

DRAFT

REGIONAL NRM STRATEGY DEVELOPMENT

WATER QUALITY

NORTH WEST REGION

1. Overview of the asset within the Region

Rivers in the north-west Region are considered assets for a number of possible reasons: their wild-river status, pristine to near pristine condition, the diverse ecosystems they support, the agriculture and forestry they support, and their water supply and hydro-power generation potential. These assets are further defined for each catchment through the detailing of community values with the development of Protected Environmental Values (PEVs) for the Region's catchments.

The Protected Environmental Values (PEVs) are the current uses and values of the environment to be protected. They have been completed for inland waters in the northwest and are presently being developed for coastal waters. Estuarine PEVs are being determined on an as needs basis. The PEVs are categorised into the protection of aquatic ecosystems, recreational water quality, agricultural water uses, raw water for drinking water, and industrial water. The PEVs for all surface water are available on the DPIWE web page site at www.dpiwe.tas.gov.au/environment. Follow link to Air, Noise & Water>Water.

Water quality targets and objectives for key indicators will be determined in order to protect the PEVs.

The rivers of the Region are characterised by significant diversity in terms of their natural setting, extent of development within their catchments and characteristic water quality. The waterways are habitats for a multitude of species including threatened, rare or endangered fauna such as: the giant freshwater lobster; freshwater snails; the Australian grayling; the Burnie burrowing lobster; velvet worms and the green and gold frog.

The Arthur River, draining to the West Coast, is a remote wild river with minimal human settlement in its catchment. The Black River, draining to the north coast near Stanley, is relatively unimpacted, and the headwaters of the Mersey, Forth and Leven are near-pristine as they rise in or near the Cradle Mountain Lake St.Clair National Park and the Walls of Jerusalem National Park. Included in the North West Region are parts of the Franklin-Gordon Wild Rivers and South West National Parks which have water of a pristine to near pristine status.

The Alum Cliffs State Reserve covering spectacular gorge country is a feature of the region along with several karst reserves near Mole Creek. These areas are assets as natural pristine reserves, high ecosystem preservation significance, and social and economic (tourism) value.

A natural feature of the Welcome River catchment is one of the most extensive and best preserved examples of mature *Melaleuca ericifolia* swamp forest of any river system in Australia (M. Askey-Doran, DPIWE – pers. comm.)

The fertile soils make north-west Tasmania one of the most important agricultural regions in the State. The lower catchments feature red krasnozems soils that are capable of supporting up to 3 crops per year (DPIWE, 2001). The productivity of farming activities (grazing of beef cattle, dairies and intensive cropping) is enhanced through irrigation from streams and storages. The second major land use of north-west Tasmania is forestry, both State and private. Other land uses in the Region include hydro-electricity production, mineral exploration and mining, conservation and recreation.

Marine farming is a growing industry in some estuarine areas around the coast.

Hydro Tasmania is the major water user in the upper Mersey catchment. The Mersey-Forth Power Scheme harnesses the waters of the Mersey, Forth, Wilmot, and Fisher Rivers and generates 15.8% of the State's electricity. Of the seven storages in the scheme Lake Barrington is recognised as a premier international rowing course.

The population of north-west Tasmania is approximately 100,000. Approximately 75% of the population reside in the major towns scattered along or near the north coast. The remainder of the Region is sparsely populated. An asset of the Region is the availability of water for water allocation purposes such as town water supplies, and industrial purposes. In the Circular Head and Waratah/Wynyard area an estimated 6,000 town water supply connections are served for domestic and industrial purposes with an annual water use of approximately 1.5 million ML. There are 474 Commissioned Water Rights allocated primarily for irrigation purposes. Further east Cradle Coast Water collects, treats and supplies bulk drinking water supplies to the Central Coast, Devonport, Latrobe and Kentish Councils from the Cam, Leven, Gawler and Forth Rivers. Burnie City Council takes water for drinking water supply from the Pet and Guide rivers for treatment and distribution within its municipality (DPIWE, 2001).

Groundwater is an integral part of the hydrological cycle and needs to be considered as part of surface water and land use management strategies, as it provides the link between what we do on land and what happens in our rivers and streams. Groundwater is an important source of water in many parts of the Region for drinking water supply, stock and domestic use and irrigation; it provides baseflow to rivers and streams during the dry summer months; and it supports uniquely diverse ecosystems both above and below the ground surface, many of which provide important ecosystem services (eg. bioremediation of contaminants). Groundwater generally moves slowly through the ground and once contamination occurs, clean up is very difficult, is very expensive and is not often very successful.

2. Current asset condition

Water quality across the Region varies depending upon local catchment geology, vegetation, rainfall and human impacts. Catchments draining to the north coast of the Region have been influenced primarily by the broad impacts of agricultural and forestry activities and, nearer to the coast, by more localised urban impacts such as sewage, stormwater, industrial effluent, and contaminated site leachate. Active and historic mining activities with acid drainage are significant pressures on water quality in the Region. Such areas include the Arthur River near Waratah, and areas in western Tasmania including Queen and King River affected by Mt Lyell mining operation, and Argent River, Ring River, Whyte River, Savage River, and the Pieman River affected by other mining operations.

The catchments of the Region are discussed below.

