



DEPARTMENT *of*  
PRIMARY INDUSTRIES,  
WATER *and*  
ENVIRONMENT

**ENVIRONMENTAL  
MANAGEMENT  
GOALS  
*for* TASMANIAN  
SURFACE WATERS**

**MACQUARIE RIVER  
& SOUTH ESK RIVER  
CATCHMENTS**

**FINAL PAPER  
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## **Environmental Management Goals for Tasmanian Surface Waters:**

### **MACQUARIE RIVER AND SOUTH ESK RIVER CATCHMENTS.**

Between 2000 and 2004 Protected Environmental Values (PEVS) were set for the Macquarie River and South Esk River catchments. A discussion paper was prepared to facilitate public participation in setting the PEVs. This discussion paper was intended as a basis for community and stakeholder participation in the process of developing environmental management goals for the waterways that are located within the Macquarie River and South Esk River catchments. \*

The discussion paper has been modified into its current form to reflect that the process for the Macquarie River and South Esk River catchments is now complete. It is considered, however, that much of the information included in the discussion paper should remain as a record of the PEV setting process.

This paper has been prepared by the Department of Primary Industries, Water and Environment in conjunction with the Tasmanian Parks and Wildlife Service Northern Midlands, Break O' Day and Central Highlands Councils.

Words and expressions used in this final paper have, unless the contrary intention appears, the same meaning as defined in the *State Policy on Water Quality Management 1997* and the *Environmental Management and Pollution Control Act 1994*. Ecosystem refers to physical, chemical and biological aspects of the aquatic environment.

This final paper is divided into six main sections:

- The first part describes water reforms in general.
- The second and third parts provide a brief description of the Macquarie River and South Esk River catchments.
- Part four discusses the State Policy on Water Quality Management.
- The final Protected Environmental Values for the Macquarie River and South Esk River catchments are shown in part five.
- Water quantity values are discussed in part six, and
- Part seven lists the community water values for the catchments.

\* *N.B.:* Catchment areas not covered in this paper are the Macquarie River catchment downstream of the Macquarie River junction with Brumbys Creek; areas of the upper Macquarie catchment within the Southern Midlands Municipality; and the South Esk River catchment below the South Esk River junction with the Macquarie River. For further information on these areas refer to the Final Papers: *Environmental Management Goals for Tasmanian Surface Waters - Great Lake & Brumbys Creek Catchments, Lower Macquarie and South Esk Rivers* and *Environmental Management Goals for Tasmanian Surface Waters – Southern Midlands Catchments*.

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# 1 INTRODUCTION

## 1.1 Why do we need water reform?

A good supply of fresh, clean water is an essential requirement for human life, a healthy environment and a productive economy.

We need it for drinking, for recreational activities like fishing, swimming and boating, to provide the food we eat and export, to generate clean electricity, and to support mining and other industries.

We also expect our rivers and lakes to look healthy, and provide a healthy environment for a wide range of aquatic plants and animals.

We take for granted that our use of water resources is sustainable; that our hard-working water will still be there in a healthy state to provide the same benefits for future generations.

Tasmanian rivers range from relatively short, swiftly flowing rivers fed from mountain sources to slowly flowing rivers which may be reduced to a series of pools during dry periods. Our waterways are not immune from problems, however, and many of our river systems are showing signs of stress.

River health, and the health of the economies that depend upon them, is clearly linked to the way we use the waters; the degree of regulation we impose; the quantity of water we take out; and the quality of water we return.

In response to a general recognition across the community of the importance of having clean water and appropriate river flows, the Tasmanian Government is currently finalising a range of reforms designed to ensure that these values are protected for the future of the State.

## 1.2 What are these reforms?

Two major aspects of the water reforms are water quality management and water quantity management.

### (a) water quality management

The *State Policy on Water Quality Management 1997* is designed to **maintain or enhance** the quality of Tasmanian surface waters. Principal objectives of the Policy include:

- Move on from reliance on 'end of pipe' controls to take into consideration the number of discharges into a given water body, or the sensitivity or current condition of the water body.
- Ensure that diffuse source and point source pollution does not endanger the achievement of water quality objectives and that pollutants discharged to waterways are reduced as much as possible using environmental best practice.
- Facilitate and promote integrated catchment management.
- Focusing on overall water quality management strategies by identifying those water quality values and uses which are considered worthy of protection.

The first purpose of this paper is to explain how water quality values were identified and will be used. Local communities played a key role in identifying these values for their areas.

### (b) water quantity management

The introduction of the *Water Management Act 1999* to replace the *Water Act 1957* provides for:

- major changes to the institutional arrangements for water management;
- the ready transfer of water rights between different users;
- enhanced stakeholder and community input into water allocation and management; and
- a more transparent and equitable water allocation system, including formal allocation of flows to maintain a healthy river environment.

The second purpose of this paper is to summarise stakeholder and public views on what is valued in water resources from a water quantity perspective.

### **1.3 What information did we receive from the community?**

Local communities have a valuable understanding of their regional waterways. A series of workshops and public meetings were held throughout the region where we asked questions like:

- What uses or values do you have for surface waters in this area that rely upon maintaining or enhancing water quality?
- Which of your activities rely upon maintaining or enhancing the flow of water into catchment waterways?
- Are there certain places on your rivers that you traditionally use for swimming or other recreational activities?
- Do you fish in them?
- Are there specific features of your rivers and streams that are recognized scenic attractions, such as rapids or waterfalls?
- Do you use water for livestock watering?

- Do you know of rare or endangered animals or plants in, or adjacent to, specific areas of your rivers or streams?
- Does your river supply the local town water supply?
- Do you draw water from it to irrigate your farm?

Answers to these questions were recorded as 'Community Water Values' and are summarised in Section 7.

Planning to ensure sustainable use of these waters and protection of river health requires sound knowledge of local water quality and quantity issues. Community input to this process was important.

### **1.4 How was public input used?**

Information from the public on values particularly relating to water quality assisted the Board of Environmental Management and Pollution Control and councils to finalise the range of Protected Environmental Values for the surface waters of the regional waterways. These values will be used in management planning for the region. Further details of what this means is given in section 4.

Information from community stakeholders, catchment groups and the public on water quantity values will be used to better plan the water resources of the catchments. Water management planning will be closely linked with overall catchment management planning to put water resource management on a sustainable footing for the State. Water management planning will be undertaken on a priority basis, with stressed rivers in the State being targeted initially.

## 2 MACQUARIE RIVER CATCHMENT OVERVIEW

### 2.1 Catchment description

The Macquarie River catchment covers an area of over 3800 square kilometres in the Tasmanian Midlands. The river rises in the Eastern Tiers near Lake Leake and heads south and west before running in a northerly direction to join the South Esk River near Longford. Major tributaries include the Elizabeth and Tooms rivers sourced in the Eastern Tiers and the Blackman, Lake and Isis rivers that rise in the Central Highlands to the west.

For the purposes of this paper, the description of the Macquarie River catchment does not include those areas of the catchment where protected environmental values have already been set. The areas not covered in this paper are the Macquarie River catchment downstream of the Macquarie River confluence with Brumbys Creek and those upper catchment areas within the Southern Midlands Municipality. For further information on these areas refer to the Papers: *Environmental Management Goals for Tasmanian Surface Waters - Great Lake & Brumbys Creek Catchments*, *Lower Macquarie and South Esk Rivers* and *Environmental Management Goals for Tasmanian Surface Waters – Southern Midlands Catchments*.

The upper reaches of the Macquarie River and its tributaries flow through high and rugged country dominated by dolerite geology before passing through the low relief landscape of the Launceston Tertiary Basin lower in the catchment. The underlying geology of this lower region is a mix of alluvial gravel, sands and till, with outcrops of older volcanic and igneous rocks.

Extensive agriculture activity in the region has meant that much of the

original native vegetation has disappeared from the lower catchment landscape. Grassy eucalypt woodland and forest remnants occur along with isolated areas of native grassland. The dominant vegetation type of the more elevated and hilly, upper catchment areas is *Eucalyptus delegatensis* forest.

The upper Macquarie River catchment, located within the rainshadow of both westerly and easterly weather systems, is one of the driest areas in the state. Ross, within this region, has an average annual rainfall of only 510 millimetres. Significant areas of the catchment receive less than 600 millimetres of rainfall per year and rely on late winter and early spring westerlies to produce highest monthly rainfalls. The drying effects of winds flowing down from the Great Western Tiers over the warmer summer months produce evaporation rates in excess of rainfall that can exacerbate drought conditions.

Land along the regional waterways is typically privately owned and used for agriculture; is State Forest; or in limited areas is subject to urban use.

Campbell Town and Ross are the major population centres in the catchment region under consideration. They both discharge treated wastewater to local rivers - Ross has an annual discharge of 22 megalitres and Campbelltown 111 megalitres. There are also smaller sewage treatment lagoons at Lake Leake.

The majority of the Macquarie River catchment lies within the Northern Midlands Municipality. Agricultural activities are the backbone of the regional economy. These include wool and sheep meat production, grains and lucerne production. Dryland cropping has expanded significantly in recent

years. Because of the low regional rainfall, irrigation is seen to have a key role in the development of alternative agricultural pursuits.

