UNIVERSITY OF TECHNOLOGY SYDNEY

Australian Government
Department of Sustainability, Environment, Water, Population and Communities

National Environmental Research Program

Institute for Sustainable Futures

THE ECONOMIC, SOCIAL AND ENVIRONMENTAL IMPLICATIONS OF POPULATION GROWTH IN AUSTRALIAN CITIES:

FINAL REPORT

2013

ABOUT THE AUTHORS

The Institute for Sustainable Futures (ISF) was established by the University of Technology, Sydney in 1996 to work with industry, government and the community to develop sustainable futures through research and consultancy. Our mission is to create change toward sustainable futures that protect and enhance the environment, human well-being and social equity. We seek to adopt an inter-disciplinary approach to our work and engage our partner organisations in a collaborative process that emphasises strategic decision-making. For further information visit: **www.isf.uts.edu.au**

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CITATION

Cite this report as:
Institute for Sustainable Futures 2013, The economic, social and environmental implications of population growth in Australian cities: report prepared by the Institute for Sustainable Futures, University of Technology, Sydney, for the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC).

ACKNOWLEDGEMENT

The authors would like to acknowledge and thank all stakeholder participants for giving up their time to participate in case study interviews. We also thank the Department of Sustainability, Environment, Water, Population and Communities for their guidance during the project and for providing comments on draft case study reports.

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Executive summary

Project background, objectives and research approach

Increasingly, population growth is concentrated in urban areas. Three-quarters of Australia's population lives in 18 major cities (Major Cities Unit, 2012). Australia's population has grown by more than three million over the past decade, and cities have absorbed 80% of this growth (Department of Infrastructure and Transport, 2011). Population growth is therefore an urban, and increasingly a suburban, narrative. This research project was commissioned by the federal Department of Sustainability, Environment, Water, Population and Community (DSEWPaC) and funded under the National Environmental Research Program to provide a better understanding of the economic, social and environmental implications of population growth for the sustainability of Australia's cities. It was undertaken by the Institute for Sustainable Futures at the University of Technology, Sydney between May and December 2012. This report provides the findings of the research, drawing on a review of the literature on Australia's suburban population growth and on the planning and policy context, with primary research from ten detailed case studies.

While the ten case studies do not technically constitute a sample of locations in which suburban population growth has taken place, they were selected to give coverage across the country, to include a mix of suburbs in different types of cities, both coastal and inland, and to enable comparison with one inner city redevelopment.

The case study locations were:

- Blacktown (New South Wales)
- Kingborough (Tasmania)
- Mandurah (Western Australia)
- Townsville (Queensland)
- Playford (South Australia)
- Palmerston (Northern Territory)
- Logan (Queensland)
- Melton (Victoria)
- Lower Hunter (New South Wales)
- Green Square (New South Wales) (the inner city development).

The research used a mixed methods approach, combining the collection of quantitative data and qualitative research for each location. For quantitative data, the research used a set of sustainability indicators based upon the Australian Government sustainability indicator framework, developed by DSEWPaC in consultation with federal government departments and agencies, state government departments, non-government organisations, academics and other stakeholders. The qualitative analysis was based on semi-structured interviews with stakeholders in each location, typically including local and state government officials and representatives of community, business and industry groups and non-government organisations. The starting point for the case studies was the local government area (LGA) in order to maximise the data it was possible to collect and because these areas were meaningful and identifiable to stakeholders.

The research is largely retrospective, focussing on case studies of locations which have experienced growth, looking at opportunities and challenges and how the growth might have been managed more sustainably. It therefore explores the sustainability of the types of development that is occurring to meet population growth but does not attempt to assess whether population growth per se is sustainable.

Suburban population growth in Australia: a literature review

There is an extensive research and policy literature on urban and suburban development in Australia relevant to the project identifying a range of significant empirical and conceptual issues.

For the purposes of assessing the economic, social and environmental implications of population growth in Australia, it is helpful to distinguish three types of development and redevelopment:

- **Suburban development in the metropolitan areas of capital cities:** A trend in Australian urbanisation is towards suburban development, where lower density housing and industry is built on the outskirts of capital city metropolitan areas. This type of development is usually found in large metropolitan areas, and plays a role in meeting immediate demand for housing. Suburbs are also increasing their role in providing employment and industry.
- **Development in major, and medium-sized cities and regional centres:** The scale of growth in these cities is as significant (in actual numbers) as that in metropolitan areas, but they face particular challenges in developing appropriate employment and service provision mixes for their growing populations.
- **Infill in CBDs and inner area development of metropolitan (capital) cities:** Capital city metropolitan areas have also absorbed significant population growth in their CBDs and inner core urban areas – a form of development characterised by higher density living. A range of challenges arise, including increased pressure on services and transport, noise pollution and a range of social issues associated with increased numbers sharing limited amenity.

What does sustainability mean in the context of urban development?

The generally accepted understanding of sustainability is being able to "meet the needs of the present generation without compromising the ability of future generations to meet their own needs" (World Commission on Environment & Development, 1987). The definition of sustainability which has informed this project is taken from the issues paper informing the Commonwealth Government's *Sustainable population strategy for Australia*:

> Sustainability refers to the maintenance or improvement of wellbeing now and for future generations. Well-being is a term aimed at capturing all of the economic, environmental and social aspects of people's lives. It is not a single measure, but rather can be viewed through a wide range of indicators across each or all of the three aspects (DSEWPaC, 2011: 5).

What distinguishes most recent concerns about sustainability in suburban areas is the increasing evidence that the types of development which have taken place in Australia have had cumulative impacts on environmental quality. In particular the footprints of our cities are starting to generate negative externalities that outweigh the positives of agglomeration, particularly in regards to congestion, commuting, and efficient provision of infrastructure. As a result the costs and benefits of the current and future composition of government services and infrastructure are changing.

Sustainability in the urban environment encompasses two considerations: sustainable patterns of overall urban growth; and sustainability in the performance of the built environment (Collia and March, 2012).

Although the debate on the relative merits of the compact city versus low-density city development is far from settled, the balance of evidence and opinion for more sustainable patterns of urban development we should give preference to: urban consolidation and increased densities rather than urban-fringe settlements with low densities; public transport instead of private car transportation; and the integration of land use patterns that provide housing, employment, and recreation in close proximity to each other (Newman and Kenworthy, 1999; Mills, 2005).

Sustainability of the suburban built environment

In Australian cities the size of new residences has been steadily increasing over recent decades despite a simultaneous trend toward smaller household sizes. Australian planning and building practices do not appear to have delivered net environmental improvements in new building stock (Fuller and Crawford, 2011). There is also evidence that urban development itself contributes to changes in local climate, causing localised warming and reduced water availability in urban areas (Kamal-Chaoui & Robert, 2009).

Patterns of suburban growth

The areas in which urban development is concentrated, particularly suburban development on the outskirts of major cities, usually have natural resources, waterways, bushland and other native vegetation and often contain prime agricultural land – both broad acre agricultural land and smaller market garden operations that provide local sources of food for the nearby population centre. Current land use planning approaches are considered inadequate for managing the complexity and implications of changing patterns of land use (Bunker and Houston, 2003).

Within urban planning policy there is a common assumption that a diverse social mix is a positive (Arthursen, 2010). In most cases the diversity referred to is in the socio-economic mix, with communities with low incomes, poorer educational attainment and high levels of unemployment seen as those which should be diversified. Arguably, this belies the complexity of what constitutes a "social mix". Even this limited conception is rarely applied to higher socio-economic status communities that self-select into wealthier suburbs and master-planned estates (Arthursen, 2010), many examples of which are found in the growth areas investigated in this research. Community cohesion is more widely and generally understood to denote a community of people with a shared vision or understanding connected by social ties and commitments. Creating community cohesion requires community engagement as a first step.

A striking feature of suburban development is the high dependence on personal vehicles for transportation as result of three interrelated factors: First, other than infill or inner city redevelopments, new residential areas tend to be built on the outskirts of cities, relatively far from employment. Second, residential development tends to be planned and delivered in isolation to other aspects of community planning and simultaneous does not take account of likely increases in the demand for local employment in and around the development. Third, new areas of residential development are often designed to be accessed exclusively by roads and freeways with relatively small amounts of funding expended on new public transport (Buxton, 2006; PIA, 2005).

Economic geography of suburbs and links to local employment and industry

Economic activity is distributed unevenly. In contemporary developed economies such as Australia this is a product of investments in human capital, social fixed capital and increasing accessibility rather than access to raw materials and natural advantages (Capello, 2007). Hence, the key factors influencing regional economic development are policy-driven and the impacts are cumulative (OECD, 2009). Innovation, as a major driver of economic activity, is also strongly influenced by an inter-relationship and combination of local assets and factors including human capital, the structure and relationships between firms, and social and environmental amenity concerns such as quality of a place to live, spaces for interaction, social life, and transport links (Sharpe and Martinez-Fernandez, 2007; Sharpe, 2008). As such, innovative activity is locally embedded and built from the ground up rather than being imported or attracted to a region. And the drivers and characteristics of population growth that impact the level of human capital (in areas such as education and social inclusion) and fixed social capital (including the availability of places for social interaction) will therefore also impact the distribution of economic activity, particularly employment. Uneven geographical distribution of labour markets is also evident, reflected both in terms of overall numbers of jobs required in growth areas (with a forecast jobs deficit of 815,000 jobs in 15 growth areas by 2030) and in terms of the skills and occupations within the labour force (with a greater dependence in growth areas on "traditional" industries) (Essential Economics and Geografia, 2012).

Australian urban policy and planning

The importance of planning

Suburban and urban development is shaped by national, state and local-level plans covering a range of interrelated but usually imperfectly integrated projections and objectives for housing, transport, employment and the other key components for developing "wellbeing" in communities. State and territory government are responsible for the strategic pattern of urban development, and each jurisdiction has developed a distinct planning system. State-based planning systems also affect the processes for allocating land and approving development proposals. Local governments, which play a significant role in establishing the character of development and how it integrates into a locality, derive most of their powers from state legislation. However, the states retain absolute power over local governments and the related planning legislation. As a result of powers and functions being split between different governments, agencies and levels of government, and a lack of coordination or strategic alignment between the various bodies, Australian cities have often been characterised by less than ideal planning and governance arrangements

State and territory governments in the urban planning system

Each state creates strategic plans and policies for development in their jurisdiction, particularly for capital cities. These strategic plans and policies provide a clear, though not rigid, direction for land planning, and thus create an environment where developers, councils and other planning bodies can base their own plans on the expected outcomes (Productivity Commission, 2011: 364).

Local government and the urban planning system

The role of local government in urban planning has been in flux in recent years, particularly planning for the types of areas investigated in this research – suburban areas facing rapid population growth. In most states planning and assessment activity for major population growth centres has been centralised with the state government and its relevant agencies. This usually involves new forms of governance, such as metropolitan strategies like the *Metropolitan Plan for Sydney 2036*, the *Greater Darwin Regional Land Use Plan 2030*, *Melbourne 2030: Planning for Sustainable Growth* and the *30-Year Plan for Greater Adelaide*. Local government planning activities must be consistent with the metropolitan plan.

National planning and policy

Historically, the federal government has not implemented a coordinated, national approach to planning and land use, as was recognised in the Commonwealth parliamentary inquiry into sustainable cities in 2004. Recent Commonwealth Government involvement in urban planning has largely been directed through Council of Australian Governments (COAG) processes. The COAG Local Government and Planning Minister's Council (LGPMC) released the National Planning Systems Principles in late 2009 to progress strategic planning reform and inform the development of an appropriate governance structure (Queensland Government, 2009). COAG has also developed nine criteria for the efficient and effective planning of Australia's capital cities, including planning for future growth, and the Commonwealth recently developed broad principles for best practice urban design (Department of Infrastructure and Transport, 2011).

Beyond COAG processes aimed specifically at planning and reform, there are several key national bodies that impact planning at the national level, including the Commonwealth Group on Cities, and Infrastructure Australia. In addition, a significant number of national policies impact on state and territory planning, including the National Urban Policy, the Sustainable Population Strategy, and schemes aimed at improving housing affordability and the ends of the *Environment Protection and Biodiversity Conservation Act 1999*.

There are now several federal programs which aim to promote or trial sustainable urban models and in which a number of case study locations for this study are participating. They include the federal Department of Climate Change and Energy's Efficiency Solar Cities program (trialling new sustainable models for electricity supply and use); the Liveable Cities program, within the Department of Infrastructure and Transport; and the Sustainable Regional Development program which promotes sustainable development in high growth regions.

Policy in Practice

It appears that the difficulty in sustainable development lies as much in the translation of policies into practice, as it does in the formulation of policies. This is evidenced by the numerous metropolitan plans that speak of compact cities when in reality consolidation has occurred in a dispersed manner, rather than being concentrated around centres or transport nodes, and has developed more in response to market forces than to planning (Michell & Wadley, 2004; Buxton & Tieman, 2005; Forster, 2006).

Much urban consolidation has occurred without explicit energy or greenhouse efficiency objectives (Bunker et al., 2002; Michell & Wadley, 2004; Clune et al., 2012). Urban consolidation has been pursued mainly to make more efficient use of existing infrastructure, but has been partially justified by alleged environmental benefits, including the claim that it promotes household greenhouse and energy efficiency (Troy, 1996; Adams, 2009).

Sustainability and population growth: the case study findings

This report synthesises the findings from individual case studies structured around the significant issues and processes as they were described and raised by stakeholders. It does not attempt to attribute them to specific data sources or to comments from particular stakeholders. Nor does it categorise issues in the three themes or domains of sustainability (economic, social and environmental) as few fit neatly into any one of these categories, and many of them cut across, or are a result of, interrelationships between all three domains. Readers should refer to individual case studies for in-depth consideration of sustainability issues in case study areas.

Opportunities from suburban urban growth

- **Critical mass for services:** In many of the case studies population growth has provided a 'critical mass' of people to support a greater range of businesses, social services and amenities. Population growth can also bring benefits to surrounding areas, transforming the growth area into a service centre for a much larger area. The question of critical mass is not straightforward however, as there are various kinds of infrastructure and services that ideally would be provided ahead of population increase rather than at a point when a 'critical mass' is achieved.

- **Cultural change:** The case studies show population growth is changing the cultural character of some areas. In some instances this is on a socio-economic basis. Diversity can also be experienced in an area's ethnic mix. However, even in locations where stakeholders spoke explicitly of the benefits of the changes introduced by greater diversity, the positive perception of diversity was not universal. Some stakeholders also spoke from a number of different perspectives, about the challenges that can accompany diversification.

- **Economic opportunities:** Population growth can have positive effects on existing businesses and services by increasing their customer base, generating increased investment and can also trigger the development of new businesses, with knock-on benefits for the local economy. However, availability and growth of local employment is not common to all the case studies – in many there is a severe lack of local employment opportunities, meaning residents were forced to travel significant distances to work.

- **Increased rate base for councils:** Increased population within an LGA provides an increased rate base for councils, meaning they have larger budgets to spend on improving local infrastructure, services and amenity. As a consequence many councils have an explicitly positive attitude towards development and growth.

Challenges from suburban population growth

The kind of urban development that has been typical in Australian cities tends to exacerbate the negative impacts of population growth across all dimensions of sustainability. Many stakeholders across the case study locations felt strongly that 'urban sprawl' development has significant downsides, and while most were supportive of future growth, they were keen for it to be better planned and coordinated. In particular, stakeholders said: residential development needs to be better integrated with services and infrastructure, particularly public transport; it needs to be planned so that it coincides with an increase in local employment; houses need to be better suited to the local climate; and there should be more diversity in housing type – including more high density residential development in the inner cities.

- **Population growth inevitably increases pressures:** *All* population growth increases pressures on the environment. When population growth is concentrated in a given area – as it is with urban population growth in Australia – localised impacts are intensified and put greater pressure on the existing infrastructure for environmental management. The case studies provide many examples of how increased population can increase pressures on the natural environment, with a cumulative impact. Population growth can offer environmental gains, with data from a number of case studies showing increasing amounts of land that have been re-vegetated or protected. However, stakeholders acknowledge that current systems and activities were largely ineffectual in protecting of local environmental quality. In each of the case studies stakeholders spoke of the struggle to accurately value, protect and manage the environmental quality of their areas. The literature further highlights that there is a general lack of methods and tools to guide effective local-level environmental management and more generally embed sustainable practices in areas of suburban growth.

- **Impacts on environmental quality**: The increasing amount of land used by cities has biodiversity impacts as development encroaches upon or destroys important habitat areas or critical wildlife corridors for native fauna. In many cases, population growth has led to land-use conflicts between rural/ agricultural land uses and urban residential land uses, as well as conflicts between development and environmental land use (waterways, riparian zones, open space and wildlife corridors and habitats). Governments recognise that land clearing for urban development has negative impacts on biodiversity. Most local councils are responding by targeting particular areas for biodiversity conservation, regeneration and revegetation and some are working with private landowners on these issues

- **Loss of rural land: In many areas,** the development of rural land on the outskirts of cities has meant that population growth has come at the cost of the rural lifestyle of these areas. Stakeholders in many areas pointed to the negative sustainability impacts of the increasing trend for cities to transport food across greater distances, as agricultural land on the urban fringes is lost to development

- **Social and socio-spatial divisions**: While the contributions of population growth to cultural diversity and change were welcomed by stakeholders in some locations, in others the tensions caused by social divisions were considered difficult to manage. Integration takes time and resources, and requires sufficient and appropriate social infrastructure. Australian urban environments typically have areas of disadvantage and advantage. In some cases socio-spatial concentration is a legacy of poor planning associated with past population growth. More recent approaches to growth and development, particularly the tendency for developers to deliver large numbers of one kind of dwelling in a single area, have also contributed to this phenomenon. There is increasing recognition that the current approach to accommodating population growth does not deliver equitable outcomes or the kind of social mix required for social sustainability. In some locations, some stakeholders felt population growth will bring new residents who will “dilute” the current concentration of social disadvantage, leading to a more diverse community. However for this to occur development needs to be managed in a way that promotes a social mix across the area. While in some cases new residents were in general financially better off than established residents, some new residents also faced vulnerabilities including mortgage stress, and cost of living and job security pressures.

- **Urban development not seen as best practice*:*** Stakeholders overall felt that the typical patterns and forms of urban population growth in Australia have a number of characteristics that generate poor sustainability outcomes, notably suburban sprawl, poor public transport and infrastructure, poor house design, poor suburb design and development being largely developer-led. Infrastructure and service provision often does not keep pace with population growth, resulting in increased travel times to work, more commuting by car, more congestion and increasing per capita emissions and resource use. These characteristics mean that the built environment in these new suburban areas exacerbates negative environmental impacts of population growth, and the overall pattern of urban development introduces negative social impacts and economic inefficiencies.

- **Inefficient resource use caused by poor house design:** House sizes in Australia have been increasing, which means an increase in the resources they consume – both at the time of building and over time. Typically new houses are not designed for local climates, so their energy and water efficiency is generally poor. This means inefficient resource use is 'built in' to these developments and this was evident in the case studies in electricity and gas consumption for heating and cooling, and water consumption due to the style of gardens. The tendency for new developments to feature large areas of non-permeable surfaces leads to increased water runoff, often exacerbating water pollution problems in local waterways.

- **Housing prices and affordability:** While suburban developments may increase the total supply of housing, the case studies illustrate that this does not necessarily mean more affordable housing, because residences in new suburban residential developments typically have higher purchase prices than established housing stock. In the case study locations, house prices in new development areas (that is within the LGA as a whole) have increased at a faster rate than inflation. Stakeholders pointed to anecdotal evidence of households on fixed incomes being forced to leave the area because of the increase in house prices and the rise in rents, even in established areas. The case studies also suggested that affordability needs to be understood in broader terms than simply the initial purchase price of a house. The cost of living over the longer term needs to include costs of transportation and other infrastructure, and energy costs.

- **Role of developers in planning**: In many of the case studies there was a strong feeling among stakeholders that recent growth and development had been 'developer-led', and had not been well planned or managed. Many stakeholders felt that development was poorly designed from both an environmental and social perspective, was not catering sufficiently well to the needs of the community, and was having a range of negative impacts.

- **Poor planning for growth**: Inadequacies in planning and governance arrangements were evident in relation to many of the case studies with stakeholders commenting on the need for the different levels of government to work together more effectively in planning for the growth of Australia's cities.

