11. Atmosphere

11.1 Goals

To have an environment that maintains the cleanest air in the world

To foster knowledge and understanding of air quality and greenhouse and climate change issues

11.2 Aspirational Targets

These are long-term targets for the desired condition of natural resources over the next 50+ years.

Air is maintained as the cleanest in the world

Net greenhouse gas emissions meet international commitments

The majority of transport systems in use are energy efficient and do not emit greenhouse gases

The use of ozone-depleting chemicals has been reduced

***The foundations for adaptation to climate change are underway, including appropriate planning, management and information dissemination**

***Agricultural opportunities for primary industries, resulting from climate change, are capitalised on**

***All buildings are designed to minimise energy consumption and maximise passive energy production options**

* Resource Condition and Management Action Targets for these Aspirational Targets will be considered in the future.

11.3 Resource Condition Targets

This chapter outlines management actions that are needed to achieve progress towards the goals for Atmosphere. The Resource Condition Targets for Atmosphere are mainly aimed at improving ambient air quality in urban areas and reducing greenhouse gas emissions. The Strategy recognises the many linkages between the different natural resource assets, and so the most closely linked targets and management actions for other assets are shown in the tables in this chapter.

The Resource Condition Targets (RCTs) and following Management Action Targets are numbered to show how they relate to the Management Action Packages at the end of the chapter.

The Resource Condition Targets for Atmosphere are coded RCT A1 to RCT A3.

Resource condition	Target no.	Resource Condition Targets for Atmosphere (10–20 years)
Air quality/ greenhouse	RCT A1	No more than 5 days per year exceedance of 50 µg/m^3 of PM10: by 2015.
	RCT A2	No exceedance of 2006 benchmarks for PM2.5: by 2015.
	RCT A3	Methods of reducing greenhouse gas emissions explored and implemented: by 2015.

11.4 Management Action Targets

There are five Management Action Targets (MATs) for Atmosphere. The second target, MAT A2 (about identifying the impacts of sea level rise), is related to the first Resource Condition Target, CEM1, for Coastal, Estuarine and Marine (about the environmental condition of these assets). This connection is indicated in brackets: (associated with RCT CEM1). Although the projected sea level rise is related to air quality (greenhouse emissions), the impacts are discussed mainly in chapter 10: Coastal, Estuarine and Marine. The links between the asset targets are shown in Appendix 6.

Management Action Targets are coded MAT A1 to MAT A5.

Resource condition	Target no.	Management Action Targets for Atmosphere (1–5 years)
Air quality/ greenhouse	MAT A1	Develop a Regional air quality strategy: by 2010.
	MAT A2 (associated with RCT CEM1)	Identify impacts of projected sea level rise on the Region's natural assets and infrastructure: by 2010.
	MAT A3	Ensure twenty percent of fleet cars across the Region are fuel hybrid vehicles: by 2010.
	MAT A4	Develop a sustainable transport strategy: by 2010.
	MAT A5	Develop a Regional strategy for greenhouse gas targets, and address climate change issues: by 2010.

11.5 Asset description

The ambient air quality in the Cradle Coast Region is an exceptional asset – by world standards the air generally is very clean. Ambient air quality refers to outdoor air quality rather than indoor air quality, which is also discussed in this section. Trends in the global atmosphere and resulting climate changes are also considered (see section 11.7).

There has been some discussion of the indoor air quality during the development of this Strategy, but this topic is relatively un-researched, particularly with respect to policy development.

Changes in atmospheric composition can also have effects, at the global level, on climate and sea level. While air pollution has an impact mostly at the local level, greenhouse gases operate at a global scale, with all parts of the world contributing to and being affected by them.

11.6 Values and services provided

Air is essential to life. The values of clean air include:

- breathing air free from pollution
- the life, health and well-being of humans and other life forms
- visual amenity and the useful life and aesthetic appearance of buildings, structures, properties and materials
- wind as a resource for energy production.

By global standards, air quality in the Region remains exceptionally good for much of the time. Truly clean air is almost unknown in large parts of North America and Europe and, increasingly, across Asia, as well as in most large urban areas throughout the world. This makes the Region, like much of Tasmania, an unusually attractive place to live and visit.

