Identifying sustainability indicators for a regional sustainability strategy within the Mornington Peninsula and Western Port Biosphere ©

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"This report aims to analyse major national and international sets of sustainability indicators to provide background for the Biosphere's project to develop indicators which will assist it in ongoing assessment and monitoring of progress. The report was prepared as part of a Master of Environment and Sustainability at Monash University by Troy Kraska under the supervision of Dr. Sharron Pfueller and Mr. Ian Stevenson. It is published with permission."

Executive Summary:

Agenda 21 introduced governments to the development of ‘‘sustainability indicators’’ as a key approach to provide a basis for sustainability-related decision-making processes. Collectively, sustainability indicators represent a way of assessing, over time, whether we are maintaining and enhancing the economy, society and environment, the three systems on which all life depends (Environment Australia, 2002). Traditionally these systems have been examined in isolation, and sustainability indicators can provide an important step towards integrating these systems when designed on a triple bottom line (TBL) framework. Utilizing indicators, especially on a local and regional scale, can aid in engaging communities about sustainability, guide evidence-based policies and planning and serve as a reporting tool for monitoring sustainability (CIV, 2009a).

The Biosphere aims to achieve sustainability as outlined in the Man and the Biosphere program and has instigated this research with a goal of developing a set of sustainability indicators that can monitor sustainable development. This project was performed to identify established indicators that may be applicable for the Biosphere and determine the relevance, interest and application of sustainability indicators for the Biosphere. While this project marks an important stage for the Biosphere in working towards a more sustainable future, it is only one stage in a process that is envisaged to continue over time. The development of sustainability

indicators for the Biosphere will allow the measuring and reporting of changes in aspects of sustainability, and from this coordinated actions and policy responses can be generated.

Overall, it was found that the most common indicators when comparing indicator sets to the Federal State of the Environment (SoE) 2006 report, were those that were associated with the human settlements dimension. Other common indicators identified in the first stage of analysis using the Federal SoE 2006 report were associated with greenhouse gas emissions, land use and land use change, and also air quality. When comparing indicator sets to the United Nations (UN) Centre for Sustainable Development (CSD) indicators, homicides and life expectancy were the most common, and indicators related to community wellbeing were the most common when comparing indicator sets to the Community Indicators Victoria (CIV) indicators. It is proposed that the common indicators identified in the analysis could be applicable for the Biosphere in some form. The actual measures and data sources of these indicators require further investigation, as well as selecting other indicators that may not have been identified in this study. Future developments of an indicator set for the Biosphere requires a collaborative and participatory approach in order to establish an indicator set that can achieve the most sustainable outcome.

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1. Introduction:

The Mornington Peninsula and Western Port Biosphere is subject to various challenges moving into the future; including increasing urbanization, a topography that is especially vulnerable to impacts of climate change, and also possible port developments (Mornington Peninsula and Western Port Biosphere Reserve Foundation, 2009). A sustainable approach to development is required to address these challenges, which is also one of the purposes of the Biosphere as outlined under the United Nations Educational, Scientific, and Cultural Organisation (UNESCO) Man and the Biosphere program (Mornington Peninsula and Western Port Biosphere Reserve Foundation, 2009). It is vital that progress towards sustainable development is monitored and assess whether human needs are being met, whilst also conserving natural processes and biodiversity. Sustainability indicators can aid in monitoring whether progress is being made towards sustainable development.

1.1 Sustainability Indicators:

Sustainability indicators are emerging tools that monitor aspects of sustainability and can be used for setting targets and improving sustainability. In 1992, as a result of the United Nations Conference on the Environment and Development (UNCED) (also known as the Earth Summit), governments introduced the concept of sustainability indicators as a key approach to provide a basis for sustainability-related decision-making processes, which is contained within Agenda 21 (paragraph 40.6 of Agenda 21, see UNCED, 1992).

Collectively, sustainability indicators are a way of assessing, over time, whether we are maintaining and enhancing the economic and social services and institutions which are necessary for our individual and community wellbeing, as well as preserving the ecological systems on which all life depends (Environment Australia, 2002).

The major benefits of utilizing indicators, especially on a local and regional scale, is that they are (CIV, 2009a):

- A **democratic tool**, for engaging citizens and communities in informed discussions about shared goals and priorities;
- A **policy tool**, guiding evidence-based planning and action to address the issues identified as important by communities;

- A **reporting tool**, tracking and communicating progress towards agreed goals and outcomes.

Sustainability indicator sets have been developed on all scales, from international organizations such as the United Nations, to local council initiatives such as the Cardinia Compass and Frankston State of the City programs (both located within the Biosphere). There is sustained interest from all Biosphere membership Councils and community interests, to develop a set of sustainability indicators for the Biosphere. A sustainability indicator set would also be compatible with UNESCO's Man and the Biosphere Programme.

In order to develop a set of indicators applicable for a regional sustainability strategy within the Biosphere, it is important to identify suitable indicators from the experiences acquired from existing initiatives and literature. The research outlined in this report is focused on the identification of these indicators. The report describes the analysis undertaken and establishes possible future directions for the Biosphere in terms of developing an indicator set to monitor sustainable development.

