REPORT AGAINST THE

NATIONAL ENVIRONMENT PROTECTION MEASURE

FOR AMBIENT AIR QUALITY FOR 2006

BY TASMANIA

30 June 2007

SECTION A – MONITORING SUMMARY

INTRODUCTION

Significant changes to the air monitoring program have occurred in 2006.

The Environment Division has monitored PM_{10} in accordance with the requirements of the Measure at Launceston and Hobart since 2001, using High Volume Air Samplers (HVAS) and TEOM instrumentation, but by 2004, this equipment was at the end of its useful service life.

Recognising the need to meet its national obligations, the Tasmanian Government approved $816,000 of capital funding over four years for *The Tasmanian Air Quality Monitoring System Development Project, 2004-2008*, to replace the old and unreliable PM_{10} high volume air samplers with low volume sequential PM_{10} Low Volume Air Samplers (LVAS), and 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 was completed and commissioned in July 2005.

As part of this project, the primary Hobart air monitoring station was re-located in May 2006 from Prince of Wales Bay to New Town, where field surveys had shown the air quality was more representative of the general population exposure, as discussed in more detail below. Carbon monoxide monitoring at Prince of Wales Bay ceased in 2004, but CO monitoring at a peak site within the Hobart CBD is planned for the future.

The 2001 Tasmanian Air Monitoring Plan was reviewed and updated in 2005 to reflect the changes in the monitoring network, and include more recent contextual information that is relevant to current air quality management programs in Tasmania. The Peer Review Committee approved the amended Plan at its 29th meeting on 19 September 2005, concurring with the proposal for a 12-month equivalence study for the PM_{10} low volume samplers against existing methodologies HV Air Samplers.

OVERVIEW OF REGIONS

1 HOBART

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

In the past the availability of meteorological data for Hobart has been limited. Moreover, development of complex atmospheric dispersion models for the region has only recently commenced, so the extent of the Hobart airshed is not yet fully characterised.

For the purpose of the Measure, the Hobart Region boundaries are defined as presented in Figure 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 521,000) and the north-east corner (Easting 550,000; Northing 5290,000).

1.2 POPULATION AND TOPOGRAPHY

The population density and topography for the Hobart Region is presented in Figure 1-1. The city of Hobart is located on the narrow coastal plain of the Derwent Estuary, which lies in a well-defined valley flanked by a complex terrain of hills and mountain ranges. The majority of the region's population of 205,500 (ABS 2006), reside within a 10 kilometre radius of the Central Business District (CBD), as illustrated in Figure 1-1, with significant satellite urban centres at Kingston-Blackmans Bay to the south (pop 29,000), Bridgewater-Gagebrook (pop. 14,000) and New Norfolk (pop. 6,800) to the north.

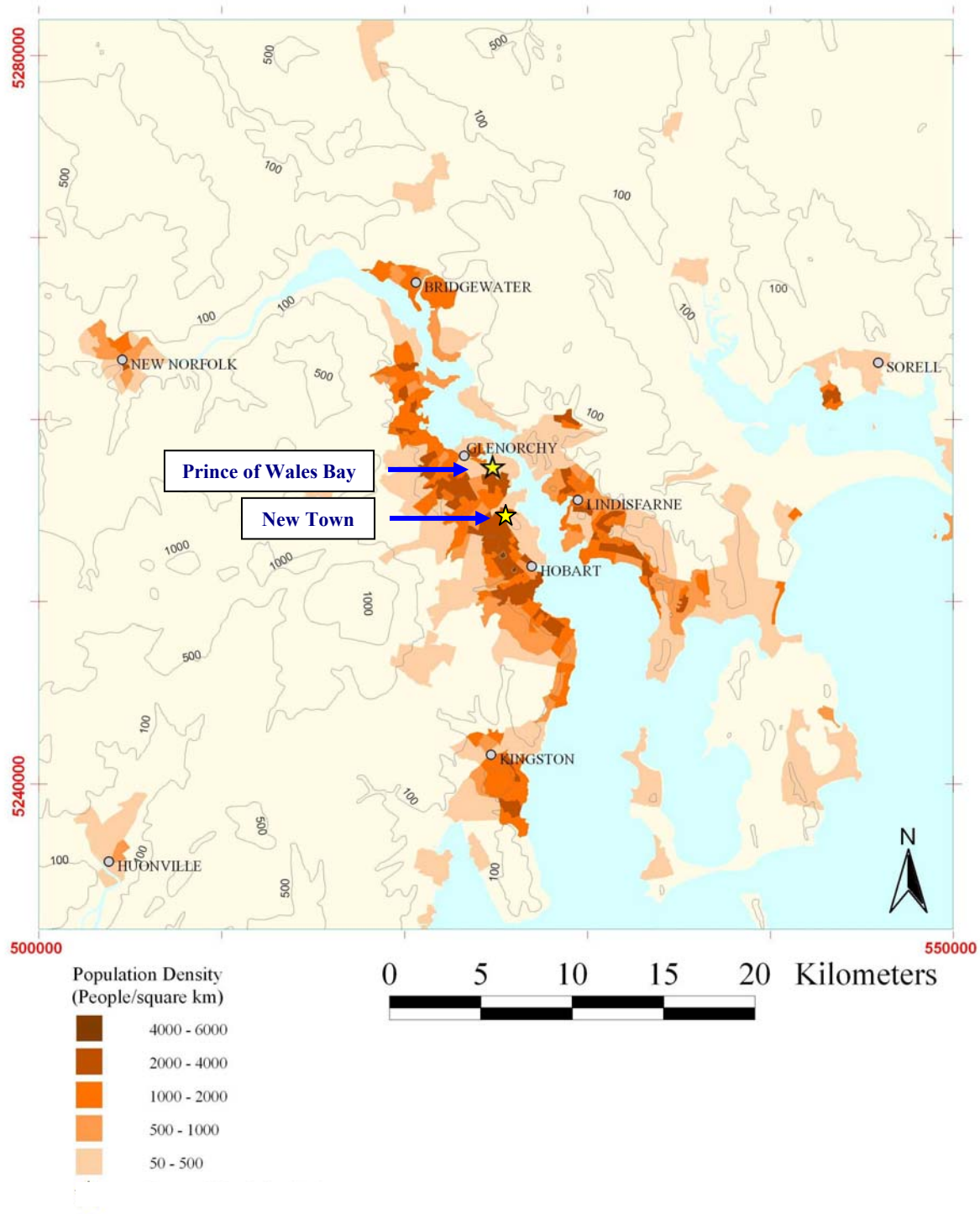

Figure 1-1: Map of the Hobart Region, showing the Population Density, Topography and the location of the NEPM Air Monitoring Stations

1.3 METEOROLOGY

The prevailing wind direction for Tasmania is northwest, which is strongly modified by the complex mountainous terrain surrounding the Derwent Estuary. While the city experiences periods of strong winds during winter storms and the equinox, the city also experiences relatively calm anti-cyclonic conditions for much of the year. During these periods, the wind flows are dominated by the katabatic drainage winds flowing down the Derwent Valley during the night and early mornings, and a south-easterly sea breeze on warm afternoons. In clear, calm autumn and winter weather, relatively high levels of locally generated air pollution can be trapped in hollows and basins.

1.4 HOBART, PERFORMANCE AND TREND MONITORING STATION:

The Performance and Trend air monitoring station for Hobart was established In June 2000 at the Prince of Wales Bay sports fields, approximately 6km WNW of the Hobart CBD in the northern suburb of Glenorchy. Following the review of the Tasmanian Air Monitoring Plan in 2005, a new Performance and Trend air monitoring station was established 2.5 km closer to the CBD at a more representative site in New Town, in May 2006, as illustrated in Figure 1-1.

