URBANVILLAGE: Exploring Synergies between Affordability and Sustainability

Student ID: 1217560

ABSTRACT

The stand alone suburban dwelling is no longer suitable for our steadily growing population, changing urban demographics, lifestyle preferences and the rising economic and ecological cost of excessive commuting. The push toward the intensification of our cities presents an opportunity to increase current supply of affordable housing. Therefore, higher density, inner city living is set to become a common typology within main centres throughout New Zealand. Many people are looking toward the purchase of multi-unit properties – which have traditionally been reserved for renters – as an affordable housing option to compensate for rising home ownership costs of the stand alone dwelling.

This project looks into the redevelopment of a brownfield site within the inner city suburb of Morningside in Auckland. The objective here is to produce a mixed-use, medium-density housing scheme in which affordability plays a key role. Through research it has become clear that housing affordability is measurable when striving toward the inclusion of sustainability features. By lowering construction costs through building re-use and recycling plus the incorporation of energy efficient strategies and water management solutions the occupants are ensured to benefit from a significantly reduced running cost of their home.

Quality design, security, privacy, and closeness to amenities all impact on peoples’ willingness to accept dense living environments. Each of these issues directly influence people’s acceptance of such developments. If people are satisfied with their living environment then they will take pride in it and, consequently, it will meet the general criteria for social sustainability.

From research it has become clear that questions of sustainability, both environmental and social, must be considered as not only equally important factors, but also mutually supporting when seeking solutions regarding the issues of housing affordability. This project has extensively explored and investigated synergies between affordability and sustainability in the medium of architectural design.
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1 INTRODUCTION
1.1 Project Outline

Intensification of the city will be a key initiative for Auckland’s future as the number of housing units required exceeds the amount of land available to build on. Medium to high density housing has huge potential as an affordable urban solution to the issues of sprawl and population growth driving the ongoing intensification of the city. This architectural project is to focus on housing design and how to produce adequate living environments for the growing population through a more efficient use of land. Being able to accommodate the growing population in affordable and sustainable housing that caters to individual needs while enhancing a sense of community will be a focus in the future development of medium to high density housing schemes throughout the country. It is the aim of this project to demonstrate how we can achieve this objective without sacrificing architectural quality.

The project’s methodical approach combines research and analysis through to planning and design. The brief has continually been adapted throughout the design process as the extent of research widened. Further reading included such topics as strategies and protocols for housing and urban planning, architectural precedents of medium density housing and mixed-use developments, and environmental and social sustainability issues. The project has been based on a combination of conventional research and research by design, frequently moving from analysing written work and research for design, to research by design and vice versa.

During this process a change in project direction took place. After an in depth analysis on affordable housing, a clear understanding of its current state, both here in New Zealand and internationally, was reached. The research question was then reformulated, so that all key objectives were taken into account – affordability, sustainability, and community.

The brownfield site on which this thriving community is to be built lies at the boundary between the residential suburbs and the light industrial sector of Morningside, in central Auckland. This project is an opportunity to create a sympathetic link between the two differing areas. A mix of light industrial and commercial businesses fills the boundaries of the immediate site. The hypothetical brief is that over time this block will be developed into a medium to high density live/work neighbourhood in which environmental sustainability and affordability are coupled with creating a sense of community throughout the development. The project outcome was defined as the production of an urban design proposal for the whole area, presented as a masterplan, with concept architectural designs for selected main types of medium-density dwellings. Stage one in the scheme has been designed in
some detail and will provide a benchmark for the rest of the site to follow in terms of both concept and design.

Investigations into a selection of buildings which currently exist within the site boundaries resulted in a shift in project direction midway through masterplanning. The re-use and recycling of existing industrial buildings and some of the supporting infrastructure led to fresh ideas when approaching design. Retaining existing foundations and many of the structural shells meant the project had been restricted in formal possibilities, but in ways that opened new possibilities to achieve the functional quality of design. The re-use allows a sustainable approach to be achieved by reducing the amount of embodied energy produced during the construction process. The re-use of elements from the existing buildings aids in the reduction of both cost and time involved in new build.

Energy conservation, producing energy from renewable sources and water harvesting and management is fast becoming a necessity for all new housing projects of the future. This necessitated incorporating many sustainable features within this mixed-use housing development. The design now aimed at resource conservation and local generation in such ways that the project is not only ecologically friendly but also less expensive to buy (or rent) and to live in. A new approach focused on exploiting synergies between affordability and sustainability, is now evident.

