Waterwatch Program

Nillumbik Shire Council Healthy Waterways Waterwatch Program 2012-2013

Annual Report

Nillumbik Shire Council

Acknowledgements

This report was written by Kathleen Petras on behalf of Banyule City Council. The Nillumbik Waterwatch program is hosted and administered by Banyule City Council on behalf of Banyule, Darebin, Nillumbik, Whittlesea and Yarra City Councils and Melbourne water.

Activities for the 2012-2013 Nillumbik program were conducted by Julia Vanderoord (North East Waterwatch Coordinator).

Front Cover Photo

Nillumbik volunteer waterwatch monitors with North East Waterwatch Coordinator Julia Vanderoord at the Nillumbik Shire Councils environmental volunteers recognition event in December 2012.

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Executive Summary

- The Healthy Waterways Waterwatch Program is designed to: encourage active community participation and activities, provide waterways health education experiences to the community raise awareness and understanding of waterways issues and encourage the conservation and preservation of local waterways.

- In 2012-2013 the North East Melbourne Healthy Waterways Program received $27,077 from the four supporting local councils (Nillumbik, Darebin, Whittlesea and Yarra) and $44,932 from Melbourne Water. Banyule City Council, as the administrator of the program contributed $23,705.

- During 2012-2013 in the North East Melbourne region, 53 waterwatch sessions were delivered across 11 primary and secondary schools. In total 1087 students were engaged in healthy waterways education programs. 39 community education sessions were delivered at community festivals, waterwatch events and in assistance/training sessions for local monitoring groups.1084 community members took part making a total participation including students of 2171.

- In Nillumbik municipality, 131 community members participated in Waterwatch activities conducted between July 2012 and June 201. In addition 50 students of preschool and primary schools participated in the program.

- Waterways monitored in 2012- 2013 in Nillumbik municipality include:

    - Arthurs Creek, near Bridge, Arthurs Creek Road, Arthurs Creek
    - Diamond Creek in St Andrews, in Hurstbridge, at Edendale Environment Centre footbridge and Railway Pde in Eltham
    - Nerreman Wetland in Eltham
    - Karingal Yallock Creek at Eltham West Drain, Eltham West and at the corner of Susan and Brougham St, Eltham
    - Plenty River at Gorge Rd, South Morang

- The waterways in Nillumbik were monitored by Arthurs Creek Landcare group, Friends of Diamond Creek, Diamond Creek at St Andrews waterwatch group, Diamond Creek at Hurstbridge waterwatch group, Diamond Creek at Eltham waterwatch group, Friends of Edendale Education Centre, Friends of Karingal Yallock Creek, Karingal Yallock Creek waterwatch monitoring group and Whittlesea area waterwatch group.

- Table 1 gives a summary of the water quality results obtained in 2012 – 2013 in Nillumbik waterways.

Table 1: Summary of Recommendations for Waterways in Nillumbik Waterways 2012-2013

Nillumbik Waterway	Waterwatch Issues	Recommendations
Arthurs Creek	no major concerns	Continue monitoring
Diamond Creek -St Andrews	High turbidity	Soil erosion mitigation by revegetation
Diamond Creek - Hurstbridge	Moderate turbidity	Soil erosion mitigation by revegetation
Diamond Creek -Eltham	High turbidity	Soil erosion mitigation by revegetation
Nerreman Wetland	Low dissolved oxygen High nutrient growth	Continue monitoring high Ammonium levels of unknown source
Karingal Creek	Moderate turbidity High nutrient growth	Continue monitoring high Ammonium levels of unknown source
Plenty River	High turbidity	Continue monitoring

1. Healthy Waterways Waterwatch Background

1.1 Introduction

The Healthy Waterways Waterwatch Program is funded by Melbourne Water and Local Government. The program has been successfully operating as Waterwatch within the Melbourne Region for over ten years.

The Healthy Waterways Waterwatch Program depends on financial support from local government organisations to enable the delivery of high quality waterways education and engagement activities within each participating municipality.

Through the Healthy Waterways Waterwatch Program, schools and the community are supported and encouraged to become actively involved in the monitoring, conservation and protection of local waterways.

1.2 Program Structure

A network of Healthy Waterways Waterwatch Program Coordinators support local communities across the Port Phillip and Westernport catchments. These Coordinators:

- Plan, implement and deliver an extensive range of waterways education experiences to the community.
- Work in partnership with local governments, friends groups and other interested stakeholders to promote the conservation and protection of local waterways.
- Raise awareness and understanding of local waterway issues.
- Provide water quality monitoring training to local Healthy Waterways Waterwatch Program volunteers.
- Facilitate partnership opportunities between all levels of government, private business and the community.