While wood harvesting provides income for some private landholders with areas of native forest, plantation forestry is subject to less than optimal growing conditions in much of the catchment due to low rainfall levels and soil type. Areas of State Forest in the Eastern Tiers and along the eastern fringes of the Central Plateau are, however, managed for multiple use by Forestry Tasmania under the *Forestry Act 1920*. Forest Reserves located within this area - Millers Bluff, Tooms Lake, Snowy River & Snow Hill - are not available for wood production. Under Schedule 3 of the *Forestry Act 1920* a management objective for Forest Reserves is 'preservation of water quality'.

The catchment includes a number of reserve classes managed under the *National Parks and Reserves Management Act 2002* (Great Western Tiers Conservation Area, Central Plateau Conservation Area and Tunbridge Tiers Conservation Area) and the *Crown Lands Act 1976* (large public reserves at Tooms Lake and on the upper reaches of the Macquarie River and areas around Lake Leake). Both Acts have defined management objectives for each reserve class that it is responsible. In all reserve classes 'preservation of water quality' is raised as a management objective.

There is little available information on Aboriginal values associated with waterways of the Macquarie River catchment, although it would be expected to have an extensive history of Aboriginal use of the waterways. Any erosion of soil deposits in areas such as the Macquarie River sandsheets would be of concern due to the high likelihood of Aboriginal sites being present.

## 2.2 Water usage <sup>1</sup>

The entire Macquarie River catchment contributes about 28% of the natural annual flow to the South Esk at Launceston. This excludes the contribution of significant volumes diverted into the system from the Great Lake. Average flows appear to be highly variable from year to year. The main river system is ephemeral, with long ponds providing the only available water during extended dry periods of little or no flow.

The low annual rainfall in the Macquarie River catchment means that releases from regional impoundments – Tooms Lake, Lake Leake and Woods Lake – are of critical irrigation importance over the drier months for much of the agricultural activity in the area. Regulated discharges from these storages are particularly evident as base flow in the upper Macquarie reaches over the drier summer months.

Lake Leake and Tooms Lake have a key role in providing 400 megalitres of annual township water requirements for Campbelltown and Ross. Town drinking water is chlorinated.

The storages also provide water for stock and domestic requirements downstream. In addition, Lake Leake has operational requirements to maintain the storage as a fishing and recreational attraction. Records show that this storage has not failed over the last fifty years.

Releases from Woods Lake provide riparian, stock and domestic requirements to prescriptive rights

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<sup>1</sup> Unless otherwise cited most background water usage information comes from: DPIF *South Esk Basin State of Rivers Report*. 1997. Funded by NHT & State Government.

holders on the Lake River and lower Macquarie River. While water can be released from Arthurs Lake into the Lake River, generally it is diverted into the Great Lake catchment.

Estimated water drawn for stock usage along the Macquarie River and tributaries is over 2,300 megalitres per year – Lake River and Macquarie River below Lake River (700 ML); Elizabeth River and Macquarie River above Lake River (715 ML); Macquarie River above Elizabeth River (930 ML).

The Macquarie River, supplemented by water from Great Lake via Brumbys Creek, ultimately provides water to the Trevallyn Power Scheme at Launceston. While water releases from the Great Lake can significantly affect the hydrological regime of the lower Macquarie and lower South Esk rivers, water usage in these lower reaches is not discussed in this paper <sup>2</sup>.

The Great Lake – South Esk Basin is an Hydro Electric Corporation (HEC) water district for which it has established rights to all the water in the South Esk River Basin for power generation purposes. However, water is provided for town-supply, riparian stock and domestic use. Riparian users on the Lake River are also guaranteed access to water under the *Electricity Supply Industry Restructuring (Savings and Transitional Provisions) Act 1995*. The HEC is the water entity responsible for managing the District. Water resource use in the region will be the subject of review between the Dept. of Primary Industries, Water and Environment and the HEC as part of the water management planning process.

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<sup>2</sup> Refer to the Public Discussion Paper: *Proposed Environmental Management Goals for Tasmanian Surface Waters - Great Lake & Brumbys Creek Catchments, Lower Macquarie and South Esk Rivers*

An environmental flow study undertaken on the Macquarie River utilised a risk analysis model to identify sustained flow requirements for these waterways.<sup>3</sup> It nominated median discharge levels of 1 cumec (86 megalitres per day) for the Macquarie River over the irrigation season. Flow at this level was considered to provide only low levels of risk that a range of ecological and fishery values would be lost. The basis upon which these values were determined should be considered and is outlined in the original environmental flow report.

Other activities utilising regional waterways include tourism, boating, conservation, duck hunting, shack-based recreation and fishing.

### 2.3 Water Quality

The Macquarie River catchment and the rest of the South Esk Basin have been the focus of considerable water quality assessment through the State of Rivers reporting process. While the major findings for the Macquarie are summarised below, the original report gives a more comprehensive and accurate summary of regional waterway health.<sup>4</sup>

Recorded levels of conductivity and total dissolved salts throughout the Macquarie River were higher than elsewhere in the South Esk Basin, although not at levels to restrict agricultural use.

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<sup>3</sup> Davies P & Humphries P 1995. *An environmental flow study of the Meander, Macquarie and South Esk Rivers, Tasmania*. Dept. of Primary Industries & Fisheries.

<sup>4</sup> DPIF *South Esk Basin State of Rivers Report*. 1997. Funded by NHT & State Government.



While turbidity - the discolouration due to suspended matter in water - is generally low in the Macquarie River, the Lake and Elizabeth rivers appear to be characterised by more turbid waters. Typically this appears to be related more to the presence of very fine suspended clay particles than to significant sediment loads. Large flood events do, however, result in a considerable deterioration in water quality with significant increases in turbidity and suspended solids.

Levels of dissolved oxygen in regional waterways show considerable variation as would be expected in conditions of varying flow (or no flow) and fluctuating temperatures. Dissolved oxygen generally appears to be at levels adequate for the protection of aquatic organisms.

Any propensity for the development of problem algal blooms is indicated by the concentrations of nitrogen and phosphorus in waterways.

Total nitrogen concentrations were higher than those recorded on the South Esk River catchment and were often at levels allowing development of aquatic algal blooms. Considerable growth of filamentous algae was recorded at many sites on the Macquarie River in the summer of 1994-5. While there is some contribution of nitrogen from treated sewage effluent downstream of plants, the nitrate component of total nitrogen increases markedly during rainfall events possibly from groundwater sources. Nitrogen loss from the over 2,000 square kilometres of the upper catchment was estimated at 417 tonnes over the three and a half year study period.

Generally, total phosphorus results are low throughout the catchment. Of the phosphorus present, approximately forty percent of this nutrient is in a dissolved

form that promotes algal growth. The discharge from the sewage treatment plant at Campbelltown is a noticeable contributor to total phosphorus on the Elizabeth River. Phosphorus loss from the over 2,000 square kilometres of the upper catchment was estimated to be nearly 25 tonnes over the three and a half years of the study. Eighty percent of this was transported in two major floods, probably entering the waterways as phosphorus bound to particulates in surface runoff. A large proportion of this phosphorus has origins in the upper Elizabeth River.

Trends for Lake River nutrients appear to partially reflect the levels of nutrients in the Woods Lake storage. These concentrations were not significantly higher than other sites in the Macquarie catchment, however. Substantial fluctuations in turbidity in Woods Lake appear to have downstream effects on turbidity in the Lake River. These fluctuations, which are probably due to the lake's shallowness and exposed position, are the cause of some concern for local anglers.

Limited sampling for microbial indicators of contamination in the Macquarie River catchment showed most sites had bacterial levels within the standards required for primary contact (swimming and bathing). Several sites in the upper reaches of the river did have high levels of faecal indicators, but these tended to be sites where stock had direct access to water. Long term contamination, as indicated by water samples of disturbed sediment, was greatest downstream of the Ross sewage treatment plant outfall. Sampling of the Blackman, Elizabeth and Lake rivers all showed contamination at levels above the guideline for primary contact. As an overview, large areas of the Macquarie are relatively free of faecal coliforms

with contaminated areas where animal or human activities are the greatest.

## 2.4 Aquatic Ecosystems

Maintaining instream habitat including river substrate, aquatic plants and large woody debris is essential in maintaining fish and invertebrate numbers and density. Changing levels of river flow and inundation can also affect the food webs of wetland and riverine ecosystems, both for instream biota and animals and plants that utilise the streamside environment.

Threatened species of galaxiids - *Paragalaxias mesotes* and *Galaxias tanycephalus* – inhabit the rocky margins of Woods Lake. The endangered Swan galaxias (*Galaxias fontanus*) is also present at sites in the upper Macquarie where it is not subject to predation by Brown trout. Exotic aquatic species can have a detrimental effect on regional waterways. Redfin perch are present in the Lake and Macquarie rivers and possibly the Elizabeth River. This predatory fish is a threat to native species and has little recreational fishing value.

