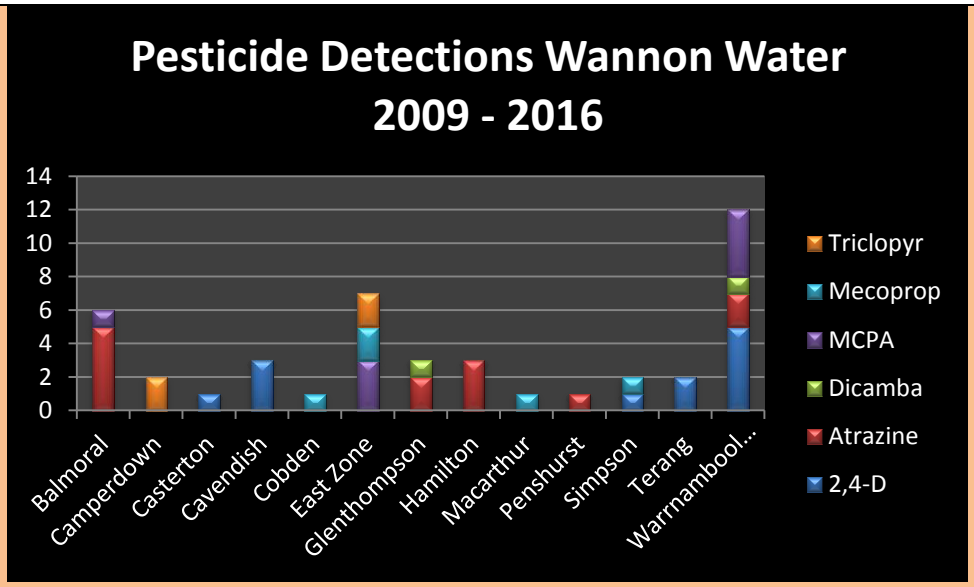


The most common time for pesticide detections in the south west appears to be November.

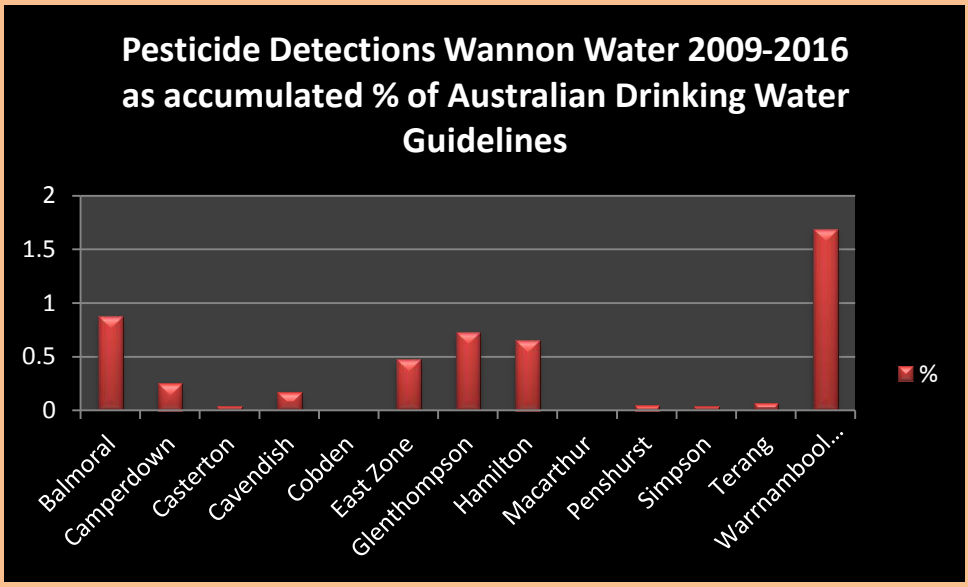
Willow removal, Gellibrand River 2007. The Gellbrand River is the major domestic water supply in South Western Victoria.



Most of the detections for Warrnambool Headworks and Storages and East Zone occurred in 2011.



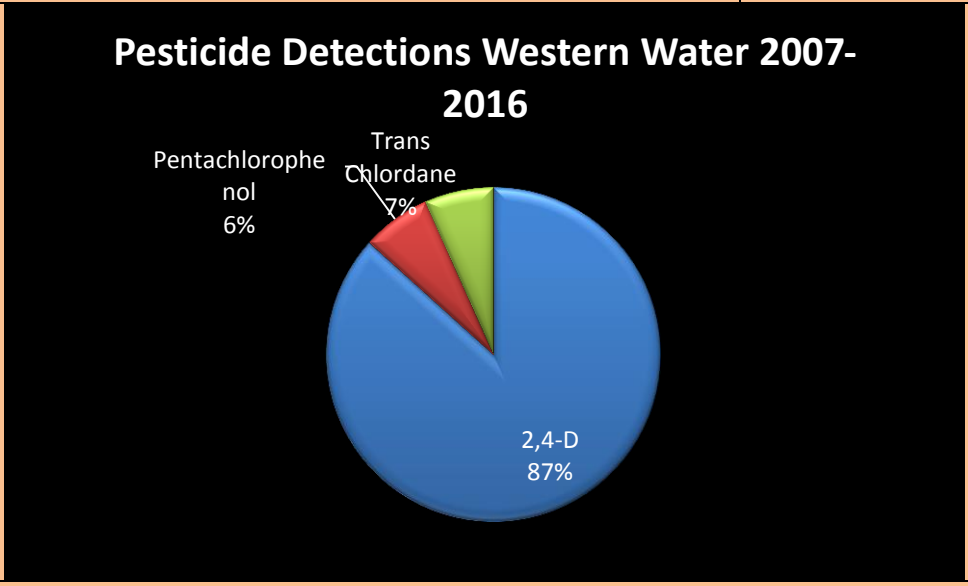
East Zone and Warrnambool Headworks and Storages could be "lumped" together in one column under the name Warrnambool.