- A) The Arthur River catchment is approximately 2,500 km², with no major towns and few roads. The headwaters of the Arthur River lie in private land and there is extensive forestry activity throughout the catchment. Part of the recently proclaimed Savage River National Park (Gazetted 30/4/99) lies within the catchment as does the Hellyer River State Reserve. The historic mine site at Mt Bischoff, Waratah, which operated between 1878 and 1945, has significantly impacted on the water quality in the upper Arthur catchment. Also Balfour acid mine drainage into the Frankland River, a tributary of the lower Arthur River, contributes poor quality acid water to the catchment (B Bourke pers.comm). Low pH, high levels of sulphate and heavy metals clearly indicate acid drainage from the old workings as the cause of poor water quality. Monitoring of giant freshwater lobster in the Arthur River has shown a 'dead zone' downstream from Mt Bischoff for at least 20 km where none of these invertebrates are found (T. Walsh, IFS – pers. comm.).
- B) The Welcome River catchment (304 km²) covers the low-lying country of the north-west corner of Tasmania where the land tenure is primarily allocated to agriculture and forestry. The main agricultural activities are intensive dairying and sheep grazing. A geomorphological survey of the Welcome River demonstrated that the river has been partially degraded through sediment inputs, and possibly acid sulphates, from surrounding agricultural drainage schemes which have largely been developed in the last 25 years. (Acid drainage can mobilise toxic levels of dissolved metals which can seriously impact on water quality and aquatic life in the drainage system.) The catchment waters experience high salinity and very low dissolved oxygen levels, believed to be related in part to low summer river flows, acid drainage and dairy effluent. The total nutrient concentrations in the river exceed ANZECC (ie. nationally agreed) trigger levels at times. The Monitoring River Health Initiative has detected impacts on the macro-invertebrate communities at sites in the lower catchment (DPIWE, 2000).
- C) The Montagu River catchment (327 km²) is sparsely populated with agriculture and forestry the main land uses. High intensity agriculture occurs in some parts of the catchment, especially around the Togari and Brittons

drainage areas. Most of the tributaries on the Montagu River have been cleared and straightened and utilised as drainage channels for neighbouring land. Water quality data collected as part of the State of the Rivers Program (Berry, 2001) found high nutrients in several sites around the Montagu catchment, and average turbidity higher than the recommended ANZECC trigger level. Drainage from acid sulphate soils affects the water quality in parts of the catchment. Dairy effluent containing nitrate, bacteria and fats is a significant problem affecting waterways in the catchment. Snap-shot records of aquatic macro-invertebrates as part of the Monitoring River Health Initiative found that communities were degraded. This is possibly due to habitat loss and poor water quality (DPIWE, 2000). There are currently five marine farms in the Montagu estuary, which have the potential to be affected by catchment water quality, particularly high faecal coliform counts.

- D) Within the Duck River catchment, which covers an area of approximately 350 km², forestry and agriculture are the primary land uses. The lower Duck River catchment has been extensively drained to improve land for agriculture. Recent water quality monitoring as part of the 'State of the Rivers' Program has shown that areas of the Duck River catchment are subject to high nutrient levels, low dissolved oxygen at times, generally high turbidity, occasional elevated salinity levels in tributaries of the river and high faecal bacteria counts. Willow infestation on the Duck River and its tributaries is a significant water resource issue for the catchment (DPIWE, 2000). At Mella west of Smithton acid mine drainage is reducing the pH (< 3) producing poor quality acidic water (elevating dissolved metal) thus potentially affecting the water quality in the Duck River (Green 2001).
- E) The Black and Detention River catchments, which cover a combined area of approximately 500 km², have small population centres and forestry and agriculture as the primary land uses. Unfortunately there is little water quality information, but the Monitoring of River Health Initiative (Krasnicki *et al*, 2001) showed that an aquatic invertebrate community in the upper Detention catchment was healthy. The Black River estuary has been identified by Edgar *et al* (1999) as having 'critical conservation significance'. It is the only one of two estuaries on the north-west coast to be given a 'Class A' rating and gives a positive indication of catchment and river health in the area.
- F) The Inglis/Flowerdale catchment (505 km²) has forestry and agriculture as the main land tenure classifications. The catchment contains just small population centres except at the mouth of the Inglis River (wynyard). According to the 'State of the Rivers' survey, water quality in the catchment may be described as good for all parameters measured, although Blackfish Creek exhibited consistently high turbidity. However interestingly an assessment of macro-invertebrates in the mid-catchment indicated that communities were moderately to severely impacted. Erosion and siltation problems from past and present gravel pit operations may be significant at times (DPIWE, 2000).

- G) The Central Coast catchments consist of the Cam, Emu, Blythe, Leven, Forth, and Don. The Forth River catchment (1,126 km²) originates in the Tasmanian Wilderness World Heritage Area at Cradle Mountain Lake St. Clair National Park. The Leven, which has its headwaters in the Black Bluff Range at the northern edge of the Cradle Mountain Lake St Clair National Park, is the second major river draining to the central coast region. Smaller rivers draining to the coast in the region are the Cam, Emu, Blythe, Gawler (drains to the Leven estuary) and Don. The Wilmot River is a significant tributary of the Forth. The major land tenure within the central coast catchments is private property (much of which has been cleared for agriculture) followed by State Forest.

