Commissioner for Environmental Sustainability

Framework for State of Environment Reporting

August 2005

Victoria
The Place To Be

The Role of the Commissioner for Environmental Sustainability

The Commissioner is an independent statutory appointment. The inaugural Commissioner for Environmental Sustainability in Victoria, Dr Ian McPhail AM was appointed in 2003 under the *Commissioner for Environmental Sustainability Act* 2003 (the Act) and reports directly to the Minister for Environment.

The Commissioner has a number of clearly defined statutory roles, which are to report on the natural environment, encourage ecologically sustainable development (ESD), enhance knowledge and understanding of environmental issues and encourage sound environmental practices across government (State of Victoria, 2003, s.7).

These roles will be delivered through a number of statutory functions, including preparation of a report on the state of the environment of Victoria; conducting annual audits of environmental management systems implemented by government agencies and public authorities; advising the Minister on the effectiveness of public education programs relating to ESD; and advising the Minister on other matters relating to ESD (State of Victoria, 2003, s.8).

In undertaking the above functions, the Commissioner must have regard for a number of principles that are outlined in s.10 of the Act, including:

- the effective integration of economic, social and environmental considerations with the need to improve community well-being and the benefit of future generations;
- that actions should add value and be targeted to achieving the most benefit for the people of Victoria;
- that decision-making should focus on developing solutions and achieving improvements; and
- the need to ensure impartiality, openness, transparency and accountability.

Achieving ESD is central to all of the Commissioner's functions and is defined under s.4 of the Act as "development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends". The Act details a number of objectives and guiding principles that further define the concept of ESD, including the protection of biodiversity and the maintenance of essential ecological processes and life support systems; equity within and between generations; safeguarding the welfare of future generations; and the precautionary principle, which states that lack of full scientific certainty should not be reason for postponing measures to prevent environmental degradation where there are threats of serious or irreversible environmental damage.

Other important principles include integration of short and long-term economic, environmental, equity and social considerations; the need to consider the global dimension of environmental impacts stemming from our actions and policies; and the need to develop a strong, growing and diversified economy that can enhance our capacity for environmental protection.

Foreword

Improving our knowledge and understanding of the natural environment is the first step to achieving environmental sustainability. State of environment reporting provides a significant opportunity to enhance our knowledge and understanding and to inform actions for better management.

Traditionally, state of environment reports are large bound documents full of facts and figures which, by the time of publication, are often out of date. Innovative ways of delivering and communicating on the state of environment report are critical if we are to raise awareness, enhance understanding and assist decision-making. I am delighted to be asked to prepare this report, which I see as being at the cutting edge of developments in environmental reporting.

The first important statutory requirement in the preparation of a state of environment report for Victoria is the development of a framework for approval by the Minister for Environment. To develop this framework I have consulted with the public and with key stakeholders, including government, industry, business and non-government organisations. The feedback I received was extremely helpful and has assisted in shaping the scope of the report.

I am very pleased to provide this framework, which will guide the development of Victoria's State of Environment report. It outlines an innovative way of understanding the condition and trends of the natural environment within the context of social, cultural and economic factors.

We all have a role in affecting environmental change. The choices we make as producers and consumers of goods and services drive a range of pressures on the environment, many of which are not sustainable. Recognising this, the scope of the framework includes an analysis of the drivers that create environmental change, the direct pressures contributing to the current condition and trends in the natural environment, the implications for our quality of life and the effectiveness of current management responses. This analysis will inform the development of my recommendations for specific actions and future directions required to move Victoria towards environmental sustainability.

My vision as Commissioner for Environmental Sustainability is a future where all Victorians are living well within our environment. To advance this goal it is essential to have a timely and in-depth understanding of the environment, which I believe will be assisted through the implementation of this framework for state of environment reporting.

Dr Ian McPhail
Commissioner for Environmental Sustainability

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For further information contact the Office the Commissioner for Environmental Sustainability.

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Part 1: Introduction

1.1 Background to State of Environment Reporting

Over recent decades the global community has become increasingly conscious of its fundamental dependency on ecosystem services[1] for air, water, food and other resources, and its simultaneous impact on these same ecosystems through the pressures of population growth, resource consumption and the emission of waste to air, land and water. Perhaps of most significance is the growing appreciation of the limits of the natural environment. It is this awareness that has driven the emergence and rapid growth of environmental reporting in an effort to improve understanding of the environment, to monitor its health and as a tool to ensure its protection for present and future generations.

State of Environment (SoE) reporting is essentially a tool for communicating useful and relevant information about the condition of the environment and pressures acting upon it, to the public, government, industry and non-government organisations (Office of the Commissioner for Environmental Sustainability 2005). The purpose of this information is to raise awareness and understanding of the environment and to assist decision-making by highlighting the cumulative environmental impacts of natural events and human activities, identifying emerging trends and highlighting the actions needed to improve the management of our environment for long-term environmental sustainability.

SoE reporting has been undertaken at both national and State levels in Australia for several years, and has more recently been adopted by some local councils. The first national SoE report was published in 1996, largely as a result of international obligations articulated in the National Strategy for Ecologically Sustainable Development, which identifies SoE reporting as one of its objectives (Commonwealth Government 1992). National reporting obligations have since been legislated in the *Environment Protection and Biodiversity Conservation (EPBC) Act* 1999 (Commonwealth Government 1999), which requires that an Australian SoE report be produced every five years. A second report was released in 2001 and a report due for publication in 2006 is currently in preparation.

