KING PARROT CREEK

WATER MONITORING REPORT 1995-2007

A monitoring program is important as:

- An educational tool that introduces water quality issues to the general community;
- A means of gathering base datasets to allow useful discussion of issues and provide some direction for future works;
- A method of assessing the value of works completed.

KING PARROT CREEK AFTER WALLABY CREEK CONFLUENCE (looking downstream)

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Introduction

Waterwatch is a community water quality monitoring program that assists the community in monitoring their local waterway. The Program aims to:

- Increase community awareness and understanding of water quality issues;
- Increase community involvement in water management decisions; and,
- Generate useful data for community and agency use which complements that collected by Agency monitoring networks.

Monitoring networks across the Goulburn Broken Catchment have been formed to study water quality in their local areas. The networks are able to test a local stream for a range of parameters using equipment supplied by the Waterwatch Program. The parameters selected for testing in each area depend upon the water quality issues identified by the monitoring network. Monitors also record the date, time and rainfall to assist in the interpretation of the data.

This report contains the following information:

1. Information about water quality parameters
2. A tabular summary of data collected at sites monitored.
3. Graphical representation of each parameter along the length of the King Parrot Creek and a site each on Chyser Creek and Pheasant Creek.
4. Comparisons of local water quality data with State Environment Protection Policy (SEPP) guidelines
5. Macro-invertebrate surveys conducted in 2007

There are many reasons why people are prepared to become involved in a water monitoring program. **In fact, there are as many different reasons as there are people participating in a program!**

The challenge for Waterwatch as a community monitoring program is to help monitoring networks gather the information that **they** want. In the process, the data collected can be extremely valuable to waterway management agencies that are committed to improving the condition of our rivers and streams.

Definitions	
Median	Middle number in a series
Mean	Average calculated by adding all data points and dividing by the number of data points

Turbidity

Turbidity is the cloudiness of water and is the result of suspended material in the water. The suspended material decreases the ability of light to pass through the water column and can limit plant growth. This, in turn, affects the fish and invertebrate communities which feed on and live in the plants. Turbidity may be caused by silt, micro-organisms, plant material and chemicals. However, the most frequent causes of turbidity in rivers and other water bodies are algae and inorganic material produced from soil weathering and erosion.

High levels of turbidity have a two-fold effect on water:

- It loses its ability to support a large variety and number of aquatic organisms. Where there is less light penetrating the water, there will be less photosynthesis which reduces the level of oxygen in the water.
- The water becomes warmer because any suspended material absorbs heat from the sun. This also decreases the amount of oxygen dissolved in water.

Turbidity can be controlled by the retention of vegetation along streams and good farming practices such as contouring, stubble retention and off-stream watering of stock.

Turbidity in King Parrot Creek Region

Waterwatch coordinators and monitors have been monitoring sites along the King Parrot Creek and its tributaries since 1995. Since 2001 there has been a more comprehensive testing regime.

The table and graphs below summarise the data that has been collected.

Site Code	Site Description	TURBIDITY MEDIANS (NTU)												
		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
KPC002	**King Parrot Creek after Wallaby Creek confluence**							**4***	**3**	**5**	**3**	**2**	**3**	**3**
PHE010	*Pheasant Creek at Kinglake – Yea Road*							*12**	*13*	*8*	*7*	*3*	*4*	*3*
CHY010	*Chyser Creek before confluence with King Parrot Creek*							*9*	*20*	*18*	*6*	*5*	*5*	*2*
KPC005	**King Parrot Creek upstream of Hazeldene at Silver Creek Road**		**8**	**8**	**8**	**11**	**13**	**10**	**9**	**13**	**6**	**3**	**3**	**2**
KPC008	**King Parrot Creek at Hazeldene bridge**							**6**	**7**	**12**	**4**	**3**	**3**	**2**
KPC025	**King Parrot Creek before Goulburn River**	**8**	**11**	**7**	**13**	**9**	**14**	**10**	**5***	**8**	**13**	**11**	**6**	**6**

Rating:Turbidity for the Valleys –
<10 NTU Excellent, <12.5 NTU Good, <15 NTU Fair, <22.5 NTU Poor, >22.5 NTU Degraded

Note: results with * indicate <5 data sets used for interpretation.

Table 1

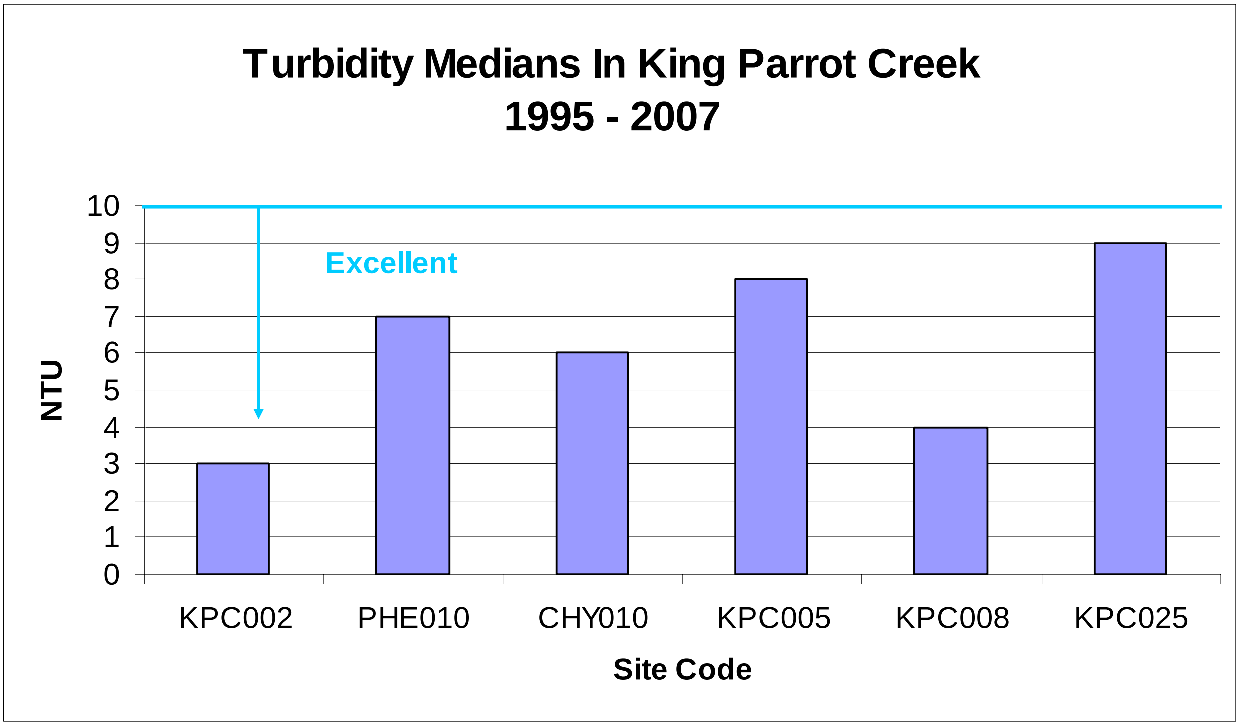

Fig 1

Figure 1 shows the median turbidity over the period of Waterwatch monitoring. These are all very low turbidities as would be expected in the Upper Catchment. In general, turbidity levels can be expected to rise as a waterway moves down a catchment. KPC005 (upstream of Hazeldene) is high in relation to KPC008 (at Hazeldene), most likely due to the input from Pheasant and Chyser Creeks, although these are all still rated as "Excellent". The overall trend is still a rise as the Creek moves downstream through the catchment. Figure 2 (below) shows the median turbidity of all sites in the King Parrot Creek for 2007 only. Results are all "Excellent".

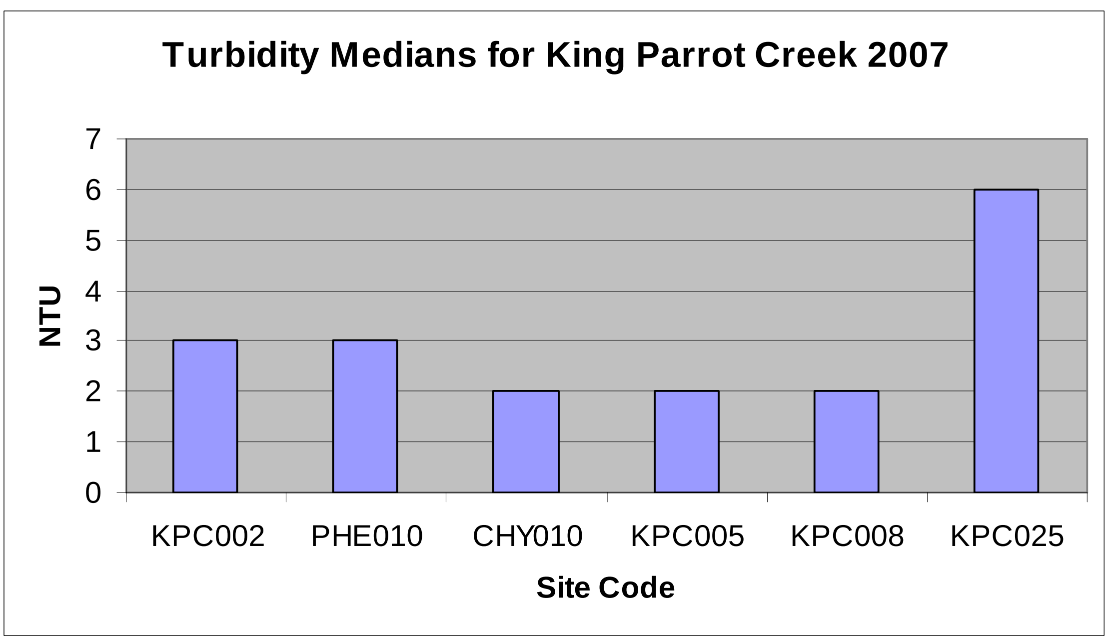

Fig 2

Salinity

Just as excess salt in our diets can be bad for our health, high salt levels in the environment negatively affect plants, animals and soils in and near waterways. Salinity is potentially the largest environmental problem facing Australia and is a major problem in Northern Victoria. The most concentrated problem areas are in the Shepparton Irrigation Region and areas around and to the west of Seymour. In the SIR, rising watertables have brought salinity closer to the surface, and at Seymour, dryland salting problems have occurred because deep rooted trees have been replaced by seasonal crops and grasses. Tree clearing can lead to dramatic rises in watertables. The solutions to salinity problems include revegetation of recharge areas and greater efficiency of irrigation in areas such as the SIR.