2. Monitoring Sustainability:

The traditional indicator used for economic growth is Gross Domestic Product (GDP). GDP incorporates all of the detail of national economic activity to a single number which encapsulates the concept of economic growth (Trewin, 2006). GDP has not only been used as an indicator of the volume of economic activity, it has also been used ineffectively as an indicator of sustainable wellbeing (Clarke and Lawn, 2005). GDP fails to take into account several important aspects of society including welfare, and this has raised interest in other composite indicators, and also sustainability indicator "sets".

Traditionally, the economy, society, and the environment have been examined separately, with focus being placed on these three broad areas in isolation. There is continued public interest in the interrelationships between economic, social and environmental aspects of life (Trewin, 2006). There is a growing consensus that countries and governments need to develop a more comprehensive view of progress, rather than focusing mainly on economic indicators such as GDP. This involves developing projects that assess sustainability on a triple-bottom line (TBL) basis, that is, they involve indicators from economic, social and environmental dimensions.

Composite indicators have been developed that combine indicators of environmental, social and economic values into single indices, which allows comparisons with traditional measures such as GDP. An example of this is the Genuine Progress Indicator (GPI), which makes adjustments to the Gross State Product (GSP) or GDP by valuing goods and services

against their positive or negative contribution to sustainable wellbeing (Commissioner for Environmental Sustainability, 2008).

In a study for Victoria, it was shown that even though GSP rose steadily between the years 1986 to 2003, the high growth rates of the Victorian economy over the past decade have failed to translate effectively into increases in the sustainable well-being of the average Victorian (Clarke and Lawn, 2005). The study suggests that the extra benefits generated by high rates of growth in this period were mostly offset by rising social and environmental costs, and therefore a greater emphasis needs to be given to qualitative improvement of development rather than quantitative growth (Clarke and Lawn, 2005). Figure 1 below displays the discrepancy between GPI and GSP.

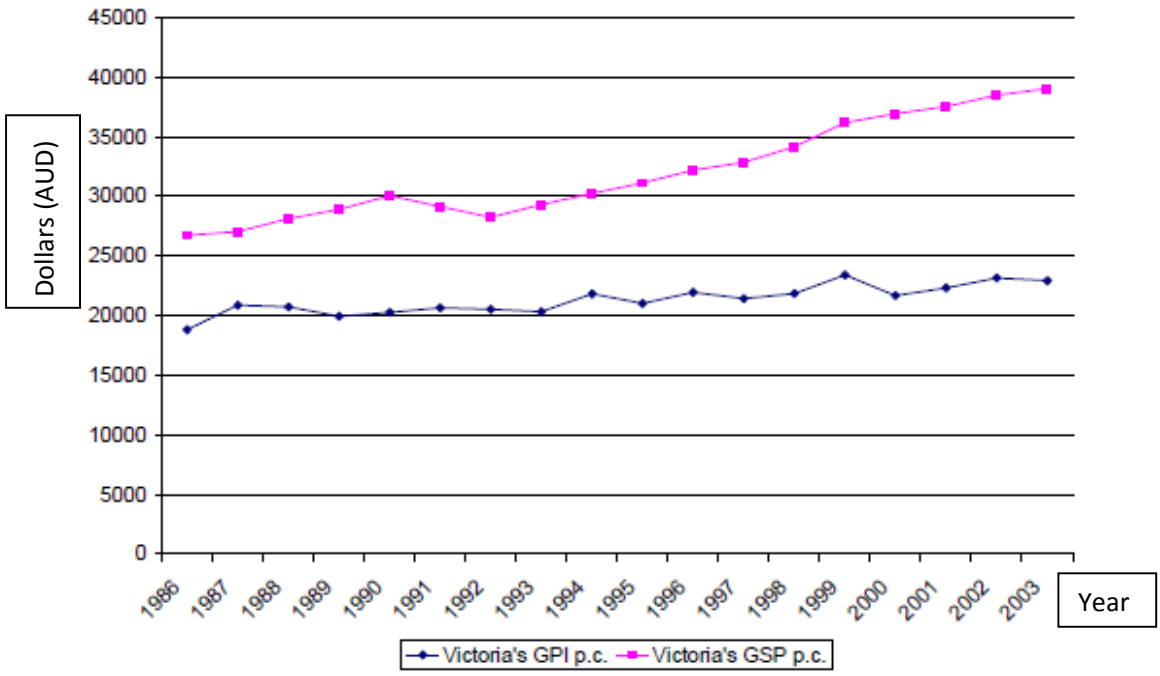

Figure 1: Victoria's GPI per capita (p.c) compared to GSP per capita (p.c.) (2002-2003 dollars) (Adapted from Clarke and Lawn, 2005).

The development of composite indicators represent important attempts to aggregate a broad range of variables in order to convey a message that is easy for both decision-makers and civil society to understand (United Nations, 2007). The drawback of using composite indicators is that they are unable to provide guidance on where action is required to enhance sustainability because they hide potentially valuable information (Reed et al, 2006). Therefore they are of limited use for policy makers and planners, and debate still exists as to whether it is possible for

a single index to integrate the many elements of wellbeing and remain broadly valid (Commissioner for Environmental Sustainability, 2008).

Because of the potential disadvantages of using composite indicators for decision making, this study focuses on indicator sets. Indicator sets measure a range of aspects of sustainability, can assess sustainability on a triple-bottom line (TBL) basis, and each individual indicator can give a signal about a specific measure. This allows policies and planning to be directed towards easily identifiable goals.

