**Department of Primary Industries,
Water and Environment**

National Environment Protection Measure For Ambient Air Quality

Amended Monitoring Plan for Tasmania

October 2005

This Amended Monitoring Plan has been prepared in accordance with the protocol of the National Environment Protection (Ambient Air Quality) Measure (1998), as amended (May 2003). The Plan documents monitoring currently being undertaken, and upgraded monitoring programs being implemented over the period 2004-2008 in the State of Tasmania, to determine compliance with the Standards and Goals of the Measure.

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ACRONYMS and SYMBOLS

ABS	Australian Bureau of Statistics
AMG	Australian Map Grid
AS	Australian Standard
b_{scat}	scattering coefficient, a measure of percentage reduction in visibility per metre due to particle scattering, as determined by a nephelometer (Units: 10^{-4} $metres^{-1}$)
CBD	Central Business District
CO	carbon monoxide
EAD	equivalent aerodynamic diameter
EPHC	Environment Protection and Heritage Council
GFC	gas filter correlation infrared absorption method for carbon monoxide
GRUB	Generally Representative Upper Bound for community exposure
masl	metres above sea level
$\mu g/m^3$	micrograms (millionths of a gram) per cubic metre of air referenced to a temperature of 0^o Celsius and an absolute pressure of 101.325 kilopascals
µm	micrometres, 1 millionth of a metre, sometimes referred to simply as microns (µ)
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council (now incorporated into EPHC)
NEPM	National Environment Protection Measure
NO_2	nitrogen dioxide
NPI	National Pollutant Inventory
O_3	ozone
PAH	polycyclic aromatic hydrocarbons, also known as polycyclic organic matter (POM)
Pb	lead
PM_{10}	Particulate Matter including particles with sizes up to 10µm EAD (50% cutoff point)
$PM_{2.5}$	Particulate Matter including particles with sizes up to 2.5µm EAD (50% cutoff point)
ppm	parts per million by volume
PRC	Peer Review Committee
SO_2	sulfur dioxide
TEOM	Tapered Element Oscillating Microbalance
TSP	Total Suspended Particulates
UV	ultraviolet radiation
UVF	ultraviolet fluorescence method for ambient sulfur dioxide measurement

GLOSSARY

accreditation	In the context of the Measure, accreditation by the National Association of Testing Authorities (or equivalent) to ensure adequate monitoring, quality assurance and validation procedures.
advisory reporting standards	National Environment Protection Standards established for $PM_{2.5}$, with an associated National Environment Protection Goal, in the Measure as amended in May 2003. They differ from the other Standards and Goals in not requiring actions to comply with the Standard, but rather, to gather information to facilitate a review. See **National Environment Protection Standard** and **Standards and Goals**, below.
equivalent aerodynamic diameter	The diameter of a sphere of unit density (1 kg/1000cc) which has the same terminal falling velocity in air as the particle under consideration. In effect, equivalent aerodynamic diameter defines the size of particle in terms of its behaviour in air, rather than its physical size or shape.
Air emissions inventory	An estimate of the amounts of each of a range of substances emitted into the atmosphere, summed over all known sources.
air monitoring	The sampling of air to determine the concentration of one or more substances.
air pollutant	Any substance that is present in the air in high enough concentrations and over sufficient time, to cause harm to human health and well being. For the purposes of the Measure, "pollutant" means a pollutant appearing in Schedule 1.
air quality	For the purposes of the Measure, the condition of the air referenced against one or more National Environment Protection Standards and associated National Environment Protection Goals appearing in Schedule 1.
airshed	An area that is defined by natural or topographic features affecting air quality. Once a substance is emitted into an airshed, it is contained therein for a reasonable period of time.
ambient air	The surrounding outside air at a specified location, excluding the air inside buildings or structures.
generally representative upper bound station	A performance monitoring station that is located in a populated area expected to experience relatively high concentrations of a pollutant, providing a basis for reliable statements about compliance within the region as a whole (see PRC 2000d). In this way, the Measure's aim of equivalent environmental protection is assured
goal	Short form for National Environment Protection Goal
katabatic	Downward flow of cooler air. Katabatic flows drain down a valley in a way that is analogous to flows of stormwater.

Measure, the — A shortened reference used in this document to the National Environment Protection Council (Ambient Air Quality) Measure, 1998, as amended 2004 – also known as the Air NEPM and the AAQ NEPM.

monitoring method — In the context of the Measure, specified Australian Standard Methods should be used for monitoring pollutants, as per Schedule 3 of the Measure. Other methods may be used if they are shown to be equivalent to the method specified by the Measure.

national environment protection goal — A goal under Part 2 of the Measure that relates to the desired environmental outcomes and guides the formulation of strategies for management of the human activities that may affect the environment.

- "(a) for carbon monoxide, nitrogen dioxide, photchemical oxidants (as ozone), sulfur dioxide, lead and particles as PM_{10}, to achieve the National Environment Protection Standards…. within 10 years from commencement to the extent specified in schedule 2 column 5…"[of the Measure].
- "(b) for particles as $PM_{2.5}$, the goal is to gather sufficient data to facilitate a review of the Advisory Reporting Standards as part of a review of this measure scheduled to commence in 2005."

See **Standards and Goals** below.

national environment protection standard — A prescribed level of air quality for the adequate protection of human health and well being, and/or against which nationally consistent reporting can be achieved. The Standards consist of quantifiable characteristics of the air against which ambient air quality can be assessed.

See **Standards and Goals** below.

particle/particulate matter — Any substance (except pure water) that exists as discrete microscopic entities of solid and/or liquid in the atmosphere. Particle concentration can be assessed as either mass concentration or number concentration.

Standards are set in the Measure only for mass concentrations of particles in two aerodynamic size ranges:

- $PM_{2.5}$, which includes all* particles with equivalent aerodynamic diameters up to 2.5 µm, and
- PM_{10}, which includes all* particles with equivalent aerodynamic diameters up to 10 µm.

The subscripts "2.5" and "10" indicate the respective EADs in µm at which 50% of the particles are captured, as defined in the USEPA performance curves for size selective inlets of particle sampling instruments.

* In practice, the lower limit on size of particles is limited by the minimum size that can be captured on the filter material used for sampling – usually around 0.5 µm.

Peer Review Committee — A committee set up by the Ministerial Council (NEPC) to advise on the adequacy of jurisdictional monitoring plans and provide advice on technical issues related to the consistent implementation of the Measure's monitoring protocol.

performance monitoring station — In the context of the Measure, a monitoring station used to measure performance against the Goal. Such a station should be operated in the same location for at least 5 years, unless the integrity of the measurements is affected by unforseen circumstances.

photochemical oxidants — Reactive substances (oxidants) formed from the action of sunlight on mixtures of organic compounds and oxides of nitrogen. The most significant photochemical oxidant is ozone, but others, such as PAN (peroxyacylnitrates) may also be important in some airsheds.

pollution — The presence of one or more pollutants at concentration(s) that can cause harmful or undesired effects.

See **air pollutant** above.

population formula — A mathematical formula for calculating the number of performance monitoring stations for a region with a population of 25,000 people or more.

protocol — The monitoring protocol under the Measure**.**

region — In the context of Monitoring Plans for the Measure, a geographical area where the air quality (for a particular pollutant) is determined either entirely or in a large part by the influence of a common collection of anthropogenic emission sources.

screening — A term used to refer to the assessment and demonstration that for a given region and pollutant, fewer monitoring stations than indicated by the Population Formula (possibly zero) are required.

standard — Short form for National Environment Protection Standard

standards and goals — Standards and Goals cited in Schedule 2 of the Measure (as amended), summarised in the Tables below:

			Goal Within 10 Years	
(a) Pollutant	*Averaging Period*	*Maximum Concentration*	*Maximum Exceedences*	*Allowable*
Carbon monoxide	8 hours	9.0 ppm	1 day a year	
Nitrogen dioxide	1 hour	0.12 ppm	1 day a year	
	1 year	0.03 ppm	none	
Photochemical oxidants (as ozone)	1 hour	0.10 ppm	1 day a year	
	4 hours	0.08 ppm	1 day a year	
Sulfur dioxide	1 hour	0.20 ppm	1 day a year	
	1 day	0.08 ppm	1 day a year	
	1 year	0.02 ppm	none	
lead	1 year	0.50 µg/m^3	none	

Particles as PM_{10}	1 day	50 µg/m^3	5 days a year

(b) Pollutant	*Averaging Period*	*Maximum Concentration*	*Goal*
Particles as $PM_{2.5}$	1 day	50 µg/m^3	Gather sufficient data nationally to facilitate a review of the Advisory Reporting standards as part of the review of this Measure scheduled to commence in 2005
Advisory Reporting Standards	1 year	8 µg/m^3	

substance Gas, particle or liquid of natural or man-made origin.

TAPM "The Air Pollution Model" — a prognostic meteorological and air pollution dispersion model developed by CSIRO Atmospheric Research (http://www.dar.csiro.au/tapm).

The meteorological component of TAPM estimates the local-scale flow, such as sea breezes and terrain-induced circulations, given the larger-scale synoptic meteorology. The air pollution component uses the model-estimated three-dimensional meteorology and turbulence, and consists of a set of species conservation equations and an optional particle trajectory module.

total suspended particulate A fraction of airborne particles ranging up to about 50 µm equivalent aerodynamic diameter. This is the oldest fraction of particles, and its cut-off size is less well defined than the more recently designated PM_{10} and $PM_{2.5}$ fractions.

trend station In the context of the Measure, a station for monitoring and assessing long term changes (over one or more decades) in ambient air quality at a given location. Such a station should be operated in the same location for one or more decades.

wind rose A diagrammatic summary of wind speed and direction for a given location. The number in the centre of each wind rose represents the frequency of calm conditions, defined as winds below 1m/s. The overall length of the segmented vanes represents the proportion of winds coming from each compass point.

EXECUTIVE SUMMARY

In 1998, the National Environment Protection Council (NEPC), made the Measure on Ambient Air Quality. The Measure established a set of Standards and a Goal for six air pollutants to allow for the adequate protection of human health and well being. Moreover, the Measure outlined the methods by which these pollutants are to be measured, assessed and reported.

The original indicators covered by the Measure were photochemical oxidants (as ozone, O_3), nitrogen dioxide (NO_2), particles (as PM_{10}), carbon monoxide (CO), sulfur dioxide (SO_2) and lead (lead). The Measure was amended in May 2003 to also include reporting Standards and a Goal for $PM_{2.5}$.

A formal requirement of the Measure is the establishment of monitoring procedures and commencement of assessment and reporting, in accordance with the protocol of the Measure, within three years after its commencement.

Monitoring for PM_{10} in accordance with the requirements of the Measure has been undertaken at Launceston and Hobart since 2001, using High Volume Air Samplers and TEOM instrumentation. However, much of the original equipment is very old and is quickly reaching the end of its serviceable life.

In response, the Tasmanian Government is providing $816,000 of capital funding over four years to upgrade the Tasmanian Air Quality Monitoring System. The Tasmanian Air Quality Monitoring System Development Project, 2004-2008, comprises a program to purchase new low volume sequential air samplers, both to replace old PM_{10} high volume air samplers and to develop a $PM_{2.5}$ monitoring capability, in accordance with requirements of the amended Measure. To support the new program, a new micro-weighing facility is due to be completed in March 2005, and is projected to be fully operating by the end of April 2005.

In view of the significant changes to the monitoring program as submitted in the original Plan, it is appropriate to amend and upgrade the document to reflect the new configuration, and to update other contextual information that is relevant to air quality management in Tasmania.

This document updates Tasmania's Plan for monitoring, assessment and reporting to the NEPC under the Measure, to reflect:

(a) re-location of the Prince of Wales Bay Station to New Town,
(b) upgrade of existing PM_{10} high volume air samplers with low volume sequential samplers.
(c) establishment of a $PM_{2.5}$ monitoring capability, using low volume sequential samplers.
(d) re-location of the carbon monoxide monitor in Hobart and re-designation from a performance and trend monitoring station to a peak CBD site.

(e) establishment of new meteorological monitoring stations at all Tasmanian performance and trend monitoring sites.

Accordingly, the following paragraphs have been modified:

Hobart

- Under Section 3.1.5 "Particulate Matter (as PM_{10})" -
  - 3.1.5.1 Review of Data
  - 3.1.5.2 Nominated Performance Monitoring and Trend Station:
- Under Section 3.1.6 "Carbon Monoxide" -
  - 3.1.6.1 Review of Data
  - 3.1.6.2 Nominated Performance Monitoring and Trend Station:

General

- Under Section 4 "Siting and Instrumentation" –
  - 4.1 Details of Monitoring Stations
  - 4.3 Meteorological Observations

The original Plan demonstrated that in Tasmania, monitoring was not required for all six pollutants, based on a consideration of the Protocol and a series of Peer Review Committee Technical Guideline Papers. The revised monitoring program for Tasmania is summarised in Table ES-1 below.

To date, daily monitoring of particles (as PM_{10}) has been conducted under the monitoring plan in both Hobart and Launceston since 2001. A campaign during winter 2003 demonstrated the need for a PM_{10} monitoring station at Devonport, installation of which is scheduled for 2006.

Results of carbon monoxide monitoring at Prince of Wales Bay in Hobart since mid-2000 showed concentrations to be insignificant when compared with the National Environment Protection Standard, with a maximum 8 hour average for that period of 2.3ppm. As such levels were well below the screening criterion specified in Technical Paper No. 4, monitoring was discontinued in August 2004. It is intended to establish a station within the Hobart CBD to assess contributions from motor vehicles along a busy thoroughfare.

For sulfur dioxide, the assessment conducted during development of the original monitoring Plan demonstrated that monitoring was only required in Hobart.

The only source of sulfur dioxide with potential for significant population exposure is the Zinifex smelter at Risdon. Although the Measure is not designed to include industrial monitoring per se, it is the location of this plant within the very suburbs of Hobart, and the real potential for broad population exposure, that make sulfur dioxide monitoring under the Measure a consideration. Establishment of a

performance monitoring station for sulfur dioxide in Hobart was originally scheduled for December 2003, but resource constraints have resulted in the postponement of any development of this capability. However, sulfur dioxide is being monitored by the company at three sites, and the data is being incorporated into the Tasmanian Air Quality Database, and we intend to include this data in our annual reports to NEPC.

Tasmania is committed to providing NATA (National Association of Testing Authorities) accredited data for reporting purposes under the Measure. To date, efforts have concentrated on development of the Tasmanian Air Quality Database, and more recently on the upgrading program, under which old PM_{10} samplers are being replaced and a PM2.5 monitoring capability established. While effective data quality processes have been in place for several years, any attempt to achieve NATA accreditation has necessarily been deferred until resources for the upgrade system were available and the final configuration of the upgraded Tasmanian Air Monitoring System monitoring system was known. Given the projected date for commissioning of the new system, development of NATA systems commenced in February 2005, with the intention to seek NATA accreditation in 2007.

TABLE ES-1: NATIONAL ENVIRONMENT PROTECTION (AMBIENT AIR QUALITY) MEASURE, MONITORING FOR TASMANIA

Shaded areas indicate cessation or change of role. Bold borders indicate P&T or PCBD stations for relevant indicators under amended plan.

Region	Station Locality/Note	PM_{10} TEOM	PM_{10} HVAS	PM_{10} LVAS	$PM_{2.5}$ LVAS	CO IR	SULFUR DIOXIDE UVF	Meteorology
Hobart	Prince of Wales Bay To be re-located 2005 Refer Paragraph 3.1.5.1	P & T cease April 2005	comparative data - retain and upgrade to daily sampling until Nov 2006			Ceased operation December 2004		
	New Town - Hockey Association to commence April 2005 Refer Paragraph 3.1.5..2, 4..3	comparative data		P & T 2005	P & T 2007			Full set 2005
	Sulfur dioxide Refer Paragraph 3.1.7.2						P & T site & schedule to be determined	
	CBD Macquarie Street Refer paragraph 3.1.6.1, 3.1.6.2					PCBD Site to be determined - scheduled for 2005		
Launceston	Ti Tree Bend Refer paragraph 3.2.5.1, 3.2.5.2, 4.3	comparative data	P & T Cease April 2005 – retain until Nov 2006 for comparative data	P & T 2005	P & T 2005			Full set 2005
Devonport	PM_{10} station to be established on basis of 2003 campaign results Refer paragraph 3.3.5.2. 4.3		C Completed 2003	P & T Site to be determined - scheduled for 2006				Full set 2005

TEOM	Tapered Element Oscillating Microbalance	P & T.	Performance and Trend Monitoring Station (single station only).
UVF	Ultraviolet Fluorescence	C	Campaign Monitoring.
IR	Gas Filter Correlation Infrared Absorption	PCBD	Peak CBD Site
"Full set"	Weather Station as per text (see para 4.3).	HVAS	How Volume Air Sampler
		LVAS	Low Volume Air Sampler

1 INTRODUCTION

On the 26 June 1998, the National Environment Protection Council (NEPC), consisting of Commonwealth, State and Territory Ministers, made the Environmental Protection (Ambient Air Quality) Measure (NEPC, 1998; hereafter referred to as "the Measure"). The Measure established a set of Standards and Goal for six air pollutants, and outlined the methods by which these pollutants are to be measured, assessed and reported.

