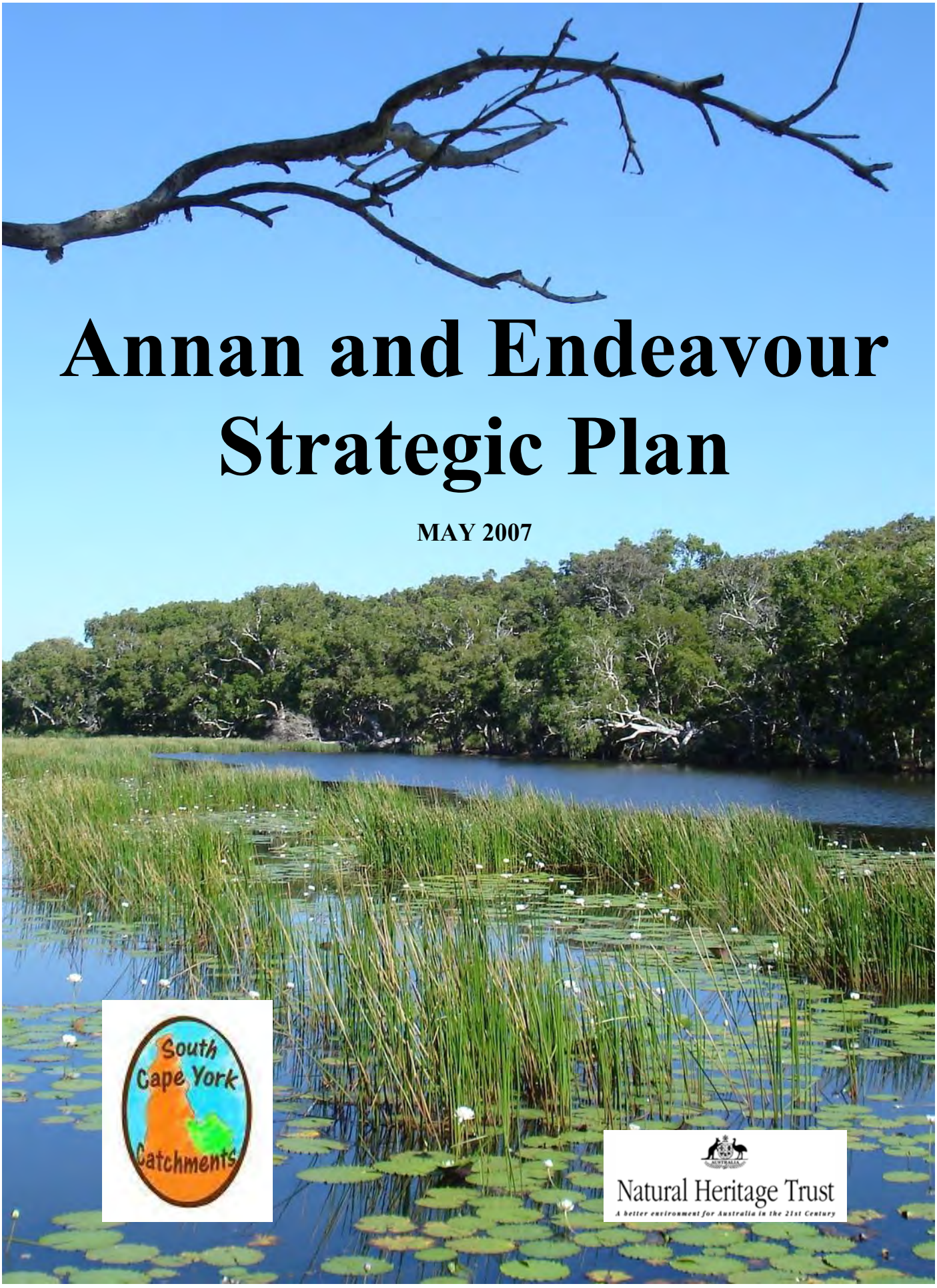

Annan and Endeavour Strategic Plan

MAY 2007

South Cape York Catchments

Natural Heritage Trust

A better environment for Australia in the 21st Century

South Cape York Catchments Inc

The Annan-Endeavour Catchment Management Group would like to acknowledge the traditional owners of this region the Kuku Yalanji and the Gugu Yimidirr

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Front cover: SCYC

ANNAN ENDEAVOUR STRATEGIC PLAN

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CHAIRPERSON'S FORWORD

During the 1990's the concept of natural resource management began to gain momentum, and Integrated Catchment Management (ICM) was proposed. The idea was to get people together, across the rural and business spectrum to advise on natural resource management within a particular catchment or watershed. It was envisaged that catchment management organisations, would be formed to cross Local Government boundaries to approach catchment management in a strategic way. They would comprise community members, organisations, businesses and government agencies.

The Annan-Endeavour Catchment Management Group was formed in 1996, from members of the fledgling Annan Catchment and the Endeavour Catchment Management groups. It had become apparent that the Government wanted a large scale approach to Catchment management. The Barron River Catchment crosses four shires, and some of the larger Catchments cross state boundaries. Accordingly the groups combined. Members represented grazing, horticulture, tourism, timber, extraction, fishing, fish re-stocking, recreational boating, conservation, Local Government, and State Government agencies. The mandate was to produce an Annan and Endeavour Rivers Strategic Plan, to provide for future land and water management.

The first task was to find out what people who live in the Catchments saw as the priorities for natural resource management. The group eventually received funding to employ a catchment coordinator to work part-time for nine months. A public survey form was circulated in 1999, and the responses indicated that water allocation and water quality management were of prime concern. Funds ran out, and the group was unsuccessful in obtaining continuing funding, so it turned its attention to doing on-ground projects. A weed eradication and revegetation project in the Alligator Creek wetland is on-going. Other projects included weed eradication and riverbank stabilisation at Jensen's Crossing on the Endeavour River, and a stake in a 16 ha similar project at Hope Vale Aboriginal Community on the Right Arm Endeavour River.

The group struggled along with minimal funds until 1996, when a successful tender to the Department of Communities brought funds to employ a coordinator to compile the background to the Annan-Endeavour Rivers Strategic Plan. Our thanks go to Jason Carroll, who has worked tirelessly to achieve this project. Jason has also worked with the Cape York Marine Advisory Group to test water quality and map seagrass. He has worked with schools and community groups on environmental projects ie pig trapping at Keating's Lagoon and a project to use the backwash from Cooktown Swimming Pool to irrigate a bush tucker planting at Cooktown P12 State School.

Catchment management groups in Laura-Normanby and the Bloomfield River had wound up, so the Annan-Endeavour group began to provide support in these areas. Water quality testing was conducted in these Catchments and Salvinia mapping in the Laura-Normanby Catchment was done in conjunction with the NHT Cape York Weeds and Feral Animals Program.

After ten years, the Annan and Endeavour Rivers Strategic Plan has been produced. It is intended to address the local issues from a local point of view. It aims to provide residents with information about their area, and ways to manage local properties without harming the health of rivers. Modern technology has devised many means of mitigating the effects of development and business activities upon our environment. There are funds available to assist landholders to manage their properties in a pro-active way.
The Annan-Endeavour Catchment Management Group supports the concept of a thriving business sector and an excellent lifestyle for all residents. It aims to keep local land management in local hands. The Annan and Endeavour Rivers Strategic Plan is a step in this direction.

ACKNOWLEDGMENTS

The Annan Endeavour Catchment Management Group would like to thank past and present members of the Group and the people of our community who volunteered their time and expertise to make this Strategy a reality. Funding for this Strategy was provided by the Natural Heritage Trust through the Department of Natural Resources and Water.

A number of people and Departments were particularly helpful in the production of this Strategic plan. They are:

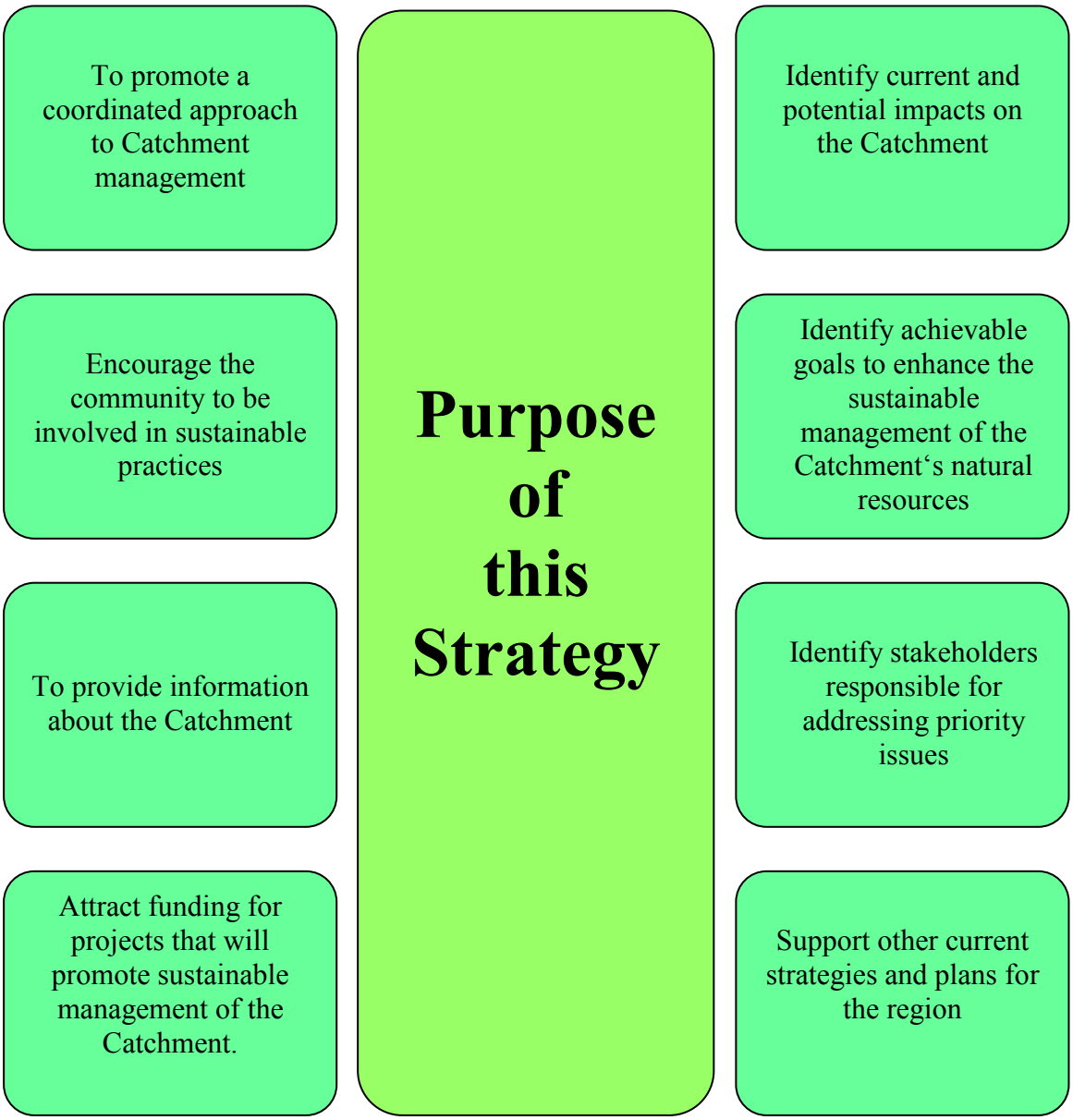
Keith McDonald (QPWS Atherton), Christina Howley, Lewis Roberts, Charlie Roberts, Jeanette Covacevich QLD Museum, Geoff Mills (NR&W), Sam Dibella (Cooktown QPWS), Dr John Winter (QPWS Atherton), Mark Peacock (District Manager, QPWS), Doug Morrison (EPA), Russell Graham (CYWAFAP), Matt Birch (Animal Control Officer, CSC), Bruce Wannan (QPWS), Eda Adacott (Principal Botanist QLD Herbarium, EPA, Mareeba), Rosemary Neehouse (EPA Qld Herbarium), Staff at Nature‘s Powerhouse, Ian Mc Collum, Richard Rock, Mary Noonan (Cooktown Caravan Park), Ally and Mark Privet (Gone Fishing), Peter Thompson (CYPDA), Allen, Marilyn and Tony (Alkoomie).

Kim Stephan would like to thank Keith McDonald, Lewis Roberts and Jeanette Covacevich who reviewed the Biodiversity section. Wendy Seabrook would like to thank Aletta Nugent who reviewed the Planning and Development section. Jason Carroll would like to thank Ian Mc Collum who reviewed the fisheries section.

1.0 INTRODUCTION

1.0 PURPOSE OF THIS STRATEGY

Catchment planning brings together community groups and provides an opportunity for the Community and Government to work closely together for the greater environmental good. Two Catchment Strategies have been developed for Cape York, the Laura/Normanby and Albatross Bay Strategies. The Albatross Bay Strategy has been successful in attracting funding for environmental restoration works, whilst also coordinating cooperative community involvement in natural resource management. The Annan-Endeavour Catchment Management Group has developed this Strategy in close association with all interested community, government and industry groups. The Annan and Endeavour Catchment Strategic Plan provides long-term direction for managing the future of land, water resources and biodiversity of the Catchment and is the foundation for community investment decisions to ensure improved natural resource management.



1.1 THE SOUTH CAPE YORK CATCHMENT MANAGEMENT GROUP

Background

South Cape York Catchments (SCYC) formerly The Annan-Endeavour Catchment Management Group (AECMG) is concerned with the interests of Traditional owners, land holders (rural and residential), as well as primary industry, commerce, industry, local government and the wider community. At any one time, members are drawn from most of these sectors. Conservation, recreation and tourism interests are also considered.

The SCYC is the result of an amalgamation of representatives from the Annan River Catchment Group and the Endeavour River Catchment Group. In 1997 the groups recognised the need for a coordinated approach Catchment management and decided to combine memberships to actively represent all land managers in both Catchments.

The group plays an important role in coordinating community monitoring efforts, reporting, community education and awareness raising, supporting community projects and initiating new projects relevant to the area.

Role of the SCYC

The SCYC has implemented a range of on-ground projects such as:

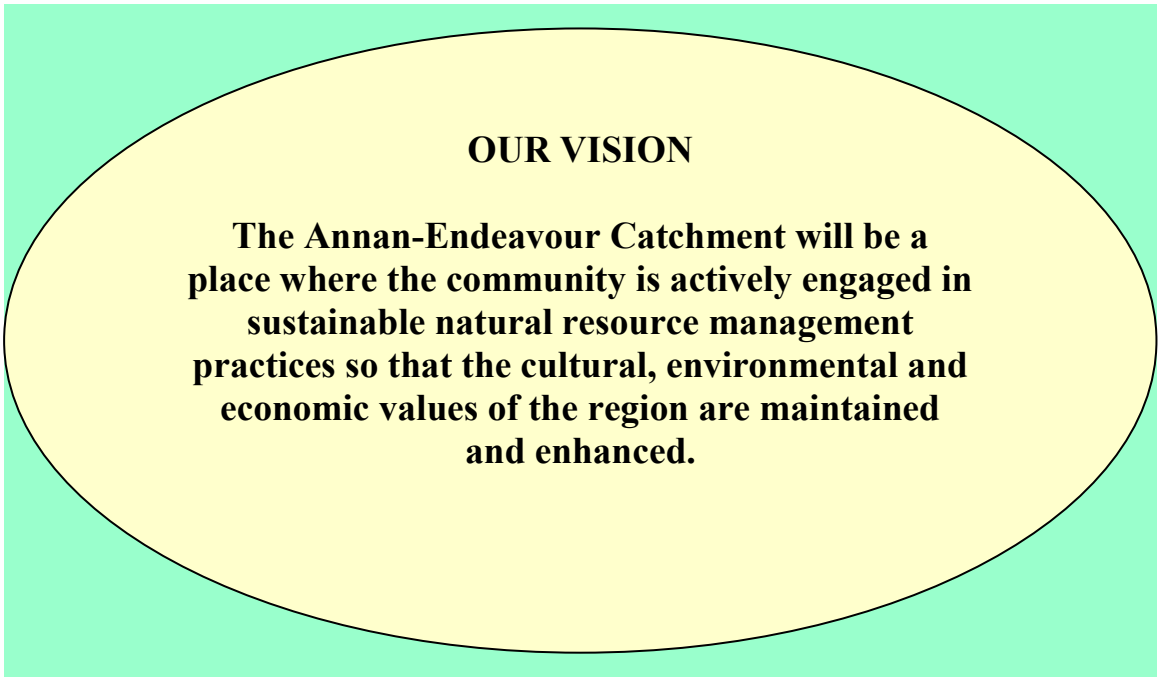
- Tree planting
- Weed control and mapping
- Water quality monitoring
- Community awareness raising through workshops and forums

Figure 1.1 Students from Laura school planting trees
Laura State School

1.2 OUR VISION

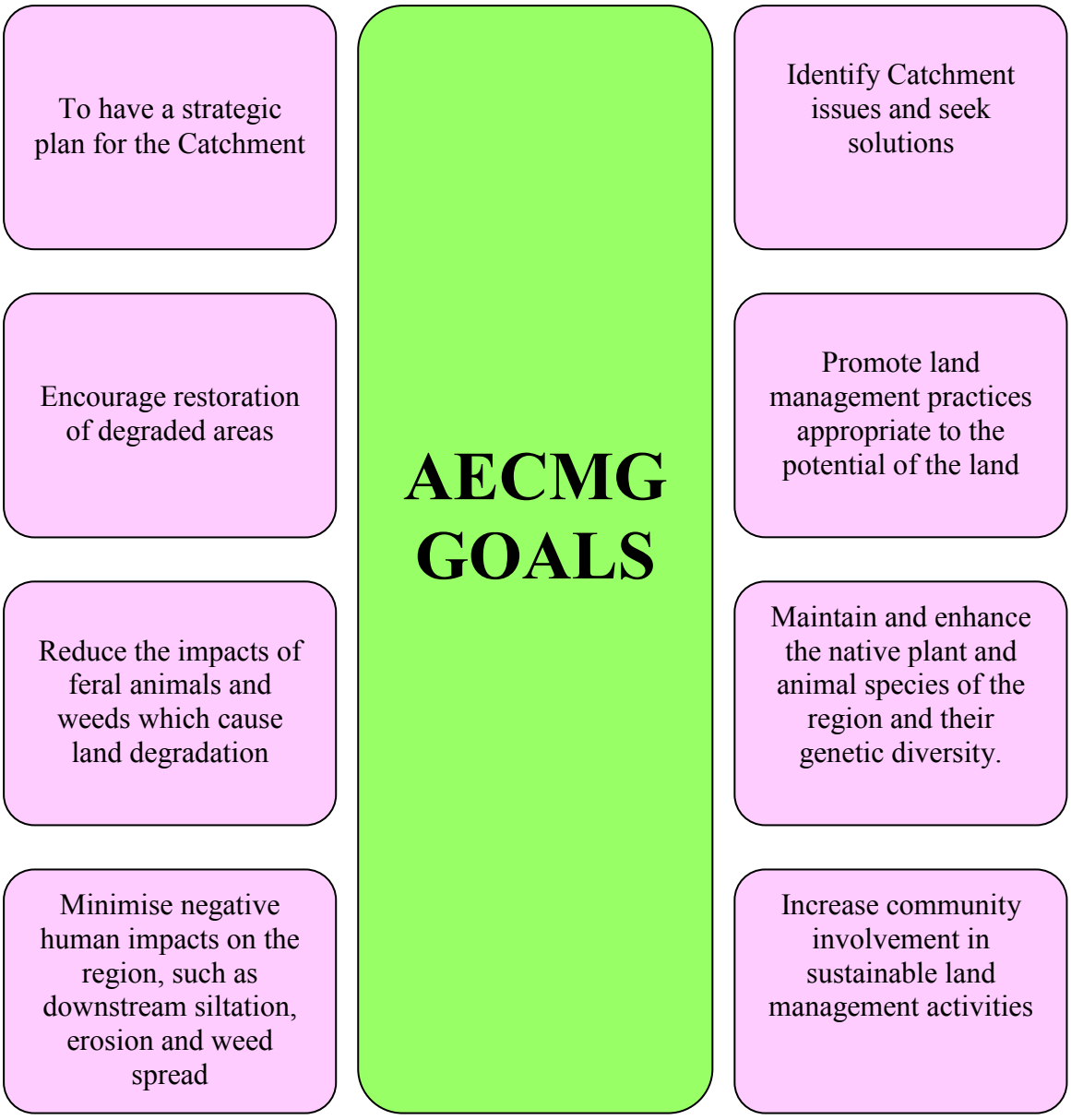
A vision creates an image on how we would like our Catchment to look in the future and guides our actions today to realise this future. This vision is the basis to focus objectives and develop actions throughout this strategy. The SCYC promotes a cooperative approach to manage the natural resources of the Catchment sustainably.

While the SCYC is a representative body we acknowledge that other stakeholder groups and the individuals within the Catchment will have their own vision for the future……...



1.3 WHAT WE WANT TO ACHIEVE

The actions proposed by this Strategy should not be interpreted to imply that the group intends to take on a larger action/implementation role. While this may be appropriate where no other group or agency is acting, it is important to note that the SCYC does not seek to duplicate services that are currently available, but rather to coordinate and add value to those services. Landholders and land managers carry the major responsibility for land and water management although many other agencies are involved in Catchment management.



1.4 THE CATCHMENT PLANNING PROCESS

HOW WE PRIORITISED THE ISSUES

The base line information used to develop this Strategy was acquired through a comprehensive literature search, supplemented by extensive consultation with the community and government between 1996 and 2006. The group conducted surveys, workshops and consultations to identify the issues and seek solutions. The SCYC survey results below (Figure 1.2) shows the percentage of respondents who indicated a high level of concern for a range of Catchment issues. Actions proposed in this Strategy are both innovative and practical and when implemented will succeed because they come from people with an intimate knowledge of the Catchment. This Strategy will be reviewed and updated periodically to ensure that natural resource management services are being delivered effectively and that community concerns are still accurately represented.

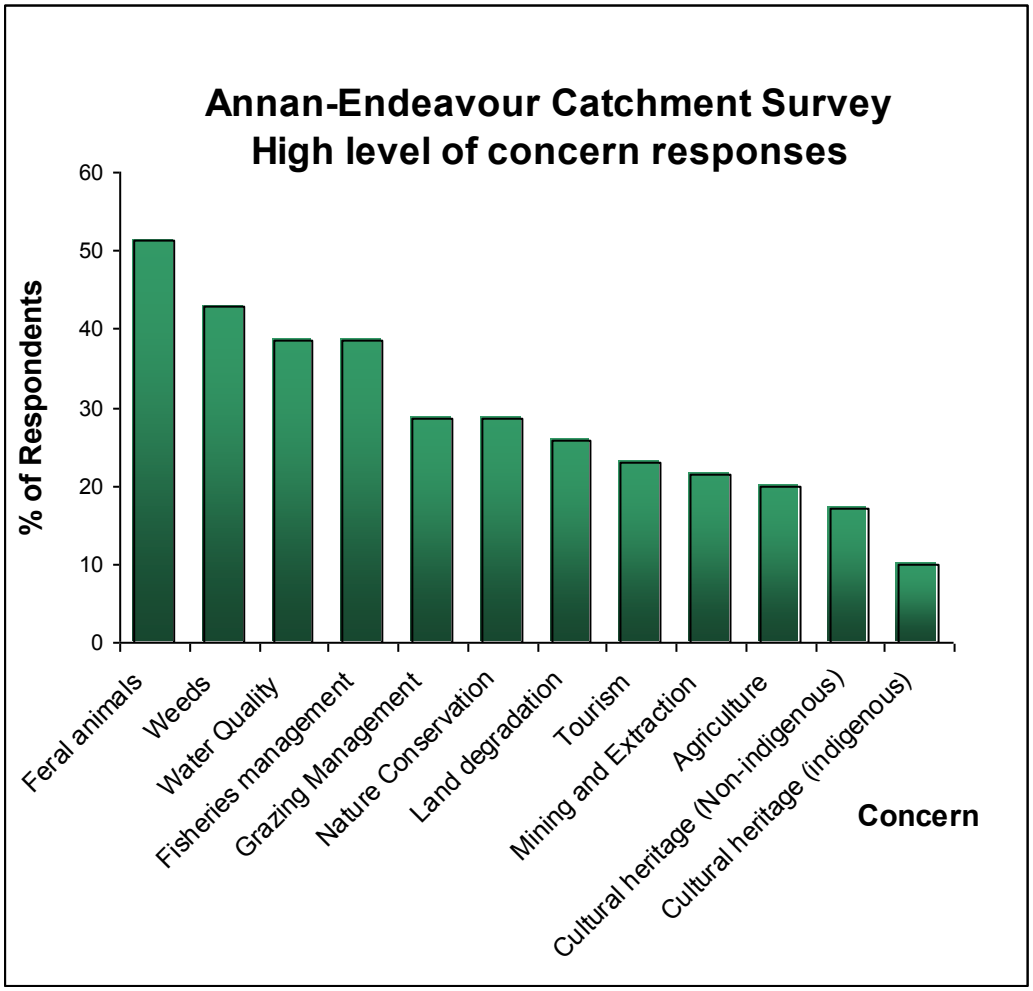


Figure 1.2 Annan-Endeavour Catchment Management Group survey. High level of concern for Catchment issues.

1.5 PLANNING AND LEGISLATIVE FRAMEWORK

It is intended that this Strategy be the primary guiding document for environmental investment in the Catchment. The Strategy can be seen as a tool for the community to bring about positive environmental change.

Existing international, national, state and regional policies all affect the way natural resources are managed in the Catchment. Many of the policies/plans can be applied either directly or indirectly to planning and natural resource management. In keeping with the philosophy of the SCYC Strategy, all goals, strategies and actions outlined in this plan have been developed with reference to:

- Wet Tropics Regional Strategy 2000 (NRM Board)
- Wet Tropics Management Plan 1998 (WTMA)
- Great Barrier Reef Water Quality Protection Plan 2003 (Department of the Premier)
- Cook Shire Council Authority Draft Planning Schemes
- Draft Wet Tropical Coast Regional Coastal Management Plan
- The National Strategy for Ecologically Sustainable Development
- Environment Protection and Biodiversity Conservation Act 1999
- National Weeds Strategy
- National Water Quality Management Strategy
- Land (Planning and Environment) Act 1991
- Heritage Places Register
- Heritage Objects Act 1991
- National Weeds Strategy
- Draft Cape York Peninsula Pest Management Plan (2006 – 2010)
- FNQ2001 Plan,
- Cook Shire Council Pest Management Plans,
- CYNHT Strategic Plan,
- Biodiversity Conservation Regional Strategy

2.0 CATCHMENT OVERVIEW

2.1 HISTORY OF THE ANNAN ENDEAVOUR CATCHMENTS

Prior to European visitation and subsequent occupation, the Annan and Endeavour River Catchments were the home of the Indigenous Guugu Yimithirr and Kuku Yalanji language groups[1] (Pohlner, 1986). The Guugu Yimithirr and Kuku Yalanji language groups had many Clan groups, which were mainly family based. Firm evidence of Aboriginal occupation of the Catchments dates back to approximately 5,000 years before present. However, it is likely that humans were living in the area from as far back as 40,000.

While each clan group had its own designated area in which to live, others could use the natural resources of that particular area if given permission. This happened especially in times of plenty, or when one clan had a deficiency of a particular resource for whatever reason. In order to maintain the status quo, strict customary laws were enforced (Roth, 1984). It was the breaking of some of these laws that caused friction between the Indigenous owners and the first white visitors.

The first known European visitor was Lt. James Cook, who visited the area from 17th June to 4th August 1770, in order to repair his vessel, the *'HMB Endeavour'*. As neither of the local clans with land bordering the mouth of the Endeavour River, the Gamay nor the Waymbuurr were warlike people, they were initially reluctant to approach the white men. Eventually they displayed great courage and entered into close dialogue with the visitors. There were occasional, relatively minor, disagreements, however on the whole relations were good (Shay, 1998). Cook was one of the first visitors to this land who spoke of the native population in glowing terms.

Once a convict settlement was established at Sydney Cove, visitations to the Endeavour River increased. The first likely visitor was the escaped convict Mary Bryant who, with her husband and other convicts, travelled up the east coast of Australia in a whaleboat in an unsuccessful bid for freedom. While a visit to either the Endeavour or Annan Rivers was not mentioned in her diary, such obviously large rivers would have been very welcome to a group who needed to replenish their supplies of fresh water on a regular basis.

Phillip Parker King visited twice in the vessel *'Mermaid'*, first in 2nd June 1819, and the second in July 27th, 1820. On both occasions, as with Cook, he had good relations with the Indigenous peoples of the area until a clash of cultures produced a minor altercation. Other known visitors include Capt. Blackwood, in the *'Fly'* on 4th June 1843, Capt. Owen Stanley in the *'Rattlesnake'* on 24th April 1848, and John Jardine in 1865. William Hann thought that he had encountered the Endeavour River in 1872, but instead he was at the mouth of the Annan. Here he saw the remnants of a fishing establishment, which he thought belonged to Robert Towns. Whether it did or not is unknown, but the find establishes the fact that European fishers were active along this portion of the coast well before 1873 (John Shay, pers. com.).

On the 25th October 1873 the steam ship *'Leichhardt'* dropped anchor in the Endeavour River. The Queensland Colonial Government was anxious to establish a port in the area to service the newly discovered gold field on the Palmer River. The wet season was fast approaching and hundreds of white miners were either on the field or were making their way overland towards it. Before too long all roads and tracks would be impassable and there was an urgent need to get stores onto the field so that starvation would not occur before the tracks south were open again.

[1] A language group is a group of people who use a common language

The Endeavour River seemed to be the most likely river in which to establish a port for the field, and the ‗*Leichhardt*' carried in the Engineer for Roads, with his surveying crew, to establish a road to the Palmer. Along with the Engineer came other Government Officials and over fifty miners. Within days a town had grown along the banks of the Endeavour River, which was to become home for about four thousand permanent residents, and the camping place for thousands of others.

It is interesting to note that by this time the people of the two clans closest to the burgeoning town, made little or no attempt to interact with the new comers. Perhaps this was because of the numbers of Europeans involved, or because they had been badly treated by visitors between the 1840s and 1873. Eventually most Aboriginal people were forced to live at ‗North Shore', on the north bank of the mouth of the Endeavour, irrespective of what clan group they belonged to. In fact, once darkness fell, it was decreed that all Aboriginal people had to be out of the town area. The missionary Johann Flierl, who was instrumental in establishing a mission on the ‗North Shore' to alleviate their suffering, saw their pitiful condition (Pohlner, op. cit., pp. 26 &). While the intention was to make the mission self-sufficient in food production, and instruct the inhabitants in farming and building trades and employments, the outcome was the loss of much of their spirituality and culture, such as art, song and dance.

The Endeavour River rapidly became a port for all types of vessels, including Royal Mail steamers from England, and immigrant vessels from all over the world especially China. However the Annan River enjoyed little European encroachment. By and large, this river did not see any significant changes until the discovery of tin in what became known as the Annan River Tin Fields. These deposits, discovered in 1885 by Jones, Starr and Greal, were followed by discoveries in areas such as Mt. Romeo, Mt. Hartley Mt. Finnegan and Rossville. Evidence exists indicating that the Aboriginal clan in the Rossville area, the Kuku Ngungal, worked with the miners in relative harmony. One example of this was when William Baird discovered tin at Mt. Romeo, within twelve months of the first discovery of the ore in the area, he named the location after his Aboriginal companion, Romeo 27 (Smith et al. 1914). The Kuku Ngungal people profited by their close association with the miners, and the miners obviously profited by the assistance rendered to them by the Indigenous owners.

As alluvial gold petered out on the Palmer, other industries gained importance in the Endeavour area. Chinese market gardens were scattered along the river from 1874, but as more land was taken up along the river, a thriving pastoral industry quickly developed. Later agriculture on a reasonably large scale was also attempted, with crops of peanuts, coffee, maze and tobacco grown. Smaller scale plantings of such things as citrus trees and cotton were also common (Dick, 2003). While there are records of such activities along the Endeavour River, little other than the pastoral industry appears to have been carried out along the Annan River.

2.2 BIOPHYSICAL ENVIRONMENT

2.21 GEOLOGY

The Annan and Endeavour Catchments lie within the Hodgkinson Formation, which is comprised mainly of greywacke and slate derived from marine Silurian, Devonian and Carboniferous sediments (Arnold & Fawckner 1980). The Hodgkinson formation is intruded by Finlayson Granite at Mt Finnegan, Mt Poverty, Mt Cook, Cooktown and inland from Amos Bay. At Black Mountain the formation is intruded by Trevethan Granite. About half of the Hodgkinson Formation in the Catchment is overlayed by alluvial and colluvial material.

There has been one eruption within the Hodgkinson formation in the Catchment, creating the Piebald Basalt province of the Endeavour valley. Here a number of vents to the north have caused the Piebald Basalt to flow down the Endeavour valley, resulting in undulating rises to low rolling hills as the dominant landform (Denaro and Ewers 1995).

The Cape Flattery - Cape Bedford dunefield extends from Cooktown north to Lookout Point (outside of the Catchment) covering an area of 580 km^2. The dunefield occupies a low-lying coastal plain, 5 to 10 m above sea-level, and formed because of a local abundance of sand derived from Palaeozoic granites and Mesozoic sandstones and exposure to strong onshore winds (Denaro and Ewers 1995). These dunefields have conservation significantce as they are the best example of development of counter wall dunes in the world (CYPLUS 1995).

Figure 2.20 Satellite image of the Catchment courtesy DNRMW Mareeba

2.22 SOILS

Coastal lowland soils are comprised mainly of alluvial and colluvial deposits, largely accumulated during the late Quaternary (Nott et al. 2001). Yellow Dermosols / Kandosols (Jeannie) and yellow Dermosols (Kingjack) soils predominate in the Catchment. These soils have low levels of plant nutrients and are deficient in phosphorous and nitrogen. Many of the soils are weakly structured and are prone to erosion when cleared.

Yellow Sodasols (Sodic soils) (Gibson) occur in isolated areas of the Catchment. These include around the community of Hope Vale, South of Archer Point Road and in Kings Plains, east of Banana Creek and west of the Annan River. This soil is moderately fertile and has the potential for improved pastures however wetness can be a limitation for agricultural production (Biggs and Philip 1994). Gibson soils are prone to erosion, especially when roads are constructed over them.

Jeannie soils cover an extensive area of the Catchment and are considered to be relatively stable (Biggs and Philip1994) Figure 2.21. Skardon soils of the Endeavour Valley and along the Annan River are very unstable soils susceptible to degradation and erosion. Kingjack soils cover extensive areas throughout the Catchment these are classified as unstable (Biggs and Philip 1994). Red Dermosol soil (Rule) is the most common soil under closed forests of the Annan Catchment and is considered to be relatively stable. (Biggs and Philip1994).

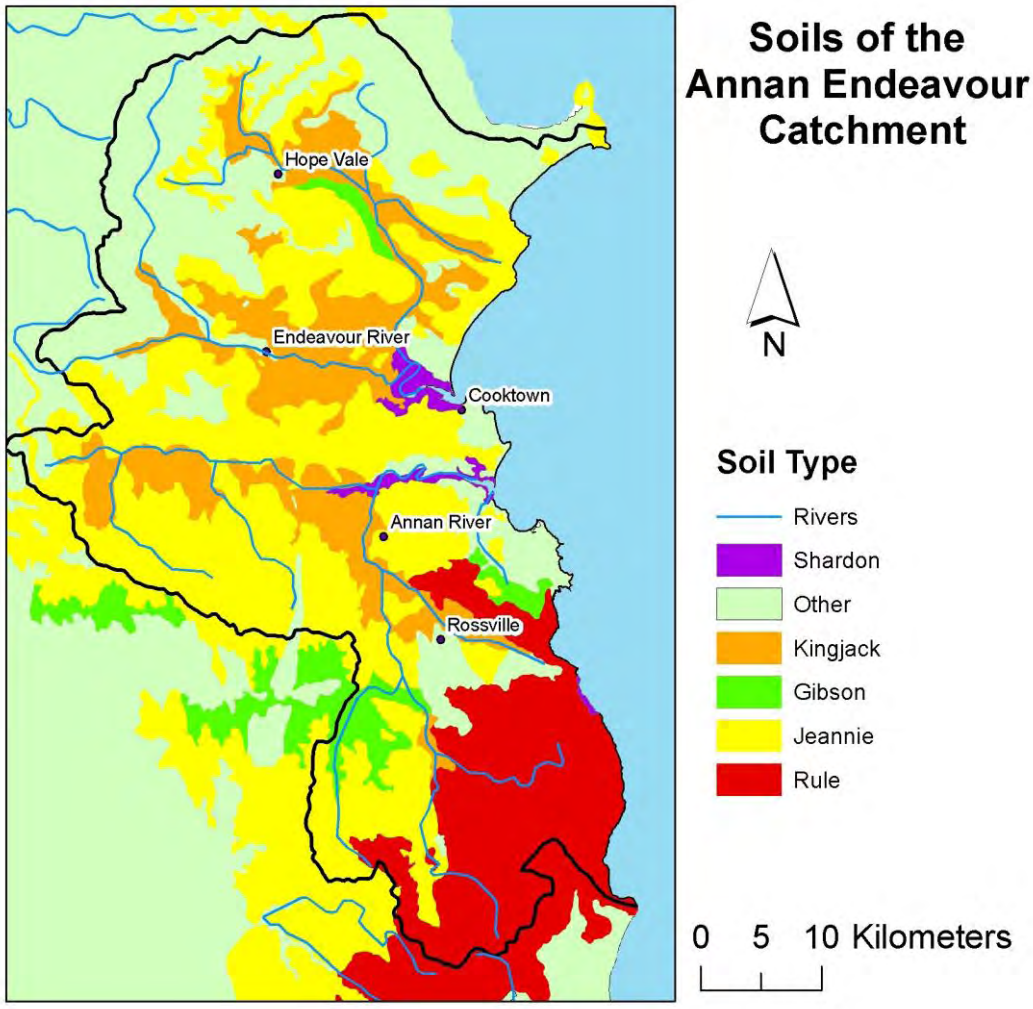


Figure 2.21 Soils of the Annan Endeavour Catchment

2.23 TOPOGRAPHY

The Annan River has a Catchment area of 750 km^2. The topography of the upper Annan River Catchment is dominated by the Trevethan Range to the south east and the Finlayson Range to the south. The highest peak is Mt Finnigan with an elevation of 1146 m. Oakey Creek is separated from the upper Annan Catchment by The Barron's Range, which has a lower relief from 0–406 m. The remainder of the Annan Catchment north of Black Mt is relatively flat.

The Endeavour River has a Catchment area of 1315 km^2. The Endeavour valley has undulating rises to low rolling hills as the dominant landform (Denaro and Ewers 1995). The topography is dominated by the Sandstone Cliffs of the Henderson Range to the west and by 7 of low relief peaks (330m -369m) from Mt Unbelievable to Tabletop Mountain to the north of the Endeavour River. The North Arm is separated from the other branches of the Endeavour River by these 7 of low relief peaks. The highest point is Henderson's Lookout (450 m). The Upper North Arm of the Endeavour River, west of Elim beach is relatively flat, wetland and sand dune country.

Figure 2.22 Mouth of the Endeavour River

2.24 CLIMATE

Both the Annan and the Endeavour Catchments experience dry winters and wet summers. The climate generally results in two seasons, a wet season from December to April, with summer monsoons and occasional tropical cyclones, and an almost dry season from May to November with only occasional showers. Showers continue regularly in the upper Annan Catchment until August.

The annual rainfall for Cooktown ranges between 1600 mm to 2000 mm with variations within this range depending on topographical influences. Mean monthly rainfall at the Cooktown Airport ranges from 367.3mm in February to 19.9mm in September (Bureau of Meteorology) Figure 2.25. Evaporation rates are low and do not generally exceed rainfall. The Wet Tropics section of the Annan Catchment experiences higher rainfall than to the north. Annual rainfall over the Wet Tropics is highly variable and is strongly influenced by local topography (Adam 1994).

Figure 2.23 Flooding at the Endeavour River Bridge May 2006

The northern area of the Catchment experiences warm to very warm mean temperatures, warm summers with hot maximum temperatures and warm winters. Mean annual maximum temperature ranges from 32 ^{o}C in December to a minimum of 17.9^{o}C in July (Bureau of Meteorology) Figure 2.26. To the south mean annual temperatures have a greater range. Here temperatures vary with topography, from 30°C in the tropical lowlands to less than 10°C in montane areas (Webb 1968).

Strong South-easterly trade winds predominate between April and October. From November to March North-easterly winds become more frequent, these winds are often associated with monsoonal troughs.

Mean yearly climate data for Cooktown Airport 1942 to 2004

Mean annual rainfall	**1665.1 mm.**
Days of rain, average per annum	**148.5, 75% of which falls between January and April inclusive**
Mean daily humidity at 9 am	**77%**
Mean daily humidity at 3 pm	**66%**
Maximum humidity	**86%**
Monthly mean evaporation	**4.7mm**
Mean maximum temperature	**29.5**°C
Mean minimum temperature	**21.6**°C
Wind direction April - October	**South-east**
Wind direction November - March	**North-east to South-east**

Figure 2.24 Mean yearly climate data for Cooktown Airport 1942 to 2004 (Bureau of Meteorology).

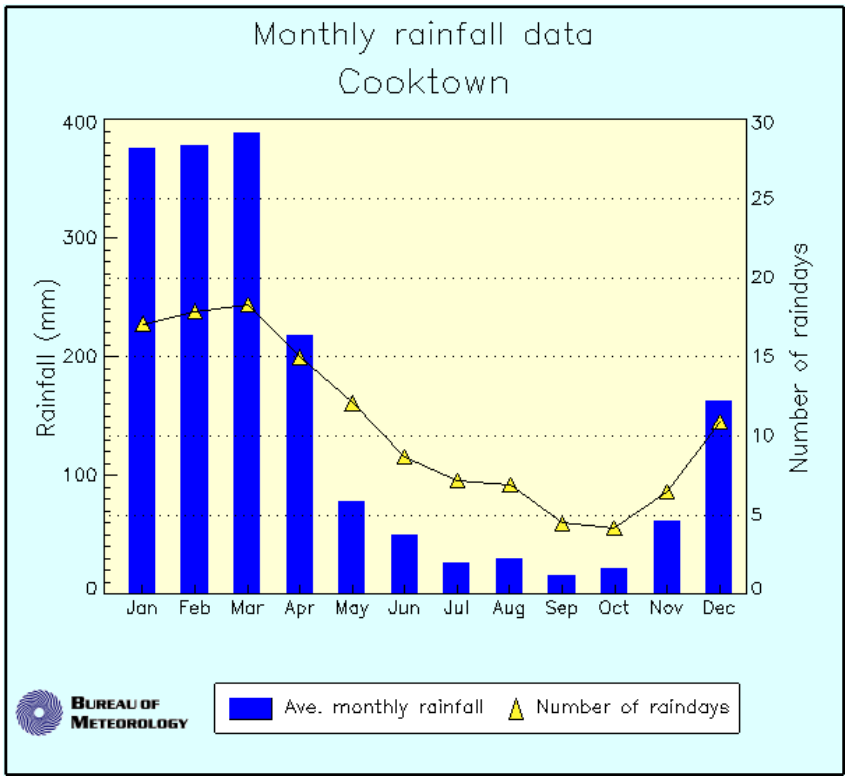


Figure 2.25 Mean monthly rainfall data Cooktown Airport 1942 to 2004 (Bureau of Meteorology)

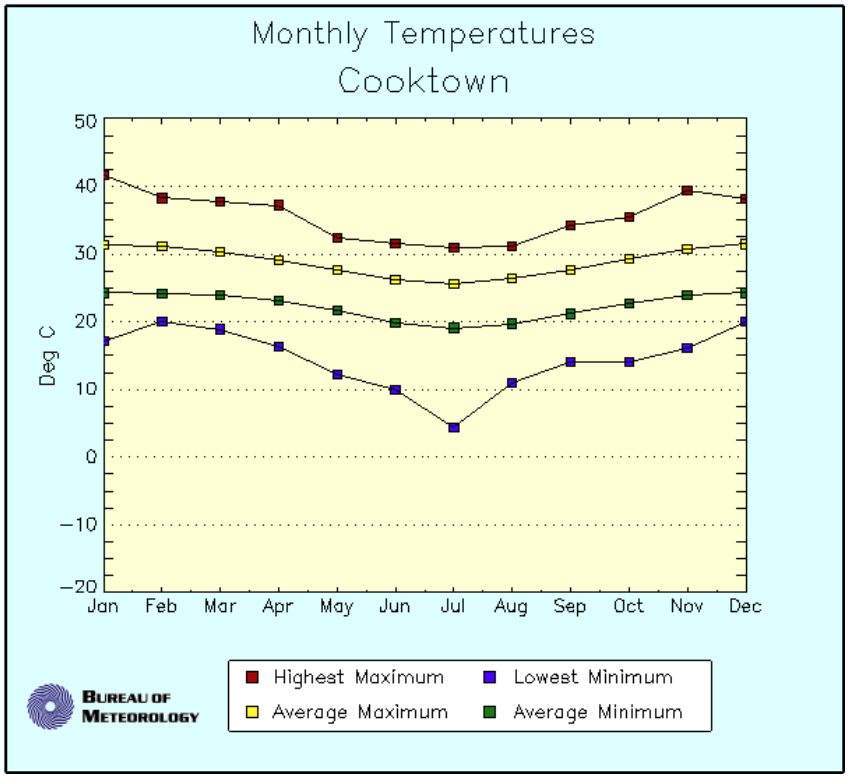


Figure 2.26 Mean monthly temperature data Cooktown Airport 1942 to 2004 (Bureau of Meteorology)

2.25 HYDROLOGY AND HYDROGEOLOGY

The Annan River is approximately 60 km long, originating in the Northern Wet Tropics World Heritage Area and emerging into Walker Bay 8 km south of Cooktown. This Tropical Lowland River flows north from the Northern side of Mt Poverty, Mt Romeo and Mt McMillan and from the southern side of Mt Finnigan. The Annan is fed all year by Wallaby Creek and seasonally by Mungumby, Trevethan and Oakey creeks. At the confluence of the Oakey, the Annan heads east and rapidly becomes tidal, winding approximately 13 km to the coast.

