



Raymond Charles Rauscher
Salim Momtaz

Sustainable Communities: A Framework for Planning

Case Study of an Australian Outer
Sydney Growth Area

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Greenfield area of an outer Sydney suburb taken by Ray Charles Rauscher

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*We dedicate this book to the Tom Farrell
Institute for Environment of the University of
Newcastle, Australia ([www.newcastle.edu.au/
research-centre/tfi](http://www.newcastle.edu.au/research-centre/tfi)). The Institute is thanked
for the support that it extends to academics
and the wider community in furthering efforts
to protect and enhance the environment.*

Preface

This book is partly a response to the increasing numbers of people expressing concerns over a number of environmental issues such as impact of climate change; carbon emissions; pressures from overpopulation of cities; coal seam gas extraction; and, depleting natural resources. Governments, in response, are trying to develop policies to address these concerns. The authors have developed a 'sustainable communities framework' (SCF) incorporating sustainability principles (that is social/cultural, environmental and economic) within urban planning. The book can be used for research purposes or as a manual by practitioners (government or private) and community groups. The framework can be applied to different sized areas, including: local; district; local government area; or, region.

The book examines current urban planning schools, such as: land use planning; natural resource planning; and sustainable urban planning. The authors focus on the extent that these schools incorporate principles of sustainability within urban planning. The authors critique the extent that current planning practices are moving towards a more coordinated and holistic framework in incorporating sustainability principles.

The authors propose a five (5) step SCF built on an application of sustainability tables. A wide range of urban planning practices utilising sustainability criteria are examined. Both qualitative (i.e. a SCF survey step) and quantitative (i.e. a SCF sustainability scorecard) tools are outlined within the framework. To guide the reader the framework is applied to a case study outer Sydney growth area of Wyong Shire, Central Coast, NSW, Australia.

The authors address the question of how best to measure the environment by presenting a table for selecting indicators of sustainability. Sustainability scorecards to record these indicators of sustainability are then outlined. Within the scorecards are sustainability ratings (using green, amber and red). The authors show how aggregating (scaling up) these ratings allows the framework to be applied to larger areas such as districts. Finally, the authors outline how scorecards can be used within sustainability reports (with actions and monitoring components) for a subject area.

In assisting the reader, the authors draw a future scenario on the application of the SCF to incorporate principles of sustainability into urban planning. Finally, readers

will be interested in future options for applications of the SCF, including: (1) adopting a systems program; (2) environmental performance monitoring and (3) showing how the framework will accommodate the social/cultural and economic components of sustainability, in addition to the environmental ones as examined in the case study presented in the book.

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Contents

1 Introduction to Sustainability	1
1.1 Defining Sustainability.....	1
1.2 Chapter Summary.....	4
References.....	4
2 Sustainability and Urban Planning	5
2.1 Sustainability and ESD	5
2.2 ESD Related Documents.....	7
2.2.1 International.....	7
2.2.2 International Non-government Organisations (NGOs).....	11
2.2.3 Commonwealth.....	14
2.2.4 NSW State	19
2.3 ESD Based Urban Planning Frameworks	25
2.3.1 Land Use Planning.....	25
2.3.2 Natural Resource Planning	27
2.3.3 Sustainable Urban Planning.....	29
2.4 Chapter Summary.....	31
References.....	32
3 Sustainable Communities Framework (SCF)	37
3.1 SCF Structure.....	37
3.2 Chapter Summary.....	43
References.....	44
4 Data Sources and Indicators of Sustainability	45
4.1 Searching Data Sources.....	45
4.2 Indicators of Sustainability	51
4.3 Chapter Summary.....	55
References.....	55

- 5 Examining the Study Area** 57
 - 5.1 Background to Study Area 57
 - 5.2 Study Area and Planning..... 60
 - 5.2.1 Greater Metropolitan Region Planning..... 60
 - 5.2.2 Central Coast Planning 64
 - 5.2.3 Wyong Shire Planning 64
 - 5.3 Chapter Summary..... 70
 - References..... 70
- 6 Applying the SCF to the Natural Environment**..... 73
 - 6.1 Step 1: Review ESD Related Documents..... 73
 - 6.2 Step 2: Selecting Indicators of Sustainability 73
 - 6.3 Step 3: Area Survey..... 73
 - 6.4 Steps 4 and 5: Complete Sustainability Score
Cards and Sustainability Reports 82
 - 6.5 Aggregating Sustainability Score Cards 87
 - 6.6 Chapter Summary..... 92
 - References..... 92
- 7 Applying the SCF to the Built Environment** 93
 - 7.1 Step 1: Review ESD Related Documents..... 93
 - 7.2 Step 2: Selecting Indicators of Sustainability 94
 - 7.3 Step 3: Survey Area..... 94
 - 7.4 Step 4: Completing a Sustainability Score Card..... 94
 - 7.5 Step 5: Adopting Sustainability Report..... 97
 - 7.6 Aggregating Sustainability Score Cards 97
 - 7.7 Chapter Summary..... 99
 - References..... 100
- 8 Future Applications of SCF** 101
 - 8.1 Overview of SCF Application..... 101
 - 8.2 Research to Expand the SCF..... 103
 - References..... 105
- Appendices**..... 107
 - Appendix A: ESD Principles Built into Eco-Village Design..... 107
 - Appendix B: GMR Urban Growth 1973–2004
and Environmental Footprint 111
 - Appendix C: Draft Central Coast Regional Strategy 112
 - Appendix D: Built Environment Simulation Model Projections 113
 - Appendix E: Sustainable Urban Planning Web Sites (Updated to Book
Printing Date, Please Inform Authors of Any Change via Email) 114
- Glossary** 119
- About the Authors**..... 123
- Index**..... 125

Acronyms

ABS	Australian Bureau of Statistics
ACF	Australian Conservation Foundation
BASIX	Building Sustainability Index
CAP	Catchment Action Plan
CCWA	Central Coast Water Authority (was GWJWA, Gosford Wyong Joint Water Authority)
CMA	Catchment Management Authority
CSIRO	Commonwealth Services in Industry and Research Organisation
CuM	Cubic metres
DECC	Department of Environment and Climate Change
DEH	Department of Environment and Heritage (was DECC)
DIPNR	Department of Planning and Natural Resources (was Planning NSW)
DoP	Department of Planning (was DIPNR)
DoPI	Department of Planning and Infrastructure (was DoP) (Department of Planning)
EA	Environment Australia
ESD	Ecologically sustainable development
GMR	Greater Metropolitan Region of Sydney
GWJWA	Gosford Wyong Joint Water Authority
HCRCMA	Hunter Coast Rivers Catchment Management Authority
ICLEI	International Council for Local Environmental Initiatives
IUCNRR	International Union for Conservation of Nature and Natural Resources
LA21	Local Agenda 21
LEP	Local environmental plan
LG	Local government
LGA	Local government area
LHCCREMS	Lower Hunter Central Coast Regional Environment Management Study
NABERS	National Australian Built Environment Ratings System
NEMP	Newcastle Environmental Management Plan

NGO	Non-government Organisation
NHT	Natural Heritage Trust
NSW	New South Wales
OEH	Office of Environment and Heritage
PNSW	Planning NSW
PVP	Property Vegetation Plan
SCF	Sustainable communities framework
SEDA	Sustainable Energy Development Agency (NSW)
SoE	State of Environment
TBL	Triple bottom line
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WSC	Wyong Shire Council
WWF	World Wildlife Fund

List of Figures

Fig. 1.1 ESD components—equal weight	2
Fig. 1.2 ESD components—balance to environment	2
Fig. 2.1 ESD related documents and ESD criteria	6
Fig. 3.1 Certification flags—terrestrial biodiversity ESD element.....	39

List of Plates

Plate 4.1	Data sources for indicators of sustainability D1–D6	48
Plate 4.2	Data sources for indicators of sustainability D7–D10	49
Plate 4.3	Data sources for indicators of sustainability D11–D13	50
Plate 5.1	Local areas of North Wyong (plan).....	58
Plate 5.2	Local areas (LAs) of North Wyong district (aerial photo).....	59
Plate 5.3	Greater metropolitan region (GMR) of Sydney	61
Plate 6.1	West Tuggerah Lakes-Wadalba (south) Aerial Photo of Core Local Environments 1994	75
Plate 6.2	West Tuggerah Lakes-Wadalba (south) Photos of Local Environments L1–L6	76
Plate 6.3	West Tuggerah Lakes-Wadalba (south) Photos of Local Environments L7–L12	77
Plate 6.4	West Tuggerah Lakes-Wadalba (south) Photos of Local Environments L13–L16	78
Plate 6.5	West Tuggerah Lakes-Wadalba (south) Major Portion of Habitat and Local Environments	79

List of Tables

Table 2.1	ESD related documents at international level	8
Table 2.2	ESD related documents at international non-government organisations (NGOs) level	12
Table 2.3	ESD related documents at commonwealth level.....	15
Table 2.4	ESD related documents at NSW state level	20
Table 3.1	Sustainable communities framework structure	38
Table 3.2	Step 3—area survey guide for natural environment.....	39
Table 3.3	Step 4—sustainability score card of natural environment for local area.....	40
Table 3.4	Step 5.1—sustainability report of the natural environment by environment component.....	42
Table 3.5	Step 5.2—sustainability report of natural environment by local environments	43
Table 3.6	Sustainability score card (natural environment) scaled up to district level	44
Table 4.1	Sustainability indicators checklist (natural environment).....	52
Table 5.1	Planning documents at the greater metropolitan region planning level	62
Table 5.2	Planning documents at the Central Coast region planning level	65
Table 5.3	Planning documents at the Wyong Shire planning level.....	67
Table 6.1	Step 3—West Tuggerah Lakes-Wadalba (south) survey of aquatic and terrestrial elements	81
Table 6.2	Step 4.1—West Tuggerah Lakes—Wadalba (south) Sustainability Score Card for Aquatic Component.....	83
Table 6.3	Step 5.1—West Tuggerah Lakes—Wadalba (south) Sustainability Report for Aquatic Component.....	84

Table 6.4	Step 5.2—West Tuggerah Lakes—Wadalba (south) Sustainability Score Card for Aquatic Component by Local Environments	86
Table 6.5	Step 4.2—West Tuggerah Lakes—Wadalba (south) Sustainability Score Card for Terrestrial Component by Local Environments	87
Table 6.6	Step 5.1—West Tuggerah Lakes—Wadalba (south) Sustainability Report for Terrestrial Component	88
Table 6.7	Step 5.2—West Tuggerah Lakes—Wadalba (south) Sustainability Report for Terrestrial Environment by Local Environments	89
Table 6.8	Step 5.3—North Wyong Natural Environment Local Areas Sustainability Score Card	90
Table 6.9	Step 5.4—Wyong Shire LGA Sustainability Score Card for Natural Environment by Districts	90
Table 6.10	Step 5.5—Central Coast Sustainability Score Card for Natural Environment by LGA	91
Table 6.11	Step 5.6—Growth Regions beyond Metropolitan Sydney—Sustainability Score Cards for Natural Environment	91
Table 7.1	Step 4—North Wyong sustainability score card for transport component	96
Table 7.2	Step 5.1—North Wyong sustainability report for transport component	97
Table 7.3	Step 5.2—Wyong Shire sustainability score card for the built environment.....	98
Table 7.4	Step 5.3—Central Coast sustainability score card for the built environment.....	98
Table 7.5	Step 5.4—Growth regions beyond metropolitan Sydney-sustainability score cards for built environment	99

Chapter 1

Introduction to Sustainability

1.1 Defining Sustainability

The subjects of sustainability, ecologically sustainable development (ESD) and ESD based urban planning have become of increasing interest worldwide, especially since the early 2000s. Concerns across countries have been aired on the failure of places to achieve environmental sustainability. These failures include for example: water shortages; rising global temperatures; unacceptable levels of greenhouse gas emissions; air and water pollution; increasing wastes; peak oil (50 % world's oil resources expended); health virus pandemics (i.e. bird flu); and, contaminated soils affecting the food chain. Given these failures and the resulting impacts on populations, the authors focus on environmental sustainability.

By 2007 the media worldwide was reporting environmental concerns at an unprecedented rate. On 27th September 2007 the World Wildlife Fund (WWF) stated the serious concerns it had with the potential impact of global warming (WWF 2007). The world political tensions around environmental issues were highlighted in 2007, with nations still not endorsing the UN sponsored Kyoto Protocol (United Nations 1997). An additional report on climate change by the International Panel on Climate Change (United Nations 2007) reinforced earlier calls for governments to act collectively on this issue. Further IPCC reporting in subsequent years to 2012 continued to call for governments' actions around the world. Finally, in an unprecedented stance, the world's leading churches from 2007 onwards expressed concerns that governments were not acting effectively on global warming.

While worldwide expressions of concern about deteriorating environments continued throughout 2007 and early 2008, the writings on the subject accelerated. By 2008 convincing scientific evidence had pointed to the validity of concerns as raised. Writers who had been adding their voices and presenting evidence of environmental problems include: Lomberg (2004), Roberts (2004), Aplin (2006), Flannery (2006), Gore (2006, 2007), Stern (2006), Suzuki (2006), Grosvenor (2007) and Lovins (2012). The writers' comments often tied these highlighted environmental problems to urban growth. The thrust of this phenomenon in many countries is the

Fig. 1.1 ESD components—equal weight (*source*: UN Agenda 21) (1992a)

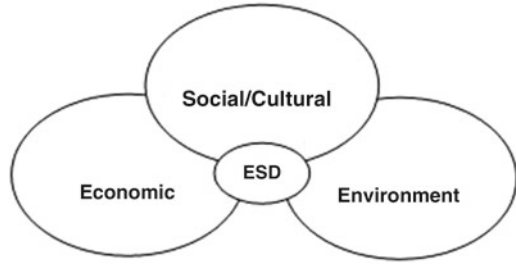
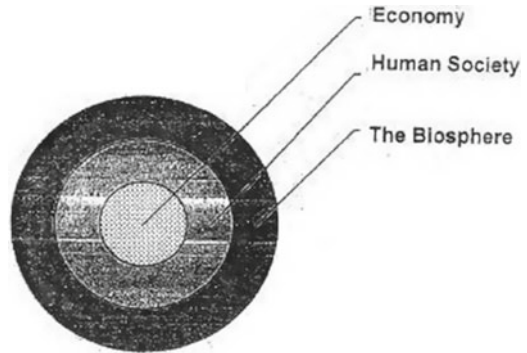


Fig. 1.2 ESD components—balance to environment (*source*: Peet, J 2002)



outward expansion of cities into new growth areas. This expansion (and resulting impacts) directly affects the sustainability in these growth areas. It is these areas that form the basis of the authors having developed the sustainable communities framework (SCF).

Throughout the 1980s and into the first decade of the 2000s there have been numerous definitions and interpretations of the expressions ‘sustainable’, ‘ESD’ and ‘sustainable urban planning’. ‘Sustainable’, as defined in the Macquarie Dictionary, is ‘to provide the means of supporting life in a balanced way’ (Macquarie Dictionary 2006). ‘ESD’ definition under the United Nations *Agenda 21* (Principle 3) (United Nations 1992a) is ‘development fulfilled equitably to meet developmental and environmental needs of present and future generations’ (Fig. 1.1). The three ESD components (social/cultural, environmental and economic) are now widely accepted (United Nations 1992b). The social/cultural component can be taken as two layers for ease of analysis in any assessment of ESD. The components are also often interpreted as the triple bottom line (TBL). The TBL (Benn et al. 2004) requires companies to balance the components of sustainability.

There are, however, other models of sustainability (Aplin 2006). While the above model shows the three ESD components of equal importance (hence called the ‘equal weight’ model), there is an oft quoted version (Peet 2002) (Fig. 1.2). This version places the biosphere (environment) as most important over human society (social/cultural) and economic. Hence this model is referred to as the ‘balance to environment’ model. The book encompasses this model using the ‘the biosphere’ and ‘built environment’ components (referred to in the book as the ‘natural environment’ component).

In summary, the two models noted present a basis to start an analysis of sustainability and ESD. There are questions the planner faces in looking at these subjects within local areas, including: how to measure impacts in local areas; how to use indicators of sustainability measurements; how can indicators fit different sized areas; and, how sustainability reports can (with recommendations and monitoring component) be adopted.

The authors adopt the term ‘local area’ as an area that people can navigate by walking. A local area encompasses variable sized areas, including for example: precinct; institutional land (i.e. university); residential or industrial estate; seniors’ area (i.e. retirement village); cultural land (Aboriginal); village; town; or suburb. A ‘district’ contains a defined number of ‘local areas’ and is usually navigated by car (rather than walking). A local government area (herein referred to as LGA) contains a defined number of districts. In turn, a ‘region’ contains a defined number of LGAs (and a ‘greater region’ or ‘metropolitan area’ often contains a defined number of regions).

The SCF is built around the application of indicators of sustainability. Sustainability ratings assign a value to social/cultural, economic or environmental components. The ratings can be included for example within a sustainability scorecard. Ratings can also be scaled up from local areas to district, local government area or regional. The authors apply the framework to the environment (natural and built) component of sustainability. It is acknowledged that the framework can equally be applied to the social/cultural and economic components of sustainability. The authors further acknowledge the importance of interactivity of sustainability components. In any application of the SCF beyond this book, these factors need consideration.

The authors (Chap. 2) review sustainability and ESD to assist the reader in appreciating the application of the framework to urban planning. The review includes examining three planning schools (land use planning, natural resource planning and sustainable urban planning). Following this review of urban planning schools the authors outline the SCF (Chap. 3).

The selection of data sources and indicators of sustainability is illustrated in Chap. 4. The existence of a large number of data sources at various levels of government can be tapped into within the SCF. A case study area is illustrated in Chap. 5.

The authors then apply the SCF to the natural environment of the study area (Chap. 6). A test is also applied on aggregating (or scaled up) sustainability ratings (within scorecards) from local level to district, LGA and regional levels. The authors show how aggregating will contribute to the proposed sustainability report (uses the scorecard results). The framework is also applied to the built environment (Chap. 7). This application to the district level (as against the local area level) provides a larger catchment to apply quantifiable data. The aggregation of sustainability ratings from the district level (within scorecards) to LGA and regional levels is illustrated (as completed for the natural environment test). Finally, the authors illustrate where future research will assist urban planning accommodating sustainability principles (Chap. 8).

1.2 Chapter Summary

This chapter summarised the state of the world's environments and the need to plan using sustainability criteria. The chapter reviewed terms of sustainability and its components. Finally, the chapter introduced the 'sustainable communities framework' (SCF) and indicated how it could be applied. The next chapter looks at sustainability and urban planning.

References

- Aplin G (2006) *Global environment in crises: an Australian perspective*. Oxford, Sydney
- Benn S, Dunphy DC, Griffiths A (2004) *Corporate change for sustainability: the way ahead*. Australian Conservation Foundation, Carlton
- Flannery T (2006) *Weathermakers*. HarperCollins, Sydney
- Gore A (2006) *Earth in balance: ecology and human spirit*. Nodale, New York
- Gore A (2007) *An inconvenient truth*. Wiley, New York
- Grosvenor M (2007) *Sustainable living for dummies*. Wiley, Sydney
- Lomberg B (2004) *Global crises, global solutions*. University Press, Cambridge
- Lovins LH (2012) *The way out*. Hill and Wang, New York
- Macquarie (2006) *Macquarie dictionary*. Macquarie, Sydney
- Peet J (2002) Sustainable development: why is it so difficult? *Pacific Ecologist*, vol. 4, Summer 2003, pp 16–20
- Roberts P (2004) *The end of oil*. Bloombury, Staffordshire
- Stern R (2006) *International climate change final report*. Her Majesty's Treasury, London
- Suzuki D (2006) *Suzuki David the autobiography*. Allen Unwin, Vancouver
- United Nations (1992a) *Agenda 21*. United Nations, New York
- United Nations (1992b) *United Nations conference on environment and development report (Rio Summit)*. United Nations, New York
- United Nations (1997) *Greenhouse gases reduction agreement report (Kyoto protocol)*. United Nations, New York
- United Nations (2007) *United Nations' global environment outlook*. United Nations, New York
- World Wildlife Fund (2007) *Living planet report*. World Wildlife Fund, Gland

Chapter 2

Sustainability and Urban Planning

2.1 Sustainability and ESD

Any review of sustainability and ESD needs to start with examining the foundations of these concepts and their rationale. The ability of towns, suburbs, cities and regions to meet ever changing social, economic and environmental needs is a challenge for governments. By the late 1990s there were authors calling for authorities to introduce sustainability principles into their urban planning. Trainer (1998), by the late 1990s, stated that society needs to find a more balanced and simpler way of building cities/regions. He states there are finite limits of resources available to build these areas. He thus argues for the incorporation of ESD criteria into the way cities/regions are planned. Troy (1998) emphasises the need for all levels of government, from local government to international, to introduce measurements of equity and efficiency in moving to sustainability of cities/regions. Newman and Kenworthy (1999) introduce a sustainability framework around designing cities that were not dependent on the automobile. Taking an overview, Saul (2002) argues that cities and regions (herein designated cities/regions) and the general functioning of societies within those cities/regions have lost their equilibrium¹. Finally, Lowe (2005) and Hunter Lovins (2012) advocate changes in the way our institutions (including urban planning) operate to heed the warnings from scientists on the urgency to act on environmental matters.

Other authors emphasise the importance of the social/cultural component of ESD. Stocker and Burke (2006), for example, places a high importance on place based sustainability education and the sharing of community wisdom. This emphasis on the social/cultural ESD component is further progressed by Hillier (2005), van de Kerkhof (2005) and Walsh and Mitchell (2002). Within the social/cultural ESD component questions of governance and the political processes also arise. Newman and Kenworthy (1999) explores this aspect around the subject of applying

¹Equilibrium is the state of rest due to the action of forces that counteract each other (Macquarie Dictionary 2005).

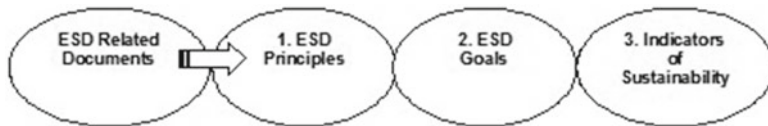


Fig. 2.1 ESD related documents and ESD criteria

sustainability criteria for planning cities, in particular transport. Other authors, including Kemp et al. (2005), Petschow et al. (2005), and Voss and Bauknecht (2006), have focused on specific aspects of governance incorporating an ESD approach. These authors emphasise the importance of flexibility in decision making and the ability of government to take on new challenges raised by the public, science or business sectors.

ESD related documents (i.e. protocols, acts and reports) represent the key advances of sustainability. These documents usually refer to sustainability criteria, consisting of: ESD principles; ESD goals; and, indicators of sustainability (Fig. 2.1). These sustainability criteria are contained within (and sometimes the bases of) documents at all levels of government (international, national, state and global) and non-government organisations. Considerable debate can centre around one or more of the principles, goals or indicators of sustainability.

There are a number of key words (e.g. principles, goals and indicators of sustainability) connected with ESD and contained in most documents on the subject (defined in the glossary). The adoption of ESD principles leads to goals and in turn leads to indicators of sustainability. ‘ESD principles’ were introduced at the international level at the *United Nations Conference on Environment and Development Report* (United Nations 1992b) (herein called the Rio Summit Report). The Rio Summit Report contains a declaration with 27 key principles varying from ‘human beings are at the centre of concerns for sustainable development’ (Principle 1) to ‘peace, development and environment protection are interdependent and indivisible’ (Principle 25). ESD principles have been advanced within a number of other documents completed at different levels of governance. These levels include for example: (a) international (i.e. *Political Declaration and Plan of Implementation (Johannesburg)* (United Nations 2002b), (b) national (i.e. *Sustainable Cities* (Commonwealth Government 2005a), and (c) state (*Building and Sustainability Index (Basix) Act* (NSW 2000).

ESD principles feature as a central focus of an Australian study on the future impacts of population development entitled *Future Dilemmas to 2050* (CSIRO 2000). The CSIRO argues that authorities and communities will need to select key ESD principles to engage in the subject of current declining environments and future threats to the environment. Key ESD principles current in Australia, CSIRO points out, include: minimising global warming; protecting biodiversity; conserving water; minimising energy use; and, reducing greenhouse gas production. The CSIRO raises the prospects of impacts (one scenario among several presented) of up to 12 million additional residents living in Australia by 2050. The CSIRO thus raises questions about preparation for disasters. In the report overview, the CSIRO proceeds to outline how ESD criteria can be used to meet planning needs of urbanisation (i.e. consuming energy sources). Finally, the CSIRO illustrates that if dilemma issues fail to get attended to, the complexities of the problems will grow.

In examining *Future Dilemmas 2050* (CSIRO 2000), Trainer (2003) refutes a number of CSIRO criteria of maximum population numbers and argues that Australia is unsustainable at present. Trainer argues that Australia faces environmental problems that are extremely serious (even without increasing the current population). He goes further in saying the reduced availability of petroleum and gas will significantly reduce agricultural production. He argues that even the lowest population scenario will still see ecological problems that are extremely serious (i.e. greenhouse gas emissions would be 2.5 times the Sydney target presented in 2002). He concludes that a limit to growth scenario suggests the present Australian population (23 m in 2012) is unsustainable without extreme change. He states this change should be in: lifestyles; settlement patterns; and, change to an economy that should be driven by sustainability criteria (not the market economy).

Authorities, having adopted ESD principles, can then adopt ESD goals. Low (2000) argues that adopting ESD goals is crucial to confronting cities that are depleting resources without limit. He spells out how cities can adopt these goals and as a result ensure resources are preserved for future generations. On a government front, the Australian government outlines ESD goals within the *Sustainability for Survival: Creating a Climate for Change* (Commonwealth Government 2007b). Equipped with ESD goals, authorities are in a position to adopt the key ESD components for measurement (called ‘indicators of sustainability’). These indicators enable ESD goals to be measured and monitored.

2.2 ESD Related Documents

At all levels of government, an increasing number of ESD related documents are being adopted. These documents include ESD related protocols, acts, agreements, reports and programs. These documents are produced at different government levels, including: international (UN); Commonwealth of Australia (herein referred to as the Commonwealth); State (NSW); and, global non-government organisations (NGOs). The review focuses on key documents that relate to ESD based urban planning, covering 35 years (1972–2007). ESD related documents at the local government level will be examined after the case study area is examined in Chap. 5. The purpose of each document and a critique of the impact of the document are now advanced.

2.2.1 *International*

International ESD related documents (particularly those applying to the natural and built environments) have increased in numbers and subject area as illustrated in Table 2.1. The first international ESD related document was the *Declaration of the UN Conference on the Human Environment* (United Nations 1972). This declaration

Table 2.1 ESD related documents at international level

1. International						
√=document relevant to study area	Date of document	Cumulative years since first document	ESD related documents P=Protocol A=Act R=Report Pr=Program	Purpose of document	Critique of impact of document	
1.1 □	1972	0	P <i>Declaration of the UN Conference on the Human Environment</i> (United Nations 1972)	Guide to nations in strengthening their commitments to the human environment	This Declaration was the first multi-nation agreement to provide guidelines for nations to move to more sustainable human environments	
1.2 □	1992	20	P <i>Rio Declaration on Environment and Development (incl. Agenda 21)</i> (United Nations 1992a)	Action plan for sustainability	The Rio Declaration spells out a program of action for sustainable development worldwide as adopted by 178 nations	
1.3 □	1993	21	Pr <i>Local Agenda 21</i> (United Nations 1993)	Program to assist local communities to adopt ESD principles	Many local government councils throughout the world committed themselves to the program	
1.4 □	1997	25	P <i>Greenhouse Gas Reduction (Kyoto)</i> (United Nations 1997a)	Sets targets for greenhouse emission reduction over a timeframe	The document has attracted widespread debate in 2006, given increased scientific evidence of climate change impact	
1.5 □	1997	25	Pr <i>Local Agenda 21 Model Communities Program</i> (United Nations 1997b)	Project to aid local government in implementing the Local Agenda 21 program	Provides documentation for those local government areas working on ESD based programs, thus increasing commitment at this level	
1.6 □	2000	28	Pr <i>UN Commission of Sustainable Development</i> (United Nations 2000a)	The setting up of this peak body furthers the UN aims of assisting nations to move to ESD policies	Having the Commission establishes a central UN point where world focus on sustainability can be pursued	

(continued)

Table 2.1 (continued)

1. International					
√=document relevant to study area	Date of document	Cumulative years since first document	ESD related documents P=Protocol A=Act R=Report Pr=Program	Purpose of document	Critique of impact of document
1.7 □	2000	28	Pr <i>UN Sustainable Cities Program</i> (United Nations 2000b)	Guidelines on adopting ESD within urban planning	Specific programs contain guides for countries to achieve more sustainable cities
1.8 □	2002	30	P <i>Political Declaration and Plan of Implementation (Johannesburg)</i> (United Nations 2002b)	Guidelines for actions within ESD programs	A strengthened statement on how nations could move towards more effective ESD programs adopted
1.9 □	2007	35	R <i>Stern Report</i> (2007 Her Majesty's Treasury)	Report updates the impacts of greenhouse gas emissions from an international perspective	Report contains recommendations to countries on amounts and time lines for CO ₂ reductions
1.10 □	2007	35	R United Nations' Global Environment Outlook-4	Report on the state of environmental health of the world	Report notes the world's water, land air, plants, animals and fish stocks are all in 'inexorable decline'

was the first multi-nation agreement to provide guidelines for nations to move to more sustainable human environments (social/cultural, environmental and economic). Twenty years after this declaration the *United Nations Conference on Environment and Development Report* (United Nations 1992b) (referred to as the Rio Summit) was convened, attracting 178 nations. The central international protocol, Agenda 21 (United Nations 1992a), relates to ESD and came out of that conference. Agenda 21 is a global action plan for sustainability. The document lays out key procedures for governments to adopt ESD strategies.

In moving beyond Agenda 21, the UN developed *Local Agenda 21* (United Nations 1993) from one chapter (Chap. 28) of Agenda 21. Local Agenda 21 is a mechanism to encourage greater involvement by local authorities in delivering Agenda 21 programs. In 1997 *Local Agenda 21 Model Communities Program* (United Nations 1997b) was adopted. This program aids local government in implementing the Local Agenda 21 program. The Model Communities Program documented those local government areas that had adopted Local Agenda 21 planning processes

for sustainable development. Agenda 21 has been taken up by many NSW local government councils. Under this program councils can proceed through different Agenda 21 milestones (levels of achievements). Within the Sydney Greater Metropolitan Region and adjacent regions of Illawarra, Central Coast and Newcastle/Lower Hunter progress is being made under Agenda 21 by councils such as Sutherland, Blacktown, Baulkham Hills, Hornsby, Gosford, Newcastle and Port Stephens.

By the year 2000, the UN became aware that new directions were needed to assist local authorities in adopting ESD strategies. The UN thus created the *United Nations Commission of Sustainable Development* (United Nations 2000a) as a peak body to further the aims of ESD. To assist local government directly the UN adopted the *United Nations Sustainable Cities Program* (United Nations 2000b). This program provides guidelines to authorities on adopting ESD criteria (i.e. principles, goals and indicators of sustainability). The international ESD related document that continues to generate major public debate is the *Greenhouse Gas Reduction Agreement* (known as Kyoto Protocol) (United Nations 1997a). This protocol sets targets within a timeframe for greenhouse gas emission reduction for signatory countries. This protocol remains central to countries in cooperating on greenhouse gas emissions such as CO₂. The *Stern Report* (2006) updated the statistics on impacts of greenhouse gas emissions from an international perspective. The report contains recommendations to countries on amounts and time lines for CO₂ emission reductions. Nations have acted more swiftly following the release of this report, with many adopting CO₂ emission limits and payments or taxes for emission quantities. Most of these measures have been inclusive of renewable energy programs.

Seeking a review of progress on Agenda 21 and subsequent protocols, the UN convened in 2002 the *World Summit on Sustainable Development* (United Nations 2002a). The World Summit adopted the *Political Declaration and Plan of Implementation* (United Nations 2002b) to provide further guidelines for local authorities to take appropriate actions towards ESD programs. This declaration addresses the need for authorities to give greater attention to areas such as: disaster management; climate change; and, protection of biodiversity. In nations such as New Zealand plan making was changed to accommodate sustainability principles (Erickson et al. 2004). The plan making framework incorporating sustainability as practiced in New Zealand is summarised by Erickson et al. (2004). In Canada, Montreal has exemplified initiatives in incorporating sustainability principles into urban planning. Brown (2006) assesses the extent that these principles are being incorporated into Montreal plans. He concludes that these plans do lead to sustainable development outcomes in most instances.