It is also the intention for this design project to achieve synergies between affordability and community - based on the simple principle that sharing some of the spaces and facilities reduces expenses for all occupants and enhances a sense of social sustainability. Designing and delivering good homes entices sustainable communities, because the people living in them tend to appreciate their environment and, therefore, take pride in the places they live. Places are respected when people enjoy occupying them and feel safe. Social sustainability will be maintained and the community will thrive when people are provided with high quality, sustainable and affordable living environments.
1.2 Research Questions

Original thoughts posed the question, ‘How can we, as New Zealand architects, design affordable medium-density housing which ensures safe and healthy communities while enhancing environmental sustainability?’

This question implies that through density an affordable living environment can be achieved. Affordability is a key concept in the project direction. However, this project also aims at incorporating a number of environmentally sustainable strategies to help with keeping the running cost of each dwelling low. In addition it is also important to achieve an environment in which people feel safe and can live together comfortably whilst sharing common outdoor spaces and neighbourhood services and facilities. Ensuring each dwelling is provided with an adequate private outdoor living space also becomes essential in the social value of the community. It has become clear that matters concerning both environmental and social sustainability go hand in hand with affordability. Hence, in answering the research question it becomes clear that each of the three aspects - affordability, sustainability and community - needs to be mutually reinforcing in order for this type of dense, inner city living to be successful.

Although dense urban living is widely accepted overseas, it is a relatively new proposition in New Zealand. This typology has been accepted internationally, with European countries, Australia, and England all fast becoming advanced in this type of residential development.

The redefined research question is: How are we to design denser housing schemes to make higher density living both acceptable and affordable for more New Zealanders?

The project will need to produce a result which looks attractive and makes dense urban living a suitable and affordable option particularly for first home buyers and households on low to moderate incomes. The end result will show that this type of living can be achieved in New Zealand and that the outcome can attain an attractive and resource-conserving answer to affordable housing issues. The final outcome will endeavour to produce an architectural scheme which provides a quality result for a vibrant, yet affordable, urban community. Environmental responsibility and community values will play an equally important role when facing the issues of affordability.
1.3 Research Objectives

The objectives of this project can be broken down into the following:

**Objective One:** To implement strategies and planning policies, set out by both the *Auckland City Council* and the *New Zealand Government*, to a real-life brownfield site.

**Objective Two:** To masterplan a high quality built environment where affordability and sustainability requirements are also met.

**Objective Three:** Synergies between affordability and sustainability are to be researched, evaluated and formulated in design relevant terms for a mixed-use, medium-density housing scheme.

**Objective Four:** To provide a proposal in which issues of density are met with a quality urban housing solution; the outcome setting a benchmark to which future developments should endeavour to achieve.
1.4 Definitions

1.4.1 Affordable Housing

The definition of affordable housing as set out by the Auckland Regional Affordable Housing Strategy (2003) will be used for the purpose of this study.

“Housing is considered to be affordable if households can access suitable and adequate housing by spending a maximum of 30% of their gross income.”

Income alone is not the only factor that measures affordability. Dwellings must meet a suitable and adequate standard of living to be considered affordable. Low quality housing is often cheap to rent or buy, but results in poor health and a greater expense to heat and maintain. This is where quality design becomes an important factor when addressing issues of housing affordability.

The New Zealand Housing Strategy, documented by Housing New Zealand, sets out a definition for what they consider to be ‘Decent Housing’. This description was selected as it describes the aims to which this housing project aspires.

“Housing must be affordable, of good quality, and meet reasonable standards of design and energy efficiency.”

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1 Regional Growth Forum, Auckland Regional Affordable Housing Strategy (Auckland: Auckland Regional Council, 2003). 9
1.4.2 Environmental Sustainability

The following statement sums up the strategy for environmental sustainability as defined for this project. This statement is a necessary definition for this project as it states clearly the environmental issues to be dealt with in order to achieve a desirable and affordable home.

An aim of this project is to; “...design and build homes which have less impact on the environment and are healthier, more comfortable, and have lower running costs.”


1.4.3 Social Sustainability

Communities are made sustainable by the people living in them. By promoting neighbourliness within a community people will want to live there and the place will be sustained. The following statement outlines the provision of social sustainability for this project:

“Sustainability is an overriding social value, influenced and complemented in turn by the provision of choice, safety and a sense of community or neighbourliness.”


