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Sustainable Area Planning Framework for Ecologically Sustainable Development, Case Study Wyong Shire, NSW, Australia



Photo Note: Aerial photo (Willows Bend, Wyong Shire) is part of the North Wyong District case study area used within the thesis. See note on bottom of next page explaining the photo.

Source: Peter Adderley, Narara, Australia, 2004

Raymond Charles Rauscher
B. Engineering (Civil), M. Town and Country Planning

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FRONT PAGE PHOTO NOTE

1. Background

The photo on the cover shows the complexity of sensitive 'local environments' (LEs) within Willows Bend at Hamlyn Terrace, a thesis study area. Willows Bend was developed in 2004 within the urban release district of North Wyong (in Wyong Shire on the Central Coast north of Sydney, in the state of New South Wales, Australia). The area at Willows Bend represents a convergence of ecology and urban development issues. The photo navigation (below) takes the reader around the area with the thesis question posed: 'how do you measure the condition of environments (natural and built) to achieve sustainable communities'?

2. Navigating Photo

The reader can scan the photo counter clockwise as follows (with the Pacific Highway running north-south or top-to-bottom at the right): lower right of Pacific Highway is a designated wildlife corridor mostly within private developer ownership; the southern end of the corridor (off photo) is Settlers Reach, a village that commenced in 1998; lower and to left of Pacific Highway is being developed as an extension of the North Wyong Industrial Estate; left of Willows Bend subdivision is wetlands (vegetated) and left again is flood prone area (cleared); near top is over-50s relocatable village; top is the lower portion of land approved for 600 homes; top right is Wadalba Community School (k-12); below the school is Wadalba Central, a proposed central business district (CBD); adjacent to Wadalba Central to the right (off photo) are Figtree and Raintree Villages (commenced 1998); below the CBD is a treed area with approval for a 100 home subdivision; finally, coming back to the commencing point of the corridor.

Photo Source: Peter Adderley, Narara, Australia, 2004

STATEMENT OF ORIGINALITY

I hereby declare the work embodied in this thesis is the result of original research and has not been submitted for a higher degree to any other University or Institution.

(Signed)

Raymond Charles Rauscher

Dated.....

DEDICATION

I dedicate this research to:

My wife Diane M. (Parr) Rauscher; oldest child Anna M. (Rauscher) Rochford and husband Kevin; youngest child Maree K. (Rauscher) Wheelahan and husband Michael; late uncle Arthur E Rauscher (NYC); older sister Gracy (Rauscher) Riccio and husband Frankie (NYC); brother Arthur E. Rauscher (Jr.) and wife Barbara (NYC); younger sister Joyce (Rauscher) Martin and husband Richard (NYC); brother-in-law John Walsh and wife Yvonne (Parr) Walsh (Sydney); and all of the children and grandchildren associated with these families.

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ACRONYMS

ABS	Australian Bureau of Statistics
ACF	Australian Conservation Foundation
BASIX	Building Sustainability Index
CAP	Catchment Action Plan
CMA	Catchment Management Authority
CSIRO	Commonwealth Services in Industry and Research Organisation
CuM	cubic meters
DIPNR	Department of Planning and Natural Resources
DECC	Department of Conservation and Climate Change
DoP	Department of Planning
EA	Environment Australia
ESD	ecologically sustainable development
GMR	Greater Metropolitan Region of Sydney
GWJWA	Gosford Wyong Joint Water Authority
HCRCA	Hunter Coast Rivers Catchment Management Authority
ICLEI	International Council for Local Environmental Initiatives
IUCNNR	International Union for Conservation of Nature and Natural Resources
LA21	Local Agenda 21
LG	local government
LGA	local government area
LHCCREMS	Lower Hunter Central Coast Regional Environment Management Study
LEP	local environmental plan
NABERS	National Australian Built Environment Ratings System
NEMP	Newcastle Environmental Management Plan
NHT	Natural Heritage Trust
NGO	Non-government Organisation
NSW	New South Wales
PVP	Property Vegetation Plan
SAP	sustainable area planning
SEDA	Sustainable Energy Development Agency (NSW)
SoE	State of Environment
TBL	triple bottom line
UN	United Nations
WSC	Wyong Shire Council
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WWF	World Wildlife Fund

ABSTRACT

The thesis is partly a response to the increasing numbers of people expressing concerns over a number of environmental issues (i.e. impact of climate change; greenhouse gas emissions; and, depleting natural resources). Governments, in response, are trying to develop a more sustainable approach to urban development. The thesis proposes a sustainable area planning (SAP) framework to incorporate sustainability principles (social/cultural, environmental, and economic) in urban planning within different sized areas, including: local; district; local government; and, region.

The thesis examines current urban planning schools (land use planning, natural resource planning and sustainable urban planning). The research focuses on the extent that these schools incorporate principles of sustainability within urban planning frameworks. The research aims to condense and build on these frameworks to develop a more coordinated and holistic framework.

The proposed SAP framework is a five (5) step process with templates developed to accompany each step. The thesis acknowledges the wide range of sustainability data sources available, and shows how these sources can be utilized within the framework. Both qualitative (i.e. SAP survey step) and quantitative (i.e. SAP sustainability scorecard step) methods are used within the framework. A case study urban growth area of North Wyong District (in the Greater Metropolitan Region of Sydney) is nominated to test the framework.

As the framework is developed, questions posed on how best to measure the environment leads to the development of indicators of sustainability. Sustainability

scorecards are also developed to record these indicators of sustainability. A system of sustainability ratings (using green, amber and red) is proposed. The thesis then tests aggregating (scaling up) these ratings to larger areas. The final research aim is to test whether the scorecard results can form the basis of a sustainability report (with actions and monitoring components) for a subject area.

The thesis draws a conclusion that the SAP framework does work and can be used as a tool to incorporate principles of sustainability into urban planning. Finally, suggested future research directions are outlined, including: 1. adopting a systems program for the SAP framework application; 2. using the framework for environmental performance monitoring; and, 3. broadening the framework to accommodate the social and economic components of sustainability.

Chapter 1: THESIS OVERVIEW

1.1 Introduction

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 are often environmental and 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 thesis focuses 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 (UN 1997a). An additional report on climate change by the International Panel on Climate Change (UN 2007) reinforced earlier calls for governments to act collectively on this issue. Finally, in an unprecedented stance, the world's leading churches in 2007 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: Lomborg (2004), Roberts (2004), Alpin (2006), Flannery (2006), Gore (2006, 2007), Stern (2006), Suzuki (2006), and Grosvenor (2007). The writers' comments often tied these highlighted environmental problems to urban growth. The thrust of this phenomenon in many countries is the 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 testing the proposed SAP framework.

Wyong Shire, an outer Sydney growth area, was selected as a thesis case study area. The object was to develop and test a framework for sustainable area planning (herein referred to as SAP). Observations of environmental impacts within Wyong Shire during the period of research (2002-2008) reflected the same environmental impacts summarised by the writers as noted above. By the end of 2007, for example, a number of environmental concerns (i.e. drought, increased bush fire dangers) had been raised within Wyong Shire (WC 2007a). Both Wyong and Gosford Councils also raised concerns about water shortages (GWCJWA 2007). In a further report (WC 2007b) environmental matters relating to State and Australia-wide circumstances were raised including: global temperature changes; renewable energy sources; peak crude petroleum and alternative fuels; and, loss of biodiversity. These concerns were expressed by other councils in outer Sydney growth areas such as within Sydney's western suburbs (WSROC 2006). To start to address these concerns within growth areas a sustainability framework is required.

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 p1419). ‘ESD’ definition under the United Nations *Agenda 21* (Principle 3) (UN 1992a p9) is “development fulfilled equitably to meet developmental and environmental needs of present and future generations” (Fig 2.1). The three ESD components (social/cultural, environmental and economic) are now widely accepted (UN 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 2003) requires companies to balance the components of sustainability.

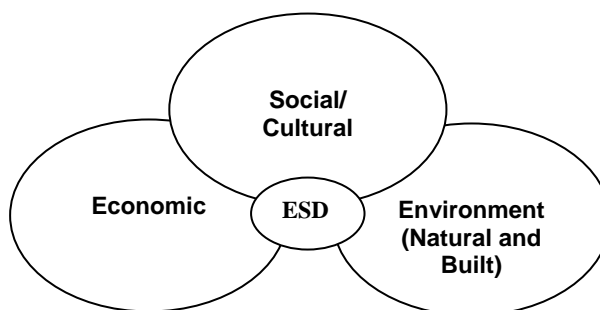


Figure 1.1 ESD Components – Equal Weight ((Source: UN Agenda 21) (1992a))

There are, however, other models of sustainability (Aplin 2006). While the above model shows the three ESD components of equal importance (hence the ‘equal weight’ model), there is a more recently quoted version (Peet 2002) (Fig 2.2). 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 thesis encompasses this model using the ‘the biosphere’ component (referred to in the thesis as the ‘natural environment’ component).

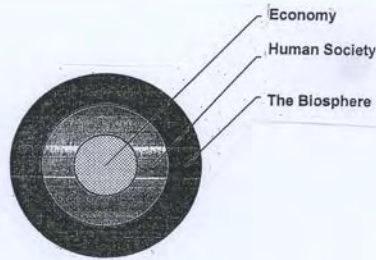


Figure 1.2 ESD Components – Balance to Environment (Source: Peet, J. 2002)

In summary, the two models noted present a basis to start an analysis of sustainability and ESD. There are questions, however, that arise in looking at the subject of sustainability within local areas, such as: how to measure impacts in local areas; how to use indicators of sustainability measurements to fit different sized areas; and, how sustainability reports can (with recommendations and monitoring components) be adopted. To answer these questions, the thesis proposes the SAP framework.

1.2 Hypothesis

The thesis hypothesis put forward is that a Sustainable Area Planning (SAP) framework can be developed to incorporate sustainability in urban planning within different sized areas, including: local; district; local government; and, region.

1.3 Research Aims

The main aim of the thesis is to develop a SAP framework and test it on a local area. Once results are evaluated it is proposed the framework be applied to larger areas. The

thesis adopts the term 'local area'. A local area is 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' contains a defined number of regions).

The proposed SAP framework is built around the application of indicators of sustainability. Sustainability ratings are proposed to assign a value to both environmental components and local areas. The ratings are included within a sustainability scorecard. It is further proposed to aggregate these ratings scaling up from local areas to district, LGA and regional levels. A final step is to translate these scorecards into a sustainability report for any sized area from local to regional. This report contains the required actions to address unsustainable ratings and to monitor these actions. The report compliments and expands upon state of environment reporting. In testing the framework, the environment (natural and built) component of sustainability is proposed. The thesis proposes, however, that the framework, with further testing, can equally be applied to the social/cultural and economic components of sustainability. The thesis acknowledges the importance of interactivity of sustainability components and that this needs to be addressed in applying the framework to all components.

1.4 Research Questions

Research questions that arise include:

1. Can a SAP framework incorporate a sustainability scorecard and a sustainability report (containing actions to be taken)?
2. Can a SAP framework be applied to different sized areas (i.e. local area, district, LGA and region)?
3. Will the SAP framework be an advance on current ESD based urban planning frameworks?

1.5 Research Objectives

To address the research questions, research objectives include: 1. to propose a SAP framework to apply to: local areas, districts, LGAs, and regions; 2. to test the proposed SAP framework on the natural and built environments; and, 3. to adopt a final SAP framework based on the test results.

1.6 Literature Review

Having established the research objectives, a literature review was undertaken. The literature review (Chapter 2) is a first step in examining the subject of creating a SAP framework. This review is completed over three subject areas, including:

1. sustainability and ESD; 2. critique of ESD related documents; and, 3. ESD based sustainable urban planning frameworks. The third review area (urban planning frameworks) centres on three planning schools (land use planning, natural resource planning and sustainable urban planning). Of shared importance is the incorporation of sustainability principles into all three planning schools.

1.7 Research Methodology

This literature review is followed by an outline of research methodology (Chapter 3). The methodology outlines the proposed SAP framework, sustainability ratings, and SAP templates. A key to the methodology is the approach to the development of the SAP framework steps and applying these steps.

1.8 Research Steps

The selection of data sources and indicators of sustainability is undertaken in Chapter 4. The existence of a large number of data sources at various levels of government can be tapped into within the SAP framework. Within the next research step the case study area is nominated and its planning background examined (Chapter 5).

Part Two of the research includes the application of the proposed SAP framework to the natural environment of the study area (Chapters 6 and 7). A test is also applied on aggregating (or scaled up) sustainability ratings (within scorecards) from local level to district, LGA and regional levels. The conclusions drawn on aggregating will contribute to the proposed sustainability report (uses the scorecard results). Using research results from this application to the natural environment, the framework is then applied to the built environment (Chapter 8). This application is the district level (as against the local area level) given the need for a larger catchment to use 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). Reviewing all results (natural and built environment tests), the final SAP framework is then adopted. Research conclusions are drawn and future research directions outlined (Chapter 9).

Chapter Summary and Conclusions

This chapter presented the thesis overview. The introduction summarised worldwide concerns expressed (especially in the early 2000s) about deteriorating environments. Key authors and authorities who examined these concerns were referred to. A local (Wyang Shire) expression of these concerns was also referred to. A conclusion was reached that these worldwide (and Wyong Shire) expressed concerns were validated by these authors and authorities. The chapter then examined the definitions and background to 'sustainability' (environment, social/cultural and economic balance).

A hypothesis was put forward that a sustainable area planning (SAP) framework can be developed to incorporate sustainability into urban planning at the local area, district, local government area, and regional levels. Research aims, including definitions of different sized urban areas, were then outlined. A main aim of applying indicators of sustainability and obtaining sustainability ratings within a scorecard was explained. A further aim of developing a sustainability report to translate the scorecard results into actions and monitoring was explained.

Following the statement of aims, the research objectives were outlined. Examining these objectives, research questions were posed. The literature review was then outlined, including its importance as a first step in examining the subject of sustainability and sustainable based urban planning. Finally, research methodology and research steps were outlined.

Chapter 2: LITERATURE REVIEW

2.1: Introduction

Since post World War Two, a great number of urban settlements have expanded beyond metropolitan areas. The operations of these outer urban areas have generally accelerated environmental impacts (Girardet 1996). One challenge for regional and local government authorities within these newly expanding areas is to develop ESD based urban planning practices. This type of urban planning aims to incorporate ESD criteria into the full range of ESD components – environmental, social/cultural and economic. As noted in the previous chapter, sustainability and ESD are complex and evolving concepts. Given this complexity, and the research aim of developing a sustainable area planning (SAP) framework, a literature review is essential.

The literature review is undertaken to assess current knowledge of the thesis topic, including: sustainability and ESD; history of ESD related documents (protocols, acts, agreements, reports and programs); and, ESD based urban planning frameworks. A key search in the literature review is to identify emerging trends and concepts of governments moving to adopt sustainability frameworks in urban planning. The chapter thus reviews changes in the schools of urban planning, including: land use; natural resource; and sustainability planning.

2.2: 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 had earlier stated, in a similar position, that society needs to find a more balanced and simpler way of building cities/regions. Trainer 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) emphasized 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) introduced 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. More recently, Lowe (2005) advocates 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 emphasize the importance of the social/cultural component of ESD. Stocker (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 (2002). Within the social/cultural ESD component questions of governance and the political processes also arise. Newman (1999) explores this aspect around the subject of applying sustainability criteria for planning cities, in particular transport. Other authors, including Kemp (2005), Petschow (2005), and Voss (2006), have focused on

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

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 2.3). 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.

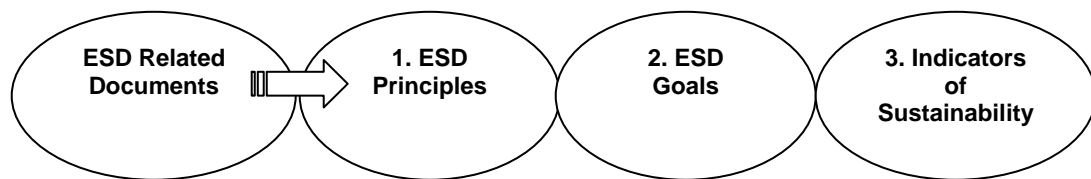


Figure 2.3 – ESD Related Documents and ESD Criteria

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* (UN 1992b) (herein called the Rio Summit Report). The Rio Summit Report contains a declaration with

Dictionary 2005 p479).

twenty seven 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)* (UN 2002b); b. national (i.e. *Sustainable Cities* (Commonwealth 2005), 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 2002a). The CSIRO argues that authorities and communities will need to select key ESD principles to confront current declining environments and future threats to the environment. Key ESD principles current in Australia, CSIRO points out, include: minimizing global warming; protecting biodiversity; conserving water; minimizing 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 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 urbanization (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 2002a), 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 (now 21m) 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 lays 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 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.

2.3: Critique of 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 nominated in Chapter 5. The purpose of each document and a critique of the impact of the document are now advanced.

2.3.1 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* (UN 1972). This declaration was the first multi-nation agreement to provide guidelines for nations to move to more sustainable human environments (environment, social/cultural and economic). Twenty years after this declaration the *United Nations Conference on Environment and Development Report* (UN 1992b) (referred to as the Rio Summit) was convened, attracting 178 nations. The central international protocol, Agenda 21, relates to ESD and came out of that conference (UN 1992a). Agenda 21 is a global action plan for sustainability. The document lays out key procedures for governments to adopt ESD strategies.

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> (UN 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> (UN 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> (UN 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> (UN 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> (UN 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> (UN 2000)	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.
1.7	2000	28	Pr <i>UN Sustainable Cities Program</i> (UN 2000)	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> (UN 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> (2007Her 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 CO2 reductions.
1.10	2007	35	R <i>United Nations' Global Environment Outlook-4</i>	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'.

In moving beyond Agenda 21, the UN developed *Local Agenda 21* (UN 1993) from one chapter (Chapter 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* (UN 1997) 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 Greater Metropolitan Region (Sydney/Illawarra/Central Coast/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* (UN 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* (UN 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) (UN 1997). 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. Finally, the *Stern Report* (2007) 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.

