Auckland and Sustainable Neighbourhoods

A thesis presented in partial fulfilment of the requirements for the degree of

Master of Resource and Environmental Planning

at Massey University, Manawatu,
New Zealand.

Marilyn Ford

2011

Abstract

Projections for continued growth in Auckland create pressure to expand an already spread-out city. It is essential that housing supply can meet growing demand, but it is also important that new developments support healthy lifestyles and a healthy environment. A key issue in striking such a balance is the way in which new developments are deemed fit for purpose. This research uses a model of neighbourhood sustainability to assess housing in Auckland neighbourhoods. There are two key questions which the research aims to answer: how sustainable are Auckland neighbourhoods, and is there an 'Auckland approach' to neighbourhood sustainability.

Case studies were made of eight neighbourhoods, four recent Auckland developments and four international developments documented in literature as being exemplary of sustainability in some way. The four Auckland neighbourhood developments were evaluated using a Neighbourhood Sustainability Observational Tool by Beacon Pathway (2008b). The observational assessments showed that the sustainability performance of the neighbourhood cases was reasonable overall, and a common area of strength was the delivery of quality public spaces and street networks.

Comparison of the Auckland case studies to the international case studies showed that the common strengths of the Auckland examples were also areas of strength internationally. The international neighbourhoods demonstrated a greater range of sustainability initiatives, however. In particular, if the Auckland cases paid greater attention to the provision of community-based infrastructure, and social equity, they could achieve a more whole expression of neighbourhood sustainability.

Contents

List of Figures

List of Tables

Chapter 1
Introduction

A key issue for planners across Auckland is how to meet growing demand for housing throughout the area. To balance the impacts of growth and development on the environment, former councils have employed Smart Growth policies, with mixed results. Greenfield developments such as those in Flat Bush and Long Bay push at the edge of the metropolitan area and expand Auckland's urban boundaries. However, some developments aim to create neighbourhoods which perform sustainably and provide quality accommodation for residents. This research uses Sustainable Neighbourhoods as a model to assess how sustainable some of these new neighbourhoods are, and whether they share a common approach to addressing sustainability.

Auckland already has a distinctive urban form, with comprehensive motorways, low-density suburbs and large metropolitan area. Given this characteristic sprawl and existing infrastructure, any improvement to the sustainability of existing housing faces challenges. It therefore important to encourage sustainability in new developments as Auckland continues to grow. Population projections show that Auckland will account for most of New Zealand's population growth over the next 20 years, increasing from 1.37 million to 1.94 million (Statistics New Zealand, 2010a). Historically, growth has resulted in the kind of low-density housing style typical across New Zealand, resulting in suburbs which spread further and further from city centres. Meeting rising demand for housing in this fashion is not desirable as it produces problems, such as reliance on private transport, a reduction of the amount of productive soil through changing land use patterns, and sedimentation of streams and coastal areas. Rising costs and declining availability mean suitable accommodation is not always possible for poorer Auckland residents.

This research asks how sustainable new neighbourhoods in Auckland are, and whether there is a particular approach to sustainability within the Auckland

context. Within this document reference to 'Auckland' means the whole of the area governed by the new Auckland Council, although case studies have been drawn from west and central Auckland only.

The first half of this thesis sets out the theoretical position, context and approach for the research. Chapter two examines what sustainability means, some of the conflicts in associated literature and the development of the concept over time. The Sustainable Neighbourhoods model underlying this research is presented here with an overview of some alternative theories to sustainable urban design, and their similarities and differences. Chapter three follows with a background of housing in New Zealand, and the development of Auckland's residential areas. This includes the influence of national and local government on the sustainability efforts in Auckland, particularly the introduction of Smart Growth policies and their outcomes. A brief research review of local and international studies suggests some possible barriers to implementing sustainable methods in neighbourhood developments, such as higher costs for new technology or an enduring preference among residents for a low-density style of housing. The research approach and questions are explained in chapter four. This unpicks what is meant by 'neighbourhood' in order to select cases and carry out research at the neighbourhood level. The two methods employed, case studies and an off-the-shelf observational assessment tool for neighbourhoods, are explained here, as well as they way these address the research questions.

The second half of this document details the results of the research. Results are presented in two chapters, the Auckland neighbourhood analysis in chapter five, and the international comparison in chapter six. The following discussion relates the results to the Auckland context. The final chapter makes some conclusions about what the research shows about sustainability in Auckland neighbourhoods. Chapter five introduces the Auckland case studies and presents the results of the observational sustainability assessments. International cases are outlined in chapter six, which compares the international cases to the Auckland cases as a group using a checklist for Sustainable Neighbourhoods adapted by Barton (2000). The comparative sustainability of

both the Auckland and international case studies are discussed in chapter seven, in relation to Auckland's context and the theoretical approach of Sustainable Neighbourhoods. Chapter seven also includes a reflection on the process of using an existing assessment tool for this research, and some of the challenges faced. To conclude, chapter eight suggests that by looking at which aspects of the case studies work towards sustainability and which do not, we can provide focus for what changes might facilitate the development of sustainable housing in the future, and improve the sustainability of Auckland's housing.

Chapter 2

Sustainability and Sustainable Neighbourhoods in theory

In order to carry out research into sustainability in Auckland neighbourhoods, it is necessary to spend some time looking at what sustainability means. 'Sustainability' is a term which can mean different things to different people and as such, it must be constantly defined by those who use it. This chapter will introduce early sources which developed ideas about sustainability and how their themes run through modern debates about the topic. There is as much diversity and conflict in the numerous theories relating sustainability to neighbourhood and cities as there are in sustainability itself. The second half of this chapter looks at different approaches to neighbourhood sustainability, ways in which they are compatible and where they diverge. This discussion begins with a conceptual framework suggested by Jabareen (2006) to group and compare approaches, and presents some selected approaches in more detail. Throughout discussions of both sustainability and sustainable design, the three themes of economic sustainability, environmental sustainability and social equity are present. These are discussed along with the challenges and conflicts they bring when attempting to satisfy all three aspects.

2.1 What do you mean by 'Sustainability'?

When Neuman discusses sustainability, he proposes that it is the vagueness of the concept which has given rise to its popularity as a term, as sustainability can be "appropriated without fear of challenge" (Neuman, 2005, p. 17). The concept of sustainability is complex for two reasons: one because theorists cannot agree on what it should mean; and two because its separate goals can create conflict. The Oxford English Dictionary defines 'sustainable' as: "1. capable of being

borne or endured; supportable, bearable", or "2. capable of being upheld or defended; maintainable" (Simpson, Weiner, & Oxford University Press., 1989, p. 327), but applying this definition raises more questions, for example: for how long must something be 'bearable'? '*The Limits to Growth'* observes that most people are only concerned with how their actions affect themselves and their immediate families in the short term, while the authors are concerned with sustainability over several generations, and on a global scale (Donella H. Meadows, Meadows, Randers, & Behrens III, 1972).

The 1983 report of the World Commission on Environmental Development ('the Brundtland Report') definition of sustainable development is the most often quoted definition for sustainability in relevant literature. Locally this is referenced in research by Saville-Smith et al (2005), Pedersen Zari (2009) and Van Roon and Van Roon (2009) and in Auckland City Council (2006) plans and Royal Commission reports (Royal Commission on Auckland Governance, 2009). This definition is as follows: "sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987, p. 61). The recommendations of the Brundtland Report are discussed in more detail below, but what this definition offers in clarity, it also offers in dissent. The definition fuses together the two concepts of sustainability and development, something Barton describes as a 'paradox': "[sustainable development] appears to put together two irreconcilable principles, that of environmental sustainability and economic development" (Barton, 2000, p. 6).

Despite conflicts in sustainability theory, three themes of sustainability come through in much of the literature, those of economic sustainability, social equity and ecological sustainability. The following section identifies the emergence of these themes in a brief exploration of the development of sustainable thought.

Economy and environment: balance or conflict?

Barton (2000) suggests that sustainable development can be conceptualised in two ways, one anthropocentric and one eco-centric. While an eco-centric approach considers sustaining the environment a valid end in itself, an anthropocentric view looks at sustaining the environment as a means to sustain humanity. This idea is evident in Neuman's (2005) discussion of sustainability, a key theme of which is the 'carrying capacity' of the natural environment.

Lumley and Armstrong (2004) trace the origins of the idea of sustainability to the ideals and concerns of the eighteenth and nineteenth centuries. Their review shows that Harriet Martineau, John Stuart Mill and Thomas Malthus expressed concerns about the limited capacity for their environment to support humanity, should the population continue to increase (Lumley & Armstrong, 2004). In his discussion of 'capacity' in sustainability, Neuman (2005) also cites Malthus, whose *'Essay on Population'* contributed the idea that human population and survival is determined by our biological reliance on the environment around us (ibid, 2005). 'Carrying capacity' is similar to the definition of 'sustainable' given above, and Neuman argues that carrying capacity has become a definition for sustainability by proxy, due to its measurability (Neuman, 2005). In more recent times, Neuman cites the work of Meadows et al (1972) in '*The Limits to Growth'* as applying an analysis based on carrying capacity (Neuman, 2005). This work was the culmination of a comprehensive effort to create a computer model of sustainability by mapping interrelated global trends over several generations (Meadows, et al., 1972). The authors concluded that existing trends were unsustainable, and without moderation the world's resources could be depleted within 100 years. This un-sustainability was reducible to one pattern in particular: continued growth, "that which all the world sees as the solution to its problems is in fact a cause of those problems" (Meadows & Meadows, 2007, p. 193).

In all of these examples, ensuring the health of the environment is essential to ensure its capacity to sustain human life. An ecological philosophy which is not based on the carrying capacity of our environment is Leopold's (1949) 'Land

Ethic'. Leopold argued that the land and its ecosystems had inherent value which was not related to their ability to support human life, or economic activity. He also proposed that humanity's understanding of the environment is imperfect, and that unvalued features in an ecosystem could be "essential to its healthy functioning" (Leopold, 1949, p. 28). This fundamental shift required that ecological thinking should be a natural extension of human ethics, in this case the ethics of human obligations to the land. He argued against balancing human development with ecological sustainability; his alternative to decision-making based on the economic values of nature was applying the 'land ethic', to examine every question in terms of its ethical and aesthetic 'rightness' (ibid). Key to the application of this land ethic was its adoption by all members of the public; conservation was not to be entrusted wholly to government institutions. Leopold argued that to protect the needs of nature, "an ethical obligation on the part of the landowner is the only visible remedy" (Leopold, 1949, p. 23). It is necessary to sustain the environment, both in terms of its carrying capacity (as per Neuman), but also as Leopold explains, because it has value of its own, which we may not yet understand.

Some sources consider both ecological protection and economic development to be contributors to sustainability. This theme is evident in the Brundtland Report, which proposes that it is possible to balance continued, indeed, expanded development, with sustainable principles. The Brundtland Commission was formed by UN Resolution 38/161 in 1983 to address concerns regarding environmental issues, and to contribute to the UN's 'environmental perspective' (United Nations, 1983). While the Commission's express scope was "to propose long-term environmental strategies for achieving sustainable development to the year 2000 and beyond" (United Nations, 1983, part8(a)), the Commission's report focused on development, particularly the development of emerging, non-Western nations. The solution espoused by the Commission was 'sustainable development' to meet the economic and social needs of these nations, while mitigating the negative environmental consequences of typical Western industrial development.

Even within an anthropocentric view of sustainability, it is difficult to reconcile the two aims of environmental sustainability and economic development. While Meadows et al (1972) argued for transformative policy to restore equilibrium by pursuing sustainable practices, they also found that continued growth was the root of the problem. The Brundtland Report also argues for a balance between the two aims, however, growth is not seen as a negative trend, but is encouraged among poorer nations as a means to improve their wellbeing, and as part of their right to global equity.

Social Equity

The concept of social equity, whether this is applied globally or inter-generationally, can be traced as far back as the works of Adam Smith and Mary Wollstonecraft in the 1700s, who were concerned respectively with the rights of the poor under-class and of women to self-determination and freedom from reliance on those more powerful (Lumley & Armstrong, 2004). This idea is one of the key themes of the Brundtland Report in 1983. The Brundtland Report is also concerned with social sustainability, pointing out that while the 'sustainable development definition' promotes equity across generations, equity within generations is also needed. Meeting the needs of impoverished people is a pillar which supports the wider concept of sustainability, as deprivation leads naturally to overuse of resources, and "a world in which poverty and inequality are endemic will always be prone to ecological and other crises" (World Commission on Environment and Development, 1987, p. 62).

The 1992 UN Conference on Environment and Development ('the Earth Summit') which was held in Rio de Janiero resulted in two documents which further developed discussions about sustainability: the Rio Declaration, and Agenda 21. The Rio Declaration, like the Brundtland Report is concerned with the reduction of poverty and promoting global equity. Principle 1 places humanity firmly at the centre of its definition of sustainability: "human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature" (United Nations, 1992, unpaged). Its twenty-seven principles emphasise the importance of social

justice, and the empowerment of women, indigenous groups and politically oppressed peoples.

Both publications from the Earth Summit emphasise social equity and the right to growth and development over ecological concerns. Agenda 21 extends the concept of social justice from simply providing for poorer and marginalised citizens, to empowering them through including communities and localities in the decision-making process. The document had a broad scope for sustainability, including health, management of human settlements, environmental infrastructure and waste issues. Harmon (2008) describes Agenda 21 as "an international sustainability planning process to encourage and facilitate the cooperation of local governments and their citizens in creating a sustainable future" (Harmon, 2008, p. 95). While Choguill described the 1992 Earth Summit in Rio as being "disappointing in its list of achievements" for not addressing the issue of sustainable cities, he considers that Agenda 21 was worthwhile in itself, as: "its mere existence is acknowledgement of the importance of urban areas within the sustainability debate" (Choguill, 1993, p. 252).

Although social equity is a recurrent theme in literature, the contribution which it makes to the sustainability of the environment can be framed in different ways. While the evolving notion of a right to self-determination is a primary issue for Wollstonecraft and Smith, it is an important element of sustainability in United Nations publications like Agenda 21 and the Rio Declaration. The Brundtland Report attributes wider benefits to equity, as an equitable world is seen to reduce the risk of environmental degradation, and societal instability.

Continuing debate

It seems that in balancing social equity and economic sustainability with environmental sustainability, one part of the whole is often short-changed. Sustainable Aotearoa NZ (2009) criticise the triple bottom line approach, arguing against the idea of balance for this very reason. They argue instead for

'strong sustainability', which requires that economic and social sustainability can only exist within a pre-requisite of ecological sustainability.

The tension between the three spheres of sustainability is something that Godschalk (2004) explores, citing Campbell's (1996) critique of sustainable development. This describes three conflicts between the competing goals of property, resource and development (Godschalk, 2004). Attempting to achieve both social equity and economic sustainability results in a "property conflict" between private and public good; "resource conflict" emerges when trying to reconcile ecological sustainability with economic, such as the concern over 'carrying capacity' discussed above. The "development conflict" occurs between goals of social equity and economic sustainability. This conflict is not explicitly addressed, but is implicit in the United Nations publications, which encourage economic growth as a means of relieving global poverty, but offer no guidance on how to ensure environmental sustainability at the same time.

Summary

The concept of sustainability has come a long way, from early works by individual writers who pioneered modern theories of feminism and economics such as Mary Wollstonecraft and Adam Smith (Lumley & Armstrong, 2004), to being the subject of world assemblies at the United Nations (United Nations General Assembly., 2005; United Nations., 1992). It still has a long way to go, however, for while its importance is now recognised on a world stage, there is little common understanding and less agreement about what it means to be sustainable, or as Neuman (2005, p. 17) points out, "sustainability is not yet branded. There is no patent, trademark, or copyright." Although there is some debate over the 'triple bottom line' of a sustainability model which attempts to balance social equity and economic sustainability with environmental sustainability (Sustainable Aotearoa New Zealand., 2009), these themes are present in many of the works discussed above. The three strands of environment, society and economy also weave through much of the theory of sustainable neighbourhood design, and these themes and approaches are discussed in the section below.

2.2 Sustainability in neighbourhoods and cities

The ecological, economic and social themes present in evolving ideas about sustainability are also present in approaches to sustainable housing and urban design. The sustainability of residential neighbourhoods can be supported by ecological considerations such as selection of materials used and location, but also by economic and social considerations regarding the accessibility of transport and services, or affordability. While there are various theories regarding urban form, many overlap in their approach to, or omission of, these themes. Early theories about how human settlements should best be organised have affected much modern debate on the subject, and writers such as Ebenezer Howard, Lewis Mumford and Jane Jacobs are often referred to in modern literature on sustainable urban form (Choguill, 2007; Kenworthy, 2006; Talen, 2006). Some of these ideas have proven enduring and influential, becoming common influences across the wide spectrum of theory relating to sustainability in neighbourhood and city planning.

Wheeler and Beatley (2009) note that with the rapid industrialisation of cities in the mid-1800s, concerns over the health of city-dwellers and growing isolation from nature was apparent in popular culture. Ebenezer Howard (1898) was concerned with providing healthy, natural environments for people to live in. he envisioned towns and cities as magnets pulling people away from rural life, leaving country areas depleted and declining, while the cities became overcrowded, polluted and toxic (Wheeler & Beatley, 2009). His concept of the Garden City was a reaction to polluted and crowded industrialising cities, intended to replicate the perceived benefits and aesthetics of the countryside, with all the elements of a city essential for everyday life: public schools, playgrounds, gardens, churches, factories and markets. The influence of Howard's ideas are clear on later writers such as Mumford, below, and elements of the Garden City can be seen in much more firmly ecologically grounded approaches, such as Eco-Cities, which attempt to incorporate wilderness into urban centres (Kenworthy, 2006). While Howard's concerns were not with the concept of sustainability, his model provided an alternative to the existing reality of city life. The Garden City also supported a form of social

sustainability and like the Brundtland Report, attempted to reconcile the needs of industry and the needs of humanity, and satisfy both.

Lewis Mumford (1938) took the idea of the Garden City and distilled it down to the Garden Suburb. Like the Garden City, the Garden Suburb should provide for all the necessities of life – work, education, recreation and retail – but on a smaller scale. He saw that the cities and neighbourhoods of the time were not meeting society's needs, and that they "grew up without the benefit of coherent social knowledge or orderly social effort" (Mumford, 1938, p. 21). People had become displaced and disoriented by the rapid growth and industrialisation of towns and cities, which were not serving the needs of humanity. Mumford's main reason for espousing the convenient grouping of facilities near people's homes was to reduce wasteful and unnecessary transportation, "since the efficiency of even the private motor car varies inversely with the density of population and the amount of wheeled traffic it generates" (Mumford, 1954, p. 115). This concept of living locally, and the need to reduce transportation has come through in many modern concepts of sustainable housing, notably government produced best-practice guides in Britain and New Zealand (Commission for Architecture and the Built Environment (CABE). 2008b; Ministry for the Environment, 2005).

In some part a reaction to the ordered, planned ideals of Mumford and Howard, Jacobs (1961) wrote in defence of dynamic and lively chaos in city life. Her focus was on a more intimate level: the neighbourhood and 'the block'. Key to both of these were the uses of streets in urban life, and echoes of her conditions for a healthy street can be found in the theories explored later in this chapter, New Urbanism, Smart Growth, Eco-Cities and Sustainable Neighbourhoods. These conditions were dense neighbourhoods of short blocks with a high degree of connectivity, and buildings oriented to the street which mixed commercial and residential uses (Jacobs, 1961). They should also support lifestyles for different ages, and community-scale business. Kenworthy (2006, p. 80) refers to the need for cities to be supported by a stable economic base: "Jane Jacobs shows that cities are the key sites and drivers of national

economies, and cities themselves cannot survive without a viable economic base".

While these authors did not explicitly address sustainability, their theories have contributed to modern approaches of dealing with economic, social and environmental issues. Mumford's reduction of transport waste, and supporting living on a local scale can be found in ideas of New Urbanism and Sustainable Neighbourhoods. Jacobs' ideas about the design and layout of a street are perhaps the most pervasive, influencing current ideas about city form, as well as practical design guides such as the New Zealand Urban Design Protocol (Ministry for the Environment, 2005). All address ideas of scale, living locally, having space to play and exercise, and preservation of the character of an area.

Approaches to sustainable housing

Unlike sustainability, there is no 'oft-quoted' definition for what sustainable housing should mean. In order to position the research in the body of knowledge, prominent approaches to sustainable housing are discussed. The way sustainable housing is framed and communicated takes a wide or narrow view of scope and scale. Sustainable housing may refer to one sustainable home, to sustainable neighbourhoods and communities, or to sustainable cities. Similarly, the range of inputs which contribute to the sustainability of a home, neighbourhood, or city can be anything from the physical construction, material, methods and design, to wider transport, economic and social concerns.

Many different approaches to sustainable human settlements and built form are discussed in literature, such as New Urbanism, Smart Growth and Liveable Neighbourhoods (Saville-Smith, et al., 2005), or Eco-Neighbourhoods and Urban Villages (Winston, 2009). Many overlap, but each has a slightly different focus, directing efforts toward one or two aspects of sustainability over others. Winston (2009) notes that the theory of housing with regard to sustainability is somewhat neglected, and there is debate about the meaning of the term , while some authors such as Durack (2001) argue against any model of what sustainability should look like at all. Rather than a fixed ideal of what a city, or a

village should be, Durack proposes a process by which sustainability should be protected, similar to Aldo Leopold's land ethic decision-making process. Her process of sustainability in planning involves participation by the public which is more than token or intermittent gestures; her version requires "continuous attention of future agents", and awards the public real decision-making authority (Durack, 2001, p. 68).

Jabareen (2006) discusses the multitude of theories about sustainable urban form, providing a framework to group theories by their characteristics, and proposes a system of theme based analysis to evaluate how sustainable each model is. This approach is also used by Winston in her analysis of general urban regeneration, New Urbanism, Urban Villages and Eco-Neighbourhoods (Winston, 2009). In this evaluation theories of sustainable urban development fall into four groups: 'Neo-traditional Development', 'Urban Containment', 'Compact City' and 'Eco-City' (Jabareen, 2006). 'Neo-traditional Development' includes such approaches as New Urbanist initiatives, Transit Villages and Urban Villages; "the ideal neo-traditional town would be self-contained, tightly clustered, walkable, and patterned on the American small town of pre-World War II" (Jabareen, 2006, p. 43). 'Urban Containment' aims to address urban sprawl by restricting growth within urban growth boundaries; this includes approaches like Smart Growth and growth management to city design (ibid). The 'Compact City' approach is similar to 'Urban Containment', but emphasises compactness and efficiency of scale rather than directed growth. Jabareen (2006) points out this approach can be implemented through intensification or through the development of greenfield New Urban or Urban Village developments. 'Eco-Cities' are described as comprising a range of approaches characterised by concepts of "greening and passive solar design" (ibid, p. 46). Some theories which fall within this approach are Green Cities, Sustainable Neighbourhoods and Eco-Villages. These groups are rated according to how strongly they incorporate the themes of: density, diversity, mixed land use, compactness, sustainable transportation, passive solar design and greening (ecological design) (Jabareen, 2006). According to this analysis, two groups of sustainable design theories score more highly, those being compact cities and Eco-Cities. The following section unpicks the key features and differences

between the two examples of Compact Cities and Eco-Cities, which will form the theoretical basis for this research.

New Urbanism

New Urbanism grew from concerns in American architecture about unchecked sprawl (Winston, 2009), and was solidified when the Congress for the New Urbanism (CNU) was formed in 1993 (Congress for the New Urbanism, 2011a). New Urbanism seeks to balance the needs of pedestrians with the needs of motor vehicles in cities which have become too motor vehicle reliant.   It emphasises a human scale for development and the use of mixed-use zones to bring people and their residences closer to the scenes of everyday life.   The CNU explain New Urbanism by describing its 'hallmarks' as: small blocks which encourage walking, diverse housing options, neighbourhood facilities which can be accessed without a private motor-vehicle, and "an affirming, human-scaled public realm" (Congress for the New Urbanism, 2011b, para. 1).

New Urbanism has its share of critics in sustainability literature.   Zimmerman (2001) posits that on the face of things there are many compatibilities between New Urbanism and sustainability.   Its features, such as higher residential density, mixed land use, promotion of 'nonautomobile' transportation, and emphasis on connecting people to 'local natural surroundings' would encourage more sustainable land use, and "may well contribute to reducing the overall impact of urban development on the natural world" (Zimmerman, 2001, p. 250). However, reducing negative impacts of new housing does not mean that there are none – something New Urbanism fails to acknowledge or address (Zimmerman, 2001).   In fact this criticism is also levelled at the Brundtland Report's concept of 'sustainable development'.   While a watershed for reconciling commercial expansion and nature (where previously the former was imperative at the expense of the latter), sustainable development is problematic as it downplays any negative effects of growth on the environment whatsoever (ibid).   Referring to a specific US case study, Zimmerman's main criticism of New Urbanism is that it reinforces suburban development as the ideal which contributes to the very sprawl it claims to oppose (Zimmerman, 2001).