Willows are widespread in the Macquarie catchment and have a range of deleterious consequences for aquatic ecosystems in terms of sediment build-up, flood debris and displacing native riverbank vegetation.

## 2.5 Catchment environmental issues

As stream conditions are determined both by in-stream activities and surrounding land-use activities, waterways act as a touchstone of catchment health. Healthy waterways are indicative of sustainably managed catchments. There are a number of environmental issues relating to

waterways of the Macquarie River catchment.

- Phosphorus loss from the upper catchment, particularly during high rainfall events.
- Contribution of sewage pond effluent at Campbelltown to Elizabeth River phosphorus levels.
- Occasional high ammonia readings were recorded with no obvious links to possible sources (such as domestic sewage discharge, fertiliser runoff or excessive decay of plant matter).
- A large percentage of nitrogen in dissolved form is being discharged from the Campbelltown and Ross sewage treatment plants.
- Fluctuations in Woods Lake turbidity are of some concern to local anglers.
- High levels of faecal contamination in some areas, probably linked to stock access to waterways.
- Willow infestation on some stretches of waterways.
- Maintaining viable populations of endangered aquatic animal and plant species.
- Ensuring environmental flows in waterways.
- The impact of exotic predatory fish such as Redfin perch and Brown trout on native fish species.
- Erosion of river banks arising from removal of riparian vegetation due to agricultural activities.
- Erosion through forestry activities (road construction, harvesting etc.) and associated loss of, or stress to, aquatic and riparian habitats.

### 3 SOUTH ESK RIVER CATCHMENT OVERVIEW

#### 3.1 Catchment description

The South Esk River rises in the heavily forested, hilly country to the north of Ben Lomond. It flows in a south-easterly direction past Mathinna before swinging back in a westerly direction to join the Break O'Day River near Fingal, meanders through the northern Midlands joining with the Macquarie and Meander rivers before discharging into the Tamar Estuary near Launceston. Other major tributaries include St Pauls River, Ben Lomond Rivulet and the Nile River. Total catchment area above Perth is nearly 3,300 square kilometres.

For the purposes of this paper, the description of the South Esk River catchment does not include those areas of the catchment where protected environmental values have already been set. The areas of the South Esk River catchment not covered in this paper are below the South Esk - Macquarie River confluence. For further information on this area refer to the paper: *Environmental Management Goals for Tasmanian Surface Waters - Great Lake & Brumbys Creek Catchments, Lower Macquarie and South Esk Rivers*

The characteristic geology of the upper South Esk River catchment is quartzwacke and mudstone. In the Ben Lomond foothills and the northern highlands this changes to dolerite and granite and, lower in the catchment, a landscape consisting of the flat, undulating valleys of the Launceston Tertiary Basin. The underlying geology of this region is a mix of alluvial gravel, sands and till, with outcrops of older volcanic and igneous rocks.

Significant rainfall events in the catchment are generally due to the passage of westerly fronts or sub-

tropical low-pressure systems from the east. Topographic effects are evident with the lower areas of the catchment receiving less rain than the higher, eastern locations such as Gray which has an annual average of 1200 millimetres. Substantial snowfalls can occur on Ben Lomond, particularly between late June and October.

Vegetation cover in the upper catchment is a mixture of high altitude heathland on the Ben Lomond plateau; rainforest and wet eucalypt woodland in the high precipitation regions to the north and west of the plateau; and dry eucalypt woodland at lower altitudes. Extensive agricultural activity on the Northern Midlands plains and river flats along the upper South Esk has meant that much of the original native vegetation has disappeared. An area such as the 665-hectare Tom Gibson Reserve is important because the type of dry forest and woodland found in the Midlands has mostly been cleared and, of the remainder, hardly any is reserved. This block has been identified as having high conservation significance because there are many rare, threatened and previously unreserved plant species on the block.

The South Esk River catchment lies within the Break O'Day and Northern Midlands municipalities. Agriculture (sheep and beef cattle grazing) and forestry are both primary land uses in the region.

The major population centres in the catchment are St Marys, Fingal, Evandale, Perth and Avoca. Annual discharge rates from town sewage treatment plants are 30, 32, 189 and 30 megalitres respectively (Avoca uses septic tanks). Sewage effluent from these centres passes through sewage treatment lagoons prior to discharge to

waterways. Nile and Conara also have small sewage treatment lagoons.

There is extensive forestry activity in the upper South Esk catchment and in the Lake Leake area. A large number of Forest Reserves are located within the Eastern Tiers area of the catchment are not available for wood production. Under Schedule 3 of the *Forestry Act, 1920* a management objective for Forest Reserves is 'preservation of water quality'. Ben Lomond National Park is the largest area within the South Esk catchment to be reserved and managed under the *National Parks and Reserves Management Act 2002*. The Parks and Wildlife Service also manage the Tom Gibson Nature Reserve near Epping Forest.

There is an extensive history of mining in the upper catchment. Storeys Creek, Rossarden, Royal George, Stanhope and Mathinna are just a few sites of past mining activity in the search for tin, gold, wolfram and coal. The only significant operation that remains is the open cut and underground mining of coal at Cornwall in the Break O'Day catchment (near Fingal).

There is little available information on Aboriginal values associated with the South Esk River, however, it would be expected to have an extensive history of Aboriginal use of the waterways.

### 3.2 Water usage<sup>5</sup>

In terms of total outflow at Launceston, the South Esk River catchment provides on average 37% of the total basin flow (ie South Esk, Macquarie and Meander rivers but excluding Great Lake

diversion). Variability of annual flows is high. While there is some variability between rivers, most appear to have peak flows in the period between July and September and lowest flows between February and April. A single ground water storage supplies low flows in the upper south Esk upon a fairly consistent basis enabling prediction of these base flows over the irrigation season.

The majority of flood flows affecting Fingal Valley, Longford, Hadspen and Launceston are sourced to the South Esk catchment and, in particular, to high rainfall events near Mathinna and Gray (near St Marys).

Generally, flows within catchment waterways are 'natural' flows. This reflects the absence of major water storages in the catchment. However, a detailed assessment of major waterways would be expected to show the effects of seasonal irrigation draw-off and in some areas hydrological changes resulting from activities involving vegetation clearance.

The Great Lake – South Esk Basin is an Hydro Electric Corporation (HEC) water district for which it has established rights to all the water in the South Esk River Basin for power generation purposes. However, water is provided for town-supply, riparian stock and domestic use. The HEC is the water entity responsible for managing the District. Water resource use in the region will be the subject of review between the Dept. of Primary Industries, Water and Environment and the HEC as part of the water management planning process.

The major population centres in the catchment use, on average, an annual town-water supply of over 840 megalitres. Town water supplies at Mathinna, St Marys and Fingal are

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<sup>5</sup> Unless otherwise cited most background water usage information comes from: DPIF *South Esk Basin State of Rivers Report*. 1997. Funded by NHT & State Government.

drawn from adjacent waterways. These raw water supplies are not disinfected and users are advised to boil before consumption. St Marys will be moving to bore water supply in the near future. Drinking water off-takes further downstream – Avoca, Conara, Epping Forest, Evandale and Perth – are chlorinated. The Rossarden town supply is untreated.

Estimated water drawn for stock usage along the entire South Esk River would be in the order of 1,000 megalitres per year. A stock feedlot at Powranna also draws significant amounts of water from the South Esk for stock watering and irrigation purposes. The substantial increase in farm dam approvals over recent years may indicate less reliance on direct pumping from streams for cropping or stock watering purposes and greater utilisation of higher winter flows to supply dams that can be used in over the lower flow summer months.

An environmental flow study undertaken on the South Esk River utilised a risk analysis model to identify sustained flow requirements for these waterways<sup>6</sup>. This study nominated a median discharge level of 2 cumec (172 megalitres per day) over the irrigation season for the South Esk River. Flows at these levels were considered to provide only low levels of risk that a range of ecological and fishery values would be lost. The basis upon which these values were determined should be considered and is outlined in the original environmental flows report.

### 3.3 Water Quality

The South Esk River has been the focus of considerable water quality assessment through the State of Rivers reporting process. While the major findings for the South Esk River and tributaries are summarised below, the original report gives a more comprehensive and accurate description of regional waterway health<sup>7</sup>.

Conductivity levels are low across the catchment. While there tends to be an increase in the lower South Esk and evidence of higher levels in some tributaries, these levels impose no restrictions on water usage. Concentrations of dissolved oxygen generally appear to be at levels that support healthy aquatic ecosystems, although occasional results from a site on Break O'Day River were at low levels. These may be linked to low flows at the time of sampling or high organic loading from streamside willows.

Catchment waters are typically very clear with low levels of turbidity and suspended solids. Within this low range, some seasonal trends are apparent with more turbid waters in evidence between June and November. Increased erosion associated with flood events dramatically increases turbidity and suspended solids levels.

Any propensity for the development of problem algal blooms is indicated by the concentrations of phosphorus and nitrogen in waterways. Concentrations of nitrate (typically the largest portion of dissolved nitrogen available to promote plant growth) were highest over the winter months, which may reflect the proportionally greater

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<sup>6</sup> Davies P & Humphries P 1995. *An environmental flow study of the Meander, Macquarie and South Esk Rivers, Tasmania*. Dept. of Primary Industries & Fisheries.