- **The costs of growth**: The case studies highlight the difficulties faced by governments, particularly councils, when planning for the cumulative impacts of development across whole areas. The "costs of growth" include the overall provision of infrastructure for new areas, the economic efficiency of providing infrastructure on a suburban scale, and the need for clarity in relation to who is responsible for the purchase and maintenance of infrastructure. Many new residential areas lack services and have an infrastructure deficit. Stakeholders across the case studies commented on the need for a wide range of community infrastructure, including community facilities (libraries, neighbourhood and community centres) and community services (child care, playgroups, pre-schools, schools, aged and youth services, and health services). In many of the case study areas funding for this kind of infrastructure is not keeping pace with population growth. It seemed that it is only once residential development is complete that communities begin to grapple with the challenge of providing the services that become necessary as a result of population growth in particular areas (including schools, social support services, community facilities and recreational activities). This lack of services in newly developed areas leads to high car dependency or social isolation. The case studies highlighted widespread frustrations about the delay in providing social and physical infrastructure to communities. There is a feeling that many social, economic and environmental problems could be avoided by proactive planning and infrastructure delivery, as delays only exacerbate the problems, which then require more resources to resolve.

- **The efficiency of infrastructure on a suburban scale**: Where development has been widely spread, various kinds of infrastructure must be provided across large geographical areas and this has economic impacts. Evidence from a number of case studies suggests that the provision of public transport in Australian cities has become something of a 'catch-22': urban development is often only serviced by roads and freeways and so people are dependent on cars. Consequently there is less demand for public transport and less incentive for governments to fund it.

- **High levels of car dependence**: The heavy car dependence of many of the fastest growing areas of Australian cities has been recognised and is in evidence across the case studies. Stakeholders in many areas said that long commuting times have social costs, as people spend many hours a week commuting, reducing their available social, community and family time. This in turn impacts on the quality of communities and the degree to which people undertake voluntary work and engage in local decision making. Stakeholder interviews also highlighted the isolation of people without a car in car-dependent places. In comparison, data suggests that car use in the one inner city case study is declining, and public transport use increasing.

- **Jobs lag behind residential development**: Provision of local employment opportunities also tends to lag behind residential development. The case studies show the nexus between the location of work and home as a critical component in sustainable development. Long commuting times can have negative impacts on people's health, wellbeing and social connections, and where these commutes are made by private vehicle; they also have negative environmental outcomes. Because urban growth tends to be driven by residential development, many new areas do not have sufficient local employment. This means people must travel increasing distances to work, which has a range of social and environmental impacts. Furthermore the kinds of jobs that are likely to become available as land is developed will not necessarily match the skills and qualifications of local residents. In the case studies, skills mismatches were highlighted by stakeholders, and the indicator data also highlighted large differences in educational attainment within these fast-growing areas. Low levels of skills attainment make workers in these areas vulnerable in the modern workplace. Initial evidence suggests a different pattern in the one inner city redevelopment in which the employment participation rate and levels of qualification are significantly different to the Metropolitan area as a whole.

Emerging Trends

- **Changing role of councils**: The case studies highlighted that many councils are beginning to take a wider sphere of influence and advocacy on behalf of their LGAs, not seeing themselves as just responsible for "roads and rubbish". They are dedicating resources to this advocacy (by commissioning studies, creating partnerships with other councils) and feel that they now have a clearer vision of the future for their communities.

- **Evidence of changing approaches**: There is some evidence of changing development practices with some locations among medium sized cities promoting higher density inner city development. There is also evidence of an increasing desire for more 'mixed use' development that integrates residential development with commercial, recreational, cultural and/or institutional uses. This generally creates higher densities and a more compact urban form. In many of the case studies, there appeared to be a growing conviction among stakeholders, and in recent planning documents associated with these areas, that mixed use development has the potential to deliver sustainability benefits.

Review of the indicator framework

The indicator framework

One objective of the project was to enhance the potential for using the set of sustainability indicators to track and measure sustainability issues relating to population growth on an ongoing basis. To do so, the research team was tasked to collect and assess existing community-level data against sustainability indicators for each case study. Then to "complement and test" the data against the subjective assessments from stakeholders, identifying priority information gaps, and exploring means by which supporting data could be collected. The sustainability indicators used were based upon the Australian Government sustainability indicator framework, developed by DSEWPaC in consultation with federal government departments and agencies, state government departments, non-government organisations, academics and other stakeholders, with modifications and adjustments by the ISF research team.

Using the framework in the case studies

For each case study, the framework was populated with publicly available data. Stakeholders were provided with a "simplified" version of the framework which summarised the "domains" (contextual environmental, social, economic, the last three of which are referred to as "capitals" in this framework), and the main themes covered in each. They were asked for comments on the adequacy of the coverage of the framework. They were also provided with the detailed framework of measures and data sources being used and asked about information they used or collected in their professional, organisational or advocacy activities which might add to or replace any of the measures.

There was a broad recognition and endorsement of the overall coverage of the indicator framework among stakeholders across the ten locations. The stakeholders made very few comments or suggestions about deficiencies in the framework. When they did, it was usually in relation to the ability of the framework to capture fine-grained and location-specific issues distinctive to their localities.

However, when reviewing the coverage of the framework against the issues which were emphasised by stakeholders in interviews and discussion, there was a lack of direct or close correspondence with many of the issues even though the framework often provides some relevant data and information on them. Overall, there are three broad sets of issues regarded as significant by stakeholders across the locations which do not appear to be captured well in the indicator framework. The first set is issues of governance and integration within and between the tiers of government. The second set is the availability of basic services, particularly in community facilities and services. The third set is the nature of the built environment.

Data available on communities and locations

In practice, the data which could be used to assess the domains ("capitals") and themes at the local/community level were derived from three broad sources:

- data available from the ABS or other national agencies on a regular basis, particularly for all the contextual indicator themes and many of the economic capital themes
- two regularly produced sources which compile, model and project detailed data: PHIDU (for data on the social capital) and the State of the Regions report based on NIEIR analysis (for data on economic capital)
- data generated and/or held locally, usually by the local council. Almost all the local- or community-level information available on natural capital/ the environment came from council sources, often a local state of the environment report or similar document.

Drawing on all these sources, the local data for environment/natural capital was the most sparse across the case studies. There is no single theme for which it is possible to use data to identify trends across all localities. For social and human capital, however, it is possible to identify sources and analyse data for each theme if PHIDU data is used (except that there is no measure for assessing the balance between supply and demand for education services). Similarly the State of the Region report makes it possible to obtain data for every theme across all localities, albeit at the regional level, for economic capital/the economy. For contextual themes, the availability of ABS data makes it possible to report on and assess every theme across the localities with the exception of land use changes and internal migration. The challenges in obtaining relevant, reliable and consistent data are even greater for precinct or neighborhood developments than LGAs.

There is no single or recommended level of assessment or analysis across domains, themes or measures. Hence the appropriate level of analysis (region, LGA, neighbourhood) is most usefully and effectively reviewed in relation to specific themes, how they are best conceptualised and the data actually available for the relevant indicators and measures.

The potential for adding new measures to the indicator framework

From the analysis of data available and reported on in the ten locations, the research reviewed additional, potential measures for future use at the location or LGA level. Based on an initial assessment of what the measure covers, how it has been used, and the sources of data, ten measures are identified with the potential for further investigation and development:

Contextual indicator measures:

- Land use change: percentage infill
- Land use change: percentage greenfield development.

Natural capital measures

- Eco systems and biodiversity: number of indigenous plants planted
- Water consumption: residential water supplied per property relative to mean annual rainfall.

Social capital measures

- Health: open space per capita
- Employment: % people working and living in the same LGA (also known as Employment Self Containment rate)
- Employment: employment self-sufficiency.

Economic capital measures

- Income disparity: social security take-up

- Income disparity: household debt service ratio
- Income disparity: ratio of average dwelling price to household disposable income.

Glossary

ABS	Australian Bureau of Statistics
ACE CRC	Antarctic Climate and Ecosystems Cooperative Research Centre
AEDI	Australian Early Development Index
AIMS	Australian Institute of Marine Science
ALGA	Australian Local Government Association
b	billion
BFV	Barmah Forest virus
BOSCAR	NSW Bureau of Crime Statistics and Research
BREED	Blacktown Regional Economic and Employment Development
CALD	culturally and linguistically diverse
CAMBA	China-Australia Migratory Bird Agreement
CBD	central business district
CCP	Cities for Climate Protection Program
CD	(Census) Collection District
CEO	chief executive officer
CR	critically endangered
Cr	councillor
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCP	development control plan
DEC	Department of Environment and Conservation
DEET	Federal Department of Employment, Education and Training
DOW	Department of Water
DPA	development plan amendment
DPTI	Department of Planning, Transport and Infrastructure
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
EPA	Environmental Protection Agency
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999* (Cth.)
ESC	employment self containment
ESS	employment self sufficiency
FIFO	fly-in fly-out
GBRMPA	Great Barrier Reef Marine Park Authority
GDP	gross domestic product
GFC	Global Financial Crisis
GHHTS	Greater Hobart Household Travel Survey
GP	general practitioner
GRP	gross regional product
ha	hectares
ISF	Institute for Sustainable Futures
IRSD	Index of Relative Socio-economic Disadvantage (a SEIFA index)
JAMBA	Japan-Australia Migratory Bird Agreement
kg	kilogram
kl	kilolitre
km	kilometre
km^2	kilometre squared
LGA	local government area
m	million
MAR	managed aquifer recharge
MBO	monosifatic black ooze
MDP	metropolitan development program

ML	megalitre
NAPLAN	National Assessment Program Literacy and Numeracy
NBN	National Broadband Network
NEPM	National Environment Protection Measure
NES	non-English speaking country
NGO	non-governmental organisation
NIEIR	National Institute of Economic and Industry Research also known as National Economics
NIMBY	not in my back yard
NSW	New South Wales
OESR	Queensland Office of Economic and Statistical Research
OSCAR	Office of Crime Statistics and Research
pa	per annum
PHIDU	Public Health Information Development Unit
PM	particulate matter
PNP	Peron Naturaliste Partnership
QCOSS	Queensland Council of Social Service
QLD	Queensland
Ramsar	Ramsar Convention on Wetlands
RDA	Regional Development Australia
RDC	Regional Development Commission
RRV	Ross River virus
SA	South Australia
SALMS	small area labour markets survey
SD	statistical district
SEIFA	Socio-Economic Indexes for Areas
SEQ	South East Queensland
SEPP	State Environmental Planning Policy
SMDA	Sydney Metropolitan Development Authority
SoC	State of the City report
SoE	State of the Environment report
SoR	State of the Regions report
SPP	Statement of Planning Policy
STCA	Southern Tasmanian Councils Authority
STRPP	Southern Tasmania Regional Planning Project
SWSA	Southern Waste Strategy Authority
TAFE	Technical and Further Education
TAFE NSW	New South Wales Technical and Further Education Commission
TAS	Tasmania
UDP	urban development program
ULDA	Urban Land Development Authority
UTS	University of Technology, Sydney
WA	Western Australia
WACOSS	WA Council of Social Services
WAPC	WA Planning Commission
WESTIR	Western Sydney Information and Research Service
WHO	World Health Organisation
WSROC	Western Sydney Regional Organisation of Councils
WSUD	water sensitive urban design
WWII	World War II

Contents

Project background, objectives and research approach

Background

This research project was undertaken by the Institute for Sustainable Futures at the University of Technology, Sydney, on behalf of the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC). DSEWPaC commissioned the project in response to a need identified by the National Environmental Research Program: to understand better the economic, social and environmental implications of population growth for the sustainability of Australia's expanding cities.

Understanding how urban areas and communities work is important; over half the world's population now lives in urban areas and this figure is forecast to rise to two-thirds by 2050. In Australia, three quarters of our population live in 18 cities.[1] Australia's population has grown by more than three million people over the past decade, and cities absorbed 80% of this growth (DIT, 2011). Clearly there are social, economic and environmental implications of urbanisation, and there is a need to consider the opportunities and challenges that further urban population growth presents across these three dimensions.

Project objectives

The overall objective of the project was to understand better the economic, social and environmental implications of population growth for the sustainability of Australia's expanding cities, and the interrelationships between these dimensions of sustainability.

In order to achieve this broad objective, the project aimed to:

1. Collect and assess existing community-level data against a set of sustainability indicators for selected growth areas across Australia.
2. Identify current and emerging challenges and opportunities, focusing on the interrelationship between social, economic and environmental issues, and where possible, to identify changes to particular issues over time.
3. Complement and test sustainability indicator data against subjective assessments obtained through on-ground interviews in order to identify priority information gaps, test the value of the data collected, identify trends based upon anecdotal evidence that may or may not be supported by existing data, and explore means by which supporting data could be collected.
4. Research and write case studies to illustrate the key findings.
5. Identify priority information gaps and report on opportunities, barriers and solutions for obtaining and utilising local information.

Research approach and methods

The research was conducted between May and December 2012, using a mixed methods approach combining the collection of quantitative data using a framework of sustainability indicators and qualitative research in case studies of ten locations across Australia. The project was also informed by reviews of the relevant literature on suburban population growth in Australia and literature on the overall urban policy and planning context.

[1] Cities defined as urban areas with population of 100,000 persons or more.

The indicator framework

The indicator framework used in the project was based upon the Australian Government sustainability indicator framework, developed by DSEWPaC in consultation with federal government departments and agencies, state government departments, non-government organisations, academics and other stakeholders. It was modified by the ISF research team, with several adjustments, additions and deletions made to the framework before it was used to collect base data for the case studies. The indicator framework is reviewed in detail in a separate section of this report.

Case study approach and selection

The main focus of the research was to explore the issue of urban population growth in Australia by focusing on ten geographically diverse case studies. The case study approach provides unique insights into the specific sustainability implications of population growth in each of these diverse locations, as well as allowing the identification of common findings and themes across the case studies.

The case study sites were selected using criteria developed in collaboration with DSEWPaC. While they do not technically constitute a sample of potential sites, they were selected to give diversity of cases using criteria which ensured that:

- there was at least one case study in each state and territory (excluding the ACT)
- the locations had experienced rapid and/or significant recent population growth
- the locations provided a mix of suburbs of capital cities, major cities and emerging major cities
- the locations included both coastal and inland areas
- while the primary focus would be on suburban developments where the majority of population growth in Australian cities has been occurring, there would also be an inner city site (Green Square in Sydney) to provide comparison.

The case studies for this research project were:

- Blacktown (New South Wales)
- Kingborough (Tasmania)
- Mandurah (Western Australia)
- Townsville (Queensland)
- Playford (South Australia)
- Palmerston (Northern Territory)
- Melton (Victoria)
- Logan (Queensland)
- Lower Hunter (New South Wales)
- Green Square, Sydney (New South Wales)

Undertaking the case studies

The project used a mixed methods approach, combining the collection of quantitative data with qualitative research conducted via semi-structured interviews with stakeholders. The research team conducted background desktop research prior to commencing the primary research for each case study.

The research team collected and assessed both relevant demographic data and existing community-level data against the set of sustainability indicators developed by DSEWPaC. This analysis of indicator data was complemented by subjective assessments obtained through on-ground interviews with stakeholders undertaken during site visits to each case study area. Background research informed a longlisting and shortlisting process that was used to identify potential stakeholders, with shortlists sometimes supplemented with suggestions made by existing stakeholders. The mix of stakeholders interviewed for each case study site typically included local and state government officers and representatives of community and business/industry groups and non-government organisations.

The interviews enabled researchers to gain a variety of perspectives on the issues, and to identify additional trends or issues based upon anecdotal evidence that may not have been evident from the existing data. In some cases interviewees also assisted with the identification of additional local-level data and/or data gaps and with advice on how missing data could be obtained.

The starting point for each case study was the local government area (LGA). To some degree this approach was necessary to maximise the data and information collected. It also corresponded to an area which was meaningful and identifiable to stakeholders even if it was not their main point of reference or the most important one for their purposes., Stakeholders interviewed in each location included people from organisations with wider geographical frames of reference (such as people with regional or state responsibilities) as well as organisations more closely focused on one set of issues.

This report

This report provides the findings of the research, drawing on the review of the relevant literature on Australia's suburban population growth and the planning and policy context, with the evidence base from the detailed case study research, including the indicator analysis and interview data. At the time of completing this report it was possible to include the findings from the first seven case studies based on the complete reports prepared for each, and to make reference to the final three case studies full reports for which were still in preparation. Readers should refer to individual case studies for in-depth consideration of sustainability issues in case study areas.

Suburban population growth in Australia

Population growth in Australia

Increasingly, population growth is concentrating in urban areas. Three-quarters of Australia's population lives in 18 major cities.[2] The population has grown by more than three million over the past decade, and cities have absorbed 80% of this growth (Department of Infrastructure and Transport, 2011). Sydney, Melbourne, Brisbane and Perth alone accounted for almost 60% of this growth. Population growth is therefore an urban, and increasingly, a suburban narrative.

The sources and drivers of population growth differ across the country (Department of Infrastructure and Transport, 2011). In Sydney and Melbourne, the majority of population growth comes from international migration, whereas in Brisbane and Perth growth has come through domestic migration.

As noted in the introduction, this research does not deal with the sustainability of population growth in terms of the absolute numbers of population increases or the sources or drivers of growth. This research seeks to explore the sustainability of development that is occurring to cater for increases in population.

There is extensive research and policy literature on urban and suburban development in Australia relevant to the project covering a wide range of empirical and conceptual issues.

Suburbs in the urban landscape

For the purposes of assessing the economic, social and environmental implications of population growth in Australia, it is helpful to distinguish between three types of development and redevelopment:

- suburban development in the metropolitan areas of capital cities
- development in major, and medium-sized cities and regional centres
- infill in CBDs and inner area development of metropolitan (capital) cities.

These three types of development are briefly described below.

Suburban development in metropolitan cities

A trend in recent Australian urbanisation is towards suburban development, where lower density housing and industry is built on the outskirts of capital city metropolitan areas. This type of development is usually found in large metropolitan areas, and plays a role in meeting immediate demand for housing. However, suburban development can also contribute to the negative impacts of agglomeration (increased travel time, reliance on private vehicle and the resulting congestion, social isolation because of the distance from services and amenities, high housing costs and higher infrastructure costs for services). These developments can also have higher environmental costs as changing land use patterns lead to a loss of biodiversity and productive agricultural land.

In Sydney, outer urban areas have absorbed 46% of the city's population growth over the past decade, while in Melbourne the figure was 61% and in Perth 69% (Department of Infrastructure and Transport, 2011). As such, in Australia, suburban development is a major feature of metropolitan population growth.

[2] Major cities are defined as urban areas with populations of 100,000 persons or more (Major Cities Unit, 2012).

Suburbs, in the past, while fluid in definition, have principally been associated with residential housing along commuting corridors on the outskirts of cities. Suburbs are a widely known urban form. Even in the last century, suburbs were understood as the belt of population living in roomier conditions (Douglas, 1925) or as communities adjoining a main city or within commuting distance to the city (Websters, 1981). A suburb is generally thought of as a "residential community" on the outskirts of a major city and as being dependent on that city for employment, retail and entertainment opportunities (Palan, 1995). Suburbs are seen as areas in land-use transition (Bartlett School of Planning, 2003).

Today, while they continue to be the site of rapid population and residential housing development, suburbs are increasingly providing employment and sites for industrial development. As the size of metropolitan areas expands, the patterns of planning are shifting from centric to polycentric. Suburbs in many large metropolitan areas are expected to create employment and recreation activities for their residents, rather than just act as dormitories, as they have in the past. Therefore suburbs are emerging as sources and locations for innovative activity and socio-economic development, essential not only in terms of the growing self-sufficiency of individual suburban regions, but also in terms of the success of the wider metropolitan regions in which they are located.

Major and medium cities and regional centres development

Population growth is also occurring in what are defined as major cities outside the metropolitan capitals and in "medium cities" or regional centres. These urban areas have populations of between 30,000 and 500,000[3] and have developed some of the specialised functions in labour markets and production and services that that have previously been associated primarily with larger metropolitan areas. The scale of growth in medium cities is as significant (in actual numbers) as that experienced by metropolitan areas, but medium cities face particular challenges in developing an appropriate employment and service provision mix for their growing populations. Unlike metropolitan areas, where residents of outer suburbs can still access employment, educational, social and cultural services and amenities within the broader metropolitan area, medium cities do not always offer the same range of opportunities.

Infill in CBDs and inner area development

Capital city metropolitan areas have also absorbed significant population growth in their CBDs and inner core urban areas – a form of development characterised by higher density living. This phenomenon is particularly evident in Sydney and Melbourne. Infill development does not result in the same dramatic changes in land use patterns seen in suburban or medium city development, and it can have positive effects on congestion and travel times as people are more likely to live relatively close to their places of education, work and recreation (or within easy access by public transport). However a range of other challenges arise including increased pressure on existing services and transport networks, as well as noise pollution and a range of social issues associated with increased numbers of people sharing limited amenity.

The focus of this study is primarily on suburban growth; of the ten case studies undertaken for this research, eight can be described as suburban, one as a medium city and one as an inner-city urban infill area. The focus of this context and literature section is on suburban development, but the vast majority of the material covered is also relevant to medium cities, and the inner city case will provide a counterpoint.