Stabilising greenhouse gases contributes to:

- the integrity of ecosystems and ecological processes, now and in the future
- protection of agriculture from weather extremes
- protection and integrity of property vulnerable to the impacts of climate change (e.g. coastal properties threatened by rising sea levels and storms).

11.7 Asset condition

Ambient air quality

Most of the Cradle Coast Region is regarded as generally having the cleanest air in the world. The Region benefits from the clean air blown by strong westerly winds across thousands of kilometres of open ocean, with little industrial development at this latitude.

The very clean air is the reason for locating the Cape Grim Baseline Air Pollution Station at the remote north-western tip of the Region, in the path of the Roaring Forties. The station is a highly sophisticated, world-class facility, operated by the Bureau of Meteorology as part of a joint program with CSIRO Atmospheric Research. It supplies vital information about changes to the atmospheric composition of the Southern Hemisphere. It is important to protect the integrity of the air reaching the Cape Grim station, and the critical information it supplies, from industrial development near this site.

While the air reaching the Region from the west is very clean, a number of mainly land-based activities generate particulates, odours, corrosive gases and potentially climate-altering greenhouse gases such as carbon dioxide and methane. Within the Region, ambient air quality at the Cape Grim station is affected by these activities for more than half the time.

The break up of air monitored at Cape Grim is as follows:

- Clean oceanic air – 46% of the time
- Mainland Australia – 27% of the time
- Tasmania – 19% of the time
- Urban – 8% of the time.

Air from the Mainland affects the air quality particularly in northerly conditions, when air from Melbourne reaches the Region. Burn-off from local land management or forestry practices in Tasmania results in high amounts of large particles that affect air quality and visibility, and has a significant impact on measurements at Cape Grim (personal communication, Atmosphere Watch Section, Australian Bureau of Meteorology). A working group of the State Fire Management Council is considering issues of smoke management from planned burning associated with hazard reduction, agricultural and regeneration burning.

Ambient air quality in specific areas within the Cradle Coast NRM Region is affected by emissions from domestic wood heaters, bushfires, forestry and other controlled burn-offs, motor vehicles, manufacturing, mining, other industry and agricultural activities.

Emissions in some locations result in elevated particle concentrations on a few days each year. In particular, when very stable weather conditions occur, temperature inversions can trap smoke and other pollutants emitted into the air at lower altitudes, building up to high concentrations.

Air pollution may contribute to significant health problems, particularly for people with respiratory problems, such as asthma. The increase in respiratory disease imposes costs on the community, not just through human suffering but also through economic costs to the State's health system. Further, high pollution levels may affect Tasmania's 'clean, green' image and have an adverse impact on tourism. Air pollutants are contributing to the greenhouse effect, which is linked to climate change.

Government regulations with respect to maximum emissions levels apply for all industries. These are intended to keep levels of air pollutants below levels that adversely affect health. In most cases these levels are not exceeded and some industries endeavour to do better by maintaining emissions at even lower levels.

Air quality can be degraded by the addition of suspended particles and irritating or corrosive gases (air pollution). Ambient air quality problems typically manifest as high concentrations of particles, notably PM10 (10 micrometres or less) and PM2.5 (2.5 micrometres or less). The smaller PM2.5 particles are able to penetrate the deep areas of the lungs, and so are believed to exert significant health effects on populations. PM2.5 particles are expected to be about 80% of the PM10 levels. Concentrations of PM10 have been measured in Australia for many years, but PM2.5 is now regarded as the most important fraction correlating with human health impacts, and so is increasingly being measured throughout the country.

A pilot study for monitoring of particles started at Devonport on 30th May 2003 and ran until 30th August, measuring Total Suspended Particulates (TSP) every second day. Over this time the

acceptable limit was sometimes exceeded, highlighting the need for a permanent air-monitoring program in Devonport. Such a program will start within the next 2 years. PM10 will be measured at Devonport, but PM2.5 will not be measured in the immediate future. Over the next year DPIWE will also conduct 'hot spot' monitoring for particles.

The Australian Government is developing legislation to improve the Australian Design Rules for diesel vehicle emissions. The effect of these changes will be felt over the time taken for the current diesel vehicles to be replaced.