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<sup>7</sup> DPIF *South Esk Basin State of Rivers Report*. 1997. Funded by NHT & State Government.

contribution of high nitrate groundwater to river base-flow than at other times of year. In terms of total nitrogen, results from sites within the South Esk are within the lower end of the range that is required for the protection of aquatic biota. Nitrogen loss from the 3,300 square kilometres of the catchment upstream of Perth was estimated at 1,480 tonnes over the three-and-a-half year study period.

Total phosphorus concentrations throughout the catchment are also at low levels that are less likely to support problem algal blooms. Phosphorus loss from the catchment upstream of Perth was estimated at 72 tonnes per annum over the three-and-a-half year study period. Flood events appear to be the major transport mechanism for nutrient loads, with very large increases in nitrogen and phosphorus concentrations during rainfall events.

Point-source inputs of nutrients into regional waterways are restricted to four sewage treatment plants – St Marys, Fingal, Evandale and Perth. During low flow periods, inputs of treated sewage effluent may produce localised nutrient enrichment of the receiving waters resulting in prolific aquatic weed growth and nuisance algal blooms.

Limited sampling for microbial indicators of contamination in the South Esk River catchment showed most sites had bacterial levels posing no risks for primary contact activities - swimming and bathing. Levels of bacterial contamination appear to increase in the lower reaches of the river.

The effects of heavy metal pollution from the Storeys Creek and Aberfoyle mines on water quality and macro-invertebrate communities remains, with significant reductions in invertebrate communities downstream of the Storeys Creek junction. A one-off survey in

1995 for a range of heavy metals in the South Esk below the Storeys Creek junction showed levels of dissolved zinc and copper at concentrations which may affect aquatic biota. Acid drainage from the Storeys Creek mine does not, however, appear to affect pH levels in the South Esk River downstream. Extensive degradation of stream habitat, unrelated to heavy metal pollution, also appears in the middle and lower reaches of the South Esk River. Past gold-mining activity in the Long Gully Creek catchment near Mathinna has also resulted in local water quality problems in terms of arsenic levels.

Mineral exploration or quarrying activities are expected to operate in accordance with the provisions of the Mineral Exploration Code of Practice and the Quarry Code of Practice. Prior to approval, new developments will need to demonstrate the use of accepted modern technology and best practice environmental management, including waste reduction, reuse and recycling, to ensure that impacts on water quality are minimised.

### **3.4 Aquatic Ecosystems<sup>8</sup>**

The South Esk River has been significantly impacted in the 1970s and 1980s by heavy metal contamination from mining activity at the Storeys Creek and Aberfoyle Creek catchments. Downstream aquatic ecosystems were severely degraded with loss of invertebrate numbers and diversity. Loss of riparian vegetation is also evident in these stretches of the river. While remediation work is underway at these sites, recent studies show ongoing downstream effects. However, evidence of habitat degradation in the South Esk upstream of the Storeys

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<sup>8</sup> DPIF *South Esk Basin State of Rivers Report*. 1997. Funded by NHT & State Government.

Creek junction suggests other factors may also be having some impact on ecosystem health.

Regional waterways also support rare and threatened invertebrate species such as the Hydrobiidae snail (*Beddomeia krybetes*) in the upper St Pauls River and several species of caddisfly (*Hydroptila scamandra* and *Leptocerus sounta*) near Evandale on the South Esk River. Efforts have also been made to ensure greater security for the endangered Swan Galaxias through the use of translocated stock to the upper catchment of the St Pauls River.

Fish stocks in the catchment appear to have been significantly affected by contamination from Storeys Creek. Concentrations of heavy metals were at levels that are lethal for both native and introduced fish species – Brown trout, Redfin perch, Tench, Short-finned eel and Pigmy perch.

The vulnerable green and gold frog (*Littoria raniformis*), which is found in permanent swamps and dams of the lower South Esk catchment, is also sensitive to disturbance from water regulation and diversion.

Exotic species, both animal and plant, are an ongoing threat in terms of their ability to out compete or displace local species in disturbed aquatic environments. The redfin perch, which is an introduced fish in the lower South Esk, may be having a negative effect on native fish species because of its highly predatory behaviour. Trout, and possibly tench, may also be having a similar detrimental impact.

Pest plants, particularly willows, are excluding native riverside vegetation (and associated fauna) along many stretches of these waterways. Prolific willow growth can strangle or alter

waterways by sediment capture and flow diversion.

### 3.5 Catchment environmental issues

As stream conditions are determined both by in-stream activities and surrounding land-use activities, waterways act as a touchstone of catchment health. Healthy waterways are indicative of sustainably managed catchments. There are a number of environmental issues relating to waterways in the South Esk catchment.

- Erosion and soil loss in the catchment and deposition in the Tamar Estuary.
- Loss of phosphorus from the catchment during flood events (probably in a form which is bound to eroded sediments).
- Maintenance and enhancement of habitat quality and diversity for aquatic flora and fauna.
- Flow related issues: potential for excessive extraction of water and the impact on in-stream flows.
- Consequences of clearing and draining flood plains and marshes in terms of regional habitat diversity.
- Consequences of clearing and draining flood plains and marshes in terms of increasing flood peaks and reduction of summer flows.
- Erosion through forestry activities (road construction, harvesting etc.) and associated loss of, or stress to, aquatic and riparian habitats;
- Heavy metal contamination from Storeys Creek degrading waterways.

- Contamination of Long Gully Creek (near Mathinna) due to past mining activity.
- Ensuring minimal waterway impacts from open-cut coal mining operations near Cornwall.
- Maintaining viable populations of endangered animal and plant species
- Environmental flow requirements.
- The impact of exotic fish, such as redfin perch, which prey upon smaller native fish.
- Willow infestations along many waterways clog existing channels; divert water to new channels with subsequent erosion; replace native riparian flora; and have impacts on water quality.



## 4 WATER QUALITY: PROTECTED ENVIRONMENTAL VALUES

### 4.1 Setting Protected Environmental Values

The first step in the implementation of the *State Policy on Water Quality Management 1997* is the identification of **Protected Environmental Values (PEVs)** of the surface waters in each region. **PEVs are the values or uses of the water body for which it is determined that any given area of that water body should be protected.** These values and uses should be clearly in evidence at the time of the implementation of the Policy.

The Policy specifies a range of PEVs which may be applied to a given water body. More than one PEV may be applied to a water body. The PEVs are:

- A. Protection of Aquatic Ecosystems
- B. Recreational Water Quality and aesthetics
- C. Raw Water for Drinking Water Supply
- D. Agricultural Water Use
- E. Industrial Water Supply

These values are described in more detail in Section 5.2.

The Board of Environmental Management and Pollution Control will then specify a range of pollutant limits called Water Quality Objectives. These will be designed to ensure the quality of water in that water body is maintained at a level which will allow the chosen values to be protected.

The Policy then sets out a range of strategies which are aimed at ensuring that waste water discharges from point sources (such as industrial or sewage treatment plant discharges) and diffuse

sources (such as runoff from highways, urban areas, farms, forest harvesting etc.) will not endanger the achievement of the Water Quality Objectives.

The Board and local planning authorities will use these strategies in land use planning and approvals processes, and in ongoing regulation, to ensure that the PEVs for a given water body are maintained or enhanced over time.

### 4.2 Protected Environmental Values categories

The Policy lists a range of PEVs which are used to describe the identified values and uses of a given water body. These are:

#### **A: Protection of Aquatic Ecosystems**

- (i) Pristine or near pristine ecosystems;
- (ii) Modified (not pristine) ecosystems:
  - (a) from which edible fish, crustacea and shellfish are harvested, or
  - (b) from which edible fish, crustacea and shellfish are not harvested.

*What does pristine mean?*

"Pristine" means waters not subject to human interference through discharges or other activities within the catchment (Australian Water Quality Guidelines 1992).

#### **B: Recreational Water Quality & Aesthetics**

- (i) Primary contact
- (ii) Secondary contact
- (iii) Aesthetics

‘Primary contact’ means recreation involving bodily immersion / submersion where there is direct contact with water, & includes swimming, diving, surfing, water skiing.

‘Secondary contact’ means activities where there is some direct water contact, but it is unlikely that water will be swallowed (e.g. paddling, boating, and fishing).

‘Aesthetics’ means visual appearance of the water, being free from oil, grease, floating debris, unnatural colour, algal blooms etc.

### **C: Raw Water for Drinking Supply**

- (i) Subject to coarse screening only;
- (ii) Subject to coarse screening and disinfection.

This PEV applies to water used as the intake source for **public use** (town water supply, in other words) and to registered private water supplies.

It does not apply to the taking of water from surface waters by individuals for private use for the purposes of drinking etc.

The Director of Public Health recommends that raw water from any surface waterbody should be boiled before use.

### **D: Agricultural Water Uses**

- (i) Irrigation
- (ii) Stock watering

### **E: Industrial Water Supply**

The actual industry type must be specified in order to identify appropriate guidelines.