2. North East Melbourne Waterwatch Programs

The North East Melbourne Healthy Waterways Waterwatch Programs are supported by five local councils (Yarra, Darebin, Banyule, Nillumbik and Whittlesea) and Melbourne Water. The funding from these organisations for 2012-2013 is outlined in Table 1.
Funding from Councils is primarily used to fund activities and maintain equipment within each particular municipality. Funding from Melbourne Water is used to support the program and allows for training, quality assurance, purchasing of new and replacement equipment, entry of data into the Waterwatch data base, reporting and other administration.

Table 2: Northeast Melbourne Waterwatch funding (GST exclusive) for 2012-2013

Funding Source	Grants 2012-2013
Council Grants:	
Banyule	$23,705
Nillumbik	$11,700
Darebin	$6,500*
Whittlesea	$7,000*
Yarra	$1,877*
Total(Councils)	$50,782
Melbourne Water	$44,932
Total	$95,714

**These Councils also funded the Merri Creek and Moonee Ponds waterwatch program. These figures represent only the portion of funding given to the North East Melbourne waterwatch program.*

3. North East Melbourne Waterwatch Participation 2012-2013 (All Council Areas)

Figure 1: North East Waterwatch region – Darebin, Plenty & Diamond Creek Catchments

The following Community Groups are currently involved in the Healthy Waterways Waterwatch Program in the Darebin, Plenty and Diamond Creek Catchments:

- Friends of Wilsons Reserve
- Edendale Education Centre
- Banyule Wetlands
- Whittlesea Area Waterwatch Group
- Karingal Creek at Nerreman Wetlands
- Karingal Creek
- Banyule Bush Crew
- Darebin Bush Crew
- Darebin Lower Waterwatch Group
- Friends of the Wildlife Reserve
- Friends of Griffith Park
- Friends of the Diamond Creek Hurstbridge
- Friends of the Diamond Creek in Eltham
- Donaldson's Creek Waterwatch Group
- Darebin Creek Management Committee
- Arthurs Creek Landcare
- Kalparrin Lake Waterwatch Group
- Friends of the Plenty River

3.1 North East Melbourne Waterwatch Participation

In the North East Melbourne region the following participation rates were achieved in 2012-2013.

- Fifty three waterwatch sessions were delivered across five primary schools and six secondary schools.
- A total student population of one thousand and eighty seven students engaged in the healthy waterways education sessions.
- Thirty nine community waterwatch sessions were delivered at community festivals, waterwatch events and in assistance/training sessions for local monitoring groups.
- One thousand and eighty four community members participated in these sessions.
- In total two thousand, one hundred and seventy one people across the community and schools participated in the North East Melbourne waterwatch Healthy Waterways program

Figure 2: Stamp applied to street drain in Ivanhoe West by St Bernadette's Primary School student in a Waterwatch Healthy Waterways education session.

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4. Nillumbik Municipality Waterwatch Participation for 2012-2013

Waterwatch activities conducted in the Nillumbik municipality between July 2012 and June 2013 are listed in Table 2. In addition to the 131 community members who participated in various waterwatch events, 50 school and preschool children participated in the program.

Participants	Audience	Date	Number of Participants	Sessions	Site Location	Waterwatch Activity
Diamond Valley Library	ages 2-6	13/07/2012	20	1	Diamond Valley Library, Greensborough	Story time - Who's still hiding?
Arthurs Creek Landcare	adults	20/07/2012	10	2	Arthurs Creek	Community - Shadow Testing
Nillumbik Shire Council Practically Green Festival	families	21/10/2012	80	1	Edendale Environmental Centre, Eltham	Family Festival
Nillumbik Shire Council event- Watsons Creek walk	adults	15/11/2012	15	1	Watsons Creek, Bend of Islands	Community - Field Visit
Diamond Valley gardening group	adults	20/11/2012	8	1	Diamond Valley Library, Greensborough	Community - raingarden session
Christmas Hills Primary School	Grade 3-6	28/11/2012	30	2	Christmas Hills, Eltham	School - Action
Friends of Diamond Creek Hurstbridge	adults	6/12/2012	6	2	Diamond Creek, Hurstbridge	Community - Shadow Testing
Nillumbik Shire	adults	12/12/2012	15	1	Edendale Environmental Centre, Eltham	Council event

Table 3: Waterwatch activities in Nillumbik

5. Water Quality Monitoring

Waterwatch provides training and equipment to enable community groups to measure a number of water quality parameters, which are discussed in detail below. The aim of the monitoring is to put together a picture of current water quality of our catchments in the time frame monitored. To determine the current health, the water quality data collected by groups can be compared with the relevant State Environment Protection Policy (SEPP) Guidelines, which are presented fully in Appendix 1. Over an annual to longer term period, we can draw conclusions as to the current health of our local waterways. The part of the guidelines that refers to the Yarra Catchment (Schedule F7), which includes Banyule, specifies water quality objectives using a different statistic for each parameter, which is derived from long term monitoring of selected reference sites.