Quastel (2009) also levels a case against New Urbanism, particularly its conservatism. He argues that 'discourses of sustainability' mask political agendas to gentrify urban spaces, i.e. "New Urbanist principles impart a series of esthetic considerations that can serve to sanitize space and drive out the poor" (Quastel, 2009, p. 703). Not only does this happen through urban regeneration, but also through construction of new areas which are both expensive and homogeneous and because of this "poorer people are precluded from living where they may otherwise have settled" (Quastel, 2009, p. 699). This illustrates why the social strand of any approach to sustainability is so important, otherwise efforts to improve housing stock and provide exemplary new builds only serves to further marginalise lower socioeconomic communities. By failing to address social equity, New Urbanism is an incomplete model to measure sustainability against.

Smart Growth

Principles of Smart Growth are similar to those of New Urbanism although while they are largely compatible, New Urbanism has more of an aesthetic sensibility. Their slightly different foci reflect their different origins. Smart Growth, springing from "environmentalists and policy planners" (Knaap & Talen, 2005, p. 109), is concerned with restricting continued sprawl through intensifying brownfield sites; while New Urbanism, "influenced by architects and physical planners" (ibid, p. 109), is concerned with providing quality-built spaces which in practice tend to be developed on greenfield sites.

Smart Growth policies began to gain prominence in the United States in the mid-1990s (Knaap & Talen, 2005), and the approach was further consolidated by the formation of the Smart Growth Network in 1996 by the American Environmental Protection Agency (Smart Growth Network, 2011). The main driver of Smart Growth is to prevent unwanted urban sprawl by directing growth to key areas, and intensifying densities in city centres and along public transport nodes. Smart Growth includes the New Urbanism 'hallmarks' mentioned above ('walkable' blocks, human scale, diversity of buildings and provision of local

facilities), but it adds the following key principles: buildings should be compact, development should be directed at existing centres, open spaces should be preserved and decision-making should involve the local community (Smart Growth Network, 2006, p. iv).

The Smart Growth Network (2006) goes on to explain that its policies enable city councils to make the most of development while avoiding over-investment in new infrastructure at the edges of cities, and to provide the needs of diverse residents. Krueger and Gibbs (2008) describe the appeal of the Smart Growth concept as an attempt to meet many needs of councils and local authorities by allowing them to redress developer contributions to open spaces and infrastructure, to direct development and funds to deprived areas, and by addressing the issue of suburban sprawl.

While it is the aesthetic elements of New Urbanism which prove a gentrifying influence, Quastel argues that Smart Growth policies of brownfield renewal and efforts at intensifying city centres has the effect of "making them more popular among those able to afford their increasing real estate prices", which – like New Urbanism – excludes the poor (Quastel, 2009, p. 703). A similar point is made by Connerly (2007, pp. 103-104), who describes Smart Growth as "ambiguous with regard to affordable housing". Greater densities could reduce housing costs, however, limits on expansion could increase the price of developable land and therefore the house prices.

Both Quastel (2009), and Krueger and Gibbs (2008) draw attention to the market-led approach of Smart Growth, arguing its fallback position is to use the market as a regulatory instrument to encourage and discourage desirable and undesirable behaviour respectively. While Smart Growth attempts to redress urban sprawl and reliance on cars, it is in itself still part of a paradigm shift (in America) from regulatory mechanisms to market mechanisms, and embodies state devolution of services. Furthermore, Smart Growth only partially addresses consumption of land by reducing and redirecting it, and "does not address the larger issue of consumption itself" (Krueger & Gibbs, 2008, p. 1272).

Eco-City

Jabareen (2006) points out that the key difference between Eco-Cities and other approaches is the emphasis on the management and function of the city as the mechanism for sustainability, rather than the physical shape and form of the city. The Eco-City approach also takes into account aspects of city life which other approaches overlook. One of the ways in which an Eco-City diverges from the theories of both New Urbanism and Smart Growth is its inclusion of public participation in decision-making, and its stronger emphasis on environmental sustainability, proposing the city's resource inputs and waste outputs should form a closed loop which re-uses and restores what it takes.

Kenworthy (2006) discusses ten key areas important to the Eco-City. Many of the points overlap with the priorities of New Urbanism and Smart Growth, such as compact, mixed-use cities and a high quality public realm which encourages walking, cycling and public transport use. One of the ways in which the Eco-City principles differ, however, is its approach to democratic decision making. Like Aldo Leopold, Kenworthy (2006) makes an argument for fundamental changes to governance: "the value systems and underlying processes of urban governance and planning need to be reformed to reflect a sustainability agenda" (Kenworthy, 2006, p. 67). In his model, decision-making should be "democratic and empowering" based on "debate and decide", rather than "predict and provide" methods (Kenworthy, 2006, pp. 68-69). Kenworthy refers to the latter of these as a 'treadmill', particularly with regard to the expansion of roads and motorways based on projections of increased demand. He argues for the ability to step back from such forecasts, and to ask "what kind of city do we want in the future?" (Kenworthy, 2006, p. 80). These key differences show the extra distance that the Eco-City model goes in pushing sustainability initiatives, as it begins to challenge the fundamental way a city operates, while other approaches reorganise the way it looks, but retain its existing functions and inner workings.

Another key aspect of the Eco-City is the relationship between the city and the surrounding natural environment. Kenworthy envisioned the city as 'an

extended metabolism', where the 'hinterland' might supply the city's requirements for food, water and energy, and "the city's life support systems become closed loop systems" (Kenworthy, 2006, pp. 68, 76). While this is intended to protect the rural and natural areas surrounding cities, it is also supposed to integrate green spaces into the cities themselves. Kenworthy provides Zurich, Stockholm, Helsinki and Freiburg as examples of cities which have adopted this internationally: "through compact planning, they have provided for urban agriculture, forests and community gardens, as well as excellent public transport systems and high levels of walking and cycling" (Kenworthy, 2006, p. 71).

The resource flows in and out of a city are also addressed in *'The green city'* (Low, Gleeson, Green, & Radovic, 2005). This proposes the Green Suburb and Green City in response to traditional planning, particularly 'master-planned' towns and cities, which view the city from several miles in the air and negate the 'on the ground' experience of a place, and its impacts on the environment. This distancing has resulted in the conventional engineering and planning approach to development, where utilities, roads and suburbs are planned in bulk, increasing waste and further removing the residents of an area from the source and outputs of their resource consumption. As not only does the density and affluence demand a high rate of consumption, all natural resources must also be transported to cities in order to be consumed, using further resources.

Low et al propose that this be reversed by setting ambitious targets and using innovative techniques, and "making changes – not so much to the citizens; lifestyles, but to production systems" (Low, et al., 2005, p. 45). The transformation of city resource and waste systems can be supported at a lower scale within the city, by eco-neighbourhoods and eco-homes. These models support self-sufficiency and independence from resources which would normally need to be transported to the home – by both passive design and technology enabling residents to meet their own energy and water needs.

The Green City is an important goal, as reflecting the arguments of Meadows et al (1972), the authors reflect on the impact of human activity on the planets

resources, "the world has the span of just a single lifetime, 70 or 80 years to turn human behaviour around from growth to sustainability before the planet's population spirals back into decline, towards ill health and shortened lives."(Low, et al., 2005, p. 14). The Eco-City is important, as – like New Zealand – Australia is highly urbanised, and there is a direct line from the city form, to the suburb, and down to the home, on the way in which we live, act and consume the earth's resources (Low, et al., 2005).

Sustainable Neighbourhoods

Like Low et al's 'Green Suburbs', Sustainable Neighbourhoods share many principles and themes with Eco-Cities, but apply these on a more intimate scale. Sustainable Neighbourhoods is an approach to housing on a smaller scale than the whole city, yet it is within an urban context, referring to neighbourhoods, rather than towns or villages. This approach requires consideration of global ecology, natural resources, the local environment, social provision, economic sustainability and social sustainability (Barton, 2000).   Like Eco-Cities, Sustainable Neighbourhoods places a greater importance on public and community input to decisions, but rather than the closed loop of the Eco-City, Sustainable Neighbourhoods promotes a renewed emphasis on local supply to meet the everyday needs of its residents.

Choguill (1993, 2008) breaks down the main features required for neighbourhood sustainability into four key areas; economic; social; technical and environmental. Notably, ecologically sustainable policies are "the most basic of all criteria. Without ecologic sustainability...no other criteria can be met as alternative measures are necessarily dependant upon human survival" (Choguill, 1993, p. 252). Social and economic sustainability are features of other sustainability models, but Choguill also adds technical sustainability. This refers to the way in which the form of a neighbourhood supports its function as such. For example, whether the neighbourhood can be clearly identified by its boundaries as a specific place, and that its internal safety and connectivity support neighbourly interaction.

Related to a neighbourhood's technical sustainability is a population sufficient to support neighbourhood activities, but not so large that it overwhelms them. Choguill (2008, p. 43) cites Fisher (1984), arguing that "the larger the community, the less the involvement with neighbours", and refers to Mumford's assertion that in larger settlements "there is a paralysis of social interaction rather than encouragement for it". To summarise Choguill (2008), a sustainable neighbourhood should:

- Be limited in size, with relatively high densities,
- Be walkable (i.e. within 500m to a primary school)
- Be of sufficient population to support local shops, providing opportunity for employment and social interaction
- Be of sufficient population to form community interest groups
- Have clear boundaries and minimise traffic through the neighbourhood
- Provide common meeting places for residents.

Referring to research by Lock (1994), Rudlin and Falk (1999) note that in order for a city or town to sustain itself economically, a population of 25,000-30,000 residents is necessary, suggesting the best way to ensure settlements are sustainable is to concentrate the existing ones. It is clear from their selection of the term 'sustainable urban neighbourhood' that the emphasis is on regeneration of cities, rather than the creation of new ones. Compactness is encouraged, not for its own sake, but to preserve rural land and to secure the sustainability of cities. Rudlin and Falk propose to "invent an urban equivalent of the eco-village" (ibid, 1999, p. 152). According to Rudlin and Falk (1999), such an urban eco-village should be:

- Walkable
- Permeable and well connected
- Legible and easy to navigate
- Oriented towards pedestrians
- Inclusive of traffic calming methods
- Appropriately dense
- Designed around public transport
- Designed to reduce energy use

- Generating power locally
- Recycling waste and household goods
- Treating water and sewage locally
- Designed to include high quality, compact green space.

Like Low et al, Engel-Yan et al (2005) propose local provision of neighbourhood infrastructure, but they note that the existing city can prove a constraint on the level of sustainability a neighbourhood can achieve. While a neighbourhood may be designed to encourage walking or cycling, or be near public transport routes, their use may depend on the "extent and quality of the regional transit network, and the relative location of the neighbourhood with respect to employment and commercial and recreational facilities" (Engel-Yan, et al., 2005, p. 46).

Social equity is present in the priorities placed on walkability and access to public transport, which enhances the freedom residents have to move around their neighbourhood. Saville-Smith et al (2005) include social equity explicitly in their framework for Sustainable Neighbourhoods. The availability of low-cost accommodation within a neighbourhood also contributes to its social equity, as well as the overall diversity, hence affordability is included as one of their indicators of neighbourhood sustainability (ibid, 2005, p. 69).

Overall, Sustainable Neighbourhoods is consistent with Eco-Cities, but on a smaller scale, and as such its focus is on the locality of the neighbourhood. One of its key defining characteristics is the importance of providing for the needs of residents on a local, decentralised scale. This is a greater range of needs than those addressed by New Urbanism and Smart Growth as it also takes into account production of food, generation of power and treatment of water runoff and waste.

Common themes in approaches to built form

There is a degree of overlap in the ideas and principles of different approaches to neighbourhood design. New Urbanism and Smart Growth are very similar in

overall policy and vision, but their methods for realising these are different. Eco-Cities and Sustainable Neighbourhoods, also described as 'Green-Cities' and 'Eco-Villages', likewise have a considerable amount of overlap, and the main differentiating factor is the scale of the enterprise. While each share a similar sensibility around mixed-use zones, access to public transport and the need for connectivity and a human scale, they differ on issues like construction of new neighbourhoods versus intensification of existing ones, the relative importance of providing low-cost housing, and the inclusion of community-owned infrastructure. These differences reflect the way that focus on one aspect of sustainability can result in a corresponding loss of sight of another, reinforcing the conflict between social, economic and environmental sustainability described by Godschalk (2004), and Jabareen's (2006) two separate approaches to achieving sustainability: one through form, and the other through function.

Summary

Sustainability is about preserving human life on the planet by preventing overuse of resources or over-pollution. Activities which would harm the ability of the earth to sustain humanity over several generations are un-sustainable. Underpinning this simple idea is a number of themes. From the Brundtland Report (World Commission on Environment and Development, 1987) there is the concept that human development and industry can continue, although its definition of 'sustainable development' has forever fused the idea of sustainability with development, and inherently, growth. From A Sand County Almanac (Leopold, 1949) comes the idea that humans have ethical obligations to our environment, and that a dramatic transformation of all aspects of human philosophy is necessary. From The Limits to Growth (Donella H. Meadows, et al., 1972), the idea that human activity cannot go on unchecked or the finite planetary resources will be exhausted in a few generations, and that a global, long-term perspective needs to be taken. Leopold (1949) also challenges valuing only the economic value of things. Emerging from the theories which have developed discussion regarding sustainability, are three strands which can

also be found in the literature on sustainable housing and urban design – that of economic, social and environmental sustainability.

Sustainable housing then, is a sub-set of sustainability. How can our need for shelter be met in ways which do not affect the planet's ability to sustain human life? Commonly understood definitions of sustainability contain elements of social equity – between generations, and between nations, and a broad assumption that change is needed, although the scope of this change is not defined, or necessarily agreed on. Looking at sustainable housing, the waters of definition become murkier, not clearer. Much of the literature accepts that sustainable housing must attempt to be economically and socially sustainable, as well as ecologically sustainable measures, but address this in different ways, and while most try to reconcile the three potentially competing strands that have come to mean 'sustainable', most fall down in one, or more areas.

Of the different approaches discussed here, all support walkable, human-scale neighbourhoods, and a greater emphasis on provision of neighbourhood facilities within residential developments, they differ in terms of how this will be achieved, for example, New Urbanism encourages local life by design and inclusions at the building level, while Smart Growth does so by site selection and maximising the use of existing infrastructure. While Eco-Cities and Sustainable Neighbourhoods share a concern with balancing pedestrian needs with the facilitation of traffic, they also place a greater importance on the provision of local infrastructure and participation in decision-making. Both are more eco-centric than either New Urbanism or Smart Growth in balancing the different strands of sustainability, and give a greater importance to the ecological sustainability of a neighbourhood. For this research project, the Sustainable Neighbourhoods approach will be used, both in terms of a definition, and a model for sustainability. Sustainable Neighbourhoods reflects a holistic and ambitious concept of sustainability, as well as a manageable scale on which to carry out research and observations.

Chapter 3
Background

The negative implications of urban life are becoming more pressing globally and the sustainability of urban areas is becoming increasingly important. Bosworth (2008, para. 3) notes that in 2008, "for the first time more than half the world's population resides in towns or cities". In New Zealand, over three quarters of the nation's population already live in urban areas (Ghosh & Vale, 2007; Ministry for the Environment, 2005). In addition, nearly one third live in the greater Auckland area (Ghosh & Vale, 2007), a population which is continuing to grow.

This growth drives a continually growing demand for housing, which, combined with New Zealand's traditional low-rise housing style, places particular pressure on land in an already spread-out city. Strategies in district plans and published reports (Auckland City Council, 1999b; Auckland Regional Growth Forum, 2003), have identified the need to provide for housing, but also to address the issue of sprawl, and future land needs. This chapter outlines some previous strategies aimed at housing in Auckland. These strategies focus in the main on intensification and improving design quality, but provide little detail on expected standards of housing, or how existing housing stock measures up. As well as the physical, economic, political and cultural context of the region, the wider context of sustainability and housing is also relevant to discussions of sustainability in terms of research already carried out, both domestically and internationally. Findings from existing research are presented here, and barriers to sustainability which apply to international situations, as well as the Auckland context.

3.1 Auckland in context

Auckland's comparatively large urban area is perpetually being pushed outward by a growing population and a low-density style of housing which is still accepted as a cultural norm. The Royal Society of New Zealand observes that while sprawl is common to many cities throughout the world, Auckland's spread is particularly prodigious, "it is extraordinary that the Auckland urban zones with less than a million residents have a geographical spread that is comparable to New York with 16.2 million residents, Los Angeles with 11.9 million people, and Tokyo with a population of 18.1 million" (Royal Society of New Zealand., New Zealand National Commission for Unesco. & Office of the Parliamentary Commissioner for the Environment., 1999, p. 28).

Auckland's characteristic urban sprawl speaks of its dynamism and growth at a time when motor cars were the dominant form of transport. Growth of residential neighbourhoods such as Henderson, Onehunga and Pukekohe around the turn of the century was encouraged along rail lines (Auckland Regional Council, 2010a) as well as early main roads, with intensification in central suburbs happening along tram corridors, "the main instrument for Auckland's metropolitan expansion into the early 1920s" (Auckland Regional Council, 2010a, p. 11). Later construction of state housing during the depression of the 1930s followed the existing single-level, low-density style of the early 1900s villas and bungalows, as this style of living was "considered more suitable for families" (Auckland Regional Council, 2010a, p. 13).

With heavy investment in a new motorway system, and the opening of the Auckland Harbour Bridge in the 1950s, transport options were very different for Aucklanders during a period of rapid growth from the mid 1940s to the mid 1960s, when Auckland roughly doubled in size. Auckland's population increased from 251,667 in 1945, to 535,167 in 1966 and the built area expanded from 13,642 hectares in 1945 to 26,793 hectares by 1964 (Auckland Regional Council, 2010a). As well as population growth, the pattern of settlement changed throughout the country. In the post-war period, New Zealand residents increasingly moved into urban areas, and in the main cities

more and more people moved into peripheral suburbs (Royal Society of New Zealand., et al., 1999).

While the Auckland Regional Council (ARC) attributed the fast spread of suburban growth to Auckland's "reliance on personal vehicles, along with lenient Government lending policies" (Auckland Regional Council, 2010a, p. 15), the Royal Society concluded that functional zoning also played a part (Royal Society of New Zealand., et al., 1999). As a result, New Zealand cities became:

- "Car dependent;
- Wasteful of land resources;
- Requiring high infrastructural capital and operating investments; and
- Requiring high levels of expenditure by families to operate across its zoned spatial arrangement" (ibid, p. 27).

The expansion of roads and motorways and the continued construction of low-density housing resulted in the current urban form, a similar pattern to America and Australia, "largely because they have essentially developed during a period of widespread motor vehicle availability" (Howden-Chapman et al, 2010, p. 35). This pattern of settlement is applied across all of New Zealand's main cities, but is perhaps most pronounced in Auckland being the largest in size and population. All of this suggests that Auckland's neighbourhoods are neither environmentally, socially or economically sustainable.

Adding to the pressure of the existing urban sprawl is Auckland's continuous population growth. At last census the population for the Auckland region was 1.371 million and Statistics New Zealand (2010a) project this population to grow to 1.94 million people (medium estimate) by 2031 (2010a). The 1.4 percent growth projected for Auckland from 2006 to 2031 is expected to be higher than that for the rest of the country, "with annual average population growth of 0.8 percent for New Zealand as a whole" (Statistics New Zealand, 2009, p. 4).

While the city's population is growing, so are Auckland's houses. Figures for the former Auckland region show that the average size for a new house in 1991

was 131 square metres, while in 2006 it was 143 square metres (Infometrics Ltd., 2007). House sizes are also increasing at a national level. The average floor area for all new dwellings, inclusive of apartments, was a little over 190 square metres in 2006, and just under 200 square metres in 2010 (Statistics New Zealand, 2010b). The growing size of houses and the growing population suggest that the way housing is managed within Auckland is unsustainable. Capacity for growth indicators published by Monitor Auckland show that residential land capacity in urban areas is due to be exhausted in 13-21 years in North Shore city and in 12-17 years in Waitakere City (Monitor Auckland, 2010a).

The negative impacts of growth are visible in the ARC's five yearly 'State of the Region' reports. Although these do not specifically address issues of housing supply or suitability, many of the environmental indicators reported on relate directly or indirectly to housing. Topics such as land uses, coastal and freshwater quality, air quality and waste production are all affected by housing construction, and the end-product of housing development: residential lifestyles. The report observes the negative relationship between air quality, water quality and biodiversity in urban environments (Auckland Regional Council, 2010b, pp. 296-297), and with regard to solid waste, energy demand and transport, "we need to become more resource efficient. That will require both technical advances and behavioural change" (ibid, p. 296).

3.2 Smart Growth and sprawl

The Auckland Regional Growth Forum (ARGF) produced a fifty-year report in 1999, intended to plan for Auckland's continuing growth and role as New Zealand's largest city. The region's rapid growth between 1991 and 1996 – "New Zealand's fastest growing region with 12.9% growth in population" – was of concern, as was its impact on city infrastructure and the environment (Auckland Regional Growth Forum., 1999, p. 14). To reduce sprawl while attempting to prevent rising costs of housing, the ARGF's housing strategy

includes aims to have more people living in medium and high density housing by 2050 (Auckland Regional Growth Forum, 1999).

Concerned that limited greenfield development sites in Auckland could affect the affordability of housing, the ARGF identifies eleven goals for housing strategy. Goals two and six of the strategy are relevant to Sustainable Neighbourhoods: "to encourage affordable housing that is well-located, appropriate to needs, well-designed, integrated into communities, and provides for people's needs for choice, security, safety, and good health", and "new affordable housing is designed with an emphasis on energy efficiency, health and safety, privacy (both visual and acoustic), and integration into the neighbourhood" (Auckland Regional Growth Forum, 2003, pp. 12, 15). Principles outlined in the strategy show that design quality, walkability and reduction of energy consumption are considered important by the ARGF, although sustainable housing itself is not the goal.

These goals reflect the principles of Smart Growth, branded as 'Liveable Communities' by the Auckland City Council (Auckland City Council, 1999b, 2003). The Auckland City Council promoted similar key initiatives in subsequent growth management plans, particularly the intensification of density around existing urban centres and transport corridors (Auckland City Council, 1999b, 2003).

The main thrust of the council's approaches seems to be the use of Smart Growth policies to address urban sprawl, rather than targeting sustainability of the city – and of housing more holistically – although sustainability concerns do come up in the community plans. Central Government attention to housing is concerned more with its affordability to low-income residents, and its durability following the issue of leaky homes.

While some documents targeted at housing provision focus on affordability and quality of housing, rather than addressing sustainability explicitly (Auckland Regional Growth Forum, 2003; Turner, Hewitt, Wagner, Su, & Davies, 2004), the Auckland City Long Term Council Community Plan (LTCCP) does address

issues of sustainability. The LTCCP vision includes social, economic and environmental outcomes. Its priorities include affordable homes, diversity, public participation, real transport choices, strong communities, a beautiful and clean environment and that the city is well cared for: "our city continues to grow, and this growth is planned and managed in a sustainable manner" (Auckland City Council, 2006, pp. 15-16). The plan also includes an objective for suitable, affordable housing (ibid). The specific projects listed include a number of elements that are related to the way that residential neighbourhoods have been planned and actualised in the past, such as planned improvements to footpaths and storm-water, and while the vision objectives include affordable housing and concern for neighbourhoods and communities, there are no projects included in the plan that address housing, or residential development. One project to facilitate "high-quality urban development initiatives" (Auckland City Council, 2006, p. 33) may be intended for residential purposes, but this is only described as "making council owned land available for development" and "investing in urban infrastructure" (ibid, p. 33).

The influence of central government through legislation and ministries does not provide the strongest example for sustainability. While the ARGF strategy flags the 2003 Government intention to become more involved in housing provision (Auckland Regional Growth Forum, 2003), this is something that the current National led coalition Government does not necessarily share. In both the Minister's foreword and the Chief Executive's overview to the Department of Building and Housing's (DBH) Statement of Intent (2010), the keywords of the document are 'improving productivity' and 'watertightness', with suggestions of reviewing social housing provision. The main strategic directions are concerned with productivity, upskilling workers in the construction industry, housing demand and affordability (Department of Building and Housing, 2010). This direction provides no guidance regarding either design quality or sustainability, and whether or not there is any consideration given to sustainability depends on the Department's interpretation of the strategy.