The pollutants originally covered by the Measure are photochemical oxidants (as ozone, O_3), nitrogen dioxide (NO_2), particles (as PM_{10}), carbon monoxide (CO), sulfur dioxide (SO_2) and lead (Pb). Council amended the Measure in May 2003 to include $PM_{2.5.}$

The Measure required jurisdictions to establish monitoring procedures and commence assessment and reporting, in accordance with the protocol of the Measure within three years of its commencement.

After making the Measure, the Ministers resolved to establish a Peer Review Committee (PRC) to advise on jurisdictional monitoring plans with two complementary roles –

- provision of advice to the NEPC on the adequacy of monitoring plans submitted by jurisdictions
- provision of advice on technical issues related to the consistent implementation of the Measure's monitoring Protocol.

In response, the PRC developed a series of guideline papers that provide a basis for the preparation of individual monitoring plans (by jurisdictions) and for the assessment of monitoring plans (by the PRC).

This document presents the current status of Tasmania's monitoring system and how it plans to upgrade facilities to fully comply with the requirements of the Measure, through the Tasmanian Air Quality Monitoring System Development Project, 2004-2008, established with State government funding of $816,000 over the life of the project.

While extensive editorial changes have been made to parts of the document in order to update the Plan, those paragraphs affected by significant changes are listed below. The original structure of the document is retained in accordance with the format specified by the PRC (PRC, 2000a), including consideration of:

- Regions to be monitored;
- Monitoring requirements of each region, including (as appropriate) physical and demographic characterisation, emission sources, air quality, identification of pollutants not required to be monitored, and monitoring network;

- Siting and instrumentation;
- Accreditation; and
- Reporting.

In essence, the changes to the text reflect:

(a) re-location of Prince of Wales Bay Station to New Town,
(b) upgrade of existing PM_{10} high volume air samplers with low volume sequential samplers.
(c) establishment of a $PM_{2.5}$ monitoring capability, using low volume sequential samplers
(d) re-location of the performance and trend monitoring station for carbon monoxide in Hobart
(e) establishment of new meteorological monitoring stations at all Tasmanian performance and trend monitoring sites.

Accordingly, a large number of changes have been made throughout the report. However, the following paragraphs pertaining to Hobart have had modifications that reflect significant changes to the network.

- Under Section 3.1.5 "Particulate Matter (as PM_{10})" -
  - *3.1.5.1 Review of Data*
  - *3.1.5.2 Nominated Performance Monitoring and Trend Station:*
- Under Section 3.1.6 "Carbon Monoxide" -
  - *3.1.6.1 Review of Data*
  - *3.1.6.2 Nominated Performance Monitoring and Trend Station:*

2 SELECTION OF REGIONS

In order to provide guidance and facilitate a consistent and transparent selection of regions by jurisdictions, the PRC has provided the following definition of a region:

'*a region for the purposes of performance monitoring is a geographical area where the air quality (for a particular pollutant) is determined either entirely or in a large part by the influence of a common collection of anthropogenic emission sources*'.

Under Clause 14 of the Measure, performance monitoring may be required in regions with a population exceeding 25,000 people.

Moreover, the PRC has produced a guidance document for jurisdictions on the selection of regions (PRC Guideline Paper No.2; PRC 2000b). This document notes that there are three types of regions, namely:

Type 1	A large urban or town complex with a population in excess of 25,000 requiring direct monitoring and contained within a single airshed;
Type 2	A region with no single population centre above 25,000 but with a total population above 25,000 and with significant point source or area based emissions as to require a level of direct monitoring; and
Type 3	A region with a population in excess of 25,000 but with no significant point or area based emissions, so that ancillary data can be used to infer that direct monitoring is not required.

The PRC (PRC, 2000b) consider the ABS 'urban centre' population data to provide a transparent basis for the identification of potential Type 1 regions. Re-classification of a Type 1 region to Type 3 must be supported by arguments based on local knowledge. Identification of Type 2 regions is also reliant on local knowledge of emission sources and airshed characteristics.

2.1 TASMANIAN REGIONS

The State of Tasmania consists of a group of islands whose total area is approximately 0.9% of the total area of Australia. Tasmania is approximately 300 kilometres from north to south and a similar distance from east to west (at its widest point).

The major urban centres in the State are shown in Figure 2-1 and are numerically ranked by population in Table 2-1.

Table 2-1 : MAJOR TASMANIAN URBAN CENTRES (ABS, CENSUS 2001*)

Urban Centre	Population ('000)
Hobart	131.8
Launceston	71.6
Devonport	25.7
Burnie-Somerset	24.0
Kingston-Blackmans Bay	15.6
Ulverstone	14.1
Bridgewater-Gagebrook	13.9
New Norfolk	10.4
Wynyard	8.6
George Town-Beaconsfield	8.6

*the information used in this table has been updated using Australian Bureau of Statistics post code population data. Where one region consists of more than one post code, all the corresponding post code population values have been totalled and the final figure used.

Figure 2-1 : MAP OF TASMANIA SHOWING MAJOR URBAN CENTRES

Hobart and Launceston, each represents a Type 1 region. Kingston-Blackmans Bay, Bridgewater-Gagebrook and New Norfolk, because of their close proximity to Hobart are included in the Hobart Region (this will be justified later in the Plan), whilst George Town is included in the Launceston Region (this will also be justified later in the Plan)

Devonport has a population of 25 700, and Latrobe, some 8 kilometres away, has a population of 7 000. Together, these two urban centres are considered to represent a Type 2 region.

Whilst the Devonport–Latrobe region is not considered to have major industrial facilities that adversely affect regional ambient air quality, anecdotal evidence indicated that the widespread use of firewood in the region could result in moderate to high levels of PM_{10}. This was confirmed by campaign monitoring during winter 2003. Also, from a consideration of topography and meteorology, Latrobe is expected to influence air quality in Devonport as a result of katabatic drainage flows down the Mersey River valley.

Burnie-Somerset and Ulverstone each represent urban centres with a sub 25,000 population. There is insufficient population in the region surrounding these two urban centres to increase the regional population beyond the 25,000 threshold. For this reason, Burnie-Somerset and Ulverstone are not considered to represent Type 1 or Type 2 regions.

There are no Type 3 regions in Tasmania.

3 PERFORMANCE MONITORING REQUIREMENTS OF REGIONS

Part 4 of the Measure sets out the monitoring processes to be followed by jurisdictions in order to determine whether the Standards of the Measure are being met, or the extent of the difference between the recorded pollutant concentrations and the Standards.

Moreover, Clause 14 of the Measure defines the number of performance monitoring stations required, as follows:

(1) Subject to sub-clauses (2) and (3) below, the number of performance monitoring stations for a region with a population of 25,000 or more must be the next whole number above the number calculated in accordance with the formula:

1.5P + 0.5

*where **P** is the population of the region (in millions).*

(2) Additional performance monitoring stations may be needed where the pollutant levels are influenced by local characteristics such as topography, weather or emission sources.

(3) Fewer performance monitoring stations may be needed where it can be demonstrated that pollutant levels are reasonably expected to be consistently lower than the Standards mentioned in this Measure'.

Sub-clauses (1) and (2) are self explanatory. Sub-clause (3) provides to jurisdictions, the opportunity to demonstrate that, for a given region, fewer monitoring stations than indicated by the formula (possibly zero) are required. The PRC refers to this process as "screening".

The PRC has prepared guidelines on screening to ensure a reasonable degree of consistency and rigour in the assessments undertaken by jurisdictions (Guideline Paper No.4; PRC 2000c). The guidelines identify a range of screening procedures which might be used for particular pollutants. Moreover, acceptance limits accompany each procedure (by pollutant) reflecting the level of confidence associated with each procedure.

The following extract from a PRC paper on monitoring strategy (Guideline Paper No.3; PRC 2000d) provides the rationale for the siting of performance monitoring stations:

> *In order to ensure compliance with the Standards, stations will generally be located so as to monitor the upper bound of the distribution of pollutant concentration likely to be experienced by portions of the population, while avoiding the direct impacts of localised pollutant sources. These stations are called generally representative upper bound for community exposure (GRUB) stations. In regions where there are to be more than one GRUB station, the stations will be distributed to record the upper bound concentrations in different portions of the populated area, reflecting different emission or dispersion regimes.*

An examination of the distribution of GRUB stations relative to the distribution of population and pollutant will determine the need for, and location of, additional stations to achieve adequate representation of population-average concentrations.

In regions where only a single performance monitoring station is required under the population based formula of the Measure, the PRC has recommended that such a station be located to be generally representative of upper bound concentrations (PRC, 2000d).

By using GRUB stations to monitor the ambient air across a region, the community can be reasonably sure that, if the Standards of the Measure are met at such sites, then most of the total population of the region will be exposed to air that complies with the Standards. In this way, the Measure's aim of equivalent environmental protection is assured.

3.1 HOBART

3.1.1 Overview

3.1.1.1 Region Boundaries

The extent to which pollutants emitted in a given area can impact on air quality elsewhere depends on a number of factors. These factors include topography, meteorology and the chemical and physical properties of pollutants. The term airshed is commonly used to refer to an area that is defined by natural or topographic features affecting air quality.

In the case of a secondary pollutant (i.e. one that is formed by chemical reactions in the atmosphere, rather than being directly emitted, e.g. O_3), the airshed may extend relatively large distances from the city centre. However, for a primary pollutant such as PM_{10} in winter, the extent of influence may be more localised and perhaps confined to areas sharing common nocturnal-drainage air flows.

For Hobart, the availability of meteorological data tends to be relatively low. Moreover, complex atmospheric dispersion models have not yet been developed for the region. For these reasons, the extent of the Hobart airshed is unclear, to date. The gaps in our knowledge will be rectified under this amended plan during 2005.

For the purpose of the Measure, the Hobart Region boundaries are defined as presented in Figure 3-1. Although there is no functional purpose served in exactly defining the boundary AMG co-ordinates, these may be taken to be defined by the south-west corner (Easting 500,000; Northing 5,230,000) and the north-east corner (Easting 550,000; Northing 5280,000).

3.1.1.2 Population and Topography

The population density and topography for the Hobart Region is presented in Figure

3-1. The majority of the population resides within approximately a 10-kilometre radius of the Central Business District (CBD). However, significant satellite urban centres also exist within a 30-kilometre radius of the CBD. These include Kingston-Blackmans Bay to the south (population 15,599), and Bridgewater-Gagebrook (population 13,868) and New Norfolk (population 10,434) to the north.

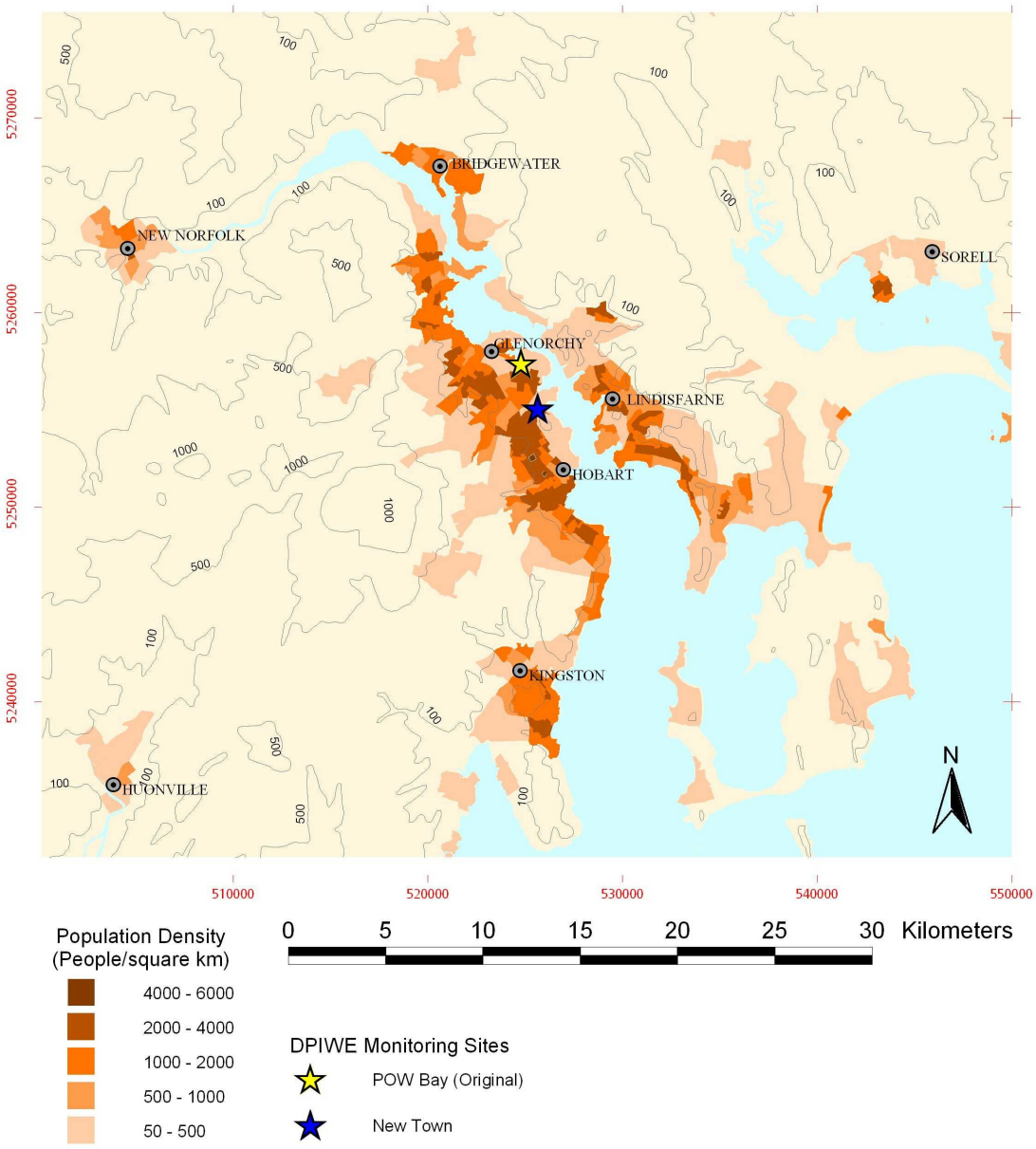

FIGURE 3-1 : MAP OF HOBART REGION INCLUDING POPULATION DENSITY AND TOPOGRAPHY

In total, the population of the Hobart Region defined in this Plan is approximately 190,000.

Figure 3-1 illustrates that much of the Hobart Region lies in complex terrain, with local hills and valleys dominating air flow and dispersion. The city of Hobart itself, is located in a well-defined valley with the Derwent Estuary running through its axis. The valley axis is mostly aligned in a north-west to south-east orientation with the dominant topographical feature being Mt. Wellington (1271 masl), approximately 7 kilometres to the south-west of the Hobart CBD.

3.1.1.3 Emissions

An extensive emission inventory was completed for Greater Hobart Region (1999/2000) as part of the National Pollutant Inventory (NPI) program (see Table 3-1). The inventory covers a range of pollutants emitted from domestic, mobile, and industrial sources, including PM_{10}, CO, NOx, lead and sulfur dioxide.