There are different reference sites for different types of waterways, which reflect the fact that the quality of waterways varies naturally depending on environmental factors such as catchment land use and geology, and thus there are different segments which cover parts of the Yarra Catchment. The upper reaches of catchments protected from urban development naturally have much higher water quality than urban waterways for example, and the SEPP objectives reflect this. References sites were selected for their exceptional health compared against other sites in the same segment. Thus SEPP gives us an idea of how our waterways are compared to what they could be. All of the waterways in Banyule belong to a SEPP category called the Urban Waterways Segment, and so in the results section of this report we use the objectives that apply to this segment.

Waterwatch Victoria has developed a more descriptive, general set of guidelines, which allow groups to judge whether their sites are excellent, good, fair, poor or degraded with respect to each parameter. These categories are derived Waterwatch Water Quality Guidelines, which give a general ideal of ecological health for waterways Victoria wide. These guidelines are shown on Table X

Another important component of Waterwatch is aquatic macro invertebrate surveying, however this report only presents and discusses physical/chemical water quality results. For macro invertebrate data or further interpretation of results please contact your Waterwatch Coordinator.

5.1 Water Quality Parameters – Description

Conductivity

Conductivity tests for salinity. Salinity is the amount of dissolved salts in the water. The types of salts may include chlorides, sulphates, carbonates, sodium, magnesium, calcium and potassium. These salts enter the waterway through runoff from the rocks and soils of a catchment. The soils and geology of the waterway's catchment normally determine salinity; however human activities can drastically increase salinity levels. Salty water conducts electricity more readily than pure water, therefore salinity is measured as electrical conductivity (EC) and total dissolved solids (TDS).

Changes in conductivity levels can be the result of changes in geological weathering, seepage of groundwater, industrial and agricultural effluent, stormwater and sewage effluent flowing into streams and changes in rainfall patterns. The SEPP objective for the Urban Waterways segment is a maximum of 1000 µS/cm for Yarra River tributaries and 200µS/cm for the Yarra River main stream.

Turbidity

Turbidity is the cloudiness of water that results from suspended material in the water. Suspended materials in the water decrease the ability of light to pass through the water column, which can limit plant growth. This in turn affects the fish and invertebrate communities that feed and live on the plants. The most common cause of turbidity in our waterways is algae and inorganic material from soil weathering and erosion. The SEPP objective for urban waterways has two objectives. One is a so called "percentile value (25NTUs), this means that for a healthy waterway, 50 % of values measured should be less than 25 NTUs. The other is a 90^{th} percentile value (80 NTUs), this means that for a healthy waterway, 90% of values measured should be less than 80 NTUs. In this way the guidelines reflect the fact that although, major storms may cause significant erosion and consequently turbidity in any waterway, in healthy waterways this happens relatively infrequently.

pH

The pH is a measure of how acidic or alkaline the water is on a scale of 1 to 14. The pH depends on the geology and soils of the catchment. Aquatic plants and animals are adapted to the natural pH range of their habitat. Human activities, such as stormwater and industrial and agricultural runoff can alter the pH of a waterway and impact upon aquatic ecosystems. The SEPP objectives specify a pH objective as a range (6.0 -8.5 for the urban waterways segment) hence healthy waterways are expected to have pH somewhere within this range.

Water Temperature

The temperature of a body of water is affected by a variety of factors, but is naturally determined by water depth, flow, turbidity, available shade and seasonal factors. Anthropogenic factors that may affect temperature include discharge from industry and runoff from roads after storms on a hot day. Temperature is a very important factor in maintaining a healthy waterway, and affects the amount of Dissolved Oxygen that is available to organisms. In addition, temperature and the temperature stratification of a water body is an important aspect of Blue-Green Algal blooms.

The SEPP objective for water temperature is <2 degrees Celsius increase. This objective is relevant when one is comparing a site with one further upstream, a temperature increase between the two suggests there may be a foreign inflow in between the two sites. Water temperature results are not presented in this document.

Phosphorous

Phosphorous (P) is a nutrient that occurs naturally at low levels in water and is essential for all forms of life. Phosphorous comes from processes such as

weathering of rocks and decomposition of organic material such as plants. Phosphorous concentrations vary naturally depending on the local soil type, geology and seasonal conditions. Phosphorous is present in streams as soluble phosphates, in soil bound to clay particles and in living organisms such as algae.
Phosphate stimulates growth of aquatic plants, providing' food for aquatic macro invertebrates and fish. However, algae and plants prosper with an excess of phosphate, which often enters waterways through human activity, subsequently choking up waterways. Algal blooms, such as Blue Green Algae can cause serious problems as they can be toxic to humans and livestock.