The Housing New Zealand Corporation publication, 'Best Practice in Medium Density Housing Design' (Turner, et al., 2004) includes background on housing

policies and strategies, as well as research and evaluation with a focus on affordable accommodation. While it does not address the issue of sustainability explicitly, it asserts that "the most successful developments take detailed account of all design issues" (Turner, et al., 2004, p. 2). The design issues listed, such as intended resident mix and neighbourhood character, relate closely to some of the sustainable housing characteristics shown in Winston (2009). Although the paper incorporates wider sustainability themes, it emphasises the use of medium-density housing as a panacea for the issues facing Auckland neighbourhoods.

Local and central government publications provide mixed and sometimes insubstantial guidance with regard to sustainability in housing and residential development. Reports such as the ARGF's regional growth strategy (Auckland Regional Growth Forum., 1999) emphasise goals compatible with Smart Growth: energy efficiency, walkability and neighbourhood integration, while the Long Term Community Plan incorporates a wider range of sustainability themes, such as: diversity, transport choices and public participation. In comparison, the Department of Building and Housing and Housing New Zealand are respectively focussed on ensuring the water-tightness of new homes, and that growing demand for housing is met through increased density.

Results of Smart Growth

The results of the Auckland City and Regional Council's Smart Growth policies are discussed in an analysis by Statistics New Zealand (2009). It finds that the strategy to concentrate growth along transport corridors and in existing metropolitan areas has not eventuated. In actuality, "infill and greenfield development have been the most popular methods to facilitate population growth" and "living in rural and coastal areas has become more popular than was anticipated" (Statistics New Zealand, 2009, p. 4). Monitor Auckland figures show that the proportion of new residential buildings outside the Metropolitan Urban Limit (MUL) has remained relatively steady since 2005: "in 2009, 78.8 per cent of residential dwelling units were authorised inside the MUL and 21.2 per cent outside the MUL. These proportions have been consistent over the last

four years" (Monitor Auckland, 2010b, para 1). Such indicators show that there has been no real reduction in the numbers of buildings built at the edges of Auckland, and that development outside key areas targeted for Smart Growth continues to spread the city.
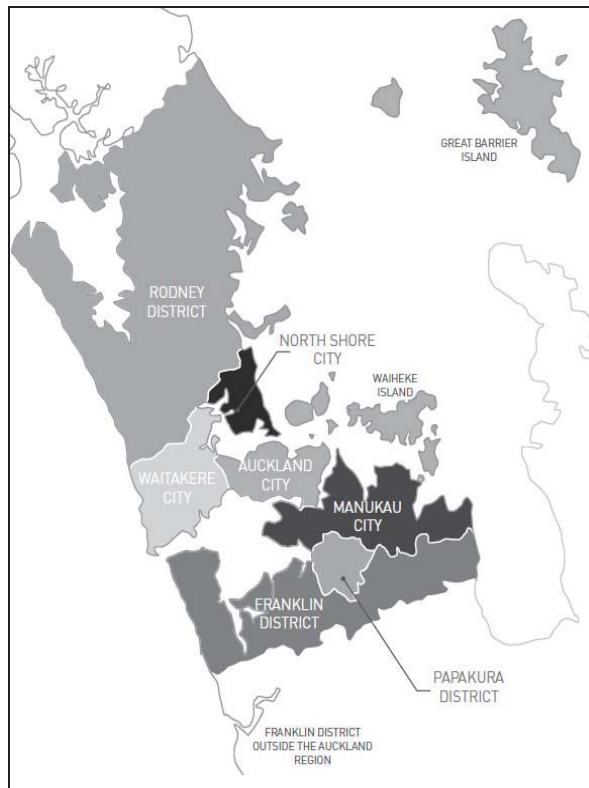
3.3 Recent Political Changes

The Royal Commission on Auckland Governance ('the Commission') was formed by the Government in 2007 "in response to growing concerns about the workability of local government arrangements" (Royal Commission on Auckland Governance, 2009, p. 43). In its comprehensive report on Auckland governance, the Commission found that Auckland's performance on economic, social and environmental goals could be improved, and that these elements were "inextricably linked and highly interdependent" (ibid, 2009, p. 2). While it acknowledged good intentions among councils, the Commission found the failure to provide transport solutions, cohesive planning systems and quality urban spaces was the result of fractured Auckland governance: "disputes between councils arise frequently over urban growth and the development and sharing of key infrastructure, including roads, water, and waste facilities, and cultural and sporting amenities" (ibid, 2009, p. 289). One example of this was the failure of existing city and district councils to plan for and enact the vision of the Regional Growth Forum's compact growth objectives from the 1999 plan (Royal Commission on Auckland Governance, 2009).

The Commission recommended that the separate councils of the Auckland region be merged into one unitary authority to "allow for much more decisive and visible leadership" (Royal Commission on Auckland Governance, 2009, p. 6). In April, 2009 the Government decided to merge the three district, one regional and four city councils with seven mayors and one elected chair, into one council and one mayor for all of Auckland (New Zealand Government, 2009). Transition took place over much of 2010, and while the Auckland Council officially became operational on the first of November, 2010, existing

planning documents from the former councils remain in operation "until a new Auckland Council unitary plan is developed" (Auckland Council, 2010a, 'Regional Plans').

Figure 1. Former Auckland region, city and district boundaries. Figure 2. Extent of new Auckland Council, wards and local boards.
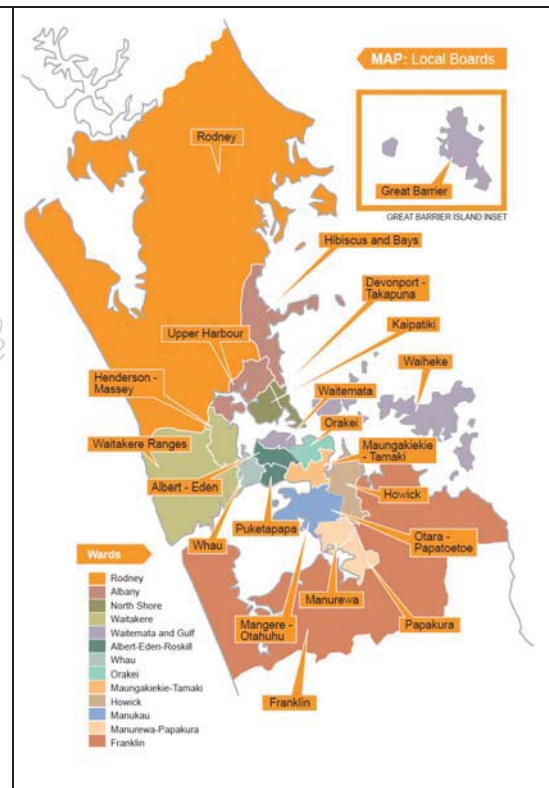
(Auckland Regional Council, 2009, p. 12)   (Auckland Council, 2010b, unpaged)

3.4 Existing research on residential sustainability

Issues affecting sustainable housing are often issues for general sustainability, as sustainable housing exists within the wider context. In a background paper to a review by the Parliamentary Commissioner for the Environment, Taylor (2006) discusses the influence of legislation on sustainable development in New Zealand.   Of the two main pieces of legislation governing sustainable development - the Resource Management Act (RMA) and the Local Government Act (LGA) (there are others, but with less influence) – the LGA section 10 in particular has real potential for positive influence, as it specifically

directs local government to "promote the SD [sustainable development] of communities" (Taylor, 2006, p. 1). Comparing the two, Taylor notes that the RMA takes a more narrow view of sustainability, one limited to 'Sustainable Management', while the LGA definition provided a more holistic approach, taking in social, economic, environmental and cultural wellbeing (Taylor, 2006). The potential of the LGA, however, has not been actualised; "providing for economic prosperity remains 'core business' and the broad SD purpose is viewed with some suspicion", and "the emphasis given by councils to Agenda 21 appears to be diminishing" (Taylor, 2006, p. 5). The Royal Society of New Zealand et al (1999) also notes the RMA's limited scope. Of the three strands running through discourses of sustainability, it emphasises only the physical environment, and "with a few notable exceptions, social and economic planning have been largely relegated to the margins" (Royal Society of New Zealand., et al., 1999, p. 18). The focus of the RMA across all three elements is at any rate on management, rather than development or improvement (ibid).

Locally, Beacon Pathway have carried out research into sustainable housing in Auckland, examining "barriers and incentives to sustainable building design and development within a local Council environment" (Easton, Mead, Trenouth, Fullbrook, & Arnold, 2006, p. 6). Analysing Auckland City regulatory frameworks, the research pays particular attention to areas the council has the greatest control over. The research finds that there are no strong incentives in the regulations regarding sustainable housing, but there are barriers. The Health Act, for example, may prove a barrier to alternatives to town supply water, such as rainwater and grey water reuse, due to its "guidance around ensuring wholesome water" (ibid, p. 7). The Building Act and Building Code also do not make provisions for sustainable approaches, and "time pressures can often lead to some sustainable building measures being discouraged" (ibid, p. 6).

Beyond the impacts of laws and regulations – intended or otherwise – on sustainable outcomes in housing, the values and preferences of Auckland residents themselves may direct the supply of housing. Saville-Smith et al (2005) emphasise the importance of housing quality in influencing the

impressions of residents. This may be a factor in the housing preferences of Aucklanders, as "housing satisfaction and neighbourhood satisfaction have time and time again shown a strong association in neighbourhood and community research", and that the importance of housing stock "should not be underestimated" (Saville-Smith, et al., 2005, p. 58). Findings from other local research (Howden-Chapman, Stuart, & Chapman, 2010) show that while housing occupation patterns within Auckland are changing, with more urban residents moving to apartment-based living, housing preferences among New Zealanders are slow to change.

Research into sustainable housing does not always define which version of sustainability it uses (Carmona, 2001; Commission for Architecture and the Built Environment. & Great Britain. Dept. of the Environment Transport and the Regions., 2001; Crabtree & Hes, 2009). Studies included here review the planning environments and housing outcomes in Britain and America (Carmona, 2001; Lang, 1999), and the sorts of housing outcomes which have resulted. Studies from Australia (Crabtree & Hes, 2009) and Ireland (Howley, Scott, & Redmond, 2009) have used surveys and first-hand accounts of developers and homeowners to examine opinions and motivation regarding sustainable homes .

Like the Royal Commission on Auckland Governance (2009), Lang (1999) finds that fragmented governance has negatively affected the American suburban landscape, creating suburbs similar to Auckland's own. This is due to ideological government reliance on zoning ordinances to control development and resistance to "any comprehensive and systematic long range town and country planning" (Lang, 1999, p. 162). The resulting 'piecemeal' solutions, have created low-density suburban sprawl akin to that in Auckland, "strung out along wide arterial roads with no organic connection to the regional shopping, office, and industrial districts located miles away" (ibid, p. 166).

The systemic difficulties suggested in Lang are echoed in an Australian study by Crabtree and Hes (2009), who also describe the Australian building industry as 'piecemeal' in its innovation of housing. Key barriers identified in the

research are problems with communication and trust between the different players in housing construction: homeowners, developers and builders (Crabtree & Hes, 2009). The authors find that barriers are institutional rather than technological, for example when builders asked what the main barriers to sustainability were, 47% identified their customers , and 27% identified local government approval (ibid). 'Cross industry antagonism' is also cited, as 37% of builders felt developers were the main problem, while 38% of developers thought that builders were the main barrier to sustainability (ibid). These cultural and institutional issues all proved a greater barrier than any challenges around using new sustainable technology or techniques. The research observes that when homeowners were asked about their attitudes to sustainability, they wanted green features to be "built in without fuss" (Crabtree & Hes, 2009, p. 207).

With legislative roadblocks to innovative sustainability measures in housing, as well as what Crabtree and Hes describe as inertia from key players in the construction industry (Crabtree & Hes, 2009), educational and structural change may be necessary in order to make meaningful inroads to improving sustainable design. In Dublin City (Howley, et al., 2009), research found that market forces and "aspiration for lower-density living" (Howley, et al., 2009, p. 7) may work against policies aimed at increasing density. Improvements to inner-city areas, such as parks were recommended, along with schools and other facilities in order to attract the young family demographic which typically moves into lower density areas. Catering only for young, single and affluent residents in city centres does not contribute to the diversity or social sustainability of the area. The researchers argued that the key challenge for planners was to provide the same quality of life in city centres as that perceived to exist in suburban locations (ibid).

Carmona (2001) also emphasised the need for high quality in planning housing alternatives, as well as better understanding of the construction industry. The quality of housing stock and improvement in sustainability performance is essential in the UK where – like Auckland – the demand for housing is growing. In order to achieve more consistency and 'quality not compromise' in the

delivery of new build housing, planners need to value design quality in residential areas – not just town centres – and need to better understand the process of speculative building (ibid). Carmona (2001) claims that residential planning control has been characterised by compromise between conflicting interests of the parties involved, and through preoccupation with efficiency, particularly in processing consents. This has resulted in inconsistent and compromised design. Changes are also needed to the housing industry; its "product-oriented disregard for context needs to be overcome" (ibid, p. 280) as there is a tendency for developers to reproduce the same design in any location, creating monotonous new buildings, and overlooking sustainable approaches.

Summary

Auckland's population is growing continuously, and traditional forms of housing create sprawl and are unsustainable across the region. While measurements show the negative relationship urban living has on the environment, further growth is projected and there is a need to meet future demand for housing. Council approaches to the housing situation have been to plan for intensification around town centres, and the promotion of higher density living. The use of such Smart Growth policies has been mainly targeted at the issue of affordability and housing demand, rather than housing sustainability, although concerns about sustainability and quality are often raised. Barriers to improving the sustainability of Auckland housing have been identified mainly as the very structure of governance itself – particularly to the Smart Growth policies of the Auckland Regional Growth Forum – as well as conflicting regulations and limitations in the governing legislation.

In international research, the quality of communication between the planning profession and the development industry was felt to be a barrier to sustainable developments, and societal expectations of what housing should provide residents are slow to change. The research findings suggest that creating a political, cultural and economic environment in which sustainable housing can thrive is a complex issue. Despite the challenge, Auckland bodies are

concerned with the future of housing, and related environmental impacts of our current style of living. While the path to change is not always clear, the intention to encourage sustainable measures has been signalled.

Chapter 4

Methods and approach

This research examines the sustainability of residential neighbourhoods in Auckland, using an existing sustainability assessment tool and looking at areas of strength and weakness in selected case studies. The first part of this chapter outlines the research questions, and what methods are employed to answer them. As discussed in chapter two, there are many possible meanings for sustainability and this research is based on the model of 'Sustainable Neighbourhoods' presented in Choguill (2008), Saville-Smith et al (2005) and Barton (2000). The second half of this chapter looks more deeply at the two methods, why they were selected and the way they are intended for use, as well as any limitations on the research.

Research questions and approach

Initially, the aim of this research was to explore sustainability in Auckland housing. This provided a huge spectrum in terms of scope since ideas of sustainable housing and sustainability itself vary widely. There is a body of literature dealing with housing on a micro-level, such as '*The New Autonomous House'* (Vale & Vale, 2002), which focuses mainly on the self-sufficiency of individual homes. However, the focus of the research is now on neighbourhoods rather than individual dwellings. One of the main reasons for selecting neighbourhoods as the topic for research is their importance to the economic, social and environmental sustainability, and the scope for planners to become involved in their future directions. The style of housing constructed today will leave a legacy for years to come, and the challenge is to ensure that they are developed right the first time. While it is possible to retrofit a single house with sustainability measures, it is extremely difficult and expensive to alter a whole neighbourhood once developed. By changing the focus of the research to look at housing at a higher level, the research was more suited to the macro-theories of sustainability in suburbs and cities discussed in chapter

two, and the direct observation used in the Beacon Pathway assessments of sustainability.

Now focussed on residential buildings and houses as they are grouped together to form neighbourhoods, the main question for the research to answer is 'how sustainable are Auckland's neighbourhoods?' This question is asked in the discussion of sustainability in four neighbourhood case studies. These case study neighbourhoods are then assessed using Beacon Pathway's Neighbourhood Sustainability Observational Tool, allowing each case to be compared by area of sustainability. The secondary question in this research is to ask if there are common strengths and weaknesses in the ways that the Auckland cases address sustainability; is there an 'Auckland approach' to neighbourhood sustainability? To answer this question, the Auckland cases are compared with international neighbourhood cases, each with their own particular focus for sustainable outcomes.

4.1 Sustainability and 'Neighbourhoods'

This research is carried out within the 'Sustainable Neighbourhoods' model of sustainability, introduced in chapter two. Briefly, a Sustainable Neighbourhood is one which addresses economic, social, technical and environmental sustainability (Choguill, 2008). Economic sustainability means that neighbourhood shops provide local employment opportunities for residents, who provide custom. The suitable size of a neighbourhood for the creation of interest groups and active participation contributes to social sustainability, while technical sustainability requires clear demarcation of where the neighbourhood starts and finishes. Choguill's 'technical sustainability' relates to the idea of connectivity and integration of neighbourhoods in Saville-Smith et al (2005). Finally, and most importantly, Sustainable Neighbourhoods must be environmentally sustainable. Choguill's (1993) explanation for Sustainable Neighbourhoods comes under the umbrella of 'strong' sustainability as ecological sustainability must first be achieved.

As this research uses neighbourhoods as the basis for case studies it is useful to consider what a neighbourhood actually is. While Choguill (2008) discusses what a Sustainable Neighbourhood should be, he does not provide a definition for 'neighbourhood'. Instead, he discards possible definitions of 'neighbourhood', such as common interests, defining characteristic or geographic area, observing that "what is a neighbourhood is primarily in the eyes of the beholder" (Choguill, 2008, p. 42). Choguill suggests that the residents themselves form a 'neighbourhood' by virtue of the number and quality of their interactions with other neighbours.

While Choguill argues for social interaction as the basis for defining neighbourhoods, Saville-Smith et al (2005, p. 55) note that (while desirable) this does not create a neighbourhood itself, arguing that "neighbourhoods exist whether their residents are satisfied with them or not". The neighbourhood is important to city function and form and although defining a neighbourhood is problematic, understanding the neighbourhood is still important (ibid, p. 55). According to Saville-Smith et al (2005), neighbourhoods are physically defined clusters of dwellings which provide an intermediary between residents' homes and the city, and which serve the residential and social functions of everyday life. Some of these ideas, such as the social function of neighbourhoods, echo Choguill's criteria for a Sustainable Neighbourhood, but even taken together provide a very loose definition with which to work.

In order to carry out the sustainability assessment, it was necessary to have specific geographic neighbourhood boundaries. Given the absence of a compelling definition of neighbourhoods from the Sustainable Neighbourhoods literature, the developments themselves act as proxy 'neighbourhoods' for assessment. The selection of cases was based on recent developments of residential dwellings, undertaken as a single project. The common location, age, style and demographic of each development goes some way in creating the more intangible elements of what constitutes 'neighbourhood'. In practice however, it also makes for a range in sizes, as the largest case covers over one hundred hectares, and the smallest less than two. The definition proved workable though, as neighbourhood questions in the observational tool ask

about access to services, and these need not necessarily be contained within the neighbourhood.

4.2 Case Studies

The aim for the Auckland based case studies is to compare cases with each other and illuminate the sustainability of Auckland housing within the context of the research definition. Ritchie and Thomas (2009) use case studies to illustrate model developments, or pioneering sustainability technology and approaches. While some of these are placed in a theoretical and political context, they are often discussed in isolation from each other, and the social, physical and political environments in which they exist. Stark and Torrance (2005, p. 38) describe the use of "Nested case studies" as teaching examples in texts where case studies describe specific situations the student may encounter in their future work. In this research, case studies will consist of four Auckland neighbourhoods and their context, and a selection of international case studies will be included in chapter six to compare against the local cases. This is to highlight any relative strengths or weaknesses in the local examples, and the influence of the Auckland, and in many ways New Zealand context on our housing options.

Assessing neighbourhoods over the whole Auckland region is problematic. At the time of commencing the research, what is now 'Auckland' was previously governed by eight local bodies. The former governance of the region meant that cases could be subject to different policies and council approaches, making it impractical to provide cases covering the whole Auckland region. Now amalgamated to become the Auckland Council, we have yet to see what effects the change in governance will have on changes in policy and the resulting residential redevelopments. Due to the 'Eco-City' priorities of the former Waitakere City, and the higher population of the former Auckland City, it was easier to locate housing developments in each area claiming sustainability measures, or held up as examples of sustainability in some way. Therefore

cases have been drawn from Auckland and Waitakere Cities only. Cases such as Addison Place in Papakura, and Sacramento and Eastpark in Botany Downs were not explored due to their distance from the researcher. Also, at the time of the study – as well their respective construction – they came under the regulations of the Papakura District and Manukau City Councils respectively. Two cases from the west of Auckland, in the former Waitakere City, were selected: Earthsong, a small development initiated by a trust formed by prospective homeowners with an interest in permaculture; and Harbour View, a larger suburban development initiated by Waitakere City council. In the Auckland isthmus the two cases selected were: Talbot Park, a substantial renovation and new build of a group of Housing New Zealand flats which attempts to incorporate green principles; and Stonefields, a significant development of thousands of homes which includes innovative approaches to water management. These cases have been selected to provide a range in terms of scale of development, target resident, and degree of sustainability initiatives included in the design or construction of the houses.

Blackmore and Lauder (2005) acknowledge that in tackling complex policy questions, quantitative analysis does not always provide an adequate response. To provide flexibility in approach as well as rich data for discussion, qualitative methods will be used – primarily case studies. The strength of using case studies to research a complex topic is the ability to "use multiple methods and data sources to explore it and interrogate it" (Stark & Torrance, 2005, p. 33). In the selection of cases to explore, the main concern was availability of data – which would have to be sourced from the public domain.

As mentioned in chapter two, and again here, the concept of 'neighbourhood' is a fluid one and no accessible or usable 'neighbourhood frame' exists from which to select. For both the Auckland and international cases purposive sampling was used, to seek out research subjects with characteristics that met the needs of the study and which were 'information rich'. International neighbourhood cases were also selected for their high profile and range of sustainable attributes with which to compare the Auckland cases. Despite the

contested nature of sustainability as a concept, these neighbourhoods have become, by proxy, best practice examples of sustainable design.

The use of qualitative methods creates some restrictions on the research. As the method involves non-probability sampling, any relationships between variables cannot be extrapolated to the whole population, and one of the weaknesses of case studies is that it can be difficult to 'draw boundaries' around what to include and how much time to spend gathering data (Gliner, Morgan, & Leech, 2009; Stark & Torrance, 2005). While there is some discussion of the regulatory factors involved in each Auckland case, a detailed analysis of the limitations in housing and planning legislation is not provided. One further limitation to the research scope is the age of the housing assessed. Neighbourhoods selected are restricted to newly constructed, or renovated developments, mainly because of the depth of information available, but also because this is more reflective of the current context in which houses and neighbourhoods are built.

4.3 Sustainability Measurement Tool

In order to assess the sustainability of each case in the same way, an assessment tool of some kind is necessary. As the theory, research and development necessary to design a useful and useable tool could justify a research project in itself, this research uses an existing assessment tool which reflects the Sustainable Neighbourhoods approach in which the research is grounded. Considerable development of a sustainability assessment tool has been carried out by Beacon Pathway, in the previously mentioned 2005 research by Saville-Smith et al (2005). Other tools have been created and are available for use: locally, the Tool for Urban Sustainability – Code of Practice (TUSC) (2011), endorsed by the former Waitakere City Council; and internationally, the Leadership in Energy and Environmental Design (LEED) (U.S. Green Building Council) certification. Less formal tools exist, such as guidelines by the Commission for Architecture and the Built Environment

(CABE) (2006, 2008a) and the NZ Urban Design Protocol (Ministry for the Environment, 2005), although these provide guidelines for what to include in sustainable neighbourhoods and buildings, rather than a means of assessment which might be used for comparison.

The different tools each have their own focus for sustainable efforts, and their own strengths. LEED is a green building certification with a range of rating systems provided for different developments, as well as professional accreditation in how to use them. While the LEED for Neighbourhood Development rating systems and checklists are available online, they are intended for use by certified project administrators (The Green Building Certification Institute, 2011). The LEED Neighbourhood Development rating system is perhaps the most comprehensive: a 112 page document with comprehensive descriptions and diagrams of concepts. Questions are asked and scored in five sections, covering themes of location, design, 'green infrastructure' and innovation (U.S. Green Building Council, 2009). The final section applies a 'regional priority credit' to developments in certain locations identified for development, and is specific to the United States (U.S. Green Building Council, 2011b).