[3] Using the categorisations of major cities and other cities in Major Cities Unit, 2012

What does sustainability mean in the context of urban development?

Sustainability is a broad term open to varied interpretations (Fowke & Prasad, 1996; Berke & Conroy, 2000; Parkin et al., 2003). The most widely accepted notion of sustainability is being able to "meet the needs of the present generation without compromising the ability of future generations to meet their own needs" (World Commission on Environment & Development, 1987: 43). Conceptually, this definition draws in issues of inter- and intra-generational equity, and of the limits to resource availability. In implementation, sustainable development is normally understood to have three tenets: environmental quality, economic prosperity and social equity.

Environmental quality has been given increasing prominence in the past decade. The ABS survey on environmental awareness and action (4102.0 - Australian Social Trends, Jun 2010) noted that 82% of adults in Australia were concerned with at least one environmental problem, and one-third of adults were concerned enough to participate in activities such as signing petitions, demonstrations or rallies because of these concerns. Information collected over time in surveys such as the NSW Government's *Who Cares about the Environment?* which has been conducted six times in the past 13 years, seems to indicate that this concern may be influenced by the impacts of business cycles. In the latest *Who Cares about the Environment?* survey (2009) 76% of respondents were concerned to some extent by environmental problems, down from 87% in 2006 (DECCW, 2009). However, the environment remains an important issue concerning three-quarters of survey participants.

The definition of sustainability used in the issues paper informing the Commonwealth Government's *Sustainable Population Strategy for Australia*, reflects inter- and intra-generational concerns and the multidimensional nature of wellbeing:

> "sustainability refers to the maintenance or improvement of wellbeing now and for future generations. Well-being is a term aimed at capturing all of the economic, environmental and social aspects of people's lives. It is not a single measure, but rather can be viewed through a wide range of indicators across each or all of the three aspects" (DSEWPaC, 2011: 5).

Definitions of sustainable development also emphasise the integrative nature of any approaches to increase sustainability, and that the three dimensions of sustainability, (environmental, economic and social), do not have clear boundaries (Newman & Kenworthy, 1999). Sustainability in the urban environment typically encompasses two main categories: sustainable patterns of overall urban growth; and sustainability in the performance of the built environment (Collia & March, 2012). Planning literature and policy tends to emphasise the former over the latter, though they are of equal importance in achieving sustainable development (Collia & March, 2012).

The first category, sustainable patterns of urban growth, includes issues of density, the character of transport infrastructure, the linkage of employment and residential land uses, the composition of the population within the urban settlement, the character of residents' relationships with each other and the wider population and increasingly, natural vegetation and open space. Sustainable patterns of urban development preference urban consolidation and increased densities instead of urban-fringe settlements with low densities; public transport instead of private car transportation; and the integration of land use patterns that provide housing, employment, and recreation in close proximity to each other (Newman and Kenworthy, 1999; Mills, 2005).[4]

[4] Although the debate on the relative merits of compact city versus low-density city development is far from settled as Echenique, Hargraves et al. (2012) and Gleeson (2008) discuss.

These preferences are evident in the major policy documents for urban development in Australia. For example the Commonwealth's *A Sustainable Population Strategy for Australia* notes that "a sustainable Australia is a nation of sustainable communities which have the services, job and education opportunities, affordable housing, amenity and natural environment that make them places where people want to work, live and build a future" (DSEWPaC, 2011: 5).

The second category focuses specifically on the performance of the built environment, including resource usage, but can also refer to the degree to which the availability of space promotes or generates social and economic activity. Recognition of the need to improve the sustainability performance of the built environment is evident in the increasing prominence and use of environmental performance ratings schemes for various kinds of buildings.

Many of the elements now included within the conceptualisation of sustainability have been recurrent concerns and issues in the literature and policy discussion on suburban development. However, what distinguishes current concerns about sustainability in suburban areas is:

- the increasing evidence of the cumulative impacts on environmental quality of this type of development
- the increasing evidence that the footprints of our cities are starting to generate negative externalities that outweigh the positives of agglomeration, particularly in regards to congestion, commuting, and efficient provision of infrastructure, and therefore
- the changing costs and benefits of the current and future composition of government services and infrastructure.

The rest of this review section is structured around expanding and addressing the two dimensions of sustainable development: the built environment and the pattern of urban growth.

Sustainability of the suburban built environment

Concern about the impact of the built environment on environmental quality has strengthened in focus in recent years. This has been partly driven by the increasing understanding of climate change impacts and the requirements for mitigation and reduction of emissions, and partly by an awareness of the resource intensity of new suburban developments. Low et al. (2005) highlight the central role urban planning has in delivering a sustainable built environment. Recent work from the OECD (2011) highlights that urban policies can have an impact on energy demand and consequently CO_2 emissions at a relatively low cost, and that national emissions reduction strategies can be complemented by urban polices which address congestion and increasing urban density.

However, in Australian cities the size of new houses has been steadily increasing over recent decades; data on building approvals collected by the ABS (2010) indicates that house sizes in Australia have increased from an average of 162.4m^2 in 1984 to 248.0m^2 in 2009. This is despite a corresponding demographic trend for smaller household sizes over the same time period. The largest increases in the size of average new residential dwellings have been in the Northern Territory (72.5%), New South Wales (69.2%) and Queensland (63.8%). Australia is currently building on average the largest new homes in the world (James, 2009). The vast majority of these new houses are in suburban areas.

Housing size is also linked to issues of density and housing type in the built environment. Suburban development is characterised by low-density, detached housing. The fact that this housing type occurs in areas with rapid population growth does not necessarily equate with it being popular and in demand.

A recent report by the Grattan Institute investigating housing choice and demand in Sydney and Melbourne found that people's selection of housing involves a trade-off between location, housing costs and income, and that housing type is rarely considered as part of the equation. However, rather than indicating that households consider house type to be unimportant, this reflects the fact that there is little choice once the trade-off between housing costs and location has been made (Kelly, 2011).

Resource efficiency of the built environment

Australian planning and building practices have historically not delivered net environmental improvements in new building stock (Fuller & Crawford, 2011). Planning practices typically rate building assessment against a minimum performance level, which in terms of ecologically sustainable measures (design, siting, ventilation) have different levels of adoption and enforcement across jurisdictions (Collia & March, 2012).

Attempts to increase minimum efficiency ratings for residential housing have been contested by the building industry on the grounds that this would negatively impact housing affordability (Clune et al., 2012). This is despite recent evidence highlighting the energy efficiency (and resultant lower household energy costs) and large greenhouse gas (GHG) emission abatement potential associated with improvements to the residential building stock. The GHG emissions reductions which could accrue from changes to the building sector have consistently been identified as having the highest benefit-cost ratios of any GHG reduction measures (UNEP, 2007; Higgins et al., 2011; Hoppe et al., 2011).

There is also evidence that the pattern of urban development itself contributes to changes in local climate, causing localised warming and reducing water availability in urban areas. The removal of vegetation and the creation of large areas of impervious surfaces increases run-off and reduces the amount of water available in the urban environment. This, together with other aspects of the urban environment such as limited horizontal airflow and heat-retaining building materials, significantly changes the climate in urban areas (Coutts et al., 2010). Increased vegetation, water sensitive urban design, and street, park and open space design can all limit these impacts.

Patterns of suburban growth

Land use conflicts

Urban development, particularly suburban development on the outskirts of major cities, is concentrated on lands that are also favourable for other purposes, including agricultural and environmental purposes. These areas usually have natural resources, waterways, bushland and other native vegetation; the features that made the land favourable to settlement in the first place. These areas often contain prime agricultural land, both broad acre agricultural land and smaller market garden type operations, that provide local sources of food for nearby population centres.

Current land use planning approaches are considered inadequate for managing the complexity and implications of changing patterns of land use (Bunker and Houston, 2003). This is particularly evident in managing emerging conflicts between urban development and biodiversity (Wheeler, 2009) and urban development and agricultural production.

Social mix and community cohesion

Within urban planning policy there is a common assumption that a diverse social mix is a positive, and therefore that the opposite (a limited social mix) is a negative and will lead to unsustainable communities (Arthursen, 2010). In most cases it is the socio-economic mix that is being referred to, with a focus on communities with low incomes, poorer educational attainment and high levels of unemployment as those that should be diversified which arguably belies the complexity of what constitutes a "social mix" (Arthursen, 2010). Even this limited conception is rarely applied to higher socio-economic status communities that self-select into wealthier suburbs and master-planned estates (Arthursen, 2010). Many examples of the latter are found in the areas of rapid population growth investigated in this research.

The term community cohesion is used for a range of different concepts in the research literature (see Coutts et al. (2007) and Holdsworth and Hartman (2009)) but is most widely used (with the closely related term social cohesion) to denote a community of people with a shared vision or understanding connected by social ties and commitments (Stone & Hughes 2002a; ABS 2004).

Community cohesion requires community engagement as a first step. If communities do not have the opportunity for engagement there is little chance of shared vision and social ties developing. Therefore how new groups and individuals (such as those in new housing developments) interact and the character of these interactions is important for establishing engagement. Cohesion and engagement are also closely linked to social inclusion and exclusion (Holdsworth & Hartman, 2009) and each has a strong bearing on wellbeing, at both the individual and community scale.

Car dependence

A striking feature of suburban development is the high dependence on personal vehicles. High car dependence is the result of three interrelated factors. First, new residential areas tend to be built on the outskirts of cities, relatively far from existing sources of employment or from sources of employment that are suitable for the new residents of these areas.

Second, residential development tends to be planned and delivered in isolation to other aspects of community planning, including planning for local employment. This can mean that residents of these new suburbs are typically forced to travel significant distances to work. For many, these large distances mean active transport is not a feasible option.

Third, new areas of residential development are designed to be accessed by roads and freeways, in which large investments are made, in contrast to the very small amounts of funding expended on new public transport links[5] (Buxton, 2006; PIA, 2005). This means that because these new areas are on the outskirts of cities where existing public transport does not reach, public transport provision to these new areas is often poor, and sometimes close to non-existent.

[5] Public transport is underfunded in many Australian cities, particularly when compared to expenditure on roads and freeways (Buxton, 2006). The Planning Institute of Australia has contrasted the lack of funding for rail infrastructure with the large investments in freeway construction, judging Australia's approach to this issue to be 'severely out of tune with urban transport funding regimes in practically every other OECD country' and suggesting that this explains why 'Australian urban rail systems have been struggling to keep up with the pace of metropolitan growth' (Planning Institute of Australia, 2005, (Submission 168), *Sustainable cities inquiry*, House of Representatives Standing Committee on Environment and Heritage Parliament of Australia, p. 56).

The negative environmental impacts (in terms of fossil fuel use and air pollution) of high levels of private vehicle dependence are well documented, and the economic impacts of traffic congestion (in terms of lost time and increased infrastructure costs) are also increasingly recognised. More recently, the negative social impacts of high levels of private vehicle dependence, and their impact on health and wellbeing, have been brought to light.

Economic activity, local employment and industry

Economic activity has a critical spatial dimension. Businesses choose where to be located on the basis of trade-offs between the locations of the factors of production. This means economic activity is distributed unevenly; it becomes concentrated in certain places and is non-existent in others.

In the modern environment this spatial distribution is determined less by access to raw materials and natural advantages, and more by past and recent contributions to human capital, social fixed capital and accessibility (Capello, 2007).

Uneven geographical distribution of labour markets, and of the skills and occupations within these labour forces, are also evident. A recent report commissioned by the National Growth Areas Alliance (NGAA) forecast that by 2030 there will be a jobs deficit of 815,000 jobs in its 15 member council areas.

There is a skill dimension to these labour force dynamics, with labour force skills in the NGAA concentrated in 'traditional' industries such as manufacturing, construction, transport, postal, warehousing and wholesaling activities (36.5% of workers in the growth areas work in these industries, compared to 27.4% nationally). Conversely, the growth areas are under-represented in professional, scientific and technical services (4.4% of the workforce in growth areas is in these professions versus 6.6% of the national workforce) and in education and training and healthcare and social assistance industries (15.3% of the workforce in the growth areas, compared with 18.2% nationally) (Essential Economics and Geografia, 2012: 4).

These differences are also reflected in educational attainment and qualifications and in the occupational structure of the growth areas. In developed countries there is an increasing move towards greater skill intensity in occupations, even in traditional industries such as manufacturing, as globalisation forces developed countries to introduce higher value-adding operations in order to remain competitive. Employment generation in these industries will increasingly be at the higher skill levels rather than the low skill levels (Essential Economics and Geografia, 2012: 6). Therefore, these figures have important implications in terms of the ability of growth areas to endogenously generate new employment, and to develop and activate skills within the population.

Regional economic development

Economic growth at the regional level is dependent on a number of factors including the availability of infrastructure, human capital, innovation and agglomeration. However, a recent OECD study has found that, critically, these factors are policy-driven, rather than being derived from natural endowments or physical geography, and that the impact of these factors is cumulative (OECD, 2009). Therefore the integration of policy will have a major impact on the effectiveness of individual policies (OECD, 2009).

This means that investments in infrastructure will not automatically lead to higher economic growth in a region if they are not also supported by improvements in education, training and innovation. Of all the factors investigated, the OECD report highlighted that human capital improvements have the most robust impacts on economic growth, evidenced through increases in the number of highly skilled workers, or the absence of low-skilled workers in a regional labour force (OECD, 2009). This provides further evidence of the strong interrelationships between the social, economic and environmental dimensions in sustainable community development. Drivers and characteristics of population growth that impact the level of human capital (in areas such as education and social inclusion) and fixed social capital (including the availability of places for social interaction) will therefore also impact the distribution of economic activity, particularly employment.

Regional innovation systems

Spatial analysis of economic activity highlights the importance of regions for economic growth. This type of analysis also highlights the need for a spatial analysis of innovative activity as innovation is also a major driver of economic activity (Brokel, 2007; OECD, 2011b).

Innovative activity is strongly influenced by a combination of local assets and factors often referred to as the triple-helix of innovation (educational institutions, industry and government) (Sharpe, 2008; Sharpe and Martinez-Fernandez, 2010). This research shows that innovative activity within firms in regions is influenced by human capital, the structure and relationships between firms, but also by social and environmental amenity concerns such as the need to have a quality place to live, spaces for interaction, social life, and transport links (Sharpe, 2008). As such, innovative activity is locally embedded, in that it is built from the ground up rather than imported or attracted to a region. The common practice of economic development at the local level, where efforts are focused on attracting new firms and investment, does not address the complex but integrated requirements for job creation which requires employment planning concerned with the *type* of jobs created, *where* they are created, and *for whom* they are created (Martinez-Fernandez and Sharpe, 2008; OECD, 2009).

This highlights the challenge in new development areas that have limited industrial activity, such as several of the case study areas in this study. These areas will have weak innovation systems, and therefore firms' roles in creating economic growth will be curtailed. This increases the importance of the role that public policy must play in establishing the industrial innovative culture of any region in which it expects to generate employment and economic growth.

Urban Planning Policy and Practice

The following section deals, in greater detail, with the urban planning system relevant to suburban development in Australia. In reviewing the patterns of urban growth It appears that the difficulty in sustainable development lies as much in the translation of policies to practice, as in the policies themselves. This is evidenced by the numerous metropolitan plans that speak of compact cities in planning documents yet in reality development has occurred in a dispersed manner, rather than being concentrated around centres or transport nodes (Michell & Wadley, 2004; Buxton & Tieman, 2005; Forster, 2006) and has developed more in response to market forces than to planning. Buxton (2006) notes that while governments do try to 'transfer a proportion of outer urban development into established areas' in no state has the state government 'limited land supply in outer urban areas or required increased average residential densities there'.[6]

Further, much urban consolidation has occurred without explicit energy or greenhouse efficiency objectives (Bunker et al., 2002; Michell & Wadley, 2004; Clune et al., 2012). Urban consolidation has

[6] While Buxton made this assessment in 2006, we are not aware of any state government introducing such limits in the period since.

been pursued mainly to make more efficient use of existing infrastructure, but has been partially justified by alleged environmental benefits, including the claim that it promotes household greenhouse and energy efficiency (Troy, 1996; Adams, 2009).

Australian urban policy and planning

The importance of planning

Suburban and urban development is shaped by national, state and local level plans covering a range of interrelated but usually imperfectly integrated projections and objectives for housing, transport, employment and the other key components for developing wellbeing in communities. State and territory governments are responsible for the strategic patterns of urban development, and each jurisdiction has evolved distinct planning systems. These systems allow for different development processes and different levels of emphasis in key policy aspects; for example each jurisdiction gives a different weight to the importance of economic development as an overriding goal. The differences between state-based planning systems also flow to the processes for allocating land and approving specific development proposals.

Australian cities are often characterised by a history of less than ideal planning and governance arrangements, with relevant powers and functions split between different governments, agencies and levels of government, and a lack of coordination or strategic alignment between the various bodies

In Sydney for example, the federal government's Regional Development Australia (RDA) initiative recognises this situation in its *Regional Plan for Sydney* which identifies significant governance challenges for the development of the Sydney region, including the 'lack of a bipartisan 40-year vision', the proliferation of different plans and strategies and their lack of integration, and the 'lack of one overarching authority for the social, economic and environmental planning of Sydney' (RDA, 2011: 68).

Local government plays a significant role in establishing the character of development and how it integrates into a locality. Even at this local level of governance there are distinctions about councils' responsibilities for planning and planning decision-making, the significance they attach to these roles, and the extent to which they are incorporated into their wider responsibilities for their communities.

To understand the dynamics of suburban developments in the case studies presented in this report it is necessary to identify the organisations, policies and processes which are shaping change and guiding decision-making. These issues are the focus for this section.

The state and territory governments and urban planning systems

The structure of urban governance in Australia is closely related to the division of political power among the three levels of government. The Constitution sets out the extent of the federal government's powers and these do not include explicit powers relating to the management of natural resources, planning, environment or land use development. This has resulted in each of the states and territories developing their own planning systems.

Each state and territory has an established statutory, policy and procedural framework for planning and managing urban development. Each state then delegates to local governments in the jurisdiction certain day-to-day decision-making processes (Thompson & Maginn, 2012). Local government is a creation of state and territory governments and therefore the exact relationship between the two in each jurisdiction is also unique. Local councils therefore derive most of their powers from state legislation. Although states have devolved many planning powers to local councils, they still retain the absolute power over local governments and the related planning legislation.

Each state creates strategic plans and policies for development in their jurisdiction, particularly for the capital cities. These strategic plans and policies provide a clear, though not rigid, direction for land planning, and thus create an environment where developers, councils and other planning bodies can base their own plans on these expected outcomes (Productivity Commission, 2011: 364). Each jurisdiction has a unique hierarchy of planning instruments. Table 1 shows the characteristics of the planning systems across the states and territories involved in seven of the case study locations.

Table 1: State and territory planning systems for seven case study locations: roles, legislation, strategic planning, planning systems

Case Study	Main agency with planning responsibilities[7]	Principal planning legislation	Strategic planning or planning policy framework at state or territory level[8]	State/territory statutory planning implements (zoning, approvals)	Regional and metropolitan planning instruments	Planning systems (Institutional and decision-making arrangements and impacts)
Blacktown NSW	• Department of Premier and Cabinet • Department of Planning and Infrastructure • Urbangrowth NSW	*Environmental Planning and Assessment Act, 1979* (NSW) (under review)	None identified	State Environmental Planning Policies (relating to housing, environment, industry, urban design, the planning system) [26% of Blacktown is zoned under an SEPP]	• Metropolitan Plan for Sydney 2036 (currently under review by state government) • Western Sydney Growth Centres strategic assessment (part of Metropolitan Plan) • Metropolitan Development Program (forecast of housing availability)	• NSW government is currently reforming its strategic planning system • Some SEPPs are incorporated in local environmental plans
Mandurah WA	• Department of Planning • Western Australia Planning Commission	*Planning and Development Act,* (WA) *2005*	State Planning Strategy	Statement of Planning Policy (provides a comprehensive policy framework for land use planning), e.g. *State Coastal Planning Policy*	• Economic and Employment Lands Strategy Directions 2031 and Beyond (strategic and spatial framework for Perth and Peel). • Sub-regional strategies and structure plans are based on Directions 2031.	State government's Urban Development Program measures and evaluates the delivery of the *Directions 2031* objectives.
Kingborough TAS	• Planning Commission • Southern Tasmanian Councils Authority (STCA).	*Land Use Planning and Approvals Act,* (Tas) *1993*	None identified	State policies made under the *State Policies and Projects Act 1993* (Tas) (relating to metropolitan and economic development, environment, housing)	• Southern Tasmania Regional Landuse Strategy (2011) (overseen by the Planning Commission). • Forthcoming infrastructure investment strategy for the region	• Requirement for state planning policies to indicate how local planning schemes should be adapted to reflect their intent • Commission assesses new planning schemes developed by local government • STCA manages the Southern Tasmania Regional Planning Project.