In order for an indicator set to be an effective tool, the indicators must be examined as a set. While each individual indicator may reveal important issues in their own right, none of the indicators read in isolation display much information about sustainability. Only when they are examined together and over time will they expose whether needs and values are being sustained without eroding other needs or values, and hence whether our way of life is becoming sustainable (Environment Australia, 2002).

There are some potential obstacles of developing a suite of indicators for monitoring sustainability. This includes the fact that some judgement is required when selecting indicators. The choice of indicators and what aspects of sustainability to be measured cannot be made based on statistical evidence alone, expert opinions are required to select indicators. There is also some judgement required in choosing the statistical measures to populate the indicators. By making the selection of indicators subjective, there is the possibility of some aspects of sustainability being excluded that may be important to some individuals. An example of this is when there is not yet a consensus about the concept that one should measure for a particular aspect, or only subjective data may be available, or simply there is no data available for a particular aspect of sustainability. In order to address this issue, it is vital that collaborative and participatory approach is taken in the development of an indicator set.

A particular indicator set may not be applicable for a different region from which it is derived and there is no perfect set of sustainability indicators that is applicable to every region. On the other hand, there are certain characteristics that are desired when developing indicators for use. Aspects that should be taken into account when selecting sustainability indicators include those that are utilised in the SMART filter, which is a tool that can be used by councils to aid in the selection of indicators. Indicators should be (SoE Reporting Unit, 2001):

- Simple

- Measurable

- Accessible

- Reliable

- Timely

Indicator sets can be designed in different ways. For example, the European Commission indicator set is designed as a three level pyramid with the headline indicators having the highest communication value (European Commission, 2009). The set also includes contextual indicators that provide valuable background information but don't directly monitor the strategy's objectives. In this way the headline indicators provide a useful snapshot of progress across the key challenges, and looking at other indicators within the set provides a fuller, more nuanced picture (European Commission, 2007). Another initiative that utilizes headline and supplementary indicators is the ABS's MAP report (Trewin, 2006). An indicator set can also be designed so that each indicator incorporates multiple measures such as the Knox, Maroondah and Yarra Ranges indicator set, and also the Port Phillip Community Pulse project (Centre for Regional Development Swinburne University, 2005; City of Port Phillip Council, 2009). This aids in simplifying multiple sources of complex data into a measure of progress for a specific aspect of sustainability. Data sources can also be qualitative like many in the Port Phillip Community Pulse project or quantitative as are the measures in the majority of the Federal SoE 2006 Indicators (Beeton et al, 2006; City of Port Phillip Council, 2009).

3. Project Outline:

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3.1 Aims:

- Collect and compile sustainability indicator sets already developed; for example SoE reporting, local Council initiatives, and indicators from other regions.
- Compare and contrast existing indicator sets to identify common indicators.
- Establish indicators that may be useful for a regional sustainability strategy within the Biosphere.
- Assess and make recommendations on the overall relevance, interest and application of a Triple Bottom Line (TBL) set of indicators for the Mornington Peninsula and Western Port Biosphere Reserve.

To meet these aims, indicator sets would have to be investigated methodically, the process of which is described below.

4. Methodology:

This study was designed to act as preliminary research for the development of a sustainability indicator set for the Biosphere. Due to the existence of sustainability indicators in many monitoring and reporting programs around the world, this study was aimed at examining existing sustainability indicator sets. This would allow suitable indicators to be identified and examined, based on already existing evidence and the experiences of other projects.

The research involved the exploration of the following potential sources of information:

- Academic research articles regarding sustainability indicators and other measures of sustainability.
- Government initiatives and projects on various scales that involve the use of sustainability indicators and sustainability reporting.
- Council websites.
- Personal contact with council representatives.
- Other internet resources.

The overall process of the research undertaken in this research included:

1. Obtaining sustainability indicators sets from various sources aimed at monitoring sustainability on multiple scales. This includes Federal State of the Environment (SoE) reporting and local Council initiatives.
2. Investigating these sustainability indicators and identifying the dimensions explored, and the indicators and measures used.
3. Examine the aims of each of the projects or reports, and assess the monitoring process and what the indicators are currently being used for.
4. Compile a list of each indicator set for further analysis using Excel.
5. Identifying common indicators by comparing all the indicator sets to the Australian Federal SoE Report 2006 (Stage 1 of comparisons).
6. Tallying the total matches in the comparisons, with a higher total representing a more common indicator.

7. Separating the indicators that did not produce a match from all the comparison sets and isolating for further analysis.

8. Comparing these indicators with the indicators from the United Nations (UN) Centre for Sustainable Development (CSD) indicators which also did not produce a match (Stage 2 of comparisons).

9. Tallying the total matches in the comparisons, with a higher total representing a more common indicator.

10. Separating the indicators that did not produce a match from all the comparison sets and isolating for further analysis.

11. Comparing these indicators with the indicators from the Community Indicators Victoria (CIV) indicators which also did not produce a match (Stage 3 of comparisons).

12. Tallying the total matches in the comparisons, with a higher total representing a more common indicator.

13. Examining the common indicators from each of the steps of analysis.

It can be seen above that the approach of the analysis conducted requires the repetition of steps 5 to 7, although changing of the indicator set to which other sets are compared (the baseline set). This was undertaken in order to identify indicators that may have been absent in the previous baseline set(s) possibly because of the common indicators based on their scale of use.