The information below explains the effect of salinity in agriculture.

0-800 EC

If you tested the water from your tap at home it would be within this range. This is good drinking water for people and suitable for all animals. When water of 300EC is used in overhead sprinklers by irrigation farmers, plants that are sensitive to salt may develop leaf scorch.

800-2500 EC

People can drink water within this range but it would start to taste very salty. This water is still suitable for all animals.

Peas, apricots and grapes can't be grown with water over 1,500 EC. If this water is used for irrigation farming, special care must be taken with drainage and choosing plants that are tolerant to salt. For example, lucerne can be irrigated with water of 2,000 EC and white clover with water of 1,000 EC, provided they are grown on sandy soil with good drainage.

2,500-10,000 EC

Water in this range is not suitable for people and should only be drunk in an emergency. When water over 4,000 EC is given to laying hens it causes their eggs to crack. Water over 6,000 EC is unsuitable for pigs and poultry. Highly saline water may also contain a high level of magnesium which can be harmful to stock. A water sample should be sent to a laboratory for analysis and specific advice obtained. This water is generally not used for irrigation farming except on some crops that have a very high tolerance to salt.

Pears, apples and tomatoes could not be grown with water in this range.

Over 10,000 EC

Don't drink this water! Water over 10,000 EC has an extremely high salinity. This water is unsuitable for people and for most animals. Only beef cattle and adult sheep can survive on water in this range. Irrigation farming is not possible with such highly saline water. In dryland areas only salt tolerant pastures will survive.

At 50,000 EC water has the same salinity as the sea. This water can be used for making concrete and flushing toilets as long as they are able to resist corrosion.

Salinity in King Parrot Creek Region

Waterwatch began monitoring salinity in the King Parrot Creek near its confluence with the Goulburn River in 1995. More comprehensive testing of the waterway and its tributaries began in 2001. Table 2 below shows electrical conductivity medians since 1995.

Site Code	Site Description	SALINITY MEDIANS (EC)												
		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
KPC002	**King Parrot Creek after Wallaby Creek confluence**							**40***	**68**	**69**	**68**	**67**	**69**	**70**
PHE010	*Pheasant Creek at Kinglake – Yea Road*							*50*	*71*	*81*	*77*	*74*	*76*	*80*
CHY010	*Chyser Creek before confluence with King Parrot Creek*							*70*	*88*	*93*	*88*	*86*	*97*	*105*
KPC005	**King Parrot Creek upstream of Hazeldene at Silver Creek Road**					**50**	**74**	**70**	**79**	**83**	**78**	**75**	**76**	**80**
KPC008	**King Parrot Creek at Hazeldene bridge**							**70**	**87**	**95**	**84**	**82**	**80**	**91**
KPC025	**King Parrot Creek before Goulburn River**	**145**	**110**	**160**	**175**	**139**	***110***	***131***	***182****	**175**	**132**	**158**	**143**	**158**

Rating: Conductivity for the Valleys –

<80 EC Excellent, <240 EC Good, <400 EC Fair, <600 EC Poor, >600 EC Degraded

Note: results with * indicate <5 data sets used for interpretation.

Table 2

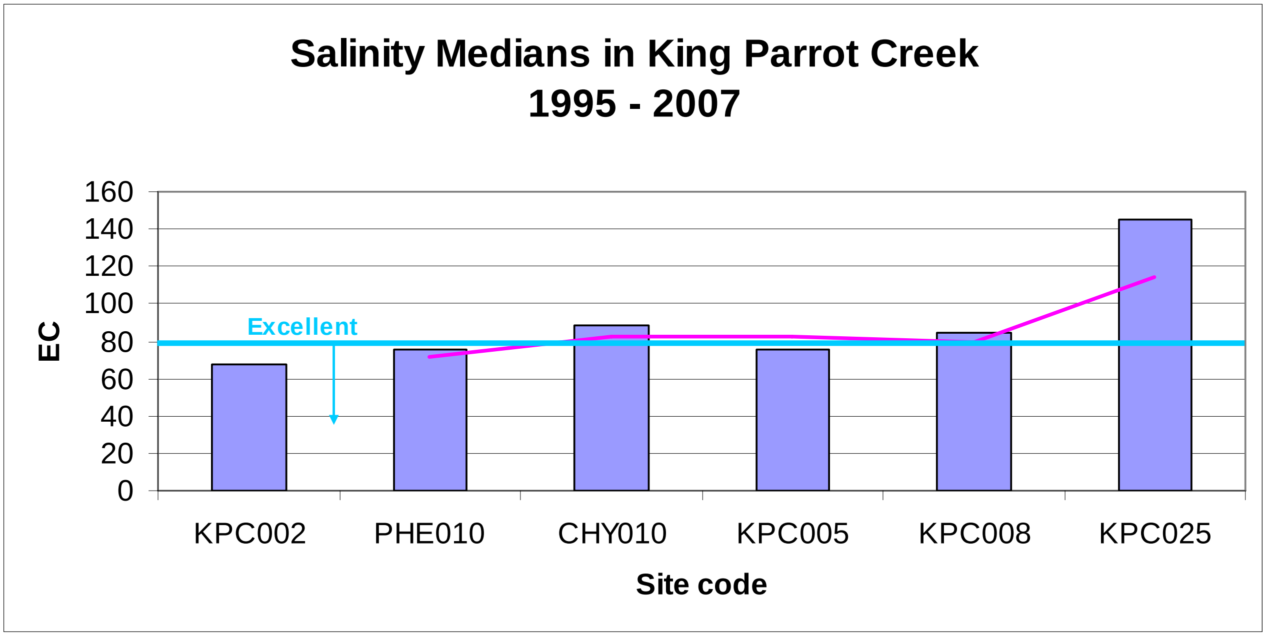

Fig 3

Electrical Conductivity (salinity) at all sites has consistently rated as "Excellent" or "Good" since 1995 (see Table 2 and Fig 3). King Parrot Creek near the confluence with the Goulburn River has salinity levels that are obviously higher than all other sites in this project, however this site is still well within the "Good" rating.

Figure 4 below shows median salinity levels in King Parrot Creek for 2007 only. It can be seen when comparing Figure 3 and Figure 4 that the trend (trendline shown in pink) over the last twelve years has continued on in 2007, with Chyser Creek, and King Parrot Creek at Hazeldene, and near the confluence with the Goulburn River having salinity levels slightly higher than "Excellent".

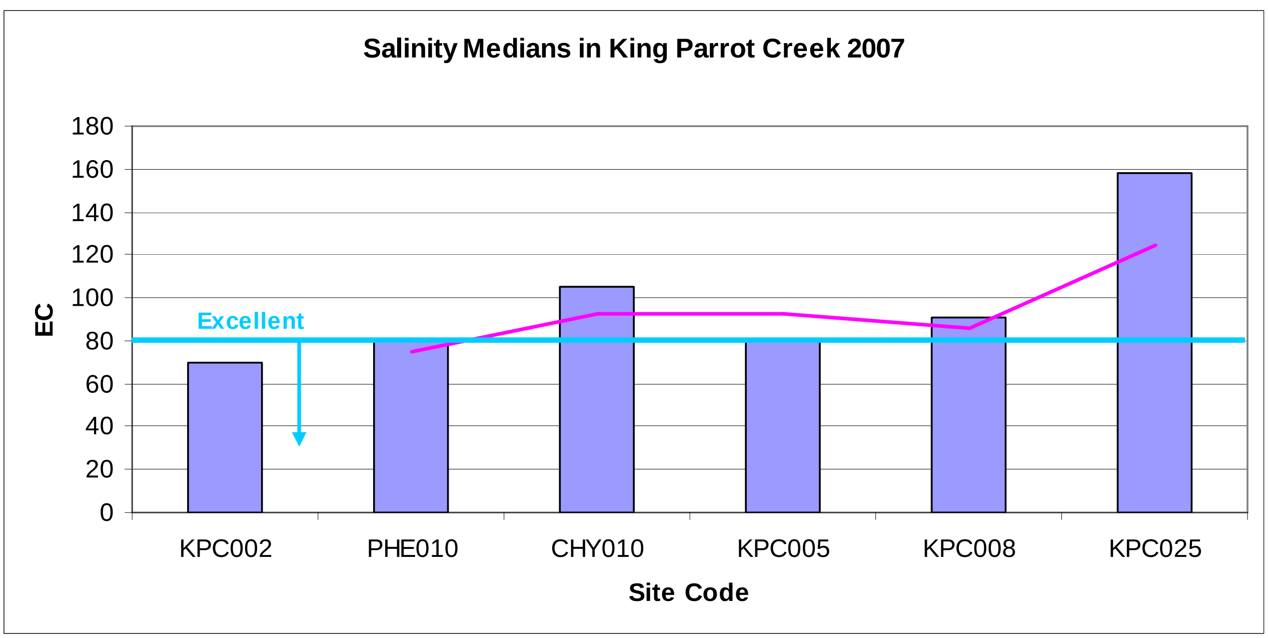

Fig 4

Phosphorus

Phosphorus is a nutrient that occurs naturally at low concentrations in water and it is essential for all forms of life. It comes from processes like the weathering of rocks and from the decomposition of organic matter such as plant litter. Other sources of phosphorus entering river systems include:

- ☐ sewage treatment works
- ☐ runoff from agricultural land
- ☐ stormwater drains
- ☐ runoff from forests
- ☐ irrigation drains intensive agricultural industries

An increase in phosphorus levels in streams may result from erosion, discharge of sewage, detergents, urban stormwater and rural runoff that contains fertilisers and animal and plant material. When the phosphorus concentration becomes too high, problems such as algal blooms, excessive growth of aquatic weeds and the loss of species diversity occurs.