Agricultural land of the central coast catchments is used to grow a wide range of commercial crops including intensive cropping, permanent pasture, and fast growing eucalypts on the steeper slopes. In this Region Cradle Coast Water collects water from the Cam, Leven, Gawler and Forth rivers and supplies bulk drinking water to the councils of the central coast region.

Small rivers and streams of the central coast region are the most impacted in terms of water quality due to their lower water discharge and greater catchment development. Claytons Rivulet and Buttons Creek are particularly impacted by agriculture and septic tank leachate (J. McNeill – Central Coast Council, pers. comm.). The Emu River has a siltation problem (D. Williams – Burnie City Council, pers. comm.). The mouth of the Blythe River is impacted by current and past industrial operations. Leachate from an industrial waste landfill in Burnie enters tributaries of the Cam River upstream from a town water supply off-take (Green 2001).

For the Forth River downstream of Paloona Power Station in the lower catchment there is a clear seasonal pattern for dissolved oxygen, conductivity and water temperature, with higher concentrations of oxygen and dissolved salts and lower water temperature during winter months, when the power station is virtually in continuous operation (Bobbi *et al.*, 2000). However when the power station is turned on during the summer period, a corresponding drop in conductivity and dissolved oxygen, which drops down to as low as 5 mg/L, occurs downstream. These drops in oxygen, possibly from intake of oxygen depleted water from Lake Paloona, may have implications for the environment downstream.

The severe changes in river flows are probably the main influence on the macro-invertebrate communities (Bobbi *et al.*, 2000). Acid mine drainage from Round Hill (above Lake Cethana) on the Forth River is more of a social issue as the Forth River Catchment is a primary source of drinking water for the region (Green 2001).

- H) The headwaters of the upper Mersey River catchment lie within the Tasmanian World Heritage Area. The upper catchment drainage has been modified by hydro-electric development with a majority of the water diverted from Lake Parangana to the Forth River catchment. The middle Mersey catchment is primarily private freehold land with substantial areas of State Forest. The middle catchment supports extensive agricultural activities such

as grazing, piggeries, dairying, and commercial cropping. Water quality monitoring results for the Mersey show that conditions in the river at present (and in the recent past) are good, however there is a general decline in water quality moving downstream with a corresponding decline in macro-invertebrate species. Compared to the main river, the water quality of Mersey tributaries is much more degraded, with elevated nutrients, turbidity and lower DO. Turbidity measurements indicated that the greatest soil loss in the catchment is occurring in the sub-catchments of Mole Creek, Lobster Rivulet, Minnow River and Dasher River (DELM, 1997).

- I) The Port Sorell catchment is primarily a modified landscape with rural and forestry land uses predominant. The major reserve in the catchment is part of the Narawntapu National Park. Many flats have been drained for development of pasture and natural stream-beds have been straightened and de-snagged aiming to facilitate drainage capacity and to reduce flooding, but erosion of channels and beds has resulted.
- J) The Pieman River catchment is approximately 3800 km². The major activities are hydro-power generation, mining, and tourism and recreation. The major alteration of the river system occurred with the construction of the Pieman River Power Station with a series of 3 schemes the Mackintosh, Rosebery and Lower Pieman commissioned in the 1980s. The Pieman River State Reserve exists just below the dam site and extends to the river mouth. Lake Murchison and Lake Mackintosh are in the Southwest Conservation Area with many of the tributaries entering the lakes emanating from the Cradle Mountain Lake St Clair National Park. Much of the flow in the Pieman River originates from pristine to near pristine environments consisting of dense temperate rainforest and peat-rich button grass plains. Run-off and discharge from five mining sites (operating or closed) are entering Lake Pieman. The tributaries draining these areas affected by mining have elevated concentrations of sulphate and heavy metals such as iron, manganese, zinc, lead, copper, and cadmium. These tributaries are Argent, Que, Huskisson, Ring, Savage, Stitt, Bakers and Chester. Note Bakers Creek and Que River discharge into the Huskisson and Ring, respectively, both of which then enter Lake Pieman. Invertebrate communities are extremely poor in the reaches of these mine-affected tributaries. Mining discharges are detectable in Lake Pieman because the Stitt, Ring, Argent and Huskisson Rivers enter the Lake within a few kilometres of each other. Zinc is the one metal present considered potentially deleterious to the ecosystems in the Lake. In the lower Pieman River, the increased sediment is an aesthetic issue in the Pieman River State Reserve (Koehnken 1992).
- K) The King River catchment is 809 km² with Lake Burbury capturing about 60% of the catchment runoff. The only major tributary of the King River below the power station is the Queen River with a catchment of 72 km² which drains the Queenstown area. The King River above Lake Burbury drains primarily pristine region of rainforest and mountains. A limited amount of runoff from Mt Lyell mining area with elevated metal concentrations and acidity enters Lake Burbury. The Queen River drains the

region north and west of Queenstown, Mt Lyell mine site and the town. Elevated metals and acidity discharge into the Queen from the mine site and surrounding hills. The John Butters Power Station commissioned in 1992 has resulted in alteration of the flow regime of the river. The lower King River, below the confluence of the King and Queen Rivers, has very poor water quality due to the mining inputs from the Queen River and substantial banks and point bars composed of tailings, which are no longer discharged from the mining site. A delta of tailings at various stages of oxidation has formed at the mouth of the King River in Macquarie Harbour (Koehnken 1996).