In critiquing the international ESD related documents it is noted that significant time lapses occur between adoption of a document and implementation (refer to Table 2.1). It was 29 years, for example, between the first protocol on ESD related matters (United Nations 1972) and the Kyoto Protocol (United Nations 1997a). And it was 35 years for a comprehensive state of global warming impacts to be issued (Stern 2006). A conclusion reached here is that contents of protocols, reports and programs at the international level are slow to be disseminated and implementation prolonged.

In some instances it is the inability to get all nations to agree on actions that slows implementation (i.e. greenhouse gases impact actions). This suggests that a more effective means of gaining cooperation among nations is needed to implement ESD based documents. Challenges here for the UN and member nations include gaining agreements on: measuring greenhouse sources being emitted; identifying types of emissions; and reduction targets for individual nations. The Kyoto Protocol debate highlighted the tensions that can arise in nations unwilling to accept targets (i.e. cap on greenhouse gas emissions). These tensions include: the debate between the rich and poor nations; past unwillingness of some nations (i.e. USA) to sign; emerging economies such as China and India vs. mature economies; and, general expanding industrialisation around the world vs. lack of environmental controls. These trends reinforce the importance of the Kyoto Protocol as essential to reverse the greenhouse gas impact trends.

2.2.2 International Non-government Organisations (NGOs)

In addition to governments producing ESD related documents, many international non-government organisations (NGOs) have also produced documents in this area, as illustrated in Table 2.2.

The NGO sector has been producing an ever expanding volume of ESD related reports since the early 2000s. These organisations to date have complemented the UN's efforts in ESD education, research and advocacy. The organisations include: World Wildlife Fund (WWF); Global Urban Observatory; International Institute for Sustainable Development; Sustainable Communities Network; Sustainable Cities; and, Urban Futures. This advocating is often primarily applicable to the interests and geographical areas that these organisations are active within.

The first NGO to produce an ESD related report was the *Club of Rome* (1972). This report by an eminent group of experts expressed concerns that have only partly been taken up by governments since 1972. An overview of how these concerns were addressed over 40 years ago was taken up by Meadows et al. (2005). She argues that exponential growth during this time has resulted in few of the concerns being addressed. She goes further to outline the means to a transition to a sustainable system and notes the tools for that transition. International environmental NGO organisations adopted the *World Conservation Strategy* (International Union for Conservation of Nature and Natural Resources IUCNNR 1980). These same groups put together a report containing an expanded set of principles for ESD entitled *Caring for the Earth—a Strategy for Sustainable Living* (IUCNNR et al. 1992). ESD principles in this report include: respect and care for the community of life; improve the quality of human life; conserve the earth's vitality and diversity; minimise the depletion of non-renewable resources; keep within the earth's carrying capacity; change personal attitudes and practices; enable communities to care for their own environments; provide a national framework for integrating development and conservation; and, create a global alliance. The European Commission in 2001

Table 2.2 ESD related documents at international non-government organisations (NGOs) level

2. International non-government organisations (NGOs)					
√ = document relevant to study area	Date of publication	Cumulative years since first publication	ESD related documents P=Protocol A=Act R=Report Pr=Program	Purpose of document	Critique of affect of document
2.1 □	1972	0	R <i>Limits to Growth</i> (Club of Rome 1972)	This report was compiled by an eminent number of world experts on the environment	The concerns expressed in the report have only partly been taken up by governments
2.2 □	1980	8	R <i>World Conservation Strategy</i> (International Union for Conservation of Nature and Natural Resources (IUCNNR) 1980)	This strategy contained a broad spectrum of recommendations on the need to address the environment	The strategy was instrumental in raising awareness and its principles are applicable today
2.3 □	1992	20	R <i>Caring for the Earth—a Strategy for Sustainable Living</i> (IUCNNR et al. 1992)	This strategy expanded on the 1980 strategy and outlined many ways for nations to implement sustainable living	The strategy showed foresight and was timely with the interests of the UN at the time
2.4 □	2007	35	R <i>Living Planet Report</i> (World Wildlife Fund 2007)	This report showed the state of the world environment continued to decline at an unacceptable rate	The report received warranted public media and comment. An increasing number of reports of this type from the NGO sector appeared in 2007

(continued)

Table 2.2 (continued)

2. International non-government organisations (NGOs)					
√ = doc- ument relevant to study area	Date of publi- cation	Cumulative years since first publication	ESD related documents P=Protocol A=Act R=Report Pr=Program	Purpose of document	Critique of affect of document
2.5 □	2007	35	Pr Worldwatch Institute Database Disc (Worldwatch Institute 2007)	The program monitors the changes in state of the world's environment on a daily basis	The program provides up-to-date data and triggers a response when required

launched a campaign for a sustainable European network of cities and towns. The aim was to group more than 540 local authorities in formulating policies to promote sustainability. Finally, the WWF produced the *Living Planet Report* (World Wildlife Fund 2007). This report shows the state of the world environment continued to decline at an unacceptable rate.

These community initiated ESD reports often contain greater protective measures for the environment than government policies at that time. Environmental groups have introduced new environmental terms in promoting ESD principles, such as ecological integrity² (Bell 1994). Community interest ranged up to a dictionary being published on sustainability (Aplin 2006). A book defining these ESD principles that the NGO sector have called for in the past are summarised by Beder (1996). These have included: social equity; limits on natural resource use; qualitative development; pricing environmental values and natural resources; natural capital and sustainable income; creating an Australian economic balance to enable ESD policies to be adopted; and, wider community participation within ESD policy making.

Observations can be drawn from assessing the timeline of accumulated years for NGO sector actions on ESD related reports. Generally, the NGO sector is increasingly pro-active in alerting governments. Key NGO documents (Table 2.2) have contributed to the debate around national actions on climate change (Stern 2006). Time delay of years and sometimes decades exist, however, in governments adopting NGO recommendations (as was illustrated earlier). At the same time, the NGO sector is increasingly producing detailed reports reflecting the need for government actions. The take up by the NGO sector of Al Gore's *An Inconvenient Truth* (2007) is a measure of this sector's work in educating the public on environmental issues. The worldwide education of groups of 'climate change educators' trained under Al Gore is testimony

²Ecological integrity means all natural processes and interactions within an ecosystem are maintained.

to the take up of sustainability issues by the NGO sector. Organisations such as national conservation groups (i.e. Australian Conservation Foundation in Australia) have been involved in this Al Gore initiative.

2.2.3 Commonwealth

The Commonwealth (referring to the Commonwealth Government of Australia) has adopted a number of ESD related documents as illustrated in Table 2.3. These documents are often based on ESD principles, goals and indicators of sustainability.

In 1990 the Commonwealth Government based its policy paper *Ecologically Sustainable Development: a Commonwealth Discussion Paper* (Commonwealth Government 1990) on ESD principles. This paper resulted from sustained discussions (under the Hawke Commonwealth Government, 1983–1991) between government, the Australian Conservation Foundation, the World Wildlife Fund and other groups. The paper contained ESD principles (where ‘ESD’ was first defined at the Commonwealth level) such as: integrating environmental and economic goals in policies and activities; ensuring that environmental assets are appropriately valued; providing equity within and between generations; dealing cautiously with risk and irreversibility; and, recognising the global dimension.

Many countries, including Australia, responded to the Rio Summit (United Nations 1992b) as noted earlier. Australia adopted a number of national ESD environmental acts commencing with the *Intergovernmental Agreement on the Environment* (IAE) (Commonwealth Government 1992a). This agreement emphasises the coordinating role of the Commonwealth Government in matters of national environmental significance. The agreement also recognises the importance of local government in developing environmental policies and councils being responsible for their environments. The Commonwealth, however, has been criticised for not fully implementing this agreement. The *National Strategy for Ecologically Sustainable Development* (Commonwealth Government 1992b) followed the agreement. This protocol establishes guidelines for ESD on a national basis. There has been, however, only minor fulfilment of this agreement (Lowe 2005; McKay and Rauscher 2007).

To specifically address biodiversity the Commonwealth adopted the *National Biodiversity Strategy* (Commonwealth Government 1995). The strategy is a framework for conserving biodiversity and implementing principles of ESD. There has, however, been criticism about the degree of implementation of this Australian Act. In the same year the Commonwealth (2006) issued a report containing a framework and timeframe for evaluating performance indicators for urban management. This report built upon the indicators developed under the SoE reporting for Australia. The Commonwealth defined some of these indicators further when it enacted the *National Local Government Biodiversity Strategy* (Commonwealth Government 1998a). This strategy was to provide all councils with an opportunity to play a leading role in addressing the loss of biodiversity. The Commonwealth, however, has to date not widely implemented this strategy.

Table 2.3 ESD related documents at commonwealth level

3. Commonwealth					
√ = document relevant to study area	Date of publication	Cumulative years since first publication	ESD related documents P=Protocol A=Act R=Report Pr—Program	Purpose of document	Critique of affect of document
3.1 □	1990	0	R <i>Ecologically Sustainable Development: A Commonwealth Discussion Paper</i> (Commonwealth Government 1990)	Introduced discussion of the role of the Commonwealth in promoting ESD	The discussion paper generated debate and led to an agreement with the States as outlined next
3.2 □	1992	2	A <i>Intergovernmental Agreement on the Environment</i> (IAE) (Commonwealth Government 1992a)	Coordinating role of Commonwealth on matters of national environmental significance	This agreement has been criticised for not being fully implemented by the Commonwealth
3.3 □	1992	2	R <i>National Strategy for Ecologically Sustainable Development</i> (Commonwealth Government 1992b)	Establishes guidelines for ESD on a national basis	While the national strategy spells out actions for ESD, there has been only minor fulfilment of the document
3.4 □	1995	5	R <i>National Biodiversity Strategy</i> (Commonwealth Government 1995)	Framework for conserving biodiversity and implementing principles of ESD	There has been criticism about the degree of implementation of the NBS by the Commonwealth
3.5 □	1998	8	R <i>National Local Government Biodiversity Strategy</i> (Commonwealth Government 1998a)	Provides local government with a leading role in addressing biodiversity	This document has given local government guidelines to address biodiversity
3.6 □	1998	8	A <i>Natural Heritage Trust Act</i> (Commonwealth Government 1998b)	The act established a funding program to local, States and community groups for environmental improvements	The trust program has provided considerable focus on environments that needed remedial works and lessons learned for future urban planning

(continued)

Table 2.3 (continued)

3. Commonwealth					
√ = document relevant to study area	Date of publication	Cumulative years since first publication	ESD related documents P=Protocol A=Act R=Report Pr—Program	Purpose of document	Critique of affect of document
3.7 □	1999	9	A <i>Commonwealth Environmental Protection and Conservation Act 1999</i> (Commonwealth Government 1999)	Guidelines for protection and conservation	This was a major step to introduce guidelines to protect the environment where the Commonwealth was involved
3.8 □	2000	10	A <i>National Greenhouse and Climate Protection Act 2000</i> (Commonwealth Government 2000)	National guidelines to reduce greenhouse gases and to take actions to plan for climate change	This contains the Commonwealth's prescription for greenhouse reduction
3.9 □	2001	11	Pr <i>National Action Plan for Salinity and Water Quality</i> (Commonwealth Government 2001)	To reduce salinity and to improve water quality	This plan recognises the extent of the problem of salinity across major sections of Australia
3.10 □	2002	12	R <i>State of Environment Report</i> (Commonwealth Government 2007a)	Summarises the state of the environment on a national basis	The SoE report provides national statistics on the environment. The report does not contain directions for ESD based urban planning
3.11 □	2002	12	A <i>National Energy Conservation Act</i> (Commonwealth Government 2002a)	To reduce the consumption of resources used in energy generation	This act will affect long term energy consumption, but does not provide immediate measures to reduce consumption on a large scale
3.12 □	2002	12	R <i>National Waste Reduction Scheme</i> (Commonwealth Government 2002b)	To reduce the quantity of waste produced	The scheme sets out guidelines to reduce waste on a national basis
3.13 □	2003	13	R <i>Climate Change Impacts on Biodiversity in Australia</i> (Commonwealth Government 2003)	Illustrates global warming concerns and potential impact of global change on biodiversity	This report further outlines the climate change impacts

(continued)

Table 2.3 (continued)

3. Commonwealth					
√ = document relevant to study area	Date of publication	Cumulative years since first publication	ESD related documents P=Protocol A=Act R=Report Pr=Program	Purpose of document	Critique of affect of document
3.14 □	2005	15	Pr <i>National Water Sharing Reduction Scheme</i> (Commonwealth Government 2005b)	Introduces procedures for water sharing programs	This scheme recognises the extent of the water provision problem across the nation
3.15 □	2005	15	R <i>Sustainable Cities</i> (Commonwealth Government 2007c)	The report introduces principles to move towards more sustainable cities	The report has a direct bearing on ESD based urban planning. The parliamentary committee set up to act on the report is examining a charter as an implementation step
3.16 □	2007	17	R <i>Sustainability for Survival: Creating a Climate for Change</i> (Commonwealth Government 2007b)	The report is a summary of the inquiry into a sustainability charter, stemming from the Sustainable Cities (2007c) Report above	This report contains a number of recommendations from the Parliamentary Committee suggesting a national Sustainability Commission, Sustainability Commissioner and Sustainability Charter be established

To further strengthen environmental protection and biodiversity conservation, the *Natural Heritage Trust Act* (Commonwealth Government 1998b) was adopted. This document created a trust with funding for actions to repair environments and to learn from these actions for future planning. In the following year the Commonwealth *Environment Protection and Biodiversity Conservation Act* (Commonwealth Government 1999) was enacted. This Act was a major step to introduce guidelines to protect the environment where the Commonwealth was involved. Also, in examining the international greenhouse protocols that were being developed, the Commonwealth Government adopted the *National Greenhouse and*

Climate Protection Act (Commonwealth Government 2000). This document provides guidelines for governments and industry to reduce greenhouse gases and to take measures to plan for climate change. There has been considerable public perception that the Commonwealth was not proactive in implementing this Act. Finally, the *National Action Plan for Salinity and Water Quality* (Commonwealth Government 2001) draws attention to the extent of the problem of salinity across major parts of Australia and aims to reduce salinity and to improve water quality.

Other Commonwealth documents addressing especially the environmental component of ESD followed. The Commonwealth government issued a book on the state of sustainability reporting (Commonwealth Government 2005a) as a guide to authorities having to produce a SoE report. By 2007, a further *State of the Environment Report* (Commonwealth Government 2007a) was released. This report summarises the state of the environment on a national basis. While the report contains broad brush statistics on environmental changes, it does not contain actions to address these environmental changes that are reported on. On an energy note, the *National Energy Conservation Act* (Commonwealth Government 2002a) highlights how to reduce energy consumption. The Act introduces long term prospects for energy reduction, but does not specifically address ESD related energy issues. In the same year the *National Waste Reduction Scheme* (Commonwealth Government 2002b) was introduced. This scheme sets out guidelines to reduce waste on a national scale.

It was the climate change concerns, however, that continued to drive public interest from 2003 to present (2012). A major Australian climate change report in 2003 was the *Climate Change Impacts on Biodiversity in Australia* (Commonwealth Government 2003). This report illustrates global warming concerns and the potential impact on biodiversity. The Commonwealth Government argued in 2007 that the recommended targets under Kyoto were too harsh on resource rich countries such as Australia. Beginning in 2007 the Australian states were moving to adopt state protocols on greenhouse, acknowledging the Kyoto Protocol. Several states in the USA were also adopting their own greenhouse gas protocols. In addition the mayors of a number of USA agreed to cooperate on CO₂ omissions. Finally, in mid-2007 the *Stern Report* (2006), as noted earlier under international ESD related documents, provided an update on greenhouse gas emissions from an international perspective. The report was examined by the international community given the report made recommendations to countries on the amounts and time lines for CO₂ reductions. With a change of government in Australia in 2007, the new government in Jan 2008 signed the Kyoto Protocol.

Three additional ESD related reports were issued by the Commonwealth. In 2005 the *National Water Sharing Reduction Scheme* (Commonwealth Government 2005b) was introduced. The scheme recognised the extent of water provision problems over most of Australia. On a broader basis, in 2005 the Commonwealth received the *Sustainable Cities* (Commonwealth Government 2007c) report. This report could have a future direct bearing on sustainable urban planning. By 2007 the same Parliamentary Committee that produced the latter report released the *Sustainability for Survival: Creating a Climate for Change* (Commonwealth Government 2007b).

This report reported on the results of further inquiries into sustainability and cities. The report contains three prime recommendations to establish: a national Sustainability Commission; a Sustainability Commissioner; and, a Charter of Sustainability. Finally, the problem of restrained water resources and the long drought (commencing early 2000) saw the Commonwealth enact legislation in September 2007 offering up to 1,000 farmer's payments to leave their farms.

Observations can be made from assessing the cumulative timeline (column 3) (Table 2.3) under Commonwealth ESD related documents. Firstly, as with international ESD related documents, significant time delays occurred between the adoptions of Commonwealth documents and follow up actions. Fifteen years (1992–2007) after the *Intergovernmental Agreement on the Environment* (Commonwealth Government 1992a) was enacted few actions had emanated from the agreement. In 2005 the *Sustainable Cities* (Commonwealth Government 2007c) had highlighted the need for the Commonwealth and States to consider greater implementation of ESD related actions in urban development matters. By Mar 2012 the Australian Parliament was still to adequately consider various recommendations of an updated sustainable cities report (Commonwealth Government 2007c).

2.2.4 NSW State

The State of NSW (as with other Australian states) has also adopted a range of ESD related documents, particularly since the increased public interest in the environment starting in the mid-1970s. The documents reviewed are all NSW acts forming the core of legislation in environmental protection and planning. These documents are summarised and critiqued in Table 2.4.

In 1979, NSW adopted an overarching land use and natural resource planning document in the *Environment Planning and Assessment (EPA) Act 1979 (Amended 1993)* (NSW 1979). In 2012 the new State government introduced the EPA Act 2012, in general easing the environment controls on developers. This Act is the prime State statute containing guidelines for development and environmental protection. The State also adopted the *Protection of the Environment Administration Act* (NSW 1991) as an overview act to protect all elements of the environment.

Under catchment management, the State adopted the *Catchment Management Act* (NSW 1989). This Act aimed at achieving a coordinated and sustainable management of natural resources on a water catchment basis. The Act was supplemented with the *Catchment Management Authorities Act 2003* (NSW 2003a). Catchment management authorities (herein referred to as CMAs) are formally constituted statutory authorities (with general manager and staff) with a broad natural resource agenda. The authorities report to the Minister for Natural Resources and engage communities in natural resource issues. In assisting the States, the Commonwealth Government is expected to be a major investor in CMA activities; hence CMA boundaries coincide at state and national levels. The *National Action Plan for Salinity and Water Quality* (Commonwealth Government 2001) and the *Natural Heritage Trust Act* (Commonwealth Government 1998b) are two funding sources for the CMAs.

Table 2.4 ESD related documents at NSW state level

4. NSW state						
√ = document relevant to study area	Date of publication	Cumulative years since first publication	ESD related documents P=Protocol A=Act R=Report Pr=Program	Purpose of document	Critique of impact of document	
4.1 □	1979	0	A <i>Protection of the Environment Administration Act 1979 (Amended 1993)</i> (NSW 1979)	Guidelines for development and environmental protection	The EPA Act has been the main flag bearer of environmental legislation for the State. The 1993 amendment to the act increased environmental protection measures	
4.2 □	1989	10	A <i>Catchment Management Act</i> (NSW 1989)	Aims to achieve coordinated and sustainable management of natural resources on a water catchment basis across the State	This act was supplemented with the <i>Catchment Management Authorities Act</i> 2003 (noted below)	
4.3 □	1991	12	A <i>Protection of the Environment Administration Act</i> (NSW 1991)	Provides an overview to protect all elements of the environment	This act was the first comprehensive action by NSW to implement environmental protection under one instrument	
4.4 □	1993	14	A <i>Local Government Act 1993</i> (NSW 1993a)	Directs councils to incorporate ESD considerations as a key aspect of council operations	The amendment contains guidelines for local councils to adopt ESD approaches to planning and development	
4.5 □	1993	14	A <i>NSW State of Environment Reporting Act</i> (NSW 1993b)	This act instructs councils to produce a state of environment (SoE) report at least every 2 years, with a supplementary report between the 2 years	This act establishes guidelines for councils to adopt performance goals for key environmental indicators. Many local government councils however do not act on the recommendations within the SoE reports	

(continued)

Table 2.4 (continued)

4. NSW state					
√ = document relevant to study area	Date of publication	Cumulative years since first publication	ESD related documents P=Protocol A=Act R=Report Pr=Program	Purpose of document	Critique of impact of document
4.6 □	1995	16	A <i>Threatened Species Conservation Act 1995</i> (NSW 1995)	Councils to consider the impact on threatened species from developments	This act has had a major effect in councils being responsible to protect threatened species
4.7 □	1997	18	A <i>Native Vegetation Conservation Act 1997</i> (NSW 1997)	Native vegetation management and protection	This act brought greater protection to native vegetation and brought local government into a role to act within this area
4.8 □	2000	21	A <i>Building and Sustainability Index (Basix) Act</i> (NSW 2000) (Monthly updating)	Provides guidelines on reducing energy, water and waste and increasing living comfort levels in houses	Basix has contributed significantly to the building industry and the public understanding the requirements of reducing the impact on the environment
4.9 □	2003	24	A <i>Catchment Management Authorities Act 2003</i> (NSW 2003a)	Aims to achieve sustainable management of natural resources	The State has now established 13 catchment management authorities covering the whole state
4.10 □	2003	24	R <i>Natural Resources Management Reform Report</i> (NSW 2003b)	Natural resource reform covering guidelines for management of natural resources	Strengthened the protection on native vegetation, in particular gave attention to the role of CMAs
4.11 □	2003	24	A <i>Native Vegetation Act 2003</i> (repeals 1997 Act) (2003c)	Act broadened the approach to the management and conservation of native vegetation	Introduced new ground rules for a wider protection of native vegetation

(continued)

Table 2.4 (continued)

4. NSW state					
√ = document relevant to study area	Date of publication	Cumulative years since first publication	ESD related documents P=Protocol A=Act R=Report Pr=Program	Purpose of document	Critique of impact of document
4.12 □	2005	26	A <i>Native Vegetation Regulations</i> (NSW 2005)	Adds the regulations to the Native Vegetation Act 2003	The regulations have been used extensively in rural areas and highly urbanising areas on city edges and coasts
4.13	2006	27	A draft Central Coast Regional Strategy	Plan to replace the Central Coast Structure Plan (NSW 1975)	This plan set the outline for development, but needed other support plans such as transport and conservation
4.14 □	2006	27	A <i>Growth Centres Commissions Act</i> (NSW 2006b)	The act creates the Growth Centres Commissions to plan the south west and north west areas of Sydney	The creation of the Growth Centres Commission was the first time the State (since the early 1970s Campbelltown and Camden planning) committed a planning team under legislation to plan growth areas
4.15 □	2006	27	A <i>Bushfire Regulations Act</i> (NSW 2006c)	The act contains guidelines for development to prevent bushfires	The stringent new regulations reflect the need to better protect urban areas in bushfire prone zones
4.16	2012	33	A EPA Amendment Act (NSW 2012)	The act was the first major overhaul of the EPA 1979 Act	The Amendment Act removes some of the environmental requirements on developers

The CMAs have a statutory obligation to develop catchment action plans (CAPs). These plans integrate earlier plans, namely: regional vegetation management plans; catchment blueprints; and, investment strategies. Most CAPs for NSW were adopted in early 2007, with a 5 year review in 2012. There is considerable potential for the CAPs to be central documents for ESD related natural resource planning. A CMA

can also work with local landholders in developing property vegetation plans (PVP). These plans will aim to protect areas of high conservation value without restricting agriculture or development that has clear benefits. The Authority funding programs will include targeted incentives to protect native vegetation, support for property planning and funding property purchases.

In 1993, NSW also introduced clearer ESD directions to local government in the amended *Local Government Act 1993* (NSW 1993a). The act directs councils to incorporate ESD considerations as a key aspect of council operations. The Act relies upon the explanations of ESD contained within the *Rio Declaration on Environment and Development* (United Nations 1992b). The State then introduced the *NSW State of the Environment Reporting Act 1993* (NSW 1993b). This act instructs councils to produce a State of Environment (herein referred to as SoE) report every 4 years with a supplementary report each year. These reports evaluate the state of that local government authority's environment. SoE reporting pulls together the full range of environmental, social/cultural and economic indicators of sustainability. Councils vary widely in their approach to SoE reporting, from standard formatting to comprehensive and innovative approaches. The act also establishes guidelines for Councils to adopt performance goals for key environmental indicators such as aquatic, biodiversity, climate/air, land and water. To provide a benchmark for local government the State produces a biennial *NSW State of Environment Report* (NSW 2006a) report.

Many local government councils have advanced beyond local government SoE reporting in measuring indicators of sustainability. The nine councils of the Western Sydney Regional Organisation of Councils (WSROC) combined their resources and produced the *Western Sydney Regional State of the Environment Report 2000* (WSROC 2000). This report concluded that the current indicators of sustainability were inadequate for effective regional decisions on ESD matters. The report proposed indicators of sustainability to be applied throughout the region under elements of land, air, water, biodiversity, noise, waste, Aboriginal heritage and community heritage. The report outlines sustainability goals that were agreed to by the community and expert advisers to WSROC. Sustainability indicators were also adopted as agreed by the Councils and expert advisers. The report incorporates the 'potential for sustainability' responses in assessing each SoE element. This technique allows data management, environmental management and environmental quality to be addressed as one. The emphasis here is on strategic responses that are long term and future goal orientated.

State environmental acts began to more specifically target environmental issues by 1995 when the *Threatened Species Conservation Act* (NSW 1995) was introduced. This act requires councils to consider the impact of developments on threatened species (as subject to the *EPA Act 1979* (NSW 1979)). To compliment this act, the State introduced the *Native Vegetation Conservation Act* (NSW 1997). This Act provides for native vegetation management and protection of conservation values. More recently the State adopted the *Natural Resource Management Reform Report* (NSW 2003b). This report suggests major changes to the approach taken on native vegetation in NSW. The report outlines the creation of Catchment Management

Authorities (CMAs) and other measures to reflect the recommendations of the *Natural Resource Management Reform Report* (NSW 2003b). Finally, the *Building and Sustainability Index (BASIX)* (DoP 2000) program provides guidelines on reducing energy, water and waste in households. The program has contributed measurably to greater efficiencies in those areas.

There were further NSW initiatives around ESD related acts into the early 2000s. In 2003 the *Catchment Management Authorities Act 2003* (NSW 2003a) came into effect. All parts of the State were, as a result of the Act, covered by a Catchment Management Authority (13 in all). The boundaries of these CMAs coincided with Commonwealth boundaries and funding is primarily under the Commonwealth's Natural Heritage Trust (as noted earlier). Also in 2003, the *Native Vegetation Act 2003* (repeals 1997 Act) (NSW 2003c) was enacted. This Act broadened the approach to the management and conservation of native vegetation. At the same time the act introduced new ground rules for a wider protection of native vegetation. Two years later the *Native Vegetation Regulations* (NSW 2005) provided the guidelines to implement and enforce native vegetation protection.

Finally, in 2006, the State enacted the *Growth Centres Commissions Act* (NSW 2006b). This act created the Growth Centres Commission to plan the southwest and northwest areas of Sydney. The creation of the Growth Centres Commission was the first time the State had taken a major role in growth centre planning since the early 1970s. It was 1975, for example, that the government enacted the Campbelltown, Western Sydney and Central Coast (NSW 1975) planning schemes. The government, in creating the Commission, had in 2006 committed a planning team to plan the southwest and northwest growth areas. The likelihood of the Commission promoting ESD based urban planning was unclear at the end of 2012.

Observations can be made from assessing the timeline of accumulated years for NSW actions on ESD related documents. As with the international and Commonwealth documents, significant time delays ensued between the adoption of a State document and follow up actions. It was 27 years between the creation of the *EPA Act* (NSW 1979) and the setting up of a Growth Centres Commission (NSW 2006b) to plan for two major outlying areas of Sydney. In addition, on the Central Coast, it was not until 2006 that a draft regional strategy (DoP 2006a) was produced to replace the *Central Coast Structure Plan* (NSW 1975). While the Growth Centres Commission would plan the southwest and northwest growth centres, the Warnervale/Wadalba growth centre on the Central Coast as designated in 1975 was not covered by any growth commission to the end of 2012.

In general, while acts were passed by the State, there remained in 2012 a need for clear ESD related policies for urban growth and renewal in the GMR and regional NSW. This need was highlighted against the sustainability planning initiatives that were taken by a number of local government councils in NSW (Newcastle City Council 2000; Hornsby Council 2007; Manly Council 2007). Newcastle City Council had been particularly vigorous in pursuing the sustainability planning directions (McKay and Rauscher 2007). Newcastle developed a 10 year program of 'pathways to sustainability'. That city's approach emphasised measuring impacts on the environment and acting in unison with neighbouring local government councils on

regional responses. The need, however, continued for local government authorities, particularly those responsible for growth centres, to adopt ESD approaches.

2.3 ESD Based Urban Planning Frameworks

Having examined the basis of sustainability and ESD (e.g. the environmental aspects), the focus now shifts to examining ESD based urban planning frameworks, especially schools of urban planning thought. Urban planning consists broadly of 'land use planning' and 'natural resource planning'. Increasingly authorities are also moving towards 'sustainability planning', where the application of ESD criteria is essential.

Before delving into the specifics of these three disciplines, it is important to place them within the realm of 'complex systems' (CSIRO 2000). There has been, especially since the early 1980s, a growing science of complex systems (combining physical, biological and social sciences). Within the urban planning sphere several examples of complex systems projects provide a background for the sustainable communities framework (SCF) as outlined in project webs (Appendix E). Complex Open Systems Research Network (COSNet) (www.complexsystems.net.au) (2008) works on analysing complex systems for prediction and control applied to urban plan forecasting. The UNESCO's man and the biosphere (MAB) Urban Group (www.unesco.org/mab) (2008) investigates biosphere reserves' contribution to sustainable urban development. In addition, Mistra Institute (www.ctmsu.sytes.net) (2008) does trans-disciplinary research on sustainable development. The IHDP Urbanisation Science Project (www.ihdp.uni-bonn.de) (2008) studies urbanising processes that contribute to environmental change. In addition, the Millennium Ecosystem Assessment (www.maweb.org) of the consequences of ecosystem change that involved 1,360 experts worldwide from 2001 to 2005 continues today. Resilience Alliance (www.resilience.org) does research on major challenges facing urban systems and the landscapes they comprise. The questions this group focuses on are: how much and which kinds of disturbances can urban areas absorb without having to shift to alternative and less desirable living conditions. Finally, there are important issues in understanding the transitions from different perspectives and how these transitions evolve into public policy (such as sustainable urban planning). Given this review of complex systems the three schools of urban planning thought (land use planning; natural resource planning; and, sustainable urban planning) are now examined.

2.3.1 Land Use Planning

Land use planning incorporates the application of land development and conservation principles to resolve the use of land. This urban planning school of thought encompasses, for example: the type of physical layout desired; accommodating,

environmental, social/cultural and economic; and, ensuring services at different levels such as localities, districts, cities and regions. Urban planning land use schools of thought date back to the Roman Empire, however the book focuses on current and recent historical changes in land use planning schools.

Other schools of land use planning thought emerged in the 1990s. Bertuglia (1994) argues that we can model the city based on the performance we expect from the city. Rose (1997) continues with that argument and states that authorities need to look at land use planning not in terms of zonings but new dimensions of creating healthy communities, locally and globally. These principles also reflect Archibugi's (1997) argument that planners need to know the likely impacts of urban growth. He suggests the means to move to more planned (and thus more sustainable) communities. Likewise, Forster (1999) pushes for reforming land use planning to achieve more sustainable cities.

Key urban planning based schools of thought influencing the take up by authorities of ESD criteria include: *compact cities* and *new urbanism*; *smart growth*; and, *eco-city planning* and *eco-villages*. These recent land use schools of thought are briefly commented on below. While the research emphasis involves developing a critique around the environmental component of sustainability (as outlined in Chap. 1) it is acknowledged there would be an equal research emphasis on critiques around the social/cultural or economic components of sustainability were these (or all three components) the focus.