Phosphorus in King Parrot Creek Region

Sites on King Parrot Creek, Pheasant Creek and Chyser Creek have been tested for phosphorus by Waterwatch since 2001, although there is data for King Parrot Creek before Goulburn River back as far as 1995. The tables and graphs below summarise the data collected.

Site Code	Site Description	TOTAL PHOSPHORUS MEDIANS (mg/L)												
		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
KPC002	**King Parrot Creek after Wallaby Creek confluence**							**0.05***	**0.04***	**<0.02**	**<0.02**	**<0.02**	**<0.02**	**<0.02**
PHE010	*Pheasant Creek at Kinglake – Yea Road*								*0.04**	*<0.02*	*<0.02*	*<0.02*	*<0.02*	*<0.02*
CHY010	*Chyser Creek before confluence with King Parrot Creek*							*0.16**	*0.27**	*0.05*	*0.03*	*0.06**	*0.06*	*0.03*
KPC005	**King Parrot Creek upstream of Hazeldene at Silver Creek Road**							**0.03***	**0.04***	**<0.02**	**<0.02**	**<0.02**	**<0.02**	**<0.02**
KPC008	**King Parrot Creek at Hazeldene bridge**							**0.03**	**0.03***	**<0.02**	**<0.02**	**<0.02**	**<0.02**	**<0.02**
KPC025	**King Parrot Creek before Goulburn River**	**0.02**	**0.04**	**0.03**	**0.03**	**0.04**	**0.03**	**0.04**	**0.04***	**<0.02**	**<0.02**	**<0.02**	**<0.02**	**<0.02**

Ratings: Total Phosphorus for the Mountains, Valleys and Plains–
<0.01 mg/L Excellent, <0.025mg/L Good, <0.05mg/L Fair, <0.1mg/L Poor, >0.1mg/L Degraded
Note: results with * indicate <5 data sets used for interpretation.

Table 3

Intensive monitoring has been carried out for Total Phosphorus in the King Parrot Creek and its tributaries. Figure 7 below shows that Chyser Creek has elevated levels of Total Phosphorus when compared with the other sites monitored for this project, and is rated as "Poor". All other sites rate as "Good". Unfortunately the lowest accurate result Waterwatch is able to gain with its Total Phosphorus testing method is "<0.02", so it may well be that these sites have even lower results, but Waterwatch is unable to confirm this.

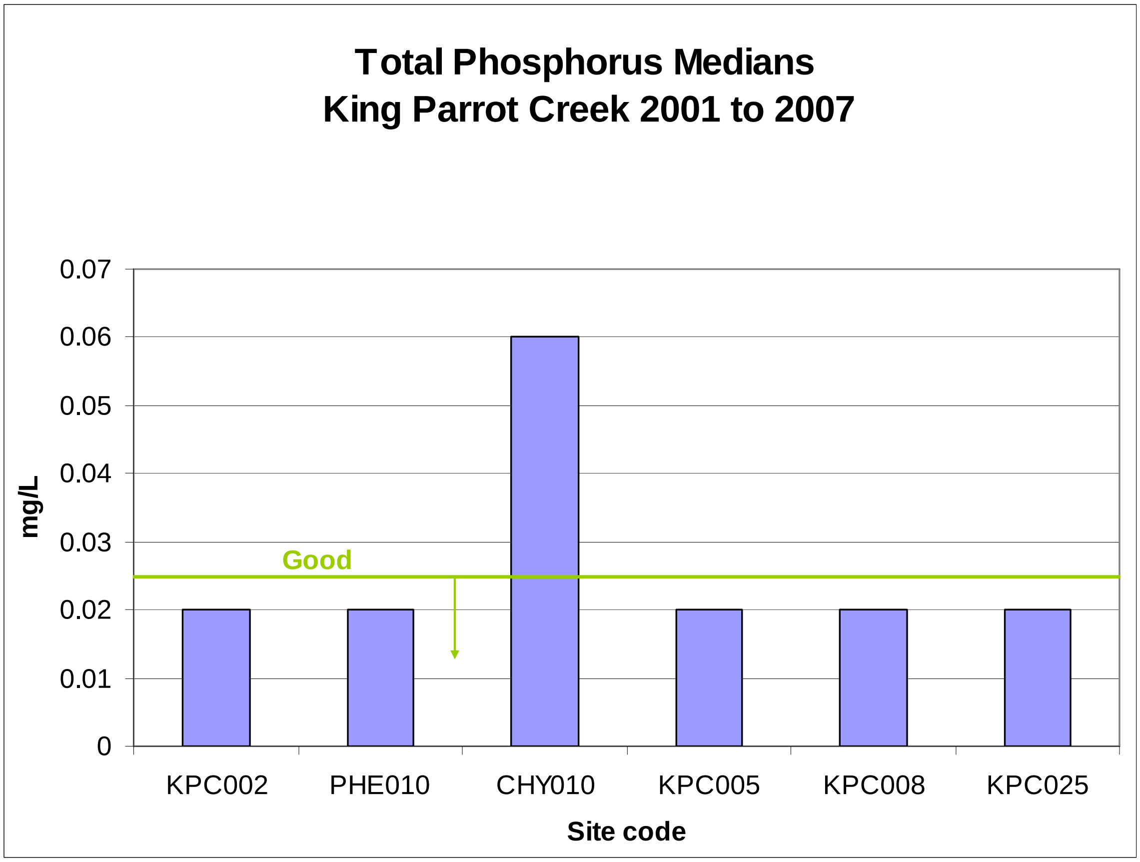

Fig 5

E.coli

Microbiological quality of a water-body is generally measured by testing for bacteria that are indicators of faecal pollution. Water intended for human consumption should contain none of these bacteria.

Indicator organisms are bacteria whose presence in water gives a simple and meaningful indication that faecal contamination has occurred. Such organisms are always present in high numbers in the faeces of humans (and other warm blooded animals and birds).

One of the major indicator organisms of faecal pollution is *Escherichia coli (E. coli).* When indicator bacteria are detected in water, their presence indicates that excrement from birds, animals or humans has recently polluted the water and that all types of pathogens (bacteria, viruses, protozoans and parasites) may also be present.

E. coli is a member of the coliform group of bacteria which grow naturally in the intestines of all warm-blooded animals. It is the predominant coliform in fresh faeces and so its presence in water is indicative of recent faecal contamination. The *E. coli* count does not differentiate between bacteria of bird, animal or human origin but, as animals and birds can act as carriers of human intestinal pathogens, the presence of *E. coli* should always be considered to have sanitary significance.

SEPP E coli Objectives for Waterways

Beneficial Use	Description	E coli (orgs/100ml)
		Median of 5 samples at regular intervals within 30 days
Primary Contact	Swimming, bathing and other direct water-contact sports	≤150
Secondary Contact	Boating and fishing	≤1,000

Some generalisations to help with interpretation:

- E coli can fluctuate widely even to the extent of increases from "tens" to "hundreds" without necessarily indicating contamination from a pollution source;
- If this magnitude of increase occurred regularly between two sampling sites and a known possible source was implicated, then there is some evidence of contamination;
- Normally, E coli levels will greatly increase after rainfall;
- Contamination from sewage can cause E coli levels up to 500,000 or more close to the point of entry of the sewage.

E.coli in King Parrot Creek Region

King Parrot Creek and its tributaries have been tested for E.coli by Waterwatch and the community since 2001. The table and graph below summarise the data collected.

Site Code	Site Description	E.coli MEDIANS (orgs/100ml)						
		2001	2002	2003	2004	2005	2006	2007
KPC002	**King Parrot Creek after Wallaby Creek confluence**	**34***	**-**	**17**	**15**	**10**	**3***	**19**
PHE010	*Pheasant Creek at Kinglake – Yea Road*	*200**	-	*119*	*114*	*37*	*109**	*140*
CHY010	*Chyser Creek before confluence with King Parrot Creek*	*78**	-	*76*	*389*	*152*	*376**	*365*
KPC005	**King Parrot Creek upstream of Hazeldene at Silver Creek Road**	**59**	**-**	**75**	**190**	**113**	**54***	**40**
KPC008	**King Parrot Creek at Hazeldene bridge**	**101***	**-**	**59**	**199**	**93**	**52***	**55**
KPC025	**King Parrot Creek before Goulburn River**	**-**	**-**	**-**	**-**	**70**	**-**	**-**

***Note:* - results with * indicate <5 data sets used for interpretation.**

Table 4

SEPP Guidelines suggest E.coli less than 150 organisms/100 ml sample for primary contact such as swimming or bathing. For 2007, all sites, with the exception of Chyser Creek, meet this guideline, but it must be noted that SEPP Guidelines use five samples within a 30 day period, whereas King Parrot Creek sites in Table 4 and Figure 6 are monitored once a month.

It can be seen from Figure 6 that the site on Chyser Creek has relatively high E.coli levels when compared with the other sites. It might be interesting to monitor another site further upstream on Chyser Creek to see if the source of the E.coli can be located. Pleasingly these increased levels from Chyser Creek are not causing a significant increase in the E.coli levels in King Parrot Creek.