- L) The Gordon River catchment is 5207 km² where 1282 km² is controlled by the Gordon Power Station in the upper catchment. The major tributaries entering the Gordon River below the power station are the Franklin, Denison, and the Olga Rivers. The water quality is typical of west coast rivers derived from rain forest with high dissolved organic carbon, naturally low pH, and low conductivity. The water quality is pristine to near pristine.

The primary estuaries of the Region, moving clockwise from the southwest, are the Lewis, Mainwaring Wanderer, Spero, Hibbs Lagoon, Henty, Little Henty, Pieman, Pedder, Lagoon, Nelson Bay, Arthur, Welcome, Montagu, Duck, West Inlet, East Inlet, Black, Detention, Crayfish, Inglis, Cam, Blythe, Emu, Leven, Forth, Don, Mersey and Port Sorell. Edgar *et al* (1999) assessed the conservation significance of Tasmanian estuaries using physico-chemical criteria, species diversity, level of human disturbance (using population density data) and proportion of catchment area under statutory protection. The estuaries of the north-west coast did not rate that well in the assessment. Just the Black River and the Wanderer estuaries were rated as Class A (critical conservation significance). Several estuaries (Arthur, Pedder, Lagoon, Spero, Mainwaring, Lewis) were rated as Class B (high conservation significance) and several estuaries (the Welcome, Montagu, West Inlet, East Inlet and Detention) were rated as Class C (moderate conservation significance). All remaining estuaries, primarily in the central coast region, were classified as either degraded (Class D) or badly degraded (Class E).

Groundwater is present throughout the Region, but varies in quantity and quality depending on the type of rocks and soils present, the hydrogeological setting, the amount of rainfall, and land use practices. The natural groundwater quality is generally good in the major rock types in the area (dolomites, limestones, sandstones, basalts and Cambrian and Precambrian sedimentary rocks) with total dissolved solids values below 500 mg/l.

Groundwater is generally of a lower quality in the lower permeability rocks (eg. dolerite and interbedded siltstone/sandstone/mudstone sequences) and in the coastal areas where the groundwater pumping may have caused sea water intrusion to develop (eg. Woolnorth area). Concentrations of bacteria, nutrients (such as nitrogen and phosphorous), pesticides and hydrocarbons will vary locally depending on current and past landuse practices, but is largely unknown. Groundwater salinity is discussed in a separate paper.

3. Issues associated with, or threats to the asset

Problems that have been identified in the catchments and estuaries are as follows:

- a) Dairy effluent management, erosion from intensive cropping, management of riparian zones, management of acid sulphate soils, and salinity issues in soil and ground water and surface water, are important agricultural issues.
- b) Potential forestry impacts on water quality arise through sediment loss in road construction and logging activities, herbicide and pesticide application leaving the site, and nutrients entering waterways.
- c) Historic mining activities are having significant negative influences through acid drainage, ie lowering pH, elevating heavy metals and electrical conductivity, and increasing turbidity with disturbances in unremediated mining sites.
- d) Release of water from storages potentially impact on the water quality through temperature and dissolved oxygen shifts, elevated turbidity, and alteration of flushing fluxes. Alteration of flows should also been seen in a total catchment approach where certain flows are required to protect ecosystems and other identified environmental values
- e) Most of the sewage treatment plants are not performing to the interim DPIWE discharge requirements. (Green 2001).
- f) For stormwater the most significant issue is infiltration of stormwater into sewerage systems. DPIWE has many reports of such incidents in many of the municipalities in the Region. Another problem in some areas is the lack of stormwater infrastructure resulting in reticulation of stormwater to sewers (Green 2001).
- g) Threats to groundwater quality are high when activities or infrastructure that are potential sources of pollutants are poorly sited, engineered and/or maintained. Common point sources of pollutants include septic tanks, dairy effluent ponds, landfills, petroleum based fuel and oil tanks, animal waste burial sites, and certain manufacturing and processing industries. Diffuse sources of pollutants include application of fertilisers, pesticides, other agricultural wastes such as dairy effluent, milk and blood products, and wastewater reuse schemes. Groundwater quality can also be compromised by over extraction where water levels are drawn down and either oxygen or contaminated surface waters (eg. from acid sulphate soils) are introduced into the aquifer.
- h) Until recently (last 10-15 years or so) landfill sites were repositories of high organics waste (animal and vegetable product) and hazardous wastes such as PCBs, pesticides, oils, and heavy metals. They are a potential risk to surface water and ground water. The leachate even from closed landfills is entering waterways, eg. Smithton – abattoir waste entering Coventry Creek, Burnie industrial waste leachate entering Cam River, and Port Sorell leachate entering creek and groundwater (Green 2001).

Refer to attachment 1 for more detail on identified issues that need to be addressed at a regional level.

4. Current responses to issues and threats

A number of statutory instruments are used to manage water quality in Tasmania. The *Environmental Management and Pollution Control Act 1994* (EMPCA)

provides for the protection of the environment from environmental harm. EMPCA provides the power to regulate activities that have the potential to cause environmental harm either at a State (Level 2 activities) or a local government level. Under EMPCA activities are regulated either through permit conditions under the *Land Use Planning Approval Act 1994* (LUPAA) or through Environment Protection Notices under EMPCA. Many activities have permit conditions regulating the emission limits to the ambient water quality environment. Other legislation such as the *Forest Practices Act 1985* and the *Inland Fisheries Act 1995* also provide the capacity to protect water quality.