Compact cities, as the name suggests, aims for higher density development around transport nodes. This school of thought came onto the NSW agenda in 1988 when the State government adopted *Sydney into its Third Century* (Planning NSW 1988). The document aimed to slow urban sprawl by increasing the allowable urban densities. This was a reversal of past strategies (after the Second World War) that encouraged urban sprawl. It is under compact cities that ESD principles gained attention in NSW.

New urbanism emphasises building neighbourhoods with a diversity of residential, commercial and light industrial land uses in close proximity. This urban planning school has been popular throughout the 1980s to current times. New urbanism seeks to 'reform urban design processes, restore life in urban centres and rely less on motor vehicles' (Crofts 1998, p28). The American planners argue new urbanism through institutions such as the American Planning Institute (1999). NSW called upon all LGAs to develop local strategies based on new urbanism 1990s. Newcastle City Council responded by applying concepts of new urbanism incorporating sustainability principles (McKay and Rauscher 2007). The authors outline the progress and setbacks of the Newcastle Council over several years starting with the Council's attendance at the Rio Summit in 1992.

The notion of *smart growth* followed new urbanism as a complementary school of planning thought in the early 1990s in the United States (Urban Land Institute 1995). This school aims to limit urban sprawl through improved land use and transport policies. The smart growth movement emphasises greater efficiencies of urbanisation through the incorporation of a wide range of ESD based urban planning principles (i.e. energy, water and transport). Newman (1998) argues that sustainable transport

will be the most important ESD principle for local government and the Commonwealth states to accommodate within their urban strategies. Stillwell (2000) also challenges Australian authorities in drawing comparisons between American sprawl compared with Australian. He offers policy directions leading to more efficient urban development across Australia.

A further land use urban planning school of thought is *eco-city* planning. Walker (1997) argues that a range of tools are being applied within the concept of eco-cities, providing authorities adopt the appropriate strategies. Hollick (1998) critiques the ESD lessons learned by eco-villages that have been functioning over several years and argues their attributes. Engwicht (1999) argues that you can create eco-communities by adopting ESD criteria at the street design level. Barton (2000a) goes beyond streets and argues that there is potential for whole neighbourhoods to become sustainable communities (environmental, social/cultural and economic components). In addition, Rauscher and Momtaz (2004) outline tools for ESD based urban planning that practitioners could utilise.

2.3.2 Natural Resource Planning

While urban planning incorporates land use and natural resource planning it has been natural resource planning that has had a major influence on urban planning from the 1970s to date. Recent natural resource planning schools of thought influencing urban planning as summarised below include: bioregional planning; eco-accounting; eco-design; ecological foot printing; limits to growth; and, measurements of progress.

Bioregional planning goes back to the 1970s and was a central principle in *Design with Nature* (McHarg 1978). The principle of bioregional planning is that the natural environment takes precedence over the built environment. Designs for development in this instance follow the natural contours and catchments of the land to maximise bio-diversity. Catchment management planning applies bio-region planning within water catchment areas. This planning establishes environmental benchmarks and targets for catchment protection. One of the best examples of current advances in catchment management planning is the catchment trusts. These trusts are established from time to time for specific tasks such as: flood mitigation; water conservation; and, vegetation protection. The State government created for example the Hunter Valley Catchment Trust in the early 1980s and the Upper Parramatta River Catchment Trust in 1989. The Hunter Central Rivers CMA absorbed the Hunter Valley Catchment Trust in 2003. The CMA undertakes a range of natural resource planning activities, including: water quality monitoring; flood mitigation planning; protection of vegetation; sustainable water usage planning; storm water management planning; sediment control planning; and biodiversity protection.

Eco-accounting complements the bioregional planning and consists of measuring the impact of development on a 'loss and gain balance sheet' basis. The Australian Conservation Foundation (ACF) (1990a) utilises eco-accounting in its argument

that taxes are a true value for measuring the cost of paying for development impact. Greenpeace Australia (1993) in the same vein takes the example of Sydney to argue the case of applying costs and benefits to development.

Ecodesign goes beyond eco-accounting by applying ecological principles to buildings and whole neighbourhoods. Barton (2000b) argues that planners need to measure and apply principles of ecodesign in achieving sustainable settlements. Inoguchi (1999) points to the prospects of ecodesign in all aspects of society. He argues that in time we can create 'eco-societies'. The work of the Rocky Mountain Institute (1998) illustrates developments that can be planned on a green design basis. The Rocky Mountain Institute demonstrates its philosophy within demonstration projects in Colorado, USA and around the world. There are now a number of developments in Australia that were designed on green design bases (e.g. ACF head offices in Melbourne). Finally, the World Wildlife Fund (WWF) maintains the Living Planet Index. This index reflects the health of the planet's ecosystems.

Ecological foot printing is another tool for natural resource planning. Foot printing provides a means of measuring the impact of human activities on an individual and on a cumulative society basis. Packard (1991) showed in the early 1990s that authorities could plan settlements naturally and thus avoid footprint impacts. The UN Office of Economic Cooperation and Development (United Nations 1995) produced a handbook to help authorities around the world to utilise renewable energy approaches to reduce footprints. Tatrav (2001) develops a thesis that the ecological footprint needs to be seen within the larger green debate. She argues a Theosophists³ viewpoint for interpreting environment practices through understanding how they evolved through the centuries and millennia. Finally, the WWF maintains the Ecological Footprint, showing the extent of human demand on ecosystems. From these footprints the WWF creates scenarios that explore likely ecosystem impacts ahead.

A limits to growth suggests there are a finite number of people that is tolerable in an environment. The introduction of people beyond a limit places undue stress on inhabitants and that environment. The Australian Theosophy Society as early as 1914 was examining the environmental impact that communities had around the world (Theosophy Society 1914). The Club of Rome (1972) originally put forth the concept of limits to growth. In 1990 the Australian Conservation Foundation (1990b) outlined how to limit urban growth through sustainability strategies. From another perspective, Fincher (1998) argues that communities need to reframe the questions we ask to assess population capacities in Australian cities. Debate over peak oil and peak coal encompasses arguments of limits to growth (Lomberg 2004). Finally, Swamy (2001) takes a broader view and argues that growth needs to be looked at against the spiritual values we place on the environment.

Complementing the limits to growth school of thought is the concept of *measurement of progress*. Measurement of progress introduces a means of adopting criteria that can be used to gain an overall rating of progress (i.e. achieving healthy and sustainable

³Theosophy is the study of all religions from antiquity to present and how religious and scientific evolution affect society and how we live.

communities). As early as 1985 Tisdell (1985) argued that there are conflicting views on what constitutes progress among economists and ecologists. He argues that an approach to sustainable development would assist in defining the differences in these views. This question was later examined by Redefining Progress Inc. (2000).

By 2002 the Commonwealth government contributed to the debate in issuing *Measuring Australia's Progress* (Australian Bureau of Statistics 2002). This publication gives an overview of commercial and social statistical trends; however it does not contain an evaluation of environmental trends. Finally, there are a number of local government areas that have tried to measure progress, in particular population capacities, including Byron Bay in the late 1990s and Gosford City in 2003.

2.3.3 Sustainable Urban Planning

There has been emerging since the 1990s a sustainable urban planning school of thought. This school of thought partly relies upon frameworks being developed to guide ESD based urban planning. Grant et al. (1996) proposed a planning framework for the protection of landscapes and ecosystems for residential environments. Given there have been a number of eco-villages already established, research was conducted to review how these villages incorporated sustainability principles (Appendix A) (see also earlier comments in this chapter on eco-cities). After years of work the Narara Ecovillage Group in 2012 was successful in obtaining ex-agricultural land on the Central Coast to create an eco-village. In general, the eco-villages subscribe to Grant et al.'s (1996) frameworks. Finally, examining land requirements, Beatley and Manning (1997) argues for land to only be consumed on a sparingly basis. He introduces 'sustainable places' considering not just physical layout of an area but the way the community operates.

Other sustainable urban planning frameworks were outlined in the late 1990s. Zachary (1999) argues that indicators of sustainability need to provide the required guideposts (contained in measurements) for a local planning framework. He states that too often urban development decisions are made without testing likely impacts (i.e. infrastructure planning affecting whole neighbourhoods). Likewise, Stimson (1999) argues for a whole of government agreement of adopting an urban planning framework of indicators of sustainability. Stimson applies his framework to land use and natural resource planning. In outlining his framework for the East Queensland region, he demonstrates how indicators can become part of a government's decision making. Ravetz (1999) adds to the Stimson work by proposing a framework of integrated strategic management methods and tools, including sustainability indicators, for cities and regions. Finally, Crilly and Mannis (2000) introduces a framework of sustainable strategic management systems as a means of sustainable urban planning.

As noted above by the late 1990s, sustainability frameworks for urban planning were being outlined. Fremantle (Newman 1998) and Newcastle (McKay and Rauscher 2007) were Australian cities adopting sustainability approaches to

planning. Beyond Australia, Manchester City Council, England, became a leader amongst local government in selecting ESD indicators of sustainability. The City of Manchester (1999) adopted a range of indicators of sustainability within urban planning policies across the city. The city council established a matrix system of indicators to measure how ESD components (social, environmental and economic) were being met. Manchester added the concept of 'needs verses wants' in applying the indicators. This enabled the authorities to make decisions based on a priority of needs to protect the environment.

Throughout the early 2000s authors continued to develop frameworks that incorporated sustainability principles into urban planning. Crowe (2000) outlined this movement in arguing that it aims for a more civil society through land use and natural resource planning being based on sustainability principles. Crilly and Mannis (2000) developed a framework for spatial urban design indicators and a methodological tool kit. Crilly and Mannis (2000) calls upon authorities to think holistically about complex urban systems and suggests a locality specific approach to explain the totality of the system. Within Ireland, O'Regan et al. (2002) reported on the Irish Environmental Protection Agency developing a framework that relied upon spatial policies in developing sustainable regions. The aim here was create optimum sized settlements that least harmed the environment. Moving from England to the USA, the Urban Land Institute (2000) produced a framework on sustainable urban planning for American planning application. Moving from the Irish experiment to the UK, Phillips (2003) developed a framework of assessment for determining the energy and environmental capabilities of a local area for sustainable development. Phillips puts forth the framework to avoid environmental consequences of ill-considered development. Finally, Spencer (2005) highlights the Scandinavian 'eco-municipalities'. Spencer describes the Stockholm's 'The Natural Step' framework as places that have voluntarily committed to integrating sustainability principles to create green solutions.

By the mid-2000s other frameworks for sustainable planning focused on the built environment. Sahely et al. (2005) develops a framework for urban infrastructure systems based on feedback mechanisms (using indicators of sustainability) between that infrastructure and the surrounding environment. Brandon (2005) argues that authorities everywhere need to be able to evaluate the built environment for the level of sustainability they wish to achieve. He sets a context for evaluating sustainable development through frameworks, including better assessment methods and management systems. His approach is to set standards within models covering a range of built environment outcomes on a regional basis. Balfors et al. (2005) argues for a strategic environmental assessment. Balfors et al. (2005) focuses on predicting impacts (especially on biodiversity). He promotes a framework based on GIS-based predictive ecological modelling to incorporate within a sustainable planning system. Finally, Hyde et al. (2007) considers the use of an environmental brief to gain more sustainable built environments. He argues for design strategies to create environmentally sensitive buildings.

A number of frameworks for sustainable urban planning incorporate metabolic (sum of processes or changes in a system). White (2002) writes about building an

ecological city without depleting the ecosystems. He argues for a set of interlinked systems of physical flows (metabolisms) illustrating how ecosystems work. Brown et al. (2005) also develops a framework to measure urban metabolic efficiency. His framework (within an Irish context) is called 'integrated sustainable cities assessment method (ISCAM). Brown et al. (2005) simulates alternative scenarios and how they divert from more sustainable scenarios.

Finally, the international debate on capping greenhouse emissions (Aplin 2006) is an example of a sustainability issue that will influence land use and natural resource decision making. Measures taken under greenhouse emissions capping are likely to impact on industry locations (land use planning) and extent of allowable vegetation removals (natural resource planning). The carbon credit systems being proposed at national, state and private industry levels is likely to affect urban growth decision making (Gore 2007). The sustainable urban planning school of thought is being researched and promoted by non-government organisations (CSIRO 2000; World Wildlife Fund 2007). The issue is summarised by Newman and Jennings (2008) in discussing cities as ecosystems and bioregion environments. Newman here argues we need to take cues from the living systems for sustainability strategies in fostering a sense of place.

Governments are thus being prodded to adopt sustainable urban planning schools of thought as noted above. By 2012, for example, all three levels of Australian government were reconsidering the zonings for coastal development areas given potential changes to sea level heights. At the same time, governments are reviewing inland farming areas in light of currently experienced, and future impacts, of longer droughts.

2.4 Chapter Summary

This chapter summarised sustainability in the context of urban planning. The authors drew a number of conclusions. Firstly, there is a wide divergence of definitions of sustainability and ESD. It is clear, however, that there is increasing awareness among authors to try to reach a consensus on sustainability definitions. Secondly, the history of ESD related documents shows that, while governments adopted reports on sustainability, there is a time lag in governments acting on those reports. Thirdly, trends of governments moving towards ESD based urban planning frameworks are evident. This movement is detected within all three planning schools of thought (e.g. land use planning, natural resource planning, and, sustainable urban planning). In summary, governments and planning schools are moving towards incorporating sustainability principles in their planning (as in many of the examples cited in this chapter). There remains, however, a need for a comprehensive framework for measuring sustainability of urban and non-urban areas (from local areas to regions). The next chapter outlines how the SCF meets this need.

References

- American Planning Institute (1999) *New American urbanism—reforming the suburban metropolis*. Cambridge, New York
- Aplin G (2006) *Global environment in crises: an Australian perspective*. Oxford, Sydney
- Archibugi F (1997) Ecological city and city effect: urban planning requirements for the sustainable city. *Urban Policy Res* 17(4):340–342
- Australian Bureau of Statistics (2002) *Measuring Australia’s progress*. Australian Bureau of Statistics, Canberra
- Australian Conservation Foundation (1990a) *Environmental tax reform*. Australian Conservation Foundation, Melbourne
- Australian Conservation Foundation (1990b) *Creating successful communities—growth management strategies*. Australian Conservation Foundation, Melbourne
- Balfors B, Mortberg U, Gontier M, Brokking P (2005) Impacts of region-wide urban development on biodiversity in strategic environmental assessment. *J Environ Assess Policy Manag* 7(2):229–246
- Barton H (2000a) *Sustainable settlements—a guide for planners*. University of West England, Bristol
- Barton H (ed) (2000b) *Sustainable communities: the potential for eco-neighbourhoods*. Earthscan, London
- Beatley T, Manning K (1997) *The ecology of place: planning for environment, economy and community*. Island Press, Washington, DC
- Beder S (1996) *The nature of sustainable development*. Scribe, Newham, Australia
- Bell F (1994) *A-Z of ESD*. Earth Foundation, Sydney
- Bertugia CS (1994) *Modelling the city: performance, policy and planning*. Routedledge, New York
- Brandon PS (2005) *Evaluating sustainable development in the built environment*. Blackwell Science, Oxford
- Brown D (2006) Back to basics: the influence of sustainable development on urban planning with special reference to Montreal. *Can J Urban Res* 15(1):99–118
- Brown D, O’Regan B, Moles R (2005) A comparative analysis of the application of sustainability metric tools using Tipperary town, Ireland, as a case study. *Manag Environ Qual* 16(1):37–55
- Club of Rome (1972) *Limits to growth*. United Nations, New York
- Commonwealth Government (1990) *Ecologically sustainable development: a commonwealth discussion paper*. AGPS, Canberra
- Commonwealth Government (1992a) *Intergovernmental agreement on the environment (IAE)*. AGPS, Canberra
- Commonwealth Government (1992b) *National strategy for ecologically sustainable development*. AGPS, Canberra
- Commonwealth Government (1995) *National biodiversity strategy (NBS)*. AGPS, Canberra
- Commonwealth Government (1998a) *National local government biodiversity strategy*. AGPS, Canberra
- Commonwealth Government (1998b) *Natural Heritage Trust Act*. AGPS, Canberra
- Commonwealth Government (1999) *Commonwealth Environment Protection and Biodiversity Conservation Act 1999, (EPBC)*. AGPS, Canberra
- Commonwealth Government (2000) *National Greenhouse and Climate Protection Act (NGCPA)*. AGPS, Canberra
- Commonwealth Government (2001) *National action plan for salinity and water quality*. AGPS, Canberra
- Commonwealth Government (2002a) *National Energy Conservation Act*. AGPS, Canberra
- Commonwealth Government (2002b) *National waste reduction scheme*. AGPS, Canberra
- Commonwealth Government (2003) *Climate change impacts on biodiversity in Australia*. AGPS, Canberra
- Commonwealth Government (2005a) *The state of sustainability reporting in Australia 2005*. AGPS, Canberra
- Commonwealth Government (2005b) *National water sharing reduction scheme*. AGPS, Canberra

- Commonwealth Government (2006) Towards best practice planning for improved urban management: benchmarks and performance indicators: technical notes/report. AGPS, Canberra
- Commonwealth Government (2007a) State of environment report. AGPS, Canberra
- Commonwealth Government (2007b) Sustainability for survival: creating a climate for change. AGPS, Canberra
- Commonwealth Government (2007c) Sustainable cities report. AGPS, Canberra
- Crilly M, Mannis A (2000) Sustainable urban management systems. In: Williams K (ed) Sustainable urban form. EFN, London
- Crofts D (1998) Place management in Newcastle city. *Aust Plann* 35(1)
- Crowe N (2000) Building cities—towards a civil society and sustainable environment. Art Media, New York
- CSIRO (2000) Future dilemmas to 2050. CSIRO, Canberra
- Department of Planning (2000) Basix. GPS, Sydney
- Department of Planning (2006a) Draft Central Coast Regional Strategy. Department of Planning, Sydney
- Engwicht D (1999) Street reclaiming: creating liveable streets and vibrant communities. Pluto Press, Sydney
- Ericksen N et al (2004) Plan-making for sustainability: the New Zealand experience. Ashgate, Aldershot
- Fincher R (1998) Population questions for Australian cities: reframing our narratives. *Aust Geogr* 29(1):31–47
- Forster C (1999) Australian cities, 2nd edn. Sydney, Oxford
- Giratdet H (1996) Gaia atlas of cities: new directions for sustainable urban living. Gaia Books, London
- Gore A (2007) An inconvenient truth. Wiley, New York
- Grant J, Manuel P, Joudrey D (1996) A framework for planning sustainable residential landscapes. *J Am Plann Assoc* 62(3):331–345
- Greenpeace Australia (1993) Sydney's future—environmental costs and benefits. Greenpeace Australia, Sydney
- Hillier J (2005) Mind the gap. In: Hillier J, Rooksby E (eds) *Habitus: sense of place*. Ashgate, Aldershot
- Hollick M (1998) Sustainable communities: lessons for aspiring eco-villages. Praxis, Sydney
- Hornsby Council (2007) *Earthwise*. Hornsby, New South Wales
- Hunter Lovins L (2012) *The way out*. Hill and Wang, New York
- Hyde R et al (2007) *The environmental brief: pathways for green design*. Taylor and Francis, Abingdon
- Inoguchi T (ed) (1999) *Cities and the environment: new approaches for eco-societies*. University Press, New York
- International Union for Conservation of Nature and Natural Resources (IUCNNR) (1980) *World conservation strategy*. IUCNNR, Switzerland
- IUCNNR, UNEP, WWF (1992) *Caring for the earth: a strategy for sustainable living*. Earthscan, Gland, Switzerland
- Kemp R, Parto S, Gibson RB (2005) Governance for sustainable development: moving from theory to practice. *Int J Sustain Dev* 8(1–2):12–30
- Lomberg B (2004) *Global crises, global solutions*. University Press, Cambridge
- Low N (ed) (2000) *Consuming cities: the urban environment in the global economy after the Rio Declaration*. MIT, Cambridge, MA
- Lowe I (2005) *A big fix: radical solutions for Australia's environmental crisis*. Black, Melbourne
- Manchester City Council (1999) *The state of the city region*. Manchester Press, London
- Manly Council (2007) *Manly sustainable plan*. Manly Council, Manly
- McHarg I (1978) *Design with nature*. Doubleday, New York
- McKay D, Rauscher R (2007) Devolving sustainability policy to local government: a case study of the city of Newcastle. *J Aust Polit Econ* 58:74–94
- Meadows D, Randers J, Meadows D (2005) *Limits to growth: the 30-year update*. Earthscan, London
- Newcastle City Council (2000) *Newnet program*. Newcastle City Council, Newcastle

- Newman P (1998) *From symbolic gesture to main stream: next steps in local sustainability*. Murdoch University, Perth
- Newman P, Jennings I (2008) *Cities as sustainable ecosystems: principles and practices*. Island Press, Washington, DC
- Newman P, Kenworthy J (1999) *Sustainability and cities: changing automobile dependence*. Island Press, Washington, DC
- NSW (1975) *Central coast structure plan*. NSW, Sydney
- NSW (1979) *Environmental Planning and Assessment (Epa) Act (Amended 1993)*. NSW, Sydney
- NSW (1989) *Catchment Management Act*. NSW, Sydney
- NSW (1991) *Protection of the Environment Administration Act*. NSW, Sydney
- NSW (1993a) *Local Government Act 1993*. NSW, Sydney
- NSW (1993b) *NSW state of environment reporting 1993*. NSW, Sydney
- NSW (1995) *Threatened Species Conservation Act*. NSW, Sydney
- NSW (1997) *Native Vegetation Conservation Act*. NSW, Sydney
- NSW (2000) *Building and Sustainability Index (Basix) Act*. NSW Govt, Sydney
- NSW (2003a) *Catchment Management Authorities Act*. NSW Govt Printer, Sydney
- NSW (2003b) *Natural resources management reform report*. NSW, Sydney
- NSW (2003c) *Native Vegetation Act 2003 (repeals 1997 Act) (2003b)*. NSW Govt, Sydney
- NSW (2005) *Native vegetation regulations (2005)*. Sydney: NSW Govt Natural Resources Management Reform Report. NSW, Sydney
- NSW (2006a) *NSW state of environment report*. NSW, Sydney
- NSW (2006b) *Growth Centres Commissions Act*. NSW, Sydney
- NSW (2006c) *Bushfire regulations*. NSW, Sydney
- NSW (2012) *EPA Amendment Act*. NSW Govt, Sydney
- O'Regan B, Moles R, Kelly R, Raveltz J, McEvoy D (2002) Developing indicators for the estimation of sustainable settlement size in Ireland. *Environ Manag Health* 13(5):450–465
- Packard S (1991) *Planning settlements natural*. Routledge, London
- Petschow U, Rosenau J, Ulrich von Weizsacker E (2005) *Governance and sustainability: new challenges for states, companies and civil society*. Greenleaf, Sheffield
- Phillips C (2003) *Sustainable place: a place of sustainable development*. Wiley, Chichester
- Planning NSW (1988) *Sydney into its third century*. Planning NSW, Sydney
- Rauscher R, Momtaz S (2004). *Sustainable area planning (SAP) framework for sustainable transport in growth centres*. 28th Australasian Transport Research Forum, Australasian Transport Research Forum 28, Sydney
- Ravetz J (1999) *City-region 2020: integrating planning for a sustainable environment*. Earthscan, London
- Redefining Progress Inc. (2000) *Community indicators handbook*. Cambridge, New York
- Rocky Mountain Institute (1998) *Green development*. Wiley, New York
- Rose M (1997) *Eco-city dimensions: healthy communities and healthy planet*. New Society, Gabriola Island, BC
- Sahely HR, Kennedy CA, Adams BJ (2005) Developing sustainability criteria for urban infrastructure systems. *Can J Civ Eng* 32(1):72–86
- Saul JR (2002) *On equilibrium*. Penguin, New York
- Theosophy Society (1914) *Ideal communities*. Herald of the Star, Sydney
- Spencer M (2005) Building sustainable cities. *E* 16(5):20–23
- Stern R (2006) *International climate change final report*. Her Majesty's Treasury, London
- Stillwell F (2000) *Reshaping Australia: urban problems and policies*. Cambridge, Sydney
- Stimson R (1999) *Urban metabolism as a framework for sustainable development in SE Queensland metro region*. Urban quality of life, Singapore Conference Proceedings, University of Singapore, Singapore
- Stocker L, Burke G (2006) *Overlay mapping—a methodology for place based sustainability education*. Chapter 25. In: Wooltorton F, Marinova D (eds) *Sharing wisdom for our future: environmental education*. Australian Association for Environmental Education, Sydney
- Swamy CRN (2001) *A spiritual ecology*. The Theosophist, New Delhi
- Tatray T (2001) *Green debate and wisdom*. Theosophy in Australia, Sydney

- Tisdell CA (1985) Sustainable development—conflicting approaches of ecologists and economists. University of Newcastle Economics Department, Newcastle
- Trainer T (1998) The simpler way. University of NSW Press, Sydney
- Trainer T (2003) Paper on Future Dilemmas 2050. Submitted to the FD 2050 Project and posted on UNSW Web. Author, Sydney
- Troy P (1998) Equity, environment efficiency: urban Australia. *Urban Futures*, May
- United Nations (1972) Declaration of the UN conference on the human environment. United Nations, New York
- United Nations (1992a) Agenda 21. United Nations, New York
- United Nations (1992b) United Nations conference on environment and development report (Rio Summit). United Nations, New York
- United Nations (1993) Local agenda 21. United Nations, New York
- United Nations (1995) Urban energy handbook: good local practice. United Nations, OECD, Washington, DC
- United Nations (1997a) Greenhouse gases reduction agreement report (Kyoto Protocol). United Nations, New York
- United Nations (1997b) Local agenda 21 model communities program. United Nations, New York
- United Nations (2000a) United Nations commission of sustainable development (CSD). United Nations, New York
- United Nations (2000b) United Nations sustainable cities programme. United Nations, New York
- United Nations (2002a) World summit on sustainable development report. United Nations, New York
- United Nations (2002b) Political declaration and plan of implementation (PDPI). United Nations, New York
- Urban Land Institute (1995) Smart growth. Cambridge Press, New York
- Urban Land Institute (2000) Development practice of sustainable cities. Cambridge Press, New York
- Van de Kerkhof M (2005) Learning and stakeholder participation in transition processes towards sustainability: methodological considerations. *Technolo Forecast Soc Change* 72:733–747
- Voss JP, Bauknecht D (2006) Reflexive governance for sustainable development. Edward Elgar, Cheltenham
- Walker B (1997) Sustainable cities: concepts and strategies for eco-city development. EcoHome, Los Angeles
- Walsh F, Mitchell P (2002) Participatory planning. Planning for country. Jukurrpa Books, Central Land Council, Australia
- Western Sydney Regional Organisation of Councils (2000) Western Sydney regional state of the environment report. Western Sydney Regional Organisation of Councils, Sydney
- White RR (2002) Building the ecological city. Woodhead, Cambridge
- World Wildlife Fund (2007) Living planet report. World Wildlife Fund, Switzerland
- Worldwatch Institute (2007) Worldwatch institute database disk. Worldwatch Institute, Washington, DC
- Zachary J (1999) Sustainable community indicators—guideposts for local planning. Wiley, New York

Chapter 3

Sustainable Communities Framework (SCF)

3.1 SCF Structure

Urban planning, as reviewed in Chap. 2, provides the basis of for the Sustainable Communities Framework (SCF). It incorporates ESD principles in urban planning. A scorecard means of recording sustainability of places is contained within the framework. A sustainability report for local areas is also incorporated and provides a basis for highlighting actions to be taken and items to be monitored. The framework in applying to a range of local areas can be scaled up to larger areas such as a district, local government area (LGA) or region. Also, the framework encompasses quantifiable indicators of sustainability. The framework structure is laid out in Table 3.1.

Step 1 involves reviewing ESD related documents (as reviewed in Chap. 2) that are relevant to a study area. These documents contain a range of ESD guidelines at International, Commonwealth and State levels. Each document should be examined for relevance to any study area. This can be done as a check list that will provide the cross section of documents that need addressing in the application of the SCF.

Step 2 involves selecting data sources from which indicators of sustainability can be selected and applied to a local area. These data sources come from a wide range of places, including: local government; state; national; and, international.

Step 3 involves conducting qualitative surveys of the local area, a major step of the SCF. The local area can be broken into smaller components to survey and apply indicators of sustainability. These smaller area components are called 'local environments' (LE). By definition 'local' is 'characterised by place' (Macquarie Dictionary 2006); and, 'environment' is 'relating to natural system' (Macquarie Dictionary 2006). Hence a 'local environment' can be viewed as a place consisting of a natural system.

Local environments are defined by natural boundaries. A local environment can contain a mix of the basic environment components (i.e. aquatic, terrestrial, land or environmental water). A lake bay and its surrounds, for example, form a local environment. A series of gullies feeding into a creek forms a local environment. Other local environments include, for example: hills, estuaries, foreshores, open plains and valleys.

Table 3.1 Sustainable communities framework structure

Step 1	Step 2	Step 3	Step 4	Step 5
Review ESD related documents	Select Data sources and indicators of sustainability	Conduct Area surveys	Complete Sustainability score cards	Adopt Sustainability reports

The SCF survey is a qualitative exercise, including: field observations using ESD related documents (i.e. Tables 2.1, 2.2, 2.3 and 2.4); data sources (accepting that environmental elements do not remain constant) as referred to by many authors in Chap. 2 and the latest SoE reports at local, state, national and international levels; using aerial photos, including flyover assessments to gain an overview of the environment and to compare these aerial photos over time (via Bathurst Office of NSW Central Mapping); comparing local environment field conditions to those conditions stated in planning documents and illustrated on maps (i.e. available at LG and State levels); on-the-ground qualitative assessment of the visible health and condition of environmental elements (i.e. visible impacts of nutrient runoffs or instances of vegetation removal); photographing local environments and assessing these photos against relevant references; and, using historical photos as benchmarks of the environment over time. Interviews can be undertaken with community organisations (i.e. precinct committee, progress association and land care groups). This will assist in interpreting historical information and on ground qualitative observations of environmental impacts and changes to the environment over time.

In summary, the SCF survey (Table 3.2) enables recording with a tick for a threat or impact on the natural environment elements (under A–D in column 1) within a local environment (LE1–LE6 illustrated here as an example) (column 2). The table enables the recording of threats and impacts for all elements present within a LE. The recording is based on the results of qualitative assessments within the survey tasks as outlined above. Any element not present within the study area is noted with an ‘N’ (not applicable).

The observation and photographing method of survey within this framework step is an important tool. Nutrient runoffs, for example, could be causing a number of impacts such as: adding pollutants; affecting water quality; and, contributing to weed growth. The observation and photographing also gives benchmark data that can be compared to previous earlier observations and earlier photographs. This method of survey has been used over many years commencing with McHarg (1978) to more recent catchment area planning (HRCMA 2007). It is important, in using qualitative survey results, to use descriptors for each category such as ‘stable’, ‘threat’ (partly unstable) or ‘impact’ (unstable). Descriptors allow a clearer understanding of each state and thresholds of cross-over between states.

The field observations and photographs focus on identifying the essential elements within that area. The survey is conducted for each local environment of the study area. Under aquatic, for example, elements to be observed include: aquatic plant life; marine

Table 3.2 Step 3—area survey guide for natural environment

✓ = recording a threat or impact based on: reviewing ESD related documents (Step 1); interpreting data sources; field observations; and, assessing photographs (current and historical) N = element not applicable to that local environment Local environments (LE) within local area							
Natural environment component elements	LE1	LE2	LE3	LE4	LE5	LE6	ETC
A. Aquatic component elements							
Element A1.	✓	✓		✓		✓	
Element A2.			✓	N	✓	N	
B. Terrestrial component elements							
Element B1.	✓	N	✓	✓	N		
C. Land component elements							
Element C1.	✓	✓	N		✓	✓	
D. Environmental water component elements							
Element D1.		✓	✓	N		✓	

Ratings	Certification values
Stable (G) (Green)	<ul style="list-style-type: none"> • Low biodiversity values • Reduced inhibition on development • Zoning appropriate for development
Partly Unstable (A) (Amber)	<ul style="list-style-type: none"> • Medium biodiversity values • Rule-based assessment of biodiversity • Offsets may be used to maintain or improve biodiversity values
Unstable (R) (Red)	<ul style="list-style-type: none"> • High biodiversity values • No development • Area could be used for restoration investment

Fig. 3.1 Certification flags—terrestrial biodiversity ESD element. *Source:* Scanlon (2006) (Abridged)

life; nutrients; water quality; water replenishment; and, weeds (aquatic). A summation of survey results over all the local environments within the local area provides an overview of the state of the natural environment of that study area.