TABLE 3-1 : SUMMARY OF NPI RESULTS FOR HOBART AIRSHED FOR YEAR 2003-2004

EXPRESSED AS PERCENT OF TOTAL EMISSIONS FOR EACH POLLUTANT

Source	**PM_{10}**	**CO**	**NOx**	**SO_2**	**Pb**
			%		
Domestic Solid Fuel Combustion	56.8	28	3.6	2.0	0.3
Paved/Unpaved Roads	27.0	0.0	0.0	0.0	7.3
Industry (sub-reporting)	4.4	0.7	13.1	74.6	5.5
Fuel Reduction, Regeneration Burns, Agricultural Burns (Fire Management) /Bushfires	5.1	1.5	1.0	0.0	0.1
Motor Vehicles	4.9	66.7	67.1	4.4	84.6
Domestic Waste Combustion	1.5	0.2	0.1	0.1	0.0
Miscellaneous Domestic and Mobile Sources	0.8	3.5	14.5	0.5	1.5
Domestic Liquid Fuel Combustion	0.5	0.0	0.2	15.4	0.0
Total	**100**	**100**	**100**	**100**	**100**

On an annual basis, domestic solid fuel combustion in Hobart (from domestic woodheaters and fireplaces), was estimated to contribute approximately 57% of total inventoried PM_{10} emissions. Other significant sources of PM_{10} include paved roads, industry, fire management/bushfires and motor vehicles. On a seasonal basis however, the relative contribution of domestic solid fuel combustion to regional PM_{10} emissions would be expected to vary by a wide margin, from near zero in summer to 80% in winter.

Motor vehicles are estimated to represent the major source of carbon monoxide, nitrogen oxides and lead, whilst industry is the largest source of sulfur dioxide emissions in the Hobart Region.

3.1.1.4 Meteorology

Based on a one year meteorological study at eight sites around the Derwent Estuary (Pendlebury, 1987), Hobart is documented to have two dominant mesoscale windflows, namely sea breeze and katabatic drainage flows.

Figure 3-2 summarises the daytime wind regimes for Hobart in winter. The dominant flow during winter is a drainage flow down the valley axis referred to as the "mountain wind". This wind increases in strength and frequency with distance down the valley. The mountain wind is fed by down slope drainage winds (katabatics) flowing off the valley walls on to the Estuary. Light winds are generally associated with either the mountain wind or katabatics.

From an analysis of high particle pollution events during winter in Glenorchy, a northern suburb of Hobart (Smeal, 1998), it is evident that relatively high concentrations of particles are frequently associated with anticyclones. During the passage of an anticyclone, synoptic-scale winds may be light and highly stable atmospheric conditions can occur. Clear skies result in significant radiative cooling at night and the formation of drainage flows. These slow-moving flows are highly stable, and entrain pollutants within them. As a result, relatively high pollutant concentrations are likely to be found in topographic hollows and basins, and on low-lying land.

Katabatic flows in a valley are analogous to stormwater flows, both draining down gullies to the valley floor. Figure 3-3 presents inferred katabatic and valley axis flows for the Hobart Region.

The summer daytime wind regime for Hobart is presented in Figure 3-4. The katabatic/sea breeze cycle is evident, with morning winds having a strong northerly component due to drainage flows, and afternoon winds from the south due to the sea breeze.

3.1.1.5 Air Quality Monitoring History

There has been limited monitoring of ambient air quality in the Hobart Region.

- Ambient air sampling for ozone was conducted in Hobart at one site between 1994 and 1995, for a single summer.
- Continuous carbon monoxide monitoring was undertaken within the CBD from July 1982 to June 1985, and grab samples were analysed as part of short-term in Liverpool Street during 1991 (see section 3.1.6, below).
- Monitoring to assess broader regional carbon monoxide concentrations was not undertaken prior to 2001, when continuous monitoring for carbon monoxide at Prince of

Wales Bay commenced in accordance with the Protocol of the Measure. Very low levels were found and monitoring ceased in 2004.

- Monitoring of nitrogen dioxide in ambient air has not been conducted over the last 15 years.
- Sulfur dioxide monitoring is currently conducted at three stations operated by Zinifex Pty Ltd in the vicinity of its zinc smelter in Risdon, approximately 6 kilometres to the north of the CBD.
- lead was monitored at a single site in Hobart until 1996.
- Particles have been monitored as PM_{10} at prince of Wales Bay using a high volume air sampler (alternate days) and a TEOM (continuously), since 2001.

3.1.2 Population Formula

From Clause 14(1) of the Measure, the number of performance monitoring stations required for the Hobart Region is one.

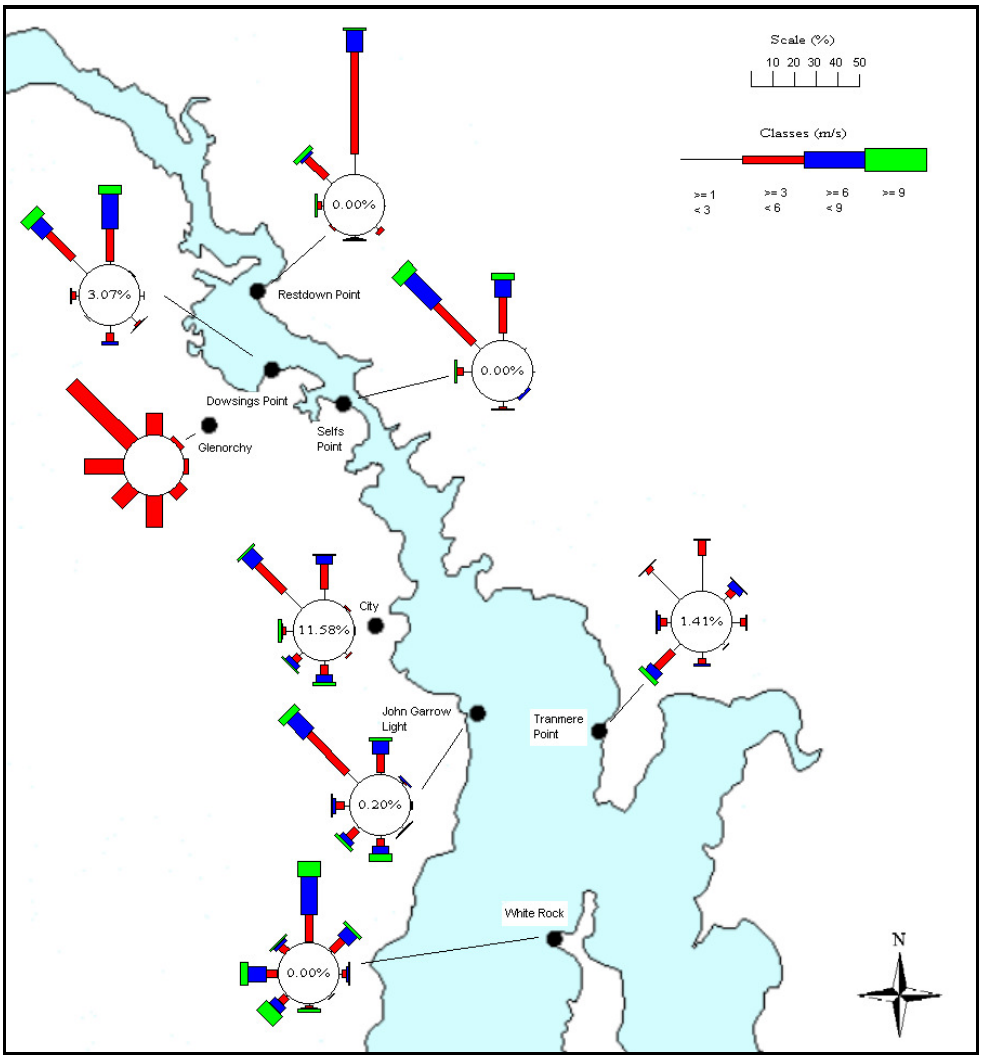

FIGURE 3-2 : WINTER WIND ROSES, HOBART REGION

(GLENORCHY ROSE EXCLUDES WIND SPEED)

Explanatory Text for Wind Roses

The number in the centre of each wind rose represents the frequency of calm conditions, defined as winds below 1m/s. The overall length of the segmented vanes represents the proportion of winds coming from each compass point.

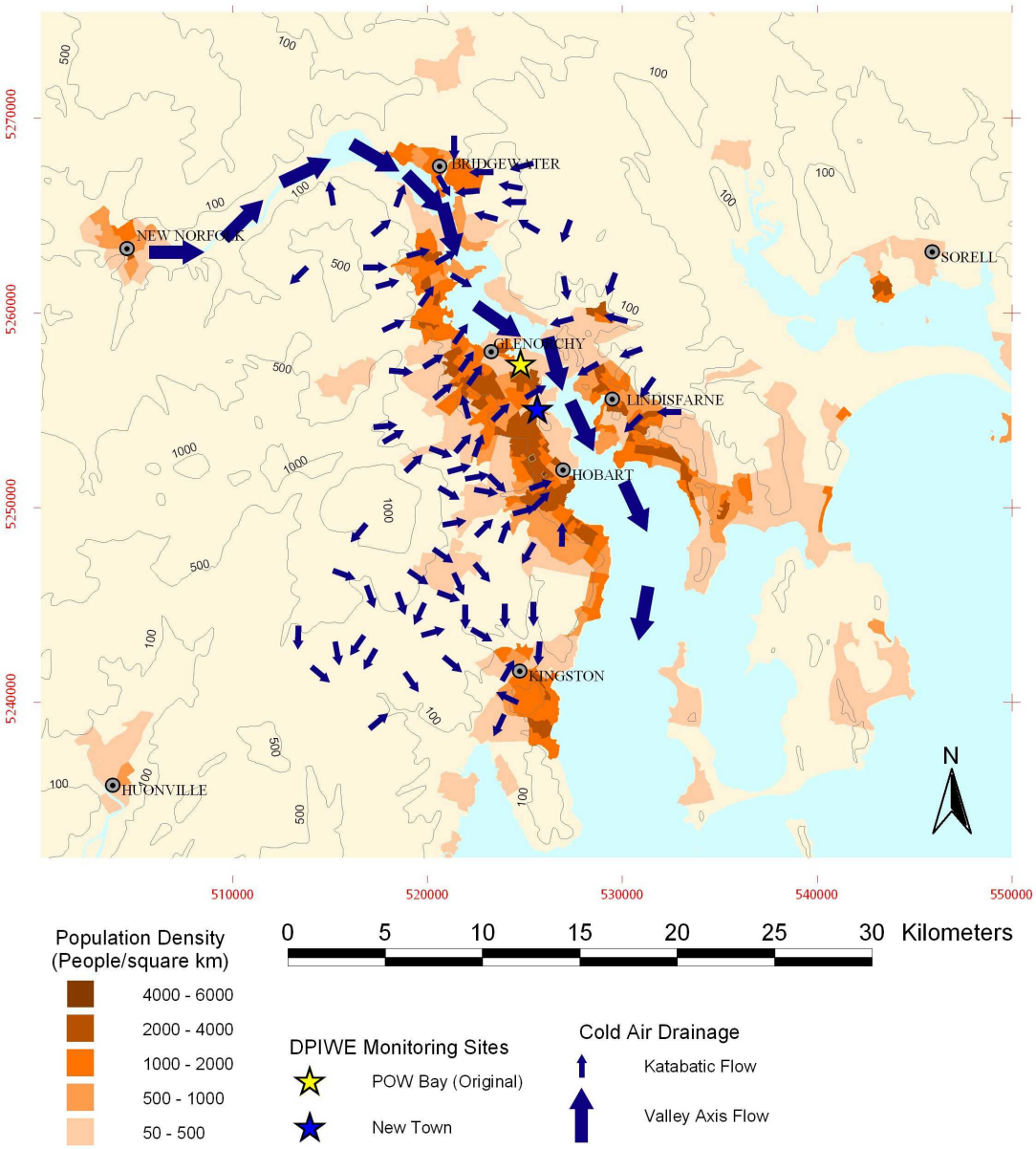

FIGURE 3-3 : DRAINAGE FLOWS, HOBART REGION

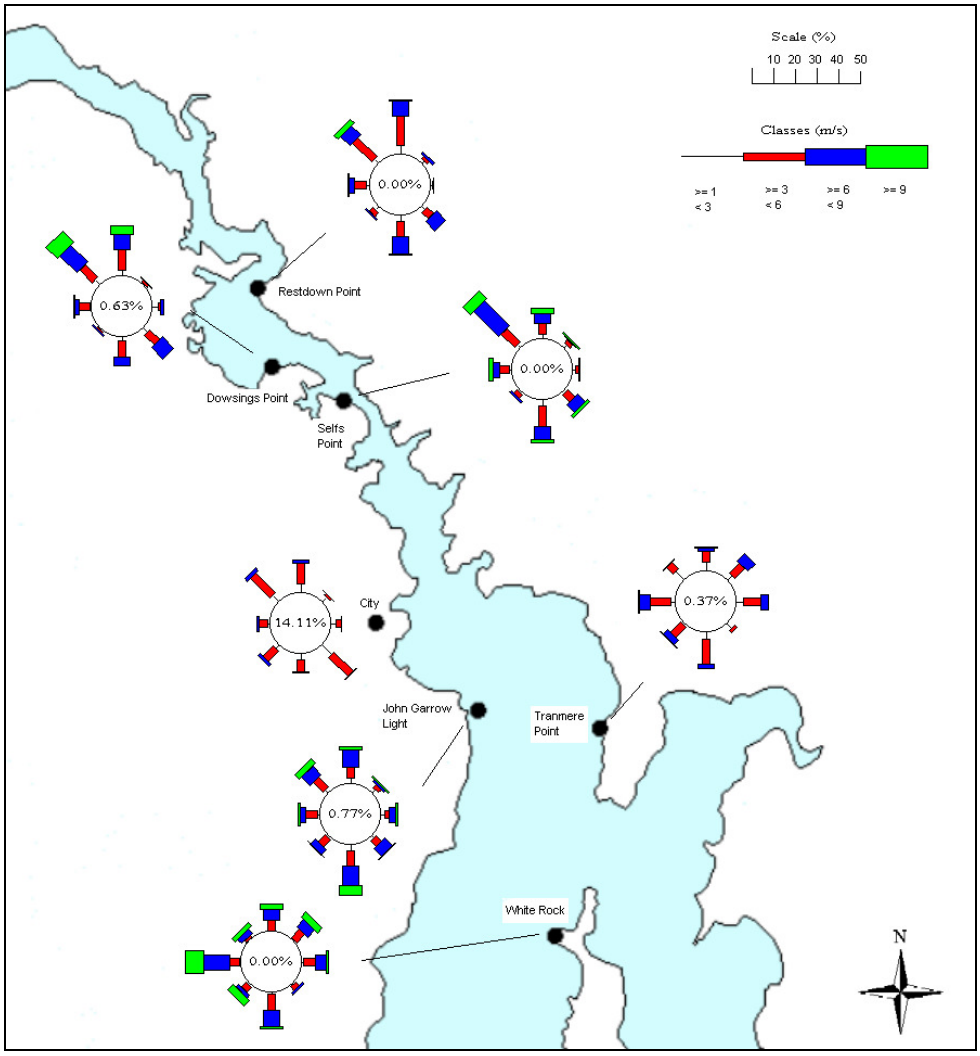

FIGURE 3-4 : SUMMER WIND ROSES, HOBART REGION

3.1.3 Photochemical Oxidants (as O_3)

3.1.3.1 Review of Data

Ambient air sampling for O_3 was conducted in Hobart between 1994 and 1995, covering a single summer period. Monitoring was conducted at Moonah, approximately 6 kilometres to the north-west of the Hobart CBD.

Maximum O_3 concentrations reported for the site were approximately 0.03 ppm (1-hr average).

3.1.3.2 Screening Analysis

In the event that the TAPM Consultancy data for O_3 become available, the following section will be modified accordingly.

Tasmania does not propose to undertake performance monitoring of photochemical oxidants (as O_3) in Hobart, based on the application of the PRC Screening Procedure A (PRC, 2000c) as follows:

Acceptance limits by screening procedure for photochemical oxidants (as O_3).

Screening Procedure	Acceptance Limit (% of Standard)
A. Campaign monitoring at a Generally Representative Upper Bound (GRUB) monitoring location (with no significant deterioration expected over 5-10 years).	60% for 1 year 70% for 2 or more years 75% for 5 or more years

Campaign monitoring of O_3 in Hobart, conducted over a single summer period revealed a maximum O_3 concentration of approximately 30% of the Standard (1-hr).

The photochemical smog generation potential in Tasmania is considered to be low by comparison with larger Australian urban areas. This is because of relatively small urban populations, low summer temperatures, low solar ultra violet (UV) flux, and low probability of inter-regional oxidant transport.

Although limited, the available ambient air quality monitoring data for O_3 in Hobart are considered to be indicative of regional concentrations. Whilst it is unclear if the monitoring location used in Hobart is representative of a GRUB site, the limited data coupled with the relatively low photochemical smog potential, indicate that O_3 concentrations in the region are low and probably satisfy the PRC screening criterion by a reasonable margin.

3.1.4 Nitrogen Dioxide

3.1.4.1 Review of Data

Monitoring data for NO_2 in Hobart's ambient air are not available.