5 Ibid. 39
1.5 Justification for Research

To own one’s own home is a common aspiration sought by the majority of New Zealanders. However, due to current changes in both economic and demographic situations and with an increasing population, supply of affordable housing is significantly compromised. The prospect of owning one’s own home has become unattainable to many.

Population projections set out by Statistics New Zealand suggest that the high population growth predicted for Auckland City is to continue. Auckland’s population will reach 468,400 people by 2011 and 530,600 by 2021; a 36% increase from the 2001 population. This yearly population growth in our urban centres is adding pressure on our limited resources and, furthermore, is increasing the need for housing production to meet future demands. Over the past decade denser housing solutions have emerged as common housing typologies within New Zealand. Medium-density housing has huge potential as an affordable urban solution to housing issues within the New Zealand context. We are now required to reduce Auckland’s ecological footprint while increasing the number of housing units available. Intensification of the city will be a key initiative for Auckland’s future.

New Zealand is one of the most urbanised nations in the world with almost 87% of our population living in our towns and cities. “It is important to find housing forms that more accurately suits the housing needs of the growing numbers of non-traditional households.” The way in which we use the home has progressively changed over time. Medium-density housing can cater for the variety of different household types which have emerged as common place within New Zealand. The shift from stand alone suburban homes to medium-density housing is going to take some persuasion for most New Zealanders as “…most Kiwis want the house with the back yard.”

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7 Auckland’s ecological footprint is 4.8 times the region’s land area. An ecological footprint is the land needed to support Auckland’s consumption. A Definition given by Regional Growth Forum, Auckland Sustainability Framework; an Agenda for the Future (Auckland: Auckland City Council, 2007). 9
However, with the change in social arrangements and an increased number of new immigrants coming into the country we are able to formulate a distinct group of occupants who will make use of medium-density housing.

Many now look toward the purchase of multi-unit properties, which have traditionally been reserved for renters, as an affordable housing option to compensate for rising home ownership costs. Younger households are deferring home ownership until later in life and, therefore, dwell in rented accommodation for prolonged periods. Medium-density housing can be used as a means of providing more people with an opportunity to purchase affordable housing. This housing typology is a viable solution which can cater for the needs of our younger generations and those seeking to find affordable home ownership options.

The architectural aspect of this project is to focus on housing design and how to produce adequate living environments for the growing population through a more efficient use of land and better use of available technologies in building and environmental development. The poor image that medium-density housing currently conveys is due to poor designs of past schemes. This image can be changed by producing successful developments which all social groups of the urban community can enjoy living in. This project aims to achieve a solution which can be used as a benchmark for changing current attitudes toward this housing typology. Via synergies between affordability and sustainability, both social and environmental, implementation of medium-density housing shall become a widely accepted housing typology of the future.
1.6 **Scope and Limitations**

A steep rise in land prices over the last few years has impacted sharply on housing affordability. Building denser living environments within the existing footprint of the city can be used as a means of providing a greater quantity of well located affordable housing for both rent and purchase. By redeveloping on brownfield sites within the existing city confines, we can significantly reduce sprawl while retaining greenfield sites on the outer city limits.

Multi-units are significantly cheaper than a typical detached house, particularly in the more central suburbs of major cities because they occupy less land per unit. This typology is now the first home choice for young households and those on low to moderate incomes who are seeking affordable housing options.

It must be made clear that this project does not aim to solve the supply issues with affordable housing in Auckland. This becomes more than a matter of design and more an issue of economics; of urban land use; of property development; of low wage economy; and of construction technology. What this project does look at is ways in which we can make multi-unit housing an accessible alternative to the low density detached dwelling. It also looks at ways in which homes can be made affordable by making them cheaper to run and live in by use of environmental strategies and technologies.