Step 4 involves applying indicators of sustainability to the subject area. The rationale of using ratings within the sustainability score cards is based on the NSW Department of Conservation and Climate Change’s *Biodiversity Certification and Banking in Coastal and Growth Areas* (DEC 2005). The framework referenced Scanlon’s (2006) work which assessed the Department of Environment and Climate Change use of ratings of biodiversity. These ratings include: green, amber and red.

Scanlon’s table is reproduced below to illustrate the factors that would place an environment element into one of the three rating areas (Fig. 3.1). ‘Green flags’ refer to areas of low biodiversity values and thus have a reduced inhibition on development.

Table 3.3 Step 4—sustainability score card of natural environment for local area

Natural Environment Component Elements	Sustainability Scores										Overall Rating of Elements		
	G (Green) = Sustainable A (Amber) = Threatened R (Red) = Impacted N = Element not applicable to that local environment										G	A	R
	Local Environments (LE1-LE6) within Local Area												
LE1	LE2	LE3	LE4	LE5	LE6	Etc.							
	G	A	R										
A. Aquatic elements													
A1. Aquatic plant Life; etc.	G												
B. Terrestrial elements													
B1. Bushland Character; etc.		A											
C. Land elements													
C1. Aboriginal cultural sites; etc.		N											
D. Environmental water elements													
D1.Environmental Flows; etc.			R										
Overall Ratings of Local Environments	G	1											
	A		2										
	R			1									

‘Amber flags’ refer to areas of medium biodiversity and will require rule based assessment and off-sets to maintain or improve biodiversity. Finally, the ‘red flag’ areas contain high biodiversity values and prohibit development.

The use of qualitative scores to rate quantitative information is always problematic and is acknowledged. For application within the SCF the ratings adopted are: green as ‘sustainable’; amber as ‘threatened’ (thus partly unsustainable); and, red as ‘impacted’ (thus unsustainable). Within the SCF, an amber (threatened) is recorded if, after the survey and application of indicators of sustainability (Step 4 below), one environment element does not meet the sustainability standards. If two or more environment elements do not meet the sustainability standards the rating is ‘red’ (impacted).

Step 4 (Table 3.3) involves the application of indicators of sustainability to the elements of each natural environment component (aquatic, terrestrial, land and environmental water) and recording the results in the scorecard.

A sustainability rating for each environment element (A1–D1 in column 1) can be determined. An overall rating arrived at by adding up the ratings for each element

can be recorded for each local environment (LE1–LE6 in column 2) within a local area. An overall rating is achieved by adding up individual ratings by element (final column to right). Alternatively, the ratings can be added up for individual LEs (L1–L6 in bottom row). If an element's sustainable indicator measurement is registering a score where permanent damage would result, it scores 'red' (impacted). Where an element is registering a partial impact, thus 'amber' (threat), it signifies the threat can be attended to in fairly easy fashion. It should be noted, however, that a score will reflect local variability of the elements. An impact (red) score will place that LE into an unsustainable category (and need immediate addressing by the authorities). It should also be noted that not all localities have the same level of data and mapping sources. This factor of available sources could affect the ability of some authorities to adopt the scorecard system. If data sources are lacking, however, a descriptive result can be used as an alternative to the score card.

The score card system relies on a range of assessments, the personnel to conduct assessments, and an amalgamation of the assessment results. An element of caution thus has to be applied to ensure the accuracy and relevance of each assessment. Obtaining second opinions of assessments or comparing assessments over time are ways to ensure a high level of accuracy.

Having created sustainability scorecards, SCF Step 5 involves adopting a sustainability report based on those scorecards. The report indicates the total sustainability ratings for all elements. Alternatively the ratings can be read for each of the LEs. Taking the report by environment elements first (Table 3.4), the report enables sustainability ratings to be commented on (column 3) and actions proposed (column 4) for one or more elements. The actions are partly based on assessing standards contained in ESD related documents (as reviewed in Chap. 2). Actions can be tracked (column 5), including information on: date started; current date; authority responsible; and, status of actions. The report can be updated, especially when new ESD related documents are adopted (i.e. state of environment reports) at all levels of government (local, state, national or international).

The sustainability report card can also be interpreted by LEs (i.e. say for environment elements) (Table 3.5). This interpretation enables sustainability ratings to be commented on (column 3) and actions proposed (column 4). The actions are based on reference to ESD related documents as reviewed in Chap. 2. Actions can be tracked (as in the previous table, column 4): date started; current date; authority responsible; and, status of actions. This report can be updated, especially when new local, state and national ESD related documents (i.e. state of environment reports) are released or when local environments come under threat. Overall, this report card presents a more comprehensive approach to measuring and taking actions than to date the state of environment reporting has achieved.

District level score cards can be achieved by aggregating (or scaling up) sustainability ratings within the local areas. The aggregation is dependent on like measurement standards applying to both district and local area levels. The aggregation can be taken to LG and regional levels providing again there are like measurement standards across these areas. An example of this aggregation at district level is illustrated in Table 3.6. Sustainability ratings for the elements can be tallied within each local

Table 3.4 Step 5.1—sustainability report of the natural environment by environment component

Natural Environment Component Elements	Overall Sustainability Rating			Comment on Rating by Elements	Actions To address threatened and impacted elements. References: 1. Tables 2.1 to 2.4 (ESD Related Documents) 2. Planning related documents.	Date Started	Current Date	Authority Responsible	Status of Actions
	G (Green) = Sustainable	A (Amber) = Threatened	R (Red) = Impacted						
A. Aquatic elements									
A1.									
A2. Etc.									
Overall Aquatic									
B. Terrestrial elements									
B1.									
B2.									
Overall Terrestrial									
C. Land elements									
C1.									
C2. Etc.									
Overall Land									
D. Environmental Water elements									
D1.									
D2. Etc.									
Overall Environmental Water	G								
	A								
	R								

area (LA1–LA4), with overall ratings at the bottom row of the table. In addition, overall ratings for one or more elements can be tallied for the district (last column). This same aggregation can be applied to complete a Sustainability Report for a district. In up-scaling score cards an adverse impact (red) is carried through to the larger sized areas. In this instance the impact (red) is a precautionary signal when assessing larger areas.

Once a score card is complete an authority assesses the score implications and actions to be taken. The score card could, for example, indicate the impacts resulting from urban expansion. There is the prospect of using the score card to prompt the authorities to examine the weaknesses of planning instruments as constructed or applied. The score card would (at minimum) challenge local governments to examine threatened and impacted local areas or impacts of particular elements within those areas.

Table 3.5 Step 5.2—sustainability report of natural environment by local environments

Local Environments (LEs) and Natural Environment Components	Overall Sustainability Rating			Comment on Rating	Actions To address threatened and impacted elements by LEs. References: 1. Tables 2.1 to 2.4 (ESD Related Documents) 2. Planning related documents.	Date Started	Current Date	Authority Responsible	Status of Actions
	G	A	R						
LE 1									
Aquatic									
Terrestrial Etc.									
Overall Rating									
LE 2									
Aquatic									
Terrestrial Etc.									
Overall Rating									
LE 3									
Aquatic									
Terrestrial Etc.									
Overall Rating									
LE 4									
Aquatic									
Terrestrial Etc.									
Overall Rating									
Overall Ratings for LEs	G								
	A								
	R								

3.2 Chapter Summary

This chapter outlined the SCF and how each step of the framework could be applied. Several tables (templates) were revealed, including: an area survey guide; sustainability score card; an area sustainability report; and, district sustainability report. The importance of selecting indicators of sustainability was illustrated in Step 2. The area survey (Step 3) was outlined, noting particularly the importance of ‘local environments’ being the geographical units in surveying a natural environment. The survey method of field observations, photographs (current and historical), databases and local study area references were then outlined.

The method of transferring the sustainability ratings within the score cards onto sustainability reports followed (Step 5). The sustainability report illustrated how actions could be taken to address the ratings. Finally, application of the SCF from local area to district size was illustrated. The next chapter looks at data sources and indicators of sustainability.

Table 3.6 Sustainability score card (natural environment) scaled up to district level

Natural Environment Component Elements	Sustainability Ratings from Indicators Application								
	G (Green) = Sustainable A (Amber) = Threatened R (Red) = Impacted								
	Local Areas (LAs) within District						Overall Ratings of Elements		
	LA1			LA2	LA3	LA4			
	G	A	R				G	A	R
A. Aquatic Elements									
A1.									
A2. etc.									
Overall Aquatic Rating									
B. Terrestrial Elements									
B1.									
B2. etc.									
Overall Terrestrial Rating									
C. Land Elements									
C1.									
C2. etc.									
Overall Land Rating									
D. Environmental Water Elements									
D1.									
D2. etc.									
Overall Environmental Water Rating									
Overall Ratings of Local Areas	G								
	A								
	R								

References

Department of Conservation (2005) Biodiversity certification and banking in coastal and growth areas. Department of Conservation, Sydney

Hunter Central Rivers Catchment Management Authority (HCRCMA) (2007) Hunter-central rivers catchment action plan (HRCAP). NSW Govt, Sydney

Macquarie (2006) Macquarie dictionary. Macquarie, Sydney

McHarg I (1978) Design with nature. Doubleday, New York

Rauscher R, Momtaz S (2006) A tool for ecologically sustainable development (ESD) based urban planning in urban growth centres. Int J Environ Cult Econ Soc Sustain 1(5):12

Scanlon (2006) Bio-banking critiqued. Business law school (Masters Course). Sydney University. Scanlon, Sydney

Chapter 4

Data Sources and Indicators of Sustainability

4.1 Searching Data Sources

A search needs to be undertaken of data sources that could be used in developing the Sustainable Communities Framework (SCF). From these data sources indicators of sustainability can be selected. These data sources need to be canvassed at different levels of government and NGOs, including: local; state; national; and, international (including NGOs).

At the local government level (using Sydney Metropolitan Area as an example) there are a number of examples where local councils have developed ESD related data sources. An examination of councils' web sites illustrates some of these data sources. Hornsby Council, for example, developed the 'Interactive Map' (IM) program under the Council's *Earthwise* (Hornsby Council 2007) program. IM enables users to survey land improvement programs. The program also provides up-to-date ESD based data on environmental conditions such as water quality and biodiversity. Baulkham Hills Council, under its environment program, provides data on that council's greenhouse program and new developments. Sutherland Council provides a wide range of data sources under sustainability, including an ecological sustainability index for residential dwellings and a 'Greenweb' data base. Liverpool City Council has a range of data sources on environment components under its environment link.

Other local government councils have developed data bases linked to sustainability. Newcastle City Council provides maps and data sources under a program entitled 'About Sustainable Newcastle'. Port Stephens Council created a comprehensive *Environmental Management Plan* (Port Stephens 2000) under Council's Sustainability Department. That council has produced interactive mapping under its local area plan making, including local area plans completed in cooperation with the local residents. Penrith City Council adopted several principles of sustainability to guide its development under a program called 'Sustainable Penrith'. Newcastle City Council's ongoing commitment to Agenda 21 illustrates a consistency to embrace ESD principles within Agenda 21. Newcastle's application of Agenda 21 was progressed

in Council and culminated with the adoption of the *Newcastle Environment Management Plan* (Newcastle City Council 1995). Council also adopted a set of *Sustainable Community Indicators* (Newcastle City Council 2000) to measure of the City's progress toward sustainability. These indicators are updated annually and made available to householders. Finally, several councils have introduced data sources into local government area wide sustainability plans (Manly Council 2007). Gosford City (2007) replaced the SOE Report in 2005 with an annual sustainability report. The data sources from these plans provide further model formats for the SCF.

Moving from local government, NSW State level data sources useful to the SCF application fall into the categories of atlases and land data sources. Under atlases, *iplan* (Department of Planning 2007) is a state-wide e-service program that provides maps and data in areas such as: land uses; environmental measurements; and, geographical conditions. The *Natural Resources Atlas* (Department of Environment and Climate Change 2007) (herein called the Atlas) is also a useful source. This Atlas provides a mapping of natural resources over the state. This site allows the user to layer the data, thus providing a further analytical tool. The Atlas provides maps and data bases on ESD criteria including for example: biodiversity, salinity and vegetation. In addition, the Atlas allows the user to construct an interactive map with environmental data. In summary, the atlases are a core tool for the SCF application.

In addition to atlases there are simulation planning models that contain data sources and allows manipulation of those sources. At the State level one of these data sources is the *Environmental Valuation Database* (Envalue) (Environment Protection Authority 2007). Envalue is a systematic collection of environmental valuation studies presented in an on-line database. Envalue enables decision makers and the community to incorporate environmental data into a range of environmental studies. Envalue, for example, allows a user to evaluate estimated changes in the environment resulting from proposed development. This program provides a resource for the application of the SCF where land uses are to change (i.e. land subdivisions). Another State source is *3D Flythrough* (Landcom 2002) was constructed by NSW Landcom to compare impacts of different development proposals at Campbelltown NSW. This mapping imposes proposed development onto aerial footage to present a visual overview of impacts on soils and vegetation types with data fed into a computer model. Finally, there are simulation models that can plot environmental (natural and built) data to generation scenarios to measure impacts or to illustrate views of altered natural and/or physical landscapes.

Moving from state government to the national, there are a number of data sources available. The Environment Australia (EA) site, for example, provides links to catchment mapping. Also, *Mapping Australia's Vegetation* (MAV) (CSIRO 2000) provides data source on greenhouse gas emissions affected by land use changes. In addition the Commonwealth produced a booklet on the state of sustainability reporting in Australia (Department of Environment and Heritage 2005). Finally, the Commonwealth created a sustainable design data base for homeowners and industry to encourage better design of homes and urban environments under the Nabers program (Commonwealth Government 2006). Finally, the Commonwealth (2003)

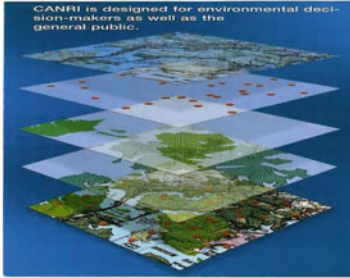
has, since 2000, required federal agencies to report to the Auditor-General annually on their environmental performance and contribution to ESD.

On the international scale, a number of ESD related data sources are available. The main UN data source remains under Local Agenda 21 (United Nations 1993) and model communities program (United Nations 1997b). There are also a number of UN ESD related data sources, many relating back to the ESD based document reviewed in Chap. 2. Many of these UN documents (i.e. Kyoto protocol) (United Nations 1997a) contain built environment indicators (e.g. greenhouse gas sources and reductions of emissions). The UN also provides analyses of changing levels of sustainability round the world (2000b and 2002c). Still within the UN, there are numerous data sources used under the UN Commission of Sustainable Development (United Nations 2000a). The Environmental Law Institute (Environmental Law Institute 2007) in the United States produced a sustainability handbook, a comprehensive guide to achieve ESD responsibility. Finally, the Worldwatch created a data on a range of environmental measurements, including: biodiversity, climate change, transportation, energy (Worldwatch Institute 2007). Community based groups within countries produce environmental data bases. Within Australia for example the Total Environment Centre has produced a database on sustainable development for Sydney (Total Environment Centre 1999). Finally, Hart (1999) developed a guide book for governments and communities to adopt and update indicators.

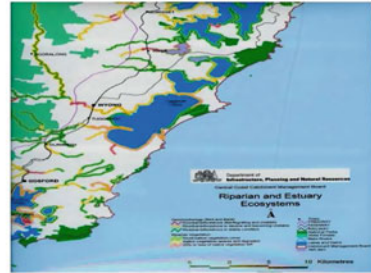
All the above sources provide data that the SCF relies upon in adopting indicators of sustainability. The framework requires data sources that contain natural environment components (i.e. aquatic, terrestrial, land and environmental water). A range of data sources for application within the SCF can be assessed. These data sources are now examined in more detail through illustrations (Plates 4.1, 4.2 and 4.3). Natural resource data is a prime data source for the SAP framework application (D1). The NSW government established *Canri* (Community Access to Natural Resources Information) as a natural resource management tool to assist professional and public use. Layering illustrates the interconnectedness of the natural environment components, important in the SCF approach. Data for each of the SCF components (aquatic, terrestrial, land and environmental water) is available here.

Data is available on a range (not exclusive) of aquatic elements that can have indicators of sustainability applied. These indicators include, for example: aquatic plant life; marine life; nutrients; water quality; water replenishment; and weeds (aquatic). There are a number of databases containing these elements. Firstly, data is available on riparian and estuary systems health (D2). This data incorporates impacts on the riparian and estuary systems on the Central Coast. In this instance the map indicates that the edges of lakes, rivers and creeks are declining and becoming unstable. As the study area borders Tuggerah Lakes, this data will be important to measuring the health of the lake and its foreshores (D3). The trend in Tuggerah Lakes illustrated here is increased 'sandy mud' and 'mud accumulation'.

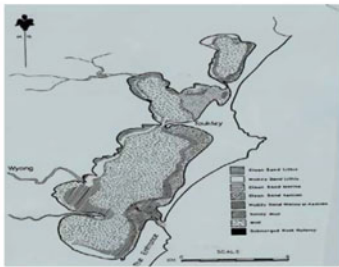
In addition to data sources on aquatic biodiversity, sources on terrestrial biodiversity also need to be identified. Data is available from a number of sources of terrestrial biodiversity (not exclusive), including: bushland character; corridors; edge habitat; endangered species; terrestrial fragments; gap habitat; native vegetation;



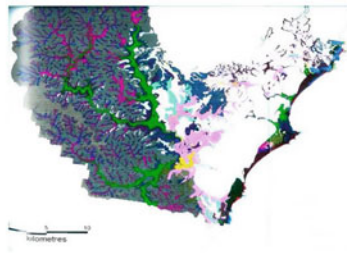
D1. Natural Resources
 Source: Canri - Community Access to Natural Resources Information, NSW (2000)



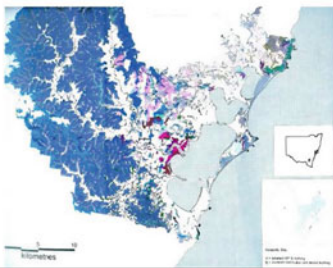
D2. Ecosystem Health: Riparian + Estuary
 Location: Central Coast
 Legend: Shows stressed rivers and lake edges
 Source: *Integrated Catchment Management Plan for the Central Coast*. DIPNR, Svdnev (2002)



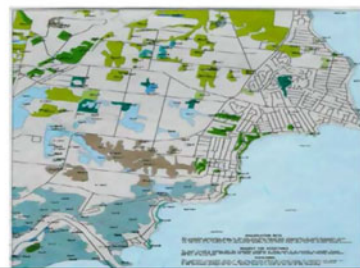
D3. Lakes and Foreshores Health
 Location: Tuggerah Lakes
 Legend: Shows mud and aquatic weeds
 Source: *Tuggerah Lakes Estuary Study*, Wyong Council, Wyong (2001)



D4. Vegetation Timeline 1750
 (Types of vegetation over Wyong Shire)
 Source: *draft Wyong Shire Conservation Strategy*, Wyong Council, Wyong (2002)



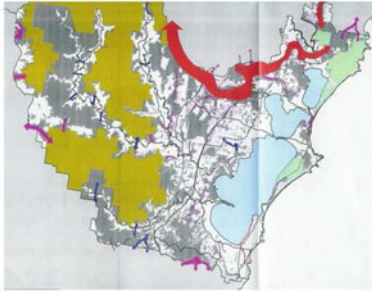
D5. Vegetation Current
 Legend: Remaining vegetation over shire
 Source: *draft Wyong Shire Conservation Strategy*, Wyong Council, Wyong (2002)



D6. Vegetation Fragments
 (Remaining fragments in colours)
 Source: *Wyong Shire Biodiversity Study*, Wyong Council, Wyong (2000)

Plate 4.1 Data sources for indicators of sustainability D1–D6

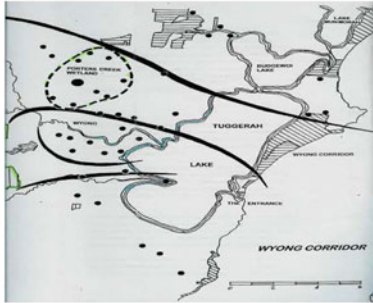
and, weeds. Under vegetation, there are data sources available, for example, on natural vegetation historical time lines (1750) (D4). The map shows the vegetation likely to have been within Wyong Shire (including North Wyong) projected back to 1750 to compare with existing vegetation. Utilising data as noted in D4, a comparison



D7. Wildlife Corridors
 Legend: main corridors in red/blue/purple
 Source: *draft Wyong Shire Conservation Strategy*, Wyong Council, Wyong (2002)



D8. Threatened Species
 (Dashed lines bracket is species' corridor)
 Source: *Corridors Study*, Community Environment Network + Wyong Council, Wyong (2000)



D9. Wildlife Protection
 (Dots show species sightings in North Wyong)
 Source: *Threatened Species Survey*, Community Environment Network, Ourimbah (2000)



D10. Bush Fire Prone Areas (Kariong)
 Source: *Central Coast Express Advocate*, Gosford (2003)

Plate 4.2 Data sources for indicators of sustainability D7–D10

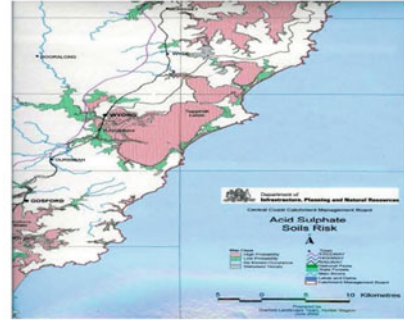
can be made of changes in vegetation within Wyong Shire (D5). Finally, to examine more closely the remaining vegetation fragments within the study area, a data source illustrating current biodiversity is required (D6). This data source illustrates the separation of the vegetation fragments and the reduced ecosystem connections.

Continuing to examine data sources (Plate 4.2), an overview of wildlife corridors (D7) is viewed first. This illustration shows, for example: major and minor corridors; existing fragments of corridors; disturbance to corridors; and, regeneration of corridor lands. Accurate map plotting of these corridors is essential to clarify any impacts or threats and to understand the role a corridor plays in protecting habitats.

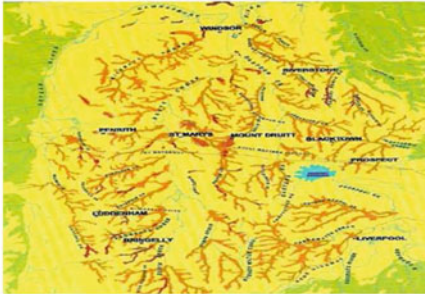
Having an overview of the corridors allows closer determination of threatened species. Corridor disturbance data is especially important as disturbances affect species' habitats (D8). The data available from plotting of these wildlife corridors is essential to use within indicators of sustainability and later within the sustainability report (Step 5).



D11. Bio-banked Areas (Western NSW)
Source: *CSIRO Greenhouse Program, Canberra (2002)*



D12. Acid Sulphates
Location: North Wyong
Source: *Integrated Catchment Management Plan for the Central Coast, DIPNR, Sydney (2002)*



D13. Salinity (Western Sydney)
Source: *West Sydney Regional State of Environment Report, WSROC, Blacktown (2002)*

Plate 4.3 Data sources for indicators of sustainability D11–D13

The quality of wildlife protection within these vegetated areas can be partly determined from this data source. Likewise, the number of threatened species in a study area (D9) can be determined and utilised as an indicator of sustainability. The threatened species plot illustrated over part of the study area provides allocation, distribution and band width pattern of species.

The third natural environment component (land) also has a wide range of data sources that could be used within the SCF. Land elements include, for example (not exclusive): Aboriginal cultural sites; acid sulphates; bushfire prone areas; drainage; erosion; European cultural sites; geological formations; bio-bank areas; minerals; salinity; soils; and, land stability. Throughout Australia data are available on bush fire prone areas (D10).

Examining additional corridors (Plate 4.3), aerial photos of past bush fires on the Central Coast provides a measure of the impact this factor has on the environment. A further land element considered is biological (bio) banked areas (D11).

The impact of tree removals for development (agriculture in this example) can be measured. This CSIRO mapping device as illustrated here measures greenhouse gas emissions using aerial sensors. Land use policies can be adjusted to stay within prescribed greenhouse standards as adopted by governments.

Urban development in the vicinity of water bodies can be restricted by acid sulphate soils (D12). Significant acid sulphate soils represent a high probability risk. It is understood that acid sulphates on sensitive low lands and wetlands can create major problems if disturbed. Finally, though there are many additional data sources, one common ground impact data source is salinity (D13). Salinity is a condition that can cause grave hazards to biodiversity and the built environment. In this instance a salinity data base map from Western Sydney is used to illustrate salinity readings in that area. Salinity follows river and creek beds and areas extending beyond those beds. These areas present salinity hazards, thus needing indicators of sustainability established to gauge impact.

The last natural environment component is environmental water. The environmental water elements include (not exclusive): environmental flows; groundwater; quality of water (accepting spatial variability of quality needs to be accounted for); nutrients; and, urban stormwater. While there is a range of data sources on each of these elements, it was felt the examples provided for the other three components (aquatic, terrestrial and land) was sufficient to illustrate the linkage between data sources and the SCF.

In respect to built environment data sources there are many available under programs such as Basix (Department of Planning 2000) at the NSW State level and Nabers (Commonwealth Government 2006) at the Commonwealth level (noted earlier). Over time it is expected that each built environment component will have sets of sustainability standards. These standards as indicators of sustainability are likely to be adopted and monitored by state and national levels of government.

4.2 Indicators of Sustainability

Indicators of sustainability are essential to the application of the SCF. Indicators can be selected from the data sources summarised above (accepting environmental elements will not remain constant). These indicators have been summarised for the SCF within a Sustainability Indicators Checklist (Table 4.1). As noted in Chap. 3, the author selected a regionally based data source applicable to Wyong Shire (e.g. Lower Hunter and Central Coast Regional Environmental Management Systems) (LHCCREMS 2003a). Referring to Table 4.1, each column within the template is outlined now in detail. The LHCCREMS's approach to standards is considered applicable to any study area as it is based on about 15 years of scientific work by that organisation within the Central Coast and adjacent Hunter Valley. The report is a best practice guide for environmental measurements. The guide and related measuring standards in an application of the SCF needs to include references that contain critical levels that could trigger an impact.

Table 4.1 Sustainability indicators checklist (natural environment)

√ = element relative to area	Natural environment Component elements	Indicator of sustainability (example)	Unit of measurement	Standard of measurement	Significance of indicator standard
<i>Aquatic biodiversity</i>					
□	A1. Aquatic plant life	A1.1 Plant health A1.2 etc.	Disease type and extent	Type/ha	Extent of disturbance to plant life
□	A2. Marine life	A2.1 Type of marine life	#	#/type	Marine life disturbed
□	A3. Nutrients	A3.1 Nutrient runoff	Type and potency	mg/1,000/L	Nutrient runoff impact
□	A4. Water quality	A4.1 Health	Impurity elements	impurities/kl	Water quality deterioration
□	A5. Water replenishment	A5.1 Quantity and quality	mgL + health	mgL + health	Long term water replenishment
□	A6. Weeds (aquatic)	A6.1 Type + Quantity	#/ha	Ha/1,000	Extent of weed invasions
<i>Terrestrial biodiversity</i>					
□	B1. Bushland character	B1.1 Type and quality B1.2 etc.	Ha + condition	Ha/1,000 + condition	Bushland character that is threatened and its condition
□	B2. Corridors	B2.1 Corridor condition + disturbance	Ha	Ha/1,000	Corridor disturbance
□	B3. Edge habitat	B3.1 Type, quantity + condition	Ha	Ha/1,000	Edge habitat under threat
□	B4. Endangered species	B4.1 Species protected + threatened	#	#	Requirements for protection of endangered and protected fauna and flora species
□	B5. Environmental Fragments	B5.1 Type, health + quantity	Ha	Ha/1,000	Environmental fragments are under threat from development
□	B6. Gap Habitat	B6.1 Type, health + quantity	Ha	Ha/1,000	Gap habitats that are isolated
□	B7. Native vegetation	B7.1 Vegetation depletion	Ha	Ha/1,000	Vegetation can be depleted; compare pre-1750 and current vegetation
□	B8. Weeds (terrestrial)	B8.1 Weed infestation	Area (ha) and type	Ha/1,000	Weed infestation can be widespread

<i>Land geography</i>							
□	C1. Aboriginal cultural sites	C1.1 Protected sites C1.2 etc.	#	# + level of protection Ph 7	Significant Aboriginal sites		
□	C2. Acid sulphates	C2.1 Amount of acid sulphate soils C2.2 etc.	Ph		Actual acid sulphate soils that are prominent near rivers and lakes		
□	C3. Bush Fire Prone Areas	C3.1 Bush fire safety zones (asset protection)	Ha	Metres to bushland edge	Refer to NSW Rural Fire Service (<i>Bush Fire Guidelines</i> (DoP 2006))		
□	C4. Drainage	C4.1 Drainage impact	Year flood occurrence	1:100 flood	Extent of drainage that causes a significant impact		
□	C5. Erosion	C5.1 Amount of erosion	Tons/ha	Tons/ha	Erosion can contribute to significant siltation		
□	C6. European cultural sites by heritage listings	C6.1 Protected sites	#	# + level of protection	Significant European cultural sites		
□	C7. Geological formations	C7.1 Type and #	#	# protected	Geological formations recorded and protected		
□	C8. Bio-bank areas	C8.1 Protect bio-bank areas (private and public lands)	Ha	Minimum Ha to maintain	Bio-bank impacts		
□	C9. Minerals	C9.1 Valuable or protected minerals	#	# protected	Mineral resources under stress		
□	C10. Salinity	C10.1 Salinity presence	Kg	Kg/ha	Salinity increases detected		
□	C11. Soils	C11.1 Type and quality	Ha	Type/quality/ha	Healthy soils noted		
□	C12. Stability	C12.1 Disturbance	Ha	Ha/1,000	Slippage occurrences		
<i>Environmental water</i>							
□	D1. Environmental flows	D1.1 Potable water availability D1.2 etc.	mgL	mgL/1,000 people	Reduction in water availability		
□	D2. Groundwater	D2.1 Area	Ha	Ha/1,000	Groundwater sources		
□	D3. Quality of Water	D3.1 Rivers, creeks and lakes physical and chemical health	mgL	mgL/1,000	Quality depletion		
□	D4. Nutrients	D4.1 Type	Quantity	Quantity/1,000	Cumulative nutrient impact		
□	D5. Urban stormwater	D5.1 Stormwater point discharges	Cu metres/minute	% >discharge capacity	Discharge impact		

In column 1, it is important to determine what natural environment component elements are relative to the subject area. A checklist provides the space to record the relative elements. The data sources (Plates 4.1, 4.2 and 4.3) provide a handy reference to determine elements that may be relative. Where there is any doubt it is best (from an ESD precautionary stance) to note the element as relative. Later survey work (Step 3) will enable the relevance to be checked.

In column 3, indicators of sustainability are listed for each of the elements. The selection of these indicators as noted above come from data sources such as LHCCREMS. As noted earlier additional indicators can be added. The addition will arise as a result of: new data sources; scientific advances; new standards; changed study area ground circumstances; or, new government standards requirements (i.e. state of environment reporting). In the selection of (and final determination of) indicators of sustainability it is essential that there be community input.

In columns 4 and 5, units of measurement and standards of those measurements are listed. These units of measurement can come from a range of sources, including: regional based (i.e. LHCCREMS) studies relative to the area; government inscribed standards; or, studies relative to an environment element within the study area.

In column 6, the significance of each indicator standard is noted. These notations provide a simple language guide to the health and condition of the natural environment component elements. This will include for example: extent of disturbance; degree of threat; or extent of impacts.

The selection of indicators is important for the accuracy of the SCF application. Referring to Table 4.1, several comments can be made. A single element of the natural environment (i.e. nutrients in an aquatic system) could be the trigger to an unsustainable rating. In addition, measuring the health of an element (i.e. corridors under terrestrial system) could be dependent of the size of the element. In the instance of corridors, the overall size of the corridor and disturbance in sections of the corridor will influence the outcomes of the measurement of the corridor within the subject site. Thus downward and upward circumstances and impacts need notation.