3.1.4.2 Screening Analysis

To be provided when TAPM Consultancy data for NO_2 become available.

3.1.5 Particulate Matter (as PM_{10})

3.1.5.1 Review of Data

A summary of ambient air quality data for PM_{10} in the Hobart Region is presented in Table 3-2. The data were collected on a daily basis over July/August 1998, in the suburb of Glenorchy, located approximately 7 kilometres to the north-west of Hobart CBD (Smeal, 1998). In total, 27 samples were collected (24-hour period) using a High Volume Sampler.

TABLE 3-2 : PM_{10} CONCENTRATIONS (HIGH VOLUME SAMPLER), GLENORCHY

Monitoring	Number of Exceedences Recorded*	Maximum $\mu g/m^3$	90^{th} Percentile $\mu g/m^3$	6^{th} Highest $\mu g/m^3$
June/July 1998	11	123	76	66

* 24-HOUR PM_{10} STANDARD IS 50µG M^{-3}, WITH A GOAL OF NOT MORE THAN 5 EXCEEDENCES PER YEAR BY 2008.

A wide range of concentrations were reported, with a minimum of 7 $\mu g\ m^{-3}$, a maximum of 123 $\mu g\ m^{-3}$, and a 6^{th} highest concentration of 66 $\mu g\ m^{-3}$.

The monitoring site used in that study was located in a region of relatively low to medium housing density. The high frequency of relatively high PM_{10} concentrations may be partially explained by the fact that the site was in a region of older housing which, relative to Hobart as a whole, may be more reliant on woodheating than other forms of home heating.

In 2004, further monitoring surveys were undertaken in Greater Hobart on the basis of increasing concerns about the representativeness of data from Prince of Wales Bay. The concerns were based partly on direct observations and partly on studies commissioned by Hobart City Council in 2003 that showed elevated levels of particles from wood smoke and inferred significant concentrations of polycyclic aromatic hydrocarbons in some areas (Todd, 2004).

The Environment Division also performed short term measurements during winter 2004, using Dustrak monitors(1) simultaneously at Prince of Wales Bay and various other areas around Greater Hobart on nights when inversion conditions were current, especially those areas where smoke was considered likely to accumulate. In at least one area, readings were greater than those at Prince of Wales Bay by a factor of close to 4, and greater than 2 in several other areas(2).

While recognising that these instruments do not represent standard methods in the Measure, we consider that these results indicate a very poor correlation between

particle concentrations at prince of Wales Bay and many of the major population regions of Greater Hobart, as other work has suggested. Based on a linear statistical relationship[3] developed for the Dustrak against a TEOM over winter 2003 from Launceston, many of the readings obtained around the suburbs of Hobart were well above 50µg/m^3.

Although these were short-term readings (10 minutes), it is likely that under favourable ambient conditions, such concentrations could be sustained for several hours, most likely leading to exceedences of the PM_{10} Standard in some cases. If we assume, as has been suggested elsewhere, that wood smoke comprises about 80% of the winter mass particulate loadings in affected areas of Hobart, it is also likely that the Advisory Reporting Standard for $PM_{2.5}$ would also be exceeded on occasions.

3.1.5.2 Nominated Performance Monitoring and Trend Station

As noted earlier in this Plan, relatively high concentrations of particles in Hobart are frequently associated with anticyclones. During the passage of an anticyclone, synoptic-scale winds can be light and highly stable atmospheric conditions may occur. Clear skies result in significant radiative cooling at night and the formation of drainage flows. These slow-moving flows are highly stable, and entrain pollutants within them. As a result, relatively high pollutant concentrations are likely to be found in topographic hollows and basins, and on low-lying land.

In Hobart, approximately 80% of people live in areas below a height of 100 metres above sea level.

In this Plan, the criteria used to identify a monitoring site for the purpose of this Measure were as follows:

- Within 100 metres of valley floor (or sea-level);
- Within 1,000 metres of housing densities at or above the 90th percentile;
- Consideration of relative woodheater and firewood use by sub-regions;
- Consistent with requirements of Australian Standard for siting (AS2922-1987); and
- Long term access to land.

Based on the above criteria, the original performance monitoring station for PM_{10} nominated for the Hobart Region was located approximately 6 kilometres north-north-west of the Hobart CBD (see Figure 3-1) on the southern shore of Prince of Wales Bay. The site is approximately 5 metres above sea level and 400 metres east of one of the most heavily trafficked arterial roads in Hobart.

(1) The three instruments used in this survey had previously been subjected to comparative tests that showed agreement between them to better than 10%, when exposed to smoke under controlled conditions.
(2) The ratios cited were calculated on raw Dustrak data.
(3) These mass concentration results are indicative only. The 95% confidence limits of the regression for 10 minute averages were very wide ($\pm$26µg/m^3). Although as expected, confidence limits were much tighter for the regression of 24-hour averages ($\pm$6µg/m^3). However, determination of 24-hour averages of Dustrak data was not possible during this study, given that measurements were intended to provide simultaneous short-term indications of particle concentrations in several areas.

The original Tasmanian Air Monitoring Plan indicated some uncertainty about the representativeness of the proposed Hobart performance monitoring station, due to the lack of simultaneous multi-site monitoring or atmospheric dispersion modelling for the region. However, by analogy with Launceston, for which multi-site data was available (see Section 3.2.5.2), the criteria employed for site selection in Hobart were, at that time, expected to result in a station that was generally representative of upper bound concentrations of PM_{10} (GRUB station) in the region.

At the time, the Plan acknowledged that because of the complex terrain of the Hobart Region, local air-pondage, coupled with above-average emission rates from neighbourhood woodheaters and fireplaces in some localities, could result in higher pollutant concentrations than those at the nominated performance monitoring station. However, the area where this could occur was expected to be small and account for only a small fraction of the Region's population.

On that basis the Prince of Wales Bay Station was also nominated as a trend station for PM_{10}. Under the Measure, trend stations are required to monitor and assess long term changes in ambient air quality at the same location for one or more decades.

Unfortunately, as discussed above, results of monitoring at Prince of Wales Bay, in conjunction with more recent surveys of PM_{10} have shown that results are unlikely to provide useful information on performance and trends of particle pollution in Greater Hobart and is certainly not representative broader upper bound population exposure. In the light of this, it is intended that the primary Hobart Performance and Trend Monitoring Station be located in New Town, on property leased by the Hockey Association of Tasmania, some 2km SSE from the original station. We make no claim that this is a GRUB station at this stage, until further data becomes available from the new Hobart network (see below). However, the preliminary studies cited above and our observations of ponding in the area have suggested that the site will exhibit elevated concentrations of PM_{10} typical of surrounding residential suburbs, when favourable meteorological conditions prevail within the valley.

This is the major amendment to the original Plan.

In order to maintain a certain level of continuity between the old and new stations, Tasmania intends to retain a high volume air sampler at Prince of Wales Bay for a period of at least 12 months.

Further, as knowledge of spatial patterns of pollution movement in Hobart is still not well-characterised, a long term study of particulates using a network of nephelometers(4) will be undertaken in strategic areas of the Derwent Valley.

In addition, we intend to commence a project in 2005 to model winter air drainage patterns in the Derwent Valley, and to develop a more complete picture of likely population exposures to particles in the region.

3.1.5.3 Exposed Population

In developing their Monitoring Plans, jurisdictions were required by the Measure to determine the exposed population represented by each station. Because of the uncertainty associated with any quantitative measure of the exposed population, the requirements of the Measure were originally met by a qualitative description of likely exposure patterns, consistent with PRC Guideline Paper No.3 (PRC, 2000d). These indicated the communities that were expected to experience similar levels of air quality to that of each performance monitoring station (by pollutant), either due to geographic proximity or similarity of emissions, meteorology and topography.

3.1.6 Carbon Monoxide

3.1.6.1 Review of Data

Ambient monitoring of carbon monoxide in Hobart was discontinued in the mid 1980's.

The most recent Hobart monitoring data for carbon monoxide available when the original Plan was under development were those reported as part of a University of Tasmania Honours project (Power, 1991). Monitoring was conducted at several sites in the Hobart CBD between July and August 1991. Estimated eight-hour average values reported were between 6 and 14 ppm over the study period, compared with the Standard of 9 ppm.

However, these averages were extrapolated from results of analyses of near-kerbside grab samples, so the uncertainty associated with the procedure was unknown. Moreover, the sampling location and monitoring methodology used in the University project did not comply with relevant Australian Standards for ambient air monitoring.

(4) We recognise that nephelometry is not an approved method for monitoring and reporting under the Measure, as indicated in PRC Technical paper No. 4 (PRC 2000c), but limited resources preclude establishment of further fully-complying stations. Rather, the nephelometer data will be used as an index of particulate pollution, that should allow characterisation of particulate "hotspots" and elucidation of drainage flows down the Derwent Valley during winter inversion conditions. Since winter $PM_{2.5}$ in Hobart is comprised primarily of wood smoke, it is expected that measurements of b_{scat} at seven locations in Greater Hobart will provide some useful information. While we intend to develop statistical correlations between b_{scat} and mass concentrations of $PM_{2.5}$ and PM_{10}, the relationship will be considered indicative only. Nephelometry data will not be reported to NEPC as part of our annual reporting requirements, unless it is requested to be included.

It should be noted that carbon monoxide emission rates from motor vehicles decreased significantly during the nineties, due to improvements in technology. According to Victorian EPA estimates (EPAV, 1999), carbon monoxide emission rates for the Melbourne fleet on arterial roads decreased by approximately 30% between 1990 and 2000. The emission rate estimates for Melbourne were considered to be broadly indicative of changes for the Tasmanian fleet over the same period.

At the time, it was considered unlikely that any regions of Tasmania suffered from high carbon monoxide concentrations due to traffic alone. However, a consideration of carbon monoxide data for a suburb in Perth WA suggested the possibility of concentrations comparable with the Standard arising in parts of Hobart. The suburb was characterised by significant use of woodheaters, and a combination of carbon monoxide from both sources resulted in elevated ambient levels (DEPWA 2000).

Continuous ambient carbon monoxide monitoring was undertaken from July 2000 to August 2004 at Prince of Wales Bay, in accordance with the Protocol. During this period, only very low concentrations of carbon monoxide were recorded at this station, leading to concerns about the usefulness of the site for carbon monoxide monitoring (see below).

3.1.6.2 Nominated Performance Monitoring and Trend Station

The performance monitoring station originally nominated for carbon monoxide in the Hobart Region is located at Prince of Wales Bay, as discussed in Section 3.1.5.2. The site is approximately 400 metres east of one of the most heavily trafficked arterial road in Hobart, in an area of low to medium density housing.

At that time, doubts were expressed about the representativeness of the proposed Hobart carbon monoxide station, due to a lack of simultaneous multi-site monitoring or atmospheric dispersion modelling for the region. However, this site was originally selected on the basis of its proximity to a major arterial road and domestic solid fuel combustion sources, and was therefore assumed to be generally representative of upper bound concentrations (GRUB) in the region.

The Prince of Wales Bay Station was also nominated as a trend station for CO.

However as noted previously, only very low concentrations of carbon monoxide were ever recorded at this station, well below the screening criterion, so the decision was made to cease monitoring in August 2004.

Therefore, it is intended that a Peak site be established within the Hobart CBD in the near future, to monitor carbon monoxide emissions from motor vehicles in a major city thoroughfare. Further information will be made available for consideration by PRC as plans for this station become more fully developed.

3.1.6.3 Population

In developing their Monitoring Plans, jurisdictions were required by the Measure to determine the exposed populations represented by each station. Because of the uncertainty associated with any quantitative measure of the exposed population, the requirements of the Measure were originally met by a qualitative description of likely exposure patterns, consistent with PRC Guideline Paper No.3 (PRC, 2000d). These were intended to indicate which communities were expected to experience similar levels of air quality to that found at each performance monitoring station (by pollutant), either due to geographic proximity or similarity of emissions, meteorology and topography. It is not at all clear whether any conclusions can be drawn from the three years of carbon monoxide data recorded at Prince of Wales Bay, about population exposures in Hobart, as discussed above in paragraph 3.1.6.2.

3.1.7 Sulfur Dioxide

3.1.7.1 Review of Data

The only source of sulfur dioxide with potential for significant population exposure is the Zinifex (formerly Pasminco, EZ) smelter at Risdon, some 6 kilometres north of the Hobart CBD. Although the Measure is not designed to include industrial monitoring per se, it is the location of this plant within the very suburbs of Hobart, and the real potential for broad population exposure, that make sulfur dioxide monitoring under the Measure a consideration. Ambient concentrations of sulfur dioxide measured by the company in the vicinity of the smelter have been reported to approach or exceed the 1-hr Standard on one or two occasions per year

3.1.7.2 Nominated Performance Monitoring and Trend Station

For sulfur dioxide, the assessment conducted during development of the original monitoring Plan demonstrated that monitoring was only required in Hobart.

Establishment of a performance monitoring station for sulfur dioxide in Hobart was originally scheduled for December 2003, subject to the results of meteorological monitoring and atmospheric dispersions modelling studies, but resource constraints have resulted in the postponement of the studies. However, the company is currently monitoring sulfur dioxide at three sites, and will continue to do so until the modelling studies are completed. It is expected that this study will be undertaken in 2006-2006.

In the meantime, the data from these stations is being incorporated into the Tasmanian Air Quality Database.

Tasmania recognises that these existing sulfur dioxide monitoring sites may not necessarily be appropriate performance and trend sites, and acknowledges that the current monitoring program is therefore inconsistent with the guidelines of the PRC.

3.1.8 Lead

3.1.8.1 Review of Data

Measurements of airborne lead (in Total Suspended Particulates) were performed in the Hobart suburb of Moonah intermittently between 1989 and 1996 (see Figure 3-5).

The data demonstrate a decline in the 3-month running average for lead from a winter peak of approximately 0.7 $\mu g/m^3$ in 1989 to 0.3 $\mu g/m^3$ in 1996 when sampling ceased. These reductions were shown to be associated with both a decrease in the lead content of petrol and decreased use of leaded petrol over that period

The annual average lead concentration in Hobart in 1996 was approximately 0.2 $\mu g/m^3$.

3.1.8.2 Screening Analysis

Based on the application of the PRC Screening Procedure A (PRC, 2000c) as follows, Tasmania does not intend to undertake performance monitoring of lead in Hobart:

Acceptance limits by screening procedure for carbon monoxide, nitrogen dioxide, sulfur dioxide and lead.

Screening Procedure	Acceptance Limit (% of Standard)
A. Campaign monitoring at a Generally Representative Upper Bound (GRUB) monitoring location (with no significant deterioration expected over 5-10 years).	55% for 1 year of data 60% for 2 or more years of data

Lead monitoring near the kerb of a road (daily traffic count of approximately 10,000 vehicles/day) in Hobart in the mid-1990's, revealed levels approximately 40% of the lead Standard. Motor vehicles were considered to be the only significant sources of lead in the Hobart Region.

Because of the scheduled introduction of lead replacement petrol, projections in the original Plan were that emissions of lead from motor vehicles will decrease by over 90% by 2001 (relative to 1996 levels). Current emissions are expected be virtually zero.

Based on the above data, the screening criterion for lead is clearly met in the Hobart Region by a wide margin.