The Endeavour River is approximately 27 km long with the tidal influence penetrating as far as Redlands and Saltwater Creek. The Endeavour is fed by 3 main tributaries, the North and South branches and the North Arm. The overall direction of flow is South Easterly, with the Endeavour meeting the sea at Cooktown. The North Branch originates north of Honeysuckle Flats and flows over the Endeavour River Falls then heads to the west of Mt Olive. The South Branch originates behind Henderson‘s Lookout and flows past Alderbury to the west of Mt Olive where both branches join. The North Arm of the Endeavour originates north of Hope Vale across the McIvor Road and flows to the east of Mt Unbelievable and Mt Surprise to join the main arm 10 km upstream from the mouth of the Endeavour River. The top of the Endeavour River (Isabella Falls) west of Cooktown is fed from perennial springs in the Laura Basin sandstone (CYCLEG 2006).

The Annan and Endeavour Rivers drain into the Great Barrier Reef Lagoon. The short relatively steep nature of the Catchment and intense rainfall during the wet season results in sediment being transported to the near-shore marine zone. The low sediment-trapping efficiency of these types of estuaries means that sediment and nutrient loads are delivered to the lagoon, which can impact on seagrass beds and inshore coral reefs (GBRMPA WQ Protection plan 2003).

The Annan-Endeavour Catchment overlies the Great Artesian Basin. DNRM classify the regional Groundwater Province as Tasman and the local Groundwater Management Unit (GMU) as The Duck Farm. The Duck farm is situated between the Endeavour River the Annan River and Oakey Creek. Groundwater from The Duck Farm is extracted principally from fractured metamorphosed rocks of the Hodgkinson Formation. These include chert, basalt, metagreywacke, metasiltstone and slate (Australian National Resources Index 2006). Recharge to the fractured rock aquifer results from direct infiltration of rainfall. Several dam sites in the headwaters also enhance recharge to the aquifer.

Currently groundwater from The Duck Farm GMU aquifer is utilised predominantly for reticulated water for Cooktown in the wet season, irrigation, stock watering and domestic supply (Australian National Resources Index). Cook Shire Council plan to upgrade the filtration system for supply of potable water from the high level reservoir on the Annan River. Consequently use of The Duck Farm for municipal supply will be greatly reduced. Cooktown‘s water demands can then be met entirely by surface water from the Annan River.

Groundwater quality is generally good throughout the Catchment. However in some areas such as around Marton, saltwater intrusion can make the ground water unusable. Quaternary alluvium, comprising grey silty clay, sand and gravel usually contains brackish groundwater (Australian National Resources Index)

2.26 BIODIVERSITY

The Annan Catchment is extensively forested with the southern and eastern portions being predominantly rainforest and open eucalypt forest. The western and northern parts are more sparsely vegetated consisting of open eucalypt forest and woodland with pockets of Rainforest along Oakey Creek. The alluvial plains are covered by tall shrubland (Specht et al., 1995). The estuarine portion of the river comprises large areas of ephemeral and tidal wetlands and saltmarsh. The tidal areas of this Catchment support extensive marine plant communities including many species of mangrove, and saltcouch (Sheppard and Helmke 1999). Wetlands between the tidal and fresh water zones are dominated by melaleuca, pandanus and eucalyptus.

The Endeavour Catchment is less extensively forested with pockets of rainforest associated with the Endeavour River and it‘s branches and to the east of Elim Beach and at Mt Cook. Vegetation is a mixture of eucalypt and melaleuca woodlands. The tidal section of this Catchment supports extensive marine plant communities including mangroves and seagrass.

The Annan-Endeavour Catchments straddle two bioregions, The Wet Tropics and Cape York Bioregions Figure 2.27. Both Catchments contain significant numbers of rare and threatened plant species. The Queensland Herbarium data base indicates that there are 61 rare and threatened plant species in the Endeavour Catchment and 106 in the Annan Catchment (Qld Herbarium 2006).

The country from Cooktown to the Wet Tropics has been described by McFarland (1993) as having a high terrestrial faunal richness. In two-ten minute grids (20 sq Kms) from Cooktown south to Black Mountain and from Black Mountain to Mt McMillan over 320 vertebrate species have been recorded (McFarland 1993). Such diverse land fauna was correlated with high vegetation diversity. There is a broad range of habitat types found in the Catchment, including wetlands, riparian forests, rainforest, open woodlands and mountains, sandstone country and Boulder Mountains.

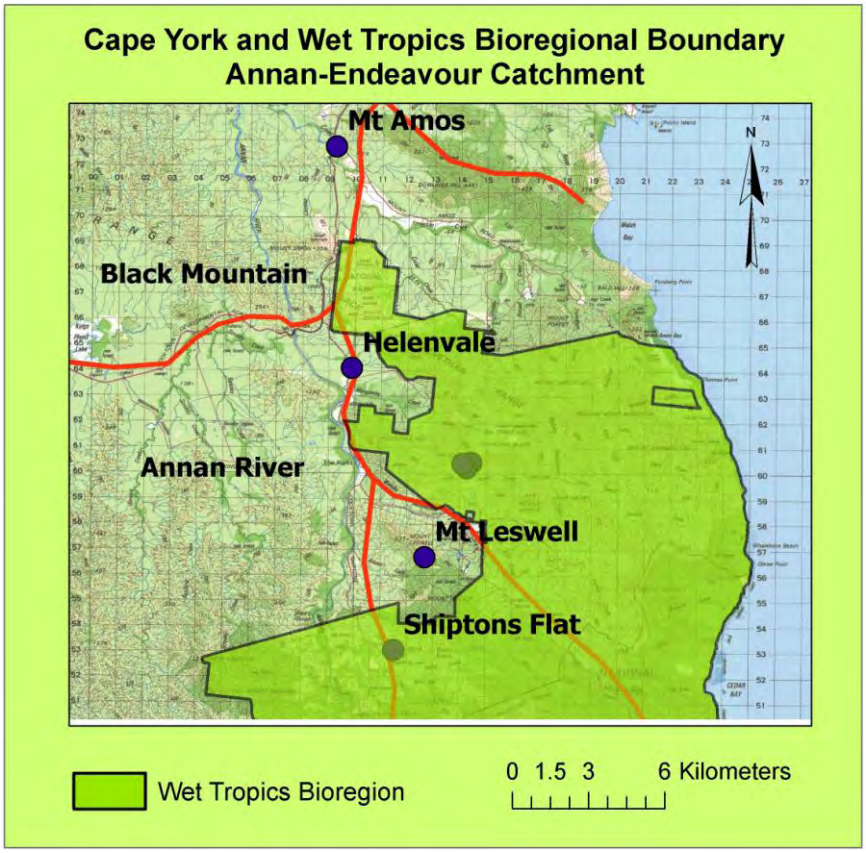


Figure 2.27 Bioregional boundary between the Cape York and Wet Tropics bioregion

2.3 DEMOGRAPHICS

Queensland is the fastest growing state in Australia. In the years 2003-2004 Queensland grew by 39.9 % (Australian Bureau of Statistics 2005). Such a large increase has been driven by interstate migration, overseas migration and natural increase. While most rapid growth has occurred in South East Queensland, Cooktown has also experienced significant growth over this period.

The current resident population in the Catchment is approximately 4000 people, with most people living in Cooktown (2000 people), Hope Vale (1000 people) and Rossville (400 people) (pers comm. John Harrison 2006). On the day of the last census in 2001 there were 500 visitors in Cooktown. In 2001 total visitation to the area was estimated to be less than 100,000 visits per year (Australian Bureau of Statistics 2005). With the sealing of the Mulligan Highway in 2006 visitor numbers will be significantly greater now.

The age structure of Cooktown‘s population reflects the overall Queensland age structure. The age structure in Hope Vale has relatively more young people and less older people than the overall Queensland age structure see figure 2.3. Hope Vale is an Aboriginal community located 44 kilometres north of Cooktown with an estimated population of 830 (as of June 2001). Approximately 94 per cent of the total population is of Aboriginal or Torres Strait Islander origin.

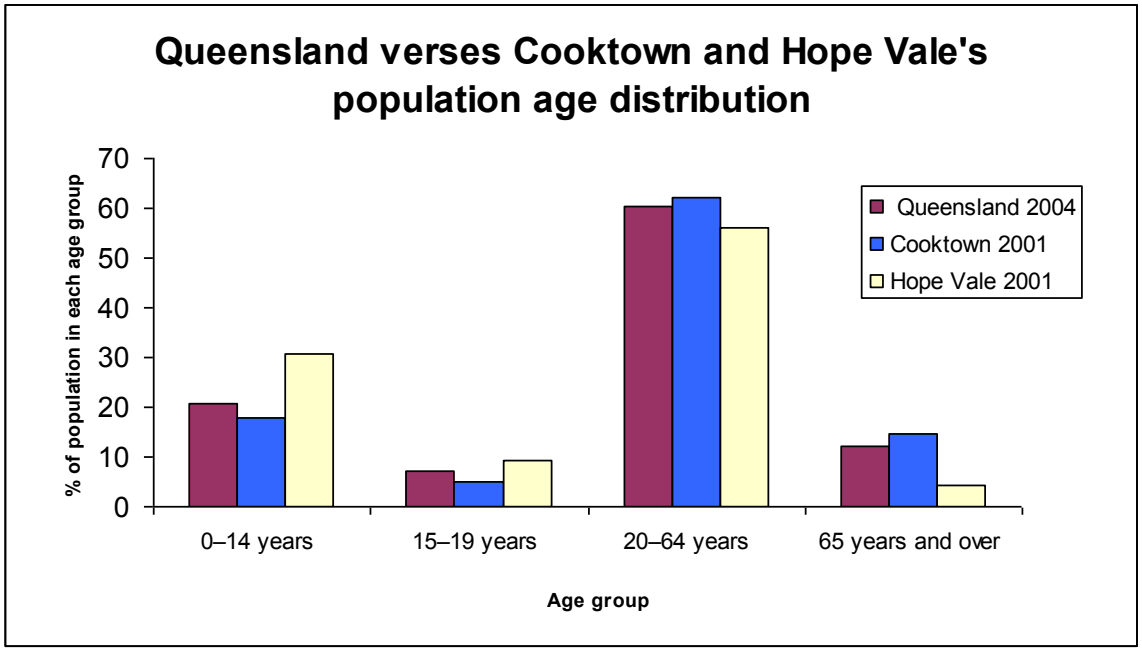


Figure 2.30 Age distribution on Cooktown 2001(Australian Bureau of Statistics 2001/2004)

2.4 LAND USES

2.40 ABORIGINAL COMMUNITY LANDUSE

Most of the Catchment of the north arm of the Endeavour River and east to the coast is Deed of Grant in Trust (DOGIT) land (110,000 ha). This land is managed by thirteen Clan Groups of the Guugu Yimithirr Language Group and Hope Vale Aboriginal Council. Currently these groups are negotiating land and infrastructure responsibilities. The Clan Groups are the Traditional Owners of this land.

Detailed environmental assessments have been undertaken of the land. In the long term the Clan Groups are working towards using the assessment information to zone suitable land uses. It is envisaged that non-agricultural areas could be used for activities like eco-tourism, education and bush foods. An important part of this planning process will be the regeneration of degraded land and fire management to build ecological resilience.

In April 2007 the Queensland Government recognised the Eastern Kuku Yalanji (see history chapter) people's traditional ownership over 230,000 hectares of land from Black Mountain to Mossman 17,000 hectares of which has become Aboriginal freehold land. Approximately 80 per cent of the agreement area is in the Wet Tropics World Heritage Area (Native Title Tribunal 2007). There were 15 indigenous land use agreements negotiated covering the practical relationships regarding people‘s rights in this broader agreement area. Indigenous land use agreements (ILUAs) are voluntary agreements between the native title group and other people about practical relationships regarding the use and management of land. ILUAs are legally binding for the parties who negotiate them (Native Title Tribunal 2007).

Agreement package

The agreement package establishes a cooperative approach to land ownership, land use, land management and community development. The 15 ILUAs will be lodged with the National Native Title Tribunal for registration. Once the ILUAs are on the Tribunal's Register of Indigenous Land Use Agreements, the parties can begin to experience the benefits of the agreement package. The agreement package includes:

- Almost doubling the national park estate in the coastal area from Mossman to Black Mountain (south of Cooktown) to about 159 000 hectares;
- Ensuring the further preservation of environmental and cultural values through State granted tenures over an area of about 48 000 hectares to be held and managed by the Eastern Kuku Yalanji as Aboriginal Freehold, subject to conservation agreements;
- The Eastern Kuku Yalanji holding smaller areas totaling about 16 500 hectares as Aboriginal Freehold for their use in providing some residential and economic potential. Importantly, these areas will also be subject to the applicable regulatory controls such as the Wet Tropics Management Plan the Vegetation Management Act and Shire planning schemes.
- A greater role for Kuku Yalanji in the management of national parks and some reserves.
- The agreements do not take away anyone's existing valid rights such as freehold, leases, licenses, and permits.
- The public can continue to access beaches, foreshores and a range of water holes and waterfalls, as well as the substantially expanded national parks.

(Native Title Tribunal 2007) http://www.nntt.gov.au/media/kuku_background.html

2.41 BUILT ENVIRONMENT AND INFRASTRUCTURE

A small amount of land in the Annan and Endeavour Catchments has been allocated for housing, commercial and industrial developments and for service infrastructure. Service infrastructure includes roads, sewerage, electricity pylons, communication towers, water and gas pipelines.

There are four main population centers in the Catchment: Cooktown, Hope Vale, Rossville and Marton. Cooktown is the largest commercial centre and the administrative centre for the Cook Shire. Outside of these urban areas the remainder of the Catchment is sparsely populated with freehold land comprised primarily of medium sized pastoral and agricultural holdings. However, sections of the Endeavour and the Helenvale / Mungumby areas lot sizes are smaller generally from 25 – 100 ha.

We can never know what the future will hold, but extrapolation of population data from the 2001 – 2006 censuses suggests that the region‘s population will continue to grow rapidly. There will be additional pressure on land resources through urbanization (See Figure 2.41) and subdivision of land into rural residential blocks. Increased population has placed pressure on solid and sewerage waste management facilities in the Catchment. Since the sealing of the Mulligan Highway tourist numbers have also increased dramatically putting additional pressure on our natural resources especially in camping areas. However, as the population increases, so to does the potential for the community to undertake natural resource management initiatives. Labour-intensive activities such as erosion control, re-vegetation, weed control and feral animal management could become more achievable if the community sees value in participating in these activities.

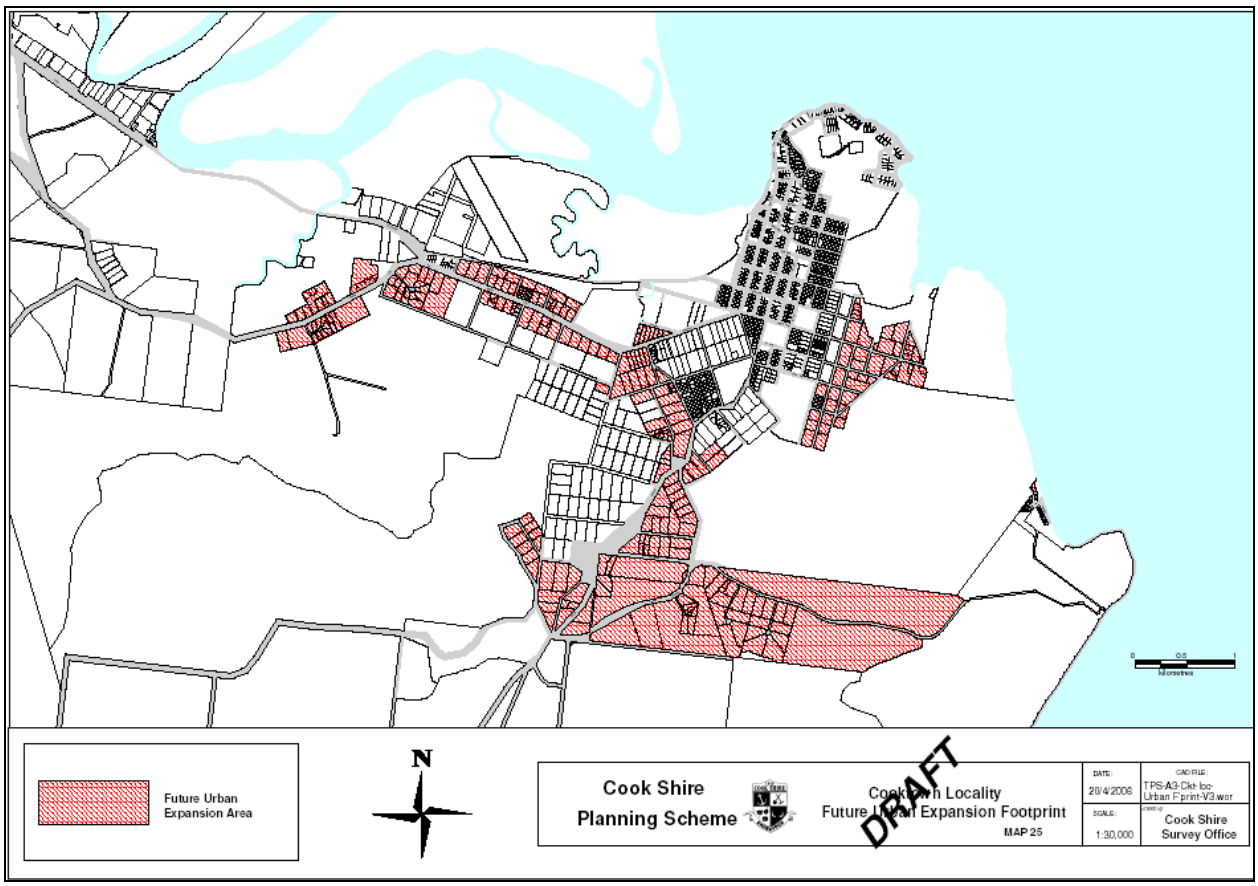


Figure 2.41: The potential future urban footprint for Cooktown (Cook Shire Council, 2006)

2.42 MINING

Most mining in the Catchment occurs in the Hodgkinson Formation, which is comprised of metamorphosed sedimentary rocks that contain gold, tin, tungsten, base metal, antimony, and limestone deposits (CYPLUS 1995).

History

On the 25th October 1873 Cooktown was established at the mouth of the Endeavour River to service the Palmer River goldfield and within months, became one of the busiest ports in Queensland (CYPLUS 1995). In 1885, alluvial cassiterite was discovered in Wallaby Creek and the upper Annan River valley. Within a year, alluvial tin was mined at several localities between Mount Amos and Mount Romeo, in the Annan River Tinfield, and lode mining had commenced at Mount Amos (Denaro & Ewers 1995). Because of the mountainous terrain, only small scale mining operations were possible in most areas (Denaro & Ewers 1995). Production peaked in 1888 with the rich surface deposits being quickly depleted. Dredging was attempted in 1892, but this and later attempts were unsuccessful.

The Annan River Company N.L. and others commenced large-scale sluicing operations in 1905. The largest mines were the Collingwood Face, Daly's Face and Home Rule. Annual production steadily declined and by the early 1960's averaged 20 t. (CYPLUS 1995).

In the late 1970's and early 1980's, small-scale mining again began throughout the field, together with moderately large-scale alluvial operations by Terrax Resources N.L. at Rossville and Serem Australia Pty Ltd at Lee Creek. Production rose significantly to peak at 250 t in 1981. The dramatic fall in tin prices in the mid-1980's caused most tin miners to seek alternative employment (Denaro & Ewers 1995).

Current mining

Currently, mining lease and mineral development permits are concentrated to the south of Oakey creek and to the west of Rossville. The majority of the leases are concerned with tin extraction. The most significant mine in the region is the Bluestone Collingwood Tin Mine, situated 35 km south of Cooktown at the base of Mount Leswell. Production at the mine began in late 2005 and is projected to produce over 1.1 million tons of 60 -70% pure ore over a 3 to five year period. Underground drilling indicated probable reserves of 3 106 980 t at 0.90 % Tin (27 833 t contained Tin) or 2 027 609 t at 1.00 % Tin (20 330 t contained Tin) (Miezitis & McNaught, 1987).

Environment

Tin mining is important for the economy of the region. However, there is potential for harmful environmental impacts unless effective management practices are in place to minimise land disturbance, control site emissions and allow appropriate site rehabilitation. Until relatively recently no consideration was given to the effect of mining on the environment.

Early tin extraction involved hydraulic sluicing of alluvium, colluvium and decomposed (altered) granite (Denaro & Ewers 1995). This practice caused significant amounts of sediment to be washed into the Annan River from up to 150 tin mining leases. The Annan River ran brown for many years from these operations (pers. comm. Lewis Roberts 21/3/06). In the late 1970s moderately large-scale alluvial tin mining resumed above Rossville. Two tailing dams remain from this operation the Terrax and Jones‘s Dam. The Jones‘s dam is believed by locals to be contaminated (pers. comm. Khun 2006), water

quality measurements by the SCYC demonstrated that this dam had very low oxygen levels with no aquatic plant or animal life evident. Further tests are needed to determine the nature of any contamination.

Today mining activities in Queensland are regulated through State Government legislation and administered by the Environment Protection Agency and Department of Natural Resources & Mines. Mining and processing must conform to strict environmental management guidelines and address issues of waste water management, water quality monitoring, rehabilitation of disturbed areas, overburdened dumps and final landform stability, including tailings dam stability and site land use after mining.

2.43 CURRENT PRIMARY PRODUCTION

There is little data available on the current value of agricultural production in the Catchment. Data from 1996-1997 from the Australian Natural Resource Atlas compares the Agricultural profit for the Catchment to an Australia wide medium value (Figure 2.42). During this period the gross revenue from agriculture in the Catchment was low, achieving approximately 20% of the Australia wide medium revenue.

Agricultural profit in Endeavour River

Attribute	Unit	Basin value	Median Australia-wide value
1996/97 Gross revenue	$000	5,548	27,636
1996/97 Variable costs	$000	1,942	8,654
1996/97 Fixed costs	$000	1,746	12,744
1996/97 Profit at full equity	$000	1,860	2,621
1996/97 Government Support	$000	1,195	1,827
1996/97 Economic returns	$000	664	707
5yr (1992/93 - 1996/97) Gross revenue	$000	5,712	31,139
5yr (1992/93 - 1996/97) Total costs	$000	3,687	23,408
5yr (1992/93 - 1996/97) Profit at full equity	$000	2,025	6,194
Dryland agriculture 5yr profit at full equity	$000	2,025	2,817
Minimum area of basin needed to produce 80% of profit at full equity within basin	ha	2,970	16,340

Figure 2.42 Australian Natural Resource Atlas 2006

2.44 HORTICULTURE

The majority of horticultural production in the Catchment occurs in the Endeavour River Valley where there is approximately 1000 hectares under production (CYP Cropping and Horticultural Industry Strategy 2002). A variety of tropical fruits such as bananas, mangoes, passionfruit, limes lychees and rambutans are grown and harvested in the region. There is also some and some tropical pasture grass seed and turf production. Short mild winters are conducive to the early maturing of most tropical fruits. Produce can reach the market a lot earlier than the established growing areas to the south (pers. comm. Keith McGuffie Dec 2006). This provides growers with an early market advantage over the southern growing regions. Over recent years due mainly to this advantage, small scale (less than 5 ha) passionfruit operations have become popular with landholders with small holdings and are increasing every year.

Most of the horticultural activity in the Endeavour River Valley is irrigated from subterranean bores, with very few landholders have allocation to draw water from the Endeavour River (pers. comm. Keith McGuffie Dec 2006).

About 1500 ha of suitable soils has been identified for agricultural production in the Endeavour River Valley region (Working paper 15 Economic issues WS Cummings Economic Research Services 2000). However tree clearing laws and water allocations are major limiting factors to future development of this area.

2.45 GRAZING

Beef production is largely limited to the rangelands to the North and West of Cooktown and the Endeavour River Valley. There are some cattle to the North East of Cooktown on Aboriginal lands. Higher intensity grazing management is possible in some areas of the Endeavour River Valley with improved pastures. Here cattle can be grazed sustainably at 1 head per 1.06 ha. On the less fertile soils outside of the Endeavour River Valley stocking rates are approximately 1 head per 6 ha (pers comm J Irwin 2006). With the exception of several moderately sized stations most cattle properties are small (from 25 to 100 ha). More intensive cattle production outside of the Endeavour Valley area is constrained by low soil nutrients and vegetation type.

Some cattle grazing occurs in the Annan Catchment at Killarney Station, Oakey Creek and Helenvale station, Shiptons flat and on Aboriginal Land.

2.5 LAND TENURE

Land tenure of the Annan and Endeavour Catchment is comprised primarily of Leasehold 36% and Freehold land 35% (Figure 2.51). Land is managed by many individual owners, leasees and traditional owners as well as The Hope Vale Aboriginal Council, Cook Shire Council and State Government agencies and the Yalanji ILUA.

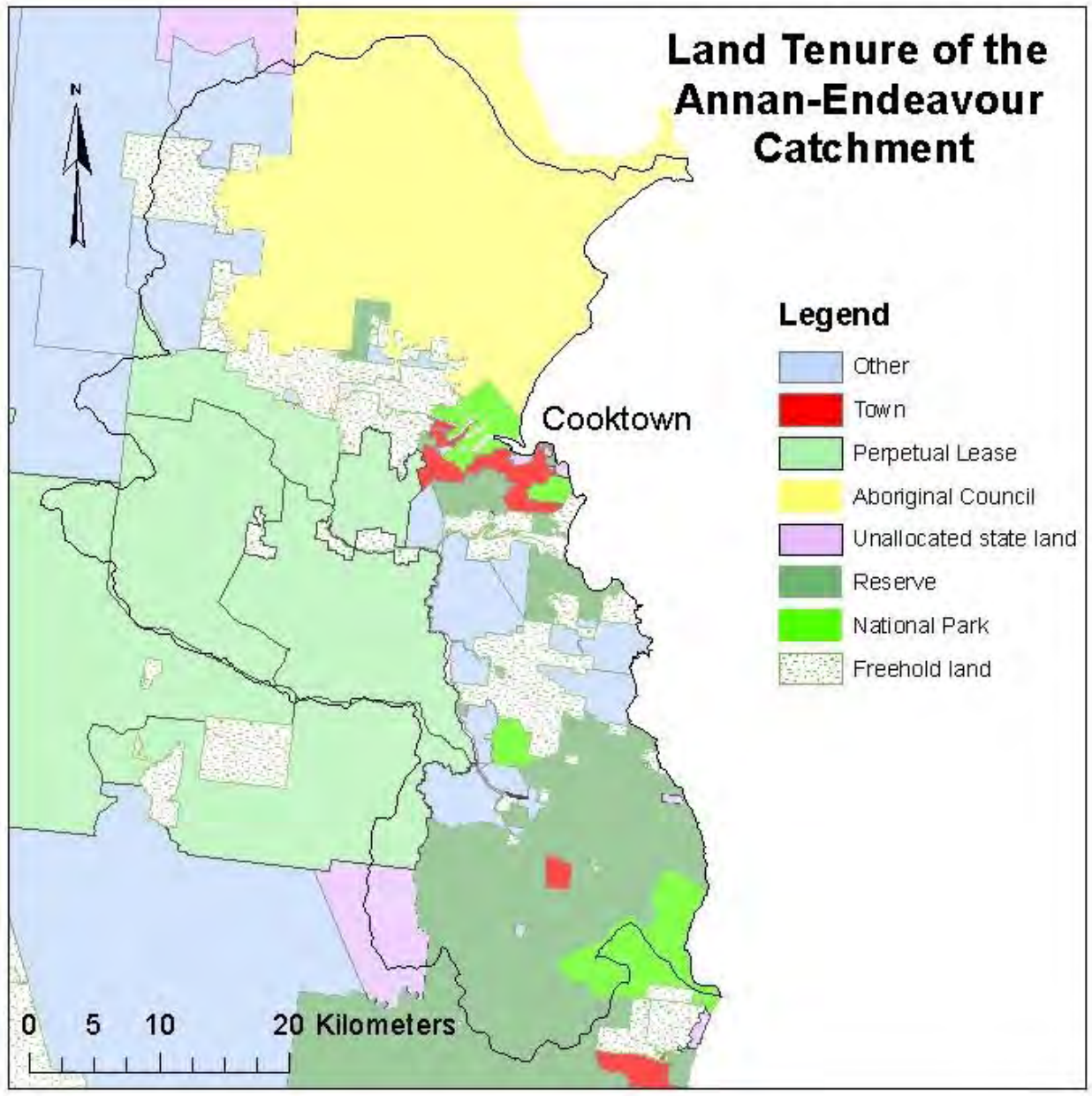


Figure 2.50 Land Tenure of the Annan-Endeavour Catchment

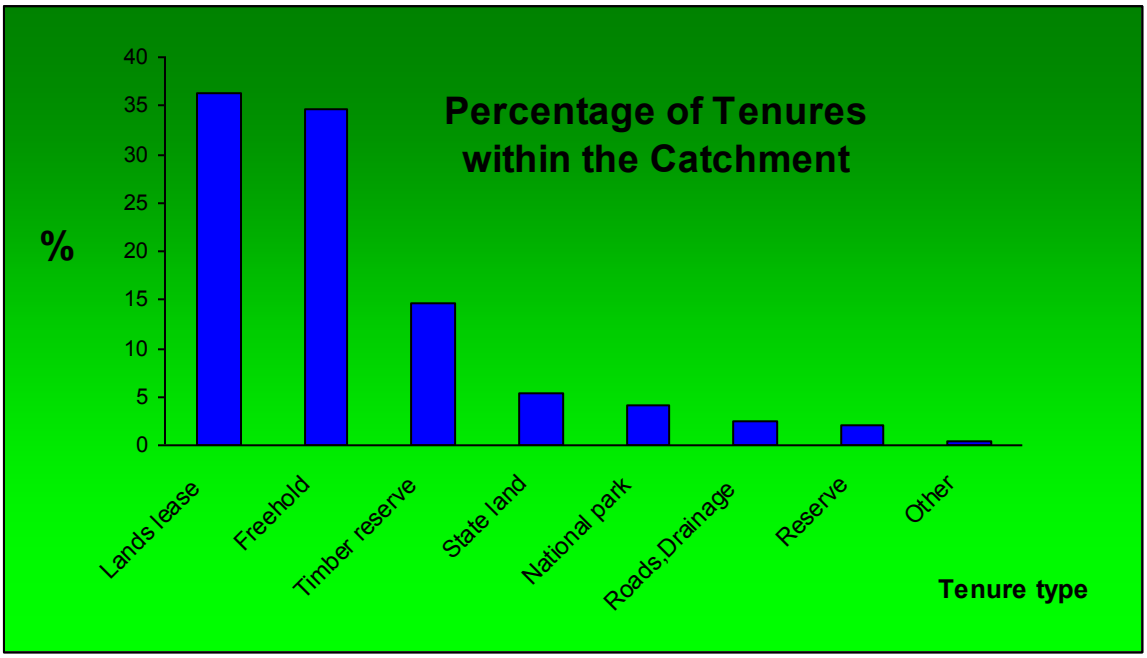


Figure 2.51 Courtesy of DNRM Mareeba

2.51 PROTECTED AREAS

National Parks and reserves cover over 21% of the Catchment. Other protected areas include Nature Refuges, Fish Habitat Areas and Conservation Parks (Figure 3.45).

2.52 STATE FORESTS AND TIMBER RESERVES

The Hann State Forest is situated 15 kilometres northwest of Cooktown. (814 ha). There are no current plans for timber extraction from this State Forest (Forest Service 2006).

Timber reserves cover approximately 14% of the Catchment. The Annan Timber Reserve is an area of 2,080 hectares bordering Walkers Bay just south of Cooktown. No harvesting has taken place on this Reserve and it is currently in the process of rationalisation to other land use tenures. The Monkhouse Timber Reserve is part of the Wet Tropics World Heritage area (to the south of Black Mountain) and covers over 160,000 hectares, approximately 30,000 ha of which is in the Catchment (see figure 2.50). Since World Heritage listing of the Wet Tropics, State Forests and Timber Reserves are no longer logged. Many of the old State Forests have now become Forest Reserves and it is planned for most of them to become National Parks (EPA 2006). The focus is now to conserve the ecological values of the forests and to manage public access through the provision of visitor facilities and access roads (EPA 2006).

3.0 KEY ISSUES AFFECTING OUR CATCHMENT

3.1 FERAL ANIMALS

Feral animals rated as the number one priority in a stakeholder survey of the Annan and Endeavour Catchment. A feral or pest animal can be described as ‗an animal causing detrimental impacts on the environment, industry or community activities' (Cook Shire Council, 2006). In many cases pest animal populations in the Annan and Endeavour Catchment have resulted from the deliberate or accidental release of domesticated animals which have become feral.

The main vertebrate pest species identified for Cape York during the 1995 CYPLUS study were feral pigs, feral cattle, feral horses, wild dogs/dingoes, feral cats, cane toads and feral fish (especially Tilapia) (Mitchell and Hardwick (1995). Ten years later these species remain the priority species for the Annan and Endeavour Catchment according to community consultation with Cook Shire Council's Animal Control Officer and the CYWAFAP Feral Animals Officer.

Feral pigs are the biggest feral animal issue in the Catchment. Horses, cattle, dogs, cats and fish species also have detrimental impacts on productivity and the environment. Native animals (e.g., dingoes, cockatoos, wallabies) are regarded as pests when they threaten agricultural productivity.

Feral pigs, wild dogs/dingoes and feral cats are Declared Animals of Queensland under the Land Protection (Pest and Stock Route Management) Regulation 2003. Declared animals pose a threat to the state's industries, natural resources, environment and human welfare. One fish species Tilapia is declared under schedule 5A of the *Fisheries Regulation 1995*.

The main impacts include:

- Damage to conservation areas e.g., pig diggings
- Predation on stock and wildlife e.g., wild dogs, feral cats
- Soil disturbance and general land degradation e.g., wild cattle, feral horses
- Competition with livestock and wildlife for resources such as food, water, shelter and breeding sites e.g., pigs, wild cattle
- Damage to fences and water sources e.g., wandering cattle and horses
- Disease threats e.g., foot and mouth in pigs

Figure 3.11 THE MAIN FERAL ANIMALS IN THE ANNAN AND ENDEAVOUR CATCHMENTS

Common Name	Scientific Name	Threat	Achievability	Declaration Category	Priority
Feral pigs	*Sus scrofa*	1	2	Class 2	High
Feral cattle	*Bos. spp*	1	2	None	High
*Cane toads	*Bufo marinus*	-	-	None	-
Wild dogs/ mangy dogs and Dingoes	*Canis familiaris* and *Canis familiaris dingo*	1	2	Class 2	High
Brumbies (Feral horses) Wandering or domestic horses	*Equus caballus*	1	2	None	High
Feral/wandering cats	*Felis catus*	1	2	Class 2	High
*Feral fish	*Tilapia marinae*	-	-	Declared noxious#	-

*Not classed as a pest animal in Cook Shire Council PMP.
Threat – to Natural, Urban, and Agricultural Areas 1= High, 2=Moderate, 3=Low, 4=No threat
Achievability of control – 1= Could be eradicated from Catchment area, 2=Could be significantly reduced, 3= Could be contained, 4=Could be managed indirectly with biological control agents
Declaration Category – A declared animal is one that is listed under Class 1, 2 or 3 in the Land Protection (Pest and Stock Route Management) Regulation 2003 (see Appendix D for Class definitions). # – Noxious fish are listed in schedule 5A the *Fisheries Regulation 1995*.
Priority – for future action – low, medium, high

3.10 PRIORITY PEST SPECIES FOR CONTROL

Feral Pigs (*Sus scrofa*)

Feral pigs rated highly as one of the major issues for the Annan and Endeavour Catchment in the stakeholder survey. This concern is shared across the Cape. The Cook Shire Council Pest Management Plan (2006) prioritised the management of feral pigs as the highest priority pest for protecting conservation, grazing and horticultural values on Cape York Peninsula.

Figure 3.12 Feral pig caught at Keating‘s Lagoon September, 2006. Photo Jason Carroll

Previous surveys have identified ~~t~~he Cape York Peninsular region as having the highest feral pig population and highest density concentrations in Queensland” (Mitchell et. al., *unpublished* 2005).

Feral pigs have an enormous, though largely unquantified, impact on the environmental, health, and economic values of Cape York Peninsula (CYWAFAP, 2002). They damage agricultural areas and habitat, and compete with stock and native animals for food.

Pigs are vectors for endemic diseases such as leptospirosis and are a real threat for spreading exotic diseases such as foot and mouth to livestock and Japanese encephalitis to humans (Jim Mitchell, pers.comm, 2006).

In the Annan and Endeavour Catchments feral pigs are widespread, but generally congregate around wetland areas during the dry season. Pigs are pests in urban areas of the Catchment where they degrade waterways and can be hazardous around gardens and people. Pigs have been caught in traps at Alligator Creek, Quarantine Bay, Botanic Gardens, Finch Bay and Keating‘s lagoon. From June to December in 2006 27 pigs were trapped and shot in the rural/residential areas of the Catchment (pers. comm., Matt Birch, 2007).

Feral pigs are declared Class 2 pests under the *Land Protection (Pest and Stock Route Management) Act 2002*. Declared animals are targeted for control because they have, or could have, serious economic, environmental or health impacts (NRMW, 2006). Feral pig impacts are also listed as a Threatening process of Endangered Species and Ecological communities under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (the EPBC Act), through predation, habitat degradation, competition and disease transmission (DEH, 2005).

The main impacts of pigs on the natural environment and economics of the Catchment are:

1. water quality reduction;
2. habitat destruction;
3. native animal predation;
4. spread of weeds;
5. economic losses to agricultural production and infrastructure

Water quality reduction

Feral pigs may pose the greatest environmental concern to water quality in the Catchment due to the extent of their activity. Pigs reduce bank stability by interfering with the riparian understorey growth and digging in and wallowing in the water holes. They have the effect of increasing turbidity and destroying the aquatic vegetation by eating rhizomes and bulbs (Eberhardt, 2006).

The trampling, wallowing, rooting, digging, defecating and urinating habit of feral pigs in water directly affects water quality.

Pigs also have an indirect impact on water quality, fish populations & biodiversity through wetland destruction. Pig rooting mostly occurs in areas of high moisture such as drainage lines and wetlands (Hone, 1995; Mitchell, 1993).

Acid sulphate soils underlie large areas of the CYP coastline. These soils are found under low-lying coastal areas like coastal plains, wetlands and mangroves (DEH, 2000) which is also the preferred habitat of feral pigs. After feral pig disturbance soils are exposed to oxygen and they produce sulphuric acid in large quantities. After rain and particularly following prolonged dry periods, the built up sulphuric acid in these soils is released. This toxic cocktail flows into surrounding waterways reducing water quality, killing fish and damaging sensitive ecosystems (DEH, 2000). Pig activity at Keating‘s Lagoon has caused disturbance of acid-sulphate soils (pers. comm., Diana Wood, 2006) and lowered the pH of the lagoon‘s waters to very acidic levels (pH 2) (pers.comm C. Howley 2006).

Habitat destruction and Native animal predation

In 1993 Mitchell reported that pig diggings were more prevalent in lowland areas and coastal swamp habitat. Feral pigs have established large populations and caused significant degradation to many wetlands in the region. Pigs have caused large areas of Keating‘s Lagoon to become shallow due to sedimentation. There is an urgent need for a long term control program for feral pigs around sensitive wetland areas in the Catchment such as Keating‘s Lagoon.

As well as creating disturbance and competing with native species for food, pigs are active predators of many native birds, reptiles, mammals, and invertebrates. Feral pigs are known to consume numerous native animals including earthworms, snails, centipedes, insects, frogs, lizards, snakes, freshwater crocodile eggs, turtles and their eggs, cassowaries, and small ground-nesting birds and their eggs (McGaw and Mitchell, 1998).

Figure 3.13 Photo Keating‘s Lagoon pH of 2 after pig activity

Spread of weeds

Evidence suggests that feral pigs also play a significant role in the spread and propagation of weeds such as pond apple, sicklepod (DEH, 2003) and lion‘s tail in their droppings and hair (Andrew Hartwig, pers. comm., 2005). Feral pigs carry weed seed such as *Parthenium* from the riverbanks to the open country and associated gullies (Mitchell and Kanowski, 2003). Quadrant sites monitored around feral pig diggings by the CYWAFAP showed an increase of weed regeneration over native regeneration and in some cases monocultures of weeds were recorded (Seymour and Molyneaux, 2001).

Pigs have also been implicated in the spread of plant diseases such as root rot fungus. They transport contaminated soil in their hooves and hair and also damage plants leaving them open to infection (McGaw and Mitchell, 1998).

Health

Feral pigs pose a health risk to humans and livestock in the Catchment. One of the biggest threats is zoonosis or diseases that can be transmitted from pigs to humans. Pigs are host to a wide variety of viruses, bacterias and parasites including roundworm, sparganosis (Figure 3.14), Brucellosis, Japanese Encephalitis, tuberculosis, melioidosis, Murray Valley encephalitis, Ross River fever and *Leptospirosi*s (McGaw and Mitchell, 1998). Feral pigs have the potential to carry Trichinella, swine fever and foot and mouth disease.

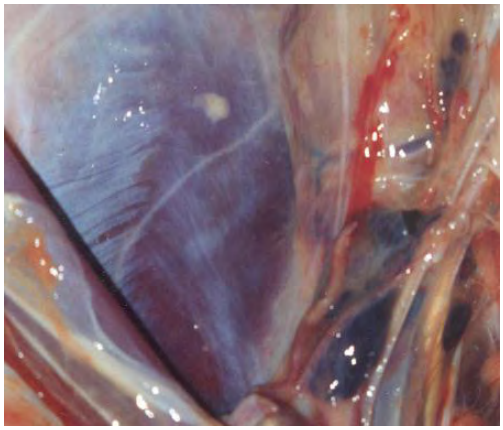


Figure 3.14 Photo Sparganosis Seymour, CYWAFAP 2001

Economic
Economic impacts as a result of feral pig damage include the direct losses to agricultural production (by destroying crops and digging up pastures), the cost of continuing expenditure on pig control and damage to infrastructure such as fencing. Destruction of wetland areas could impact on local community values and recreational fishing industries.

METHODS OF CONTROL

Pigs are difficult to control on a large scale for the long term. At the proceedings of the Feral Pig Action Agenda in 2003 the consensus was that the eradication of feral pigs is the long-term goal for feral pig management in Australia (Lapidge *et al*, 2003). Eradication means ~~"t~~he complete and permanent removal of the entire population by a time limited campaign" (Hart, 2003). Braysher and Moore (2003) noted that eradication, except on islands, is not possible with the current technology. Consequently, a more immediate goal was put forward to minimise the economic, agricultural, public health and environmental impacts of feral pigs in Australia through sustained control using currently available techniques.

Aerial shooting with follow up 1080 baiting
The CYWAFAP have trialled a number of controlled techniques and have found that in open areas with large pig numbers integrated pest management using aerial shooting and follow up 1080 baiting was the most successful. Trapping has been successful in urban areas for small numbers of pigs or in dense vegetation such as rainforest. Control strategies such as aerial shooting and baiting can be specialised to target pig populations. Control is more effective when pigs are concentrated around water sources at the end of the dry season and where populations are localised within the riparian habitat.

Fencing
Fencing is generally not regarded as the best control technique for feral pigs except for enclosing relatively small, highly valuable areas (McIlroy 1993 cited in Choquenot *et al*.1996 and Long and Robley, 2004). Since feral pigs are large, robust animals reaching up to 115 kg in size (Choquenot *et al*.1996); fences must be equally robust to exclude them. Where possible it is important to erect exclusion fences before pigs become accustomed to utilising the enclosed food source. Electrified wires can be used in conjunction with a fence to prevent it being breached. Fences used to exclude pigs at Red Lily Lagoon in Lakefield National Park have met with some success. The SCYC has secured funding to fence off a section of Keating's Lagoon, the group will assess the environmental benefits of excluding feral pigs from this wetland.

Biological Control
Peacock reported that it was now very unlikely that a virally-vectored immunocontraceptive was viable for pig control due to the potential problems with the domestic pig industry. Pigs are also poor candidates for immunocontraception as they have a high reproductive rate and highly fecund animals are very difficult to control through fertility disruption (Peacock, 2003).