## 5 PROTECTED ENVIRONMENTAL VALUES FOR THE MACQUARIE RIVER & SOUTH ESK RIVER CATCHMENTS

### 5.1 PEV Setting Process

Between 2000 and 2004 the Board of Environmental Management and Pollution Control, local government (Northern Midlands, Break O’Day, Dorset and Central Highlands Councils) and the Tasmanian Parks and Wildlife Service set Protected Environmental Values (PEVs) for surface waters (rivers, lakes and streams) of the Macquarie and South Esk catchments as required by the *State Policy on Water Quality Management 1997* (‘the Policy’).

A public discussion paper – *Proposed Environmental Management Goals for Tasmanian Surface Waters: Macquarie River and South Esk River Catchments* – was developed by the Department of Primary Industries, Water & Environment in consultation with local government and Parks officers. This paper explained the Policy, how the PEVs are identified and used, and proposed draft PEVs suitable for the catchments.

Draft PEVs provided the basis for discussion with regional stakeholders and interest groups at workshops at Campbell Town (14 March 2000), Cressy (15 March 2000) and Fingal (16 March 2000). Information and comment arising from these workshops were incorporated into the Discussion Paper to further develop the PEVs. Public meetings to provide opportunity for wider community input into the PEV setting process were then advertised in the Examiner and Tasmanian Country newspapers. These meetings were held at Campbell Town (3 April 2000), Cressy (4 April 2000) and Fingal (5 April 2000) followed by an extended period for comment until 12<sup>th</sup> May 2000.

The PEVs detailed in Table 1 have been endorsed by The Board of Environmental Management and Pollution Control, local government (Northern Midlands, Break O’Day, Dorset and Central Highlands Councils) and the Tasmanian Parks and Wildlife Service.

### 5.2 Notes on PEVs

The PEVs chosen from the Policy are those values and uses that are currently in evidence and apply only for surface waters within the Macquarie and South Esk catchments.

Information collected on PEVs and Community Water Values will be incorporated into the future development of water management and catchment management plans.

Community Water Values should be incorporated into the future development of water management and catchment management plans.

The PEVs apply to all surface waters within each land tenure category, other than<sup>9</sup>:

- privately owned waters that are not accessible to the public and are not connected to, or flow directly into, waters that are accessible to the public; or
- waters in any tank, pipe or cistern.

“Privately owned waters” means any surface waters confined within the boundary of privately owned land and which do not flow into, or do not communicate with:

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<sup>9</sup> *State Policy on Water Quality Management 1997*

- (a) the sea or arm or creek of the sea;
- (b) a source of supply for a water district or irrigation water district;
- (c) any river, stream, watercourse, lake, pond or marsh.

Management of all surface waters within the catchment shall focus on the achievement of water quality objectives.

The water quality objectives will be determined by the Board of Environmental Management and Pollution Control in accordance with the *State Policy on Water Quality Management 1997*.

Achievement of these water quality objectives will maintain or enhance the water quality of those surface waters to ensure the protection of all of the following values and uses applying to each land use category. These values and uses are derived from the formal PEVs listed in Clause 7 of the Policy.

In general, diffuse source pollution can be managed to protect the PEVs by compliance with approved codes of practice, or by development and implementation of best practice environmental management guidelines where codes are not available.

In general, point source pollution should be managed to protect the PEVs by implementation of best practice environmental management, and by compliance with emission limits set by the regulatory authority. This may also require the setting of a mixing zone by the Board of Environmental Management and Pollution Control. For specific details refer to Part 4 of the Policy.

**Protected Environmental Values reflect current values and uses of a water body but do not necessarily imply that the existing water quality will support these values and uses.**

**Table 1: Protected Environmental Values for the Macquarie River Catchment**

<b>Land Tenure</b>	<b>Protected Environmental Values, upper Macquarie River</b> *(see notes on page 17)
For all surface waters within private land (including forest on private land)	<p>A: Protection of Aquatic Ecosystems</p> <ul style="list-style-type: none"> <li>(ii) Protection of modified (not pristine) ecosystems from which edible fish are harvested</li> </ul> <p>B: Recreational Water Quality &amp; Aesthetics</p> <ul style="list-style-type: none"> <li>(i) Primary contact water quality (Campbell Town weir; where most public roads cross over rivers - not the Lake River)</li> <li>(ii) Secondary contact water quality</li> <li>(iii) Aesthetic water quality</li> </ul> <p>C: Raw Water for Drinking Water Supply (Ross, Campbelltown)</p> <ul style="list-style-type: none"> <li>(ii) Subject to coarse screening plus disinfection</li> </ul> <p>D: Agricultural Water Uses</p> <ul style="list-style-type: none"> <li>(i) Irrigation</li> <li>(ii) Stock watering</li> </ul> <p>E: Industrial Water Supply (Hydro-Electric Power Generation)</p> <p>That is, as a minimum, water quality management strategies should provide water of a physical and chemical nature to support a modified, but healthy aquatic ecosystem from which edible fish may be harvested; that is suitable to supply town drinking water (subject to coarse screening plus disinfection) at Ross and Campbelltown; that is acceptable for irrigation and stock watering purposes; and which will allow people to safely engage in primary and secondary contact recreation activities such as swimming (at specified sites), paddling or fishing in aesthetically pleasing waters; and is suitable for use (following impoundment) in the Trevally Power Scheme.</p>
For all surface water on Hydro land.	<p>A: Protection of Aquatic Ecosystems</p> <ul style="list-style-type: none"> <li>(ii) Protection of modified (not pristine) ecosystems from which edible fish are harvested</li> </ul> <p>B: Recreational Water Quality and Aesthetics</p> <ul style="list-style-type: none"> <li>(i) Primary contact water quality (where primary contact recreation permitted)</li> <li>(ii) Secondary contact water quality</li> <li>(iii) Aesthetic water quality</li> </ul> <p>D: Agricultural Water Uses</p> <ul style="list-style-type: none"> <li>(i) Irrigation</li> <li>(ii) Stock watering</li> </ul> <p>E: Industrial Water Supply (Hydro-Electric Power Generation)</p> <p>That is, as a minimum, water quality management strategies should provide water of a physical and chemical nature to support a modified, but healthy aquatic ecosystem from which edible fish may be harvested; that is acceptable for downstream stock watering and</p>

Land Tenure	Protected Environmental Values, upper Macquarie River* <sup>(see notes on page 17)</sup>
	irrigation purposes; and which will allow people to safely engage in primary and secondary contact recreation activities such as swimming, paddling or fishing (where Hydro operations permit) in aesthetically pleasing waters; and is suitable for use (following impoundment) in the Trevallyn Power Scheme.
<p>For all surface waters within State Forest</p> <p>(managed under the <i>Forestry Act 1920</i>)</p>	<p>A: Protection of Aquatic Ecosystems</p> <p>(ii) Protection of modified (not pristine) ecosystems from which edible fish are harvested taking into consideration Forestry Tasmania's Management Classification System.</p> <p>B: Recreational Water Quality and Aesthetics</p> <p>(i) Primary contact water quality</p> <p>(ii) Secondary contact water quality</p> <p>(iii) Aesthetic water quality</p> <p>E: Industrial Water Supply (Hydro-Electric Power Generation)</p> <p>That is, as a minimum, water quality management strategies should provide water of a physical and chemical nature to support a modified, but healthy aquatic ecosystem (recognising the designation of the area for multiple use forestry activities) from which fish may be harvested; that allows people to safely engage in primary and secondary contact recreational activities such as swimming and wading in aesthetically pleasing waters; and is suitable for use (following impoundment) in the Trevallyn Power Scheme.</p>
<p>Surface waters flowing through Forest Reserves from private land, hydro land, state forest or un-allocated crown land</p>	<p>A: Protection of Aquatic Ecosystems</p> <p>(ii) Protection of modified (not pristine) ecosystems from which edible fish are harvested having regard to the management objectives for forest reserves outlined in Schedule 3 of the <i>Forestry Act 1920</i></p> <p>B: Recreational Water Quality &amp; Aesthetics</p> <p>(i) Primary contact water quality</p> <p>(ii) Secondary contact water quality</p> <p>(iii) Aesthetic water quality</p> <p>E: Industrial Water Supply (Hydro-Electric Power Generation)</p> <p>That is, as a minimum, water quality management strategies should provide water of a physical and chemical nature to support a modified, but healthy aquatic ecosystem from which edible fish may be harvested; which will allow people to safely engage in recreation activities such as swimming, kayaking, paddling or fishing in aesthetically pleasing waters; and is suitable for use (following impoundment) in the Trevallyn Power Scheme.</p>
<p>Surface waters that have their headwaters within Forest Reserves</p>	<p>A: Protection of Aquatic Ecosystems</p> <p>(i) Protection of pristine or nearly pristine ecosystems having regard for the management objectives for forest reserves outlined in Schedule 3 of the <i>Forestry Act, 1920</i></p> <p>B: Recreational Water Quality &amp; Aesthetics</p> <p>(i) Primary contact water quality</p> <p>(ii) Secondary contact water quality</p> <p>(iii) Aesthetic water quality</p> <p>E: Industrial Water Supply (Hydro-Electric Power Generation)</p>