1.2 State of Environment Reporting in Victoria

SoE reports were previously published in Victoria in 1988 and 1991, with a focus on inland waters and agriculture, respectively. SoE reporting has now been formalised by the Victorian Government through the *Commissioner for Environmental Sustainability Act* 2003 (State of Victoria 2003). The Commissioner is required to prepare and make publicly available the SoE report at least once every 5 years. The SoE report will make recommendations to government on possible responses for the future management of the environment. Under the Act, the Minister must table a copy of the SoE report in Parliament and must also table a response to the recommendations within 12 months.

The first important phase in the development of the SoE report was a consultation process held in March 2005 to ensure that the final product is relevant to the widest possible

[1] Ecosystem services are the benefits, such as food and water, people obtain from ecosystems. Ecosystems are defined as a "dynamic complex of plant, animal and micro-organism communities and the non-living environment, interacting as a functional unit" (Millennium Ecosystem Assessment (2005a)).

audience including policymakers, business, industry, non-government organisations, academics, community groups and the public. The consultation process sought to provide a snapshot of community and stakeholder views on their environmental concerns and on elements of the structure and format of the report. A summary of the consultation results has been prepared for the Commissioner and is available on the Commissioner's website[2].

The consultation provided a wealth of information that has informed the development of this Framework, which will in turn guide the development of the SoE report for Victoria. The following sections outline the key elements of the SoE report, including the objectives of the report and the methodology, structure and process to be adopted.

1.3 Purpose of Victoria's SoE Report

There are seven key objectives that this Victorian SoE report aims to achieve. These are:

- To provide access to scientifically credible, robust, timely and relevant information on the current environmental conditions and trends in Victoria;
- To identify driving forces and direct pressures influencing environmental change in Victoria;
- To identify the likely implications of environmental trends;
- To evaluate the effectiveness of current management responses to environmental issues;
- To assist decision-making in policy development, environmental management and resource use;
- To raise public awareness and understanding of environmental issues in order to improve the way we use, manage and value the environment; and
- To make recommendations on specific actions and future directions required to advance Victoria's progress towards environmental sustainability.

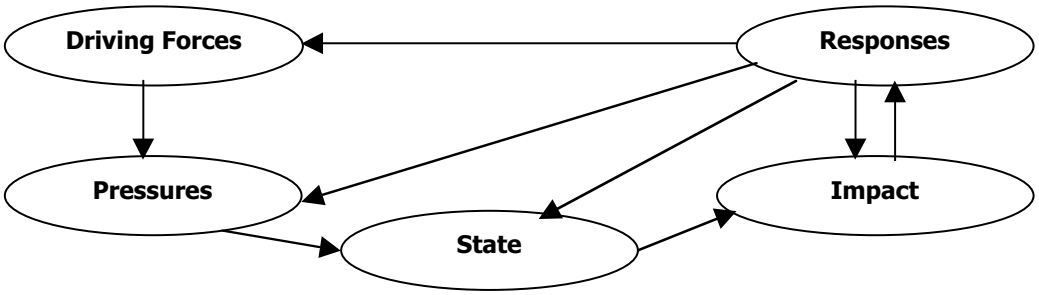
1.4 Reporting Model

The most frequently used approach to SoE reporting, both internationally and within Australia, is the *Pressure – State – Response* (PSR) model developed by the Organisation for Economic Co-operation and Development (OECD 1993). The PSR model provides for the organisation of information on the *state* or condition of the environment, in regard to its quality and the functioning of natural processes, and on human *pressures* affecting the natural environment. It also captures information on the societal *responses* implemented through programs or legislation to address the pressures and environmental issues. This information is primarily captured through the use of indicators (see Part 1.5).

An extension of the PSR model is the *Driving forces – Pressure – State – Impact – Response* (DPSIR) approach (Figure 1). This incorporates two additional elements of *driving forces*, which are the underlying causes of activities that affect the environment, and *impact*, which represents the effect of changes in environmental quality on the functioning of ecosystems and human health (EEA, 1999).

[2] To download a copy of the Community Consultation Report, please visit www.ces.vic.gov.au/soe/consultation

Figure 1. The DPSIR Framework (EEA 1999)



This DPSIR approach will form the basis of the Victorian SoE report as it represents a more comprehensive approach to assessing the state of the environment through the inclusion of the origins and consequences of environmental change. It is important to acknowledge that no single model is capable of capturing the true complexity of the natural environment and its relationship with human activities. The chosen model, however, does provide a comprehensible framework through which to navigate the multiple causal relationships, linkages and cross-sectoral issues which emerge in such a complex system.

The SoE report will be divided into four main sections, represented by Parts 2 – 5 of this Framework. The socio-economic driving forces influencing environmental change in Victoria will be addressed in Part 2, followed by a more in-depth analysis of the human activities driving natural resource consumption and waste generation in Part 3.