Community attitudes
Feral pigs can affect the availability of some very sought-after bush tucker including lotus lilies, yams, magpie geese, fresh water turtles, and goannas (Thorburn, 2000). The total eradication may not be a preferred option for those who use pigs as a food source. Some aboriginal communities recognise that pigs are pests and use them for food. Pig hunting and eating is a popular cultural pastime. Others see feral pigs as a food resource, but do not hunt pigs. Many Aboriginal people believe that the meat can make them sick, and in fact, just don't like the taste.

Commercial Harvesting

In 2003 business consultants proposed a project for harvesting pig meat by the Hope Vale community and locating a collection box at the partially completed abattoir. The meat would be processed at the Townsville abattoir. Cook Shire Council allocated $7500 to undertake a feasibility study for a mobile pig abattoir (Cook Shire Council Minutes, December 2003).

Profitable harvesting of game meat is not a guaranteed venture. Factors that determine the profitability of a harvest include the:

- distance travelled to chillers (feral pig meat requires refrigeration within two hours during daylight time (Seymour and Molyneaux, 2001));
- distance travelled to abattoirs (Figure 15);
- ease of access for harvesters;
- density of pigs; and
- disease and condition of the animals (six out of ten pigs must be thrown away due to Sparganosis (Seymour and Molyneaux, 2001))

FUTURE MANAGEMENT

The current emphasis of feral pig management in the Catchment has come from recommendations made in the Queensland Feral Pig Strategy (2004) and Cape York Peninsula Feral Pig Management Plan (2006). These actions include:

- develop awareness in the community of the feral pig problem;
- manage feral pigs effectively;
- ensure there are adequate resources for research and control programs in the long term;
- gain commitment from stakeholders to contribute to control programs; and
- determine priorities for control in high-value environmental, economic and disease risk areas.

High-value areas could include conservation zones, wetlands, horticultural land and areas where the risk of introduction and spread of disease is high.

Wandering Cattle *(Bos spp)*

It is difficult to define feral cattle. Most properties in Cape York are inadequately fenced. Cattle that miss out on mustering could be considered feral. However, even unbranded or cleanskin cattle can be traced back to an owner through DNA testing (pers. comm., Matt Birch, 2007). Officially all cattle belong to someone so the term *feral* cattle is not strictly correct. The term wandering cattle will be used for this plan. Wandering cattle are widespread throughout the Catchment, especially Rossville, Home Rule, Leggett‘s Crossing and traditional Hope Vale lands.

Wandering cattle were identified during the CYPLUS (1995) study as one of the main vertebrate pest species on Cape York Peninsula. Cattle (both domestic and wandering) cause compaction of the soil around water courses and cause destruction of the understorey reducing protection for trees which can result in tree death (Eberhardt, 2006). Additionally cattle damage the underbank habitat and can spread weeds through seed dispersal and by breaking off branches which can float downstream and germinate. Further problems are caused by trampling, compacting and stirring up river banks and beds. Water quality problems result from decomposing cattle in water courses and cattle defecation on the

banks and in the water. Grazing animals have direct impacts on wetland vegetation, soils, crops, gardens and water quality. Landholders in the Catchment have been active in protecting wetland areas from stock on their properties. Grants offered by Cape York Peninsular Landcare have seen many sensitive wetland areas in the Catchment fenced by landholders to protect them from stock.

Figure 3.15 A bull on Endeavour Valley Road, Photo courtesy Matt Birch

Wild dogs/ Mangy dogs and Dingoes *(Canis familiaris/ and Canis familiaris dingo)*

The term wild dog refers collectively to purebred dingoes, dingo hybrids and domestic dogs that have escaped or been deliberately released (NRM _Wild dog control' fact Sheet, 2004). Under current legislation, dingoes and wild dogs are declared species (Cook Shire Council, 2006) and it is the responsibility of landholders to reduce the number of dingoes/wild dogs on their property (DNR Fact sheet, 2003).

The dingo has been regarded as a serious predator of domestic stock since early European settlement in Australia. On grazing country, wild dogs can harass, injure or kill calves. Calf losses to dingos are reported to be significant in some areas. Dingoes and wild dogs are also vectors of diseases such as distemper and parvo-virus, and parasites (Cook Shire Council, 2003). Mangy dogs are usually owned domestic dogs that have strayed. Mangy dogs in Hope Vale are a health concern, aggressive dogs are frequently reported in Cooktown and stray dog attacks on cattle and wildlife at night are an issue in Rossville. The goal of the Cape York Peninsula Pest Management Strategy (2006) is to prevent an increase in numbers. This will be measured by a decrease in dingo or dog attacks in cattle areas.

Wild dogs impact significantly upon cassowaries and are thought to have removed the population that was present around Rossville Helenvale since the 1980's (pers comm., Diana Wood 2007)

Figure 3.16. Mangy dog. Photo courtesy Matt Birch

The most common control method for wild dogs in cattle areas is 1080 baiting. Poison baits are the most economic, efficient, humane and effective method of controlling wild dogs, especially in inaccessible or extensive areas (NRM _Wild dog control‘ fact Sheet, 2004). Shooting is an opportunistic method mostly used to control small populations or individual problem animals (NRM _Wild dog control‘ Fact Sheet, 2004).

Some conservationist groups disagree with the control of dingoes (Cook Shire Council, 2003). The Australian government protects dingoes in national parks and reserves only. In many public areas, dingoes are considered pests and are subject to control measures.

Wild dogs and dingoes were not listed as a priority for control by stakeholders of the Annan and Endeavour Catchment. However, problem dogs are the biggest issue for the Cook Shire Council‘s Animal Control Officer. The numbers of wild or problem dogs around Hope Vale, Rossville and Cooktown are controlled by the Animal Control Officer and have been dramatically reduced in recent years.

Cane toad *(Bufo marinus)*

Figure 3.17 Cane toad

Although not a declared pest under the Rural Lands Protection Act, the cane toad is still considered a pest in Queensland. _The biological effects, including lethal toxic ingestion, caused by cane toads (*Bufo marinus*)‘ are listed as key threatening processes under the EPBC Act. Cane toads are widely spread throughout the Catchment.
Since its introduction, the cane toad has had a negative impact on native fauna as its range has rapidly expanded. The biggest threat is to animals that eat the toad. From egg to adult, the cane toad is dangerously toxic and ingestion can cause death (from heart failure) within 15 minutes. Adult cane toads exude venom when provoked. Studies have shown that where toad populations have been established, numbers of goannas and northern quolls have been devastated. The northern quoll is present in the Annan and Endeavour Catchment. Some birds and native predators have learnt to safely consume cane toads by avoiding the poison glands. Recent reports suggest that some Cape York northern quoll populations are coexisting with cane toads. The cane toad is not listed as a priority pest in the CYP Pest Management Plan as it is now unofficially considered by the EPA as naturalised.

In the aquatic environment the impacts are likely to be widespread from large freshwater predators such as the freshwater crocodile and barramundi to turtles, fish and crustacea (Ryan et. al., 2002). In the freshwater environment the cane toad may potentially compete for resources and directly prey on the eggs and hatchlings of native frog and fish species (Ryan et. al., 2002).

For small areas the most humane method of disposing of toads is to place them double-bagged in the freezer overnight. However, this method is unlikely to make a difference to overall population numbers. The most effective method maybe biological control.

Feral or wandering horses *(Equus caballus)*

Also know as brumbies or wandering domestic horses, horses can be serious environmental pests (Department of the Environment and Heritage, 2004). Horses cause erosion, damage and foul waterholes, spread weeds, knock down fences and compete with stock and wildlife for water and food. They also compact soil, eat pasture grasses, obstruct mustering and can carry exotic diseases such as equine influenza (Department of the Environment and Heritage, 2004). The greater mobility of horses allows them to graze further away from water than cattle (Mitchell and Hardwick, 1995).

Figure 3.18 Wandering horses in Hope Vale. Photo Matt Birch

Mobs of wandering horses roam throughout the Endeavour Valley especially around Bald Hills, Keating's Lagoon and Hope Vale. Some of these horses are escaped rodeo horses that have joined others and established a huge range spread over the Endeavour Valley. Horses were noted as a high priority pest in the Hope Vale Pest Management Plan (2003). There are said to be approximately 100 horses that reside in and around Hope Vale. The spread of weeds, road safety, aggressive stallions and health issues are among the many problems associated with roaming horses in such high numbers (CSC, 2006). The goal of the Hope Vale Pest Management Plan (2003) is ~~to~~ remove all horses from the town area and prevent them from returning". Cook Shire Council currently subcontracts its Animal Control Officer to Hope Vale upon request. In order to lawfully remove the horses and to prevent their return, Hope Vale Council needs to adopt The Model Local Law (Impounding of Animals) to allow their own authorised officer to legally impound. However, horses from Hope Vale are targeted by CSC when their presence or associated risks impact within Cook Shire jurisdiction.

The goal of the Cape York Pest Management Strategy (2003) is to significantly reduce the number of feral horses. Aerial culling is the best method for control, especially during the Dry when horses gather around water holes (Department of the Environment and Heritage, 2004).

Feral Cats *(Felis catus)*

Cats are a known threat to biodiversity as they kill many different species of wildlife in large numbers (Cook Shire Council, 2003). Feral cats are common around Cooktown, Hope Vale and Rossville. In Cape York, where the rabbit does not occur, feral cats prey heavily on native species. Predation by feral cats is listed as a key threatening process under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act). Under the EPBC Act, the Australian Government in consultation with the states and territories has developed the *Threat Abatement Plan for Predation by Feral Cats*. Cape York is described as a region with localised distributions of endangered species at high risk of feral cat predation (DEH, 1996).

Figure 3.19 Trapped feral cats, Hope Vale Photo Matt Birch

The domestic cat population continually replenishes and increases the feral cat population (Cook Shire Council, 2006). Roaming pet cats also prey on wildlife especially birds and ground dwelling mammals and reptiles. Feral cats can also spread diseases such as Toxoplasmosis, ringworm and Sarcosporidiosis (Mitchell and Hardwick, 1995).

The goal of the Cape York Pest Management Strategy (2006) is to reduce the number of stray/feral cats.

Cats are notoriously hard to control. Baiting is the primary control technique for broad scale cat population control. Cats are also killed incidentally to dingoes in 1080 poisoning campaigns (Mitchell and Hardwick, 1995). Around built up areas traps set at night are successful at catching feral cats. Cook Shire Council loans out cat traps and encourages responsible pet ownership including,

- Desexing cats - Unless specifically intended for breeding, all cats must be desexed by the time the animal is six months old
- Confining cats from dusk till dawn. Cook Shire Council policy is to only trap cats out at night
- Identification –all cats wear identification.
- Responsible disposal of unwanted cats. Contact Animal Control Officer Ph 40695444

Feral cat control programs need to be coordinated with other activities such as on ground protection of threatened plants and animals and control of other invasive species such as pigs and wild dogs.

Feral Fish *(Tilapia marinae, Oreochromis mosambiccus, Sarotherodon species)*

Tilapia is the common name used for a variety of cichlid fishes of the genera *Oreochromis*, *Sarotherodon*, and *Tilapia*. Originally from Africa cichlids are popular aquarium fish. Tilapias inhabit a variety of fresh and, less commonly, brackish water habitats from shallow streams and ponds through to rivers, lakes, and estuaries. They are reported to be able to withstand short periods in salt water and this way potentially invade new river systems. Most tilapias are omnivorous with a preference for soft aquatic vegetation and detritus. Where tilapia has been deliberately or accidentally introduced, they have frequently become problematic invasive species. This introduced fish is declared noxious in Queensland as it competes aggressively with native fish for habitat and food, and disturbs plant beds when building nests.

Under ideal conditions with unlimited resources tilapia breeds up quickly into huge populations. In 2001 five tilapia were released into a resort pond in Port Douglas. Within three years 18 tonnes (over 1 million fish) of the fish were poisoned and removed (DPI & F, 2005).

A single Tilapia specimen was reported in the Endeavour River in 2004 (Pusey et. Al. 2004). A survey at Jensen's Crossing in the Endeavour River in December 2007 by James Cook University and SCYC staff confirmed this discovery. Further investigation by SCYC staff revealed 2 farm dams near the crossing that held significant populations of Tilapia. How they got into these Dams is unknown. In January 2008 the Department of Primary Industries and Fisheries poisoned these dams and removed an estimated 6000 fish. Unfortunately this was only a partial kill. During the March 2008 flood events caused these dams to overflow into the Endeavour River. There is an urgent need to conduct a full survey of Tilapia in the Endeavour Catchment and eradicated fish from these 2 dams.

Figure 3.110 Tilapia Endeavour Valley dam and DPI & F, Poisoing Tilapia Jensens Crossing January 2008

Sooty grunter (*Hephaestus fuliginosus*) do not naturally occur in the Annan and Endeavour Catchments. In 1980 the DPI released 2030 of these fish into the Annan River Falls. They have since established self-sustaining populations and provide good catches for recreational fishers in the Annan and Endeavour Rivers (Burrows, 2002). The impacts of the sooty grunter are unknown.

Figure 3.111 Sooty Grunter (DPI, 2005)

Noxious fish are listed in schedule 5A the *Fisheries Regulation 1995*. Fines of up to $150 000 can be imposed on anyone having noxious fish in their possession without a permit. Noxious fish cannot be kept, hatched, reared or sold. When caught all noxious fish should be destroyed; they must not be returned to the water and must not be used as bait, live or dead. Anyone found to be releasing noxious fish may be charged for the cost of eradication and removal of those fish (DPI, 2005).

Once established in a river system noxious fish are virtually impossible to eradicate. At present there is no effective method for eradicating noxious fish from larger water bodies and flowing river systems. Due to the sensitivity of aquatic systems fish poisons are the last possible option and are only successful for small, enclosed water bodies such as farm dams, resort lakes, ornamental ponds and

some isolated pools within river systems where noxious fish sometimes congregate. Eradication is a costly procedure and involves the destruction, collection and disposal of fish.

Biological control methods, such as manipulating the genetic structure of tilapia to disrupt their breeding or inducing early death, have yet to be developed and a great deal of research is required. It may be many years before these techniques can be used outside laboratories. Another possible control measure is rehabilitation of the riverine environment which may reduce the competitive advantage noxious fish have over native fish (DPI, 2005).

Other potential pest animals

Feral Deer (*Cervus timorensis)* are an issue in the southern part of the Wet Tropics and have been reported as far north as Kuranda. Feral deer are capable of breeding rapidly to form large herds that could cause significant and possibly irreversible environmental damage (Rainforest CRC, 2006). Indian Mynah Birds (*Acridotheres tristis*) common in Cairns are a potential threat to native bird species should they become established in the Catchment.

Pest Management

The National Feral Animal Control Program (NFACP) recommends that a feral animal control program is impact based not pest based. The focus of the NFACP is not on killing pest animals but reducing their impact. The relationship between pest density and resultant damage is not well known, so reducing pest animals down to a target density may not achieve an expected or proportional reduction in damage. In other situations, pest animals are not causing major damage, or there are more significant causes of damage. The NFACP offers funding once a year to landholders for feral animal control. Incentives offered by Cape York Weeds and Feral Animals project include $500 for ammunition for feral animal control, seventeen portable pig traps and five spray units that are available for loan to landholders. Funding is also available from the Envirofund.

3.2 WEEDS

Weeds were rated as the number two priority in the stakeholder survey of the Annan and Endeavour Catchment.

Plants become weeds when they are introduced to an area outside their normal range and then spread because their natural predators and other regulators are not present.

Of the many weeds in the Catchment, only a few are regarded as significant pests. Determining the priority weeds can be a complicated process and sometimes a formula is used to incorporate all factors that might make a weed a priority. The factors used for prioritising weed species include declaration status, strategic importance, detrimental effects, operational feasibility (social, financial, technical) and how achievable the weed is to control (CYWAFAP, 2006b).

Weeds are controlled to maintain tourism/recreational values, agricultural values, pastoral values, cropping/horticultural values, nature conservation values, Aboriginal cultural values, forestry values, mining values and residential values (CYWAFAP, 2006b).

For the purposes of this report, fifteen weeds have been identified by the CYWAFAP Pest Management Officer Russell Graham as a priority in the Catchment (Figure 1). Until the priority weeds for the Catchment are identified the ratings for priority, achievability and threat will be derived from the Cook Shire Council Pest Management Plan (2006b). The SCYC may wish to prioritise weeds for planning purposes at some point in the future.

Pond apple, Lantana and Hymenachne are three of the twenty Weeds of National Significance (WONS) which are present in the Catchment .

Figure 3.21 PRIORITY WEEDS OF THE ANNAN AND ENDEAVOUR CATCHMENTS

Common Name	Scientific Name	Threat	Achievability	Declaration Category	WONS	Priority
Bauhinia	*Bauhinia monandra*	3	2	-		Medium
Cats Claw Creeper	*Macfadyena unguis-cati*	2	1	Class 3		High
Elephant Creeper*	*Argyreia nervosa*			-		
Gamba Grass	*Andropogon gayanus*	2	1	-		High
Giant Sensitive Plant	*Mimosa diplotricha*	1	3	Class 2		High
Hymenachne	*Hymenachne amplexicaulis*	1	1	Class 2	YES	High
Lantana	*Lantana sp.*	3	3	Class 3	YES	High
Leucaena	*Leucaena leucocephala*	1	3	Code of practice		High
Mother-in-law's tongue**	*Sansevieria trifasciata*	3	2	-		Medium
Mother of Millions	*Bryophyllum sp.*	2	2	Class 2		High
Pond Apple	*Annona glabra*	1	2	Class 2	YES	High
Sicklepod	*Senna obtusifolia*	1	2	Class2		High
*Sensitive Weed**	*Mimosa pudica*					
*Singapore Daisy**	*Sphagneticola trilobata*			3		
Thunbergia	*Thunbergia grandiflora*	2	2	Class 2		High

*Not classed as a pest plant in CYWAFAP (2006b). Listed as having potential if they become established or increase in extent
** Added to list by the Annan and Endeavour Catchments Management Group
Declaration Category -Declaration Class definitions in Appendix C
Threat – to Natural areas, Urban Areas, Agricultural Areas. 1= High, 2=Moderate, 3=Low, 4=No threat
Priority – for future action
Achievability of control – 1=Could be eradicated from Catchment area, 2=Could be significantly reduced, 3= Could be contained, 4=Could be managed indirectly with biological control agents or fire
WONS –Weed of National Significance

A comprehensive database of weeds on Cape York Peninsula is currently being compiled by the Cape York Weeds and Feral Animals Program. The location of all known weeds is being recorded using a GPS and used for research purposes or to determine the effectiveness of control programs. At present, most weeds have been recorded along roadsides and more data is required from all tenures including freehold property and Indigenous Shires. These records are also incorporated into Geographical Information Systems (GIS) and used to create distribution maps and predict the potential spread of weeds.

Weed invasion is often associated with disturbances to ecosystems such as clearing, fire, floods and grazing. Land disturbance, combined with the constant introduction of potential weeds by vehicles, dumping of garden waste, fodder, seed supplies, wind, water and wildlife all contribute to weed establishment (CYWAFAP, 2006b). The source of introduction and reason for the disturbances could be investigated as part of a weed species management plan to prevent continued establishment.

In riverine situations, it is important to coordinate eradication programs with stakeholders to undertake control work from the most upstream outbreak towards downstream outbreaks to avoid continued reestablishment from weeds being washed downstream.

3.21 PRIORITY WEED SPECIES FOR CONTROL

Sicklepod (*Senna obtusifolia*)

Figure 3.22 Sicklepod in flower with seed pod. Photo CYWAFAP, 2000

Sicklepod is a vigorous and competitive shrub of pastures and crops, especially on high nutrient soils. It is common in overgrazed pastures and along rivers and floodplains (NRM _Sicklepod' Fact Sheet, 2004). The shrub grows to 1.5 metres to 2 metres tall. It only invades remnant areas after significant disturbance. A native of the Caribbean (Mitchell and Hardwick, 1995) it is believed to have been accidentally introduced from America. The seed is commonly spread by cattle and horses eating and transporting mature seed. It is also suspected that Sicklepod seed may be spread in hay.

Slashing will reduce mature plants to a manageable size but will not kill sicklepod. Blunt blades must be used to shatter the stems of the plant before flowering (March-May) and before the seed sets. If slashed too early sicklepod can flower and set seed. Regrowth should be sprayed. Once eradicated sicklepod should be replaced with a competitive pasture species such as *Brachiaria decumbens* or native vegetation. Any emerging

Figure 3.23 Sicklepod seedlings emerging from cow pad (top left) and Russell Graham eyes off a rampant Sicklepod infestation Photos CYWAFAP, 2000

seedlings should be spot sprayed. Herbicide spraying is recommended from early seedling stage until before flowering stage. Follow up maintenance is required for up to ten years while seed is viable in the soil. In conservation areas tree planting programs may control Sicklepod through shading (Mitchell and Hardwick, 1995).

A fungus (*Myrothecium verrucaria*) has been patented for Sicklepod biocontrol and was approved for biological control in 2003 (Van Driesche, et *al.*, 2002).

Sicklepod is throughout the Endeavour Valley and Annan Catchment including Shiptons Flats and Helenvale areas. QPWS has had good results in controlling an outbreak on the south side of the Annan River. The CYWAFAP annual control program has been underway on properties for the past 11 years and is proving successful. Properties are able to receive assistance with control through the CYWAFAP‘s incentive scheme.

Bauhinia/Pink Orchid Tree (*Bauhinia monandra*)

Figure 3.24 Bauhinia Photo by Top Tropicals

Native to Africa. Toxic to animals. Bauhinia is a common invader of disturbed forest (Space & Falanruw, 1999). The seed is spread by floods, birds and animals (Smith, 2002). Bauhinia is an example of a ‗slœper plant' which appear as minor weeds but can develop into major pests in the future (CRC, 2001). Current infestations are at Rossville, Wallaby Creek, Oakey Creek and along the Endeavour River. Control work is being done at Jensen's Crossing using the basal bark spraying technique and foliar spraying on seedlings. It is hoped once the infestation is controlled natural regeneration will replace dead plants.

Cat's Claw Creeper (*Macfadyena unguis-cati*)

Figure 3.25 Cat's Claw Creeper Photo University of Florida (2005)

Native to West Indies and South America cat's claw creeper was introduced to Australia as a garden plant. There are two ongoing control sites in gardens in Cooktown. These outbreaks are thought to have originated from a nursery (CYWAFAP, 2006b). Follow up work has just been completed and monitoring of both sites for seedlings is continuing.

Common Sensitive Plant (*Mimosa pudica)*

Figure 3.26 Common Sensitive Plant, Photo Kim Stephan (2007)

Native to Tropical America sensitive weed is widespread throughout the urban areas of the Catchment. It was introduced as a curiosity plant to gardens as the small leaflets close up when disturbed. It has since escaped and is now found in the wetter parts of the Catchment. Sensitive weed is a weed of disturbed areas. It competes with tropical crops and because of sharp prickles it is a nuisance in lawn areas. It can be sprayed before seeding with the appropriate chemical, but the sharp woody prickles remain long after the plant has died. Hand removal using a small crow bar, preferably before seeding can be effective for small areas, ensuring that the long roots are completely removed. The seeds are viable for many years.

Elephant Creeper (*Argyreia nervosa*)

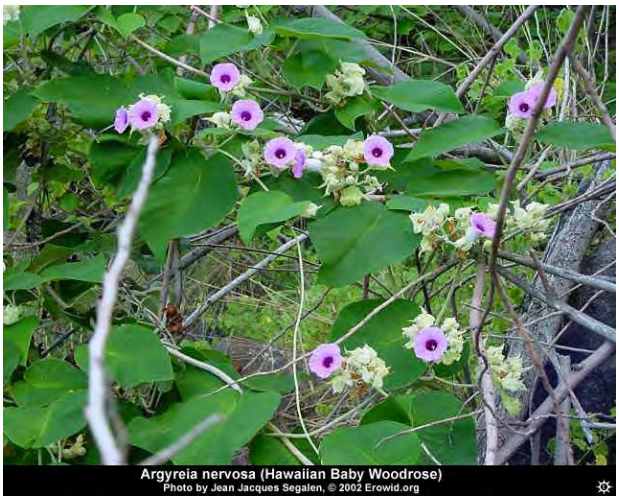


Figure 3.27 Elephant Creeper. Photo by Erowid, 2004

Native to Burma and India elephant creeper is commonly grown as an ornamental plant in home gardens. It is an aggressive invader of rainforest and other tropical forest communities. Although it is currently not declared its control is recommended (DNR, 2001). Elephant creeper is scattered throughout the Catchment, especially in towns. Control work is done when it is located.

Gamba Grass (*Andropogon gayanus*)

Figure 3.28 Stems and leaves of gamba grass. Photo J. Clarkson, EPA

Native to Africa, Gamba grass was introduced into northern Australia in the 1930‘s as a pasture grass, and is highly valued by the pastoral industry as fodder for cattle. This introduced tall cane like grass grows in clumps and is now established outside pastoral areas. It can grow up to 5m. The high fire intensities generated by Gamba grass pose a threat not only to biodiversity and ecological function, but also to human life and property (Whelan et. al., 2006). Furthermore, Gamba grass rapidly re-sprouts following fire and can attain sufficient biomass to support another fire within the same dry season (DNR, 2005).

In the Endeavour Catchment it is present on roadsides including Poison Creek Road and Endeavour Valley Road (DNR, 2005). An infestation at Keating‘s Lagoon Conservation Park has been controlled by QPWS and is occasionally checked for regrowth. It is observed as an occasional weed elsewhere in the Catchment. There is a push from some sectors to have Gamba grass declared. Graziers praise the benefits of Gamba grass for fattening cattle and report that it only becomes a weed when not well managed. Control work is occurring along roadsides. A public education program is needed as it has the potential to become one of the Catchment‘s worst weeds (pers. comm., Russell Graham, 2005).

Giant Sensitive Plant (*Mimosa diplotricha*)

Figure 3.29 Giant Sensitive Plant Photo CYWAFAP

Native to Brazil and incredibly thorny this plant is a close relative of common sensitive weed. It can choke out cane, other crops and grassland (DNR, 2006). Seeds are transported by running water, vehicles, stock, and contaminated earth. Vehicles passing through giant sensitive plant areas should be washed down before moving on to another area (DNR, 2006). The best form of weed control is prevention (DNR, 2006). Treat infestations when small; do not allow weeds to establish. Introduced psyllids (insects) can control giant sensitive plants in north Queensland in non-crop areas (DNR, 2006). In the Catchment it is found in the Annan River National Park, and Esk Valley Rd. Control work is currently being undertaken by CYWAFAP and QPWS staff. This plant is very difficult to eradicate once established as the seed can survive in the soil for fifty years.

Hymenachne (*Hymenachne amplexicaulis)*

Figure 3.210 Hymenachne Photo Courtesy CYWAFAP

Hymenachne was introduced into Australia from South America to provide ponded pasture for cattle. It has become an aggressive weed of stream banks, wetlands, and irrigation channels. Hymenachne grows from seed and broken stem fragments. Two main vectors for seed dispersal are water movement and migratory aquatic birds. Broken stem fragments washed downstream can lead to the rapid establishment of Hymenachne into new locations (DNRW, 2006). As it grows in waterways sensitive control is required when using herbicides.

Patches of Hymenachne are found along both the Annan and Endeavour Rivers and Keating‘s Lagoon. It has the potential to destroy several wetlands in the valley especially seasonal Melaleuca swamps, farm dams and natural lagoons. QPWS is controlling an outbreak on the south side of the Annan River and is monitoring natural freshwater lagoons in the Annan River National Park. Three years of funding through the Defeating the Weed Menace Program is driving the current control program that plans to eradicate this weed from this Catchment.

The spread of Hymenachne can be prevented by monitoring downstream of known infestations after flood events. Maintaining riparian vegetation on riverbanks will provide competition and shade out Hymenachne (DNRW, 2006).

Lantana (*Lantana sp*)

Figure 3.211 Lantana Photo by CYWAFAP

Originating from Brazil lantana is the world‘s most widespread tropical woody weed. It was introduced as an ornamental garden plant. It is poisonous to stock and is a common weed of rainforest margins. Lantana mostly invades disturbed areas and is commonly spreads by birds ingesting and dispersing the seed. It rarely penetrates into healthy undisturbed forest. Lantana can provide habitat for small native bird species such as wrens, finches and silvereyes and protect seedling native species underneath from grazing. Smaller plants can be pulled by hand. Larger plants can be cut to flat stumps and painted with Glyphosate. Always work from the lightest area towards the densest. Plants can be cut and painted and left in place as habitat. Once cut stems are painted with full strength Glyphosate lantana rarely regenerates. The use of fire as part of a management program is recommended for dense infestations, but follow up for a few years after is essential (DNRW, 2006).

Lantana is scattered throughout the Catchment. No control programs are currently in place.

Leucaena *(Leucaena leucocephala)*

Figure 3.212 *Leucaena. Photo DNRW, 2006*

A native of Central America, Leucaena has been planted as a fodder crop. Established stands can form dense thickets, hindering the movement of wildlife and excluding all other plants (DNRW, 2006). It invades disturbed areas and riverbanks. Leucaena is out of control in the Cooktown area (pers. comm., Russell Graham, 2007). Small individual plants may be manually removed, taking care to remove the roots to avoid regrowth.

Mother-in-law tongue (*Sansevieria trifasciata*)

Figure 3.213 Mother in law's tongue Alligator Creek infestation, before and after control with "Brushoff"

Native to Tropical Africa. A long lived fleshy plant growing to 1m high. It was introduced and is still sold as an ornamental plant. It has become a serious bushland weed in Queensland as it prevents the regeneration of native plants.

There is an infestation at Alligator Creek and on the Cooktown Esplanade. It is also throughout gardens in the Catchment. Escaped fragments from specimens in the Cooktown Botanic Gardens upstream are thought to be the source of the Alligator Creek infestation, which is located downstream. The Annan Endeavour Catchment Management Group has been working to control the infestation over a number of years using a variety of techniques. Plants were dug out ensuring the root system was entirely removed. Dense infestations have been removed with a mini bulldozer. Six months ago, the bulk of the infestation was sprayed with _Brushoff', which has resulted in mass leaf drop and apparent death of plants. Time will tell if these plants are dead or if they will regenerate from underground roots. If the herbicide proves successful the remaining plants should be treated. Ongoing maintenance to control regrowth for a few years after is essential. Control and maintenance should continue from the most upstream population and work downstream to prevent the species reestablishing. The source from the Botanic Gardens has been removed but will require ongoing control to eradicate all propagules.

Mother of Millions (*Bryophyllum* sp.)

Mother of millions is an escaped ornamental plant from Madagascar. It is highly toxic to stock, especially the flowers and because of it succulent nature adapts well to dry areas (DNRW, 2006). All species produce small plantlets along the edges of leaves. These plantlets drop readily, develop roots, and establish quickly to form a new colony (DNRW, 2006). Small populations can be removed by hand and trowel and placed into a bag, ensuring to collect all small plantlets. This species can establish into healthy undisturbed bush. There is a population of mother of millions on the Cooktown waterfront area that is described as controllable. No work has been done to date (pers.comm. Russell Graham, 2007).

Figure 3.214 Mother of Millions Photo DNRW (2006)

Pond Apple (*Annona glabra)*

Figure 3.215 Pond Apple. Photo Ian Holloway, QPWS and the fruit photo Stephen Setter, DNRW

A native of West Africa and Tropical America. Pond apple was introduced to Australia for horticultural development of a rootstock for custard apple. Pond apple is an extremely serious pest. Listed as a Weed of National Significance (WONS) it is regarded as one of Australia‘s worst weeds because of it‘s invasiveness, potential for spread, and economic and environmental impacts (CRC, 2003). It invades wetlands, swamps, mangroves or any wet areas such as creeks. Pond apple can form dense thickets preventing the regeneration of native species. The fruit and seed float and can remain viable for some time in fresh, brackish or sea water, permitting dispersal to remote locations along the coastline. Unlike many weeds pond apple has the ability to invade relatively undisturbed areas. Seeds are also dispersed by pigs (CRC, 2003). It is also a pioneering plant and will opportunistically invade after cyclones and floods. It is a major environmental weed of the Wet Tropics (DNRW, 2006).

Isolated outbreaks should be treated immediately as it can produce seed from two years of age. Stem injection or ‗drill and fill‘ is the preferred method for treating pond apple in aquatic habitats because it minimises herbicidal run off and impacts on non-target species. Three years of funding has been received by CYWAFAP to undertake control work between Walker Bay and Cape Bedford. Escaped seeds from a former specimen in the Cooktown Botanic Gardens are considered the source for the Alligator Creek infestation, which was located downstream. The dense thickets at Alligator Creek and behind the council depot in Cooktown have been eradicated or dramatically reduced by CYWAFAP, QPWS and the Annan Endeavour Catchment Management Group. Small seedlings are still being removed by hand at Alligator Creek. The main source at the Cooktown Botanic Gardens has been removed.

Figure 3.216 Pond Apple Photo CYWAFAP, 2000

Singapore Daisy (*Sphagneticola trilobata*)

Singapore daisy is a vigorous spreading creeper that is native to Central America. It is often introduced into gardens as a soil stabiliser or ground cover. It competes successfully with native vegetation and colonises creek banks and disturbed areas. Singapore daisy spreads rapidly and smothers seedlings, ferns and shrubs and will out-compete them for survival. It is very difficult to control (DNRW, 2006).

Singapore Daisy is a declared Class 3 plant of Queensland. This act prohibits the supply or sale of Class 3 plants and may require their removal from environmentally significant areas.

Singapore daisy produces variable amounts of seed, but is mainly spread by cuttings via slashing, mowing and pruning (DNRW, 2006). Hand pull and dig up runners, disposing of waste carefully as the smallest cutting can regrow. Place in a black plastic bag and leave in the sun a few days before putting in the bin (DNRW, 2006). Alternatively Singapore Daisy can be sprayed with a registered herbicide such as Brushoff.

Figure 3.217 Singapore Daisy Photo Kim Stephan

Singapore daisy is an environmental weed throughout wetland areas of the Annan and Endeavour Catchment, particularly roadsides, urban areas, including Rossville and parts of the Endeavour River and Wallaby Creek.

Thunbergia (*Thunbergia grandiflora*)

Figure 3.218 Thunbergia infestation Photo (DNRW, 2007)

Native to India and Malaysia (CRC, 2003). Thunbergia was introduced to Australia as a garden ornamental. Thunbergia is an aggressive vine with sky-blue tubular flowers. It climbs and smothers native vegetation, killing understorey and large trees that fall to the ground collecting other trees as they fall (CRC, 2003). Control is difficult underground tubers can weigh up to 70kg. On large vine infestation the stems can be collected in a cluster and cut and painted with glyphosate. Once severed from the roots the foliage dies and the vines can be traced back to the tubers which are usually in the top layer of the soil. The tubers can then be injected with herbicide (CRC, 2003).

Thunbergia species are a major threat to the vegetation in the Wet Tropics, especially vine thickets (DNRW, 2007). Annual control work in the Cooktown town area is keeping Thunbergia under control (pers.comm. Russell Graham, 2007).

Other weeds

Some other weed species have the potential to become major pests in the Annan and Endeavour Catchment. *Praxelis clematidea* is in both the Annan and Endeavour Catchments including the Cook Shire Council quarry in the Upper Endeavour, indicating spread by earth moving machinery. This quarry drains into the Endeavour Catchment. *Praxelis* has also been observed at the Telstra tower (Mt Leswell) and Cooktown Airport. Another infestation in gardens arose from using mulch brought in from outside the Shire.

Parthenium hysterophorus has occurred previously in Cooktown at Trevethan Station as a result of chicken food contamination. It has been eradicated but required vigilance to control further outbreaks.

The purple plague (*Miconia calvescens*) is an aggressive invader of the Wet Tropics.

Some weeds such as grader grass (*Themeda quadrivalvis*) are a nuisance to graziers. However Grader grass is so widespread across the Catchment that it is not cost effective to control.

Weed controllers

Cape York Weeds and Feral Animals Program (CYWAFAP) are an NHT funded weed management program for the whole of Cape York Peninsula. They undertake the majority of the weed control work in

the Catchment and can be contacted on Ph 40695020 regarding incentives for weed control or in the case of suspected new weed outbreaks.

QPWS control weeds in National Park. They work in conjunction with CYWAFAP where the outbreak of weeds overlaps onto National Park. They are actively working in the Annan River National Park on the southern side of the Annan River. The priority weeds for Cooktown QPWS are giant sensitive plant, *Hymenachne,* sicklepod and gamba grass. QPWS frequently monitor wetlands for weed outbreaks and appreciate calls from the public reporting new weed outbreaks in National Parks. They can be contacted on Ph 40695777.

Cook Shire Council Parks and Garden staff regularly sprays weeds in drains to prevent flooding and undertake weed control at the Cooktown Botanic Gardens and urban areas when required. The main weeds controlled are Guinea grass, purple snake weed, *Sida* sp., *Leucaena*, Sicklepod, **Cassia** sp and *Hyptis suaveolens*.

Landholders and the public have an important role to play in reporting weed outbreaks, weed control and weed eradication.

The recommended actions for Weeds can be found in Section 4. Acceptance of and commitment to these recommended actions should occur after consultation with the relevant stakeholders.

3.3 WATER QUALITY & QUANTITY

3.31 BACKGROUND

Water Quality has been identified as a high priority issue for the Annan-Endeavour Catchment area. The maintenance of water quality and quantity are critical to local industries including commercial & recreational fishing, agriculture and cattle stockwatering, as well as to the supply of clean drinking water and the protection of biodiversity and aquatic habitat.

In general, the Annan & Endeavour Rivers are believed to have good water quality due to the relatively small population, comparatively little industry and low levels of infrastructure. The Queensland river condition workshop rated the Endeavour and Annan Rivers highly, with good water quality and river/floodplain ecology. Both rivers were classed in the top 50 waterways in the State (Eberhardt 2006). Maintenance of this high standard of water quality is a major priority for the local communities and is critical to the sustainable growth of the area.

The Endeavour River Catchment has been subject to a larger degree of development than the Annan, including urban development at Cooktown and Hope Vale, small scale agriculture and cattle grazing. Extensive mining and cattle grazing has also occurred within the Annan River Catchment area. The small communities of Rossville and Helenvale are located along the Annan River Catchment.

A high level reservoir on the Annan River is used for the town water supply for Cooktown. Rossville residents obtain their water supplies from Wallaby Creek on the Annan River. Hope Vale residents obtain water from a reservoir at Firebridge Hill on the Endeavour River North Branch.

Maintenance of good water quality and quantity is necessary for the preservation of aquatic ecosystems in the river, estuaries and the Great Barrier Reef lagoon. Extensive coastal and estuary seagrass meadows support local commercial and recreational fisheries and provide food for marine turtles and dugongs. Both seagrass meadows and coral reefs can be affected by changes in water quality, particularly increases in turbidity and nutrient levels. While seagrass meadows in the area appear to be healthy and diverse, there are anecdotal reports that in-shore coral reefs have declined over the past 15 years.

Groundwater accounts for the majority of water entering the Annan & Endeavour Rivers during the dry season. It is important to ensure that groundwater within the Catchment is also protected from contamination or over-extraction.

Key priorities related to the maintenance of Catchment water quality & quantity are:

- Maintenance of high quality drinking water;
- Maintenance of water quality and quantity for the preservation of aquatic ecosystems in the river, estuary and Great Barrier Reef lagoon; and
- Improved knowledge and public information regarding local water quality.

3.32 POTENTIAL WATER QUALITY IMPACTS & COMMUNITY CONCERNS

The results from a 2005 SCYC survey of local stakeholders showed that 38% of respondents had a high level of concern regarding water quality in the Catchment area, while 33% had a medium level of concern. Community consultations have identified a number of specific concerns, including the following:

- Sewerage, Rubbish, & Oil Spills from boats
- Oil & fuel run-off from land based pollution
- Erosion & siltation from cleared land & dirt roads
- Sewerage outfalls into river
- Run-off from Cooktown & Rossville rubbish tips
- Pollution from cattle manure entering waterways
- Feral Pigs
- Tourism Impacts
- Mining Impacts
- Feral Pigs in waterways
- Acid Sulphate Soils
- Fertiliser and other agricultural chemical run-off from farms
- Rotting vegetation & rubbish from roads washed into the waterways
- Ash from fires

Management Issues Related to Water Quality

The following is a discussion of some of the threats to water quality in the Annan-Endeavour Catchment Area.

Erosion: Significantly accelerated rates of erosion associated with dirt roads, subdivisions and other earthworks have led to increased levels of turbidity and sedimentation in adjacent waterways. Long-term Cooktown residents have observed decreasing water clarity at the mouth of the Endeavour River, which may be associated with accelerated rates of erosion. Increased sediment loads at the mouths of rivers can smother aquatic ecosystems such as seagrasses and corals.

Cook Shire Council has recently implemented new erosion-mitigation requirements for developments within the Shire. Previous efforts to minimize erosion around development sites have been largely ineffective or non-existent. The clearing of trees from entire subdivisions continues to occur despite the passing of a strict Qld Vegetation Management Act (*Vegetation Management and Other Legislation Amendment Act 2004).* Sediment run-off and gully formation is evident around many recent developments and dirt roads.

Figure 3.30 Sediment run-off from an Endeavour River waterfront construction site

Sewage: Sewerage treatment plants (STP) in Cooktown and Hope Vale release treated sewerage effluent into the Endeavour River. The Cooktown sewerage treatment system has recently been upgraded to the highest level of treatment and expanded to cover the majority of Cooktown. Since many of the previous domestic septic systems were located in flood prone areas, this should reduce the amount of un-treated sewage run-off entering the Endeavour River and Alligator Creek. However, it also means that a greater volume of treated effluent is being released at the STP outfall near the mouth of the Endeavour River. While the level of treatment is an improvement, treated effluent contains nutrients and may affect water quality and aquatic ecosystems around outfalls.

Low level sewerage treatment occurs at Hope Vale before treated effluent is released into the North Arm of the Endeavour River. Untreated sewerage has been released into the river at times when the pumps have shut down. Bacteria and diseases from insufficiently treated sewage can impact drinking water supplies, fish and other aquatic biota.

A number of residences outside of the range of the STPs remain on independent septic systems. Members of the community have expressed concerns over potential leaching from septic systems and public toilets located along the Annan River, particularly at hotels and popular camping grounds.

Rubbish Tips: Rubbish tips in Cooktown, Hope Vale and Rossville lack proper lining or leachate collection systems and therefore may contaminate groundwater and adjacent surface waters. Poorly located and maintained dumps also allow garbage to be washed or blown into waterways. Although the Rossville tip is now closed, and management of the Cooktown tip has improved, leachates from buried waste at both sites may drain off into creeks that feed the Endeavour and Annan Rivers.

Acid Sulphate Soils
Disturbance of acid-sulphate soils can result in the release of harmful acids and toxic metals into waterways. The presence of acid sulphate soils in the Annan & Endeavour Catchment area must be taken into consideration for development planning.

Feral pigs & cattle: Feral pigs are responsible for the widespread degradation of wetlands and riparian zones, and may represent the greatest threat to water quality in the Catchment area due to the extent of their activity. Pigs congregate near most water sources throughout the Annan & Endeavour Catchment area. The faeces and sediment they stir up directly impacts upon the water quality in river and wetland areas. Their activity destroys native vegetation, increases turbidity in adjacent waterways and may result in bacterial contamination.

There have been reports of feral pigs disturbing acid sulfate soils along the Endeavour River and at Keatings Lagoon in the Annan Catchment. One water test from an area of feral pig diggings at Keatings Lagoon revealed a pH of 2, which is highly acidic and lethal to most aquatic species.

Cattle Grazing/ Agriculture: Tree clearing for cattle grazing or other agricultural land use can lead to increased erosion and sedimentation in rivers. Where cattle have access to waterways they can cause further erosion by trampling, compacting and stirring up river banks and beds. Bacterial contamination can occur from cattle defecation on the banks and within water courses. Cattle density in the Catchment area is low and cattle have not been identified as a major threat to water quality. However, there may be locations where fencing of rivers and the provision of off-stream watering points is required.

Agriculture accounts for only a small percentage of land-use within the Annan-Endeavour Catchment and is mostly located around the Endeavour Valley. Community members have expressed some concern about the potential impact of agricultural chemicals on local water quality. Fertilisers, pesticides, herbicides and silt can be transported via groundwater and surface water runoff into local streams, where they may impact upon aquatic ecosystems. Although there is no evidence of surface water contamination from agricultural chemicals, little monitoring has been conducted.

Mining: Extensive historical mining for tin has occurred in the Annan River Catchment. Due to the widespread soil disturbance and the occurrence of alluvial (in-stream) mining operations, it is likely that this has had a significant impact on water quality in the past. The extent of this impact is unknown, and any on-going impacts resulting from the disturbance have not been identified. However, several unused dams previously used for mining operations in the upper Annan Catchment appear to have poor water quality and may require further assessment.

Tin mining has recently resumed at the Collingwood Mine in the Annan River Catchment area. Local residents have expressed concern over the extraction of groundwater from below surface tunnels, which may reduce freshwater flows at connected springs. Oil spills, soil erosion and the discharge of sediment laden waters are the primary water quality concerns at the mine. Increased turbidity levels have been observed downstream from the mine after heavy rains. Erosion mitigation works have been completed at the mine in order to reduce this impact.