[7] These are the main agencies, but state-level administrative functions relating to urban land use are rarely contained within a single government department or agency.
[8] For example, Infrastructure planning and economic development.

Case Study	Main agency with planning responsibilities[7]	Principal planning legislation	Strategic planning or planning policy framework at state or territory level[8]	State/territory statutory planning implements (zoning, approvals)	Regional and metropolitan planning instruments	Planning systems (Institutional and decision-making arrangements and impacts)
Townsville QLD	Department of Local Government and Planning	*Sustainable Planning Act,* (Qld) *2009*	None identified	State Planning Policies (SPPs) and State Interest Planning Policies (SIPPs) (relating to housing, environmental quality, etc.)	Regional planning process (statutory)	Following the change of government in 2012 the State Government approach to planning is in a degree of flux.
Playford SA	• Department of Planning, Transport and Infrastructure • Renewal SA • Development Assessment Commission	*Development Act,* (SA) *1993* Development Regulations 2008	Planning Strategy for South Australia, prepared under *Development Act 1993* (relating to a range of social, economic and environmental issues).		South Australia has nine regional plans, or Volumes, within their Planning Strategy.	• Minister must annual report to parliament about the implementation of the Planning Strategy. • State planning policies are drafted to enable insertion within local planning instruments.
Melton VIC	• Department of Planning and Community Development • Support from the Growth Area Authority • A state Advisory Committee is reviewing the planning systems	Planning and Environmental Act of 1987 (under review)	Integrated land use and transport plan (*Delivering Melbourne's newest sustainable communities, 2010*)	Victorian Planning Provisions	• Melbourne Urban Growth Boundary (recently extended) • Growth area framework plans and Growth Corridor Plans • Precinct Structure Plans	• Local government planning schemes developed in line with state planning policy (including a community vision) • Victoria is currently undergoing zone modifications to streamline development to meet the needs of growing populations • The Urban Growth Zone was recently created to expatiate the approval of new communities on greenfield sites
Palmerston NT	• Department of Lands, Planning and the Environment • Development Consent Authority	Planning Act 1999	Integrated land use plan (*Greater Darwin Land Use Plan – Towards 2030)*	NT Planning Scheme	Darwin Region Land Use Framework	Local government in the Northern Territory does not have responsibility for development assessment and land use planning. The NT Planning Scheme provide the land use planning. • The Development Consent Authority assesses the development.

Local government and the urban planning system

The role of local government in urban planning has been in flux in recent years, particularly planning for the types of areas investigated in this research – suburban areas facing rapid population growth. In most states planning and assessment activity for major population growth centres has been centralised with the state government and its relevant agencies usually under new forms of governance, such as metropolitan strategies, for example the *Metropolitan Plan for Sydney 2036*, the *Greater Darwin Regional Land Use Plan 2030*, *Melbourne 2030: Planning for Sustainable Growth* and the *30-Year Plan for Greater Adelaide*.

These metropolitan plans designate areas for residential, industrial, recreational and open space land uses. They formulate densities and dwelling targets, employment targets and announce investment for roads, railways and other forms of transport. Local government planning activities must fit within the parameters of the metropolitan plan.

National planning and policy

The following section outlines national frameworks, policies, bodies and programs that influence planning and population growth.

Historically, the federal government has not implemented a coordinated, national approach to planning and land use. A parliamentary inquiry conducted in 2004 by the Commonwealth into sustainable cities found that "[in] the absence of national urban policies and integrating urban impacts into policy-making, cities have developed as chaotic responses to discrete programs and policies" (Commonwealth of Australia, 2005: 24). The inquiry found that "jurisdictional boundaries and the responsibilities of different levels of government mean that a cohesive and integrated approach to urban frameworks is essential" (2005: 27) and recommended that the Australian Government "establish an Australian Sustainability Charter that sets key national targets across a number of areas, including water, transport, energy, building design and planning" (Commonwealth of Australia, 2005: 31). In other words, the committee believed that shaping Australia's future cities requires a national agenda of coordinated governance on sustainability.

Recent Commonwealth Government involvement in urban planning has largely been directed through the Council of Australian Governments (COAG) process. Until the reorganisation of its standing committees in 2011 the COAG structure included the Local Government and Planning Minister's Council (LGPMC). The Council had remit over urban sustainability issues and the national charter on integrated land use and transport planning (Commonwealth of Australia, 2005: 25). The Council released the National Planning Systems Principles in late 2009. These principles sought to progress strategic planning reform and inform the development of appropriate governance structures (Queensland Government, 2009).

In addition to these planning principles, COAG has developed nine criteria for the efficient and effective planning of Australia's capital cities, which includes planning for future growth[9] and the Commonwealth recently developed broad principles for best practice urban design[10] (Department of Infrastructure and Transport, 2011). The criteria used by COAG to review capital city strategic planning systems included (COAG Reform Council, 2012: 31):

[9] See http://www.coagreformcouncil.gov.au/agenda/cities.cfm
[10] See: www.urbandesign.gov.au

1. Capital city strategic planning systems should be **integrated** across functions, including land-use and transport planning, economic and infrastructure development, environmental assessment and urban development; and across government agencies.
2. Capital city strategic planning systems should provide for a consistent **hierarchy of future oriented and publicly available plans**, including: a) long term (for example, 15–30 year) integrated strategic plans, b) medium term (for example, 5–15 year) prioritised infrastructure and land-use plans, and c) near term prioritised infrastructure project pipeline backed by appropriately detailed project plans.
3. Capital city strategic planning systems should provide for **nationally-significant economic infrastructure** (both new and upgrade of existing) including: a) transport corridors, b) international gateways, c) intermodal connections, d) major communications and utilities infrastructure, and e) reservation of appropriate lands to support future expansion.
4. Capital city strategic planning systems should address **nationally-significant policy issues** including: a) population growth and demographic change, b) productivity and global competitiveness, c) climate change mitigation and adaptation, d) efficient development and use of existing and new infrastructure and other public assets, e) connectivity of people to jobs and businesses to markets, f) development of major urban corridors, g) social inclusion, h) health, livability, and community, i) housing affordability, j) matters of national environmental significance.
5. Capital city strategic planning systems should consider and strengthen the **networks** between capital cities and major regional centres, and other important domestic and international connections.
6. Capital city strategic planning systems should provide for **planned, sequenced and evidence-based** land release and an appropriate balance of infill and greenfields **development**.
7. Capital city strategic planning systems should clearly identify **priorities for investment** and policy effort by governments, and provide an effective **framework** for private sector investment and innovation.
8. Capital city strategic planning systems should encourage world-class **urban design and architecture**.
9. Capital city strategic planning systems should provide effective implementation arrangements and supporting mechanisms, including clear **accountabilities, timelines and performance measures**.

The Commonwealth's broad principles for best practice urban design include principles specifically related to place, people, leadership and governance.

Table 2: Urban design principles for Australian cities [11]

Place: productivity + sustainability	Creates the context for people to engage with the place	Enhancing	Enhances local economy, environment + community
		Connected	Connects physically + socially
		Diverse	Diversity of options + experiences
		Enduring	Sustainable, enduring + resilient
People: Livability	Creates the context for people to engage with each other	Comfortable	Comfortable + welcoming
		Vibrant	Vibrant, with people around
		Safe	Feels safe
		Walkable	Enjoyable + easy to walk + bicycle around
Leadership and governance		Context	Works within the planning, physical + social context
		Engagement	Engages with stakeholders
		Excellence	Excellence, innovation + collaboration
		Custodianship	Considers custodianship, management + maintenance over time

Relevant bodies

There are several key national bodies that impact planning at the national level, including the Commonwealth Group on Cities and Infrastructure Australia.

The internal Commonwealth Group on Cities formed following the agreement of the COAG agenda on cities.[12] As a forum on cities internal to the Commonwealth Government, it is the principal vehicle for coordination of city-related activities at the federal level. In 2011, its terms of reference were revised to acknowledge the role of the new Standing Council on Transport and Infrastructure (COAG Reform Council, 2012: 77).

Infrastructure Australia is an independent body that advises on infrastructure funding priorities. Infrastructure Australia's agenda for Australian cities includes a national public transport strategy, a national roads network, managing road flows and congestion pricing (COAG Reform Council, 2012: 85). Its role has recently expanded to include developing policies to deal with infrastructure bottlenecks, improving freight networks and encouraging private sector investment in infrastructure (COAG Reform Council, 2012: 77).

The Australian Government also established the Major Cities Unit to "advance integrated governance structures and best practice strategic planning to support the coordinated development of Australia's major cities, and to set a geographic context for policy, planning and investment decisions, including infrastructure. The Major Cities Unit works across portfolios to ensure that relevant policies and investment are aligned with, and support, the objectives of the National Urban Policy" (see below). [13]

Policy directions

National policies that impact state and territory planning include the National Urban Policy, the Sustainable Population Strategy, and schemes related to the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) and housing affordability.

[11] www.urbandesign.gov.au
[12] See: http://www.coag.gov.au/sites/default/files/2009-12-07.pdf
[13] See: http://www.infrastructure.gov.au/infrastructure/mcu/about.aspx

Our Cities, Our Future – A National Urban Policy for a productive, sustainable and livable future was released in 2011. The *National Urban Policy* "sets out a framework of high-level goals, objectives and principles intended to shape the Commonwealth Government's approach to cities" and "outlines direct and indirect roles through investing in transport and infrastructure, health and education funding and through regulation" (COAG Reform Council, 2012: 83). The Policy recognises that "in the past, Commonwealth policies, investments and activities were not always coordinated with other levels of government, nor well understood from the spatial/geographic perspective of cities" (Department of Infrastructure and Transport, 2011: 9). The Liveable Cities Program "seeks to improve the capacity of the 18 eligible capital and major regional cities that are the subject of the National Urban Policy" (see below).[14]

Also in 2011, the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities, launched *Sustainable Australia – Sustainable Communities: A Sustainable Population Strategy for Australia* (DSEWPaC, 2011). The Sustainable Population Strategy "outlines the Commonwealth Government's framework to ensure that future population change is compatible with the economic, environmental and social wellbeing of people in Australia, and with appropriate settlement patterns and employment growth" (COAG Reform Council, 2012: 84). The 2011–12 Commonwealth budget allocated $150 million for four measures to support the Sustainable Population Strategy: the Suburban Jobs Initiative (see below), Sustainable Regional Development Program (see below), the Promoting Regional Living Program and the Measuring Sustainability Program.[15]

The *Environment Protection and Biodiversity Conservation Act* 1999 (Cth) is the principal environmental legislation of the Commonwealth Government. The EPBC provides a legal framework to manage and protect areas of national and international significance. State and territory governments also have environmental legislation that covers development within their jurisdictions. New bilateral arrangements are now being developed to streamline assessments between jurisdictions (COAG, 2012: 2).

In relation to housing affordability, the Commonwealth Government has several schemes to improve affordability such as the National Affordable Housing Agreement, the National Rental Affordability Scheme, and first home owners' grants.

Programs and initiatives

The Australian Government has initiated several programs that have influenced urban planning, which is traditionally the responsibility of the states and territories. These initiatives, including the Better Cities Program and the Year of the Built Environment (introduced in 1991 and 2004 respectively), aimed to improve social justice and coordination between governments, and to raise awareness of the built environment and sustainability (Commonwealth of Australia, 2005).

There are several current federal programs that influence or are trialling sustainable urban models. The federal Department of Climate Change and Energy Efficiency, in partnership with local and state governments, industry, business and local communities, is implementing the Solar Cities program to trial new sustainable models for electricity supply and use.[16] Currently there are seven participating cities, including Blacktown and Townsville.

[14] See: http://www.infrastructure.gov.au/infrastructure/mcu/urbanpolicy/index.aspx
[15] See: http://www.environment.gov.au/sustainability/population/index.html
[16] See: http://www.climatechange.gov.au/solarcities

The Liveable Cities program, within the Department of Infrastructure and Transport, is seeking to develop partnerships between levels of government "to foster innovative solutions to promote high quality urban design, improve the quality of open space and public places, address high levels of car dependency and traffic congestion and support cities in tackling the challenges of climate change".[17] Several of the case studies have received funding through this program (including Lower Hunter, Melton, and Logan) or are expected to receive funding (Green Square).

Regional Development Australia (RDA) is an Australian Government initiative, administered by the Department of Regional Australia, Local Government, Arts and Sport, that brings together all levels of government to enhance the development of Australia's regions. A national network of 55 RDA committees has been established to achieve this objective.[18] Regional Development Australia also aims to reduce duplication and overlap in regional activities, as well as bring a focus to the role of regional centres as productive agricultural hinterlands for urban and regional areas through proper strategic management (COAG Reform Council, 2012: 84). Committees are encouraged to work together on projects and other activities where they have common interests and common boundaries, such as sustainable infrastructure or services. One of the roles of Regional Development Australia committees is to develop a Regional Plan for their region which outlines priorities for the region and actions to strengthen communities. Each case study area is covered by an RDA area and has a regional plan.

The Commonwealth Government's Suburban Jobs Program provides grant funding to support state and local governments to plan and provide for increased local employment opportunities in those areas of Australia's capital cities that are experiencing the pressures of population growth. The program seeks to support the development of local employment precincts in order to ameliorate some of the multiple negative impacts of long commuting times and traffic congestion. In describing the objectives of the program, the Australian Government states that:

> *well planned and delivered local employment precincts will assist communities to be more sustainable in the long term by providing local employment opportunities for the diverse skills and aspirations of residents, improving the quality of public spaces, increasing the outputs of the local economy, and fostering a vibrant sense of place for residents. Attracting and retaining jobs closer to where people live will also help to reduce the environmental impacts of our suburbs - by encouraging people to walk or ride to work, reducing traffic congestion on the road, and taking advantage of new technologies to design healthy, productive workspaces.*[19]

The Sustainable Regional Development program promotes sustainable development in high growth regions. The program seeks to protect matters of national environmental significance, as defined in the EPBC Act, whilst helping to streamline environmental approvals. Grants are offered to build capacity and increase engagement around holistic approaches to planning and development.[20] The Lower Hunter region was the first region to receive support under this program, through an agreement between the Australian and New South Wales governments in August 2012.

[17] See: http://www.nationbuildingprogram.gov.au/funding/liveablecities/index.aspx
[18] See: http://rda.gov.au/
[19] See: http://www.environment.gov.au/sustainability/suburbanjobs/index.html
[20] See: http://www.environment.gov.au/sustainability/regional-development/index.html

Sustainability and population growth: the case study findings

The focus of the case studies

This section synthesises the findings from individual case studies conducted for the primary research. Each of the case studies brings together information and data on the sustainability indicator framework used in the research (described further in the following section) and the content of discussions with a range of stakeholders in the locality. In this synthesis the focus is on identifying significant issues and processes, rather than attributing them either to specific data sources, or comments from particular stakeholders. However, examples are given from specific localities.

Because this research focuses on detailed case studies of locations which have experienced growth, it is largely retrospective, it looks at opportunities and challenges and how the growth which has taken place might have been managed more sustainably. It does not attempt an assessment of whether population growth per se is sustainable (under whatever definitions are used of that term).

As discussed earlier, sustainability is conventionally discussed in terms of three dimensions: environmental, economic and social (the "triple bottom line"). The environmental dimension is described in this framework as natural capital; the economic dimension is described economic capital and the social dimension is described as social and human capital. However, the integration of these dimensions is essential in both the practice and analysis of sustainability. While sustainability assessments (like the indicator framework used in this project) typically include social, environmental and economic domains, or dimensions, the strength of the sustainability framework is in its capacity to integrate these various dimensions and demonstrate the connections and interrelationships between them. For this reason, while issues might be thought of as largely 'social' or 'environmental' or 'economic', few of them fit neatly into any one of these categories, and many of them cut across, or are a result of, interrelationships between all three domains. This presentation is therefore structured around the issues as they were described and raised by stakeholders in the case study locations and there is no attempt to attribute them to the three domains. This approach allows the various and interrelated impacts to be discussed in each case.

Opportunities from sustainable urban growth

Critical mass for services

Increased population provides a 'critical mass' of people to support a greater range of businesses, and social services and amenities. It was clear in many of the case studies that population growth has had this effect. Many stakeholders in Townsville, for example, were positive about the way that population growth had brought various 'city-like' amenities to what had previously been a country town, and this has enabled the city to support a greater range of health and education services. Similarly, in Kingborough and Playford, population growth has been accompanied by an increase in the number and types of shopping outlets available in the local area.

By creating a critical mass for an expanded range of services and amenities, population growth can also bring benefits to surrounding areas, transforming the growth area into an important service centre for a much larger area. This is particularly true of Townsville, which services many smaller and more remote communities in Northern Queensland. Population growth will continue to contribute to the status of the city as a focal point for Northern Queensland, and as a 'second state capital'. Townsville is also an important home base for many people who travel to work in the mining and other industries in the region, and population growth has seen an improvement in the amenities and services Townsville provides to this group of workers. On a smaller scale, Kingston provides an alternative shopping and service centre for people living further south in Kingborough, meaning they no longer need to travel all the way to Hobart.

The question of critical mass is not straightforward however, as there are various kinds of infrastructure and services that ideally would be provided ahead of population increase rather than at a point when a given 'critical mass' is achieved. For example, growth can provide a critical mass of population to support public transport, but in reality this is often not the case because population *densities* are not high enough in newly developed areas. Similarly, in many cases other kinds of infrastructure – particularly social services lag behind population growth. The timing of infrastructure development is one of the issues that cuts across all aspects of sustainability and is discussed in more detail in a later section.

Cultural change

The case studies provide numerous examples of how population growth is changing the cultural character of areas. In some instances this is on a socio-economic basis. For example in Kingborough stakeholders commented that the influx of people with new skills and attitudes, backgrounds and experience is generating positive cultural and attitudinal shifts, and helping to modernise what was previously a fairly conservative, rural culture. Kingborough is thought to be experiencing something of a 'brain gain', as many new residents have been attracted to the area because of several world-leading research centres that are located there.

The potential for cultural diversity and vibrancy was identified by interviewees in Logan as one of the main benefits anticipated from future growth. It was thought that growth would bring new employment opportunities and a diversification of economic activities, as well as consolidated urban centres with leisure and recreation opportunities, to an already culturally diverse area.

Diversity of the socio-economic mix was also seen as a positive for the Playford region. The area has a history of high concentrations of socio-economic disadvantage and public housing. New residents to the Playford area have a different socio-economic status and this is evidenced by the comments of stakeholders and by increasing levels of income and educational attainment and decreasing levels of social disadvantage (based on SEIFA[21] IRSD[22] scores) in some suburbs of Playford.

[21] Socio-Economic Indexes for Areas (SEIFA) is a product developed by the ABS that ranks areas in Australia according to relative socio-economic advantage and disadvantage. The indexes are based on information from the five-yearly Census.

[22] The Index of Relative Socio-economic Disadvantage (IRSD) is a general socio-economic index that summarises a range of information about the economic and social resources of people and households within an area. Unlike the other SEIFA indexes, this index includes only measures of relative disadvantage.

Diversity can also be experienced in an area's ethnic mix. In the Blacktown case study the multicultural nature of much of the population growth is seen as an advantage by most residents, according to stakeholders. Stakeholders in Blacktown and Playford also commented on the dynamism that new migrants brought to the community and how this was reflected in local entrepreneurship and volunteerism.

However, even in locations where stakeholders spoke explicitly of the benefits of the changes introduced by greater diversity, the positive perception of diversity was not universal. While many stakeholders spoke of the benefits of increasing diversity that tends to accompany population growth, some also spoke of the challenges that can accompany diversification, from a number of different perspectives. In Playford, for example, there was a perception among some existing social housing residents that they are being forced to adapt to a new reality. It was suggested that many of these residents have little sense of control over the way their local area is changing, and little confidence that they will be benefit from the increased diversity of the local population. In Blacktown, stakeholders suggested that some long-term community members found the increasing cultural diversity of the area to be a source of discomfort, or even experienced it as threatening – responses that sometimes manifested as racism.

Economic boost, more opportunities

Population growth can have positive effects on existing businesses and services by increasing their potential customer base, and can also trigger the development of new local businesses, with positive knock-on effects for the local economy. This can manifest in a number of ways. In Townsville, population growth was seen as a driver of increased prosperity in the population and was reflected in high average incomes and very high disposable incomes. In Playford the boost to economic activity had led to the opening of more retail and service-oriented businesses in the area, and this has increased employment in these industries. In Blacktown, population growth has triggered economic activity that has the potential to increase higher-order commercial activity in the area. Population growth is likely to increase the role the Blacktown city centre plays in business service provision for surrounding areas and for the industrial development that is expected to occur. It is anticipated that this population growth will impact future employment growth, and is also expected to increase the proportion of higher skilled occupations in the region.