Phosphate is measured in mg/L, and the SEPP objective for Phosphate is a maximum under base flow conditions. In more recent SEPP policies, there is a trend away from using base flow condition objectives because distinguishing between storm flow and base flow conditions is not always easy. Here we use a 75th percentile statistic as a rough approximation to a maximum in base flow conditions. The 75th percentile is a value beneath which 75% of values will fall, so it can approximate a maximum in base flow conditions if the top 25% of phosphate values are likely to be caused by storm flow.

Nitrogen

Nitrogen is often measured by the concentration of nitrate (N03) or Ammonium (NH4). Nitrogen is recycled continually by plants and animals and is present in freshwaters in higher concentrations than phosphate. Although both nutrients are required for plant growth, phosphate is considered to be the limiting factor in fresh water. In saltwater ecosystems, however, nitrogen is much less abundant and it becomes the nutrient that limits plant and algal growth. The main factors affecting nitrogen include rock type and geology, vegetation, seasonal condition, animal and human wastes (including sewage) and decomposing plants and animals.

Due to safety reasons and time constraints, Waterwatch measures Ammonium rather than Total Nitrogen. The SEPP objectives do not include an objective for Ammonium, so we typically use an objective from the ANZECC guidelines, which is an 80th percentile value of 0.02 mg/L. This means that 80% of values should fall beneath this value.

Dissolved Oxygen

Dissolved Oxygen (DO) is the small amount of oxygen gas dissolved in the water. The concentration of dissolved oxygen is an important indicator of the health of the aquatic ecosystem. It is essential for the respiration of fish, aquatic animals, micro-organisms and fish. DO test kits measure results in milligrams per litre (mg/l). A percentage saturation of DO can be calculated by also measuring the water temperature and salinity and plotting the results on a monogram.

The SEPP objectives for urban waterways for DO are a minimum of 6.0mg/L and a minimum of 60% saturation.

Table 4 : Victorian Waterwatch Water Quality Guidelines

	EXCELLENT	GOOD	FAIR	POOR	DEGRADED
CONDUCTIVITY (µS/cm)	<100	100 - 250	250 - 500	500 - 750	>750
TURBIDITY (NTU)	<15	15 – 17.5	17.5 - 20	20 - 30	>30
DISSOLVED OXYGEN (%)	> 80%	80 – 60%	60 – 50%	50 – 40%	<40%
pH	6 - 7	5.5 – 6 or 7 - 8	8 – 8.5	5 – 5.5 or 8.5 - 9	<5 or >9
PHOSPHATE (mg/L)	< 0.008	<0.02	<0.04	<0.08	>0.08
AMMONIUM*					

* No exact rating guideline available at the time of printing. Anything over zero is considered degraded

6. Water Quality Results

6.1 Arthurs Creek

The following site was monitored within the Nillumbik municipality in 2012-2013:

- YAR580 - Arthurs Creek, near Bridge, Arthurs Creek Road, Arthurs Creek, this site was monitored in 2012-2013 by John Cother of Arthurs Creek Landcare

Table 5: Site YAR580 monitored on Arthur's Creek 2012-2013

Site Code	Date	Turbidity (NTU)	pH (pH Units)	Electrical Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Reactive Phosphate (mg/L)	Ammonium (mg/L)
YAR580	21/06/2013	9	7.4	270	10	0	0
YAR580	19/04/2013	15	7.3	290	8	0.1	0
YAR580	15/03/2013	10.3	6.3	270	4	0.07	0.02
YAR580	15/02/2013	4.76	5.7	210	6	0.02	0
YAR580	19/10/2012	9	7.2	290	8	0.02	0
YAR580	21/09/2012	11	8.4	290	6	0.01	0
YAR580	17/08/2012	80	8.1	290	8		0
YAR580	20/07/2012	27	6.9	250	10	0.02	0
SEPP Objective		**50^{th} <15 90^{th} <30**	**>6 <8.5**	**<500**	**>6.0**	**<0.05**	**< or = 0.02**

Arthur's Creek belongs to a more stringent segment of the EPA State of Environment Protection Policy (SEPP) than the other waterways in Nillumbik. It is part of the Rural Eastern Waterways Segment. The Rural segment of the SEPP guidelines has more rigorous expectations in terms of water quality as rural waterways are generally expected to be less polluted than urban waterways.

Only one site was monitored on Arthurs Creek in 2012-2013. The results of this monitoring are given in Table 4 above. The measured parameters are generally in line with the SEPP objectives as shown.

It should be noted that in 2009-2010 the turbidity at this site was extremely high which was thought to be due to the waterway being affected by the February 2009 bushfires which had denuded the bank vegetation and left large amounts of ash. This in turn had caused high bank erosion once heavy rainfall occurred.