Tourism/ Recreation: Public consultation has identified a number of areas where tourism and camping may be impacting upon water quality. Soil erosion along dirt roads, rubbish and bacterial contamination can impact water quality in areas of heavy tourist or recreational use. Tourist numbers are increasing and in some locations there is inadequate infrastructure to accommodate this increase.

Over 15 sites have been identified by the SCYC where improvements such as designated camping areas, (effluent-free) toilets or rubbish bins may be required. These sites include:

- Shipton's Flat road - Twin Bridges
- Little Annan (Rocky Annan) pull-off and composting toilet (Mulligan H'way).
- Uncontrolled camping areas between Parrott Creek and Bloomfield Road.
- Gampe Drive
- Mt Amos & Trevathan Creek
- Archer Point – rubbish everywhere
- Camping and windy loo at Yuku Baja Big Annan Bridge
- Home Rule Resort – Wallaby Creek Festival
- Moses Creek locally known as "Toilet Creek"
- Jensen's Crossing
- Isabella Falls

Fire: Fires (especially wild fires) can have a significant effect on Catchment areas by removing ground cover and reducing soil moisture content. This can significantly increase soil detachment rates and the sediment yield into water courses. Intense wild fires can also destroy water course riparian zones and reduce stream bank stability (Horn, 1995). Specific impacts from fire on water quality in the Annan Endeavour Catchment area have not been documented.

Other: Additional potential impacts upon water quality that have been identified during community consultations include the following:

- Vehicles being washed off the Annan River Causeway and never being recovered, and a major fuel carrier spill in this location in 2003.
- Cars washed down from properties near Wallaby Ck and off Wallaby Ck bridge.
- Abandoned Prawn Farm at Annan River estuary
- An old car dump at Crooked Ck, *Rossville.*
- Gravel pit near Palm Gully

3.33 WATER QUALITY MONITORING & RESEARCH

Monitoring of water quality and water quantity in the Annan and Endeavour Rivers is conducted by a number of groups including:

- Cape York Marine Advisory Group (CYMAG): monthly- ambient water quality
- Qld Dept of Natural Resources (NRMW): stream flow and irregular water quality
- Cook Shire Council (CSC): Monthly water quality monitoring 1 km upstream from sewerage effluent outfall at Endeavour River
- GBRMPA: Chlorophyll-a at Endeavour River mouth

Qld Department of Natural Resources Mines & Water: NRMW currently collects surface water flow data at 2 gauging stations in the Annan-Endeavour Catchments. These are located at Beesbike in the upper Annan Catchment area (monitored since 1990), and Flaggy Creek on the Endeavour River (monitored since 1958). Some water quality data is also collected on an irregular basis from the Annan River Beesbike site. Water quality sampling at this site generally includes conductivity, pH, dissolved ions and nutrients. The current NRMW water gauging network is substantially reduced from previous activities, which included water gauging stations along the Annan River at Mt Simon, and along the Endeavour River at Hazelmere and Jensen's Crossing. The data collected from these sites is available to the public on the NRMW website (www.nrm.QLD.gov.au/watershed/html/wshed.html).

Very limited interpretation and reporting of the NRMW water quality data has been undertaken. However, Grinter & Hunter (2005) analysed water quality data collected by NRMW from the Beesbike location in 2003-2004 and reported that:
"The Annan River was found to have good condition ratings, consistent with ecological health determined by Wet Tropic guideline values, for electrical conductivity, total nitrogen, total phosphorous and turbidity" (Eberhardt 2006).

CYMAG: Monthly monitoring of water quality in the Annan & Endeavour River estuaries & Catchment area has been conducted since 2002 by CYMAG and the SCYC. The CYMAG project has helped to establish baseline water quality parameters for the Annan & Endeavour Rivers. Monthly parameters monitored include temperature, oxygen, salinity, conductivity, pH, turbidity, total and dissolved nutrients, and chlorophyll-a.

One-time water and sediment sampling was conducted in 2004 by CYMAG for hydrocarbons, pesticides, and metals. Metal and nutrient levels at several sites slightly exceeded the water quality guidelines for tropical rivers; however these guidelines may not be relevant to Cape York Peninsula. Elevated metals concentrations in sediments in the vicinity of Coast Guard slipway may have resulted from boat maintenance conducted at this site and or from town stormwater runoff. Low concentrations (70 – 80 µg/L) of petroleum hydrocarbons were detected in the Annan & Endeavour Rivers. (CYMAG WQ Database, 2007). On-going monitoring for contaminants, including bacteria, is planned for 2008.

Although an in-depth assessment of the CYMAG water quality data has not been conducted, the nutrient data has been summarised in the table below. Additional CYMAG water quality monitoring results are summarised in Appendix F.

Figure 3.31 Annan & Endeavour River Mean Nutrient Concentrations
November 2004 – June 2006
CYMAG Water Quality Data

Sample Location	No. of Samples	Total Phosphorus	Filt Reac Phosphorus	Ammonia Nitrogen	Nitrogen Oxides	Total Nitrogen
		mg/L as P	mg/L as P	mg/L as N	mg/L as N	mg/L as N
ANZECC Water Quality Guidelines* Tropical Estuary		**0.02**	**0.005**	**0.015**	**0.03**	**0.25**
ER-01-Endeavour Mouth	12	0.012	0.002	0.008	0.008	0.155
ER-02-Endeavour at 2 Mile Creek	12	0.011	0.001	0.010	0.009	0.180
ER-03-Endeavour at 4 Mile Creek	12	0.012	0.001	0.013	0.015	0.221
ER-04-Endeavour River North Arm	12	0.016	0.001	**0.018**	**0.036**	**0.303**
ER-05-Endeavour River Main Arm, upstream from North Arm confluence	12	0.014	0.001	**0.017**	**0.035**	**0.261**
AR-01-Annan River Bridge	12	0.012	0.002	0.009	0.024	0.146
ANZECC Guidelines Tropical Freshwater Lowland		**0.01**	**0.004**	**0.01**	**0.01**	**0.2 - 0.3**
AR-02- Little Annan Bridge	10	0.013	0.002	0.004	**0.029**	0.144
AR-03-Annan River at Leswelll	12	0.014	0.002	0.004	**0.039**	0.193
AR-04-Wallaby Creek (Rossville)	10	0.009	0.002	0.003	0.006	0.083

Regional water quality guidelines have not been developed for Cape York. The Qld EPA advises utilising the default ANZECC 2000 water quality guidelines for these rivers**.**

CSC: Cook Shire Council monitors water quality on a monthly basis approximately 1 km upstream from the sewerage treatment plant outfall near the mouth of the Endeavour River. The following data, collected between 1998 and 2005 was supplied to the SCYC.

Cook Shire Council Sampling Program Water Quality Results, 1998 – 2005 Site: Endeavour River (1 km upstream from STP outfall) (Table Prepared by SCYC)							
Units	**Analysis**	**Number of samples**	**Number of samples above guidelines***	**% of samples above guide-lines**	**Minimum**	**Maximum**	**Mean**
mg/l O2	Dissolved Oxygen	55	8	15	5.7	9.5	7.4
mg/L	Oil and Grease	52			0.5	48	3
mg/L/N	Ammonia	55	55	100	0.025	1	0.144
mg/L	BOD	53			0.25	3	0.70
us/cm	Conductivity	52	0	0	3500	56000	44567
	pH	55	0	0	6.9	8.3	8.0
mg/L/N	TN	55	5	9	0.05	0.6	0.182
mg/L/P	TTP	55	1	2	0.01	0.27	0.028
NTU	Turbidity	51	3	6	0.6	56	4.6

Figure 3.32 Results were compared against the Qld Water Quality Guidelines for the Wet Tropics

The above listed ammonia and dissolved oxygen concentrations fall outside of the recommended guidelines for water quality. Bacteria samples are also collected by CSC, however the data was not available at the time this report was prepared.

CSC has also planned groundwater monitoring in the vicinity of the Cooktown tip for 2007. Monitoring of leachates from the tip will allow Council to assess potential threats to water quality in the Endeavour River.

GBRMPA: The Great Barrier Reef Marine Park Authority is monitoring ambient chlorophyll-a concentrations at the Cooktown wharf as part of the Reef Water Quality Protection Plan. The monitoring began in 2006 and no data is available as yet.

Water Quality Research

Hart et al, (1988) published material on the Annan River that reported variations in water quality during a major flood event on the Annan River. That study was undertaken as part of the feasibility studies for the Collingwood Mine, which discharges during the intense wet season (Eberhardt Consulting, 2005). The results of the report indicated that during flood conditions, river water quality was influenced predominantly by surface water run-off and the flushing of ions from surface soils. At low river flow, water quality was dominated by groundwater flow into the river systems. Heavy metals were mostly transported in particulate forms (Fe 99%; Mn 95%; Pb, Zn, Sn c. 80%; Cu c. 60%), while dissolved metal concentrations were low and changed little with flow.

Eyre & Davies (1996) conducted an assessment of suspended sediment and nutrient concentrations during the dry season (1994) and wet season (1995) at a number of locations in the upper Annan River Catchment area. They compared these results with data from more heavily modified north Queensland Catchments and from the more pristine Jardine River. They reported that particulate inorganic

phosphorous and dissolved nitrate concentrations showed a clear relationship to the level of disturbance in the different Catchments. The Annan River showed significantly higher suspended sediment levels than the Jardine, Daintree, or Moresby Rivers during the wet season.

Carbon and nutrient loads in the Endeavour River have been estimated using computer modelling programs as part of the commonwealth Government National Land & Water Resource Assessment. The results of this assessment are available on the NLWRA website (http://audit.ea.gov.au/ANRA/navigator/search_result.cfm#water).

Monitoring Results & Comparison with Water Quality Data Guidelines

There are no guidelines for water quality in rivers and estuaries in Cape York Peninsula. This means that when water samples are collected they must be compared against the federal guidelines for tropical water quality (which are based on samples collected in Western Australia) or the Queensland guidelines for water quality in the Wet Tropics.

Samples collected from the Annan & Endeavour estuaries have exceeded these guidelines for nutrient & metal concentrations and oxygen levels. In some cases this may be due to localised impacts on water quality, however, it is more likely to indicate a need for the development of more locally relevant water quality guidelines.

A significant amount of water quality data exists and continues to be collected from the Annan & Endeavour Rivers. However much of the data has not been thoroughly reviewed and the quality of historic data is unknown. A thorough assessment of all existing data is required to draw conclusions about long-term trends in water quality condition, and to establish local water quality benchmarks (regional guideline values).

Continued monitoring of water quality parameters, including bacteria and other contaminants, is required to assess some of the potential water quality impacts that have been listed in this report. Where specific impacts are identified through monitoring, actions can be taken to mitigate these impacts.

3.34 SURFACE WATER & GROUNDWATER QUANTITY & ALLOCATION

Surface Water Extraction

Public consultation identified water management as a high priority. Problems with water allocations, re-charge bores, landholders exceeding allotted water extraction, and unlicensed extraction were identified as issues on the Endeavour River.

The Department of Natural Resources Mines & Water (NRMW) water resource planning process is designed to plan for the allocation and sustainable management of water to meet Queensland's future water requirements. There is no water resource plan for the Endeavour Surface Water Management Area (this SWMA includes the Annan River).

All water diversion requires a license from the NRMW. The licensed water diversion volume for 1996 (more recent data was not available) is 1,945 ML. This includes 747 ML for pasture irrigation and stockwatering, 1,153 ML/yr for domestic water supply, and 9 ML/yr for industrial use. However, much of the water diversion within the Catchment area is not metered and therefore actual diversion volumes are unknown (NLWRA 2002).

According to the NLWRA, there are limited records of the actual quantity of water extracted from the Annan & Endeavour Rivers, and the sustainable yield from these rivers has not been assessed (NLWRA, 2002).

The Cook Shire Council (CSC) manages water extraction from the Annan River weir for the Cooktown water supply. According to the CSC, the Annan River water supply is currently an underutilised resource and the dam could provide enough water for a town much bigger than Cooktown. However, the output of the facility is limited by the ability of the filtration system to deal with the increased turbidity during the wet season. When the water becomes too turbid for the existing filters the town switches to bore water from the Duck Farm Ground Water Management Unit (GMU). An upgrade of the Annan water supply filtration system is currently being planned to reduce reliance on the bore fields during the wet season (Carroll 2006).

Groundwater Resources

Groundwater in the Catchment area falls under the Hodgkinson Unallocated Area (UA) and the Duck Farm GMU. The majority of groundwater within the Hodgkinson UA occurs in fractured igneous and metamorphic rock aquifers. Groundwater in the UA generally has low pumping rates suitable for stock and rural domestic supplies only. Rossville water supplies are extracted from the Hodgkinson UA (NLMRA).

Groundwater aquifers underlying Cooktown fall within the Duck Farm GMU. Groundwater in this GMU is extracted principally from fractured metamorphosed rocks of the Hodgkinson Formation. Groundwater is also present in Quaternary alluvium (river deposits) comprising grey silty clay, sand and gravel; however due to the presence of brackish water this source is not suitable for domestic use (NLRWA, 2002).

Recharge to the fractured rock aquifer results from direct infiltration of rainfall. Thus the sustainable yield for groundwater extraction will also depend upon rainfall amounts. No assessment of sustainable yield has been conducted for the groundwater resources of the Catchment area.

According to the NLWRA, groundwater allocation and extraction data is not complete for properties within the Catchment area. Estimated total water use for Duck Farm GMU is 28 ML/yr. Groundwater is utilised mostly for irrigation, stock and domestic supply (NLWRA, 2002). Groundwater extraction will be significantly reduced in the GMU after upgrades to the Annan River water supply filtration system are completed.

Cook Shire Council currently monitors groundwater quality and water levels in groundwater bores utilised for the town drinking water supply. A maximum allowable drawdown level has been set, and if this level is met groundwater extraction must cease until groundwater recharge occurs (NLWRA, 2000).

Environmental Flow Requirements

Environmental flows relate to the volume of water required in a waterway to maintain the normal functioning of natural ecosystems. There is little understanding of environmental flow requirements

within the Annan-Endeavour Catchment area or of the sustainable surface and groundwater extraction levels required to maintain downstream river and wetland health throughout the wet and dry seasons. Current groundwater and surface water use is assumed to be below the sustainable yield, however there are some concerns about water extraction in some locations (i.e. Barratt‘s Lagoon and Collingwood Mine) and the potential impacts of over-extraction on water quality and quantity.

3.35 CONCLUSION

Maintenance of good water quality and quantity is a high priority for residents of the Annan-Endeavour Catchment Area. Water quality in the Catchment is generally considered to be in good condition, however; potential threats to water quality have been identified and need to be addressed in order to maintain the current high standard.

Water quality impacts have been documented at Keating‘s Lagoon, where feral pig damage is extensive, downstream from the Collingwood tin mine, and in the vicinity of the Coast Guard slipway near the stormwater drain. Actions to address these specific issues may include on-going feral pig trapping at Keating‘s Lagoon, erosion mitigation works at the tin mine (underway), stormwater filtration devices and waste disposal and run-off control measures at the slipway and other waterfront service locations. Improved erosion mitigation works are required for road construction and other developments within the Catchment to minimise river siltation. Infrastructure such as composting toilets and rubbish bins are required to protect water quality at popular camping spots.

Continued monitoring of water quality, including bacteria and other contaminants, is necessary to assess the potential water quality impacts that have been listed in this report. The results of water monitoring should be made available to the public. Where specific impacts are identified through monitoring or direct observation, actions should be taken to mitigate these impacts.

There is currently little monitoring of groundwater or surface water use in the Catchment area and no assessment of sustainable yield environmental flow requirements. As population growth and other potential development occurs within the Catchment area, it will be necessary to evaluate the sustainable surface water and groundwater extraction levels and to ensure that environmental flow requirements are considered in water allocation.

3.4 BIODIVERSITY

The term biodiversity refers to the variety of all life forms on earth. It includes genes, micro-organisms, plants, animals, ecosystems and communities (Environment Australia, 2002). Maintaining biodiversity preserves life on earth and provides us with a source of clean air, clean water, food and medicine. Biodiversity contributes to economic and community values and assists environmental adaptation to new changes such as climate change.

The Annan and Endeavour Catchments are two separate systems that because of their relatively small size and proximity to each other are often grouped together. Together the Catchments form the Endeavour River Basin (NHT, 2001). The two Catchments are separated by the Dickson range and are not known to merge together when in flood. The Annan and Endeavour Catchments are different Catchments in terms of biodiversity. The Endeavour Catchment and the northern part of the Annan Catchment can generally be classified into the Cape York Peninsula Bioregion and the southern part of the Annan Catchment is in the Wet Tropics Bioregion (EPA, 2005).

Cape York Peninsula Bioregion

While not the most diverse bioregion in Queensland, Cape York Peninsula has a high degree of endemicity and is an area of interchange between Australia and New Guinea. Seventeen species of plants and animals occur nowhere else in Australia (NLWRA, 2007).

The Cape York Bioregion contains rainforests, woodlands, shrublands, heathlands, sedgelands, grasslands, and mangroves in a relatively intact condition. Ancient Gondwanian plant species have been recorded and the area is an important key to understanding the evolutionary development of Australian flora and fauna. Populations of threatened species in this area are declining. Recovery of the majority of the threatened species requires significant intervention (NLWRA, 2007).

Wet Tropics Bioregion

The southern part of the Annan Catchment contains the northern tip of the Wet Tropics Bioregion. This area is recognised as World Heritage Area (Wet Tropics Management Authority, 2006). The Wet Tropics contain the most complete and diverse living record of the major stages in the evolutionary history of land plants (from the very first plants to the higher plants) as well as one of the most important living records of the history of marsupials and songbirds (Keto and Scott, 1987). The biodiversity of the region resides in it complex interweaving habitats as diverse as rainforest, sclerophyll shrubland, sclerophyll woodland, tall sclerophyll forest, and melaleuca-dominated woodlands and swamp forests (Stanton et. al, 2004).

Figure 3.40 Wet tropics / Cape York bioregional boundary

3.41 THE ANNAN CATCHMENT

Figure 3.41. The rocky gorge of the Little Annan in flood.
Photo courtesy Cooktown Caravan Park

The Annan River originates in the Trevethan and Finlayson Range from the south side of Mt Finnegan and flows a distance of 65km in a northerly direction to the Coral Sea south of Cooktown (NHT, 2001). The Annan Catchment (750km^2) is smaller than the Endeavour, but on average carries a greater volume of water (NHT, 2001). The upper Catchment is extensively forested with rainforest and open sclerophyll woodland. The topography is often steep and the highest peak is Mt Finnigan at 1148m high (Ramsey and Cairns, 2004). The river gouges through rock to form canyons, waterfalls and pools (Figure 3.41). Further down it widens out into deep pools, rocky riffles and sandy banks lined with Sheoak and Bottlebrush trees. The tidal section of the river is fringed with mangrove and Melaleuca vegetation communities.

A water supply dam is situated on the Annan River and supplies Cooktown with most of its town water. This dam is described as the only significant harnessing of rivers on Cape York Peninsula (EPA, 2001).

3.42 THE ENDEAVOUR CATCHMENT

The Endeavour River originates in the Henderson Range and the dunefields of Cape Bedford. It flows in an easterly direction to the Coral Sea north of Cooktown. Most of the river is tidal. Upstream the river divides, the water freshens, and the vegetation thickens into riparian rainforest (Figure 3.42) with lagoons and wetlands.

Figure 3.42 North Arm of the Endeavour River. Photo courtesy _Gone Fishing‘

The mangrove forest on the river‘s edge forms a significant vegetation component of the Endeavour River National Park (Figure 3.43). Twenty five species of mangroves have been recorded on the Endeavour (Bunt et.al, 1991).

Figure 3.43 The Endeavour River and Cooktown. Photo courtesy Heidi Blanch

The highest point in the Catchment is Mt Cook at 431m. In 1980 the Endeavour River National Park was registered on the National Estate as a type locality for more than 20 species of flowering plants (DEH, 2007c). Most of these type localities were botanical specimens collected by Joseph Banks and Daniel Solander 237 years ago. The Endeavour River National Park remains the most intact location where Banks and Solander collected their specimens. Banks and Solander collected 186 species of plants from the Endeavour Valley out to Elim beach and 300 in total form the Catchment.

3.43 VEGETATION COMMUNITIES IN THE ANNAN AND ENDEAVOUR CATCHMENTS

Vegetation types are largely related to geological types and rainfall (Morgan, 1984). The EPA has comprehensively classified and mapped all vegetation communities in the Catchments into regional ecosystems (REs). A wide variety of vegetation types are found within the area. The six major vegetation groups are Eucalyptus woodland, rainforest, Melaleuca forest, grassland, mangroves and heathland (Figure 3.44). Other vegetation types include saltmarsh, and mesophyll vine forest.

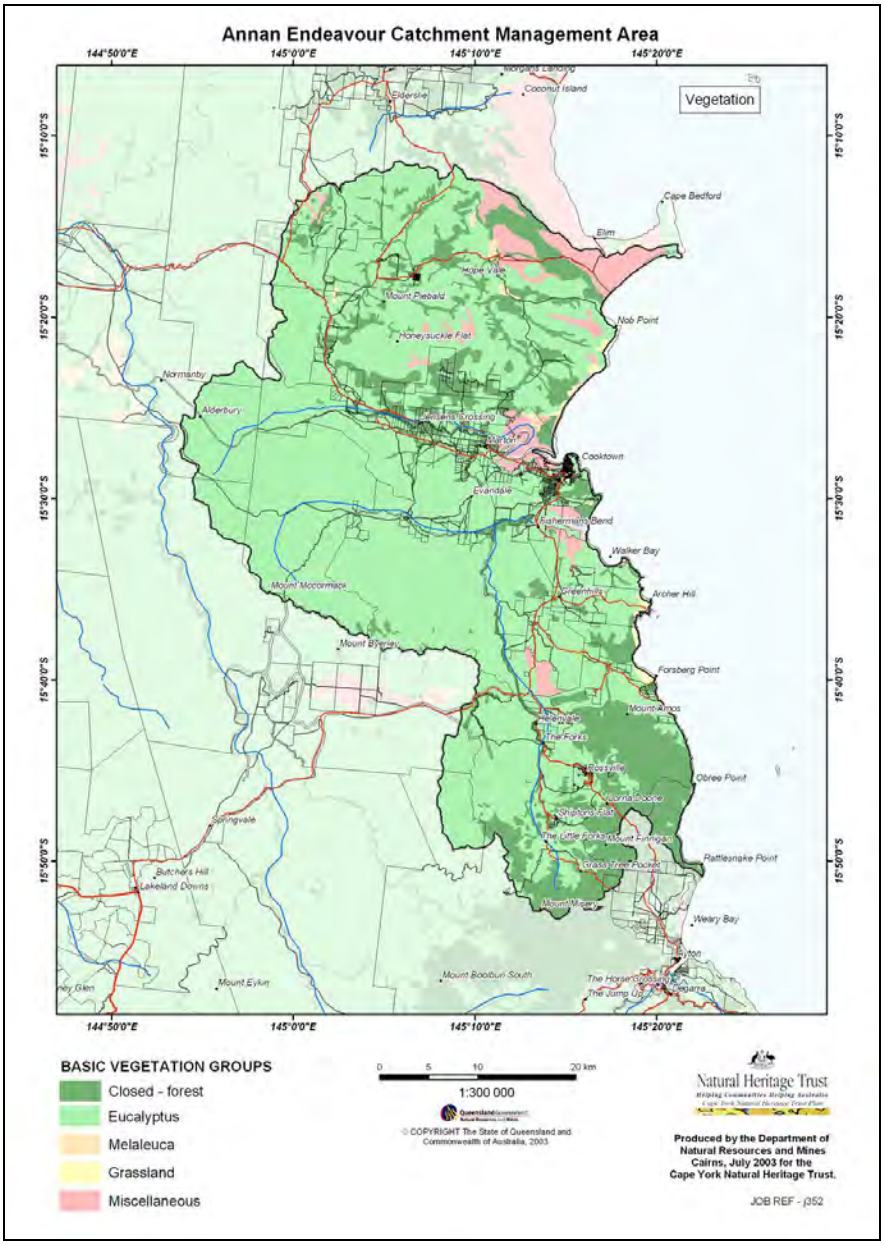


Figure 3.44. Basic Vegetation Groups of the Annan and Endeavour Catchments. Geoff Mills, DNR

3.44 AREAS OF CONSERVATION SIGNIFICANCE IN THE ANNAN AND ENDEAVOUR CATCHMENTS

Areas of conservation significance that are protected in the Catchments include national parks, conservation parks, a resource reserve and nature refuges (Figure 3.45).

Reserve	Size	Classification
South Endeavour	4100ha	Nature Refuge
Esk River	126ha	Nature Refuge
Mungumby Creek	96ha	Nature Refuge
Mount Cook National Park	494ha	National Park
Endeavour River National Park	1840ha	National Park
Cedar Bay National Park	5630ha (Mt Finnigan part)	National Park
Black Mountain National Park	781ha	National Park
Annan River (Yuku Baja-Muliku) National Park	8830ha	National Park
Annan River (Yuku Baja-Muliku) Resource Reserve	2281ha	Resource Reserve
Keating‘s Lagoon	46ha	Conservation Park
Annan River	1750ha	Fish Habitat Area

Figure 3.45 Protected Areas in the Catchments

Regional Ecosystems identified as significant

Regional Ecosystems were defined by Sattler and Williams (1999) as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The Queensland Herbarium and EPA have mapped Regional Ecosystems (REs) for much of Queensland using a combination of satellite imagery, aerial photography and on-ground studies.

The Regional Ecosystem Description Database (REDD) lists the status of regional ecosystems as gazetted under the Vegetation Management Act 1999 (their Vegetation Management Status) and their Biodiversity Status as recognised by the Environmental Protection Agency.

The *Vegetation Management Act 1999* status is based on an assessment of the pre-clearing and remnant extent of a regional ecosystem. The Biodiversity Status is based on an assessment of the condition of remnant vegetation in addition to the pre-clearing and remnant extent of a regional ecosystem. Each regional ecosystem is assigned a conservation status that is either endangered, of concern or not of concern.

A regional ecosystem is listed as endangered under the *Vegetation Management Act 1999* if:

Remnant vegetation is less than 10 per cent of its pre-clearing extent across the bioregion; or 10-30% of its pre-clearing extent remains and the remnant vegetation is less than 10,000 hectares.

In addition to the criteria listed for an endangered regional ecosystems the Environmental Protection Agency also classifies a regional ecosystem as endangered if:

- less than 10 per cent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss; or
- 10-30 per cent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss and the remnant vegetation is less than 10,000 hectares; or
- it is a rare regional ecosystem subject to a threatening process.

There are at least 7 different types of regional ecosystems with endangered biodiversity in the Annan & Endeavour Catchments (in red Figure 3.46) including:

- RE 3.8.3 Hope Vale. *Eucalyptus leptophleba* open forest + *Corymbia tessellaris* + *C. clarksoniana* woodland on basalt flows
- RE 7.3.12 Alluvial plains of lowlands Mixed eucalypt open forest to woodland, dominated by *Eucalyptus tereticornis* (forest red gum) and *Corymbia tessellaris* (Moreton Bay ash) +/- *Melaleuca dealbata* (cloudy tea tree), (or vine forest with these species as emergents);
- *RE 7.3.40 Black Mountain *Eucalyptus tereticornis* (forest red gum) open forest. Well-drained alluvial plains of lowlands.
- *RE 7.12.38 Black Mountain Deciduous microphyll vine forest and/or blue-green algae-covered granite and rhyolite boulderfields
- RE 7.8.3b: Shiptons Flat area. Complex semi-evergreen to semi-deciduous notophyll vine forest in the. Uplands on basalt;
- RE 7.3.10 Simple-complex mesophyll to notophyll vine forest. Moderately to poorly-drained alluvial plains of moderate fertility.
- RE 7.2.5b: Beach ridges and sand plains of beach origin. *Acacia polystachya* dominant communities, mostly closed forest but includes some woodlands, with a lower layer of vine forest species. Beach ridges and sand plains of beach origin.

*Are present in conservation reserves in the Catchments

Regional Ecosystems with Endangered Biodiversity Status

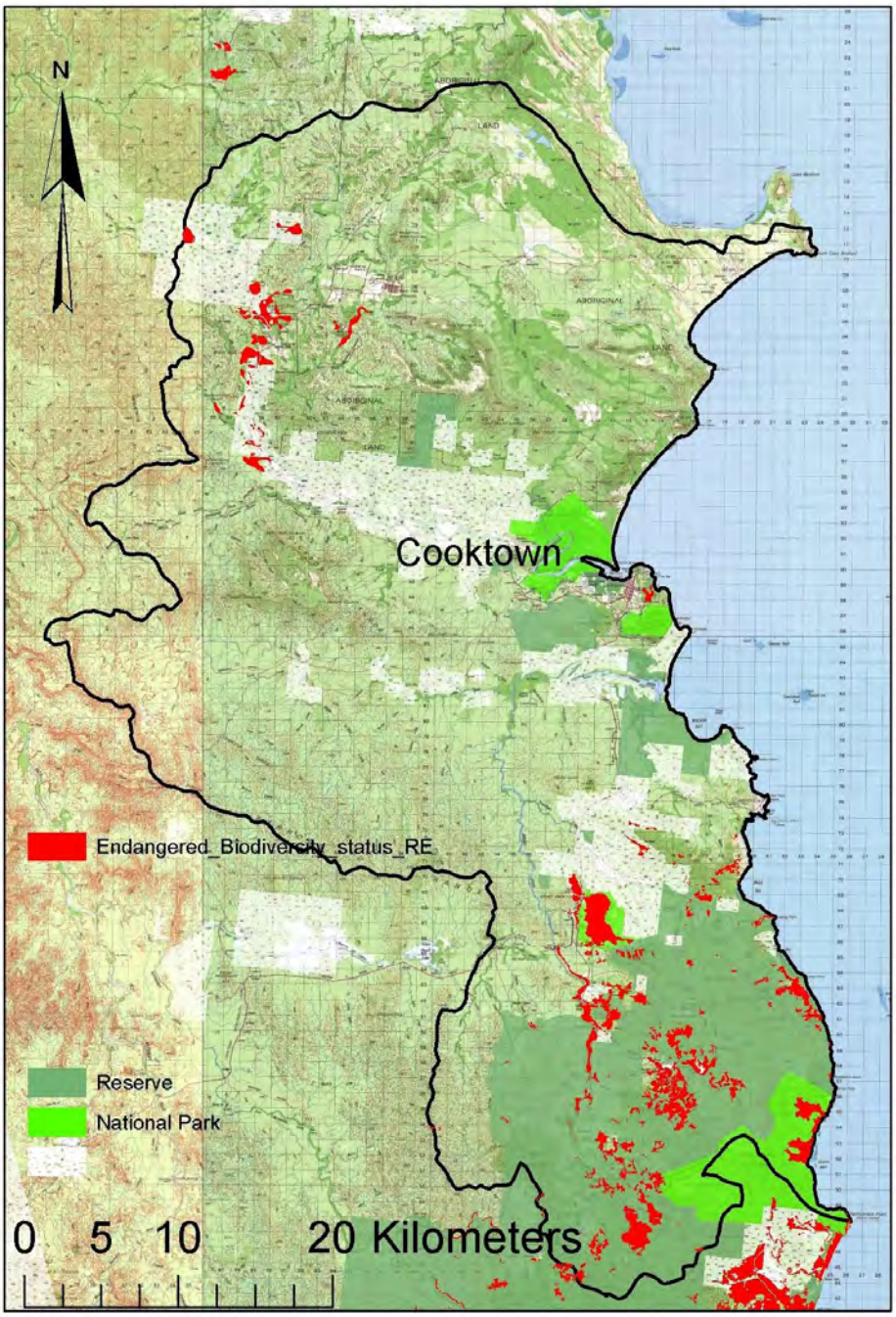


Figure 3.46 Regional Ecosystems with Endangered Biodiversity status

CYPLUS areas of conservation significance The 1995 CYPLUS report identified the Annan and Endeavour Catchments to contain the following significant areas:

1.The Mangrove communities along the Endeavour River contain high diversity and act as a nursery ground for many species of fish. They support significant populations of ant-plants and rare butterflies that feed on them.

2.The Mangrove and fringing Melaleuca communities on the south side of the Annan River (*Eucalyptus platyphylla,* and *Corymbia* association) of the Annan River also support major populations of ant-plants, butterflies and frogs.

The Endeavour-Annan River Area is reported by CYPLUS, 1995 to have natural conservation significance because:

- it supports a high diversity of vertebrate fauna;
- parts of the Endeavour River, Oakey Creek and the Annan River, contain good examples of features associated with the reversal of rivers, resulting from upwarping of the Eastern Escarpment;
- about 10% of the area supports vegetation classes that are rare on the Peninsula (predominantly eucalypt woodlands or open forests); and
- several locations in the area contain Permian (280 - 225 million year ago) plant fossil material (Abrahams et. al., 1995).

The area of sand dunes north of the Endeavour River carries a peculiar type of tall scrub in which the Rose Butternut tree (*Blepharocarya involucrigera*) is a common feature. No similar plant community has been reported elsewhere (DEH, 2007c). This is thought to be a Neldner & Clarkson community 121 and Regional Ecosystem (3.2.12 -Araucarian microphyll vine forest on coastal dunefields and beach ridges).

Black Mountain (Kalkajaka)

Figure 3.47 Black Mountain. Photo courtesy Kerry Trapnell, DEH

This regional ecosystem is confined to the Black Mountain-Mount Simon area near Cooktown. The spectacular granite boulder mountain landscape of Black Mountain (Figure 3.47) is considered by CYPLUS to be significant because it is nationally uncommon and the great granite boulders shelter endemic species of frog, skink, and gecko (Abrahams et. al., 1995). The spaces between the boulders can be large and lead to caves. The blackness of the rocks is caused by a form of lichen or algae covering the boulders. Vegetation is minimal due to the absence of any soil development. There are patches of thicket growing in depressions within the boulderfield that get larger towards the base of the rockfield (Figure 3.47). These patches of usually ficus trees accumulate soil and can support small ecosystems. It has been observed that these patches are increasing in size. Increase in this habitat could change the dynamics of the boulder ecosystem and favour species such as the Cooktown Gecko which preys on the rare Black Mountain Gecko (*Nactus galgajuga*) (pers. comm., Lewis Roberts, 2007). QPWS are responsible for weed control and establishing appropriate fire regimes.

Black Mountain is listed by the EPA as the only known habitat for several restricted rare and threatened species of fauna. The EPA rate the ecosystem biodiversity status of Black Mountain as endangered and subject to weed invasion especially around the edges of the rockfield. The World Conservation Union (IUCN) has listed Black Mountain National Park as a protected area II (National Park).

4. Wetlands

Figure 3.48 Keating‘s Lagoon, July 2006. Photo Jason Carroll

Wetlands play a crucial role in flood control, water purification (toxin removal), erosion control, groundwater recharge and trapping sediment. Surface water accumulates to form wetlands in coastal low-lying floodplains at Keating‘s Lagoon, Alligator Creek Swamp and isolated sections along the Endeavour Valley up north to Elim Beach. These areas create important habitat for many species of plants, crustaceans and fish as well as endemic and migratory waterbirds. Keating‘s Lagoon (Figure 3.48) provides vital habitat for a number of rare bird species including the Radjah Shelduck (*Tadorna radjah)* and the Black-necked Stork or Jabiru (*Ephippiorhynchus asiaticus*).

The Alligator Creek Swamp is an unprotected wetland that is identified by the EPA as an endangered regional ecosystem. It is a vegetated Melaleuca swamp with Cloudy Tea Tree (*Melaleuca dealbata*) and Weeping Tea Tree (*Melaleuca leucadendra*). Over the past 5 years the Annan Endeavour

Catchment Management Group have undertaken weed control of pond apple and mother-in-law's tongue. Weed and feral pig invasion remain the major threatening processes.

The wetlands of the Annan Catchment were recently mapped by the EPA (Figure 3.410). The map for the Endeavour Catchment was unavailable at the time of writing.

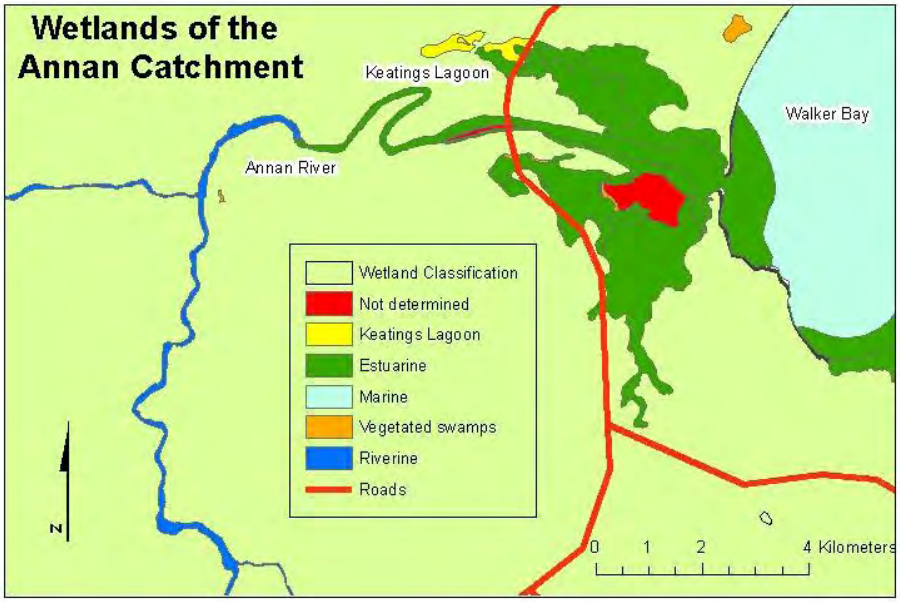


Figure 3.49 Wetlands of the Annan Catchment, EPA, 2006

5. Mabi Forest Complex Notophyll Vine Forest 5b
In 2006, the Environment Protection and Biodiversity Conservation Act 1999 *(EPBC Act)* Protected Matters Report identified the Annan Catchment area to contain the Critically Endangered Mabi Forest Complex Notophyll Vine Forest 5b on basalt. This regional ecosystem (number Re7.8.3.) is identified as significant tree kangaroo habitat. The word Mabi is the local aboriginal name for tree kangaroo.

6. The Cooktown-Daintree-Windsor Tableland Area, including Mt Cook and the Endeavour River National Park is listed on the Register of the National Estate as a pristine wilderness area (DEH, 2007b). However, in this regard the term _pristine' could be open to interpretation.

Other significant areas

The Annan River (Yuku Baja-Muliku) National Park and Annan River (Yuku Baja-Muliku) Resource Reserve
This newly designated National Park is the largest protected area in the Annan Catchment. The Resource Area is allocated for research to determine the potential of a wind farm (Figure 10).

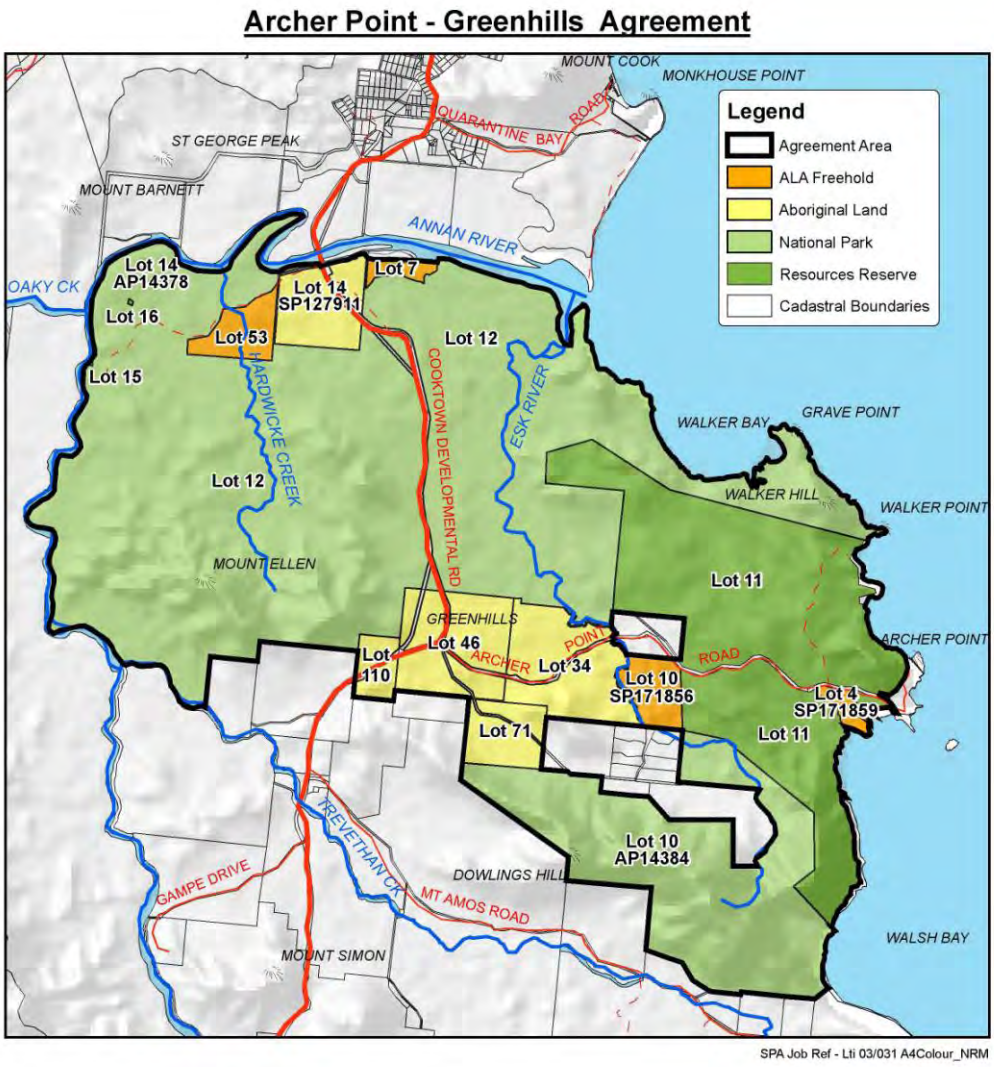


Figure 3.410 Location of the Annan River National Park and Annan River Resource Reserve. Map courtesy QPWS, 2007

3.45 RARE AND THREATENED PLANTS IN THE CATCHMENTS

Under the (*Nature Conservation Act 1992* Wildlife Schedules 1992-2006) wildlife of concern are placed into one of six classes. The classification is determined by criteria regarding the frequency of sightings. The classes are extinct, endangered, vulnerable, rare, near threatened and least concern (Definitions Appendix C). Sixty one Rare and Threatened Plants are found in the Annan and Endeavour Catchments (see Appendix A and Figure 3.411).

Classification	Numbers	Species
Presumed Extinct	1	*Rhaphidospora cavernarum*
Endangered Species	1	*Crepidium lawleri*
Vulnerable Species	10	(Appendix A)
Rare Species	49	(Appendix A)
TOTAL	**61**	

Figure 3.411 Rare and Threatened Plants in the Annan and Endeavour Catchment, Environmental Protection Agency (2006) WildNet. (Database).

The flowering plant *Rhaphidospora cavernarum* is a threatened plant which was presumed to be extinct until rediscovered at Black Mountain and elsewhere in Cape York. *Gossia lucida* from the Myrtaceae family is a rare plant of the Cape York Bioregion. *Crepidium lawleri* is an endangered terrestrial orchid threatened by pig diggings in areas of seepage where it occurs. The unique ground orchids *Cooktownia robertsi, Habenaria exilis* and *Habenaria chlorosepala* have a very restricted distribution in the Annan drainage. Weeds, especially introduced grasses, are encroaching on orchid habitat. The exclusion of fire is resulting in uncontrolled native vegetation shading out orchid habitat.

When the localities of the threatened plants are placed over the land ownership map about half of the records are outside of protected areas (Figure 3.412). This could mean that greater protection of rare and threatened plants is required. However, it is possible that areas with the most records have been surveyed more frequently. It is important to note that the absence of a record does not necessarily mean the species is not present at a location. It could be this area has not been surveyed yet.