The positive and relatively immediate impact on local employment from population growth can have a cumulative effect on the area, as additional employment, education and training opportunities develop to support the needs of the growing population. Availability and growth of local employment is not common to all the case studies however – in many there is a severe lack of local employment opportunities, meaning residents are forced to travel significant distances to work.

It also seems that population growth can help generate increased investment. This seems to be the case in Townsville, and in Kingborough there is a sense that what was previously a rural area with few services and infrastructure, now has an improved capacity to attract investment and funding.

Where population growth has positive impacts on local economies, there are additional factors which determine whether those impacts are sustainable. One key factor is the diversity of the local economy. This is illustrated in Townsville case study, where the strength of the local economy is, to a significant degree, attributed to its unusual diversity, with no one sector dominant. This provides a range of employment opportunities for new arrivals with various skill sets, but also means that if there is a downturn in one sector, people are more likely to be able to find alternative employment in another sector, thus avoiding the 'boom and bust' cycle that sees people becoming unemployed, or forced to leave an area when a particular sector experiences a contraction.

Increased rate base for councils

Increased population within an LGA provides an increased rate base for councils, meaning they have larger budgets available to spend on improving local infrastructure, services and amenity. As a consequence councils such as Logan have a positive attitude towards development and future growth.

Challenges from suburban population growth

As established previously from the research literature, *the particular kind* of urban development that is typical in Australian cities tends to exacerbate the negative impacts of population growth, across the various dimensions of sustainability. Many stakeholders across the case study locations felt strongly that 'urban sprawl' development has significant downsides, and while most were supportive of future growth, they were keen for future development to be better planned and coordinated. In particular there was a feeling that residential development needed to be better integrated with services and infrastructure (particularly public transport), planned to coincide with an increase in local employment, with houses that are better suited to the local climate, and more diversity in housing type – including the provision of more infill, or higher density residential development in the inner part of the city.

Population growth inevitably increases pressures

Any kind of population growth inevitably increases pressures on the environment. Human impacts multiply and pressures on the natural environment increase. A larger population uses more resources, produces more waste and emissions and intensifies pressures on ecosystems. When population growth is concentrated in a given area – as it is with urban population growth in Australia – localised impacts are also intensified.

A growing awareness of the importance of resource efficiency – particularly with regard to water and energy saving measures – may be slowing *per capita* resource use. Nonetheless population growth has meant that *total* resource use continues to grow, and greenhouse gas emissions and waste production continue to increase. Increased population also intensifies pressure to ensure sound environmental management of the existing infrastructure. For example in Kingborough, increased volumes of waste produced by the growing population has meant local landfill sites have recently been exhausted, necessitating the transport of waste much further afield. Kingborough's sewage treatment facilities are also reaching capacity. In Playford population growth has curtailed the council's ability to make strategic investments in dealing with waste, and Playford is one of the only council areas in Adelaide that does not have a green waste recycling capacity.

The case studies also provide many examples of how increased population can increase pressures on the local natural environment, producing a greater cumulative impact. In Kingborough, Mandurah and Playford for example, increased numbers of people engaging in boating and fishing activities in local waterways is increasing the pressures on those ecosystems. In Kingborough, population growth has also meant an increase in the number of domestic animals, posing a serious risk to native fauna.

With population growth, increased environmental impacts in some form are inevitable. Population growth can act as a driver for environmental improvements. In Playford new landowners in the more rural areas were motivated to increase the biodiversity of their land, although they lacked the training and advice to achieve this. In Blacktown a system of biodiversity offsets enabled the protection of some larger contiguous areas of high biodiversity value. Each of these areas had active landcare and bushcare groups that included volunteers. Indicator data from a number of case studies (Playford, Blacktown, and others) show increasing amounts of land that have been revegetated or protected. However, each of the case studies also shows increasing numbers of threatened and extinct species of flora and fauna. Stakeholders acknowledge that current systems and activities are largely ineffectual for maintaining local environmental quality at pre-development levels.

In each of the case studies stakeholders spoke of the struggle to accurately value, protect and manage the environmental quality of their areas. The literature further highlights that there is a general lack of methods and tools to guide effective local-level environmental management and more generally embed sustainable practices within the new and developing urban areas.

Impacts on environmental quality

The increasing amounts of land used by cities have biodiversity impacts as development encroaches upon or destroys important habitat areas or critical wildlife corridors for native fauna. Development can also damage or destroy fragile environments, as evidenced in Mandurah where physical modifications to foreshore areas and clearing have impacted negatively on estuary quality, and where the Peel-Harvey Estuary is under threat from increased nutrients entering the system. In Kingborough, septic tank leachates and sewage treatment, both of which tend to increase as population increases, have been identified as sources of local water pollution. In Palmerston stakeholders raised a number of concerns about the catchment-level impacts of development, including the increased volumes of water runoff and the increased erosion that results from the increase in impermeable surface areas as roads, pathways and driveways increase.

The negative impacts on biodiversity of land clearing for urban development are recognised by governments. Most local councils are responding by targeting particular areas for biodiversity conservation, regeneration and revegetation and some, such as Playford, are working with private landowners on these issues.

In some cases state governments have introduced biodiversity offsets. For example in Blacktown, parts of the Cumberland Plain can be 'traded against' high quality, or more connected sites in other locations in the NSW Government's growth centres. However, such offset policies are not universally supported, with some people seeing them as a means of shifting the environmental impacts of development from one area to another.

This pattern of development also brings domestic animals into closer proximity to native species, posing a risk to these species in some cases. Recent attacks by domestic dogs on fragile penguin populations in Kingborough are a case in point.

Loss of rural land

In many areas, the accommodation of new residents via the development of previously rural land on the outskirts of cities has meant that population growth has come at the cost of the rural lifestyle of these areas. This was evident, for example, in Blacktown where agriculture and market gardens have given way to new housing developments on 'greenfield' sites, and where development is reducing the vegetation communities of the Cumberland Plain. In Kingborough there is concern that land likely to be developed to accommodate future population growth was prime agricultural land, and that its development will reduce the capacity of the area to produce its own food. Stakeholders in many areas pointed to the negative sustainability impacts of the increasing trend for cities to transport food across greater distances, as previously agricultural land on the urban fringe is lost to development.

In many cases then, population growth has led to land-use conflicts between rural/ agricultural land uses and urban residential land uses, as well as conflicts between development and environmental land use in waterways, riparian zones, open space and wildlife corridors and habitats.

Social and socio-spatial divisions

As indicated previously, population growth can contribute to cultural diversity and positive change, but it can also lead to a clash in values between old and new residents. In some cases the increased diversity brought by population growth is welcomed. For example, stakeholders in Kingborough saw the influx of new people as 'a breath of fresh air' because they brought new attitudes, experiences and perspectives to a previously conservative culture. However in some areas, the tensions caused by social divisions can be more difficult to manage, such as in Playford and Blacktown which are both 'first stop' destinations for large numbers of recently arrived migrants and refugees who are drawn to these areas by inexpensive rental housing stock. Residents from non-English speaking backgrounds may experience difficulties understanding and interacting with existing residents, institutions, structures and practices. The integration process takes time and resources, and requires sufficient and appropriate social infrastructure – that is, public and private facilities, buildings and open spaces, support services, programs and activities that facilitate community development (SGS Economics & Planning, 2007).

Australian urban environments are typically characterised by socio-spatial divisions – that is, disadvantage and advantage are not evenly spread, but are concentrated in particular areas. Indicators of this include the wide variations in SEIFA IRSD scores and in average house and unit prices within a given area, and the differences in health status between people living in parts of a city.

In some cases this socio-spatial concentration is a legacy of poor planning associated with population growth in the past. For example, in Blacktown and Playford the provision of large areas of public housing has led to a high concentration of people living on very low incomes in those areas. More recent approaches to growth and development have also contributed to this phenomenon however, particularly the tendency for developers to deliver large numbers of one kind of dwelling in a single area. In Blacktown this has resulted in new residential suburbs that are areas of relative advantage existing in very close proximity to areas of disadvantage. Similarly, Mandurah has both large areas of newly built high-end canal-side real estate and a shortage of affordable housing with a third of private renters experiencing rental stress.

Many stakeholders in Palmerston pointed to a perception that social divisions have resulted from the juxtaposition of older public housing and newer, larger, more luxurious housing that has been provided by Defence for its personnel. Similarly, in Playford, there is a strong sense that it is a place of "haves" and "have-nots", and that this will only be exacerbated further with population growth. In Playford there is a positive sentiment that population growth will offer a chance to increase the standards of living for all across the local government area, but also a concern that if the planning, infrastructure, and service delivery are not undertaken in a timely and needs-driven way, there is a real chance that social divisions will be exacerbated and pockets of the population will experience increasing isolation and deprivation.

There is increasing recognition that the current approach to accommodating population growth does not deliver equitable outcomes or the kind of social mix that is required to ensure social sustainability. In many cases the failure of governments to integrate residential development with the location of employment and transport infrastructure is creating 'two city types: service rich, higher income inner and middle suburbs; and service poor, lower income outer urban areas' (Buxton 2006: 3). Many of the case study cities, areas of new development display levels of access to various goods and services that are very different from the levels of access in established areas.

There is a view in Playford that one of the advantages of population growth will be that the new residents will "dilute" the current concentration of social disadvantage, and lead to a more diverse community. However if this is to occur development needs to be managed in a way that promotes a social mix across the area, rather than simply resulting in areas of advantage existing adjacent to older areas of disadvantage. The current Playford Alive project in Playford, and the Newleaf development in Bonnyrigg, are examples of new developments that are actively attempting to deliver this kind of social mix. The Playford Alive project aims to deliver a mix of dwelling and tenure types, including owner occupiers, and private and public renters.

While in some cases there is an obvious difference in socio-economic status between new residents and established communities, there may also be difficulties for new residents who face vulnerabilities including mortgage stress and cost of living and job security pressures. In Mandurah for example, stakeholders were concerned about the high levels of bankruptcy in the area and the higher than average levels of owner-occupiers experiencing mortgage stress.

Urban development not seen as best practice

The typical patterns and forms of urban population growth in Australia have a number of specific characteristics that generate relatively poor outcomes from a sustainability perspective. These characteristics, and the sustainability implications of typical Australian urban development, are described below, illustrated with some of the numerous examples of negative impacts provided by the case studies.

- **suburban sprawl** – much growth is accommodated in new suburbs of low density development (large, detached houses in spread out estate developments) on the outskirts of cities.
- **poor public transport infrastructure and links** – residential development often happens in isolation from public transport planning and delivery, meaning that the provision of public transport infrastructure has not kept pace with urban growth, and in many cases it has not been delivered to new areas of development at all.
- **poor house design** – residential developers tend to build a 'standard' type of dwelling across the country, which is poorly designed from an environmental perspective, often not tailored to local climatic conditions, and not designed to make efficient use of land or enable efficient use of resources (particularly energy and water) by occupants over time.
- **poor suburb design** – new areas of development are often solely residential, with poor integration of other uses (such as services and amenities), and they display homogeneity rather than diversity in housing type.
- **developer-led developments** – the timing and form of much development has often been determined by the development industry based on its largely commercial assessments. This has a number of negative implications, one of which is that new developments are generally designed to minimise the upfront capital costs of the building rather than maximise the longer-term efficiency or sustainability of the dwelling.

In addition, the case studies highlighted that Australian cities are often characterised by a history of less than ideal planning and governance arrangements. The various powers and functions governing land use change, development planning and approval, and infrastructure and service provision, are spread between three levels of government. Furthermore, government intervention in land use and city planning has historically been minimal, leading some to conclude that the form and functioning of Australian cities is largely determined by housing companies and road planning agencies, leading to very poor urban efficiency (Buxton, 2006: 3).

This means that infrastructure and service provision often does not keep pace with population growth. Not only is there often an absence of any coordinated or strategic approach to planning and development, but often there is also insufficient capacity to assess and manage the interrelated, cumulative and long-term sustainability impacts of population growth. This failure of planning is, however, reflected in increasing journey times to work, more commuting by car, more congestion and increasing per capita emissions and resource use in these suburban areas, and lack of appropriate social infrastructure/services.

These characteristics mean that, from a sustainability perspective, the performance of the built environment in these new suburban areas exacerbates the negative environmental impacts of population growth, and the overall pattern of urban development introduces various negative social impacts and economic inefficiencies.

The suburban built environment

Inefficient resource use caused by poor house design

Residential development in new suburban areas is generally developer-led. Consequently, development is often designed to minimise the upfront capital costs of the building rather than ensuring the longer-term efficiency or sustainability of the dwelling. As noted in earlier sections, house sizes in Australia have been increasing, which also means an increase in the resources they consume – both at the time of building and over time. Typically, new houses are not designed for specific local climates, so their energy and water efficiency is generally poor. This means inefficient resource use is 'built in' to these developments. Inefficient resource use was evident in the case studies in electricity and gas consumption for heating and cooling, and in water consumption through the style and composition of gardens.

In Townsville and Palmerston in particular, the use of the standard 'southern' model of house design is seen as particularly inappropriate, with many stakeholders pointing out how poorly it performs in terms of energy use compared to more traditional 'Queenslander' or 'tropical' style homes that were tailored to the tropical climate.

In Playford, housing design was also seen as unsuitable for the climatic conditions, particularly summer heat waves. Planning requirements that mandate the inclusion of additional features such as solar panels cannot compensate for poor housing design. Stakeholders pointed out that the whole community is paying for the provision of new electricity infrastructure that is needed largely due to the increasing prevalence and magnitude of peaks in electricity demand to which air conditioning in new houses is a primary contributor. The high costs of electricity network augmentation is socialised across all households, including low income and fixed income households, even though many of these households cannot themselves afford to use air conditioning.

The tendency for new developments to feature large areas of hard (non-permeable) surfaces leads to increased water runoff, often exacerbating water pollution problems in local waterways.

Housing prices and affordability

Outer suburban development is often portrayed as a means of providing affordable new housing. While suburban developments may increase the total supply of housing, the case studies illustrate that we cannot infer that this translates directly into more affordable housing for households, because new residential developments in suburban areas typically have higher purchase prices than established housing stock. In the case study locations, house prices in new development areas (that is, within the LGA as a whole) have increased at a faster rate than inflation. Stakeholders in Palmerston and Townsville pointed to anecdotal evidence of households on fixed incomes being forced to leave the area because of the increase in average house prices and the rise in rents, even in established areas.

Rapid population growth, where it is driven by an expansion of employment opportunities in the area, can also cause a rapid rise in demand for housing, which pushes prices up. In Palmerston for example, the various job opportunities created by the expansion of resource projects and Defence facilities has attracted large numbers of workers from interstate. This has put great pressure on the local housing supply and pushed up house prices and rents as new arrivals attracted by well-paying jobs tend to have a greater capacity to pay higher housing costs than locals. In Palmerston this phenomenon, combined with the sell-off of public housing stock has created a significant shortage of housing and a high demand for more affordable housing in particular.

The case studies also suggest that affordability needs to be understood in broader terms than simply the initial purchase price of a house. Even where the purchase price of a new house in an outer suburban area initially appears to be affordable, calculations of the costs to the household of living in that housing over the longer term need to include costs of transportation, other infrastructure, and energy. Housing may not be affordable over the long term if it is not well served by public transport, resulting in a need to run two cars and travel long distances to access workplaces and other services. The resource intensity of new houses discussed in the previous section also means these newer houses are more expensive to run because they are not designed for optimum energy efficiency.

Role of developers in planning

In many of the case studies there was a strong feeling among stakeholders that recent growth and development had been 'developer-led', and had not been well planned or managed. Stakeholders in both Kingborough and Palmerston, for example, explicitly pointed to what they saw as a poorly regulated planning system (at least in the past) which had allowed developers who were 'self-interested' or 'driven almost entirely by profit motives' to exert undue influence over a long period of time. As a result, many stakeholders felt that development was poorly designed from both an environmental and social perspective, did not cater sufficiently to the needs of the community, and was causing a range of negative impacts.

In Palmerston, stakeholders repeatedly pointed to a history of poorly regulated planning, in which developers had exercised excessive influence leaving a difficult legacy from a sustainability perspective. Particular issues included the poorly designed and highly constrained layout of the CBD, and the poor design of Palmerston suburbs from a transport planning perspective.

In Logan, stakeholders said the lack of coordination between the council's strategic planning and developer-led growth has caused two key problems. Firstly, it has meant the planned growth for the area will be difficult to achieve overall. Secondly this lack of coordination produces difficulties in sequencing the provision of infrastructure with development and population growth and in negotiating responsibilities for funding infrastructure .

Planning for growth

Inadequacies in planning and governance arrangements were evident in many of the case studies. In Blacktown stakeholders felt that the current institutional structures did not have the capacity to manage future population growth in a sustainable way. Problems included the underfinancing of local government, a perceived lack of integration between the levels of government in relation to service delivery, and the consequences of previous major decisions (such as the concentration of public housing estates, and the poor layout of the CBD). There was concern among stakeholders that this lack of integrated planning would leave Blacktown less able to cope with the impacts, not only of future population growth, but also of demographic changes (an ageing population), environmental changes (the loss of biodiversity) and climate change impacts (heat waves, heat island effects).

In Townsville, the current City of Townsville area was previously administered by two smaller councils, and according to many stakeholders this had led to a disjointed an uncoordinated approach to planning and development. The recent amalgamation of these councils is seen by many as a positive change that will enable a more strategic approach to planning for population growth. Similarly in Tasmania, a large number of relatively small councils continue to administer planning and development functions, a situation which is believed by many to produce a competitive rather than cooperative environment. This is unlikely to be conducive to planning for sustainable outcomes.

It is evident in many areas that there is a need for the different levels of governments to work together more effectively in planning for the future growth of Australia's cities. This is evident for example in Blacktown Council's strategic plan, which includes plans to build stronger partnerships with state government in an attempt to address the issue of infrastructure provision. This was also evident in Palmerston, where the Territory Government and Palmerston Council had independently produced separate plans for the CBD and have subsequently acknowledged the need to discuss how these plans can be merged.

While in Palmerston the local council has no planning powers, in other jurisdictions, councils do have a role in the planning system. However, despite this there appears to be a common perception that councils tend to have a limited say on development size and character but must nevertheless take various actions to accommodate the growth that has been planned by state governments, with many councils not well equipped or resourced to play this role.

Evidence from a number of the case studies suggests a need for a more continuous focus on sustainability, both over time and by successive governments. While changes of strategy are inevitable when governments change, the long-term challenges of improving the sustainability of population growth require a greater consistency of vision over time.

The costs of growth

The case studies also highlighted the difficulties faced by governments, and by councils in particular, when planning for and providing funds to cover the cumulative impacts of development across the whole area. There are three important considerations:

- the overall provision of infrastructure for new areas
- the economic efficiency of infrastructure on a suburban scale
- clarity on responsibilities for the purchase and maintenance of infrastructure.

Provision of infrastructure for new areas

In many areas, a lack of sufficiently integrated and strategic planning, combined with the tendency for development to be led by developers, has meant that new residential areas of cities lack services and amenities and have an "infrastructure deficit". Areas of high population growth tend to have demographic characteristics in common, including populations that are younger than the state average, with a predominance of families with dependent children. These characteristics in themselves will generate an ongoing and possibly increased need for the provision of schools and other children's and family services in the area

Kingborough stakeholders identified deficits in transport services, in health and community services, and in recreation options. Blacktown also has deficits in each of these areas, as well as a shortage of access to open space. In Mandurah, some public facilities such as libraries, community centres and a recently built arts centre, seem to meet current needs, but there appears to be a shortfall in the other kinds of social infrastructure that are necessary to meet the needs of growing population for education, family support, recreation and other social services. As one stakeholder in Logan put it "when adequate infrastructure isn't provided, you can create problems that last for decades". Poor public transport, and the resulting social isolation, lack of amenity and social infrastructure, was a problem raised by a majority of interviewees in Logan, particularly in relation to young people.

Stakeholders across the case studies said that for an urban area to be socially sustainable, there needs to be a wide range of community infrastructure, including community facilities (libraries, neighbourhood and community centres) and community services (child care, playgroups, pre-schools, schools, aged and youth services, and health services). However, in many of the case study areas it seems that funding for this kind of infrastructure is not keeping pace with population growth.

In the case studies it seemed that it is only once residential development is complete that communities begin to grapple with the challenges of providing the wide range of services that become necessary as a result of population growth in particular areas (including schools, social support services, community facilities and recreation activities). This lack of services in newly developed areas leads to one of two outcomes for residents of those areas: either they become highly car dependent, and have to use private vehicles to travel significant distances to access appropriate services and amenities, or, if they are unable to afford the costs of running a vehicle, they are at risk of social isolation and marginalisation. Either way, this failure of planning creates an ongoing gap between the level and quality of services enjoyed by residents of outer urban areas compared to inner areas.