1.4.1 Prince of Wales Bay Station

From July 2000 to June 2006, two indicators were monitored at Prince of Wales Bay:

(i) Carbon monoxide according to AS3580.7.1-1992, using a Monitor Labs 9830B analyser.

Carbon monoxide monitoring at this site was terminated in August 2004 as the levels were very low and had never exceeded 30% of the National Environment Protection Standard of 9ppm over an 8 hour period.

(ii) PM_{10} using:

- a High Volume Air sampler (HVAS), according to AS3580.9.6-1990, sampled every second day, and
- a collocated TEOM direct-reading instrument with a PM_{10} head.

For reasons discussed below, the TEOM was moved from the Prince of Wales Bay station in May 2006, and installed in a more representative site in New Town. The High Volume Air Sampler was scheduled to remain at the Prince of Wales Bay site for a further 12 months, to acquire comparative PM_{10} data between the two Hobart monitoring sites. This study had to be terminated in May 2006, after the air sampler was damaged by persistent vandalism at the Prince of Wales Bay site.

By 2004, observations of visible particulate pollution in the residential suburbs of Hobart and Glenorchy, suggested that the data from the station at Prince of Wales Bay was not representative of the broader population exposure. A study commissioned by Hobart City Council in 2003 (Todd, 2004), reported elevated levels of particles from wood smoke in the northern suburbs, with an inferred significant population exposure to polycyclic aromatic hydrocarbons.

These findings were confirmed by a series of short term field surveys of the Hobart Region conducted by the Environment Division during winter 2004 using Dustrak monitors. These surveys showed that airborne particulate levels in some northern residential areas on evenings when inversion conditions prevailed were consistently higher than those recorded at Prince of Wales Bay. Some areas experienced particulate concentrations between 2 and 4 times higher than simultaneous measurements from the Prince of Wales Bay station.

These results showed that data from Prince of Wales Bay were not representative of broader upper bound population exposure, and were unlikely to provide useful information on performance and trends of particulate pollution in the Greater Hobart region. Observations of smoke ponding in the northern suburbs suggested that a station located in the New Town area would measure elevated concentrations of PM_{10} typical of surrounding residential suburbs, when temperature inversions and poor smoke dispersion meteorological conditions prevail within the valley. The choice of a site in the New Town area is also supported by recent preliminary TAPM modelling of the greater Hobart airshed, which predicts elevated smoke concentrations in the area (Figure 1-2).

1.4.2 New Town Station

The Environment Division moved the primary *Hobart Performance and Trend Monitoring Station* to New Town in May 2006, on property leased by the Hockey Association of Tasmania, some 2.5km SSE from the original station. The new station incorporates the original TEOM, plus an Andersen RAAS low volume sampler for each of PM_{10} and $PM_{2.5,}$ and provision for installing an integrating nephelometer.

As noted above, the choice of this site is also supported by recent preliminary TAPM modelling of the greater Hobart airshed, which predicts elevated smoke concentrations in the areas illustrated in Figure 1-2.

In order to maintain a level of continuity between the old and new stations, Tasmania intended to retain a high volume air sampler at Prince of Wales Bay for a period of at least 12 months, but the sampler had to be removed in June 2006 after repeated damage by vandals.

Because knowledge of spatial patterns of pollution movement in Hobart is still not well-characterised, a long-term study of particulate distribution using a network of nephelometers installed at the New Town Station and three schools across Greater Hobart will commence in 2007. As nephelometry is not an equivalent method under the NEPM, this data will not be reported for compliance purposes.

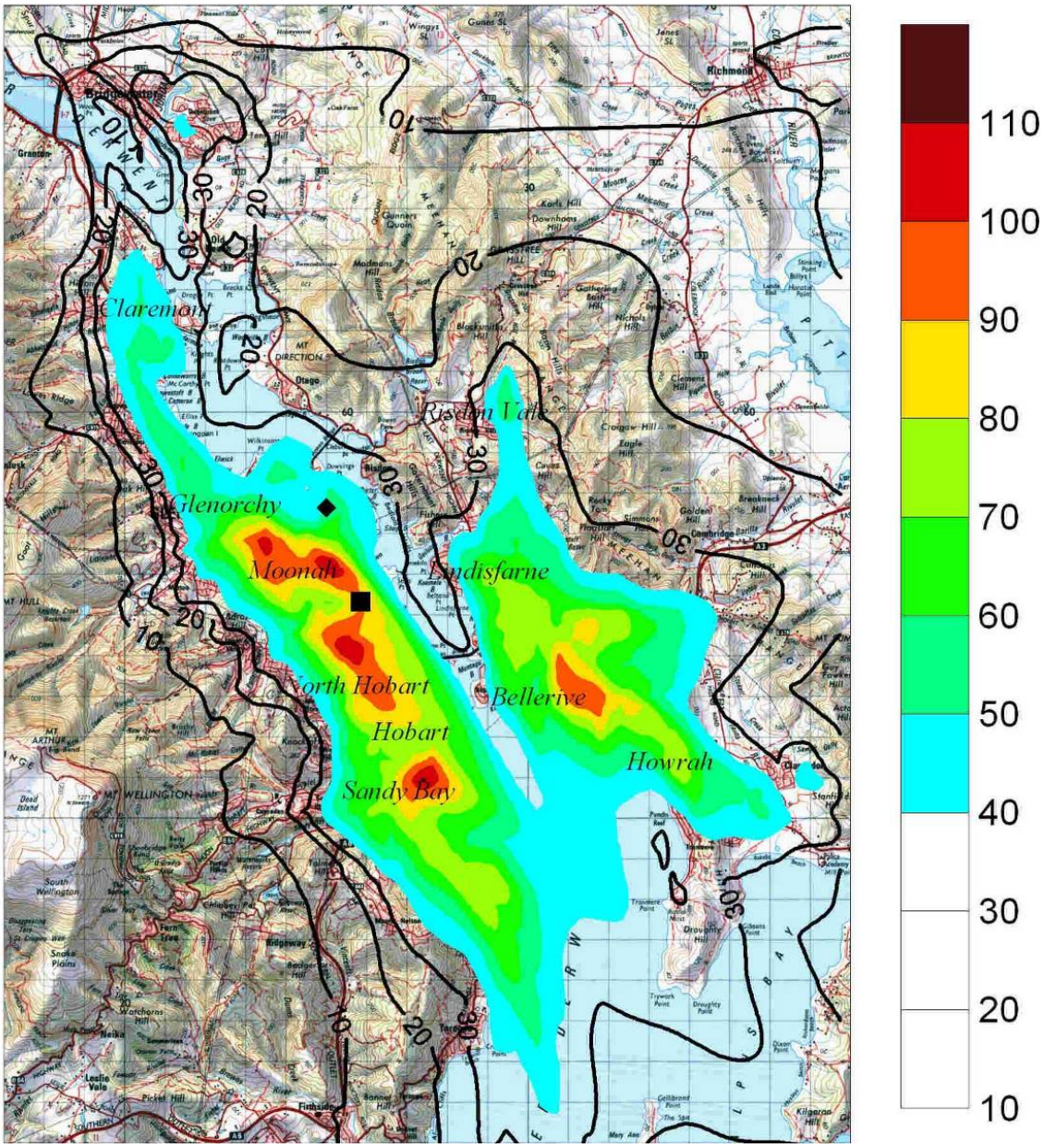

Figure 1-2: Results of preliminary modelling of maximum 24 hr average PM_{10} concentrations in the Hobart region, showing indicative "hot-spots" (in red) for particulates.