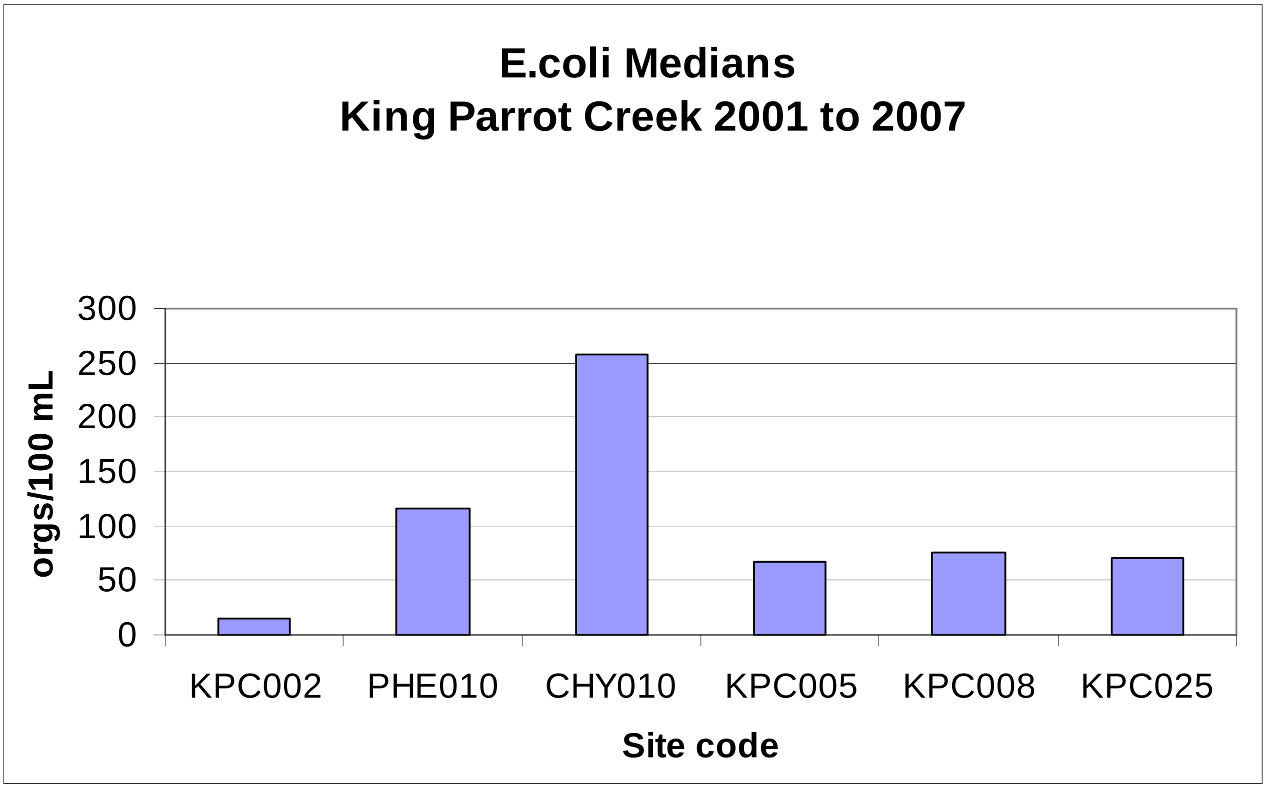
E.coli Medians
King Parrot Creek 2001 to 2007
orgs/100 mL
300
250
200
150
100
50
0
KPC002
PHE010
CHY010
KPC005
KPC008
KPC025
Site code

Fig 6

SEPP Compliance

The State Environment Protection Policy (SEPP) Waters of Victoria (WoV) water quality objectives identify the 'ideal' result range for environmental data at a particular location in a waterway. If a site fails a SEPP objective for one parameter, it indicates a possible problem for the whole system, not just for the one parameter and not just for the one site). It is recommended that an ecological risk assessment (ERA) be undertaken to determine if there is a risk to the values (or "beneficial uses") associated with that stream.

Basically, any set of results that fails the objective is a red flag to look more closely at what's going on. This differs from aiming for a particular turbidity or total phosphorus result, as an ERA may determine that it is acceptable to exceed the SEPP objectives for some parameters depending on the use/value of the waterway.

SEPP (WoV) Environmental Quality Objectives for Rivers and Streams – water quality

Colours highlight the SEPP (WoV) segments and objectives applicable within the Goulburn Broken CMA region for the tests of relevance to the King Parrot Creek.

SEGMENT	INDICATOR							
	Total phosphorus (ug/L)	Total nitrogen (ug/L)	Dissolved oxygen % saturation		Turbidity (NTU)	Electrical conductivity (uS/CM)	pH (pH units)	
	75^{th} percentile	75^{th} percentile	25^{th} percentile	maximum	75^{th} percentile	75^{th} percentile	25^{th} percentile	75^{th} percentile
Cleared Hills and Coastal Plains								
• mid-reaches of Ovens, Goulburn and Broken catchments	≤25	≤600	≥85	110	≤10	≤500	≥6.4	≤7.7

Table 5

2007 results at King Parrot Creek (below) compared to SEPP objectives – water quality

SEGMENT	INDICATOR							
	Total phosphorus (ug/L)	Total nitrogen (ug/L)	Dissolved oxygen % saturation		Turbidity (NTU)	Electrical conductivity (uS/CM)	pH (pH units)	
	75th percentile	75th percentile	25th percentile	maximum	75th percentile	75th percentile	25th percentile	75th percentile
KPC002 *King Parrot Creek d/s Wallaby Confluence*	20				3.3	70		
PHE010 *Pheasant Creek at King Parrot Confluence*	20				5.7	90		
CHY010 *Chyser Creek at King Parrot Confluence*	50				3.5	110		
KPC005 *King Parrot Creek at Silver Creek Road*	20				3.8	90		
KPC008 *King Parrot Creek at Hazeldene Bridge*	30				2.6	120		
KPC025 *King Parrot Creek at Goulburn Confluence*	20		89	100	9.4	183	7.0	7.5

Table 6

75% of readings at each site should not exceed the 75th percentile.

Note: SEPP objectives are long term theoretical goals for water quality. It is not expected that waterways will comply at this stage

Three quarters of the readings taken should fall below the 75th percentile. With the exception of Total Phosphorus results for Chyser Creek, and King Parrot Creek at Hazeldene Bridge, all results above fall within the SEPP Objectives. It must be noted that SEPP objectives are long term theoretical goals for water quality. It is not expected that waterways will comply at this stage. It is therefore excellent that the results for King Parrot Creek and tributaries meet with these guidelines.

Why do a Macro-invertebrate Survey?

Macro-invertebrates are animals without backbones that live at least a part of their life in water.
One reason for studying macro-invertebrates (or waterbugs) is that they can be useful indicators of the ecological health of freshwater habitats. Some aquatic invertebrates are more tolerant to pollution than others.

If a stream is polluted, tolerant bugs will usually be found in larger numbers than the intolerant or sensitive ones. However, if a habitat is close to pristine, or in its natural state, tolerant types of bugs will be found alongside the more sensitive bugs which will be in equal or greater numbers than the tolerant.

Sites and habitats within the King Parrot Creek were assessed against the SEPP WoV biological objectives (State Environmental Protection Policy – Waters of Victoria), outlined in Tables below.

There are many ways of analysing and interpreting invertebrate data to assess ecological condition. Currently five biological indices are used in Victoria for assessing the condition of aquatic ecosystems. These fall into three categories:

- a measure of diversity – number of families.
- biotic indices – the SIGNAL and EPT indices
- measuring of community composition – numbers of key families.

The development of these indices for assessing ecosystem condition has included the establishment of environmental quality objectives to aid in their interpretation. In recognition of the fact that aquatic communities will vary naturally across the State, the State has been characterised into five biological regions. The biological indices and their respective environmental quality objectives have been developed specific to the invertebrate communities within each region (EPA Victoria, 2003a). These biological indices and their associated environmental quality objectives have been set down in the ***State Environmental Protection Policy (Waters of Victoria)*** SEPP (WoV) and its schedules.

USING THE BIOLOGICAL INDICES

Separate assessments are made for riffle and edge habitats. In order to make a complete and accurate assessment of a site, the biological samples must be collected in both autumn and spring, and the invertebrate data from both seasons combined in the calculation of the indices

1. Number of Families.

The number of invertebrate families found at a site can give a reasonable representation of the ecological health of a stream as healthy streams generally have more families. **The Number of Families** index is calculated by simply summing the total ‘families’ of invertebrates present at a site.

Throughout a biological region, the expected number of families will vary according to quality of habitat and stream size, with larger streams, in general, supporting more taxa. Mild nutrient enrichment can increase the number of families due to an increase in food supply. Reduction in the expected number of families present can be caused by poor quality habitat and by various pollutants.

2. The SIGNAL biotic index.

SIGNAL (Stream Invertebrate Grade Number- Average Level) is an index of water quality based on the tolerance of aquatic biota to pollution (Chessman 1995). Using data from various studies of pollutants in south-eastern Australian streams, most, but not all, families of aquatic invertebrates have been assigned sensitivity grades according to their tolerance or intolerance to various pollutants. The list of invertebrate families and SIGNAL scores currently in use is based largely on those in the original publication

(Chessman 1995). Oligochaeta has been added and assigned a score of one**. See Appendix B, Sub-appendix 2**.

The SIGNAL index is calculated by summing together the sensitivity grades of each of the families found at a site that have been assigned a sensitivity grade, and then by dividing the number of graded families present. The output is a single number, between zero and ten, reflecting the degree of water pollution. Generally, high quality sites have high SIGNAL scores and, low quality sites have low SIGNAL scores.

Table 2: Generic key to SIGNAL scores

SIGNAL score	Water Quality
>7	Excellent
6-7	Clean water
5-6	Mild pollution
4-5	Moderate pollution
<4	Severe pollution

3. The EPT biotic index

The EPT index is the total number of families in the generally pollution sensitive insect orders of Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies). It is calculated by summing together the number of families in these three orders present at a site. Any loss of families in these groups usually indicates disturbance.

The EPT index cannot be used in all stream systems due to the natural variations in the biogeographical distribution of the relevant taxa. For example, due to their ecological preference for well oxygenated, cool water streams, stoneflies and some mayfly families are naturally uncommon in the warmer, slower flowing waters that are typical of lowland regions.

4. Key Invertebrate Families

This index focuses mainly on the loss of key taxa that are indicative of good habitat and water quality. It is based on a pre-determined list of invertebrate families that are expected to occur in each of the biological regions of the State as defined in the State Environmental protection Policy (*Waters of Victoria*). **See Appendix B, Sub-appendix 1**.