The rationale for each of the baseline sets used is as follows:

- Federal SoE Report 2006: This was the first baseline set used for comparisons, primarily because it is the most extensive sustainability reporting process in Australia, especially for the environment. The Federal SoE Report 2006 as a baseline set was also selected because the Biosphere is located within Australia and contains conservation values specific for Australia.

- UN CSD Indicators: This set is based on indicators developed on an international scale and applicable for various countries, therefore it was proposed that the indicator set would be quite extensive and encompassing. It was also selected because the Biosphere is a UN-based initiative and originates from UNCED.

- CIV Indicators: In order to identify indicators that may be specific on a local and regional scale, CIV indicators were used for the final analysis. This set is also applicable for the Biosphere because it is a Victorian initiative.

Overall, all of the sets used in the analysis were selected because of their region of use and also because they were the indicator sets most likely to contain indicators that would be

applicable for the Biosphere. The local and regional indicator sets are all from Victoria, including the Cardinia Compass and Frankston State of the City indicators, which are from Councils within the Biosphere. The federal indicator sets include the Australian Bureau of Statistics (ABS) Measuring Australia's Progress (MAP) indicators, as well as indicators originating from the United Kingdom (UK). The UK-based set was chosen in order to investigate indicators that are both extensive and from a foreign country to gain a different perspective than from Australian-based indicator sets. The international United Nations Educational, Scientific, and Cultural Organisation (UNESCO) indicator set was used because the Man and the Biosphere is a UNESCO-based programme and therefore the underlying principles of the indicators would be compatible with the Biosphere. The European Commission set was the other international indicator set used, and was selected because it is one of the most well researched sets and is applicable to multiple countries within the European Union (EU).

Listed below are the sustainability indicator sets used for analysis, including details such as the numbers of indicators and aims of the particular indicator set.

5. The sustainability indicator sets used for analysis:

The full indicator sets are attached to this report in Appendix 1, although the Australian SoE 2006 indicators are incorporated into the comparison tables in Appendix 2.

Australian Federal State of the Environment (SoE) report 2006 (Beeton et al, 2006):

The Commonwealth SoE report is the only mandated national reporting process in Australia, for which data from different aspects of the environment are brought together and assessed by independent experts. The report from 2006 is the third independent national stocktake of the Australian environment, and covers the five-year period from 2001 to 2006.

This report focuses on environmental problems and progress, but also includes environmental and social indicators. The report is widely available for people to evaluate, comment and act on environmental issues.

The report works on 296 indicators separated into 8 themes, these being:

- Human settlements
- Atmosphere
- Biodiversity

- Coasts and oceans
- Inland waters
- Land
- Natural and cultural heritage
- Australian Antarctic Territory

Frankston State of the City Indicators (Frankston City Council, 2008):

The Frankston State of the City Indicators have been established as part of the Frankston 2025 scheme. Targets have been set for several of the indicators, and currently the reporting process is still establishing baseline data and monitoring progress.

There are 21 indicators from the following areas:

- Connected community
- Well governed
- Proud and safe
- Active and healthy
- Rich and vibrant culture
- Learning community
- Business prosperity and local employment
- Well planned, well built and well maintained
- Clean and green

Cardinia Compass Indicators (Cardinia Shire Council, 2006):

The Cardinia Compass Indicators aim to measure whole community sustainability for community decision making and council planning, and are currently being used for monitoring.

There are 45 indicators that represent a range related to a compass model:

- N - Natural environment

- S - Social environment
- E - Economic environment
- W - Individual Wellbeing

Community Indicators Victoria (CIV, 2009b) :

CIV was created in the Victorian Community Indicators Project commissioned by VicHealth, which began in January 2005. The indicators were developed to present and report on the wellbeing of Victorians using an integrated set of community wellbeing indicators. The program aims to establish a sustainable Victorian approach to the development and use of local community wellbeing indicators, with the purpose of improving citizen engagement, community planning and policy making.

There have been 75 indicators developed so far in 5 domains of community wellbeing:

- Social
- Economic
- Environmental
- Democratic
- Cultural

Port Phillip Community Pulse (City of Port Phillip Council, 2009):

The Port Phillip Community Pulse is a Council initiative and aims to aid community to track trends on issues and stimulate broader community awareness and action. It is currently being used for monitoring, with 2 reports having been published over the past 8 years. The Community Pulse has been endorsed for an initial period of 10 years and draws on values outlined in the community plan.

There are 13 core indicators that are divided into a total of 41 measures. These measures have been designed to relate to individual's everyday experiences, rather than technical validity.

Knox, Maroondah and Yarra Ranges Community Indicators (Centre for Regional Development Swinburne University, 2005):

The Knox, Maroondah and Yarra Ranges community indicators are a result of a collaborative regional project, developed as a means of monitoring community sustainability. Through developing community visions, residents in each of the three municipalities in the Outer East, (Knox, Maroondah and Yarra Ranges) have expressed a common desire to achieve a better quality of life now and for future generations. In developing the indicator set, the project aims to track the community's progress in attaining the vision of a sustainable future.