TUSC (2011) provides a range of rating tools which can be created and saved online. It rates a range of indicators relating mainly to energy and water consumption. While TUSC is a locally developed rating system, and includes a neighbourhood assessment, the 'Neighbourhood Tool' was at the time of carrying out the research unavailable online, and is still unable to be publicly accessed. TUSC's Site Design Tool and Site Audit Tool are for rating prospective new homes and existing homes as individual buildings, and are not appropriate for research on a neighbourhood level.

A new rating tool became available in October 2010, after data capture had begun for this research: the Homestar (2010) rating system developed by BRANZ, Beacon Pathway and the New Zealand Green Building Council. Like TUSC, it is a hosted web page where you can directly input details about your home to obtain a rating. Coached assessment – assistance by a qualified

assessor from Homestar – and certified assessment services are also available, although these, like TUSC, apply only to individual homes and not to neighbourhoods.

The Beacon Pathway Neighbourhood Sustainability Observational Tool ('the observational tool') is clearly influenced by the LEED neighbourhood tool, although it has far fewer questions and is specific to the New Zealand context. It also has the very definite advantage of being in a more usable and simpler format by being created in spreadsheets with pre-formatted cells to provide immediate ratings based on the data inputted. While the LEED Neighbourhood Development rating system is publicly available, it is designed to be used by an accredited professional, and the Beacon Pathway observational tool is designed to be used more by a lay audience of prospective developers and planners. The Beacon tool was selected for this study as it applies to the neighbourhood scale, rather than providing a rating for individual homes, such as TUSC or the recently developed Homestar rating system. It is also aligned with the overall approach of the research, to explore sustainability in housing using the 'Sustainable Neighbourhoods' definition of sustainability.

The observational tool used in data collection for the four Auckland case studies has nine sections, each providing a rating based on: walking access, public transport access, viability of local centres, protection of the environment, dwelling sustainability, quality of space, diversity and resilience, street network and eco alternatives. While this is being used as a measurement tool to assess sustainability, subjective judgements are made when using the tool, and in the tool's rating system itself. For example, extra points are awarded if the development includes public artwork, and users are asked to use their own discretion in awarding up to six points for a development's connectivity.

Collecting data required for the observational tool involved site visits for direct observation of the neighbourhoods selected. As the tool has been developed specifically for the New Zealand context, and given the necessity for physical interaction with the site, assessment via the observational tool could not be

carried out for the international examples, and detailed analysis of international contexts and background will also be omitted from this study.

Beacon Pathway point out that while it provides an assessment, the observational tool is "not a rating tool. It does not give you directions about what to do in the neighbourhood, but rather it identifies where neighbourhood outcomes need to be addressed" (Beacon Pathway Ltd, 2008c, p. 2). Consequently, the results of this tool are for the purpose of discussion; to provide a deeper understanding of what sustainability means in practice in Auckland neighbourhoods. The comparison also serves this end, exploring what sustainability could mean, and how it is attempted in the Auckland environment.

Finally, the use of an off the shelf assessment tool in this research may produce unexpected results that would otherwise be inconsistent with the research approach and more general impressions of the case study comparisons. The discussion of results will also reflect on the experience of using the Beacon Pathway observational tool, and any effects it had on the data.

Summary

This research examines the sustainability of residential neighbourhoods in Auckland, and whether there are commonalities in the techniques used in the Auckland cases to achieve sustainable outcomes. To address the first research question, two methods are used: an examination of four Auckland case study neighbourhoods; and the use of a neighbourhood 'observational tool' with which to measure and compare the cases on the themes of 'Sustainable Neighbourhoods'. The assessment tool selected is aligned with the theoretical approach of the research, and allows different housing developments – of different size and in different cities within Auckland – to be compared with each other and assessed in terms of their degree of sustainability.

To address the second question, Auckland case studies are compared with international neighbourhood cases, to reveal aspects of the local cases which

are strong or weak according to the Sustainable Neighbourhoods model. It is hoped that the case study comparison will reveal a depth of information about sustainability initiatives missing from council and ministry plans and policies, and not best attempted through quantitative methods.

As mentioned in chapter two, one of the problems with sustainability is how to define it, and how much of the term's meaning is assumed. By placing the research firmly within a defined approach to sustainability it will be possible to make a more informed decision about how much effort is really being made toward sustainability, and how much is 'greenwash'.

Chapter 5

How sustainable are Auckland neighbourhoods?

In order to evaluate the sustainability of Auckland's neighbourhoods, this research has compared four case studies in Auckland to each other through the use of an observational tool. This chapter presents the details of the four Auckland neighbourhood case studies and the results of the neighbourhood sustainability assessment. Each case is introduced with a brief history of its development, context and key features, followed by the results of using the neighbourhood sustainability observational tool to evaluate it. The observational tool addresses neighbourhood sustainability with eight themes, and the results of each case are discussed for each theme. The international case studies and comparison to the local cases are presented in the following chapter.
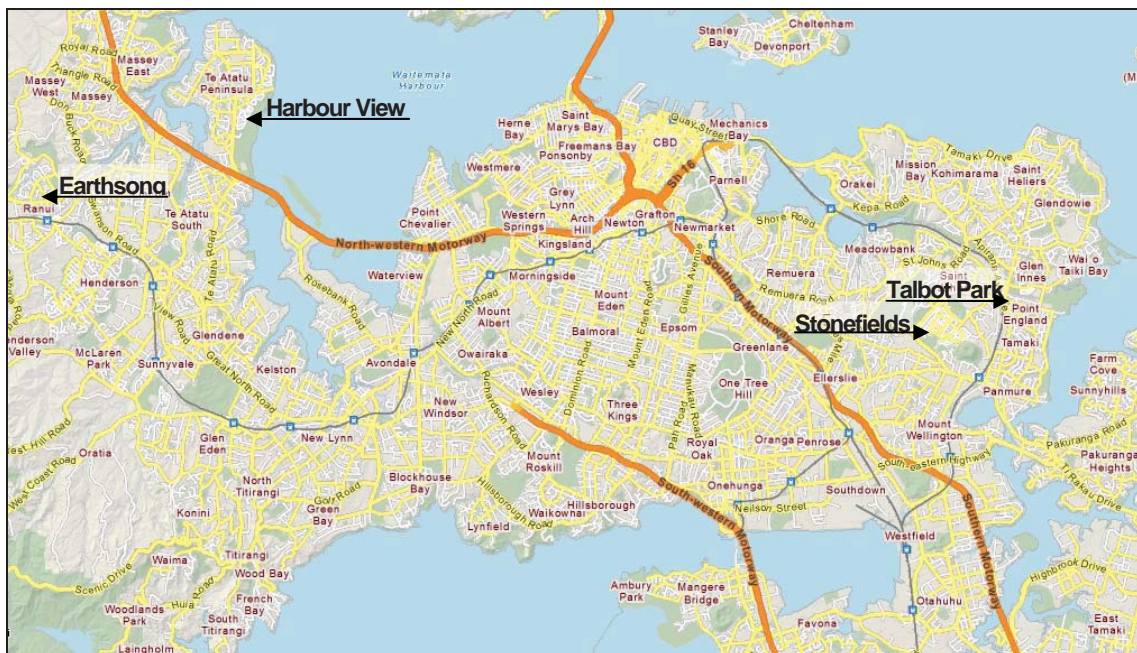
5.1 Auckland case studies

Figure 3. Location of the four Auckland case studies
(Auckland Council., 2011)

The four Auckland case studies are located in the western and central areas of Auckland City. Harbour View is the oldest of the neighbourhood developments, located on the Te Atatu peninsula. Earthsong is in the small suburb of Ranui, near the Waitakere Ranges. The most recent development, Stonefields, is still under construction in the former Mt Wellington quarry. Nearby is the Talbot Park neighbourhood in the more established suburb of Glen Innes. This research was carried out before the creation of the Auckland 'super city', and the joining of the eight regional and district councils comprising what is now simply 'Auckland Council'. When selected the Earthsong and Harbour View cases to the west were under Waitakere City Council governance and Stonefields and Talbot Park under the Auckland City Council.

Harbour View

Figure 4. Harbour View streetscape

Harbour View is a suburban development located on the Te Atatu Peninsula in what was formerly Waitakere City. Sited on what was council-owned land, the development was initiated by the Waitakere City Council in the mid 1990s, with an express vision of realising sustainability objectives, particularly the use of New Urbanism design principles and protection of the neighbouring coastal area. Undertaking sustainably oriented developments was new at the time, and Waitakere Properties Ltd was established by the Council as this was something "the private market was not prepared to do at the time" (Ministry for the Environment., n.d., 'Introduction'). The area itself is between the Te Atatu

shopping centre and the Waitemata Harbour, on a site of just over 40 hectares. Three hundred and seventy dwellings are in the development, including a range of medium-density and single-level attached houses, and small and large single-section houses with lot sizes ranging from 150 to 3,392 square metres (Ministry for the Environment., n.d.).

On the whole, much of the development looks like a conventional suburban housing development, although there are small blocks of medium-density terraced houses within the site. There are numerous green spaces which break up the area and provide green space for many residences which overlook the parks.   The defining feature of the area is Te Atatu Reserve (also called Orangihina Park) which borders the developed area along its coastal edge. The neighbourhood has been designed to maximise views of the park, and the water beyond. Native plantings along the water's edge filter and reduce fresh-water runoff, and walking tracks throughout provide recreation for neighbourhood residents.

Harbour View has been analysed in Ministry for the Environment (MfE) (n.d.-b) and Beacon Pathway (2008a) studies. The former includes Harbour View as an example of a development which uses the *'New Zealand Urban Design Protocol'*. Outlining its progress against 'the seven Cs' of urban design, MfE (2005) notes in particular its mix of housing, connectivity and pedestrian friendliness of streets, inclusion of open spaces and its enhancement of the local wetland, using this as a framework for quality if not explicitly for sustainability. Beacon Pathway (2008a) also cite the development's layout and design, as well as storm-water mitigation measures, but include a number of negative observations in their case study. Many of these are related to the location of the development and ability to access key services, either through walking or public transport. The large size and expense of dwellings are also counted against the overall sustainability of the neighbourhood (Beacon Pathway Ltd, 2008a).

Earthsong

Figure 5. Earthsong's shared green and pedestrian 'street'

Earthsong is a co-housing initiative that was first started in the early 1990s, when a group of prospective home owners formed their own development group to create the kind of neighbourhood that they eventually wanted to live in (Earthsong Eco-Neighbourhood, n.d.-b). The group, which was originally called the 'Waitakere Eco-Neighbourhood Trust', aimed to secure a site in "Waitakere City, primarily around town centres and transport nodes in line with Eco-City and urban sustainability values" (Earthsong Eco-Neighbourhood, n.d.-b, '1994-1997'). They initially explored the site for what would later become the Harbour View development before settling on a former organic orchard in Ranui as their development site. Phase one of the development took place between 1995 and 2002 (Meltzer, 2005), and the full project construction was finished in July 2008 (Earthsong Eco-Neighbourhood and the Earthsong Centre Trust, 2008). The 1.29 hectare site includes 32 dwellings, 2, 3 or 4 bedroom attached houses and 1 or 2 bedroom apartments, ranging from 56 square metres to 122 square metres (Earthsong Eco-Neighbourhood, n.d.-e)

The development is squarely aimed at enabling as many sustainability measures as possible, concerned with environmental, social and economic sustainability in the design and execution. The central philosophy of the Earthsong project is that of co-housing, but it incorporates Sustainable

Neighbourhood ideals, such as selecting a site to be within walking distance to neighbourhood facilities and public transport to the city centre. Meltzer points out that "striving for integration and connectivity (as opposed to autonomy and self-sufficiency) but without the use of private transportation is a fundamental ecological strategy" (Meltzer, 2005, p. 85).

Key features of the development are its location, layout and construction. Despite being at the edges of the Auckland metropolitan area, it is located near shops and community facilities, and is within walking distance to Swanson train station. Homes are arranged around a common house, with all car parking to one side of the site. The on-site common house is also a facility for the neighbourhood; it provides spaces for interaction with other residents including a bookable space for parties, shared kitchen, spare bedroom for visitors (useful for people in smaller dwellings), shared laundry, teenagers' room, and a quiet room used for yoga practice. Rainwater swales lead to a storm-water retention pond, and all homes are fitted with solar hot-water heating (Meltzer, 2005). The homes themselves are constructed from rammed earth, untreated macrocarpa and re-used wood from original buildings on the site. Rainwater is collected from rooftops and treated in a central collection tank, intended to meet 80% of residents' water needs. This is supplemented by town supply in the summer months when demand is higher, and supply lower (Earthsong Eco-Neighbourhood, n.d.-c).

Of the entire 1.67 hectare site, a 3,900 square metres area has been separated into a business zone adjacent to the road, owned separately by Walk-to-Work Eco-Developments Ltd. It aims to have commercial businesses which complement Earthsong's eco-principles and to provide working opportunities for those living there (Earthsong Eco-Neighbourhood, n.d.-d).

Challenges experienced by the co-housing group during development of the site have been discussed on the website (Earthsong Eco-Neighbourhood, n.d.-e; Earthsong Eco-Neighbourhood and the Earthsong Centre Trust, 2008), and in a study by Meltzer (2005). Some of the sustainability initiatives that were intended to be included in the design were not possible due to regulations or

decisions taken by regulatory authorities at the time. In some cases, the council was able to recognise the sustainability aims of the development. The development contribution for reserves was able to be reduced from 6 per cent to 3.5 per cent of the development total, which would undoubtedly have assisted the residents' efforts to reduce costs for the build (Waitakere City Council, 2002).

Where the development came under the jurisdiction of other agencies, however, its initiatives were prevented, not by any strong objection, but a lack of any motivation to allow deviation from the conventional approach. Sewage is not treated on-site, as an exemption to the provisions of the Auckland Metropolitan Drainage Act 1960 sought in 1990 was denied by WaterCare Services Ltd (Meltzer, 2005). Earthsong decided not to appeal to the Environment Court over this, due to the delays and costs which would have been incurred, choosing instead to install conventional plumbing, but with a provision to change to on-site treatment should restrictions be removed in future (Earthsong Eco-Neighbourhood and the Earthsong Centre Trust, 2008). Waitakere City Council later funded Earthsong with $10,000 in 2005 "to monitor and demonstrate the feasibility and benefits of installing composting toilets in an urban area" (Earthsong Eco-Neighbourhood and the Earthsong Centre Trust, 2008, p. 8). However, this remains a working model in the common house only.

Rainwater collected and treated in a common collection tank meets some of the water needs of Earthsong residents. However, all kitchen and bathroom cold taps can only be supplied with council water (Earthsong Eco-Neighbourhood and the Earthsong Centre Trust, 2008). Dwellings have been plumbed to allow for future changes should they be able to install the alternative systems at a later date (Earthsong Eco-Neighbourhood and the Earthsong Centre Trust, 2008).

Talbot Park

Figure 6.   Talbot Park 'star flat' and cycleway

Talbot Park is a group of Housing New Zealand units in Glen Innes, Auckland City, which were re-developed in the mid 2000s. A substantial refurbishment of existing 'star flats' – so named for their shape when viewed from above - was carried out between 2003 and 2005, and new terraced and stand-alone housing was constructed over 2005 and 2006. The existing housing was redeveloped primarily for social issues, "Talbot Park, a residential development originally built in the 1960s... had become rundown and notorious for crime" (Beston, 2005, unpaged). While concerned with social sustainability, the project team also took the opportunity to embody good design principles and implement sustainability measures where possible: "it was chosen as a HNZC community renewal project to demonstrate quality urban design principles, sustainable building practices, community partnerships and innovative architectural design in medium density housing" (Ministry for the Environment, n.d.-a, unpaged). The development consisted of 111 new and 108 refurbished residential units, a mixture of large family homes, terraced houses, single and two-bedroom apartments.

The main work carried out on the 108 existing units was to renovate kitchens and bathrooms, and make changes to car-parking and roof design.   The redevelopment project intended to demonstrate quality urban design "guided by

the Auckland City Council District Plan" (Housing New Zealand Corporation, 2009, 'Talbot Park') through new public spaces and open space design, including the alignment of new houses, and street layouts. Objectives of the design team were to achieve good quality, rather than sustainability, however, where practicable, sustainability measures were implemented.

The site has a variety of housing styles, both in outward appearance and in accommodation provided (apartment; terraced flat; house). Narrow roads and excellent passive surveillance have improved the safety for pedestrians walking through the area. Two parks offer shade and children's play equipment, although perhaps due to the small size of the neighbourhood and proximity to the local shopping centre, there seemed to be few informal gathering spaces where neighbours might bump into each other.

Care was taken to involve the residents and community in the redevelopment process. Involvement included both consultation and residents from the area being employed by the construction group for the renovation of the 'star flats' (Canam Group, 2011). The redevelopment also undertook considerable consultation with the existing tenants on their preferences and hopes for the area: "Boffa Miskell led a collaborative process with the community (not only HNZC tenants), Auckland City Council and HNZC staff. This consisted of a series of community workshops, focus groups, surveys, open days and newsletters" (Ministry for the Environment, n.d.-a, unpaged).

The redevelopment also incorporated a number of sustainability features into new and renovated dwellings. Rainwater recycling, design and layout to encourage pedestrian access, and measures to reduce energy needs such as thermal mass, high performance insulation, solar hot water heating and energy efficient lighting were all employed. As the project was reusing existing buildings, this contributed to reducing waste onsite, and the need for new construction materials (Easton, et al., 2006).

During the redevelopment, some challenges to the inclusion of sustainable features were encountered by the developer. Research carried out by Beacon

Pathway discusses challenges stemming particularly from local regulations, and note that issues arose due to regulations regarding natural ventilation and noise control (Easton, et al., 2006). While it was desirable for the new houses to have natural 'passive' ventilation to promote air quality and reduce humidity in the homes, minimum noise standards for the zone meant that this was not possible and mechanical ventilation was installed (ibid).

Further issues arose throughout the development with regard to Council concerns over the storm-water drainage plan, and roading.   While the development team were in favour of narrow roads to encourage slower speeds through the area, the council and the New Zealand Fire Service were concerned that emergency vehicles would not have sufficient access. Negotiations over these issues caused delays to the development of the neighbourhood, and these delays "led to the perception that it would be easier to 'dumb things down' and stick to Code minimums than go to the extra effort of using more innovative, sustainable solutions" (Easton, et al., 2006, p. 44).

Stonefields

Figure 7. Stonefields and its storm-water pond under construction.

Stonefields is an important new development in Auckland. On a 110 hectare site in the central Auckland isthmus, it provides scope for a significant development. It was a large part of the former Auckland City Council's attempt to meet projected housing demand, with the Mt Wellington site identified as a "key growth area" (Auckland City Council, 2007, unpaged). This development site is a former quarry, lying lower than its surrounds and bounded on three sides by the quarry walls. Work is well underway on the site and even though

construction is incomplete, separate and terraced houses are already occupied by residents. Many roads are still closed and the storm-water pond and the main park at the back of the site are still under construction, however, three small parks are completed, some with benches and planted gardens and one with children's play equipment. Two planned parks for the site have already won silver awards from the New Zealand Institute of Landscape Architecture for 'Landscape design rural/park/recreational' (New Zealand Institute of Landscape Architects, 2010).

On completion, the development is planned to provide just fewer than three thousand dwellings, including apartment blocks bordering the main road and commercial buildings. Styled as a 'new urban village', the development will also include a school, parks and a shopping centre. The development has put particular emphasis on its storm-water system, making use of swales, specially developed wetlands and the neighbouring Waiatarua reserve, with the intention of providing non-potable water in separate pipes to residents for irrigation and flushing toilets.

The areas surrounding Stonefields are undeveloped on one side, and the introduction of thousands of new residents will increase demand on local services and infrastructure. Commentary on the development in popular media has focussed on the impacts of the development on traffic in the area. With limited through roads (Dearnaley, 2005; Orsman, 2005), there is concern that congestion is inevitable, and fears that the increased volume of traffic would "pour thousands of vehicles a day through residential streets to Panmure, St Johns, Meadowbank and Kohimarama" (Orsman, 2005, para. 2).

5.2 Assessment results

Details about each Auckland case were entered into Beacon Pathway's Neighbourhood Sustainability Observational Tool. This observational tool has nine sections with questions about different features affecting the overall

sustainability of residential developments. Its purpose is to help planners and developers identify areas where the greatest gains in improving neighbourhood sustainability might be found. Data for the assessments – summarised in the case studies above – was gathered from online resources and direct observations. The results of each section and the overall rating for each case are discussed by topic in the following section. These results are illustrated in the table below.
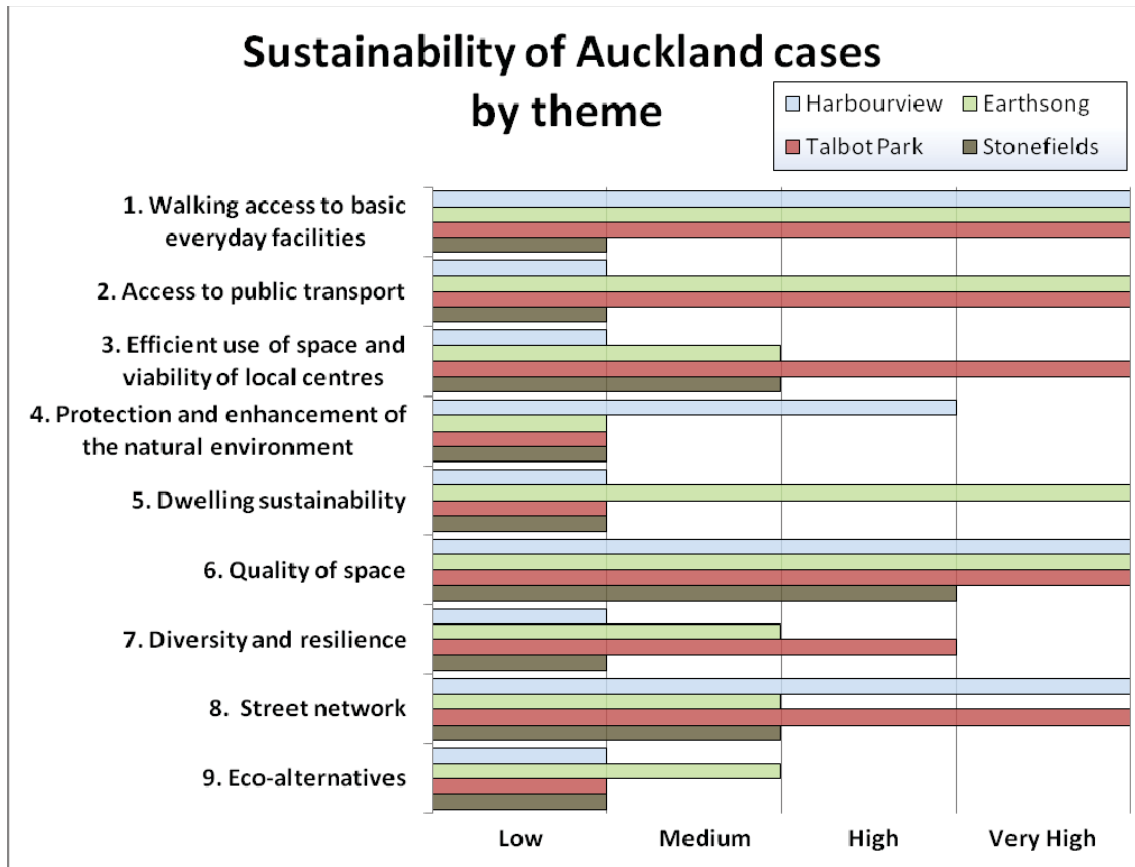

Figure 8. Sustainability performance of Auckland cases by theme

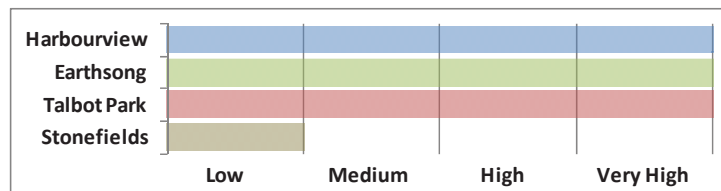## 1 Walking access to basic everyday facilities

Figure 9. Walking access to everyday facilities

This section asks questions about the proximity of houses in the neighbourhood to commonly used services such as schools, retail and recreation facilities. Distances along walking routes were taken from an online mapping tool (*mapometer.com*, n.d.) according to the Beacon Pathway guidelines for using safe walking routes, for example only crossing busy, main roads at pedestrian crossings.