The case studies highlighted widespread frustrations about failure to provide social and physical infrastructure to communities when they need it. There is a feeling that many social, economic and environmental problems could be prevented by more proactive planning and infrastructure delivery, as delays only exacerbate the issues further, which then require more resources to resolve.

The efficiency of infrastructure on a suburban scale

Recent studies have highlighted the resource costs associated with particular urban forms, with lower density urban forms requiring higher inputs of resources, particularly energy resources related to transport (Victorian Department of Transport, 2009). However, urban efficiency encompasses more than travel patterns and includes infrastructure and energy use, and social and environmental costs including water use, congestion costs and the costs of sprawl. As Buxton puts it:

> Societies which consume less land for urban purposes use roads less, infrastructure more efficiently and can transfer more investment to productive sources. Better urban design reduces social costs by increasing social cohesion. Cities function less efficiently as they expand and reduce their average population density (2006: 2).

While the relationship between density and resource efficiency is complex, the predominant pattern of development in Australia of necessity requires that infrastructure must be provided across much larger geographical areas with resulting economic inefficiencies. Public transport provision illustrates the problem. The evidence from a number of case studies suggests that the provision of public transport in Australian cities has become something of a 'catch-22' dilemma. Urban development tends to be designed as car-centred, so new development is often only serviced by roads and freeways. Once these roads are built (at great expense) and people are dependent on cars, there is less demand for public transport and less incentive for governments to fund it. This point was made my numerous stakeholders in the various case study locations.

Governance and responsibility for infrastructure delivery

The various powers and functions that govern land use changes, development planning and approval, and infrastructure and service provision are spread between three levels of government. This means there is not always a coordinated or strategic approach to planning and development and that often there is insufficient capacity to assess and manage the interrelated, cumulative and long-term sustainability impacts of population growth.

This is further complicated by the lack of an established and transparent framework for developer contributions. Managing developer contributions was found to be an issue in each of the case study areas, but differences in quality of the planning systems between jurisdictions means a universal approach is not forthcoming.

High levels of car dependence

The built environments of suburban areas are characterised by high levels of private vehicle dependence, low public transport use and low active transport use. The heavy car dependence in many of the fastest growing areas of Australian cities has been previously recognised. For example, the federal government's Regional Development Australia (RDA) initiative, in its *Regional Plan for Sydney* notes that while Blacktown is one of Sydney's fastest growing areas it is, like much of Western Sydney, 'not well resourced in terms of public transport and employment' (RDA, 2011: 16) and is characterised by 'heavy car reliance due to lack of connectivity' (RDA, 2011: 69).

Stakeholder interviews highlighted the isolation that people without cars feel in car dependent places. The marketing for new suburban developments is directed towards families and households that are likely to include children in the near future; yet accessing many of the health and community services relating to children in these places depends on having access to a car.

In Townsville, public transport is almost non-existent, and new areas of residential development are low density and spread across the outer suburbs of the city. This means not only that current levels of car dependence are high, but that it will be difficult to 'retrofit' public transport networks into the city because densities are too low to justify the provision of public transport (at least based on current models of transport planning). Palmerston was also found to be a highly car dependent city, as a result of its location relatively far from Darwin, its relative lack of local employment and services, and the poor provision of public transport. Palmerston stakeholders pointed out that not only does high car dependence have negative environmental consequences (associated with fuel use and emissions), but that the assumption that everyone has a car makes accessing services very difficult for people on low incomes who may not have access to a vehicle.

This is one area in which inner city redevelopment of Green Square appears to offer a different experience to the other suburban developments, showing declining car use over time and increasing use of public transport and bicycle ridership.

Stakeholders in many of the case study areas pointed out that long commuting times result in social costs as people spend many hours a week commuting, reducing their time available for social, community and family life. This in turn impacts on the quality of communities and the degree to which people are likely to volunteer, and the level of participant and engagement in local decision-making processes.

Many of the case studies seem to support Buxton's (2006) suggestion that the discrepancy between massive spending on freeway construction and 'almost nothing' on public transport 'will inevitably cause strategic city plans to fail'.

Jobs lag behind residential development

As with social services and amenities and public transport, the provision of local employment opportunities also tends to lag behind residential development. The case studies emphasise that the nexus between the location of work and home is a critical component in sustainable development. Long commuting times can have negative impacts on people's health, wellbeing and social connections, and if these commutes are made by private vehicle, they also produce negative environmental outcomes, notably increased fossil fuel use and pollution.

Because urban growth tends to be driven by residential development, many new areas do not have sufficient levels of local employment. This means people must travel increased distances to work, which results in a range of social and environmental impacts. The lack of jobs for people close to where they live increases car dependence and the associated negative externalities.

Blacktown has the largest quantity of zoned and serviced industrial and commercial land in NSW and will be the site of the majority of new industrial land development in Sydney over the next five years. As such it has the potential to become a major employment hub in Western Sydney. However, currently large numbers of Blacktown residents still travel outside the area for employment. This is typical of the broader region – in Western Sydney, despite significant population growth in recent years, there is an estimated employment deficit of 182,000, which is expected to climb to 290,000 by 2036 (WSROC, 2012). Furthermore the kind of jobs that are likely to become available in the area as industrial land is developed in coming years will not necessarily match the skills and qualifications of local residents. Interestingly, a recent National Growth Areas Alliance publication examining the skills deficits and mismatch in outer metropolitan growth areas reported that growth in manufacturing employment was occurring but only in higher-skilled occupations and that the trend toward lower skills intensity is diminishing (Essential Economic and Geografica, 2012).

Mismatches between the skill levels of resident workers and the local employment requirements cement continued long commutes and car dependence. Research literature also indicates that the numbers of unskilled and low-skilled jobs are decreasing rapidly, and this trend is forecast to continue. Economic development that targets local industrial development and up-skilling of the population will be able to address skills mismatches and provide greater resilience in the local labour market. In the case studies, skills mismatches were highlighted by stakeholders, and the indicator data also highlighted large differences in educational attainment within these fast-growing areas. Low levels of skills attainment make these workers vulnerable in the modern workplace.

The initial, tentative evidence from the inner city redevelopment at Green Square is that the levels of participation in employment are higher (they are significantly higher than for Sydney as a whole and the state). As a result employment rates may be more susceptible to overall changes in economic conditions. The skill base is also different, with a far higher proportion of the local population having tertiary qualifications compared with the metropolitan area or the state.

Emerging trends

Changing role of councils

The case studies highlighted that many councils are beginning to acknowledge and take on a wider sphere of influence (no longer seeing themselves as just responsible for "roads and rubbish"), and attempting to exert a wider influence to advocate on behalf of their LGA. In NSW and WA this broader community and strategic focus is an obligation under changed planning requirements introduced in the past two years. Councils are dedicating resources to this advocacy role (including commissioning studies, creating partnerships with other councils) and feel that they now have a clearer vision of the future for their communities.

Evidence of changing approaches

There is some evidence of changing approaches to development practices. For example, in Blacktown, while most new development in 2009 was still on greenfield sites, there was an increase in the proportion of infill development from 31 to 42 per cent over the decade to 2009. Similarly in Townsville, while growth continues to be concentrated in the outer suburbs, there has been some increase in high density inner city development. Townsville Council would like to see further infill development, with its CBD Masterplan suggesting that the CBD has a greater capacity for infill residential development and should be the focus of increased residential density.

There is also evidence of an increasing desire for more 'mixed use' development that integrates residential development with other uses, commercial, recreational, cultural or institutional. This generally creates higher densities and a more compact, self-sufficient urban form. While the issues involved are complex, and evidence mixed, urban development based on the principles of mixed use is seen by many to deliver a number of sustainability benefits. These include reduced distances between people's homes, workplaces and the services and facilities they need to access, greater variety of housing options, more efficient use of land, more walkable and bicycle-friendly neighbourhoods, and greater community connections. In many of the case studies, there appeared to be a growing conviction, both among stakeholders, and in the various recent planning documents associated with these areas, that mixed use development has the potential to deliver sustainability benefits. For example, the CBD masterplans developed by Townsville Council and Palmerston Council are based on these principles. Similarly, many Palmerston stakeholders pointed to a need for more mixed use development, particularly in the CBD. Stakeholders felt that attracting a range of commercial and residential tenants to the CBD would both create local job opportunities and help to 'activate' the local centre, particularly by attracting after hours activities such as restaurants and entertainment facilities.

Recent NSW Government policy has been to move away from both large concentrations of public housing in geographically confined spaces (Gilmour, 2012) and public delivery of social housing. Current policy favours public–private housing development models with a mix of social and other residential tenure (Morgan, 2006). In line with this policy position, contemporary regeneration developments of large public housing sites in Sydney aim to deliver both higher housing densities and more mixed housing tenure types within the existing communities.

The *30-Year Plan for Greater Adelaide* sets out the state's broad directions for its capital. It includes new strategies for urban infill, locating housing near transportation, and increased density. Urban infill is one of the key strategies with a target for 70 per cent of all new housing to be built in established areas by 2040. Other relevant targets are for 50 per cent of the Greater Adelaide region's new housing to be located within 800 metres of transit corridors, and gross densities to increase on average from 15 to 25-35 dwellings per hectare.

We can also anticipate changes in the form of the built environment as codes mandated in the different jurisdictions and voluntary building codes begin to affect the efficiency of new housing. These include the NSW BASIX code and Victorian 5 Star housing requirement. Voluntary codes include residential energy performance assessment guides, such as FirstRate and NatHERS, the WA Liveable Neighbourhoods code, and commercial building greenhouse and energy codes. [23]

[23] For further information on the various codes mentioned here, see: BASIX (NSW): https://www.basix.nsw.gov.au, 5 Star Homes (VIC): http://www.sustainability.vic.gov.au/www/html/2035-5-star-homes.asp, FirstRate: http://www.sustainability.vic.gov.au/www/html/1491-energy-rating-with-firstrate5.asp, NatHERS: http://www.nathers.gov.au/, Liveable Neighbourhoods (WA): http://www.planning.wa.gov.au/650.asp, commercial building greenhouse and energy codes: http://www.climatechange.gov.au/en/what-you-need-to-know/buildings/commercial.aspx.

Review of the indicator framework

The indicator framework

One of the research tasks for the project was to "collect and assess existing community-level data against 30 (±5) sustainability indicators for selected growth areas across Australia", and in conducting the case studies of the selected growth areas, to complement and test sustainability indicator data against subjective assessments, and to identify priority information gaps and explore means by which supporting data could be collected. The objective of this aspect of the research has been to enhance the potential of the indicators to track and measure sustainability issues relating to population growth on an ongoing basis.

The framework of indicators to be used in this project was based upon the Australian Government sustainability indicator framework, developed by DSEWPaC in consultation with federal government departments and agencies, state government departments, non-government organisations, academics and other stakeholders as shown in Figure 1 (DSEWPaC, 2012). It was modified by the ISF research team, with several adjustments, additions and deletions made to the framework before it was used to collect base data for the case studies. Rather than testing or trying out the framework as a stand-alone process, the main intention was to identify how well the indicator framework captured the key issues which emerged at a local scale in the case study locations and what improvements or additions might be made to better expose sustainability issues.

This section of the report draws on and summarises the assessments of the indicator framework in each of the individual case studies to examine how well the existing measures support the indicators and themes, and whether any indicators, measures or data sources used in the case studies are worth considering as additions or replacements.

Figure 1: Sustainability indicators framework (Source: DSEWPaC, 2012)

Using the framework in the case studies

The framework was used in developing the individual case studies and in securing feedback from stakeholders in the following ways:

- For each case study, the framework was populated with as much data as possible from publicly available sources before the research team visited the location to talk with the stakeholders
- Stakeholders were provided with a simplified version of the framework summarising the domains or "capitals" (environmental, social, economic, and contextual) and the main themes covered in each (the summary version provided is indicated in Figure 2). In the interviews they were asked for their overall comments on the framework, the extent to which they thought the framework captured the issues which had been identified by them in the discussion, and whether there were any additional areas not covered.
- Stakeholders were also shown the more detailed framework including the measures beneath the themes, and were asked about information they used or collected in their professional, organisational or advocacy activities which might add to or replace any of the measures.

The process of populating the indicator framework with data for case study areas exposed two broad issues with the development and application a broad framework at the community level. The first is how to develop a framework which is sufficiently generic to identify those issues which are general or common between cases, whilst at the same time allowing the important differences between communities and locations to emerge. The second is finding data or information at the appropriate or required level to populate the framework. In practice, the two issues are often linked. In general, there is a wider and more detailed availability of data and information at the state and national level on those issues which are general across locations, and, where it is available at all, data and information on particular or important local concerns tends to be collected and reported locally.

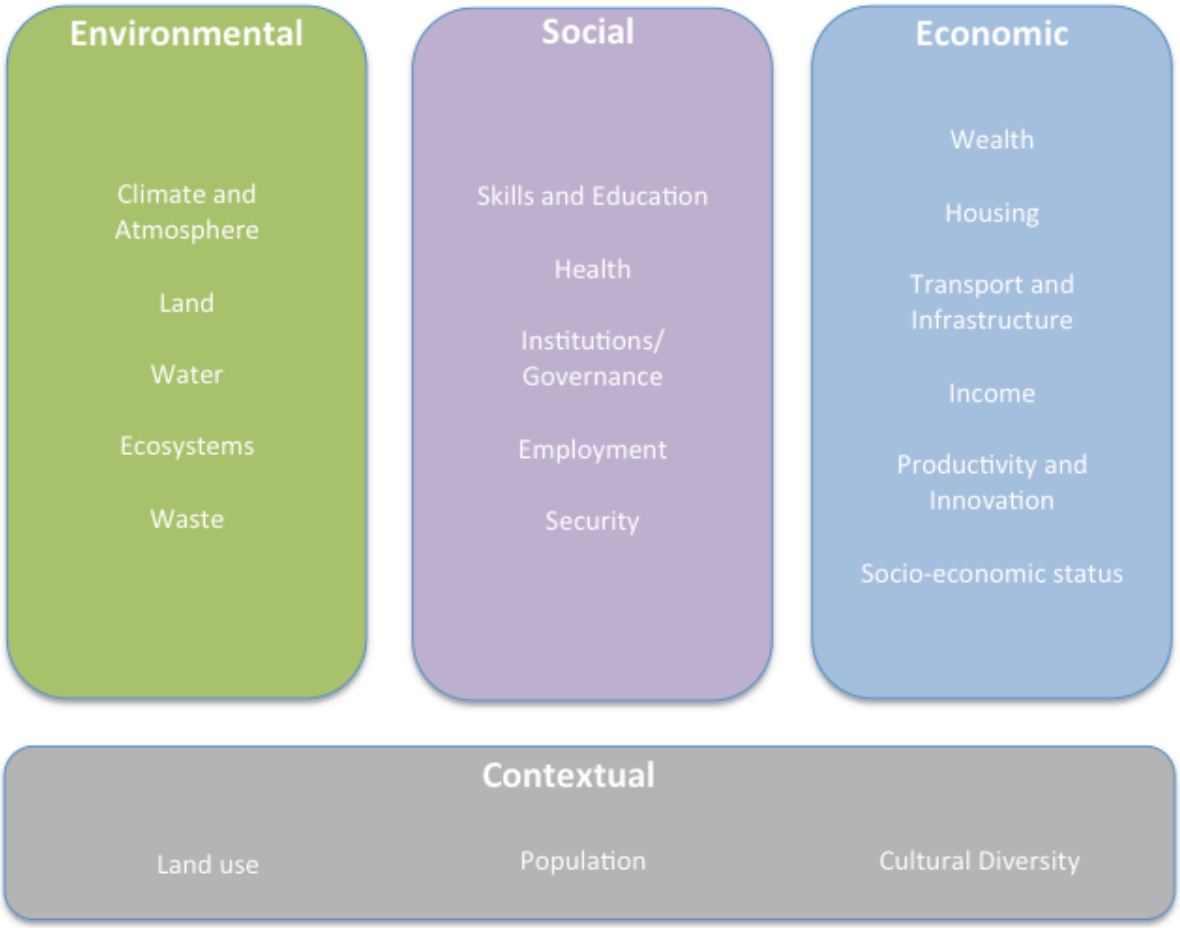

Figure 2: Summary of the Indicator Framework used in Stakeholder Discussions

Data available on communities and locations

Data sources

To find community-level or locality-level information and data, the research team reviewed available national, state and local sources in addition to asking for advice and direction from stakeholders who often had quite specific concerns which were expected to depend upon or generate local detail. In practice, the data which could be used to assess the themes and capitals (domains) at the local/community level derived from three broad sources:

- data made available by the ABS or other national agencies on a regular basis. In particular this data was used for all the contextual indicator themes and many of the economic capital themes
- two regularly produced sources which compile, model and project detailed data: Public Health Information Development Unit (PHIDU) (for data on health) and the *State of the Regions* report based on National Institute of Economic and Industry Research (NIEIR) analysis (for data on economic capital)
- data generated and/or held locally, usually by the local council. Almost all the local or community level information available on natural capital/the environment has been from council sources (often a local state of the environment report or similar document).

The detailed report for each of the case study locations indicates whether data was available on each of the themes and measures identified in the indicator framework and if not it suggests a potential

alternative measure with data if there is any. The data availability information from the case studies is summarised in Appendix A.

In this table, cells corresponding to any measure for which no **locality**-level data is **currently** available are marked in grey. This enables a review of the extent to which local data is available for measures and indicators across localities. From this information it is apparent that the coverage of local data for environment/natural capital is the most sparse across the case studies. There is no single theme on which it is possible to use data to identify trends across all localities. Detailed and fairly comprehensive information is only available when it has been prepared or commissioned by the local council, as is the case with the state of the environment report in Blacktown.

For social and human capital, however, it is possible to identify sources and analyse data for each theme (with the exception of a measure of the balance between the supply of education services and demand) if PHIDU data is used. Similarly, the NIEIR *State of the Regions* report makes it possible to obtain data for every theme across all localities, albeit at the **regional** level, for economic capital. For contextual themes, the availability of ABS data makes it possible to report on and assess every theme across the localities with the exception of land use change and internal migration.

Scales

The spatial resolution or scale for which information is available raises conceptual as well as practical issues. The LGA has been taken as the basic point of reference for each locality case study because a greater body of information, covering a wider range of issues, is more likely to be accessible from a local council than from any other single potential source, and because the LGA is a common unit of analysis and data provision used by the ABS. For many flows and processes (natural and economic) a regional point of focus is more legitimate and is conventional in analysis However, at the local or regional level, the boundaries of agencies and departments covering different services at the state level do not coincide, and nor do the boundaries of state and federal government departments. There are also many dynamics and processes for which LGA-level data is too general and not sufficiently finely grained. Understanding the social, demographic and cultural changes and challenges associated with suburban growth requires identifying smaller areas or neighbourhoods which develop at different rates, in different periods and often with populations with quite disparate characteristics and requirements. This was a common observation across the case study locations.

The implications of these observations are that there is no single or recommended level of assessment or analysis. The appropriate level of analysis (region, LGA, neighbourhood) is therefore most usefully and effectively reviewed in relation to specific themes, how they are best conceptualised and the data actually available for the relevant indicators and measures.

The potential for adding measures to the indicator framework

From the analysis of data available on the themes, indicators and measures in the indicator framework for the ten case study locations in the research, it was possible to identify a number of potential indicators and measures which illustrate sustainability issues at the location or LGA level. Table 3 provides an indication of the sources of data used for the measures and the locations for which data is available in the case studies. It also provides an initial assessment of the feasibility and worth of future investigation for possible inclusion in a revised or extended indicator framework. The measures which may benefit from further investigation are shaded in Table 3. Following the table, a more detailed consideration of each measure is given, providing the rationale for the assessment of its potential for future investigation and inclusion in the indicator framework.

Capturing stakeholder issues

There is no single, universally accepted set of indicators for wellbeing available in Australia, let alone internationally. However, across the indicator frameworks which have been developed (including the Australian State of the Cities Report which now covers eighteen major and regional cities across the country with populations over 100,000 there is a common endorsement of the need to ensure that the broad domains of environmental, social and economic issues (commonly referred to as the "triple bottom line") are covered. In addition a fourth domain, governance, is also added in many instances.

Similarly, at the level of themes there is a notable degree of agreement between the frameworks (though terminology may differ). This broad agreement nationally and internationally on key domains and themes was also reflected in the comments received from stakeholders in the case study locations. There was almost universal recognition and endorsement among the stakeholders interviewed across the ten locations regarding the intended thematic coverage of the indicator framework used in this study.