There are 30 indicators with 46 measures under 7 themes:

- An active healthy community
- An accessible community
- A prosperous community
- A community that protects and enhances the environment
- A well designed and well built community
- A learning community
- A culturally rich community

United Kingdom (UK) Government Strategy Indicators (UK Department for Environment, Food and Rural Affairs, 2008):

The UK government strategy indicators were outlined in the UK government sustainable development strategy, called securing the future, in 2005. They are intended to highlight progress in key issues for sustainable development and priority areas, and identify where action is required.

There are 74 indicators with 126 measures in four priority areas:

- Sustainable consumption and production
- Climate change and energy
- Protecting natural resources and enhancing the environment
- Creating sustainable communities and a fairer world

Australian Bureau of Statistics (ABS) Measures of Australia's Progress (MAP) (Trewin, 2006):

This report builds upon ABS's large resource base and is aimed at addressing progress with an alternative to GDP. The current report is the 3rd edition of the report since the first was released in 2002. The main purpose of the report is to facilitate community engagement with a focus on sustainability, because it "allows Australian's to make their own assessment of whether life in Australia is getting better".

There are 111 total indicators split into 14 dimensions:

- Health
- Education and training
- Work
- National income
- Economic hardship
- National wealth
- Housing
- Productivity
- The natural landscape
- The air and atmosphere
- Oceans and estuaries
- Family, community and social cohesion
- Crime
- Democracy, governance and citizenship.

European Commission Indicators (European Commission, 2009):

The European Commission Indicators were developed through the EU Sustainable Development Strategy (SDS), which was first adopted in 2005, and reviewed in 2007.

There are 140 total indicators that are designed as a three level pyramid with the headline indicators having the highest communication value.

The set includes contextual indicators that provide valuable background information but don't directly monitor the strategy's objectives.

The indicator set is separated into ten themes:

- Socio-economic development
- Sustainable consumption and production
- Social inclusion
- Demographic changes
- Public health
- Climate change and energy
- Sustainable transport
- Natural resources
- Global partnership
- Good governance

United Nations (UN) Centre for Sustainable Development (CSD) Indicators (United Nations, 2007):

The UN centre for sustainable development commission and indicator set was developed in direct response to UNCED in 1992 (the Earth Summit) and Agenda 21. The indicators aim to play a role in implementing national sustainable development strategies and Millennium Development Goals (MDGs).

There are 50 core indicators that are a part of a larger set of 96 indicators of sustainable development. The larger set allows countries to do a more comprehensive assessment of sustainable development.

United Nations Educational, Scientific, and Cultural Organisation (UNESCO) Indicators (UNESCO-SCOPE, 2006):

The UNESCO indicator set was initially developed by The Scientific Committee on Problems of the Environment (SCOPE) and aided by the United Nations Environmental Program (UNEP), the European Environment Agency (EEA), and the International Human Dimensions Programme on Global Environmental Change (IHDP). The aim of the indicator set is to inform countries of global sustainability targets performance such as the Kyoto Protocol, and measure progress towards MDGs, as in the UN CSD indicator set.

There are 61 indicators in total, which spread across the following dimensions:

- Environment
- Society
- Institution
- Economy

5.1 Changes made to the Federal SoE 2006 Indicators:

In order to make comparisons of other indicator sets with the Australian Federal SoE 2006 Report more efficient, changes were made because a total of 296 indicators were examined. In some instances indicators were removed because they were considered to have no application in the Biosphere, in other instances indicators were pooled in order to make comparisons more straightforward. The changes made to the Federal SoE 2006 indicator list prior to analysis are as follows:

- Indicators deleted:

- All indicators from the Australian Antarctic Territory theme.
- IW-38 - Cane toad distribution.

- Indicators pooled:

- Air quality: into urban areas (A-17 to A-23) and regional areas (A-24 to A-30).
- Water quality (IW-17 to IW-22).
- A-38 and A-39 - Methane and nitrous oxide concentrations and growth rates, respectively.
- A-42 to A-44 - Carbon dioxide equivalent emissions by sector, primary fuel type, mode of travel and road transport emissions by vehicle type.

After the changes were made to the original indicator set the indicators were separated based on the themes of the original Federal SoE 2006. However, some themes were collated in order to make comparisons more efficient, these being Land and Biodiversity, Inland waters and Coasts and Oceans, and Human Settlements and Heritage. The atmosphere-related indicators were kept separate.

6. Results and Discussion:

The Federal SoE 2006 indicator set was the first baseline set used for identifying common indicators. Table 1 below displays the most common indicators when comparing with the Federal SoE 2006 indicators. These indicators produced at least 7 matches in the comparisons for the Human Settlements theme, and at least 5 matches for any other theme.