Seeking a review of progress on Agenda 21 and subsequent protocols, the UN convened in 2002 the *World Summit on Sustainable Development* (UN 2002a). The World Summit adopted the *Political Declaration and Plan of Implementation* (UN 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. With nations such as New Zealand plan making was changed to accommodate sustainability principles (Ericksen 2004). The plan making framework incorporating sustainability as practiced in New Zealand is summarised by Ericksen (2004). Within 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 twenty nine (29) years, for example, between the first protocol on an ESD related matters (UN 1972) and the Kyoto protocol (UN 1997). And it was thirty five (35) years for a comprehensive state of global warming impacts to be issued (Stern 2007). 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 current Kyoto Protocol debate highlights the tensions that can arise in nations unwilling to accept targets (i.e. cap on greenhouse gas emissions). These include: the debate between the rich and poor nations; the unwillingness of some nations (i.e. USA) to sign; emerging economies such as China and India; and. general expanding industrialisation around the world. These trends reinforce the importance of the Kyoto Protocol as essential to reverse the greenhouse gas impact trends.

2.3.2 International Non-government Organisations (NGOs)

In addition to governments producing ESD related documents, many international non-government organizations (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 organizations 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 applicable to the interests and geographical areas that these organisations are active within.

Table 2.2: ESD Related Documents at International Non-government Organisations (NGOs)

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 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> (WWF 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.
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.

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 thirty years was taken up by Meadows (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 organizations adopted the *World Conservation Strategy* (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 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; minimize 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 launched a campaign for sustainable European network of cities and towns by grouping more than 540 local authorities in formulating policies to promote sustainability. Finally, the WWF produced the *Living Planet Report* (WWF 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 often 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 (Alpin 1996). 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.

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

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 proactive in alerting governments. Key NGO documents (Table 2.2) have contributed to the debate around national actions on climate change (Stern 2007). 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 recent testimony 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.

2.3.3 Commonwealth

The Commonwealth 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 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, recognizing the global dimension.

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 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 1992a)	Coordinating role of Commonwealth on matters of national environmental significance	This agreement has been criticized for not being fully implemented by the Commonwealth
3.3	1992	2	R <i>National Strategy for Ecologically Sustainable Development</i> (Commonwealth 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 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 1998c)	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 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.
3.7	1999	9	A <i>Commonwealth Environmental Protection and Conservation Act 1999</i> (Commonwealth 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 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 2001)	To reduce salinity and to improve water quality	This plan recognizes the extent of the problem of salinity across major sections of Australia.
3.10	2002	12	R <i>State of Environment Report</i> (Commonwealth 2006)	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. Commonwealth cont.					
✓ = 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
3.11	2002	12	A <i>National Energy Conservation Act</i> (Commonwealth 2002)	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 2002)	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 2003)	Illustrates global warming concerns and potential impact of global change on biodiversity	This report further outlines the climate change impacts.
3.14	2005	15	Pr <i>National Water Sharing Reduction Scheme</i> (Commonwealth 2005b)	Introduces procedures for water sharing programs	This scheme recognizes the extent of the water provision problem across the nation.
3.15	2005	15	R <i>Sustainable Cities</i> (Commonwealth 2005)	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 2007b)	The report is a summary of the inquiry into a sustainability charter, stemming from the Sustainable Cities (2005) 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.

Many countries, including Australia, responded to the Rio Summit (UN 1992b) as noted earlier. Australia adopted a number of national ESD environmental acts commencing with the *Intergovernmental Agreement on the Environment* (IAE) (Commonwealth 1992a). This agreement emphasizes the coordinating role of the Commonwealth Government in matters of national environmental significance. The agreement also recognizes the importance of local government in developing environmental policies and councils being responsible for their environments. The Commonwealth, however,

has been criticized for not fully implementing this agreement. The *National Strategy for Ecologically Sustainable Development* (Commonwealth 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 2007).

To specifically address biodiversity the Commonwealth adopted the *National Biodiversity Strategy* (Commonwealth 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 government (2006a) 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 1998). 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.

To further strengthen environmental protection and biodiversity conservation, the *Natural Heritage Trust Act* (Commonwealth 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 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 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 2001a) 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 2005) as a guide to authorities having to produce a SoE report. By 2007, a further *State of the Environment Report* (Commonwealth 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 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 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 (Mar 2008). A major Australian climate change report in 2003 was the *Climate Change Impacts on Biodiversity in Australia* (Commonwealth 2003). This report illustrates global warming concerns and the potential impact on biodiversity.

Australia at Nov 2007, however, had not signed the international Kyoto Protocol (noted earlier). The Commonwealth Government argued that the recommended targets under Kyoto were too harsh on resource rich countries such as Australia. By Nov 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* (2007), 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 Nov 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 2005a) was introduced. The scheme recognized the extent of water provision problems over most of Australia. On a broader basis, in 2005 the Commonwealth received the *Sustainable Cities* (Commonwealth 2005b) 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 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 1000 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 adoption of Commonwealth documents and follow up actions. Fifteen (15) years (1992-2007) after the *Intergovernmental Agreement on the Environment* (Commonwealth 1992) was enacted few actions had emanated from the agreement. In 2005 the *Sustainable Cities* (Commonwealth 2005b) had highlighted the need for the Commonwealth and States to consider greater implementation of ESD related actions in urban development matters. By Mar 2008 the Australian Parliament was still to consider various recommendations on this report (Commonwealth 2007c).

2.3.4 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). 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.

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 two years, with a supplementary report between the two 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.
4.6	1995	16	A <i>Threatened Species Conservation Act 1995</i> (NSW 1995a)	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. NSW State cont.					
✓ = 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
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.
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 urbanizing areas on city edges and coasts.
4.13	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.
4.14	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.

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 2001) and the *Natural Heritage Trust Act* (Commonwealth 1998b) are two funding sources for the CMAs.

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. 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* (UN 1992a). 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 four 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 1995a) 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* (DIPNR 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* (DIPNR 2003b). Finally, the *Building and Sustainability Index (BASIX)* ((DoP 2000) program instigated 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 Mar 2008.

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 twenty seven (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 at Mar 2008.

In general, while acts were passed by the State, there remained in early 2008 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 2000a, Hornsby 2007, Manly 2007). Newcastle City Council had been particularly vigorous in pursuing the sustainability planning directions (McKay and Rauscher 2007). Newcastle developed a ten year program of 'pathways to sustainability'. That city's approach emphasized 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.

2.4: 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 2000a). 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 SAP framework as outlined in project webs (Attachment One). 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 urbanizing 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 2001-2005 continues

today. Resilience Alliance (www.resalliance.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, The subject of transitions (within complex systems such as sustainability) to alternative conditions is addressed by a number of authors, including Loorbach (2006), Rotmans (2001), and van der Brugge (2007). Important issues raised by these authors include the need to understand 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.

2.4.1: 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 thesis 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 Chapter 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 emphasizes 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 1990's 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 emphasizes greater efficiencies of urbanization 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. Stilwell (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.

2.4.2: 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 maximize biodiversity. 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) utilizes 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 (UN 1995) produced a handbook to help authorities around the world to utilize renewable energy approaches to reduce footprints. Tatray (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

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

measured to gain an overall rating of progress (i.e. achieving healthy and sustainable communities). As early as 1985 Tisdell (1985) argued that there are conflicting approaches between economists and ecologists. He argues that an approach to sustainable development would assist in defining the differences in these approaches. 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* (ABS 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.

2.4.3: 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 (1996) proposed a planning framework for the protection of landscapes and ecosystems for residential environments. Parham (1996) outlined the policies that are required to protect and enhance a whole ecosystem using ecological cities as frameworks. Given there have been a number of eco-villages already established, a thesis search was conducted to review how these villages incorporated sustainability principles (Appendix A) (see also earlier comments in this chapter on eco-cities). In general, the eco-villages subscribe to Grant's (1996) and Parham's (1996) frameworks. Finally, examining land requirements, Beatley (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. Zackary (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 (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 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 (2000) develops a framework for spatial urban design indicators and a methodological tool kit. Crilly (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 (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 (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 (2005) argues for a strategic environmental assessment. Balfors (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 (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. Browne (2005) also develops a framework to measure urban metabolic efficiency. His framework (within an Irish context) is called 'integrated sustainable cities assessment method (ISCAM). Browne (2005) simulates alternative scenarios and how they divert from more sustainable scenarios.

Finally, the current 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 2000a, WWF 2007). The issue is summarised by Newman (2008) in discussing cities as ecosystems and bioregion environments. Newman (2008) 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 Mar 2008, 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.

Chapter Summary and Conclusions

This chapter summarised results of a literature review, interpreting writings on three areas of literature, being: 1. sustainability and ESD; 2. history of ESD related documents (i.e. protocols, acts, agreements, reports and programs); and, 3. ESD based urban planning frameworks. The literature review drew a number of conclusions. Firstly, there is a wide divergence of definitions of sustainability and ESD. It was 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 was a time lag in governments acting on those reports. Thirdly, trends of governments moving towards ESD based urban planning frameworks were evident. This movement could be

detected in the literature reviewed under the 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 proposes the research methodology to develop such a framework.

Chapter 3: RESEARCH METHODOLOGY

3.1: Introduction

The literature review (Chapter 2) documented the gradual move by governments and schools of urban planning to measure the sustainability of urban and non-urban areas (from local areas to regions). It was concluded, however, this move was being done in an uncoordinated fashion and generally in the absence of frameworks. The review concluded that there was a demand for a framework to measure sustainability of these areas. This chapter outlines the research methodology proposed to develop this framework.

While the development and testing of the framework is built around one local area, the research will explore the aggregation of local area sustainability measurements to district, local government and regional levels. The methodology will need to incorporate a number of components, including: a framework structure; the method of testing that structure; drawing conclusions from the testing; and, adopting a framework based on those conclusions. These methodology components are now addressed.

3.2: SAP Framework Structure

A prime objective of this research is to develop the structure of the SAP framework. Urban planning, as reviewed in Chapter 2, provides a basis of for the SAP framework to be proposed. There are a number of shortcomings of existing frameworks. Firstly, the matrixes that are used generally fall short of full a comprehensive incorporation of indicators of sustainability (Archibugi 1997, Zackary 1999, and Hart 1999). Secondly, most of the frameworks are not structured to apply to local areas as being proposed

within the SAP framework. For example, where metabolic flows of inputs and outputs are suggested (Forster 1999, Stimson 1999) the areas required need to be on a city or regional scale. Thirdly, most of the current writers about frameworks do not focus on the current natural environment issues (i.e. greenhouse and climate change) that are likely to be affected by development, with the exception of Packard (1991) and Walker (1997). In the two latter instances there is insufficient indicator development to be applied to urbanising areas. Fourthly, many of the frameworks concentrate on the physical design (Engwicht, Barton, Brandon, Urban Land Institute and Manchester). There thus remains a need for a framework that accommodates both the physical and natural sustainable components such as suggested within the SAP framework (acknowledging further research would incorporate social/cultural and economic components). Finally, most of the frameworks examined are broad in approach, and do not lend themselves to examining sustainability. This thesis research aims at using the environmental component and to examine that component at different sized local areas.

There are additional factors to consider in developing a framework for incorporating ESD principles in urban planning. A scorecard means of recording sustainability of places needs to be developed. A sustainability report for local areas needs to also incorporate the means of noting actions to be taken and monitored. In summary there is a need for a framework that can be applied to local areas and that can be scaled up to larger areas such as a district, local government and region. The thesis proposes a sustainable area planning (SAP) framework to apply to a range of areas and to apply quantifiable indicators of sustainability. The proposed framework structure (Table 3.1) stems from the literature review and in particular the examination of current frameworks as critiqued.

Table 3.1: Proposed SAP Framework Structure

Step 1 Review ESD Related Documents	Step 2 Select Data Sources and Indicators of Sustainability	Step 3 Conduct Area Surveys	Step 4 Complete Sustainability Score Cards	Step 5 Adopt Sustainability Reports
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Step 1 involves reviewing ESD related documents (as reviewed in Chapter 2) that are relevant to the 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 any SAP framework.

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; Commonwealth; and, International. The selection of indicators of sustainability can be made from these data sources.

Step 3 involves conducting qualitative surveys of the local area, a major step of the SAP framework. The local area is broken into smaller components to survey and apply indicators of sustainability. These smaller area components (for research purposes) can be called 'local environments'. By definition 'local' is 'characterized by place' (Macquarie Dictionary 2006 p. 838); and, 'environment' is 'relating to natural system' (Macquarie Dictionary 2006 p. 475). 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.

The SAP survey is a qualitative exercise, including: field observations using ESD related documents (i.e. Tables 2.1 - 2.4); data sources (accepting that environmental elements do not remain constant) as referred to by many authors in Chapter 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 being surveyed and to compare these aerial photos with earlier ones (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 LEs and assessing these photos against relevant references; and, using historical photos as benchmarks of the environment over time. Interviews were held with a number of people from community organisations (i.e. precinct committee, progress association, and land care groups). This assisted in interpreting historical information and on ground qualitative observations of environmental impacts and changes to the environment over time.

In summary, the SAP survey (Table 3.2) enables recording with a tick a threat or impact for the natural environment elements (under A-D in column 1) within a local environment (LE) (LE1 - LE6 illustrated here as an example) (column 2). The table enables the recording of threats and impacts for all elements present in 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).

Table 3.2: Step 3 – SAP Area Survey Guide for Natural Environment

Natural Environment Component Elements	✓ = 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											
	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		✓						

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 HcHarg (1978) to more recent catchment area planning (HCRCMA 2007). It is important, in using qualitative survey results, to use descriptors for each category of 'stable', 'threat' (partly unstable) or 'impact' (unstable) result. Descriptors allow a clearer understanding of each state and thresholds of cross between states.

The field observations and photographs focus on identifying the essential elements within that area. This survey is conducted for each local environment of the study area. Under aquatic, for example, elements to be observed include: aquatic plant life; marine 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 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). A recent study (Scanlon 2006) assessed the Department of Environment and Climate Change (DECC) 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. '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.

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

Figure 3.1: Certification Flags – Terrestrial Biodiversity ESD Element
Source: Scanlon 2006) (Abridged)

The sustainability rating can utilise Scanlon's certification flags by extending these ratings into sustainability nomenclature. The use of qualitative scores to rate quantitative information is always problematic and thus is acknowledged. For application within the SAP framework the ratings adopted are: green as 'sustainable'; amber as 'threatened' (thus partly unsustainable); and, red as 'impacted' (thus unsustainable). Within the SAP framework 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 correctness.

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													
	Local Environments (LE1-LE6) within Local Area										G	A	R	
	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										

Having created sustainability scorecards, SAP 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 Chapter 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 (international, national, state and local).

Table 3.4: Step 5.1 – Sustainability Report of 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	A	R						
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								

The sustainability report card can also be interpreted by LEs (as against the ‘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 Chapter 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 Commonwealth ESD related documents (i.e. state of environment reports) are released or 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.

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								

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 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 3.6: Step 5.2 – Sustainability Score Card (Natural Environment) Scaled Up to District Level

Natural Environment Component Elements	Sustainability Ratings from Indicators Application								
	<div><div>G</div> (Green) = Sustainable</div> <div><div>A</div> (Amber) = Threatened</div> <div><div>R</div> (Red) = Impacted</div>								
		Local Areas (LAs) within District						Overall Ratings of Elements	
LA1			LA2	LA3	LA4				
<div>G</div>		<div>A</div>				<div>R</div>	<div>G</div>	<div>A</div>	<div>R</div>
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	<div>G</div>								
	<div>A</div>								
	<div>R</div>								

In conclusion, the draft framework will be developed around the natural environment, and subsequently applied to the built environment. The final framework will be based upon the results of these two applications (natural and built). The feasibility of applying the framework to the social and economic components of sustainability will be commented on at that stage.

Chapter Summary and Conclusions

This chapter outlined the research methodology. Using the results of the literature review (Chapter 2), a draft SAP framework structure was proposed. The chapter then outlined how each step of the structure would be applied. Several tables (templates) were constructed, 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. Finally, the Scanlon (2006) certification rating method was introduced. This method was considered appropriate in using for the SAP framework's sustainability ratings.

Having adopted the Scanlon certification rating method, the sustainability ratings were outlined, including: green as sustainable; amber (threatened); and, red as unsustainable (impacted) (Step 4). 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 SAP framework from local area to district size was illustrated.

Chapter 4: DATA SOURCES AND INDICATORS OF SUSTAINABILITY

4.1: Introduction

Sustainability data sources are required to be used within the SAP framework's application. Two important data sources are map databases and indicators of sustainability. These sources will be used to complete SAP Step 3 (area survey) and Step 4 (sustainability score card). The research relies initially on current data sources to avoid duplication by adopting new data. These sources will be expanded upon when the framework is applied in Chapters 6, 7 and 8.

4.2: Searching Data Sources

A search was undertaken of data sources that could be used in developing the SAP framework. From these data sources indicators of sustainability can be selected. These data sources were canvassed at different levels of government and NGOs, including: local; State; national; and, international (including NGOs).

At the local government level 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 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 1995). Council also adopted a set of *Sustainable Community Indicators* (Newcastle 2000b) 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 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 SAP framework.

Moving from local government, NSW State level data sources useful to the SAP framework application fall into the categories of atlases and land data sources. Under atlases, *iplan* (DoP 2007b) 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* (DECC 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 SAP framework application.

In addition to atlases there 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) (EPA 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 SAP framework 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 Commonwealth, there are a number of data sources available. The Environment Australia (EA) site, for example, provides links to

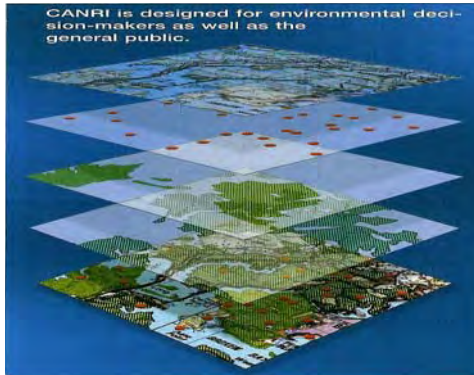
catchment mapping. Also, *Mapping Australia's Vegetation* (MAV) (CSIRO 2000b) provides data source on greenhouse gas emissions affected by land use changes. In addition the Commonwealth produced a booklet on the state of sustainability reporting in Australia (DEH 2005). Finally, the Commonwealth created a sustainable design data base for homeowners and industry to encourage better design of homes and urban environments under the Nabers program (Commonwealth 2006b). Finally, the Commonwealth (2003b) 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 (UN 1993) and model communities program (UN 1997b). There are also a number of UN ESD related data sources, many relating back to the ESD based document reviewed in Chapter 2. Many of these UN documents (i.e. Kyoto protocol) (UN 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 (UN 2000a). The Environmental Law Institute (ELI 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 (TEC 1999). Finally, Hart (1999) developed a guide book for governments and communities to adopt and update indicators.