The *Water Management Act 1999* provides for the development of Water Management Plans in consultation with the community.

The protection of threatened species including recovery plans, is through the *Tasmanian Threatened Species Protection Act 1995* and the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*. In Tasmania threatened flora and fauna are categorised as endangered, vulnerable and rare.

The State Policy on Water Quality Management 1997 (Water Policy) provides the strategic framework for the management of water quality in Tasmania. It sets a framework for setting PEVs and Water Quality Objectives (aspirational targets) and guides the management of both point and diffuse sources of pollution. Many natural resource management issues relate to the diffuse source impacts of land use activities on water quality. The Water Policy provides a framework for the management of diffuse sources of pollution through the use of best practice environmental management guidelines or codes of practice for a range of activities that impact on water quality. Such activities include: dairy effluent management, works in streams, road construction and maintenance, forestry management and soil management on agricultural land.

All forestry operations are required to apply the legislatively-imposed Forest Practices Code, which contains many provisions to protect water quality. Other non-legislated codes and best practice guidelines, such as various agricultural and industrial codes of practice, may require implementation at the regional and local level.

Non-legislative responses to issues and threats include Hydro Tasmania's aquatic environmental policy, water health initiative program, and water management review process.

The NRM planning process provides an opportunity to prioritise water quality issues at the regional level and to implement appropriate management responses to them at the local and regional levels.

Water quality monitoring plays an important part in measuring the effectiveness of natural resource management activities. The DPIWE is responsible for a baseline water quality monitoring network but monitoring at the local and regional level will provided an important addition to the baseline network. The national Monitoring and Evaluation protocol provides for the setting of aspirational, resource condition and management water quality targets.

5. Productive use and other opportunities in relation to the asset

Tasmania's fresh waters support a wide range of economic, social and environmental values. The productive use and realisation of other opportunities of these assets is within a sustainable development policy framework where Tasmania's surface water and groundwater resources are sustainably managed to protect or enhance their quality while allowing for sustainable development. This is achieved through the establishment of PEVs and associated water quality objectives (numerical values for parameters) for surface water and groundwater.

The PEVs represent current values and uses of water quality and reflect the economic, social and environmental values of Tasmania's fresh waters. PEVs have been set or are near completion for all of Tasmania's fresh waters. These values and uses recognise that most of our freshwater has important agricultural values for stock watering and irrigation, recreational water values such as fishing, swimming and aesthetic values, industry values where a large number of our industries rely upon a consent supply of good quality water, raw water for drinking water purposes, and ecosystem protection values.

6. Available data and its usefulness

Specific studies/programs across the Region consist of regional studies, NRM projects, catchment management plans and ongoing monitoring by Cradle Coast Water for water supply quality, Hydro Tasmania operational monitoring, industries and councils effluent monitoring and recreational area monitoring by Councils. There has been very little work in the Region to characterise the impact of sewage and stormwater discharges on river health so currently anecdotal evidence is the best guide. The regional studies include the Australia-wide Assessment of River Health program, the giant freshwater lobster survey, the State of the Rivers Program, and erosion and soil loss investigation.

The Australia-wide Assessment of River Health program (Krasnicki *et al.*, 2001) monitored aquatic invertebrates from all catchments of the Region to determine river health according to the presence or absence of particular species. Also most of the rivers of the north-west have been surveyed for the presence of the giant freshwater lobster (*Astacopsis gouldi*), which may be used as an indicator of water quality and habitat health, in a project that commenced in 1997. The findings of the study should be available from the Inland Fisheries Service.

The State of the Rivers Program, funded jointly by the Commonwealth and Tasmanian Governments, has conducted surveys in several rivers in the Region. This program involves short-term (1–3 year) systematic investigations assessing water quality, aquatic ecology, hydrology, and river condition. Under the water infrastructure package monthly sampling is being conducted at sites in several north-west rivers: the Inglis, Duck, Montagu and Welcome. Water quality parameters monitored are: conductivity, dissolved oxygen, turbidity, pH, total nitrogen and total phosphorus. Progress reports on the water quality are given by Berry (2001). Water quality and identification of key point source impacts have

been identified in the Mersey River Experimental Study Technical Reports (DELM, 1997).

Erosion and soil loss (related to agricultural practices) and its effect on rivers and water quality has been investigated in catchments of the central coast region (Sims & Cotching, 2000). Rivercare work such as willow removal and stock access management has gained momentum in the Region over the past 5 years.

The regular and ongoing water sampling include:

- Cradle Coast Water (formerly the North West Regional Water Authority) undertakes water quality testing daily for parameters such as colour, turbidity, pH, alkalinity and temperature and monthly to quarterly for parameters in the Australian Drinking Water Guidelines 1996 including nutrients, faecal indicators, organics, inorganics, heavy metals, herbicides and pesticides. Water quality testing sites are Lake Barrington and Lake Palooona (Forth River), the Forth River just upstream of Forth township, Lake Isandula (West Gawler River), Leven River, Cam River and lake Mikany at Smithton (Van Eysden, Cradle Coast Water – pers. comm.). Results are published annually by the Department of Health and Human Services.
- Hydro Tasmania has a water quality monitoring station on the Forth River downstream of Lake Palooona dam.
- Two Waterwatch groups, Burnie/Wynyard and Five Rivers, sample sites on rivers in the central part of the Region between the Inglis and the Mersey rivers.
- Councils of the Region are involved in the bathing water sampling program which involves weekly monitoring over summer months at sites along the north-west coast (mostly coastal rather than river sites). Results are published annually by the Department of Health and Human Services.
- Several projects have been undertaken on the Mersey River - natural resource management plan (Armstrong et al., 2000), Rivercare plans (Armstrong et al., 2000a), river styles report (Lampert, 2000), and a river flow and catchment assessment (Mersey River Working Group, 1998).
- Catchment management plans have been completed for the following rivers: Welcome, Montagu, Pet and Guide, and Caroline Creek (Latrobe). Rivercare plans have been completed for the Welcome, Duck, Inglis/Flowerdale, Leven, Don, Mersey, and Rubicon rivers.
- Hydro Tasmania have conducted a number of reviews in relation to the North West Region catchments as *Environmental Reviews* and also as part of the Basslink Integrated Impact Assessment process. The latter includes Impact Assessment Statements for King and Gordon Rivers relating to the Hydro schemes.
- Forestry Tasmania undertakes regular sampling in sites where its operations may affect water quality.

Basic information on natural groundwater quality is available in map form but there is very little information available on current and changing human influenced groundwater quality across the Region, or indeed in the State. Under the *Water Management Act 1999*, drillers must forward to the State Government basic information on all bores as soon as they are drilled, including water

analyses if available although in general they are not. There have been a number of specific detailed hydrogeological studies carried out (eg. on the Devonport Basin, and a statewide study on landfills) which include some groundwater quality data.

Mineral Resources Tasmania (MRT) is the traditional and current custodian of the State's groundwater related data. Basic groundwater bore information (including total dissolved solids which is often used as an indicator of salinity) and a database of publications and reports are available from the MRT website at www.mrt.tas.gov.au. Detailed groundwater bore information is available from MRT on demand for specific projects. MRT has a suite of some 33 monitoring bores around the State that are sampled twice annually. In this Region there are 9 active monitoring sites and another which was recently abandoned due to damage to the borehole. There may also be an opportunity in the future, through the development of water management plans, to work towards incorporating groundwater monitoring programs in highly significant areas.

Gurung (2001a) has investigated surface waters throughout Tasmania and has documented high sulphate and metal levels and low pH values in watershed impacted by abandoned mines. He also has done drainage reconnaissance for the distribution of acid sulphate soils.

7. Information gaps and actions required to fill these gaps

More information gaps will become apparent as the regional NRM strategy is further developed, but some gaps from the detail provided above are apparent. It should be noted that several projects now under way (including some funded by the NAP – not in this Region but hopefully producing results of general application) are aimed at greatly improving the availability and usefulness of information on basic water quality issues.

The monitoring river health index program to determine river health according to the presence or absence of particular aquatic invertebrates was a series of snapshot monitoring programs in all catchments. To develop a more rigorous data set this program should be undertaken again and more frequently in those regions identified on a priority basis as requiring remedial action.

Equally the State of Rivers monitoring is a snapshot monitoring program that required more intensive monitoring. Some catchments have little water quality information such as the Black and Detention River catchments. Under the water infrastructure package more intensive monitoring is occurring on monthly basis at stream gauge sites to determine the mass loads of pollutants being exported such as nutrients and suspended solids in problematic catchments such as the Montagu River catchment.

There is little detailed information about pollutants, such as nutrients and faecal material, contaminating waterways via drainage lines put in place to increase productivity of the land. On farm retention of such pollutants also needs further investigation.

More robust baseline monitoring programs are required for critical and high conservation significance estuaries. As a result of the more effective water quality monitoring network under the State Water Quality Monitoring Strategy details will emerge that will assist with refining such baseline monitoring under a total catchment management (including estuaries) framework.

Water quality impacts on riverine and estuarine waters due to seepage from septic tanks have not been quantified to-date, however, it is a concern that is frequently expressed by Councils and the community.

The groundwater monitoring network needs to be expanded to include more sites, particularly in areas where significant groundwater use is known (eg. Smithton, Wesley Vale and Sheffield). There is also a need to collate water sample analyses and other bore data from bore owners who have had their groundwater tested, in order to determine the baseline conditions. As the development of water management plans proceeds throughout each catchment, more information should become available.

The scale of acid sulphate soil pollution of waterways needs to be clearly identified through more intensive monitoring, and management practices implemented to retard the progression of this problem with subsequent monitoring to review the success of the management practices.

There has been very little work in the Region to characterise the impact of sewage and stormwater discharges on river health. Further intensive stream monitoring, inter-related with point and diffuse sources of pollution data, should be undertaken as part of a whole of catchment assessment. This information will assist in prioritising actions to be taken on a catchment basis to maintain or improve water quality.

Preliminary risk mapping of acid drainage has occurred but needs implementation at regional level to prioritise action areas. Historic mine discharges of acid mine drainage in the Bischoff area need to be accurately quantified so as State and Federal funding can be sought to implement actions plans to remediate the site and significantly reduce the export of heavy metals pollutants. Some intensive monitoring in the Mt Bischoff area is being undertaken over 2003. Mt Lyell acid mine drainage into the Queen River continues to be an issue but it is hoped that a project funded by the Natural Heritage Trust will allow a treatment option to be implemented. Intensive monitoring has been undertaken in the Pieman catchment to identify problematic areas and possible remediation options. E

An effective water quality monitoring network is presently under development to support NRM. This is being realised with the implementation of the State Water Quality Monitoring Strategy. Without good quality and uniform baseline monitoring it will be difficult for regions to get an idea of the effectiveness of management measures.