Land Tenure	Protected Environmental Values, upper Macquarie River* <sup>(see notes on page 17)</sup>
	<p>That is, as a minimum, water quality management strategies should provide water of a physical and chemical nature to support a pristine or near pristine aquatic ecosystem and which will allow people to safely engage in recreation activities such as swimming, paddling or fishing in aesthetically pleasing waters; and is suitable for use (following impoundment) in the Trevallyn Power Scheme.</p>
<p>Surface waters having their headwaters within Conservation Areas  (managed under the <i>National Parks and Reserves Management Act 2002</i>)</p>	<p>A: Protection of Aquatic Ecosystems</p> <p>(i) Protection of pristine or nearly pristine ecosystems having regard for the management objectives for conservation areas outlined in Schedule 1 of the <i>National Parks and Reserves Management Act 2002</i></p> <p>B: Recreational Water Quality and Aesthetics</p> <p>(i) Primary contact water quality</p> <p>(ii) Secondary contact water quality</p> <p>(iii) Aesthetic water quality</p> <p>E: Industrial Water Supply (Hydro-Electric Power Generation)</p> <p>That is, as a minimum, water quality management strategies should provide water of a physical and chemical nature to support a pristine or near pristine aquatic ecosystem that allows people to safely engage in primary and secondary contact recreational activities such as swimming, rafting and fishing in aesthetically pleasing waters; and is suitable for use (following impoundment) in the Trevallyn Power Scheme.</p>
<p>Surface waters flowing through Conservation Areas from state forest, un-allocated crown land, hydro or private land  (managed under the <i>National Parks and Reserves Management Act 2002</i>)</p>	<p>A: Protection of Aquatic Ecosystems</p> <p>(ii) Protection of modified (not pristine) ecosystems from which edible fish are harvested and having regard for the management objectives for conservation areas outlined in Schedule 1 of the <i>National Parks and Reserves Management Act 2002</i></p> <p>B: Recreational Water Quality and Aesthetics</p> <p>(i) Primary contact water quality</p> <p>(ii) Secondary contact water quality</p> <p>(iii) Aesthetic water quality</p> <p>E: Industrial Water Supply (Hydro-Electric Power Generation)</p> <p>That is, as a minimum, water quality management strategies should provide water of a physical and chemical nature to support a modified, but healthy aquatic ecosystem from which edible fish may be harvested; that allows people to safely engage in primary and secondary contact recreational activities such as swimming, rafting and fishing in aesthetically pleasing waters; and is suitable for use (following impoundment) in the Trevallyn Power Scheme.</p>

<b>Land Tenure</b>	<b>Protected Environmental Values, upper Macquarie River*</b> (see notes on page 17)
Surface Waters on Un-allocated Crown Land	<p>A: Protection of Aquatic Ecosystems</p> <p>(ii) Protection of modified (not pristine) ecosystems from which edible fish are harvested</p> <p>B: Recreational Water Quality and Aesthetics</p> <p>(i) Primary contact water quality</p> <p>(ii) Secondary contact water quality</p> <p>(iii) Aesthetic water quality</p> <p>E: Industrial Water Supply (Hydro-Electric Power Generation)</p> <p>That is, as a minimum, water quality management strategies should provide water of a physical and chemical nature to support a modified, but healthy aquatic ecosystem from which edible fish may be harvested; that allows people to safely engage in primary and secondary contact recreational activities such as swimming, rafting and fishing in aesthetically pleasing waters; and is suitable for use (following impoundment) in the Trevallyn Power Scheme.</p>



**Table 2: Protected Environmental Values for the South Esk River Catchment**

<b>Land Tenure</b>	<b>Protected Environmental Values, upper South Esk</b> *(see notes on page 17)
For all surface waters within private land (including forest on private land)	<p>A: Protection of Aquatic Ecosystems</p> <ul style="list-style-type: none"> <li>(ii) Protection of modified (not pristine) ecosystems from which edible fish are harvested</li> </ul> <p>B: Recreational Water Quality &amp; Aesthetics</p> <ul style="list-style-type: none"> <li>(i) Primary contact water quality ( Fingal upstream of sewage treatment plant past railway; Mathinna; Avoca; Briar Corner on Break O'Day; Royal George; Ormley between Avoca and Fingal and where most public roads cross over rivers)</li> <li>(ii) Secondary contact water quality</li> <li>(iii) Aesthetic water quality</li> </ul> <p>C: Raw Water for Drinking Water Supply (Mathinna, St Marys, Fingal, Rossarden, Avoca, Conara, Epping Forest, Evandale &amp; Perth)</p> <ul style="list-style-type: none"> <li>(ii) Subject to coarse screening plus disinfection</li> </ul> <p>D: Agricultural Water Uses</p> <ul style="list-style-type: none"> <li>(i) Irrigation</li> <li>(ii) Stock watering</li> </ul> <p>E: Industrial Water Supply (Hydro-Electric Power Generation, Fingal Coal Washery, Powranna Feedlot)</p> <p>That is, as a minimum, water quality management strategies should provide water of a physical and chemical nature to support a modified, but healthy aquatic ecosystem from which edible fish may be harvested; that is suitable to supply town drinking water (subject to coarse screening plus disinfection) at Mathinna, St Marys, Fingal, Rossarden, Avoca, Conara, Epping Forest, Evandale &amp; Perth; that is acceptable for irrigation and stock watering purposes; and which will allow people to safely engage in primary and secondary contact recreation activities such as swimming (at specified sites), paddling or fishing in aesthetically pleasing waters; and is suitable for use in the Fingal Coal Washery, Powranna Feedlot and (following impoundment) in the Trevallyn Power Scheme.</p>

<b>Land Tenure</b>	<b>Protected Environmental Values, upper South Esk</b> *(see notes on page 17)
Surface Waters on Un-allocated Crown Land	<p>A: Protection of Aquatic Ecosystems</p> <p>(ii) Protection of modified (not pristine) ecosystems from which edible fish are harvested</p> <p>B: Recreational Water Quality and Aesthetics</p> <p>(i) Primary contact water quality</p> <p>(ii) Secondary contact water quality</p> <p>(iii) Aesthetic water quality</p> <p>E: Industrial Water Supply (Hydro-Electric Power Generation)</p> <p>That is, as a minimum, water quality management strategies should provide water of a physical and chemical nature to support a modified, but healthy aquatic ecosystem from which edible fish may be harvested; that allows people to safely engage in primary and secondary contact recreational activities such as swimming, rafting and fishing in aesthetically pleasing waters; and is suitable for use (following impoundment) in the Trevallyn Power Scheme.</p>
For all surface waters within State Forest  (managed under the <i>Forestry Act 1920</i> )	<p>A: Protection of Aquatic Ecosystems</p> <p>(ii) Protection of modified (not pristine) ecosystems from which edible fish are harvested taking into consideration Forestry Tasmania's Management Classification System.</p> <p>B: Recreational Water Quality and Aesthetics</p> <p>(i) Primary contact water quality</p> <p>(ii) Secondary contact water quality</p> <p>(iii) Aesthetic water quality</p> <p>E: Industrial Water Supply (Hydro-Electric Power Generation)</p> <p>That is, as a minimum, water quality management strategies should provide water of a physical and chemical nature to support a modified, but healthy aquatic ecosystem (recognising the designation of the area for multiple use forestry activities) from which fish may be harvested; that allows people to safely engage in primary and secondary contact recreational activities such as swimming and wading in aesthetically pleasing waters; and is suitable for use (following impoundment) in the Trevallyn Power Scheme.</p>
Surface waters flowing through Forest Reserves from private land, state forest or un-allocated crown land	<p>A: Protection of Aquatic Ecosystems</p> <p>(ii) Protection of modified (not pristine) ecosystems from which edible fish are harvested having regard to the management objectives for forest reserves outlined in Schedule 3 of the <i>Forestry Act 1920</i></p> <p>B: Recreational Water Quality &amp; Aesthetics</p> <p>(i) Primary contact water quality</p> <p>(ii) Secondary contact water quality</p> <p>(iii) Aesthetic water quality</p> <p>E: Industrial Water Supply (Hydro-Electric Power Generation)</p> <p>That is, as a minimum, water quality management strategies should provide water of a</p>