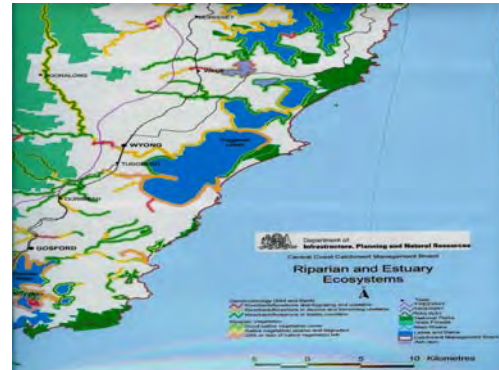
All the above sources provide data that the SAP framework relies upon in adopting indicators of sustainability. The framework requires data sources that contain natural environment components (i.e. aquatic, terrestrial, land and environmental water). A range of data sources for application within the SAP framework were assessed. These data sources are now examined in more detail through illustrations (Plates 4.1 – 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 SAP approach. Data for each of the SAP framework 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'.

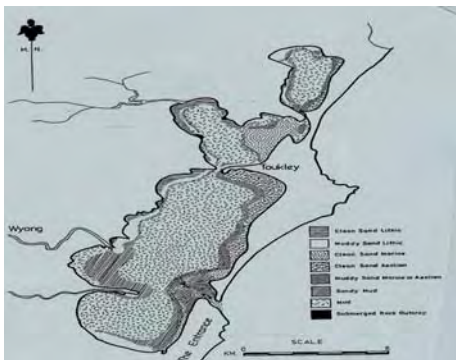
Plate 4.1: Data Sources for Indicators of Sustainability D1 – D6



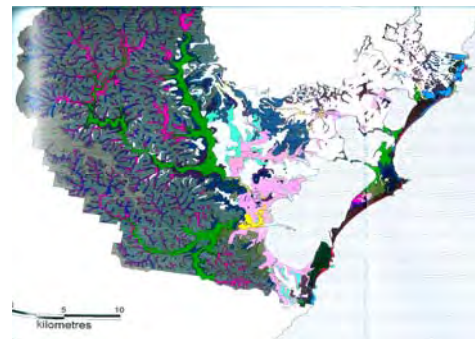
D1. Natural Resources
Source: Canri - Community Access to Natural Resources Information, NSW (2000)



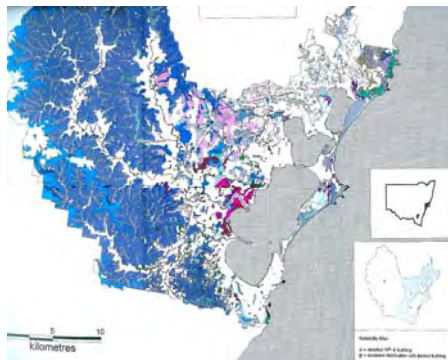
D2. Ecosystem Health: Riparian + Estuary
Location: Central Coast
Legend: Shows stressed rivers and lake edges
Source: *Integrated Catchment Management Plan for the Central Coast*. DIPNR. Svdnev (2002)



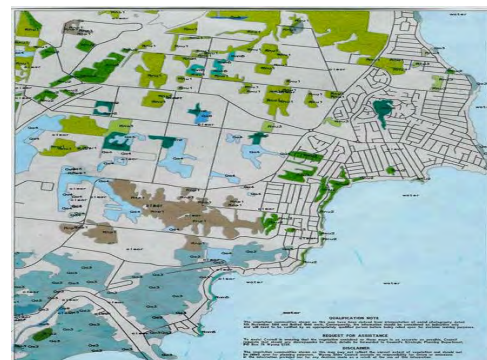
D3. Lakes and Foreshores Health
Location: Tuggerah Lakes
Legend: Shows mud and aquatic weeds
Source: *Tuggerah Lakes Estuary Study*, Wyong Council, Wyong (2001)



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)



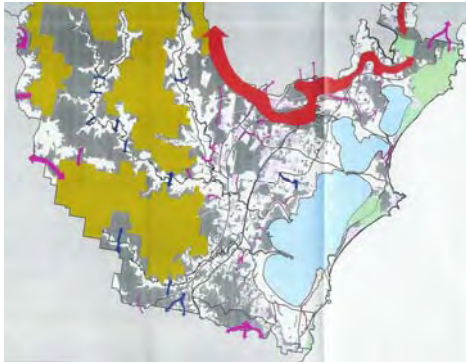
D6. Vegetation Fragments
(Remaining fragments in colours)
Source: *Wyong Shire Biodiversity Study*, Wyong Council, Wyong (2000)

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; 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 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).

Plate 4.2: Data Sources for Indicators of Sustainability D7 - D10



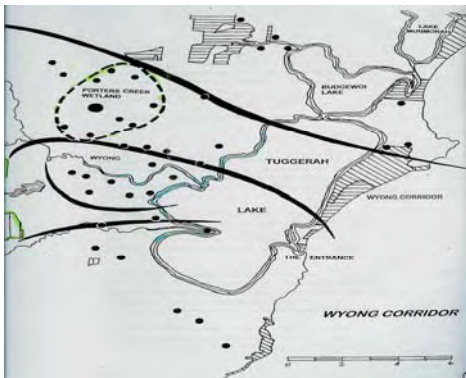
D7. Wildlife Corridors

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, Wvona (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 (Kariang)

Source: *Central Coast Express Advocate*, Gosford (2003)

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.

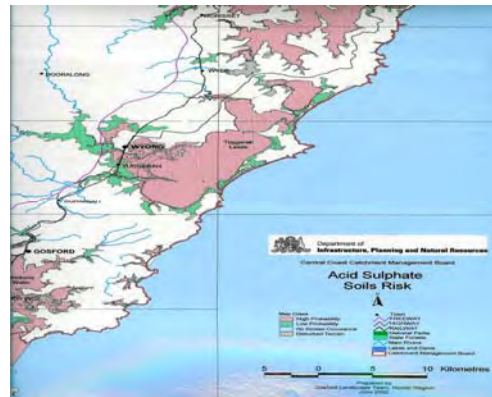
The third natural environment component (land) also has a wide range of data sources that could be used within the SAP framework. Land elements include, for example (not exclusive): Aboriginal cultural sites; acid sulphates; bushfire prone areas; drainage; erosion; European cultural sites; geological 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.

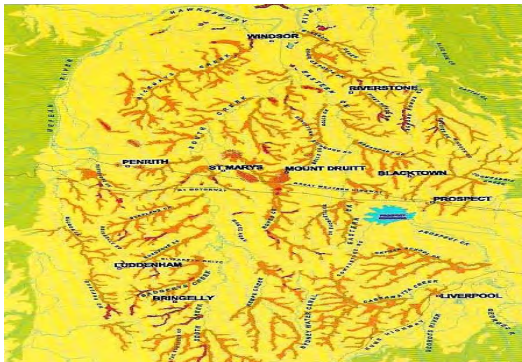
Plate 4.3: Data Sources for Indicators of Sustainability D11-D13



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)

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 SAP framework.

In respect to built environment data sources there are many available under programs such as Basix (DoP 2000) at the NSW State level and Nabers (Commonwealth 2006b) 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 Commonwealth levels of government.


4.3: Indicators of Sustainability

Indicators of sustainability are essential to the application of the SAP framework. Indicators can be selected from the data sources summarised above (accepting environmental elements will not remain constant). These indicators have been summarised for the SAP framework within a Sustainability Indicators Checklist (Table 4.1). As noted in Chapter 3, the research 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 the study area as it is based on about fifteen 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 SAP needs to include references that contain critical levels that could trigger an 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 – 4.3) 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.

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
Aquatic biodiversity					
	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/1000/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/1000	Extent of weed invasions
Terrestrial biodiversity					
	B1.Bushland character	B1.1 Type and quality B1.2 etc.	Ha + condition	Ha/1000 + condition	Bushland character that is threatened and its condition
	B2.Corridors	B2.1 Corridor condition + disturbance	Ha	Ha/1000	Corridor disturbance
	B3.Edge habitat	B3.1 Type, quantity + condition	Ha	Ha/1000	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/1000	Environmental fragments are under threat from development
	B6.Gap Habitat	B6.1 Type, health + quantity	Ha	Ha/1000	Gap habitats that are isolated
	B7.Native vegetation	B7.1 Vegetation depletion	Ha	Ha/1000	Vegetation can be depleted; compare pre-1750 and current vegetation
	B8. Weeds (terrestrial)	B8.1 Weed infestation	Area (ha) and type	Ha/1000	Weed infestation can be widespread
Land geography					
	C1.Aboriginal cultural sites	C1.1 Protected sites C1.2 etc.	#	# + level of protection	Significant Aboriginal sites
	C2.Acid sulphates	C2.1 Amount of acid sulphate soils C2.2 etc.	Ph	Ph 7	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	Meters to bushland edge	Refer to NSW Rural Fire Service (<i>Bush Fire Guidelines</i> (DoP 2006c).
	C4.Drainage	C4.1 Drainage impact	Year flood occurrence	1:100 flood	Extent of drainage that causes an a significant impact
	C5.Erosion	C5.1 Amount of erosion	Tons/ha	Tons/ha	Erosion can contribute to significant siltation

 = element relative to area	ESD Natural Environment Component Elements	Indicator of Sustainability (example)	Unit of Measurement	Standard Measurement	Significance of Indicator Standard
Land geography cont.					
	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/1000	Slippage occurrences
Environmental Water					
	D1.Environmental flows	D1.1 Potable water availability D1.2 etc.	mgl	Mgl/1000 people	Reduction in water availability
	D2.Groundwater	D2.1 Area	Ha	Ha/1000	Groundwater sources
	D3.Quality of Water	D3.1 Rivers, creeks and lakes physical and chemical health	Mgl	MgL/1000	Quality depletion
	D4.Nutrients	D4.1 Type	Quantity	Quantity/1000	Cumulative nutrient impact
	D5.Urban stormwater	D5.1 Stormwater point discharges	Cu meters/minute	% > discharge capacity	Discharge impact

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 SAP 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 have (within that SAP 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 2006c) 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.

Chapter Summary and Conclusions

This chapter explored data sources and indicators of sustainability required to apply the SAP framework. 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). The research concluded that there is an ever increasing choice of mapping formats, especially e-mapping, available for selecting indicators of sustainability for use within the SAP framework.

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 select a case study area and examine the planning background of that study area.

Chapter 5: CASE STUDY AREA AND PLANNING BACKGROUND OF STUDY AREA

5.1: Introduction

Following the examination of data sources and indicators of sustainability (Chapter 4) a case study area was selected. The study area's planning background needs also to be examined. This examination includes planning at three levels as outlined in Chapter 2, that is: land use planning; natural resource planning; and, sustainable urban planning. The examination includes planning at three levels of government: Wyong Shire; Central Coast; and, Greater Metropolitan Region (GMR).

5.2: Nominating a Case Study Area

The North Wyong district (herein referred to as North Wyong) (Plate 5.1) was selected as the study area. The main reason for this nomination was that North Wyong is within the Wyong Shire urban release area and has experienced rapid urban growth over the last 30 years (1977-2007)⁴. 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 over the next 24 years (2007-2031) (Department of Planning 2006a)

⁴ The population of Wyong Shire was estimated at 145,740 in 2007 (Wyong 2007a) and was expected to be 216,000 in 2027. The Central Coast Regional Strategy (DoP 2006a), however, recommended a population increase of 52,900 by 2031 (Shire population of 200,640 in 2031).

Plate 5.1: Local Areas of North Wyong (Plan)



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

At this stage of the research a CD-Rom (Attachment Two) was completed as a component of research to examine the nominated case study area and to update the research work to date. The overview summarises (in pictures where practical): the methodology (Chapter 3); data sources selection (Chapter 4); and, visual examination (a preliminary survey under SAP Step 3) of the proposed case study area. The CD-

Rom can be played audio-video (15 minutes). Alternatively the reader can manipulate the CD in slide format (53 slides). The overview also helped to confirm the direction of the SAP framework development by presenting a visual picture of the SAP steps. The overview was presented to the School of Environmental and Life Sciences (Ourimbah Campus) Post Grad Seminar Series on 10/7/04) providing valuable feedback on the research project components. The feedback here centred on the need for measurements of sustainability (e.g. indicators of sustainability) to be as precise as possible. The feedback also highlighted the importance of developing the SAP framework for different sized areas (i.e. district and local).

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 (11) established suburbs; six (6) 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 nominated as a test area to apply the draft SAP framework. This test area needed 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 draft SAP framework to this test area also allows for an illustration of aggregating sustainability

scores to the North Wyong district level. Further, an illustration of aggregating sustainability scores to shirewide, region and greater region can be undertaken.

The West Tuggerah Lakes-Wadalba (south) local area is bounded by the following natural and man made 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/50s 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 (Chapter 6).

Plate 5. 2: Local Areas (LAs) of North Wyong District (Aerial Photo)



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

North Wyong consists of a mix of residential, industrial and commercial land uses. There are six (6) residential areas and one (1) 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 suburbanized 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.

5.3: Case Study Area Background

To understand the planning of the North Wyong district it is necessary to examine the planning of this district at the GMR, Central Coast and local government levels. Planning of North Wyong is affected by governance decisions at all three of these levels.

5.3.1: Greater Metropolitan Region (GMR) Planning

The GMR (Plate 5.3) has experienced significant urban development over the last 30 years (1970's onwards). The GMR offers a variation of urban settlement types, including: four sub-regions (Sydney, Illawarra, central Coast, and Lower Hunter); and, 13 cities and 37 non-city municipalities within those subregions.

Plate 5.3: Greater Metropolitan Region (GMR) of Sydney



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

The extent of the GMR growth over the last 30 years is illustrated in Table 5.1. Before critiquing the documents that influenced this growth, an aerial view of the changes to land use on the ground reveals a trend (Appendix B). This map shows the GMR land development 1973-2004 in red. A comparison with the urban areas in 1973 (yellow) shows the development along: 1. the plains of Western Sydney (centre left); 2. the coastal Central Coast Region (immediate north of Sydney); the low lying lands of Newcastle and Lower Hunter Region (top right to left); and, the coastal areas of Wollongong and the Illawarra Region (lower). The map shows the closeness of the GMR's natural resources to Sydney and these GMR regions (i.e. National and State Parks, coastal areas, rivers, and escarpments).

The impact of the GMR growth is illustrated by the GMR's environmental footprint (an impact concept as outlined in Chapter 2) contained in *City of Cities Metropolitan Strategy* (DoP 2005) (Appendix B). 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* (DoP 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 summarized under: (1) land use planning; (2) natural resource planning; and, (3) sustainability planning.

Table 5.1: Planning Documents at the Greater Metropolitan Region Planning Level

1. Greater Metropolitan Region Planning					
✓ = 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
Land Use Planning					
1.1	1995	0	<i>Transport 2010 Plan</i> (DOT 1995).	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</i> (Planning NSW 1999a)	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</i> (Planning NSW 2002b).	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</i> (2003) (DIPNR 2003)	The review of draft Plan First reduced the prospects of Plan First adoption.	This review of <i>draft Plan First</i> (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> (DoP 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> (DoP 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> (DoP 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.
Natural Resource Planning					
1.8	2007	0	<i>Sydney Metropolitan Region Catchment Action Plan</i> (NSW 2007b)	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.

1. Greater Metropolitan Region Planning cont.					
Sustainable Urban Planning					
✓ = 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
1.9	1995	0	S <i>Cities in the 21st Century</i> (NSW 1995b)	Strategy to guide urbanization 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	S <i>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 2007a)	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.

Land use planning at the GMR level has gone through several transitions from 2001 with minor incorporation of ESD based planning. *Plan First* (Planning NSW 2001) was a State policy aimed at simplifying plan making at the LGA, regional and State levels. *Plan First* (Planning NSW 2001) was to provide major changes to plan making as prescribed under the *EPA Act 1979, Part 3* (NSW 1979). *Plan First* (Planning NSW 2001) highlighted ESD principles as an opportunity to incorporate ESD criteria into plan making. Following this plan the State made a significant policy change in the creation of the Department of Infrastructure, Planning and Natural Resources (DIPNR) in 2002. The creation of this new department from an amalgam of several departments signalled the State's intent to pursue greater coordination of urban planning and natural resource management.

Under the new DIPNR, an integrated approach to land use and transport was taken. The government proposed the draft *Integrated Land Use and Transport State Environmental Planning Policy 66* (Planning NSW 2002b). This draft policy (remains in draft in 2008) provides guidelines to integrate transport and land use planning but falls short of applying ESD principles. The State government states within this document that it had been unable to effectively reduce auto dependency within the GMR generally over the last 25 years. In 2003 the Lower Hunter Public Transport Liaison Group (a non-government organization) adopted the *Sustainable Transport for the Lower Hunter Plan* (Regan 2003). This Lower Hunter document demonstrates how the Lower Hunter could adopt sustainable transport principles as part of ESD based urban planning strategy.

NSW had been moving through planning reforms from the early 2000s as noted (DIPNR 2002b). The prescription of what the State would require of Councils came out of the review and was contained firstly within the *Plan First Review* (DIPNR 2003a). First, the review paper outlined types of plans that councils would need to undertake. The State discussion about the new planning system in general did not contain ESD based urban planning references, but did introduce prospects of a new planning system integrating land use and natural resource planning. The review recommended the State embark on a new 'Sydney Metropolitan Plan'. The review also suggested local government councils' management plans should incorporate all council's operational plans such as SoE reports and conservation strategies. The review proposed longer term strategic plans would be required by local government via guidelines issued through the Department of Local Government.