Indoor air quality

We spend 75–80% of our time indoors, yet most of us rarely think of the potential air quality pollutants associated with being indoors. Indoor pollution is an important local air quality and human health issue. Indoor air quality can be affected by house dust mites, tobacco smoke, toxic compounds including insecticides, *Legionella* bacteria in air conditioning systems, inadequate ventilation, and volatile irritants from furnishings and equipment. All of these can create 'sick buildings'.

Little is known about the impact of indoor air pollution on health, and further studies need to be undertaken.

Global atmosphere and climate change

The greenhouse effect is a natural process whereby various gases in the Earth's atmosphere trap some of the heat radiating from the Earth. This greenhouse effect is essential to sustain life on Earth. However, for the past 200 years the quantity of greenhouse gases being released into the atmosphere has been increasing significantly above the quantity released through natural processes.

The increasing concentration of greenhouse gases affects the world's climate and contributes to global warming.

The global atmosphere maintains the climate to which plants and animals in different parts of the world have adapted. Rapid changes will create stresses on these communities, the very foundation on which the natural environment depends.

The potential for change in the Region, arising from global climate change, has only been identified at a preliminary level. Recent climatic modelling by the CSIRO indicates that, in Tasmania, rainfall patterns are likely to change. Any climate change is likely to be felt more widely and rapidly in the agricultural sector, due to such changes in rainfall patterns. In the Cradle Coast region, summer rainfalls have decreased significantly in recent years, associated with the more frequent El Nino events related to global warming.

Tasmania is also likely to experience stronger westerly winds associated with deeper low pressure systems. As a result, storm surges will increase in frequency and intensity, with higher waves. These changes could significantly affect erosion and sedimentation processes, both inland and along the coast.

Ozone depletion in the upper atmosphere is another issue of concern to the Region. The ozone layer absorbs most of the sun's ultraviolet (UV) radiation and so makes life on Earth possible. Since the 1970s, there has been a rapid decline in the amount of ozone over Antarctica and Australia, causing a 'hole' in the ozone layer. This thinning of the ozone layer, caused by chemicals manufactured by humans, increases the risk of sunburn and skin cancer in humans.

Sea level rise

While sea levels rose significantly at the end of the last ice age (between 10 000 and 6 500 years ago), the most recent changes have been created by global warming, resulting from human impacts on the world environment.

The United Nations Intergovernmental Panel on Climate Change (IPCC, 2001) has estimated that there was a 10 to 20 cm rise in sea level in the 20th century, and predicted a further rise of 9 to 88 cm over the 110 years from 1990 to 2100. Although similar changes have occurred at various times throughout geological history, the present rates of climate change and sea level rise are much greater than changes that would occur naturally. These changes will significantly affect human infrastructure, agriculture and other systems that have developed with the expectation of a stable climate and sea level.

The impacts of sea level rise (such as increased erosion and sedimentation) on coastal areas are insufficiently understood and inadequately planned for by coastal management organisations in the Region. However, the West North West Coastal Management Plan project commissioned a report that identified areas at risk from the effects of a rise in sea level and climate change (Sharples, 1998). Nevertheless, locations within the Region likely to be affected – particularly those containing permanent human activity and infrastructure investment – require more detailed assessment to determine the nature and level of impacts and actual risk.

The State Government has data available that provides indicative mapping of potential coastal erosion and flooding relating to climate change and sea level rise (Sharples 2004), and will have data available (during 2005) for modelling the impacts of climate changes on primary industries and water.

Recent sea level rise is a probable cause of some of the active coastal erosion presently widespread throughout Tasmania. In the Cradle Coast Region, areas at greatest risk are flat sandy coasts, where the sea could intrude between 10 m and 100 m inland.

Locations of this nature with substantial human usage and infrastructure include:

- Port Sorell/Bakers Beach sand-spit
- Northdown Beach/Pardoe Beach (East Devonport)
- Lillico Beach
- Turners Beach
- Forth Estuary
- Ocean Beach spit (Macquarie Harbour).

On the other hand, sandy coasts currently prograding (growing outwards) may continue to do so at an decreased rate. The main prograding area is between Woolnorth and Rocky Point.