Part 4 encompasses the core elements of traditional SoE reporting, identifying the current state of the environment and the direct pressures acting on it. This section will assess the implications of the current environmental pressures, condition and trends, and the effectiveness of societal responses to environmental issues. It will also make recommendations on specific actions and future directions required to move towards environmental sustainability.

Part 4 is structured on the basis of themes representing atmosphere, land, biodiversity, inland waters, and coasts, estuaries and the sea. Traditionally, SoE reporting also includes a theme on 'human settlements'. Human settlements have a complex relationship with and impact on the natural environment, and many of the issues for reporting cut across a range of sectors. In a State with an estimated population of 4.9 million, the metropolitan population of 3.6 million has a dominant economic, social and environmental footprint. It is therefore considered more pertinent to report on and analyse many of the issues relating to human settlement issues within Part 2, *driving forces* and Part 3, *production, consumption and waste* and in the final summary part of the report.

Recognising the role of the Commissioner in encouraging environmental sustainability, the final section (Part 5) of the SoE will draw together the complex relationships and linkages between many of the issues raised in this report in order to highlight a path towards improving environmental sustainability and its impact on the quality of life for Victorians, both now and in the future.

The breadth and scope of each part may vary as the SoE report develops and information sources and gaps are identified.

1.5 Environmental Indicators and Data

The use of indicators is the fundamental basis of environmental reporting. An environmental indicator is a statistical tool used to measure the current state or trend of a specific component of the environment, including the pressures acting on the environment, and the outcomes of management responses. A set of indicators can provide valuable information on the health of ecosystems and represent where we are presently, where we have come from, and through trend analysis, where we are heading.

All Australian jurisdictions based their SoE reports on indicators agreed in 1999 by State, Territory and Commonwealth Ministers. The Australian Government Department of Environment and Heritage (DEH) defines environmental indicators as measures of physical, chemical, biological, social, cultural or economic factors which best represent the key elements of complex ecosystems or environmental issues (Williams J, et al. 2001).

Examples of environmental indicators include: the amount of land affected by salinity, emissions of greenhouse gases, and estimated wild fish stocks. The SoE report will include a complete list of indicators, including those for which data are not presently available. Where inadequate data exist, case studies or commentary reports may be used to represent specific issues. The report will also provide recommendations on future monitoring requirements where gaps in data are identified.

The environmental indicators will be selected on the basis of a suite of criteria consistent with methodology used nationally and internationally for environmental reporting. The selected indicators will meet as many of the following criteria as possible:

- Able to measure a valued element of the environment or an important environmental issue;
- Be useful for tracking environmental trends at a range of spatial scales, from local to global;
- Be scientifically credible;
- Serve as a robust indicator of environmental change;
- Be cost effective;
- Be readily interpretable;
- Be monitored regularly, either by existing programs or by new programs that might be established in the future at reasonable cost.
- Have relevance to policy and management needs;

The availability of historical or baseline data is essential for trend analysis and for setting and evaluating progress towards targets and long term goals. The underlying assumptions relating to historical or current data collection methods will be clearly identified in the final report, as will the quality and availability of data.

Data verification is essential to ensure the indicators presented are scientifically credible. All indicator data will be well documented and validated according to established methodologies.

It is anticipated that data will be drawn from a wide range of sources, including government, research institutes, universities, non-government and community organisations, among others. The Commissioner will review the data requirements for the SoE report during its development and will establish formal arrangements with relevant organisations for the provision of data, where deemed appropriate.

The management of data will be determined via agreements between the Commissioner and the relevant data custodians. These agreements will provide information on the purpose, provision of services, methodologies, data management, and responsibilities of each party. Where appropriate,

the guidance provided in the Intergovernmental Agreement on the Environment will be followed for data collection and handling.

1.6 Collaboration and Consultation

The Commissioner for Environmental Sustainability is an independent statutory appointment who works collaboratively with government, business, industry, non-government organisations and the community. The Commissioner will continue to undertake consultation during the development of the SoE report and draw on the expertise of representatives from a range of sources. The Commissioner's Reference Group, which comprises experts and environmental practitioners from business, academia and the community in Victoria and interstate, will be one such source of expert guidance. The Reference Group provides advice and direction, and contributes new ideas to assist implementation of the Commissioner's major projects, including the SoE report.

The Commissioner has also established a Whole-of-Government Steering Committee, which provides high level advice from the Government's perspective on the Commissioner's functions, and an Inter-Agency Committee that facilitates the input of Victorian Government Agencies during the development of the SoE report.

A Scientific Advisory Committee will also be established to provide expert advice on the selection of indicators, data integrity and analysis, and the preparation of chapters for the SoE report. Additional expert working groups to focus on specific themes may be established to assist the SoE process.

The authoring of sections of the SoE report is expected to occur via contributions from both the Commissioner's SoE team and a range of experts. The Commissioner and an independent peer review process will ensure the impartiality and integrity of the final report.

1.7 SoE Report Timeframe and Communication

The first SoE report will be released in 2008. Progress reports will be released regularly ahead of this date to inform the public of the development of the SoE report. It is anticipated that subsequent SoE reports may be published on a more frequent basis than the five-year period required by the Act.