The State however legislated in August 2005 to divide DIPNR back into separate departments of planning and natural resources. These departments were the Department of Planning (DoP) and Department of Natural Resources respectively. Finally, the State, in another initiative, released a series of regional plans along the NSW coast in 2005 and 2006. These included: earlier mentioned *draft Central Coast Regional Strategy* (DoP 2006a); *Illawarra Regional Strategy* (DoP 2006b); and, *Lower Hunter Regional Strategy* (DoP 2006c).

Integral to GMR land use planning is natural resource planning. The *Natural Resources Management Reform Report* (NSW 2003) introduced guidelines to better manage natural resources throughout the state. In addition, the *State of the Environment* (NSW 2007a) illustrated a greater government concern to analyse of the natural environments of NSW, in particular those of the GMR. The State also started to produce a range of specific studies, including: vegetation; threatened species; water; and, catchments. The State also oversaw in 2007 the adoption of catchment action plans (CAPS) as noted earlier in looking at the Central Coast. Within the Sydney metro area the state adopted through the Sydney Metropolitan Catchment Management Authority the *Sydney Metropolitan Region Catchment Action Plan* (NSW 2007b). Likewise, CAPs were adopted for the Central Coast, Illawarra, and Lower Hunter sub-regions of the GMR.

Having examined land use and natural resource planning at the GMR level the focus now turns to sustainable urban planning. There are three GMR planning documents that contain aspects sustainable urban planning. The *Cities in the 21st. Century* (NSW 1995b), for example, provided the State with a strategy to guide urbanization within the GMR. This document contained objectives of sustainable development; however, there the document was not implemented given a change of government at the time. The

second document was draft *Plan First* (Planning NSW 2001). This plan introduced: more regional planning focus; more citizen participation; and, showed the potential to secure ESD based planning in the GMR. Finally, the *NSW State of Environment Report* (NSW 2007a) introduced an assessment of the environmental, social/cultural, and economic health of NSW. Unfortunately, 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* (DOT 1995). Like the *Cities into the 21st Century* (NSW 1995b) 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 1999) and subsequent regional shaping plans made reference to ESD but contained no overall ESD quantifiable applications.

5.3.2: 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). In examining land use planning the *Central Coast Structure Plan* (NSW 1975) is still the key guide to planning on the Central Coast. This plan provides a broad development strategy for the Central Coast, but is significantly outdated. The regional two plans (though not adopted) that followed this plan both contain aspects of sustainable urban planning. Under transport, the *Central Coast Transport Action Plan* (DOT 2003) was introduced. This plan however is more a public works program than a sustainable urban planning approach to transport planning.

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
Land Use Planning					
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 Warnervale.	The plan was superseded by development decisions contrary to the Plan recommendations. For example within North Wyong the proposed new city of Warnervale did not go ahead. Tuggerah shopping centre became the new regional district centre.
2.2	2003	28	<i>Central Coast Transport Action Plan</i> (DOT 2003)	A ten 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> (DoP 2006).	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.
Natural Resource Planning					
2.4	2002	0	<i>Central Coast Regional Vegetation Study</i> (CRVC 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.
2.5	2002	0	<i>Integrated Catchment Management Plan for the Central Coast</i> (referred to as 'the Blueprint' (DIPNR 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 (HCRMA 2007).
2.6	2003	1	<i>Cool Climate Report</i> (Gosford 2003a).	This contains climate change actions and greenhouse reduction programs.	Report needs to be incorporated within an overall Central Coast climate change report.
2.7	2003	1	<i>Water Sensitive Design Guidelines</i> (LHCCREMS 2003c).	Contains guidelines for integrating water systems into developments.	Water sensitive designs are gaining the attention of the authorities and private industry.

2. Central Coast Region Planning cont.					
✓ = 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
Natural Resource Planning cont.					
2.8	2007	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.
Sustainable Urban Planning					
2.9	1999	0	<i>Shaping the Central Coast</i> (Planning NSW 1999c)	Urbanization 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.
2.10	2003	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 1999).	This plan was not adopted by either Gosford or Wyong Councils, or the State.
2.11	2007	8	<i>Water Plan 2050</i> (GWJWA 2007)	Plan adopted for water provision to 2050	The plan partly addresses sustainable water approaches.

Finally, the *draft Central Coast Regional Strategy* (DoP 2006a) was drawn up to provide a planning strategy to replace the *Central Coast Structure Plan* (NSW 1975). Within the draft Strategy major urban centres and broad acre growth areas are nominated. There are some references to ESD within the draft Strategy, however no concerted ESD criteria application.

Having examined Central Coast land use planning, the focus turns to the region's natural resource planning. Natural resource planning is outlined in a number of documents, commencing in the early 2000s. The *Central Coast Regional Vegetation*

Study (CRVC 2002) outlines the range of vegetation occurring across the Central Coast and the protection mechanisms that are required. In addition, Gosford City, taking an initiative of relevance to the whole Central Coast region, outlined its approach to greenhouse reduction within its *Cool Climate Report* (Gosford 2003). Gosford Council is utilizing the recommendations within this report to implement a range of measures to meet international, Commonwealth and State climate control guidelines.

The *Integrated Catchment Management Plan for the Central Coast* ((referred to as 'the Blueprint' (DIPNR 2002a)) was introduced to set up a strategy for natural resource management for the Central Coast and Lake Macquarie City. In addition *Water Sensitive Design Guidelines* (LHCCREMS 2003b) were adopted to guide Central Coast and Hunter councils towards adopting designs that capture water runoffs. Finally, at a catchment level, the *Hunter-Central Rivers Catchment Action Plan* (HCRCA 2007) was adopted under the Hunter Central Rivers CMA. This plan, incorporating the *Integrated Catchment Management Plan for the Central Coast* (DIPNR 2002a) (noted above), is a program of natural resource management. The HCRCA contains a number of components, including: environmental benchmarks and targets; priority management programs; and, works areas with costings. The CAP targets, for example, include: example water quality; sediment retention; riparian and littoral areas restoration; storm water and erosion control; and, wetland reclamation.

Having examined land use and natural resource planning, the focus now turns to sustainable urban planning. There are two planning documents at the Central Coast regional level that contain aspects of sustainable urban planning. These documents are: *Shaping the Central Coast* (Planning NSW 1999c); and, *Shaping the Central Coast Action Plan* (Planning NSW 2003). Both documents were to replace the Central Coast

structure plan noted earlier. These plans contain urbanization forecasts over 20 years and management principles to guide development. The plans introduced ESD criteria by adopting 'interim indicators' such as: vegetation; vehicle kilometres travelled; water consumption; waste generated; and, hectares of open space. The plans, however, need to be followed up with a more comprehensive set of ESD principles to achieve sustainability on the Central Coast. The *draft Central Coast Regional Strategy* (DoP 2006a) (outlined under land use planning) did not follow up the overall theme of sustainability that the above two documents introduced. How greater metropolitan planning affects the North Wyong study area is examined next under Wyong Shire planning.

5.3.3: 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 5000-7000 people to 2021⁵. These centres, however, were scaled down in population growth under the *draft Central Coast Regional Strategy* (DoP 2006a). This scaling down was prompted by the State because of a severe shortage of potable water.

⁵ Warnervale and Wadalba development will be in accordance with: the Warnervale and Wadalba Development Control Plan (DCP) 49 (WC 1999); the Warnervale District Strategy (WC 2002b); and, the Wider Warnervale District Contributions Plan (WC 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') (WC 2003a). The draft Central Coast Regional Strategy (DoP 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 5.3: 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	Critique of Document's Contribution to ESD Based Urban Planning
Land Use Planning					
3.1	1990	0	<i>Wyong Shire LEP 1990</i> (Wyong 1990)	Guidelines for permissible and prohibited land uses.	Predominantly a zoning plan, not a shirewide strategic plan. State requires updating within 3 years from 2008.
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.	Needs updating to match new population projections and ESD design controls.
3.3	2002	12	<i>Wyong Shire Residential Development Strategy</i> (Wyong 2002c)	Density guidelines to achieve higher intensity land uses.	Higher densities are spread over a large section of the green fields and renewal areas.
3.4	2002	12	<i>Warnervale District Strategy</i> (Wyong 2002b)	Concepts of layout and development of the Warnervale District	A new strategy is required for the whole of the release area, beyond the district centre.
3.5	2003	13	<i>Wyong Shire LEP Amendment 135</i> (Wyong 2003a)	Investigation precinct zone introduced covering the majority of North Wyong's undeveloped lands.	All of the release area needs updating of this LEP's zonings.
Natural Resource Planning					
3.6	2003	13	<i>Draft Wyong Shire Conservation Strategy</i> (Wyong 2003b)	Analysis of and policies for conservation of lands in Wyong Shire.	The strategy needs to be revisited in light of the proposed Central Coast Conservation Plan proposed for 2008.
3.7	2006	16	<i>Tuggerah Lakes Estuary Management Plan</i> (Wyong 2006b)	Analysis of the health of Tuggerah Lakes and programs to improve.	A rate tax per house was instituted to raise about \$2m. to undertake estuary improvement programs.
Sustainable Urban Planning					
3.8	2002	12	<i>Wyong Shire Quality Housing DCP 100</i> (Wyong 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 2007a)	Details on the environmental, social and economic health of Wyong shire and projected impact of continued urbanization.	The SoE reports for Wyong since the completion of the first report (1995/96) 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. Wyong Shire Planning cont.					
✓ = 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
Sustainable Urban Planning cont.					
3.10	2007	17	<i>Wyong Shire Management Plan 2007/08</i> (Wyong 2007b)	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 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.

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 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 zoning, threatened species and airport expansion proposals). With the potential benefits of ESD based urban planning (Chapter 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* (DoP 2007a). This program guides the release of land for urbanization, 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 1990) is predominantly a zoning and statutory procedures plan and not a strategy plan. Council in early 2008 were however engaged in developing a shirewide 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 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 2002c). This strategy sets out density guidelines to achieve higher intensity land uses (often reflecting principles of new urbanism as outlined in Chapter 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 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 2002b). Finally, the *Wyong Shire LEP Amendment 135* (Wyong 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 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 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 2007a) contains detail on the environmental health of Wyong Shire and the projected impact of continued urbanization (i.e. impacts of land, water, air and biodiversity). The Wyong Shire SoE report states the importance of Council expanding the incorporation of ESD principles into its urbanization 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 2007b), provides goals and financial estimates for managing the Shire, including some (though limited) programs where ESD criteria are introduced.

Chapter Summary and Conclusions

This chapter nominated the case study areas of the North Wyong district and, within that district, the West Tuggerah Lakes-Wadalba (south) test area. The study areas' background in planning was then reviewed (using a table format). This review included critiquing land use, natural resource and sustainable urban planning documents. A number of conclusions were reached from this review of documents. Firstly, the planning documents in all three categories were not linked to any overall ESD based approach to planning. Secondly, the state of environment (SoE) reporting held good prospects for ESD based urban planning. Finally, the low rate of implementation of recommendations within documents at all three levels of governance (i.e. SoE reports) illustrated the gap between reports and actions to implement these reports. The next chapter applies the SAP framework to the natural environment of the study area.

Chapter 6: APPLYING THE SAP FRAMEWORK TO THE NATURAL ENVIRONMENT, PART ONE - STEPS 1- 3

6.1: Introduction

The next research stage is to apply the draft SAP framework to the study areas. The draft SAP framework is built around the SAP Framework Structure (Table 3.1 p50). This stage in the development of the SAP framework will use the steps within Table 3.1 in applying the framework. This application of the framework will be to the West Tuggerah Lakes-Wadalba (south) study area Steps 1-3. The methodology used in these key steps is built on the use of: data sources; aerial photos; field observations; site photographs; and, historical photographs (for comparison over time). The next chapter will apply the SAP framework Steps 4-5.

6.2: Step 1 – Review ESD Related Documents

The first part of SAP 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 Chapter 2. ESD related documents, for the Greater Metropolitan Region, Central Coast and Wyong Shire were critiqued in Chapter 5, in examining the background of the study area..

6.3: 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 Chapter 4. The data sources were reviewed in that chapter and a sample list of indicators composed (Table 4.1 p74).

6.4: 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 SAP framework application. Local environments (LE1-LE16) (Plate 6.1 and Plate 6.2) were identified (2003-2007) through completing a number of tasks. The exact boundaries of each local environment would be identified more precisely in any full application of the SAP framework. The research SAP survey step included a number of tasks to gain qualitative results:

1. A review of each the LE's environment was conducted using the data sources (Plates 4.1– 4.3 p67-71) (Chapter 4). The review included a qualitative assessment of most of the major environment components (as contained in these plates) as well as earlier referenced literature (Chapter 2).
2. The major environmental habitats were examined by viewing aerial photos. An aerial flyover in 2006 was arranged to assess the value of aerial survey and a qualitative assessment from the air (i.e. as noted earlier the front cover aerial photo).
3. Environmental assessments (i.e. Wyong Shire SoE reports 1994-2006) and other relative planning documents (Tables 5.1-5.3 p87-96) were further interpreted against visual field observations.

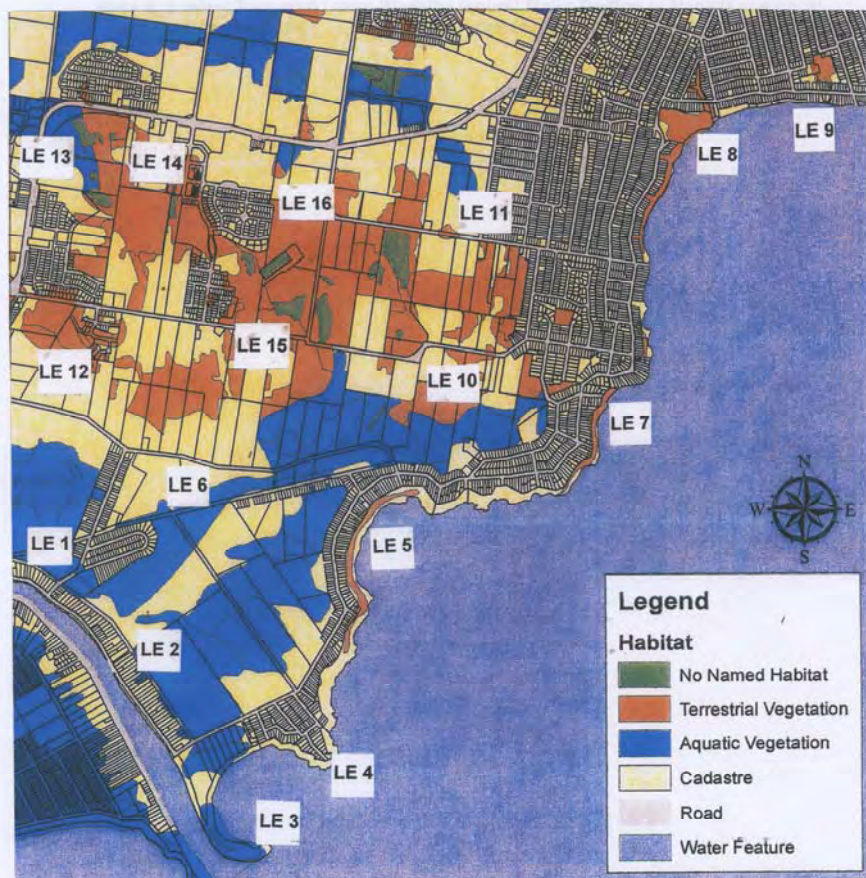
4. Field inspections included photographing all local environments over the 2002-2007 period. There were usually several follow-up visits for each LE after assessing the photos (400 photos).

5. Historical photos were used to give a benchmark of environmental conditions over years stretching back to the 1950's. Sources here included: the local Wyong Historical Society and Museum; Wyong Council Library; the Wyongah Progress Association; and, numerous written local histories on the study area.

A summary of all preliminary survey work (2001-2004) was placed on CD-Rom 2 for analysis (illustrating 155 sites within the study area). This CD-Rom 2 is included in Attachment Two (SAP Survey Step 3). The CD-Rom contains an option to play an audio video version (25 minutes) or a slide version allowing user to manipulate slides and timing. The preliminary field survey covered potential case study Local Areas in North Wyong vicinity. The bulk of the preliminary survey was around the most likely to be selected Local Areas, West Tuggerah Lakes (south) and Wadalba (Chapter 5).

This CD-Rom 2 provides 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).

Plate 6. 1: West Tuggerah Lakes-Wadalba (south) Major Portion of Habitat and Local Environments
(Base Map provided by: Wyong Council 2007)



Local Environments (LEs) of West Tuggerah Lakes-Wadalba (south)

LE1. Tacoma Central	LE9. Marks Rd Foreshores
LE2. Tacoma Eastern	LE10. Johns Rd Rural
LE3. Tacoma Peninsula	LE11. Louisiana Rd Rural
LE4. Rocky Point Foreshores	LE12. Hilltop Conservation
LE5. Big Bay	LE13. Wadalba Drainage Corridor
LE6. Tuggerah Wetlands	LE14. Figtree West
LE7. Prawn Beach	LE15. Wadalba Hill South
LE8. Craigie Park	LE16. Wadalba Hill North

Plate 6. 2: West Tuggerah Lakes-Wadalba (south) Aerial Photo of Core of the Local Environments 1994
(Source: NSW Land Information Centre, Bathurst)



The land features of the study area are varied (Plate 6.2). 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 2003c). 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.

The 'land component' of the natural environment (while not included in the SAP test for the case study area) were also observed. Any full application of the SAP framework would be examining all four natural environment components (aquatic, terrestrial, land and environmental water). Observed under land for example were bush fire zones that

of West revealed 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 6.3 - 6.5). Multiple photographs (400 plus photos in all taken over the 16 local environments) allowed close qualitative evaluation of the natural environment components. 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 6.3) (see location of LEs shown in Plate 6.1 and geography in Plate 6.2).

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.

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.

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.