The stakeholders made very few specific comments or suggestions about deficiencies in the framework. In the limited instances when they did so, it was usually in relation to the ability of the framework to capture the fine-grained and location-specific issues which were particular to their locality or community. For example, in the case study of Mandurah, the city council was explicit about the need for more detailed modeling data to assess the risk to coastal environments. Mandurah has a significant Ramsar site and estuarine complex of particular concern, and the tension between the need to maintain the integrity of coastal environments and the pressure for further development is something that most coastal councils would also wish to monitor and include within their assessments of future sustainability.

Governance processes and coordination

However, in relating the overall coverage of the framework to the main issues which arose more generally in the interviews and discussions with stakeholders, the research team observed a lack of close correspondence between the framework and many of the issues raised by local organisations and representatives. For many of these issues, the framework provides some, if partial, relevant data and information. But there are three broad areas emphasised as significant by stakeholders across the locations and which do not appear to be adequately addressed in the indicator framework.

The first relates to issues of governance and integration within and between the tiers of government. As summarised in the earlier section of this report which outlines the key findings from the case studies,

> this analysis highlighted that Australian cities are often characterised by a history of less than ideal planning and governance arrangements. The various powers and functions governing land use change, development planning and approval and infrastructure and service provision are spread between three levels of government.

While governance as a broad theme is acknowledged in many indicator frameworks as significant (in some frameworks it is deemed significant enough to be made a specific theme or domain), addressing the issues of process and coordination being referred to by stakeholders is difficult with an indicator framework.

Service provision

The second area is the availability of basic services, particularly educational and community services. The jurisdictions with responsibility for services (federal, state or local government) invariably collect data on the key parameters of service delivery. While data on levels of service provided does not provide a totally reliable or accurate guide to how much use is made of facilities, how well it is matched

to current or potential demand or any issues of differential access between groups or locations inclusion of basic measures of service provision would allow the framework to address a major area of concern for stakeholders.

Measures of the built environment

Third, but at a rather different level of generality and analysis, is the design of the houses and accommodation. This is a concern for stakeholders in terms of the potential sustainability of developments because of the tendency for the use of "standard" house designs which do not necessarily take account of local climatic conditions and are not designed for efficient use of resources over time. Inclusion in the framework of measures for the built environment would address these concerns of stakeholders.

Table 3: Potential for adding new measures to the indicator framework

Contextual Indicators							
Theme and Indicator	**Measure**	**What measure covers**	**Example case study**	**Scale/ Resolution**	**Measure used / reported by (example)**	**Data source, collection method, frequency**	**Worthy of further investigation or consideration?**
Land use Land use change	% infill development	Proportion of new development in an area that is 'infill' (that is, occurs on sites that are, or have previously been, used for urban purposes).	Blacktown	LGA	Blacktown Council (State of Environment report)	NSW Dept. of Planning. Data collected annually 2005-2010. Method not known.	Yes
Land use change	% greenfield development	Proportion of new development in an area that is 'greenfield' (that is, occurs on land that has not previously been developed for urban purposes; most commonly rural lands)	Blacktown	LGA	Blacktown Council (State of Environment report)	NSW Dept. of Planning. Data collected annually 2005-2010. Method not known.	Yes

Natural Capital							
Theme and Indicator	**Measure**	**What measure covers**	**Example case study**	**Scale/ Resolution**	**Measure used / reported by (example)**	**Data source, collection method, frequency**	**Worthy of further investigation or consideration?**
Climate and Atmosphere GHD Emissions	Tonnes CO_2 saved from entering the atmosphere	This measure estimates the tonnes of carbon dioxide prevented from entering the atmosphere as a result of particular emission reduction programs.	Mandurah	LGA	Mandurah Council State of the Environment report 2011	Internal council data. Frequency of collection unclear – total figure for 1999-2010 reported on Mandurah Council website: http://www.mandurah.wa.gov.au/8985.htm	No – too specific to impact of particular programs, rather than providing overall picture of emissions in the area. Total emissions for a given area is a better measure.
Ecosystems and Biodiversity Re-establishment of vegetation	Indigenous plants planted	Number of indigenous plants planted in the LGA by Council staff, volunteers, contractors and landowners.	Playford Blacktown	LGA LGA	Playford Council *State of the city* report 2011) p. 61. Blacktown Council (State of Environment report 2006-2010)	Council corporate data e.g. Playford and Blacktown collected and reported annually (at least between 2006-2010)	Yes – if reworded in more meaningful comparative terms, e.g. 'number of indigenous plants planted *per square kilometre'.*
Ecosystems and Biodiversity Re-establishment of vegetation	Number of hectares of vegetation under restoration	Number of hectares within the LGA that are subject to bush regeneration projects (typically undertaken by volunteers, administered by Councils).	Blacktown	LGA	Blacktown Council (State of Environment report 2010) p.38	Annual (2006-2010)	Possibly. More meaningful as a comparative indicator if it were expressed as 'percentage of total LGA land area (kilometres squared) under restoration'.

Water Water consumption and availability	Residential water supplied relative to mean annual rainfall	Average residential water supplied per property relative to the mean annual rainfall for that area.	Townsville	LGA	Australian Conservation Foundation (Sustainable cities index). One off publication 2010.	Water supply data: as reported by water utilities to the National Water Commission (NWC). Rainfall data: as reported by Australian Bureau of Meteorology (BoM). Further investigation needed to determine frequency of data collection by NWC and BoM.	Yes

Social and Human Capital							
Theme and Indicator	Measure	What measure covers	Example case study	Scale/ Resolution	Measure used / reported by (example)	Data source, collection method, frequency	Worthy of further investigation or consideration?
Health Access to open space	Open space per capita	Kilometres squared of open space per head of population in a given area. Definition of 'open space' may vary, but generally includes land zoned for conservation or other environmental purposes, parkland and other recreational areas, and land used for other purposes such as corridor or drainage.	Blacktown, Mandurah, Townsville, Playford	LGA	Blacktown Council (*State of Environment* report) Mandurah Council	Internal council zoning data (combined with ABS population data). Blacktown and Mandurah Councils cite annual data in their respective reports	Yes – but careful attention to different definitions of 'open space' will be necessary in order to compare across jurisdictions with different zoning legislation.
Institutions and Governance Fair and functioning	Residents' satisfaction with their ability to influence decisions	Subjective measure asking survey participants to rate their level of satisfaction with their ability to influence decision-making in their local council	Playford	LGA	Playford City Council *State of the City* report 2011 p. 43	Customer satisfaction survey conducted annually by Council 2005-2010.	No – comparability of data likely to be poor.
Employment Local Employment	% people working and living in the same LGA.	Proportion of the population that both lives and works within a single LGA.	Blacktown	LGA	WSROC (2007) (commissioned report by WESTIR)	WESTIR analysed ABS Census journey-to-work data	Yes – however may need refinement to avoid LGA boundary issues.
Employment Local Employment	Also known as 'employment self-containment rate'.		Mandurah	LGA	WA Government (Economic and Employment Lands strategy *Directions 2031 and Beyond)*	WA Planning Commission reports employment self-containment rate	

Employment Local Employment	Employment Self Sufficiency	Quantity of jobs available in a given area as a proportion of that area's labour force.	Mandurah	WA Govt. sub-region	WA Government (Economic and Employment Lands strategy *Directions 2031 and Beyond*	WA Planning Commission	Yes – useful in combination with employment self-containment rate (see above)
Security Security	Perception of safety/lighting	Subjective measure asking survey participants to rate the safety / lighting of their local area	Playford	LGA	Playford City Council *State of the City* report 2011 p. 36	Customer satisfaction survey conducted annually by Council 2005-2010.	No – quality and comparability of survey data likely to be poor.

Economic Capital							
Theme and Indicator	**Measure**	**What measure covers**	**Example case study**	**Scale/ Resolution**	**Measure used / reported by (example)**	**Data source, collection method, frequency**	**Worthy of further investigation or consideration?**
Transport and Infrastructure Transport Infrastructure	Kilometres of dedicated cycling paths	Total number of kilometres of dedicated (off-road or separated) cycle paths in an area.	Blacktown	LGA	Blacktown Council (State of Environment report 2006-2010)	Internal council data. Collected and reported annually by Council	No – limited use as a comparative indicator because LGAs are all different sizes.
Income Income Disparity	Social security take-up	Proportion of the population aged 16-64 years receiving Newstart, Disability Support Pension, Parenting Payment – Single, and Youth Allowance for non-students/apprentices.	All	NIEIR region. Data for other levels would need to be sought from Centrelink.	National Institute of Economic and Industry Research (*State of the Regions* report)	Reported by NIEIR annually. NIEIR uses Centrelink data.	Yes. Further investigation needed to determine precisely what data is available from Centrelink (including geographic level).
Income Income Disparity	Household debt service ratio	The extent to which households are able to service their debt. Calculated by National Economics (2012) as 'interest paid on debt plus 0.07 of the outstanding stock of liabilities to allow for repayments divided by disposable income'	All	NIEIR region.	National Institute of Economic and Industry Research (*State of the Regions* report)	Reported by NIEIR annually. Based on ABS data. Further investigation necessary to determine frequency of data collection	Yes. Further investigation needed to determine how complex ABS data analysis and modeling is.

Income Income Disparity	Ratio of average dwelling price to household disposable income	Measures housing affordability by comparing average dwelling prices with average household disposable incomes.	All	NIEIR region.	National Institute of Economic and Industry Research (*State of the Regions* report)	Reported by NIEIR annually. Uses ABS data. Further investigation necessary to determine frequency of data collection	Yes. Further investigation needed to determine how complex ABS data analysis is.
Productivity and Innovation Innovation	Patent counts to population	Number of patent applications per 100,000 population	All	NIEIR region. (Data also available for purchase	National Institute of Economic and Industry Research (*State of the Regions* report)	Reported by NIEIR annually.	No – relevance is too limited.

Contextual indicator measures

Land use change: percentage infill and percentage greenfield development

This indicator compares the proportion of infill and greenfield development in a given area. Infill development is development that occurs on sites that are, or have previously been, used for urban purposes, for example, the erection of a residential flat building (high density) on a site which was previously occupied by a detached dwelling (low density). Greenfield development is development that occurs on land that has not previously been developed for urban purposes. Most commonly it is on rural land. Presenting these two figures together demonstrates the split between 'greenfield' and 'infill' development in a given area. A time series of this data would demonstrate any trend towards either type of development over time.

This indicator is used in many sources, including for example by Blacktown City Council in its *State of the Environment Report* (2010). It is an important indicator because as Buxton (2006) has pointed out, many Australian state governments have land use policies that aim to increase infill development and limit outer urban ('greenfield') growth, as part of the goal of increasing urban density and encouraging mixed use, transit-oriented development in activity centres and to improve public transport. However, translating these strategies into reality has proven very challenging, partly because of a lack of political will to enforce compliance with such policies (Buxton, 2006). For this reason this indicator is useful in monitoring whether these goals are actually being delivered.

This is a meaningful indicator because, as Blacktown City Council points out, and as many of the government strategies for urban development cited by Buxton (2006) acknowledge, while there are sustainability impacts associated with both infill and greenfield developments, negative impacts are generally greater for greenfield developments (2010: 24).

Data for this indicator is sourced from the NSW Department of Planning. Whether or not this indicator is applicable on a wider scale would be dependent on the availability of consistent and comparable data at appropriate levels. Further investigation would be necessary to determine the feasibility of using this indicator in any given part of Australia. This investigation would need to include consultation with state and territory government planning departments to determine whether such data is collected and if so, how often and at what geographical level. It would also be necessary to determine whether the data collection and reporting methods of the various government agencies across Australia are consistent enough for such an indicator to be comparable across different jurisdictions.

Natural capital measures

Climate and atmosphere: tonnes CO_2 saved from entering the atmosphere

This measure estimates the tonnes of carbon dioxide prevented from entering the atmosphere as a result of particular emission reduction programs. It is generally used to measure (or estimate) the impact of particular actions or programs, usually undertaken by the organisation reporting the data – such as a council.

For example, Mandurah (and many other local councils) use this measure to quantify the impact of their emission reduction programs, many of which are developed as part of their membership of the Cities for Climate Protection Program (CCP). Typically, these council programs work with the community with the aim of reducing greenhouse gas emissions from a range of sectors, usually including the waste, transport and energy sectors. The indicator requires a baseline year against which emissions are then compared. For Mandurah this is 1999.

While this indicator is useful for estimating the impact of specific organisation-level actions, it does not provide information about total emissions for a geographic area, or a given population as a whole. For example, council programs may have saved an estimated volume of emissions, but emissions from other sources in the LGA may have increased over the same period. For this reason, a more meaningful measure for an area as a whole would be the *net* difference in total emissions (from all sources combined) reported annually to enable a comparison of emission levels over time.

Eco systems and biodiversity: number of indigenous plants planted

This measure indicates the number of indigenous plants planted within a given area within a given timeframe. Increasing the number of indigenous plants is an important contributor to environmental sustainability as it increases biodiversity and can help provide habitat and/or wildlife corridors for native fauna species.

The measure is used by Playford Council in its *State of the City* report (2011), in which Council reports on the numbers of indigenous plants planted each year in the LGA by Council staff, volunteers, contractors and landowners. Many Australian local governments collect similar data.

This is an interesting sustainability indicator to monitor *within* an LGA, as time series data provides a picture of whether the number of indigenous plants planted is increasing or decreasing over time. However, strictly speaking this measure would need to be combined with a measure of the number of indigenous plants lost or removed in that same area over the same time period, in order to provide a net figure.

LGAs differ in size (i.e. area) and the significance of planting a given number of plants will vary according to the size of the area. For this reason the measure would be more meaningful as a comparative indicator if it were expressed as 'numbers of indigenous plants planted per square kilometre'.

Ecosystems and biodiversity: number of hectares of vegetation under restoration

This is a measure of the number of hectares within an LGA that are covered by bush regeneration projects (typically undertaken by volunteers, administered by councils). Bush regeneration, because it involves removing weeds and planting native species, is an important contributor to improving biodiversity conservation, which is a critical component of environmental sustainability.

For this reason, the measure is potentially useful. However, because LGAs differ in size (i.e. in area) the significance of a given number of hectares will vary according to the size of the LGA. For this reason the measure would be more meaningful as a comparative indicator if it were expressed as 'percentage of total LGA land area under restoration'.

Water consumption and availability: residential water supplied per property relative to mean annual rainfall

This indicator measures the average residential water supplied per property relative to the mean annual rainfall for a given area.

This is the water indicator in the *Sustainable cities index* developed by the Australian Conservation Foundation (2010). It is a useful indicator because it gives not only a sense of how people's water use in one geographical area might compare to water use in another, but also a sense of how water usage in an area compares to available rainfall in that area – thereby more explicitly connecting water use and local water availability.

For this reason the indicator is worthy of further investigation. However, there may be some barriers to the collation of data. The indicator relies on access to water supply data reported by water utilities to the National Water Commission, and rainfall data reported by the Australian Bureau of Meteorology. However the ACF reports that despite a current intergovernmental agreement, a number of water utilities have to date failed to provide the required data to the National Water Commission (Australia Conservation Foundation, 2010: 17). Further investigation would be necessary to determine whether this issue has been resolved since the publication of the ACF report, or if not, whether it can be. Scale of the data, relevance of ground water, and interrelationships of water transfer between catchment areas and available water also require further investigation.

Social capital measures

Health: open space per capita

This is a potentially useful land use indicator. As urban population growth continues, competition for the often very limited available land increases. There is typically a range of different and competing pressures on land within a given urban area, including residential development and other forms of urban expansion, transport and other kinds of infrastructure, industry and agriculture. Monitoring the area of open space per capita is one way of understanding how these competing pressures (including but not limited to urban expansion) are impacting on a given area.

Open space is important for both environmental and social sustainability. Urban open space provides a wide range of recreational opportunities and can also enhance biodiversity, enable environmental conservation, improve neighbourhood aesthetics and amenity, improve air quality and increase water retention.

Many councils are likely to have access to data in relation to this indicator. However, land use zoning is somewhat complex as some land is zoned under state planning legislation and some under local government policies. It is also important to understand that there are different kinds of land use that fall under the 'open space' category, including land zoned for conservation or other environmental purposes, parkland and other recreational areas, and land used for other purposes such as corridor or drainage.

Because zoning arrangements, as well as the various categories and sub-categories of land use may vary from state to state, further investigation would be needed to determine whether the data available around the country is strictly comparable.

Institutions and governance: residents' satisfaction with their ability to influence decisions

This is a useful subjective measure of people's perceptions of how easy or difficult it is to participate in and influence council decision-making. This is an element of the 'governance' topic within the domain of social sustainability. Many councils include a question on this topic when they conduct surveys of their residents.

There are a number of limitations with this indicator. Firstly, while potentially useful and relevant *within* an LGA, the measure does not necessarily enable comparisons across areas. To be reliable, all survey samples used by different councils would need to be representative of the demographic profile of the population. Secondly, it is unlikely that different councils' survey questions would be consistently worded, or survey methodologies sufficiently consistent to enable comparison. Thirdly, if this measure was to rely on council survey data it would provide only a very partial measure of people's perceptions of this governance issue, because it does not take into account the many significant decisions and issues that are the responsibility of the other two levels of government in Australia.

Employment: % people working and living in the same LGA (also known as Employment Self Containment rate)

This measures the proportion of the residential population of an LGA that works within in the same LGA.

This measure is indicative of the strength of the local economy, and helps to draw a picture of whether a given area is merely a 'dormitory' or 'commuter' suburb for a nearby centre of employment, or whether the local economy is more self-sufficient and has significant employment opportunities of its own. It also helps measure whether the local employment opportunities that do exist are a good match with the skills and qualifications of local residents.

This measure can also be indicative of commuting times, which are significant in sustainability terms, because long commutes have been shown to be negatively correlated with health and wellbeing outcomes as people have less time to spend with family and friends, or to participate in physical activity. If this measure were combined with data indicating *mode* of travel, it could be useful for determining the proportion of people making long commutes by private vehicle – a contributor to increased fuel use, pollution and congestion.

However, a significant limitation of this measure is its use of LGA (or any other geographically-defined) boundaries. For example, a person's home and workplace may be located on different sides of an LGA boundary yet still be close to each other, and therefore the distance they travel may be very small. A more useful version of this measure may be people living and working within a defined distance, for example, 'people travelling less than X kilometres to work'.

In a very general sense, this indicator may also provide a sense of people's levels of connection to, or engagement with their local community. Engagement is an aspect of social sustainability, however it is difficult to specify and very difficult to measure.

Employment: employment self sufficiency

Employment self-sufficiency measures the quantity of jobs available in a given area as a proportion of that area's labour force. This is a potentially useful measure of economic sustainability as it gives a picture of the proportion of the population for whom locally based jobs are potentially available. This measure would be most useful if combined with the employment self-containment rate (see above), which measures the actual (as opposed to potential) rate of local employment.

Security: perception of safety/lighting

This is a useful subjective measure of the safety, or perceived safety, of an area, which in turn contributes to social sustainability. Many councils include a question on this topic when they conduct surveys of their residents. However, while potentially useful and relevant *within* an area, there are a number of barriers to the comparability of this measure across areas. First, to be reliable, all survey samples would need to be representative of the demographic profile of the population. Secondly, because these surveys are generally conducted by different councils, it is unlikely that the survey questions would be consistently worded, or survey methodologies sufficiently consistent to enable comparison.

Economic capital measures

Transport and Infrastructure: kilometres of dedicated cycling paths

The provision of dedicated cycling infrastructure has been shown to be an important factor in encouraging people to cycle regularly. As such this indicator can help provide a picture of how well the urban environment is supporting improved environmental outcomes (by encouraging people to cycle instead of using private vehicles, thereby reducing emissions and fuel use), as well as social (health) outcomes (by enabling people to more easily achieve the recommended daily levels of physical activity).

This may therefore be an interesting sustainability indicator to monitor *within* an LGA, as time series data provides a picture of whether the provision of cycling infrastructure is increasing or decreasing over time. This indicator is used for this purpose by a number of Australian local governments. However, the indicator may be of limited value as a *comparative* indicator because LGAs differ in size (i.e. in area) so the significance of a given number of kilometres of cycling path will vary according to the size of the area. For this reason it is perhaps not ideal as a comparative indicator.

Another limitation of this indicator is that it does not provide information about the connectivity or usefulness of the cycle paths in an area. Therefore a simple kilometre measure, while valuable, does not distinguish between paths used mostly for casual recreation (for example within a park) and paths that provide a realistic option for commuters to travel regularly, safely and efficiently between key destinations in the local area.

Income disparity: social security take-up

This is a measure of the proportion of the population aged 16-64 years receiving the following kinds of government social security payments: Newstart, Disability Support Pension, Parenting Payment – Single, and Youth Allowance for non-students/apprentices. It is expressed as a percentage of the population aged 16-64 years (National Economics, 2012: A.287).