The method of delivery and communication is critical to the success of the SoE report in meeting its objectives of raising awareness and assisting decision-making. Traditionally, SoE reports have been large, cumbersome printed documents which are often out of date by the time they are published. However, significant advances in information technology now allow for a variety of communication techniques to be used to meet the needs of different audiences.

A communications strategy will be developed and implemented to ensure that the SoE report is delivered and communicated in a manner that meets the needs of target audiences, including linguistically diverse groups and the vision impaired. The main form of communication is likely to be via the Internet, which will allow for the linkages between issues to be highlighted and more easily explored. The Commissioner is required to make the report available to the Victorian public via the Internet. This is consistent with best practice in environmental reporting and agreement made between the States. Online reporting will allow users to access the level of information they require to meet their specific needs and will enable

spatial representation of issues to be published using the latest technology. Other forms of communication will also be investigated, such as an interactive DVD as part of an education package.

1.8 Evaluation and Review

In order to ensure continuous improvement in the preparation and outcomes of the SoE report, an evaluation and review process will be implemented. This will include a review of the Framework for SoE reporting prior to commencing the preparation of each future SoE report. An evaluation and review of the SoE report will also be undertaken through consultation with the public and key stakeholders.

Within 12 months of the release of the SoE report, the Minister must table in Parliament Government's response to the Commissioner's recommendations. This response outlined by Government will be tracked by the Commissioner during the following SoE reporting period.

Part 2: Driving Forces Influencing Environmental Change

2.1 Introduction

While a key objective of this report is to understand the state of the environment and the direct pressures acting upon it, it is also critically important to understand the driving forces influencing environmental change. It is widely recognised that environmental conditions, trends and problems are deeply embedded in the socio-economic structures of our societies and regions (Yencken and Wilkinson 2000). Conversely our socio-economic structures and our well-being depend on our natural environment.

Driving forces are understood to mean any broad level factors that directly or indirectly influence change in the environment. Population growth is identified as a core factor driving our impact on the environment. Affluence can affect the extent of that impact, particularly as a result of society's increasing levels of consumerism. Our levels of affluence can pose as many risks for the environment as it does opportunities, depending on the choices we make as producers and consumers of goods and services. Evidence suggests that as our incomes rise so do our levels of wasteful consumption (Hamilton C. et al. 2005). Cultural and social values and education play a key role in influencing how we value our environment. Our choices as individuals and households have a direct impact on the rate at which we consume scarce natural resources. Increasing urbanisation and coastal development represents a significant driving force to environmental change. Identifying the factors driving urbanisation such as population and demographic trends, lifestyle choices, trends in house sizes and settlement patterns can help us better understand the impacts we are having on the natural environment.

Technological advancements can have both positive and negative implications for the environment. They can both fuel pressures or mitigate against environmental impacts. For example, the latter includes advances in alternative energy technologies which can reduce our reliance on and consumption of fossil fuels, and technological advances which can improve energy efficiency of production processes. The implications for the environment arising from some technological innovations are not yet fully realised.

We all have a part to play in how we value and manage our environment. Government has a critical role in setting policy, operating frameworks conducive to achieving environmental sustainability and providing public education. Innovative industry has a key role in providing more sustainable options and innovations, as well as communicating them to government and the community. As individuals, our consumption, lifestyle and other relevant choices are crucial to whether the government frameworks and the industrial innovations will result in environmental sustainability.

Driving forces can be grouped in multiple ways and across a variety of scales. The recent Millennium Ecosystem Assessment identifies a list of 'agreed-upon – big picture' drivers for its study of environmental change, some of which are global in nature while others have a distinct local and regional dimension (Millennium Ecosystem Assessment 2005a).

The major driving forces include:

- Demographic drivers
- Economic drivers
- Socio-political drivers
- Science and technology drivers
- Cultural and religious drivers; and
- Physical, biological and chemical drivers

Driving forces are complex and diffuse and therefore interact with and influence each other. Some of these drivers will have direct impacts on our environment while others will be more indirect in their implications. The Millennium Ecosystem Assessment (2005a) makes the distinction between 'exogenous' and 'endogenous' drivers. Exogenous drivers are those outside the direct control of any one particular decision maker, that is they are the result of the long term cumulative effect of many decisions made across many different scales. Endogenous drivers are those that can be directly influenced by particular decision makers at certain levels.

In order to better understand the 'state' of our environment it is necessary to identify the myriad of factors driving environmental change in Victoria so that we can reduce our negative impacts on the environment, mitigate against environmental problems and improve and maintain the quality of our natural assets for present and future generations. Those factors can result from our choices, as individuals, in business and as a community. They are often a result of historical choices and patterns of behaviour. Some driving forces affecting Victoria's environment are determined beyond our borders at the national or global scale. Distinguishing between exogenous and endogenous drivers is important when we consider our responses to environmental problems and who has responsibility for decision making. Identifying those significant factors driving environmental change is the first step towards changing our behaviour and making better choices for the environment in the future.

2.2 Driving Forces

Using a range of information sources and trend data, significant factors driving environmental change in Victoria will be examined within the following sections:

2.2.1 Population and Demographic Factors

This analysis will include trends in population growth, age and gender structure, household distribution and size, spatial distribution (ie. urban and rural distribution patterns), urban densities and migration patterns.