The families included in each list are those which:

- are typically found in non-degraded streams in that region;
- are representative of particular habitat types, such as riffles, woody debris, fringing vegetation, macrophytes or pools in that region;
- represent reasonable to good water quality and tend to disappear as conditions deteriorate, and
- are commonly collected when present, using the rapid bioassessment method.

Because the lists incorporate taxa from a range of habitat types, stream sizes and stream types, it is unlikely that a site would contain all families. Thus, the environmental quality objective for the Key Families index requires the presence of a proportion, not all, of the listed families.

Unlike the other indices, edge and riffle habitats are not distinguished with the key Families index. Both habitats must be sampled where present and the data from both samples and both seasons (autumn and spring) combined when making an assessment.

To calculate the Key Families index, simply compare the list of families present at a site with the appropriate list of key families as specified in the ***State Environmental Protection Policy (Waters of Victoria*)**. The key families score is the total number of these key families present at a site.

Biological regions from the SEPP (WoV) are as follows:

1. **Forests A (B2)** – upland region with moderate to high altitudes and moderate to high rainfall in predominantly forested areas with some forestry and grazing. Cool, clear streams with good water quality and riparian vegetation, located on moderately steep slopes. Stream substrate relatively coarse.

2. **Cleared Hills and Coastal Plains (B4**) – lowland region with low rainfall, gradients and altitude. Substantial clearing for intensive agriculture has resulted in poor riparian vegetation. Warm water streams with high alkalinity and low to moderate turbidity and salinity. Stream substrate is predominately moderate to fine grained particles.

1. Sampling, identification and data collation

Sampling was conducted in accordance with the Victorian Rapid Bio-assessment (VRBA) sampling protocol (Victorian EPA). This involved collecting water quality data and sampling aquatic invertebrates from available stream habitats. Sampling was undertaken in autumn 2007 and spring 2007. Samples were collected from 'riffle' habitat i.e. slow to fast areas where the water breaks over the substrate and 'edge' habitat i.e. slow to no flow areas which can include pool, undercut banks and backwaters. Riffle samples (also known as kick samples) were collected using a fine mesh net held downstream and kicking the substrate for a total of ten metres at each site. Edge samples (also known as sweep samples) were taken using a fine mesh net and sweeping the net through the water as well as in amongst the vegetation in the edge and pool sections of the stream for approximately ten metres. Both habitats were sampled where present. Each sample was emptied into a white sorting tray and aquatic invertebrates were picked from the sample for 30 minutes and placed in 70% ethanol for preservation and later identification in the laboratory.

Aquatic invertebrates were identified in the laboratory to Family level where possible with the exception of Acarina (mites), identified to Class level and Chironomidae (midges) identified to Sub Family.

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The Waterwatch sites for 2007 are

1. King Parrot Creek at Wallaby Creek, Waterwatch code KPC002
2. King Parrot Creek upstream of Moore's Rd Bridge at Flowerdale, Waterwatch code KPC011

2. Results

Table 7 has been reproduced from the SEPP WoV (Victorian Environment Protection Authority 2003). To meet objectives, sites assessed must return values equal to or greater than the values given in Table 7. If one or two habitats at a site fail, an overall failure is given to the site. In region B2, three of the four objectives should be met for the site to be given a pass.
All three objectives should be met in region B4 and failure to meet any one of the objectives should trigger further investigation.

Table 7 Objectives for biological indicators of environmental quality as listed in the SEPP WoV (Victorian Environmental Protection Authority 2003)

Indicators Region & Habitat	No of Families	SIGNAL index score	EPT index score	Key families combined habitat
B2 riffle	21	6.0	9	22
B2 edge	22	5.7	7	22
B4 riffle	23	5.5	N/A	22
B4 edge	26	5.5	N/A	22

N/A Not applicable in that region

Table 8. Biotic indices results for four sites in the Goulburn Broken Waterwatch Program 2007 assessed against SEPP WoV objectives for biological indicators of environmental quality.

Site code/ year	Site location	Biological Region	Habitat	Number of families score	SIGNAL index score	EPT	Key families Combined Habitat score	Site Pass Fail
KPC002 2007	King Parrot Creek at Wallaby Creek	B2	Riffle	30	6.6	14	30	Pass
KPC002 2007	King Parrot Creek at Wallaby Creek	B2	*Edge	20	6.2	7	30	Pass
KPC011 2007	King Parrot Creek at Moore's Road Flowerdale	B2	Riffle	31	5.9	11	27	Pass
KPC011 2007	King Parrot Creek at Moore's Road Flowerdale	B2	*Edge	25	5.3	6	27	Fail

Marginal value
Fail
* Based on only one spring sample in 2007, not the required two samples for the year

3. Discussion

The data provided for the King Parrot Creek at Wallaby Creek shows that the King Parrot Creek is meeting the SEPP biological objectives for the riffle and edge habitats in 2007. The only non compliance from the edge sample is for the number of families (20 whereas SEPP expects 22). This is probably due to no autumn edge habitat being sampled and this has affected the final result. The site was also chosen for its riffle habitat and does not necessarily provide the best habitat for an edge sample.

The tables provided above for the King Parrot Creek at Flowerdale upstream of Moore's Bridge, show that the King Parrot Creek is meeting the SEPP biological objectives for the riffle in all but one aspect (the SIGNAL score is 5.9 and SEPP expects 6.0).

The edge habitat in 2007 is not SEPP compliant. The non compliance from the edge habitat is for the SIGNAL Score (5.3 whereas SEPP expects 5.7) and the EPT taxa (6 whereas SEPP expects 7).This is possibly due to no autumn edge sample being taken and this has affected the final result. The site was also chosen for its riffle habitat and does not necessarily provide the best habitat for an edge sample.

It is anticipated that in autumn 2008, edge samples for both sites on the King Parrot Creek will be obtained and then a more valid comparison to SEPP (WoV) guidelines will be able to be made. SEPP values will be recalculated using both spring 2007 and autumn 2008 data and a new report issued.

Also, it is possible that this site should be compared to a Cleared Hill and Coastal Plains region rather than Forest A region.

TABLE 9

Families present in combined autumn and spring surveys for
KPC002 – King Parrot Creek at Wallaby Creek Biological Region B2 Riffle
Shaded boxes represent Key Families for Key Families Combined Habitat score.

Order	Family	SIGNAL GRADE SEPP	Common name
Plecoptera	Eustheniidae	10	Large green stonefly nymph
Trichoptera	Philopotamidae	10	Free swim caddis larva
Ephemeroptera	Leptophlebiidae	10	Feathery split gills mayfly
Ephemeroptera	Coloburiscidae	10	Mayfly nymph – spiny horse
Trichoptera	Glossosomatidae	8	Saddle case caddis larva
Plecoptera	Notonemouridae	8	Stonefly nymph
Trichoptera	Conoesucidae	8	Hooped case caddis larva
Trichoptera	Calocidae	8	Sand case caddis larva
Diptera	Dixidae	8	U bend fly larva
O. Odonata S.O Zygoptera	Megapodagrionidae	7	Damselfly nymph
Plecoptera	Gripopterygidae	7	Stonefly tufted abdomen
Trichoptera	Hydrobiosidae	7	Free swimming caddis large front leg
Coleoptera	Elmidae	7	Beetle larva
Trichoptera	Leptoceridae	7	Stick caddis (sand) larva
Odonata S.O Epiproctophora	Hemicorduliidae (Corduliidae)	7	Dragonfly nymph
Decapoda	Parastacidae	7	Yabby
Empemeroptera	Caenidae	7	Mayfly nymph
Diptera	S.F. Diamesinae	6	Non biting midge larva
Odonata S.O Epiproctophora	Telephlebiidae (Aeshnidae)	6	Dragonfly nymph
Diptera	SF Chironominae	6	Non biting midge larva
Trichoptera	Hydropsychidae	5	Free caddis larva
Coleoptera	Psephenidae	5	Water penny beetle larva
Diptera	Simuliidae	5	Blackfly larva
Diptera	Tipulidae	5	Cranefly larva
Ephemeroptera	Baetidae	5	Mayfly nymph
Amphipoda	Ceinidae	5	Scuds orange
Diptera	SF Orthocladiinae	5	Non biting midge larva
Hemiptera	Veliidae	4	Water cricket
Megaloptera	Corydalidae	4	Dobson fly larva
C. Oligochaeta		1	Aquatic worm
	No of Families 30	Total 198	
		SIGNAL index score 6.6	

TABLE 10
Families present in spring survey for
KPC002 – King Parrot Creek at Wallaby Creek Biological Region B2 - Edge
Shaded boxes represent Key Families for Key Families Combined Habitat score.

Order	Family	SIGNAL GRADE SEPP	Common name
Trichoptera	Philopotamidae	10	Free swim caddis larva
Ephemeroptera	Leptophlebiidae	10	Mayfly nymph
Trichoptera	Conoesucidae	8	Hooped case caddis larva
Trichoptera	Calamoceratidae	8	Sleeping bag caddis larva
Diptera	Dixidae	8	U bend fly larva
Trichoptera	Leptoceridae	7	Stick caddis (sand) larva
Plecoptera	Gripopterygidae	7	Stonefly nymph
Odonata SO Zygoptera	Synlestidae	7	Damselfly nymph
Odonata S.O Epiproctophora	Telephlebiidae (Aeshnidae)	6	Dragonfly nymph
Diptera	SF. Tanypodinae	6	Non biting midge larva
Diptera	SF Chironominae	6	Non biting midge larva
Acarina		NA	Water mite
Diptera	Simuliidae	5	Blackfly larva
Ephemeroptera	Baetidae	5	Mayfly nymph
Diptera	SF Orthocladiinae	5	Non biting midge larva
Coleoptera	Dytiscidae	5	Diving beetle
Coleoptera	Gyrinidae	5	Whirligig beetle
Amphipoda	Ceinidae	5	Scuds orange
Hemiptera	Veliidae	4	Water cricket
Oligochaeta		1	Aquatic worm
	No of Families 20 (19 for SIGNAL index score)	Total 118	
		SIGNAL index score 6.2	

TABLE 11

Families present in combined autumn and spring surveys for
KPC011– King Parrot Creek at Flowerdale Biological region B2 - Riffle
Shaded boxes represent Key Families for Key Families Combined Habitat score.