Earthsong, Talbot Park and Harbour View scored very highly, as they are located near the existing suburban centres of Ranui, Glen Innes and Te Atatu respectively. These established community centres already include libraries, shops and parks. The neighbourhoods are also within walking distance to schools in the area. The Stonefields development has a 'Low' score as it is located much further (along walking routes) from such facilities. Access is further restricted because the neighbourhood is still under construction and planned facilities such as a shopping centre, parks and a primary school have not yet been built, and many roads are still closed. The neighbourhood was assessed in its incomplete state at the time of the research. When the development is finished, however, approximately seven points could be added for this section, which would give the neighbourhood a "Very High' ranking.

2 Access to public transport
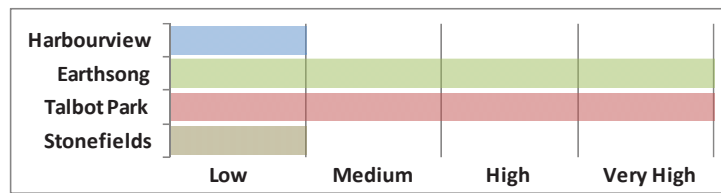
Figure 10. Access to public transport

This section deals with the frequency and proximity of public transport services to the cases, but only allows points to be awarded if the transport is adequate. 'Adequate transport' is defined as being at least one ride every 30 minutes in the direction of the main town/city centre between the hours of 7 and 9am, and the same in the opposite direction between 5 and 7pm (Saville-Smith, et al., 2005). Frequency of bus and train services to each neighbourhood were taken from 'maxx.co.nz' (Auckland Transport, n.d.).

In the case of Harbour View and Stonefields, services were not frequent enough in the evenings to meet the criteria for adequate public transport, and they received no points at all for these questions. Additional points could be awarded if 'medium' or 'high frequency' public transport was available, but none of the cases were eligible, even though both Talbot Park and Earthsong have access to rail transport as well as bus services. Like section one, when development is complete for Stonefields development, the proximity and frequency of bus services may improve.
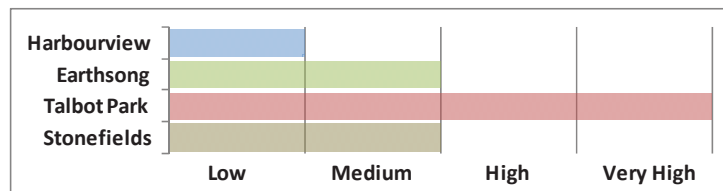
3 Efficient use of space and viability of local centres

Figure 11. Use of space and local centres

Section three of the observational tool looks at the previous use of the development site, how developed the surrounding sites are and the overall density of the residential development. Scores for the density questions are interesting as the observational tool screens cases into two different categories based on answers given to previous questions and these categories are assigned two different ideal density levels. The highest points are awarded to neighbourhoods closest to the target density and not necessarily the densest development.

As they scored higher for access to facilities and transport, the observational tool assumes a higher target density for Earthsong and Talbot Park of 24 dwellings per hectare. With regard to previous use of the site, Talbot Park's 'Very High' rating is in part due to the fact that this is the only redevelopment of existing housing, while Earthsong, with a 'Medium' score is sited on a former orchard. Stonefields and Harbour View were scored against a 15 dwelling per hectare ideal. Harbour View, with a 'Low' score was built on semi-park land used for a rural theme park and therefore assumed to be undeveloped, while Stonefields scored higher with 'Medium', as it is built in a former quarry and re-uses a commercial site. Further points were available if houses adjacent to neighbourhood shops were denser than those in the wider surrounds, and it is interesting to note that this did not apply to any of the cases, the distribution of houses was fairly even throughout whole suburbs.
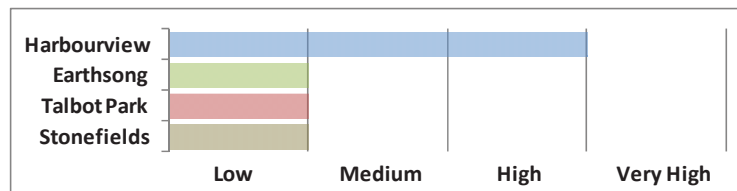
4 Protection and enhancement of the natural environment

Figure 12. Protection of the natural environment

The questions in section four encompass storm-water runoff and impermeable surfaces in the neighbourhood. It is concerned with the protection of local waterways, and natural areas, particularly those which might provide habitats for local fauna.

In this case imperfect data was available, and it was difficult to get the percentage and actual values for the impermeable proportion of the development site. Even if information is known for one dwelling, the whole neighbourhood is being assessed and in all cases there are many different house types within the neighbourhood. A proxy figure for the percentage of impermeable surfaces was reached by using the appropriate guidelines for permitted activities in the relevant zone and district plan. An estimate for the actual values was also used to avoid artificially lowering the overall sustainability rating due to missing data. Based on house plans provided on the Earthsong website (Earthsong Eco-Neighbourhood, n.d.-a) an average house size of 100 square metres was used, in the other cases, with no designs or dimensions an average house size of 140 square metres[1] was used.

Harbour View's 'High' score in this section is due in large part to the comprehensive native planting in the park which borders the coastal waters of the neighbourhood. This includes ponds to further filter freshwater runoff before it reaches the harbour. Earthsong, Talbot Park and Stonefields received 'Low' scores for this section, which heavily weighted the degree of impermeable

---

[1] A conservative estimate for average house size. Figures for Auckland (the former Auckland region) show that the average size for a new house in 1991 was 131 square metres, while this was 143 square metres in 2006 (Infometrics Ltd., 2007).

surfaces in the neighbourhoods. The use of proxy scores[2] for this section may have artificially lowered the scores for all cases, particularly Earthsong and Harbour View, which include permeable paving in their streetscapes. Though this section relates to storm-water, it does not take into account the use of rainwater tanks (which Earthsong includes throughout, and Talbot Park includes for some units) or storm-water swales and retention ponds (used by both Earthsong and Stonefields) in its management.

5 Dwelling sustainability
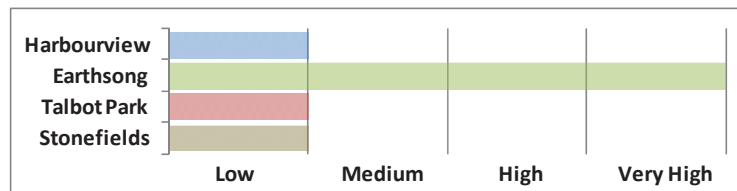
Figure 13. Dwelling sustainability

The dwelling sustainability questions require construction details such as the level of insulation, heating and waste disposal methods. As in the previous section, data is required for the whole neighbourhood and the availability of this information in the public domain was limited.

Earthsong's 'Very High' score in this section is due both to its inclusion of sustainable technology – solar water heating, reuse of rainwater as non-potable supply – and also to richer information being available for the neighbourhood. Stonefields also reuses rainwater for the whole neighbourhood and some of Talbot Park's units are equipped with solar water heating, but overall scores for this section are unreliable. The 'Low' score for Harbour View, Talbot Park and Stonefields effectively represents incomplete data. Scores were adjusted for the three cases with missing data, by changing their rating to 'Medium'. In all three cases changing the rating for section five from 'Low' to 'Medium' had no effect on their overall sustainability rating.

---

[2] An estimate of 60% impermeable surfaces was used based on permitted rules from the Auckland and Waitakere City District Plans (Auckland City Council, 1999a; Waitakere City Council, p. 30)

6 Quality of space
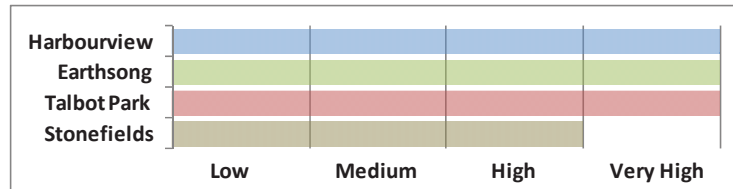
Figure 14. Quality of space

Section six looks at the footpaths, roads and open spaces within the neighbourhood development, in particular the safety and quality of the environment for pedestrians. Some questions require the assessor's discretion on the quality of spaces. Observational data for this section was taken from site visits and observations on two separate occasions at different times of the day for all the cases except Earthsong, which was visited only once, during a public open day.

Again, due to ongoing development Stonefields lost points, mainly for lack of passive surveillance of footpaths and open spaces which are effectively construction areas. Stonefields still scored highly, and all other cases were rated 'Very High', in general there was a lot of care taken to provide attractive, safe public spaces. One common factor for all cases, however, was the lack of safety for pedestrians crossing roads bordering the neighbourhood.   All neighbourhoods had busy thoroughfares without pedestrian crossings nearby, two of which were four-lane roads.

7 Diversity and resilience
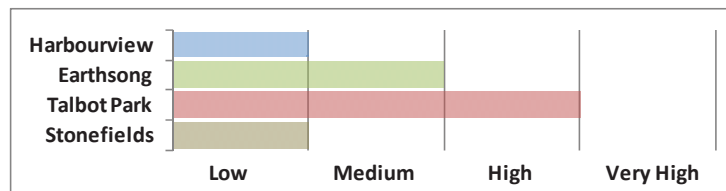
Figure 15. Diversity and resilience

The diversity and resilience questions cover the mixture and uses of buildings and open spaces in the neighbourhood, as well as the size and style of dwellings and their accessibility to people on lower incomes. This includes how well the buildings in the selected neighbourhood complement those in surrounding areas.

Although both Talbot Park and Harbour View provide exclusively residential buildings, with no mix of use, Talbot Park is scored highly; as a Housing New Zealand owned development it provides low-cost, social housing, while Harbour View provides no such residences and received a 'Low' score. According to the Stonefields (2007) and Earthsong websites (Earthsong Eco-Neighbourhood, n.d.-b), both are intending to develop commercial business space (the Earthsong commercial site is to be developed by a separate company but on adjoining land), and while existing buildings may be used for work-from-home purposes, they are essentially residential buildings.   The small difference between the 'Medium' score of Earthsong and the 'Low' score of Stonefields is mainly due to the former having a wider range of facilities within walkable distance.

8 Street network
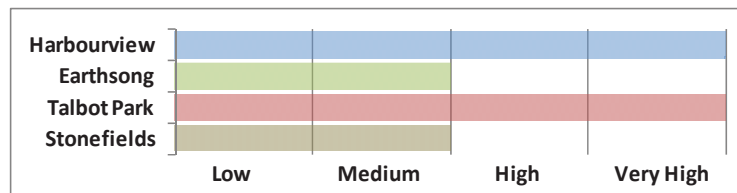
Figure 16. Street network

This section expands on ideas of pedestrian safety from section six, and includes solar orientation and connectivity of streets. While the smallest neighbourhood – Earthsong – does not really have a street network, the pathway leading through the site acts as a pedestrian street for the neighbourhood, and many of the questions were still relevant.

Harbour View and Talbot Park were ranked 'Very High', due to their solar orientation of buildings and good connectivity. All cases performed well in this section, with measures to reduce traffic speeds within the neighbourhood, although Earthsong lost points as its 'street' is private and not open to the public 24 hours a day. The Stonefields development has issues with connectivity due to former quarry walls and the slopes of Mt Wellington acting as a physical barrier on three sides, and roads in undeveloped parts of the neighbourhood are fenced off from the public.

9 Eco-alternatives
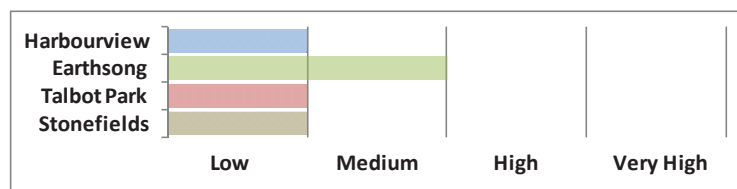
Figure 17. Eco-alternatives

Section nine gives the opportunity for additional sustainability initiatives to be identified, and many of these features must be provided on a neighbourhood-wide scale to qualify for points. Some examples of eco-alternatives in this

section are communal composting, or food growing areas, car sharing schemes and on-site electricity generation.

All cases scored 'Low' except for Earthsong, which achieved a 'Medium' score. Few developments included any eco-alternatives at all, although Earthsong and Stonefields both scored additional points for their storm-water retention ponds. As section five does not ask about the construction methods, Earthsong's untreated timber and rammed earth walls are included here under 'other'. These additional 'eco-alternatives' are not scored individually, but are given a maximum of two points, despite the number, or importance of these features, limiting their significance in the final score.

Overall neighbourhood sustainability rating
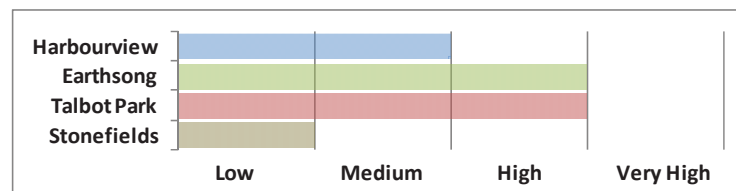
Figure 18. Overall sustainability of all cases

The overall scores are useful to compare cases at a high level, and demonstrate the contribution a wide range of initiatives can make to the sustainability of neighbourhoods. Both Earthsong and Talbot Park scored a 'High' overall rating for neighbourhood sustainability, and as neighbourhoods, they have very different priorities for residents, and different historical context; one being developed by a cooperative of future residents, and the other being developed by a government department. Harbour View's overall rating of 'Medium' reflects its strengths in some ways, for example open spaces and protection of waterways, and its weaknesses regarding public transport. Stonefields 'Low' total reflects its incompletion as well as isolation from transport options and poor linkages to neighbouring areas. In general the four rating categories of 'Low', 'Medium', 'High' and 'Very High' disguises how close together the cases are. Although two cases were rated 'High', no case scored above 53 percent of the total points available, and the lowest score was 36

percent. Results have been presented in this format as it best represents the way the tool is intended to be used.

Summary

There were some commonalities across the cases, all cases scored very highly for section one: walking access to basic facilities. While Stonefields is the notable exception to this, it is expected that on completion it would achieve a 'Very High' score. Also highly rated among all the cases was the quality of space, section six. Together these show that the location of these developments, and their neighbourhood design is a common strength, and major contribution to their overall sustainability. Scores were mixed for section two, regarding the neighbourhood's access to public transport. Earthsong and Talbot Park had access to both rail and bus transport, while Stonefields and Harbour View scored no points as the frequency of public transport services was deemed inadequate. While the proximity to transport is a consideration for locating a neighbourhood development, the frequency of transport provision is something that the developers have no control over. The 'Low' score among all cases for eco-alternatives was notable. Few points were scored in this section for any case, and it is these sustainable housing features and new technologies which feature most strongly in the international cases which follow.

Chapter 6

Is there an 'Auckland approach' to sustainability?

Two research methods were introduced in chapter four: the use of an observational tool to assess the sustainability of Auckland neighbourhood cases, and a comparison between international and local cases in order to explore whether there is a characteristic Auckland approach addressing sustainability. This chapter compares neighbourhoods by theme, using Barton's (2000) checklist for Sustainable Neighbourhoods. International cases are briefly introduced and their sustainability features are then compared with the Auckland neighbourhoods, looking in particular at whether there are any areas in which the international cases perform more strongly than the Auckland cases, or vice versa.

6.1 Overview of the international cases

International cases have been purposively sampled, like the Auckland cases, based on the quality of information available, as well as their national and geographic contexts, and scale of development. Like the domestic cases, the international cases are referred to in literature as examples of neighbourhood sustainability (Low, et al., 2005; Ritchie & Thomas, 2009). Each neighbourhood has been selected from a different country, with its own social, climatic and environmental concerns. Each case also has its own key sustainability issues on which its design is focussed on resolving.

Christie Walk

Located in Adelaide, Australia, Christie Walk provides 27 dwellings over 2,000 square metres (Urban Ecology Australia, 2010, 'Basic Facts'), making it the densest development of the case studies presented with 135 dwellings per hectare. The development was undertaken by Urban Ecology Australia, a non-profit educational and activist group advocating and practising Eco-City design (Crabtree, 2008). The Christie Walk project was initiated after the larger and more ambitious 'Halifax EcoCity Project' fell through (Crabtree, 2008; Low, et al., 2005). The construction started in 2000, with the final stage completed in 2006 (Wheeler & Beatley, 2009), and it provides a mix of stand-alone 'cottages', three-storey terraced townhouses and a block of apartments which includes a common space, library, kitchen and laundry. Its key issues are water and energy efficiency, reuse and reduction of waste, and providing people-friendly spaces (Urban Ecology Australia, 2010).

Christie Walk combines the issues of water demand and treatment of storm-water runoff by collecting roof runoff in tanks and reusing this for flushing toilets and watering gardens (Natural Space Ltd, 2004a; Urban Ecology Australia, 2010). Extensive soil planted roof gardens further reduce runoff, and provide insulation and plantable garden space in a small neighbourhood (Urban Ecology Australia, 2010). Thermal mass, natural ventilation, solar water heating and photovoltaic power generation are incorporated to reduce the demand for energy used in heating and cooling (Low, et al., 2005; Urban Ecology Australia, 2010).

Although the compact site provides little room for non-residential facilities, Christie Walk reduces the need for residents to use private motorised transport due to its central city location which is close to public transport and other city amenities (Low, et al., 2005; Urban Ecology Australia, 2010; Wheeler & Beatley, 2009).

The neighbourhood design has kept buildings compact to allow walking paths and communal food gardens throughout the neighbourhood. Cars are kept to

the neighbourhood's edges to create a pedestrian friendly environment (Urban Ecology Australia, 2010). The overall design "balances this sense of privacy with a sense of wider coherence and unity" (Crabtree, 2008, p. 1).

Christie Walk developers have not included social rental housing, but have endeavoured to keep the cost of properties down, as it was important to the developers that Christie Walk house prices remained "comparable to conventional inner-city properties in Adelaide" (Urban Ecology Australia, 2010, 'House Prices'). Actual house prices range from $150,000 to over $400,000 (prices in Australian dollars) (ibid).

Beddington Zero Emission Development

Beddington Zero Emission Development (BedZED) is a residential development completed in Surrey, England in 2002 by the Peabody Trust (BioRegional, 2010; Ritchie & Thomas, 2009; Wheeler & Beatley, 2009). BedZED was initiated by BioRegional, a charitable organisation which promotes sustainable business and housing, as a working example of a sustainable neighbourhood (BioRegional, 2010). A key part of the BedZED brief was to reduce the amount of fossil fuels used in car trips to half that of a typical neighbourhood over ten years (Low, et al., 2005). This was driven by concern over the unsustainable origins of much of the UK's energy supply – particularly nuclear power – and the size of the average UK citizen's carbon footprint: "If everyone in the world enjoyed the same level of natural resource consumption as a typical UK citizen, we would need three planets to support us" (Lazarus, p. 4).

The design includes a wide range of sustainability initiatives. The choice to reuse a formerly industrial site by capping contaminated soil beneath the houses, and its density (82 units over 1.65 hectares) preserve greenfield sites which might otherwise have been used (Natural Space Ltd, 2004a). As part of BedZED's attempt to reduce the carbon footprint of its residents, construction materials were sourced locally "from a 35 mile radius of the site" as much as possible (Natural Space Ltd, 2004a). BedZED also makes use of solar panels on the roofs of houses, and aims to further reduce energy demand by designing

buildings to maximise passive solar gain and including high levels of insulation (Natural Space Ltd, 2004a). Roof runoff is collected in tanks and reused for flushing toilets and watering gardens (Natural Space Ltd, 2004a). Sedum roof planting insulates roofs and further reduces runoff.

BedZED takes into account resident behaviour as well as design and construction, including the production of waste and consumption choices for food. To encourage the use of 'active' and public transport, care was taken to locate the neighbourhood close to existing public transport links. BedZED is within walking distance to rail and bus transport and new residents are provided with cycling packs to encourage this mode of transport (BioRegonal, 2010). The use of motor-vehicles is restricted by charging residents for allocated parking spaces, which are prioritised for accessibility vehicles and electric or low-emission vehicles. Like Christie Walk, BedZED also keeps parked cars to the periphery of the development, and a fleet of electric powered club cars are available for residents' use which are powered by photovoltaic cells on the roofs of dwellings (BioRegonal, 2010).

BedZED provides a range of residential units, as well as commercial and 'live/work units' (Wheeler & Beatley, 2009). The developer; the Peabody Trust is a major social housing provider in the UK, and BedZED includes 25% social housing for rent and 25% key worker shared ownership (BioRegonal, 2010). Although on a small site, the neighbourhood includes a cafe and shop, nursery, sports field and clubhouses on-site, with an adjoining eco-park proposed for future development (Ritchie & Thomas, 2009). Recycling is managed on-site, and communal gardens are available for local food production (BioRegonal, 2010).

Bo01 – Vastra Hamnen

Vastra Hamnen ('West Harbour') in Malmo, Sweden is located on the site of a former shipyard and car factory (Low, et al., 2005). It was purchased by the city of Malmo in 1996 for redevelopment (Sustainable Cities, n.d.), as part of an international housing exhibition in 2001 to showcase "design and holistic

sustainability measures" (Ritchie & Thomas, 2009, pp. 168-169). Bo01 is the first neighbourhood within Vastra Hamnen to be completed, and covers 25 hectares with 559 housing units (Natural Space Ltd, 2004b), an average residential density of 22 dwellings per hectare. The redevelopment of the remaining Vastra Hamnen area continues in stages, with a smaller project called 'Flaghussen' the next to be constructed.

Bo01 deals particularly with energy supply and design of space. Power is supplied to the neighbourhood through entirely renewable sources, including wind turbines, photovoltaic cells, and the use of an underground aquifer as a heat pump to cool homes in summer and heat them in winter (Low, et al., 2005; Natural Space Ltd, 2004b). Household waste is converted into biogas and returned to apartments "for cooking, for local transport and for running the waste removal vehicles" (Natural Space Ltd, 2004b, unpaged).

The neighbourhood is designed to encourage walking and cycling, with parked cars kept to the edge of the development. It provides good access to public transport and on-site facilities such as early childcare and schools, as well as community and shopping centres and premises for 80 companies employing 6,000 people (Low, et al., 2005, p. 63; Natural Space Ltd, 2004b). The site is described as a 'distorted grid', "an adaptation of the broad grid boulevards in the local district and allows a diversity of human and social experience within" (Natural Space Ltd, 2004b, unpaged).

As water consumption is not considered an issue in Sweden, it is not a key area for Bo01(Ritchie & Thomas, 2009), but it has included a green points system to encourage native wildlife back in to the residential area (Low, et al., 2005) (Ritchie & Thomas, 2009).

Although the Bo01 developers have been criticised for only catering to a homogeneous upper-class population (Sustainable Cities, n.d.), the planned 'Flaghussen' development neighbouring Bo01is intended to provide affordable options, with two-thirds available as low cost rentals (Ritchie & Thomas, 2009, pp. 168-169).

Kronsberg

Kronsberg is built on the semi-rural outskirts of Hannover City, Germany. It was built by the Hannover City Council as part of its contribution to the Hannover World Expo 2000 and "a contribution to its obligations under the UN's 'Agenda 21' and the Aalborg Charter" (Low, et al., 2005, p. 56). The development employs building design to maximise passive solar energy and uses different technologies for on-site energy generation, but it places special emphasis on the management of rainwater. The largest of the case studies, the entire Kronsberg site covers 160 hectares and is planned to provide 6,000 dwellings but the first phase has constructed 3,000 dwellings so far (Low, et al., 2005, p. 56; SECURE).

Kronsberg's main theme is its approach water consumption and storm-water runoff, with a target to save 100,000 cubic metres of water each year (Low, et al., 2005). Storm water from public areas is treated onsite via bio-swales and retention boulevards and rainwater is collected from roofs and private, paved areas and directed into a system of ponds and wetlands, or reused in flushing toilets (Low, et al., 2005; Wheeler & Beatley, 2009). The development also aims to reduce neighbourhood carbon emissions by 60% compared with conventional housing. Electricity is supplied by wind turbines, solar panels and an on-site gas powered station (Low, et al., 2005; Wheeler & Beatley, 2009).

To promote diversity within the neighbourhood, Kronsberg includes flexible dwellings of varied sizes and provides independent living for elderly and disabled residents through its FOKUS program (City of Hannover, 2003; Connected Cities). It also includes specific house designs and a programme to meet the needs of new immigrants (ibid).