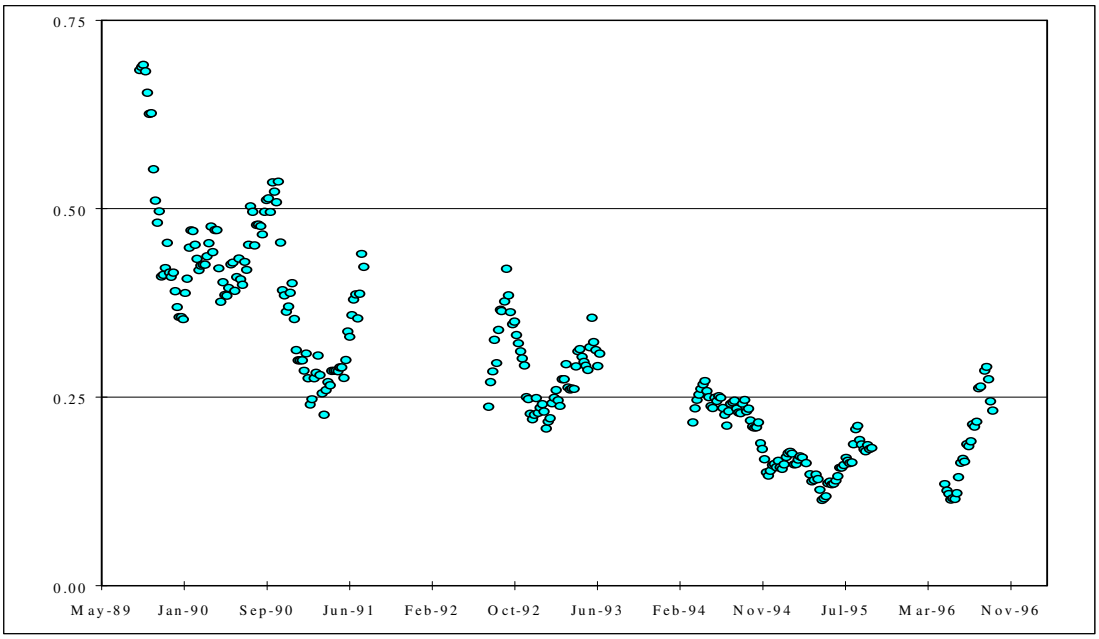

FIGURE 3-5 : 3-MONTH MOVING AVERAGE CONCENTRATION FOR TSP-LEAD (MICROGRAMS PER CUBIC METRE), DERWENT PARK RD, MOONAH

3.2 LAUNCESTON

3.2.1 Overview

3.2.1.1 Region Boundaries

Launceston and the Tamar Valley as a whole have been reasonably well studied in terms of the meteorology and atmospheric dispersion of the region. Results of three-dimensional atmospheric dispersion modelling have indicated that emissions from heavy industry at Bell Bay, some 40 kilometres north-west of Launceston, may in cases impact on air quality in Launceston (DPIWE, 1997).

For the purpose of the Measure, the Launceston Region boundaries are defined as presented in Figure 3-6 and cover a rectangular area approximately 40 kilometres wide and 60 kilometres long. This area has been selected for consistency with the Tamar Valley Airshed Study (DELM, 1995). Although there is no functional purpose served in exactly defining the boundary AMG co-ordinates, the coordinates of the corners are as shown:

Corner	*Easting*	*Northing*
North	498,750	5,467,250
East	533750	5412250
South	501,250	5,389,750
West	466250	5444750

3.2.1.2 Population and Topography

The population density and topography of the Launceston Region is presented in Figure 3-6.

Launceston has a population of 71.6 thousand with the second largest urban centre in the region, George Town, having a population of 4.8 thousand. The majority of Launceston's population is located within approximately 5 kilometres of the city centre, with the highest densities located south-east of the city centre and significant densities on the banks of the Tamar River to the north and north-west of the city.

In total, the population of the Launceston Region defined in this Plan is approximately 95,000.

Launceston is located on the upper reaches of the Tamar River, in a well-defined valley, which extends some 50 kilometres to Bass Strait. The valley axis is mostly aligned in a north-west to south-east orientation and is flanked by hills which reach heights of up to 400 m.

3.2.1.3 Emissions

The NPI data for the Launceston Region have been updated recently. The inventory covers a range of pollutants emitted from domestic, mobile and industrial sources, including PM10, carbon monoxide, nitrogen oxides, lead and sulfur dioxide.

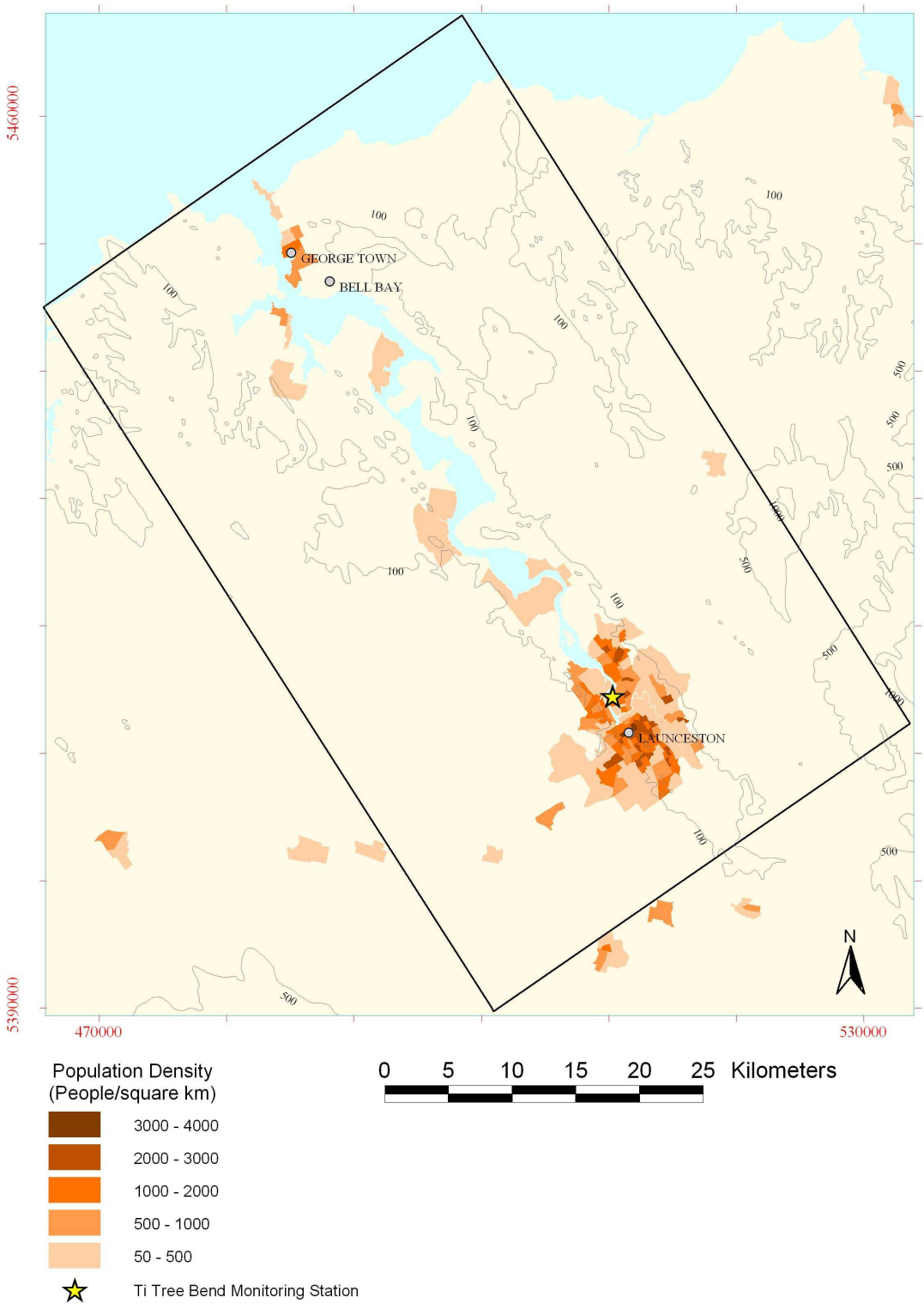

FIGURE 3-6 : MAP OF LAUNCESTON REGION INCLUDING POPULATION DENSITY AND TOPOGRAPHY

Earlier inventories have been reported for Launceston (NPI Trials, 1996) and the Tamar Valley Airshed Region (DELM, 1995). The quality of these two inventories however, is not considered to be as high as that of the current NPI program, and moreover some significant emission changes have since occurred. For these reasons, a discussion of the relative significance of emission sources in the Launceston Region is based on available results from the current NPI program for both Launceston and Hobart.

According to a recent update of emission figures for the NPI, domestic solid fuel combustion contributes 73% of total PM_{10} emissions in the Launceston Region during the coolest six months of the year.

Several significant industrial facilities are located at Bell Bay, some 5 kilometres to the south-east of George Town. The two most significant air emissions sources are an aluminium smelter (Comalco) a ferro-alloy producer (TEMCO), which according to 2003-2004 NPI estimates, have emission rates in tonnes per year, as shown:

	Sulfur dioxide	**Carbon monoxide**	**Nitrogen oxides**	**PM_{10}**
Comalco	3300	20,000	23	69
TEMCO	3	5600	78	220

Other significant industrial facilities at Bell Bay include:

- a fibre/particle board mill (originally Starwood, now Carter Holt Harvey).
- A gas-fired power station (Bell Bay Power).
    - The original oil-fired power station had not been in use (other than firing for maintenance purposes) for over five years at the time writing of the original Plan.
    - Bell Bay Power has now converted this plant to natural gas to take advantage of Basslink, and may begin operating continuously within the next few years.

3.2.1.4 Meteorology

Northerly winds tend to prevail all year round in Launceston, with atmospheric calm conditions reported to be most frequent in the winter and autumn months (Power, 2000).

Strongly stable atmospheric conditions in Launceston are normally associated with southerly, south-easterly or easterly winds draining out of the Valley. This is especially evident in winter.

Figure 3-8 illustrates the inferred drainage flow for Launceston. The predicted drainage flows are based on an analysis of stream directions and the spatial variation in the orientation of the valley axis, as was presented for Hobart.

3.2.1.5 Air Quality Monitoring History

The original plan indicated that there had been limited monitoring of ambient air quality in the Launceston Region to that time. Historical monitoring data for O_3 in Launceston were available, as were data for PM_{10} and lead in Launceston, and sulfur dioxide in George Town. Data for NO_2 were not available.

As indicated in section 3.2.5.2, there has now been extensive monitoring of PM_{10} in the area, commencing with a four-site study culminating with the establishment of the Ti Tree Bend Long-term performance and Trend monitoring station.

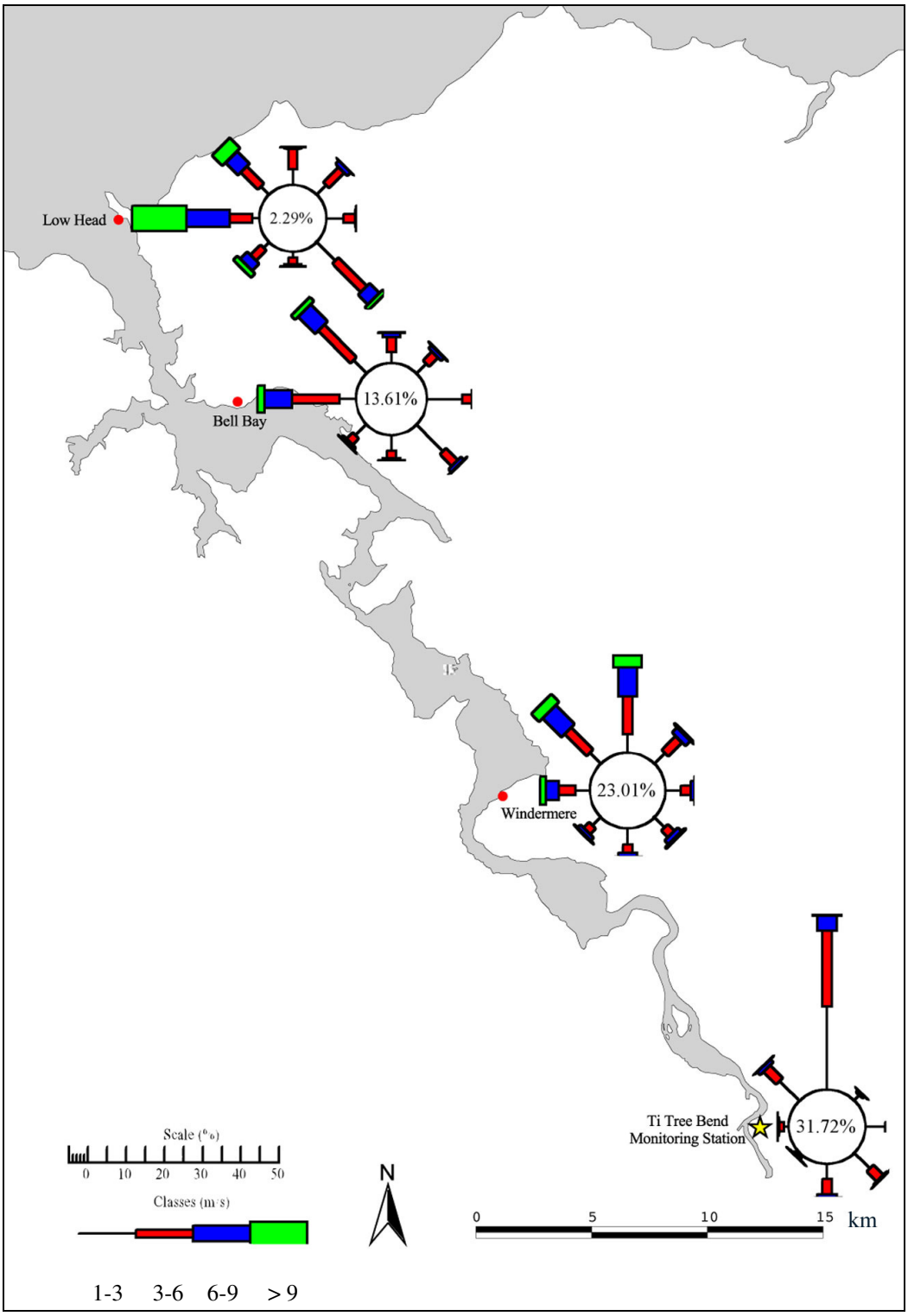

FIGURE 3-7 : WIND ROSES, LAUNCESTON REGION

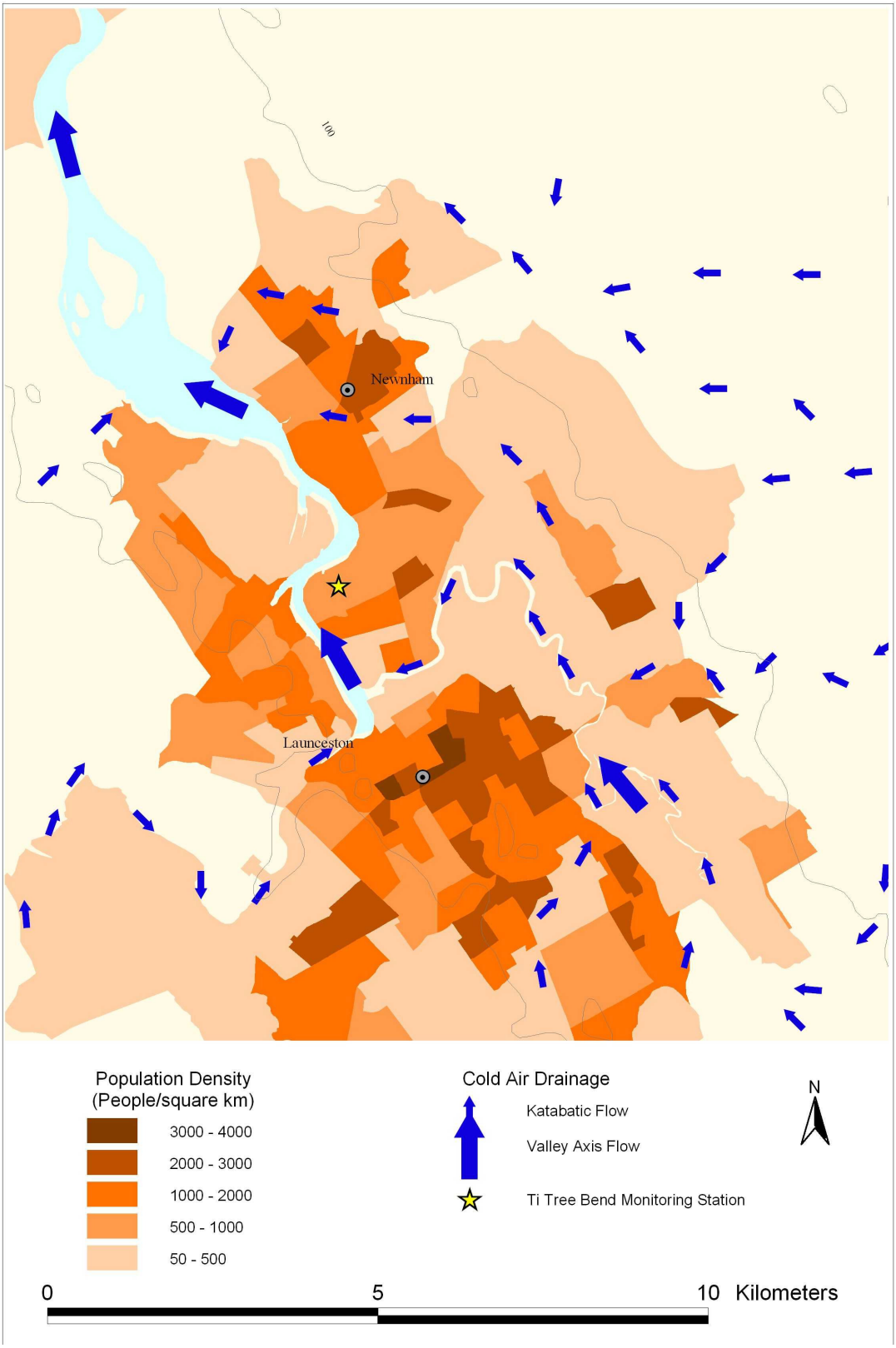

FIGURE 3-8 : INFERRED DRAINAGE FLOWS, LAUNCESTON REGION

3.2.2 Population Formula

From Clause 14(1) of the Measure, the number of performance monitoring stations required for the Launceston Region is one.