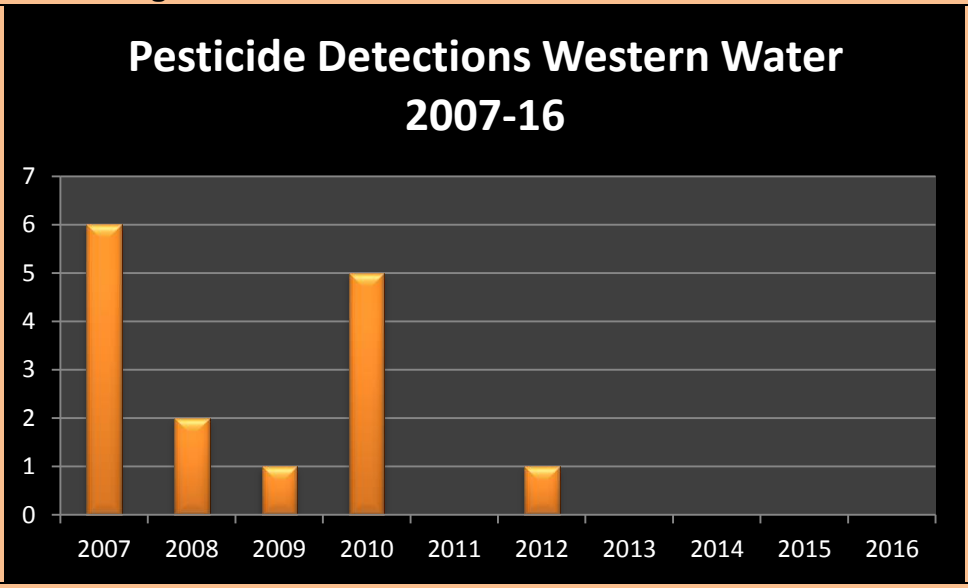
In comparison to levels published in the Australian Drinking Water Guidelines, all Wannon Water pesticide detections fall well short of the guidelines, however pesticide detections at Warrnambool in 2011, were the highest in the region.

Western Water

Total Pesticide Detections 2007-16: 15



Average Western Water Detection Level: 0.28µg/L
Average Statewide Detection Level: 0.46µg/L
Average Western Water Level as % of ADWG: 2.65%
Average Statewide Detection Level as % of ADWG: 0.98%



Western Water test for 26 pesticides at a number of locations on an annual basis. Only three (11.5%) of these pesticides, are registered for current use: 2,4-D, MCPA and Simazine. (Note: There could be a discrepancy in data sent to FoE in the FoI process and that published in Western Water'sDrinking Water Quality Report 2007/8).

Pesticides Types Detected: (3)

Willimingongon Reservoir supplies Mt Macedon with drinking water

2,4-D (13)
Pentachlorophenol (1)
Trans Chlordane (1)

Most Frequent Detections

2,4-D (13): Western Water Average: 0.03µg/L	**2,4-D: State av. 0.16µg/L**
Pentachlorophenol (1): Western Water Average: 3.8µg/L	**Pentachlorophenol: State av. 3.8µg/L**
Trans Chlodane (1): Western Water Average: 0.01µg/L	**Trans Chlordane: State av 0.01 µg/L**

Four Highest Detections:

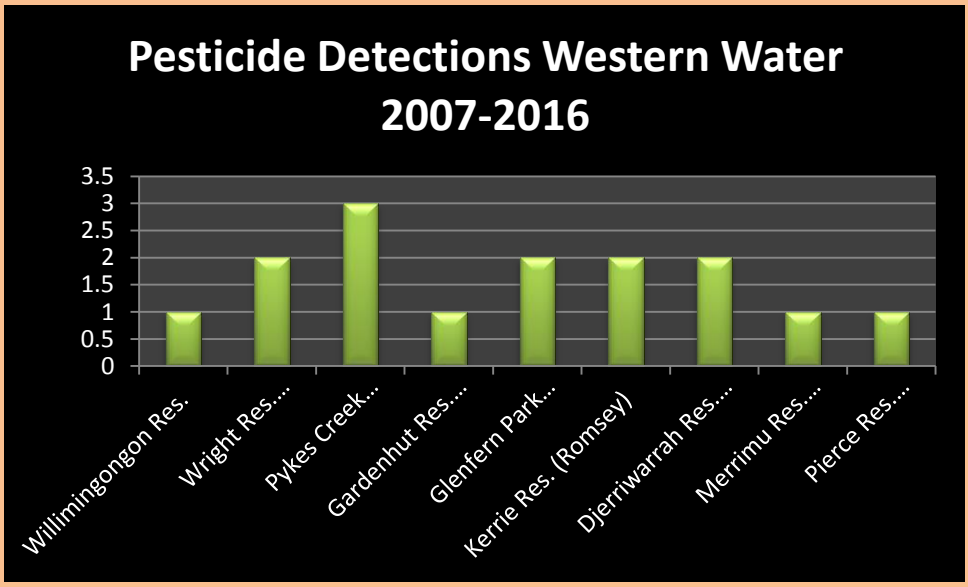
Kerrie Reservoir – Water Supply for Romsey has farmland upstream of it.