Estuaries are also likely to experience significant impacts due to climate change. Sediment is likely to be eroded between mean sea level and mean high water, and redeposited below the tidal zone. This may cause estuary mouths to widen and become shallower. Consequently, there will be disruption and retreat of intertidal communities such as salt marshes.

Rocky coastlines will be less rapidly affected by sea level rise and climate change, although some exposed rocky coasts may experience more coastal landslips and unstable sea-cliffs.

11.8 Causes of degradation

Ambient air quality

Ambient air quality in specific areas within the Cradle Coast Region is degraded by smoke, primarily from burning in the agricultural and forestry sectors, and domestic woodheaters. Air quality in some areas is also affected by smoke from bushfires, accidentally and deliberately lit, and controlled burning. Relatively minor air pollution comes from other sources such as motor vehicles and industry.

As with other areas of Tasmania, a major issue is the widespread use of woodheaters for domestic heating in urban areas. The way these heaters are used determines the level of smoke and other emissions that they generate. Ideally, the complete combustion of wood will produce carbon dioxide, water and a small amount of inorganic ash. But when people shut down the dampers on a heater, or burn inadequately seasoned wood, the wood smoulders, burns inefficiently and wastes most of its heat value as smoke and products of partial combustion. Smoke consists of fine particles of carbon (within the PM2.5 range), and volatile organic (carbon-containing) products, many of which are toxic and highly irritating to delicate tissues such as eyes and lungs.

Even a heater that complies with National Design Standards (AS/NZS 4013) can be operated badly, producing excessive smoke. The two important issues relating to woodheaters are the need to:

- encourage people in urban areas to choose alternatives to woodheaters for domestic heating
- educate woodheater owners to operate their heaters correctly and minimise polluting emissions.

Among transport vehicles, diesel engines are the most significant sources of fine particle pollution and oxides of nitrogen. Diesel vehicle emissions have risen due to the continued annual growth in vehicle kilometres travelled and fuel consumption, and poor maintenance and condition of diesel vehicles.

Industry sources contributing to poor air quality include:

- emissions from coal, diesel and wood burning, e.g. sulphur dioxide and nitrogen oxides
- vapour and other emissions from fuel storage
- air-borne wood dust from woodchip stockpiles
- dust from quarry operations
- forestry regeneration, agricultural and fuel reduction burns
- chemical spray drift in agricultural areas and urban areas nearby
- odour and other gaseous emissions from waste refuse sites
- odours associated with noxious activities, e.g. meat processing, tanning
- fumes associated with underground mining
- particles discharged by mines and mills.

The introduction of natural gas and its availability and accessibility to larger industries is likely to reduce particle emissions.

Indoor air quality

Indoor air quality issues arise from:

- tobacco smoke
- insecticides
- *Legionella* bacteria in air conditioning systems
- inadequate ventilation of buildings, e.g. un-flued gas heaters
- volatile irritants from furnishings, e.g. formaldehyde in synthetic bench tops and bathrooms.

The extent of threats from these indoor pollutants is not well documented in general or in the Region.

Enhanced greenhouse effect

While a range of greenhouse gases contributes to global warming, the principal contributors are carbon dioxide and methane. Carbon dioxide concentrations in the atmosphere have risen throughout the past 200 years, due mainly to the burning of fossil fuels, the clearing of vegetation and the loss of carbon from soils.

The other major greenhouse gases, methane and nitrous oxide, also arise from a range of natural processes, with emissions to the atmosphere recently increased by human activity. The main human sources of methane are farming of cattle and sheep, landfills, and fossil fuel exploration and extraction. Methane and nitrous oxide have a much higher 'greenhouse warming potential' than carbon dioxide, and methane has contributed about 20% to the enhanced greenhouse effect over the past 200 years. Cattle farming is a significant source of nitrous oxide.

Recent measurements by CSIRO at Cape Grim show that atmospheric concentrations of methane have stopped growing over the past four years. This compares to a 15% rise over the preceding 20 years, and a 150% rise since pre-industrial times. Suspected sources of reduction include improvements in exploration and use of fossil fuels, and landfill gas recovery. Carbon dioxide and nitrous oxide levels, however, continue to increase.