Order	Family	SIGNAL GRADE SEPP	Common name
Coleoptera	Ptilodactylidae	10	Beetle larva
Ephemeroptera	Coloburiscidae	10	Mayfly nymph – spiny horse
Ephemeroptera	Leptophlebiidae	10	Mayfly nymph
Trichoptera	Glossosomatidae	8	Saddle case caddis larva
Trichoptera	Hydrobiosidae	7	Free swimming caddis larva
Trichoptera	Leptoceridae	7	Stick caddis larva
Plecoptera	Gripopterygidae	7	Stonefly nymph
O Odonata SO Epiproctophora	Gomphidae	7	Dragonfly nymph
Ephemeroptera	Caenidae	7	Mayfly nymph
Decapoda	Parastacidae	7	Yabbie
Acarina		NA	Water mite
Diptera	S.F. Podonominae	6	Non biting midge larva
Diptera	S.F. Diamesinae	6	Non biting midge larva
O Odonata SO Epiproctophora	Telephlebiidae (Aeshnidae)	6	Dragonfly nymph
Trichoptera	Hydroptilidae	6	Micro caddis larva
Diptera	S.F. Tanypodinae	6	Non biting midge larva
Diptera	Ceratopogonidae	6	Pog larva
Decapoda	Atyidae	6	Shrimp
Diptera	S.F. Chironominae	6	Non biting midge larva
Diptera	Simuliidae	5	Blackfly larva
Coleoptera	Psephenidae	5	Water penny larva
Trichoptera	Hydropsychidae	5	Caddis larva
Ephemeroptera	Baetidae	5	Mayfly nymph
Diptera	S.F. Orthocladiinae	5	Non biting midge larva
Amphipoda	Ceinidae	5	Brown scud
Megaloptera	Corydalidae	4	Dobson fly larva
Trichoptera	Ecnomidae	4	Free swim caddis larva
Hemiptera	Veliidae	4	Water cricket
Tricladida	Dugesiidae	3	Black flatworm
C. Gastropoda	Physidae	3	Snail mottled shell Sinister shell
C. Oligochaeta		1	Aquatic worms
	No of Families 31 (30 for SIGNAL index score)	Total 177	
		SIGNAL index score 5.9	

TABLE 12

Families present in spring survey for
KPC011 – King Parrot Creek at Flowerdale Biological Region B2 Edge
Shaded boxes represent Key Families for Key Families Combined Habitat score.

Order	Family	SIGNAL GRADE SEPP	Common name
Ephemeroptera	Leptophlebiidae	10	Mayfly nymph
Trichoptera	Calamoceratidae	8	Sleeping bag caddis larva
Diptera	Dixidae	8	U bend fly larva
Trichoptera	Leptoceridae	7	Stick caddis larva
O. Odonata S.O Zygoptera	Synlestidae	7	Damselfly nymph
Trichoptera	Hydrobiosidae	7	Free swimming caddis larva
O. Odonata SO Zygoptera	Coenagrionidae	7	Damselfly nymph
Acarina		NA	Water mite
O Odonata SO Epiproctophora	Aeshnidae	6	Dragonfly nymph
Diptera	Ceratopogonidae	6	Pog larva
Trichoptera	Hydroptilidae	6	Micro caddis larva
Decapoda	Atyidae	6	Shrimp
Diptera	S.F. Chironominae	6	Non biting midge larva
Diptera	Simuliidae	5	Blackfly larva
Coleoptera	Psephenidae	5	Water penny larva
Diptera	S.F. Orthocladiinae	5	Non biting midge larva
Ephemeroptera	Baetidae	5	Mayfly larva
Coleoptera	Dytiscidae	5	Diving beetle
Hemiptera	Corixidae	5	Water boatmen
Hemiptera	Notonectidae	4	Backswimmer
Hemiptera	Veliidae	4	Water cricket
Hemiptera	Gerridae	4	Water strider
Tricladida	Dugesiidae	3	Black flatworm
C. Gastropoda	Physidae	3	Snail mottled shell Sinister shell
Diptera	Culicidae	2	Mosquito larva
	No of Families 25 (24 for SIGNAL index score)	Total 128	
		SIGNAL index score 5.3	

King Parrot Creek General Comments

With all sites in the upper catchment it could be expected that results would generally be very good. In this case we did find:

a) Turbidity was very low in comparison with results commonly found in the Goulburn Broken Catchment. It also fell within the SEPP objectives which is excellent as these are long term theoretical goals, and it is not expected waterways will meet them at this stage.

b) Salinity was low

c) Phosphorus was mid to low range. It fell above the SEPP objectives at Chyser Creek and King Parrot Creek at Hazeldene Bridge in 2007.

d) E.coli was pleasingly low, falling within the SEPP objectives for primary contact for all but one site, that being Chyser Creek.

e) Macroinvertebrates gave a very good rating for all riffle sites, however poor ratings for all edge sites due to lack of an Autumn sample. An Autumn sample will be obtained in 2008 and ratings recalculated.

f) Overall an excellent result; the King Parrot Creek region is in very good health.

It is recommended that testing continue as these results provide excellent base line data for use by numerous authorities in the industry. These results have so far been distributed to

- Goulburn Broken Catchment Management Authority
- Waterwatch State Office

Chemical Test Ratings

The figures below are a guide for each of the water quality tests to help you interpret your results in terms of water quality.

Index of Stream Conditions (ISC) Ratings for each of the parameters.

Parameter	Excellent	Good	Fair	Poor	Degraded
Conductivity (uS/cm EC) mountain	<30	<90	<150	<225	>225
Conductivity (uS/cmEC) valley	<80	<240	<400	<600	>600
Conductivity (uS/cmEC) plain	<100	<250	<500	<750	>750
Turbidity (NTU) mountain	<5.0	<7.5	<10	<12.5	>12.5
Turbidity (NTU) valley	<10	<12.5	<15	<22.5	>22.5
Turbidity (NTU) plain	<15	<17.5	<20	<30	>30
pH	6.0 - 7.5	5.5 - 6 or <8.0	8.0 - 8.5	5.0 - 5.5 or 8.5 - 9.0	< 5.0 or > 9.0
Reactive Phosphorus (mg/L)	< 0.008	< 0.02	< 0.04	< 0.08	> 0.08
Total Phosphorus (mg/L)	< 0.01	< 0.025	< 0.05	< 0.10	> 0.10
Nitrates (mg/L)	< 0.05	< 0.1	< 0.2	< 0.4	> 0.4

Appendix B

ASSESSING THE CONDITION OF AQUATIC ECOSYSTEMS

There are many ways of analysing and interpreting invertebrate data to assess ecological condition. Currently five biological indices are used in Victoria for assessing the condition of aquatic ecosystems. These fall into three categories:

- a measure of diversity – number of families.
- biotic indices – the SIGNAL and EPT indices
- measuring of community composition – numbers of key families.

The development of these indices for assessing ecosystem condition has included the establishment of environmental quality objectives to aid in their interpretation. In recognition of the fact that aquatic communities will vary naturally across the State, the State has been characterised into five biological regions. The biological indices and their respective environmental quality objectives have been developed specific to the invertebrate communities within each region (EPA Victoria, 2003a) These biological indices and their associated environmental quality objectives have been set down in the ***State Environmental Protection Policy (Waters of Victoria)*** SEPP (WoV) and its schedules.

USING THE BIOLOGICAL INDICES

Separate assessments are made for riffle and edge habitats. In order to make a complete and accurate assessment of a site, the biological samples must be collected in both autumn and spring, and the invertebrate data from both seasons combined in the calculation of the indices

1. Number of Families.

The number of invertebrate families found at a site can give a reasonable representation of the ecological health of a stream as healthy streams generally have more families. **The Number of Families** index is calculated by simply summing the total 'families' of invertebrates present at a site.

Throughout a biological region, the expected number of families will vary according to quality of habitat and stream size, with larger streams, in general, supporting more taxa. Mild nutrient enrichment can increase the number of families due to an increase in food supply. Reduction in the expected number of families present can be caused by poor quality habitat and by various pollutants.

2. The SIGNAL biotic index.

SIGNAL (Stream Invertebrate Grade Number- Average Level) is an index of water quality based on the tolerance of aquatic biota to pollution (Chessman 1995). Using data from various studies of pollutants in south-eastern Australian streams, most, but not all, families of aquatic invertebrates have been assigned sensitivity grades according to their tolerance or intolerance to various pollutants. The list of invertebrate families and SIGNAL scores currently in use is based largely on those in the original publication (Chessman 1995). Oligochaeta has been added and assigned a score of one**. See Appendix 2**.

The SIGNAL index is calculated by summing together the sensitivity grades of each of the families found at a site that have been assigned a sensitivity grade, and then by dividing the number of graded families present. The output is a single number, between zero and ten, reflecting the degree of water pollution. Generally, high quality sites have high SIGNAL scores and, low quality sites have low SIGNAL scores.

Table 2: Generic key to SIGNAL scores

SIGNAL score	Water Quality
>7	Excellent
6-7	Clean water
5-6	Mild pollution
4-5	Moderate pollution
<4	Severe pollution

3. The EPT biotic index

The EPT index is the total number of families in the generally pollution sensitive insect orders of Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies). It is calculated by summing together the number of families in these three orders present at a site. Any loss of families in these groups usually indicates disturbance.

The EPT index cannot be used in all stream systems due to the natural variations in the biogeographical distribution of the relevant taxa. For example, due to their ecological preference for well oxygenated, cool water streams, stoneflies and some mayfly families are naturally uncommon in the warmer, slower flowing waters that are typical of lowland regions.

4. Key Invertebrate Families

This index focuses mainly on the loss of key taxa that are indicative of good habitat and water quality. It is based on a pre-determined list of invertebrate families that are expected to occur in each of the biological regions of the State as defined in the State Environmental protection Policy (*Waters of Victoria*). See Appendix 1.