2. LAUNCESTON

2.1 REGION BOUNDARIES

Launceston and the Tamar Valley as a whole have been 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 occasionally have a minor impact on air quality in Launceston under unfavourable weather conditions (DPIWE, 1997).

For the purpose of the Measure, the Launceston Region boundaries are defined as presented in Figure 2 and cover an 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, these may be taken to be defined by the south-most corner (Easting 501,250; Northing 5,389,750) and the north-most corner (Easting 498,750; Northing 5,467,250).

2.2 POPULATION AND TOPOGRAPHY

The population density and topography of the Launceston Region is presented in Figure 2-1.

The total population of the Launceston Region as defined in the *Air Monitoring Plan for Tasmania,* and illustrated in Figure 2-1, is approximately 108,000 (ABS 2006). The city of Launceston, is located on the upper reaches of the Tamar River, in a well defined valley that 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 that reach heights of up to 400 m.

Most of Launceston's population of 64,000 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. George Town, near the mouth of the Tamar river, is the second largest urban centre in the region, with a population of 6,700.

2.3 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).

Available data for the Region clearly indicate that high concentrations of particles are 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 are likely to be found in topographic hollows and basins, and on low-lying land.

2.4 LAUNCESTON, TI TREE BEND PERFORMANCE AND TREND MONITORING STATION.

Seasonal PM_{10} measurements using a High Volume Air Sampler have been collected at Ti Tree Bend since 1992, with year round sampling commencing in 1997. The station is located in the grounds of the Launceston Council Waste Water Treatment Plant, on the banks of the Tamar River, some 300 metres from the Launceston Weather Station operated by the Bureau of Meteorology, as illustrated in Figure 2-1. The station was upgraded in March 2002 with the installation of a PM_{10} TEOM, a permanent station building in 2004, and the installation of Andersen RAAS Low Volume Air Samplers (LVAS) for $PM_{2.5}$ and PM_{10} in August 2005, as part of the *Tasmanian Air Quality Monitoring System Development Project, 2004-2008*.

The following indicators were measured at the Ti Tree Bend station in 2006.

- $PM_{2.5}$ measured by Andersen RAAS low volume air sampler (LVAS), according to AS 3580.9.10-2006, sampled every day.

- PM_{10} measured by Andersen RAAS low volume air sampler (LVAS), according to AS 3580.9.9-2006, sampled every day.
- a collocated TEOM direct-reading instrument with a PM_{10} head.
- In addition, comparative studies have been undertaken of DustTrak particle counters against both of the above methods, as part of the Launceston Woodheater Program.
- PM_{10} measurements by High Volume Air Samplers (HVAS) according to AS 3580.9.6-1990 were continued until May 2006, when the programme had to be cancelled by the advanced age and unreliability of the samplers.

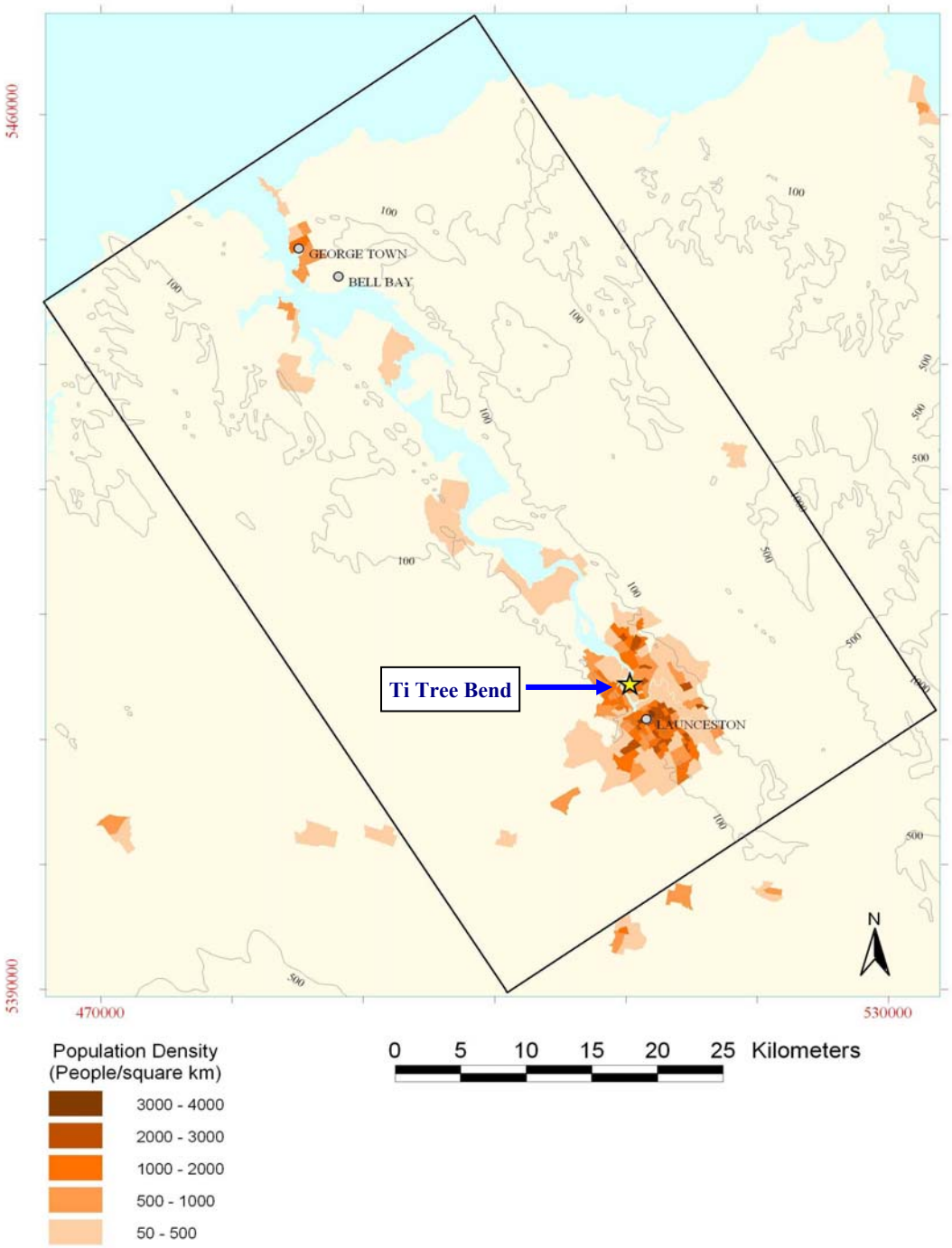

Figure 2-1: Map Of Launceston Region showing the Population Density, Topography and the location of the Air Monitoring Station.

3. DEVONPORT

3.1 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 purpose 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).

3.2 POPULATION AND TOPOGRAPHY

The population density and topography for the Devonport Region is presented in Figure 3-1. The majority of the population resides within approximately a 5 km radius of the CBD. In total, the population of the Devonport Region as defined in the *Air Monitoring Plan for Tasmania* is approximately 33,500 (ABS 2006).

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 METEOROLOGY

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

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

3.4 DEVONPORT PERFORMANCE AND TREND MONITORING STATION

Campaign monitoring of particulates was completed at Devonport in 2003, to assess the need for a permanent station. The results of this survey confirmed that central Devonport experienced elevated levels of PM_{10} air pollution during the winter months, which could exceed the 50µg/m^3 NEPM limit under calm atmospheric conditions. In response to these findings, plans are well advanced to install a monitoring station in the grounds of the Devonport High School in 2007 as part *The Tasmanian Air Quality Monitoring System Development Project, 2004-2008*. The proposed location is in an open space close to the Devonport CBD as shown in Figure 3-1.