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. 3: West Tuggerah Lakes-Wadalba (south) Photos of Local Environments LE1-LE6



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)

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 (Chapter 5).

LE7-LE12



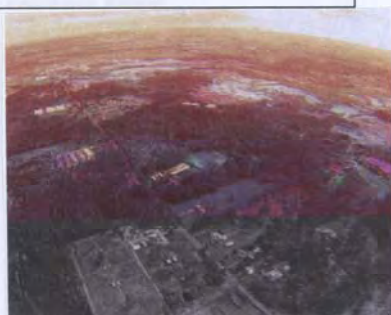
LE7. Local Environment: Prawn Beach, Wyongah
Source: Rauscher R (2004)



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)

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 hectares the remainder of this local environment is also subject to a current (2008) approved subdivision development application.

**Plate 6. 5: West Tuggerah Lakes-Wadalba (south) Photos of Local Environments
LE13-LE16**



**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)

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) as completed during the research (as noted earlier, 2003-2007) are now examined more closely (Table 6.1).

Table 6.1: Step 3 - West Tuggerah Lakes-Wadalba (south) Survey of Aquatic and Terrestrial Elements

Natural Environment Component Elements	Notes: 1. ✓ = concluding from the survey, the environment element is considered threatened or impacted (thus unsustainable in both instances) 2. A blank box indicates the element is considered sustainable 3. N = element not applicable to that local environment															
	Local Environments															
	LE 1	LE 2	LE 3	LE 4	LE 5	LE 6	LE 7	LE 8	LE 9	LE 10	LE 11	LE 12	LE 13	LE 14	LE 15	LE 16
Aquatic																
A1. Aquatic plant life	✓	✓	✓	✓	✓	N	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
A2. Marine life	✓	✓	N	N	N	N	N	N	N	N	N	N	N	N	N	N
A3. Nutrients	✓	✓	✓	✓	✓	✓	✓	N	N	N	N					
A4. Water quality	✓	N	N	N	N	N	N									
A5. Water replenishment	✓	✓	N	✓	N	N	N	N								
A6. Weeds (aquatic)	✓	✓	✓	✓	✓	N	✓	✓	N	✓	✓	✓	✓	✓	✓	✓
Terrestrial																
B1. Bushland character	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
B2. Corridors	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
B3. Edge habitat	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
B4. Endangered species	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
B5. Environmental fragments	✓	✓	✓	✓	✓		✓	N	N	N	N	N	N	N	N	N
B6. Gap Habitat	✓	✓	✓	✓	✓	✓	✓	N	N	N	N	N	N	N	N	N
B7. Littoral zones	✓	✓	✓	✓	✓	✓	N	N	N	N	N	N	N	N	N	N
B8. Native vegetation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
B9. Weeds (terrestrial)	✓	✓	✓	✓	✓	✓										

Under column 1 are the selected natural environment component elements (aquatic and terrestrial). These elements are samples as reviewed in Chapter 5 and summarised in Table 4.1 p74). 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 SAP 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 SAP) (Chapter 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 of conclusions were reached in completing the survey of the local area ((West Tuggerah Lakes-Wadalba) (south)). Firstly, the identification of the relevant local environments to include in the survey took 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 was 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 SAP framework 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 was considered of grouping the local environments into 'precincts' within the

local area. When this option was trialled, however, it was concluded that the grouping would only complicate the SAP surveys that needed to be completed over the study area. Finally, it was concluded that a full SAP framework application would expand the survey observations and apply greater quantification of measurements

Chapter Summary and Conclusions

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

The review of study area ESD related documents (Step 1) (Table 6.1) included referring to documents reviewed in the literature review (Chapter 2) and to those applying to the study area (Chapter 4). Moving to Step 2, the selecting of indicators of sustainability relied upon the data sources as outlined in Chapter 4. The data sources selected were reduced to the scale of the study area, thus providing a useful source. These data sources (on a layering format) provided 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 study area was completed. The results of this survey were plotted and the photos to illustrate the 16 local environments were selected. This survey work enabled the identification of aquatic and terrestrial elements present in those local environments. Conclusions were drawn about the survey procedures, strengths and weaknesses. Field work, in testing the framework, demonstrated the practicality of using the framework and its tables. This demonstrated an acceptance of the hypothesis of the

thesis was reasonable. Field survey work showed the value of qualitative assessment. Those elements considered as being threatened or impacted as a result of the survey work would be more closely examined in the next chapter (part two in applying the framework).

Chapter 7: APPLYING THE SAP FRAMEWORK TO THE NATURAL ENVIRONMENT, PART TWO - STEPS 4-5

7.1: Introduction

The SAP framework Steps 1-3 were applied to West Tuggerah Lakes-Wadalba (south) in Chapter 6, including: a review of ESD criteria and related studies; the selection of indicators of sustainability; and, surveying West Tuggerah Lakes-Wadalba (south) test study area. This chapter continues the framework application following the draft SAP framework structure (Table 3.1) through Step 4 (Complete Sustainability Score Cards) and Step 5 (Adopt Area Sustainability Report). The chapter also includes an illustration of aggregating sustainability score cards from local area to district, local government area and region.

7.2: Steps 4 and 5 – Complete Sustainability Score Cards and Sustainability Reports

Having identified in Chapter 6 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 SAP survey and using the selection of indicators of sustainability (Table 4.1 p69), the 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 7.1). The table uses the sustainability ratings (green, amber and red) as outlined in Chapter 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 SAP framework to avoid quantification results that lead to a disconnection between sustainability reporting and implementation by authorities. Tagging elements that need further quantification in the SAP application is a means to avoiding these disconnections.

Table 7.1: 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																		
Note: Refer to Table 4.1 (Indicators of Sustainability Checklist)		Local Environments (LEs)																		
		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		13	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	14	
Overall Ratings within Local Environments	G								1	2	2	2	3	3	3	3	3	22		
	A	6	3	2	3	1	1	2	2	1	2	2	2	2	2	2	2		35	
	R		2	1	1	2		1												7

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 (Figure 3.1 p50); assessing sustainability indicators on a qualitative basis (Table 4.1 p74) (noting that full quantification would be required in a full SAP 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) 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 7.2).

Table 7.2: Step 5 – 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.					

This table highlights a number of factors. The overall sustainability rating (taken from the scorecard of Table 7.1) 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 SAP references can be referred to in formulating actions (Tables 2.1-2.4 p15-29 and Tables 5.1-5.3 p87-96). 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 7.3). 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 SAP framework (Tables 2.1-2.4 p15-29 and Tables 5.1-5.3 p87-96) are referred to. Finally, the notation of implementation of actions can be completed (end four columns).

Table 7.3: Step 5 - West Tuggerah Lakes-Wadalba (south) Sustainability Report for Aquatic Environment 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. Tuggerawong 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.					

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								
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.					

Having applied the framework to the aquatic environment (Table 7.1), 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 7.4). This scorecard utilises the results of the SAP Step 3 survey (Table 6.1). As noted in Chapter 3, 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.

Table 7.4: 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		
B. Elements		G (Green) = Sustainable A (Amber) = Threatened R (Red) = Impacted N = Element not applicable to subject local environment																		
Note: Refer to Table 4.1 (Indicators of Sustainability Checklist)		Local Environments (LEs)																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	G	A	R
B1.Bushland character		R	A	A	A	A	G	R	A	A	A	A	A	A	A	A	A	1	13	2
B2.Corridors		R	R	R	R	R	A	A	A	A	A	A	A	A	A	A	A		11	5
B3.Edge habitat		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A		16	
B4.Endangere d species		A	R	R	R	R	A	A	A	A	A	A	A	A	A	A	A		12	4
B5.Envirionme ntal fragments		A	A	A	A	A	G	A		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	15	
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 Environm ents	G		2	2	2	2	6											14		
	A	6	4	4	4	4	3	6	5	5	5	5	5	5	5	5	5		76	
	R	3	2	3	3	3		1												15

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 in Chapter 6) 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 7.5), based on Table 7.4 results.

Table 7.5: 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.					

This table highlights a number of factors. The overall sustainability rating (taken from the scorecard of Table 7.4) 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 SAP references Tables 2.1-2.4 pp15-29 and Tables 5.1-5.3 p87-96). 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 (Tables 7.6) can also be laid out (based on the information in Table 7.4) by the sixteen (16) local environments (as was done for the aquatic component).

Table 7.6: 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: 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 (Green) = Sustainable	A (Amber) = Threatened	R (Red) = Impacted						
	G	A	R						
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.					

7.3 Aggregating Sustainability Score Cards

Were the SAP framework applied to the other local areas of North Wyong (Plate 5.1 p79) the sustainability ratings from the score cards could be aggregated or 'scaled up' (Table 7.7). The hierarchy of scales is important in ecology and geography dynamics. Allen 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 SAP 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 SAP framework, 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 SAP framework 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, 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).

Table 7.7: Step 5.3 - North Wyong Natural Environment Local Areas Sustainability Score Card

Natural Environment Components	Sustainability Ratings from Indicators Application										
	<div><div>G</div> (Green) = Sustainable</div> <div><div>A</div> (Amber) = Threatened</div> <div><div>R</div> (Red) = Impacted)</div>										
	Local Areas (LAs) of North Wyong										
	LA1.1 West Tuggerah Lakes-Wadalba (south)			LA 1.2 West Tuggerah Lakes-Wadalba (north)	LA 2. Hamlyn Terrace	LA 3. Woongarra	LA 4. North Wyong Industrial Area	LA 5. Warnervale	LA 6. Halloran	LA 7. Wallarah	Overall Rating by Component
	G	A	R								
A. Aquatic	2 2	3 5	7								
B. Terrestrial	1 4	7 6	1 5								
C. Land											
D. Environmental Water											
Overall Ratings by Local Areas											

District level sustainability reports can further be aggregated to an LGA level. The sustainability score card for the North Wyong District (Table 7.8) can be included within an aggregated score card for the whole Wyong LGA. This is illustrated as a case example in Table 7.8.

Table 7.8: Step 5.4 - Wyong Shire LGA Sustainability Score Card for Natural Environment by Districts

Natural Environment Component	Sustainability Ratings from Indicators Application										
	<div>G (Green) = Sustainable</div> <div>A (Amber) = Threatened</div> <div>R (Red) = Impacted</div>										
	Districts of Wyong Shire										
	D1. North Wyong			D2. Toukley	D3. Budgewoi	D4. North Lakes	D5. Wyong-Tuggerah	D6. South Lakes	D7. The Entrance	D8. Ourimbah	Overall Rating of Components for Shire
	G	A	R								
A. Aquatic											
B. Terrestrial											
C. Land											
D. Environmental water											
Overall Rating of Components by District											

As in the aggregation to district level above (Table 7.7) 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 7.7) for a district, any of the natural environment components could be compared across all districts (D1 to D8) of the Shire.

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 7.9).

Table 7.9: Step 5.5 – Central Coast Region 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						

In addition to a regional sustainability report card, a sustainability report card for a group of regions can be achieved. The outer metropolitan growth area LGAs of Sydney's Greater Metropolitan Region (GMR) are used to illustrate this aggregated sustainability score card (Table 7.10).

**Table 7.10: Step 5.6 – GMR Outer Metropolitan Growth Regions
Sustainability Score Card for Natural Environment by Region**

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												

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.

Chapter Summary and Conclusions

This chapter applied the remaining Steps 4-5 of the draft SAP framework to the study area of West Tuggerah Lakes-Wadalba (south) and illustrated aggregation of sustainability ratings. A number of conclusions were reached. Firstly, having successfully completed the survey test on the study area in Step 3 (Chapter 6), the indicators of sustainability (aquatic and terrestrial) (Step 4) were next to be applied. The results of application proved successful as laid out within the sustainability score cards. The chapter also illustrated how the score card results in turn formed the basis of the sustainability report (Step 5). This report contained a section for addressing the

sustainability ratings from the scorecard. Finally, the chapter illustrated how the SAP framework 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. In summary, the SAP framework as applied to the natural environment (Chapters 6 and 7) proved workable. The next chapter applies the SAP framework to the built environment.

Chapter 8: APPLYING THE SAP FRAMEWORK TO THE BUILT ENVIRONMENT

8.1: Introduction

Having applied the draft SAP framework to the natural environment of West Tuggerah Lakes-Wadalba (south) (Chapters 6 and 7), the framework is now tested against the built environment. While the natural environment was measured in relatively small areas (i.e. 16 local environments), the built environment requires a district sized area to apply indicators of sustainability (i.e. energy, transport, water engineering).

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 twenty years the means of incorporating sustainability principles into transport planning. Strong (2005) for example has developed a whole policy directory (from international to local policies) in key built environment themes and their relationship to sustainable development. Likewise Ke Li (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 test the SAP framework on the built environment component of transport. A successful test on transport would suggest the framework could be applied to the 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 (p50). The same five steps under natural environment components (Chapters 6 and 7) 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.

8.2: Step 1 – Review ESD Related Documents

The first part of Step 1 involves reviewing ESD related built environment documents in Chapter 2 (Tables 2.1–2.4 p15-29 and Tables 5.1-5.3 p87-96) 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 SAP framework application. The built environment components include: buildings; communications; energy; greenhouse gas sources; recreation and open spaces; transport; waste; and, water engineering.

8.3: Step 2 – Selecting Indicators of Sustainability

SAP Step 2 requires selecting indicators of sustainability as outlined in Chapter 4 (Table 4.1 p74). 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.

8.4: 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 (Chapter 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 SAP framework steps are progressed (similar to the natural environment survey follow ups outlined in Chapter 6).

8.5: SAP 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 was 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 SAP framework utilising sustainability indicators to measure the transport sustainability of the district. With 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 SAP framework survey guide (Table 3.2

p52). The observation method was promoted and a qualitative rating system of sustainable, threatened and impacted was 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 SAP framework.

To test the SAP framework against the transport component all of the elements were observed within the North Wyong District study area during the research. The field trips for the qualitative assessment of the natural environment allowed observations of the transport elements in that district. As with the natural environment application, a review of relevant documents and data sources provided a qualitative basis for considering the threats and impacts on transport in North Wyong. These documents and sources included: ESD related documents (Chapter 2); data sources (Chapter 4); and planning documents at GMR, Central Coast and Wyong Shire levels (Chapter 5). The transport planning critiqued in Chapter 2 (Beatley, Bithas, Brandon, Brown D, and Newman) provided a range of examples of indicators of sustainability being applied to transport. Finally, researcher participation in the Sustainable Transport Committee of the Community Environment Network (CEN) (peak environment group on the Central Coast) during the whole of the research period provided valuable sources for assessing transport sustainability. A critique of two key transport planning documents completed in Chapter 5 (DoT 1995, DoT 2003) providing further indicators of sustainable and non-sustainable operations of transport.

To develop a case model for the SAP application to the built environment component of transport a research paper was completed. This paper (Rauscher 2005) (as noted in Chapter 2) was peer reviewed, presented to the 28th Australasian Transport Research

Forum (ATRF) and published under the ATRF. The paper (Appendix E) outlines: 1. using transport studies and inquiries to ascertain the current status of transport (paper Table 1 p178); 2. using the SAP framework to apply to a region (Central Coast) (paper Table 2 p181); 3. conducting a survey of the state of transport in the study area; 4. placing the SAP Steps within a framework matrix (paper Table 3 p182); adopting a sustainability report card on transport as a final SAP step. The paper concluded that the SAP framework was workable in developing a sustainability report on a built environment component such as transport.

The SAP framework Table 8.1 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 Chapter 5. These ratings in this table are for the local areas of North Wyong district (LA1.1 - LA6).

Table 8.1: 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		
			G (Green) = Sustainable (element meets standards) A (Amber) = Partly Unsustainable (at least one element does not meet standard) R (Red) = Unsustainable (more than one element does not meet standard) N = Not applicable to the study area									
			Local Areas (LAs)									
			LA1.1 West Tuggerah Lakes-Wadalba (south)	LA 1.2 West Tuggerah Lakes-Wadalba (north)	LA 2. Hamlyn Terrace	LA3. Woongarra	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

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 2.1-2.4 p15-29

and Tables 5.1-5.3 p87-96). 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 SAP framework 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.

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 that 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.

8.6: SAP Step 5 – Adopting Sustainability Report

The next step involves adopting a sustainability report. This step involves transferring the transport score card results (Table 8.1) into the sustainability report (SAP Step 5) (Table 8.2). This report contains comments on each of the transport elements (column 3). In any full application of the SAP framework the actions (column 4) would be completed. It is noted here that the SAP references can be referred to in formulating actions (Tables 2.1-2.4 and Tables 5.1-5.3). The report notes (as with the natural environment sustainability report in Chapter 7) actions can be recorded by: date started; current date; responsible authority; and, status of action.

Table 8.2: 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									

8.7 Aggregating Sustainability Score Cards

As illustrated in Chapter 7, the SAP framework 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 8.3). 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.

Table 8.3: Step 5.2 – Wyong Shire Sustainability Score Card for the Built Environment

Built Environment Components	Indicators of Application and Survey								Overall Ratings of Components		
	<p>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)</p>								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										

An application of the SAP 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 8.4). This score card for the built environment over the Central Coast provides an opportunity to illustrate partly unsustainable (amber) and unsustainable (red) built environment components (1-8) across both LGAs.

Table 8.4: 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)					
	Wyang 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						

In addition to a regional sustainability score card (Central Coast example above) a sustainability score card for a group of regions can be achieved. The outer metropolitan growth area LGAs of Sydney's Greater Metropolitan Region (GMR) are used to illustrate this aggregated sustainability score card (Table 8.5). This score card for the built environment over the GMR provides an opportunity to illustrate partly unsustainable (amber) and unsustainable (red) built environment components (1-8) across all four growth regions. The research highlighted an important note in that the

aggregating of scores in an ‘up-scaling’ of data (say to region) can also involve a ‘down-scaling’ of data (say from a region to local government areas).

Table 8.5: Step 5.4 - GMR Growth Regions Sustainability Score Card (Built Environment)

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

Chapter Summary and Conclusions

Having successfully applied the SAP framework to the natural environment (Chapters 6 and 7) this chapter applied the framework to the built environment of the North Wyong district. As in the earlier application of the framework to the natural environment of the West Tuggerah Lakes-Wadalba (south) test area, the North Wyong application followed the SAP steps.