Land Tenure	Protected Environmental Values, upper South Esk <sup>*(see notes on page 17)</sup>
	physical and chemical nature to support a modified, but healthy aquatic ecosystem from which edible fish may be harvested; which will allow people to safely engage in recreation activities such as swimming, kayaking, paddling or fishing in aesthetically pleasing waters; and is suitable for use (following impoundment) in the Trevallyn Power Scheme.
Surface waters that have their headwaters within Forest Reserves	<p>A: Protection of Aquatic Ecosystems</p> <p>(i) Protection of pristine or nearly pristine ecosystems having regard for the management objectives for forest reserves outlined in Schedule 3 of the <i>Forestry Act 1920</i>. *</p> <p>B: Recreational Water Quality &amp; Aesthetics</p> <p>(i) Primary contact water quality</p> <p>(ii) Secondary contact water quality</p> <p>(iii) Aesthetic water quality</p> <p>E: Industrial Water Supply (Hydro-Electric Power Generation)</p> <p>That is, as a minimum, water quality management strategies should provide water of a physical and chemical nature to support a pristine or near pristine aquatic ecosystem and which will allow people to safely engage in recreation activities such as swimming, paddling or fishing in aesthetically pleasing waters; and is suitable for use (following impoundment) in the Trevallyn Power Scheme.</p>
Surface waters flowing through National Parks or Nature Reserves from private land, state forests or un-allocated crown land  (managed under the <i>National Parks and Reserves Management Act 2002</i> )	<p>A: Protection of Aquatic Ecosystems</p> <p>(ii) Protection of modified (not pristine) ecosystems from which edible fish are harvested having regard for the management objectives outlined in Schedule 1 of the <i>National Parks and Reserves Management Act 2002</i></p> <p>B: Recreational Water Quality &amp; Aesthetics</p> <p>(i) Primary contact water quality</p> <p>(ii) Secondary contact water quality</p> <p>(iii) Aesthetic water quality</p> <p>E: Industrial Water Supply (Hydro-Electric Power Generation)</p> <p>That is, as a minimum, water quality management strategies should provide water of a physical and chemical nature to support a modified, but healthy aquatic ecosystem from which edible fish may be harvested; which will allow people to safely engage in recreation activities such as swimming, kayaking, paddling or fishing in aesthetically pleasing waters; and is suitable for use (following impoundment) in the Trevallyn Power Scheme.</p>

<b>Land Tenure</b>	<b>Protected Environmental Values, upper South Esk</b> *(see notes on page 17)
<p>Surface waters that have their headwaters within National Parks or Nature Reserves</p> <p>(managed under the <i>National Parks and Reserves Management Act 2002</i>)</p>	<p>A: Protection of Aquatic Ecosystems</p> <p>(i) Protection of pristine or nearly pristine ecosystems having regard for the management objectives outlined in Schedule 1 of the <i>National Parks and Reserves Management Act 2002</i></p> <p>B: Recreational Water Quality &amp; Aesthetics</p> <p>(i) Primary contact water quality</p> <p>(ii) Secondary contact water quality</p> <p>(iii) Aesthetic water quality</p> <p>E: Industrial Water Supply (Hydro-Electric Power Generation)</p> <p>That is, as a minimum, water quality management strategies should provide water of a physical and chemical nature to support a pristine or near pristine aquatic ecosystem and which will allow people to safely engage in recreation activities such as swimming, kayaking, paddling or fishing in aesthetically pleasing waters; and is suitable for use (following impoundment) in the Trevallyn Power Scheme.</p>
<p>Surface waters flowing through reserves dedicated under the <i>Crown Lands Act 1976</i> (inc. Lake Leake) from private land, state forests or un-allocated crown land</p>	<p>A: Protection of Aquatic Ecosystems</p> <p>(i) Protection of modified (not pristine) ecosystems from which edible fish are harvested having regard to the management objectives for objectives for reserves</p> <p>B: Recreational Water Quality &amp; Aesthetics</p> <p>(i) Primary contact water quality</p> <p>(ii) Secondary contact water quality</p> <p>(iii) Aesthetic water quality</p> <p>E: Industrial Water Supply (Hydro-Electric Power Generation)</p> <p>That is, as a minimum, water quality management strategies should provide water of a physical and chemical nature to support a modified, but healthy aquatic ecosystem from which edible fish may be harvested; which will allow people to safely engage in recreation activities such as swimming, kayaking, paddling or fishing in aesthetically pleasing waters; and is suitable for use (following impoundment) in the Trevallyn Power Scheme.</p>

Land Tenure	Protected Environmental Values, upper South Esk <sup>*(see notes on page 17)</sup>
Surface waters that have their headwaters within reserves dedicated under the <i>Crown Lands Act 1976</i> (inc. Lake Leake).	<p>A: Protection of Aquatic Ecosystems</p> <p>(i) Protection of pristine or nearly pristine ecosystems having regard to the management objectives for reserves. * #</p> <p>B: Recreational Water Quality &amp; Aesthetics</p> <p>(i) Primary contact water quality</p> <p>(ii) Secondary contact water quality</p> <p>(iii) Aesthetic water quality</p> <p>E: Industrial Water Supply (Hydro-Electric Power Generation)</p> <p>That is, as a minimum, water quality management strategies should provide water of a physical and chemical nature to support a pristine or near pristine aquatic ecosystem and which will allow people to safely engage in recreation activities such as swimming, paddling or fishing in aesthetically pleasing waters; and is suitable for use (following impoundment) in the Trevallyn Power Scheme.</p>

\* Subject to assessment under the *Regional Forest Agreement (Land Classification) Act 1998*

# Historic mining activities or other historic land uses may have resulted in long term water quality impacts to some streams or rivers within these reserve classes and to their associated ecosystems. This may mean that the water quality in these rivers or streams may not currently support pristine or nearly pristine ecosystems or primary contact recreational activities. This should be taken into consideration at the time that management decisions are being made for individual rivers or streams. Water quality data is not currently available for most surface waters in these areas.

## 6 WATER QUANTITY VALUES FOR THE MACQUARIE RIVER & SOUTH ESK RIVER

### 6.1 Overview

While water quality is a very important part of any water management regime, the issue of how much water a river or stream carries, and how that flow is managed, is of equal importance. Water quality and quantity are closely linked.

The State Government proposes to re-organise the way water flow in our rivers and streams is managed, and one of the key understandings is that there needs to be a specific allocation of water for the river or stream itself. This is necessary not only to protect the aquatic life of the river, but also to maintain basic "river health". If there is insufficient flow at crucial times of the year, the overall quality of the remaining water may be badly affected. This will very likely have a negative effect on human uses of the water, as well as on the environment.

In some instances there may be competing uses for the available resource, and that there may need to be trade-offs to ensure a balanced sharing arrangement between human uses and the needs of the river environment.

The allocation of water for the environment must be based on scientific information, and also on legitimate community values and uses. This community values information was collected as part of the community consultation process.

### 6.2 Water quantity values

Five broad categories of water quantity values have been identified, and as with the water quality PEVs, it is likely that most rivers will attract more than one value/use category. The categories are:

- Ecosystem values;
- Physical landscape values.
- Consumptive and non-consumptive use values;
- Recreation values;
- Aesthetic landscape values;

The information from the public input, and gathering water management values from stakeholders, community groups and government agencies will be utilised when water management planning for the catchment is undertaken.

An appraisal of water quantity values will be undertaken in order to develop water management goals for the catchment. This will be undertaken during the water management planning process.

An explanation of the water quantity value categories and examples of specific values are given below:

#### Ecosystem values

The term is used to identify those values which are to be protected and/or enhanced in the current state of aquatic and adjacent land ecosystems. Specific water values associated with the ecosystem value category may be:

- protection of an endangered species (plant or animal);
- protection or improvement in native fish populations;
- protection of riverine vegetation;
- provision of adequate water for stream habitat for flora and fauna;
- provision of water for wetland and/or estuary ecosystems.

### Physical Landscape values

These values are closely related to the physical nature of the catchment. This includes the nature and constitution of channels, the frequency of floods and droughts, soil and rock types, and vegetation coverage. These values are also closely associated with ecosystem function, and may overlap with the protection of ecosystem values. Specific water values associated with physical landscape values may include:

- provision of variable flows;
- prevention of erosion;
- protection or improvement of riparian zone.

### Consumptive and non-consumptive use values

These are related to the current and potential human uses of water bodies. Consumptive use refers to the extraction of water from the water body, with no return of it to the waterbody. Examples may include:

- provision of water for irrigation;
- provision of water for town supply;
- provision of water for industry.

Non-consumptive use refers to extraction or use of water, where the water is eventually returned to the river. Examples may include:

- use of water for hydro-electricity generation;
- use of water for fish farming.

### Recreational values

These include the range of direct human uses of water bodies for purposes such

as kayaking, canoeing, sailing, swimming, fishing etc. This type of value is difficult to quantify, but is an essential part of our way of life in Tasmania. Water quality issues are also important, especially where primary contact occurs (swimming for example), or where the recreational activity relies on a base of good quality water, such as a recreational fishery. Examples may include:

- maintenance or improvement of the quantity (and quality) of water for recreational fishery (trout, blackfish etc);
- provision of sufficient water for whitewater rafting;
- provision of sufficient water (of adequate quality) for swimming.

### Aesthetic Landscape values

These values relate to human appreciation of water and adjacent environments. It is often extremely difficult to address these types of values, or work out the flow requirements to ensure their protection. They are, however, legitimate values which must be acknowledged in any good management process. Examples may include:

- maintenance or improvement of flow through gorges or over waterfalls;
- protection of scenic features in a river.

The community Water Values identified through the PEVs and water management processes can be considered when making management decisions for water quality.