Some areas of indicator application may have (within that SCF application) additional sources of data needing review. One example of this is Aboriginal cultural sites (C1) under the Table 4.1. Given the sensitivity of these sites it is expected that extensive consultation with Aboriginal stakeholders and searches of archaeological studies would be undertaken. Secondly, in the instance of bush fire prone areas (also under land geography) there is a further reference to the NSW Rural Fire Service (NSW 2006) for additional indicator standards. Finally, some indicators will apply to a natural environment system that is influenced significantly upstream (i.e. environmental water). In this instance it is important to identify those indicators predominantly relative to the local area. For environmental water, for example, measurement of impact of urban stormwater discharges is normally completed locally.

4.3 Chapter Summary

This chapter explored data sources and indicators of sustainability required to apply the SCF. The chapter summarised data sources, ranging over local government, state, Commonwealth and international governance levels. Map layering was selected as a main basis of selecting data, including elements within three of the four ESD components (aquatic, terrestrial and land). It can be concluded that there is an ever increasing choice of mapping formats, especially e-mapping, available for selecting indicators of sustainability for use within the SCF.

The development of the indicators of sustainability checklist within a table was then outlined. These indicators covered all four natural environment components (aquatic, terrestrial, land and environmental water). The comprehensiveness of the indicators would depend on the availability of data sources. Finally, the chapter highlighted the difficulties of adopting indicators of sustainability from a wide range of data sources. The next chapter will outline how a case study area is selected where the SCF is to be applied.

References

- LHCCREMS (2003a) Coast regional environmental management systems
 Commonwealth Government (2003) Annual reporting on ecologically sustainable development. AGPS, Canberra
 Commonwealth Government (2006) Nabers. AGPS, Canberra
 CSIRO (2000a) Future dilemmas to 2050. CSIRO, Canberra
 CSIRO (2000b) Mapping Australia vegetation (MAV). CSIRO, Canberra
 Department of Environment and Climate Change (2007) Natural Resources Atlas. Sydney
 Department of Environment and Heritage (2005) The state of sustainability reporting in Australia 2005. Department of Environment and Heritage, Canberra
 Department of Planning (2000) Basix. GPS, Sydney
 Department of Planning (2006) Lower Hunter Regional Strategy. Department of Planning, Sydney
 Department of Planning (2007) iPlan. Department of Planning, Sydney
 Environmental Law Institute (2007) The sustainability handbook. Environmental Law Institute, Washington, DC
 Environment Protection Authority (2007) Environmental Valuation Database (Envalue). Environment Protection Authority, Sydney
 Gosford City Council (2007) Gosford city sustainability report. Gosford City Council, Gosford
 Hart M (1999) Guide to sustainable community indicators, 2nd edn. Author, West Hartford
 Hornsby Council (2007) Earthwise. Hornsby, New South Wales
 Landcom (2002) 3D flythrough. Landcom, Sydney
 Manly Council (2007) Manly sustainable plan. Manly Council, Manly
 Newcastle City Council (1995) Newcastle environment management plan. Newcastle City Council, Newcastle
 Newcastle City Council (2000) Sustainable community indicators. Newcastle City Council, Newcastle
 NSW (2006) Bushfire Regulations. NSW, Sydney
 Port Stephens (2000) Environmental management plan. Port Stephens, Nelson Bay
 Total Environment Centre (1999) Greenprint: for Sydney. Total Environment Centre, Sydney

United Nations (1993) Local Agenda 21. United Nations, New York

United Nations (1997a) Greenhouse gases reduction agreement report (Kyoto protocol). United Nations, New York

United Nations (1997b) Local Agenda 21 model communities program. United Nations, New York

United Nations (2000a) United Nations commission of sustainable development (CSD). United Nations, New York

United Nations (2000b) United Nations sustainable cities programme. United Nations, New York

United Nations (2002) United Nations state of environment report. United Nations, New York

Worldwatch Institute (2007) Worldwatch Institute database disk. Worldwatch Institute, Washington, DC

Chapter 5

Examining the Study Area

5.1 Background to Study Area

The authors have selected as a study area the urban growth North Wyong district within Wyong Shire on the Central Coast of NSW (herein referred to as North Wyong) (Plate 5.1). Selecting a study area and reviewing its characteristics and applied planning regime is an important step before applying the sustainable communities framework (SCF). The main reason for selecting North Wyong as a study area is that this district is an outer metropolitan urban release area with rapid growth over the last 35 years (1977–2007)¹ (Wyong Shire population estimated at 160,000 in 2012). This development has left North Wyong as one of the most highly impacted areas of Wyong Shire. This district is projected to continue to be developed as greenfield development to 2031 (Department of Planning 2006a).

North Wyong districts' background is reviewed below in more detail to gain a better appreciation of the area's planning. North Wyong encompasses a wide spectrum of natural features including: Tuggerah and Budgewoi Lakes; Wyong River; Wallarah Creek; diverse vegetation communities; expansive wetlands; environmental corridors; and, flood plains. North Wyong also contains: eleven established suburbs; six newly developing suburbs under the State land release program; and, a number of rural areas.

The local areas within North Wyong share common geographical and ecological characteristics. Within North Wyong the sub-district of West Tuggerah Lakes-Wadalba (south) is selected as a test area to illustrate the SCF. Test areas need to be small enough for a survey to be conducted, yet big enough for indicators of sustainability to be measurable. Indicator measurements often cover much larger areas than the areas needing to be measured. This application of the SCF to this test

¹The population of Wyong Shire was estimated at 145,740 in 2007 (Wyong Council 2007a) and was expected to be 216,000 in 2027. The Central Coast Regional Strategy (Department of Planning 2006a), however, recommended a population increase of 52,900 by 2031 (Shire population of 200,640 in 2031).



Local Areas (LAs) of North Wyong District: 1a. West Tuggerah Lakes-Wadalba (south); 1b. West Tuggerah Lakes-Wadalba (north); 2. Hamlyn Terrace; 3. Woongarra; 4. North Wyong Industrial; 5. Warnervale; 6. Halloran; and, 7. Wallarah

- = North Wyong District Study Area
- ■ ■** = West Tuggerah Lakes-Wadalba
- 1a** = West Tuggerah Lakes-Wadalba (south) Local Area (Test Area)
- 1b** = West Tuggerah Lakes-Wadalba (north) Local Area

Source: Wyong Council, GIS 2007

Plate 5.1 Local areas of North Wyong (plan)

area also allows for an illustration of aggregating sustainability scores to the North Wyong district level. Further, an illustration of aggregating sustainability scores to local government area, region and greater region can be undertaken.

The West Tuggerah Lakes-Wadalba (south) local area is bounded by the following natural and manmade landforms: Wyong River in the south; Tuggerah Lake foreshore to the east; the Pacific Highway to the west; and, Wallarah Rd to the north. This local area has been subject to a range of impacts, including: loss of and damage to biodiversity (i.e. reduction in flora and fauna); impact on Tuggerah Lakes, Wyong River, Wallarah Creek and all foreshores; and, reduction in wetlands, estuary and riparian zones.

All local areas in North Wyong were part of the early 1940s/1950s rural communities of Wyong Shire. The aerial photo (Plate 5.2) provides a visual picture of the North Wyong land and urban development. Key features of the area include extensive bushland, flood plains and wetlands. These features will be examined further when the indicators of sustainability are discussed (Chap. 6).



Local Areas (LAs) of North Wyong District: 1. West Tuggerah Lakes-Wadalba 2. Hamlyn Terrace (includes Willows Bend on thesis cover) 3. Woongarra 4. North Wyong Industrial 5. Warnervale 6. Halloran 7. Wallarah

Note: photo covers most of North Wyong to the west of Tuggerah Lakes.
 Source: Aerial Photo North Wyong District Study Area, Peter Adderley, 2006

Plate 5.2 Local areas (LAs) of North Wyong district (aerial photo)

North Wyong consists of a mix of residential, industrial and commercial land uses. There are six residential areas and one industrial area within North Wyong. The residential areas are: West Tuggerah Lakes-Wadalba including the suburbs of Tacoma, Rocky Point, Tuggerawong, Wyongah, Kanwal, Gorokan (South), Gorokan (North), Lake Haven and Charmhaven; Hamlyn Terrace; Woongarra; Warnervale; Wallarah; and, Halloran. The industrial area (North Wyong Industrial Zone) is the current main industrial growth area in North Wyong. With the exception of some of the established suburbs of West Tuggerah Lakes-Wadalba, all seven local areas (six residential areas and one industrial) are part of the Warnervale/Wadalba growth area.

North Wyong district’s background is now reviewed in more detail to gain a better appreciation of the district’s planning history. The local areas within North Wyong share common development staging and some geographical and ecological commonality.

The local areas of North Wyong have a common land use background but are varied in geography. Firstly, West Tuggerah Lakes-Wadalba, as shown in Plate 5.1 (1a, 1b) has a majority of its area zoned under the Wyong Shire LEP 1991 for either urban release (2e) or investigation zone (10a) (Wyong Council 2003a). The established suburbs here started as scattered village communities around Tuggerah Lakes and became more suburbanised starting in the 1950s. Among the new suburbs, Wadalba saw new estate development commence in the late 1990s.

Examining other suburbs, Hamlyn Terrace (2) and Woongarra (3) experienced accelerated suburban type development commencing in the early 1990s. Woongarra also contains the sites of the proposed Warnervale Town Centre and new Warnervale railway station. Warnervale (4), centred on the Warnervale railway station, contains a number of future residential release areas. Wallarah (5) contains rural-residential properties (Bruce Crescent) and is partially scheduled for higher densities on its eastern boundary adjacent to the proposed railway station. The last residential area, Halloran (6), contains a large portion of the proposed Wyong Employment Zone (WEZ). Finally, the North Wyong Industrial Area (7) is predominantly zoned 2(e). This area has experienced significant industrial development in the late 1990s and early 2000s.

5.2 Study Area and Planning

To understand the planning of a study area it is necessary to examine the planning of this area at regional, district and local levels. The selected study area of North Wyong District, for example, is affected by planning decisions at all three of these levels, as will now be examined.

5.2.1 Greater Metropolitan Region Planning

North Wyong District is within the GMR (Plate 5.3), a region that has experienced significant urban development over the last 30 years (1970s onwards). The GMR offers a variation of urban settlement types, including: four sub-regions (Metropolitan Sydney, Illawarra, Central Coast and Lower Hunter); and, 13 cities and 37 non-city municipalities within those subregions. The extent of the GMR growth over the last 30 years is illustrated in Table 5.1.

The impact of the GMR growth is illustrated by the GMR's environmental footprint (an impact concept as outlined in Chap. 2) contained in *City of Cities Metropolitan Strategy* (Department of Planning 2005). The Department of Planning (DoP) states this footprint currently is estimated to cover half (49 %) the State of NSW. At current rates of growth and consumption of goods and services, the Department argues, the city's environmental footprint is likely to cover 95 % of the State by 2031. The GMR is expected to grow at a slightly slower rate over the next 20 years, but still adding 1.1 million people (outlined in *City of Cities Metropolitan Strategy* (Department of Planning 2005)). The NSW State government is, like other authorities around the world, challenged to adopt ESD criteria to plan for the GMR. There are a number of State documents from the mid-1990s developed to guide development within the GMR (Table 5.1). These key documents are noted by: year (column 1); document (column 2); purpose (column 3); and, critique of document's incorporating ESD based urban planning (column 4). The documents are now summarised under: (1) land use planning; (2) natural resource planning; and, (3) sustainability planning.



The Greater Metropolitan Region (GMR) of Sydney includes: The Sydney Metropolitan Area in centre and left; Illawarra to the south; Central Coast north of Sydney Metropolitan Area; and Lower Hunter further north. The Sydney Metropolitan Growth Areas include the South West and North West. Source: Dept. of Planning (NSW) 2006

Plate 5.3 Greater metropolitan region (GMR) of Sydney

Table 5.1 Planning documents at the greater metropolitan region planning level

√ = doc. relevant to study area	Date	Cumulative years from first doc.	Document S = superseded	Purpose of document	Critique of document's contribution to ESD based urban planning
<i>Land use planning</i>					
1.1 □	1995	0	<i>Transport 2010 Plan (DOT 1995)</i>	Transport strategy to guide GMR transport to 2010	Plan was heavily weighted to roads transport and Sydney centric, not sustainable transport (i.e. public transport emphasis)
1.2 □	1999	4	<i>Shaping Our Cities (Planning NSW 1999a)</i>	Groundwork laid for separate 'shaping plans'	A broad plan containing population forecasts and infrastructure commitments, however few sustainability references
1.3 □	2002	7	<i>Draft Integrated Land Use and Transport State Environmental Planning Policy 66 (Planning NSW 2002b)</i>	Policies to integrate transport and land use planning	At year 2007 the plan remained in draft only, showing no intentions of government to adopt
1.4 □	2003	8	<i>Plan First Review (2003)</i> (Department of Infrastructure, Planning and Natural Resources 2003)	The review of draft Plan First reduced the prospects of Plan First adoption	This review of <i>draft Plan First</i> (Planning NSW 2001) criticised the draft's aims; no further action under Plan First followed the review
1.5 □	2005	10	<i>City of Cities Metropolitan Strategy</i> (Department of Planning 2005)	Strategy for the Sydney Metropolitan Area and intent to create additional plans for the GMR regions and NSW coast	The first of a series of plans for the regions within the GMR. Strategy provided a concept for the cities of the GMR. Planning further on a GMR basis was not embraced, as against planning for separate cities

1.6	2006	11	<i>Lower Hunter Regional Strategy</i> (Department of Planning 2006c)	Lays out a strategy for population settlement of the Lower Hunter. Forecasts a population increase of 117,200 dwellings to 2031 (69,200 new release, 48,000 infill)	Plan committed the Govt. to a regional conservation plan, as done in 2007. The question of further biodiversity being lost as a result of development only has only been partly addressed	
1.7	2006	11	<i>Draft Illawarra Regional Strategy</i> (Department of Planning 2006b),	Lays out a strategy for population settlement of the Illawarra region. Forecasts a population increase of 42,000 dwellings to 2031 (25,900 new releases and 16,100 infill)	As above Govt completed regional conservation plan in 2007, but the question of further biodiversity loss only partly addressed	
<i>Natural resource planning</i>						
1.8	2007	0	<i>Sydney Metropolitan Region Catchment Action Plan</i> (NSW 2007)	A catchment action plan (CAP) for the Sydney metropolitan area	There are CAPs for each of the GMR sub-regions (Sydney Metro, Illawarra, Central Coast and Hunter as adopted in 2007	
<i>Sustainable urban planning</i>						
1.9	1995	0	<i>S Cities in the 21st. Century</i> (NSW 1995)	Strategy to guide urbanisation within the GMR	The document was not implemented in any major way that would have secured an ongoing program of ESD based GMR planning and development	
1.10	2001	6	<i>S Draft Plan First</i> (Planning NSW 2001)	A new approach to planning was outlined, including participation in regional plans	The document was not implemented, yet it had potential to secure an ongoing program of ESD based GMR planning	
1.11	2007	12	<i>NSW State of Environment</i> (NSW 2007)	Major report on the environmental, social and economic health of NSW	Provides an overview of the SOE of NSW. Many of the impacts noted do not have recommended actions	

In general few GMR urban planning documents contain aspects of sustainable urban planning. The Government adopted a separate GMR transport strategy entitled *Transport 2010 Plan* (Department of Transport 1995). Like the *Cities into the 21st Century* (NSW 1995) this plan contained few ESD references. *Shaping Our Cities* (Planning NSW 1999a) followed and laid a framework for the creation of separate ‘shaping plans’ for each of the four growth regions within the Greater Metropolitan Region (Sydney). *Shaping Our Cities* (Planning NSW 1999a) and subsequent regional shaping plans made reference to ESD but contained no overall ESD quantifiable applications. How GMR planning affects planning at the Central Coast regional level is examined next.

5.2.2 Central Coast Planning

The Central Coast planning, as with the GMR, can be summarised under the components of land use, natural resource and sustainable urban planning (Table 5.2). As with GMR urban planning documents few documents contain aspects of sustainable urban planning. How Central Coast planning affects the North Wyong study area is examined next under Wyong Shire planning.

5.2.3 Wyong Shire Planning

The challenge before Wyong Council has been to address environmental impacts as highlighted in past environmental studies and to meet new growth demands (Table 5.3). The growth centre of Warnervale is projected to add 40,000 people and the growth centre of Wadalba 5,000–7,000 people to 2021.² These centres, however, were scaled down in population growth under the *draft Central Coast Regional Strategy* (Department of Planning 2006a). This scaling down was prompted by the State because of a severe shortage of potable water.

North Wyong remains one of the fastest growing districts in Wyong Shire. Wyong Shire’s growth averaged 3.2 % over years 1973–2003, with an overall population percentage increase of over 300 % (Wyong Council 2003b). That population growth slowed down by 2006 (1 % for that year). During these 30 years, there have been many conflicts over development versus the environment (i.e. sewer outfall, heavy industry

² Warnervale and Wadalba development will be in accordance with: the Warnervale and Wadalba Development Control Plan (DCP) 49 (Wyong 1999); the Warnervale District Strategy (Wyong Council 2002b); and, the Wider Warnervale District Contributions Plan (Wyong Council 2004). The extent of development of Warnervale and Wadalba will also be dependent on the outcomes of reviews of the Wyong Shire Local Environment Plan 1991 Amendment 135 (incorporating ‘10a Investigation Precinct Zone’) (Wyong Council 2003a). The draft Central Coast Regional Strategy (Department of Planning 2006a) reduced the population projections for the broad acre release areas such as Warnervale/Wadalba by about one third (increase subject to water availability).

Table 5.2 Planning documents at the Central Coast region planning level

2. Central Coast Region Planning					
√=doc. relevant to study area	Date	Cumulative years from first doc.	Document	Purpose of document	Critique of document's contribution to ESD based urban planning
<i>Land use planning</i>					
2.1 □	1975	0	<i>Central Coast Structure Plan</i> (NSW 1975)	Guide to planning from 1975 to present (2007). This has been planned for a population of 400,000, including a new city of Wamervale	The plan was superseded by development decisions contrary to the Plan recommendations. For example within North Wyong the proposed new city of Wamervale did not go ahead. Tuggerah shopping centre became the new regional district centre
2.2 □	2003	28	<i>Central Coast Transport Action Plan</i> (Department of Transport 2003)	A 10 year transport works program and special transport improvements for the Central Coast	The transport plan does not contain any guidelines or strategies for planning transport on a sustainable basis
2.3 □	2006	31	<i>draft Central Coast Regional Strategy</i> (Department of Planning 2006a)	Provides a regional strategy to the year 2031, replacing the <i>Central Coast Structure Plan</i> (NSW 1975)	Forecasts a population increase of 36,000 dwellings to 2031 (7,900 new release, 21,100 renewal centres and 7,000 infill). The Strategy contains few references to sustainability measurements. The State is committed to a Regional Conservation Plan and a North Wyong Structure plan by the beginning of 2008
2.4 □	2012	37	<i>North Wyong Structure Plan</i> (Department of Planning and Infrastructure 2012)	The NWSP is a land use plan outlining the next phase of North Wyong release areas	The NWSP contains notes of the need for conservation (incl. wild life corridors) measures to be examined, however presents no prescriptions and no CC Conservation Plan adopted to date (though promised in 2006)
<i>Natural resource planning</i>					
2.5 □	2002	0	<i>Central Coast Regional Vegetation Study</i> (Central Coast Regional Vegetation Committee 2002)	This outlines the vegetation occurring on the Central Coast and the means of protecting	The study results need to be incorporated within the Central Coast Conservation Plan proposed for 2008

(continued)

Table 5.2 (continued)

2. Central Coast Region Planning		Document	Purpose of document	Critique of document's contribution to ESD based urban planning
√ = doc.				
relevant to study area				
Date	Cumulative years from first doc.			
2.6	0	<i>Integrated Catchment Management Plan for the Central Coast</i> (referred to as 'the Blueprint' Department of Infrastructure and Natural Resources (2002c))	This is a natural resource management strategy covering Wyong, Gosford and Lake Macquarie councils	Plan now absorbed within the <i>Hunter-Central Rivers Catchment Action Plan</i> noted below (HCRCMA 2007)
□				
2.7	1	<i>Cool Climate Report</i> (Gosford City Council 2003)	This contains climate change actions and greenhouse reduction programs	Report needs to be incorporated within an overall Central Coast climate change report
□				
2.8	1	<i>Water Sensitive Design Guidelines</i> (LHCCREMS 2003)	Contains guidelines for integrating water systems into developments	Water sensitive designs are gaining the attention of the authorities and private industry
□				
2.9	5	<i>Hunter-Central Rivers Catchment Action Plan</i> (HCRCMA 2007)	Plan contains a natural resource management strategy covering the Hunter Valley and Central Coast	The plan introduces a methodology of assessing needs and programs for the regions under a catchment management approach
□				
<i>Sustainable urban planning</i>				
2.10	0	<i>Shaping the Central Coast</i> (Planning NSW 1999c)	Urbanisation forecasts over 20 years and management principles to guide development, including references to sustainability guidelines	A broad plan containing population forecasts and social, economic and infrastructure needs. Not adopted by Gosford/Wyong councils or the State
□				
2.11	4	<i>Shaping the Central Coast Action Plan</i> (Planning NSW 2003)	Plan introduced the actions that would be required to implement the earlier <i>Shaping the Central Coast</i> (Planning NSW 1999c)	This plan was not adopted by either Gosford or Wyong Councils, or the State
□				
2.12	8	<i>Water Plan 2050</i> (Gosford and Wyong Councils Joint Water Authority 2007)	Plan adopted for water provision to 2050	The plan partly addresses sustainable water approaches
□				

Table 5.3 Planning documents at the Wyong Shire planning level

3. Wyong Shire planning			
√ = doc. relevant to study area	Date	Cumulative years from first doc.	Document
			Purpose of document
<i>Land use planning</i>			
3.1	1990	0	<i>Wyong Shire LEP 1990</i> (Wyong Council 1990)
□			Guidelines for permissible and prohibited land uses
3.2	1999	9	<i>Warnervale East and Wadalba North-West Development Control Plan 49 1999</i> (amended 2005) (Wyong 1999)
□			Design parameters for the first stage of Warnervale and Wadalba District
3.3	2002	12	<i>Wyong Shire Residential Development Strategy</i> (Wyong Council 2002c)
□			Density guidelines to achieve higher intensity land uses
3.4	2002	12	<i>Warnervale District Strategy</i> (Wyong Council 2002b)
□			Concepts of layout and development of the Warnervale District
3.5	2003	13	<i>Wyong Shire LEP Amendment 135</i> (Wyong Council 2003a)
□			Investigation precinct zone introduced covering the majority of North Wyong's undeveloped lands
<i>Natural resource planning</i>			
3.6	2003	13	<i>Draft Wyong Shire Conservation Strategy</i> (Wyong Council 2003b)
□			Analysis of and policies for conservation of lands in Wyong Shire
3.7	2006	16	<i>Tuggerah Lakes Estuary Management Plan</i> (Wyong Council 2006)
□			Analysis of the health of Tuggerah Lakes and programs to improve

Critique of document's contribution to ESD based urban planning

Predominantly a zoning plan, not a shirewide strategic plan. State requires updating within 3 years from 2008

Needs updating to match new population projections and ESD design controls

Higher densities are spread over a large section of the green fields and renewal areas

A new strategy is required for the whole of the release area, beyond the district centre

All of the release area needs updating of this LEP's zonings

The strategy needs to be revisited in light of the proposed Central Coast Conservation Plan proposed for 2008

A rate tax per house was instituted to raise about \$2 m. to undertake estuary improvement programs

(continued)

Table 5.3 (continued)

3. Wyong Shire planning					
√ = doc. relevant to study area	Date	Cumulative years from first doc.	Document	Purpose of document	Critique of document's contribution to ESD based urban planning
<i>Sustainable urban planning</i>					
3.8	2002	12	<i>Wyong Shire Quality Housing DCP 100</i> (Wyong Council 2002a)	Details on the development of new housing to meet better energy and design parameters	The DCP has resulted in energy and water savings and improved living comfort levels
3.9	2007	17	<i>Wyong State of Environment Report</i> (Wyong Council 2007a)	Details on the environmental, social and economic health of Wyong shire and projected impact of continued urbanisation	The SoE reports for Wyong since the completion of the first report (1995/1996) indicate a movement down of all environmental indicators (except air pollution and waste in 05/06). The SoE reports state that finances to reverse the downward movement of the indicators need to be allocated from all levels of government
3.10	2007	17	<i>Wyong Shire Management Plan 2007/08</i> (Wyong Council 2007c)	Provides goals and financial estimates for managing the shire	The allocation of funds has been mostly on infrastructure, social needs and economic development. The environment budget has not been big enough to tackle the SoE downward indicators
3.11	2007	17	<i>Bio-banking Report</i> (Wyong Council 2007c)	Provides guidelines to Council for establishing a bio-bank reserve scheme	The report was the first step in Council's adopting a bio-bank reserve program

zoning, threatened species and airport expansion proposals). With the potential benefits of ESD based urban planning (Chap. 2), conflicts of this scale could potentially be diminished in the future.

Wyong Shire has seen nearly 105,000 people settle in the area from 1975 when the population was 35,000 (NSW 1975). The leverage on population growth is partly controlled under the *Urban Release Program* (Department of Planning 2007). This program guides the release of land for urbanisation, such as within North Wyong. Wyong Shire urban planning policies fall within the categories of ‘land use planning’ and ‘natural resource planning’. The challenge facing Wyong Council and the State is how to adopt a sustainable urban planning approach.

There are a number of land use, natural resource and sustainable urban planning documents central to Wyong Shire development. Under land use planning, the *Wyong Shire LEP 1990* (Wyong Council 1990) is predominantly a zoning and statutory procedures plan and not a strategy plan. Council in early 2008 were however engaged in developing a shire wide strategic plan within a Shire Vision Plan. Examining current planning, there are a variety of land use plans that link back to the *Wyong Shire LEP 1990* (Wyong Council 1990). One plan is the *Warnervale East and Wadalba North-West Development Control Plan 49 1999* (amended 2005) (Wyong 1999). This plan needs updating to accommodate new ESD design controls. Another plan is the *Wyong Shire Residential Development Strategy* (Wyong Council 2002c). This strategy sets out density guidelines to achieve higher intensity land uses (often reflecting principles of new urbanism as outlined in Chap. 2). Consequently, Council encourages the populating of older suburbs within the Shire and higher densities in the release areas such as Warnervale and Wadalba.

Council has also adopted several planning controls and strategies, including the *Wyong Shire Quality Housing DCP 100* (Wyong Council 2002a). This document contains a number of ESD principles in the water, energy and comfort areas. Another relevant plan is the *Warnervale District Strategy* (Wyong Council 2002b). Finally, the *Wyong Shire LEP Amendment 135* (Wyong Council 2003a) prescribes an ‘investigation precinct zone’ covering a majority of the Wyong District’s undeveloped lands. Amendment 135 thus provides Wyong Council with a strategic opportunity to introduce ESD criteria within this new zone, however to date (2008) this had not occurred.

There are key natural resources planning documents that guide planning in North Wyong. In 2002 Council released the *draft Wyong Shire Conservation Strategy* (Wyong Council 2003c), though subsequently it was never adopted or implemented. There are many components of the conservation strategy based on ESD criteria. The main components of the conservation strategy include: future direction for the protection and maintenance of biodiversity within Wyong Shire; environmental management policy areas (based on ESD conservation methodology); policy directions on biodiversity and threatened species; conservation principles for protection of landscapes, flora and fauna, ecological processes, plant communities and wildlife movements; and regional biodiversity targets of set minimum percentages of local vegetation extends across the Shire. Finally, the *Tuggerah Lakes Estuary Management Plan* (Wyong Council 2006) provides the authorities with a scientific

based document to gauge changes of quality of Tuggerah Lakes and foreshores. This plan notes the importance of an ESD approach thus holding prospects that ESD criteria may be applied.

Having reviewed land use and natural resource planning, the focus now turns to sustainable urban planning. There are two planning documents at the Wyong Shire level that can be singled out as containing aspects of sustainable urban planning. Firstly, State of Environment (SoE) reporting (started in Wyong Shire in 1993) moves in the direction of sustainability planning. The *Wyong Shire State of Environment Report* (Wyong Council 2007a) contains detail on the environmental health of Wyong Shire and the projected impact of continued urbanisation (i.e. impacts of land, water, air and bio-diversity). The Wyong Shire SoE report states the importance of Council expanding the incorporation of ESD principles into its urbanisation decision making, however there only a few instances within Wyong SoE reporting where this is laid out. Finally, Council is required under the State to link its SoE report to the annual Wyong Shire Management Plan. The *Wyong Shire Management Plan 2007/2008* (Wyong Council 2007b), provides goals and financial estimates for managing the Shire, including some (though limited) programs where ESD criteria are introduced.

5.3 Chapter Summary

This chapter reviewed how a study area can be more closely examined, both in physical and planning levels. Selecting the North Wyong District as an illustrated study area, the authors reviewed the area's land uses and urban planning. A smaller area, West Tuggerah Lakes-Wadalba (within North Wyong District) has been nominated by the authors for application of the SCF. The main conclusion reached in examining the urban planning documents at regional and local government levels was that few documents contained aspects of sustainable urban planning. The next chapter shows how the SCF can be applied to the natural environment of the study area (using West Tuggerah Lakes-Wadalba as a case study).

References

- Central Coast Regional Vegetation Committee (2002) Central Coast regional vegetation study. Gosford Council, Gosford
- Department of Infrastructure, Planning and Natural Resources (2002c) New Planning System, DIPNR Web Site. Department of Infrastructure, Planning and Natural Resources, Sydney
- Department of Infrastructure, Planning and Natural Resources (2003) Plan first review. Department of Infrastructure, Planning and Natural Resources, Sydney
- Department of Planning (2005) City of cities metropolitan strategy. Department of Planning, Sydney
- Department of Planning (2006a) Draft Central Coast regional strategy. Department of Planning, Sydney
- Department of Planning (2006b) Illawarra regional strategy. Department of Planning, Sydney

- Department of Planning (2006c) Lower hunter regional strategy. Department of Planning, Sydney
- Department of Planning (2007) Urban release program 2007. Department of Planning, Sydney
- Department of Planning and Infrastructure (2012) North Wyong structure plan. NSW Department of Planning and Infrastructure, Sydney
- Department of Transport (1995) Transport 2010. Department of Transport, Sydney
- Department of Transport (2003) Central Coast transport action plan. Department of Transport, Sydney
- Gosford and Wyong Councils Joint Water Authority (2007) Water plan 2050. Gosford and Wyong Councils Joint Water Authority, Gosford
- Gosford City Council (2003) Cool climate report. Gosford City Council, Gosford
- Hunter Central Rivers Catchment Management Authority (HCRCMA) (2007) Hunter-Central rivers catchment action plan (HRCAP). NSW Government, Sydney
- Lower Hunter and Central Coast Regional Environmental Management Strategy (LHCCREMS) (2003) Water sensitive design. LHCCREMS, Newcastle
- NSW (1975) Central Coast structure plan. NSW, Sydney
- NSW (1995) Cities into the 21st century. NSW, Sydney
- NSW (2007) Sydney metropolitan region catchment action plan. NSW, Sydney
- Planning NSW (1999a) Shaping our cities. Planning NSW, Sydney
- Planning NSW (1999b) Shaping of Western Sydney. Planning NSW, Sydney
- Planning NSW (1999c) Shaping of the Central Coast. Planning NSW, Sydney
- Planning NSW (2001) Plan first. Planning NSW, Sydney
- Planning NSW (2002) Draft integrated land use and transport (State environmental planning policy) (SEPP 66). Planning NSW, Sydney
- Planning NSW (2003) Shaping of the Central Coast action plan draft. Planning NSW, Sydney
- Wyong Council (1999, amended 2005) Warnervale East and Wadalba North-West Development Control Plan 49. Wyong Council, Wyong
- Wyong Council (1990) Wyong Shire LEP 1990. Wyong Council, Wyong
- Wyong Council (2002a) Quality housing DCP 100. Wyong Council, Wyong
- Wyong Council (2002b) Warnervale district strategy. Wyong Council, Wyong
- Wyong Council (2002c) Wyong Shire residential development strategy. Wyong Council, Wyong
- Wyong Council (2003a) Wyong Shire LEP Amendment 135. Wyong Council, Wyong
- Wyong Council (2003b) Report to council on population task force. Wyong Council, Wyong
- Wyong Council (2003c) Wyong conservation strategy (Draft). Wyong Council, Wyong
- Wyong Council (2004) Wider Warnervale district contributions plan. Wyong Council, Wyong
- Wyong Council (2006) Tuggerah lakes estuary plan. Wyong Council, Wyong
- Wyong Council (2007a) Wyong Shire State of the Environment Report 2006/07 (earlier reports 2002/03, 2003/04, 2004/05, 2005/06). Wyong Council, Wyong
- Wyong Council (2007b) Wyong Shire management plan (WSMP), 2007/2008. Wyong Council, Wyong
- Wyong Council (2007c) Bio-banking report. Wyong Council, Wyong

Chapter 6

Applying the SCF to the Natural Environment

6.1 Step 1: Review ESD Related Documents

The first part of Sustainable Communities Framework (SCF) Step 1 involves reviewing ESD related documents relevant to the study area of West Tuggerah Lakes-Wadalba (south). ESD related documents, at the international, Commonwealth and NSW State were critiqued in Chap. 2. ESD related documents, for the Greater Metropolitan Region, Central Coast and Wyong Shire were critiqued in Chap. 5, in examining the background of the study area..