We should ensure that the Region meets international commitments to cooperate in reducing the global effects, however small its contribution may be in global terms. Only by all communities around the world taking this responsibility is there any possibility of moderating global climate change.

If the climate changes more rapidly than human and natural systems can respond, many species and ecosystems and much human investment will be lost. The values of these are inestimable, but are likely to be experienced as:

- loss of agricultural production and water resources due to reduced summer rainfall
- loss of coastal areas to erosion and inundation, resulting in loss of coastal developments
- increased damage from storms, including wind and flooding and crop losses
- increased insurance costs
- changes in frequency, distribution and intensity of diseases affecting human health, crops and native plants and animals
- degeneration of ecosystems through loss of species.

As part of the community education and capacity building aspects of climate change and greenhouse, the National Greenhouse Office has set up the Cool Communities Program. In Tasmania there are three projects, all outside the Cradle Coast Region. The projects deal with air quality, especially wood smoke, transport and sustainable home energy use.

The Tasmanian Government will establish a Consultative Committee to deal with the Tasmania *Together* Greenhouse targets and National gas emission targets.

The thinning of the ozone layer is caused by emissions from manufactured chemicals such as halons, CFCs (chlorofluorocarbons, in refrigerants and aerosols) and methyl bromide (a fumigant). International efforts to phase out the use of ozone-depleting chemicals are reducing their levels, but ozone recovery is unlikely before about 2010–2015, as the chemicals persist in the atmosphere. The timing is uncertain because, although the size and duration of the ozone hole was greatly reduced in 2002, in 2003 it was the largest yet recorded.

In Tasmania, initiatives to reduce the use of ozone-depleting chemicals include strict controls on their use by the Department of Industries, Water and Environment, and the collection and destruction of halons as part of the Australia-wide Halon Bank program.

Sea level rise

Sea level rise is expected to occur mainly from climate change, and is caused by the same processes contributing to the enhanced greenhouse effect. The Tasmanian Shoreline Monitoring and Archiving Project (TASMARC), recently initiated by the

Antarctic Climate & Ecosystems Cooperative Research Centre, is a community-supported program to monitor shoreline recession around Tasmania.

Gaps in existing knowledge or management systems

Gaps in existing knowledge or management systems include lack of:

- knowledge about which areas are at risk from sea level rise (with regard to future urban development)
- Local Government regulations to promote energy efficient and innovative designs, and to promote passive solar benefits
- baseline data on vehicle emissions
- Local Government monitoring of air quality, and active pursuit of non-compliance
- indoor air quality information
- a Greenhouse Local Action Plan
- a State or Regional sustainable transport policy.

Other issues at the State and National level include:

- the need for legislation to regulate emissions from wood heaters and vehicle exhausts
- the failure to ratify the Kyoto Protocol in support of a global effort to stabilise greenhouse gas emissions
- inadequate resourcing of ecological burning by the Parks and Wildlife Service.

11.9 Priority issues

The priority issues for Atmosphere were developed from the community consultation process as outlined in chapters 4 and 13 (see Table 13.4). The detailed process for determining these priorities *(Methodology for prioritising management actions)* is available as a Supplementary Document from Cradle Coast NRM and is on our website www.nrmtas.com.au (click on Cradle Coast Region).

Note that because many natural resources belong to more than one asset group, some of the priorities affecting Atmosphere are also discussed in other chapters. For instance, the impacts of climate change are discussed in chapter 10: Coastal, Estuarine and Marine.

The priority issues identified for Atmosphere are:

- ambient air quality decline
- greenhouse emissions.

These priorities were used to develop the packages of management actions described in the following section.

11.10 Management Action Packages

A suite of management actions has been designed to achieve the Management Action Targets and to contribute to achieving the longer-term Resource Condition Targets for the priority issues. These management actions are grouped in packages as set out in the following tables. The tables contain groups of actions, called Management Action Packages, which address each cause of the priority issues for the Atmosphere asset. The action packages are designed to address causes rather than symptoms.

Our Goals for the Region provided the direction for setting all the targets and the Management Action Packages. Many of the actions have been drawn from the various action plans and strategies that support the Strategy. A number of these activities are already underway as Priority Projects for NRM, funded by the Natural Heritage Trust. These have been identified in the tables below.