2.2.2 Economic Factors

This will identify broad trends at the global and national economic scales, including trade (import/export), economic growth rates and the role of globalisation and macro-economic policies. Trends in Victoria's key economic sectors will be identified as well as employment and per capita income trends, amongst others. Part 3 of this report will examine in more detail those key economic sectors and activities driving consumption of natural resources.

2.2.3 Political, Institutional and Legislative Factors

This section will examine broad institutional arrangements, such as Victoria's political system, the allocation of responsibilities across agencies, and the role of business and non-government organisations. The role of national and international laws, conventions and agreements affecting our environmental responsibilities will also be identified.

2.2.4 Social and Cultural Factors

Social values and attitudes will be examined particularly as they relate to the environment. The role of heritage as an environmental value will be discussed, including the importance of indigenous and historic heritage values. Community attitudes will be explored by examining participation rates in voluntary, community and environmental organisations, amongst others. The role of education will be assessed in shaping our relationship with the natural environment. The rise of consumerism in times of affluence will also be explored as it raises significant questions about our potential impact on the environment, particularly in terms of waste generation.

2.2.5 Scientific and Technological Factors

The range of issues and trends identified are likely to include rates of investment in research and development, research priorities and funding levels and rates of adoption of new technologies. Technological innovations which may have both positive and negative impacts on the environment will be identified, for example innovations in energy efficiency, the design and manufacture of products or innovations in waste management, as well as biotechnology developments.

2.2.6 Environmental Factors

This section will explore the role of global and regional environmental factors that have compounding impacts on human activities and local environmental processes. Examples of compounding environmental factors driving environmental change in Victoria may be human-induced climate change, ozone depletion and El Niño events.

Part 3: Production, Consumption and Waste

3.1 Introduction

> *The major cause of the continued deterioration of the global environment is the unsustainable pattern of consumption and production, particularly in the industrialised countries, aggravating poverty and imbalances (UNCED 1992)*

In the previous section broad level driving forces affecting environmental change were identified. Those largely socio-economic drivers have important implications for our production and consumption processes, which in turn have direct impacts on our natural environment. If we are to promote more sustainable behaviour patterns, it is critical to start with improving our understanding of natural resources and those processes that cause them to become depleted and degraded. This part of the report will examine in more detail the key human activities driving natural resource consumption and waste generation in Victoria.

A range of activities and processes have been identified as having the potential to significantly impact on the environment, and include both the natural resource or primary industry sectors, such as agriculture, forestry, fishing and mining, and other activities and processes such as energy generation and consumption, manufacturing, transport, water usage, urbanisation, tourism and waste generation and disposal. The impacts of these activities and processes can be both positive and negative for the environment. While they can include many 'risks' or 'pressures' there are also potential 'opportunities' for better managing the environment and changing behaviour. While each sector or activity will be examined separately, the linkages and relationships will be highlighted.

The role of consumption patterns and the choices we make as individuals and as a wider community are critically important to understanding our impacts on the natural environment. A recent study from the Australia Institute found that Australian household wasteful consumption, that is annual spending on unused goods and services, amounts to over $10.5 billion annually, of which food accounts for $5.3 billion (Hamilton C. et al. 2005). Our household energy consumption patterns, our production of waste, as well as our choices about modes of transport are all part of a chain of decision making which has implications for a range of the sectors and activities that will be examined in this section of the report.

To a large extent the activities analysed will encompass the physical processes, resulting from the driving forces, upon which our industrial economy depends. Physical processes are understood to mean the materials and energy 'stocks and flows' involved in maintaining our livelihoods (Foran and Poldy 1999). While it is possible to identify the resource base (renewable and non-renewable) of each sector and the use of resources within different activities and processes, there are many cross-sectoral dimensions to our system of production, consumption and waste generation that will be identified.

3.2 Ecological Footprint

Ecological Footprint Analysis has gained worldwide support in recent years as a tool for measuring our ecological performance whether it is at an individual, regional, national or global scale. The 'ecological footprint' measures the amount of renewable and non-renewable ecologically productive land area required to support the resource demands and absorb the wastes of a given population or specific activities. It is a tangible indicator representing our environmental impact using land expressed in global hectares. A recent EPA Bulletin (April 2005) stated that the average Australian needs 7.7 global hectares (gha) of land to sustain its lifestyle while the average Victorian needs 8.1 gha. This means that if everyone lived like Victorians we would need the equivalent of four planets to support us (EPA 2005).

While the 'ecological footprint' does not purport to be comprehensive in its measurement, it does illustrate our resource consumption and waste generation through one overarching indicator. It also provides the opportunity for international comparison (Wackernagel 1996) as it becomes more widely adopted (i.e. it is now included in the European Environment Agency's SoE report as one of its leading indicators). An ecological footprint analysis for Victoria will be presented here as it provides a useful context for the following section which analyses in more detail resource consumption and waste generation within and across specific sectors, activities and processes.

3.3 Resource Consumption Analysis

The analysis of driving forces in Part 2 of this report provides an important foundation for understanding the physical needs or materials and energy required for our way of life. The purpose of this section and Part 3 as a whole is to both conceptually and quantitatively assess those key human activities which have the potential to significantly impact on the rate at which we consume natural resources and generate pollution and waste. While many of the activities and processes examined have negative impacts on the natural environment this analysis also aims to identify where opportunities have emerged for mitigating or relieving pressure on the environment, whether it be through changes in production practices, technological innovations or consumer preferences.