The families included in each list are those which:

- are typically found in non-degraded streams in that region;
- are representative of particular habitat types, such as riffles, woody debris, fringing vegetation, macrophytes or pools in that region;
- represent reasonable to good water quality and tend to disappear as conditions deteriorate, and
- are commonly collected when present, using the rapid bioassessment method.

Because the lists incorporate taxa from a range of habitat types, stream sizes and stream types, it is unlikely that a site would contain all families. Thus, the environmental quality objective for the Key Families index requires the presence of a proportion, not all, of the listed families.

Unlike the other indices, edge and riffle habitats are not distinguished with the key Families index. Both habitats must be sampled where present and the data from both samples and both seasons (autumn and spring) combined when making an assessment.

To calculate the Key Families index, simply compare the list of families present at a site with the appropriate list of key families as specified in the ***State Environmental Protection Policy (Waters of Victoria*).** The key families score is the total number of these key families present at a site.

APPENDIX 1. KEY FAMILIES USED TO CALCULATE SEPP (WATERS OF VICTORIA) OBJECTIVES

SEPP (WoV) SEGMENT				
Highlands	**Forests A**	**Forests B**	**Cleared Hills and Coastal Plains**	**Murray and Western Plains**
Aeschnidae	Aeschnidae	Aeschnidae	Aeschnidae	Aeschnidae
Acarina	Acarina	Acarina	Acarina	Acarina
Aphroteniinae	Ameletopsidae	Ameletopsidae	Ancylidae	Ancylidae
Austroperlidae	Ancylidae	Ancylidae	Atyidae	Atyidae
Baetidae	Athericidae	Athericidae	Baetidae	Baetidae
Blepharoceridae	Austroperlidae	Atriplectidae	Caenidae	Caenidae
Calocidae	Baetidae	Atyidae	Calamoceratidae	Calamoceratidae
Ceratopogonidae	Blepharoceridae	Austroperlidae	Ceinidae	Ceinidae
Chironominae	Caenidae	Baetidae	Ceratopogonidae	Ceratopogonidae
Coloburiscidae	Calocidae	Caenidae	Chironominae	Chironominae
Conoesucidae	Ceratopogonidae	Calamoceratidae	Coenagrionidae	Coenagrionidae
Dixidae	Chironominae	Calocidae	Conoesucidae	Corbiculidae
Dugesiidae	Coloburiscidae	Ceinidae	Corixidae	Cordylophora
Elmidae	Conoesucidae	Ceratopogonidae	Dixidae	Corixidae
Eusiridae	Corduliidae	Chironominae	Dugesiidae	Culicidae
Eustheniidae	Corixidae	Coenagrionidae	Dytiscidae	Dytiscidae
Gripopterygidae	Corydalidae	Coloburiscidae	Ecnomidae	Ecnomidae
Helicophidae	Dixidae	Conoesucidae	Elmidae	Gerridae
Hydrobiosidae	Dugesiidae	Corduliidae	Gomphidae	Gomphidae
Hydropsychidae	Dytiscidae	Corixidae	Gripopterygidae	Gripopterygidae
Hydroptilidae	Ecnomidae	Corydalidae	Gyrinidae	Gyrinidae
Leptoceridae	Elmidae	Dixidae	Hydrobiidae	Hydrobiidae
Leptophlebiidae	Empididae	Dolichopodidae	Hydrobiosidae	Hydrometridae
Limnephilidae	Eusiridae	Dugesiidae	Hydrometridae	Hydrophilidae
Nannochoristidae	Eustheniidae	Dytiscidae	Hydrophilidae	Hydroptilidae
Neoniphargidae	Glossosomatidae	Ecnomidae	Hydropsychidae	Hyriidae
Notonemouridae	Gomphidae	Elmidae	Hydroptilidae	Janiridae
Oligochaeta	Gripopterygidae	Empididae	Leptoceridae	Leptoceridae
Orthocladiinae	Gyrinidae	Gerridae	Leptophlebiidae	Leptophlebiidae
Philopotamidae	Helicophidae	Glossosomatidae	Mesoveliidae	Mesoveliidae
Philorheithridae	Helicopsychidae	Gomphidae	Nepidae	Naucoridae
Psephenidae	Hydrobiosidae	Gripopterygidae	Notonectidae	Nepidae

SEPP (WoV) SEGMENT				
Highlands	**Forests A**	**Forests B**	**Cleared Hills and Coastal Plains**	**Murray and Western Plains**
Scirtidae	Hydrophilidae	Gyrinidae	Oligochaeta	Notonectidae
Simuliidae	Hydropsychidae	Helicophidae	Orthocladiinae	Oligochaeta
Siphlonuridae	Leptoceridae	Helicopsychidae	Parastacidae	Orthocladiinae
Tanypodinae	Leptophlebiidae	Hydrobiidae	Physidae	Parastacidae
Tipulidae	Limnephilidae	Hydrobiosidae	Psephenidae	Physidae
	Notonemouridae	Hydrophilidae	Pyralidae	Planorbidae
	Oligochaeta	Hydropsychidae	Scirtidae	Pleidae
	Oniscigastridae	Hydroptilidae	Simuliidae	Pyralidae
	Orthocladiinae	Leptoceridae	Stratiomyidae	Simuliidae
	Philopotamidae	Leptophlebiidae	Tanypodinae	Stratiomyidae
	Philorheithridae	Mesoveliidae	Tipulidae	Tanypodinae
	Polycentropodidae	Notonectidae	Veliidae	Veliidae
	Psephenidae	Odontoceridae		
	Ptilodactylidae	Oligochaeta		
	Scirtidae	Oniscigastridae		
	Simuliidae	Orthocladiinae		
	Tanypodinae	Parastacidae		
	Tipulidae	Philopotamidae		
	Veliidae	Philorheithridae		
		Physidae		
		Planorbidae		
		Polycentropodidae		
		Psephenidae		
		Ptilodactylidae		
		Scirtidae		
		Simuliidae		
		Stratiomyidae		
		Synlestidae		
		Tanypodinae		
		Temnocephalidea		
		Tipulidae		
		Veliidae		

APPENDIX 2. SIGNAL BIOTIC INDEX GRADES USED TO CALCULATE SEPP (WATERS OF VICTORIA) OBJECTIVES

Family	Grade	Family	Grade	Family	Grade
Aeshnidae	6	Gerridae	4	Oligochaeta	1
Ameletopsidae	10	Glossiphoniidae	3	Oniscigastridae	10
Amphipterygidae	8	Glossosomatidae	8	Orthocladiinae	5
Ancylidae	6	Gomphidae	7	Osmylidae	8
Aphroteniinae	8	Gordiidae	7	Palaemonidae	5
Athericidae	7	Gripopterygidae	7	Paracalliopidae	7
Atriplectididae	10	Gyrinidae	5	Paramelitidae	5
Atyidae	6	Haliplidae	5	Parastacidae	7
Austroperlidae	10	Hebridae	6	Perthiidae	6
Baetidae	5	Helicophidae	10	Philopotamidae	10
Belostomatidae	5	Helicopsychidae	10	Philorheithridae	8
Blepharoceridae	10	Hydraenidae	7	Physidae	3
Caenidae	7	Hydridae	4	Planorbidae	3
Calamoceratidae	8	Hydrobiidae	5	Pleidae	5
Calocidae	8	Hydrobiosidae	7	Podonominae	6
Ceinidae	5	Hydrometridae	5	Polycentropodidae	8
Ceratopogonidae	6	Hydrophilidae	5	Protoneuridae	7
Chironominae	6	Hydropsychidae	5	Psephenidae	5
Clavidae	5	Hydroptilidae	6	Psychodidae	2
Coenagrionidae	7	Hygrobiidae	5	Ptilodactylidae	10
Coloburiscidae	10	Hymenosomatidae	4	Pyralidae	6
Conoesucidae	8	Isostictidae	7	Scirtidae	8
Corbiculidae	6	Janiridae	5	Sialidae	4
Corduliidae	7	Leptoceridae	7	Simuliidae	5
Corixidae	5	Leptophlebiidae	10	Sphaeriidae	6
Corydalidae	4	Lestidae	7	Sphaeromatidae	5
Culicidae	2	Libellulidae	8	Spionidae	5
Curculionidae	7	Limnephilidae	8	Spongillidae	5
Diamesinae	6	Lymnaeidae	3	Staphylinidae	5
Dixidae	8	Megapodagrionidae	7	Stratiomyidae	2
Dolichopodidae	6	Mesoveliidae	4	Synlestidae	7
Dugesiidae	3	Muscidae	3	Tabanidae	5
Dytiscidae	5	Nannochoristidae	10	Talitridae	5
Ecnomidae	4	Naucoridae	5	Tanypodinae	6
Elmidae	7	Nepidae	5	Tasimiidae	7
Empididae	4	Neurorthidae	8	Temnocephalidea	6
Ephydridae	2	Noteridae	9	Tetrastemmatidae	5
Erpobdellidae	3	Notonectidae	4	Thaumaleidae	7
Eusiridae	8	Notonemouridae	8	Tipulidae	5
Eustheniidae	10	Ochteridae	5	Veliidae	4
Gelastocoridae	6	Odontoceridae	8		

Appendix C

King Parrot Creek

For Samples from 01 Jan 2007 to 31 Dec 2007

SiteNo: GOU018 Goulburn River after Alexandra

Parameters:

Date:	Time:	Sample Type:	Turb NTU	pH pH Units	TPhos mg/L P	Ecoli orgs/100 mL	% O2 Sat	Tcolif orgs/100 mL	EC µS/cm	Temp ° C	Rainfall mm	DO mg/L
17-Jan-07	**3:00 PM**	Grab		6.8	<0.02		88		58	21.7	0	7.5
21-Feb-07	**2:50 PM**	Grab	6	6.8	<0.02		90		58	22.8	0	7.4
21-Mar-07	**2:00 PM**	Grab	12	6.7	<0.02		79		52	20.8	25	6.8
18-Apr-07	**3:00 PM**	Grab	50	7.0	<0.02		80		62	17.4	0	8.1
19-Jun-07	**2:40 PM**	Grab	3.9	6.7	0.02		88		47	7.5	0	10.4
18-Jul-07	**3:10 PM**	Grab	38	6.5	<0.02		84		68	7.1	7	10.0
14-Aug-07	**3:00 PM**	Grab	7.8	6.5	<0.02				41	8.4	0	
19-Sep-07	**3:15 PM**	Grab	7.9	6.6	<0.02		96		38	10.7	0	10.1
16-Oct-07	**3:30 PM**	Grab	6.3	7.2	0.02		93		43	15.0	0	9.1
18-Dec-07	**2:30 PM**	Grab	6.5	7.3	0.03		95		50	18.4	0	8.8

SiteNo: KPC002 King Parrot Creek after Wallaby Creek confluence

Parameters:

Date:	Time:	Sample Type:	Turb NTU	pH pH Units	TPhos mg/L P	Ecoli orgs/100 mL	% O2 Sat	Tcolif orgs/100 mL	EC µS/cm	Temp ° C	Rainfall mm	DO mg/L
20-Feb-07	**4:10 PM**	Grab	2		<0.02	46		>2420	70	21.6	4	
20-Mar-07	**4:50 PM**	Grab	3.5		<0.02	>2420		>2420	70	16.0	27.5	
18-Apr-07	**8:55 AM**	Grab	1.4		<0.02	15		1986	67	11.9	0	
15-May-07	**3:45 PM**	Grab	1.5		0.03				70	12.3	3	
17-May-07	**2:00 PM**	Grab	30	6.1	0.03				80	12.6	10	
18-Jun-07	**12:05 PM**	Grab			<0.02	0		0	70	7.8	0	
19-Sep-07	**10:30 AM**	Grab	1.4		<0.02	19		88	70	10.8	0	
15-Nov-07	**1:30 PM**	Grab	3	6.6			85		69	16	0	8.1
20-Nov-07	**5:50 PM**	Grab			<0.02	28			70		0	
17-Dec-07	**3:35 PM**	Grab	3.2		<0.02	11		613	70	17.4	0	

Waterwatch Victoria Application (WVA) - Site Report

SiteNo: CHY010 Chyser Creek before confluence with King Parrot Creek

Parameters:

Date:	Time:	Sample Type:	Turb NTU	pH pH Units	TPhos mg/L P	Ecoli orgs/100 mL	% O2 Sat	Tcolif orgs/100 mL	EC µS/cm	Temp ° C	Rainfall mm	DO mg/L
20-Feb-07	**3:50 PM**	Grab	2.1		0.04	687		>2420	110	21.4	4	
20-Mar-07	**4:35 PM**	Grab	26		0.09	>2420		>2420	130	17.0	27.5	
18-Apr-07	**8:40 AM**	Grab	1.9		0.02	488		>2420	87	12.2	0	
15-May-07	**3:25 PM**	Grab	1.7		0.02				90	12.5	3	
18-Jun-07	**11:50 AM**	Grab			0.07	93		99	110	7.0	0	
19-Sep-07	**10:10 AM**	Grab	3.9		<0.02	40		245	90	10.0	0	
20-Nov-07	**5:25 PM**	Grab			0.02	365			110		0	
17-Dec-07	**3:20 PM**	Grab	0.8		0.04	86		>2420	100	17.5	0	

SiteNo: KPC005 King Parrot Creek Upstream of Hazeldene at Silver Creek Rd

Parameters:

Date:	Time:	Sample Type:	Turb NTU	pH pH Units	TPhos mg/L P	Ecoli orgs/100 mL	% O2 Sat	Tcolif orgs/100 mL	EC µS/cm	Temp ° C	Rainfall mm	DO mg/L
20-Feb-07	**3:35 PM**	Grab	5		<0.02	36		>2420	100	27.2	4	
20-Mar-07	**4:20 PM**	Grab	4.3		<0.02	1120		>2420	90	17.0	27.5	
18-Apr-07	**8:30 AM**	Grab	1.8		0.02	31		>2420	77	12.2	0	
15-May-07	**3:15 PM**	Grab	1.2		<0.02				80	12.7	3	
18-Jun-07	**11:35 AM**	Grab			0.02	40		51	90	7.4	0	
19-Sep-07	**9:45 AM**	Grab	2.4		<0.02	179		517	80	10.1	0	
20-Nov-07	**5:10 PM**	Grab			<0.02	291			80		0	
17-Dec-07	**4:10 PM**	Grab	1		0.02	35		>2420	80	20.0	0	

Waterwatch Victoria Application (WVA) - Site Report

SiteNo: KPC008 King Parrot Creek at Hazeldene bridge

Parameters:

Date:	Time:	Sample Type:	Turb NTU	pH pH Units	TPhos mg/L P	Ecoli orgs/100 mL	% O2 Sat	Tcolif orgs/100 mL	EC µS/cm	Temp ° C	Rainfall mm	DO mg/L
20-Feb-07	**3:20 PM**	Grab	1.6		0.03	6		>2420	120	26.4	4	
20-Mar-07	**4:10 PM**	Grab	2.7		<0.02	>2420		>2420	120	18.0	27.5	
18-Apr-07	**8:15 AM**	Grab	1.1		0.03	55		>2420	92	13.0	0	
15-May-07	**3:00 PM**	Grab	1.3		<0.02				90	13	3	
18-Jun-07	**11:25 AM**	Grab			0.03	14		19	120	7.3	0	
19-Sep-07	**9:30 AM**	Grab	2.4		<0.02	111		816	90	12.0	0	
20-Nov-07	**5:00 PM**	Grab			<0.02	205			90		0	
17-Dec-07	**3:05 PM**	Grab	8.5		<0.02	31		>2420	90	21.0	0	

SiteNo: KPC025 King Parrot Creek before Goulburn River

Parameters:

Date:	Time:	Sample Type:	Turb NTU	pH pH Units	TPhos mg/L P	Ecoli orgs/100 mL	% O2 Sat	Tcolif orgs/100 mL	EC µS/cm	Temp ° C	Rainfall mm	DO mg/L
17-Jan-07	**1:30 PM**	Grab									0	
21-Mar-07	**1:00 PM**										25	
18-Apr-07	**2:15 PM**										0	
19-Jun-07	**1:00 PM**	Grab	3.1	7.2	<0.02	19	97	33	289	7.8	0	11.2
18-Jul-07	**1:30 PM**	Grab	10	6.8	<0.02		92		200	7.1	7	11.0
14-Aug-07	**1:30 PM**	Grab	9.4	6.7	<0.02	44		169	67	9.4	0	
19-Sep-07	**1:50 PM**	Grab	5.1	7.1	<0.02		100		151	11.7	0	10.6
16-Oct-07	**1:15 PM**	Grab	5.8	7.5	0.02	102	93	>2420	158	16.6	0	9.0
21-Nov-07	**2:30 PM**	Grab	9.4	7.5	0.02		82		156	19.4	0	7.6
18-Dec-07	**12:20 PM**	Grab	6.0	7.4	0.02		88		166	21.8	0	7.7

Waterwatch Victoria Application (WVA) - Site Report

SiteNo: PHE010 Pheasant Creek at Kinglake - Yea Road u/s of King PC Conflue

Parameters:

Date:	Time:	Sample Type:	Turb NTU	pH pH Units	TPhos mg/L P	Ecoli orgs/100 mL	% O2 Sat	Tcolif orgs/100 mL	EC µS/cm	Temp ° C	Rainfall mm	DO mg/L
20-Feb-07	**4:00 PM**	Grab	6.2		0.04	238		>2420	90	22.3	4	
20-Mar-07	**4:45 PM**	Grab	5.7		<0.02	>2420		>2420	100	16.5	27.5	
18-Apr-07	**8:50 AM**	Grab			0.03	140		>2420	80	11.3	0	
15-May-07	**3:35 PM**	Grab	2.8		<0.02				80	12.5	3	
18-Jun-07	**11:55 AM**	Grab			<0.02	11		99	90	6.5	0	
19-Sep-07	**10:20 AM**	Grab	3.2		<0.02	12		135	80	10.0	0	
20-Nov-07	**5:40 PM**	Grab			<0.02	291			80		0	
17-Dec-07	**3:30 PM**	Grab	1.5		<0.02	135		>2420	80	17.0	0	

SiteNo: GOU030 Goulburn River before Seymour

Parameters:

Date:	Time:	Sample Type:	Turb NTU	pH pH Units	TPhos mg/L P	Ecoli orgs/100 mL	% O2 Sat	Tcolif orgs/100 mL	EC µS/cm	Temp ° C	Rainfall mm	DO mg/L
17-Jan-07	**1:30 PM**	Grab	10	7.1	<0.02		90		60	25.5	0	7.0
21-Feb-07	**1:25 PM**	Grab	6	7.0	<0.02		87		61	26.2	0	6.6
21-Mar-07	**12:40 PM**	Grab	5.6	7.1	<0.02		86		59	20.5	25	7.5
18-Apr-07	**1:30 PM**	Grab	7.1	7.5	<0.02		88		62	17.5	0	8.0
16-May-07	**1:30 PM**	Grab	5.7	7.1	<0.02		87		57	15.9		8.4
19-Jun-07	**12:40 PM**	Grab	5.6	6.8	<0.02		89		68	7.6	0	10.2
18-Jul-07	**1:10 PM**	Grab	12	6.7	<0.02		88		88	7.2	7	10.4
14-Aug-07	**1:35 PM**	Grab	3.8	6.9	0.02				177	9.0	0	
19-Sep-07	**1:40 PM**	Grab	9.6	6.8	<0.02		97		52	12.2	0	9.8
16-Oct-07	**1:10 PM**	Grab	7.8	7.4	0.02		96		48	16.8	0	9.0
21-Nov-07	**2:25 PM**	Grab	9.4	7.5	0.02		93		51	20.9	0	8.5
18-Dec-07	**12:00 PM**	Grab	5.9	7.1	0.02		93		50	20.9	0	8.1