Results this year indicate that the waterway functioning and riparian vegetation has largely recovered.

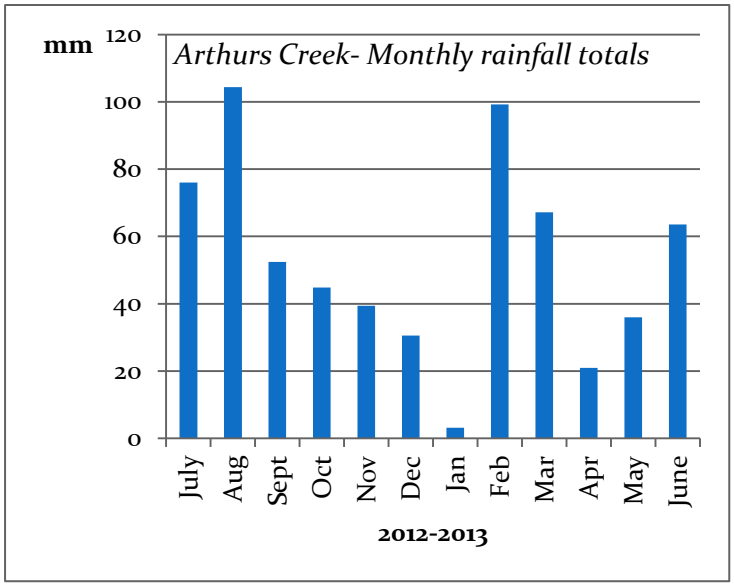

Figure 3: Rainfall information from http://www.melbournewater.com.au

The data shows that Arthurs Creek experienced elevated turbidity in July and August of 2012. When we check the rainfall chart for this region (Arthurs Creek – given in Figure 3) we can see that large rainfall totals occurred in both these months.

There seems to be a correlation between rainfall and high turbidity although there was also heavy rainfall in February 2013 which didn't result in a high turbidity reading. It can be noted that in the data taken on the 15 Feb 2013 the weather was sunny with no rain in the previous week so perhaps the large rainfall totals in February 2013 occurred in conjunction with periods of dry weather.

6.2 Diamond Creek

The following sites were monitored within the Nillumbik municipality in 2012-2013:

- YDI350 - Diamond Creek, behind 1529 Heidelberg-Kinglake Road, St Andrews (monitored in 2012-2013 by Diamond Creek at St Andrews waterwatch group - monitor Paul Kitchell)
- YDI500 - Diamond Creek near Knowle Grove, Hurstbridge (monitored in 2012-2013 by the Friends of Diamond Creek monitor Anne Fitzpatrick)
- YDI800 - Diamond Creek @ Edendale Environment Centre footbridge (monitored in 2012-2013 by Friends of Diamond Creek monitor Anne Wilson
- YDI810 - Diamond Creek, at 87-88 Railway Pde, Eltham (monitored in 2012 - 2013 by Diamond Creek at Eltham waterwatch monitor Bill Wilkie)

Table 6: Sites monitored on Diamond Creek 2012- 2013

Site Code	Date	Turbidity (NTU)	pH (pH Units)	Electrical Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Reactive Phosphate (mg/L)	Ammonium (mg/L)
YDI350	24/04/2013	20	6.6	450	10	0.01	0
YDI350	17/01/2013	30	7.2	310	8	0.01	0.01
YDI350	15/12/2012	250	7.1		10	0.01	0.01
YDI350	21/11/2012	30	6.9	320	10	0.01	0.01
YDI350	17/10/2012	30	7	350	10	0.02	0.01
YDI350	13/09/2012	150	6.9	250	10	0.03	0.02
YDI350	18/08/2012	310	7	330	10	0.01	0.02
YDI350	18/07/2012	310	6.9	330	10	0.02	0.02
SEPP Objective		**50th <15 90th <30**	**>6 <8.5**	**<500**	**>6.0**	**<0.05**	**< or = 0.02**
YDI500	20/06/2013	26	6.8	650	8	0.01	0.01
YDI500	18/04/2013	14		410	6	0.02	0.02
YDI500	21/03/2013	21	8.2	610	6	0.07	0.02
YDI500	21/02/2013	16	6.9	440	9	0.05	0.02
YDI500	23/01/2013	21	7.1	540	6	0.05	0
YDI500	06/12/2012	13	7.9	440	7	0.07	0
YDI500	15/11/2012	9	6.8	410	7	0.02	0
YDI500	18/10/2012	13	6.8		7	0.03	0
YDI500	20/09/2012	24	8	360	8	0.07	0.02
YDI500	16/08/2012	90	8	290	8	0.03	0.04
YDI500	19/07/2012	35	8	260	8	0.02	0.1
YDI800	05/06/2013	200	7.3	1100	8		0.3
YDI800	08/05/2013	13	7.6	570	7	0.02	0
YDI800	19/02/2013	35	7.2	630	5		0.02
YDI800	05/12/2012	19	7.3	470	7	0.05	0.02
YDI800	07/11/2012	19	7.2	480	8	0.1	0.04
YDI800	27/09/2012	21	7.2	410	8	0.07	0
YDI800	01/08/2012	100	7.7	290	9		0.12
YDI810	30/06/2013	50	7.2	340	8	0.05	0.02
YDI810	25/05/2013	23	7.2	370	6	0.02	0.02
YDI810	23/03/2013	55	7.4	700	6	0.025	0.02
YDI810	23/02/2013	40	6.9	620	4	0.01	0.02
SEPP Objective		**50th <25 90th <80**	**>6 <8.5**	**<1000**	**>6.0**	**<0.1**	**< or = 0.02**