Kronsberg developers reforested 60 hectares in its development (Wheeler & Beatley, 2009) and designed the neighbourhood to encourage walking and cycling. No dwelling is further than 600 metres from a tram stop. (Low, et al., 2005), and traffic calming, car-sharing and restriction of carparks to 0.8 per apartment (Wheeler & Beatley, 2009) discourages motor-vehicle use. It also

provides a number of facilities for residents on-site and within walking distance, these include early childcare and schools, as well as community centres, garden allotments, and an organic farm providing food directly to the area (Low, et al., 2005).

To maintain the standards implemented at the outset of the Kronsberg development, the Hannover City Council developed the 'Kronsberg Standard', regulations for homes built in the Kronsberg area, supported by training for contractors and site visits (Low, et al., 2005).

6.2 International sustainability initiatives by theme

The Beacon Pathway neighbourhood sustainability observation tool assesses sustainability in nine key areas; walkability, public transport, land-use and town centres, environmental protection, dwelling construction, open space, social diversity, street networks and green technology. These areas relate to the key features of neighbourhood sustainability discussed by Choguill (1993). This requires that they are first of all ecologically sustainable and that they: are limited in size (though large enough for interest groups to develop), are pedestrian scaled, provide residents with employment; shops and meeting places and have clear boundaries. As Beacon Pathway's observational tool was unsuitable for international assessments due to the need for site visits and to a lesser degree, its design for the New Zealand context, it was not used to evaluate these cases. Instead, Barton's (2000) *'A Sustainability Checklist, Applied to Neighbourhoods'* is used to compare the Auckland cases against the international cases presented above. The analysis is presented by the six themes of the checklist, and aims to answer the second question for this research: is there an Auckland approach to sustainability?

Most of the sustainability areas covered in the observational tool are covered by one or more items on Barton's checklist. This covers six different elements of sustainability: Global Ecology, Natural Resources, Local Environment, Social

Provision, Economic Sustainability and Social Sustainability. There are some subtle differences which may be due to the different contexts of each resource, the observational tool having been developed for use in New Zealand, and Barton's checklist being adapted from UK Governmental guidance on environmental assessments (Barton, 2000). Areas which Barton does not count as important as the observational tool are the re-use of existing town centres and developed sites, and measures to protect waterways, although there is some partial coverage of these through the requirement for walking access to a range of services (which might be found in a town centre) and through local surface water treatment, which goes some way to address water protection if not plantings and ownership as the observational tool does.

In the table below, two ticks indicates that the neighbourhood positively addresses the particular sustainability criteria and a cross indicates that it does not. In some cases there was insufficient information, or no information about the particular criteria – this is shown by a dash in the table. A single tick in the table is used where a neighbourhood has partially met the sustainability criteria described.

Table 1. All cases according to Barton's Sustainability Checklist

	Harbour View	Talbot Park	Earth song	Stone fields	Bo01	Bed ZED	Christie Walk	Krons berg
Global Ecology								
Locations that minimise trip length and are well served by public transport	X	✓✓	✓✓	✓	✓	✓	✓✓	✓✓
Design that fosters walking and cycling and discourages car reliance	✓	✓	✓✓	✓	✓✓	✓✓	✓✓	✓
Energy-efficient built form and layout	-	-	✓✓	-	✓✓	✓	✓✓	✓
Development of community renewable energy	X	✓	✓✓	X	✓✓	✓✓	✓✓	✓✓
Wildlife refuges and corridors	✓✓	X	X	X	✓✓	X	X	✓
Natural Resources								
Traffic reduction and air quality management	X	X	✓✓	X	✓✓	✓✓	✓✓	✓
Local [water] sourcing and demand management	X	✓✓	✓✓	✓✓	X	✓✓	✓✓	✓✓
Local surface water/sewage treatment, aquifer recharge	✓	X	✓✓	✓✓	-	✓✓	✓✓	✓✓
Higher densities to reduce urban land take	✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Local composting/organic recycling schemes	X	X	✓✓	X	✓✓	✓✓	✓✓	✓✓
Locally-sourced and recycled building materials	X	✓	✓✓	✓	-	✓✓	✓✓	-
Local Environment								
Attractive pedestrian-scale local environment	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Legible environment with a sense of place	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Design reflecting distinctive landscape and cultural heritage	✓✓	✓	✓✓	✓✓	✓✓	✓	✓	✓
Social Provision								
Accessible, good quality health, educational retailing and leisure facilities	✓✓	✓✓	✓✓	X	✓✓	✓✓	✓✓	✓
Diverse, affordable good quality housing stock	✓	✓✓	✓	X	X	✓✓	✓	-
Adaptable good quality commercial / institutional space	X	X	✓	✓	✓✓	✓✓	X	✓✓
Accessible, well run parks / playgrounds / playing fields / allotments	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓	✓✓
Adaptable , easily maintained road and utility networks	✓	✓	✓✓	✓	-	-	-	-
Economic sustainability								
Diverse and accessible job opportunities with good local training services	X	✓	✓	✓	✓✓	-	-	✓
Encouragement for local offices / workshops, home-working and tele-centres	X	X	✓✓	✓✓	✓✓	✓✓	X	✓✓
Social Sustainability								
Pollution-free environment facilitating healthy exercise, local food production and mental well-being	✓	✓	✓✓	✓	✓✓	✓	✓	✓✓
Safe traffic-calmed streets with good visual surveillance	✓✓	✓✓	✓✓	✓✓	✓✓	✓	✓✓	✓✓
Neighbourhood social balance and continuity	✓	X	✓✓	✓	✓	✓✓	✓✓	✓✓
Access to housing for all social groups	-	X	✓	-	X	✓✓	✓✓	✓✓
All facilities accessed by foot or public transport, with special attention to needs of children and the disabled.	✓	✓	✓	X	✓	✓	✓	✓✓

Global Ecology

Table 2. Global Ecology

Global Ecology	Harbour View	Talbot Park	Earth song	Stone fields	Bo01	Bed ZED	Christie Walk	Krons berg
Locations that minimise trip length and are well served by public transport	X	✓✓	✓✓	✓	✓	✓	✓✓	✓✓
Design that fosters walking and cycling and discourages car reliance	✓	✓	✓✓	✓	✓✓	✓✓	✓✓	✓
Energy-efficient built form and layout	-	-	✓✓	-	✓✓	✓✓	✓✓	
Development of community renewable energy	X	✓	✓✓	X	✓✓	✓✓	✓✓	✓✓
Wildlife refuges and corridors	✓✓	X	X	X	✓✓	X	X	✓

One of the areas to be addressed for a development to qualify as a Sustainable Neighbourhood is an approach to improving global ecology. Global Ecology covers the neighbourhood's effects on the wider environment. This includes considerations of biodiversity, the location of the neighbourhood, and the generation of renewable energy. The difference between the international neighbourhoods and the Auckland neighbourhoods in terms of Global Ecology is largely due to a greater emphasis among the international neighbourhoods on selecting sites which reduce the need for travel, and on meeting demand for power at a local level.

Neighbourhoods which are located at the fringes of town and city centres require longer trip lengths even if they have good access to public transport. In the heart of Adelaide, Christie Walk is close to retail, education and employment centres. While Kronsberg, Bo01 and BedZED all have good access to public transport, they are all located on the outskirts of city centres. Despite accessible public transport, residents may need to make longer trips to city centres for employment or specialised services not provided in a typical suburban centre. The same is true for some Auckland cases, while Earthsong's location was selected for its proximity to rail and retail services, it is over three kilometres from a main centre. Talbot Park was already established close to bus and rail links and like Stonefields is far more centrally placed. Harbour View is isolated from main centres both geographically, and through infrequent transport, meaning it does not meet all the criteria for this theme.

Local generation of energy is one area in which all the international neighbourhoods are strong. Compared with the Auckland cases, the international neighbourhoods use more innovative approaches to meeting energy demands. While Earthsong and the renovated units of Talbot Park include solar hot water heating, BedZED and Christie Walk provide solar water heating and generate photovoltaic electricity to reduce reliance on the national grid. Kronsberg makes use of wind turbines and solar panels to meet energy demand, as well as a gas powered generator. Bo01 has perhaps the most novel approach; like Kronsberg it uses wind turbine generation and solar panels to meet electricity needs, but also uses an underground aquifer to regulate dwelling temperatures, and recycles household waste into bio-gas for use in the neighbourhood.

Reduction of motorised transport overlaps with the theme below as it contributes to both Global Ecology and Natural Resources. As a group, the international neighbourhoods employed more methods than the Auckland cases to reduce motor vehicles within the neighbourhoods, which is one of the main points of difference in the following section. Whether they are Auckland-based or not, a key factor in provision of wildlife refuges appears to be the size of the neighbourhood. Smaller neighbourhoods have maximised dwelling density at the expense of natural open spaces, although larger cases such as Kronsberg and Bo01 have included reforestation and wildlife habitats respectively to contribute to biodiversity in their regions. As noted in chapter five, there is insufficient information to know whether the buildings themselves contribute to the neighbourhood's sustainability. Overall, the contributions of the international cases to Global Ecology were stronger than the Auckland cases because of a greater range of initiatives at the neighbourhood level, particularly to provide energy and reduce transport related carbon emissions.

Natural Resources

Table 3. Natural Resources

Natural Resources	Harbour View	Talbot Park	Earth song	Stone fields	Bo01	BedZED	Christie Walk	Krons berg
Traffic reduction and air quality management	✓	✓	✓✓	✓	✓✓	✓✓	✓✓	✓
Local [water] sourcing and demand management	X	✓✓	✓✓	✓✓	X	✓✓	✓✓	✓✓
Local surface water/sewage treatment, aquifer recharge	✓	X	✓✓	✓✓	-	✓✓	✓✓	✓✓
Higher densities to reduce urban land take	✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Local composting/organic recycling schemes	X	X	✓✓	X	✓✓	✓✓	✓✓	✓✓
Locally-sourced and recycled building materials	X	✓	✓✓	✓	-	✓✓	✓✓	-

Where Global Ecology is concerned with the worldwide impacts of carbon emissions and biodiversity, Natural Resources looks at local air quality, and consumption of water, land and building materials. A common area of strength across both Auckland and international cases is the density of the neighbourhoods. However, there is a marked difference between the two regarding neighbourhood recycling schemes, and as with Global Ecology, reduction of traffic through the neighbourhood.

As well as proximity to key services, neighbourhood design can encourage active modes of transportation (those requiring human energy) such as walking and cycling. While all the neighbourhoods have implemented high design standards, some discourage motor vehicles more actively than others. Of the Auckland cases, Harbour View, Talbot Park and Stonefields all provide a mix of garaging, carports, on and off-street parking in quantities similar to conventional suburbs. While Kronsberg includes similar provisions, it has limited carparks to 0.8 per apartment (Wheeler & Beatley, 2009). Earthsong, Bo01, BedZED and Christie Walk have all ensured that off-street parking is arranged to the edge of neighbourhoods, encouraging residents to walk through the neighbourhood, rather than driving up to their houses.

While all international neighbourhoods provided some communal facility for composting or recycling organic material, the same was true of only Earthsong among the Auckland cases. In other areas, such as using higher densities to

reduce the amount of land taken up by housing, and treatment of rainwater, Auckland cases were comparable to the international cases. In general, however, the international cases employed slightly more comprehensive methods in dealing with protection of Natural Resources.

Local Environment

Table 4. Local Environment

Local Environment	Harbour View	Talbot Park	Earth song	Stone fields	Bo01	BedZED	Christie Walk	Krons berg
Attractive pedestrian-scale local environment	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Legible environment with a sense of place	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Design reflecting distinctive landscape and cultural heritage	✓✓	✓	✓✓	✓✓	✓✓	✓	✓	✓

Barton's Local Environment theme regards the overall neighbourhood design, its scale, legibility and whether it is appropriate to the surrounding landscape and culture. It is interesting that all the neighbourhoods – either fully or partially – met these criteria.

Each neighbourhood has worked to create environments in which residents would want to walk, socialise and recreate and provide a sense of place through public artworks, gardens and parks. As with the Beacon data capture, questions of quality or the attractiveness of space are entirely subjective and it is particularly difficult to assess whether international neighbourhood developments reflect their cultural heritage. Two examples which incorporate their unique contexts are Bo01, with boardwalks along its 'West Harbour' and dwellings oriented towards the sea, and Harbour View, with native bushwalks along the coastal edge and a neighbourhood park which makes a feature of a former WWII gun emplacement.

The high number of cases both domestically and internationally which meet the criteria for local environment quality shows that the strengths of the local cases from the observational assessments are not unique to Auckland.

Social Provision

Table 5. Social Provision

Social Provision	Harbour View	Talbot Park	Earth song	Stone fields	Bo01	BedZED	Christie Walk	Krons berg
Accessible, good quality health, educational retailing and leisure facilities	✓✓	✓✓	✓✓	X	✓✓	✓✓	✓✓	✓
Diverse, affordable good quality housing stock	✓	✓✓	✓	X	X	✓✓	✓	-
Adaptable good quality commercial / institutional space	X	X	✓	✓	✓✓	✓✓	X	✓✓
Accessible, well run parks / playgrounds / playing fields / allotments	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓	✓✓
Adaptable , easily maintained road and utility networks	✓	✓	✓✓	✓	-	-	-	-

Social Provision is distinct from Social Sustainability, although there is some overlap. This theme mainly covers the notion of equity, ensuring that the neighbourhood caters for everyday residential needs, as well as providing affordable and flexible buildings. Auckland and international neighbourhoods are fairly mixed with regard to this theme, but the main point of difference is greater availability of commercial space within the international neighbourhoods. One point in common between both sets of cases was the high standard of open spaces provided in all neighbourhoods.

Barton's checklist (2000) features the need to have adaptable commercial space within the neighbourhood, and this is repeated in the Economic Sustainability theme below. Commercial space is not included in any of the Auckland cases, although both Stonefields and Earthsong intend to include such spaces and Stonefields has commercially zoned land available. In contrast, three of the four international cases have included commercial space within the neighbourhood development. The size of the neighbourhood development may also be a constraint on the provision of commercial space. On a site of only 2,000 square metres, Christie Walk has focussed on neighbourhood density and usable garden spaces over providing commercial facilities.

Access to facilities overlaps with many other ideas in this framework, such as walkability and mixed use. Neighbourhoods which are close to the city centre

and have good transport options therefore provide the most services. However, neighbourhoods such as Earthsong are within walking distance to such everyday facilities as shops, schools and medical centres.

All cases attempt to provide some variety of housing styles to meet the needs of different residents, although some do more than others to establish a diverse population. Quality and varied housing styles may promote neighbourhood diversity, but the high end target markets of Bo01 and Stonefields do not. The two co-housing initiatives, Earthsong and Christie Walk have tried to keep costs down, however as they were self-developed by residents costs have had to be reflected in house prices, and although Earthsong provides rental accommodation its freehold houses are on-sold at market value.

The international cases have included mixed use design more than the Auckland cases, but neither are consistent with regard to providing affordable and diverse housing. Well run parks and open spaces are present in all neighbourhood cases, reflecting the strength that presentation of the local environment plays in these cases.

Economic Sustainability

Table 6. Economic Sustainability

Economic sustainability	Harbour View	Talbot Park	Earth song	Stone fields	Bo01	BedZED	Christie Walk	Krons berg
Diverse and accessible job opportunities with good local training services	X	✓	✓	✓	✓✓	✓	✓✓	✓
Encouragement for local offices / workshops, home-working and tele-centres	X	X	✓✓	✓✓	✓✓	✓✓	X	✓✓

The Economic Sustainability theme is concerned with the range of job and training opportunities in the neighbourhood and support for new businesses. Again, this theme overlaps with others. The accessibility of services contributes to Social Provision and Social Sustainability, as does the presence of suitable commercial premises.

While commercial premises may be accessible from the neighbourhood, it can be challenging to fit them within the neighbourhood itself unless it is large

enough to support enterprises beyond a basic neighbourhood centre. This is the case in only one example, Bo01, which is host to a far greater range of commercial enterprises than the neighbourhood shops, crèches and services provided in either Kronsberg or BedZED. Christie Walk, though hosting no facilities on-site is in the centre of Adelaide, making a wide range of opportunities available. Encouragement of local businesses is restricted by the restrictions of a small site in the case of Christie Walk, and by single-use zoning for both Talbot Park and Harbour View.

Social Sustainability

Table 7. Social Sustainability

Social Sustainability	Harbour View	Talbot Park	Earth song	Stone fields	Bo01	BedZED	Christie Walk	Krons berg
Pollution-free environment facilitating healthy exercise, local food production and mental well-being	✓	✓	✓✓	✓	✓✓	✓✓	✓	✓✓
Safe traffic-calmed streets with good visual surveillance	✓✓	✓✓	✓✓	✓✓	✓✓	✓	✓✓	✓✓
Neighbourhood social balance and continuity	✓	X	✓✓	✓	✓	✓✓	✓✓	✓✓
Access to housing for all social groups	-	X	✓	-	X	✓✓	✓✓	✓✓
All facilities accessed by foot or public transport, with special attention to needs of children and the disabled.	✓	✓	✓	X	✓	✓	✓	✓✓

Social Sustainability is one factor of Sustainable Neighbourhoods, the ideal is that a neighbourhood has a socially diverse population with a mix of ages, ethnicities and income groups to spread demand for social services and to allow residents to age and meet their changing needs without having to move to another neighbourhood. The main difference between the Auckland cases and the international neighbourhoods was the level of access for all groups in society, and the ability to access facilities by walking to them.

Access for all social groups is mixed across all the cases. Kronsberg's programmes to encourage elderly, disabled and new immigrants into the neighbourhood, is the most involved approach to ensuring inclusion of social groups. Among other neighbourhoods the main method of providing social balance in each neighbourhood is by providing a mix of building styles, sizes and prices. This is something included in most of the international cases, but

only Earthsong domestically. While Stonefields, Talbot Park and Bo01 provide a range of housing types and sizes, a particular target market in each case may prove a barrier to diversity, and Talbot Park providing exclusively social housing in a low income area does nothing to overcome this.

As all international cases – and most Auckland cases – have included public transport, or are located near existing services, and many include facilities internally they partially fulfil this criterion, however Kronsberg is the only neighbourhood development to have explicitly mentioned the needs of disabled residents.   As Stonefields is incomplete and has poor walking and public transport access to services, it does not address this requirement.

Social Sustainability is one area most cases could have better addressed, although the international cases did satisfy more elements of the checklist than the Auckland cases.   In the provision of pollution-free environments, all neighbourhoods are constrained by their own urban contexts, and not all provide either the individual space, or the communal allotments for local food production. Once again the area of strength for the Auckland cases - provision of safe streets within neighbourhoods - is also matched by the international neighbourhoods, which share an emphasis on design quality and the need to balance the needs of pedestrians with motorists.

Summary

Using Barton's (2000) checklist for sustainable neighbourhoods, it is possible to see that the areas of strength common to the Auckland cases were also areas of strength for the international neighbourhoods in implementing sustainability. All cases have also demonstrated concern for improving the built environment wider than each individual dwelling, by investing in parks and shared spaces, and providing safe streets and pathways for the neighbourhood.

Although the Auckland cases covered fewer elements than the international neighbourhoods, both groups were mixed in their coverage of the Social Provision, Social Sustainability and Economic Sustainability themes.   The

clearest difference between the Auckland and international examples was under Global Ecology and Natural Resources. The sustainability of the Auckland cases would benefit from simple efforts to manage recycling locally, as well as a different approach to the infrastructure of the neighbourhood. Looking out from Auckland at international cases it is possible to see much more scope in the kinds of sustainability initiatives used in housing, especially with regard reducing demand for, and locally supplying power. International examples demonstrate active as well as design-based measures to reduce the proportion of travel undertaken by private motor-vehicle. In comparison, most of the Auckland cases appear to enshrine this as the dominant transport mode. Overall, which aspects of sustainability each development focuses on depends on both their physical and social context, but also on the priorities and abilities of the developers driving the project. Although they have individual merits, as a group the Auckland cases excel in the sustainable neighbourhood form rather than function.

Chapter 7

Discussion

Earlier chapters reviewed the concept of sustainability and different theoretical approaches to sustainable housing. This chapter reflects on how the fluid concepts have proved an issue for carrying out the research, and how sustainable the selected Auckland case studies are within the defined approach to sustainable housing. I will also cover some of the implications of the research method selected, in particular the use of an off-the-shelf assessment tool, and the availability of appropriate data. The research objectives identified at the outset of the project were: to assess the sustainability of Auckland neighbourhoods; and to explore the approach of Auckland developments to enhancing neighbourhood sustainability. The sustainability of Auckland's neighbourhoods is addressed by exploring the four Auckland case studies and their respective ratings from the Beacon neighbourhood assessment tool. To complement the Auckland case studies, international case study details are discussed to contrast some of the regional influences present in Auckland's housing options, and the kinds of sustainability technology, design and ideas which are employed in Auckland. These regional strengths and weaknesses are discussed finally alongside some potential barriers to sustainable housing introduced in the background.

7.1 Concepts and definitions

Before examining Auckland housing, it was necessary first to address concepts of sustainability, sustainable housing and urban design. It also became necessary to define what is meant by 'neighbourhood'. As discussed in chapter two, 'sustainability' and 'sustainable housing' are terms frequently used, but seldom defined. Discussions of sustainability commonly cite the Brundtland report 'Our Common Future' (World Commission on Environment and

Development, 1987), but this is actually a definition for Sustainable Development, and carries an underlying assumption that development is necessary and inevitable in human endeavour around the planet. Other theories of sustainability, such as Barton (2000), argue that reconciling sustainability and development is not always so simple, and the notion of sustainable development is a 'paradox'. In the discussion of sustainability in chapter two, three themes emerged: those of ecological sustainability (D. H. Meadows & Meadows, 2007), social equity (United Nations., 1992) and economic sustainability (World Commission on Environment and Development, 1987). These three principles are also present in many approaches to sustainability in urban development.

While it is possible to find any number of individual houses which have employed sustainable methods in their construction, these represent the efforts of individuals in isolation, and do not take the surrounding environment into account. It is not possible to look at implications for transport, or contribution to the wider built environment or social structures when considering a single dwelling. In selecting an approach to centre the research, Sustainable Neighbourhoods provided a holistic philosophy of what contributes to sustainable houses, as well as a useable scale – larger than individual houses – but more manageable than Eco-Cities. Barton's (2000) discussion of Sustainable Neighbourhoods includes a checklist covering six different elements of sustainability (Global Ecology, Natural Resources, Local Environment, Social Provision, Economic Sustainability and Social Sustainability). As mentioned in the previous chapter, although there are some differences between Barton's checklist and the observational tool – which may be due to their different contexts – features included in the observational tool are largely covered by one or more items on Barton's checklist. Like a holistic approach to sustainability, this requires that sustainable housing must address ecological, social and economic spheres.

The Sustainable Neighbourhoods approach underpins the neighbourhood rating tool Beacon Pathway created for planners and developers to use. The purpose of the Neighbourhood Sustainability Observational Tool (Saville-Smith, et al.,

2005) is to help planners or developers identify areas where a neighbourhood's sustainability can be improved (Beacon Pathway Ltd, 2008b). A combination of observational and collected data are input on different themes – such as walking access to basic everyday facilities – access to public transport, efficient use of space and viability of local centres, and the tool ranks each section from 'Low' to 'Very High', and also provides an overall sustainability score. The tool has been used in the context of this research to compare Auckland case studies to one another using a standard measure.

Using the assessment tool in this way, it was necessary to define the concept of 'neighbourhood', as this is the reference for all the questions asked. The definitions of 'neighbourhood' and 'sustainable neighbourhood' provided by Saville Smith et al (2005) and Choguill (1993), provide only a loose description of neighbourhood attributes, rather than a useable definition. A definition of 'neighbourhood' is needed however, when using the observational tool, or undertaking research on a particular neighbourhood. The neighbourhood is in fact a sample of houses to assess within any given city, but it is also a sample unit, within a city made up of numerous neighbourhoods. As mentioned in chapter four, the selected development acts as 'the neighbourhood' for the purpose of this study. In the case of Stonefields, this was complicated by the fact that the development, its houses, parks, roads and business areas are only partially completed and occupied. As noted in chapter five, the decision to consider the entire site in its incomplete state as the neighbourhood meant that its sustainability rating has been negatively affected.

7.2 Reflections on using the Beacon tool

As it was impractical to design my own assessment tool for the case studies included in the research, Beacon Pathways' Neighbourhood Sustainability Framework Observational Tool offered an approach to sustainability which was compatible with my research approach, and a user-friendly format which was locally developed and therefore appropriate for the Auckland context. Using

any decision-making tool designed elsewhere can have issues however, and in this case, some aspects of the tool were unexpected or counter-intuitive in places.