3.2.3 Photochemical Oxidants (as O_3)

3.2.3.1 Review of Data

Ambient air sampling of O_3 was conducted in Launceston between 1992 and 1993. Monitoring was conducted at Glen Dhu near a major highway several kilometres from the Launceston CBD.

Maximum O_3 concentrations reported for the site were approximately 0.04 ppm (1-hr average).

3.2.3.2 Screening Analysis

In the event that suitable TAPM Consultancy data for O_3 become available, the following section will be modified accordingly.

Tasmania does not propose to undertake performance monitoring of photochemical oxidants (as O_3) in the Launceston Region, based on the application of the PRC Screening Procedure A (PRC, 2000c) as follows:

Acceptance limits by screening procedure for photochemical oxidants (as O_3).

Screening Procedure	Acceptance Limit (% of Standard)
A. Campaign monitoring at a Generally Representative Upper Bound (GRUB) monitoring location (with no significant deterioration expected over 5-10 years).	60% for 1 year 70% for 2 or more years 75% for 5 or more years

Ambient air sampling of O_3 in Launceston between 1992 and 1993 (Lyons, 1996) found maximum O_3 concentrations of approximately 40% of the Standard.

The photochemical smog generation potential in Tasmania is considered to be low by comparison with larger Australian urban areas. This is because of relatively small urban populations, low summer temperatures and UV flux, and low probability of inter-regional oxidant transport.

Although limited, the available ambient air quality monitoring data for O_3 in Launceston are considered to be indicative of regional concentrations. Whilst it is unclear if the monitoring location used in Launceston is representative of a GRUB site, the limited data coupled with the relatively low photochemical smog potential, indicate that O_3 concentrations in the region are low and probably satisfy the PRC screening criterion by a reasonable margin.

3.2.4 Nitrogen Dioxide

3.2.4.1 Review of Data

Monitoring data for NO_2 in the Launceston Region are not available.

3.2.4.2 Screening Analysis

To be provided when TAPM Consultancy data for NO_2 become available.

3.2.5 Particulate Matter (as PM_{10})

3.2.5.1 Review of Data

Monitoring data for PM_{10} in Launceston demonstrate that the Ambient Standard of 50 $\mu g/m^3$ is regularly exceeded during the cooler months of the year. Over the period 1997 to 2001, PM_{10} was monitored on a daily basis between April and September (via high volume samplers), and on a six day cycle during the warmer months. Subsequently daily monitoring was instituted at Ti Tree Bend. Exceedences of the PM_{10} Standard recorded at this site are shown in Figure 3-9 and Table 3-3.

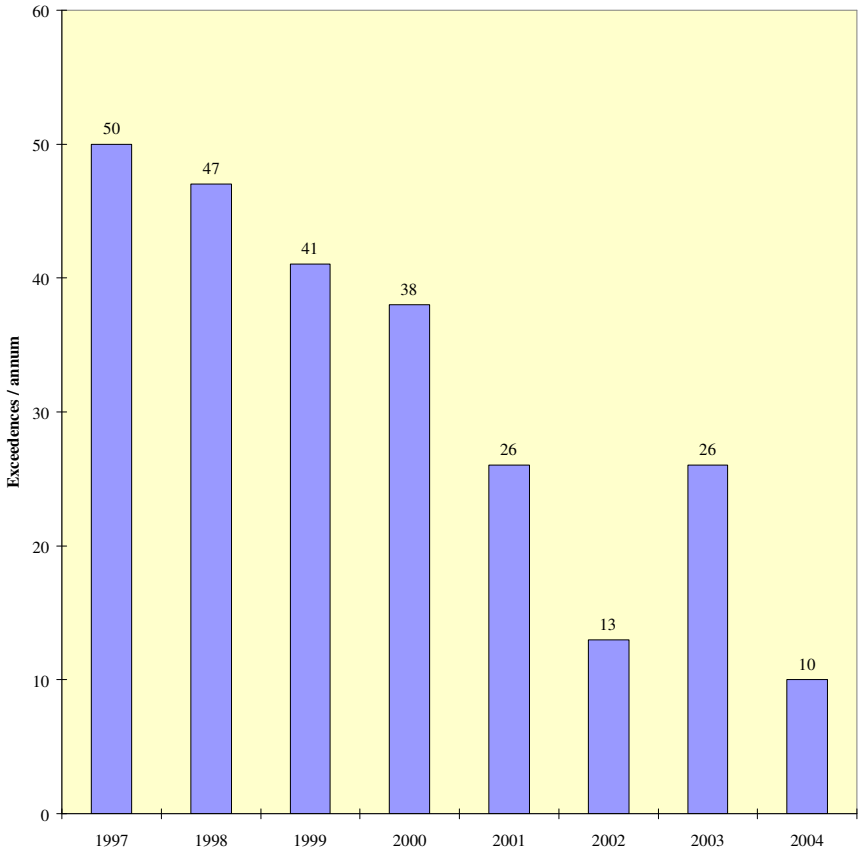

FIGURE 3-9 : YEARLY EXCEEDENCES OF THE PM_{10} NATIONAL ENVIRONMENT PROTECTION STANDARD AT TI TREE BEND

However, exceedences are not a particularly robust statistic on which to base management programs, even though the Goal is written in those terms. In recognising this, the PRC has requested that a range of percentile statistics be presented in annual reports to the NEPC, as they provide better information on the nature of the underlying distribution of data. The sixth highest concentration is of particular value because it indicates performance levels outside the 5 days per year Goal in the Measure. Percentile data for Ti Tree Bend are presented in Table 3-3, for the period 1997 to 2004.

TABLE 3-3 : PM_{10} CONCENTRATIONS (HIGH VOLUME SAMPLER), TI TREE BEND, LAUNCESTON

Year	Number of Exceedences Recorded	Maximum ug/m^3	6th Highest ug/m^3	90th Percentile ug/m^3
1997	47	121	90	72
1998	45	122	100	73
1999	38	92	80	65
2000	36	108	83	69
2001	25	81	67	51
2002	13	76	62	38
2003	26	92	66	43
2004	10	86	55	38

It is notable that the 6th highest statistic for PM_{10} in Launceston has remained above the Standard for the entire period shown in Table 3-3. However, clearly, there has been a decrease in the severity of the exceedences. It is informative to look at the figures in blocks of four years, 1997-2000 and 2001-2004, as below. The year 2001 marks commencement of monitoring at Ti Tree Bend accordance with the Protocol, and the period 2001-2004 also covers the period of operation of the Launceston Woodheater Replacement Program.

Period	Average of 6th Highest data	Average of 90th Percentile data
1997-2000	88	70
2001-2004	63	43

Although still well above the Standard of 50 ug/m^3, the average of 6th highest concentrations for the period 2001-2004 at Ti Tree Bend represents a marked improvement in air quality over the average for the previous four years. This is also mirrored in the 90th percentile data in Table 3-3, which shows values consistently well in excess of the Standard in the first four-year period, and less than or close to the Standard for 2001-2004.

3.2.5.2 Nominated Performance Monitoring and Trend Station

Ti Tree Bend was nominated as the site for both performance and trend monitoring in the Launceston Region, on the basis of multi-site studies as discussed below. Results of monitoring over subsequent years has confirmed the choice of this site, where very clear trends in air quality have become evident as the Launceston Woodheater Replacement Program and associated education programs have begun to exert their effects (Fig 3-10).

The original Plan cited available data for the Region clearly indicating that high concentrations of particles were frequently associated with light winds and highly stable atmospheric conditions. Moreover, because of night-time ground cooling and the formation of drainage flows, relatively high pollutant concentrations were likely to be found in topographic hollows and basins, and on low-lying land.

Strongly stable atmospheric conditions in Launceston are normally associated with southerly, south-easterly or easterly winds draining out of the Valley. This is especially evident in winter. Such flows slowly transport pollutants from the relatively dense housing situated to the south-east of the Launceston CBD along the Valley axis.

The Ti Tree Bend site is located on the valley axis, downstream of both the Launceston CBD and the relatively densely populated suburbs further south of the city. The site itself lies on flat open ground near the banks of the Tamar River.

The Ti Tree Bend site was considered to be representative of a GRUB location for particulate matter because of the predicted drainage flows in Launceston and its vicinity to residential areas and major arterial roads. Supporting evidence for this, is obtained from a comparison of same-day monitoring of particles conducted at several sites in Launceston during 1992 and 1993. Table 3-4 presents particle monitoring data for four sites in Launceston. For each of the days presented in Table 3-4, same day monitoring was conducted at two sites.

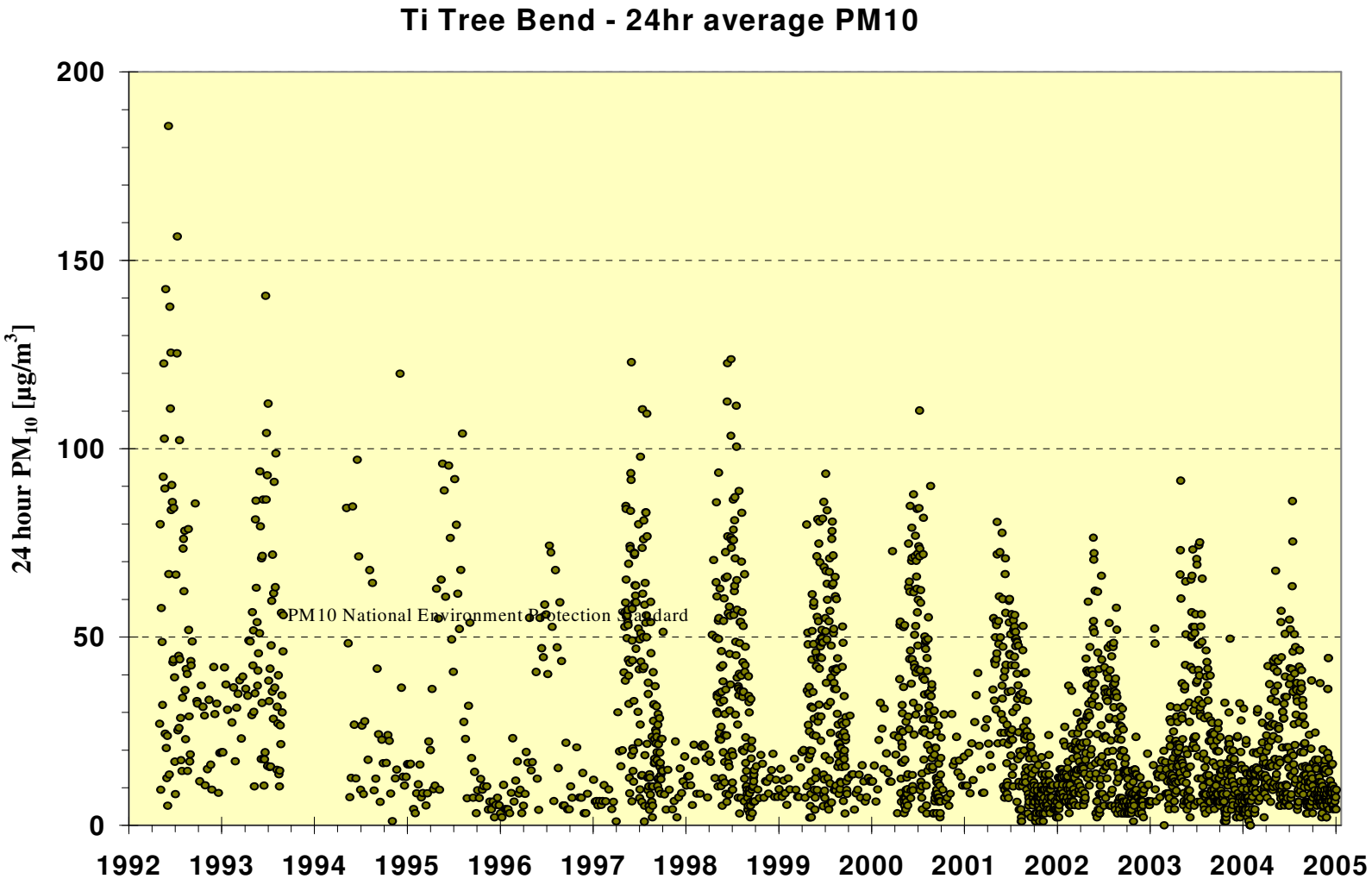

FIGURE 3-10 : 24-HOUR AVERAGE PM_{10} CONCENTRATIONS (HVAS plus TEOM)TI TREE BEND, LAUNCESTON, TO JANUARY 2004

(Note that prior to 2001, some data was obtained from HVAS sampling on alternate days)

TABLE 3-4 : MULTI-SITE COMPARISON OF HIGH POLLUTION EVENT DAYS, LAUNCESTON[A]

Date	Ti Tree Bend TSP	Newnham PM_{10}	East Launceston PM_{10}	Glen Dhu PM_{10}
23/05/92		139		144
28/05/92	144		146	
13/06/92	140		135	
30/06/92		135		142
11/07/92	128		135	
13/07/92	159		162	
14/06/93		150		131
25/06/93	143		160	
Distance from Ti Tree Bend (km) And Bearing	- -	1.2 to NNE	2.7 to SE	4.3 to SSE

a. Adapted from Table 2, Pg 23A, Lyons, 1996, 'Air Pollution, Environmental Health and Respiratory Diseases, Launceston and Upper Tamar Valley, Tasmania, 1991-94'.

PM_{10} was monitored at three of the sites during 1992/93, whilst TSP was monitored at the fourth site (Ti Tree Bend), due to lack of resources at the time. However, because of the high proportion of fine woodsmoke particles from domestic (and industrial) sources in Launceston's air pollution load, TSP was reasonably assumed to be equivalent to PM_{10} for the purpose of multi-site comparisons.

Moreover, given that the Newnham site was approximately only one kilometre from Ti Tree Bend, same day monitoring data for East Launceston and Glen Dhu (see Figure 3-11) respectively, may be compared with that for either Ti Tree Bend or Newnham.

Monitoring results for East Launceston and Glen Dhu for specific high pollution event days in 1992/93, were found to be typically within 10% of those for Ti Tree Bend /Newnham. Such a high level of agreement between sampling results at different locations, coupled with the fact that the majority of the Region's population resides within 5 kilometres of the Launceston GPO, indicated that the Ti Tree Bend site was representative of generally upper bound concentrations in Launceston. However, it is acknowledged that local air-pondage coupled with above-average emission rates from neighbourhood woodheaters and fireplaces in some localities, could result in higher pollutant concentrations than those at the nominated performance monitoring station. The area of such localities is expected to be small and account for a small fraction of the Region's population.