Site Code	Date	Turbidity (NTU)	pH (pH Units)	Electrical Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Reactive Phosphate (mg/L)	Ammonium (mg/L)
YDI810	19/01/2013	33	6.8	750	6	0.02	0
YDI810	24/11/2012	32	6.7	540	6	0.03	0
YDI810	20/10/2012	48	6.8	460	6	0.07	0.02
YDI810	29/09/2012	70	7.2	300	6	0.03	0.02
YDI810	25/08/2012	80	7.5	310	4	0.03	0.04
YDI810	21/07/2012	45	7.3	330	8	0.05	0
SEPP Objective		**50^{th} <25 90^{th} <80**	**>6 <8.5**	**<1000**	**>6.0**	**<0.1**	**< or = 0.02**

Table 5 gives the monitoring results from the sites monitored on Diamond Creek in Nillumbik. The site YDI350 in St Andrews is the most remote of the sites monitored on Diamond Creek in Nillumbik. It is part of EPA's SEPP – Rural EasternWaterways Segment. The remaining three sites are in the SEPP – Urban Waterways Segment. The Rural segment of the SEPP guidelines has more rigorous expectations in terms of water quality as rural waterways are generally expected to be less polluted than urban waterways.

It can be seen that in the upper reaches of Diamond Creek (at YDI350) that turbidity is high and always exceeds the recommended levels. The most excessive instances of turbidity were recorded in July, August, September and December 2012. Rainfall in this period in Arthurs Creek not far from St Andrews can be seen from Figure 3 on page 15. Although a correlation can be seen between higher rainfall and higher turbidity, in months of heavy rain that are preceded by dryer months the effect does not seem to be as marked.

The consistent high readings of turbidity across the year at the site YDI350 indicate that soil erosion may usually be causing turbidity issues which are aggravated by periods of heavy rainfall. This suggests that riparian vegetation and soil stability may not have fully recovered from the effects of the February 2009 bushfires which denuded the area. It should be noted that turbidity levels have decreased significantly at all monitored locations on Diamond Creek compared to the aftermath of the bushfires with the exception of this upper site.

Other parameters at this site were all within the normal range, with excellent levels of dissolved oxygen and low levels of unwanted nutrients.

Further downstream at Hurstbridge turbidity levels are much lower and usually within the SEPP guidelines. As the stream moves down into Eltham turbidity starts to rise again. This is a more moderate rise but seems to be steady across the year with only a slight increase in months of high rainfall.

Most of the other measured parameters are generally within SEPP guidelines except for slightly elevated levels of nutrient growth. This was generally apparent in June, July and August 2012 when higher rainfall may have been contributing to nutrient growth. As this also corresponded with high turbidity levels, which make it difficult to accurately measure nutrients, and considering that dissolved oxygen levels remained good at these times this is not of high concern.

6.3 Karingal Creek

The following sites were monitored within the Nillumbik municipality in 2012-2013:

- YDI833 - Nerreman Wetland in Eltham (monitored in 2012-2013 by the Friends of Karingal Yallock Creek's -Anna Richtarik)
- YDI838 - Karingal Yallock Creek near Fort Knox Self Storage, Eltham West.
- YDI847 - Karingal Yallock Creek, corner Susan and Brougham St, Eltham (YDI838/847 monitored in 2012-2013 by the Karingal Yallock Creek waterwatch group's – Leonie Morgan)