This measure is useful as a supplementary indicator to the more commonly used indicators relating to unemployment, and contributes to an understanding of both the social and economic sustainability of an area. While unemployment data tells us the proportion of people who are accessing unemployment benefits, it does not capture other social security payments, such as disability pensions or sole parent payments. As the NIEIR *State of the Regions* report notes, the proportion of the population accessing these other kinds of payments can be indicative of 'other aspects of community crisis' that are not evident from the unemployment rate alone (National Economics, 2012: 94). Because it includes all kinds of social security payment categories, the rate of social security take-up will always be higher than the unemployment rate.

Because the data source is the Commonwealth Government (Centrelink payments) data, this measure is highly comparable from one geographic area to another. However, some analysis and aggregation of Centrelink data may be necessary to derive the actual figure for a given area. ISF has relied on National Economics (2012) for the social security take-up data quoted in this report and the case study reports. National Economics reports that the measure is derived from Centrelink data (National Economics, 2012: A.287), however further investigation would be necessary to determine what format Centrelink data can be obtained in, and how onerous this analysis/aggregation would be.

Income disparity: household debt service ratio

This measure provides an indication of the extent to which households are able to service their debts. From a household point of view, the significance of debt is the burden it imposes on household budgets. The debt service ratio is a measure of this burden (National Economics, 2012: 101). A high debt service ratio indicates that household borrowing is high in relation to household income. Changes in this ratio reflect both changes in indebtedness and changes in incomes.

This indicator is useful as a supplementary indicator to 'household income', because it provides a more nuanced picture of the financial situation or 'balance sheet' of the average household. It is also highly relevant in any assessment of the impacts of population growth in urban areas because debt service ratios tend to be higher in metropolitan areas, as a result of relatively high land values compared to rural areas. There is also significant variability in the distribution of debt service ratios in different cities in Australia, as a result of a range of factors (see National Economics, 2012: 101-2). This measure is therefore a useful indicator as a dimension of economic sustainability.

ISF has relied on National Economics (2012) for the household debt service ratio data quoted in this report and the case study reports. National Economics states that this measure equals 'interest paid on debt plus 0.07 of the outstanding stock of liabilities to allow for repayments divided by disposable income'. National Economics derives debt service ratios from ABS data (for details of calculation method see National Economics (2012), pg. A.292), which suggests that the measure will be highly comparable across Australia. However further investigation would be needed to determine the feasibility of replicating the necessary analysis and modelling of ABS data.

Income disparity: ratio of average dwelling price to household disposable income

This indicator helps demonstrate the affordability of housing in a particular area, by comparing average dwelling prices with average household disposable incomes. For example, a ratio of 7.0 means the average house is priced at seven times average annual household earnings. This ratio indicator is more useful than either average dwelling prices or average incomes alone in providing a realistic picture of household affordability.

However, this measure can be misleading because many residents own their homes outright, having bought at past prices (National Economics, 2012: 102-3). A more useful measure might be the ratio of a mortgage on a new house to the income available within commuting distance from that house, including allowance for the number of people competing for that income. Using this measure National Economics finds new houses to be particularly expensive in outer Sydney, the NSW Central Coast, and the SEQ Gold Coast and Sunshine Coast regions (National Economics, 2012: 103).

ISF has used data from National Economics (2012) for the dwelling price to income ratio data quoted in this report and the case study reports (see National Economics (2012), pg. 102-3). National Economics uses ABS data on household disposable income (see National Economics (2012), pg. A.290 for calculation method). Further investigation would be necessary to determine the feasibility of replicating the necessary analysis of ABS data for a given area. Further investigation would also be necessary to determine what an appropriate data source and calculation method might be to derive ratios for the preferred indicator suggested by National Economics, namely the mortgage on a new house compared to the income available within commuting distance from that house, for any given area.

Innovation: patent counts to population

This is a measure of the number of patent applications per 100,000 population. It is reported in the NIEIR *State of the Regions* report. In the absence of other reliable data, the measure is sometimes used as a proxy for business 'innovation'. However, the measure is of limited use as patents are only used in certain types of innovation (technology based and radical innovative activity), meaning this measure excludes other more common forms of innovative activity such as service or organisational innovation.

Overall conclusions

Sustainability of population growth

This research has focussed on the experience of urban and specifically suburban population growth in Australia exploring the sustainability of the types of development that have been taking place and looking in particular at opportunities and challenges and how the growth might have been managed more sustainably in ten locations across the country.

The challenges and opportunities for sustainability from suburban growth are relatively well documented and widely known. To a large extent, the information from the detailed case studies, discussions with the range of local stakeholders and data collected, are consistent with what is already known, and seems to be relatively common across the locations, be they suburban developments spreading metropolitan areas, or medium sized and regional centres, though the scale of issues varies.

Most stakeholders interviewed were supportive of future growth in their urban communities, and it was possible to identify positive opportunities: the increase in the critical mass of the population to support a wider range of services and businesses, cultural and social diversity, economic opportunities and an increase in the resources potentially available locally for councils.

However, stakeholders across the case study locations articulated a strong view that the types of development which had taken place have had considerable downsides for sustainability. As reflected in this report these challenges and difficulties outweighed the perceived benefits significantly (notwithstanding that the structure of the discussions gave equal time and opportunity for stakeholders to talk about both benefits and challenges). They saw a strong need for development to be better planned and coordinated; for residential development to be better integrated with services and infrastructure, particularly public transport; for housing development to be in closer step with demand; for greater diversity types of housing and accommodation being built and residences which are better suited to the local conditions. Their views confirmed the need to give consideration to sustainability both in the patterns of overall urban growth and in the nature and performance of the built environment.

To an extent these challenges result from the less than ideal governance arrangements for planning which have been said to characterise Australian cities as a result of powers and functions being split between different governments, agencies and levels of government, and a lack of coordination or strategic alignment between the various bodies.

While all population growth puts increasing pressure on the environment it is the particular characteristics of Australia's development that has produced a built environment in new suburban areas which tends to exacerbate negative environmental impacts of population growth, while the overall pattern of urban development has had significant negative social impacts and can generate economic inefficiencies.

The case study locations included one inner city development to provide a point of comparison with the developments in suburban metropolitan areas and medium sized cities or regional centres. It is impossible to draw any major conclusions from a single case, and at the time of completing this report, the detailed assessment of that case study was still being finalised. However, from initial data analysis it appears there may be important differences in two of the areas of significant challenge identified in the other case studies: car dependence and availability of local employment, with car usage declining and employment participation rates higher than those of the rest of the metropolitan area.

The potential for developing an indicator framework for use at the local level

The current absence of a commonly applied framework of indicators for a wide range of themes or issues across localities or local government areas is widely recognised.

There have been a number of initiatives with the objective of bringing greater coordination (if not uniformity) to the way local government is collect and report data across its wide range of responsibilities and interests. Though without a specific focus on sustainability, the most fully developed local framework and data collection process involving local government in Australia is most probably Community Indicators Victoria (CIV), with its broad range of "wellbeing" indicators designed to report community wellbeing across Victoria. The CIV framework has been reviewed for potential adaptation for councils in both Queensland (an initiative prior to the change in state government in 2012) and New South Wales (as a State Division of Local Government funded project).

Individual councils (such as the City of Sydney) have also made use of the architecture of the CIV approach and modified it to support and inform their own objectives and strategic plans. The federally funded Australian Centre of Excellence in Local Government (ACELG) collaborated with Penrith Council in New South Wales in 2011-12 to commission a report on *Options for a Local Government Framework for Measuring Livability*, with the objective of promoting a tool which would be of use to other councils in rapidly growing areas.

These various initiatives signal an interest in greater coordination and the potential for adoption of a common understanding of what to measure when assessing wellbeing and, of equal importance, **how** to go about it. However, beyond Victoria, at this stage there does not seem to be a major impetus or the resources to go through what would undoubtedly be a long-term development process to put something more formal or comprehensive in place at the local government level.

In this context, the Australian Government sustainability indicators set can be used to present existing data on some sustainability issues in a uniform manner at local levels across jurisdictions. Though it does not capture all sustainability issues experienced at local levels, it could be used as a base framework for synchronisation of the measurement of sustainability and wellbeing, and for the alignment of data collection to support such measurement into the future.

Many of the issues evident from the case studies raised environmental, social and economic dimensions and which were interrelated. Marked dependence on cars results from the location of new developments on the outskirts or cities or metropolitan areas, a disjuncture between the availability of housing and employment and developments which are designed predominantly for access by roads and freeways. Longer commuting times then have social costs and the forms of transport used (compared with the forms of public transport which are not available) have environmental impacts.

The increase in the concern about the impact of the built environment on environmental quality in Australia in recent years was echoed in the views of the stakeholders. While they could identify local initiatives to redress negative impacts of growth through, for example protections of species or re-vegetation, there was a general view that current systems for valuing protecting and managing the environment were insufficient. This is consistent with stakeholder assessments that there has been a lack of methods and tools for effective environmental management and to embed sustainable practices. This is reflected in the availability of data about localities and communities to populate the set of sustainability indicators used in the project. Across the domains in the indicator framework (economic, social, environmental, and contextual) there is less consistent and comparable data on the environmental indicators and measures than for other indicators, though where information is available it is locally generated and relevant.

Indicator framework

As a means of tracking and measuring sustainability issues relating to population growth on an ongoing basis, the indicator framework has a broad coverage which is recognisable to and generally endorsed by stakeholders. However, while the framework potentially provides some relevant data and information on many of the issues emphasised in interviews, there is a lack of direct or close correspondence. The research has identified three broad sets of issues regarded as significant by stakeholders across the locations which do not appear to be adequately captured by the indicator framework (governance and integration, availability of services and the built environment). From the analysis of data actually available and reported across the case studies, ten measures were identified as having potential for further investigation and development for use in the framework.

In the introduction to this report it is observed that the research is largely retrospective and it has reviewed the experience of growth occurring over many years if not decades. There are various points in the final report, however, in which changes are identified which are already taking place and are likely to influence the shape that future development will take. These include, at the national level, COAG planning principles and criteria for effective planning in Australia's capital cities which will impact on coordination and alignment between planning bodies. There are the other national initiatives to promote and trial more sustainable urban models. At the local level, we have documented the emerging trend of councils adopting wider frames of reference than those which may have been traditional, and cities and urban areas looking at opportunities for denser, infill developments, and for developments with mixed residential, commercial, recreational and cultural uses. Changes in the built environment are also anticipated as mandated and voluntary building codes have an impact on the resource efficiency of new accommodation and buildings.

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Appendix A

Table 4: data availability for themes and indicators across seven case study locations

Contextual Indicators								
Theme & Indicator	**Blacktown**	**Mandurah**	**Kingborough**	**Townsville**	**Playford**	**Melton**	**Palmerston**	**Source of data for measure and resolution**
Population								
Population size	Number of persons	Number of persons	Number of persons	Number of persons	Number of persons	Number of persons	Number of persons	ABS/LGA
Rate of growth	Annual rate of growth	Annual rate of growth	Annual rate of growth	Annual rate of growth	Annual rate of growth	Annual rate of growth	Annual rate of growth	ABS/LGA
Population density	Number of persons per square km	Number of persons per square km	Number of persons per square km	Number of persons per square km	Number of persons per square km	Number of persons per square km	Number of persons per square km	ABS/LGA
Gender and age profile	Gender and age profile	Gender and age profile	Gender and age profile	Gender and age profile	Gender and age profile	Gender and age profile	Gender and age profile	ABS/LGA
Land use								
Land use change	% infill development;	Not available	Not available	Not available	Not available	Not available	Not available	Non or local/LGA
	% greenfield development	Not available	Not available	Not available	Not available	Not available	Not available	Non or local /LGA

Cultural Diversity								
Proficiency in spoken English	% do not speak English well / at all	% do not speak English well / at all	% do not speak English well / at all	% do not speak English well / at all	% do not speak English well / at all	% do not speak English well / at all	% do not speak English well / at all	ABS/LGA
Indigenous population	% indigenous	% indigenous	% indigenous	% indigenous	% indigenous	% indigenous	% indigenous	ABS/LGA
Country of birth	Country of birth	Country of birth	Country of birth	Country of birth	Country of birth	Country of birth	Country of birth	ABS/LGA
Regional migration								
Net overseas migration	Not available	Not available	Not available	Not available	Not available	Not available	Not available	
Overseas born	% born overseas	% born overseas	% born overseas	% born overseas	% born overseas	% born overseas	% born overseas	ABS/LGA
Domestic or internal migration	Net number of regional internal migrants	Net number of regional internal migrants	Net number of regional internal migrants	Net number of regional internal migrants	Net number of regional internal migrants	Net number of regional internal migrants	Net number of regional internal migrants	ABS/SLA

Natural Capital								
Blacktown	**Mandurah**	**Kingborough**	**Townsville**	**Playford**	**Melton**	**Palmerston**	**Source of data for measure and resolution**	
Climate and Atmosphere								
Air Quality	Average annual RAQI value	Not available	No. of days exceeding air quality standards (PM_{10})	Number of days in year that key pollutants exceed national air quality standards	Not available	Yearly maxima – ozone (O_3) ppb	Not available	Local e.g. Council/LGA/EPA Victoria
GHD Emissions	Net greenhouse gas emissions	Tonnes CO_2 saved from entering the	Not available	Not available	Net greenhouse gas emissions	Not available	Not available	Council/LGA

		atmosphere since 1999						
	Greenhouse gas emissions per capita	Greenhouse gas emissions per capita	Not available	Not available	Greenhouse gas emissions per capita	Not available	Not available	Council/LGA
Energy Usage	Energy consumption	Not available	Not available	Not available	Energy consumption industrial basis	Electricity consumption per dwelling/ Gas consumption per customer	Not available	Council/LGA Melton DSE/LGA Playford one off study/LGA
Ecosystems and Biodiversity								
Terrestrial ecosystems	Not available	Not available	Not available	Not available	Remnant vegetation (% of area)	Not available	Not available	Council/LGA
	Not available	Not available	Not available	Not available	Extent of bushland reserves (% of area)	Not available	Not available	Council/LGA
Vulnerable and endangered species	Number of endangered species, population and communities listed under the *EPBC Act*	Number of threatened / rare / priority-listed species / communities	Number of species in catchment	Not available	Number of species of threatened status	Number of species in area listed under the *EPBC Act*	Not available	Council/LGA Independent organisation/LGA
			Number of sites per different type of dog-use area	Not available			Not available	Council/LGA

Reestablishment of local vegetation communities	Number of hectares under restoration by Council and volunteers	Not available	Not available	Not available	Indigenous plants planted	Not available	Not available	Council/LGA
					Indigenous plants demonstrated the ability to grow			Council/LGA
Water								
Water consumption and availability	Water consumption (per capita)	Water consumption (per capita)	Not available	Average residential water supplied per property	Not available	Not available	Not available	Local e.g. Council/LGA
Land								
Ground Cover	Not available	Not available	Not available	Not available	Not available	Not available	Not available	

Social and human capital								
Theme & Indicator	**Blacktown**	**Mandurah**	**Kingborough**	**Townsville**	**Playford**	**Melton**	**Palmerston**	**Source of data for measure and resolution**
Skills and education								
Educational attainment and qualification	Highest level of educational attainment	Highest level of educational attainment	Highest level of educational attainment	Highest level of educational attainment	Highest level of educational attainment	Highest level of educational attainment	Highest level of educational attainment	ABS/LGA
Education services	Not available	Not available	Not available	Not available	Not available	Not available	Not available	
Health								
Self-reported health status	% reporting fair to poor health	% reporting fair to poor health	% reporting fair to poor health	% reporting fair to poor health	% reporting fair to poor health	% reporting fair to poor health	% reporting fair to poor health	PHIDU/LGA
Life expectancy	Not available	Not available	Median age at death	Not available	Not available	Not available	Not available	

Persons who smoke daily	% of adults who are daily smokers	% of adults who are daily smokers	% of adults who are daily smokers	% of adults who are daily smokers	% of adults who are daily smokers	% of adults who are daily smokers	% of adults who are daily smokers	PHIDU/LGA
Obese persons	% of adults that are overweight or obese	% of adults that are overweight or obese	% of adults that are overweight or obese	% of adults that are overweight or obese	% of adults that are overweight or obese	% of adults that are overweight or obese	% of adults that are overweight or obese	PHIDU/LGA
Mental health	Proportions of adults rated as psychologically distressed	Proportions of adults rated as psychologically distressed	Proportions of adults rated as psychologically distressed	Proportions of adults rated as psychologically distressed	Proportions of adults rated as psychologically distressed	Proportions of adults rated as psychologically distressed	Proportions of adults rated as psychologically distressed	PHIDU/LGA
Access to open space	Open space per capita	Open space per capita	Not available	Open space per capita	Open space per capita	Not available	Not available	None or local/LGA
Institutions and Governance								
Fair and functioning institutions and governance	Not available	Not available	Not available	Not available	Voter participation;	Not available	Not available	None or local/LGA
					Satisfaction with resident's ability to influence decision			None or local/LGA
Community engagement	Proportion of people who volunteer	Proportion of people who volunteer	Proportion of people who volunteer	Proportion of people who volunteer	Proportion of people who volunteer	Proportion of people who volunteer	Proportion of people who volunteer	ABS/LGA
Employment								
Under-employment	Hours worked per week	Hours worked per week	Hours worked per week	Hours worked per week	Hours worked per week	Hours worked per week	Hours worked per week	SOR/Region
Unemployment	Unemployment rate	Unemployment rate	Unemployment rate	Unemployment rate	Unemployment rate	Unemployment rate	Unemployment rate	ABS/LGA
Local employment	% people working and living in the same LGA	Participation rate	Participation rate	Participation rate	Participation rate	Participation rate	Not available	DEEWR/Region

Security								
Security	Incidence of personal and household crime	Incidence of personal and household crime	Not available	Incidence of personal and household crime	Rate of offences against a person	Offences reported per 100,000 population against the person and against property	Offences against person and against property	State/LGA
					Rate of offences involving property	Feelings of safety when walking home at night		CIV/LGA
					Perception of safety/lighting			Local/LGA

Economic Capital								
Theme & Indicator	**Blacktown**	**Mandurah**	**Kingborough**	**Townsville**	**Playford**	**Melton**	**Palmerston**	**Source of data for measure and resolution**
Wealth								
Household net wealth	Wealth per household	Wealth per household	Wealth per household	Wealth per household	Wealth per household	Wealth per household	Wealth per household	SoR/Regions
Housing								
Housing supply gap	Average dwelling price	Average dwelling price	Average dwelling price	Average dwelling price	Average dwelling price	Average dwelling price	Average dwelling price	SOR/Regions
Housing affordability	Low income households in rental stress	Low income households in rental stress	Low income households in rental stress	Low income households in rental stress	Low income households in rental stress	Low income households in rental stress	Low income households in rental stress	PHIDU/LGA

	Low income households in mortgage stress	Low income households in mortgage stress	Low income households in mortgage stress	Low income households in mortgage stress	Low income households in mortgage stress	Low income households in mortgage stress	Low income households in mortgage stress	PHIDU/LGA
Transport and Infrastructure								
Mode of transport to work	Car, public transport, walking, other	Car, public transport, walking, other	Car, public transport, walking, other	Car, public transport, walking, other	Car, public transport, walking, other	Car, public transport, walking, other	Car, public transport, walking, other	ABS/LGA
Transport infrastructure	Ks of dedicated cycling paths	Not available	Not available	Not available	Not available	Not available	Not available	Local/LGA
Access to broadband internet	% households with broadband internet	% households with broadband internet	% households with broadband internet	% households with broadband internet	% households with broadband internet	% households with broadband internet	% households with broadband internet	ABS/LGA
Income								
Income disparity	Social security take-up	Social security take-up	Social security take-up	Social security take-up	Social security take-up	Social security take-up	Social security take-up	SOR/Region
	Household debt service ratio	Household debt service ratio	Household debt service ratio	Household debt service ratio	Household debt service ratio	Household debt service ratio	Household debt service ratio	SOR/Region
	Average dwelling price –household disposable incom	Average dwelling price to household disposable income	Average dwelling price to household disposable income	Average dwelling price to household disposable income	Average dwelling price to household disposable income	Average dwelling price to household disposable income	Average dwelling price to household disposable income	SOR/Region
Productivity and Innovation								
Multifactor productivity	GRP per capita	GRP per capita	GRP per capita	GRP per capita	GRP per capita	GRP per capita	GRP per capita	Local dev agency/region
innovation	Patent counts - population	Patent counts - population	Patent counts - population	Patent counts - population	Patent counts - population	Patent counts - population	Patent counts - population	SOR/Region
Socio economic status								
Relative socio economic (dis)advantage	ABS IRSD score	ABS IRSD score	ABS IRSD score	ABS IRSD score	ABS IRSD score	ABS IRSD score	ABS IRSD score	ABS/LGA