While much of the data required to complete each section was observational, some factual details of the building and construction were required, and as data for the whole neighbourhood were required, the scale could be difficult. As there were challenges in obtaining the right data to complete the Beacon rating exercise, some proxy details had to be entered to ensure cases were being compared on the right details rather than those which were absent. Detailed information such as the actual amount of impervious surfaces was not available, for example, and while exact details for a particular dwelling might be available from such sources as a site file from the relevant council, this would be for an individual property only. As data is needed for the whole neighbourhood, this would be an impractical and potentially expensive way to source data.

Data requirements to complete the observational assessments were quite high. Although the Sustainable Neighbourhoods philosophy underpinning the tool was a good fit with the research, the depth of information needed was greater than the amount of data available. The quality of the information may therefore have affected the quality of the eventual ratings. However, even if Harbour View, Talbot Park and Stonefields had reached 'Medium' sustainability for section five (about 14 points), where there was missing data, their overall sustainability scores would remain unchanged.

The choice to use an existing measurement system had unintended effects on the research results, due to assumptions inherent in the observational tool. As well as the defined neighbourhood boundaries, features of the observational tool affected the overall scores. For example, in section three, neighbourhoods closer to transport nodes were expected to have a higher density regardless of their proximity to a town centre. One such neighbourhood was Earthsong, which is located in Ranui at the foothills of the Waitakere ranges. It was deemed to have a target density of over 24 dwellings per hectare, while Stonefields – in central Mt Wellington – had a target density of only 15 dwellings

per hectare. In section four, both Earthsong and Stonefields were again held to a higher standard by virtue of the fact that their on-site storm-water retention ponds were counted as water bodies requiring 5 metre buffers planted in native vegetation. Had these ponds not been included in the scoring, Earthsong would have gone from a 'Low' score to a 'Medium' for protection and enhancement of the environment.

Overall, the assessment of neighbourhood sustainability is incomplete without also taking into account resident behaviour. The Beacon Pathway Sustainability Framework (Beacon Pathway Ltd, 2008b) includes a resident self-report tool which partially covers such behaviours, with questions on: participation in community groups, mode of travel and use of neighbourhood shops. The strength of the locality in providing the resources for consumption as well as absorbing waste outputs is one of the main qualities of a sustainable neighbourhood, stemming from the wider Eco-City movement, and should be included in such assessments, along with the ability of residents to participate in local decision-making.

Summary

Although there were instances where the rating provided by the observational tool seemed counter-intuitive, the tool is generally transparent in its priorities and easy to use. This is because each score is broken down by the outcome domains considered important, and the scores are immediately available when entering data. It has also provided a user-friendly and accessible method for comparing different cases on a range of sustainability elements. Wider use of tools such as the Beacon Pathway observational tool would lead to a deeper understanding of the way neighbourhoods can contribute to sustainable living.

7.3 Neighbourhood sustainability and the Auckland cases

The Beacon Pathway observational tool was used to examine the sustainability of four neighbourhood cases within Auckland to answer the research question: how sustainable are Auckland neighbourhoods? The four cases were Earthsong and Harbour View from western Auckland (formerly Waitakere City), and Talbot Park and Stonefields in the central Auckland isthmus (formerly Auckland City). Overall, the sustainability performance of the selected Auckland cases was fair, although these ratings may be affected by limitations in the data.

The overall results for each case showed that the sustainability of the selected neighbourhoods was reasonable. In the final scores, two cases were rated 'High', one 'Medium' and one 'Low', although this last score is expected to improve on completion of the development. There are some limitations to the findings however. The absence of planned shops and a local school in the Stonefields development reduced its score, and the absence of data for dwelling sustainability and to a lesser degree, amount of impermeable surfaces, possibly reduced scores for all cases. As mentioned in the section above, the observational tool embedded certain assumptions into each evaluation. The number of points that were awarded for each question affected the weighting carried in the final tally. For example, the percentage of impervious surfaces for the whole neighbourhood was worth up to 16 points, or nearly half the available points for this section.

A further limitation of the observational assessments is that they cannot be applied to Auckland neighbourhoods as a whole. Although the observational tool incorporates some quantitative measurements, overall ratings involve subjective judgements and the research has been carried out on a qualitative scale. Neither do the selected neighbourhoods reflect the typical characteristics of residential dwellings in Auckland described in chapter three: low rise stand-alone houses, distanced from services by roads and motorways (Auckland

Regional Council, 2010a). While the case studies each attempt sustainability differently, they have all incorporated Smart Growth ideas of increased density, pedestrian scale, and while, to date, none have managed to fully realise a mixed use development, all are either within walking distance to existing neighbourhood shops and facilities, or are planning to develop these internally.

The 'Very High', 'High', 'Medium' and 'Low' scores available in the observational tool provide only a blunt analysis. While the two overall 'High' scores are positive, they only reflect a maximum score of 53 per cent, or 113 points out of an available 212. This method of ranking can smooth or intensify differences between cases, depending on which end of each scale they fall into. The intended purpose of the observational tool however, is not to provide a rating for sustainability in itself, but to highlight areas where changes within a neighbourhood might improve its sustainability.

Areas where sustainability can be improved vary slightly with each case's strengths and weaknesses. Some measures contributing to this area of sustainability can be easily remedied, while others are difficult to address when a neighbourhood has already been built and settled. Some aspects of sustainability cannot be addressed at the neighbourhood level at all, as they are restricted by the sustainability and function of the surrounding city .

Talbot Park, although scoring very highly in most areas, was 'Low' in protection and enhancement of the natural environment and in provision of eco-alternatives. Earthsong's results are similar to Talbot Park, and although faring better with regard to eco-alternatives, it achieved a 'Low' score for protection and enhancement of the natural environment as well. Increasing the amount of native plantings in each neighbourhood would help to improve their scores, although this may not be practical unless adequate public land is available. Some eco-alternatives, such as car clubs and community composting programmes, may be retrofitted to a neighbourhood easily; the provision of community infrastructure less so.

Unlike the previous two cases, Harbour View scored highly for protection of the natural environment, but achieved a 'Low' score for access to public transport, viability of existing centres, diversity and eco-alternatives. This reflects the neighbourhood's location and lack of mixed use. Stonefields' higher scores in viability of local centres and quality of space and street networks reflect both its site selection, which is close to main town centres, and its overall design aesthetic. While its scores for public transport and walking access can be expected to change on completion, scores for diversity and eco-alternatives are unlikely to do so. With regard to Stonefields and Harbour View, 'Low' scores for public transport and social provision access are much harder to address after the neighbourhood has been developed and settled. Public transport especially is outside the influence of a developer, unless a custom service for the neighbourhood is funded and organised. As Engel-Yan et al (2005) note, the city surrounding a neighbourhood can act as a limit on the degree to which it performs sustainably.

Summary

The Auckland neighbourhoods performed well overall, particularly so in design and layout of streets and open spaces within the development. In terms of the neighbourhood scale view of sustainability, it is a positive step that quality of the built environment and provisions in each neighbourhood are being addressed. There was less success, however, in providing social housing, including commercially viable spaces, or including eco-alternatives in the neighbourhoods. While some of these areas can be remedied retrospectively, others needed to be considered at the time of development. In addition, some aspects contributing to neighbourhood sustainability are outside the control of both developers and the eventual residents. In light of the experience of using the assessment tool, it is perhaps best used for evaluating developments which are still in the planning phase, when changes can still be made which might improve their overall sustainability performance.

7.4 International comparison

Results from the neighbourhood sustainability assessment using Beacon Pathway's observational tool are reinforced by the comparison of the Auckland case studies with international case studies. The general impression of the Auckland cases is that their approach to sustainability is to emphasise the form of the neighbourhood, rather than the way it functions. The international cases were more consistent at including the functional elements of a sustainable neighbourhood in their design, and at providing services at the level of the locality. A preoccupation with neighbourhood design could have a number of reasons: design may be the easiest element of sustainability to include in a commercial development, or it may have the most clear guidance and fewest barriers to implement.

International neighbourhood case studies were compared to the Auckland neighbourhood cases in order to establish whether there is a characteristic approach among the Auckland cases to creating sustainable neighbourhoods. Results from both the observational assessments and the international comparison indicate that there is a common approach across the Auckland cases, although each had their own strengths and weaknesses. This 'Auckland approach' delivers the form of a Sustainable Neighbourhood, rather than the function, although all cases did provide some form of neighbourhood storm-water treatment or reuse.

The results of the observational analysis indicate that the Auckland cases were strongest overall in elements of neighbourhood design, but mixed in regard to other areas which directly support ecological, social and economic sustainability. These results correspond with the checklist used in the international comparison. The Auckland cases were compared to international cases using a checklist for neighbourhood sustainability adapted by Barton (2000). While the Auckland cases consistently met criteria which related to street design, open spaces and the quality of the neighbourhood, they were inconsistent in other elements such as community-generated energy, commercial premises or social provision. The international cases, by contrast,

performed as strongly as the Auckland cases with regard to design, but included specific features to improve sustainability across a broader range of areas.

The difference between the Auckland and international cases was most marked in the areas of 'Global Ecology' and 'Natural Resources'. The delivery of community infrastructure and services, encouragement of sustainable transport options, delivery of mixed use and commercial spaces and provision of diverse and low-cost dwellings were the areas with the most marked difference. The international cases were also stronger than the Auckland cases both at supplying locally-generated energy to neighbourhood dwellings, and at employing a range of methods to do so. The two Auckland cases demonstrating local energy supply provided solar water heating only, while the international measures included recycling household waste into biogas, wind turbines, gas powered generators and photovoltaic panels to supplement conventional grid supply.

Some of the international examples were expressly funded to implement their new technological approaches. BedZED's photovoltaic panels were funded through an external grant from the European Union's 'Thermie project' (Low, et al., 2005), while local developments such as Earthsong found it difficult to fund photovoltaic panels from their cooperative funding pool (Earthsong Eco-Neighbourhood and the Earthsong Centre Trust, 2008). Further to the financial difficulties of providing technological solutions, many New Zealand sources (such as MfE's Smart Homes initiative, or the EECA's Energy Wise programme) emphasise energy efficiency of buildings, rather than the local generation of power. Easton et al's (2006) study of barriers to sustainability in local government found that in most (former Auckland district and regional) plans, small-scale energy generation was not recognised, thereby creating a barrier to its implementation.

As well as generation of energy at a local level, the international cases proved more adept at local treatment of sewage and storm-water. Again, this is an issue where local government barriers exist. Earthsong experienced resistance

to alternative treatment of sewage, and neighbourhood developers were forced to connect to town services (Earthsong Eco-Neighbourhood and the Earthsong Centre Trust, 2008). These issues were also identified in Easton et al's (2006) finding that features such as composting toilets were only suitable in residential settings which did not have access to piped sewage systems.

One area where there are no documented barriers is the provision of community-run schemes such as car-clubs, recycling and communal gardens. The international cases seem to be better at organising facilities and services, particularly infrastructure, at a local level than the Auckland cases. Research discussed in chapter three (Howden-Chapman, et al., 2010; Howley, et al., 2009) indicated a preference among both New Zealand and Irish residents for low-density living with plenty of space. Perhaps this reflects a cultural preference for independence. Possibly the 'Sustainable Neighbourhoods' model of which neighbourhood-level services are an important part does not fit well within the Auckland, and the New Zealand culture, where homes are built to function as individual dwellings, even within a neighbourhood community.

As mentioned in chapter six, there is a stronger showing among the international cases for discouraging car reliance in their neighbourhoods. Talbot Park experienced institutional resistance to narrowing roads through the development, for fear this would impede emergency vehicle access (Easton, et al., 2006). Reliance on cars, is a generally accepted reality for all but the most centrally located of Aucklanders, and this issue reflects the difficulty of overcoming the limitations that city-wide transport issues place on creating independent, sustainable neighbourhoods.

In Barton's checklist, 'Economic Sustainability' depends on the provision of other elements; it is dependent on the diversity and accessibility of the area. The overlap between social sustainability and economic sustainability in this model is interesting given the conflicts between each aspect of sustainability discussed in chapter two. Due to the better accessibility and more mixed use in the overseas examples, they were able to fulfil more criteria than the Auckland cases. Ensuring mixed use within the development assists in promoting

walking as a means of transport, but also the economic sustainability of an area, and this is something in which the large scale international cases are more successful. Christie Walk is the notable exception: on the most restricted site of just 2,000 square hectares it provides residential buildings only. While both Earthsong and Stonefields intend to include commercial premises within their respective neighbourhoods, these are not yet built. In the case of Stonefields, although commercial buildings are planned, they are not really mixed use as they exist within a designated town centre, and the surrounding homes are residential only. This may be due to the nature of land-use planning, which is still zone-based. It is clear from referring to district plans that portions of Stonefields are zoned for schools, the shopping centre is zoned for retail and the remainder is residential, as are the other Auckland cases. Integrating different building uses seems to be something that even the international cases have trouble managing, for while Kronsberg and Bo01, like Stonefields, recognise the importance of including neighbourhood facilities and services within the neighbourhood, they still separate out functional areas, but on a small scale. BedZED with its live/work units has a more integrated approach to mixing building use. But perhaps the main reason for this difference is that the international examples tend to be larger than the Auckland cases.

Auckland and international cases were similarly mixed in most elements relating to the protection of Natural Resources. Both groups were strong in ensuring higher densities to reduce urban land take, although the international average density of approximately fifty-six dwellings per hectare was considerably higher than the average density of the Auckland case studies of twenty-seven dwellings per hectare. The higher density of the international cases may reflect a greater cultural acceptance of high density living. However, the densest neighbourhood, Christie Walk, is located in central Adelaide which, with its population of approximately 1.18 million (Australian Bureau of Statistics, 2010), is comparable to Auckland, with approximately 1.46 million residents (Statistics New Zealand, 2010c)[3].

---

[3] Adelaide population estimate as at the 30th of June 2009, and Auckland population as at 30th June 2010.

Both groups of cases meet the social provision elements in a similarly mixed way. While not all cases were able to provide diverse, affordable housing, most provided quality open spaces. The international cases displayed a higher availability of commercial space, which may reflect the greater size and scope of these developments, or more institutional willingness to incorporate mixed environments. Social sustainability overlaps with mixed use, accessibility, street design, diversity of housing and affordability which are all covered elsewhere. The Auckland cases were stronger in street design than in diverse and affordable dwellings, while the international cases were fairly even across both. While Talbot Park is a Housing New Zealand owned development, and does include regard to the social sustainability of housing, of the Auckland cases Earthsong has achieved the most successful mix of housing to meet changing needs in the smallest development. While Talbot Park provides for low income residents, it does so in the predominantly low income area of Glen Innes, providing no diversity in the surrounding area, or the immediate neighbourhood itself.

Given the greater range of sustainability initiatives in the overseas examples, perhaps we should ask why Auckland fails to deliver more with regard to sustainability. In the cases of Earthsong and Talbot Park, developers tried to implement more options, but were prevented from doing so. It could be that these same barriers would prevent other future developments from implementing innovative techniques and technology to improve sustainability. Earthsong, for example, experienced institutional barriers to on-site water supply and sewage treatment, while the issue of funding restricted alternative power supply options for the neighbourhood. Although a variety of housing sizes and styles have been delivered, and contribute to the neighbourhood's diversity, the need for owner/occupiers to recover costs from developing the neighbourhood has made low-cost housing untenable.

It is possible that the priorities of neighbourhood developers themselves restrict the range of sustainability initiatives, particularly where they are to provide dwellings which appeal to homebuyers, and which sell. The Earthsong and Christie Walk cases show how much is possible when like-minded individuals

come together to develop housing for themselves, and that there is a sector of the housing market which is simply not being served by conventional developments. Not all of the selected developments were developed by co-operatives however. The Stonefields example shows the scale of what is possible when large commercial developers and councils work together towards a common goal. The storm-water pond may address only one facet of sustainable resource management, but it is done on a scale to cater for almost three thousand future residents. Of all the developments, Stonefields perhaps aligns the closest with a Smart Growth sensibility, with its emphasis on density and proximity to the central city. Being a new build (although on a former commercial site), it is not built along existing nodes. It proposes to construct community facilities for the new neighbourhood, similar to New Urbanist, or Urban Village developments. While the maturity of these planned facilities will improve the sustainability of the neighbourhood by providing resources and social opportunities within walkable distance, there will always be a need to travel outside the neighbourhood for a wider range of retail, education and employment services. It is likely, given the transport connections that these will be made by car. There is no overall coordination of the location and distribution of services, and in this respect Stonefields is not far removed from conventional suburbs.

Assumptions of what sustainability means are also important. The highest scoring Auckland case had an approach which most closely matched the ideal underlying this research. In the common Auckland approach, we can see the elements of Smart Growth and urban design which have been promoted over the past two decades coming through. A more holistic approach to sustainability and a more ambitious, even demanding, expectation of what neighbourhoods should deliver could encourage the housing industry to meet a higher level of sustainability. Tools such as the Beacon Pathway observational tool used here may prove a useful mechanism for encouraging this change, as it translates the principles of Sustainable Neighbourhoods into a practical application and illustrates where improvements to sustainability could be made. Among the Auckland cases, Earthsong achieving the highest scores when using the observational tool is no surprise as it had the most holistic and

ambitious approach to implementing a sustainable housing development. As an Eco-Village, Earthsong also had the closest alignment with the sustainability approach underpinning this research, and the observational tool. Both Eco-Village and Sustainable Neighbourhoods are described by Jabareen (2006) as belonging to the wider 'umbrella' category of Eco-Cities.

The design and layout of the Auckland cases are their strong points, rather than a wide range of sustainability approaches. In this regard the newly built and renovated local examples seem to have embraced the Ministry for the Environment Protocol for Urban Design, to which both the Auckland City Council and Waitakere City Councils were signatories. It is twelve years since the ARGF's Smart Growth (liveable communities) policies were first promoted, and six since the publication of the Ministry for the Environment's Urban Design Protocol. Perhaps a higher standard in neighbourhood and housing guidelines would ensure that in ten years time the evolving concept of sustainability is reflected in our built environment.

Findings from the international comparison

In the case studies included here, the Auckland approach to sustainability is to focus on the design elements of the neighbourhood to improve its appearance and coherence as an area. Steps to ensure that appropriate open space is provided, well overlooked, attractive and fitting within the overall area can be traced to the influence of the Ministry for the Environment's Urban Design Protocol (2005), to which both of the former city councils were signatories. These inclusions are a positive step, and show that a philosophy about how housing should be approached is filtering through to the construction industry. These neighbourhood design elements are also highly marketable, making a new development more attractive to potential buyers, and enhancing the neighbourhood in a commercial sense.

The degree to which the Auckland cases have utilised sustainable features is related to the development priorities underlying each neighbourhood. Legislative barriers have also been identified with regard to sewage treatment

and street layout, and research suggests that public preference for conventional housing may also be a barrier to more sustainable developments.

Like the Auckland cases, the international cases were strong in neighbourhood design, but included more sustainability features regarding local energy provision and community facilities generally, but particularly recycling facilities, as well as site selection to maximise public transport links and reduce private motor vehicles. The comparison strengthens the findings from the observational analysis that the Auckland cases are stronger in neighbourhood design over other elements of sustainability such as social provision or ecological sustainability.

Summary

Definitions are necessary when discussing sustainable housing as there are many different interpretations of what sustainability is, as well as the best way to measure and promote sustainable housing. In carrying out this research, the definition of one concept has led to the definition of others, such as 'neighbourhood' and to some extent 'quality'.

The sustainability of the Auckland cases was positive overall, despite gaps in the data for housing construction, and one neighbourhood being incomplete. Measures to address storm-water treatment, maximise solar gain and particularly the provision of safe parks and streets within neighbourhoods contributed to the sustainability of neighbourhoods. The results of the assessment show that the approach taken by each development affected their score depending on how closely the development and sustainability model the tool is built on align. Each had its own strengths, but all had areas in which they could still improve. The identification of these areas demonstrated the usefulness of assessment tools such as the observational tool used, as they can pinpoint areas where the greatest gains in sustainability can be made. While the observational tool was useful, it was effectively used as a 'black box' with no ability to adjust the scoring or criteria, and its internal logic sometimes affected the sustainability scores in unexpected ways.

The strengths of the Auckland cases as a group, in both the observational assessment and in the checklist comparison to international neighbourhoods, were in higher densities and neighbourhood design, elements emphasised in guidelines about housing and urban development in New Zealand. These influences may also have a bearing on the common theme among the Auckland case studies, that of design over technology.

Chapter 8
Conclusions

Sustainability is a concept not often defined, and there is no one accepted meaning. Despite this, discussions of sustainability have come to include ecological, economic and social concerns in discussions of sustainability, which informs understanding of what sustainable housing might mean. Improving sustainability is important due to the effects of human activity on the planet's capacity to support life. Meadows et al (1972) first illustrated this, showing that continuation of the existing consumption patterns could exhaust the earth's resources within 100 years. In Auckland, a near continual population growth drives housing demand and physical sprawl, a process which successive Auckland councils have attempted to halt through the use of Smart Growth policies.

This research set out to examine the sustainability of Auckland neighbourhoods, employing the Sustainable Neighbourhoods model. This provides an appropriate scale and a holistic approach to sustainability, including economic, social and technical sustainability, and environmental sustainability criteria (Choguill, 2008). The research was to establish how sustainable Auckland's neighbourhoods are, by examining four neighbourhood case studies. These were then compared to international case studies to establish whether there an 'Auckland approach' to neighbourhood sustainability.

In order to assess how sustainable Auckland neighbourhoods are, four case studies were selected from central and west Auckland, assessed using the 'Neighbourhood Sustainability Observational Tool' by Beacon Pathway (2008b). The use of an off-the-shelf assessment tool introduced some unexpected assessments of the neighbourhoods, and was not a perfect fit in terms of matching the data available, such as building specifications for the whole neighbourhood. A measurement tool requiring observational data only might have been more suitable, but would not have been able to cover the range of

sustainability features that were covered by the Beacon Pathway observational tool. Nevertheless, this resource provided a straightforward way to conceptualise and evaluate the sustainability of the selected neighbourhoods. Used in conjunction with the self report tool, it would provide a useful system for ongoing and wider neighbourhood research.

Overall, the selected Auckland neighbourhoods were fairly sustainable, although some neighbourhoods performed well in only a few areas. Each case had different priorities in terms of sustainability, however, results from the assessments showed that, as a group, all cases performed well in the areas of neighbourhood design and access to services. While efforts are being made with regard to the quality and surrounding environment of neighbourhoods, there was far less evidence of attempts to encourage walking, cycling and use of public transport, either through site selection or discouraging the use of private motor vehicles, and less attempts to provide for socially diverse resident populations. Two evaluations of 'High' overall sustainability, one 'Medium' and one 'Low' (Stonefields, which is expected to improve on completion of the neighbourhood) show that the high design quality has lifted sustainability of all neighbourhoods. A potential theme emerged from the neighbourhood analysis, that of focus on the neighbourhood style and form over more technological approaches to attempting neighbourhood sustainability. This theme was further explored by treating the Auckland cases as a group, and then comparing them to a group of international neighbourhood cases, using Barton's (2000) 'Checklist for Sustainable Neighbourhoods'.

The international comparison reinforced the findings of the observational analysis of the Auckland cases. The strong design sensibility evident in the Auckland case studies was not particular to them. Comparison with international neighbourhoods showed that the overseas examples included as many elements of good design, but also included ecological elements more frequently and more inventively. The Auckland cases could have improved sustainability with greater investment in community infrastructure such as power supply, neighbourhood recycling and waste management, and in more active discouragement of motor vehicles throughout the neighbourhoods. These are

all areas in which the international comparison cases outperformed the Auckland cases. While the research does not explore the reasons behind the sustainability of each case, the intention to create neighbourhoods exemplary of sustainability may have much to do with this difference, as well as the greater resources behind such developments. It may be also that there is a greater maturity in the respective construction industries of Germany, Sweden, Britain and Australia with regard to using sustainable methods and materials.

Employing a wider range of sustainability measures in neighbourhoods enables sustainability to become effortless and a part of everyday life, rather than a conscious decision. It is important, however, to acknowledge that as planners, it may not be possible to control the range of actions and choices that living in a city provides to residents, simply by regulating the form of the built environment. Although built form is a contributing factor to economic and social sustainability, theorists (Jabareen, 2006; Neuman, 2005) have challenged the underlying assumption that design and form in a city can affect the behaviour and choices of residents. Such assumptions are evident in the Smart Growth policies of the 1990s, and in contrast with what Jabareen (2006) describes as the more functional approach of Eco-Cities and Sustainable Neighbourhoods. While some of the Auckland neighbourhood cases embodied an approach to sustainability closer to the Sustainable Neighbourhoods model used in this research, the most common approach among the Auckland neighbourhoods to emphasise the quality and attractiveness of the built environment. While there are several areas in which sustainability can be improved, the ideas that have come through in the Auckland cases in areas relating to design and form have still improved their overall sustainability.