The application of the SAP framework's sustainability score cards and sustainability report for North Wyong was illustrated. The transport built environment component was singled out to test the SAP framework. The chapter, as with the SAP application to the natural environment, illustrated the SAP framework aggregation to local government area and regional levels (both up-scaling and down-scaling). The overall conclusion is that the SAP framework could be successfully applied to the built environment as it had earlier been applied to the natural environment. The next chapter draws overall research conclusions and outlines future research directions.

Chapter 9: RESEARCH CONCLUSIONS AND FUTURE RESEARCH DIRECTIONS

9.1: Introduction

The development of the SAP framework and applications to both natural and built environments has been the main focus of the research. This chapter examines the overall conclusions of the research, adding to the individual chapter conclusions. Secondly, contributions that the SAP framework development makes to research are noted. Finally, future research directions to further develop models of ESD based urban planning are addressed.

9.2: Overall Research Conclusions

The research commenced with acknowledgement that governments are searching for frameworks to introduce sustainability principles within urban planning. The thesis hypothesis ‘that a sustainable area planning (SAP) framework can be developed to incorporate sustainability into urban planning at the local area, district, local government area, and regional levels’ was proven positive. The thesis was able to condense previous work in this field into a more coordinated and holistic framework.

Structuring the framework within five (5) steps and applying these steps at the local area level provided a sound basis of testing the framework. The templates that accompanied each step provided the required constructs in applying the framework. Assessing the current wide range of sustainability data sources took considerable research time, but was useful in avoiding duplication in adopting new data. The research was able to analyse these sources and apply them within the templates at the case study level. Both qualitative (e.g. survey step) and quantitative (e.g. scorecard

step) methods were applied (using the templates). Finally, using an urban growth centre study area such as North Wyong provided a wide source of data and historical urban planning history.

As the framework was developed, concerns about levels of measurement and size of area to apply these measurements arose. Sustainability scorecards were thus developed with the assistance of previous research in this area. The adoption of the sustainability ratings approach of green (sustainable), amber (partly unsustainable) and red (unsustainable) proved a sound mechanism. The research successfully trialled aggregating the ratings by scaling up from local areas to district, local government and regional levels. The translation of the overall ratings within the score cards into sustainability reports (final step) proved workable. The thesis achieved this partly by building upon current practices in state of environment reporting. It was acknowledged that social/cultural and economic components (in addition to environmental) of ESD need to be assessed in any application of the SAP framework.

During the research there was a dramatic increase in expressed public concerns (through the media) about environment deterioration, in particular global warming and greenhouse gas impacts (Chapter 1). Even within the local government study area of Wyong Shire there was a continuing public and government expression of these concerns during the research.

The question of selecting the size of area that would be ideal for testing the SAP framework meant trialling a number of configurations. The case study area had to be sufficiently large to be able to apply indicators of sustainability (i.e. aquatic, terrestrial, land and environmental water). On the other hand, the area had to be sufficiently small

to conduct the SAP surveys. In the end a 'local area' size was chosen to satisfy both these requirements. To apply the framework to the built environment a 'district' size area was required, given built environment indicators (i.e. buildings, communications, energy, greenhouse gas sources, recreation, transport, waste and water engineering) normally apply to larger than local areas. In all instances the discussions with community groups provided valuable input. This assisted for example in the selection of area sizes (i.e. large enough areas to apply indicators of sustainability, yet small enough for the community to relate to).

The literature review (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. There was a particular absence of sustainable based urban planning at local area level. The framework structure (Chapter 3), containing the five (5) steps, kept the framework simple but still allowed quantification through the adopted templates. It became clear in examining the SAP steps that the indicators of sustainability would provide essential measurements for the framework. Working the indicators on a qualitative basis allowed the later (after application of indicators of sustainability) adoption of quantitative measurements.

Also, the selection of the key natural environment components (aquatic, terrestrial, land and environmental water) focused the research without compromising the vigour of analysis. At this stage of research it was concluded that SAP survey work and application of indicators of sustainability would best be undertaken within the 'local environments' (geographically defined) of the study area. 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 SAP application. To achieve a measurement of sustainability the research successfully built upon and expanded the 'certification flags' system (Scanlon 2006) into a sustainability ratings system. The research had to vary the rating system to apply to the built environment, but still maintain the ratings methodology.

Data sources (Chapter 4) proved to be fundamental to the selection of indicators of sustainability within the SAP framework. Given data sources however varied widely, the research selected key sources (Plates 4.1– 4.3, p67-71) and was able 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 was both rigorous and time consuming. To categorise a range of indicators of sustainability that could be used in the research, Table 4.1 (p74) was created. The selection of indicators was limited to the chosen sustainability components (aquatic, terrestrial, land and environmental water). Using the LCCCREMS (2003a) data base on indicators of sustainability provided an initial base that could be (and was) expanded.

The selection of the case study area (Chapter 5) of North Wyong and the test area ((West Tuggerah Lakes-Wadalba (south)) took considerable time. Successfully applying the framework at these levels provided valuable conclusions on the size of areas that the framework could be applied to. The aggregating of sustainability score card results from local areas to larger areas (i.e. district) illustrated that the results could be scaled up. Finally, completing the critiques of the planning documents (Tables 5.1-5.3, p87-96) provided a measure of the extent that authorities had (or had not) incorporated principles of sustainability.

The application of the SAP framework (Chapter 6) allowed all the earlier formulated SAP templates to come together. The local area surveys took considerable time and required multiple area visits and photographing over the length of the research. The reasons for this large time requirement included a number of factors, for example: 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 a single photo for each local environment (16 in all) was an exacting exercise to ensure that the selected photo best illustrated the environmental components of that area.

The application of the indicators of sustainability to the test area of West Tuggerah Lakes-Wadalba (south) (Chapter 7) gave the SAP framework a quantification basis. It was here that the green (sustainable), amber (threatened) and red (impacted) score card ratings were determined. It is noted that in any framework application, beyond the research, a full application of indicators of sustainability would be required. The application of the final step of the framework illustrated that a sustainability report could be completed for local areas.

An additional research aim was to test the SAP framework against the built environment (Chapter 8). Given the framework had been successfully applied to the natural environment (Chapter 7), it was anticipated the application to the built environment

would be less time consuming. Selecting the transport component of the built environment to test the framework against proved useful in completing the test. The selection of transport indicators of sustainability, for example, utilised current data sources that were readily available. This was reflected in community concerns stemming from discussions with community groups within the study area.

These data sources were easily incorporated into the final score card for the transport component. At the same time, this scorecard was translated into a sustainability report as had been done for the natural environment components. Aggregation of sustainability ratings scaled up to LGA and region levels was also shown as feasible. In conclusion, the SAP framework, in being successfully applied to the natural and built environments, was adopted. Overall, the research contributed to the discipline of urban planning by proving the importance of developing sustainability measurements down to the local area level. It also proved that local area measurements were able to be scaled up to regional level. The research also proved 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 was apparent at this stage of the research.

The research illustrated 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 used in this instance). A further contribution was the construction of a sustainability report, again being able to scale up from local up to regional levels. Finally, the research showed that the SAP framework 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 SAP implications, singly and aggregated, would need to be considered.

9.3: Research Contributions

There are a number of research contributions that the SAP framework makes. Firstly, is the development of a relatively simple, methodical and structured framework (Table 3.1 p50). A five step framework overcomes many of the more complicated frameworks as critiqued in Chapter 2. The development of checklists of 'ESD Related Documents (International, Commonwealth, and NSW State levels)' simplifies document finding (Tables 2.1-2.4 p15-29). The expanded checklist (Chapter 5) incorporating 'planning documents' (thesis categorised under 'land use planning', 'natural resource planning' and 'sustainable urban planning') (Tables 5.1-5.3 p87-96) broadened this thesis contribution.

The thesis advanced the sustainability rating system (with colours) (Scanlon 2006) (Fig 3.1 p53). The development of an area survey template (Table 3.2) to record environmental (natural and built) conditions for qualitative assessment was 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 p56) was a further contribution. Building on scorecards, the thesis contributed a simplified sustainability report template (Table 3.4 p57) (a contribution to Sue reporting and monitoring). Researching the perplexing question of how to apply indicators of sustainability to different sized areas, the thesis contributed a 'scaling up' of scorecards (e.g. from local to district) (Table 3.6 p60). To effectively select data sources and standards for indicators of sustainability, the thesis contributed both a 'data

source pool' (Plates 4.1-4.3 p67-71) and a 'sustainability indicators checklist' (Table 4.1 p69). The thesis showed how the sustainability scorecard and sustainability report could be applied to the built environment (through case application of the SAP framework to transport) (again incorporating scaling up) (Table 8.1 p141). In summary, the SAP case study testing (Chapters 6,7, and 8) gave a 'proofing basis' that led to the outcomes (and thus contributions) as noted.

9.4: Future Research Directions

The research conclusions lead to a number of future research directions. Firstly, the research illustrates how 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 SAP 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 score cards). 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 framework 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 (Chapter 8) 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. This is illustrated in Appendix D where built environments have been simulated for a district centre, a local area, and cityscape.

The framework needs to 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 SAP framework 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 SAP framework 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 templates 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 research suggests the SAP framework 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 SAP framework 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 SAP framework 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 SAP framework 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 in the research, the community engagement process would need to remain central to any application of the SAP framework. Finally, the framework could be a useful tool for governments, businesses and individuals in thinking about and promoting a sustainable lifestyle and sustainable communities.

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 p.13).
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.
Area	A region (or other size) such as a <i>settled area</i> (Macquarie Dictionary 2006 p.69)
Agreement	Coming to an arrangement; a condition of agreeing. (Macquarie Dictionary 2005 p.27)
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 p.142).
Catchment	The area of land drained by a river and its tributaries (Macquarie Dictionary 2005 p. 235).
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 p.354)
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 p. 475).

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 p561)
Goal	A goal is 'that towards which effort is directed; an aim or end' (The Macquarie Dictionary 2006 p606).
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
Local	Characterized by place as in local situation (Macquarie Dictionary 2006 p. 838).
Local environment	An environment limited to a particular place or small area. Also relates to parts of an area as of a system.
Littoral	Pertaining to the shore of a lake, sea or ocean
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 oxidized
Precinct	A space of definite or understood limits and its environs (Macquarie Dictionary 2005 p.1121).
Principle	A principle is 'a rule or law exemplified in natural phenomena' (The Macquarie Dictionary 2005 p1131).
Protocol	A protocol is 'rules of behaviour to be agreed upon by heads of organizations' (Macquarie Dictionary 2005 p.1142).
Program	A plan to be followed
Report	A report is "a statement in reply to inquiry as a result of an investigation" (Macquarie Dictionary 2005 p.1201).
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 p.1288).
Standard	A basis of comparing things of a similar nature. Serving as a basis or measure or value (Macquarie Dictionary 2005 p.1374).
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 p.1550)
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

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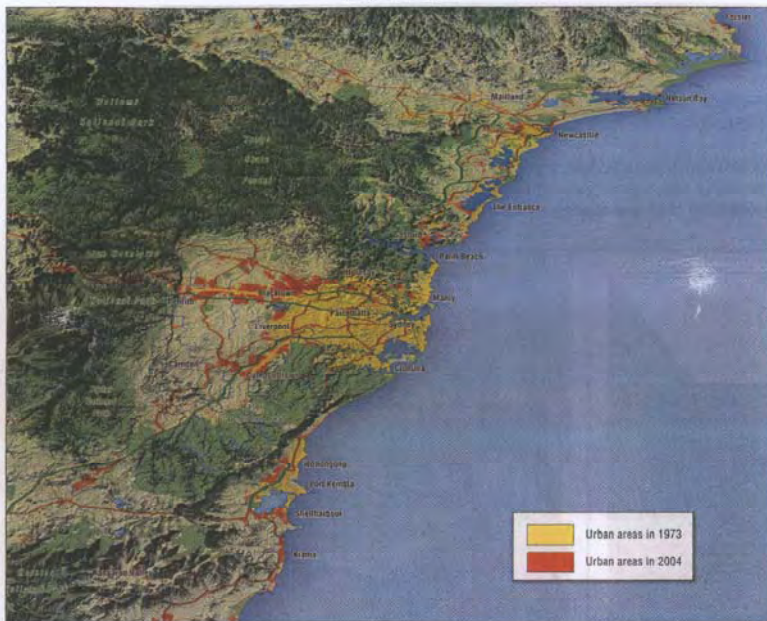
Appendix A: ESD Principles Built into Eco-village Design

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.
Queensland			
Currumbin www.theecovillage.com.au		Sustainable subdivisions.	Currumbin 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 characterizes 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.

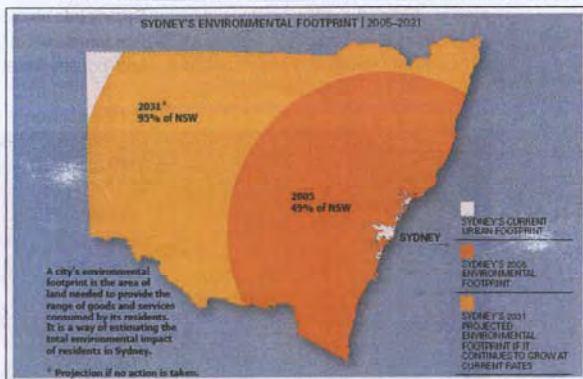
States and Eco-villages		ESD Principles	Background to Eco-village
	✓	Checklist ✓ = the ESD principles that a local area may wish to incorporate	
South Australia			
Aldinga Arts Ecovillage (near Aldinga) www.aldinga-artsecovillage.com.au		Village commons and communal gardens.	This eco-village has used 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 litre rainwater tank. Up to 16 hectares 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.
Tasmania			
Glamorgan Spring Bay Council www.gsbc.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.
Victoria			
Moora Moora Co-operative www.mooramoora.org		Hamlet communities.	Moora Moora is a co-operative residential community designed as six small hamlets located on co-operatively owned 245 hectare (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'.
Western Australia			
Old Broome Estate www.olddbroomestate.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.

States and Eco-villages		ESD Principles	Background to Eco-village
	✓	Checklist ✓ = the ESD principles that a local area may wish to incorporate	
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 organization 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 metres 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



Map 2. Centres, Current Land Release Areas and North Wyong Shire Structure Plan Area
Source: Department of Planning

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: PAPER ON SAP FRAMEWORK for SUSTAINABLE TRANSPORT

Paper peer reviewed, presented at the 28th Australasian Transport Research Forum (ATRF) (Rauscher and Momtaz 2005) at Sydney and published under the ATRF.

Sustainable Area Planning (SAP) Framework for Sustainable Transport in Growth Centres – Case Study Central Coast, New South Wales, Australia

Ray Rauscher, The University of Newcastle, School of Applied Sciences, Faculty of Science and Information Technology, Ourimbah Campus, Ourimbah, NSW, Australia, PO Box 127, Ourimbah, NSW 2258 ray.r@id1.net.au

Dr. Salim Montaz, Centre for Sustainable Use of Coasts and Catchments, School of Applied Sciences, Faculty of Science and Information Technology, Ourimbah Campus, Ourimbah, NSW, Australia, PO Box 127, Ourimbah, NSW 2258

Introduction

Governments around the world are expressing a desire to better balance development with current and forecasted diminishing natural resources. These governments are concluding there is a need to adopt sustainability principles within an ecologically sustainable development (ESD) based urban planning framework (Beder 1996). Many of these governments are turning to sustainability programs at both local and regional levels to balance social, economic and environmental components of ESD, including equity and good governance principles. Urban planning that combines land use planning and natural resource planning into one discipline can be called 'sustainable planning' or 'ESD based urban planning' (Brandon 1997). Sustainable transport is one of those ESD based urban planning disciplines. Many current urban planning schools of thought reinforce the need for sustainable transport, including schools of: integrated urban planning (Forster 1999), compact cities (Newman 1998), eco villages (Barton 2000), new urbanism (Crofts 1998), smart growth (Crowe 2000), and sustainable transport (Portland City 2002).

The paper's aim is to illustrate how a sustainable transport program can be achieved using the author's research on a sustainable area planning (SAP) framework. The framework can be applied to biodiversity, land, water or transport with an aim to adopt sustainability programs. The author has selected transport to apply the framework using a case study method. The case study area to illustrate how the SAP framework would apply is the Central Coast, a northern growth region within the New South Wales (NSW) Greater Metropolitan Region (GMR) of Sydney-Metropolitan, Illawarra, Central Coast and Lower Hunter regions. The paper firstly explains the concept of sustainability and the SAP framework. Secondly, the paper outlines the SAP framework relative to transport within a case study area. Finally, the paper illustrates the application of the SAP framework to the case study area.

1. Sustainability and sustainable area planning (SAP) framework

A starting point in developing an understanding of sustainable transport and the sustainable area planning (SAP) framework is defining 'sustainable' and 'ESD'. Throughout the 1980s and into the 2000s there have been numerous definitions and interpretations of the expressions 'sustainable' and 'ESD'. 'Sustainable' according to the Macquarie Dictionary is 'to provide the means of supporting life in a balanced way' (Macquarie Dictionary 2001). 'ESD' definition under Agenda 21 is 'the balance of social, economic and environmental factors in development so as not to impact on the next generation' (UN 1992) (Fig 1).

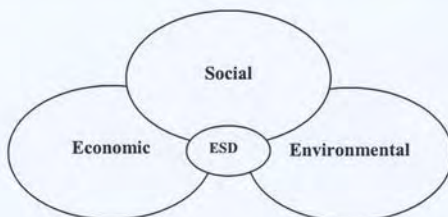


Fig. 1 – ESD Components

The ESD components include balance between social, economic and environmental, with all components essential to sustainability programs. Within Australia the National Strategy for Ecologically Sustainable Development (NSED) (Commonwealth 2000) details the importance of development proposals meeting ESD guidelines. While the environmental component of ESD will be used within this paper, the author acknowledges that all three ESD components (social, economic and environmental) need to be incorporated in a full ESD based sustainability program. The environment component consists of both natural (i.e. air and fossil sources) and man made (i.e. infrastructure and housing) parts.