Equipment has been acquired to measure the following air quality indicators at the Devonport site:

- $PM_{2.5}$ measured by sequential Low Volume Air Sampler (LVAS), according to AS 3580.9.10 (2006), sampled every day.
- PM_{10} measured by sequential Low Volume Air Sampler (LVAS), according to AS 3580.9.9 (2006), sampled every day.
- a collocated TEOM direct-reading instrument with a PM_{10} head.

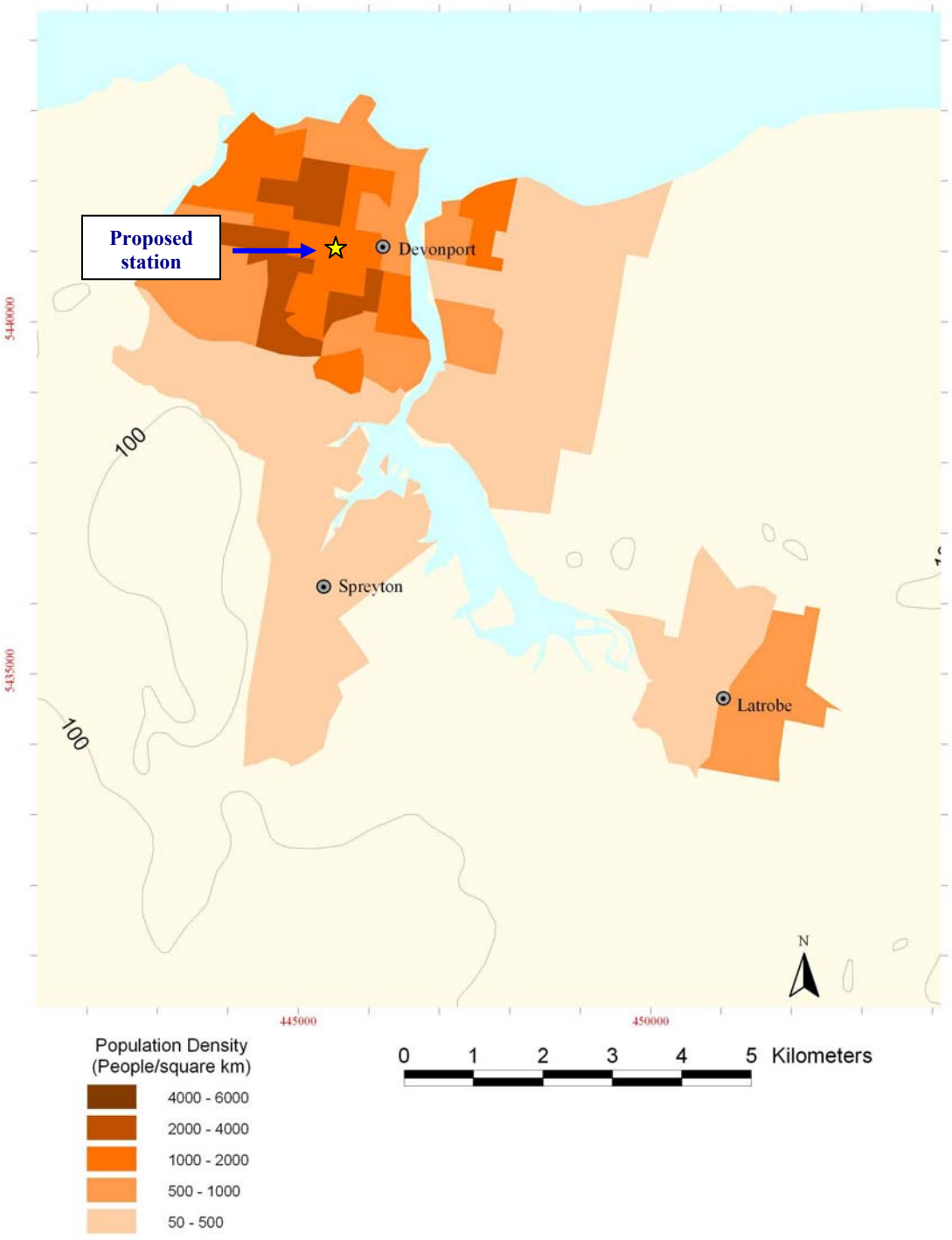

Figure 3-1: Map Of Devonport Region Including Population Density And Topography

4. REFERENCE METHODS

The reference methods specified in Schedule 3 of the *National Environment Protection (Ambient Air Quality) Measure* (2003) for determining PM_{10} particulate concentration in ambient air are:

AS3580.9.6–1990	Determination of Suspended Particulate Matter – PM_{10} High Volume Sampler with Size Selective Inlet – Gravimetric Method.
AS3580.9.7-1990	Determination of Suspended Particulate Matter - PM_{10} Dichotomous Sampler – Gravimetric method

Advances in air sampler technology and the requirement to measure smaller particulate size fractions have seen the widespread adoption of USEPA compliant low volume air samplers as the preferred method for the measurement of PM_{10} and $PM_{2.5}$ in ambient air. These techniques are now recognised by the following Australia/New Zealand standards:

AS3580.9.9–1990	Determination of Suspended Particulate Matter – PM_{10} low volume sampler – Gravimetric Method.
AS3580.9.10-1990	Determination of Suspended Particulate Matter – $PM_{2.5}$ low volume Sampler – Gravimetric method

The Thermo-Electron/Andersen RAAS and Partisol sequential low volume air samplers used by the Environment Division are recognised as the following Manual Reference Methods for $PM_{2.5}$ and PM_{10} monitoring in the USEPA *List of Designated Reference and Equivalent Methods* (www.epa.gov/ttn/amtic/criteria.html):

Air Sampler	**Size**	**USEPA Approval No.**
Andersen Model RAAS10-300	PM_{10}	*Manual Reference Method* RFPS-0699-132
R&P Partisol®-Plus Model 2025	PM_{10}	*Manual Reference Method* RFPS-1298-127
Thermo-Electron Model RAAS2.5-300	$PM_{2.5}$	*Manual Reference Method* RFPS-0699-132
R&P Partisol®-Plus Model 2025 FEM	$PM_{2.5}$	*Manual Reference Method* RFPS-1298-145

Where practicable, the daily average PM_{10} concentrations measured by an approved High Volume or Low Volume air sampler were used for the purposes of determining compliance with the NEPM Standard. In the absence of validated air sampler data, the daily average PM_{10} measurement from the TEOM was used, with the following empirical temperature adjustment developed for Tasmanian conditions.

Adjusted PM_{10} = Measured PM_{10} x Temperature Correction Factor [TCF]

Where	TCF	=	1.00	For 24 hr average temperature $[T_{24}] >/= 15°C$
			$1.00 + (15 - T_{24}) / 15$	$0°C < T_{24} < 15°C$
			2.00	When $T_{24} =< 0°C$

5. PROGRESS TOWARDS NATA ACCREDITATION

During 2006, the Environment Division of the Tasmanian Department of Tourism Arts and the Environment (DTAE) completely revised and upgraded the Air Monitoring Quality System to comply with the requirements of ISO:17025, as part of its commitment to achieving NATA Accreditation for the Ambient Air Monitoring Programme. These changes included:

- The preparation of an ISO:17025 compliant Quality Manual.
- Revision of all operating and calibration protocols, especially those associated with the measurement of PM_{10} and $PM_{2.5}$ airborne particulates using LVAS according to AS 3590.9.10 (2006).
- Staff training in NATA Quality System workshops
- The institution of a full document control system including;
  - Approved calibration and operation procedures,
  - Test forms
  - Technical Records and
  - Staff Training records
- Revision and upgrading of instrument Service and Calibration schedules
- External calibration of all critical test equipment (*e.g.* Flow meters, balances, temperature, pressure and humidity sensors) by NATA accredited measurement laboratories to ensure traceability to national and international standards.