## 7 Community Water Values

The following community water values were collected at a number of workshops in the Macquarie River and South Esk River Catchment Areas. These values relate to both water quality and water quantity.

**Table 3: Nominated Water Values - Campbell Town stakeholder workshop (14 March 2000) and advertised public meeting (3 April 2000).**

Water Value Categories	Nominated Water Values
<b>Ecosystem values</b>	<ul style="list-style-type: none"> <li>• Water for maintaining riparian vegetation</li> <li>• Waterways with less willows and more tea-trees</li> <li>• Less cumbungii in waterways (possibly related to flows or spread by birds)</li> <li>• Successful translocation of Swan galaxiids (native fish) to upper South Esk tributaries</li> <li>• Pygmy perch in the Macquarie and South Esk rivers</li> <li>• Brown trout in some of the regions waterways</li> <li>• Rainbow trout at Lake Leake</li> <li>• Platypus widely distributed</li> <li>• Eels</li> <li>• Fresh water mussel in parts of the South Esk &amp; Macquarie</li> <li>• Provides bird habitat</li> <li>• Astercopsis franklinii (freshwater crayfish)</li> <li>• Provision of seasonal flow cycles</li> <li>• Maintaining fish life</li> <li>• Maintain instream habitat for animals and plants</li> <li>• Maintain environmental flow in Elizabeth/Macquarie system (3 ML/day suggested)</li> </ul>
<b>Consumptive or non-consumptive values</b>	<ul style="list-style-type: none"> <li>• Water storage values of broadwaters</li> <li>• Irrigation use</li> <li>• Hydro electricity generation (Hydro has primary control over waters in South Esk Basin)</li> <li>• Stock and domestic use</li> <li>• Coal washery at Fingal</li> <li>• Town water supply</li> <li>• Feedlot supply on South Esk at Powranna</li> <li>• Swimming pools at Campbelltown and Ross</li> <li>• Use for forestry activities (new growth reduces catchment yield as opposed to old growth, this change in yield is particularly significant over low flow summer periods)</li> </ul>
<b>Recreational values</b>	<ul style="list-style-type: none"> <li>• Fishing for trout and eels (particularly Tooms Lake, Lake Leake and lower reaches of Macquarie and South Esk rivers)</li> <li>• Canoeing on the Macquarie (starting at Ross)</li> <li>• Camping (Griffen Park on South Esk; Bridge at Mathinna)</li> <li>• Swimming at all towns without pools. At Mathinna. Possibly weir at Campbell Town but broken glass.</li> <li>• Power-boating on broadwaters</li> <li>• Duck shooting all waterways</li> <li>• Bird watching</li> </ul>



<b>Water Value Categories</b>	<b>Nominated Water Values</b>
<b>Aesthetic landscape values</b>	<ul style="list-style-type: none"> <li>• Rivers at Ross, Campbell Town and Perth as part of townscape</li> </ul>
<b>Physical landscape values</b>	<ul style="list-style-type: none"> <li>• Water over Perth weir</li> <li>• Riffle (rapids) zones along rivers</li> <li>• Broadwaters on the Macquarie and South Esk</li> </ul>
<b>Other issues</b>	<ul style="list-style-type: none"> <li>• Hydro operations and interactions with u/s users in terms of peak flows periods</li> <li>• Relative economic values of different water usages</li> <li>• Need for well-controlled weirs</li> <li>• Storage of excess winter flows and releases which mimic seasonal flow variations</li> <li>• Call for construction of dam at Longmarsh on upper Macquarie</li> </ul>

**Table 4: Nominated Water Values - Cressy stakeholder workshop (15 March 2000) and advertised public meeting (4 April 2000).**

<b>Water Value Categories</b>	<b>Nominated Water Values</b>
<b>Ecosystem values</b>	<ul style="list-style-type: none"> <li>• Native vegetation instead of willows on waterways (while willows generally undesirable because they block river and reduce habitat, they may be preferable to no vegetation cover)</li> <li>• Macquarie free of 'ricegrass' (probably reed <i>Phragmites australis</i>), some patches upstream of Woolmers Bridge</li> <li>• Waterways free of blue-green algal blooms</li> <li>• River flows which maintain native vegetation of waterways</li> <li>• Maintaining variable flows in waterways</li> <li>• Breeding habitat (flow over gravel bed ideal for breeding trout)</li> <li>• Clear water in tributary streams</li> <li>• Maintaining threatened galaxiids in Woods Lake</li> </ul>
<b>Consumptive or non-consumptive values</b>	<ul style="list-style-type: none"> <li>• Rivers have value as transport mechanism for tradeable water</li> <li>• Town drinking water</li> <li>• Stock and domestic use for riparian landowners</li> <li>• Homestead use (drawing water from waterways for individual domestic use [this may include drinking but the Director of Public Health requires all drinking water to be treated])</li> <li>• Watering gardens (domestic)</li> <li>• Irrigation (increasing demand)</li> <li>• Water supply for power generation at Trevallyn (ability to undertake works allowed for under the water licence)</li> <li>• Stable regulated flow regimes arising from Hydro operations (opportunity for community input into these operations)</li> <li>• Industrial use at Sevrup fish farm and Longford abattoirs (however PEVs have already been set for these areas)</li> <li>• Use by small scale commercial enterprises in the area – vehicle wash downs etc</li> </ul>
<b>Recreational values</b>	<ul style="list-style-type: none"> <li>• Swimming at varied locations. Particularly over summer where public roads cross over rivers. Not on the Lake River.</li> <li>• Angling</li> <li>• Kayaking (scouts use the Macquarie between Campbell Town and Longford)</li> <li>• Duck shooting along the Macquarie and South Esk</li> <li>• Camping &amp; bushwalking on riverbanks</li> </ul>
<b>Aesthetic landscape values</b>	<ul style="list-style-type: none"> <li>• General appeal of native riparian (riverside) vegetation</li> </ul>
<b>Physical landscape values</b>	<ul style="list-style-type: none"> <li>• Unblocked streams (no blockages due to sediment build-up around willows)</li> </ul>
<b>Other issues</b>	<ul style="list-style-type: none"> <li>• Woods Lake used for flood control</li> <li>• Minimise sewage input into waterways</li> <li>• Private storages – could be used as flood buffer for downstream areas by keeping empty over high rainfall period, alternative view that should fill up at these periods</li> <li>• Higher water levels in Woods Lake provide higher water values – in terms of the ecology, water quality and downstream use</li> <li>• Lake Sorell related to upper Macquarie river and catchment health.</li> </ul>



**Table 5: Nominated Water Values – Fingal stakeholder workshop (16 March 2000) and advertised public meeting (5 April 2000).**

<b>Water Value Categories</b>	<b>Nominated Water Values</b>
<b>Ecosystem values</b>	<ul style="list-style-type: none"> <li>• Protection and retention of riparian vegetation</li> <li>• Water filtering role provided by wetlands (including Epping Marshes)</li> <li>• Galaxiids (native fish) translocated to sites in upper South Esk</li> <li>• Blackfish</li> <li>• Waterways free of weeds (willows, cumbungii etc.)</li> <li>• Visits by white breasted sea eagle</li> <li>• Role of floods in maintaining floodplain and wetland health</li> </ul>
<b>Consumptive or non-consumptive values</b>	<ul style="list-style-type: none"> <li>• Stock watering</li> <li>• Household/Domestic (this may include drinking but the Director of Public Health requires all drinking water to be treated)</li> <li>• Town drinking water supply (both river and groundwater)</li> <li>• Irrigation</li> <li>• Other water used in food production</li> <li>• Coal washery at Fingal</li> <li>• Electricity generation</li> </ul>
<b>Recreational values</b>	<ul style="list-style-type: none"> <li>• Tourism related</li> <li>• School camping and water related activities at Rostrevor</li> <li>• Photography</li> <li>• Fishing</li> <li>• Duck shooting</li> <li>• Water skiing (Ormley between Avoca and Fingal)</li> <li>• Bird watching</li> <li>• Swimming (Fingal upstream of sewage treatment plant past railway; Mathinna; Avoca; Briar Corner on Break O'Day; Royal George)</li> <li>• Camping (Griffen Park at Mathinna; State Forest areas; where permitted on private land)</li> </ul>
<b>Aesthetic landscape values</b>	<ul style="list-style-type: none"> <li>• Tourism related (waterfalls etc.)</li> <li>• Provides more interesting surroundings</li> <li>• Aesthetic value of river as whole</li> </ul>
<b>Physical landscape values</b>	<ul style="list-style-type: none"> <li>• Meadstone Falls in St Pauls catchment</li> <li>• Falls at Mathinna</li> </ul>
<b>Other issues</b>	<ul style="list-style-type: none"> <li>• Educational value as resource for schools</li> <li>• Waterways have historical and cultural value in determining the pattern of settlement</li> <li>• Scientific value for water quality &amp; ecological studies</li> <li>• Water has range of economic values</li> <li>• Social value for recreation, tourism and aesthetic appreciation</li> <li>• Use of waterways as drain (runoff from private dwellings, irrigation etc)</li> </ul>