It must also be made clear that this project does not intend to produce a social housing development. This project is geared toward creating a mixed community, where all types of people who are faced with home ownership difficulties can afford to buy a home. The major difference in affordable housing, as defined in this project, is that the people intended for this scheme do not require subsidies from the government in order to supplement a low income. It is more about capital cost of home ownership. With good job prospects, average mortgage repayments are often easily obtainable by households on a moderate income. Many who fit within this income bracket tend to have no assets and very little capital to invest in the purchase of a home. Government subsidy may be provided by means of helping with the purchase price, but is not necessary for the ongoing living costs of these inhabitants. It is intended that the running costs of the dwellings in this scheme will be low by employing sustainable features, therefore making payments toward ongoing housing costs easily obtainable to households on a moderate income.
2 METHODOLOGY
2.1  Methodology Overview

The project’s methodological approach progressed in a systematic order, flowing from research and analysis through to planning and design. Adaptations to the brief have been made throughout the process, in successive attempts to crystallise the research question, aims and objectives. Research topics investigated in the project were focused on the three key attributes of the scheme; current supply and demand of affordable housing available within the Auckland context; features and strategies of environmental sustainability of which can aid in the reduction of running cost in the home; and social sustainability concerns, where providing safe and healthy communities ensures successful neighbourhoods.

The project has combined investigating the literature and current practice with generating design ideas and solutions, and then using those to direct further research into theory and practice.
2.2 *Design Criteria for Medium-Density Housing*

A number of key references, from New Zealand and Australia, talk generally about medium-density housing schemes and state specific design criteria and guidelines that dictate these types of developments. Common requirements run throughout the guidelines of both New Zealand and Australian references.

Data was collated into a set of fifteen key design principles of which the project aimed to pursue in order to be measured as successful (Refer to Appendix B for the full set of criteria). This list provided a basis on which a number of international and local examples of medium-density housing schemes could be critically explored. In order to rate each scheme’s level of success, or in some cases failure, it was necessary to evaluate all based on the planning principles already universally recognised as being acceptable. During this evaluative process, recognition of both successful and unsuccessful design features became evident. From here the design principles were then re-evaluated and adapted specifically to this scheme (Refer to *Project Development* for a list of these principles). These features are then utilised during the design process to explore improved alternatives to the current examples. Subsequently, a design brief began to be formulated and site selection became an easy task. The criteria which eventually developed proved to be a useful tool during the site selection process.
2.3 Case Study Selection and Analysis

A review of case studies was essential in formulating a starting point for the design process of this project. The design principals mentioned in the previous section were used to address each of the selected case studies, both international and local, in a critical and evaluative process.

High-density housing solutions have become the norm in many overseas cities where this level of housing density is required in the intensification of their already dense urban environments. Australia, the United Kingdom, and European countries have progressed much further in developing high-density housing as a necessary architectural typology. Their advanced knowledge and experience in this area makes international models a critical resource.

Australian examples were assessed – in terms of density, site and dwelling layout and architectural style - as they are comparable to those in New Zealand. With a similar demographic, climate and built environment, Australian case studies were established as a valuable tool in the initial stages of design. An example sourced from the United Kingdom - BedZED (2002) in Wallington, London - was selected for investigation as its design outcomes are similar to the aims outlined in this project.

Local case studies present a varied range of examples sourced from across the Auckland metropolitan area and include a range of suburbs from inner city to the outer ring. Auckland examples provide a background to the current standard of existing medium-density housing schemes around the city. The case studies were chosen to examine density, architectural quality and house types. Each case study was analysed based on the characteristics discussed in Criteria Required in the Design of Medium-Density Housing (See Project Development for full set of criteria). These studies are not model examples or award winning designs and do not always represent the best quality environment or optimal design. Examination into successful and unsuccessful qualities of each case study helped to determine features suitable for implementation in this project. Information collected from these studies has helped to establish an architectural solution based on investigation into architectural precedents.

The Auckland case studies considered were:

- *Harbour View Estate* in Harbour View, Waitakere City
- *Corbans Village* in Henderson, Waitakere City
- *Albionvale* in Sunnyvale, Waitakere City
- *Fairhaven* in Glen Eden, Waitakere City
- *Talbot Park* in Glen Innes, Auckland
2.4 Site Selection in the Wider Context

Site selection has been based on field and cartographic research findings and evaluation of existing developments. Easy access to local amenities such as public transport, work places, shops, community facilities and other services have been key features in the search for a suitable site. The process of site selection began by looking at suburbs within a 1km radius of the train stops positioned along Auckland’s Western Train line. Close proximity to public transport played a key role in the site selection process, as it helps to lessen reliance on the car and the necessity to own one.

The selection of suburbs was then narrowed down to New Lynn, Avondale, Mt Albert, Morningside and Mt Eden. Each location was chosen due to their proximity to public transport as well as to other community services and facilities. These suburbs are ideal as they sit within a close proximity to the city while both rent and purchase prices are generally cheaper than those directly bordering the city.