1). Pentachlorophenol 10/2/09 Willimingongon 3.8µg/L. 38% Australian Drinking Water Guideline

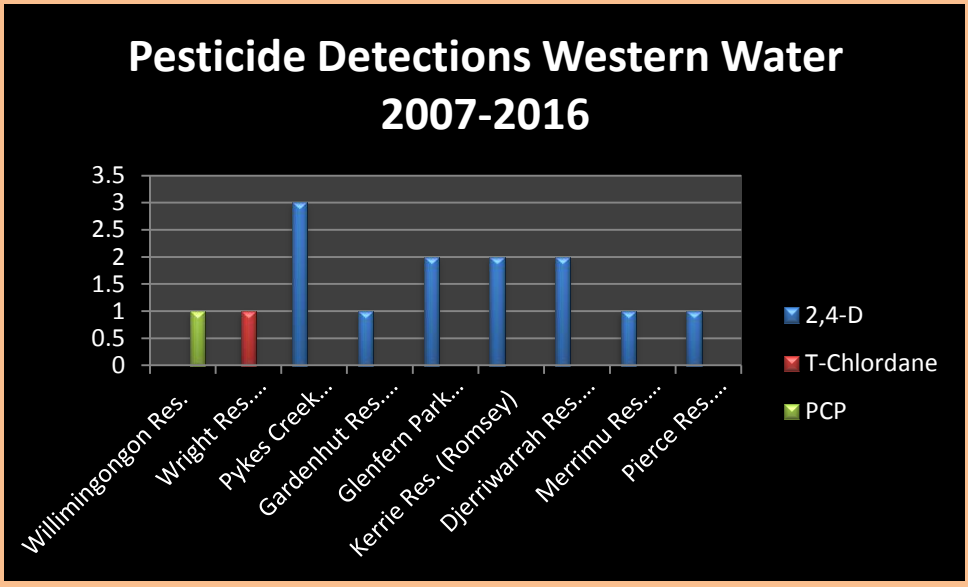
2).Trans Chlordane 7/2/12 Wright Reservoir (Riddells Creek) 0.01µg/L. 0.5% Australian Drinking Water Guideline

3) 2,4-D 6/2/07 Pykes Creek Reservoir 2,4-D 0.06µg/L. 0.2% Australian Drinking Water Guideline

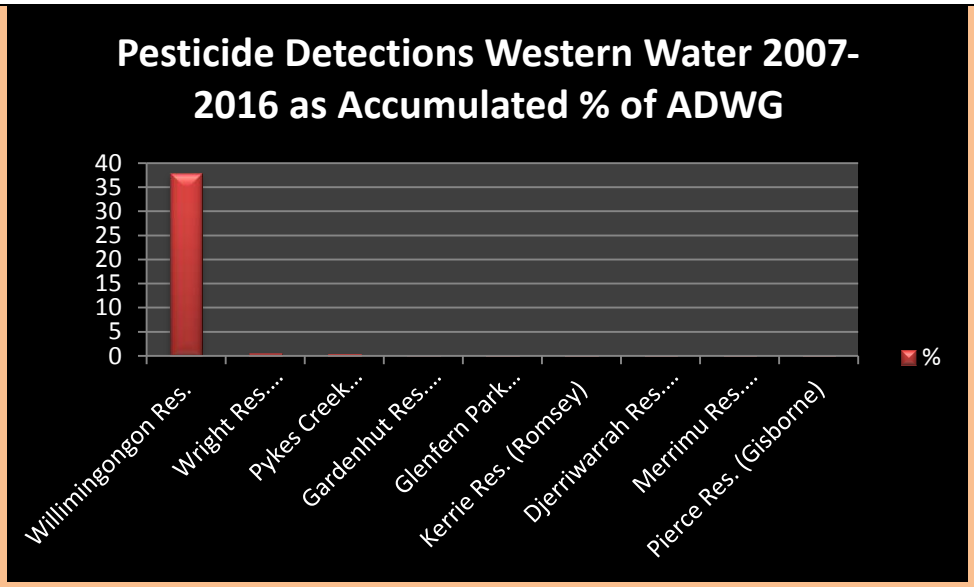
4) 2,4-D 8/2/07 Garden Hut Reservoir (Lancefield) 0.05µg/L. 0.167% Australian Drinking Water Guideline



Detections for each of the 9 locations appear to be low and spread evenly



2,4-D was detected at seven different locations over the decade.



The one detection at Willmingongon Reservoir dominates all other detections for the decade time period and is the second highest pesticide detection in a Victorian domestic water supply between the years 2007-16.