An external audit of the Air Monitoring Programme by an accredited NATA inspector is scheduled for early July 2007.

6. SITING CRITERIA FOR AIR QUALITY MONITORING STATIONS

The following Australian Standards were used to select appropriate locations for Tasmania's air quality monitoring stations in Hobart and Launceston.

6.1 APPLICABLE AUSTRALIAN STANDARDS

1. AS2922 (Guide for siting of sampling)
   Critical criteria for location of sampling site.
   (i) Hg = Height of sampling inlet above ground. (2 to 5 m)
   (ii) Ho = Height of nearby obstacle above sampling inlet
   (iii) D = Horizontal Distance to nearby obstruction - typically >20 m.
   (iv) 120^0 = Minimum clear sky angle above sampling inlet
2. AS2923 (Ambient Air- Guide for the Measurement of Wind).
   Critical criteria for placement of 10 m meteorological tower
   Recommended minimum distance from obstruction = 10 x H
   Where H = Height of obstruction

6.2 COMPLIANCE WITH APPLICABLE STANDARDS

(i) New Town Air Quality Monitoring Site, Hobart

The Air Monitoring Station is located in a corner of an old jam factory site at 0 Bell St, New Town, which is currently used as a hockey complex. This air monitoring site has several obstructions within critical distances.

AS2922 (*Guide for siting of sampling*)

No.	Obstruction Description	Distance D (m)	H_o (m)	$2 H_o \leq D$	120^0 Sky Angle
1	Power Pole [1]	**3**	**7.6**	Does not comply	Does not comply
2	Met Mast [1]	**6**	**6.6**	Does not comply	Does not comply
3	Brick Wall	**15**	**-1**	Complies	Complies
4	Chimney	**50**	**22.6**	Complies	Complies

AS2923 (Ambient Air- Guide for the Measurement of Wind).

No.	Obstruction Description	Distance (m)	Height (m)	D > 20m	D > 10H
1	Power Pole [1]	**5**	**11**	Does not comply	Does not comply
2	Brick Wall	**13**	**2.4**	Does not comply	Does not comply
3	Chimney	**47**	**26**	Complies	Does not comply

Note 1. The power pole and meteorological masts are integral parts of the air monitoring station, and do not have a significant effect on air flow to the samplers and meteorological instruments.

6.2 COMPLIANCE WITH APPLICABLE STANDARDS (continued)

(ii) Ti-Tree Bend Air Quality Monitoring Site, Launceston.

The Launceston Ambient Air Quality Monitoring Station is located within the grounds of the Launceston City Council Waste Water Treatment Plant at Ti-Tree Bend. The station building and instruments are located besides the 4 settling lagoons away from the built-up area of the sewage treatment plant.

AS2922 (*Guide for siting of sampling*)

No.	Obstruction Description	Distance D (m)	H_o (m)	$2 H_o \leq D$	120^0 Sky Angle
1	Met Mast [1]	**8**	**6.6**	Does not comply	Does not comply
2	Tree 1	**27**	**4**	Complies	Complies
3	Shed 1	**30**	**1.6**	Complies	Complies
4	Shed 2	**50**	**1.6**	Complies	Complies

AS2923 (Ambient Air- Guide for the Measurement of Wind).

No.	Obstruction Description	Distance (m)	Height (m)	D > 20m	D > 10H
1	Tree 1	**38**	**8**	Complies	Does not comply
2	Shed 1	**22**	**5**	Complies	Does not comply
3	Shed 2	**55**	**5**	Complies	Complies

Note 1. The meteorological mast is an integral part of the air monitoring station, and does not have a significant effect on air flow to the samplers and meteorological instruments.

SECTION B – ASSESSMENT OF COMPLIANCE WITH STANDARDS AND GOALS

The monitoring results from 1st January 2006 to 31st December 2006, at Tasmanian Performance Monitoring stations are presented in Table 1.

Table 1: Summary of Performance Against Standards for PM_{10} and $PM_{2.5}$ at Tasmanian Monitoring stations for the 2006 calendar year.

Region/Performance Monitoring Station	Data Availability Rates (% of days for sampling regime)					No. of Exceedences		Performance Against Standard and Goal
Hobart: [Notes 1 & 3] **Prince of Wales Bay**	***Q1***	***Q2***	***Q3***	***Q4***	***Annual***	***Period***	***No.***	
PM_{10} (All instruments)	60	35	0	0	24	24 hour	0	***NOT DEMONSTRATED*** [See Note 6 below]
- HVAS (alternate days)	41	35	0	0	19	24 hour		
- TEOM [2] & [3]	31	0	0	0	8	24 hour		
$PM_{2.5}$ [Reporting Standard only]	No Data. Monitoring commenced at New Town site from May 2006					24 hour	N/A	
						Annual	N/A	
Hobart: New Town [4]	***Q1***	***Q2***	***Q3***	***Q4***	***Annual***	***Period***	***No.***	
PM_{10} (All instruments)	0	78	100	100	70	24 hour	0	***NOT DEMONSTRATED*** [See Note 6 below]
- LVAS (every day) [5]	0	0	50	83	33	24 hour		
- TEOM [2] & [3]	0	77	99	94	68	24 hour		
$PM_{2.5}$ *Reporting Standard only*								***NOT DEMONSTRATED*** [See Note 6 below]
- LVAS (every day)	0	23	69	99	55	24 hour	2	
	Average annual $PM_{2.5}$ conc. = 7.2 µg/m^3					Annual		
Launceston: Ti Tree bend	***Q1***	***Q2***	***Q3***	***Q4***	***Annual***	***Period***	***No.***	
PM_{10} (All instruments)	100	100	100	92	98	24 hour	6	***NOT MET***
- HVAS (alternate days)	40	23	0	0	16	24 hour		
- LVAS (every day)	100	85	61	84	82	24 hour		
- TEOM(2)	98	96	95	84	93	24 hour		
$PM_{2.5}$ *Reporting Standard only*								***NOT MET***
- LVAS (every day)	98	98	99	84	95	24 hour	36	
	Average annual $PM_{2.5}$ conc. = 10.4 µg/m^3					Annual		***NOT MET***
Devonport: Devonpt High School PM_{10}	Station under construction. Scheduled to begin operation in late 2007 No data					24 hour	N/A	

Notes: **1.** Site considered not representative of population exposure. Station moved in May 2006 (see text)

2. Temperature adjusted using local model according to Technical Guidance Paper 10

Adjusted PM_{10} = Measured PM_{10} x Temperature Correction Factor [TCF]

Where TCF = 1.00 For 24 hr average temperature [T_{24}] >/= 15°C
1.00 + (15 - T_{24}) / 15 0°C < T_{24} < 15°C
2.00 When T_{24} =< 0°C

3. Data collected for less than a full year

4. Prince of Wales Bay station closed May 2006

5. TEOM moved from POW Bay to New Town 21/4/2006, LVAS installed New Town 21/4/2006

6. The compliance with the PM_{10} standard or the $PM_{2.5}$ reporting standard was not demonstrated because the overall data capture for the first two quarters was less than 75%, due to relocation of the station and equipment failures.

SECTION C – ANALYSIS OF AIR QUALITY MONITORING

1. HOBART

The results of monitoring at Prince of Wales Bay are could not demonstrate compliance with the NEPM Standards for $PM_{2.5}$ or PM_{10}, as data was collected for less than 272 days (75%) of the year, due to the station changeover and equipment failures in the first half of 2006. However, no exceedences of the PM_{10} Standard were recorded at either Prince of Wales or New Town station during the year (Tables 2 & 3).