> *Every economic activity needs materials for its infrastructure and products, energy to drive it and a realm in which it takes place. It is the capacity of humankind to extract, transform, and use materials of every kind that distinguishes the world inhabited by humans today from the world inhabited by humans even a few hundred years ago. The environmental cost has, however, been high. The disturbances and waste flows from the extraction, conversion and use of energy and materials in the industrial economy are the sources of most of our acute environmental problems (Yencken and Wilkinson, 2000, p. 86).*

There are a number of possible methods of assessing material, waste and energy stocks and flows in Victoria. While the ecological footprint tool represents one approach, a more comprehensive method of analysing 'stocks and flows' incorporating each of the identified sectors and activities – agriculture, forestry, fishing and mining, energy generation and consumption, manufacturing, transport, water usage, urbanisation, tourism and waste generation and disposal – will also be adopted. It is anticipated that the method of analysis adopted for this section of the report will determine how these sectors and activities are assessed and categorised.

The CSIRO's (Commonwealth Scientific and Industrial Research Organisation) Australian Stocks and Flows Framework (CSIRO Sustainable Ecosystems 2002) represents one possible approach to assessing the physical processes within the Victorian context. The model uses a series of 'calculators' which, "account for the physical processes of … buildings, transport, construction, manufacturing, energy supply, agriculture, forestry, fishing, mining, land, water and air resources and international trade". (CSIRO, 2002, p.24). The CSIRO model could provide an account of current and past stocks and flows within and across the identified activity sectors. The potential for this model to be adapted to the dimensions of the Victorian SoE report will be further explored as a basis for analysis in this section.

The potential scope of Part 3 will be developed once an appropriate model(s) of analysis is adopted and the data inputs are identified. Any analysis will depend on the availability of data sets relating to the range of activities and processes being assessed.

Part 4: The State of Our Environment

Part 4 represents what many consider the core function of traditional SoE reporting, which is to identify the current condition and trends in the natural environment. This section will evaluate Victoria's environmental condition and trends through the use of indicators (refer to Part1.5 for further explanation and examples of indicators). In addition, the direct pressures acting on the environment, with reference to relevant pressures discussed in Part 3, and the likely implications of current environmental conditions and trends will be reported. Society's response, if any, to address these environmental issues will also be identified and assessed.

To assist interpretation, this section will report on broad themes that represent the basic natural assets of our environment. These themes are consistent with those used within SoE reports produced by other States and at the national level. A key departure from the structure of the national report is the inclusion of 'human settlement' related issues within Parts 2 and 3 rather than as a distinct theme within this section. However, the pressures associated with human settlements and related activities will be intrinsic to each of the themes reported in Part 4. The themes within Part 4 of the Victorian SoE report will be:

- Atmosphere
- Land
- Biodiversity
- Water
  - Inland Waters
  - Coasts, Estuaries and the Sea

Within each theme, broad-level environmental issues have been identified for investigation and possible reporting within the SoE report. These broad issues, detailed in the following pages, were primarily identified through consultation with the community, government, non-government organisations, business and industry groups. The scope of the issues included for reporting will be finalised as the SoE report develops and data sources are verified and confirmed. Cross-cutting issues, such as human-induced climate change, will be clearly identified and referenced to maximise continuity of the discussion throughout the report.

4.1 Reporting for Each Theme

Each theme will be reported separately. An introduction to each theme will include discussion of the relevant issues to be reported, reference to important linkages with other themes and issues, and also provide an overview of the indicators used. Each issue will then be assessed through discussion of the following key elements:

- Indicator(s)
  The indicator(s) will be described with reference to their role as a measure of condition, pressure, response and/or response outcomes. Any underlying assumptions and limitations of individual indicators will be acknowledged, and the level of monitoring and quality of available data will be clearly identified.
- Status of the issue
  The current state of the environment, including trends, will be assessed based on discussion of the indicators and other relevant and available data. The pressures contributing to the current environmental condition and trends will also be assessed using indicators.

- Implications
  The likely implications of the environmental conditions and trends will be discussed, including associated business, government and societal risks and opportunities.
- Response to the issue
  The activities established in response to the issue, by government, community groups, non-government organisations, business and industry will be identified.
- Effectiveness of responses
  The effectiveness of responses to environmental issues will be evaluated, particularly in regard to their specific outcomes. Indicators will be used where available.
- Future directions
  Based on the preceding assessment of the current state of the environment and management responses, the Commissioner will make recommendations on specific actions and future directions required to move towards environmental sustainability.
- Linkages
  Specific reference will be made to other relevant issues.

Case studies will be used, where appropriate, to highlight risks, opportunities and challenges posed by environmental issues and identify examples of leadership and best practice in response to the state of our environment.

4.2 Themes

4.2.1 Atmosphere

The atmosphere enveloping the Earth sustains life on this planet. It protects plants, animals and humans from the Sun's harmful rays, regulates the surface temperature and influences the world's weather. Pollution generated by human activities has impacted on the atmosphere, with local and global effects (Manins, Allan et al. 2001). For instance, it is argued that increasing concentrations of greenhouse gases in the atmosphere due to the burning of fossil fuels and land clearing are contributing to climate change.