Actions related to the projected rise in sea level are in chapter 10: Coastal, Estuarine and Marine.

The text at the top of each table shows how each Management Action Package for Atmosphere is linked to the Resource Condition Targets and Management Action Targets.

The Management Action Packages have been numbered for ease of referring to them in developing the Regional Investment Proposal. This will involve further stakeholder consultation to identify the funding requirements for implementing the highest priority management actions, as discussed in the next section, Part E.

Atmosphere Package 1: Ambient air quality decline. This package addresses Resource Condition Targets A1 and Management Action Targets A1.

Cause	No.	Action	Possible Lead Org.[6]
Lack of strategic planning	A1	Develop and implement a Regional air quality strategy, that includes air quality forecasting and public education, to reduce atmospheric emissions to meet the National Environmental Protection (Ambient Air Quality) Measure standards and goals.	DPIWE
	A2	Update planning schemes to minimise new pollutant-emitting activities within the Region.	DPIWE/ Local Govt
	A3	Implement the proposed State Environmental Protection Policy for Air Quality (Air EPP).	DPIWE
	A4	Enforce the relevant provisions of the *Local Government Act 1993*, the *Environmental Management and Pollution Control Act 1994*, the proposed Environmental Protection Policy (Air Quality) and proposed air quality regulations.	DPIWE/ Local Govt
	A5	Revise the Forest Practices Code and develop forest industry guidelines or protocols to reduce and better manage smoke emissions.	FPB
	A6	Support implementation of a licensing scheme for firewood suppliers.	DPIWE
Lack of knowledge	A7	Develop an education program on reducing particulate emissions from wood heaters, and alternatives to wood heaters for domestic heating.	CCNRM
	A8	Model the Cradle Coast Region to determine areas where air pollution potential is high.	DPIWE
	A9	Review and analyse National Pollutant Inventory data for diffuse and point sources of air pollution, to provide an updated assessment of Regional air quality.	DPIWE

6 Possible lead organisations have been identified. Negotiation with these organisations is part of the next phase, developing the first Regional Investment Proposal. Acronyms are explained on the last page of this Strategy.

Atmosphere Package 2: Greenhouse emissions. This package addresses Resource Condition Targets A2, A3 and Management Action Targets A2, A5.

Cause	No.	Action	Possible Lead Org.
Inadequate strategic planning	A10	Develop and implement Regional strategies to meet relevant greenhouse gas targets and address climate change issues (e.g. reducing land clearing, transport fuel emissions and agricultural emissions).	CCNRM
	A11	Encourage industry compliance with greenhouse gas emission targets and participation in the Greenhouse Challenge.	CCNRM
	A12	Encourage the community to participate in the Cool Communities program.	Local Govt
	A13	Encourage the Australian Government to develop policies to reduce the use of fossil fuels and to utilise renewable energy.	CCNRM
Inadequate planning and policy	A14	Protect and expand carbon sinks through regulatory controls and incentive mechanisms.	DPIWE
	A15	Encourage energy efficient, innovative designs and promote passive solar benefits through Local Government approvals processes.	Local Govt
	A16	Coordinate and support Regional and local climate change initiatives.	CCNRM
	A17	Establish a Tasmanian Greenhouse Consultative Committee as a coordination and information-sharing forum, incorporating Regional bodies, State and Local Governments and other relevant stakeholders.	State NRM Council
Lack of knowledge	A18	Encourage research into the impacts of projected climate change and sea level rise on the Region's natural assets, infrastructure and agricultural systems.	CCNRM/ DPIWE
	A19	Identify key sources of Regional greenhouse gas emissions through the National Pollutant Inventory.	DPIWE

Monitoring and Evaluation Package

Monitoring and evaluation will allow the Region to learn about the effectiveness of actions taken, to make changes where necessary and to report on progress in achieving Regional targets. The following table contains the monitoring and evaluation actions for Atmosphere. For more information and the full set of monitoring and evaluation actions see chapter 14: Monitoring and Evaluation.

Monitoring and Evaluation Package for Atmosphere: This package addresses Resource Condition Target A1.

Asset	No.	Action	Possible Lead Org.
Atmosphere	M23	Facilitate a Regional atmospheric monitoring program.	DPIWE