Many professional disciplines and authorities resolve to adopt ESD approaches, but few achieve their intentions (Stillwell 2000). Urban planning is moving to ESD in combining land use planning and natural resource planning components into one discipline called 'sustainable planning' or 'ESD based urban planning'. ESD based urban planning thus utilises ESD criteria in making decisions about land uses and the natural environment in a holistic manner. Authorities are hopeful, in adopting an ESD approach, of achieving better environments and reducing the conflicts often generated over development versus protection arguments (Stimson 1999).

Sustainable transport forms a prime component of urban planning. Rose (1997), for example, argues that authorities need to look at land use planning not in terms of zonings but new dimensions of creating healthy communities, locally and globally. Crowe (2000) goes a step further and states that we can build a more civil society through land use planning based on sustainable building principles. In New South Wales the government introduced a State Environmental Planning Policy (SEPP) – Building Sustainability Index (Basix) (referred to as the Basix SEPP) 2004 (DIPNR 2004a) requiring all newly constructed buildings to be more energy and water efficient commencing in metropolitan areas in July 2004 and outer metro areas in July 2005.

The sustainable area planning (SAP) framework is built around ESD criteria, including ESD protocols, principles, goals and indicators of sustainability (Fig 2).



Figure 2 – ESD Criteria – Protocols, Principles, Goals and Indicators of Sustainability

Government or community initiated ESD **protocols** can be adopted at international, national, state, local government (LG) and non-government organisation (NGO) levels. A protocol is 'rules of behaviour to be agreed upon by heads of organisations (the Macquarie Dictionary 2001). The central international protocol relating to ESD is Agenda 21 Program of Action for Sustainable Development. This protocol was adopted in 1992 at the United Nations Conference on Environment and Development (UNCED) (UN 1992a) (called the Earth Summit and often referred to as the Rio Summit given the conference was in Rio de Janeiro, Brazil). Agenda 21 lays out key procedures for governments to adopt ESD strategies, including transport strategies. Also adopted at the Summit were the Rio Declaration on Environment and Development and the Statement of Forest Principles. Advancing on Agenda 21 the UN later developed Local Agenda 21 (LA 21) (UN 1993) from one chapter (Chapter 28) of Agenda 21. LA21 is a mechanism to encourage greater involvement by local authorities in delivering Agenda 21 programs.

The most recent international protocol to gain major public debate is the Greenhouse Gas Reduction Agreement (known as Kyoto Protocol) (UN 1997). This protocol came out of the United Nations Framework Convention on Climate Change (UN 1992b). The Kyoto protocol sets targets for greenhouse emission reduction for signature countries within a timeframe (activated by the subscribing countries in 2005). NSW and several other states are examining greenhouse targets under Kyoto principles that could be activated in the absence of the Federal government signing up to Kyoto. Finally, an example of an NGO transport protocol is the 'Toronto Protocol on Public Transport'. This protocol was signed before NGO and professional transport representatives from 79 countries at the 53rd Congress of the International Union of Public Transport in Toronto, Canada, in 1999 (LHCPTLG and Transit Planners 2003). Enactment of New South Wales (NSW) State (herein referred to as State) government acts will often interpret Federal and international protocols and spell out statutory powers to implement the spirit of protocols.

ESD **principles** are integral parts of ESD protocols and related legislative acts. Having adopted ESD principles, authorities are in the position to establish ESD **goals**. Equipped with ESD principles and goals authorities are then in a position to adopt **indicators of sustainability**. Indicators of sustainability are standards that enable ESD goals to be measured and for ESD benchmarks to be established. Transport indicators, for example, include the measurements of greenhouse gases and transport safety.

A case study method is the preferred means of illustrating the application of the sustainable area planning (SAP) framework to sustainable transport. The Central Coast, consisting of Gosford City and Wyong Shire, makes an ideal case study area given the regions transport challenges resulting from high growth rates and dispersed population. The Central Coast is immediately north of the Sydney Metropolitan region and south of Lake Macquarie, Newcastle and Cessnock LG areas and contains a population of just fewer than 300,000 (Fig 3).



Figure 3. Part of Greater Metropolitan Region (GMR) Sydney to Newcastle.
Source: Wyong Council (WC 1999)

Over the past 30 years (1973-2003) the Central Coast experienced an approximate 3% annual growth rate (Wyong 2005). In Wyong Shire the growth averaged 3.2% during these 30 years for an overall population percentage increase of over 300%. During this time Gosford and Wyong councils have experienced many policy debates over development versus the environment. These debates have included subjects such as sewer outfalls, hazardous industry zonings, threatened species, airport expansion and car versus public transport conflicts (Troy 1998). It is this latter policy debate area of transport and sustainability that this paper wishes to examine.

2. The sustainable area planning (SAP) framework in relation to transport

Sustainable transport is a fundamental component of ESD based urban planning. Examining recent transport and urban planning studies provides an understanding to how to approach sustainable transport challenges. The table below summarises transport and urban planning studies and inquiries from 2001-2004, these influencing transport decision making within the case study area (Table 1).

Table 1. Transport and Urban Planning Studies and Inquiries

Transport and Urban Planning Studies and Inquiries (Source and Date) 2001-2004	Synopsis
1. Federal	
Auslink Green Paper (DTARD 2003)	Australia wide transport priorities
Inquiry – Report on Sustainable Cities 2025 (Commonwealth 2004)	Parliamentary inquiry into sustainable city requirements
2. State	
Integrated Transport and Land Use - SEPP 66 (DUAP 2001)	Transport criteria needing to be met for approval of major developments
F3 to Sydney Orbital Link Study (RTA 2003)	New expressway link proposal between Central Coast and Sydney
Parry Report (DOT 2003a)	Improving the transport system in the NSW
Unsworth Report (DOT 2003b)	Improving bus transport in the Greater Metropolitan Region (GMR)
Metropolitan Strategy Discussion Paper (DIPNR 2004b)	A Sydney urban planning strategy
NSW Planning Reform Papers (DIPNR 2004c)	Package of planning reforms, including new LGA wide LEPs required within 3-5 years
Managing Sydney's Growth Centres (MSGC) (DIPNR 2005)	A report for settlement within the release areas of NW and SW Sydney
3. Local/Regional government	
Shaping the Central Coast (DUAP 2001)	Regional planning for the Central Coast
Central Coast Transport Action Plan (DOT 2002)	A plan for Central Coast transport projects
Shaping the Central Coast Action Plan (DIPNR 2003)	Actions to implement the Shaping the Central Coast defined needs
Sustainability Report 2004 (Gosford 2004)	Measuring the Gosford state of environment, including transport initiatives
State of Environment (SOE) 2003/4 (Wyang 2005)	Measuring the Wyong state of environment, including transport

At the **Federal** government level, transport proposals have generally not been developed within a sustainable transport framework. Within the Auslink's funding package in late 2003 (after green paper submissions) nearly all of the ten year multi-billion dollar funding went into non-metropolitan programs with minimal references to indicators of sustainability. The Federal government's House of Representatives Environment Committee's Inquiry on Sustainable Cities 2025 (Commonwealth 2004) contained many submissions that raised prospects of how sustainable transport methods would be considered by the government. The Inquiry (suspended after the 2004 Federal election), was reinstated in mid-2005 to report back to the public. Finally, the planning and recent funding of additional F3 laneways on the Central Coast appeared to lack scrutiny by the Federal government of long term sustainable transport options.

At the **State planning** level, there has been considerable focus on transport in recent studies and papers. Firstly, under the Integrated Transport and Land Use draft of State Environmental Planning Policy (SEPP) 66 (DUAP 2001a) sustainable transport was to be a consideration in State and LG approvals of major development applications. In practice LG

councils have not applied the SEPP to any level of effectiveness. The SEPP has thus not developed the statutory teeth required to see sustainable transport results on the ground. Secondly, the State government announced in 2003 that there would be a Metropolitan Strategy (MS) development. MS documents released under this program, ((Ministerial Directions Paper (DIPNR 2004d) and the Metropolitan Strategy Discussion Paper (DIPNR 2004b)) use sustainable cities and sustainable transport terminology, but implementation clauses are few. Under the F3 to Sydney Orbital Link Study (RTA 2003) the Roads and Traffic Authority (RTA) appeared to give only minimal consideration to sustainable transport alternatives, such as public transport and population settlement options. The only options offered to LG were three route alternatives (Fig 4).

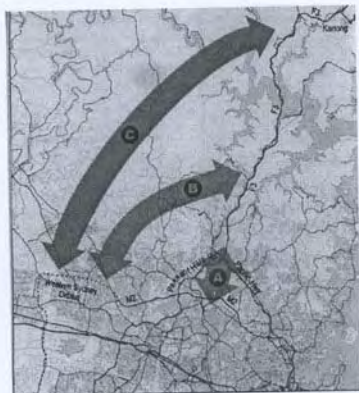


Figure 4. F3 to Sydney Orbital Link Study – Broad Corridor Types
 Source: RTA 2003

Finally, under Managing Sydney's Growth Centres (MSGC) (DIPNR 2005) (Sydney's NW and SW growth areas to settle 300,000 residents over the next 25-30 years) the State adopts eight sustainability criteria. Two criteria (access and jobs/economy), as noted by the NSW Government Sustainability Commissioner in MSGC, will only be assessed as people move into the new release areas. The report notes that standards in a range of criteria will be assessed by the Commissioner as development proceeds. It would appear critical that sustainability criteria, including the application of indicators of sustainability, be carried out before the MSGC is adopted. There is a prospect that experience gained by LG and the State in implementing a best practice MSGC could allow the State (in cooperation with LG) to set sustainability benchmarks for all release areas and renewal of existing urban areas throughout the State. This would auger in a new era for ESD based urban planning across the Greater Metropolitan Region (GMR) and NSW regional areas.

There have been a number of **State inquiries** into transport questions. The Parry Report (DOT 2003a) focused on many transport issues, but the inquiry resulted in minimal recommendations on achieving sustainable transport. The NSW Bus Review (Unsworth Review) (DOT 2003b) outlined the need for a comprehensive plan for bus systems, including infrastructure (i.e. bus shelters, signage and timetables). Finally, the in-house NSW Planning Reform State review (DIPNR 2004c) resulted in a number of new requirements on LG, including the requirement that all LG councils prepare new LG wide local environment plans (LEPs) over the next 3-5 years. Another reform requirement is that LG councils link their State of Environment (SOE) reporting into their annual Management Plans and LG wide

strategic plans. Finally, considerable more detail from the State is required on these reform requirements, particularly how sustainability principles (i.e. applying to transport) can be accommodated within the new LEPs and SOE reports.

Local/regional government is central to translating sustainable transport policies at the local/regional level, though many councils prefer to refer all non-traffic transport matters to the State. Several councils in the State, however, have instituted policies moving their areas toward sustainable transport, including Newcastle City, Lake Macquarie City and Sutherland Shire. The Australian Capital Territory (ACT) LG council produced a benchmark sustainable transport plan in 2003 (ACT Office 2003).

The first local/regional government transport planning study on the Central Coast was contained in the Central Coast Structure Plan (CCSP) (SPA 1977), nearly 30 years ago. The CCSP proposed innovative radial public transport right-of-ways (corridors) for buses and light rail under a 'Radial Corridor Structure Plan' (Fig 5). Proposals such as these were not investigated beyond 1977; hence these public transport rights-of-ways never eventuated. Only now are road outer lanes near busy town centres being declared and painted 'bus only'.

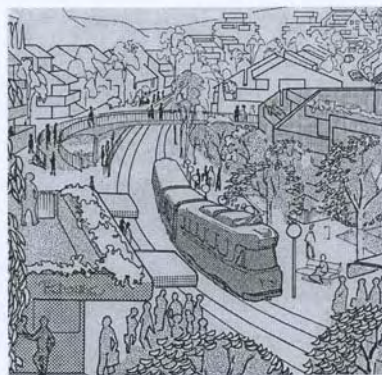


Figure 5. Central Coast Structure Plan ('Gosford/Wyong Sector – Radial Corridor')
Source: State Planning Authority 1977

Since the adoption of this 1977 Central Coast plan, neither the State, Gosford nor Wyong Council has expanded these early plan concepts to develop a sustainable transport plan. On a Central Coast regional basis, Shaping the Central Coast (SCC) (DUAP 2001b) provides an overview of development projected for the Central Coast over the next twenty years. The Shaping the Central Coast Action Plan (SCCAP) (DIPNR 2003), the implementation plan following SCC, contains a number of actions under State Government Departments and Gosford and Wyong Councils. The SCCAP has to date not been adopted by State, Gosford or Wyong Councils. The Central Coast Transport Action Plan (CCTAP) (DOT 2002) listed various road, rail, bus and cycleway projects, but to date the Department of Transport (DOT) has avoided setting out requirements of a sustainable transport strategy. A CC Transport Task Force was established to guide and monitor the implementation of the CCTAP, but the Task Force was abandoned by the State in 2005.

The state of environment (SOE) reports at the LG level often contain transport indicators highlighting the need for authorities to move to more sustainable transport programs. SOE reports of Gosford City (Gosford 2004) and Wyong Shire (Wyong 2005) indicate an

increased need for sustainable transport on the Central Coast. Finally, NGOs at the LG level are becoming more involved in promoting sustainable transport, including the Sutherland Shire Environment Centre (SSEC), the Community Environment Centre (CEN) (Central Coast), the Central Coast Community Council (CCCC) (Transport Projects Office), the Natural Conservation Council (NCC) and the National Road and Motoring Association (NRMA). The Department of Transport has assisted several LG councils and regional NGOs to produce broad based overview needs of transport, for example the Illawarra (DOT 2004).

3. Applying the SAP framework to achieve a sustainable transport program

Given the complexities of transport planning reflected in Table 1 and Figures 4, 5 there is a clear need to apply a sustainability framework to achieve sustainability programs. The sustainable area planning (SAP) framework, introduced earlier, enables sustainable transport programs to be considered within six steps. These steps (3S's and 3A's) are outlined in Table 2.

Table 2 – Sustainable Area Planning (SAP) Framework Steps

Step 1 Sustainability Review of ESD Components, ESD Criteria and ESD Studies	Step 2 Survey Study Area for Environmental Impacts and Trends and Threats	Step 3 Select Indicators of Sustainability for Study Area	Step 4 Apply Indicators of Sustainability to Study Area	Step 5 Adopt Sustainability Programs Contained in Sustainability Plan	Step 6 Adjust and Monitor Sustainability Programs → Sustainability Plan through Report Card
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Step 1 – Sustainability Review

Step 1 consists of three sustainability reviews relative to the geographical area. The first review looks at ESD components that apply to transport (i.e. air quality and energy use). The second review examines ESD criteria, including protocols and legislative acts, principles, goals and indicators of sustainability relative (in this instance) to transport. The third review critiques current planning, environmental studies and sustainability studies relevant to transport.

Step 2 - Survey

Surveying a study area provides an up-to-date summary of that area's state of transport. The survey includes for example examining air quality, impact of transport volumes and congestion, car dependence versus public transport use, walkability, cycling provisions, energy consumption, and transport safety measures.

Step 3 – Select Indicators

Selecting indicators of sustainability follows SAP steps One and Two. Key indicators of sustainability, with units of measurement and standards, can be selected from a range of sources. The research used a regionally based best practice source of state of environment standards (i.e. greenhouse, air pollution and use of fossil sources) under the Lower Hunter and Central Coast Regional Environmental Management Systems (LHCCREMS 2003). The

indicators that would apply to the Central Coast are laid out within the SAP framework matrix for ease of reference, calculations and for making comparisons between indicators (Table 3).

Table 3. Sustainable Area Plan (SAP) Framework Matrix

Step 1 Sustainability Review of ESD Components, ESD Criteria and ESD Studies	Step 2 Survey Study Area for Environmental Impacts and Trends and Threats	Step 3 Select Indicators of Sustainability for Study Area	Step 4 Apply Indicators of Sustainability to Study Area	Step 5 Adopt Sustainability Programs Contained in Sustainability Plan	Step 6 Adjust and Monitor Sustainability Programs and Sustainability Plan through Report Card
Federal, State and Local Government	Air quality Impact of transport volumes and congestion	Air pollution Greenhouse gases	Tons/day/ pollutant Tons/day of CO ₂	Air pollution reductions by source Greenhouse gas reduction targets	Pollutant source monitoring Targets met
	Car dependence versus public transport use	Car/public transport journeys	Number	Public transport program	Public transport program implemented
	Walkability	Footpaths	Km	Footpaths and shared pathways programs	Footpaths and shared pathways completed
	Cycling provisions	Cycleways	Km	Cycleway program	Cycleways constructed
	Energy consumption	Use of fossil sources	Kj	Energy plan with targets	Energy targets met
	Transport Safety	Danger spots and accidents	No. of danger spots eliminated	Transport safety program	Safety audits

Step 4 – Apply Indicators

The indicators of sustainability for transport can be applied across a State, LG area, region or locality. In the instance of applying indicators the data available will often be for different geographically sized areas (i.e. catchments, cities or regions). Extrapolation of the data to apply to the subject area needs to be done under rigorous standards procedures (Table 3).

Step 5 – Adopt Sustainability Programs Contained in a Local Sustainability Plan (LSP)

A sustainability program contains ESD principles, goals, indicators of sustainability and actions to achieve sustainability in particular geographical areas under key components (i.e. air, biodiversity, housing, transport etc.) This program can be built on from the results of applying the first four SAP steps. A sustainable transport program would contain, for example, policies under areas such as greenhouse emission reduction, transport safety, and fossil fuel energy savings. A more comprehensive Local Sustainability Plan (LSP) is a plan containing a cluster of sustainability programs. The LSP spells out how a local area, district, LGA, city or region can move to an overall sustainability, such as in the area of transport. The matrix above illustrates for example specific sustainability programs within transport that could be contained within a sustainable transport plan (Table 3).