At the local scale, recent consultation undertaken by the Commissioner has highlighted public concern about the health and environmental impacts of air pollutants, such as carbon monoxide and sulphur dioxide, among others (Socom 2005). There is also increasing concern about the health impacts of indoor air pollution.

The following broad issues will form the basis of further investigation through the SoE report to identify the current condition of the atmosphere at local and global scales, the pressures acting upon it, and the effectiveness of responses implemented to address the current condition and pressures. The potential impacts associated with climate change will be addressed within each of the biodiversity, water and land themes.

- Air pollution
  - Ambient air pollution
  - Indoor air pollution
- Stratospheric ozone depletion
- Climate variability and change
  - Climate variability
  - Human-induced climate change
  - Global dimming

4.2.2 Land

The land theme includes a wide range of issues based around how the land is valued and used by Victorians. The landscape has changed significantly since European settlement, with Victoria now supporting a variety of land uses, including urban settlements and agricultural activity as well as preservation and management of its natural values in parks and forests.

The public consultation process raised a range of issues, from the pressures acting on the land, its current condition and changes over time, to management responses in place to improve its long-term viability. This section will examine how the long-term viability of land based activities may be compromised by significant pressures, such as reduced rainfall and fundamental changes in the way we live. It will consider these issues in the context of Victoria's place in a global market and the efficiency of its resource allocation mechanisms.

This theme will report on the status of critical issues such as erosion, salinisation, soil acidification and the impacts of agricultural pests and will provide the latest information on how such issues are being managed to enable sustainable land use and improved productivity. It will also examine a range of issues raised during consultation, such as the negative impacts of chemicals on the land. Some case studies will be included on emerging issues or issues of regional importance.

This section will also address some landscape level issues such as how we value our natural heritage, the links between people and the land, and how indigenous and historic heritage is managed in the landscape.

The following shows the breadth of issues that may be examined for reporting in the land theme.

- Sustainable land and water management
- Land use and land use change
- Soil condition - erosion, nutrients, salinity, acidification and soil biota
- Agricultural pests
- Waste and contamination
- Impacts of climate change and reduced rainfall
- Education and awareness
- Heritage issues

4.2.3 Biodiversity

Biodiversity is often equated to an intricate, complex web - the 'web of life'. It is usually defined as consisting of three levels: the diversity of ecosystems, the diversity of plants, animals and micro-organisms (species diversity) and the diversity of genes they contain (genetic diversity) (UNEP United Nations Environment Programme 1992).

Biodiversity is vitally important to us culturally. From the myths and the stories we tell our children, to our national symbols, Australia's unique plants and animals help make us who we are. We are also both directly and indirectly dependent on biodiversity for the provision of food, fibre (e.g. wood), genetic resources, pharmaceuticals, clean water and air, climate regulation, biological control, pollination, erosion control and fertile soils, among a multitude of other significant and indispensable services (Millennium Ecosystem Assessment 2005a).

Although we are fundamentally dependent on biodiversity and its 'ecosystem services' for our overall well-being, often our activities, such as land clearance, the introduction of exotic species and altered fire regimes, contribute to its deterioration. The global Millennium Ecosystem Assessment (Millennium Ecosystem Assessment 2005b) recently highlighted that biodiversity loss and the decline of 'ecosystem services' has significant implications for human health, resource security (food, water and energy) and material wealth, with many people around the world being increasingly pushed into poverty.

The following broad issues will form the basis of further investigation through the SoE to identify the current condition of Victoria's biodiversity, the pressures acting upon it, and the type and effectiveness of management responses in place.

- Condition of biodiversity
- Threatened species and communities
- Extent and quality of native vegetation and marine habitat
- Knowledge of biodiversity
- Clearance of native vegetation
- Habitat fragmentation
- Introduced species
- Fire regimes
- Utilisation of flora and fauna
- Impacts of climate change

4.2.4 Water

Water sustains all living things. Water moves cyclically and continually through the human body and our environment. Water shapes the natural features of the land, provides habitat and supports the physical processes that underpin the living things that exist within these habitats. Water is the basis of and supports every human activity on earth including recreation, industry, agriculture, forestry, and transport, just to name a few.

The sustainable management of aquatic environments is essential for maximising the usefulness and benefits of this limited resource for both human use and for the sustenance of life in the natural environment.

Water will be separated spatially in the SoE report into two themes, Inland Waters and Coasts, Estuaries and the Sea. Case studies on significant aquatic environments such as Port Phillip Bay or the Gippsland Lakes may also be presented.

4.2.4(i) Inland Waters

This theme covers all surface and ground waters that are not associated with the coastal zone. This includes rivers, lakes, wetlands, streams, aquifers, ponds and floodplains, which may be freshwater or saline. The issues raised during community consultation include water quality, environmental flows, water availability for agriculture, and catchment management. The issues selected for reporting will attempt to address community concerns by providing information on the condition of inland waters and their use. It will also provide an analysis of the effectiveness of current management in delivering sufficient clean water supplies to all users, that is, for environmental outcomes as well as human activities.