As noted previously, particulate concentrations measured at Prince of Wales Bay are not considered to be representative of general population exposure and, as a result, the primary station was re-located to New Town in May 2006. The high volume sampler continued to be operated at the Prince of Wales Bay site until May 2007, when the station had to be closed due to persistent vandalism.

An automated sequential low volume air sampler for $PM_{2.5}$ was installed in New Town in June 2006 and a PM_{10} sampler in August 2006.

The 24 hour $PM_{2.5}$ concentration was observed to exceed the 25µg/m^3 reporting limit on two (2) days during July 2006.

The annual average $PM_{2.5}$ concentration for 2006 was 7.2µg/m^3 but compliance with the NEPM $PM_{2.5}$ annual reporting limit of 8µg/m^3 could not be demonstrated as data was collected for less than 272 days (75%) of the year.

Table 2: Exceedences of PM_{10} Standard during 2006 at Prince of Wales Bay, Hobart, with Attribution of Cause.

Date	HVAS (µg/m^3)	24 Hour TEOM (µg/m^3)	Mean Temp (^{o}C)	Reason
NO EXCEEDENCES RECORDED				

Table 3: Exceedences of PM_{10} Standard during 2006 at New Town, Hobart, with Attribution of Cause.

Date	LVAS (µg/m^3)	24 Hour TEOM (µg/m^3)	Mean Temp (^{o}C)	Reason
NO EXCEEDENCES RECORDED				

Table 4: Exceedences of $PM_{2.5}$ 24-Hour Reporting Standard in 2006 at New Town, Hobart, with attribution of causes (In descending order of concentration).

National Environment Protection (Reporting) Standards: 25 µg/m^3 24 hour average
8 µg/m^3 annual average

Date	LVAS $PM_{2.5}$ (µg/m^3)	TEOM PM_{10} (µg/m^3)	Mean Temp (^{o}C)	Reason
1. 24/07/2006	30	42	7.0	Cold weather with wood smoke
2. 28/07/2006	28	34	6.9	Cold weather with wood smoke

2. LAUNCESTON

Results for Ti Tree Bend show that the Air Quality in Launceston did not comply with the NEPM Standard and Goal for PM_{10} during 2006 (see Table 5), with 6 days where the daily average PM_{10} concentration exceeded 50 µg/m^3. Three of these exceedence events have been attributed to winter woodsmoke built up under still atmospheric conditions, and three to smoke from widespread bushfires in Tasmania and Victoria.

2006 is the first year where $PM_{2.5}$ monitoring data has been available for Launceston covering the full year. These data show that the annual average $PM_{2.5}$ concentration [10.4 µg/m^3] for 2006 exceeds the reporting standard of 8 µg/m^3. The 24 hour average $PM_{2.5}$ concentration exceeded the Reporting Standard of 25 µg/m^3 on 36 days during 2006 (see Table 6).

Table 5: Exceedences of PM_{10} standard at Ti Tree Bend, Launceston in 2006, with attribution of causes (In descending order of concentration).

National Environment Protection Standard: 50 µg/m^3 (24 hour average)

Date	LVAS PM_{10} (µg/m^3)	Corr. TEOM (µg/m^3)	Mean Temp (^{o}C)	LVAS $PM_{2.5}$ (µg/m^3)	Reason
1. 28/11/2006	87	85	17.5	23	Dust and Bushfire smoke
2. 10/12/2006	59	62	22.6	44	Strong winds and bushfires
3. 14/12/2006	54	64	15.8	40	Bushfire smoke
4. 07/08/2006	54	49	4.8	33	Temp. inversion with smoke
5. 20/06/2006	53	57	5.0	39	Temp. inversion with smoke
6. 08/06/2006	No Data	53	4.7	36	Temp. inversion with smoke

Note. The 24-hour average PM_{10} concentration from the TEOM was adjusted for the loss of volatiles from the heated TEOM filter using an empirical local temperature correction model developed according to Technical Guidance Paper 10

Adjusted PM_{10} = Measured PM_{10} x Temperature Correction Factor [TCF]

Where TCF = 1.00 For 24 hr average temperature [T_{24}] >/= 15°C

= 1.00 + (15 - T_{24}) / 15 where 0°C < T_{24} < 15°C

= 2.00 When T_{24} =< 0°C

Table 6: Exceedences of $PM_{2.5}$ 24-Hour Reporting Standard at Ti Tree Bend, Launceston, with attribution of causes (In descending order of concentration).

National Environment Protection (Reporting) Standards: 25 μg/m^3 for 24 hours
8 μg/m^3 annual average

Date	LVAS $PM_{2.5}$ (μg/m^3)	PM_{10} (μg/m^3)	Mean Temp (^{o}C)	Reason
1. 10/12/2006	44	59	22.6	Strong winds with bushfire smoke
2. 17/06/2006	40	48	4.9	Temperature inversion with smoke
3. 14/12/2006	40	54	15.8	Bushfire smoke
4. 20/06/2006	39	53	5.0	Temperature inversion with smoke
5. 08/06/2006	36	53	4.7	Temperature inversion with smoke
6. 27/05/2006	36	38	7.7	Temperature inversion with smoke
7. 12/06/2006	35	41	4.8	Temperature inversion with smoke
8. 07/06/2006	34	44	5.9	Temperature inversion with smoke
9. 07/08/2006	33	54	4.8	Temperature inversion with smoke
10. 09/06/2006	33	41	5.2	Temperature inversion with smoke
11. 13/07/2006	32	41	4.8	Temperature inversion with smoke
12. 01/08/2006	32	47	6.2	Temperature inversion with smoke
13. 18/06/2006	32	37	4.3	Temperature inversion with smoke
14. 19/06/2006	32	45	5.1	Temperature inversion with smoke
15. 29/06/2006	32	41	7.5	Smoke
16. 06/08/2006	31	47	7.4	Smoke
17. 28/06/2006	31	40	3.7	Temperature inversion with smoke
18. 13/06/2006	31	35	4.8	Temperature inversion with smoke
19. 18/05/2006	30	41	9	Smoke
20. 25/06/2006	30	35	3.6	Temperature inversion with smoke
21. 06/06/2006	30	44	5.6	Temperature inversion with smoke
22. 28/07/2006	30	40	7.8	Smoke
23. 31/05/2006	30	43	8.2	Smoke
24. 15/05/2006	30	36	8.9	Smoke
25. 05/06/2006	29	46	3.6	Smoke
26. 22/07/2006	29	38	6.8	Smoke
27. 14/07/2006	29	40	6.1	Smoke
28. 12/05/2006	29	31	7.9	Smoke
29. 28/04/2006	28	40	11.3	Smoke?
30. 03/08/2006	28	40	8.9	Smoke?
31. 28/05/2006	27	35	7.1	Smoke?
32. 02/08/2006	27	37	5.8	Temperature inversion with smoke
33. 21/07/2006	27	37	5.4	Temperature inversion with smoke
34. 14/08/2006	26	41	9.0	Smoke?
35. 11/05/2006	26	30	6.1	Smoke?
36. 29/04/2006	25	29	14.1	Smoke?

3. DEVONPORT

No data is available. A new PM_{10} station is due to be established at Devonport High School by the end of 2007 in response to the results of monitoring undertaken there in 2003.

SECTION D – DATA ANALYSIS

1. HOBART:

As discussed earlier, the status of the Prince of Wales Bay Performance and Trend station was reviewed in 2004, and the station was relocated in May 2006 to the new site in New Town. The details of the re-location are contained in the amended Tasmanian Air Monitoring Plan, submitted to the Peer review Committee in May 2005.