Table 1: Common indicators from comparisons with Federal SoE 2006

Indicator (Theme)	Number of matches
Measures of knowledge and skills (Human Settlements)	**8**
Employment rates by population, industry and region (Human Settlements)	**8**
Water consumption per capita (Human Settlements)	**8**
Total solid waste produced and disposed (Human Settlements)	**8**
Amounts of solid waste recycled (Human Settlements)	**8**
Other economic indicators (Human Settlements)	**8**
Indicators of health and wellbeing (Human Settlements)	**7**
Journey to work modal split (Human Settlements)	**7**
Carbon dioxide concentrations and growth rates (Atmosphere)	**6**
Change in total carbon dioxide equivalent emissions by gas (Atmosphere)	**6**
Air quality - concentrations of certain compounds in urban areas (Atmosphere)	**6**
Methane and nitrous oxide concentrations and growth rates (Atmosphere)	**6**
Land use and land use change (Land)	**6**
Carbon dioxide equivalent emissions by sector, primary fuel type, mode of travel, and road transport emissions by vehicle type (Atmosphere)	**5**
Assessment of river condition indices (Inland waters)	**5**

As it is evident in the table above, the majority of the matches made in the comparisons were in the Human Settlements theme, and this is most likely due to half of the comparison sets

being on the local or regional level. These sustainability indicator sets have a high prevalence of social indicators and indicators that relate to human settlements, because of their scale of application. This observation is illustrated by examining the total numbers of matches in each of the themes, where human settlements alone produced 120 matches and all other themes combined (including heritage) produced 97 matches.

There were 8 indicators in the Human Settlements theme that displayed at least 7 matches when comparing with the other indicator sets. Some of the most common indicators from the Human Settlement theme include indicators that incorporate multiple measures, these being:

- Measures of knowledge and skills
- Other economic indicators
- Indicators of health and wellbeing

The incorporation of multiple measures and their nature both contributed to these indicators being more common than other indicators. The measures of these indicators are listed below:

Measures of knowledge and skills:

- Stock of human capital by skill level
- Numbers in the labour force
- Education levels of population and numbers by age currently in post-secondary training
- Household use of information and communication technology

Other economic indicators:

- Average wage and salary income
- Disposable household income
- Household income by quintiles
- Household debt
- GDP and GDP per capita
- Household expenditure
- Income by cities and regions

Indicators of health and wellbeing:

- Number of employed medical practitioners relative to population
- Hospitals by separation from population
- Mortality rates by causes of mortality

Table 1 above shows that 4 out of the 7 most common indicators from a theme other than Human Settlements were associated with greenhouse gas emissions. Greenhouse gas emissions are a very important indicator of sustainability, especially with the current focus worldwide on climate change. They are also one of the most established indicator types in Australia, due to the development of the National Greenhouse Gas Inventory as part of Australia's commitments in the United Nations Framework Convention on Climate Change (UNFCCC) (Wentworth Group of Concerned Scientists, 2008).

The other identified common indicators were associated with air quality, land use and land use change, and river condition assessments. According to the Federal SoE 2006 Report, urban air quality has steadily improved in Australia and by international standards, Victoria has good air quality (Beeton et al, 2006; Commissioner for Environmental Sustainability, 2008). Land use and land use change are indicators that are especially applicable to Victoria, because Victoria's historic use of land has left a legacy of highly cleared and fragmented native vegetation over much of the state (Commissioner for Environmental Sustainability, 2008). There is a requirement for improvements in river management in Victoria. Alarmingly, the 2004 Index of Stream Condition assessment reported that only 21% of major rivers and tributaries in Victoria were in good or excellent condition (Commissioner for Environmental Sustainability, 2008).

After comparisons with the Federal SoE 2006 indicators, non-matched indicators were isolated and compared to the non-matched UN CSD indicators, and this was also repeated for the CIV indicators. The most common indicators from these comparisons are listed below in Table 2.

Table 2: Common indicators from non-matched indicators compared with UN CSD and CIV indicators

Baseline Set	Indicator	Number of matches
UN CSD Indicators	Number of intentional homicides per 100,000 population	**7**
	Life expectancy at birth	**6**
	Share of women in wage employment in non-agricultural sector	**4**
CIV Indicators	Volunteering	**6**
	Opportunities to have a say on important issues	**5**
	Perceptions of safety	**5**
	Community acceptance of diverse cultures	**4**
	Participation in citizen engagement	**4**
	Subjective wellbeing	**4**

As can be seen in the table above, there were 3 indicators in the comparison with the UN CSD indicators that had at least 4 matches. For the most common indicator, number of intentional homicides per 100,000 population, another indicator was considered a match if it contained any measure corresponding to homicide. This was most likely common because of the lack of indicators related to crime in the Federal SoE 2006 report.

Another indicator that is not included in the Federal SoE 2006 report is life expectancy, which was found to be the second most common indicator in the comparison with the UN CSD indicators. It is postulated that the absence of life expectancy and crime from the Federal SoE report is because the focus of the report is on environmental values and observations. The main aim of the SoE report is to take a national stocktake of the Australian environment (Beeton et al, 2006).

The other most common indicator observed in the comparison with the UN CSD indicators was the share of women in wage employment in a non-agricultural sector. An indicator was considered a match if it included the percentage of women working in any type of

employment. It was found that 2 out of the 4 matches referred to the prevalence of women in Council (both Council-level indicator sets).

It was shown from the comparisons with the CIV indicators that the most common indicators are related to community wellbeing. These indicators are displayed above in Table 2. This is due to the prevalence of community wellbeing indicators in the CIV indicator set and also the lack of these indicators in the Federal SoE 2006 and UN CSD sets. Volunteering was found to be the most common indicator, with 6 total matches. Subjective wellbeing, another one of the most common indicators, includes self-observed measures of wellbeing, such as security and feeling part of the community.

Due to the method of analysis, each subsequent stage of the comparisons utilized a reduced number of indicators because only the non-matched indicators were compared. Table 3 below displays the different indicator sets and how many non-matched indicators were left after each stage of the comparisons.