6.2 Step 2: Selecting Indicators of Sustainability

The task of selecting indicators of sustainability for the West Tuggerah Lakes-Wadalba (south) study area was outlined in Chap. 4. The data sources were reviewed in that chapter and a sample list of indicators composed (Table 4.1).

6.3 Step 3: Area Survey

The area survey of the West Tuggerah Lake-Wadalba (south) study area provides an on-the-ground identification of local environments. Focusing on the aquatic and terrestrial components is considered appropriate as an illustration of the SCF application. Local environments (LE1–LE16) (Plates 5.1 and 5.2) can be identified through completing a number of tasks. The exact boundaries of each local environment would be identified more precisely in any full application of the SCF. The SCF survey step included a number of tasks to gain qualitative results:

1. A review of each of the LE's environments can be conducted using the data sources (Plates 4.1, 4.2 and 4.3) (Chap. 4). The review needs to include a qualitative

assessment of most of the major environment components (as contained in these plates) as well as earlier referenced literature (Chap. 2).

2. The major environmental habitats can be examined by viewing aerial photos. This allows a qualitative assessment from the air.
3. Environmental assessments include for example local government SoE reports and other relevant planning documents. These type of documents for an area such as Wyong Shire are laid out in Tables 5.1, 5.2 and 5.3. These documents can be further interpreted against visual field observations.
4. Field inspections should include photographing all local environments. Follow-up visits for each LE after assessing the photos is often required.
5. Historical data can be used to give a benchmark of environmental conditions over years stretching back perhaps to the 1950s. Sources here would include for example: the local historical society or museum; local library; any progress or community association with environmental interests; and, written local histories on the study area.

The preliminary field survey needs to cover Local Areas in North Wyong vicinity. The bulk of the preliminary survey is likely to be around selected Local Areas (in this example for instance West Tuggerah Lakes (south) and Wadalba) (Chap. 4).

A DVD could be completed to provide a historical statement of the study area's environment for benchmarking in follow-up surveys. Such a record is also useful in completing the Sustainability Score Card (Step 4). In a similar vein, the record is useful for any monitoring of sites under SAP Step 5 (Sustainability Report).

The land features of the study area are varied (Plate 6.1). They include lake foreshores; shallow lake and deposited sands; general flatness of topography; vegetation to the west; wetland areas; and, rivers and creeks flowing west–east into Tuggerah Lake. The topography of the area consists of built up areas along the lake on the east; woodlands in the centre; wetlands in the south; and, Wyong River flowing east–west. The area reflects early 1900s subdivisions. The land elevations climax in two peaks of Wadalba Hill in the centre-upper and Davies Hill in the centre-left. The aquatic vegetation of the area is extensive and concentrated in the south and south-east. These aquatic areas consist of wetlands fed by flood plains draining into Wyong River and Tuggerah Lake.

The terrestrial areas of West Tuggerah Lake-Wadalba (south) have been altered significantly by development as illustrated over several years (WC 2007). The vegetation is concentrated in the centre and west. The ecological communities of the area are scattered and thus many gap habitats exist. These communities are more diverse in the vicinity of Wyong River where they meet Tuggerah Lake. The built up areas on the east have retained few ecological communities. There are proposed conservation areas of West Tuggerah Lake-Wadalba (south) as proposed under the draft Wyong Conservation Strategy (Wyong Council 2003). These suggested conservation areas generally coincide with the ecological communities identified above. This includes a band of wetlands and flood plains in the south feeding into Wyong River and Tuggerah Lake and north feeding into Porters Creek.



Source: New South Wales Land Information Centre, Bathurst.

Plate 6.1 West Tuggerah Lakes-Wadalba (south) Aerial Photo of Core Local Environments 1994

The ‘land components’ of the natural environment (while not included in the SCF test for the case study area) were also observed. Any full application of the SCF would be examining all four natural environment components (aquatic, terrestrial, land and environmental water). Observed under *land* for example are bush fire zones that reveal the continuing threat of bush fires (regenerating areas in several of the LEs). Established areas in the north-east (top right on map) were generally free of bush fire hazards. Another sensitive environment component that was observed, for example, was acid sulphate deposits at Big Bay, Tuggerawong (LE5). Finally, impacts of past flooding in the vicinity of wetlands and foreshores were observed (mostly around the eastern part of the study area).

A sample photo is provided to illustrate each local environment (Plates 6.2, 6.3 and 6.4). Multiple photographs would need to be taken over the 16 local environments to allow close qualitative evaluation of the natural environment components. In this case study most of the local environments contain all the natural environment components (aquatic, terrestrial, land and environmental water). These will now be examined in detail starting with LE1–LE6 (Plate 6.2) (see location of LEs shown in Plate 6.5 and geography in Plate 6.1).

Photo of local environment LE1 (Tacoma Central Wetlands) shows part of the wetland zone. This environment covers nearly half of Tacoma and has restricted development to the edge of the Wyong River. The wetlands are privately owned and covered under Wyong Council and State government conservation and protection measures.



LE1. Local Environment: Tacoma Central Wetlands, Tacoma
Source: Rauscher R (2006)



LE2. Local Environment: Tacoma Eastern Wetlands, Tacoma
Source: Rauscher R (2005)



LE3. Local Environment: Tacoma Peninsula, Tacoma
Source: Rauscher R (2004)



LE4. Local Environment: Rocky Point Foreshores
Source: Rauscher R (2004)



LE5. Local Environment: Big Bay, Tuggerawong
Source: Rauscher R (2004)



LE6. Local Environment: Tuggerawong Wetlands
Source: Rauscher R (2004)

Plate 6.2 West Tuggerah Lakes-Wadalba (south) Photos of Local Environments L1–L6

LE2 (Tacoma Eastern Wetlands) shows the eastern section of a wetlands zone. This environment as with LE1 covers more than half this section of Tacoma and is protected. Both this local environment and that of LE1 are subject to flooding.



LE7. Local Environment: Prawn Beach, Wyongah
Source: Rauscher R (2004)



LE8. Local Environment: Craigie Park and Foreshores, Kanwal
Source: Rauscher R (2006)



LE9. Local Environment: Marks Rd Foreshores, Gorokan
Source: Rauscher R (2006)



LE10. Local Environment: Johns Rd Rural Precinct, Wyongah
Source: Adderley, Peter (2006)



LE11. Local Environment: Louisiana Rd Rural Precinct, Kanwal
Source: Rauscher R (2006)



LE12. Local Environment: Hilltop Conservation Area, Wadalba
Source: Rauscher R (2006)

Plate 6.3 West Tuggerah Lakes-Wadalba (south) Photos of Local Environments L7–L12

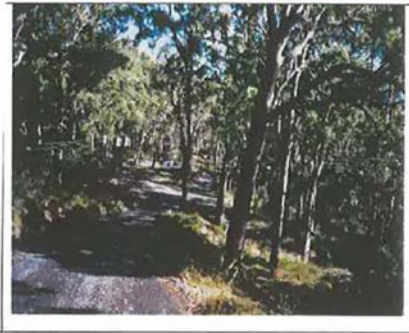
Photo of local environment LE3 (Tacoma Peninsula) shows shallow bays and salt marshes on the eastern end of the peninsula. This is a fragile environment that has escaped major impact as it is located at the tip of the peninsula and is within the Don Small Reserve. This environment attracts considerable marine and bird species.



LE13. Local Environment: Wadalba Drainage Corridor
Source: Rauscher R (2006)



LE14. Local Environment: Figtree West
Source: Rauscher R (2006)



LE15. Local Environment: Wadalba Hill South
Source: Rauscher R (2006)



LE16. Local Environment: Wadalba Hill North
Source: Rauscher R (2006)

Plate 6.4 West Tuggerah Lakes-Wadalba (south) Photos of Local Environments L13–L16

Photo of local environment LE4 (Rocky Point) on Tuggerah Lake shows one of the bays where significant stands of salt marsh and native vegetation have survived urban development. The limitation of development caused by wetlands to the east has helped protect this local environment from more severe impact.

Photo LE5 (Big Bay) at Tuggerawong shows the impact of nutrient runoff and contains potential acid sulphates soils. This survey was completed during the draught (2004), hence illustrating the sediment that is often below water mark. The build up of wrack (dead sea weed) is a significant occurrence in this local environment.

Photo of local environment LE6 (Tuggerawong Wetlands) shows a portion of the extensive Tuggerawong wetlands north and south of Warner Rd and extending to Jensen Rd. These wetlands form the northern portion of the wetlands at Tacoma central and Tacoma eastern. The Tuggerawong Wetlands, as illustrated, contain a significant vegetation community.

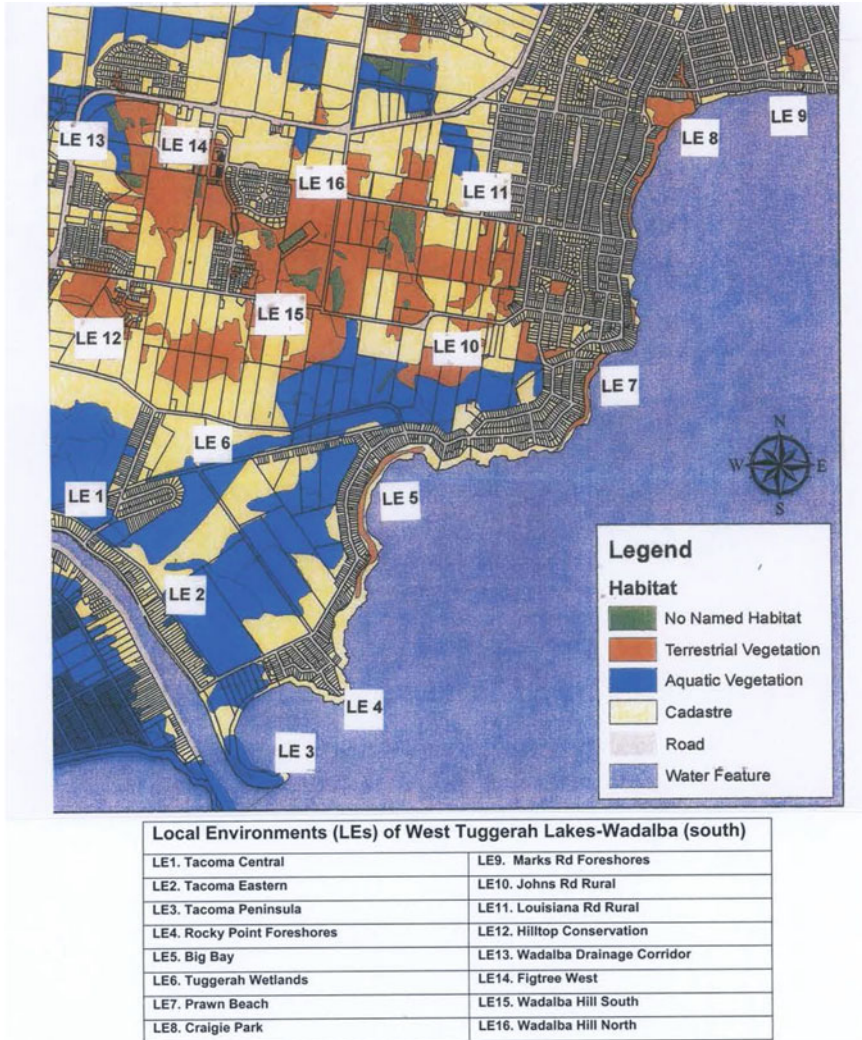


Plate 6.5 West Tuggerah Lakes-Wadalba (south) Major Portion of Habitat and Local Environments

Continuing north along the edge of Tuggerah Lakes, photo of local environment LE7 (Prawn Beach), Wyongah on Tuggerah Lake, shows the high impacts from urbanisation. The extent of this impact was determined with the assistance of historic photos from 1960s and from Wyong Council SoE reports in the early 1990s. Prawn Beach visually exhibits, for example: high nutrient run off; pollutants; and, weed proliferation.

The photo of local environment LE8 (Craigie Park), at Kanwal, shows there is severe erosion within the ravine (carrying storm water runoff into Tuggerah Lakes). This local environment provides drainage of a large portion of the Kanwal suburb.

Photo of local environment LE9 (Marks Rd Foreshore) at Gorokan South shows foreshores heavily impacted by nutrient runoffs and erosion. This photo was taken in the draught of 2006 and reflects the extent of sediment build up normally below water surface and thus not visible to the observer. This local environment of Marks Rd Foreshore stretches for over a km east towards the Toukley Bridge.

Photo of local environment LE10 (Johns Rd) at Wyongah shows part of the Wadalba Wildlife Corridor (centre running east–west) and rural properties both north and south of the corridor. This local area is high in terrestrial biodiversity with a lesser impact from development than foreshore local environments viewed above. Surface water from this area feeds into the Tuggerawong and Tacoma wetlands discussed above. It is also an environment that is under pressure from residential estate development under the Warnervale/Wadalba land release program noted earlier (Chap. 5).

Photo of local environment LE11 (Louisiana Rd) at Kanwal shows rural properties forming part of a biodiversity system of the Wadalba Wildlife Corridor (running east–west or lower to top in photo) as well as north–south (right to left in photo). The local environment, as in LE10, contains significant biodiversity. The ground water of this area feeds into both the wetlands to the south and Porters Creek wetlands system to the north and west. The development in this area is generally following the Pacific H'way (right on photo).

Continuing to examine the remainder of the local environments in West Tuggerah Lake-Wadalba, photo of local environment LE12 (Hilltop) at Wadalba shows part of the Davies Hill conservation area. This local environment shows biodiversity disturbance from earlier European settlement. On the other hand it is the only declared terrestrial conservation area to date in addition to the wildlife corridor noted above.

Photo of local environment LE13 (Wadalba Corridor) shows the low lying drainage area of the corridor that flows into the Porters Creek wetlands. This environment is adjacent to the declared corridor. The area is scheduled to be developed under a current (2008) subdivision approved development application.

Photo of local environment LE14 (Figtree West) at Wadalba shows a significant vegetated area. This area has a recently declared (2004) extension of the Wadalba Corridor as a result of a discovery that it provided nesting areas for the Powerful Owl. Other than these 2 ha the remainder of this local environment is also subject to a current (2008) approved subdivision development application.

Photo of local environment LE15 (Wadalba Hill South) shows a significant bushland area that rises to Wadalba Hill. This local environment feeds into two small creeks, east and west. This local environment contains a high biodiversity and verified Aboriginal sites. This local environment is currently subject to Wyong Council's consideration of a 99 lot residential subdivision proposal.

Photo of local environment LE16 (Wadalba Hill North) shows significant native vegetation on Wadalba Hill. This local environment at its western end is currently subject to Wyong Council's consideration of a 27 lot residential subdivision proposal.

The survey results (Step 3) are now examined more closely (Table 6.1).

Under column 1 are the selected natural environment component elements (aquatic and terrestrial). These elements are samples as reviewed in Chap. 5 and summarised in Table 4.1. In the top row the tick (✓) indicates from the survey

(as a qualitative conclusion for the survey tasks summarised above) that the element is likely threatened or impacted. In the application of the SCF details of the criteria used to designate elements as being ‘threatened’ or ‘impacted’ would be spelled out. This tick notation targets each of these elements to be further examined under a quantitative application of indicators of sustainability (Step 4 of the SCF) (Chap. 7). For ease of reading the table, blank boxes signify the element is sustainable (no threats or impacts). In some instances an element is not present in a local environment, in which case this is indicated (by an ‘N’ for not applicable).

Examining the results of the survey, under the aquatic component, it was considered on a qualitative basis that about one third of aquatic elements were threatened or impacted. Two elements in particular (‘aquatic plant life’ and ‘weeds-aquatic’) were observed as threatened or impacted in nearly all local environments. In addition there were many instances of nutrient runoff impacts in nearly half the local environments.

Under the terrestrial survey it was observed that over half the terrestrial elements were observed as threatened or impacted across most of the LEs. The impacts included: bushland character weakening; wildlife corridors reduced in size and habitat health; edge habitat diminished; and, native vegetation reduction.

A number hints in completing a survey (in this case the local area of West Tuggerah Lakes-Wadalba (south)). Firstly, the identification of the relevant local environments to include in the survey can take considerable time, including time involved in: field visits for observation and assessment; interpreting maps and data sources for background information; reviewing older photographs; and, reading background studies. It is important to include all the major local environments to gain a cross section for analysis and an adequate number for sampling validity.

A full application of the SCF would result in identifying more precisely the local environments. In addition, it’s acknowledged that most local environments form part of a larger environmental system (i.e. wetlands, an estuary or bush corridors). An option to consider is grouping the local environments into ‘precincts’ within the local area. Caution suggests grouping could complicate the SCF surveys needing to be completed over the study area. Finally, it is worth noting that a full SCF application would expand the survey observations and apply greater quantification of measurements

6.4 Steps 4 and 5: Complete Sustainability Score Cards and Sustainability Reports

Having identified the likely threatened or impacted natural environment elements in each local environment (LE1–LE16) of West Tuggerah Lakes-Wadalba (south), the next step is to apply indicators of sustainability to the environmental components (aquatic, terrestrial, land and environmental water). Building on the completed SCF survey and using the selection of indicators of sustainability (Table 4.1 p69), the

Table 6.2 Step 4.1—West Tuggerah Lakes—Wadalba (south) Sustainability Score Card for Aquatic Component

A. Aquatic	Sustainability Ratings from Indicators of Sustainability Application															Overall Ratings of Elements			
Component Elements	G (Green) = Sustainable A (Amber) = Threatened R (Red) = Impacted N = Element not applicable to subject local environment															G	A	R	
	Local Environments (LEs)																		
Note: Refer to Table 4.1 (Indicators of Sustainability Checklist)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	G	A	R
A1. Aquatic plant life	A	R	A	A	R	N	A	A	A	A	A	A	A	A	A	A	1	3	2
A2. Marine life health	A	A	N	N	N	N	N	N	N	N	N	N	N	N	N	N			2
A3. Nutrients	A	R	R	R	R	A	R	N	N	N	N	G	G	G	G	G	5	2	5
A4. Water quality	A	N	N	N	N	N	N	G	G	G	G	G	G	G	G	G	9	1	
A5. Water replenishment	A	A	N	A	N	N	N	N	G	G	G	G	G	G	G	G	8	3	
A6. Weeds (aquatic)	A	A	A	A	A	N	A	A	N	A	A	A	A	A	A	A	0	1	4
Overall Ratings within Local Environments	G								1	2	2	2	3	3	3	3	3	2	
	A	6	3	2	3	1	1	2	2	1	2	2	2	2	2	2	2	3	5
	R		2	1	1	2		1											7

sustainability score cards can be completed. These score cards would normally be completed for all components, however as noted earlier the aquatic and terrestrial components are selected as samples in this research. The first score card is for the aquatic environment (Table 6.2). The table uses the sustainability ratings (green, amber and red) as outlined in Chap. 3.

It is expected that quantification of some variables (like salinity and acid sulphates) could create complications for the score card system. These variables would need to be assessed through industry standards (i.e. number of soil samples required). An area to be classified as impacted would be dependent on those standards specifying levels of impact. It is important in applying the SCF to avoid quantification results that lead to a disconnection between sustainability reporting and implementation by authorities. Tagging elements that need further quantification in the SCF application is a means to avoiding these disconnections.

The table highlights a number of factors for the aquatic component and its elements. The ratings are based on: the results of Steps 1–3; referral to sustainability ratings (Fig. 3.1); and, assessing sustainability indicators on a qualitative basis (Table 4.1) (noting that full quantification would be required in a full SCF application). The threatened rating (amber) (as noted earlier) is based on at least one indicator of sustainability for an environment element being observed (qualitative in this research)

Table 6.3 Step 5.1—West Tuggerah Lakes—Wadalba (south) Sustainability Report for Aquatic Component

Aquatic Component	Overall Sustainability Rating			Comment on Rating	Actions To address threatened and impacted elements. References: 1. Tables 2.1-2.4 (ESD related documents) 2. Tables 5.1-5.3 (planning related documents).	Date Started	Current Date	Responsible Authority	Status of Action
	G (Green) = Sustainable	A (Amber) = Threatened	R (Red) = Impacted						
A. Elements	G	A	R						
A1. Aquatic plant life		13	2	Aquatic plant life is generally threatened and partly impacted.					
A2. Marine life health		2		Marine life is threatened in two local environments.					
A3. Nutrients	5	2	5	Nutrient runoff is a threat and impacts directly on a third of the local environments.					
A4. Water quality	9	1		Water quality is a threat in one local environment.					
A5. Water replenishment	8	3		Water replenishment is mostly sustainable, though under threat in three local environments.					
A6. Weeds (aquatic)	0	14		Weeds (aquatic) are a threat in all local environments.					
A1-A6 Aquatic Overall Rating	22	35	7	The aquatic environment overall is threatened and is impacted upon in several local environments.					

as likely not meeting indicator standards. Likewise the impacted rating (red) is based on an environment element being observed where two or more indicators (qualitative) are likely not meeting indicator standards.

The table lays out the natural environment elements within each local environment under the ratings of: sustainable (green); threatened (amber); and, impacted (red). The two most 'threatened' (amber) elements on a qualitative basis, for example, are aquatic plant life (13 instances of threats) and weeds (aquatic) (14 instances of threats).

Examining overall ratings within the local environments, there is a high number (35 instances) of threatened elements. This represents a significant overall threat to the aquatic natural environment for the local area. At the same time, the impacted elements (red) (7 instances) raise a second concern. It's noted that there are more instances of elements under threat (amber) and impact (red) than elements that are sustainable (22) (green). Finally, it's noted that the local environment with the highest instances of threats (6) is LE1. The next step (Step 5) is to complete a sustainability report for the aquatic natural environment (Table 6.3).

This table highlights a number of factors. The overall sustainability rating (taken from the scorecard of Table 6.2) is laid out in column 2. Within column 3 comments on the sustainability ratings can be completed. These comments can provide a quick overview of the sustainability of any element.

It is in Column 4 that actions to address threatened and impacted elements can be detailed. It is noted here that the SCF references can be referred to in formulating actions (Tables 2.1, 2.2, 2.3, 2.4, 5.1, 5.2 and 5.3). The table enables (end four columns) a recording of actions for each element under: date started; current date; responsible authority; and, status of action.

The sustainability report can also be completed for each of the local environments (LE1–LE16) (Table 6.4). This allows actions to be targeted to any of the local environments and to present a comparison among the local environments. The table enables the aquatic sustainability ratings to be summarised (column 2) with accompanying comments (column 3). Actions (column 4) can be noted in addressing threatened and impacted local environments. As in the previous table, references completed for the SCF (Tables 2.1, 2.2, 2.3, 2.4, 5.1, 5.2 and 5.3) are referred to. Finally, the notation of implementation of actions can be completed (end four columns).

Having applied the framework to the aquatic environment (Table 6.2), a scorecard can be completed for the second natural environment component, terrestrial biodiversity. The results of applying the indicators of sustainability to this component (Step 4) are also recorded within a sustainability score card (Table 6.5). This scorecard utilises the results of the SCF Step 3 survey (Table 6.1). As noted, a rating of amber (threatened) is a qualitative assessment when one indicator of sustainability is not met. Likewise an environment element is red (impacted) when two or more indicators are not met.

The table highlights a number of factors for the terrestrial component and its elements. The elements most ‘threatened’ (amber) and impacted (red) (reference to the survey) are: bushland character; corridors; edge habitat; endangered species; gap habitat; and, native vegetation.

Examining overall ratings within the local environments, there is a high number (76 instances) of threatened elements. This represents a significant overall threat to the terrestrial environment of the local area. At the same time, the impacted elements (15 instances) raise a second concern. It’s noted that there are significantly more instances of elements under threat and impact than elements sustainable (14) (green). Finally, it is noted that all local environments (LE1–LE16) show a proportion of threats (amber). Nearly half the local environments also register a significant number of impacts (bottom line). The next step (Step 5) is to complete a sustainability report for the terrestrial environment (Step 5) (Table 6.6), based on Table 7.4 results.

This table highlights a number of factors. The overall sustainability rating (taken from the scorecard of Tables 6.5, 6.6 and 6.7) is laid out in column 2 (as was completed for the aquatic component) and comments in column 3. It is in column 4 that actions to address threatened and impacted terrestrial elements are laid out (note again the SCF references Tables 2.1, 2.2, 2.3, 2.4, 5.1, 5.2 and 5.3). The table enables (last four columns) a recording of actions for each terrestrial element under: date started; current date; responsible authority; and, status of action. The terrestrial sustainability report (Table 6.7) can also be laid out (based on the information in Table 6.5) by the sixteen (16) local environments (as was done for the aquatic component).

Table 6.4 Step 5.2—West Tuggerah Lakes—Wadalba (south) Sustainability Score Card for Aquatic Component by Local Environments

Local Environments	Aquatic Sustainability Rating			Comment on Rating	Actions To address threatened and impacted elements. References: 1. Tables 2.1-2.4 (ESD related documents) 2. Tables 5.1-5.3 (planning related documents).	Date Started	Current Date	Responsible Authority	Status of Action
	G (Green) = Sustainable	A (Amber) = Threatened	R (Red) = Impacted						
	G	A	R						
LE1. Tacoma Central		6		Aquatic environment is threatened.					
LE2. Tacoma Eastern		3	2	Aquatic environment is threatened and impacted upon.					
LE3. Tacoma Peninsula		2	1	Aquatic environment is partly threatened or impacted upon.					
LE4. Rocky Point Foreshores		3	1	Aquatic environment is partly threatened or impacted upon.					
LE5. Big Bay		1	2	Aquatic environment is partly impacted upon.					
LE6. Tuggerawang Wetlands		1		Wetlands are mostly sustainable.					
LE7. Prawn Beach		2	1	Aquatic environment is partly threatened or impacted upon.					
LE8. Craigie Park	1	2		Aquatic environment is partly threatened.					
LE9. Marks Rd Foreshores	2	1		There is one instance of the aquatic environment under threat.					
LE10. Johns Rd Rural	2	2		There are two instances of the aquatic environment under threat.					
LE11. Louisiana Rd Rural	2	2		There are two instances of the aquatic environment under threat.					
LE12. Hilltop Conservation	3	2		There are two instances of the aquatic environment under threat.					
LE13. Wadalba Drainage Corridor	3	2		There are two instances of the aquatic environment under threat.					
LE14. Figtree West	3	2		There are two instances of the aquatic environment under threat.					
LE15. Wadalba Hill South	3	2		There are two instances of the aquatic environment under threat.					
LE16. Wadalba Hill North	3	2		There are two instances of the aquatic environment under threat.					
LE1-LE16 Aquatic Overall Rating	22	35	7	West Tuggerah Lakes-Wadalba (south)'s aquatic environment is mostly threatened or impacted upon.					

Table 6.5 Step 4.2—West Tuggerah Lakes—Wadalba (south) Sustainability Score Card for Terrestrial Component by Local Environments

B. Terrestrial Component	Sustainability Ratings from Indicators of Sustainability Application																Overall Ratings of Elements		
	G (Green) = Sustainable A (Amber) = Threatened R (Red) = Impacted N = Element not applicable to subject local environment																		
B. Elements	Local Environments (LEs)																G	A	R
Note: Refer to Table 4.1 (Indicators of Sustainability Checklist)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16			
B1. Bushland character	R	A	A	A	A	G	R	A	A	A	A	A	A	A	A	A	1	1	2
B2. Corridors	R	R	R	R	R	A	A	A	A	A	A	A	A	A	A	A	1	1	5
B3. Edge habitat	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	1	6	
B4. Endangered species	A	R	R	R	R	A	A	A	A	A	A	A	A	A	A	A	12	4	
B5. Environmental fragments	A	A	A	A	A	G	A	N	N	N	N	N	N	N	N	N	1	6	
B6. Gap habitat	A	R	R	R	R	G	A	N	N	N	N	N	N	N	N	N	1	2	4
B7. Littoral zones	A	G	G	G	G	G	N	N	N	N	N	N	N	N	N	N	5	1	
B8. Native vegetation	A	A	A	A	A	G	A	A	A	A	A	A	A	A	A	A	1	1	5
B9. Weeds (terrestrial)	R	G	G	G	G	G	N	N	N	N	N	N	N	N	N	N	5	0	1
Overall Ratings within Local Environments	G		2	2	2	2	6										1	4	
	A	6	4	4	4	4	3	6	5	5	5	5	5	5	5	5		7	6
	R	3	2	3	3	3		1											1

6.5 Aggregating Sustainability Score Cards

Were the SCF applied to the other local areas of North Wyong (Plate 5.1) the sustainability ratings from the score cards could be aggregated or ‘scaled up’ (Table 6.8). The hierarchy of scales is important in ecology and geography dynamics. Allan and Starr (1982) outline why one of the major issues in ecology is the ability to take into account the multiplicity of scales so phenomena (such as the SCF ratings) can be ‘scaled up’ or ‘scaled down’. Forman and Gordon (1986) and Kareiva and Wennergren (1995) outline how ecology and geography (both components of urban planning) come together where environmental problems go beyond one subject and solutions require a multi-subject (or sustainable) approach.

In thus looking at scaling under the SCF, the aquatic and terrestrial sustainability ratings (noted earlier) are carried over here in column 2. The table illustrates the range of outcomes achievable in this level of SCF application. For instance, the table provides an overall measurement of sustainability within any local area within North Wyong. Comparisons of natural environment components among local areas can also be completed using the table. Terrestrial biodiversity sustainability, for example, could be compared across all local areas (LA1.1 to LA7). Alternatively,

Table 6.6 Step 5.1—West Tuggerah Lakes—Wadalba (south) Sustainability Report for Terrestrial Component

Terrestrial Component	Sustainability Rating of Elements			Comment on Rating	Actions To address threatened and impacted elements. References: 1. Tables 2.1-2.4 (ESD related documents) 2. Tables 5.1-5.3 (planning related documents).	Date Started	Current Date	Responsible Authority	Status of Action
	G (Green) = Sustainable	A (Amber) = Threatened	R (Red) = Impacted						
B. Elements	G	A	R						
B1.Bushland character	1	13	2	Most of the bushland in the area is threatened or impacted upon.					
B2.Corridors	0	11	5	The corridor's health is generally threatened or impacted upon.					
B3.Edge habitat health	0	16	0	All edge habitats are threatened.					
B4.Endangered species	0	12	4	Endangered species are threatened or impacted upon over nearly the whole of the study area.					
B5.Environmental fragments	1	6	0	Environmental fragments are partly threatened.					
B6.Gap habitat	1	2	4	Gap habitat is threatened and impacted upon.					
B7.Littoral zones	5	1	0	Littoral zones are generally sustainable					
B8.Native vegetation	1	15	0	Native vegetation throughout the area is threatened.					
B9. Weeds (terrestrial)	5	0	1	Weeds are a major impact in one of the local environments.					
B1-B11 Terrestrial Overall Rating	14	76	15	The majority of the terrestrial biodiversity is threatened or impacted upon.					

one element or more within the natural environment may be focused on. This element may be consistently unsustainable across all local areas (i.e. nutrient runoff as noted earlier under aquatic threats).

District level sustainability reports can further be aggregated to an LGA level. The sustainability score card for the North Wyong District (Table 6.8) can be included within an aggregated score card for the whole Wyong LGA. This is illustrated as a case example in Table 6.9.