Given the prevailing urban form in Auckland, and absence of strong guidance or support for sustainable developments in relevant legislation, the selected Auckland case studies have achieved a reasonable level of sustainability according to the Sustainable Neighbourhoods model. When compared as a group to international neighbourhood case studies, Auckland neighbourhoods appear to focus on the built form of the neighbourhood, its design, layout, look and feel, over neighbourhood infrastructure and encouragement of sustainable

behaviour.   This suggests that if there is an Auckland approach to neighbourhood sustainability, it is one which focuses on the form of the neighbourhood, rather than the way it functions.   This focus reflects the priorities of guidelines and policies regarding housing and design over the last twenty years. Given the continued growth projected for Auckland, it is important that future policies and guidelines encourage the most sustainable options for housing and neighbourhood developments.   These policies are informed by underlying notions of sustainability and what it means to live in a sustainable way.

Reference List

Auckland City Council. (1999a). City of Auckland - District Plan: Isthmus Section, *Appendix 10: The Reisdential Design Guide for Developments in Residential Zones in Specified Growth Areas*. Auckland, New Zealand: Author.

Auckland City Council. (1999b). *Growing our city through Liveable Communities 2050* (Draft April 1999. ed.). Auckland, New Zealand: Author.

Auckland City Council. (2003). *Auckland City : growth management strategy : Auckland urban living*. Auckland New Zealand: Author.

Auckland City Council. (2006). Auckland City's Long-term Plan 2006–2016 (Vol. 1 - Our Vision and Strategy). Auckland, New Zealand: Author.

Auckland City Council. (2007). Plan change for former quarry approved. (14 September). Retrieved from http://www.infonews.co.nz/news.cfm?id=6134

Auckland Council. (2010a). District and regional plans. 2011, from http://www.aucklandcouncil.govt.nz/en/buildingpropertyconsents/DistrictRegionalPlans/Pages/Home.aspx

Auckland Council. (2010b). Local Boards. 2010, from http://www.aucklandcouncil.govt.nz/EN/AboutCouncil/LocalBoards/Pages/home.aspx

Auckland Council. (2011). Auckland Council GIS Viewer.   Retrieved 15 March, 2011, from http://maps.aucklandcouncil.govt.nz/aucklandcouncilviewer/

Auckland Regional Council. (2009). Long-Term Council Community Plan 2009-19. Auckland, New Zealand: Author.

Auckland Regional Council. (2010a). *A brief history of Auckland's urban form*. Auckland, New Zealand: Author.

Auckland Regional Council. (2010b). *State of the Auckland Region Report 2010*. Auckland, New Zealand: Author.

Auckland Regional Growth Forum. (1999). *A vision for managing growth in the Auckland Region : Auckland regional growth strategy: 2050*. Auckland New Zealand: Author.

Auckland Regional Growth Forum. (2003). *Auckland regional affordable housing strategy, March 2003*. Auckland, New Zealand: Author.

Auckland Regional Growth Forum. (1999). *Growth: the 50-year challenge: Auckland regional growth strategy, 2050: summary*. Auckland, New Zealand: Author.

Auckland Transport. (n.d.). Maxx. 2010, from http://www.maxx.co.nz/

Australian Bureau of Statistics. (2010, November 22). National Regional Profile: Adelaide (Statistical Division). 2011, from http://www.abs.gov.au/ausstats/abs@nrp.nsf/lookup/405Main+Features1 2005-2009

Barton, H. (Ed.). (2000). *Sustainable communities: the potential for eco-neighbourhoods*. London: Earthscan.

Beacon Pathway Ltd. (2008a). Neighbourhood Case Study: Harbour View. Retrieved Friday 30, July, 2010, from http://beaconpathway.co.nz/neighbourhoods/article/neighbourhood_case _study_harbour_view

Beacon Pathway Ltd. (2008b). The Neighbourhood Sustainability Framework. 2010, from http://beaconpathway.co.nz/neighbourhoods/article/the_neighbourhood_ sustainability_framework

Beacon Pathway Ltd. (2008c). The Neighbourhood Sustainability Framework and Assessment Kit, *Part I: Introduction*. Auckland, New Zealand: Author.

Beston, A. (2005, Tuesday Nov 8). Talbot Park residents hopeful about development's future. *New Zealand Herald*. Retrieved from http://www.nzherald.co.nz/glen-innes/news/article.cfm?l_id=337&objectid=10354138

BioRegonal. (2010). BedZED. 2010, from http://www.bioregional.com/what-we-do/our-work/bedzed/

Blackmore, J., & Lauder, H. (2005). Researching Policy. In B. Somekh & C. Lewin (Eds.), *Research methods in the social sciences* (pp. 97-104). London: SAGE.

Bosworth, R. (2008). Urban Nature. *Mindfood, Dec 05, 2008*. Retrieved from http://www.mindfood.com/at-mag-ecovillage-earthsong-urban-nature-green.seo

Canam Group. (2011). Talbot Park. 2010, from http://www.canam.co.nz/afawcs0144678/CATID=1/ID=193/SID=2084811 55/productdetails.html

Carmona, M. (2001). *Housing design quality: through policy, guidance, and review*. New York: Spon Press.

Choguill, C. L. (1993). Editorial: Sustainable Cities: Urban Policies for the Future. In T. B. Levent (Ed.), *Urban Planning*. Cheltenham, United Kingdom: Edward Elgar.

Choguill, C. L. (2007). The search for policies to support sustainable housing. *Habitat International, 31*(1), 143-149.

Choguill, C. L. (2008). Developing sustainable neighbourhoods. *Habitat International, 32*(1), 41-48.

City of Hannover. (2003). Living in Kronsberg. In K. Rumming (Eds.) Available from http://connectedcities.eu/downloads/showcases/kronsberg_handbook.pdf

Commission for Architecture and the Built Environment (CABE). (2006). Building for Life: Assessment Excercise. London: Author.

Commission for Architecture and the Built Environment (CABE). (2008a). Building for Life: Delivering Great Places to Live. London: Author.

Commission for Architecture and the Built Environment (CABE). (2008b). Building for Life: Evaluating Housing Proposals Step by Step. London: Author.

Commission for Architecture and the Built Environment., & Great Britain. Dept. of the Environment Transport and the Regions. (2001). *The value of urban design: a research project commissioned by CABE and DETR to examine the value added by good urban design*. Tonbridge: Thomas Telford.

Congress for the New Urbanism. (2011a). CNU History. 2010, from http://www.cnu.org/history

Congress for the New Urbanism. (2011b). Who is CNU?   , 2010, from http://www.cnu.org/who_we_are

Connected Cities. (n.d.). Kronsberg. 2010, from http://connectedcities.eu/showcases/kronsberg.html

Connerly, C. (2007). Smart Growth: Opportunity or threat to affordable housing? In G.-J. Knaap, H. A. Haccou, K. J. Clifton & J. W. Frece (Eds.), *Incentives, Regulations and Plans: The Role of States and Nation-states in Smart Growth Planning* (pp. 103-123). Cheltenham, United Kingom: Edward Elgar.

Crabtree, L. (2008, 13-14 February). *Christie Walk: a Co-operative Ecocity Development.* Paper presented at the Living Cooperatively Symposium: Affordable Housing - Sustainable Communities, Petersham Town Hall, Sydney, Australia.

Crabtree, L., & Hes, D. (2009). Sustainability Uptake in Housing in Metropolitan Australia: An Institutional Problem, Not a Technological One. . *Housing Studies, 24*(2), 203-224.

Dearnaley, M. (2005). Mt Wellington development fuels call for more railway stations*. The New Zealand Herald*. Retrieved from http://ezproxy.massey.ac.nz/login?url=http://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,cookie,url,uid&db=anh&AN=HOB137586 292405&site=ehost-live

Department of Building and Housing. (2010). *Better homes and Buildings: Statement of Intent 2010/2013*. Retrieved from www.dbh.govt.nz.

Durack, R. (2001). Village Vices: The Contradiction of New Urbanism and Sustainability. *Places: Forum of Design for the Public Realm, 14*(2), 64-69.

Earthsong Eco-Neighbourhood. (n.d.-a). Design and Development, Buildings. 2011, from http://www.earthsong.org.nz/design/buildings.html

Earthsong Eco-Neighbourhood. (n.d.-b). Design and Development, History Part 1. 2010, from http://www.earthsong.org.nz/design/history.html

Earthsong Eco-Neighbourhood. (n.d.-c). Design and Development, Services - Water Supply.   Retrieved Wednesday, 4 August, 2010, from http://www.earthsong.org.nz/design/services-watersupply.html

Earthsong Eco-Neighbourhood. (n.d.-d). Design and Development, Walk-to-work. 2010, from http://www.earthsong.org.nz/design/w2w.html

Earthsong Eco-Neighbourhood. (n.d.-e). Earthsong Eco-Neighbourhood. 2010, from http://www.earthsong.org.nz

Earthsong Eco-Neighbourhood and the Earthsong Centre Trust. (2008). World Habitat Awards 2008: Final stage submission for Earthsong Eco-Neighbourhood.

Easton, L., Mead, D., Trenouth, C., Fullbrook, D., & Arnold, P. (2006). *Local Council Sustainable Building Barriers and Incentives – Auckland City Case Study*: Beacon Pathway Limited.

Engel-Yan, J., Kennedy, C., Saiz, S., & Pressnail, K. (2005). Toward sustainable neighbourhoods: the need to consider infrastructure interactions. [Article]. *Canadian Journal of Civil Engineering, 32*(1), 45-57.

Ghosh, S., & Vale, R. (2007, Feb 21-23). *Is policy leading to improved sustainability at the local urban scale?* Paper presented at the 2nd International Conference on Sustainability Engineering and Science, Auckland, New Zealand.

Gliner, J. A., Morgan, G. A., & Leech, N. L. (2009). *Research methods in applied settings : an integrated approach to design and analysis* (2nd ed.). New York: Routledge/Psychology Press.

Godschalk, D. R. (2004). Land Use Planning Challenges: Coping with Conflicts in Visions of Sustainable Development and Livable Communities. *Journal of the American Planning Association, 70*(1), 5-13.

Harmon, K., M. (2008). Chapter 8 - Moving Toward Urban Sustainability: A Comparison of the Development of Sustainability Indicators in Seattle and Minneapolis. In L. C. Heberle & S. M. Opp (Eds.), *Local Sustainable Urban Development in a Globalised World.* Aldershot, United Kingdom: Ashgate.

Homestar. (2010). Homestar.   Retrieved 5th February, 2011, from http://www.homestar.org.nz/

Housing New Zealand Corporation. (2009). Community Renewal. 2010, from http://www.hnzc.co.nz/hnzc/web/councils-&-community-organisations/community-groups/community-renewal.htm

Howard, E. (1898). "The Three Magnets and The Town-Country Magnet" from *Garden Cities of To-morrow* In S. M. Wheeler & T. Beatley (Eds.), *The Sustainable Urban Development Reader. 2nd ed. (2009)* (pp. 11-17). Abingdon, United Kingdom: Routeledge.

Howden-Chapman, P., Stuart, K., & Chapman, R. B. (Eds.). (2010). *Sizing up the city : urban form and transport in New Zealand.* Wellington, N.Z.: Steele Roberts.

Howley, P., Scott, M., & Redmond, D. (2009). An examination of residential preferences for less sustainable housing: Exploring future mobility among Dublin central city residents. *Cities, 26*(1), 1-8.

Infometrics Ltd. (2007, May 08, 2007.). Building big and small. 2011, from http://www.infometrics.co.nz/article.asp?id=4154

Jabareen, Y. R. (2006). Sustainable Urban Forms. *Journal of Planning Education and Research, 26*(1), 38-52.

Jacobs, J. (1961). 'Author's Introduction' and 'The Uses of Sidewalks: Contact' from *The Life and Death of Great American Cities.* In M. Larice & E. Macdonald (Eds.), *The Urban Design Reader (2009).* Abingdon, United Kingdom: Routledge.

Kenworthy, J. R. (2006). The eco-city: ten key transport and planning dimensions for sustainable city development. *Environment and Urbanization, 18*, 67-85.

Knaap, G., & Talen, E. (2005). New Urbanism and Smart Growth: A few words from the academy. *International Regional Science Review, 28*(2), 107–118.

Krueger, R., & Gibbs, D. (2008). 'Third Wave' Sustainability? Smart Growth and Regional Development in the USA. [Article]. *Regional Studies, 42*(9), 1263-1274.

Lang, M. H. (1999). *Designing Utopia : John Ruskin's urban vision for Britain and America*. Montréal, Canada: Black Rose.

Lazarus, N. (2003). Beddington Zero (Fossil) Energy Development: Toolkit for Carbon Neutral Developments – Part II: BioRegional Development Group.

Leopold, A. (1949). "The Land Ethic" from *A Sand County Almanac*. In S. M. Wheeler & T. Beatley (Eds.), *The Sustainable Urban Development Reader. 2nd ed. (2009)* (pp. 23-32). Abingdon, United Kingdom: Routledge.

Low, N., Gleeson, B., Green, R., & Radovic, D. (2005). *The green city : sustainable homes, sustainable suburbs* (1st ed.). Abingdon, United Kingdom: Routledge.

Lumley, S., & Armstrong, P. (2004). Some of the Nineteenth Century Origins of the Sustainability Concept. *Environment, Development and Sustainability, 6*, 367–378.

mapometer.com. (n.d.). 2010, from http://www.mapometer.com

Meadows, D. H., & Meadows, D. (2007). The history and conclusions of The Limits to Growth. *System Dynamics Review, 23*(2-3), 191-197.

Meadows, D. H., Meadows, D. L., Randers, J., & Behrens III, W. W. (1972). "Perspectives, Problems , and Models" from the "Introduction" to *The Limits to Growth*. In S. M. Wheeler & T. Beatley (Eds.), *The Sustainable Urban Development Reader. 2nd ed. (2009)* (pp. 48-52). Abingdon, United Kingdom: Routledge.

Meltzer, G. (2005). *Sustainable Community: Learning from the cohousing model*. Victoria, Canada: Trafford.

Ministry for the Environment. (2005). *New Zealand Urban Design Protocol*. Wellington, New Zealand: Author.

Ministry for the Environment. (n.d.-a). Community Renewal – Housing New Zealand Corporation, Talbot Park, Auckland. Retrieved 14 July, 2010, from http://www.mfe.govt.nz/publications/urban/urban-design-case-studies-may08/html/page11.html

Ministry for the Environment. (n.d.-b). Harbour View - Waitakere City. *Urban Design Case Studies - New Zealand Urban Design Protocol* Retrieved 19/07/10, from http://www.mfe.govt.nz/publications/urban/urban-design-case-studies-mar05/html/page11.html

Ministry for the Environment. (2005). *New Zealand Urban Design Protocol*. Wellington: Ministry for the Environment.

Ministry for the Environment. (n.d.). Harbour View - Waitakere City. *Urban Design Case Studies - New Zealand Urban Design Protocol* Retrieved 19/07/10, from http://www.mfe.govt.nz/publications/urban/urban-design-case-studies-mar05/html/page11.html

Monitor Auckland. (2010a, 1 March). Built Environment: Capacity for Growth. from http://monitorauckland.arc.govt.nz/built-environment/capacity-for-growth/capacity-for-growth.cfm

Monitor Auckland. (2010b, 29 June). Housing and Construction: Number of residential dwelling units and commercial buildings authorised inside/outside the Metropolitan Urban Limit. from http://monitorauckland.arc.govt.nz/built-environment/housing-and-construction/number-of-residential-dwelling-units-and-commercial-buildings-authorised-insideoutside-the-metropolitan-urban-limit.cfm

Mumford, L. (1938). "Cities and the Crisis of Civilization" from the "Introduction" to *The Culture of Cities*. In S. M. Wheeler & T. Beatley (Eds.), *The Sustainable Urban Development Reader. 2nd ed. (2009)* (pp. 18-22). Abingdon, United Kingdom: Routledge.

Mumford, L. (1954). 'The Neighbourhood and the Neighbourhood Unit', Town Planning Review, XXIV (4), January, 256-70. In T. B. Levent (Ed.), *Urban Planning*. Cheltenham, United Kingdom: Edward Elgar.

Natural Space Ltd (Producer). (2004a, 29/07/2010) BedZED Text. *Sustainable architecture and the natural world*. retrieved from http://www.naturalspace.com/

Natural Space Ltd (Producer). (2004b, 29/06/2010) Sweden Text. *Sustainable architecture and the natural world*. retrieved from http://www.naturalspace.com/

Neuman, M. (2005). The Compact City Fallacy. *Journal of Planning Education and Research, 25*, 11-26.

New Zealand Government. (2009). *Making Auckland Greater*. Wellington, New Zealand: Author.

New Zealand Institute of Landscape Architects. (2010). NZILA Resene Pride of Place Landscape Architecture Awards 2010. from http://www.nzila.co.nz/awards_current.asp

Orsman, B. (2005). Quarry plan provokes traffic fears. *The New Zealand Herald*. Retrieved from http://ezproxy.massey.ac.nz/login?url=http://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,cookie,url,uid&db=anh&AN=HOB398758144905&site=ehost-live

Pedersen Zari, M. (2009). *Towards a sustainable future: Adopting a regenerative approach to development*. Wellington, New Zealand: Victoria University.

Quastel, N. (2009). Political Ecologies of Gentrification. *Urban Geography, 30*(7), 694–725.

Ritchie, A., & Thomas, R. (Eds.). (2009). *Sustainable urban design : an environmental approach* (2nd ed.). New York, NY: Taylor & Francis.

Royal Commission on Auckland Governance. (2009). *Royal Commission on Auckland Governance*. Auckland, New Zealand: Author.

Royal Society of New Zealand., New Zealand National Commission for Unesco., & Office of the Parliamentary Commissioner for the Environment. (Eds.). (1999). *Urban sustainability in New Zealand : proceedings of a workshop*. Wellington, New Zealand: Royal Society of New Zealand.

Rudlin, D., & Falk, N. (1999). *Building the 21st century home : the sustainable urban neighbourhood*. Auckland, New Zealand: Architectural Press.

Saville-Smith, K., Lietz, K., Bijoux, D., & Howell, M. (2005). *Neighbourhood Sustainability Framework: Prototype. Report NH101 prepared for Beacon Pathway Limited*. Auckland, New Zealand: Beacon Pathway Limited.

SECURE. (2009). Kronsberg. *Benchmark Study: European Sustainable Urban Development Projects case 11,* (1). Retrieved from http://www.secureproject.org/download/18.360a0d56117c51a2d30800078408/Kronsberg_Germany.pdf

Simpson, J. A., Weiner, E. S. C., & Oxford University Press. (1989). *The Oxford English dictionary* (2nd ed.). Oxford: Clarendon Press.

Smart Growth Network. (2006). This is Smart Growth. Washington DC: International City/County Management Association (ICMA), U.S. Environmental Protection Agency (EPA).

Smart Growth Network. (2011). Smart Growth Network.   Retrieved March 15, 2011, from http://www.smartgrowth.org/network.php

Stark, S., & Torrance, H. (2005). Case Study. In B. Somekh & C. Lewin (Eds.), *Research methods in the social sciences* (pp. 33-40). London: SAGE.

Statistics New Zealand. (2009). Mapping Trends in the Auckland Region, Population Growth. *2010*. Retrieved from http://www.stats.govt.nz/browse_for_stats/people_and_communities/geographic-areas/mapping-trends-in-the-auckland-region.aspx

Statistics New Zealand. (2010a, 24 February). Auckland home to 38 percent of population in 2031.   Retrieved 22 March, 2010, from

http://www.stats.govt.nz/browse_for_stats/population/estimates_and_proj
ections/subnationalpopulationprojections_mr2031.aspx

Statistics New Zealand. (2010b). Building Consents Issued: December 2010.
2010, from
http://www.stats.govt.nz/browse_for_stats/industry_sectors/Construction/
BuildingConsentsIssued_HOTPDec10/Commentary.aspx

Statistics New Zealand. (2010c). Subnational Population Estimates: At 30 June
2010. 2011, from
http://www.stats.govt.nz/browse_for_stats/population/estimates_and_proj
ections/subnationalpopulationestimates_hotp30jun10.aspx

Stonefields. (2007). Town Centre. from
http://www.stonefields.co.nz/TownCentre.aspx

Sustainable Aotearoa New Zealand. (2009). Strong sustainability for New
Zealand: Principles and Scenarios. Auckland, New Zealand: Nakedize
Limited

Sustainable Cities. (n.d.). Malmo. 2010, from http://sustainablecities.dk/en/city-
projects/cases/malmo-bo01-an-ecological-city-of-tomorrow

Talen, E. (2006). Design That Enables Diversity: The Complications of a
Planning Ideal. *Journal of Planning Literature 20*, 233-249.

Taylor, P. (2006). Background Paper on Environmental Sustainability in New
Zealand: Parliamentary Commissioner for the Environment.

The Green Building Certification Institute. (2011). LEED for Neighbourhood
Development. Retrieved 12 February, 2011, from
http://www.gbci.org/main-nav/building-certification/certification-
guide/leed-for-neighborhood-development/project-
registration/registration.aspx

Turner, D., Hewitt, J., Wagner, C., Su, B., & Davies, K. (2004). *Best Practice in
Medium Density Housing Design*: Housing New Zealand Corporation.

TUSC. (2011). Tool for Urban Sustainability - Code of Practice. Retrieved
14June, 2010, from http://tusc.synergine.com/

U.S. Green Building Council. (2009). LEED 2009 for Neighbouhood
Development. Washington: U.S. Green Building Council, .

U.S. Green Building Council. (2011a). LEED. from
http://www.usgbc.org/DisplayPage.aspx?CategoryID=19

U.S. Green Building Council. (2011b). LEED for Neighbourhood Development.
from http://www.usgbc.org/DisplayPage.aspx?CMSPageID=148

United Nations. (1983). Process of preparation of the Environmental Perspective to the Year 2000 and Beyond, *General Assembly Resolution 38/161*.

United Nations. (1992). Rio Declaration on Environment and Development, *Report of the United Nations Conference on Environment and Development (Rio de Janeiro, 3-14 June 1992)*. New York: Author.

United Nations General Assembly. (2005). *2005 World Summit Outcome.* Paper presented at the 2005 World Summit, New York.

United Nations. (1992). "The Rio Declaration on Environmental and Development". In S. M. Wheeler & T. Beatley (Eds.), *The Sustainable Urban Development Reader. 2nd ed. (2009)* (pp. 72-76). Abingdon, United Kingdom: Routeledge.

Urban Ecology Australia. (2010, 18/5/2010). Christie Walk. 2010, from http://www.urbanecology.org.au/christiewalk/

Vale, B., & Vale, R. (2002). *The new autonomous house : design and planning for sustainability*. London: Thames & Hudson.

Van Roon, M., & Van Roon, H. (2009). *Low Impact Urban Design and Development: the big picture*. Auckland, New Zealand: University of Auckland.

Waitakere City Council. (2002). Earthsong Eco-Neighbourhood Reserve Contribution: 449-455 Swanson Road (RMA 20002585 / SPW 21216) – objection to conditions of consent pursuant to section 357 of the Resource management Act 1991. In Cohousing New Zealand Limited (Ed.) (pp. 2). Auckland, New Zealand: Author.

Waitakere City Council. (2010). District Plan Rules, *General Natural Area*. Auckland, New Zealand: Author.

Wheeler, S., & Beatley, T. (Eds.). (2009). *The Sustainable Urban Development Reader* (2nd ed.). Abingdon, United Kingdom: Routledge.

Winston, N. (2009). Urban Regeneration for Sustainable Development: The Role of Sustainable Housing? . *European Planning Studies, 17*(12), 1781-1796.

World Commission on Environment and Development. (1987). "Towards Sustainable Development" from *Our Common Future*. In S. M. Wheeler & T. Beatley (Eds.), *The Sustainable Urban Development Reader. 2nd ed. (2009)* (pp. 59-63). Abingdon, United Kingdom: Routledge.

Zimmerman, J. (2001). The "Nature" of Urbanism on the New Urbanist Frontier: Sustainable Development, or Defense of the Suburban Dream? *Urban Geography, 22*(3), 249-267.