Table 3: The number of non-matched indicators after each stage of the comparisons

Scale	Indicator Set	Number of indicators/measures	Non-matched indicators/matches after Fed SoE comparison	Non-matched indicators/matches after UN CSD comparison	Non-matched indicators after CIV comparison
International	UN CSD Indicators 2007	96	47	-	-
International	UNESCO Indicators 2008	61	30	9	9
International	European Commission 2007	140	87	52	49
Federal	ABS MAP 2006	111	63	52	49
Federal	UK Government Strategy Indicators 2008	126	39	29	23
Local/Regional	Frankston State of the City Indicators 2009	21	16	16	5
Local/Regional	Cardinia Compass Indicators 2006	45	34	29	9
Local/Regional	Community Indicators Victoria 2009	75	45	39	-
Local/Regional	Port Phillip Community Pulse 2009	41	31	29	20
Local/Regional	Knox, Maroondah, Yarra Ranges Regional Indicators 2005	46	26	24	8

It can be seen in Table 3 that there were no indicator sets that had all indicators matched after the final stage of analysis. The Frankston State of the City indicators displayed the least number of non-matched indicators (however there were only 21 indicators in total), and the UK Government Strategy Indicators had the greatest number of matching indicators, with 103 indicators being matched out of a total of 126. For the UK Government Strategy Indicators, most

of the matches were made in the first stage of analysis, and this is most likely due to the indicators being of the same scale as the Federal SoE 2006 Report.

Even though the analysis identified common indicators, they may not be the only indicators that would be best suited for the Biosphere. Other suitable indicators may only be present in one indicator set or possibly have not yet been developed. Examples of indicators that may be applicable for the Biosphere that were not identified as common include:

- Seagrass in Western Port Bay (Cardinia Compass Indicators)
- Sea level (Federal SoE 2006 Indicators)
- Southern Brown Bandicoot population distribution and conservation status (not present in indicator sets examined)

The Mornington Peninsula and Western Port Biosphere is unusual in that it includes areas of vital importance for conservation as well as urban areas. Therefore it requires a range of indicators that cover all dimensions of sustainability; these being the environment, society and economy. The common indicators identified in the analysis address all of these dimensions, such as:

Environment:

- Solid waste related indicators
- Greenhouse gas emissions related indicators
- Land use and land use change
- Assessment of river condition indices

Society:

- Personal and community wellbeing related indicators (eg. subjective wellbeing, perceptions of safety)
- Employment rates
- Water consumption
- Air quality
- Crime (homicide)
- Life expectancy

Economy:

- Average wage and salary income

- Disposable household income
- GDP and GDP per capita
- Household income by quintiles
- Household debt

The most common indicators listed above suit a TBL framework, which allows the integration of the dimensions of sustainability to ensure genuine progress is monitored. Additional efforts are required to develop a balanced TBL indicator set as well as identifying other indicators applicable for the Biosphere. The possible directions for future research into the development of an indicator set for the Biosphere are described below.

7. Conclusions and Future Directions:

This study has identified common indicators by comparing various indicator sets from different sources and scales. Overall, it was found that the most common indicators when comparing indicator sets to the Federal SoE 2006 report were those that were associated with the human settlements dimension. Other common indicators identified in the first stage of analysis were associated with greenhouse gas emissions, land use and land use change, and also air quality. The most common indicators identified when comparing to the UN CSD indicators were associated with homicide and life expectancy. When comparing to the CIV indicators, the most common indicators were related to community wellbeing. Due to the fact that there is no perfect set that can be applicable for any region or scale, there was also no indicator set that could be used as a baseline set to identify all the common indicators possible. This is the reason for three stages of analysis, and changing the scale of the baseline set in each case. It is thought that in future research other methods could be utilized that improve the identification of indicators for the Biosphere, such as modelling and gap analysis. For example, there is the possibility of using data modelling tools to undertake extensive analysis of the different indicator sets used in this study.

It is known that indicator sets can be presented in various ways, including headline and supplementary indicators, and incorporating multiple measures into separate indicators. Not all indicator sets include this type of grading of indicators; however it can create more transparency and simplicity when conveying data from the indicators to determine a measure of progress or sustainability. Considerations need to be made for the design of the indicator set for the Biosphere so that there is effective communication of information whilst also producing an accurate measure of progress. The individual indicators themselves should also be designed with certain characteristics in order to be most effective. These characteristics are utilised in the SMART filter, where indicators are selected based on being simple, measurable, accessible, reliable, and timely (SoE Reporting Unit, 2001).

The analysis undertaken in this research will not be able to identify all the indicators that may be applicable for the Biosphere and further research is required. It was not within the scope of the project to recommend a complete set of indicators, due to the intensive process involved in not only selecting the indicators, but also populating them with data. Finding the right approach to representing a given issue through an indicator is important, however it is also difficult. For example, when selecting indicators it is important that the measures used to assess them are determined so that the source of data is measureable and easily communicated. Also selecting the indicators requires some judgement to be made and cannot be based on scientific evidence alone. This process requires input from various sources, including government representatives, scientists and the community (Valentin and Spangenberg, 2000). The consideration and discussion of the values and concepts underlying each indicator and the inclusion of the individuals that will be affected by decisions related to the indicators can lead to a more balanced outcome (Cobb and Rixford, 1998). Therefore the development of an indicator set in the Biosphere requires a collaborative and participatory approach. This will aid in obtaining measures of sustainability best suited for the Biosphere, by selecting indicators that reflect collective values and inform collective decisions. Communication and coordination between the councils within the Biosphere is also required, of which are at various stages of indicator set development. One of the limitations of this study is that indicator sets have not been developed in the Bass Coast, Casey and Mornington Peninsula councils, and therefore these council's key objectives for sustainability could not be incorporated in the analysis. Future collaborative projects will aid in developing an indicator set that represents the views of all councils within the Biosphere.