As in the aggregation to district level above (Table 6.8) the LGA table illustrates the range of outcomes achievable. The table provides an overall measurement of sustainability within any district (D1 to D8) of Wyong Shire. Comparisons of natural environment components among districts, for example, can be completed using the table. As in the earlier layout (Table 6.8) for a district, any of the natural environment components could be compared across all districts (D1 to D8) of the Shire.

Table 6.7 Step 5.2—West Tuggerah Lakes—Wadalba (south) Sustainability Report for Terrestrial Environment by Local Environments

Local Environments	Terrestrial Sustainability Rating			Comment on Rating	Actions To address threatened and impacted elements. References: 1. Tables 2.1-2.4 (ESD related documents) 2. Tables 5.1-5.3 (planning related documents).	Date Started	Current Date	Authority Responsible	Status of Actions
	G	A	R						
		6	3						
LE1. Tacoma Central		6	3	Terrestrial environment is threatened or impacted upon.					
LE2. Tacoma Eastern	2	4	2	Terrestrial environment is threatened or impacted upon.					
LE3. Tacoma Peninsula	2	4	3	Terrestrial environment is threatened or impacted upon.					
LE4. Rocky Point Foreshores	2	4	3	Terrestrial environment is threatened or impacted upon.					
LE5. Big Bay	2	4	3	Terrestrial environment is threatened or impacted upon.					
LE6. Tuggerawang Wetlands	6	3		Local environment is mostly sustainable, with several threats.					
LE7. Prawn Beach		6	1	Local environment is mostly sustainable, with several threats.					
LE8. Craigie Park		5		Local environment is mostly sustainable, with several threats.					
LE9. Marks Rd Foreshores		5		Local environment is mostly sustainable, with several threats.					
LE10. Johns Rd Rural		5		Local environment is mostly sustainable, with several threats.					
LE11. Louisiana Rd Rural		5		Local environment is mostly sustainable, with several threats.					
LE12. Hilltop Conservation		5		Local environment is mostly sustainable, with several threats.					
LE13. Wadalba Drainage Corridor		5		Local environment is mostly sustainable, with several threats.					
LE14. Figtree West		5		Local environment is mostly sustainable, with several threats.					
LE15. Wadalba Hill South		5		Local environment is mostly sustainable, with several threats.					
LE16. Wadalba Hill North		5		Local environment is mostly sustainable, with several threats.					
LE1-LE16 Terrestrial Overall Rating	14	76	15	Terrestrial environment is mostly threatened and impacted upon.					

Table 6.10 Step 5.5—Central Coast Sustainability Score Card for Natural Environment by LGA

Natural Environment Components	Sustainability Ratings from Indicators Application					
	G (Green) = Sustainable A (Amber) = Threatened R (Red) = Impacted					
	Local Government Areas in Region					
	Wyong LGA			Gosford LGA		
	G	A	R	G	A	R
A. Aquatic						
B. Terrestrial						
C. Land						
D. Environmental water						
Overall Rating of Components by LGA						

Table 6.11 Step 5.6—Growth Regions beyond Metropolitan Sydney—Sustainability Score Cards for Natural Environment

Natural Environment Component	Sustainability Ratings from Indicators Application											
	G (Green) = Sustainable A (Amber) = Threatened R (Red) = Impacted											
	GMR Growth Regions											
	1. Central Coast			2. SW Sydney			3. NW Sydney			4. Newcastle/Lake Macquarie		
	G	A	R	G	A	R	G	A	R	G	A	R
A. Aquatic												
B. Terrestrial												
C. Land												
D. Environmental water -												
Overall Rating of Components by LGA												

In addition to an LGA sustainability score card being constructed, a regional scorecard can be achieved by aggregating score cards among LGAs within a region. This is illustrated using the Central Coast Region (Gosford and Wyong LGAs) (Table 6.10).

In addition to a regional sustainability report card, a sustainability report card for a group of regions can be achieved. The growth regions beyond Metropolitan Sydney are used to illustrate this aggregated sustainability score card (Table 6.11).

As in earlier examples at the LGA and regional level, the table enables a profile of sustainability of the natural environment within each growth region. In addition

individual natural environment components (aquatic, terrestrial, land, environmental water) can be examined across all regions.

6.6 Chapter Summary

This chapter applied the steps of the draft SCF (natural environment) to test the framework within the illustration study area of West Tuggerah Lakes-Wadalba (south). These steps included: (1) the review of ESD related documents; (2) selection of indicators of sustainability; (3) completing a survey of the study area; (4) sustainability score cards; and, (5) sustainability reports.

The review of illustrated study area ESD related documents (Step 1) (Table 6.1) included referring to documents reviewed in Chap. 2 and to those applying to the study area Chap. 4. Moving to Step 2, the selecting of indicators of sustainability relied upon the data sources as outlined in Chap. 4. The data sources selected can be reduced to the scale of a subject study area, thus providing a useful source. These data sources (on a layering format) provide a basis for delineating the local environments and selecting indicators of sustainability.

In Step 3 (survey) the identification of natural environment elements present within the illustrated study area was completed. The results of this survey were plotted and the photos to illustrate the 16 local environments selected. Survey work allows the identification of aquatic and terrestrial elements present in those local environments. Conclusions can be drawn about the survey procedures, strengths and weaknesses. Field work, in testing the framework, will demonstrate the practicality of using the framework and its tables.

The chapter also illustrated aggregation of sustainability ratings and the application of indicators of sustainability (aquatic and terrestrial), as well as the adoption of sustainability score cards and sustainability reports. Finally, the chapter illustrated how the SCF could be applied to areas larger than a local area. To achieve this, natural environment scorecards were completed for district, LGA, region and greater region levels. The next chapter applies the SCF to the built environment.

References

- Allan TFH, Starr TB (1982) *Hierarchy: perspectives for ecological complexity*. University of Chicago Press, Chicago
- Forman RTT, Gordon M (1986) *Landscape ecology*. Wiley, New York
- Kareiva P, Wennergren U (1995) Connecting landscape patterns to ecosystem and population processes. *Nature* 373:299–302
- Wyong Council (2003) *Wyong conservation strategy (draft)*. Wyong Council, Wyong
- Wyong Council (2007) *Wyong Shire State of the Environment Report 2006/07 (earlier reports 2002/03, 2003/04, 2004/05, 2005/06)*. Wyong Council, Wyong

Chapter 7

Applying the SCF to the Built Environment

7.1 Step 1: Review ESD Related Documents

There has been a gradual move among planners to incorporate sustainability criteria into the built environment. A number of authors, including Low and Gleeson (2003), have promoted over the last 20 years the means of incorporating sustainability principles into transport planning. Other authors have developed policy directories (from international to local policies) in key built environment themes and their relationship to sustainable development. Likewise Li et al. (2007) proposes a framework that evaluates environmental impacts from urban development and construction practices. Li introduces a guide that incorporates more sustainable urban planning.

It is proposed to illustrate the sustainable communities framework (SCF) on the built environment component of transport, though it could be applied to other built environment components. All built environment components (as with transport) would be subject to sustainability indicator standards. These standards will vary with location of the areas and the extent that field observations would be required. Each of the built environment components would require comprehensive sustainability criteria.

An outline of the steps for applying the framework to the built environment is contained in Table 3.1. The same five steps under natural environment components (Chap. 6) are followed as applied to the built environment. Each of the steps is now examined more closely. As the framework was applied to selected environment components (aquatic and terrestrial) within the natural environment test area, the framework is applied here to the built environment.

The first part of Step 1 involves reviewing ESD related built environment documents in Chap. 2 (Tables 2.1, 2.2 and 2.4; Tables 5.1, 5.2 and 5.3) that are relevant to the built environment of the study area. Additional built environment ESD related documents would be added to the tables under any full SCF application. The built environment components include: buildings; communications; energy; greenhouse gas sources; recreation and open spaces; transport; waste; and, water engineering.

7.2 Step 2: Selecting Indicators of Sustainability

SCF Step 2 requires selecting indicators of sustainability as outlined in Chap. 4 (Table 4.1). The indicators for the built environment would be laid out and then selected in a similar fashion as was done to the natural environment. As with the natural environment, for each built environment element provision is made for: indicators of sustainability; unit of measurement; standard of measurement; and, significance of each indicator.

7.3 Step 3: Survey Area

The survey of the study area under Step 3 provides an on-the-ground identification of the built environment. The built environment components of North Wyong do not vary widely, given most of the built environment is outer area suburban in design. In contrast, when examining the natural environments (Chap. 6) there were wide variations of natural environment components within the test area of West Tuggerah Lakes-Wadalba (south).

The survey recording is similar to the method used in surveying the natural environment, that is observation and photographing. The survey would provide on-site understanding of the built environment, including: comments on the built environment elements; location significance; and, overall observations of the built environment components. Follow up surveys would likely be required as the SCF steps are progressed (similar to the natural environment survey follow ups outlined in Chap. 6).

7.4 Step 4: Completing a Sustainability Score Card

The next step involves the application of indicators of sustainability to the built environment (transport as selected). Transport is selected as it is a high priority community need with a high impact (i.e. roads, rail and bus routes). Rauscher (2005) outlines how authorities could use the SCF utilising sustainability indicators to measure the transport sustainability of the district. Within that document indicators of sustainability are proposed for the elements of transport (air quality, car/public journeys, cycleways, footpaths, fossil fuel use, pollutants and safety). The approach to the application of indicators to transport follows the SCF survey guide (Table 3.2). The observation method is promoted and a qualitative rating system of 'sustainable', 'threatened' and 'impacted' is outlined. In the instance of transport there is an abundance of quantifiable data (i.e. road accidents; fuel consumption; car and bicycle use; modal splits of transport types; etc). All of these indicators would be used in a full application of the SCF.

To illustrate the SCF on the transport component all of the elements need to be observed within the North Wyong District illustrated study area. Field trips for the qualitative assessment of the natural environment allow observations of the transport elements in a district. As with the natural environment application, a review of relevant documents and data sources provides a qualitative basis for considering the threats and impacts on transport in North Wyong. These documents and sources included: ESD related documents (Chap. 2); data sources (Chap. 4); and planning documents at GMR, Central Coast and Wyong Shire levels (Chap. 5). The transport planning critiqued in Chap. 2 (Beatley, Bithas, Brandon, Brown D and Newman) provided a range of examples of indicators of sustainability being applied to transport. A critique of two key transport planning documents noted in Chap. 5 (Department of Transport 1995, 2003) provided further indicators of sustainable and non-sustainable operations of transport.

To illustrate a case model for the SCF application to the built environment component of transport the authors refer to a published research paper. This paper (Rauscher 2005) (as noted in Chap. 2) was presented to the 28th Australasian Transport Research Forum (ATRF) and published under the ATRF. The paper outlines: (1) using transport studies and inquiries to ascertain the current status of transport; (2) using the SCF to apply to a region (Central Coast); (3) conducting a survey of the state of transport in the study area; (4) placing the SCF steps within a framework matrix; and, adopting a sustainability report card on transport as a final SCF step. The paper concluded that the SCF framework is useful in developing a sustainability report on a built environment component such as transport.

The SCF Table 7.1 lays out the transport component elements (T1–T7) (column 1) against indicators of sustainability (column 2). The sustainability score card uses sustainability ratings (green, amber and red) (column 3) as referred to in Chap. 5. These ratings in this table are for the local areas of North Wyong district (LA1.1–LA6).

These ratings for the built environment (transport in this instance), as with the natural environment, provide an initial qualitative result (Step 4 Survey). Once sustainability indicators are applied a quantitative (actual) result is realised. Research surveys of the North Wyong local areas and an understanding of the transport documentation affecting North Wyong would enable sustainability ratings to be made (Tables 2.1, 2.2, 2.3 and 2.4; Tables 5.1, 5.2 and 5.3). The ratings are (as with the natural environment): green (sustainable); amber (partly unsustainable); and red (unsustainable). Partly unsustainable (amber) applies where there is at least one built environment element not meeting indicator of sustainability standards. Unsustainable (red) applies where two or more elements fail to meet indicator of sustainability standards.

As noted in the introduction to this chapter the SCF is at the district level for this application. The transport elements to be tested include: air quality; car/public/cycle/pedestrian journeys; cycleways; footpaths; fossil fuel use; pollutants; and, safety. The overall rating for each transport component element is contained in Column 4. The overall rating for the elements (T1–T7) is in the last column. Likewise, the overall rating for each local area (LA1–LA6) is on the bottom row. The far right bottom box contains the overall rating for transport in North Wyong.

Table 7.1 Step 4—North Wyong sustainability score card for transport component

Transport Component Elements	Indicators of Sustainability Measurement	Sustainability Ratings from Indicators of Sustainability Application								Overall Rating for Elements		
		Local Areas (LAs)										
		LA1.1 West Tuggerah Lakes- Wadalba (south)	LA 1.2 West Tuggerah Lakes- Wadalba (north)	LA 2. Hamlyn Terrace	LA3. Woongarah	LA4. North Wyong Industrial Area	LA5. Warnervale	LA6. Halloran	G	A	R	
T1.Air quality	tons/day/pollutant	G	G	G	G	G	G	G	7			
T2. Car/public/cycle/ pedestrian journeys	Number and ratio	R	R	R	R	R	R	R			7	
T3. Cycle ways	Km/dwellings	R	R	R	R	R	R	N			6	
T4. Footpaths	Km/population	A	A	A	A	N	N	N		4		
T5.Fossil fuel use	Tons greenhouse gases/type/population	A	A	A	A	A	A	A		7		
T6.Pollutants	Tons/day/type	G	G	G	G	G	G	G	7			
T7.Safety	Number accidents/type/frequency	R	R	R	R	R	R	R			7	
Overall Rating for Elements	G	2	2	2	2	2	2	2	14			
	A	2	2	2	2	1	1	1		11		
	R	3	3	3	3	3	3	2			20	

A qualitative assessment of the transport component based on the research tasks as noted above reveal a number of threats and impacts on the North Wyong transport component. ‘Partly unsustainable’ (amber) transport elements where at least one element does not meet an indicator of sustainability (last column) include: cycleways; footpaths; and fossil fuel use. It is the use of fossil fuel that was ‘partly unsustainable’ across all of the local areas (LA1 to LA6). Like wise a number of elements represented more than one indicator of sustainability (on a qualitative basis) not meeting standards. These elements included: car/public/cycle/pedestrian journeys (numbers and ratio); and, safety (number of accidents/type/frequency). These elements reflected the transport stresses that exist in outer metropolitan growth areas such as North Wyong.

Table 7.2 Step 5.1—North Wyong sustainability report for transport component

Transport Component	Sustainability Rating of Elements			Comment on Rating	Actions To address unsustainable elements. References: 1. Tables 2.1-2.4 (ESD related documents) 2. Tables 5.1-5.3 (planning related documents).	Date Started	Current Date	Responsible Authority	Status of Action
	G (Green) = Sustainable	A (Amber) = Partly Unsustainable	R (Red) = Unsustainable						
T. Elements	G	A	R						
T1. Air quality									
T2. Car/public/cycle/ pedestrian journeys									
T3. Cycle ways									
T4. Footpaths									
T5. Fossil fuel use									
T6. Pollutants									
T7. Safety									
Overall Rating for Transport									

7.5 Step 5: Adopting Sustainability Report

The next step involves adopting a sustainability report. This step involves transferring the transport score card results (Table 7.1) into the sustainability report (Step 5) (Table 7.2). This report contains comments on each of the transport elements (column 3). In any full application of the SCF the actions (column 4) would be completed. It is noted here that the SCF references can be referred to in formulating actions (Tables 2.1, 2.2, 2.3 and 2.4; Tables 5.1, 5.2 and 5.3). The report notes (as with the natural environment sustainability report in Chap. 6) actions can be recorded by: date started; current date; responsible authority; and, status of action.

7.6 Aggregating Sustainability Score Cards

As illustrated in Chap. 6, the SCF enables sustainability score cards to be aggregated into areas larger than local areas, including: districts; local government areas; and, regions. The results of the application of the indicators of sustainability can provide built environment sustainability ratings for all districts within Wyong Shire (Table 7.3). The table allows comparisons of sustainability elements between districts within the shire (i.e. transport is highlighted here). Finally, were the framework applied to all districts within the shire, an overall transport sustainability rating could be recorded.

An application of the SCF framework to the built environments of LGAs within a region can also be made. It is thus possible, for example, to achieve a sustainability report card of the built environment for each of the LGAs within the Central Coast (Table 7.4). This score card for the built environment over the Central Coast

Table 7.3 Step 5.2—Wyong Shire sustainability score card for the built environment

Built Environment Components	Indicators of Application and Survey								Overall Ratings of Components		
	G (Green) = Sustainable under standards A (Amber) = Partly Unsustainable (one built environment component element does not meet indicator of sustainability standard) R (Red) = Unsustainable (more than one built environment component element does not meet indicator of sustainability standard)								G	A	R
	Districts (Ds)										
	D1. North Wyong	D2. Toukley	D3. Budgewoi	D4. North Lakes	D5. Wyong-Tuggerah	D6. South Lakes	D7. The Entrance	D8. Ourimbah			
	G	A	R								
1. Buildings											
2. Communications											
3. Energy											
4. Greenhouse gas sources											
5. Recreation											
6. Transport											
7. Waste											
8. Water engineering											
Overall Ratings for Districts	G	A	R								

Table 7.4 Step 5.3—Central Coast sustainability score card for the built environment

Built Environment Components	Sustainability Ratings from Indicators Application					
	G (Green) = Sustainable under indicators of sustainability standards A (Amber) = Partly Unsustainable (one built environment component element does not meet indicator of sustainability standard) R (Red) = Unsustainable (more than one built environment component does not meet indicator of sustainability standard)					
	Wyong LGA			Gosford LGA		
	G	A	R	G	A	R
1. Buildings						
2. Communications						
3. Energy						
4. Greenhouse gas sources						
5. Recreation						
6. Transport						
7. Waste						
8. Water engineering						
Overall Rating by LGA						

natural environment, illustrated the SCF aggregation to local government area and regional levels (both up-scaling and down-scaling). The chapter showed that the SCF can be successfully applied to the built environment as it had earlier been applied to the natural environment. The next chapter offers readers future applications of the SCF and provision of examples of research for expanding the application of the SCF.

References

- Department of Transport (1995) *Transport 2010*. Department of Transport, Sydney
- Department of Transport (2003) *Central Coast transport action plan*. Department of Transport, Sydney
- Li K, Zhang P, Crittenden J, Buhathakurta S et al (2007) Development of a framework for quantifying the environmental impacts of urban development and construction practices. *Environ Sci Technol* 41(14):5130–5146
- Low N, Gleeson B (eds) (2003) *Making urban transport sustainable*. Palgrave Macmillan, Basingstoke
- Rauscher RM (2005). Sustainable area planning (sap) framework for sustainable transport in growth centres. In: 28th Australasian Transport Research Forum. Australasian Transport Research Forum 28, Sydney, p 12

Chapter 8

Future Applications of SCF

8.1 Overview of SCF Application

It is acknowledged that governments are searching for frameworks to introduce sustainability principles within urban planning. The SCF is an example of how a sustainability framework can be applied to urban planning. It has been illustrated how the framework can be applied at different levels, including: the local area, district, local government area and regional levels. The SCF application within the chapters illustrates that the framework is a coordinated and holistic urban planning tool.

Applying the five SCF steps at the local area level provides a sound basis for application of the framework. The tables that accompany each step provides the required constructs in applying the framework. It's acknowledged that selecting and using a wide range of sustainability data sources is challenging to the application of the SCF. As illustrated both qualitative (e.g. survey step) and quantitative (e.g. scorecard step) methods need incorporation within SCF tables.

Chapter 2 provided an understanding of sustainability, especially related to urban planning. The review overall showed sustainability subject areas had been significantly written about. Insufficient advances, however, had been made on incorporating sustainability principles into urban planning and the required frameworks.

The SCF structure (Chap. 3), containing the five steps, illustrates that the framework can be kept simple, yet still allowing quantification through the SCF templates. Also, the selection of the key natural environment components (aquatic, terrestrial, land and environmental water) focuses the application without compromising the vigour of analysis. It was at this level that the community would also be able to better comprehend principles of sustainability. Community assistance is vital for example in determining local area boundaries for the SCF application. To achieve a measurement of sustainability the SCF application needs to take into account building upon and expanding the 'certification flags' system (Scanlon 2006).

Data sources (Chap. 4) illustrated how fundamental these sources are to the selection of indicators of sustainability within the SCF application. Given data sources however varied widely, the authors selected key sources (Plates 4.1, 4.2 and 4.3)

to illustrate how these provided the bases of indicators of sustainability. Given indicators of sustainability exist at all levels of government, the search of data sources will always be both rigorous and time consuming. To categorise a range of indicators of sustainability that could be used in the SCF application, Table 4.1 was introduced. The selection of indicators will always be limited within the chosen sustainability components (aquatic, terrestrial, land and environmental water). Using the LCCCREMS (2003a) data base on indicators of sustainability within a SCF illustrated how important an initial base of indicators is.

The study area (Chap. 5) of North Wyong and West Tuggerah Lakes-Wadalba (south) provided the reader with parameters on selecting a subject area. Successfully applying the framework at these levels provides valuable lessons on the size of areas that the framework can be applied to. The aggregating of sustainability scorecard results from local areas to larger areas (i.e. district) illustrates that the results can be scaled up.

The application of the SCF (Chap. 6) allowed the authors to show how SCF tables come together. It was emphasised that local area surveys take considerable time and require multiple area visits and photographing over the length of the SCF application. The authors outlined the reasons for this large time requirement, including: gaining information from community groups on defining local areas familiar to them; the complexities of defining natural features and 'local environments' (LEs); selecting natural environment elements to examine (e.g. under aquatic and terrestrial components); assessing sustainability studies relative to the study area; obtaining historical photos from the community to compare past and current conditions of local environments; and obtaining proper scaled maps containing the natural environment components (aquatic and terrestrial). The selection of photos for each local environment can be an exacting exercise to ensure that the selected photos best illustrate the environmental components of that area.

The application of the indicators of sustainability to the test area of West Tuggerah Lakes-Wadalba (south) showed how the SCF can be used on a quantification basis. It is here that the green (sustainable), amber (threatened) and red (impacted) score card ratings are determined. It is noted that in any framework application, beyond this book's illustration, a full application of indicators of sustainability would be required. The application of the final step of the framework illustrates the importance of adopting sustainability reports for local areas.

The authors also illustrated the SCF against the built environment (Chap. 7). Using the transport component of the built environment allowed the authors to further apply the SCF. Here it was shown that data sources for the SCF application are usually available. These data sources can normally be incorporated into the final score cards, as was illustrated for the transport component. At the same time, this scorecard can be translated into a sustainability reports, both natural and built environments, Aggregation of sustainability ratings scaled up to LGA and region levels was also shown as feasible.

Overall, it is hoped the SCF contributes to the discipline of urban planning by proving the importance of developing sustainability measurements down to the local area level. It has also been illustrated that local area measurements are able to

be scaled up to regional level. The authors showed that a sustainability score card (to record indicators of sustainability) could be developed and applied to areas, from local up to regional. The importance of consulting the community is emphasised in all applications of the SCF.

The SCF application illustrates that this scorecard could be used for one or more environmental components (aquatic, terrestrial, land, environmental water) as well as the built environment (e.g. transport example was used). Further the authors showed the value of a sustainability report, again being able to scale up from local up to regional levels. Finally, the authors showed that the SCF could be applied across all urban areas globally. The sociological and governance differences within and between nations would need to be taken into account. Likewise the extent of the SCF implications, singly and aggregated, would need to be considered.

8.2 Research to Expand the SCF

There are a number of research contributions that the SCF makes. Firstly, is the development of a relatively simple, methodical and structured framework. A five step framework overcomes many of the more complicated frameworks as critiqued in Chap. 2. The development of checklists under ‘ESD Related Documents’ (International, Commonwealth and NSW State levels) helps simplify document finding (Tables 2.1, 2.2, 2.3 and 2.4). The expanded checklist (Chap. 5) incorporating ‘planning documents’ (categorised under ‘land use planning’, ‘natural resource planning’ and ‘sustainable urban planning’) (Tables 5.1, 5.2 and 5.3) broadens this framework’s contribution.

The SCF advances the sustainability rating system (with colours) (Scanlon 2006) (Fig. 3.1). The development of an area survey template (Table 3.2) to record environmental (natural and built) conditions for qualitative assessment is a further contribution. The development of a sustainability scorecard (where quantitative indicators of sustainability are applied to ‘local environments’, incorporating survey results) (Table 3.3) can be expanded. Building on scorecards, the SCF contributes a simplified sustainability report template (Table 3.4) (a contribution to SOE reporting and monitoring). Researching the perplexing question of how to apply indicators of sustainability to different sized areas, The SCF contributes a ‘scaling up’ of scorecards (e.g. from local to district) (Table 3.6). To effectively select data sources and standards for indicators of sustainability, SCF contributes both a ‘data source pool’ (Plates 4.1, 4.2 and 4.3) and a ‘sustainability indicators checklist’ (Table 4.1). The framework shows how the sustainability scorecard and sustainability report could be applied to the built environment (through case application of the SCF to transport) (again incorporating scaling up) (Table 7.1). In summary, the SCF (Chaps. 6 and 7) gives a ‘proofing basis’ for applying sustainability principles to urban planning.

The application of the SCF leads to a number of future research directions. Firstly, the framework could be adopted within planning schools (e.g. land use, natural resources and sustainability). Secondly, a systems approach to applying the framework could

see more quantifiable data (using the SCF templates) and more rigorous analysis introduced. Such an approach would further review the framework variables, including: indicators of sustainability; varied sizes (e.g. local areas, districts, LGAs and regions); and the aggregation of sustainability ratings (as illustrated within the scorecards). Finally, a systems approach could be used to address more quantitative detail within all natural and built environment components.

There are several other future research directions to explore. Firstly, in spite of major use by authorities of sustainability terms (including sustainable, ESD and ESD based urban planning), further industry and public agreements on definition are required. At the local government level the SCF could be used to supplement state of environment reporting, focusing at the local area and district levels. The application of the framework to the transport component (Chap. 7) can now be expanded to all built environment components (including buildings, communications, energy, greenhouse gas sources, recreation, waste and water engineering). One future research direction will be to visually represent the results of sustainable standards being applied across all these built environment components. A visual presentation of end built environments can also be researched. One of the useful presentation tools to examine further is model simulation.

The SCF could be extended to cover the other components of sustainability (social/cultural and economic). In completing this extension to cover all three components of sustainability, the framework would be providing the holistic approach that is required. The application of the SCF to areas larger than the local area also calls for additional research. This research could be aimed at the regional strategic planning exercises the NSW government is currently undertaking. The framework could be tested at this scale of planning for sustainable communities. At the same time the framework could be assessed for adaptation to a range of public, scientific and government perspectives on sustainable based urban planning. In further research, the SCF could be applied in other areas of urban planning. At local government and regional levels there appears to be value in the use of indicators of sustainability for environmental monitoring. Within this, for example, the framework could be used to monitor environmentally sensitive, impacted or threatened sites. In addition, the framework tables could be expanded to measure the extent that an area is moving in the direction of a sustainable community. Finally, the research illustrated the value of involving the community in discussions on local area planning.

The application of the SCF within the book suggests the SCF could be used for collecting data and reporting on sustainability across a state or nation. The framework could, at the same time, be used to designate areas for remedial action. These actions could be either for a particular component (i.e. aquatic or terrestrial) or over a designated area (i.e. local, district, local government or region). The use of the framework to monitor remedial actions under bodies such as a local council, catchment authority or land care group could be examined. The SCF could also be expanded to wider applications beyond ESD based urban planning. These could include: local government management plans; risk assessment where sustainability is a factor; and joint planning for sustainable communities by all three levels of government (Commonwealth, State and local).

In summary, there appears to be a number of research directions for the SCF to be expanded. These directions broadly fit within the discipline of sustainable based urban planning. The directions are applicable both within Australia and within other countries. Given the SCF templates were developed for different sized areas in different environments, the framework could be applied anywhere in the world. The form of the framework needs to remain flexible to meet new environment, social/cultural and economic challenges in years to come. As illustrated within the book, the community engagement process would need to remain central to any application of the SCF. Finally, the framework could be a useful tool for governments, businesses and individuals in thinking about and promoting a sustainable lifestyle and sustainable communities.