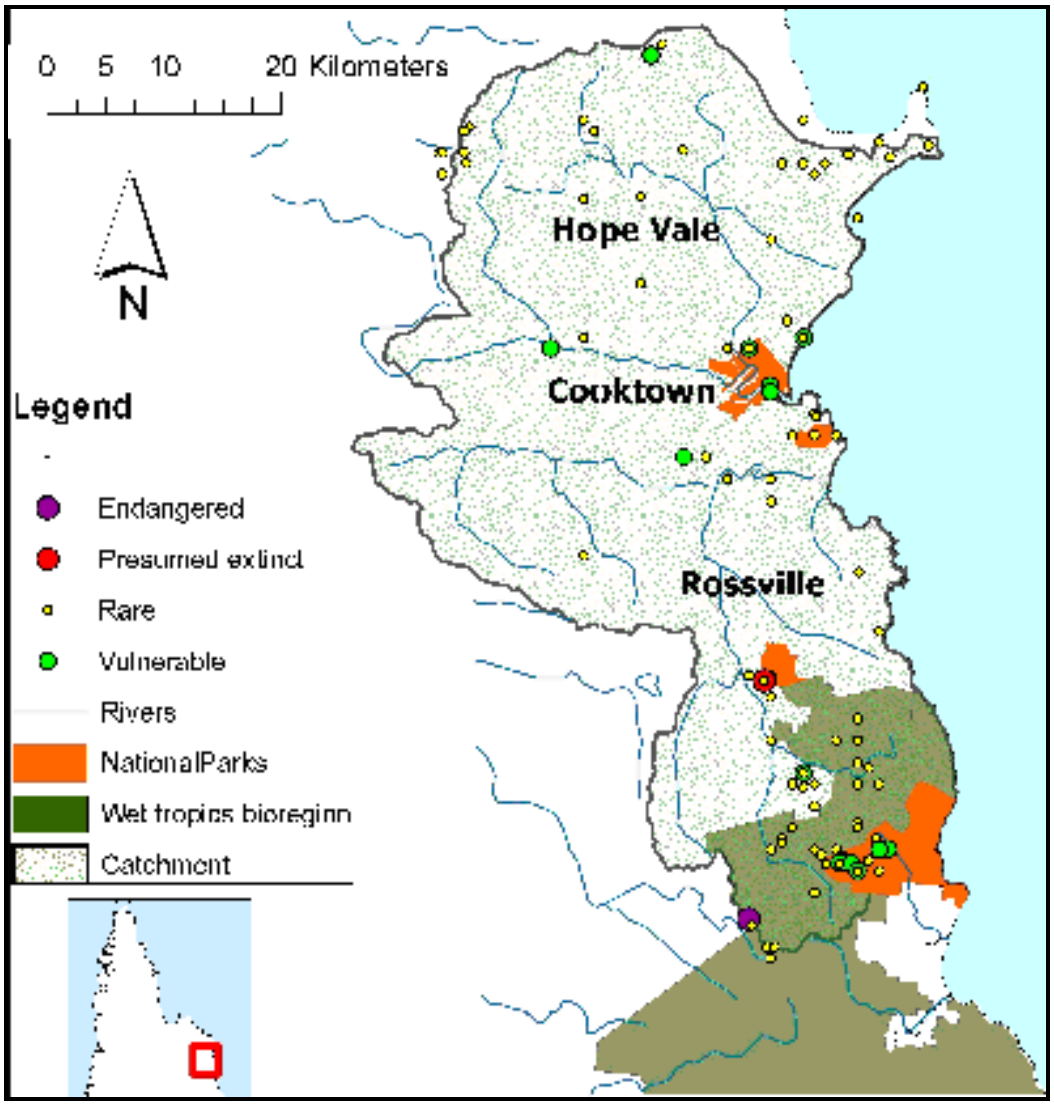


Figure 3.412 Locations of Rare and Threatened Plant Species in the Annan and Endeavour Catchment (excluding the new 11111ha Annan River National Park and Resource reserve. Map by Jason Carroll

3.45 FAUNA

(The list of Rare and Threatened Fauna in the Catchments is in Appendix B)
Under the Nature Conservation Act (1992) there are 52 rare and threatened fauna species in the Catchments (Figure 3.413).

Classification	Numbers	Species
Endangered Species	11	Spotted tailed quoll, bats birds and frogs
Vulnerable Species	13	Bats, birds, Estuarine crocodile, butterfly, and frog
Rare Species	26	Tree kangaroo, bats, birds, reptiles, frogs
Least Concern	2	Northern quoll, spectacled flying fox
TOTAL	52	

Figure 3.413 Numbers of rare and threatened fauna in the Annan and Endeavour Catchments. Environmental Protection Agency (2005) WildNet. (Database).

The Annan and Endeavour Catchments support a high diversity of vertebrate fauna (Abrahams et. al., 1995). There are several vertebrate species which are only found within the Annan River Catchment‘s Wet Tropic zone especially the rainforest. These species include several rainforest frogs, reptiles and Bennett's Tree Kangaroo (*Dendrolagus bennettianus).*

The Annan Catchment represents the northern distribution for a number of plants and animals in Australia such as the the Platypus (*Ornithorhynchus anatinus*) and Red Bellied Blacksnake (*Pseudechis porphyriachus*) (pers. comm, Barry Lyons, QPWS, May 2006). It is also the northern limit of species endemic to the Wet Tropics bioregion especially the rainforest species of plant and animals.

Black Mountain in the Wet Tropics Area is the only known habitat of restricted species including the Black Mountain Boulder Frog (*Cophixalus saxatilis*), the Black Mountain Gecko (*Nactus galgajuga*), the Black Mountain Skink (*Carlia scirtetsis*). *Ctenotus nullum* has a disjunct (widely separated from other populations of same species) population in the area. Caves formed in these boulders provide roost sites for Australia's only carnivorous bat the rare Ghost Bat (*Macroderma gigas*) (WTMA, 2002).

Invertebrates
Ant-plants (*Myrmecodia beccarii*) found on paperbark (*Meleleuca sp.*) trees and mangroves (Figure 13) support significant colonies of vulnerable butterfly species including the Apollo Jewel Butterfly (*Hypochrysops apollo*) (Figure 3.414). This is a good example of the complex relationships between different species in an ecosystem. The melaleuca swamp trees provide habitat for the ant plant; the ant plant provides shelter for the ant colony; the ant colony provides nutrients for the ant plant from ant food leftovers stored inside the plant‘s chambers; the butterfly larvae provide a sugary secretion as food for the ants, and the ants provide a safe haven for the developing larvae before they emerge from the plant as butterflies (EPA, 2006a).

Figure 3.414 Ant plant. (Photo courtesy Gone Fishing) and the Apollo Jewel Butterfly. (Photo courtesy The Insect Company)

The south side of the Annan River has been identified as significant area for butterflies (CYPLUS, 1995).

Fish

No rare or threatened fish species occur in the Annan or Endeavour Rivers (Pusey et. al. 2004).

When adjusted for stream size, the fish fauna of the Annan River system is relatively rich, compared with temperate Australian systems and streams on other continents (Hortle and Pearson, 1990). The Annan has more species than the Endeavour (Pusey et. al, 2004). Fish were sampled at a range of sites in the Annan River system. In all, 25 species were recorded, including 14 principal freshwater forms. Species richness increased in a downstream direction and was directly related to stream size (Pusey et. al. 2004).

Rendahl's Catfish (*Porochilus rendahli)* have been collected in lagoons near the Endeavour, (CYPLUS 1995). These fish appear to be restricted to confined areas and only occur in low numbers. Jungle Perch (*Kuhlia rupestris*) are a popular freshwater angling species in North Queensland, where they can reach a maximum size of 5 kg. They are present in both the Annan and Endeavour Rivers (Pusey et. al, 2004). Jungle Perch are an indicator of the health of a stream (DPI, 2006). This fish is in serious decline over much of Queensland mostly due to habitat modification and fish passage barriers (it breeds in saltwater and then can't return above barriers to the fresh). It is possible that the Annan Weir may prevent this fish and other native fish species from moving upstream (Pusey et. al. 2004).

A massive reduction in the number of herring (*Herklotsichthys spp.)* in the Endeavour has been reported (pers.comm., Ian Mc Collum, 2007). The herring is an important base food fish for many fish. One suspected reason for their decline is poor water quality (pers. comm. Ian McCollum, 2007).

The False Celebes Goby (*Glossogobius sp.*) an undescribed species has been recorded in the Annan (Pusey et. al. 2004).

Sooty grunter (*Hephaestus fuliginosus*) do not naturally occur in the Annan and Endeavour Catchments. In 1980 the DPI released 2030 of these fish into the Annan River Falls. They have since established self-sustaining populations and provide good catches for recreational fishers in the Annan

and Endeavour Rivers (Burrows, 2002). Impacts of these fish on biodiversity are unknown. The pest fish Tilapia (*Tilapia mariae*) has been recorded in the Endeavour (Pusey et. al. 2004). This introduced fish is declared noxious in Queensland as it competes aggressively with native fish for habitat and food, and disturbs plant beds when building nests.

Amphibians

In addition to the Vulnerable Black Mountain Boulder Frog the following rainforest stream dwelling frogs are listed as endangered – the Waterfall Frog or Torrent Tree Frog (*Litoria nannotis*) (from Mungumby Creek, Parrot Creek and Home Rule), the Common Mistfrog *(Litoria rheocola*), the Sharp-snouted Dayfrog (*Taudactylus acutirostris*) and the Lace-eyed Tree Frog (*Nyctimystes dayi*) (McDonald 1992, Wildnet, 2006). The Tapping Greeneyed Frog (*Litoria genimaculata*) (Figure 3.415), Peeping Whistle Frog *(Austrochaperina fryi)* and *Cophixalus spp.* are also rare species that live in rainforest. The causal factor for the population crashes has been determined to be the chytrid fungus (McDonald et. al 2005, Berger et al 1998). A threat abatement plan for chytrid has been undertaken (DEH, 2006c). Three species in the Annan Catchment have been lost at altitudes over 400m. A recovery plan to determine the possible threats for seven of the endangered frogs of the Wet Tropics was undertaken during 2000-2004 at a cost of $1.523 million dollars (DEH, 2006a).

Figure 3.415 Tapping Greeneyed Frog (*Litoria genimaculata*). Photo Hal Cogger. Australian Frog Database

Reptiles

A number of rare species are restricted to boulder and/or cliff habitats. The Black Mountain Gecko (*Nactus galgajuga*) and the Black Mountain Rainbow Skink (*Carlia scirtetis*) all only occur on Black Mountain. The rare skink *Carlia tanneri* has a restricted distribution centred on the Endeavour Valley in closed forests and adjacent areas (Cogger, 1992 in Abrahams et.al., 1995).

Vulnerable reptiles in the Catchments include the Yakka Skink (*Egernia rugosa*) and the Saltwater Crocodile (*Crocodylus porosus*). Crocodiles are protected nationally.

The sea grass meadows at Walker Bay are foraging grounds for the threatened Green Turtle (*Chelonia mydas)*.

The unique Blind Snake (*Ramphotyphlops robertsi*) is only known from Shipton‘s Flat.

Birds

The Red Goshawk (*Erythrotriochis radiatus*) (Figure 3.416) is one of the world‘s rarest birds of prey. The genus *Erythrotriochis* is endemic to Australia and monospecific (contains only one species). This bird occupies a range of habitats in north-eastern Australia. The Red Goshawk is a woodland bird with

extremely sparse populations and nests in trees greater than 20m in height and within 1km of water. It is estimated that there are about 350 pairs of Red Goshawk remaining worldwide (Abrahams et. al., 1995).

Figure 3.416 Red Goshawk (*Erythrotriochis radiatus*)

There is a notable absence of waterbirds that were once common in the Annan and Endeavour estuaries such as the Australian Pelican *(Pelecanus conspicillatus)* (pers. comm. Ian Mc Collum, 2007).

The near threatened Australian Bustard (*Ardeotis australis*) (Garnett and Crowley 2000) is a large ground bird of grassland and woodland that has been observed on the plains near the Annan Water Supply. Populations are highly nomadic following rain and feed, which includes seeds, fruit, centipedes, insects, molluscs, lizards, young birds and small rodents. This species is highly regarded for reducing numbers of pasture feeding insects (Dorricott et. al., 1999). Bustard numbers and range appears to have contracted in recent years as a result of illegal shooting, feral predators (e.g., pigs) and habitat destruction (BirdLife International, 2004).

The Southern Cassowary (*Casuarius casuarius johnsonii (southern population))* occurs in the Annan Catchment (Garnett and Crowley 2000). The Southern Cassowary is a threatened species because of habitat loss and fragmentation. Dog attack, vehicles, shooting, disease and accidental capture in pig traps also contribute to Cassowary decline. There are an estimated 2000 cassowaries remaining in the wild.

The Cotton Pygmy-Goose (*Nettapus coromandelianus)* and Beach Stone-Curlew (*Esacus neglectus*) are threatened species found in and around Cooktown. The Cotton Pygmy Goose is threatened by modification or loss of habitat through wetland drainage. The Beach Stone-curlew is threatened by disturbance from vehicle traffic on beaches and large numbers of people moving in areas where these birds are nesting (Garnett and Crowley, 2000).

Mammals

Several populations of the Brush-tailed Phascogale (*Phascogale tapoatafa*) have been located in the sclerophyll woodlands and forests of the both the Annan and Endeavour Catchments including the Endeavour River and Black Mountain National Parks, Shipton‘s Flat, Hope Vale area, and Jensen‘s Crossing (pers. comm. Keith Mc Donald, 2007). This species is threatened by the loss of old trees with hollows, habitat clearing, and cat predation (WTMA, 1998).

The Common Ringtail Possum (*Pseudocheirus peregrinus*) has declined in numbers in Cooktown and is no longer found in places for which pre-1970s records exist (Winter and Allison, 1980). Post 1960‘s

records are confined to north of Coen and south of the Mt Windsor Tableland (pers. comm. Dr John Winter, 2007).

The Black Mountain boulders form habitat for the Godman's Rock Wallaby (*Petrogale godmani*) which is found south to the Mitchell River near Mt Carbine and north to the Bathurst and Melville Ranges (Johnson, 2003). The Common Rock Rat (*Zyzomys argurus*) has been located at Black Mountain National Park and has a patchy distribution across northern Australia. It is more common than previously thought and is frequently encountered in rocky areas.

The decline of the endangered Semon's Leaf-nosed Bat (*Hipposideros semoni*) and the endangered Greater Large-eared Horseshoe bat (*Rhinolophus philippinensis*) in the Wet Tropics area is thought to be the result of human disturbance of roost sites and the collapse and intentional closure of old mines (DEH, 1999). A lack of accurate data on the distribution and abundance of these species makes assessment of their conservation status difficult. The priority issues for effective management and conservation of these species are listed in the Commonwealth Action Plan for Australian Bats. They include:

- clarification of the taxonomic status of these species;
- protection of priority roosts and maternity sites;
- identification of specific threats to these species; and
- study of the species' ecology (Thomson, et. al., 2002).

Echidnas (*Tachyglossus aculeatus*), Bandicoots (*Isoodon macrourus and Perameles nasuta*) and Northern Quolls (*Dasyurus hallucatus*) were reported to be once common in Cooktown, but are now rarely seen (pers. comm., Ian McCollum, 2007). Their decline in urban areas is suspected to be due to an increase in human urban and rural residential population pressure. The Northern Quoll (Figure 3.417) is a nationally endangered species (*Environment and Biodiversity Conservation Act,199*9) that is reported to be fairly common in the Annan drainage and around Black Mountain (pers.comm., Keith McDonald, 2007).

Figure 3.417 The Northern Quoll (*Dasyurus hallucatus*) Wikipedia, 2006

The early stages of a recent quoll counting study suggest the Northern Quoll may be making a recovery at the Einasleigh and Wet Tropics Bioregions interface (pers.comm., Dr John Winter, 2007). This study aims to measure the extent and density of the remaining populations and investigate why the Cape York population of Northern Quolls appear to co-exist with the toxic cane toad, a known cause of quoll poisonings across Australia. *Cape York residents have been urged to report all quoll sightings both past and present to Dr John Winter Ph 4097 0048 or jw.winter@bigpond.com. Please*

note which species it is. Northern quolls have a black fluffy tail and the spotted-tailed quoll has a spotted tail.

The Bennett's Tree-Kangaroo (Figure 3.418) lives almost completely on the leaves of a wide range of rainforest trees, including umbrella trees (*Schefflera actinophylla*), vines, ferns, and various wild fruits (Martin, 2005). Although the IUCN still rates the status of Bennett's Tree-Kangaroo as "Near Threatened", its numbers seem to be increasing and its range expanding. Sightings have become far more common in recent years. The increase in numbers and range are likely to be due to the fact that it is no longer hunted and most of its range is now protected under World Heritage legislation. Sightings of Tree Kangaroo were very rare to the south of the Annan Catchment and non existent to the north 30 years ago. Now the sightings extend as far north as the junction of Oakey Creek and the Annan, down to the mouth of the Annan (pers.comm. Lewis Roberts, 2006). Both Roger Martin and Charlie Roberts, two of the world's top experts on this species, agree that it should now be classified as "secure" (Martin, 2005). A dead specimen was reported in Hope Vale. No other records have been verified for the Endeavour Catchment.

Figure 3.418 Bennett's Tree-Kangaroo mother & baby. Photo by Sandra Lloyd, Mt. Poverty 2006

The Sugar Glider (*Petaurus breviceps*), Squirrel Glider (*Petaurus norfolcensis*) and Feather-tail Glider (*Acrobates pygmaeus*) have a patchy distribution in the Endeavour Valley and are more common in the Annan (pers.comm., Keith McDonald, 2007).

A number of rat species have been recorded. The most significant is the Black-footed Tree Rat (*Mesembriomys gouldii*) which is scarce and has a patchy distribution in dry Eucalypt woodland. It's eastern population centred on north east Queensland may be declining (pers.comm., Keith McDonald, 2007).

The Red-cheeked dunnart (*Sminthopsis virginiae*), a small carnivorous marsupial, has a disjunct, limited distribution across northern Australia but can be locally common in Melaleuca swamps, soaks and savannah grasslands where suitable habitat remains (pers.comm., Keith McDonald, 2007).

There is a disjunct population of the Antilopine Kangaroo (*Macropus antilopinus*) in the Endeavour Valley. The Common Wallaroo (*Macropus robustus*), Whiptail Wallaby (*Macropus parryi*) and

Swamp Wallaby (*Wallabia biclor*) have not been recorded for the Annan and Endeavour Catchments although they are found in adjacent Catchments (pers.comm., Keith McDonald, 2007).

The healthy and varied seagrass beds at the mouths of the Annan and Endeavour Rivers are potential Dugong (*Dugong dugon*) feeding grounds. Both rivers contain the Seagrass preferred by Dugong and the Walker Bay Seagrass meadows are described as extensive (pers. comm., Christina Howley, 2006). The Dugong is listed as vulnerable to extinction by the IUCN and is the only herbivorous marine mammal on the Convention on International Trade in Endangered Species (CITIES).

3.46 THREATS TO BIODIVERSITY IN THE CATCHMENTS

The threats to biodiversity in the Annan and Endeavour Catchments have been determined by community consultation, scientific studies, Queensland Museum archives, regional ecosystems database and the Biodiversity workshop hosted by the Annan and Endeavour Catchment Management Group in May 2006. The loss of Biodiversity in the Catchments could be due to one threatening process, or a combination of the following threatening processes.

1. HABITAT LOSS AND FRAGMENTATION

Clearing of land for development has occurred in the vicinity of Cooktown, the river flats along the Endeavour River and on basalt soils around Hope Vale. Development results in previously vegetated land being cleared or replaced with buildings and roads. From 2006 broadscale clearing is being phased out with new ammendents to the *Queensland Native Vegetation Act 1999* (the Act), (NRM, 2005). Clearing for agriculture has also been restricted.

The Endeavour River Basin has been described as having medium risk of development pressure (QLD Government, 2003). Concerns have been raised by Catchment residents and scientists that remnant vegetation and species are threatened by inadequate planning for wildlife corridors and buffer zones for new developments. Melaleuca wetlands and riparian vegetation could be most at risk. The biodiversity of the Endeavour Valley and the Endeavour River riparian zone have been identified as under threat due to vegetation clearing. The fragmentation and habitat loss of Melaleuca habitat on the Endeavour River is a potentially threatening process for certain species of frogs (pers. comm., Keith McDonald, 2006). The encroachment of housing blocks into wetland areas threatens ecosystems and fauna and flora especially frog breeding sites (pers.comm., Keith Mc Donald, 2007). EPA recommends buffer widths to be left between wetlands and development for different wetland systems.

Melaleuca forest, tropical rainforest and subtropical rainforest and dry rainforest are identified as the most common threatened vegetation types (DEH, 2004). The clearing of Melaleuca paperbark country between Tully and Townsville has destroyed much of the habitat of the vulnerable Apollo Jewel Butterfly's habitat. The clearing destroys Ant-plants inside which Apollo Jewels must breed (QLD Museum, 2007). Melaleuca habitat is particularly vulnerable as it is already naturally patchy and fragmented (pers.comm. Keith Mc Donald, 2007). Clearing of Melaleuca can also result in exposure of jarosite and result in acid sulphate soil.

Fragmentation of habitat is an event that breaks up larger areas of habitat into smaller patches. Fragmentation can leave species vulnerable to predation, reduce genetic diversity, favour larger more mobile species and produce even greater population decline than habitat loss. Concerns have been raised over the trend in the Cook Shire to rezone rural land to rural residential in the Endeavour Valley and break up large tracts of land into smaller residential blocks. Of particular concern is the loss of

continuity in riparian zones. The connectivity of riparian corridors is considered most important. These areas contain high numbers of flora and fauna species different to species in the vegtation type they cross. Riparian corridors allow safe passage for animals moving between conservation reserves and uncleared areas. The riparian zone also acts as a buffer between developments and maintains water quality by filtering sediment and other run off.

The protection of _Off Park' (unprotected) habitat areas that support rare and threatened species is considered a priority by Jeanette Covacevich the Former Senior Curator (Vertebrates) and Honorary Fellow of the Queensland Museum.
Over clearing of vegetation on basalt patches along the Endeavour River is also a concern (pers.comm. Barry Lyons, 2006).

Cooktown is fortunate to still have a range of wildlife in town including the Bush Stone-curlew (*Burhinus magnirostris*) and Northern Brown Bandicoot (*Isoodon macrourus*). It is important that action is taken now, possibly in the form of a Bushland Management Plan, to ensure wildlife corridors, riparian corridors and adequate amounts of habitat are available for these species. Connected reserve areas incorporating freshwater may even encourage uncommon species such as Echidnas and Northern Quolls back to the Catchments.

2. WEEDS AND FERAL ANIMALS

There are fifteen species of weeds and eight species of feral animals that are significant pests in the Catchments. Some of these species are adversely impacting on the biodiversity of the Annan and Endeavour Catchments (CSC PMP, 2006). (See the Weeds and Feral Animal section for more)

Weeds
In terms of the environmental and financial costs the most damaging weeds in the Catchment are sicklepod, *Bauhinia,* pond apple, mother-in-law's tongue and *Hymenachne*. Weed invasion is often associated with disturbances to ecosystems such as clearing, fire, floods and grazing. The Australian Terrestrial Biodiversity Assessment (NLWRA 2002) identified weeds as a key threat to the wetlands of eastern Australia.

Sicklepod (*Senna obtusifolia*) is throughout both Catchments and is moving down and choking stretches of the Annan and Endeavour River riparian zones (pers.comm. Barry Lyons, 2006 and Lewis Roberts, 2006). Sicklepod is also widespread around Hope Vale. *Praxelis clematidea* is in both the Annan and Endeavour Catchments *Praxelis* has also been observed at the Telstra tower (Mt Leswell), Cooktown Airport and in gardens from mulch brought from outside the Shire.

The edges of the endangered Black Mountain ecosystem are subject to weed invasion that could threaten the integrity of the native vegetation community. Late season wildfire and the subsequent invasion of weeds is having the biggest impact on this vegetation type.

There are large infestations of Mother- in-law's tongue (*Sansevieria trifasciata*) at Jensen's Crossing along the Endeavour River banks along with several other weeds such as Bauhinia (*Bauhinia monandra)*. Escaped plants of Mother- in-law's tongue from the Botanic Gardens have led to the infestation at the Alligator Creek Swamp. This area has been the focus of the Annan Endeavour Catchment Management Group. The repair of fragmented melaleuca swamplands including Alligator Creek Swamp was identified by the FNQ Regional Plan (Committee Report on the Environment 1997)

as a regional rehabilitation priority. Initially Pond Apple (*Annona glabra*) was removed and then successful attempts were made to eradicate the Mother-in-law‘s tongue and re-establish Melaleucas.

Hymenachne (*Hymenachne amplexicaulis)* is located along the Endeavour River and at Keating‘s Lagoon. It has the potential to destroy several wetlands in the valley especially seasonal Melaleuca swamps, farm dams and natural lagoons.

Due to it‘s capacity to alter fire regimes Gamba grass (*Andropogon gayanus*) has the potential to become one of the Catchment‘s worst weeds (pers. comm. Russel Graham, 2006). Gamba grass can have up to ten times as much fuel as native grasses and burn about twenty times as hot as native grass fires destroying ecosystems, houses and crops. Currently gamba grass is not a declared weed in Queensland.

Feral Animals

The most obvious impact on wetlands in the Annan and Endeavour Catchments is from feral pigs. Keating‘s Lagoon and Alligator Creek are two areas that are constantly trampled by feral pigs. Feral pigs also spread weeds, destroy habitat, uproot plants, prey on wildlife and their eggs and dig up acid-sulphate soils which increases the acidity of water in the wetland.

The large seasonal Melaleuca swamp in the Endeavour River National Park is also seasonally impacted by pigs. This is one of the best, intact representations of Melaleuca swamp in the Endeavour valley.

It has been suggested that introduced bees may have negative impacts such as facilitating the pollination of rainforest species and increase their reproductive success leading to ‗Forest Thickening‘.

Feral or wandering dogs and cats can directly prey on wildlife and horses, deer and cattle can trample waterways, spread weeds and degrade habitat (see the Weeds and Feral Animal section in the plan for more).

3. ALTERED FIRE REGIMES

Fire regimes and intensity are important to maintaining the biodiversity of many ecosystems. Too frequent fires at the wrong time of year can lead to a change in vegetation structure, create disturbance cause erosion and can lead to greater invasion of weeds. Equally long term exclusion of fire in these habitats can result in loss of species diversity as plant species or microhabitats are shaded out or out competed by a select group of plant species. Inevitably these areas which have not been burnt for a long term will be badly burnt by a late dry season, severe wildfire will even kill large trees.

Fire at the ‗right time‘ can encourage the regeneration of native species and reduce fuel build up. Fire is considered important to maintaining the regional ecosystem confined to the Black Mountain-Mount Simon area and Grassy Hill.

Early season burning is believed to be at least partly responsible for a major shift in biodiversity with the loss of open woodland and grassland from (termed ‗Forest Thickening‘) (pers.comm. Lewis Roberts, 2006). Lewis Roberts estimates that there has been a 50% increase in rainforest in the Annan river region in the last 100 years. Early season burns are detrimental to the growth of grasses but do not overly hinder shrubby understorey. Consequently there is a competitive advantage for bushes over grass and the rainforest takes over. As the forest thickens orchid species, quolls and phascogales

become locally extinct or scarce. Russell-Smith et. al (2004) also report the rainforest to be advancing in Iron Range National Park. Tall Eucalypt forest on the western edge of rainforest in the Wet Tropics Bioregion has been invaded by rainforest species resulting in loss of species diversity (Harrington and Saunders 1994). One advantage is the increase in some rainforest species such as the Tree Kangaroo population as a result of increased habitat, combined with a loss of hunting pressure in the last 40 or so years (Martin 2005).

For many native species it is better to have a late season fire or _stormburn' after the first rains in the wet season which gives the competitive advantage to grasses. However, late season hot wildfires are detrimental to dryer rainforest.

The Cape York Peninsula Development Association (CYPDA) receive ongoing funding to continue its work on developing sustainable fire management strategies and practices on Cape York (DEH, 2002). The project aims to document existing fire regimes, biodiversity conservation, traditional Aboriginal approaches and broad community issues to establish best practice fire management. This is to be achieved through analysis of detailed fire histories, vegetation plots, Aboriginal and community consultation and the development of fire plans.

4. OTHER

Other potential sources of threats to Biodiversity include

- Poor water quality (see Water Quality and Quantity section)
- Mining – During a fish sampling study on the Annan River mining impacts were associated with a reduced number of species; those eliminated were apparently less tolerant of sediment (Hortle and Pearson, 1990).

3.47 WAYS TO CONSERVE BIODIVERSITY IN THE CATCHMENTS

Action is required to conserve endangered ecosystems and species in the Catchments. This action could be in the form of nominating ecosystems for conservation, Recovery Plan implementation, altering fire regimes, fencing off remnants, weed control and other threat abatement work.

The recommended actions are listed in the Management Tables (Table 4.5). Further scientific study and biodiversity assessment is required to verify anecdotal evidence of a species presence. The priorities for funding could be determined using RE maps and biodiversity assessment.

Some threatened ecosystems such as Melaleuca swamp and those containing a high proportion of endemic or rare and threatened species may exist in unprotected areas and require greater protection. Suitable areas for assessment and possible protection include threatened ecosystems or species, large tracts of habitat in good condition, ecosystems not adequately represented in current protected areas, riparian zones, gully heads, buffers to wetlands and other habitats important to ecological processes.

Protected areas alone will not ensure that biodiversity and ecological processes are conserved. Private landholders have a vital role in preserving biodiversity. Funding from the state and federal governments should be allocated to landholders who wish to undertake biodiversity assessment on

their properties. Information from the Environmental Protection Authority should be available to landholders who are interested in sustainable land use for conservation and productivity purposes.

Determining areas of biodiversity significance

Endangered regional ecosystems that lie outside of protected areas should be an initial point of reference when determining new conservation areas. Traditional knowledge, biodiversity assessment, key indicator species and previous records should also be used to determine priority areas for protection. Identifying and conserving areas of significant biodiversity should be a priority for future NRM planning in the Catchment.

The EPA BAMM (Biodiversity Assessment and Mapping Methodology) system provides a consistent approach to assessing biodiversity and determining priority areas. The BAMM is used by the EPA to assess the biodiversity of bioregions in eastern Qld. It is a dynamic model which can be reviewed from time to time as additional information comes to hand. It can also be used by members of the community using vegetation mapping data approved by the Qld Herbarium (EPA, 2002) as well as information on distribution of flora and fauna. A BAMM system for Cape York is planned once the RE mapping is completed for the region.

Self assessment of landscape and biodiversity can also be done using the Self-assessment guide by NSW Agriculture (2001).

Protecting areas of Biodiversity significance

Once unprotected areas of significance have been identified they can be protected as:

- *National Parks* - Acquired areas that are added to existing protected areas of National Park or are declared National Park. These are areas with the highest degree of legislative protection for biodiversity but are state government tenures managed under the Nature Conservation Act (1992).
- *Conservation Parks* – Conserve an area's cultural and natural resources and their values. They protect and manage scientific sites and special natural features and a greater range of commercial and recreational activities can be undertaken on conservation parks than on National Parks (EPA, 2000). These are state government tenures managed under the Nature Conservation Act (1992).
- *Nature Refuges* - A nature refuge is a category of protected area under the Nature Conservation Act 1992. It is a voluntary conservation agreement between a landholder and the Queensland Government. Each agreement is tailored to suit the management needs of the particular area and the needs of the landholder. The agreement allows for productivity and conservation to work together. A nature refuge can cover part or all of a property protecting wildlife and wildlife habitat and emphasise biodiversity as an important part of property management (EPA, 2006b).
- *Coordinated Conservation Areas* - Is a form of multi-owner/multi-tenure Nature Refuge where private landowners join other landholders. They provide for consistent management of adjacent areas of varying tenure to conserve the area's natural and cultural values. Landholder interests must be maintained. Queensland has one co-ordinated conservation area.
- *Land for Wildlife* – Is a voluntary, non-binding program by Greening Australia which encourages and supports landholders to provide habitat for native plants and animals on their property. Landholders can leave at any time and get free advice and assistance on managing

wildlife. All types of small and large properties are eligible such as farms, bush blocks, parks, school grounds, golf courses and cemeteries. Landholders can also get together with a group of neighbours and join Land for Wildlife to conserve habitat for a particular species of native animal.

- *Fish Habitat Areas*- Declared Fish Habitat Areas (FHAs) give protection to inshore and estuarine fish habitats that are important for sustaining local and regional fisheries. Once an area is declared it equally protects all habitat types (e.g. vegetation, sand bars and rocky headlands) from direct physical disturbance and coastal development (DPI, 2006).
- *Council Parks and Gardens* – Council owned and maintained parks can also be managed for their biodiversity values.
- *Fenced off areas on private land*

Suggested areas for protection in the Annan and Endeavour Catchments due to biodiversity values include Isabella Falls, Mt Fantastic State Forest, Cherry Tree Bay, Alligator Creek, Grassy Hill, Old Cooktown Dam Site, Gampe Drive Picnic Area, Rossville‘s Terrax Old Dam site, Jensen‘s Crossing and parts of the northern Endeavour River.

Measures need to be in place to ensure that newly protected reserves are adequately funded and well managed.

Other ways to protect Biodiversity includes good management in:

- weed and feral animal control, burning practices,
- sustainable grazing,
- monitoring and protecting water quality,
- better tourist facilities and education, and
- community education
- protecting native habitat on private property by planting local native plants, avoiding using poisons and providing bird baths and frog ponds

Research

More surveys into the location and presence of species is required to determine which species require greater habitat protection. In many cases perceived scarce animals or plants are found to be secure when systematic surveys designed to locate the species are undertaken.

Recovery plans set out the research and management actions necessary to stop the decline of, and support the recovery of, listed threatened species or threatened ecological communities. The aim of a recovery plan is to maximise the long term survival in the wild of a threatened species or ecological community (DEH, 2006b).

The recommended actions for Biodiversity from this and the other sections are listed in section 4. Acceptance of and commitment to these recommended actions should occur after consultation with the relevant stakeholders.

3.5 PLANNING AND DEVELOPMENT

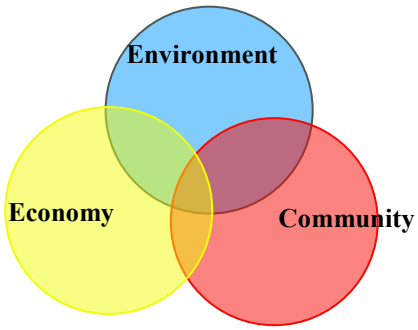
INTRODUCTION

In this section of the Catchment Plan we will be focusing on Planning and Development as it relates to the land use planning undertaken by Local Councils, and the construction of buildings and service infrastructure (communications, roads, water, sewerage and electricity) controlled by Local Councils, State and the Federal Government and corporations such as Telstra and Ergon.

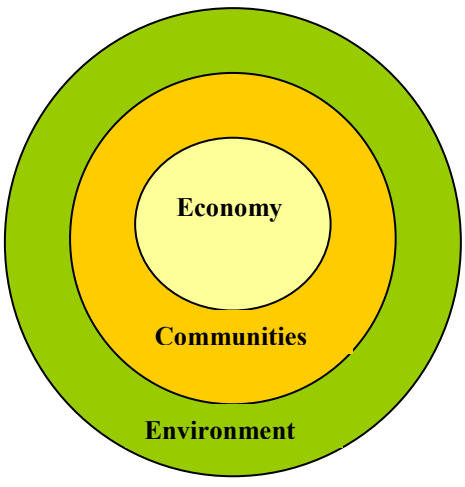
Planning and development in the Annan Endeavour Catchment is controlled by Cook Shire Council and Hope Vale Aboriginal Council, in conjunction with State government departments, through the Queensland Integrated Planning Act 1997. Hope Vale is located 44 km north of Cooktown, covering an area of 110,000 hectares and is a Deed of Grant in Trust (DOGIT) land. Hope Vale Aboriginal Council is in the process of becoming a Local Council under the Local Government Act 1993 and, as such by July 2008, will also control planning and development through the Integrated Planning Act 1997. Cook Shire extends over all of the Annan and most of the Endeavour Catchment, the extent of Hope Vale Shire is shown in Figure 3.5.1. Figure 3.5.1 Hope Vale Aboriginal Council Shire

The Annan Endeavour Catchment Management Group believe that the maintenance and, where appropriate, restoration of natural resources and ecosystem services in the Annan Endeavour Catchment needs to be a priority goal in all community planning and development decisions. This could be considered the aim of any Catchment group, because of the focus of Catchment groups on natural resource management. However, the Annan Endeavour Catchment Management Group believe that it should also be the priority goal of the whole community. Ultimately it is our natural resources maintained by healthy ecosystems that support our economic systems and therefore our communities (see Figure 3.50). With higher transport costs in the future due to Peak Oil our economic dependence on local natural resources will become more significant.

Figure 3.50 Two viewpoints on the relationships between our environment and communities and the economy



A: There are links between our environment, and healthy communities and the economy



B: We need a healthy environment to have healthy communities and need both for a healthy economy

This direction is supported by the purpose of the *Integrated Planning Act 1997*, in which the stated aim is to seek to achieve ecological sustainability. Cook Shire Council, in it's Corporate Plan states that Council wants to *"work with our shareholders to conserve our natural and built environments, cultural landscape and heritage"* (Cook Shire Council, 2002) and in Cook Shire Council's draft *Integrated Planning Act 1997* compliant Planning Scheme that the *~~n~~atural habitat, biodiversity and visual beauty of the Shire's terrestrial and aquatic environments are protected and the quality of its air and water is of a high standard. Human activities with significant impacts on the environment are carefully planned and managed, so that its long-term health is not diminished. Known mineral and other extractive resources are protected and used in a sustainable manner"* (Cook Shire Council. 2007).

Also by the policies of the main service providers:

- Ergon Energy *"regards best practice environmental management and sustainable development principles as critical. As such, our policy stipulates that in all our operations and dealings, we will act with regard to the environmental expectations of our employees, our customers and the community"* (from www.ergon.com.au/environment/environmental_management/)
- Main Roads is *~~c~~ommitted to managing this network in a manner that optimises environmental outcomes for natural, human and built environments. The department uses knowledge of the actual and potential impacts of road infrastructure on these environments when planning, designing, constructing and maintaining the road network"* (fromwww.mainroads.qld.gov.au/MRWEB/Prod/Content.nsf/DOCINDEX/Environmental+Management?OpenDocument.
- Telstra *~~r~~espect and recognise our responsibility to the natural and urban environment and are committed to sound environmental practices* (Telstra, 2005)

3.50 OVERVIEW OF THE PLANNING PROCESS

The *Integrated Planning Act 1997* gives the Councils the mandate to develop Planning Schemes for their shires. Cook Shire Council is in the process of finalising its draft Integrated Planning Act compliant Planning Scheme. Hope Vale Aboriginal Council will be developing its plan over the next few years. The Planning Schemes allows Councils in Queensland to zone land into categories such as Medium Density Residential, Business, Industry, Conservation and Rural. The zoning of land will determine the level of assessment that will apply to activities carried out on the land.

Integrate Planning Act compliant Planning Schemes, like Cook Shire Council's, contain various codes which contain provisions applicable/relevant to new development. The Planning Scheme states which codes apply to different types of development or land use in any particular zone. Codes cover factors such as development, buildings, flood immunity, erosion, water course protection, conservation and acid sulphate soils and set the standards/performance criteria new development must comply with Councils need to incorporate State government legislative requirements in their planning schemes. During the development of Council planning schemes, the Queensland Department of Local Government and Planning coordinates the whole-of-government review and collates responses from the relevant State agencies.
Many of the responses from the State agencies relate to the maintenance of natural resources and ecosystem services. The Department of Natural Resources and Water for example will comment on

draft planning schemes in relation to issues such as extractive resources, conservation of good quality agricultural land, and the Environmental Protection Agency and Department of Natural Resources and Water on issues such as cultural heritage, native vegetation, nature conservation and contaminated land.

3.51 OVERVIEW OF THE BUILDING AND INFRASTRUCTURE DEVELOPMENT PROCESS

All the development that happens in Cook Shire Council is directed by the Council draft planning scheme. The Planning schemes show where new development can go and what form new development can take.

For most development that is assessable in accordance with a Planning Scheme or the *Integrated Planning Act*, a formal request to the Council for approval must be made using a Development Application which is assessed using a process laid down by the *Integrated Planning Act 1997*. This includes an assessment of whether the development meets the relevant codes listed in the planning scheme.

Development requiring a Development Application will be either ‗code assessable' or ‗impact assessable'. Impact assessable development undergoes a higher level of scrutiny and the general public has the ability to make submissions which are taken into account before making a decision about an approval.

For the actual construction of buildings a building permit - also known also as a Development Permit for Building Works – must be obtained from either the Local Council or a private building certifier. The approval process involves assessment by a building certifier against the *Building Act 1975* and associated standards. The building permit states which inspections are required and at what stages of construction. The Council or private certifier who issued the permit is responsible for carrying out these inspections.

3.52 SERVICE INFRASTRUCTURE DEVELOPMENT PROCESS

Service infrastructure provided by the Local Councils, Main Roads, Ergon and Telstra are not solely regulated by Local Councils. Service infrastructure developments can be regulated by up to three levels of government. Smaller service infrastructure projects may only need to meet Local Council requirements under the Local Council planning schemes. However larger projects developed by these service providers need to meet State Government and often Federal legislative requirements as well.

Planning and Development controls are complex, involving all levels of government and a diversity of different Acts. The processes are extremely complicated and difficult to negotiate through. If you would like to find out more we have included some good sources of information in Appendix H.

3.52 ADDRESSING KEY PLANNING AND DEVELOPMENT ISSUES

Considerable concern has been expressed by members of the Cook Shire community about the potential of planning and development decisions to impact natural resources in the Catchments. Community surveys undertaken previously by the SCYC and issues raised at meetings held by CSC in 2006, as part of their community consultation for the planning scheme, have highlighted many concerns in the community. For example:

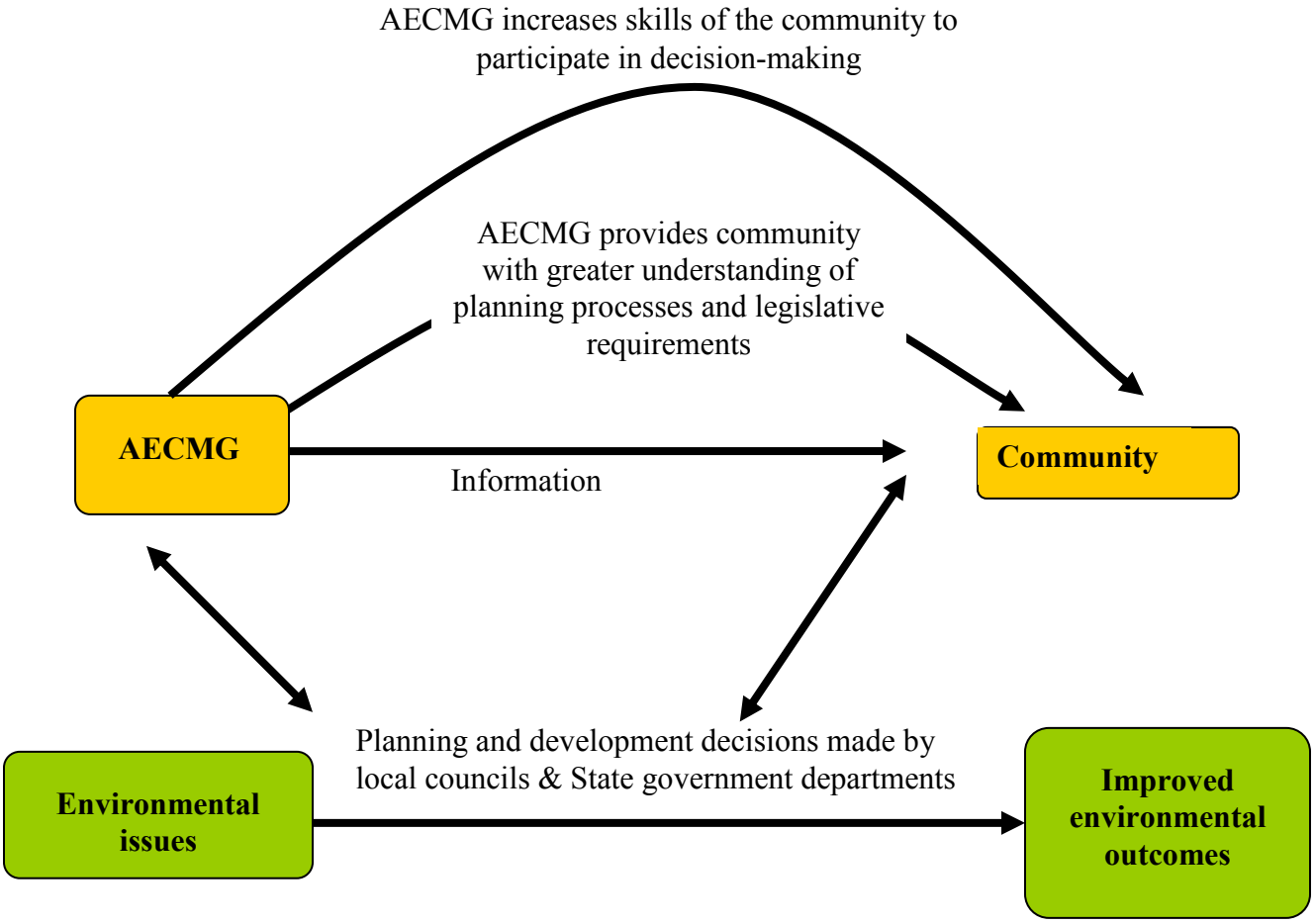
- development on Grassy Hill and around the reservoir,
- erosion and sedimentation from road, track, land clearing, sewerage infrastructure and fire breaks,
- problems caused by rural subdivisions,
- loss of amenity vegetation in urban areas and
- restrictions on clearing native vegetation in rural areas.

In Cook Shire some of these concerns may be addressed by the draft Integrated Planning Act Planning Scheme once it comes into force. However, for continuing and new environmental issues, how can SCYC help improve the environmental outcomes of planning and development decisions? Mainly through:

1. liaising directly with CSC and Hope Vale Council, State Government Departments, developers and service providers such as Ergon and Main Roads regarding planning and development decisions,
2. empowering the Catchment community to participate and advise in planning and development decision-making, and
3. working with the Local Councils and State government agencies to develop processes and tools empowering the community in participating in decision-making.