Future research can aid in the development of sustainability indicators by identifying key themes of sustainability that the Biosphere are focused on monitoring, and basing these themes on TBL dimensions. There are two major steps in developing sustainability indicator sets, these being (Trewin, 2006):

- Defining and applying a mechanism for choosing what aspects of sustainability are to be measured.
- Deciding how each aspect is to be measured and how the measures are to be presented.

Specifically, in order to select the indicators, the following steps can be followed (Trewin, 2006):

1. Define the broad dimensions of sustainability to be measured (eg. Society, economy, and environment).
2. Make a list of issues of sustainability of interest (eg. transport) within each of the dimensions.
3. Choose a subset of issues for which to find suitable indicators.

4. Select an indicator (or indicators) to give statistical expression to each of these issues.

It is expected that this process is not linear, and that continuous re-examination of the dimensions and indicators would be required in order to design an indicator set that is the most suited for the Biosphere.

References:

Beeton, R.J.S., Buckley, K., Jones, G., Morgan, D., Reichelt, R., Trewin, D. (2006) *"Australia State of the Environment 2006"* Department of the Environment and Heritage, Canberra, Australia.

Cardinia Shire Council (2006) *"Cardinia Compass: indicators of community sustainability"* Centre for Regional Development, Melbourne, Australia.

Centre for Regional Development Swinburne University (2005) *"Community Sustainability Summary Report, Outer Eastern Melbourne"* Melbourne, Australia.

City of Port Phillip Council (2009) *"The Community Pulse"* Community Pulse Steering Committee, Melbourne, Australia.

Clarke, M., Lawn, P. (2005) "Measuring Victoria's genuine progress: A genuine progress indicator (GPI) for Victoria" *Economic Papers* **24**(4) pp. 368-389.

Cobb, W., Rixford, C. (1998) *"Lessons learned from the history of social indicators"* Redifining Progress, San Francisco, USA.

Commissioner for Environmental Sustainability (2008) *"Victorian State of the Environment Report"* Melbourne, Australia.

Community Indicators Victoria (CIV) (2009a) *"CIV resource guide"* McCaughey Centre, Melbourne, Victoria.

Community Indicators Victoria (CIV) (2009b) *"Community Indicators Victoria"* (http://www.communityindicators.net.au/). Last accessed, 26 October, 2009.

Environment Australia (2002) *"Are we sustaining Australia? Report against headline sustainability indicators"* Canberra, Australia.

European Commission (2009) *"Indicators for monitoring the EU Sustainable Development Strategy"* (http://epp.eurostat.ec.europa.eu/portal/page/portal/sdi/introduction). Last accessed, 26 October, 2009.

European Commission (2007) "*Measuring progress towards a more sustainable Europe: 2007 monitoring report of the EU sustainable development strategy"* Eurostat, Luxembourg.

Frankston City Council (2008) *"State of the City reporting indicators"* Melbourne, Australia.

Mornington Peninsula and Western Port Biosphere Reserve Foundation (2009) *"Mornington Peninsula and Western Port Biosphere Reserve Foundation"* Melbourne, Victoria (http://www.biosphere.org.au/index.html). Last accessed, 26 October, 2009.

Reed, M.S., Fraser, E.D.G., Dougill, A.J. (2006) "An adaptive learning process for developing and applying sustainability indicators with local communities" *Ecological Economics* **59** pp. 406-418.

State of the Environment (SoE) Reporting Unit (2001) *"Local Government Case Studies in Environmental Management - Case Study Number 6"* Environment Australia, Canberra, Australia.

Trewin, D. (2006) *"Measures of Australia's Progress"* Australian Bureau of Statistics, Commonwealth of Australia, Canberra, Australia.

UNESCO-SCOPE (2006) "Indicators of sustainability: Reliable tools for decisions making" *UNESCO-SCOPE Policy Briefs* **May, 2006** (1).

United Kingdom (UK) Department for Environment, Food and Rural Affairs (2008) *"Sustainable development indicators in your pocket"* Department for Environment, Food and Rural Affairs, UK.

United Nations (2007) *"Indicators of sustainable development: Guidelines and methodologies"* New York, USA.

United Nations Conference on Environment and Development (UNCED) (1992) *"Agenda 21, Programme of action for sustainable development, adopted at the United Nations conference on environment and development"* Rio de Janeiro, Brazil.

Valentin, A., Spangenberg, J.H. (2000) "A guide to community sustainability indicators" *Environmental Impact Assessment Review* **20** pp. 381-392.

Wentworth Group of Concerned Scientists (2008) *"Accounting for Nature: A model for building the national environmental accounts of Australia"* Sydney, Australia.