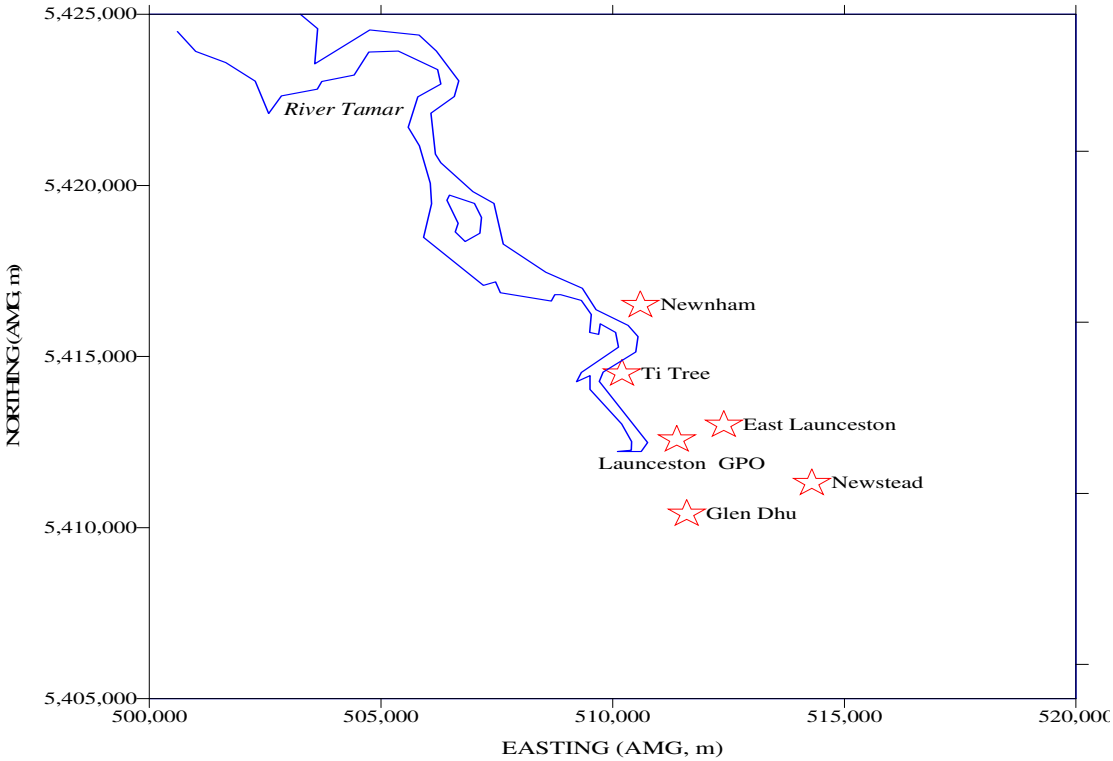

FIGURE 3-11 : HISTORICAL MONITORING SITES RELATIVE TO LAUNCESTON GPO

3.2.6 Carbon Monoxide

3.2.6.1 Review of Data

Monitoring data for carbon monoxide are not available for the Launceston Region.

3.2.6.2 Screening Analysis

Screening analysis was originally expected to be based on results of monitoring in Hobart. At the time, such data were not available and it was unclear if the carbon monoxide screening criterion could be complied with in Launceston. Monitoring has since been conducted at Prince of Wales Bay station in Hobart, where only low levels were recorded. As discussed elsewhere in this report, this site is no longer regarded as representative of population exposure to either carbon monoxide or PM_{10}, and the carbon monoxide monitor is to be re-located to a Peak CBD site. Therefore, no truly comparative data exists at this time. There are no plans to extend carbon monoxide monitoring to Launceston in the near future.

3.2.7 Sulfur Dioxide

3.2.7.1 Review of Data

Monitoring data for sulfur dioxide in Launceston are not available.

Continuous monitoring of sulfur dioxide at a single site in the Bell Bay region, between August 1997 and September 1998, indicate that the maximum one-hour concentration was less than 10% of the Standard.

3.2.7.2 Screening Analysis

Tasmania does not propose to undertake performance monitoring of sulfur dioxide in the Launceston Region, based on the application of the PRC Screening Procedure A (PRC, 2000c) as follows:

Acceptance limits by screening procedure for carbon monoxide, nitrogen dioxide, sulfur dioxide and lead.

Screening Procedure	Acceptance Limit (% of Standard)
A. Campaign monitoring at a Generally Representative Upper Bound (GRUB) monitoring location (with no significant deterioration expected over 5-10 years).	55% for 1 year of data 60% for 2 or more years of data

Whilst there are no significant emission sources of sulfur dioxide in Launceston, the industrial centre at Bell Bay some 50 kilometres to the north-west includes several medium sized industrial sources of sulfur dioxide (see section 3.2.1.3 above). Some

emissions from Bell Bay may be transported to Launceston under the influence of prevailing winds, but modelled data suggests that mixing from Bell Bay to the remainder of the Tamar Valley is limited to less than 5 % (Power, 2005, Pers. Comm.).
As noted above, monitoring of sulfur dioxide near Bell Bay was performed prior to compilation of the original Plan. The results indicated that the maximum one-hour concentration was less than 10% of the Standard. During that time, the Bell Bay oil fired power station was not operational. However, given that this was always a peak load station and relatively small, it is likely that in any case, emissions from other sources would have predominated in the area.

The Power Station has since been converted to natural gas. This implies that, although it is likely to commence continuous operation in the next few years, sulfur dioxide emissions from this source will be negligible.

From the available data and consideration of the magnitude and location of sulfur dioxide sources in the Region under existing and most likely future emission scenarios, it is concluded that ambient concentrations of sulfur dioxide in urban areas will be below 10% of the Standard. The screening criterion for sulfur dioxide in the Launceston Region is therefore considered to be met by a wide margin.

Establishment of a monitoring station in Bell Bay is currently under negotiation. The proposal includes, inter alia, sulfur dioxide monitoring to assess the impact of the industrial emissions in the area on air quality experienced in residential areas around the Bay.

3.2.8 Lead

3.2.8.1 Review of Data

Monitoring data for lead (in PM_{10} fraction) at Ti Tree Bend, Launceston, are presented in Figure 3-12.

The concentration of lead in Launceston has decreased progressively over the last decade. The most recent data indicate that the annual average concentration was approximately 0.02 $\mu g/m^3$ (in 1998).

3.2.8.2 Screening Analysis

Tasmania does not propose to undertake performance monitoring of lead in the Launceston Region, based on the application of the PRC Screening Procedure A (PRC, 2000c) as follows:

Acceptance limits by screening procedure for carbon monoxide, nitrogen dioxide, sulfur dioxide and lead.

Screening Procedure	Acceptance Limit (% of Standard)
A. Campaign monitoring at a Generally Representative Upper Bound (GRUB) monitoring location (with no significant deterioration expected over 5-10 years).	55% for 1 year of data 60% for 2 or more years of data

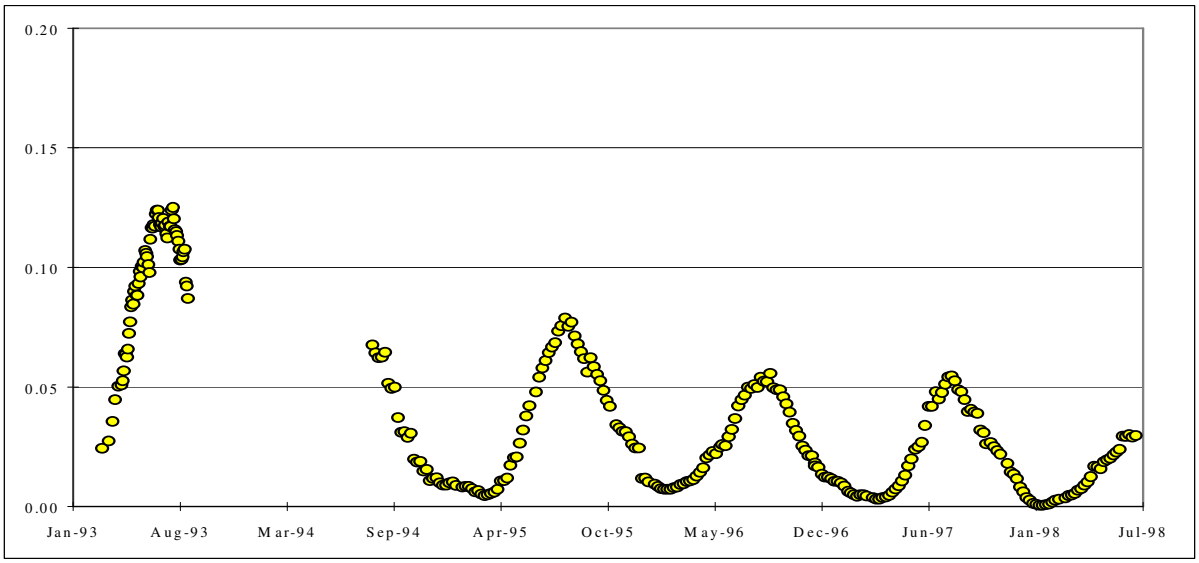

FIGURE 3-12 : 3-MONTH MOVING AVERAGE CONCENTRATION FOR LEAD (MICROGRAMS PER CUBIC METRE OF AIR IN PM_{10} FRACTION), TI TREE BEND, LAUNCESTON

Results of lead monitoring in Launceston prior to compilation of the original Plan, indicated that ambient concentrations are less than 5% of the Standard.

At that time, motor vehicles were considered to be the largest source of lead emissions in the Launceston Region. As a result of the introduction of lead replacement petrol in Tasmania in 2001, it was projected that emissions of lead from motor vehicles will decrease by over 90% by 2001 relative to 1996. This reducing trend would have continued in more recent years, as leaded fuel has been removed from the market.

The screening criterion for lead is met by a wide margin in the Launceston Region.

3.3 DEVONPORT

3.3.1 Overview

3.3.1.1 Region Boundaries

For Devonport, the availability of meteorological data tends to be relatively low. Moreover, complex atmospheric dispersion models have not been developed for the Region. For these reasons, the extent of the Devonport airshed is unclear.

For the purposes of the Measure, the Devonport Region boundaries are defined as presented in Figure 3-12. Although there is no functional purpose served in exactly defining the boundary AMG co-ordinates, these may be taken to be defined by the south-west corner (Easting 441,000; Northing 5430,000) and the north-east corner (Easting 454,000; Northing 5444,000).

3.3.1.2 Population and Topography

The population density and topography for the Devonport Region is presented in Figure 3-12.
The majority of the population resides within approximately a 5 kilometres radius of the CBD.

In total, the population of the Devonport Region defined in this Plan is approximately 32, 735.

Devonport is located in a shallow coastal plain on the banks of the Mersey River. The Mersey connects the town of Latrobe with Devonport.

3.3.1.3 Emissions

There is no existing inventory of air emissions for the Devonport Region. The major sources of emissions to air in the Region are considered to be domestic (woodheaters and fireplaces) and motor vehicles.

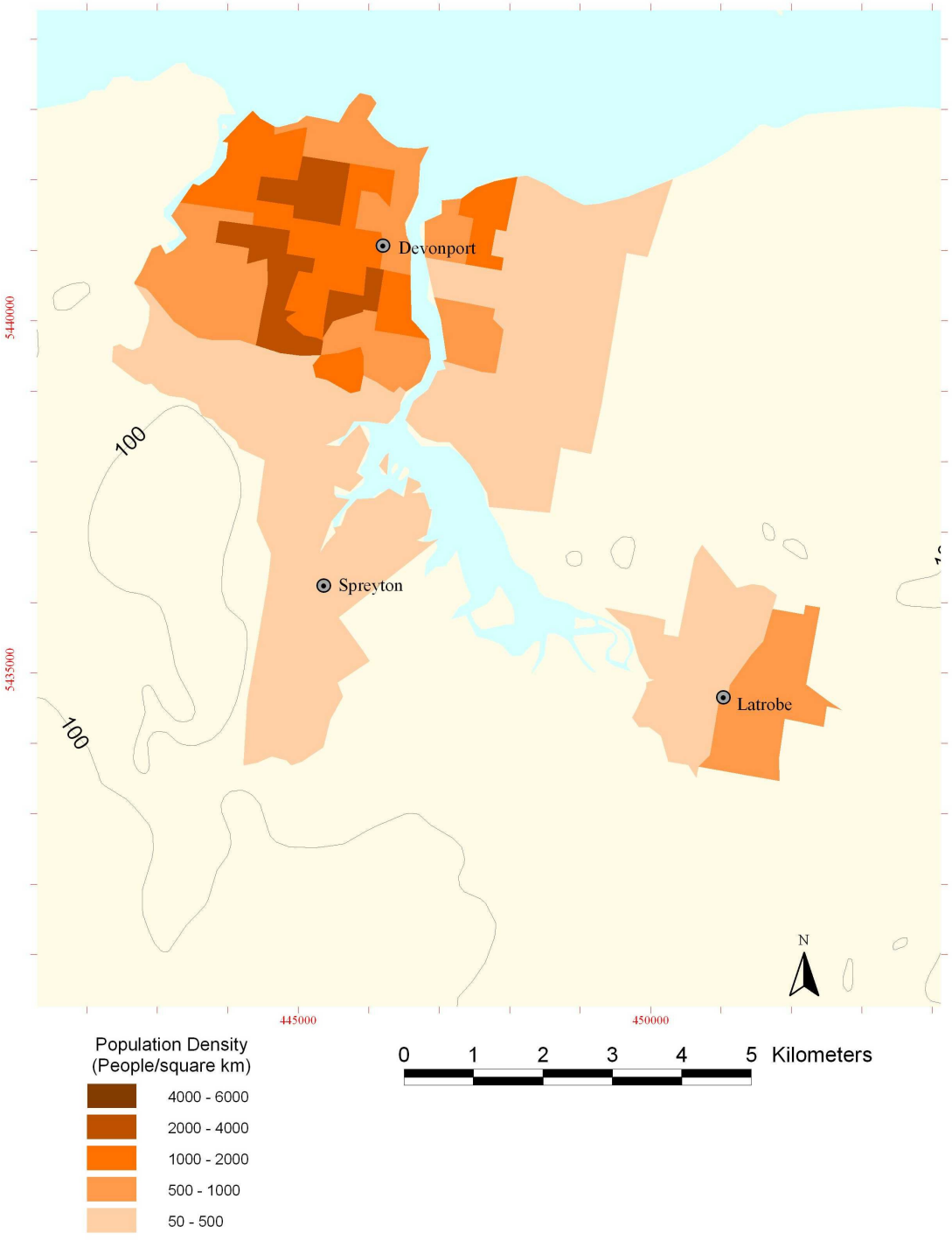

FIGURE 3-12 : MAP OF DEVONPORT REGION INCLUDING POPULATION DENSITY AND TOPOGRAPHY

3.3.1.4 Meteorology

Wind Roses for the Devonport Region are presented in Figure 3-14 below.

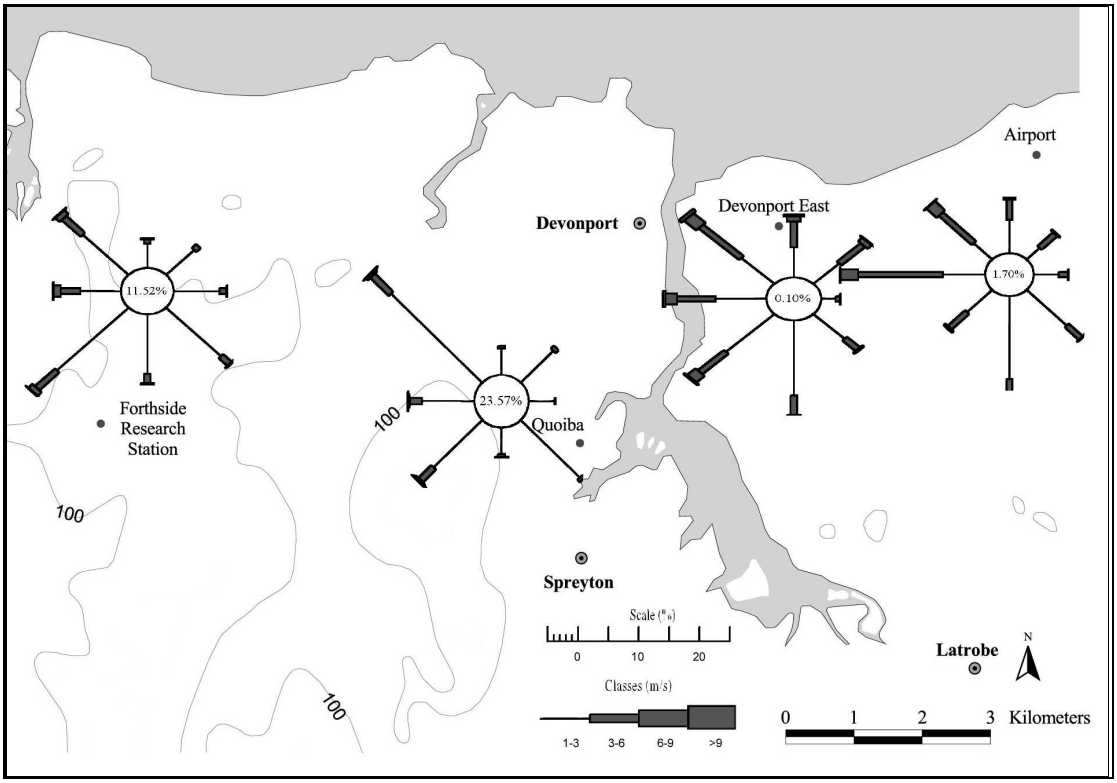

FIGURE 3-14 : WIND ROSES, DEVONPORT REGION

Westerly winds tend to prevail in the Devonport Region, with atmospheric calm conditions most frequent in winter and autumn.