Westernport Water

Total Pesticide Detections 2007-16: 1

eservoir	06-Dec-11	W-OPP-MW / METHANESULPHONATE ETHYL	<0.001	MG_P_L
eservoir	06-Dec-11	W-OPP-MW / METHANESULPHONATE METHYL	<0.001	MG_P_L
eservoir	06-Dec-11	W-OPP-MW / METHYL PARATHION	<0.001	MG_P_L
eservoir	06-Dec-11	W-OPP-MW / MONOCROTOPHOS	0.020	MG_P_L
eservoir	06-Dec-11	W-OPP-MW / PARATHION	<0.001	MG_P_L
eservoir	06-Dec-11	W-OPP-MW / PRIMOPHOS-ETHYL	<0.001	MG_P_L
eservoir	06-Dec-11	W-OPP-MW / PROTHIOFOS	<0.001	MG_P_L
eservoir	06-Dec-11	W-OPP-MW / SAFROL	<0.001	MG_P_L
eservoir	06-Dec-11	W-OPP-MW / TRANS-ISOSAFROLE	<0.001	MG_P_L
eservoir	06-Dec-11	W-PYRETHR / BIFENTHRIN	<0.01	MG_P_L

The only positive pesticide detection for Westernport Water occurred on December 6 2011. The deregistered pesticide, Monocrotophos was detected at Candowie Reservoir at 0.02mg/L (20µg/L). Monocrotophos was last registered in Australia in 1999.

This event is possibly the highest level of pesticide recorded in a Victorian domestic water supply since the early 1970's. The source of the pollution was never investigated. Levels of insecticide this high, would suggest that high volumes would have to made their way into Candowie Reservoir. It also appears plausible that the detection may have been associated with an algal bloom which occurred in the Reservoir at the same time.

"Note: *For Pesticides and Herbicides, all samples below detection limit except for Monocrotophos, which had a result of 0.02 sampled on 6 December 2011." **P25 GHD Report for Westernport Water - Annual Drinking Water Quality Report 2010/11**

Westernport Water test for ~50 pesticides at Candowie Reservoir on a quarterly basis and also test at a number of other locations less frequently.

Candowie Reservoir looking towards reservoir wall. Its major tributary is Tennant Creek. Candowie Reservoir supplies drinking water to Pioneer Bay, Dalyston, San Remo and Phillip Island.

The major uses of Monocrotophos up to the end of the 1990's were: are in cotton, lucerne, potato, sorghum, soybean, tobacco, tomatoes and commercial flower crops. (also used in Pome fruit, beans: French, millet, wheat, sorghum, sunflowers, non-crop areas, bananas, maize, panicum, soybeans, sweet corn, non-fruit bearing trees)

"Reforestation" has occurred over 100 hectares of land near Candowie Reservoir associated with Malaysian interests over the past decade. One of the past uses of Monocrotophos in Australia was on non fruit trees (see below). It is still used in Malaysia to control Bagworm Caterpillars in Oil Palm Plantations.

("Monocrotophos is also used for non-fruit tree injection. Holes that are 5 cm deep, 1 to 5 cm in diameter and slanted downwards at 45o, are drilled around the tree at 30 cm intervals. These holes must be at least 1.5 metres below the lowest branch. Monocrotophos is placed in the holes with an eyedropper and then the next day the holes are plugged with putty or mastic. The plugs and surrounding area are painted over with bitumen emulsion sealer.")
https://apvma.gov.au/sites/default/files/publication/14621-monocrotophos-final_report-summary.pdf

Also of interest is that Algal blooms occurred one day after the high level of Monocrotophos was detected.

***"The Candowie Reservoir experienced three algal blooms between December 2011 and March 2012. An increase in the potentially toxic blue-green Anabaena circinalis occurred on 7 December 2011 and the reservoir was treated with cupricide* on 9 December 2012. Sampling on 11 December 2011 showed that the treatment was successful."* GHD Report for Westernport Water - Annual Drinking Water Quality Report 2010/11**

(*Cupricide is a chelated copper algaecide Active Constituent: 105 g/L Copper present as mixed Copper-Ethanolamine Complexes.).

Strains of Anabaena have been known to create organophosphate neurotoxins (ENVIRONMENTAL AND ECOLOGICAL CHEMISTRY - Volume I) "Anatoxin –a(S) is an organophosphate produced by the Cyanobacteria Anabaene flos-aquae and A.lemmermannii. (found in North America and Northern Europe) This toxin blocks acetylcholinesterase activity in a manner analogous to organophosphate insecticides..." (Toxic Cyanobacteria in Water A Guide to their public health consequences, monitoring and Management WHO 1999)