We have summarised these in Figure 3.51

Figure 3.51: Role of the Catchment Group in working with the community, Local Councils and State government departments to improve environmental outcomes



Commonly when individuals and community groups are concerned about the impacts of planning and development decisions on their local environment they check and, if appropriate lobby for compliance with Local Council, State and Federal Government legislation and policies. However this is only one appropriate strategy. There are many other factors that can lead to perceived _poor' environmental planning and development decisions (see Table 3.5.2). Understanding which factors have a role gives us other effective strategies to work with developers, service providers, Local Councils and State agencies to improve the environmental outcomes of planning and development decisions.

Figure 3.52: Strategies the Annan Endeavour Catchment Management Group and Catchment community can use to improve the environmental outcomes of planning and development decisions.

How ‗poor' decisions can occur?	Some strategies individuals and community groups can use to achieve better environmental outcomes
Land has been inappropriately zoned allowing unsustainable activities to occur	Work with the Local Council and Department of Local Government and Planning to have the land rezoned and/or codes reassessed
Proposed activities do not comply with Local Council, State and Federal Government legislation, regulations and policies.	Lobby Local Council and/or appropriate State government agencies to ensure planning and development proposals comply with Local Council, State and Federal Government legislation and policies. It may be necessary to seek independent legal advice, seek political support and media coverage.
Developers appear to be deliberately exploiting loop holes and ambiguity in the wording of the Local Council, State and Federal Government legislation and policies to push proposals through the development application process	Work with the Local Council and Department of Local Government and Planning to ensure that determination they make on the Development Application is correct taking into account the relevant legislation. Work with local government and the Department of Local Government and Planning for a revision of the legislation, regulations and policies to close loop holes and reduce ambiguity. Get independent legal advice about ‗testing' the legislation. The meaning of legislative provisions are regularly clarified in court decisions.
Decisions are being made with insufficient information to adequately assess: • On-site environmental impacts, • accumulative and staged impacts • impacts on neighbouring areas and the Catchments, and • long-term impacts.	Work with the Local Council and, if required, the appropriate state agencies to ensure that • on-site environmental impacts • accumulative and staged impacts • impacts on surrounding areas and Catchments, and • long-term impacts are adequately assessed. If appropriate work with the Local Council and Department of Local Government and Planning to reassess the zoning and code requirements

The advice given to councillors by Local Council planning and or State government agency staff and or the determinations made by the Local Councilors does not appear to reflect the emphasis of the *Integrated Planning Act 1997* towards ecological sustainability as required by the legislation and the SCYC and community are concerned that decisions will detrimentally impact natural resources and ecosystem services.	Most areas of planning legislation and policy are open to some degree of interpretation by the community and government decision-makers. The personal values and beliefs of the decision-makers can have considerable influence on the interpretations they make and hence also on their planning decisions. Hence decisions which appear not to adequately address ecological sustainability may stem from personal value-driven decisions biased towards other values such as economic development.
Decision makers under the *Integrated Planning Act 1997* are under a duty to seek to achieve ecological sustainability, including carrying out defined duties such as applying the precautionary principle in decision making (EDO, 1997).	This influence on planning decisions is mostly overlooked by individuals and community groups and it is challenging to address. We need to use strategies enabling better understanding of our priority values and the influence of our _worldview' on values. Potential strategies include communities developing future visions (based on values rather than issues) and assessment of external factors influencing the community. The latter is essential to adequately incorporate changing realities into our worldviews and hence values, such as the need for greater emphasis on sustainability and activities to reduce climate change.
Construction work causing environmental damage	Work with Local Council and developers to ensure industry environmental best practices are employed. Many industries and state government agencies have recommended best management practices. Ensure development approvals include environmental best management practices and that these controls are enforced by the local councils. Environmental best management practices may include the need to control certain types of construction work before and during the wet season to reduce erosion and sedimentation.

Figure 3.53 PLANNING AND DEVELOPMENT

Details on Management Actions for Planning and Development

Priority Action	**Details**	**By whom**
Community workshop providing information on Local Council Planning and Development Controls	One-day workshop empowering the community to have a greater role in planning and development decision making.	SCYC coordinate workshop with presenters from Environmental Defenders Office and CSC
Information Sheet _What can I do if I am concerned about a development?‘	The information sheet will list simple steps that members of the community can undertake to _have their say‘ on planning and development decisions. Create as a pdf file for easy updating and downloading from SCYC web site and/or Local Council web sites	Local Councils and SCYC
Promotion Environmental Best Management Practices (EBMP)	Work with Local Councils and State government agencies to ensure EBMP are required procedures in Local Council work programs, Development Applications and works carried out by service providers in the Catchment and that these controls are enforced	Local Councils, Industry Groups and relevant State government agencies
Community workshop on Environmental Benefits of Environmental Best Management Practices	Evening workshop on the environmental benefits of Environmental Best Management Practices. What are they and why we should promote their use by local councils and industry groups.	SCYC coordinate workshop with support of Local Councils, State government agencies and industry groups

Information sheet on _Environmental Best Management Practices‘	On SCYC or CSC website develop a page on _Environmental Best Management Practices‘ (pdf information sheet) with references/links where to find information on _current‘ Environmental Best Management Practices. Regularly updated. Include EBMP for planning and development including, erosion and sediment control, sustainable building design, energy and water conservation etc..	SCYC and Local Councils
Processes developed and events run to build community and Local Council appreciation of the role of values in Planning and Development decision-making	Work with Local Councils and Cooktown‘s Future Group to develop processes to build council staff, councilor and community understanding of the influence of _values‘ in planning and decision-making and ensure ecological sustainability is a priority value in planning and development decision-making	SCYC, Cooktown‘s Future Group, and Local Councils
Community workshops _Role of State government agencies in ensuring planning and development decision-making in the Annan Endeavour Catchments are ecologically sustainable‘	Evening workshop in Cooktown, Rossville and Hope Vale	SCYC and relevant State government agencies

3.6 CLIMATE CHANGE

WHAT IS CLIMATE CHANGE?

There is now a strong consensus in the scientific community and government that climate change is happening.

Climate Change or, as it is also called Global warming, is caused by the greenhouse effect. The greenhouse effect is actually a natural part of our planet's atmosphere keeping air temperatures at an average of 15°C (see Figure 3.6.1 below). Up until the Industrial Revolution, we had very little impact on the _greenhouse', but when we discovered coal, gas and oil as energy sources we began to release tons of carbon from the earth's underground storage into the air, increasing the heat storage capacity of our atmosphere and consequently causing global warming.

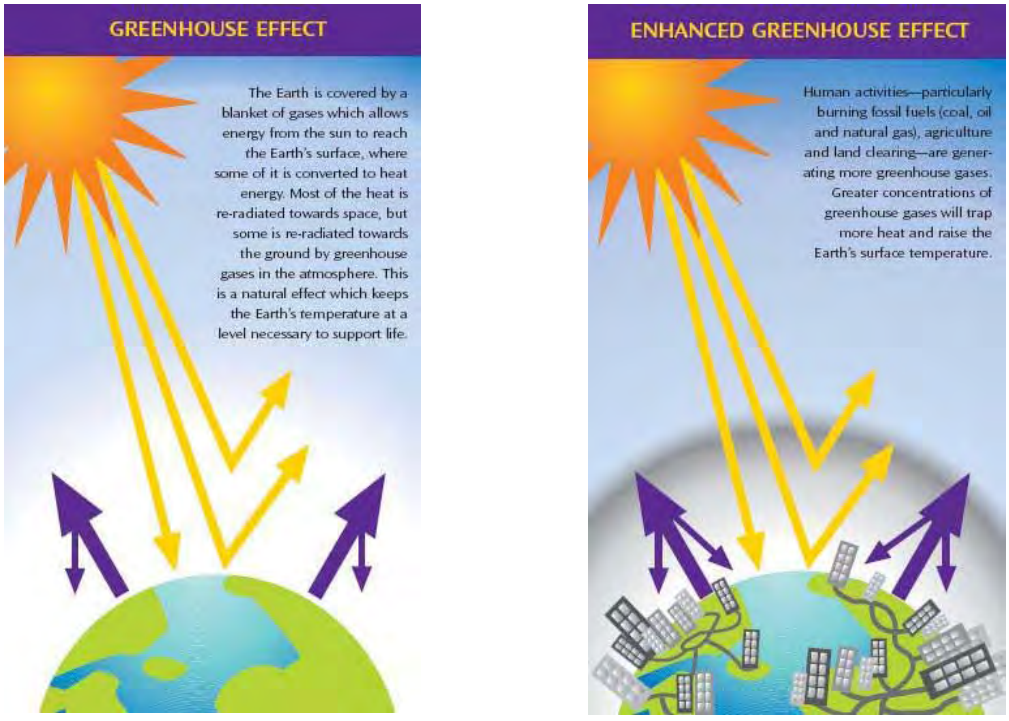


Figure 3.61: How we are warming the atmosphere by releasing greenhouse gases (from Australian Greenhouse Office)

Have a look at the graphs below. They show the increase in carbon dioxide in our atmosphere and how this links with increases in temperature. Carbon dioxide levels haven't been this high in 420,000 years, and CSIRO[2] predict probably not in the last 20 million years!

[2] CSIRO – is the Commonwealth Scientific, Industrial Research Organisation

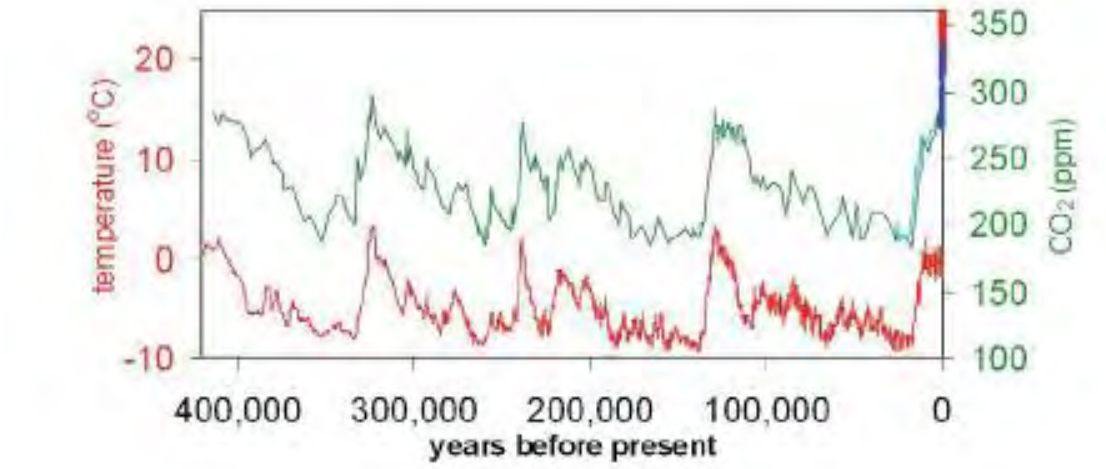


Figure 3.62: Carbon dioxide and temperature over the last 420,000 years (from Intergovernmental Panel on Climate Change, 2001)

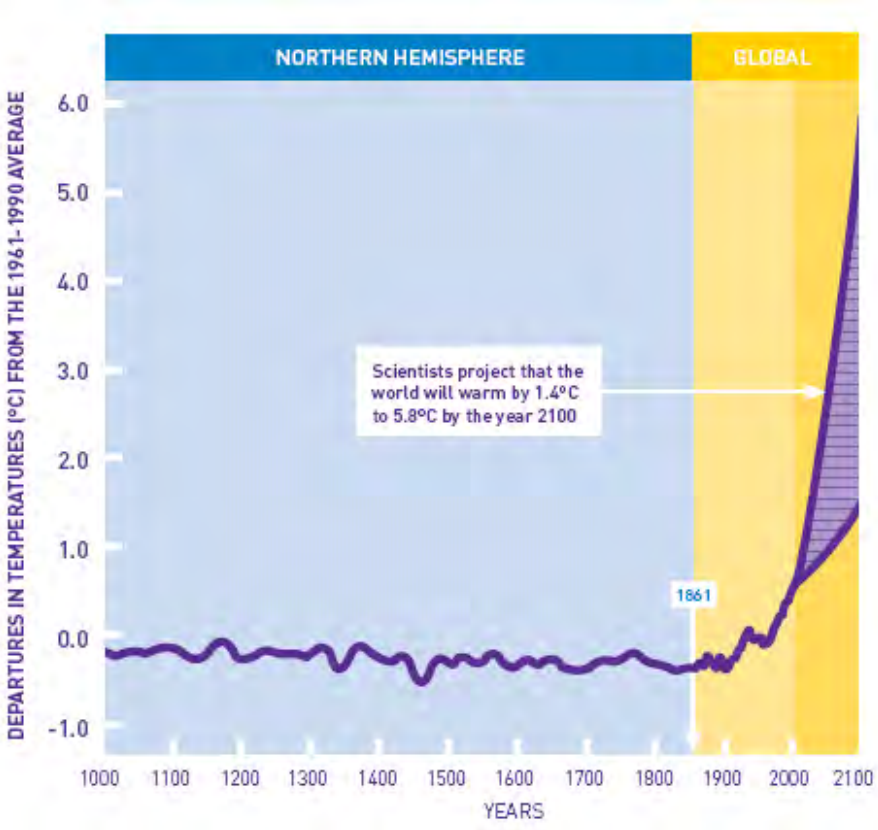


Figure 3.63: Increases in the Earth‘s surface temperature since the mid 19th century (From Australian Greenhouse Office).

How to find out more about climate change.

If you would like to find out more about climate change check out three great web sites: the Intergovernmental Panel on Climate Change web site (www.ipcc.ch/), CSIRO Atmospheric Research division site (www.dar.csiro.au/information/climatechange.html) and the Australian Government's Greenhouse Office site (www.greenhouse.gov.au).
There are many books available, but two standing out from the rest and specifically about Australia are _The Weather Makers' by Tim Flannery (Text Publishers) and _Living in the Hothouse: How global warming affects Australia', by Ian Lowe (Scribe Publications)

3.61 HOW CAN WE PREDICT CLIMATE CHANGE IN THE ANNAN ENDEAVOUR CATCHMENTS?

CSIRO's Division of Atmospheric Research provides predictions on how global warming will change the climate of different regions in Australia, and we can use these predictions to develop future climate scenarios for Annan Endeavour Catchment. The predictions are made using sophisticated computer models that simulate our present climate conditions, and then see what happens to our climate with increased greenhouse gases in our atmosphere. These predictive models are important tools to help us prepare for global warming, but remember that they are only _models' of what is a very complex solar system and depend on predictions of the levels of future greenhouse gas emissions.

3.62 POTENTIAL IMPACTS OF CLIMATE CHANGE ON THE ANNAN ENDEAVOUR CATCHMENTS

So what do the models tell us about the future climate in our region? We have attached an information sheet prepared by CSIRO for Cape York Peninsula in Appendix G , which provides a good general overview of the climatic changes that could occur in Cape York Peninsula and their predicted impacts and have summarized these in Figure 3.61.

We can then use this information to develop management actions that to reduce the impacts of climate change on the health of the Annan and Endeavour Catchments and viability of our primary industries.

Figure 3.61 Summary of potential impacts of Climate Change on the Annan Endeavour Catchments (information on climate change from CSIRO predictions for Cape York Peninsula (see Appendix G and on impacts, compiled mainly from a report by Intergovernmental Panel on Climate Change (McCarthy et al, 2001))

Changes to climate	Range of Impacts
Temperature increase 1.0 – 1.2^{o}C	• Lower soil moisture levels due to higher rates of evaporation and transpiration from vegetation • Water quality is likely generally to be degraded by higher water temperature • Changes in the distribution of native, introduced plants and animals and weeds • Increased use of water for irrigation • Agricultural yields may be reduced
Change in annual rainfall between 0 - +2%	• Changes in soil moisture levels, stream flow and groundwater recharge (see also extreme weather events)
Sea-level rise somewhere between 9 – 88cm	• Increased risk of flooding from rising seas and storm events • Encroachment of tidal waters into estuaries, freshwater wetlands and river systems causing impacts on fisheries and ecosystems • Accelerated coastal erosion, particularly during extreme weather events • Salt water intrusion into surface and ground water • The resilience of mangrove, salt marsh and other coastal ecosystems reduced through rising sea levels, but also from increasing sea temperatures, and other changes including prevailing wave activity and storm waves and surges.
Increased frequency and severity of extreme weather general	• Increased risk of weed invasion due to higher _disturbance levels' to natural and human-modified ecosystems • Increased risk of exceeding the capacity of water and sewerage systems • Flood magnitude and frequency are likely to increase due to extreme rainfall events • Increased vulnerability of buildings and service infrastructure due to flooding and landslides • Adverse effects on food production, freshwater availability and quality, and increased risks of infectious disease epidemics
More intense cyclones	• Damage to crops, service infrastructure, buildings, and native vegetation from flooding, storm surges and wind damage.

Intense or prolonged droughts	• Increased vulnerability of water supplies for human settlements, livestock and irrigation • Increased rates of soil erosion • Reduced plant growth • Increased risk of fire danger
Extreme heat days and heat waves	• Increased risk of heat-related illness and death • Expansion of the range of mosquitoes carrying malaria, dengue and Ross River virus

3.63 PREPARING FOR CLIMATE CHANGE

Building and maintaining the resilience of our natural and human modified (pastoral, horticultural and urban) ecosystems, is the key factor in adapting to the impacts of climate change (Natural Resource Management Ministerial Council, 2006). Resilience is the regenerative ability of ecosystems and their capability in the face of change to continue to deliver natural resources and ecosystem services that are essential for human livelihoods and community development. Let‘s look at a straight forward example. The resilience of a grazing property will depend on the ability of the land manager to promote pastures that can survive higher temperatures and drought, and are protected against damage from extreme weather events like floods and wild fires.

How can we build and maintain the resilience of our natural and human-modified systems if we can only predict the ways climate change will impact our Catchments (see Table 3.6.1) but we can not predict the magnitude of the impacts? One tool the Federal government is promoting is Scenario Planning (Australian Greenhouse Office, 2006). Climate change scenarios provide _pictures‘ of the potential changes in climate and their impacts. We can then use these tangible pictures to look at the risks to our farming enterprises, industrial and commercial businesses, community infrastructure and natural systems (Figure 3.6.4).

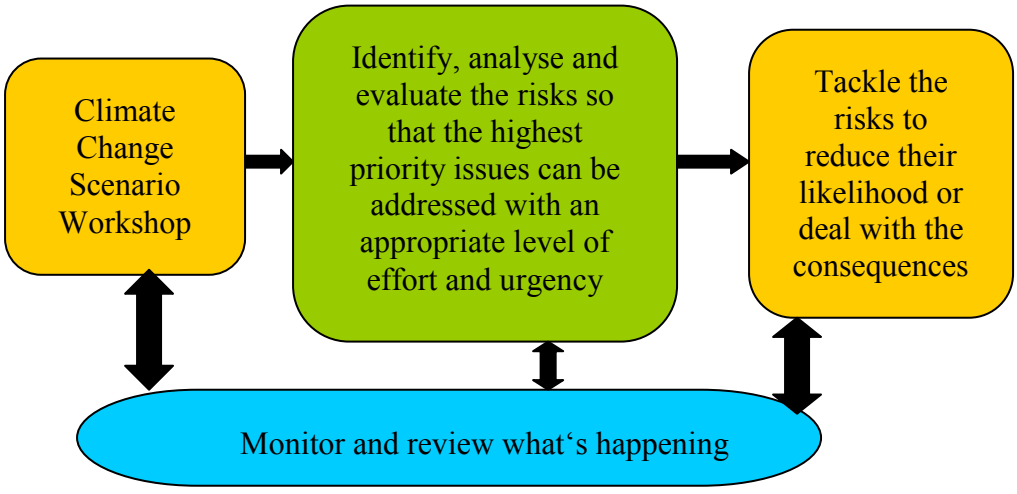


Figure 3.64 Summary of how to plan for climate change

The Annan Endeavour Catchment Management Group is proposing to use Scenario Planning as a tool for working with the community to build the social and ecological resilience of the Catchments (see section on Management Actions). Lets‘ have a look at a practical example of how the community and the Catchment can benefit from scenario planning.

Jim and Pauline Parkinson own a mixed horticulture and grazing property along the Endeavour River. From attending the scenario workshop Pauline and Jim get a better idea of the sort of changes that could occur to their local climate and weather and the likely impacts these will cause. A couple of weeks later they set aside a time to look at the risks to their property and their income. They list all the risks and then prioritise them. They both decide that the increased risk of flooding is one of their major concerns. The house and shed should be ok but their passion fruit vines may go under and they are concerned about the loss of their topsoil and creek bank erosion from the floods. They set about modifying their farm plan and work program to reduce these risks. Extending the vines higher up the slope is one of the options giving them room to sow pasture to protect the soil. Plus they contact landcare about getting a grant to regenerate the natural vegetation on the creek bank knowing that this will help reduce creek bank erosion. By going through this process of risk assessment and adaptation Pauline and Jim have started to build the resilience of their horticulture production system as well as the natural systems they rely on.

Looking at ways we can adapt and reduce the risks of climate change is obviously important, but our primary task must be to reduce our emissions of global warming gases. There is no end point to climate change. No time at which climate change will stop getting worse, unless we significantly reduce our emissions. Furthermore our efforts to maintain the natural resource values and ecosystems services provided by the Annan Endeavour Catchments will be mostly futile in the face of the impacts of climate change. That is why we have listed management actions to reduce green house gas emissions as the highest priority level management action in this Plan.

4.0 Climate Change

Details on Management Actions for Climate Change

Priority Action	Details	By whom
Reduce emissions		
Workshops with local industry groups - ‗Actions to reduce Greenhouse Gas Emissions'	SCYC coordinates a series of workshops with each of the local industry groups to identify mechanisms to reduce greenhouse gas emissions and develop local industry action plan.	Coordinated by the SCYC with the assistance of industry experts and local industry groups/representatives
Forum – How will Climate Change affect our community in the future?	Forum with Global Trend Analysts presenting scenarios on the external influences that will affect the Cooktown area in the future. Forum for Local Council staff, Councilors, community and local industry groups	Coordinated by the SCYC with the assistance of DNR&M and DPI&F Climate Change and Global Trend Analysts
Industry Climate Change Planning Workshops. .	Using the climate change scenarios developed in the first workshop, coordinate workshops with different local industry sectors to develop business and property risk management strategies and future action options to adapt to climate change	Coordinated by the SCYC with the assistance of local industry groups, DNR&M and DPI&F Climate Change and representatives from State Industry Groups like GrowCom, AgForce etc.

3.7 FIRE MANAGEMENT

Fire is an integral part of the Annan Endeavour Catchment. It has been a key factor in shaping the composition and distribution of plants and animals that we see today. Species of both flora and fauna relied upon a well-established indigenous fire regime. Since the settlement of non-aboriginal people in the area 140 years ago and the construction of permanent buildings and infrastructure the focus of fire management has been to protect human lives, assets and to promote the growth of pasture for cattle. Land managers are now increasingly realising the importance of fire and fire regimes in the maintenance of biodiversity.

Fire is an essential land management tool for many of the pastoralists in the region who often conduct their burns in close association with neighbours and rural brigades. Other stakeholders involved in fire management in the region include DNRMW, Rural and QFRS urban brigades and QPWS. Due to the close proximity of many of these groups and the mixed tenure nature of the Catchment there is often considerable cooperation between these groups both in fire prevention and fire fighting. The newly formed Cooktown and Districts Fire Management Committee aims to prepare a fire management plan for the region that will draw upon this high level of cooperation. The regional fire plan will link directly with individual property fire plans (for individual property fire plans see Appendix I)

Uncontrolled wildfires (often deliberately lit) continue to be an issue every year. Unfortunately, the good planning and cooperation between neighbours and rural brigades can be undone by stakeholders with contradictory opinions on the most appropriate fire management strategy for their area. This includes both inappropriate burning practices and fire exclusion (pers.com Marton Rural, McLeod Creek Rural 2006). Addressing this issue involves raising public awareness of the dangers of wildfires and reaching a consensus between neighbours to decide on the most appropriate fire regime for their area.

Figure 3.70 Marton rural volunteers prepare to fight an on coming bush fire at Oakey Creek. Photo courtesy of Marie Alsford

Fire on a property is deemed the owners responsibility under the *Queensland Fire and Rescue Authority Act 1990*. –If you own the land you own the fire" (John Thompson RFS pers comm. 2006) the owner must control, contain or extinguish a fire on their land. This responsibility is supported by the community through the local volunteer Rural Fire Brigades. Taking a proactive approach to fire management that prevents wildfires is the best way to discharge these responsibilities. An individual property fire plan (2 pages) is an excellent way to start this process (Russell Jack pers comm. 2006). Other proactive management includes hazard reduction burns, construction of fire breaks, acquisition of fire fighting equipment and the use of satellite fire mapping technology such as www.firenorth.com.

The Rural Fire Service (RFS) is the best organization to coordinate burning activities between neighbours. The RFS provides volunteers, equipment, insurance and delivers fire safety and training programs (under the *Queensland Fire and Rescue Authority Act 1990*). A regional Fire Warden appointed by RFS administers the –Permit to Light Fire' system, which aims to encourage the use of fire for hazard reduction by providing legal protection for responsible users of fire (RFS 2006). Communication and coordination between parties involved in burning in the Annan and Endeavour Catchment has improved dramatically over the last few years. Yet there is still considerable opportunity to increase this.

Factors to consider when planning a controlled burn include:

- The type of vegetation / country
- Atmospheric conditions, Weather influences, Climate
- Fuel load
- Time of day
- Desired fire intensity
- Resources available
- Land form
- Terrain

3.71 FIRE AND THE ENVIRONMENT

There is a considerable variety of vegetation communities within the Catchment, ranging from the rainforests of the World Heritage Area (WHA) Wet Tropics in the south to the eucalypt and open woodlands communities to the north. Rainforests are generally protected from fire. The rainforest canopy shades out the grasses that fuel fires, shielding most of the forest from fire. However, the rainforest edge is vulnerable to burning, and advances and retreats in response to fire (WTMA 2006). The Wet Sclerophyll or transitional forest (between the rainforests and the drier eucalypt country) of the Rossville, Helenvale and Shiptons Flat area of the World Heritage Area Wet Tropics rely on fire to maintain its open structure and keep the rainforest at bay. In the last 100 years, increased settlement of this region has disrupted both traditional Aboriginal burning and burning by pastoralists, allowing the rainforest to overtake these areas (pers. Comm., Lewis Roberts, 2006). Here early season burns are detrimental to the growth of grasses but do not overly hinder the re-growth of bushes. Consequently, there is a competitive advantage for bushes over grass and the rainforest takes over. As the forest thickens Orchild species, Quolls and Phascogales become locally extinct. It is considered better practice in these areas to have a late season fire which gives the competitive advantage to grasses (pers. Comm., Lewis Roberts, pers. 2006).

Figure 3.71 Oakey Creek Grass fire Photo courtesy of Marie Alsford

Eucalypt and open woodlands forests need regular cool fires to survive. Such fires reduce the build up of fuel that can cause hot late season, destructive fires. Damaging fires are most likely to occur at the hottest and driest time of year, usually from October to January, when they can threaten native plants and animals over huge areas of land (WTMA 2006). Peter Thompson from The Cape York Fire Program recommends using early season burns in a mosaic pattern to break up the fuel load on a property and only having hot fires not more than every 4th year.

Currently there is patchy knowledge about the impacts of fire on these communities. However, it is likely that an appropriate fire regime is the key to maintaining the biodiversity of an area. For grasslands this would be every 2 years for woodlands every 4 years and for rainforest almost never (per comm. Peter Thompson 2007). Land managers and Rural brigades are increasingly burning country in a mosaic pattern with patches burning every 2 – 5 years (lighting smaller, controlled fires during the winter months from June to September, when there is still moisture in the grass). This pattern reduces the likelihood of intense wild fires and is less destructive to wildlife and vegetation.

FIGURE 3.72 FIRE MANAGEMENT STRATEGIES AND RECOMMENDATIONS

Annan Endeavour Catchment

Goal - Cooperation, Planning, Communication, Education

Strategy Determined by Stakeholder Consultation	Recommended Actions For Implementation of Strategy	Management Action Targets Proposed By The Community	By Whom
Better Communication.	▪ Conduct fire management workshops to encourage better communication between parties.	–Understanding different peoples agendas" –Clear protocols in communication"	QFRS SCYC
Increase cooperation with all members of the community involved in burning	• Cooperate with agencies and organisations contributing to community awareness of NRM issues, including Rural Fires,	–Help each other out"	DNRMW, QPWS QFRS
Increase community awareness and public education about rural fire management issues.	▪ Education - QFRS to conduct talks at schools - Public awareness raised through management workshops and newspaper articles. ▪ Increase support for the Cooktown and District fire management committee ▪ Fire management committee/ QFRS to liaise with Ergon Energy ▪ Promote the use of fire as a land management tool ▪ Encourage membership of Rural brigades	–Ergon energy should be educated in fighting of fires when caused by fallen power lines". –Educate the younger members of the community ie QFRS representatives to conduct talks with school children" –Employers should be educated to support members of the fire brigades when needed in emergencies and for controlled burns when the winds are suitable". –More and better community awareness"	QFRS Cooktown and District fire management committee Ergon Energy

Public & private landholders take responsibility for fire on their land.	▪ Fire management committee to liaise with Council, Main Roads, and Ergon Energy ▪ Individual property fire management plans	–Council to be responsible for maintaining their land where there is a potential for fires". –Main Roads department to slash sides of highway on a regular basis" –Main Roads attendance of fire risks on roadsides" –Ergon Energy supplied with a fire-fighting knapsack on the truck would be a big help".	CSC Main Roads Ergon Energy DNRW Main roads
Research & monitoring used to identify best fire management practices for the Catchment	▪ Mechanisms for sharing of knowledge developed ▪ Use of GIS fire mapping technology ▪ Collation of best fire management practices for the Catchment ▪ Monitor fire impact on the environment ▪ Collate information on the fire regimes and management requirements for the maintenance of ecosystems.	–Identify problem areas and issues" –Vegetation to be managed using appropriate fire regimes"	Cape York Fire Program QPWS JCU
Provide training for landholders and relevant organisations.	▪ Organise training days for fire management	–Need for first aid knowledge, being aware of your fellow managers condition" –Training for fire management"	Cooktown and District Fire Management Committee SCYC QFRS

Burning practices in the region to be coordinated and based upon best practice	▪ The Cooktown and District Fire Management Committee to coordinate burning on a regional scale ▪ Develop a regional plan ▪ Plan burning times to reduce the likelihood of soil erosion	–Control burns should consider wind changes later in the season" –Mosaic burns" –Monitor the season and burn early" –Don't be embarrassed to look over your shoulder, the fire may be behind you where you have been" –Early burns to establish breaks prevent later burns taking off" –QFRS to step in to authorise burns on properties where landholders do not agree to controlled burns to protect the wider environment".	Cooktown and District Fire Management Committee SCYC QFRS

3.8 SOIL EROSION

Soil erosion occurs when soil is transported from one place to another by the forces of water, wind or gravity. While this is a naturally occurring process some land management practices have the potential to greatly increase the rate at which this occurs. Also certain soil types and soil structures are highly susceptible to erosion, particularly when the land surface is exposed. When activities such as urban development, roads, fire and over grazing occur on these soil types there is potential for significant erosion. There is clear evidence of erosion throughout the Catchment. Public consultation by the SCYC in February 2006 identified 30 sites of serious erosion in the region (see table 3.84). It is likely that this is not the full extent of problem.

Erosion can be minimised in urban areas by adherence to, and enforcement of erosion and sediment control plans. Historically such control plans have seldom been implemented by the construction industry in Cooktown. This has lead to significant erosion problems. The Cape York Coastal and Marine Action Plan 2006 noted that –efforts to minimise erosion around development sites are often ineffective and have an impact upon water quality in coastal areas". In rural areas of the Catchment there are many proactive measures available that limit the impacts of soil erosion on the natural environment. These include revegetation of degraded areas, using contours on hillsides, sediment traps in gullies and maintaining vegetative cover over the soil.

3.81 SOILS AND THEIR POTENTIAL FOR EROSION

Many soils found in the Catchment are prone to erosion. Coastal lowland soils formed on a geologic base of alluvial and colluvial deposits are especially susceptible. These soils are weakly structured and are prone to erosion when cleared. Biggs and Philip (1994) identified three categories as indicators of soil degradation potential. These included stable soils - low potential for degradation, unstable soils - moderate potential for degradation and very unstable soils - susceptible to degradation.

Skardon soils of the Endeavour Valley and along the Annan River are very unstable soils susceptible to degradation and erosion. Kingjack soils cover extensive areas throughout both Catchments, these are classified as unstable. Jeannie (Kandosols), soils cover an extensive area of the Catchment and are considered to be relatively stable (Biggs and Philip1995) (Figurre 3.80).

Gibson soils (Yellow Sodasols) occur in isolated areas of the Catchment. These include around the community of Hope Vale, South of Archer Point Road and in Kings Plains, east of Banana Creek and west of the Annan River. Gibson soils are prone to erosion, especially when roads are constructed over them (Biggs and Philip 1995).

Areas of very high erosion potential occur south of Cooktown. This is an area of very steep slopes and rainforest vegetation. Red Dermosol soil (Rule) is the most common soil under the closed rainforests of the Annan Catchment and is considered by Biggs and Philip1995 to be relatively stable when uncleared. However, Ruxton 1967 believes that even natural erosion by surface wash under such rainforest can be high. Soil erosion rates following clearing of rainforest in these areas could be extremely high (Ruxton 1967). In the past tin mining activities on these sensitive soils has caused significant erosion and sedimentation issues for the Annan River.

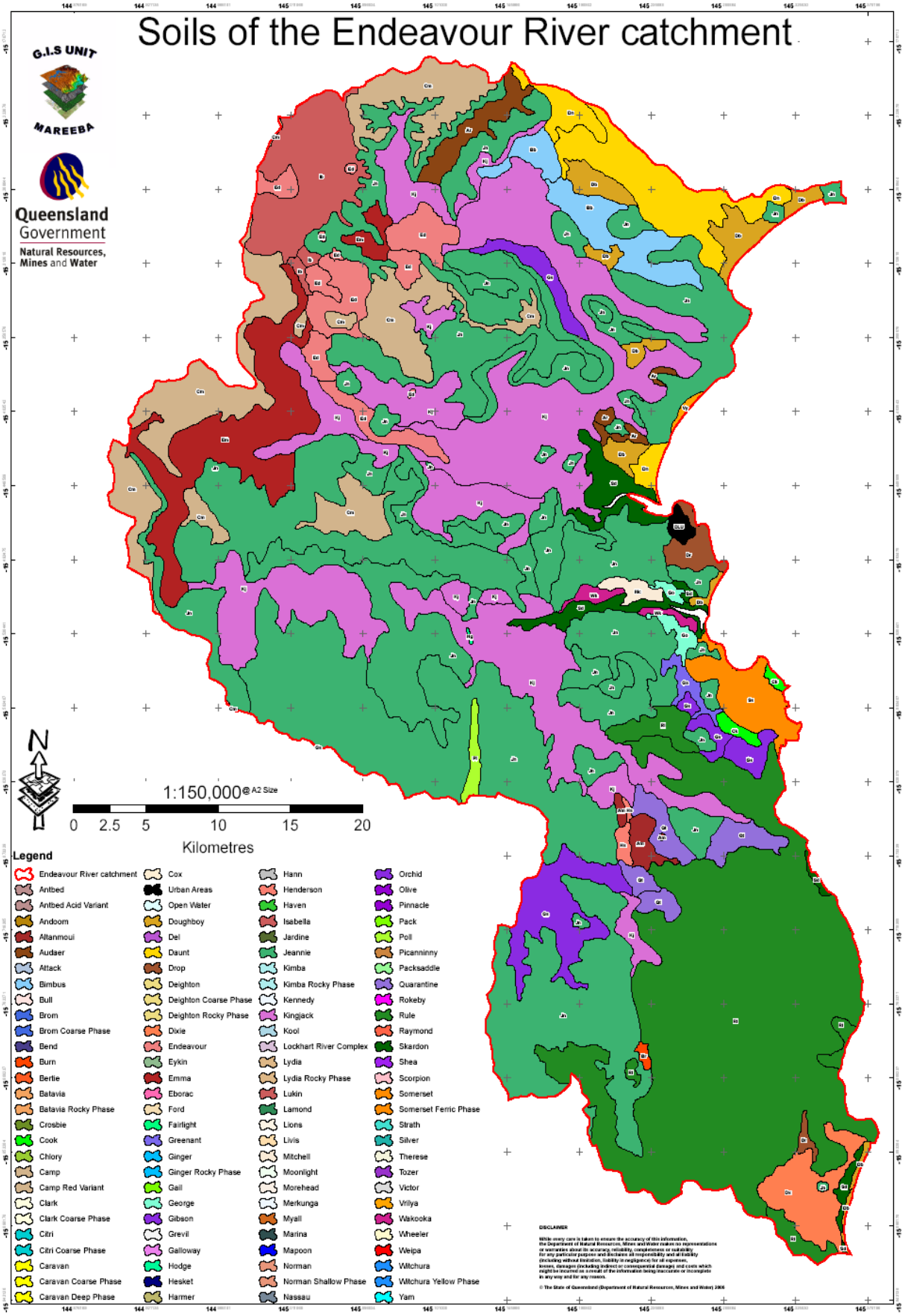


Figure 3.80 Soils of the Annan-Endeavour Catchment. Courtesy of DNRW

3.82 WATERCOURSE EROSION

Erosion in watercourses may be due to a number of reasons. The most obvious cause may be the natural tendency of a specific watercourse to seek an alternative route. This natural process may have contributing factors which are man-made.

Most watercourses in the Annan and Endeavour River Catchments have a riparian zone. This is a heavily vegetated strip located on either side of the watercourse usually composed of species which differ from the surrounding drier areas. In a flood event, the riparian vegetation obstructs the flow of water, and slows it down. This may cause sediment to drop to the bottom, and the combination of a slower flow rate with less sediment load will significantly reduce the capacity of the water to scour at the banks.

To mitigate erosion efficiently, a riparian zone must be at least 50 metres wide, on either side of a watercourse. There is a local school of opinion which insists that trees cause riverbank erosion. This is likely to be true where the riparian zone has been narrowed through fire, grazing, weed infestations or mechanical means. Where there is insufficient width in a riparian zone, the zone itself is not capable of slowing down the flood waters. Any individual tree, particularly if it is growing right on the riverbank, will have water resistance. This will cause an eddy around the base of the tree, and the surrounding bank will scour away. In time, the tree will be uprooted and cause significant erosion. The hole left in the bank will cause water resistance and eddies and there will be further scouring until the water has eroded sufficient material to effect a smooth contour along which to flow. Trees will cause erosion if they are not part of a healthy riparian zone.

The sharp hooves of domestic and feral animals may also de-stabilise riverbanks, as may vehicle crossings and other human infrastructure.

There are several techniques for riverbank stabilisation:

- Maintain or plant a healthy riparian zone.
- Fence riparian zones and provide off-stream watering points for stock.
- Stabilise cattle and vehicle crossings.
- Contour the bank to remove obstacles to the flow of water.
- Direct stormwater to a single armoured drainage point.
- Repair washouts with contouring, armouring, grassing and planting.

3.83 OTHER CAUSES OF EROSION

Feral pigs

Feral pigs (*Sus scrofa*) are common throughout the Catchment and cause extensive damage to riparian and wetland habitats. Pigs accelerate erosion by disturbing the soil, uprooting plants, spreading weeds diggings and increasing sedimentation. Wallows greatly increase the erodability of the soil. In coastal areas wallows can allow saltwater to enter previously fresh water systems, killing large areas of fresh water vegetation (Hadden 1993). Pig control work requires a long term commitment and must cull a large proportion of the population to be effective.

Figure 3.81 Feral pig destruction at Keating‘s Lagoon

Public consultation identified 5 areas in the Catchment where the community was concerned about feral pig causing erosion they included:

- The Airport
- Shiptons Flat
- The Wet Tropics World Heritage Area.
- Alligator Creek, Cooktown
- Keating‘s Lagoon

Fire

Fire can also cause erosion problems. Hot fires that reduce ground cover can leave the soil exposed. Loss of vegetation leads to increased runoff and less infiltration of water into the soil. The problem is compounded when there is heavy rain that follows soon after burning. Prevention of late season hot fires is essential for soil conservation. Prescribed burns that maintain the ground stabilising vegetation are a solution to this problem.

Firebreaks

Firebreaks require the removal of vegetation to be effective. Removing the vegetation leaves the soil exposed and vulnerable to accelerated erosion. Badly eroded firebreaks make firefighting vehicle access impossible and require expensive maintenance. Firebreaks constructed on a stable soil type and which follow ridge lines or run parallel to contour lines are both cost effective and have a lower erosion risk. Other options include incorporation of natural features which act as a barrier to fire such as rivers and streams into a firebreak network. Care should be taken to avoid grader windrows which may cause water to run down the firebreak and channel down the cleared line (Hadden 1993).

Figure 3.82 Firebreak erosion – A Mount Cook Firebreak eroded 1.5 metres after 1 wet season

Weeds
Weeds can change the species composition of an ecosystem. They can reduce vegetation cover (especially of grasses), disrupt water flow patterns, and may cause soil instability. Public consultation in 2006 by the SCYC identified Sicklepod infestations on the Annan River at Shipton's Flat/Helenvale and the head waters of the Endeavour River as a serious concern. Here Sicklepod forms a monoculture, eliminating grass cover and excluding native vegetation. When Sicklepod dries off and is burnt the soil is left exposed and vulnerable to erosion. Application of selective herbicides to Sicklepod infestations early in growing season can help to maintain grass cover and reduce the risk of erosion.

Sicklepod and Grader Grass are two weeds which use fire to gain a foothold. Both have seeds which regenerate well after fire. Both grow in locations where access may be difficult in the growing season. Neither responds well to herbicide after flowering commences. One technique is to blunt blade with a slasher when ground dries out and flowering or fruiting has commenced. Weeds will revert to the vegetative stage to grow more canopy, and may then be treated successfully with selective herbicide.

Unsealed roads
Erosion from unsealed roads and associated infrastructure is a significant source of sediment to both the Annan and Endeavour Catchments. During monsoonal rain events, storm water uses gravity to escape. Ideally, roads are constructed and maintained, so that water flows to the table drains and is directed to a culvert or watercourse. Should the drains or culverts become blocked, the effect of gravity will cause the storm water to seek another path. This causes scouring, and damage to the road surface, as the water crosses it, carrying more sediment away in the process. Once in a watercourse, which in the wet season, may well constitute part of the road surface, the sediment load in the water has a bulking factor of 50%. The sediment already in the water has an abrasive effect where it runs, compounding its ability to scour. As the sediment load increases, so does the scouring effect. Keeping drains clear and free of weeds is an important anti-erosion technique.

Storm water can be slowed by placing rocked riffles across drains. As the water slows, the sediment drops out. Small, rather than large rocks should be used. Riffles should be kept clear of weeds and other debris, or they will cease to function.

The movement of traffic on unsealed roads during the wet season is extremely undesirable, particularly if vehicles become bogged. Retrieval operations inevitably result in more scouring and sediment. Once the road surface is broken through, the potential for more bogged vehicles increases, and repair operations will result in the escape of more sediment.
A few mitigating principles apply here:

- Avoid sightseeing drives during the wet season.
- Stock up on foods and essentials to avoid unnecessary drives to town.
- Plan your route to avoid getting bogged.
- Stabilise creek crossings and bogs on your property by installing sub-surface drains and covering with coarse material.

The unsealed commuter roads are McIvor Road and Endeavour Valley Road between Marton and Hope Vale, and the Bloomfield Road between the Finlayson Range and Black Mountain. Ancillary commuter roads include McIvor Road north to Elderslie Station, Battle Camp Road, Archer Point Road and Mt. Amos Road. Urban expansion into satellite areas has resulted in an increase of traffic on these roads as people commute to and from employment.

The sealing of the road between Marton and Hope Vale is a priority. The road links the two substantial communities of Cooktown and Hope Vale. Both are undergoing urban expansion and vehicle movements have increased. This road is often cut by bogged vehicles which are subsequently retrieved, contributing to erosion. Given the increasing problem of sediment in the Endeavour River, the road construction program should be accelerated.

3.84 EROSION CONTROL RESOURCES AVAILABLE

The ecological and economic benefits of appropriately managing soil and riparian vegetation, is now increasingly recognised and practiced by land managers. There is a large amount of literature available that details good stream and soil management principals and practices in Australia some of which is specific to Northern Australia. Publications such as those listed below provide good broad management principals and management techniques to support land managers in their efforts to repair degraded areas and protect land from erosion. Another good recourse is the Northern Australia land managers web site http://www.landmanager.org.au

Stream Stabilisation for Rehabilitation in North-East Queensland: a report funded by the Land and Water Resources Research and Development Corporation, the National Landcare Program and the Queensland Department of Natural Resources (Kapitzke et al. 1998).

A Rehabilitation Manual for Australian Streams Volumes 1 & 2 (Rutherfurd et al. 2000), a comprehensive manual containing information on all aspects of managing Australian rivers including planning, vegetation and weed management, fencing and erosion control.