3.3.1.5 Air Quality Monitoring History

Campaign particulate monitoring was conducted in the Devonport Region during 2003, using a TSP sampler. While no longer a standard method for monitoring particles under the Measure, the high proportion of smoke expected in particle loadings in Devonport during winter prompted the assumption that TSP would reflect PM_{10} reasonably well. During this short campaign, two exceedences were recorded, providing sufficient evidence of a need for long term PM_{10} monitoring in Devonport.

A PM_{10} monitoring program is scheduled to commence in 2006 under this amended plan. The program will utilise a new low-volume sampler to be purchased under The Tasmanian Air Quality Monitoring System Development Project, 2004-2008.

3.3.2 Population Formula

From Clause 14(1) of the Measure, the number of performance monitoring stations required for the Devonport Region is one.

3.3.3 Photochemical Oxidants (as O_3)

3.3.3.1 Review of Data

Monitoring data for O3 in Devonport's ambient air are not available.

3.3.3.2 Screening Analysis

To be provided when TAPM Consultancy data for O_3 become available.

3.3.4 Nitrogen Dioxide

3.3.4.1 Review of Data

Monitoring data for NO_2 in Devonport's ambient air are not available.

3.3.4.2 Screening Analysis

To be provided when TAPM Consultancy data for NO_2 become available.

3.3.5 Particulate Matter (as PM_{10})

3.3.5.1 Review of Data

A winter monitoring campaign was undertaken at Devonport from June to August 2003. Because of resources constraints at the time, a Total Suspended Particulate (TSP) high volume air sampler was utilised. By analogy with other Tasmanian population centres, it was assumed that the major source of winter particle loadings in Devonport was domestic wood-fuelled heating, so the TSP results were taken as being

indicative of PM10 concentrations.

Concentrations exceeding the PM_{10} Standard were recorded on two days during the period, with concentrations approaching the Standard on several further days. This was taken to be sufficient evidence for establishing a performance and trend station in the region.

3.3.5.2 Nominated Performance Monitoring and Trend Station

As discussed above, Tasmania has scheduled commencement of performance monitoring of PM_{10} in the Devonport Region in 2006, on the basis of 2003 winter campaign results. The location for the proposed station has not yet been determined and will be advised when the selection has been made.

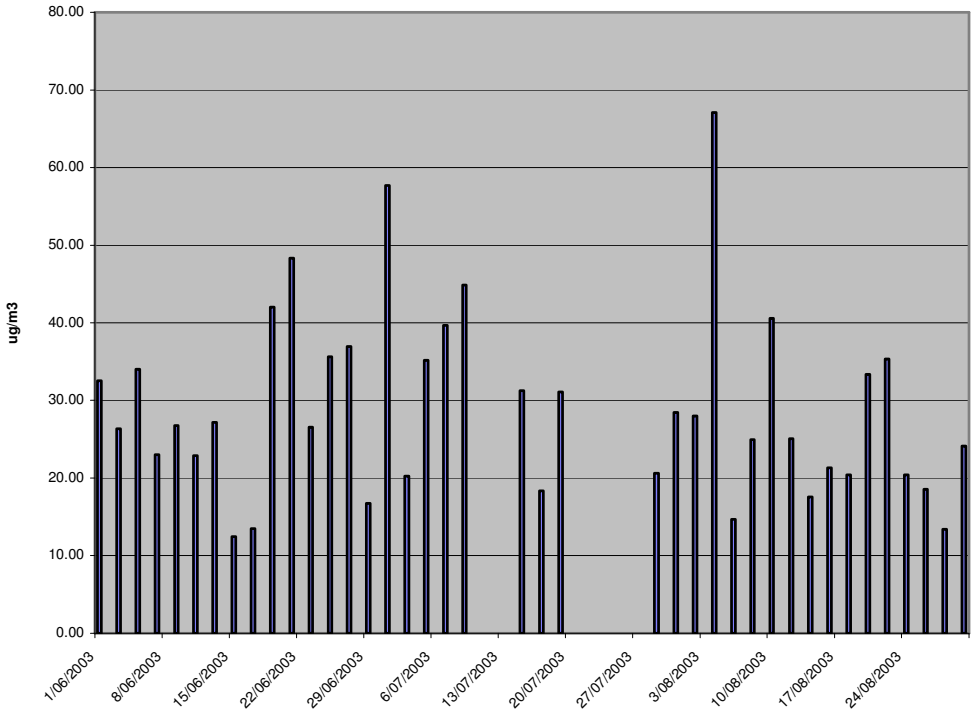

FIGURE 3-15 : TOTAL SUSPENDED PARTICULATE MONITORING IN DEVONPORT WINTER 2003

3.3.6 Carbon Monoxide

3.3.6.1 Review of Data

Monitoring data for carbon monoxide in Devonport's ambient air are not available.

3.3.6.2 Screening Analysis

Originally, screening analysis was to be predicated on the outcome of monitoring in Hobart. Given the concerns about representativeness of carbon monoxide monitoring at prince of Wales Bay, it remains unclear whether the carbon monoxide screening criterion can be complied with in Devonport. However, monitoring of particle concentrations is viewed as the most pressing priority and there are no plans to conduct carbon monoxide monitoring in Devonport at this time.

3.3.7 Sulfur Dioxide

3.3.7.1 Review of Data

Monitoring data for sulfur dioxide in Devonport's ambient air are not available.

3.3.7.2 Screening Analysis

Tasmania does not propose to undertake performance monitoring of sulfur dioxide in the Devonport Region, based on the application of the PRC Screening Procedure F (PRC, 2000c) as follows:

Acceptance limits by screening procedure for carbon monoxide, nitrogen dioxide, sulfur dioxide and lead.

Screening Procedure	Acceptance Limit (% of Standard)
F. In a region with no performance monitoring, comparison with a compliant region with greater population, emissions and pollution potential[a].	35%

a. Pollution potential must take into account meteorology and topography.

There are no known significant industrial sources of sulfur dioxide emissions in the Devonport Region. Moreover, the Region lies on a shallow coastal plain that is expected to have better atmospheric dispersion than the Launceston Region. The population of the Devonport Region is significantly lower than that of Launceston.

As noted previously, sulfur dioxide concentrations in the Launceston Region have been reported to be less than 10% of the Standard. By analogy, Screening Criterion F is satisfied by a wide margin in the Devonport Region.

3.3.8 Lead

3.3.8.1 Review of Data

Monitoring data for lead in Devonport's ambient air are not available.

3.3.8.2 Screening Analysis

Tasmania does not propose to undertake performance monitoring of lead in the Devonport Region, based on the application of the PRC Screening Procedure F (PRC, 2000c) as follows:

Acceptance limits by screening procedure for carbon monoxide, nitrogen dioxide, sulfur dioxide and lead.

Screening Procedure	Acceptance Limit (% of Standard)
F. In a region with no performance monitoring, comparison with a compliant region with greater population, emissions and pollution potential[a].	35%

a. Pollution potential must take into account meteorology and topography.

There are no known significant industrial sources of lead emissions in the Devonport Region. The major source of this pollutant is considered to be motor vehicles.

As noted earlier, the Launceston Region is a compliant region for lead, with greater population, emissions and pollutant potential than the Devonport Region. Moreover, ambient concentrations of lead in Launceston are less than 5% of the Standard, and will continue to decline in future across the State.

By analogy, Screening Criterion F is satisfied by a wide margin in the Devonport Region.

4 SITING AND INSTRUMENTATION

4.1 DETAILS OF MONITORING STATIONS

The amended ambient air quality monitoring program for Tasmania, in fulfilment of the requirements of the Measure, is presented in Table 4-1. Note that the program also includes development of quality systems designed to obtain NATA accreditation by end 2007.

TABLE 4-1: NATIONAL ENVIRONMENT PROTECTION (AMBIENT AIR QUALITY) MEASURE ON, MONITORING FOR TASMANIA

Shaded areas indicate cessation or change of role. Bold borders indicate P&T or PCBD stations for relevant indicators under amended plan.

Region	Station Locality/Note	PM_{10} TEOM	PM_{10} HVAS	PM_{10} LVAS	$PM_{2.5}$ LVAS	CO IR	SULFUR DIOXIDE UVF	Meteorology
Hobart	Prince of Wales Bay To be re-located 2005 Refer Paragraph 3.1.5.1	P & T cease April 2005	comparative data - retain and upgrade to daily sampling until Nov 2006			Ceased operation December 2004		
	New Town - Hockey Association to commence April 2005 Refer Paragraph 3.1.5..2, 4.3	comparative data		P & T 2005	P & T 2007			Full set 2005
	Sulfur dioxide Refer Paragraph 3.1.7.2						P & T site & schedule to be determined	
	CBD Macquarie Street Refer paragraph 3.1.6.1, 3.1.6.2					PCBD Site to be determined - scheduled for 2005		
Launceston	Ti Tree Bend Refer paragraph 3.2.5.1, 3.2.5.2, 4.3	comparative data	P & T Cease April 2005 - retain until Nov 2006 for comparative data	P & T 2005	P & T 2005			Full set 2005
Devonport	PM_{10} station to be established on basis of 2003 campaign results Refer paragraph 3.3.5.2. 4.3		C Completed 2003	P & T Site to be determined - scheduled for 2006				Full set 2005

TEOM	Tapered Element Oscillating Microbalance	P & T.	Performance and Trend Monitoring Station.
UVF	Ultraviolet Fluorescence	C	Campaign Monitoring.
IR	Gas Filter Correlation Infrared Absorption	PCBD	Peak CBD Site
"Full set"	Weather Station as per text (see para 4.3).	LVAS	Low Volume Air Sampler

Hobart

In Hobart, two ambient air monitoring stations were proposed in the original Plan. The status of these two stations is summarised below (see also Table 4.1).

1. Particulate material:

- The original particulate monitoring station was located in the suburb of Lutana, within the City of Glenorchy on the banks of Prince of Wales Bay (Easting 524,800; Northing 5257,400).
- This is to be replaced in early 2005 with a station in the suburb of New Town, within the City of Hobart, on land leased by the Hockey Association of Tasmania (Easting 525,650; Northing 5255,075), some 2.4 km SSE of Prince of Wales Bay.

2. Sulfur dioxide

- Selection of a performance and trend station for sulfur dioxide in the proximity of the Zinifex zinc smelter (formerly Pasminco) in Lutana is still under consideration. The company is to undertake modelling studies to assist with this evaluation.
- However, the company itself is operating three ambient sulfur dioxide stations, the data from which is included into the Tasmanian Air Quality database on a regular basis.

Launceston

In Launceston, the existing monitoring station is located in the suburb of Invermay (Easting 510,200; Northing 5,414,500) within the Ti Tree Bend Sewage Treatment Works on the east bank of the Tamar River, approximately 3 kilometres north-west of the Launceston CBD.

$PM_{2.5}$ Equivalency program

Schedule 5 of the Measure cites Tasmania's agreement to participate in the $PM_{2.5}$ Equivalency Program by undertaking comparative monitoring between the TEOM method and the Reference Method at Launceston over a period of three years. Tasmania's participation was predicated on acquiring an additional TEOM instrument that was suitable for this purpose. Unfortunately, this has not eventuated. As a result, Tasmania does not currently have the resources to undertake this study in addition to its existing commitments under the Tasmanian Air Monitoring Plan to stakeholders in Launceston, Hobart and Devonport. It is therefore unlikely that this study can be formally commenced before winter 2007.

Devonport

On the basis of results from campaign monitoring in 2003, long term monitoring of PM_{10} in Devonport is projected to commence in 2007.

Methods

Tasmania employs the Australian Standard Methods referenced in Schedule 3 of the Measure for monitoring PM_{10}, carbon monoxide and sulfur dioxide and is establishing $PM_{2.5}$ monitoring systems in accordance with the USEPA Federal Reference method also cited in Schedule 3

As noted previously Tasmania intends, during the four-year Tasmanian Air Quality Monitoring System Development Project, 2004-2008, to:

- replace all existing PM_{10} High Volume Air Samplers with low volume sequential air samplers.
- retain existing TEOM instruments in Hobart and Launceston to provide supporting data.
- install additional $PM_{2.5}$ low volume sequential air samplers for Hobart and Launceston, to meet the requirements of the Amended Measure.
- establish meteorology monitoring stations at each of Hobart, Launceston and Devonport.

4.2 DATA HANDLING

Tasmania is committed to data handling in a manner that is consistent with PRC Guideline Paper No.5 (PRC, 2000e).

4.3 METEOROLOGICAL OBSERVATIONS

The four year upgrading program for the Tasmanian Air Quality Monitoring System includes the establishment of meteorological stations at each of Launceston, Hobart and Devonport air monitoring stations, to assist in evaluating exceedences of Standards, as required under Clause 18(3) of the Measure. These will comprise instruments to measure:

- wind speed and direction at 10 metres,
- pressure at 2 metres,
- temperature at 10 metres and 2 metres, and
- solar radiation as convenient.

4.4 MONITORING STATION SITE COMPLIANCE

Tasmania proposes, to the extent practicable, to site performance monitoring stations in accordance with the requirements of Australian Standard AS2922-1987 (Ambient Air- Guide for Siting of Sampling Units).

Table 4-2 presents an assessment of Tasmanian air monitoring stations against the criteria of AS2922-1987. Note that the site for the station at Devonport, projected to commence operating in 2006, has not yet been selected. However, as for the other Tasmanian stations, the location and configuration of the new station will be determined according to Australian Standard AS2922-1987 (Ambient Air- Guide for Siting of Sampling Units).

TABLE 4-2 : STATION SITING COMPLIANCE WITH AS2922 CRITERIA

✓ = complies with criterion.

Criterion	Hobart Region Prince of Wales Bay	Hobart Region New Town	Launceston Region Ti Tree Bend
Height Above Ground	✓	✓	✓
Minimum Distance to Support Structures	✓	✓	✓
Clear Sky Angle	✓	✓	✓
Unrestricted Airflow	✓	✓	✓
20m From Trees	✓	✓	✓
No Boilers or Incinerators Nearby	✓	✓	✓
Minimum Distance From Road Traffic	✓	✓	✓
Sample Line Material	✓	✓	✓
Sample Line Length	✓	✓	✓
Comment	Complies with all AS2922 Criteria	Complies with all AS2922 Criteria	Complies with all AS2922 Criteria

5 ACCREDITATION

Tasmania is committed to providing NATA (National Association of Testing Authorities) accredited data for reporting under the Measure. Such accreditation is consistent with PRC Guideline Paper No.7 (PRC, 2000f).

Work has commenced on a review of air-monitoring related quality assurance processes. Funding has become available under the Tasmanian Air Quality Monitoring System Development Project, 2004-2008, to meet the full costs associated with the NATA accreditation process.

The process to develop a total quality system in accordance with NATA practices will commence in early 2005, with the aim of achieving NATA accreditation by December 2007.

6 REPORTING AND EVALUATION

6.1 ANNUAL REPORTS

Clause 18 of the Measure documents the reporting requirements for jurisdictions. To meet the requirements of the Measure, Tasmania continues to submit annual reports by the 30th June following each reporting calendar year (ending 31 December).

The annual reports are submitted in an approved format, including:

- The evaluation and assessments mentioned in Clause 17 of the Measure;
- An analysis of the extent to which the Standards of the Measure have or have not been met in Tasmania; and
- A statement of the progress made towards achieving the Goal.

Moreover, Tasmania endeavours to report in a manner consistent with PRC Guideline Paper No.8 (PRC, 2000g).

According to Clause 3 of the Measure, monitoring in accordance with the Protocol is to commence within 3 years of its commencement. Tasmania proposes to report monitoring data for July to December 2001 by 30 June 2002.

6.2 EVALUATION OF PERFORMANCE

Under Clause 17 of the Measure, jurisdictions are required to evaluate their annual performance against the Standards and Goal of the Measure.

For each performance monitoring station, Tasmania will:

Determine the exposed population represented by the station. There is a large uncertainty associated with any quantitative measure of the exposed population, so

the requirement of the Measure is met by a qualitative description. This indicates the communities that are expected to experience similar levels of air quality to that of each performance monitoring station (by pollutant), either due to geographic proximity or similarity of emissions, meteorology and topography. For clarity, such information on each performance monitoring station (by pollutant) will be presented in tabular form. This approach is consistent with that specified in PRC Guideline Paper No.3 (PRC, 2000d); and

- *Evaluate the performance against the Standards and Goal of the Measure as* "MEETING", "NOT MEETING" or "NOT DEMONSTRATED".

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