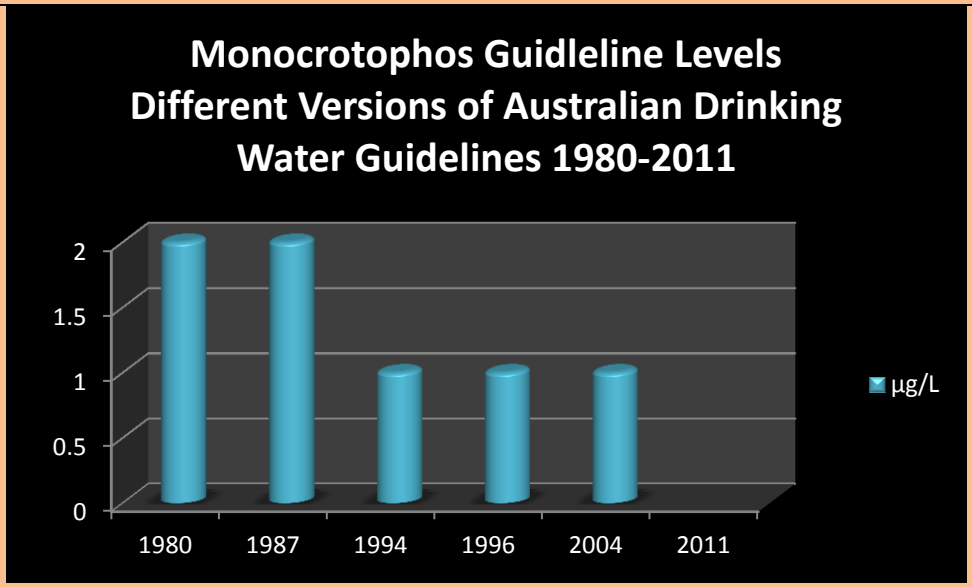
Anabaena circinalis

"In freshwater these toxins are produced by a fairly limited number of species of cyanobacteria. To date the only neurotoxic cyanobacterium encountered in Australia is Anabaena circinalis, which produces saxitoxins" **http://www.waterra.com.au/cyanobacteria-manual/Chapter1.htm Saxitoxins are also known as Paralytic Shellfish Poisons (PSP's) and are different to the Anatoxin-a(S).**

Westernport Water Response

"The herbicide/pesticide, monocrotophos exceeded the ADWG health-based guideline value during the 2011/12 reporting period. Westernport Water were not advised of this exceedence by their consultant laboratory and were therefore unable to take any remedial actions in response to the detection. It is important to note that this result was obtained in the raw water, and the health-based guideline values apply in the treated water." **P26 Report for Westernport Water - Annual Drinking Water Quality Report 2010/11**

"4.1 Reportable Events under Section 22. No events were reported under Section 22 of the Safe Drinking Water Act during 2011/2012." **P45 Report for Westernport**



There is no Australian Drinking Water Guideline for Monocrotophos in the latest version of the Australian Drinking Water Guidelines. The level recorded at Candowie is 20 times higher than the "safe" level published in the 2004 version of the Australian Drinking Water Guidelines.

Yarra Valley Water

Total Pesticide Detections 2007-16:	0

Yarra Valley Water purchase water from Melbourne Water and rely on Melbourne Water to test for pesticides. A letter sent to Yarra Valley Water in June 2017 by Friends of the Earth requesting further information was not answered.

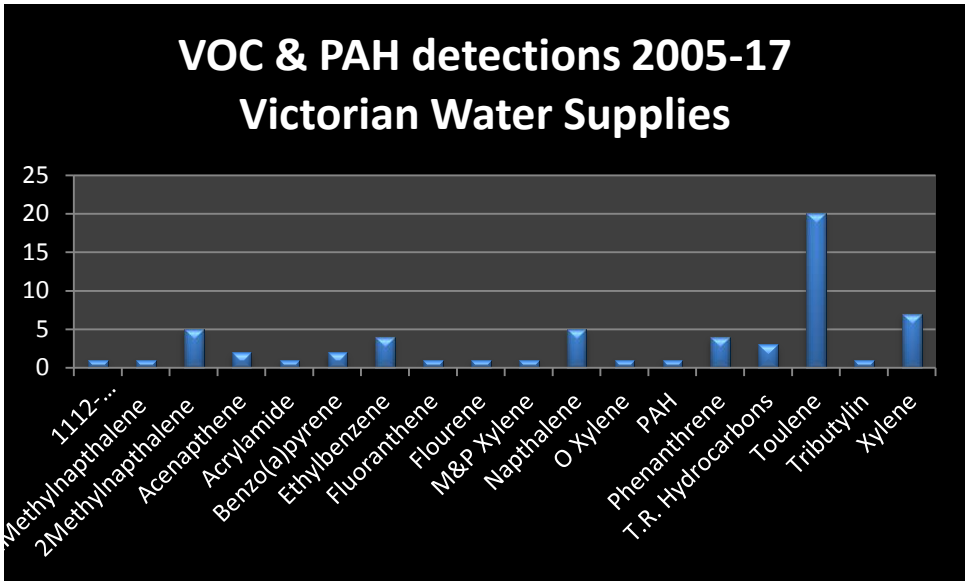
Approximately 30% of water supplied by Yarra Valley Water comes from the Yarra River.

For more information see the Melbourne Water page.

Also see South East Water.