The assessment of compliance of Hobart's ambient air quality with the PM_{10} standard was based on high volume air samples on alternate days and TEOM data at the Prince of Wales Bay station until 24 April 2006. At that time the TEOM was moved to the New Town site and the high volume air sampler continued to operate on alternate days at the Prince of Wales Bay station until the station had to be closed on 14 June 2006.

Andersen RAAS sequential Low Volume air samplers for $PM_{2.5}$ and PM_{10} measurements were installed at the New Town station in June 2006, as they are now a recognised method for gravimetric PM_{10} and $PM_{2.5}$ measurements under AS 3580.9.9 and AS 3580.9.10 (2006). Validated $PM_{2.5}$ data are available from 5 June 2006, but validated PM_{10} data was not available until 11 August 2006. In the 8 week interval when no PM_{10} sampler was operating in Hobart, the compliance for Hobart's ambient air quality was assessed using the TEOM data from the New Town station with the local temperature correction detailed in Table 1.

No daily average PM_{10} concentrations exceeding 50µg/m^3 were recorded at the Prince of Wales Bay and New Town Performance and Trend stations in 2006, but the overall data availability was not sufficient to demonstrate that Hobart's air quality complied with the NEPM standard for PM_{10}.

The daily average $PM_{2.5}$ concentration measured at New Town from 5 June to the end of the year, and exceeded the 25µg/m^3 reporting limit on two days in July 2006.

2. LAUNCESTON

A TEOM with a PM_{10} size selective inlet, and Andersen Reference Ambient Air Samplers (RAAS) for PM_{10} and $PM_{2.5}$ were collocated at the Launceston station for the whole year. The two obsolescent PM_{10} HV air samplers, which had been in service since 1992, had reached the end of their working life, and were decommissioned in early 2006. Exceedences of the NEPM PM_{10} air quality standard were determined using the data from the Andersen RAAS low volume sampler, as is an approved method for PM_{10} measurements under AS 3580.9.9 (2006).

Air Quality in Launceston, as measured at Ti Tree bend has consistently been out of compliance with the PM_{10} Standard since commencement of monitoring in 1997. However, the overall air quality has improved dramatically over recent years, with only six (6) exceedences of the National Environment Protection Standard for PM_{10} in 2006, compared with 13 exceedences in 2005, and 50 in 1997, as illustrated in Figure 3-2.

In contrast to previous years, only three (3) of the PM_{10} exceedences occurred in the autumn and winter period when temperature inversions can lead to high levels of fine particulate pollution from trapped wood smoke. The remaining three exceedences were directly attributed to smoke from large bushfires burning in Tasmania and Victoria during November and December 2006.

The $PM_{2.5}$ data indicate that Launceston still experiences relatively high levels of fine particulate pollution, with the daily average $PM_{2.5}$ concentration measured at Ti Tree Bend exceeding the 25µg/m^3 reporting standard on 36 days during the year. Two (2) of these events occurred in the summer and were associated with the bushfires burning at the time.

Further analysis of the data showed that the remaining 34 $PM_{2.5}$ exceedence events occurred during late autumn and winter, with 31 (90%) occurring on days when the minimum air temperature recorded at the TEOM inlet was below 4°C. These events included 24 days (66%) with air temperatures below 2°C and 16 days with temperatures below 0°C. These weather conditions are usually associated with temperature inversions which prevent the effective dispersion of the locally generated wood smoke and industrial particulates.

3. DEVONPORT

The winter monitoring campaign in Devonport during winter 2003 showed that the local air quality is adversely affected by particulate pollution and may not comply with the NEPM goal. It is planned to establish a PM_{10} monitoring station at Devonport High School by the end of 2007.

4. STAISTICAL SUMMARY

The statistical summary of the $PM_{2.5}$ and PM_{10} data collected in Tasmania during 2006 against the National Environment Protection Measure for Air Quality is listed in Table 6 below.

Table 6: 2006 Summary Statistics for PM_{10}

National Environment Protection Standard: 50 µg/m³ (24 Hour Average)

Pollutant	Number of Valid days	Highest		6th Highest		Percentiles [µg/m³]		
		µg/m³	Date	µg/m³	Date	98th	95th	90th
POW Bay, Hobart								
HV Air Sampler (alternate days)	69	37	01/06/2006	28	22/01/2006	29	28	26
TEOM - Measured	29	31	27/01/2006	20	10/01/2006	30	26	23
- Corrected	29	31	27/01/2006	21	15/01/2006	30	26	23
New Town, Hobart								
LV Air Sampler [1]	122	47	10/12/2006	29	12/08/2006	36	29	19
TEOM - Measured	244	45	10/12/2006	31	20/12/2006	32	27	21
- Corrected	244	51	03/07/2006	40	09/12/2006	42	35	32
Ti Tree Bend, Launceston								
HV Air Sampler	57	50	18/05/2006	35	28/05/2006	47	40	35
TEOM - Measured	355	86	28/11/2006	57	27/11/2006	53	31	27
- Corrected	355	86	28/11/2006	57	27/11/2006	57	44	37
LV Air Sampler	300	87	28/11/2006	54	07/08/2006	54	41	36
Devonport High School, Devonport	Monitoring scheduled to commence by end of 2007							

Note 1. The data sets for the PM_{10} statistics for LV sampler and TEOM at New Town station are not the same. The LV air sampler was only operating for the last 4 months of the year (September – December), while the TEOM was operating for 8 months from early May.

Table 7: 2005 Summary Statistics for $PM_{2.5}$

National Environment Protection (Reporting) Standards: 25 µg/m³ (24 Hour Average); 8µg/m³ (Annual Average)

Pollutant	Number of Valid days	Highest		6th Highest		Percentiles [µg/m³]		
		µg/m³	Date	µg/m³	Date	98th	95th	90th
New Town, Hobart LV Air Sampler	200	30	24/07/2006	22	22/07/2006	23	21	16
Ti Tree Bend, Launceston LV Air Sampler	345	44	10/12/2006	36	27/05/2006	35	31	26