Table 7: Sites monitored on Karingal Creek in 2012-2013

Site Code	Date	Turbidity (NTU)	pH (pH Units)	Electrical Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Reactive Phosphate (mg/L)	Ammonium (mg/L)
YDI833	15/05/2013	19	6.9	130	8	0.07	0.05
YDI833	03/04/2013	21	6.3	170	5	0.06	0.06
YDI833	25/02/2013	13	6.9	440	2.5	0.9	0
YDI833	16/01/2013	9	7.1	1030	3.5	0.04	0.06
YDI833	01/12/2012	30	7	230	5	0.15	0.05
YDI833	31/10/2012	9	7.2	500	3	0.17	0.1
YDI833	15/09/2012	13	7.3	560	6	0.06	0.085
YDI833	11/08/2012	24	7.8	370	10		0.08
YDI833	17/07/2012	9	7.3	1200	6	0.08	0.07
YDI838	25/06/2013	10	7.1	760		0.05	0
YDI838	22/05/2013	30	6.8	220		0.07	0
YDI838	24/04/2013	30	7.5	180		0.05	0.07
YDI838	28/03/2013	40	7.4	220		0.09	0
YDI838	27/02/2013	27	6.9	340		0.06	0.02
YDI838	12/12/2012	24	7.3	770		0.1	0.6
YDI838	14/11/2012	17	7.4	420		0.08	0.15
YDI838	17/10/2012	19	7.3	580		0.08	0.07
YDI838	19/09/2012	9	7.6	820		0.07	0.1
YDI838	15/08/2012	35	7.7	480		0.07	0.1
YDI838	04/07/2012	80	8	430		0.06	0.15
YDI847	25/06/2013	24	7.1	830	8	0.08	0.03
YDI847	22/05/2013	200	7.1	480	8	0.25	0.3
YDI847	24/04/2013	27	8.4	280	8	0.08	0
YDI847	28/03/2013	40	7.8	230	6	0.09	0
YDI847	27/02/2013	21	7.7	380	6	0.06	0
YDI847	12/12/2012	12	7.9	760	5	0.15	0.4
YDI847	14/11/2012	60	8	670	6	0.15	0.9
YDI847	17/10/2012	200	8.1	680	6	0.08	0.3
YDI847	19/09/2012	24	8.1	960	8	0.15	0.4
YDI847	15/08/2012	30	8.1	500	8	0.08	0.03
YDI847	04/07/2012	24	8	600	8	0.08	0.07
SEPP Objective		**50th <25 90th <80**	**>6 <8.5**	**<1000**	**>6.0**	**<0.1**	**< or = 0.02**

These three sites are part of SEPP – Urban Waterways segment. The data obtained from monitoring over 2012 -2013 are shown in Table 6.

The results show low dissolved oxygen levels and high ammonium levels which is consistent with previous records for these sites. The site YDI833 is close to a dam wall which causes low water flow which means low water agitation which can lead to low dissolved oxygen levels. The high ammonium levels are of a greater concern as they are seen at all sites monitored on Karingal Creek.

6.4 Plenty River

The following site was monitored within the Nillumbik municipality in 2012-2013:

- YPL280 -Plenty River at Gorge Rd, South Morang, downstream of bridge (Whittlesea area Waterwatch group – David Ford)

Table 8: Site YPL280 monitored on Plenty River in 2012-2013

Site Code	Date	Turbidity (NTU)	pH (pH Units)	Electrical Conductivity (µS/cm)	Dissolved Oxygen (mg/L)
YPL280	03/06/2013	150	7.4	530	8.1
YPL280	21/05/2013	14	7.8	600	8.4
YPL280	08/04/2013	27	7.7	410	7.2
YPL280	06/03/2013	90	7.4	410	5.7
YPL280	15/02/2013	15	7.4	540	5.5
YPL280	06/01/2013	21	7.3	490	5.3
YPL280	12/12/2012				
YPL280	07/12/2012	21	7.6	470	6.5
YPL280	05/11/2012	24	7.4	550	6.2
YPL280	08/10/2012	12	7.7	470	8
YPL280	13/09/2012				
YPL280	11/09/2012	30	7.8	420	9.9
YPL280	21/08/2012	120	7.6	270	10.3
YPL280	20/07/2012	50	7.4	350	9.1
SEPP Objective		**50th <15 90th <30**	**>6 <8.5**	**<500**	**>6.0**

There has only been one site monitored on the Plenty river in Nillumbik in 2012 - 2013. This site YPL280 is on the border of SEPP's – Rural Western Waterways segment and Urban Waterways segment. In the measured parameters here the more stringent guideline has been applied. No results are available for Reactive Phosphate or Ammonium.

Turbidity has been elevated in the past at this location and this has previously been credited to the Plenty River being susceptible to soil erosion due to its Sedimentary Silurian Geology. Compared to the 2009-10 monitoring results from this site, turbidity has actually improved and this is probably due to riparian vegetation recovery following the loss of vegetation in the February 2009 bushfires.