Additional Data

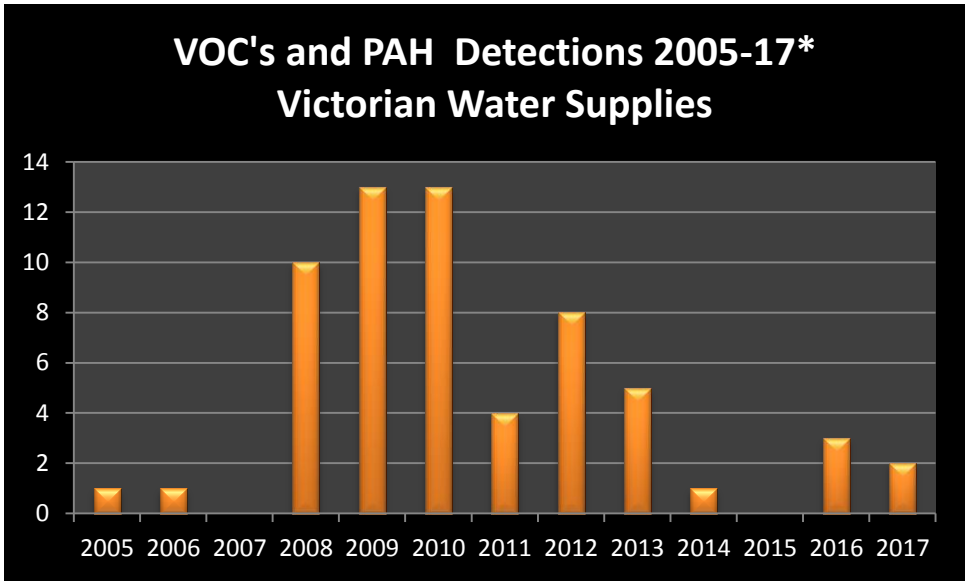
Volatile Organic Chemicals, Polycyclic Aromatic Hydrocarbons etc



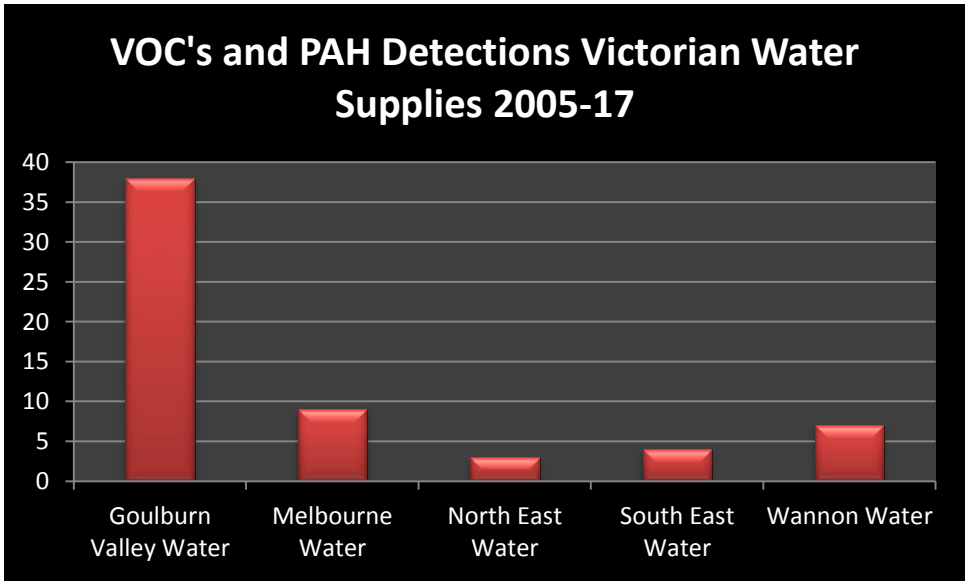
During FoE's FoI applications, five water authorities sent through information concerning detections of volatile organic chemicals and polycyclic aromatic hydrocarbons. Not all water authorities provided this information, so a statewide picture for these substances cannot be determined. (1112 refers to 1,1,1,2 Tetrachloroethane detected at Nar Nar Goon 8/4/10 by South East Water at 3µg/L).

715	4/08/2009	Acrylamide	mg/L		0.0003	HAMILTON

According to the Australian Drinking Water Guidelines, the "safe" guideline for Acrylamide is 0.0002mg/L (0.2µg/L). The detection of Acrylamide at Hamilton in August 2009 by Wannon Water, therefore exceeded the safe guideline by 50%. Acrylamide has apparently never been detected in Australian drinking water supplies, according to the ADWG. It is an impurity in polyacrylamide, which can be used as grouting agents and flocculant aids in water treatment.



A total of 61 detections for these substances were detected from 2005 through to early 2017. Generally speaking, an assumption could be made that VOC and PAH detections would represent approximately 20% of the amount of detections for pesticides.



The majority of detections occurred in waters supplied by Goulburn Valley Water. The most serious of these incidents included two detections of Benzo(a)pyrene at 0.003µg/L Kyabram and Pyalong in 2005 and 2006 respectively. Both detections were at 30% of the Australian Drinking Water Guideline Levels.

Naphthalene was detected in the Melbourne suburb of Prahan in February 2017 at 0.64µg/L. According to the Australian Drinking Water Guidelines "PAH's have not been detected in Australian Drinking Water".

More than 22 PAH's were detected in Victorian Water Supplies between 2005-17 and include: 1-Methylnapthalene, 2-Methylnapthalene, Acenapthene, Benzo(a)Pyrene, Fluoranthene, Fluorene, Napthalene and Phenanthrene. Guideline levels in Australia for PAH's are only granted or Benzo(a)Pyrene.