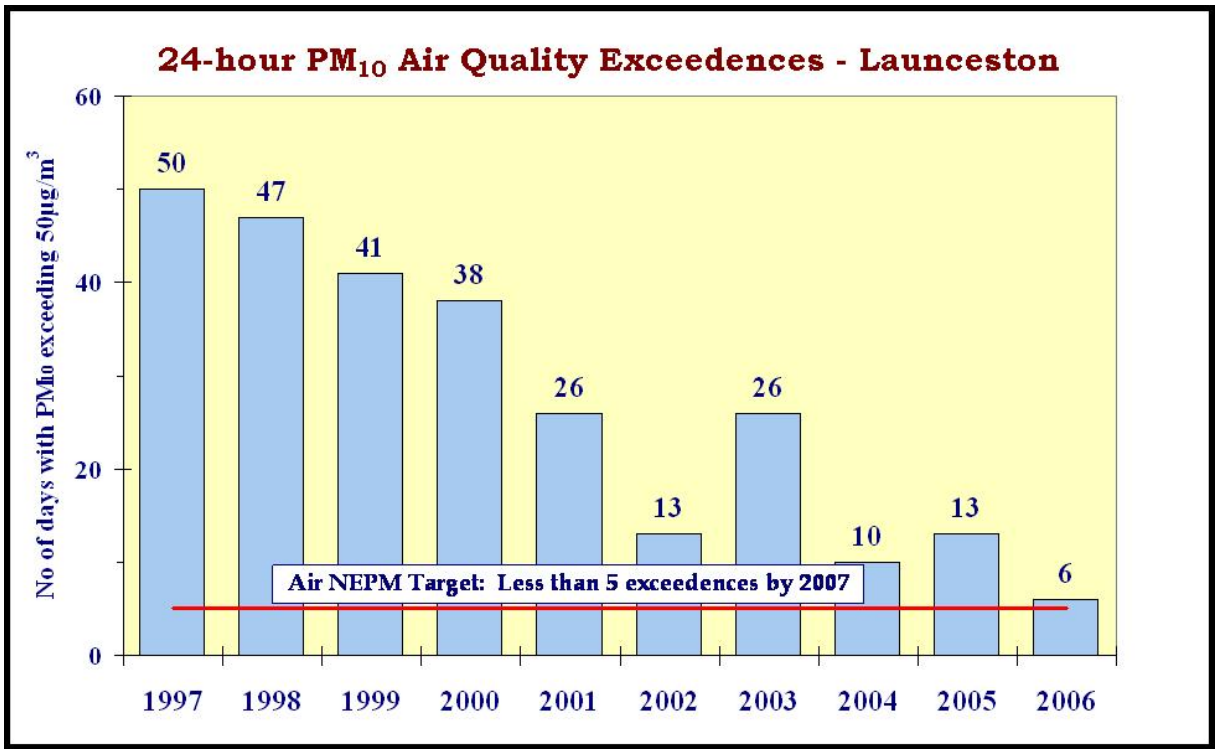

Figure 3-2: Annual exceedences of the PM_{10} Standard at Launceston for 1997 to 2005

NOTE: The development of the Tasmanian Air Quality Database has allowed the air density corrections for the historical high volume air sampler data to be recalculated using the observed meteorological data for the measurement period. This has resulted in some revision of the historical PM_{10} concentrations and the number of exceedences for past years.

SUMMARY OF ACHIEVEMENTS AND FUTURE DIRECTIONS

The Tasmanian Government has several programmes in place to assess compliance with the Air NEPM and to achieve progressive improvement in air quality towards meeting the Air NEPM Goals throughout the state.

These include:

- The Environment Protection Policy (Air Quality) 2004 came into force on 1 June 2005. The Policy includes specific reference to meeting the requirements of the Air NEPM through regulation of industry and management of diffuse sources and planned burning activities.
- New Regulations, titled *Distributed Atmospheric Emissions*, have been developed, and are aimed at controlling the manufacture, import and sale of solid fuel heaters, creating an offence for emission of excessive smoke and restricting backyard burning in Tasmania. Three workshops for local government officers were conducted in April 2007. The workshops detailed how the regulations are likely to function and the role the officers will take as agents of the main regulating body.
- The *Tasmanian Air Quality Strategy* was released by the Minister for Tourism, the Arts and Environment, Hon Paula Wriedt on 5 June 2006. The five-year Strategy includes programs to further reduce domestic and industrial emissions of fine particles in critical regions of the State, while maintaining a balance with economic growth and social equity issues, particularly relating to home energy use and conservation.
- The Tasmanian Government has provided funding of $816,000 over the period 2004 to 2008 to develop a monitoring capability for $PM_{2.5}$ particles as required in the amendment to the Air NEPM (May 2003), and upgrade existing PM_{10} monitoring. The new system is in operation at Hobart and Launceston and will be extended to Devonport in late 2007, in line with the *Amended Tasmanian Air Monitoring Plan 2005*.
- The Australian Government-funded Launceston Woodheater Replacement Program replacement Scheme ceased in May 2004. This was a joint project between local, State and national governments, managed through the Launceston City Council and directly resulting in removal of some 2200 woodheaters from the airshed. However, many more were also replaced during the three-year program and it is likely that some of these were an indirect result of the education component of the program. The education program is continuing in Launceston as part of the Tamar Valley Air Quality Strategy developed by councils in the Valley, with input from the Environment Division.
- The Department initiated a radio advertising campaign during winter 2006 to encourage woodheater users to improve the operation of their heaters.
- A pilot air monitoring education program using two nephelometers and a DustTrak is also underway in three schools in the Greater Hobart area. A consultant has been contracted to work with the teachers to develop teaching and learning materials on air quality issues using the data collected at each of the schools. These Materials will be incorporated into school curricula and will be made available for other schools to implement.
- A Partnership Agreement has been signed between the State Government and several individual Tasmanian Councils. These agreements are designed to reflect the desire of both parties for improved cooperation between the State and Local Governments. The parties aim to work together to identify new opportunities to promote and implement environmental policies and practices. The councils which currently have a partnership agreement with the State Government dealing with improving air quality include: Launceston City Council, Hobart City Council and Region North.

- Establishing an ambient air monitoring station at George Town in the upper Tamar Valley, as a cooperative project between the Industry, State and Local Government. This is a non-NEPM station established to provide valuable information about the air quality in George Town, which is the second largest population centre in the Tamar Valley, and situated adjacent to the heavy industrial area of Bell Bay and the Port of Launceston near the mouth of the Tamar River.

  This station, which is scheduled to be commissioned in July 2007, will measure the following air quality parameters.

  - $PM_{2.5}$ measured by a sequential Low Volume Air Sampler (LVAS), according to AS 3580.9.10 (2006) sampled every day.
  - PM_{10} measured by a sequential Low Volume Air Sampler (LVAS), according to AS 3580.9.9 (2006) sampled every day.
  - Particle count and size distribution, measured by a 180 Grimm continuous optical particle counter – 10 minute average data
  - Sulphur Dioxide – 10 minute average data
  - Oxides of Nitrogen – 10 minute average data
  - Poly Aromatic Hydrocarbons measured by a high volume 6-day PUF sampler
  - Meteorology using a Vaisala MAWS-300 automatic weather station.
- A Tamar Valley air Monitoring Project to measure background levels of air pollutants in the central Tamar Valley in the vicinity of the proposed pulp mill. This is a non-NEPM project that includes the following air quality monitoring equipment:
  - A network of 11 Level 1 stations distributed along the valley, measuring the following parameters:
    - PM_{10} using Microvol (1 l\Litre/minute) air samplers – 7 day samples
    - Sulphur dioxide using passive adsorption tubes – 14 day average.
    - Oxides of Nitrogen using passive adsorption tubes – 14 day average.
    - Meteorology
  - A Level 2 station near the township of Rowella in the central Tamar Valley, measuring air quality parameters including:
    - $PM_{2.5}$ using a Tapered Element Oscillating Microbalance (TEOM)
    - PM_{10} using a Tapered Element Oscillating Microbalance (TEOM)
    - Sulphur Dioxide – 10 minute average data
    - Oxides of Nitrogen – 10 minute average data
    - Poly Aromatic Hydrocarbons measured by a high volume PUF sampler
    - Meteorology.
- The Environment Division of The Department of Tourism, Arts and the Environment has submitted a proposal for funds to purchase and operate mobile facilities to monitor $PM_{2.5}$ and PM_{10} in selected smaller communities in Tasmania.
- The Environment Division is working with the National Woodheater Reference Group to ensure a national certification system will be in place for wood heaters, and the Australian Standard is revised to include a reduced particulate emission standards and to include an efficiency standard.

- The Environment Division is actively working with interested stakeholders to reduce the impact of planned burning operations on air quality by ensuring that the forestry practices regulatory system is used to enforce best practice smoke management procedures in forestry operations. The Division is also committed to partial funding of a research project on the health effects of planned burning.
- Funding is also currently being sought to implement a state-wide domestic heating survey together with a comprehensive review and collation of stack-test emission results for industry throughout the state. This information will be used to improve the predictive capability of dispersion modelling undertaken by the Environment Division and may enable some Tasmanian cities to be included in the Australian Air Quality Forecasting System administered by the Bureau of Meteorology.