Soil Conservation Handbook, Kate Hadden - Conservation Commission of the Northern Territory 1993

Soil Conservation Measures – Design Manual for Queensland. October 2004.
http://www.nrw.qld.gov.au/land/management/pdf/c1scdm.pdf

Figure 3.83 Erosion sites in the Catchment identified by the community - February 2006

Annan Erosion

- Sediment from old tin workings continually eroding, in River and washing downstream. Sediment from access tracks.
- Upper Annan R
- Devils Staircase, Shipton's Flat Rd
- Shipton's Flat Rd
- Mt Misery Track
- Bald Pocket
- Jubilee Ck
- Romeo Ck
- Parrot Ck
- Bluestone Mine and access tracks
- *Site upstream of powerline identified at workshop 20/2/06*
- Powerline – Beesbike – Shipton's Flat Rd
- Confluence Annan R and Wallaby Ck – 10 yr old NHT riparian stabilisation project site recently burnt by Rossville Rural Fire Brigade as training exercise.
- Trevethan Ck
- Amos Bay Rd?
- High Bank upsteam of Yuku Baja Big Annan Bridge
- Archer Pt Rd and adjacent tracks – other Archer Pt? Where dozer went in near old jetty?
- Keatings Lagoon Reserve
- Sediment from Brown St and adjacent subdivision
- Hutchison St
- Unsealed Section of Quarantine Bay Rd?
- Quarantine Bay dune batter has receded 8m since 2000

Endeavour Erosion

- Ticklebelly Flat on the heritage trail (Degraded tourism value)
- Stone Wall on the Endeavour
- Upstream of the Endeavour bridge
- The Big Bend on the Endeavour
- Oakey Creek – natural erosion processes occurring
- Riverbank at side of the road by the Airport
- Paw Paw Gully Endeavour Valley Rd
- Extensive sediment runoff from roadways – Cooktown to gravel pit on Endeavour Valley Rd
- Spraying of vegetation in drains by Cooktown mowing contractors and the Department of Main Roads leads to scouring of drains and erosion. Pers comm. Trevor Meldrum
- Elim Beach foreshore

Figure 3.84 Erosion sites in the Catchment identified by the community February 2006

Goal: To increase the stability of riverbanks and erosion affected areas. Development that does not accelerate erosion. Protect the environmental values and water quality of the Catchment.

3.9 FISHERIES AND FISH HABITAT

3.91 FISHERIES

The Annan and Endeavour River's are a very limited fisheries resource. This is due to the relatively short reaches of the rivers and the restricted Mangrove and Saltmarsh habitats. The Endeavour River is closed to all commercial fishing (QDPI&F 2006). Commercial fishing and crabbing is permitted in the Annan River from Walker Bay to 800 m downstream of the Cooktown Development Road Bridge and includes the Esk River (QDPI&F 2006). Barramundi and Mud Crabs are the prime commercial target species. Recreational species targeted in the Catchment include Barramundi, Mangrove Jack and Mud Crab. Currently there are 3 part time sportfishing tour operators in the Catchment.

Cooktown is promoted as a fishing town. With the sealing of the Mulligan Highway there has been a significant increase in fishing effort from a growing number of recreational fishers. However there is limited data for catch and effort by recreational or indigenous fishers on the Annan River and none for the Endeavour River. Consequently it is difficult to determine the sustainability of fishing in these rivers. The Cape York Peninsula Marine and Coastal Action Plan 2006 stated that "There is no possibility of responsible fisheries management on Cape York Peninsula until a database of visitor numbers, areas of activity, and composition and quantity of catch is established. Stock assessments in heavily fished areas are urgently needed. There is also a low level enforcement of recreational and charter fishing regulations". In addition there has been very little investigation or monitoring of the health of fish habitat in the Catchment.

The primary fisheries issue identified during consultation for this strategy concerned fishing practices in the Annan River. Historically the Annan and Endeavour River's were seldom targeted by commercial fishers (pers comm., Ian M^{c}Collum October 2006). However zoning changes in 2004 closed many long-established fishing grounds along the coast which has lead to displaced fishing effort being focused on places such as the Annan River Mouth and Walker Bay (pers comm., Ian M^{c}Collum October 2006). Some commercial fishers operating from the Mouth of the Annan River have caused serious concern among the community. There have been numerous reports of fish frames and shark carcasses discarded on the river banks at the mouth which has brought crocodiles into close proximity to people (pers comm., Barry Lyon March 2006). Other issues identified included concern that leachates from the Cooktown dump was impacting on crab and fish breeding (pers comm., T Nickleson October 2006). Urban storm water runoff with associated turbidity and highly concentrated acid sulphate soil runoff are also a concern for fish stock health (pers comm., Ian M^{c}Collum October 2006).

Figure 3.91 Recreational Fishers on the Cooktown Wharf

3.92 ANNAN RIVER FISH HABITAT AREA

In 2003 the Queensland Department of Primary Industry and Fisheries (QDPI&F) declared 1750 ha of the Annan River as a Fish Habitat Area (FHA). This area is protected by the *Fisheries Act 1994* and extends from the tidal habitats at the mouth of the Annan River to the freshwater habitats reaching upstream to the Annan River Weir. The Act restricts development activities to protect fish habitats important for sustaining local and regional fisheries. Protection of these habitats provides significant marine conservation benefits (DPI&F 2006). A FHA is a form of ~~"~~multiple-use" marine protected area, protecting natural fish habitats from alteration and degradation while allowing for community use, including community access; boating; commercial and recreational fishing; traditional fishing; yabby pumping; and collection of molluscs (DPI&F 2006). The Annan River FHA has a management level of 'B' which allows for constructing a permanent structure within the area; ie the Annan Bridge. Activities such as pesticide application and biological controls introduction for the management of noxious fish, declared animals and plants, and environmental weeds may only be undertaken in accordance with the Fish Habitat Area code of practice (Fish Habitat Area Code Number: FHACoP01 Last revised: February 2005).

3.93 FISH FAUNA

Fish fauna of the Annan River system is relatively rich, compared with temperate Australian systems and streams in other continents (Hortle and Person1990). Hortle and Person (1990) recorded 25 species of fish, including 14 principal freshwater forms from the Annan River. There is one species of Goby that may have a very limited distribution found in the Annan River, however more research is needed to confirm this (pers comm. Damien Burrows 2006). A fisheries resource assessment of the Annan River was completed by Sheppard and Helmke, in 1999. In the estuarine section of the river 22 fish species were recorded while in the fresh water section 29 species were recorded. Two species of scaleless goby and the pipefish *Microphis leiaspis* where recorded, these fish are found only rarely in Australian freshwater streams (Sheppard and Helmke 1999). The Weir and the Annan River Gorge present barriers to fish movement in the river. Gobies, Jungle Perch, Gudgeons and Eels are able to traverse the Annan River weir from estuarine areas; other estuarine species such as Mangrove Jack are unable to traverse the weir (McDougall and Pearce 1999). The Annan River Gorge prevents the movement of most catadromous fish species up stream (Barlow et al 1987).

In 1999 one Survey was done on the South arm of the Endeavour River at Rutherford's Lagoon by DPI&F, A survey of the North arm at the same time 14 species of fish were recorded. Good numbers of barramundi were caught at this site and the habitat appears to be in near pristine condition (McDougal and Pearce 1999). McDougal and Pearce 1999 believed that this area be ~~re~~commended for protection to ensure the continued viability of this area as a nursery area. Consideration needs to be given to declaration of the upper reaches of this system as a Freshwater Fish Habitat Area. The area would adjoin the existing Conservation Park Zone and continue upstream to encompass the associated lagoon systems". A fisheries resource assessment of Endeavour River (similar to that done by Sheppard and Helmke 1999) would be of significant benefit for developing fisheries management strategies for this system.

Jungle Perch is a fish that is in serious decline over much of Queensland. Mostly due to habitat modification and fish passage barriers (it breeds in saltwater and then can't return above barriers to the freshwater pers comm. Damien Burrows 2006). The status of Jungle Perch in the Catchment is poorly known. In 1999 DPI&F surveyed above the Annan weir and found Jungle Perch. It is likely that this population has not been able to recruit since the construction of the weir (pers comm.. Malcolm Pearce DPI&F March 2007) and may have died out. There are reports of Jungle Perch below the Annan weir (pers comm. J Pyke 2006) and in the Endeavour River around to the waterfall near the junction of McLeod Creek (pers comm. Barry Lyon 2007).

3.94 FISH RESTOCKING

From 1991 to 2001 the Cooktown Fish Restocking Association were actively stocking the lower Annan and Endeavour rivers with Barramundi. A total of 195,000 15mm to 40mm fingerlings were released (Keating's Lagoon has also been stocked with Barramundi). The Association made 2 submissions between the years of 1992 and 2003 to the Great Barrier Reef Marine Park Authority that Walker Bay and the Annan River be closed to commercial netting (pers comm., Joan Thistlethwaite December 2006). After the rezoning of the Great Barrier Reef Marine Park in July 2004 Walker Bay remained open to commercial netting. Continued netting in Walker Bay and the Annan River and lack of tag returns lead to disillusionment of Association members (pers comm., Joan Thistlethwaite December 2006). There has been no restocking of Barramundi in the Catchment since 2001 and the Association is no longer active.

In May 1981 the DPI stocked 2,030 Sooty Grunter fingerlings above the Annan River Gorge which subsequently established a self-sustaining population (Burrows 2002). Sooty Grunter is not native to the Annan River system. South of the Annan River Gorge is within the Wet Tropics World Heritage Area and includes very high value tributaries that contain remnant populations of six frog species listed as _Endangered' under the EPBC (1999) (Richards *et al.* 1993). There is a possibility that Sooty Grunter may be present in the same stream reaches where endangered frog species are found (Burrows 2002). A survey to determine the overlap in distribution of Sooty Grunter and the risk to these frog species is urgently required (Burrows 2002). Future inappropriate fish introductions are now less likely as fish stocking now comes under The *Fisheries Act 1994.* The Department of Primary Industries and interest groups have developed a policy for translocating fish in Queensland freshwater systems, including rivers, impoundments, farm dams and aquaculture facilities. The Act sets out key principles under which the Department will operate, and decision-making procedures following specific protocols (Arthington and McKenzie 1997).

Figure 3.92 Recreational fishing for Sooty Grunter –Annan River

3.95 SEAGRASS

The most diverse Seagrass communities in Australia are found in the waters of north-eastern Queensland (AIMS 2006). The mouths of Annan and Endeavour Rivers are no exception. Four species of Seagrass have been identified in the Endeavour River these include; *Halophila ovalis*, *Halodule uninervis*, *Cymodocea rotundata*, and *Zostera muelleri* and five in the Annan river/ Walker Bay area these include *Halophila ovalis*, *Halodule uninervis*, *Halophila spinulosa*, *Cymodocea serrulata*, and *Syringodium isoetifolium* (pers. Comm. Howley 2006).

Seagrasses are of significant value within coastal ecosystems because of their high rate of primary production and ability to trap sediments and organic nutrients (Poiner and Peterken1995). Seagrass are important habitat for turtle and dugong and many species of fish and invertebrates. Seagrass growth and distribution is very susceptible to environmental variability and poor land use practices. Human pollution has contributed most to Seagrass declines around the world. The greatest pollution threat to Seagrass populations is from high levels of plant nutrients (AIMS 2006). High nutrient levels, often due to agricultural and urban run off, cause algae blooms that shade and kill Seagrass (AIMS 2006). Currently there is no regular monitoring of Seagrass beds in the Annan and Endeavour Rivers. Consequently it is difficult to determine the impact of land use practices in the Catchment on Seagrass health.

Figure 3.93 Seagrass meadow at the mouth of the Endeavour River. Photo courtesy of CYMAG

Provisions under the Fisheries Act 1994 protect marine plants. A permit is required to disturb any marine plants (including Seagrassant, mangroves, saltmarsh and other littoral vegetation)

McDougal and Pearce 1999

3.96 WETLAND FISH HABITAT

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Wetlands are important habitats for many species of fish and crustaceans. Recreationally important species such as Barramundi use wetlands as a nursery area. Unfortunately there are many pressures on the health of wetlands in the Catchment.

The Australian Terrestrial Biodiversity Assessment (NLWRA 2002) identified key threats to wetlands to in eastern Australia as overgrazing, exotic weeds, feral animals and changed fire regimes. Blackman *et. al.* 1996 identified grazing as the most widespread pressure on Queensland's wetlands. Grazing animals have direct impacts on wetland vegetation, soils and water quality that may have indirect impacts on the biology and biogeochemistry of wetlands by altering habitat structure and patterns of primary and secondary production (EPA 1999a). Landholders in the Catchment have been active in protecting wetland areas from stock on their properties. Grants offered to landholders by Cape York Peninsula Landcare have seen some sensitive wetland areas in the Catchment fenced off from stock.

Feral pigs impact heavily on wetlands in the Catchment. Feral pigs have established large populations and cause significant degradation to many wetlands in the region. Pig activity at Keating's Lagoon has caused disturbance of acid-sulphate soils (pers.comm D Wood 2006) and lowered pH of Lagoon waters. (pers.comm C. Howley 2006). Pigs have caused large areas of Keating's Lagoon to become shallow due to sedimentation and large numbers of Magpie geese are no longer seen here (pers.comm J. Giese 2006). There is an urgent need for a long term control program of feral pig numbers around sensitive wetland areas in the Catchment.

Few weed species have established in the Catchments wetlands; however the recent discovery of *Hymenachne* in Keating's Lagoon has the potential to significantly threaten fish habitat and nursery areas if not controlled promptly.

Wetland Management

Key elements of any future wetlands management strategy will include:

- Nature Refuges - a voluntary conservation agreement under Queensland legislation that are binding on the property title.
- A wetland management plan that provides practical guidelines.
- Cooperative management arrangements incorporating Traditional Owners.
- Conserving the region's coastal wetlands, which are critical for fisheries productivity.

Wetlands in the Catchment are protected by a number of agreements and conventions these include;

- China/Australia Migratory Birds Agreement (CAMBA)
- Japan/Australia Migratory Birds Agreement (JAMBA)
- *Water Resources Act 1989*.
- Council of Australian Governments strategies for reform of the water industry 1994
- National Principles for the Provision of Water for Ecosystems 1996
- Commonwealth Government Wetland Policy 1997
- Strategy for the Conservation and Management of Queensland's Wetlands 1999

3.96 SALTMARSH

Saltmarshes are intertidal plant communities dominated by salt tolerant herbs and low shrubs that can endure high soil salinity, high temperatures and occasional inundation from salt water http://www2.dpi.qld.gov.au/fishweb/17196.html. Saltmarsh is important fish habitat because;

- They provide a source of food to foraging fish at high tide,
- They provide nutrients which support adjacent estuarine food webs; and
- They provide habitats and shelter when the saltmarsh is inundated at high tide.

Extensive saltmarsh communities can be found either side of the Annan River to the East of the Mulligan Highway. There is some Saltmarsh on the Endeavour River to the east of Four Mile Creek to the Race Course. These communities are described as sparse herbland or bare saltpans, associated with salt plains and saline flats (EPA regional ecosystem Data base 2006)

Figure 3.94 Annan Saltmarsh community

Many areas of saltmarsh in Australia, particularly those near urban centres, have been lost or have become degraded as a result of factors such as drainage, stock, weeds, vehicles and mangrove encroachment. No study has been made of the Saltmarsh within the Catchment so it is difficult to determine how these processes impact on these communities. However examination by the Annan-Endeavour Catchment Management Group has documented extensive vehicle damage and litter at the Endeavour Saltmarsh, while the Annan Saltmarsh appears to be relatively un-impacted. The issue of the landward incursion by mangroves into saltmarsh cannot be determined without a long term study. Mangroves will be more likely to encroach on Saltmarsh when the Saltmarsh is restricted along its landward edge by urban development or elevated topography and when changes to Catchments occur from urban activities that result in altered sediment and nutrient inputs see http://www2.dpi.qld.gov.au/fishweb/17196.html. These are factors which are impacting on the Endeavour Saltmarsh and provide important indicators for a strategic and integrated approach to protecting Saltmarsh in the Catchment.

4.0 POSITIVE ACTIONS TO IMPROVE OUR CATCHMENT

4.1 ABORIGINAL COMMUNITY LANDUSE

Management Action Table

Goals:

PRIORITY ACTION	BY WHOM	BY WHEN	OTHER RELEVANT STRATEGIES	PRIORITY LEVEL (high, medium, low)
Feral Animals				
Implement pest animal control and eradication as outlined in Pest Management Plan Cook, Hope Vale and Property Plans.	CYWAFAP Hope Vale Council	Long term	CSC, Hope Vale and Property Pest Management Plans,	High
Encourage Hope Vale council to adopt the Model Local Law (Impounding of Animals) to authorise their own Animal Control Officer to impound and control problem animals.	CSC Animal Control Officer Hope Vale Council	Short term	Wandering Horses in Hope Vale Aboriginal Community – Report by CSC Animal Control Officer Matthew Birch	High
Work together with other stakeholders to control pigs in Wetlands	All stakeholders	Long term	CYP Feral Pig Pest Mangement Plan Queensland Feral Pig Strategy	High
Weeds				
Undertake weed control and eradication as outlined in Pest Management Plans	Hope Vale Council CYWAFAP	Long term	Hope Vale Pest Management Plan	High
Apply for additional funding for CYWAFAP to undertake weed and feral animal control work on Hope Vale land	Hope Vale Council CYWAFAP CYPDA	Short term	CYPDA, DNRW	Medium
Encourage the public to contact the relevant weed authority regarding new weed outbreaks	Hope Vale Council CYWAFAP	Long term	CYWAFAP, CSC	High
Biodiversity				
Assess biodiversity of wetlands on Indigenous land	Hope Vale Council Researchers	Long term	AQUA BAMM Guidelines	High
Ensure adequate buffers to wetlands from development	Developers EPA	Long term	AQUA BAMM Guidelines	High
Investigate opportunities for joint indigenous programs with nature conservation agencies to protect significant areas.	Hope Vale Council Gungarde EPA, QPWS	Long term	Indigenous Protected Areas Program	Medium
Planning and Development				

Promote Environmental Best Management Practices	SCYC, CYP Landcare, TO representatives and relevant State Government Departments	Long term	Yalanji Indigenous Land use Agreement	High
Climate change				
Workshop with local Indigenous groups - ‗Actions to reduce Greenhouse Gas Emissions'	Coordinated by the SCYC with the assistance of Indigenous community group representatives	2008		High
Forum – How will Climate Change affect our community in the future? Indigenous community representatives together with industry and other community groups	Coordinated by the SCYC with the assistance of DNR&M and DPI&F Climate Change and Global Trend Analysts	End 2008	National Agriculture & Climate Change ACTION PLAN 2006 – 2009, NRM and the Joint Ministerial Council	High
Industry Climate Change Planning Workshops.	Coordinated by the SCYC with the assistance of local industry groups, DNR&M and DPI&F Climate Change and representatives from State Industry Groups like GrowCom, AgForce etc.	End 2008		High
Erosion				
Provide support for Traditional Owners engaged in riverbank stabilisation.	EPA CSC SCYC	Long term		High
Prevention of late season fires for soil conservation purposes by using prescribed burning techniques to maintain the ground stabilizing vegetation.	CYFire programme SCYC	Long term		Medium
Conduct study into the causative mechanisms of bank	EPA	Long term		High

erosion in the Catchment. Treat the causes of erosion before undertaking rehabilitation work.	SCYC			
Control riparian weeds to improve river bank stabilisation	Hope Vale Council Gungarde, EPA	Long term		High
Fisheries				
Undertake stock assessments of indigenous target species	Hope Vale Council DPI&F	Long term		Medium
Collate data for catch and effort from recreational or Indigenous fishers in the Catchment	Hope Vale Council DPI&F	Long term		Medium

4.2 GRAZING

Management Action Table

PRIORITY ACTION	BY WHOM	BY WHEN	OTHER RELEVANT STRATEGIES	PRIORITY LEVEL (high, medium, low)
Feral Animals				
Encourage landholders to undertake and implement pest management plans with assistance from CYWAFAP	Landholders CYWAFAP CYPDA	Short term	Other pest management plans	Medium
Weeds				
Encourage landholders to undertake and implement pest management plans with assistance from CYWAFAP	Landholders CYWAFAP CYPDA	Short term	Other pest management plans	Medium
Encourage landholders to hold cattle in yards for appropriate length of time when they come from Sicklepod infested areas				
Wash down trucks that have come from Sicklepod areas. Wash down facility soon at Lakeland		Ongoing	CSC PMP	High
Contact relevant weed authority regarding new weed outbreaks	Graziers CYWAFAP, QPWS	Ongoing		High
Eradicate isolated weed outbreaks of priority weeds	Landmanager CYWAFAP	Long term		High
Coordinate with neighbouring properties to control recommended weeds at the same time	CYWAFAP	Long term		High
Work on riparian weeds upstream and work down to prevent reoccurring infestation.	Graziers CYWAFAP, QPWS	Long term		High
Water Quality				
Identify locations where fencing of rivers and the provision of off-stream watering points is required. Support provided to landowners to implement these actions.	SCYC/ Graziers	2010	-Priority creeks and rivers identified for fencing. -Extension program established to encourage the establishment of off-stream watering points. (CYPNRM Plan)	Medium
Biodiversity				
Seek funding to encourage certain landholders in assessing the biodiversity value of properties	SCYC Graziers CSC, NHT	Short term		High
Investigate options to protect threatened ecosystems or species on grazing land through recovery plans or the nature refuge system / Land for wildlife	Graziers EPA	Long term		High
Planning and Development				
Promote Environmental Best Management Practices	SCYC, CYP Landcare, Grazing Industry groups,	Long term		High

	DNR&W, EPA and DPI&F			
Climate change				
Workshop with local grazing industry groups - _Actions to reduce Greenhouse Gas Emissions‘	Coordinated by SCYC and CYP Landcare with the assistance of industry experts and local industry representatives	2008		High
Forum – How will Climate Change affect our community in the future? Grazing industry representatives together with other industries and community groups	Coordinated by SCYC with the assistance of DNR&M and DPI&F Climate Change and Global Trend Analysts	End 2008	National Agriculture & Climate Change ACTION PLAN 2006 – 2009, NRM Ministerial Council	High
Grazing Industry Climate Change Planning Workshops.	Coordinated by the SCYC and CYP Landcare with the assistance of local industry groups, DNR&M and DPI&F Climate Change and representatives from State Industry Groups like GrowCom, AgForce etc.	End 2008		
Fire Management				
Graziers coordinated with a regional fire plan	CYPDA, Graziers Cooktown Fire Brigade. Cooktown and District Fire Management Committee	Short term	Cooktown and District Fire Management Plan – yet to be produced	Medium
Erosion				
Provide advice and funding for graziers engaged in riverbank stabilisation.	EPA, CSC, SCYC	Long term		High
Conduct study into the causative mechanisms of bank erosion in the Catchment. Treat the causes of erosion before undertaking rehabilitation work.	EPA SCYC	Long term		High
Increase awareness of river bank erosion in the Catchment and seek community cooperation to prevent further degradation.	SCYC	Long term		High
Prevention of late season fires for soil conservation purposes by using prescribed burning techniques that maintain the ground stabilizing vegetation.	CYFire programme SCYC	Long tern		Medium
Control work for riparian weeds to improve river bank stabilisation.	EPA Industry	Long term		High
Fisheries				

Determine the impacts of stock, on Saltmarsh communities.	CYMAG, SCYC	Long term		Low

4.3 HORTICULTURE

Management Action Table

Goals:

PRIORITY ACTION	BY WHOM	BY WHEN	OTHER RELEVANT STRATEGIES	PRIORITY LEVEL (high, medium, low)
Feral Animals				
Encourage growers to undertake and implement pest management plans with assistance from CYWAFAP	Landholders CYWAFAP CYPDA	Short term	Other pest management plans	Medium
Weeds				
Encourage growers to undertake and implement pest management plans with assistance from CYWAFAP	Landholders CYWAFAP, CYPDA	Short term	Other pest management plans	Medium
Continue incentives for landholders with pest management plans	CYWAFAP, CYPDA, NHT	Long term		High
Use truck wash down facilities when coming from weed infestations before entering Catchment area	Farmers	Ongoing	CSC PMP	High
Contact relevant weed authorities regarding new weed outbreaks.	Landmanagers CYWAFAP,QPWS CSC	Ongoing		High
Eradicate isolated outbreaks of priority weeds	Landmanagers	Long term		High
Work in conjunction with neighbouring properties to eradicate recommended weeds at the same time	Landmanagers CYWAFAP	Long term		High
Work on riparian weeds upstream and work down to prevent repeat infestation	Farmers CYWAFAP, QPWS	Long term		High
Water Quality				
Analyse surface water for the presence of agricultural chemicals. Results reported to relevant land-owners and agricultural associations.	CYMAG, SCYC	2008 (annual)		medium
Biodiversity				
Investigate options to protect threatened ecosystems or species on horticultural land through recovery plans or the nature refuge system	CDFA, SCYC	Long term		High
Seek funding to encourage land holders to assess the biodiversity value of properties	CDFA	Short term		High
Planning and Development				
Promote Environmental Best Management Practices	SCYC, CYP Landcare, Cooktown District	Long-term		High

	Farmers, DNR&W, EPA and DPI&F			
Climate change				
Workshop with local horticulture industry representatives - _Actions to reduce Greenhouse Gas Emissions‘	Coordinated by SCYC and CYP Landcare with the assistance of industry experts and local industry representatives	2008		High
Forum – How will Climate Change affect our community in the future? Horticulture industry representatives together with other local industries and community groups	Coordinated by the SCYC with the assistance of DNR&M and DPI&F Climate Change and Global Trend Analysts	End 2008	National Agriculture & Climate Change ACTION PLAN 2006 – 2009, NRM Ministerial Council	High
Horticulture Industry Climate Change Planning Workshops as detailed in section 3.6.	Coordinated by SCYC and CYP Landcare with the assistance of local industry representatives, DNR&M and DPI&F and representatives from State Industry Groups like GrowCom, AgForce etc.	End 2008		
Erosion				
Support growers engaged in riverbank stabilisation.	EPA, CSC SCYC	Long term		High
Conduct study into the causative mechanisms of bank erosion in the Catchment. Treat the causes of erosion before undertaking rehabilitation work.	EPA SCYC	Long term		High
Increase awareness of river bank erosion in the Catchment and seek community cooperation to prevent further degradation	SCYC	Long term		
Prevention of late season fires for soil conservation purposes by using prescribe burning techniques that maintain the ground stabilizing vegetation.	CYFire programme SCYC	Long tern		Medium
Control work for riparian weeds to improve river bank Stabilisation.	EPA Industry	Long term		High

4.4 MINING AND EXTRACTION

Management Action Table

Goals:

PRIORITY ACTION	BY WHOM	BY WHEN	OTHER RELEVANT STRATEGIES	PRIORITY LEVEL (high, medium, low)
Feral Animals				
Encourage mining companies to undertake and implement pest management plans with assistance from CYWAFAP	All stakeholders	Long term	CYP Feral Pig Pest Management Plan Queensland Feral Pig Strategy	High
Weeds				
Wash down trucks and machinery that have come from weed infested areas. Washdown facility soon at Lakeland	Landmanagers Truck drivers	Ongoing	CSC PMP	High
Contact relevant weed authority regarding new weed outbreaks	Mine staff CYWAFAP	Ongoing		High
Eradicate isolated weed outbreaks of priority weeds	Mine staff CYWAFAP	Long term		High
Reduce unnecessary disturbance to vegetation and soil	Mine staff			
Water Quality				
Identify and evaluate historic mining infrastructure that may impact water quality.	NRMW/ SCYC	2008		Low
Implement best practice erosion-mitigation and waste oil disposal works to minimise impacts on adjacent waterways.	Industry	2007		High
Continue monitoring water quality downstream from mining activities, including turbidity, heavy metals and hydrocarbons.	Industry/ CYMAG/ SCYC	On-going		Medium
Where water quality impacts are identified by monitoring or direct observation, implement measures to reduce impacts.	Industry/ EPA/ NRMW	As necessary		High
Erosion				
Address the issue of sediment runoff from unsealed roads and earthworks on mine sites.	Industry, EPA	Short term		High
Planning and Development				

Promote Environmental Best Management Practices	SCYC, Peak Mining Industry Groups DNR&W and EPA	Long-term		High
Climate Change				
SCYC lobby local mining companies to work with Mining Industry Peak Bodies and relevant State Government Agencies to coordinate and implement - ‗Actions to reduce Greenhouse Gas Emissions'	Local mining companies, Mining Industry Peak Bodies and relevant State Government Agencies	2008		High
SCYC lobby local mining companies to work with Mining Industry Peak Bodies and relevant State Government Agencies to coordinate and implement plans for adapting to and reducing the ‗risks' of Climate Change	Coordinated local mining companies together with Mining Industry Peak Bodies and relevant State Government Agencies	End 2008		High

4.5 CONSERVATION AREAS

Management Action Table

Goal: To ensure the protection of threatened species and ecosystems through effective management of protected and unprotected areas

PRIORITY ACTION	BY WHOM	BY WHEN	OTHER RELEVANT STRATEGIES	PRIORITY LEVEL (high, medium, low)
Feral Animals				
Encourage greater control of pigs in protected areas	SCYC CYWAFAP CSC QPWS	Long term	Cape York Feral Pig Management Plan Queensland Feral Pig Management Plan Cape York and CSC Pest Management Plan (PMP)	High
Continue funding for feral animal control for QPWS and CYWAFAP	NHT EPA CYPDA QPWS	Long term	Pest Management Strategies	High
Identify wetland areas in the Catchment where feral pigs are impacting on the biodiversity.	QPWS SCYC	Short-term		Low
Work together to control pigs in Wetlands	All stakeholders	Long term	CYP Feral Pig Pest Management Plan Queensland Feral Pig Strategy	High
Establish a long term control program to reduce feral pig numbers around sensitive areas in the Catchment.	CYWAFAP QPWS	Long-term		High
Weeds				
Ensure effective control of invasive wetland and riparian weeds e.g. Sicklepod, Hymenachne	SCYC CYWAFAP QPWS	Long term	Cape York and CSC PMP	High
Wash down vehicles that have come from Sicklepod areas. Wash down facility soon at Lakeland	QPWS	Ongoing	CSC PMP	High
Eradicate isolated weed outbreaks of priority weeds	QPWS staff CYWAFAP	Long term		High
Coordinate with neighbouring properties to control recommended weeds at the same time	QPWS CYWAFAP CSC landholders	Long term		High
Work on riparian weeds upstream and work downstream to prevent repeat infestation	Graziers CYWAFAP	Long term		High

Investigate the potential for a recovery team to coordinate and undertake threat abatement work	EPA	Short term		Medium
Trial the use of fire in smaller burn piles to promote regeneration of native species e.g., orchids	Lewis Roberts EPA	Medium term		Medium
Continue SCYC workshops in conjunction with CYWAFAP, QPWS, CYPDA on topics such as biodiversity assessment on properties weed control, feral animal control etc.	SCYC CYWAFAP QPWS CYPDA	Long term		High
Water Quality				
Continue monitoring water quality in the Annan and Endeavour River systems including petrochemicals, heavy metals and faecal coliforms	CYMAG SCYC EPA CSC	Long term		High
Biodiversity				
Identify and prioritise threatened ecosystems and species in the Catchment that require greater protection	EPA SCYC Landholders Researchers	Long term	-EPA Regional Ecosystem Mapping Project	High
Implement protection of significant areas.	SCYC Landholders EPA	Long term		High
Implement recovery plans for rare ecosystems and species	Researchers EPA Landholders, EPA, DNRW, CYPDA	Long term		High
Funding for regular monitoring of seagrass beds in the Annan and Endeavour Rivers.	CYMAG Researchers	Medium term		Medium
Prevent the practice of draining Melaleuca swamps by developers.	Developers CSC, SCYC	Long term		Medium
Enforce recommended buffers zones between wetlands and developments	Developers CSC	Long term		High
Investigate the use of a fish ladder on the Annan Weir	CSC ACTFR	Short term		Medium
Investigate the use of bat gates to prevent human disturbance at bat roost and maternity sites	EPA, SCYC	Short term		Medium
Conduct a survey to determine the overlap in distribution of Sooty Grunter with endangered frog and the risk to these frog species in the Annan Catchment	JCU, EPA	Long term		Low
Planning and Development				

Promote Environmental Best Management Practices	SCYC and EPA	Long-term		Medium
Climate change				
Forum – Strategies to reduce the Impacts of Climate Change on Biodiversity in the Annan Endeavour Catchments	SCYC, EPA, local naturalists and landholders	2008		High
Fire Management				
Seek update on Fire Management Plan for the Catchment	CYPDA	Short term		High
Investigate the feasibility of burning forest edges to maintain threatened Orchid species and other fire dependant species.	SCYC L.Roberts EPA Fire Brigade	Short term		
Erosion				
Provide support for community organisations engaged in riverbank stabilisation.	EPA CSC SCYC	Long term		High
Address the issue of sediment from unsealed roads.	EPA, CSC, Mining companies, Main Roads	Short term		High
Conduct study into the causative mechanisms of river bank erosion in the Catchment and treat the causes of erosion before undertaking rehabilitation work.	EPA SCYC	Long term		High
Increase awareness of river bank erosion in the Catchment and seek community cooperation to prevent further degradation.	SCYC	Long term		High
Fisheries				
Map saltmarsh communities on the Annan and Endeavour Rivers	CYMAG SCYC	Medium		Low
Determine the impacts of mangrove encroachment on Saltmarsh communities	CYMAG SCYC	Medium		Low

4.6 BUILT ENVIRONMENT AND SERVICE INFRASTRUCTURE

Management Action Table

PRIORITY ACTION	BY WHOM	BY WHEN	OTHER RELEVANT STRATEGIES	PRIORITY LEVEL (high, medium, low)
Planning and Development (details section 3.5)				
Community workshop providing information on Local Council Planning and Development Controls	SCYC coordinate workshop with presenters from Environmental Defenders, CSC and Hope Vale Council	End of 2007		High
Information Sheet _What can I do if I am concerned about a development?‘	Local Councils, SCYC and Environmental Defenders	End 2007		High
Promotion Environmental Best Management Practices (EBMP)	Local Councils, Industry Groups and relevant State government agencies	Long term		High
Community workshop on Environmental Benefits of Environmental Best Management Practices	SCYC coordinate workshop with support of Local Councils, State government agencies and industry groups	End 2007		High
Information sheet on _Environmental Best Management Practices‘	SCYC and Local Councils	End 2007		High
Processes developed and events run to build community and Local Council appreciation of the role of values in Planning and Development decision-making	SCYC, Cooktown‘s Future Group, and Local Councils	End 2008		Medium
Community workshops _Role of State government agencies in ensuring planning and development decision-making in the Annan Endeavour Catchments are ecologically sustainable‘	SCYC and relevant State government agencies	End 2008		Low
Climate change				
SCYC lobby CSC and Hope Vale Council to work with other Qld Councils to coordinate and implement - _Actions to reduce Greenhouse Gas Emissions‘	Coordinated by local councils with assistance of State government agencies	2008		High
Forum – How will Climate Change affect our community in the future? Local Council representatives together with industry and community groups	Coordinated by the SCYC with the assistance of DNR&M and DPI&F Climate Change and	End 2008	National Agriculture & Climate Change ACTION PLAN 2006 – 2009,	High

	Global Trend Analysts		NRM Ministerial Council	
SCYC lobby CSC and Hope Vale Council to work with other Qld Councils to coordinate and implement plans for adapting to and reducing the _risks' of Climate Change	Coordinated by local councils with assistance of State government agencies	End 2008		High
Water Quality & Quantity				
Sediment traps installed at stormwater drains.	CSC	2008		High
Improve options for sewerage and other waste disposal from boats in Cooktown harbour.	CSC	2010		Medium
Identify sources of siltation in waterway and implement measures to reduce sedimentation.	CSC/ SCYC	2008	By 2008, identify erosion problem spots and develop a management strategy (CYPNRM Plan)	High
Enforce water quality legislation in development planning and applications.	CSC	2007		Medium
Maintain riparian zones along watercourses	CSC/ Landowners	ON-going		Medium
Monitoring of water quality impacts in vicinity of sewerage treatment plant outfalls, rubbish tips, mines and other significant developments. Where water quality impacts are identified, implement actions to minimize impacts.	CSC/ CYMAG/ SCYC	On-going	-Develop and implement a program to collect water samples -Undertake a full analysis of existing water quality data and develop and implement recommendations. (CYPNRM Plan)	High
Investigate options for improved sewerage treatment system at Hope Vale	Hope Vale Aboriginal Council	2010	-Investigate economic viability and implications of tertiary treatment of urban sewage (CYPNRM Plan)	High
Presence of acid-sulfate soils is assessed at proposed coastal development sites. Avoid disturbance of acid-sulphate soils wherever possible.		ON-going		Medium
Upgrade infrastructure at sites where tourist/camping facilities are impacting on water quality.		2008	By 2008 popular visitation sites managed in consultation with landowners and land managers to minimize erosion and water quality degradation. (CYPNRM Plan)	High
Assess sustainable extraction rates for groundwater and surface water and manage allocation	NRMW/ CSC/ Landowners	2010	-By 2007 river systems are managed in ways that ensure ongoing water extraction for domestic, stock, agriculture and other economic uses while maintaining environmental	Low

			flows. -Establish sustainable yield and permissible anuual volumes for groundwater resources (CYPNRM Plan)	
Erosion				
Address the issue of sediment from unsealed roads.	EPA	Short term		High
Erosion mitigation plans to be required for all new developments in urban and rural residential areas, both for the construction phase and finished product	CSC, EPA	Short term		High
Prioritise erosion affected areas on the basis of soil loss rather than aesthetics.	CSC	Short term		High
Fisheries				
Determine the effect of leachates (from the Cooktown dump),urban storm water runoff, turbidity and acid sulphate soil runoff on fish habitat health.				
Begin long term monitoring of Seagrass beds in the Annan and Endeavour Rivers. to determine the impact of land use practices in the Catchment on Seagrass health.	DPI&F CYMAG	Medium		Medium
Determine the impacts of drainage, on Saltmarsh communities.	CYMAG SCYC	Long term		Low

4.7 FISHERIES AND FISHERIES HABITAT

Management Action Table

Goals:

Well managed wetlands, Saltmarsh, estuaries, riparian zones to protect fisheries habitat

Ensure that sufficient fish stocks remain to preserve the aquatic biodiversity of the Catchment

PRIORITY ACTION	BY WHOM	BY WHEN	OTHER RELEVANT STRATEGIES	PRIORITY LEVEL (high, medium, low)
Fisheries				
Collect catch and effort data to determine a sustainable level of fishing pressure	DPI&F			
Stock assessments of recreational and commercial target species.	DPI&F			Medium
Lobby government for a permanent Fisheries Offer for enforcement in the Cooktown	CYMAG			
Determine the extent of recreational fishing activity and impact on fish stocks.	DPI&F			
Create a database of visitor numbers, areas of activity, and composition and quantity of catch for fishers in the Catchment.	DPI&F			
Identify critical fish habitats in the Endeavour River Catchment	DPI&F			
Increase enforcement of recreational, commercial and charter fishing regulations.	DPI&F			
Investigate ways to limit the impact of displaced commercial fishing effort on Annan River and Walker Bay.	CYMAG DPI&F			
Complete a fisheries resource assessment of Endeavour River to develop fisheries management strategies for this system.				
Feral Animals				
Raise public awareness of the impact of feral pigs on fish habitat	SCYC			
Feral pig control in critical fish habitats	CYWAFAP, EPA			
Weeds				
Remove Hymenachne from the Catchment	CYWAFAP			
Water Quality				
Measure Leachate‘s from the Cooktown dump to identify potential impacts on the fishery	CYMAG SCYC			
Biodiversity				
Identify and rehabilitate key riparian zones to protect and enhance significant fisheries habitat	DPI&F Researchers	Medium		Medium

Determine if Annan Weir is restricting the movement of native fish. Manage accordingly e.g., install fish ladders etc.	CSC Researchers DPI&F	Medium		High
Determine if gill netting in Walker Bay is adversely affecting fish, turtle and dugong species	Researchers	Medium		Medium
Promote education of freshwater and estuarine ecosystems and the importance of these for the maintenance of fish stocks	SCYC DPI&F Fishing club	Medium		Low
Increased monitoring of fish habitat health in the Catchment.	JCU, DPI&F	Long term		High
Conduct a survey to determine the overlap in distribution of Sooty Grunter with endangered frog and the risk to these frog species in the Annan Catchment	DPI&F SCYC JCU	Long term		Low
Raise public awareness of noxious fish such as Tilapia and their potential threat to the Catchment .	DPI&F SCYC	Short term		High
Map saltmarsh communities on the Annan and Endeavour Rivers	CYMAG SCYC	Medium		Low
Determine the status of Jungle Perch in the Catchment and investigate impact of habitat modification and fish passage barriers	JCU EPA SCYC	Medium		Medium
Planning and Development				
Determine the effect of leachates (from the Cooktown dump),urban storm water runoff, turbidity and acid sulphate soil runoff on fish habitat health.				
Begin long term monitoring of Seagrass beds in the Annan and Endeavour Rivers. to determine the impact of land use practices in the Catchment on Seagrass health.	DPI&F CYMAG	Medium		Medium
Planning and Development				
Promote Environmental Best Management Practices	SCYC, EPA and DPI&F	Long-term		Medium
Climate change				
Workshop with local fishing industry group representatives - _Actions to reduce Greenhouse Gas Emissions‘	Coordinated by the SCYC with the assistance of industry experts and local industry groups/representatives	2008		High
Forum – How will Climate Change affect our community in the future? Local fishing industry representatives together with other industry and community groups	Coordinated by the SCYC with the assistance of DNR&M and DPI&F Climate Change and Global Trend Analysts	End 2008	National Agriculture & Climate Change ACTION PLAN 2006 – 2009, NRM Ministerial Council	High
Fishing Industry Climate Change Planning Workshops as	Coordinated by the SCYC	End 2008		High

detailed in Section 3.6.	with the assistance of local fishing industry representatives, DNR&M and DPI&F			
Erosion				
Rehabilitation of key riparian zones to prevent erosion and reduce sediment run off to protect fish habitat	SCYC Landholders Bluestone mine	Long term		Medium

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Appendix A

Rare and Threatened Plants in the Annan-Endeavour Catchment

Class	Family	Scientific name	Taxon author	NCA	EPBC	
Liliopsida	Aponogetonaceae	Aponogeton queenslandicus	H.Bruggen	R		
Liliopsida	Araceae	Remusatia vivipara	(Roxb.) Schott	R		
Liliopsida	Arecaceae	Linospadix palmeriana	(F.M.Bailey) Burret	R		
Liliopsida	Arecaceae	Livistona concinna	Dowe & Barfod	R		
Liliopsida	Cyperaceae	Carex cruciata var. rafflesiana	(Boott) Noot.	R		
Liliopsida	Orchidaceae	Acianthus amplexicaulis	(F.M.Bailey) Rolfe	R		
Liliopsida	Orchidaceae	Bulbophyllum boonjee	B.Gray & D.L.Jones	R		
Liliopsida	Orchidaceae	Bulbophyllum grandimesense	B.Gray & D.L.Jones	R		
Liliopsida	Orchidaceae	Corybas cerasinus	D.L.Jones & B.Gray	R		
Liliopsida	Orchidaceae	Crepidium lawleri	(Lavarack & B.Gray) Szlach.	E	E	
Liliopsida	Orchidaceae	Dendrobium bigibbum	Lindl.	V	V	
Liliopsida	Orchidaceae	Dendrobium johannis	Rchb.f.	V	V	
Liliopsida	Orchidaceae	Dendrobium phalaenopsis	Fitzg.	V	V	
Liliopsida	Orchidaceae	Eulophia zollingeri	(Rchb.f.) J.J.Sm.	R		
Liliopsida	Orchidaceae	Taeniophyllum confertum	B.Gray & D.L.Jones	R		
Liliopsida	Poaceae	Centotheca philippinensis	(Merr.) C.Monod	R	V	
Liliopsida	Zingiberaceae	Amomum dallachyi	F.Muell.	R		
Lycopodiopsida	Lycopodiaceae	Huperzia phlegmaria	(L.) Rothm.	R		
Magnoliopsida	Annonaceae	Haplostichanthus sp. (Mt Finnigan L.W.Jessup 632)		R		
Magnoliopsida	Lauraceae	Endiandra collinsii	B.Hyland	R		
Magnoliopsida	Menispermaceae	Hypserpa smilacifolia	Diels	R		
Magnoliopsida	Menispermaceae	Tinospora sp. (Mapoon F.M.Bailey AQ63326)		R		
Magnoliopsida	Monimiaceae	Wilkiea wardellii	(F.Muell.) Perkins	R		
Magnoliopsida	Winteraceae	Bubbia queenslandiana subsp. queenslandian	Vink	R		
Polypodiopsida	Grammitidaceae	Ctenopteris walleri	(Maiden & Betche) S.B.Andrews	V	V	
Polypodiopsida	Grammitidaceae	Grammitis albosetosa	(F.M.Bailey) Parris	R		
Polypodiopsida	Grammitidaceae	Grammitis leonardii	Parris	R		
Polypodiopsida	Grammitidaceae	Grammitis reinwardtii	Blume	V	V	
Rosopsida	Acanthaceae	Rhaphidospora cavernarum	(F.Muell.) R.M.Barker	PE (E)		Not extinct. Specimen collected at Black Mountain N.P. ar
Rosopsida	Asclepiadaceae	Marsdenia hemiptera	Rchb.	R		
Rosopsida	Caesalpiniaceae	Labichea buettneriana	F.Muell.	R		
Rosopsida	Celastraceae	Euonymus globularis	Ding Hou	R		
Rosopsida	Ebenaceae	Diospyros sp. (Bamaga B.P.Hyland 2517)		R		
Rosopsida	Euphorbiaceae	Dissiliaria tuckeri	P.I.Forst.	V		
Rosopsida	Euphorbiaceae	Glochidion pungens	Airy Shaw	R		
Rosopsida	Fabaceae	Bossiaea arenicola	J.H.Ross	R		
Rosopsida	Fabaceae	Callerya pilipes	(F.M.Bailey) Schot	R		
Rosopsida	Grossulariaceae	Polyosma rigidiuscula	F.Muell. & F.M.Bailey ex F.M.Baile	R		