References

- Lower Hunter and Central Coast Regional Environmental Management Strategy (LHCCREMS) (2003) Template for state of the environment reports. LHCCREMS, Newcastle
- Scanlon (2006) Bio-banking critiqued. Business Law School (Masters Course). Sydney University, Sydney, Scanlon

Appendices

Appendix A: ESD Principles Built into Eco-Village Design

States and Eco-villages	ESD principles	Background to Eco-village
NSW	√ Checklist √ = the ESD principles that a local area may wish to incorporate	
Crikey Creek www.crikeycreek.com.au	Sustainable development	The Crikey Creek Environmental Estate states that 'it is a response to the problems of our unsustainable urban developments and human induced global climate change'. The Estate states that 'it is one of most comprehensive environmentally sustainable residential development ever undertaken in Australia'
Green Square www.dop.nsw.gov.au	Water, energy and building eco-design	The Green Square project within the City of Sydney and built around the Green Square railway station is to be built around principles of eco-city. This approach was announced by Landcom (unit of the State of NSW) in June 2007 and is to incorporate water, energy and building eco-design parameters
Murrays Beach www.murraysbeach.com.au	Subdivision maintaining the natural environment	This subdivision in Lake Macquarie City has designed the housing and facilities with minimum disturbance to the natural environment. Lots are generally designed around the trees and geography, including water sensitive design

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States and Eco-villages	ESD principles	Background to Eco-village
NSW	√ Checklist √ = the ESD principles that a local area may wish to incorporate	
<i>Queensland</i>		
Curumbin www.theecovillage.com.au	Sustainable subdivisions	Curumbin was awarded as Queensland's finest example of sustainable urban development and best residential subdivision. The location makes it possible to live amidst nature while still being just a stone's throw of city amenities. With sustainability as the goal, convenience facilities are included in a Village Centre. The Ecovillage concept embraces the land as the first priority
Caral Ecovillage www.caralecovillage.com.au	Natural corridors	This ecovillage seeks to create a life and place connected to nature and the beach. The sense of community life that characterises traditional small fishing villages on Australia's coast is the driving force behind the design. The ecovillage states: 'that homes will reflect the character of holiday shacks by the beach'. The new landscape will blend with the old cane fields into the natural bushlands surrounding the site. New wildlife corridors will link into natural waterways'
Kookaburra Park Eco Village www.kookaburra.eco-village.com.au	Common parklands and permaculture	The ecovillage offers freehold building lots set amongst community owned 'Common Parkland'. The common land contains access roads that meander through the park past lakes that have been created along an existing watercourse. These Lakes provide utility water to the lots through a gravely fed water system. All lots are serviced by underground power and phone as well as the utility water. An extensive design process was carried out in the creation of the eco-village that employed the permaculture principles. Natural features were set aside and building lots were pegged out by hand

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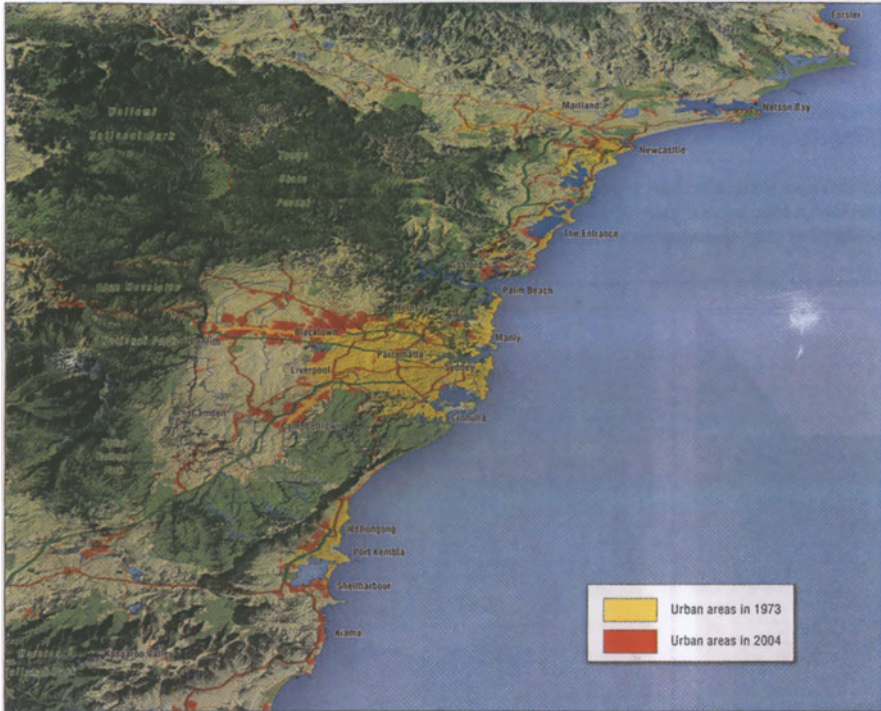
States and Eco-villages	ESD principles	Background to Eco-village
NSW	√ Checklist √ = the ESD principles that a local area may wish to incorporate	
<i>South Australia</i>		
Aldinga Arts Ecovillage (near Aldinga) www.aldinga-artsecovillage.com.au	Village commons and communal gardens	This eco-village has used sustainable design principles throughout the development. Through Community Title, purchasers own their plots outright, together with a share in the common land, farm and cultural facilities. Residents are obliged to respect by-laws requiring environmental and social responsibility. Houses must be energy efficient, include solar hot water provision and be served by a 10,000 L rainwater tank. Up to 16 ha will accommodate the 'village farm', which will eventually be certified organic. The farm includes a treatment plant which recycles waste water for irrigation, lagoons, tree buffers, wood lots, community plots for individuals and lease arrangements for organic food crops, all developed on permaculture principles. Further open space allows for village commons, and communal gardens and orchards. The farm will also host a permaculture education centre and native nursery, providing opportunities for volunteers, and horticulture therapies
<i>Tasmania</i>		
Glamorgan Spring Bay Council www.gsbcc.tas.gov.au	Retaining natural resources	This council operates with a vision of building communities consistent with the objectives of sustainable development and natural resource management
<i>Victoria</i>		
Moora Moora Co-operative www.mooramooracoop.org	Hamlet communities	Moora Moora is a co-operative residential community designed as six small hamlets located on co-operatively owned 245 ha (600 acre) property
Ceres (Melbourne suburbs) www.ceres.org.au	Environmental park	This place provides a community focus to demonstrate environmental initiatives. The 10-acre site as procured by the group was an area of wasteland dominated by piles of rubbish and high tension power lines. CERES states that 'today the site is an urban oasis, a thriving community environment park in Brunswick'

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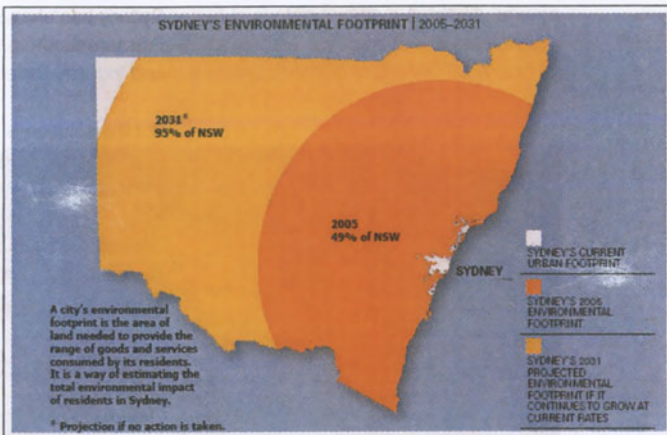
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States and Eco-villages	ESD principles	Background to Eco-village
NSW	√ Checklist √ = the ESD principles that a local area may wish to incorporate	
<i>Western Australia</i>		
Old Broome Estate www.oldbroomeestate.com	Sustainable layout and infrastructure	This estate is developed around sustainability principles in layout and infrastructure provisions
Pinakarri Community (near Fremantle) www.pinakarri.org.au	Eco-designed houses	In June 1999 the first residents moved in to the vibrantly coloured, passive solar designed houses the first community in Australia with private and Federal equity
Rosneath (near Dunsborough) www.rosneath.com.au	Sustainable designed residential clusters	Rosneath Farm is the first eco-village to use a new act of WA Parliament designed to enable villages to be established. The act provides a framework for design elements such as: permaculture; pattern language; alternative technologies; cluster development; co-housing options; and, special zoning. Rosneath believes all of the above is necessary for designing a lifestyle for residents which is sustainable
Green Edge www.greenedge.org	Urban eco-village design	This organisation works to design urban eco-villages to reflect on the global scale of advances of urban eco-villages
Somerville Eco-village (Chidlow, east of Perth) www.somervilleecovillage.com.au	Permaculture	The village design is based on permaculture principles and pattern language as utilised successfully in leading ecovillages around the world. Residents are encouraged to build solar passive homes with composting toilets. Power will be generated using photo voltaic panels and water will be harvested and stored in water tanks. The housing will be clustered and where possible be within 500 m of the village centre. Some of the land has been reserved for agriculture. Areas of native bush will be retained and encouraged to regenerate. Local wildlife will be encouraged
Harvest Lakes (LandCorp) www.landcorp.com.au	Smart design villages	This eco-village the state's first large-scale 'green smart village', designed to minimise environmental impact. It's also been created as a 'liveable neighbourhood', maximising the human values of the village

Appendix B: GMR Urban Growth 1973–2004 and Environmental Footprint



1. GMR Growth 1973-2004. Source: Planning Research Centre, Sydney University (Generated based on National Mapping Division Maps 2006)



2. GMR Environmental Footprint 2005-2031. Source: Department of Planning, City of Cities – A Plan for Sydney's Future, Dec 2005

Appendix C: Draft Central Coast Regional Strategy



Appendix D: Built Environment Simulation Model Projections



1. Church St, Parramatta (Source: Urban Futures Consulting 2005)



2. Bourke Street Mall, Melbourne (Source: Urban Futures Consulting 2005)



3. Melbourne and Hinterland (Source: Urban Futures Consulting 2005)

Appendix E: Sustainable Urban Planning Web Sites (Updated to Book Printing Date, Please Inform Authors of Any Change via Email)

Agenda 21	www.unchs.org
Agenda 21 Europe	www.iclei.org/la21/eurola21.htm
American Planning Association	www.planning.org/
American Society of Civil Engineers	www.asce.org
Architects Australia	www.raia.com.au/
Austin, Texas	www.ci.austin.tx.us
Australian Conservation Foundation	www.acfonline.org.au
Australian Housing and Urban Research	www.ahuri.edu.au
Baulkham Hills Council, NSW, Australia	www.baulkhamhills.nsw.gov.au
Blacktown Council, NSW, Australia	www.blacktown.nsw.gov.au
British Columbia (Climate Change)	www.sdri.ubc.ca
Brookings Institute (Urban Policy), US	www.brook.edu.es/urban
Canada Planning	www.cip-icu.ca
Carfree	www.carfree.com/
Centre for Neighbourhood Technology (Chicago)	www.cnt.org/
Citistates Group, US	www.citistates.com
Citizens for Better Environments, US	www.cbzeambia.org
Citizens Network for Sustainable Development, US	http://orgs.tigweb.org
Community Environment Council, Santa Barbara	www.cecsb.org/
Community Environment Network, NSW, Australia	www.cccen.org.au
Community Initiatives, US	www.communityinitiatives.com
Community Sustainability Resource Institute, US	www.sustainable.org
Community Viz (Vision), US	www.communityviz.com
Complex Open Systems Research Network (COSNet)	www.complexsystems.net.au
Congress for New Urbanism, US	www.cnu.org
Context Institute (Planning), US	www.context.org
Criterion Planners/Engineers (GIS), US	www.crit.com
Cyberbia, US	www.cyberbia.org
Cyberhood, US	www.thecyberhood.net
Department of Planning and Infrastructure, NSW, Australia	www.dopi.nsw.gov.au
Earthsharing, Australia	www.earthsharing.org.au
Earth Council Summit	www.ecouncil.ac.cr
EcoAction 2000, US	www.ec.gc.ca/ecoaction
Ecodesign, US	www.ecodesign.com
Ecodesign Foundation/Australia	www.edf.edu.au
Ecopolitics, Australia	www.ecopolitics.org.au
Ecosystem Anthologies, US	www.ecoiq.com
Ecotransit, NSW, Australia	www.ecotransit.org.au

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Electronic Cultural Atlas Initiated, US	http://ecai.org
Environment Australia (Commonwealth)	www.environment.gov.au
Environment Defenders Office (EDO), Australia	www.edo.org.au
Environment Protection NSW (see Envalue)	www.epa.nsw.gov.au
Environment Protections Authority, US	www.epa.org
Europe Expert Group	www.iclei.org/europe/expert.htm
Forests GIS (Mapping), US	www.americanforests.org/
Futures Preferred, Australia	www.preferredfutures.org
Geocities, US	www.geocities.com/athens/2962/bos
Geotools, US	www.geotools.org
Global Urban Observatory (intranet), UN	www.urbanobservatory.org/indicators
Gosford City Council, NSW, Australia	www.gosford.nsw.gov.au
Greenbelt, UK	www.greenbelt.org
Greendesign, US	www.greendesign.net
Greenmap, NYC, US	www.greenmap.org
Green Mountain Institute for Environ. Democracy, US	www.gmied.org
Green Network, Australia	www.greenet.org.au
Ground Swell	www.progress.org.cg
Hamilton-Wentworth Regional Council, Canada	www.hamilton-went.on.ca/vis2020
Hawaii Ho'okipa Network	www.hawaiian.net/cbokauai
Healthy City Office (Toronto) (Healthy City Index)	www.city.toronto.on.ca/
Healthy Cities, UN	www.who.org
Hornsby Council (see Earth Share), NSW, Australia	www.hornsby.nsw.gov.au
Innovative Urban Planning, NYC, US	www.columbia.edu/~jws150/urban
Institute for Local Self-Reliance, US	www.ilsr.org
Institute for Sustainable Futures, NSW, Australia	www.isf.edu.net.au
International Institute of Sustainable Development, US	www.iisd.org
International Society for Ecological Economics	www.csf.colorado.edu/ISEE
Jacksonville Community Council, US	www.sustainablemeasures.com
Lake Macquarie Council, NSW, Australia	www.lakemacquarie.nsw.gov.au
Lansing Sustainable, US	www.urbanoptions.org/sustain
Lincoln Land Use Institute, US	www.lincolnst.edu/main.html
Local Environment Initiatives, US	www.iclei.org/iclei.htm
Local Government and Shires Association, Australia	www.lgsa.org.au
Maine Development Foundation, US	www.mdf.org/meip.htm
Mapquest, US	www.mapquest.com
Metro Virtual (books/webs), US	www.metrovirtual.org
Millennium Ecosystem Assessment	www.maweb.org
Millennium Institute	www.igc.org/millennium
Minnesota Planning, US	www.mnplan.state.mn.us/mm/index.html
Mistra Institute	www.ctmsu.sytes.net
Mountain Association for Community Economic Development, US	www.maced.org
Natural Resources Atlas (NSW aspects of NR), NSW	www.nr.nsw.gov.au

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Neighbourhood Preservation Centre, NYC, US	www.neighborhoodpreservation.org
New Urbanism, US	www.newurbanism.org
New Urbanism News (Image Bank Mapping), US	www.newurbannews.com
New Urbanism Resource Site, US	www.netsense.net/terry/newurban.htm
Newcastle City Council, NSW, Australia	www.newcastle.nsw.gov.au
Olympia, WA, US	www.olywa.net/roundtable
Ontario Healthy Communities Coalition, Canada	www.opc.on.ca/ohcc
Ontario Roundtable on Environment and Economy	www.web.net.ortee/scrp
Oregon Progress Board, US	www.econ.state.or.us/opb
Penrith Council, NSW, Australia	www.penrith.nsw.gov.au
Planners Network, NYC, US	www.plannersnetwork.org
Planners Network, UK	www.plannersnetwork.co.uk
Planners Web, US	www.plannersweb.com
Port Stephens Council, NSW, Australia	www.portstephens.nsw.gov.au
Preserve Net, US	www.preserve.org
Positive Futures Network, UK	www.futurenet.org
Project for Public Spaces, US	www.pps.org
Office of Environment and Heritage, NSW, Australia	www.environment.nsw.gov.au/
Quality Planning, New Zealand	www.qualityplanning.org.nz
Real Estate Institute, Australia	www.reinsw.com.au
Redefining Progress (progress indicators), US	www.rprogress.org
Resilience Alliance	www.resalliance.org
Rocky Mountain Institute, Colorado, US	www.rmi.org
Santa Monica Council, US	www.ci.santa-monica.ca.us/environment
Seattle, US	www.ci.seattle.wa.us
Smart Growth America	www.smartgrowthamerica.com
Smart Growth Network, US	www.smartgrowth.org
Smart Growth Rhode Island, US	www.growsmartri.com
Smart Land Development, US	www.landuse.org
Society for Responsible Design, Australia	www.green.net.au/srd
Sprawl City, US	www.sprawlcity.org
Sprawl Watch Clearinghouse, US	www.sprawlwatch.org
Sustain Western Maine, US	www.mainewest.com/swm
Sustainability Project, US	www.cyberus.ca/choose.sustain
Sustainable Boston, US	www.ci.boston.ma.us/environment/sustain.asp
Sustainable City, San Francisco	www.sustainable-city.org
Sustainable Communities Network, US	www.sustainable.org
Sustainable Development Centre (US DO Energy)	www.sustainable.doe.gov
Sustainable Development Research Institute, Canada	www.sdri.ubc.ca
Sustainable Earth Electronic Library, US	www.envirolink.org/pubs/seel/about.html
Sustainable Industries, Australia	www.sustainindustries.org.au
Sustainable Measurements, US	www.sustainablemeasurements.com
Sutherland Council, NSW, Australia	www.sutherland.nsw.gov.au
Ted Trainer (Environmental Teacher/Writer)	www.arts.unsw.edu.au/socialwork/trainer.h

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Thoreau Centre for Sustainability, US	www.naturalstep.org
Tom Farrell Institute	www.newcastle.edu.au/research-centre/tfi
Transportation for Liveable Communities Net, US	www.tlcnetwork.org
UN Commission of Sustainable Development	www.un.org/esa/sustdev
UN Habitat	www.unchs.org
UN Sustainable Cities Programme	www.undp.org/un/habitat/scp/index.html
UNESCO Man and the Biosphere (MAB) Urban Group	www.unesco.orb/mab
Urban Advantage (digital), US	www.urban-advantage.ocm
Urban Ecology, US	www.urbanecology.org
Urban Futures, US	www.urbanfutures.org
Urban Regeneration Companies, UK	www.urcs-online.co.uk
Urban Photo, US	www.urbanphoto.org
Urbanisation Science Project IHDP	www.ihdp.uni-bonn.de
US Department of Housing and Urban Development	www.huduser.org
Vermont, US	www.vitalcommunities.org
Virtual Library on Sustainable Development, US	www.ulb.ac.be/ceese/meta/sustvl.html
Walkable Communities, US	www.walkable.org
Waterfront Regeneration Trust, US	www.waterfronttrust.com
Wiley Books (Sustainable Design)	www.interscience.wiley.com
World Business Council on SD	www.wbcasd.ch
World Watch Institute, UN	www.worldwatch.org
Wyong Council, NSW, Australia	www.wyong.nsw.gov.au
Wyong Land Care Network (Wycare)	www.wycare.org.au

Glossary

- Acid sulphate soils** Soils containing highly acidic soil horizons or layers resulting from the oxidation of soil material that are rich in sulphides
- Act** An act is ‘an order, law or judgment as of Parliament’ (Macquarie Dictionary 2005)
- Agenda 21** Agenda 21 is a detailed plan of actions dealing with all aspects of ecologically sustainable development and desirable national policies. The concept was agreed to by the national representatives at the United Nations Conference on Environment and Development (UNCED) at Rio de Janeiro in June 1992
- Agreement** Coming to an arrangement; a condition of agreeing (Macquarie Dictionary 2005)
- Area** A region (or other size) such as a *settled area* (Macquarie Dictionary 2006)
- Biodiversity** The variety of life forms, including the different plants, animals and micro organisms, the genes they contain and the ecosystems they form (Macquarie Dictionary 2005)
- Catchment** The area of land drained by a river and its tributaries (Macquarie Dictionary 2005)
- Catchment management** Coordination of land use and resource development within natural catchment areas rather than artificially defined areas or districts
- Climate change** Global changes in climate associated with the greenhouse effect, including the overall effects on climate of human made and natural changes
- Cultural land** Relating to tradition of Aboriginal lands (Macquarie Dictionary 2006)
- Development control plan** A local government plan prepared to provide detail on particular policies for certain types of development or geographical areas
- District** An area of land delineated by geographical features, and can also be an administrative area such as a sub-part of a city (Macquarie Dictionary 2006)
- Ecology** Branch of biology dealing with organism and their environment
- Environment** The aggregate of surrounding things, conditions or influences. Broad natural surrounding conditions, such as the bush, rivers, air, sea in which human and natural elements exist (Macquarie Dictionary 2005)

- Erosion** The removal of soil by running water, resulting in the formation of channels sufficiently large enough that they disrupt normal flow of water
- ESD** Ecologically Sustainable Development—using, conserving and enhancing the community's natural resources so that ecological processes on which life depends are maintained and the total quality of life, now and into the future, can be increased
- Framework** A structure composed of parts fitted and united together (Macquarie Dictionary 2006)
- Goal** A goal is 'that towards which effort is directed; an aim or end' (The Macquarie Dictionary 2006)
- Groundwater** Water beneath the surface held in or moving through saturated layers of soil, sediment or rock
- Impacted** Impinging upon or influencing
- Indicator** Recording variations, reactions or changes affecting a system
- Kyoto** Agreement under the United Nations as signed by nations effective when Russia signed in September 2004; requires nations to reduce greenhouse gases
- Landcare** A scheme to assist groups of people (name registered by government of Victoria in 1986) in land conservation, including activities as wide as erosion control, planning, planting native vegetation and community awareness raising
- Limits to growth** The title of a book published in 1972 by the Club of Rome with predictions of severe consequences if the world's population and resource use continued to grow
- Littoral** Pertaining to the shore of a lake, sea or ocean
- Local** Characterised by place as in local situation (Macquarie Dictionary 2006)
- Local environment** An environment limited to a particular place or small area. Also relates to parts of an area as of a system
- Natural capital** Potential wealth in resources and the environment due to their original natural qualities, as against human made capital due to human activities
- Neighbourhood** A district or locality with reference to boundaries
- PH** A measure of the degree of acidity or alkalinity
- Potential acid** Potential acid sulphate soils which contain iron sulphides or sulphides material which have not been exposed to air and oxidised
- Precinct** A space of definite or understood limits and its environs (Macquarie Dictionary 2005)
- Principle** A principle is 'a rule or law exemplified in natural phenomena' (The Macquarie Dictionary 2005)
- Program** A plan to be followed
- Protocol** A protocol is 'rules of behaviour to be agreed upon by heads of organizations' (Macquarie Dictionary 2005)
- Report** A report is 'a statement in reply to inquiry as a result of an investigation' (Macquarie Dictionary 2005)
- Riparian** Vegetation on the banks of rivers, creeks and streams
- Seniors area** A planning term relating to areas set aside for older aged group living
- Sensitive** Affected by external agencies or influences; affected by small amounts of change (Macquarie Dictionary 2005)

Standard A basis of comparing things of a similar nature. Serving as a basis or measure or value (Macquarie Dictionary 2005)

Suburb A part of a district or local government area

Sustainability Managing our natural resources in a way that maintains their environment, economic and cultural values, so that they continue to be available in the long-term

Threatened To be a subject to danger or high risk, as in threatened species being at risk of extinction

Urban Relation to a city or town (Macquarie Dictionary 2006)

Vulnerable Susceptible to physical impact; not protected or immune

Wetlands Land area along fresh and salt water courses that are flooded all or part of the time, leading to the development of a characteristic suite of plant and animal communities

About the Authors



Dr. Ray Charles Rauscher was born in Bushwick, Brooklyn, New York City in 1943. He graduated from Bushwick Highschool (1961) and received his bachelor of engineering (civil) at the City College of New York (1966). He is a dual citizen of Australia and the US. He served in Vietnam in the US Corps of Engineers (1967/68). He is currently a director of Habitat Association for Arts and Environment (www.habitatassociation.com.au).

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Index

A

Aboriginal cultural sites, 50, 53, 54
ACF. *See* Australian Conservation Foundation (ACF)
Acid sulphates, 50, 51, 53, 75, 78, 83, 121, 122
Agenda 21, 2, 8–10, 45, 114, 121
Air quality, 94, 95
Allan, T.F.H., 87
American Planning Institute, 26
Aplin, G., 2, 13, 31
Aquatic plant life, 38, 47, 52, 81, 82, 84
Archibugi, F., 26
Area surveys, 38, 39, 43, 73–84, 94, 102, 103
Australian Conservation Foundation (ACF), 14, 27, 28, 114

B

Balfors, B., 30
Barton, H., 27, 28
Basix. *See* Building and sustainability index (Basix)
Beatley, T., 29, 95
Beder, S., 13
Bell, F., 13
Benn, S., 2
Bertugia, C.S., 26
Bio-banked areas, 50
Biodiversity, 6, 10, 14–18, 23, 27, 30, 39, 40, 45–47, 49, 51, 52, 58, 63, 69, 80, 85, 87, 121
Bioregional planning, 27
Bithas, K.P., 95
Brandon, P.S., 30, 95

Brown, D., 10, 31, 95
Building and sustainability index (Basix), 6, 21, 24, 45, 51
Buildings, 5, 6, 21, 24, 26, 28, 30, 82, 93, 101, 103, 104, 107–109
Bushfire Regulations Act, 22

C

CAP. *See* Catchment action plan (CAP)
Caring for the Earth, 11, 12
Catchment action plan (CAP), 22, 63, 66
Catchment Management Act, 19, 20
Catchment management authority(ies) (CMAs), 19, 21, 22, 24, 27
Climate change, 1, 8, 10, 13, 16, 18, 39, 46, 47, 66, 107, 114, 116, 121
CMAs. *See* Catchment management authority(ies) (CMAs)
Commonwealth, 6, 7, 14–19, 24, 27, 29, 37, 46, 51, 55, 73, 103, 104, 115
Commonwealth Services in Industry and Research Organisation (CSIRO), 6, 7, 25, 31, 46, 51
Communications, 93, 104
Compact cities, 26
Corridors, 47, 49, 50, 52, 54, 57, 65, 80–82, 85, 108
Crilly, M., 29, 30
Crofts, D., 26
Crowe, N., 30
CSIRO. *See* Commonwealth Services in Industry and Research Organisation (CSIRO)
Cycle ways, 94–96

D

- Data sources, 3, 37–39, 41, 43, 45–55, 73, 82, 92, 95, 101–103
- DECC. *See* Department of Environment and Climate Change (DECC)
- Declaration of the UN, 7–9
- DEH. *See* Department of Environment and Heritage (DEH)
- Department of Conservation, 39
- Department of Environment and Climate Change (DECC), 39, 46
- Department of Environment and Heritage (DEH), 46
- Department of Infrastructure, Planning and Natural Resources, 62
- Department of Planning, 46, 51, 59, 60, 62–65, 69
- Department of Planning and Infrastructure (DoPI), 65, 114

E

- Eco-accounting, 27, 28
- Eco-design, 27, 107, 110
- Ecological foot printing, 27, 28
- Ecologically sustainable development (ESD), 1–3, 5–27, 29–31, 37–39, 41, 45–47, 54, 55, 60, 62–64, 66–70, 73, 92, 93, 95, 103, 104, 107–110, 121, 122
- Ecology, 87, 117, 121
- Ecosystem, 13, 25, 28, 29, 31, 49, 114, 115, 121
- Edge habitat, 47, 52, 81, 82, 85
- Energy, 6, 10, 16, 18, 21, 24, 26, 28, 30, 47, 68, 69, 93, 104, 107, 109
- Engwicht, D., 27
- Environmental fragments, 52, 81
- Environmental Law Institute, 47
- Environment Australia (EA), 46, 115
- Environment Protection Authority, 46
- Ericksen, N., 10
- ESD. *See* Ecologically sustainable development (ESD)
- European cultural sites, 50, 53

F

- Fincher, R., 28
- Flannery, T., 1
- Footpaths, 94–96
- Forman, R.T.T., 87
- Forster, C., 26
- Fossil fuel, 94–96

- Framework, 3, 5, 10, 11, 14, 15, 25–31, 37–39, 43, 47, 64, 85, 92, 93, 95, 97, 99, 101–105, 122

G

- Gap habitat, 47, 52, 74, 81, 85
- Geological formations, 50, 53
- Gore, A., 1, 13, 14, 31
- Gosford City Council, 66, 115
- Grant, J., 29
- Greenhouse gases, 1, 6–11, 16, 18, 46, 47, 51, 93, 104, 122
- Greenhouse Gas Reduction (Kyoto), 8, 10
- Greenpeace Australia, 28
- Grosvenor, M., 1
- Groundwater, 51, 53, 122
- Growth Centres Commissions Act, 22, 24
- Growth regions, 64, 91, 99

H

- Hart, M., 47
- Hillier, J., 5
- Hollick, M., 27
- Hornsby Council, 24, 45, 115
- Hunter Central Rivers, 27, 66
- Hyde, R., 30

I

- Indicators of sustainability, 3, 6, 7, 10, 14, 23, 29, 30, 37–40, 43, 45–55, 57, 58, 73, 82, 85, 92, 94, 95, 97, 101–104
- Inoguchi, T., 28
- Intergovernmental Agreement, 14, 15, 19
- International Union for Conservation of Nature and Natural Resources (IUCNNR), 11, 12

K

- Kareiva, P., 87
- Kemp, R., 6
- Kyoto Agreement, 122

L

- Landcare, 122
- Landcom, 46, 107
- Land use planning, 3, 25–27, 29–31, 60, 62, 65, 67, 69, 70, 103
- Li, K., 93
- Limits to growth, 12, 27, 28, 122

Living Planet Report, 12, 13
 Local Agenda 21 (LA21), 8, 9, 47
 Local environments (LE), 37–39, 41, 43, 73–82,
 84–87, 89, 92, 102, 103, 115, 122
 Local government (LG), 5, 7–10, 14, 15, 20,
 21, 23–25, 27, 30, 37, 38, 41, 42, 45,
 46, 55, 74, 104, 121
 Local Government Act 1993, 20, 23
 Lomberg, B., 1, 28
 Lovins, L., 1, 5
 Lowe, I., 5, 14
 Low, N., 7

M

Manchester City Council, 30
 Manly Council, 24, 46
 Marine life, 39–40, 47, 52, 81
 McHarg, I., 27, 38
 McKay, D., 15, 24, 26, 29
 Meadows, D., 11
 Mortberg, U., 30

N

National Action Plan for Salinity and Water
 Quality, 16, 18, 19
 National Biodiversity Strategy, 14, 15
 National Energy Conservation Act, 16, 18
 National Greenhouse and Climate Protection
 Act 2000, 16
 National Local Government Biodiversity
 Strategy, 14, 15
 National Strategy for Ecologically Sustainable
 Development, 14, 15
 National Waste Reduction, 16, 18
 National Water Sharing Reduction Scheme,
 17, 18
 Native vegetation, 21, 23, 24, 47, 52, 78,
 80–82, 85, 122
 Native Vegetation Conservation Act, 21, 22
 Native Vegetation Regulations, 22, 24
 Natural Heritage Trust Act, 15, 17, 19
 Natural resource planning, 19, 22, 25, 27–31,
 60, 63, 65, 67, 69, 70, 103
 Natural Resources Management Reform
 Report, 21, 23, 24
 Neighbourhood, 26–29, 110, 122
 Newcastle City Council, 24, 26, 45, 46, 116
 Newman, P., 5, 26, 29, 31, 95
 New South Wales (NSW), 6, 7, 10, 19–25, 38,
 39, 46, 47, 51, 53, 54, 57, 60, 62–66,
 69, 73, 103, 104, 107–110, 114–117
 New urbanism, 26, 69, 116

NSW. *See* New South Wales (NSW)
 NSW State of Environment Reporting
 Act, 20, 23
 Nutrients, 38, 39, 47, 51–54, 78–82, 88

O

O'Regan, B., 30

P

Packard, S., 28
 Peet, J., 2
 Petschow, U., 6
 Phillips, C., 30
 Planning NSW (PNSW), 26, 62–64, 66
 Political Declaration and Plan of
 Implementation (Johannesburg), 6, 9
 Pollutants, 38, 79, 94, 95
 Port Stephens, 10, 45
 Protection of the Environment Administration
 Act 1979, 19, 20, 23
 Protocols, 6–10, 12–18, 20–22, 122

R

Rauscher, R., 24, 26, 27, 94, 95
 Ravetz, J., 29
 Recreation, 93, 104
 Redefining progress, 116
 Rio Declaration on Environment and
 Development, 8, 23
 Rio Summit, 6, 9, 14, 26
 Roberts, P., 1
 Rocky Mountain Institute, 28, 116
 Rose, M., 26

S

Safety, 53, 94–96
 Sahely, H.R., 30
 Salinity, 16, 18, 46, 50, 51, 53, 83
 Saul, J.R., 5
 Scanlon, 39, 101, 103
 SoE. *See* State of environment (SoE)
 Spencer, M., 30
 State government, 19, 26, 27, 46, 60, 75
 State of environment (SoE), 14, 16, 18, 20, 23,
 38, 43, 63, 68, 70, 74, 79, 103
 State of Environment Report, 16, 18, 20, 23,
 41, 54, 104
 Stern Report, 9, 10, 18
 Stillwell, F., 27
 Stimson, R., 29

- Stocker, L., 5
- Sustainability, 1–31, 37–55, 57, 58, 60, 62, 65, 66, 70, 73, 74, 82–99, 101–104, 108, 110, 116, 123
- Sustainability criteria, 4, 6, 7, 93
- Sustainability frameworks, 5, 29, 101
- Sustainability planning, 24, 25, 60, 70
- Sustainability ratings, 3, 40, 41, 43, 83–85, 87, 92, 95, 97, 102–104
- Sustainability reports, 3, 18, 37, 38, 41–43, 46, 49, 74, 82–89, 91, 92, 95, 97, 99, 102, 103
- Sustainability score cards, 38–40, 43, 44, 74, 82–92, 94–99, 103
- Sustainable cities, 6, 9, 11, 17–19, 26, 31, 116, 117
- Sustainable Development Research Institute, 116
- Sustainable transport, 26, 62
- Sustainable urban planning, 2, 3, 18, 25, 29–31, 63, 64, 66, 68–70, 93, 103, 114
- Suzuki, D., 1
- Swamy, C.R.N., 28
- T**
- Tatray, T., 28
- TEC. *See* Total Environment Centre (TEC)
- Theosophy Society, 28
- Threatened species, 21, 23, 49, 50, 69, 123
- Threatened Species Conservation Act, 21, 23, 69
- Tisdell, C.A., 29
- Total Environment Centre (TEC), 47
- Trainer, T., 5, 7
- Transport, 6, 22, 26, 62, 64, 65, 93–97, 99, 102–104
- Troy, P., 5
- U**
- UN Commission of Sustainable Development, 8, 47, 117
- United Nations (UN), 1, 2, 6–12, 14, 23, 28, 47, 115, 117, 121
- United Nations Global Environment Outlook, 9
- UN Sustainable Cities Program, 9, 10, 117
- Upper Parramatta River Catchment Trust, 27
- Urban Land Institute, 26, 30
- Urban planning, 1, 3–31, 37, 60, 62, 64–70, 87, 101–105, 114–117
- Urban settlements, 60
- V**
- Van de Kerkhof, M., 5
- Vegetation fragments, 49
- Voss, J.P., 6
- W**
- Walker, B., 27
- Walsh, F., 5
- Waste, 1, 16, 18, 21, 23, 24, 68, 93, 104, 109
- Water engineering, 93, 104
- Water quality, 18, 19, 26, 27, 38, 39, 45, 47, 52, 81
- Weeds, 38, 39, 47, 48, 52, 78, 79, 81, 82, 84
- Western Sydney Regional Organisation of Councils, 24
- Wetlands, 51, 57, 58, 74–76, 78, 80, 82, 123
- White, R.R., 30
- Wildlife corridors, 49, 80, 82, 108
- Wildlife protection, 50
- World Conservation Strategy, 11, 12
- Worldwatch Institute, 13, 47
- World Wildlife Fund (WWF), 1, 11–14, 28, 31
- Wyong Council, 57, 59, 64, 66–70, 74, 75, 79, 80, 117
- Z**
- Zachary, J., 29