A significant issue is obtaining adequate data to set WQOs. Under the networking of data proposed, gaps in the required data will be identified. Interim

levels may need to be applied, determined from smaller data sets or using default national values.

Impacts of salinity on water quality in surface and ground water need further investigation.

The impacts of releases of water from storages, including on estuarine processes (total catchment flow requirements), need to be better understood. The State has committed, in the State Water Development Plan, to develop guidelines for implementation at regional level.

8. Current Aspirational, Resource Condition, and Management Action targets for the asset (at the national, State and/or regional level) and any data on progress towards targets

The National Standards and Targets and Monitoring and Evaluation Frameworks, which apply to both NAP and NHT activities, provide for the setting of aspirational, resource condition (nutrients, turbidity and salinity) and management action water quality targets, and also provide key water quality indicators for which targets should be set.

The PEV and WQO (aspirational targets) in the State Policy also provide for a range of water quality indicators (nutrients, turbidity, salinity, faecal coliform, and toxicants) for which targets should be set, as does Tasmania *Together* (salinity, faecal coliform, and turbidity).

It is important that the targets set by each of these frameworks show consistency. Through the State Water Quality Monitoring Strategy DPIWE is formulating a framework to help achieve this consistency through rationalising, centralising and applying quality control on the data.

A number of Tasmania *Together* Goals and Standards are applicable to the management of Tasmania's surface water quality. In particular Goal 24 'Ensure our natural resources are managed in a sustainable way now and for the future' is relevant with a number of standards, including standard 3 and 7 being relevant. Goal 23 'Ensure there is a balance between environmental protection and economic and social development' is also relevant.

A number of bilateral partnership agreements (between the State Government and the Cradle Coast Authority or individual Councils) contain objectives that relate to improved NRM or catchment management outcomes. Some agreements, including Circular Head, Burnie King Island, and Latrobe include water quality management objectives either in the form of specific issues (dairy effluent, salinity) or in relation to water quality monitoring, support of community based water quality monitoring and data management.

9. Proposed Management Action targets for the asset (at the national, state and/or regional level)

The surface water and groundwater quality is to be maintained or enhanced while allowing for sustainable development in accordance with the objectives of Tasmania's Resource Management and Planning System. Issue and management actions targets for surface waters are detailed in Attachment 1.

For groundwater the following management targets are relevant:

- Adoption of best practice guidelines and codes of practice for high risk potentially contaminating activities.
- Collate and store centrally all currently available groundwater data and determine baseline conditions.
- Increase the level of groundwater monitoring in the Region
- Increase community awareness about the importance of groundwater in the hydrological system and the needs of groundwater dependent ecosystems

In part water quality in the Region could be improved and protected through the implementation of integrated property planning.

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Attachment 1

Below is a list of issues, assessments of the priorities, and considered management actions. There are management actions such as the determination of the WQO setting process, water quality monitoring network and access, and facilitation of guidelines such as the road construction stormwater management guidelines that need high priority at the State level. It is important to note that prioritising of the other management actions are site specific and should be assessed on an as needs cost-benefit environmental outcome basis.

After the PEVs have been determined, the environmental concerns identified, the water quality evaluated for the catchments, and the scale of an impact assessed is it possible to identify the necessary management actions. The order of the priorities detailed below will be determined by the type and magnitude of the stressors, eg. bacteria, nutrients, metals, dissolved oxygen, and the sensitivity of the receiving environment as identified by the PEVs. Social, political, economic and environmental factors associated with the affected areas will also influence the order and scale of management action.

ISSUE	ASSESSMENT OF PRIORITY	MANAGEMENT ACTION TARGET
<p>Implementation of water quality management framework:</p> <ul style="list-style-type: none"> • Setting PEVs for coastal waters; • Setting PEVs for groundwater; • Setting Water Quality Objectives for all waters. 	<p>Consistency with National Water Quality Management Strategy with implementation of water quality management framework is important for integration with other policies and programs for improving or maintaining water quality.</p> <p>Water quality target/objective setting for the protection of the identified environmental values is critical to the sustainable management of surface water and groundwater.</p>	<p>The process for setting WQOs and PEVs for groundwater to be determined at State level however will be implementation at regional level.</p> <p>The setting of Water Quality Targets will be in consultation with stakeholders. NRM Regions are involved in this process, incl. through a NAP project.</p>
<p>Ensure effective WQ monitoring network to support NRM (implementation of State Water Quality Monitoring Strategy):</p> <ol style="list-style-type: none"> 1. Water Quality Monitoring Network 2. State of Rivers Program 3. AusRivAs 4. A total catchment approach for environmental flows (including estuaries) 5. WMP monitoring 6. Baseline monitoring of critical and high conservation significance estuaries 7. Community water quality monitoring 8. Monitoring of the groundwater quality in the main aquifers 	<p>For effective catchment management the major influences on water quality in a catchment (or coastal waters) need to be quantified and understood through effective monitoring. To undertake effective management actions, adaptive management is applied where quantitative targets are set, and monitoring is undertaken to determine if such targets are being met. An iterative process applies where actions undertaken are continued or modified and monitored until the targets are achieved,</p> <p>[</p>	<p>The State baseline monitoring is to be linked to regional monitoring through a monitoring network.</p> <p>A new Water Initiative will allow an expanded stream flow and water quality monitoring network on a statewide basis. In addition river health assessment will be increased although the spatial density of sites will be limited. The National Action Plan is funding work in this area. It is expected that other programs, and requirements NRM regional committees, will help complement the expanded monitoring network and river health assessments part-funded by the new Water initiative.</p>
<p>Water quality data management and community access (Implementation of State Water Quality Monitoring Strategy):</p>	<p>Effective data management is critical as it will systematically link data, co-ordinate integration, characterise the quality of data collected, providing a complete picture of data collected in catchments being investigated,</p>	<p>Integration of data including ambient with point and diffuse sources of pollution. Will also require a GIS based system to make information accessible. Produce interactive Web platform.</p>