The following shows the breadth of issues that may be investigated.

- Effects of land use on inland waters
- Human use of inland waters
- Inland waters management
- Condition and use of ground-water resources
- Rivers, streams, creeks and wetlands
- Condition and use of surface water
- Aquatic flora and fauna
- Water discharges and pollution
- Treatment and recycling
- Water cycle processes and climate change

4.2.4(ii) Coasts, Estuaries and the Sea

The coasts, estuaries and seas theme encompasses a vast array of ecosystem services and natural resources. The coastal zone includes areas of estuaries, salt-water marshes, beaches, sand dunes, the seabed, the sea, reefs, coastal waters, and the biodiversity within these coastal habitats.

The Victorian community places high aesthetic and amenity values on our coasts. The coastal zone, more than ever, is experiencing increasing pressures from industrial and urban development, population, tourism, fishing, pollution, shipping and boating activities, species and habitat loss, and unsustainable resource use.

An analysis of the following issues will identify the pressures acting on the coastal environment and its current condition. It will also include an assessment of current management practices and identify options for the future sustainable management of the coastal zone. The issues for investigation include:

- Marine and coastal ecosystems
- Coastal development and land use
- Coastal processes and climate change
- Coastal water quality
- Fisheries
- Ports and shipping
- Tourism and recreation

Part 5: Living Well Within Our Environment

The primary purpose of the final part of the SoE report is to bring together the key findings from the report, examine our progress towards achieving environmental sustainability and provide recommendations for future directions for the State of Victoria.

Understanding the 'state' of our environment involves more than a snapshot of the environment at a particular time through a collection of indicators. The intention of this SoE report is to present environmental trends and issues and identify and analyse the complex relationships between the drivers of environmental change, the significant pressures acting on the environment, the implications for the state of the environment and assess the effectiveness of our responses to those changes. The strength of the DPSIR model is that it provides a framework for analysing the complexities of our environment and our interactions with it. Bringing together such an analysis to raise awareness and understanding about environmental sustainability is a key function of the Commissioner. The next step, which is to look towards the future and provide directions for change, is also priority for the Commissioner.

The complex relationships and linkages between many of the issues raised in the SoE report will be discussed in order to highlight a path towards improving environmental sustainability and quality of life in Victoria. This report focuses on understanding the complex natural system that provides essential 'ecosystem services' to Victorians, such as clean air and water. It recognises that the way we value, use and manage those 'ecosystem services' is shaped by wider socio-economic factors. The report will also recognise that we each have a key role in affecting environmental change and therefore in achieving environmental sustainability.

The State government has developed a whole of government environmental sustainability framework, *Our Environment, Our Future*, (State of Victoria 2005). This aims to provide direction for Victorians in building environmental considerations into the way we work and live, placing the goal of environmental sustainability as a priority for the State. If we are to achieve environmental sustainability and in doing so live well within our environment we need a clear understanding of how to proceed. We need to ask - how is Victoria working towards achieving those goals, both in terms of the quality of our environment and our quality of life, for the longer term?

This section of the report will assist in answering this question by bringing together the reports findings as part of an overall examination of Victoria's progress towards environmental sustainability. This holistic analysis is consistent with a more global trend towards including sustainability measures in state of environment reporting. The national *Environment Protection and Heritage Council's State of Environment Reporting Taskforce*[3] has also identified the trend towards incorporating sustainability reporting as important to contributing to a holistic understanding of our environment and our relationship with it.

The analysis in this part will draw on the wealth of existing research into measuring and reporting on environmental sustainability and liveability as a means to assessing our progress. This will provide a useful context for assessing how we, as Victorians, value our natural, indigenous and historical heritage. Drawing together the SoE report's assessment of our responses to environmental change some conclusions will be made about the adequacy and effectiveness of current management regimes in ensuring long-term environmental sustainability and continuous improvement in our quality of life. It will also highlight important innovations in policy and

[3] The Taskforce comprises experts in State of Environment reporting from all Australian jurisdictions. This includes a representative from both the Commissioner's office and the Department of Sustainability and Environment.

practice for improving the quality of the environment and identify major gaps in our responses to addressing environmental problems.

Emerging issues will be identified and, where appropriate, case studies used to highlight where specific practices have either increased or relieved pressure on the environment. Identifying innovative case studies, in particular, illustrates the potential that new ways of thinking and acting can have on reducing Victoria's ecological footprint whilst maintaining and improving our quality of life. It will highlight examples of leadership in government, business and society in better environmental management and describe the challenges they face.

Finally, the vision of the Commissioner for Environmental Sustainability is a future where all Victorians are living well within our environment and in order to achieve this highlighting some potential actions for change is a priority. It is anticipated that the new level of knowledge about Victoria's environment comprised in this report will help inform future policy making and individual behaviour. The report will conclude with a summary of recommendations for priority actions and directions for the future. This summary will be drawn from the list of recommendations that will have emerged throughout the report, in addition to any further recommendations that arise from this more holistic view of our environment and our future. The Commissioner recognises that we all - governments, business and industry, the wider community and individuals - have a role and responsibility in creating an environmentally sustainable future for Victoria.

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Commissioner for Environmental Sustainability
8 Nicholson Street, East Melbourne VIC 3002

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