Top 20 Pesticide Detections Victorian Domestic Water Supplies 1972-2016

Authority	Date	Location	Pesticide	Level Detected	Comparison to Health Guideline
State Rivers & Water Supply Commission	1972	Nathalia	Amitrole	430µg/L	477.8 times over guideline
State Rivers & Water Supply Commission	1972	Swan Hill	Amitrole	320µg/L	355.6 times over guideline
Westernport Water	6/2/11	Candowie Reservoir	Monocrotophos	20µg/L	20 times over guideline
State Rivers & Water Supply Commission	6/1/75	Broken Creek	Amitrole	7.3µg/L	8.11 times over guideline
State Rivers & Water Supply Commission	6/1/75	Broken Creek	Amitrole	6.3µg/L	7 times over guideline
State Rivers & Water Supply Commission	6/1/75	Broken Creek	Amitrole	5.5µg/L	6.11 times over guideline
State Rivers & Water Supply Commission	13/12/73	Broken Creek	Amitrole	3.7µg/L	4.11 times over guideline
State Rivers & Water Supply Commission	6/1/75	Broken Creek	Amitrole	3.7µg/L	4.11 times over guideline
State Rivers & Water Supply Commission	29/11/73	Broken Creek	Amitrole	2µg/L	2.22 times over guideline
State Rivers & Water Supply Commission	20/12/73	Broken Creek	Amitrole	2µg/L	2.22 times over guideline
Goulburn Murray Water	October 2005	Kerang Channel 14/2	Esfenvalerate	65µg/L	2.17 times over guideline
Wannon Water	4/8/09	Hamilton	Acrylamide	0.3µg/L	1.5 times over guideline
Barwon Water	12/5/03	Wurdee Boluc Raw Water	2,4-D	34µg/L	1.13 times over guideline
Barwon Water	19/8/03	Wurdee Boluc Inlet Channel	2,4-D	27µg/L	90%
•	2008	Yarra River Upstream Sugarloaf Res.	Simazine	15µg/L	75%
EPA	21/4/89	Wangaratta Raw	Heptachlor	0.22µg/L	73.3%
Barwon Water	5/8/03	Stony Creek Res. #3	2,4-D	20µg/L	66.7%
Goulburn Valley Water	22/6/06	Broken Creek Numurkah	2,4-D	17µg/L	56.7%
State Rivers & Water Supply Commission	1980?	Broken Creek	Dieldrin	0.16µg/L	53.3%
Western Water	10/2/09	Willimingongon Res. Mt Macedon	Pentachlorophenol	3.8µg/L	38%

Notes for the above table:

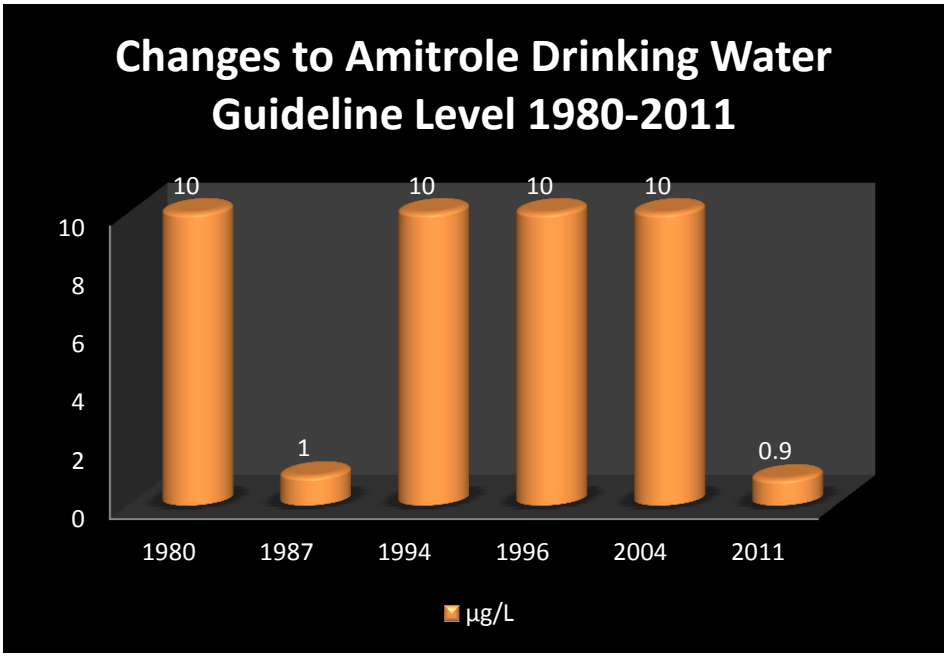
- ***January 2011 Environment, Science & Technology, in article Effects of Pesticides Monitored with Three Sampling Methods in 24 Sites on Macroinvertebrates and Microorganisms. Ralf B. Schäfer*†‡, Vincent Pettigrove§∥, Gavin Rose⊥, Graeme Allinson§#, Adam Wightwick#, Peter C. von der Ohe▽, Jeff Shimeta†, Ralph Kühne○, and Ben J. Kefford†◆ † Biotechnology and Environmental Biology, School of Applied Sciences, RMIT University, ‡ Institute for Environmental Sciences, University Koblenz-Landau, Landau, § CAPIM, Bio21 Institute, University of Melbourne, Australia∥ Melbourne Water, Research and Technology, Melbourne, Australia⊥ Department of Primary Industries, Future Farming Systems Research, Werribee Vic, Australia# Department of Primary Industries, Future Farming Systems Research, Queenscliff Vic 3225, Australia▽ Department of Effect-Directed Analysis, Helmholtz Centre for Environmental Research − UFZ, Leipzig, Germany○ Department of Ecological Chemistry, Helmholtz Centre for Environmental Research − UFZ, Leipzig, Germany◆ Centre for Environmental Sustainability, Department of Environmental Science, University of Technology Sydney, Broadway NSW, Australia***