ISSUE	ASSESSMENT OF PRIORITY	MANAGEMENT ACTION TARGET
	enable more effective interpretation of inter-related variables, reduce monitoring costs by minimising unnecessary repetition, effectively filling knowledge gaps, and make possible a more complete presentation of the knowledge on the Web.	
<p>Agriculture impacts on water quality</p> <ol style="list-style-type: none"> 1. Dairy Effluent Management (eg. Montague River Catchment, Duck River Catchment) 2. Erosion from intensive cropping 3. Management of riparian zone 4. Acid Sulfate Soils (eg Welcome River Catchment, 	The monitoring data shows that these activities are having major impacts in the region and are significant contributors to the water quality not being met.	<ol style="list-style-type: none"> 1. Implement framework for dairy effluent management, guidelines for erosion control from intensive cropping, and guidelines for management of riparian zone. 2. High risk ASS areas identified so implement agreed action plan and possibly remediate on a priority basis.
Forestry impacts on water quality	Sediment loss in road construction, cultivation and logging activities, and runoff from, herbicide and pesticide use, impact on water quality if not effectively managed.	Maintain and improve compliance with the forest practices system. The efficacy of the Forest Practices Code is subject to ongoing reviews.
Impacts of salinity on WQ. (See NRM paper on salinity)	See NRM Paper on Salinity	See NRM Paper on Salinity
Acid Mine Drainage	Acid drainage from active and historic mine sites is significantly impacting on rivers in the region eg., Mt Bischoff, Smithton , Pieman, Mt Lyell areas.. Preliminary risk mapping has occurred but need implementation at regional level.	Review and develop prioritisation action plan. Develop case for further federal funding with State Government involvement.
Release of water from storages including impacts on river and estuarine processes (total catchment flow requirements). (eg.	Release of water from both large and small storages does impact on water quality. The scale of the effects on river and estuarine water quality is site-specific but can include the release of highly saline water, different water temperature, low DO, and algal blooms. The release can result in sediment mobilisation and bank erosion, and ecosystem modification through flow variations.	There is a requirement for guidelines to be developed at a State level to address associated issues.
<p>Sewage treatment plants not performing to the interim discharge requirements..</p> <p>Wastewater systems issues are</p> <ol style="list-style-type: none"> 1. Sustainable effluent reuse 2. Septic tank disposal system issues 3. WWTP upgrades options 	High bacterial, nutrient, algal blooms and DO sags are attributable to some wastewater releases directly or indirectly (on site septics). All wastewater treatment and disposal should apply the hierarchy of waste management (State Policy on Water Quality Management); reduce, reuse, and recycle with discharge as only the last option..	Use State framework and assist with risk assessment of the activity. Regional implementation

ISSUE	ASSESSMENT OF PRIORITY	MANAGEMENT ACTION TARGET
Management of leachate from landfills – see NRM paper on waste management.	See NRM paper on waste management, but landfill sites have been identified as pollutants sources to groundwater and surface waters.	See NRM paper on waste management.
Urban stormwater management. <ul style="list-style-type: none"> State stormwater management strategy requires implementation at regional level. 	The effects of stormwater in urban areas are known as being problematic with such pollutants as sediment, nutrients bacteria, and petroleum hydrocarbons and infiltration into sewerage systems – problems experienced by most Councils.	State has developed State Stormwater Strategy and stormwater management plan models. Also the Derwent Estuary Program is developing a model stormwater management plan for an urban area (involving a number of councils and industries) – this could be used as a model for other urban catchments.
Road construction and maintenance – especially of gravel roads.	Sediment from this source is known to have significant potential impact on rural waterways.	Guidelines developed by Launceston and Hobart City Council. State need to facilitate implementation of these guidelines at regional level.
Pesticide and Herbicide impacts: on surface water and groundwater quality: <ul style="list-style-type: none"> effectiveness of existing codes should be tested 	Complaints are received by local and State government about chemical use and potential chemical presence in waterways by local and State government. In the intensive agriculture or forestry areas of the region introduction of pesticides and herbicides directly through drift or indirectly through stormwater assisted run-off into waterways is a real potential problem.	Existing codes require review to test efficacy. Forestry Tasmania implements detailed planning procedures prior to the use of chemicals and monitors streams immediately below chemical application areas for the presence of chemicals. The results of monitoring are published in Forestry Tasmania's annual <i>Sustainable Forest Management Report</i> .