Step 6 – Adjust and Monitor Sustainability Programs and Sustainability Plan through Report Card

A sustainability report card enables authorities and communities to compare their areas' progress towards sustainability and to become aware of strengths and weaknesses within their sustainability programs. The report is ongoing and identifies trends such as improvements and declines. The report carding includes the crucial component of monitoring (i.e. measurement) selected sustainability indicators, sustainability programs and a sustainability plan (Table 3). The governance of the Central Coast for example would ultimately adopt and systematically report on a Central Coast Sustainable Transport Plan. Finally, the report carding under any plan, in the long term, needs to include an administrative process of legal accountability for failing to achieve the stated sustainability targets.

Conclusions

The author's research to date has drawn a number of conclusions. Firstly, in spite of major use by authorities of the terms 'sustainable', 'ESD', and 'sustainable transport' the outcomes of studies and recommendations of authorities may not be matching their rhetoric. More analysis is required to determine the effectiveness of programs claiming to adhere to sustainability principles. Secondly, a sustainable area planning (SAP) framework provides a useful tool within ESD based urban planning to assist local government to develop sustainability programs, such as sustainable transport. Thirdly, an authority can develop a cluster of sustainability programs leading to a more comprehensive area wide Local Sustainability Plan (LSP). Fourthly, there is a prospect that experience gained by LG and the State in implementing best practice sustainability approaches (i.e. sustainable transport programs) in one locality (growth area or renewal of an existing area) could set sustainability benchmarks for other localities throughout the GMR and regional NSW. Finally, further research on State and LG methods of accountability for implementing and monitoring sustainability programs and sustainability plans is required if a SAP framework is to be workable and long lasting.

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ATTACHMENT ONE

SUSTAINABLE URBAN PLANNING WEB SITES (31/3/08)

1. Webs Referenced in Thesis

Complex Open Systems Research Network (COSNet)	www.complexsystems.net.au
IHDP Urbanisation Science Project	www.ihdp.uni-bonn.de
Millennium Ecosystem Assessment	www.maweb.org
Mistra Institute	www.ctmsu.sytes.net
Resilience Alliance	www.resalliance.org
UNESCO Man and the Biosphere (MAB) Urban Group	www.unesco.orb/mab

2. Webs Examined During Research

Agenda 21	www.unchs.org/quo
Agenda 21 Europe	www.iclei.org/la21/eurola21.htm
American Planning Association	www.planning.org/
American Society of Civil Engineers	www.asce.org/professional/sustainability
Architects Australia	www.raia.com.au/
Austin, Texas	www.ci.austin.tx.us/sustainable
Australian Conservation Foundation	www.acfonline.org.au
Australian Housing and Urban Research	www.ahuri.csiro.au/index.htm
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/research_activities/tools.cfm
Brookings Institute (Urban Policy), US	www.brook.edu/es/urban
Canada Planning	www.cip-lcu.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.cbemu.org/
Citizens Network for Sustainable Development, US	www.citnet.org
Community Environment Council, US	www.igc.org/citizennet
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
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 Environment and Climate Change, NSW	www.dec.nsw.gov.au
Dept. of Planning, NSW, Australia	www.dop.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.ecoig.com
Ecotransit, NSW Australia	www.ecotransit.org.au
Electronic Cultural Atlas Initiated, US	http://ecai.org
Environment Australia (Commonwealth)	www.ea.gov.au/esd//a21/framework/index.html
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
Europe Sustainability	www.whocdk/tech/hcp/eurosust.htm
Forests GIS (Mapping), US	www.americanforests.org/
Futures Foundation, Australia	www.futurists.net.au
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
Green Communities, US	www.grc.org/cec
Greenbelt, US	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)	www.city.toronto.on.ca/
	healthycity/index.htm
Healthy Cities, UN	www.who.org
Hornsby Council (see Earth Share), NSW Australia	www.hornby.nsw.gov.au
Innovative Urban Planning, NYC US	www.columbia.edu/~jws150/urban_planning
	www.ilsr.org
Institute for Local Self-Reliance, US	www.isf.edu.net.au
Institute for Sustainable Futures, NSW Australia	www.sdi.gov
Interagency Working Group (US Fed. Agencies)	www.soc.scitech.au.jp/isocarp
International Regional Planning	www.iisd.org
International Institute of Sustainable Development, US	www.csf.colorado.edu/ISEE
International Soc. For Ecological Economics	www.sustainablemeasures.com
Jacksonville Community Council, US	/resourcesw.ww.jcci.org
	www.lakemacquarie.nsw.gov.au
Lake Macquarie Council, NSW Australia	www.urbanoptions.org/sustain
Lansing Sustainable, US	www.lincolnst.edu/main.html
Lincoln Land Use Institute, US	www.livablecommunities.gov
Liveable Communities, US	www.iclei.org/iclei.htm
Local Environment Initiatives, US	www.lgsa.org.au
Local Government and Shires Assoc, Australia	www.mdf.org/meip.htm
Main Development Foundation, US	www.mapquest.com
Mapquest, US	www.metrovirtual.org
Metro Virtual (books/webs), US	www.igc.org/millennium
Millennium Institute	www.mnplan.state.mn.us/mm/index.html
Minnesota Planning, US	www.maced.org
Mountain Assoc. for Community Econ. Dev., US	www.nr.nsw.gov.au
Natural Resources Atlas (NSW aspects of NR), NSW	www.neighborhoodpreservation.org
Neighbourhood Preservation Centre, NYC US	www.newurbanism.org
New Urbanism, US	www.newurbannews.com
New Urbanism News (Image Bank Mapping), US	www.netsense.net/terry/newurban.htm
New Urbanism Resource Site, US	www.newcastle.nsw.gov.au
Newcastle City Council, NSW Australia	www.olywa.net/roundtable
Olympia WA, US	www.opc.on.ca/ohcc
Ontario Healthy Communities Coalition, Canada	www.web.net.ortee/scrp
Ontario Roundtable on Environment and Economy	www.econ.state.or.us/opb
Oregon Progress Board, US	www.penrith.nsw.gov.au
Penrith Council, NSW, Australia	www.co.pierce.wa.us/services/
Pierce County, WA, US	Family/benchmrk/qol.htm
	www.plannersnetwork.org
Planners Network, NYC US	www.plannersnetwork.co.uk
Planners Network, UK	www.plannersweb.com
Planners Web, US	www.internet.state.mn.us
Planning Impact Networks, US	

Port Stephens Council, NSW, Australia	www.portstephens.nsw.gov.au
Preserve Net, US	www.preserve.org
Positive Futures Network, US	www.futurenet.org
Project for Public Spaces, US	www.pps.org
Quality Planning, New Zealand	www.qualityplanning.org.nz
Real Estate Institute, Australia	www.reinsw.com.au
Redefining Progress (progress indicators), US	www.rprogress.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
Suburbia Project, US	www.living-room.org/suburbia/contents.htm
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 Resource 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.htm/
Thoreau Centre for Sustainability, US	www.naturalstep.org
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
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
US Dept. of Housing and Urban Dev.	www.huduser.org
Vermont, US	www.vitalcommunities.org
Village At, US	www.villageat.org
Virginia Govt., US	www.avenue.ogr/GovTJPDC
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.wbcsd.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

ATTACHMENT TWO: CD-ROMS

CD ROM 1. OVERVIEW OF SAP FRAMEWORK DEVELOPMENT

Running: Windows 95 or later versions

Time: 15 min, 26 sec

Slides: 48

Background:

The attached CD-ROM 1 contains an overview of the development of the SAP Framework as completed on the 10/7/04 and presented to the School of Environmental and Life Sciences (Newcastle University, Ourimbah Campus) Post Grad Seminar Series.

Playing:

There is an option to play: **1.** an audio video version; or, **2.** a slide version.

a. **Start:** After loading CD from 'my computer' a prompt may appear (depends on computer) with programs, scroll 5 down to 'play'. Press the 'test' (E) program and if audio only program plays (depends on computer) press blue 'X' button and red 'X' button (top right). If 'not responding' shows, just press 'end now'.

b. 'My computer' screen reappears, again press 'test' (E) and the SAP Overview program will appear.

c. Press 'Replay Broadcast' (grey box top) and audio visual will start (can adjust volume on your computer or within index box, same maximum volume result). Viewer can slide left screen over for full screen and back.

Important Play Option for Slide Only Manual Operation with Index of Slides:

d. To view slide by slide manually (an index on left appears) (with video in the background) press '**view previous slide**' on top blue bar). Viewer can slide index to left for full screen.

e. To return to audio-video click the red 'X' button (top right); can go back to manual function anytime.

f. **Exit:** 'X' will exit CD.

Note: Only for pages 27 and 32: The audio video version will require pressing left mouse click to allow several dot points (each press for a dot) to appear on screen.

CD ROM 2. SAP PRELIMINARY SURVEY STEP 3 (see index of survey next page)

Time: 25 min

Slides: 155

Background:

The attached CD-ROM contains key SAP Step 3 survey photos (155) (in addition to the 16 used in the thesis body) of West Tuggerah Lakes-Wadalba (south) and other Local Areas in the West Tuggerah Lakes-Wyong-Warnervale (3Ws) taken in 2001 - 2004. **The notes for this survey as are contained in the CD Rom 2 are on the next page of this attachment.**

Playing:

Same as above CD Rom 1 above, except in 'my computer' press 'survey' (E) button.

CD ROM 2: SAP PRELIMINARY SURVEY STEP 3 (2001-2004) INDEX OF SLIDES

The preliminary field survey covered potential case study Local Areas (A-F) (listed below) in North Wyong vicinity. The survey as presented on CD moves from north to south through suburbs as noted below. Local Areas are noted, if surveyed. Slides 1 and 2 show aerial views of the survey area a number of years ago. Research observations were made (using SAP framework 'Survey Step 3' methodology, Chapter 3) of sites called 'local environments' (LEs) as defined in Chapter 3) (slides 3-154). The bulk of the preliminary survey was around the most likely to be selected Local Areas, West Tuggerah Lakes (south) and Wadalba.

The final case study Local Area selected at the conclusion of the preliminary survey was a combined 'West Tuggerah Lakes-Wadalba (south)' (Local Areas A and B). This combined Local Area was selected for the reasons: it was contiguous; had been under major development since the 1960s; contained a wide variety of 'local environments'; and, was the right size for the full SAP framework survey and application of indicators of sustainability (Chapter 6 and 7). Slide numbers to the left follow the CD video and manual slideshow.

Local Areas:

- A. West Tuggerah Lakes (south)
- B. Wadalba
- C. Mardi
- D. Wyong
- E. Hamlyn Terrace
- F. Tuggerah

- 1. West Tuggerah Lakes-Wyong- Warnervale Study Area – Historic Aerial Photo: 1992
- 2. Wyong Town and Surround - Historic Aerial Photo: 1992

A. West Tuggerah Lakes

A1. Gorokan Suburb

- 3. Wallarah Point Park, Gorokan
- 4. Fishing Coop - Wallarah Park, Gorokan
- 5. Tuggerah Lake at Toukley Bridge, Wallarah Park North
- 6. Wallarah Bay Club - Marks Rd, Gorokan
- 7. Wallarah Bay Club Revetment, Gorokan
- 8. Stormwater Dispersion, Gorokan
- 9. Wrack and Rock Shelves, Gorokan
- 10. Marks Rd – Site 1, Gorokan
- 11. Marks Rd – Site 2
- 12. Marks Rd – Site 3
- 13. Marks Rd – Site 4
- 14. Marks Rd – Site 5
- 15. Marks Rd – Site 6
- 16. Marks Rd – Site 7
- 17. Marks Rd – Site 8
- 18. Marks Rd – Site 9
- 19. Marks Rd – Site 10
- 20. Marks Rd – Site 11
- 21. Marks Rd – Site 12

A2. Kanwal Suburb

22. Tuggerawong Rd – Craigie Park
23. Craigie Park – North Shore
24. Craigie Park – South Shore
25. Craigie Park – Creek Site 1
26. Craigie Park – Creek Site 2
27. Craigie Park – Creek Site 3
28. Craigie Park – Creek Site 4
29. Creek Park – Creek Site 5
30. Craigie Park – Creek Site 6
31. Craigie Park – Creek Site 7
32. Craigie Park – Land Rehabilitation 1
33. Craigie Park – Land Rehabilitation 2
34. Craigie Park – Land Rehabilitation 3
35. Craigie Park – Land Rehabilitation 4
36. Craigie Park – Land Rehabilitation 5
37. Craigie Park – Land Rehabilitation 6
38. Craigie Park – Land Rehabilitation 7
39. Craigie Park – Land Rehabilitation 8
40. Craigie Park – New Accessed Area
41. Craigie Park – Marks Rd Entry
42. Craigie Park – Pioneers Dedication
43. South Creek – Craigie Park

A3. Wyongah Suburb

44. Prawn Beach – Site 1. Wyongah. Historic Photo 1: 1996
45. Prawn Beach - Experimental Wrack Removal Rake
46. Prawn Beach – Site 2. Historic Photo 2: 1950s
47. Prawn Beach – Site 3. Historic Photo 3: Start of Research 2001
48. Prawn Beach – Site 4. Historic Photo 4: 2003
49. Prawn Beach - Site 5
50. Prawn Beach – Site 6
51. Prawn Beach – Site 7
52. Prawn Beach – Site 8
53. Prawn Beach – Site 9
54. Prawn Beach – Site 10
55. Prawn Beach – Site 11
56. Prawn Beach – Site 12
57. Prawn Beach – Site 13. Historic Photo 5: 1950s
58. Prawn Beach – Site 15. Historic Photo 6: 1950s
59. Prawn Beach – Site 16. Historic Photo 7: 1950s
60. Prawn Beach – Site 17. Historic Photo 8: 1950s
61. Prawn Beach – Site 18. Historic Photo 9: 1950s
62. Prawn Beach – Site 19. Historic Photo 10: 1950s
63. Prawn Beach – Site 20. Historic Photo 11: 1950s

A4. Tuggerawong Suburb

- 64. Friday St – Completed Native Plant Rehabilitation
- 65. Friday St – Rehabilitation 2
- 66. Friday St – Rehabilitation 3
- 67. Friday St Looking to Prawn Beach. Historic Photo 12: 2004
- 68. Friday St – Embankment Erosion
- 69. Friday St – Restoration 4
- 70. Tuggerawong – Site 1
- 71. Tuggerawong – Site 2
- 72. Tuggerawong – Site 3
- 73. Tuggerawong – Site 4
- 74. Tuggerawong – Site 5
- 75. Tuggerawong – Site 6
- 76. Tuggerawong – Site 7
- 77. Tuggerawong – Site 8
- 78. Tuggerawong – Site 9
- 79. Tuggerawong – Site 10
- 80. Tuggerawong – Site 11
- 81. Tuggerawong – Site 12

A5. Rocky Point Suburb

- 82. Rocky Point – Site 1
- 83. Rocky Pont – Site 2

A6. Tacoma Suburb

- 84. Tacoma Peninsula – Historic Aerial Photo: 1992
- 85. Tacoma Park (Don Small Park) - Entry
- 86. Tacoma – Peninsula Point Entry
- 87. Tacoma - Peninsula Point Site 1
- 88. Tacoma – Peninsula Point Site 2
- 89. Tacoma – Peninsula Point Site 3
- 90. Tacoma – Peninsula Point Site 4
- 91. Tacoma – Peninsula Point Site 5

A7. Wyong River Precinct

- 92. Wyong River – Site 1
- 93. Wyong River – Site 2
- 94. Wyong River – Site 3
- 95. Wyong River – Site 4
- 96. Wyong River – Site 5
- 97. Wyong River – Site 6
- 98. Wyong River – Site 7
- 99. Wyong River – Site 8
- 100. Wyong River – Site 9

A8. Pioneer Dairy

- 101. Pioneer Dairy – Site 1
- 102. Pioneer Dairy – Site 2
- 103. Pioneer Dairy – Site 3
- 104. Pioneer Dairy – Site 4
- 105. Pioneer Dairy – Site 5
- 106. Pioneer Dairy – Site 6
- 107. Pioneer Dairy – Site 7a
- 108. Pioneer Dairy - Site 7b
- 109. Pioneer Dairy – Site 8
- 110. Pioneer Dairy – Site 9
- 111. Pioneer Dairy – Site 10
- 112. Pioneer Dairy – Wyong Historical Society Inspection: 2002

B. Wadalba

- 113. Wadalba – Site 1
- 114. Wadalba – Site 2
- 115. Wadalba – Site 3
- 116. Wadalba – Site 4

C. Mardi

- 117. Mardi – Site 1
- 118. Mardi – Site 2
- 119. Mardi – Site 3
- 120. Mardi – Site 4
- 121. Mardi – Site 5
- 122. Mardi – Site 6
- 123. Mardi – Site 8
- 124. Burbank Estate – Site 1
- 125. Burbank Estate – Site 2
- 126. Burbank Estate – Site 3
- 127. Burbank Estate – Site 4
- 128. Burbank Estate – Site 5
- 129. Burbank Estate - Site 6
- 130. Burbank Estate – Site 7
- 131. Burbank Estate – Site 8
- 132. Burbank Estate – Site 9
- 133. Burbank Estate – Site 10

D. Wyong

- 134. Wyong Historic Photo: 1920s
- 135. Wyong – Site 1
- 136. Wyong – Site 2
- 137. Wyong – Site 3
- 138. Wyong – Site 4
- 139. Wyong – Site 5a
- 140. Wyong – Site 5b
- 141. Wyong – Site 6a

142. Wyong - Site 6b

E. Hamlyn Terrace

- 143. Hamlyn Terrace, Gorokan/Kanwal – Historic Aerial Photo:1992
- 144. Hamlyn Terrace -Kanwal Wetland to Porters Creek
- 145. Hamlyn Terrace – Site 1
- 146. Hamlyn Terrace – Site 2
- 147. Hamlyn Terrace – Site 3
- 148. Hamlyn Terrace – Site 4
- 149. Hamlyn Terrace – Site 5
- 150. Hamlyn Terrace – Historic Aerial: 1990
- 151. Hamlyn Terrace – Historic Aerial: 2001
- 152. Hamlyn Terrace – Site 7

F. Tuggerah

- 153. Westfields Shopping Centre
- 154. Westfields Drainage and Wyong Rd

Historic Past

- 155. Hamlyn Terrace ((old Warnervale Methodist (now Uniting) Church (early 1900s))