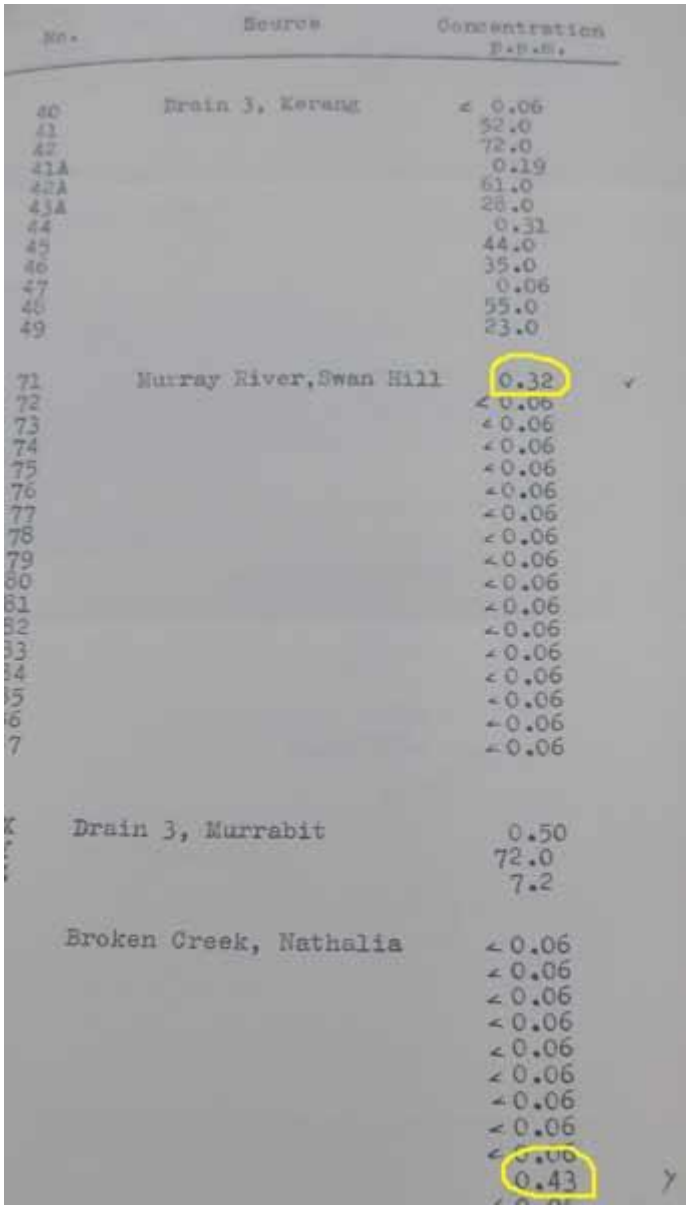
Rows highlighted in red are detections above 2011 Australian Drinking Water Guidelines. Note that the Monocrotophos detection breached the 2004 guidelines, as Monocrotophos is not listed in the 2011 guidelines.

Rows highlighted in yellow are detections from 2007-16. The row in green is for a detection of a non-pesticide, but included in this report.

There are also many detections for pesticides that do not have a drinking water guideline and as such cannot be listed here.

The Australian Drinking Water Guideline for Amitrole was reduced from 10µg/L to 0.9µg/L in 2011, a decrease of 91%, meaning that instead of 10 Amitrole detections over Australian Drinking Water Guidelines in 2011, there would have been 2 in 2004. This also shows how guideline levels can be increased or decreased over time. A level which may appear to be "safe" one year, may be deemed to be unsafe in another.





No.	Source	Concentration p.p.m.
40	Drain 3, Kerang	< 0.06
41		52.0
42		72.0
41A		0.19
42A		61.0
43A		28.0
44		0.31
45		44.0
46		35.0
47		0.06
48		55.0
49		23.0
71	Murray River, Swan Hill	0.32
72		< 0.06
73		< 0.06
74		< 0.06
75		< 0.06
76		< 0.06
77		< 0.06
78		< 0.06
79		< 0.06
80		< 0.06
81		< 0.06
82		< 0.06
83		< 0.06
84		< 0.06
85		< 0.06
86		< 0.06
87		< 0.06
X	Drain 3, Murrabit	0.50
		72.0
		7.2
	Broken Creek, Nathalia	< 0.06
		< 0.06
		< 0.06
		< 0.06
		< 0.06
		< 0.06
		< 0.06
		< 0.06
		< 0.06
		0.43

'Contamination Limits' State Rivers and Water Supply Commission, showing concentrations of Amitrole in drains and waterways. Note highest levels were in drains at Kerang and Murrabit. 72p.p.m, 72,000µg/L

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