Rosopsida	Lamiaceae	Plectranthus spectabilis	S.T.Blake	R	
Rosopsida	Mimosaceae	Acacia guymeri	Tindale	V	V
Rosopsida	Mimosaceae	Acacia solenota	Pedley	V	V
Rosopsida	Myrtaceae	Gossia bamagensis	N.Snow & Guymer	R	
Rosopsida	Myrtaceae	Gossia lucida	(Gaertn.) N.Snow & Guymer	R	
Rosopsida	Myrtaceae	Gossia macilwraithensis	N.Snow & Guymer	R	
Rosopsida	Myrtaceae	Rhodomyrtus effusa	Guymer	R	
Rosopsida	Myrtaceae	Sphaerantia chartacea	Peter G.Wilson & B.Hyland	R	
Rosopsida	Myrtaceae	Syzygium malaccense	(L.) Merr. & L.M.Perry	R	
Rosopsida	Myrtaceae	Xanthostemon arenarius	Peter G.Wilson	R	
Rosopsida	Rubiaceae	Myrmecodia beccarii	Hook.f.	V	V
Rosopsida	Rubiaceae	Randia audasii	C.T.White	R	
Rosopsida	Rutaceae	Leionema ellipticum	Paul G.Wilson	V	
Rosopsida	Rutaceae	Medicosma glandulosa	T.G.Hartley	R	
Rosopsida	Sapindaceae	Diploglottis harpullioides	S.T.Reynolds	R	
Rosopsida	Sapindaceae	Harpullia ramiflora	Radlk.	R	
Rosopsida	Sapindaceae	Sarcopteryx acuminata	S.T.Reynolds	R	
Rosopsida	Sapotaceae	Chrysophyllum roxburghii	G.Don	R	
Rosopsida	Sterculiaceae	Argyrodendron sp. (Whyanbeel B.P.Hyland RFK1106)		R	
Rosopsida	Symplocaceae	Symplocos ampulliformis	C.T.White	R	
Rosopsida	Symplocaceae	Symplocos sp. (Mt Finnigan L.J.Brass 20129)		R	
Rosopsida	Symplocaceae	Symplocos stawellii var. montana	C.T.White	R	
	Hemerocallidaceae	Dianella incollata	R.J.F.Hend.	R	

Appendix B

List courtesy the EPA's Wildnet 2006

Rare and Threatened Species List for the Annan Endeavour Catchment

Queensland Government
Environmental Protection Agency
Queensland Parks and Wildlife Service

WildNet

Class	Family	Scientific Name	Common Name	NCA	EPBC	Sig	End
Mammalia	Dasyuridae	*Dasyurus hallucatus*	northern quoll	C	E	Y	QA
Mammalia	Dasyuridae	*Dasyurus maculatus gracilis*	spotted-tailed quoll (norther subspecies)	E	E	Y	Q
Mammalia	Macropodidae	*Dendrolagus bennettianus*	Bennett's tree-kangaroo	R		Y	Q
Mammalia	Pteropodidae	*Pteropus conspicillatus*	spectacled flying-fox	C	V	Y	QAI
Mammalia	Megadermatidae	*Macroderma gigas*	ghost bat	V		Y	QA
Mammalia	Rhinolophidae	*Rhinolophus philippinensis*	greater large-eared horsesh	E	E	Y	QAI
Mammalia	Hipposideridae	*Hipposideros cervinus*	fawn leaf-nosed bat	V		Y	QAI
Mammalia	Hipposideridae	*Hipposideros diadema regin*	diadem leaf-nosed bat	R		Y	QAI
Mammalia	Hipposideridae	*Hipposideros semoni*	Semon`s leaf-nosed bat	E	E	Y	QAI
Mammalia	Emballonuridae	*Saccolaimus saccolaimus nudicluniatus*	bare-rumped sheathtail bat	E	CE	Y	QAI
Mammalia	Emballonuridae	*Taphozous australis*	coastal sheathtail bat	V		Y	QAI
Mammalia	Vespertilionidae	*Kerivoula papuensis*	golden-tipped bat	R		Y	QAI
Mammalia	Vespertilionidae	*Murina florium*	tube-nosed insectivorous ba	V		Y	QAI
Aves	Casuariidae	*Casuarius casuarius johnsoi (southern population)*	southern cassowary (south population)	E	E	Y	Q

Aves	Anatidae	*Nettapus coromandelianus*	cotton pygmy-goose	R		Y	QAI
Aves	Anatidae	*Tadorna radjah*	radjah shelduck	R		Y	QAI
Aves	Ciconiidae	*Ephippiorhynchus asiaticus*	black-necked stork	R		Y	QAI
Aves	Accipitridae	*Accipiter novaehollandiae*	grey goshawk	R		Y	QAI
Aves	Accipitridae	*Erythrotriorchis radiatus*	red goshawk	E	V	Y	QA
Aves	Accipitridae	*Lophoictinia isura*	square-tailed kite	R		Y	QA
Aves	Falconidae	*Falco hypoleucos*	grey falcon	R		Y	QA
Aves	Turnicidae	*Turnix olivii*	buff-breasted button-quail	V	E	Y	Q
Aves	Scolopacidae	*Numenius madagascariensis*	eastern curlew	R		Y	QAI
Aves	Burhinidae	*Esacus neglectus*	beach stone-curlew	V		Y	QAI
Aves	Haematopodidae	*Haematopus fuliginosus*	sooty oystercatcher	R		Y	QA
Aves	Laridae	*Sterna albifrons*	little tern	E		Y	QAI
Aves	Psittacidae	*Cyclopsitta diophthalma mac*	Macleay's fig-parrot	V		Y	Q
Aves	Strigidae	*Ninox rufa queenslandica*	rufous owl (southern subsp	V		Y	Q
Aves	Apodidae	*Collocalia spodiopygius*	white-rumped swiftlet	R		Y	Q
Aves	Meliphagidae	*Melithreptus gularis*	black-chinned honeyeater	R		Y	QA
Aves	Meliphagidae	*Melithreptus gularis laetior*	golden-backed honeyeater	R		Y	QA
Aves	Passeridae	*Erythrura trichroa*	blue-faced parrot-finch	R		Y	QAI
Aves	Passeridae	*Neochmia phaeton iredalei*	crimson finch (eastern form	V		Y	Q
Aves			Australian Bustard				
Reptilia	Crocodylidae	*Crocodylus porosus*	estuarine crocodile	V		Y	QAI
Reptilia	Gekkonidae	*Nactus galgajuga*		R		Y	Q
Reptilia	Scincidae	*Carlia scirtetis*		R		Y	Q
Reptilia	Scincidae	*Carlia tanneri*		R		Y	Q
Reptilia	Scincidae	*Egernia rugosa*	yakka skink	V	V	Y	Q
Reptilia	Scincidae	*Eulamprus tigrinus*		R		Y	Q
Reptilia	Typhlopidae	*Ramphotyphlops broomi*		R		Y	Q
Reptilia	Elapidae	*Acanthophis antarcticus*	common death adder	R		Y	QA
Amphibia	Myobatrachidae	*Taudactylus acutirostris*	sharp snouted dayfrog	E	EX	Y	Q
Amphibia	Hylidae	*Litoria genimaculata*	tapping green eyed frog	R		Y	QAI
Amphibia	Hylidae	*Litoria nannotis*	waterfall frog	E	E	Y	Q
Amphibia	Hylidae	*Litoria rheocola*	common mistfrog	E	E	Y	Q

Amphibia	Hylidae	*Nyctimystes dayi*	Australian lacelid	E	E	Y	Q
Amphibia	Microhylidae	*Austrochaperina fryi*	peeping whistlefrog	R		Y	Q
Amphibia	Microhylidae	*Cophixalus aenigma*	tapping nursery-frog	R		Y	Q
Amphibia	Microhylidae	*Cophixalus bombiens*	buzzing nurseryfrog	R		Y	Q
Amphibia	Microhylidae	*Cophixalus exiguus*	dainty nurseryfrog	R		Y	Q
Amphibia	Microhylidae	*Cophixalus saxatilis*	Black Mountain boulderfrog	V		Y	Q
Insecta	Lycaenidae	*Hypochrysops apollo apollo*	Apollo jewel (Wet Tropics subspecies)	V		Y	Q

NCA Status - Indicates the conservation status of each taxon under the *Nature Conservation Act 1992*.NCA
The codes are; Extinct in the wild (PE), Endangered (E), Vulnerable (V), Rare (R),
Near threatened (NT) Least concern (C) or Not Protected ( ).
Endemicity: Queensland Endemic (Q), Intranational (QA), Regional Endemic (QI),
Not Endemic to Australia (QAI), Vagrant (International) (VI), Vagrant (Intranational) (VA),
Vagrant (Unknown) (VU), Introduced (International) (II), Introduced (Intranational) (IA), Introduced (Unknown) (IU),
Exotic (International) (XI), Exotic (Intranational) (XA), Exotic (Unknown) (XU) or Unknown (U)

EPBC status: Environment Protection and Biodiversity Conservation Act 1999.
Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX),
Extinct in the Wild (XW), Vulnerable (V) and Threatened (includes taxa listed as CD, CE, E, EX, V and XW).

Significant*:* Indicates whether a taxon is conservation significant by the display of a Y (i.e. Yes).
Conservation significant species include those that are listed as rare or threatened under the
Nature Conservation Act 1992 or threatened under the Environment Protection
and Biodiversity Conservation Act 1999, have a management status of rare or threatened,
or are listed under an international agreement (such as JAMBA, CAMBA and Bonn Convention).

When acknowledging WildNet Data please use the following:

Environmental Protection Agency (2005) WildNet. (Database).
Environmental Protection Agency, Brisbane. 22 December 2005

Appendix C

76 Native wildlife may be prescribed as extinct in the wild wildlife

A regulation may prescribe native wildlife as extinct in the wild wildlife if--

(a) there have been thorough searches conducted for the wildlife; and
(b) the wildlife has not been seen in the wild over a period that is appropriate for the life cycle or form of the wildlife.

77 Native wildlife may be prescribed as endangered wildlife

A regulation may prescribe native wildlife as endangered wildlife if--

(a) there have not been thorough searches conducted for the wildlife and the wildlife has not been seen in the wild over a period that is appropriate for the life cycle or form of the wildlife; or
(b) the habitat or distribution of the wildlife has been reduced to an extent that the wildlife may be in danger of extinction; or
(c) the population size of the wildlife has declined, or is likely to decline, to an extent that the wildlife may be in danger of extinction; or
(d) the survival of the wildlife in the wild is unlikely if a threatening process continues.

78 Native wildlife may be prescribed as vulnerable wildlife

(1) A regulation may prescribe native wildlife as vulnerable wildlife if--

(a) the population size or distribution of the wildlife has declined, or is likely to decline, to an extent that the wildlife may become endangered because of a threatening process; or
(b) the population size of the wildlife has been seriously depleted and the protection of the wildlife is not secured; or
(c) the population of the wildlife is--
(i) low or localised; and
(ii) dependent on habitat that has been, or is likely to be, adversely affected, in terms of quantity or quality, by a threatening process.

(2) In this section--

endangered, in relation to wildlife, means the wildlife falls within a description mentioned in section 77.

78A Native wildlife may be prescribed as rare wildlife

(1) A regulation may prescribe native wildlife as rare wildlife if the wildlife is not threatened wildlife and--

(a) the population of the wildlife is represented by--
(i) a relatively large population in a restricted range; or
(ii) relatively small populations thinly spread over a wide range; or
(b) the survival of the wildlife in the wild is affected to an extent that the wildlife is in danger of becoming vulnerable.

(2) Native wildlife may be prescribed as rare wildlife even if the wildlife is the subject of a threatening process.

(3) This section expires 5 years after it commences.

(4) In this section--

vulnerable, in relation to wildlife, means the wildlife falls within a description mentioned in section 78(1).

79 Native wildlife may be prescribed as near threatened wildlife

(1) A regulation may prescribe native wildlife as near threatened wildlife if--

(a) the population size or distribution of the wildlife is small and may become smaller; or
(b) the population size of the wildlife has declined, or is likely to decline, at a rate higher than the usual rate for population changes for the wildlife; or
(c) the survival of the wildlife in the wild is affected to an extent that the wildlife is in danger of becoming vulnerable.

(2) Native wildlife may be prescribed as near threatened wildlife even if the wildlife is the subject of a threatening process.

(3) In this section--

vulnerable, in relation to wildlife, means the wildlife falls within a description mentioned in section 78(1).

80 Native wildlife may be prescribed as least concern wildlife

(1) A regulation may prescribe native wildlife as least concern wildlife if the wildlife is common or abundant and is likely to survive in the wild.

(2) Native wildlife may be prescribed as least concern wildlife even if--

(a) the wildlife is the subject of a threatening process; or
(b) the population size or distribution of the wildlife has declined; or
(c) there is insufficient information about the wildlife to conclude whether the wildlife is common or abundant or likely to survive in the wild.

Appendix D

CLASSES OF DECLARED ANIMALS QUEENSLAND

Land Protection (Pest and Stock Route Management) Act 2002.

Class 1 pests

A Class 1 pest is one that is not commonly present in Queensland, and if introduced would cause an adverse economic, environmental or social impact. Class 1 pests established in Queensland are subject to eradication from the state. Landowners must take reasonable steps to keep land free of Class 1 pests.

- Crazy ants (*Anoplolepis gracilipes*)
- **All mammals, reptiles and amphibians *except*:**
    - Class 2 declared pest animals
    - mammals, reptiles and amphibians indigenous to Australia, including marine mammals
    - 32 non-declared animals.

Class 2 pests

A Class 2 pest is one that is established in Queensland and has, or could have, a substantial adverse economic, environmental or social impact. The management of these pests requires coordination and they are subject subject to programs led by local government, community or landowners. Landowners must take reasonable steps to keep land free of Class 2 pests.

- Australian plague locust (*Chortoicetus terminifera*)
- cat, other than a domestic cat (*Felis catus*)
- dingo (*Canis familiaris dingo*)
- dog, other than a domestic dog (*Canis familiaris*)
- European fox (*Vulpes vulpes*)
- European rabbit (domestic and wild breeds)(*Oryctolagus cuniculus*)
- feral pig (*Sus scrofa*)
- goat, other than a domestic goat (*Capra hircus*)
- migratory locust (*Locusta migratoria*)
- spur–throated locust (*Austracris guttulosa*)

Class 3 pests

Class 3 pests are established in Queensland and have, or could have, an adverse economic, environmental or social impact.Landholders are not required to control Class 3 pests unless their land is adjacent to an environmentally significant area.

There are currently no animals declared as Class 3 pests.

Appendix E
Declaration Categories Definition

CATEGORY	DESCRIPTION	EXAMPLES
Class 1	A Class 1 pest is not commonly present in Queensland and, if introduced, would cause an adverse economic, environmental or social impact, Class 1 pests established in Queensland are subject to eradication from the state. Landowners must take reasonable steps to keep land free of Class 1 pests. Other powers of the Act apply.	Giant Sensitive Tree *(Mimosa pigra)*
Class 2	Class 2 pests are established in Queensland and have, an adverse economic, environmental or social impact. The management of these pests requires coordination and they are subject to Local Government-, community- or landowner- led programs. Landowners must take reasonable steps to keep land free of Class 2 pests. Other powers of the Act apply.	Parthenium Weed *(Parthenium hysterophorus)*
Class 3	Class 3 pests are established in Queensland and have, or could have, an adverse economic, environmental or social impact. A pest control notice can only be issued for land that is, or is adjacent to, an environmentally significant area. Thus, the impact of species in this class is primarily environmental. Only some of the other powers of the Act apply.	Singapore daisy *(Sphagneticola trilobata)*
It is illegal to sell a declared plant or its seed anywhere in Queensland without permission from the Minister for Natural Resources, Mines and Water. Species not declared under the Land Protection (Pest and Stock Route Management) Act may still be subject at a Local Government level under local laws. Species declared as Class 3 may be subject to local legal control outside environmentally significant areas.		

Appendix F

Endeavour River Estuary*
CYMAG Ambient Water Quality Monitoring Data
2002-2006 (Wet & Dry Season sampling)

	ANZECC 2000 Guidelines- tropical estuaries	Number of samples	Minimum	Maximum	Mean	Standard Deviation
pH	7.0 – 8.5	189	5.31	8.37	7.71	0.52
Temp	NA	198	18.93	30.53	26.50	2.49
Conductivity (mS/cm)	NA	190	0.08	62.5	40.11	18.30
Salinity (ppt)	NA	200	0.00	37.30	26.05	12.38
Oxygen (mg/L)	NA	153	4.24	8.82	6.06	0.83
Oxygen (% sat)	80-120	152	63.17	126.70	88.40	12.36
Turbidity (NTU)	1-20	202	0.00	456.00	14.35	35.67
Chlorophyll a (µg/L)	2	25	<0.005	1.6700	0.5595	NA
TP (µg/L)	20	56	6	27	13	6
FRP (µg/L)	5	54	<2	4	1	1
TN (µg/L)	250	56	80	480	223	104
NOx (µg/L)	30	54	<2	75	20	20
NH_4 (µg/L)	15	54	<2	38	13	11

*Sampling Locations from River Mouth to North Arm

*Qld water quality guidelines have not been derived for Cape York. The Qld EPA advises utilising the default ANZECC 2000 water quality guidelines for these rivers.

Annan River Estuary*

CYMAG Water Quality Monitoring Data 2002-2006 (Wet & Dry Season sampling)

	ANZECC 2000 Guidelines*- tropical estuaries	Number of samples	Minimum	Maximum	Mean	Standard Deviation
pH	7.0 – 8.5	37	6.63	8.68	7.78	0.47
Temp	NA	37	20.20	30.80	25.69	2.54
Conductivity (mS/cm)	NA	35	0.05	53.80	32.00	19.42
Salinity (ppt)	NA	35	0.00	35.73	20.95	13.24
Oxygen (mg/L)	NA	32	4.69	8.18	6.69	0.93
Oxygen (% sat)	80-120	32	76.03	104.37	90.54	7.25
Turbidity (NTU)	1-20	41	1.20	151.00	10.43	24.46
Chlorophyll a (µg/L)	2	13	<0.005	2.2862	0.694	NA
TP (µg/L)	20	12	8	28	12	6
FRP (µg/L)	5	11	<2	4	2	1
TN (µg/L)	250	11	110	240	146	40
NOx (µg/L)	30	11	<2	160	24	47
NH_4 (µg/L)	15	11	3	27	9	7

* Sampling locations at mouth of river and Annan River Bridge

*Qld water quality guidelines have not been derived for Cape York. The Qld EPA advises utilising the default ANZECC 2000 water quality guidelines for these rivers.

Annan River Freshwater *
CYMAG Water Quality Monitoring Data
2002-2006 (Wet & Dry Season sampling)

	ANZECC 2000 Guidelines*- Lowland rivers	Number of samples	Minimum	Maximum	Mean	Standard Deviation
pH	6.0 – 8.0	79	5.12	7.54	6.64	0.36
Temp		84	19.73	30.10	23.89	2.48
Conductivity (mS/cm)	0.02- 0.250	71	0.012	0.10	0.06	0.01
Salinity (ppt)		74	0.00	0.10	0.00	0.00
Oxygen (mg/L)		70	1.83	9.29	7.33	1.25
Oxygen (% sat)	85-120	70	23.07	110.80	87.39	14.05
Turbidity (NTU)	2-15	88	0.80	141.33	9.81	21.51
Chlorophyll a	5		**NA**	**NA**	**NA**	**NA**
TP (µg/L)	10	32	4	33	**12**	6
FRP (µg/L)	4	32	<2	5	2	1
TN (µg/L)	200-300	32	50	470	143	114
NOx (µg/L)	10	32	<2	350	**25**	74
NH_4 (µg/L)	10	32	<2	9	4	2

*Sampling Locations at Little Annan Bridge, Annan River below Leswelll Creek and at Wallaby Creek (Rossville)

*Qld water quality guidelines have not been derived for Cape York. The Qld EPA advises utilising the default ANZECC 2000 water quality guidelines for these rivers**.**

Annan & Endeavour River Mean Nutrient Concentrations by Site
November 2004 – June 2006
CYMAG Water Quality Data

Sample Location	Number of Samples	Total Phosphorus	Filt Reac Phosphorus	Ammonia Nitrogen	Nitrogen Oxides	Total Nitrogen
		mg/L as P	mg/L as P	mg/L as N	mg/L as N	mg/L as N
ANZECC Guidelines ESTUARY		**0.02**	**0.005**	**0.015**	**0.03**	**0.25**
ER-01-Endeavour Mouth	12	0.012	0.002	0.008	0.008	0.155
ER-02-Endeavour at 2 Mile Creek	12	0.011	0.001	0.010	0.009	0.180
ER-03-Endeavour at 4 Mile Creek	12	0.012	0.001	0.013	0.015	0.221
ER-04-Endeavour River North Arm	12	0.016	0.001	**0.018**	**0.036**	**0.303**
ER-05-Endeavour River Main Arm, upstream from North Arm confluence	12	0.014	0.001	**0.017**	**0.035**	**0.261**
AR-01-Annan River Bridge	12	0.012	0.002	0.009	0.024	0.146
ANZECC Guidelines Freshwater Lowland		**0.01**	**0.004**	**0.01**	**0.01**	**0.2 - 0.3**
AR-02- Little Annan Bridge	10	0.013	0.002	0.004	**0.029**	0.144
AR-03-Annan River at Leswelll	12	0.014	0.002	0.004	**0.039**	0.193
AR-04-Wallaby Creek (Rossville)	10	0.009	0.002	0.003	0.006	0.083

Appendix G

CSIRO Marine and Atmospheric Research

For more information, please contact:
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CLIMATE CHANGE IN CAPE YORK

What is the Greenhouse Effect?

Greenhouse gases are a natural part of the atmosphere. They absorb and re-radiate the sun's warmth, and maintain the Earth's surface temperature at a level necessary to support life. The problem we now face is that human actions—particularly burning fossil fuels (coal, oil and natural gas), agriculture and land clearing—are increasing the concentrations of the gases that trap heat. This is the enhanced greenhouse effect, which is contributing to a warming of the Earth's surface.
For more information on the greenhouse effect and other climate change questions, visit http://www.dar.csiro.au/information/climatechange.html

How Will Global Warming Affect Cape York?

Australia's Cape York is likely to be affected by global warming in four different ways. First, temperatures in Cape York will increase as the rest of the world warms. A "middle-of-the-road" estimate is that temperatures will increase by approximately 1.3-1.8°C by 2050 (Figure 1) and 2.6-3.6°C by the year 2100. However, warming both above and below this range is possible.

Second, global warming will change rainfall patterns in Cape York. Generally, modest changes in rainfall are projected over the next 50 years, with increases or decreases of up to 2% (Figure 1). The change in rainfall in any given month may vary from this pattern, and thus rainfall may increase in some seasons, even though rainfall for the entire year is lower. By 2100, these rainfall changes are estimated to be twice as large, meaning increases of up to 4% in some areas while other areas experience declines of up to 4%.

Third, as temperatures rise, the oceans will warm and glaciers and ice caps will melt, contributing to sea-level rise of somewhere between 9 and 88 cm. This sea-level rise will pose a particular challenge for coastlines and coastal communities. For example, due its low elevation, the western coast of Cape York south of Archer Bay is most at risk from inundation from rising seas and storm events (Figure 3).

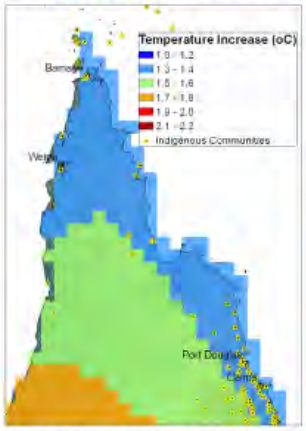

Figure 1. Projected change in average annual temperatures in Cape York in 2050.

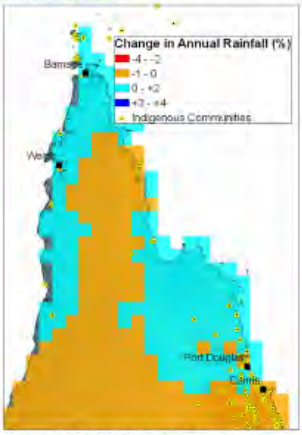

Figure 2. Projected change in average annual rainfall in Cape York in 2050.

Fourth, global warming will also likely change the variability of climate, including potential increases in the frequency or severity of extreme weather events. Cape York is frequently exposed to tropical cyclones such as the recent Cyclone Larry, although the frequency of cyclone strikes tends to be lower than other regions of northern Australia (Figure 4). Nevertheless, research suggests that tropical cyclones may become more intense as the world warms. In addition, extreme heat days and heat waves, extreme rainfall events, and more intense or prolonged droughts are all potential consequences of climate change in Australia.

CSIRO Marine and Atmospheric Research

What are the Potential Consequences of Global Warming?

The aforementioned climate changes are likely to have a broad range of downstream consequences for humans as well as the natural environment of Cape York over the next century. Some of these potential consequences are summarised below:

Human Health

- Increased risk of heat-related illness and death due to extreme heat events
- Expansion of the range of mosquitoes that carry dengue and Ross River virus into new areas
- Potential increase in injury and death from extreme weather events
- Increased risk of water and food-borne illness

Biodiversity

- Loss of freshwater wetlands due to sea-level rise
- Degradation and loss of the Great Barrier Reef
- Changes in the abundance or location of coastal fisheries
- Changes in the growth and distribution of native forests
- Increased risk of species invasions
- Increased risk of disturbances such as fire and pests

Water Resources

- Changes (positive or negative) in annual and seasonal rainfall
- Potential increase in drought and flooding events
- Potential reduction in inland and coastal water quality
- Salt-water intrusion into surface and groundwater

Coastal Communities

- Inundation of coastal communities from sea-level rise
- Increased erosion of coastlines, particularly during storms and severe weather

Extreme Weather

- Increased frequency or intensity of extreme heat days and heat waves
- Increase in extreme rainfall events
- Increase in the intensity of tropical cyclones in the region

Buildings and Infrastructure

- Increased maintenance costs for infrastructure such as roads and bridges
- Forced relocation of buildings and infrastructure from high risk areas
- Increased risk of exceedence of the capacity of water and sewage infrastructure

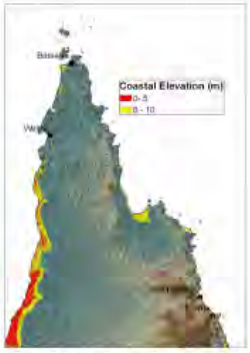

Figure 3. Low-lying coastal areas in the Cape York region, with areas below 5 meters in elevation in red, and between 6 and 10 meters in yellow.

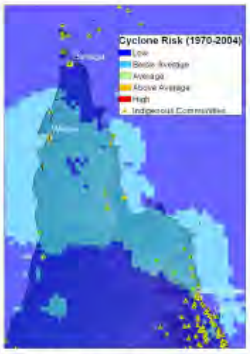

Figure 4. Relative risk of cyclone occurrences in the Cape York region, based upon historical cyclone events between 1970 and 2004.

Sharing Knowledge http://www.dar.csiro.au/sharingknowledge/index.html

Appendix H

FURTHER INFORMATION ON PLANNING AND DEVELOPMENT

1. Environmental Defenders Office (Qld) Inc. ph (07) 3210 0275 edoqld@edo.org.au

   Environmental Defenders Office of Northern Queensland Inc. ph (07) 4031 4766 edonq@edo.org.au

   EDO has good fact sheets on its website www.edo.org.au/edoqld, and can provide independent legal advice.

2. Department of Local Government and Planning
   ph (07) 3234 1870 enquiries@dlgpsr.qld.gov.au
   The Department provides excellent information on planning and development on its website www.ipa.qld.gov.au
3. Cook Shire Council. Ph (07) 40695444 e-mail anugent@cook.qld.gov.au
   CSC has a CD available for the public on their planning scheme

4. Hope Vale Aboriginal Council Ph (07) 40609133
5. David Farrier and Paul Stein. 2006. Environmental Law Handbook 4th Ed Redfern Legal Centre Publishing

Appendix I

PROPERTY FIRE PLANS
(Courtesy of CYPDA)

SHOULD INCLUDE THREE PARTS:

1. STRATEGY
2. BURN PROGRAM
3. WILDFIRE RESPONSE PLAN

STRATEGY INCLUDES:

BRIEF PROPERTY DESCRIPTION
Area, Location, Property History

VALUES TO PROTECT/MANAGE

Improvements – Yards Fences buildings bores etc
Grazing Values – Improved pasture, dry season feed, areas of woody encroachment to control
Vegetation – Fire sensitive areas, habitat maintenance, variety of communities
Erosion management and stream bank veg

PLAN OBJECTIVES

Protection of life, property, improvements
Maintenance of grazing values and control of woody encroachment
Protection of dry season grazing
Control potential of storm season burning to escape from planned areas
Protect fire sensitive vegetation and maintain habitat variety

RESPONSIBILITY

Plan implementation to be undertaken by landholder with assistance from neighbours, Rural Fires and QPWS where appropriate/available.

THREATS

Source of fires
SE winds bring high intensity, uncontrollable fires from the east during July to October
NW winds during late dry season can cause extreme fire conditions.
Values at risk from wildfire events
Fire History
Recent major fire events

FIREBREAKS

Constructed firebreaks roads
Natural Firebreaks, rivers, creeks and dense vegetation
Burnt firebreaks and sacrificial zones

FIRE MANAGEMENT AREAS

Property subdivision in to manageable blocks using natural features, firebreaks early season burning etc

WATER SOURCES

Accessible water sources. Locations and seasonal reliability

PROPOSED BURNING REGIMES

Preferred fire regimes for grazing
Fire regimes for habitat management
Aerial Incendiary operations
Rotational; burning opportunities

MAPS

Vegetation
Infrastructure Roads fences firebreaks
Fire Management blocks and water sources

PLANNED BURNING PROGRAM

Blocks – Time and season, frequency of burning
Alternate lighting techniques and locations to prevent continually burning same areas early.
Holding over –old grass" to burn early next year
Program monitoring (What level of information is required)

- Mapping of fires
- Recording times dates weather conditions
- Fire intensity
- Photo reference points

WILDFIRE RESPONSE PLAN

Action taken upon becoming aware of fire:
At all times the order of priority in wildfire suppression is:

1 Protection of human life
2 Protection of property/infrastructure on the land and on neighbouring landholdings

3 Protection of pastoral, biological and cultural values, or other fire management objectives as defined in the Fire Management Strategy.

Responsibilities of the first person at a wildfire

1 Ensure their own safety and the safety of any other persons in the immediate vicinity of the wildfire.

2 If possible, contact the land owner or manager of the area immediately and advise them of the wildfire

3 Assess the situation and **if it is safe to do so and likely to succeed**, take immediate action to extinguish or control the wildfire

4 If the wildfire cannot be controlled quickly, the land owner or manager is to be notified and given a detailed assessment including:

- the exact location of the fire
- size of the fire
- direction of spread
- rate of spread
- flame height
- terrain
- vegetation and fuel description
- weather conditions
- who is at the fire
- what equipment is at the fire
- what assistance is required

FIRE ASSESSMENT

Control Action required – Protocols for decision making near property boundaries.
Informing neighbours

Organisation of fire control effort –Priority areas for fire protection
Access to areas – locked gates etc

Fire equipment, Machinery, Neighbour contacts, Training requirements

GLOSSARY

Accountability A responsibility for which an individual or organisation must be answerable to others, and bear defined consequences of not adequately meeting the responsibility.
Accreditation A formal process for assessing the appropriateness of a strategy or plan for implementation.
Acid sulphate soils These are soils containing iron pyrite which when exposed to oxygen react to form sulfuric acid.
Algal Relating to algae, simple plants, mostly microscopic without roots and leaves.
Alluvial material Includes soil or sediments deposited by a river or other running water. Alluvium is typically made up of a variety of materials, including fine particles of silt and clay and larger particles of sand and gravel.
Baseline data Information that relates to a specific time or defined area of land or water from which changes or trends can be detected.
Best practice Best practice is the management of an activity to achieve ongoing minimisation of its environmental harm using cost effective measures.
Biodiversity The variety of life forms, plants, animals and microorganisms, the genes they contain, the ecosystems they form, and ecosystem processes.
Bioregion - An area of the continent defined by a combination of particular geology, landforms, climate and vegetation. For the definition of regional ecosystems, the bioregions of Sattler and Williams (1999) are adopted. Currently thirteen bioregions, numbered one to 13, have been defined for Queensland, however, parts of five regions are small extensions of nationally recognised bioregions in adjacent states and the Northern Territory (see Interim Biogeographic Regionalisation for Australia (IBRA) — www.deh.gov.au/parks/nrs/ibra/). Bioregions provide the primary level of classification of land for biodiversity values on a statewide and nationwide basis and have been mapped at scales smaller than 1:1,000,000.
Bioregions, defined as "geographic clusters of ecoregions that may span several habitat types, but have strong biogeographic affinities, particularly at taxonomic levels higher than the species level (genus, family.
Bioregional Relating to the management of biological diversity on a regional basis, using natural boundaries to facilitate the integration of conservation and production-oriented management. Bioregions most often refer to the extent of a particular ecosystem or similar types of ecosystems.
Bush regeneration The rehabilitation of degraded plant communities to healthy communities composed of native plants.
Capacity Ability to manage natural resources including legal, institutional, planning, management, financial, technical and information skills and capacities, and leadership skills.
Catchment The area of land drained by a river and its tributaries.
Catchment area The area of land surrounded by hills and mountains where water flows to the lowest point or drains to a specific water body.
Catchment community Rural and regional communities, landholders and land managers, Indigenous people, Landcare groups, urban people, industries, businesses, special interest groups and individuals who live and work in the Catchment or have a special interest in the Catchment
Catchment health The environmental condition of a Catchment, represented by the aggregate condition of its waters, land, vegetation and ecosystems.
Catchment management organisation An organisation comprising members of the Catchment

community, government and other interested parties established by State Government for the specific purpose of overseeing the management of a Catchment's natural resources.

Catchment scale Affecting a Catchment or taking effect across a Catchment.

Consumptive use The use to which a natural resource may be put that takes it out of its original situation and uses it for human purposes, e.g. using water for drinking purposes or irrigation

Credit A unit of measure of environmental benefit which can be allocated or debited and possibly traded.

Critical conservation land Parcels of land which contain fauna, flora or landform features of very high conservation value.

Colluvial material The name for loose bodies of sediment that have been deposited or built up at the bottom of a low grade slope or against a barrier on that slope which has been transported by gravity.

Community based The cooperative efforts of the community, industry decision-making groups and decision making government departments reaching common agreement on natural resource issues.

Declared animal An animal considered a serious enough pest to warrant its control being enforced under legislation.

Declared plant A plant considered a serious enough pest to warrant its control being enforced under legislation.

Degradation Any decline in the quality of natural resources resulting from both natural and human activities.

Ecosystem A community consisting of all living life forms which together with the physical environment function as a holistic unit.

Effluent The water discharged following a wastewater treatment process.

Endangered species Plant and animal species in danger of extinction and whose survival is unlikely if the causal factors continue.

Environmental 'best management practice' Environmental _best management practice' is simply undertaking activities in a way that is least likely to harm the environment. That is, the procedures and practices outlined are _best' for the environment and are preferred to certain existing procedures and practices that may create more waste and/or cause more pollution.

Environmental flows The minimum amount of flow required to protect and maintain the ecological values associated with river systems.

Environmental services The benefits that come to humans from nature and its components (e.g. renewal of soil fertility; purification of air and water); these benefits are sometimes called _ecosystem services'. Environmental services can also refer to an environmental benefit provided by land and water management practices that help to preserve natural resources or ecosystems.

Environmental weed Environmental weeds are plants that invade and thrive in environments in which they don't naturally occur and often out-compete local native species.

Ecology

Ecologically sustainable development Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased.

Ecosystem services Ecosystem Services are the processes by which the environment produces resources that we often take for granted such as clean air and water, timber, and habitat for fisheries, and pollination of native and agricultural plants. Whether we find ourselves in the city or a rural area, the ecosystems in which humans live provide goods and services that are very familiar to us.

These services are extensive and diverse ... affecting the quality of our land, water, food, and health. Ecosystems provide "services" that:

- moderate weather extremes and their impacts
- disperse seeds

- mitigate drought and floods
- protect people from the sun's harmful ultraviolet rays
- cycle and move nutrients
- protect stream and river channels and coastal shores from erosion
- detoxify and decompose wastes
- control agricultural pests
- maintain biodiversity
- generate and preserve soils and renew their fertility
- contribute to climate stability
- purify the air and water
- regulate disease carrying organisms
- pollinate crops and natural vegetation

Endemic / Endemism An organism being "*endemic*" means exclusively native to a place or biota

Erosion Occurs when material is transported from one place to another by the forces of water, wind or gravity.

Fish habitat area Those declared Fish Habitat Areas B declared over lands that contain important fish habitats. These areas do not impact on the normal day to day uses of the habitats by the community and allow permits to be granted for construction of certain private and public facilities subject to minimal impacts on the habitats.

Flow regime The pattern of flow in a river that can be described in terms of quantity and variability of water flows.

Geographic information system A computer system which stores, analyses and displays spatial and geographic mapping information.

Governments Commonwealth, State and local governments and their statutory authorities.

Groundwater Water beneath the surface held in or moving through saturated layers of soil, sediment or rock.

Habitat The type of environment in which a given animal or plant lives and grows, including physical and biological conditions.

High importance Highly essential for the health and well being of the Catchment or for the well being of the activity under discussion,

- Damage or failure will occur if not implemented,
- Often an essential first step for following steps,
- Associated risks of not implementing are unacceptable.

Holistic Taking account of all aspects of natural resources (environmental, economic and social) and the interactions between them.

Integrated Catchment management (ICM) A process through which people can develop a vision, agree on shared values and behaviours, make informed decisions and act together to manage the natural resources of their Catchment: their decisions on the use of land, water and other environmental resources are made by considering the effect of that use on all those resources and on all people within the Catchment.

Institution An organisation, and the laws, rules or customs that govern it.

Institutional reform A major change to an institution or its way of operating.

Land managers Those who manage land, including farmers, graziers, irrigators, land holders or custodians, councils, and government agencies.

Land tenure The legally recognised right to use a given piece of land.

Landcare group A group of people from the same area who join together to do a range of things to benefit the environment through land management and related activities.

Landholders Those who own or lease land.

Landscape An area of land and its physical features. This term is often used to describe an area that has common features.
Landuse refers to the type of activity occurring at a particular location and is determined by historical factors, landform, planning restrictions, land quality and location.
Low importance Desirable for the health and well being of the Catchment or for the well being of the activity under discussion,

- Limited chance of damage or failure if not implemented.
- Little or no risk to Catchment health if not implemented.

Long term + 6 years
Management target A target for the actions we take to manage natural resources.
Mechanisms Ways of achieving the desired outcome. Mechanisms are most often designed to trigger action by others that is likely to lead to the outcome being sought.
Medium importance Essential for the health and well being of the Catchment or for the well being of the activity under discussion.

- Some damage or failure may occur if not implemented.
- May be an essential first step for following steps.
- Associated risks of not implementing are moderately acceptable

Medium term 2 – 6 years
Native vegetation Vegetation comprising plant species originating in an area. Often refers to plant species originating in Australia, but vegetation can also be native to a local area.
Nature Refuge - a voluntary conservation agreement under Queensland legislation that is binding on the property title.
Natural resources The assets of land, water, plants, animals and air.
Outcome A long-term result that represents a measure of achievement of goals.
Public good A benefit accruing to the community as a whole, particularly to the Australian community.
Precautionary Principle A lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
Principle An accepted rule to guide action.
Property scale Actions and impacts at the scale of an individual farm, land holding or business.
Rare species - Species that are uncommon but are not currently considered endangered or vulnerable. Such species may be represented by a relatively large population in a very restricted area or by smaller populations thinly spread over a wider range, or some intermediate combination.
Regional communities People who consider themselves part of a region, often an economic or social grouping.
Regional ecosystem……..
Regional organisation An organisation responsible for regional issues, such as regional development, regional natural resources management etc.
Regulation A control by government on the use of natural resources.
Resource condition target A target for the condition or health of a natural resource. (See also ‗Catchment health target'.)
Remnant bushland Intact bushland which has incurred minimal human disturbance.
Responsibility Duty to undertake a particular role and be reliable in undertaking the role.
Revegetation The replacement of weed species with local native species in degraded areas.
Riparian Relating to the area along the bank of a river or a stream.
Riparian Vegetation Any vegetation on land which adjoins, directly influences or is influenced by a body of water.
Riverine Relating to rivers, their floodplains and wetlands.

Short term 0-2 years
Salinity The concentration of salts in soil or water, usually sodium chloride.
Stormwater Rainwater which runs from urban and agricultural areas often carrying pollutants such as hydrocarbons, heavy metals and chemicals, which are transported to creeks and rivers.
Surface water Water on the surface of the land, for example rivers, creeks, lakes, dams and overland flows.
Sustainability Managing our natural resources in a way that maintains their environmental, economic, social and cultural values so that they continue to be available in the long term.
Target A measured result, expected to be achieved in a given timeframe. A target is a short- or medium-term result leading to long-term outcomes.
Terrestrial Relating to land.
Transpiration The loss of water from a plant by evaporation is known as transpiration. Most of the water is lost through the surface openings, or stomata, on the leaves.
Type locality - *Biology.* The place or source where a holotype or type specimen was found.
Value A belief or accepted standard that influences the way we behave.
Vulnerable species Plant and animal species believed likely to move into the ~~"e~~ndangered" category in the near future if causal factors continue operating.
Wetland Land inundated with temporary or permanent water that is usually slow moving or stationary, shallow, and either fresh, brackish or saline.
Wetland EPA (QLD) definition – Wetlands are areas of permanent or periodic inundation, whether natural or artificial; fresh, brackish or saline; still or flowing. A wetland generally has plants and animals that have adapted to living in wet conditions.
Wildlife corridor A migration route along which wildlife can travel from one location to another.

ACRONYMS

ACTFR Australian Centre For Tropical Freshwater Research
AECMG-Annan and Endeavor Catchment Management Group
AIMS-Australian Institute for Marine Science
ANZECC-Australia and New Zealand Environment & Conservation Council
AQIS-Australian Quarantine Inspection Service
Bioregion-Biogeographic Region; e.g. Wet Tropics
BMP-Best Management Practice
BOM-Bureau of Meteorology
BVG-Broad Vegetation Group
CRC-Cooperative Research Centre
CSC-Cook Shire Council
CSIRO-Commonwealth Scientific and Industrial Research Organisation
CYMAG-Cape York Marine Advisory Group
CYP-Cape York Peninsula
CYPDA-Cape York Peninsula Development Association
CYPLUS-Cape York Peninsula Land Use Strategy
CYPNRM-Cape York Peninsula Natural Resource Management
CYWAFAP-Cape York Weeds and Feral Animals Program
DEH-Department of Environment & Heritage (Commonwealth)
DNRW Department of Natural Resources and Water
DNRMW Department of Natural Resources
DOGIT-Deed of Grant in Trust
DPI&F-Queensland Department of Primary Industries & Fisheries
EMP-Environmental Management Plan
EPA-Environmental Protection Agency
EPBC-Environment Protection and Biodiversity Conservation Act 1999
ESD-Ecologically Sustainable Development
FHA-Fishery Habitat Area
FRDC-Fisheries Research and Development Corporation
GBR Great Barrier Reef
GBRMPA-Great Barrier Reef Marine Park Authority
GIS-Geographic Information Systems
Ha-hectare
IPA-Integrated Planning Act 1997 (Qld)
IUCN-International Union for the Conservation of Nature (now World Conservation Union)
Km-kilometres
LGA-Local Government Authority
NHT-Natural Heritage Trust
NP-National Park
NRM-Natural Resource Management
Pers.comm-Personal Communication

PMP-Pest Management Plan
PMP-Property Management Plan
QFMA-Queensland Fisheries Management Act
QPWS-Queensland Parks and Wildlife Service
RE-Regional Ecosystem
RFS-Rural Fire Service
RVMP-Regional Vegetation Management Plan
SCYC South Cape York Catchments
SF-State Forest
SoE-State of the Environment
VMA-Vegetation Management Act 1999 (Qld)
WTMA-Wet Tropics Management Authority
WONS-Weeds of National Significance
WRP-Water Resources Plan