7. Water Quality Results Summary and Recommendations

Table 9: Summary table of Waterway health in Nillumbik municipality 2012-2013

Nillumbik Waterway	Turbidity	pH	Electrical Conductivity	Dissolved Oxygen	Reactive Phosphate	Ammonium
Arthurs Creek	fair	fair	fair	fair	fair	good
Diamond Creek - St Andrews	degraded	good	fair	excellent	fair	fair
Diamond Creek - Hurstbridge	poor	good	fair	good	fair	fair
Diamond Creek - Eltham	degraded	good	fair	fair	fair	fair
Nerreman Wetland	fair	fair	fair	degraded	poor	degraded
Karingal Creek	poor	fair	poor	good	poor	degraded
Plenty River	degraded	good	fair	fair	no data	no data

Table 8 gives an indication of results obtained using the Victorian Waterwatch water quality guidelines colour coding scheme for visual clarity. These results have been analysed in section 6 using both these guidelines and the EPA's State of Environment Protection Policy (SEPP) guidelines. Recommendations for each waterway are given in Table 9.

Table 10: Summary of Recommendations for Waterways in Nillumbik Waterways 2012-2013

Nillumbik Waterway	Waterwatch Issues	Recommendations
Arthurs Creek	no major concerns	Continue monitoring
Diamond Creek -St Andrews	High turbidity	Soil erosion mitigation by revegetation
Diamond Creek - Hurstbridge	Moderate turbidity	Soil erosion mitigation by revegetation
Diamond Creek -Eltham	High turbidity	Soil erosion mitigation by revegetation
Nerreman Wetland	Low dissolved oxygen High nutrient growth	Continue monitoring high Ammonium levels of unknown source
Karingal Creek	Moderate turbidity High nutrient growth	Continue monitoring high Ammonium levels of unknown source
Plenty River	High turbidity	Continue monitoring

8. References

- Australian and New Zealand Environment and Conservation Council (ANZECC) (2000), “Australian and New Zealand Guidelines for Fresh and Marine Water Quality” *Paper No. 4 - Volume 1 (Chapters 1-7)*
- EPA Victoria (2003), “State Environment Protection Policy (Waters of Victoria)” *Victorian Government Gazette: No S 107*.
- Victoria Government Gazette (1999) Variation of the State Environment Protection Policy (Waters of Victoria) – Insertion of Schedule F7. Waters of the Yarra Catchment.

Appendix I – Water Quality Environmental Objectives

Waterwatch Monitoring groups use the EPA State of Environment Protection Policy (SEPP) guidelines and environmental objectives to determine the water quality condition of their waterways monitored. If water quality results fall significantly outside these ranges for unaccountable reasons, a pollution report is logged with the EPA.
Waterwatch sites in Nillumbik span three of the environmental segments defined by the SEPP Schedule F7. The sites on Arthurs Creek, Watsons Creek and the upstream part of Diamond Creek belong to the rural eastern waterways segment. The sites on the Plenty River belong to the rural western waterways segment. Sites on Karingal creek, and all but the most upstream site on Diamond Creek, and the Yarra River main stream, belong to the Urban Waterways Segment.

Segments	Urban Waterways	Rural Western	Rural Eastern
Indicators (Units)	Karingal creek, sites on Diamond Creek, south of confluence with Arthurs Creek, and the Yarra River main stream	Plenty River, upstream of Gorge Road	Arthurs Creek, and one site on Diamond Creek in St Andrews upstream of Arthurs Creek confluence
Temperature (^{o}C increase)	<2 ^{o}C	<2 ^{o}C	<2 ^{o}C
pH (pH units) range Maximum variation	6.0-8.5 0.5	6.0-8.5 0.5	6.0-8.5 0.5
Electrical Conductivity Max (µS/cm)	<500* <1000	<1500	<200* <500
Dissolved Oxygen min (mg/L) Min % saturation	>6.0 60%	>6.0 60%	>6.0 60%
Turbidity (Suspended solids)	<25 <30*	<25	<15
Total phosphorus # (mg/L)	<0.1 <0.08*	<0.05	<0.05
Total nitrogen @ (mg/L)	<1.0 <0.9*	<0.6	<0.6
E.coli (organisms/100ml)	<200* <1000	<200	<200
Invertebrate community SIGNAL Index score Min No of families (see note*) Key Families No of key families Present	 5.5/6* 20/26* List 3 12/16*	 5.5 20 List 2 10	 6.5 27 List 2 17*/16

Table 11: Environmental quality indicators for mid Yarra River, lower Darebin Creek, lower Plenty River & Salt Creek are derived from Schedule F7 EPA SEPP guidelines for the Yarra Catchment (1999)

**values for Yarra River main stream only*
 # Reactive phosphate is tested by Waterwatch, not Total Phosphorous, thus this value is a guide only
@Ammonium is tested by Waterwatch, not Total nitrogen, thus this value is a guide only.