2.5 Site Analysis of Morningside

Morningside emerged as an area of great potential for a development of this typology. The next step in the process was to analyse the surroundings based on the principals formulated in the preliminary research. The Morningside area as a whole was evaluated to gain a wider understanding of the existing neighbourhood, its characteristics and its adjoining amenities.

Further analysis of the site and its existing buildings occurred over many other stages in the design process. Continued analysis resulted in a change in project direction. Taking a thorough look at the existing buildings positioned on the selected site led to a decision to retain many of the foundations and structural elements.
2.6  *Design Exploration*

Masterplanning and design work came after much of the initial research, case studies and site analysis had been completed. The initial design process undertook a detailed look into masterplanning of the area. Masterplanning included locating existing amenities in the area as well as public transport. The masterplan also acknowledged the different zoning areas within the site’s vicinity. Zoning was broken down into low-density housing, commercial businesses, light industrial buildings, public amenity, open space, and higher density housing. Pedestrian and vehicle movement patterns were also indicated in the masterplan. Masterplanning of the wider neighbourhood, including a proposal for the new development, led to a concept urban design solution for the project site.

Design exploration involved a constant process of trial and error, through the use of sections and planning, in the search for an architectural solution. Design was informed by a thorough understanding of the economic, behavioural and technological issues involved. The tentative design solutions then indicated areas for further research. Hence, research for design aided research by design, which in turn assisted in directing further research for design.

Throughout the year a research based approach to design has been utilised. Research was explored to aid in design and design was used as means of investigating the findings. Physical modelling, sketching, commuter modelling and hard line drawing have all been used as a means of presenting design solutions.
3 CURRENT STATE OF KNOWLEDGE
3.1 Managing Growth

The *Auckland Regional Growth Strategy* has identified a need to minimise sprawl and encourage compact development. Projections suggest that by 2050 the region could be home to between 1.6 to 2.2 million people; an average increase of 20,000 people per annum. Around 700,000 dwellings are required to house a potential population of two million people. In 1996, 356,000 dwellings were available in the region. Another 155,500 will be created as part of district planning incentives and is estimated to be sufficient for the next 10-20 years. With the city expected to expand to double its current population, a further 200,000 dwellings are required to accommodate the influx of inhabitants over the next 50-60 years.\(^2\)

Growth management is about accepting that growth is an inevitable issue that must be dealt with. Future growth will focus on the development of existing built-up centres, where higher density, mixed-use developments can be incorporated and connected by high quality public transport. Vacant land within the metropolitan area, infill-type development and redevelopment potential are all key areas for housing possibilities. Work in these areas has begun and will need to continue in the process of managing growth in an efficient way.

Auckland’s Growth is placing considerable pressure on the region’s physical and social infrastructure, the economy and the environment. The *Auckland Regional Growth Strategy* has set outcomes in which the region can strive to attain in order to manage growth and its impacts.

A number of outcomes in the strategy can be directly implemented in this project and include the following: (Refer to Appendix C for the *Full statement of desired regional outcomes to be achieved in a Regional Growth Strategy*)

- Access and Transport Efficiency
- Sustainable Use of Resources
- Urban Amenity
- Safe, Healthy Communities
- Housing Choice / Affordability
- Physical and Social Infrastructure

3.1.1 Combating Sprawl through Residential intensification

Sprawl is a term used to describe low density residential development and outward growth. Minimising sprawl and encouraging more intensified development can have positive impacts on the community, between neighbours, increasing energy efficiency and improving housing affordability and choice. New developments located in and near town centres and transport corridors offer a range of services and amenities within a convenient proximity.

A more compact urban form encourages development at higher densities. As defined in the Auckland Regional Growth Strategy, intensification is “an increase in density (of dwellings, activity units, population, employment etc) over current density of a given area” and refers specifically to residential site densities in this strategy.

It is stated in the strategy that 70% of new growth to occur in the region over the next 50 years can be accommodated within the existing metropolitan area. Urban intensification looks at the re-use of brownfield land, a more intensive use of urban buildings, sub-divisions and conversions of existing development and an increase in the density of population in urban areas. A significant increase in residential intensification and multi-unit dwellings is promoted by the Auckland Regional Growth Strategy. Higher density development or intensification may include low to high rise apartments, town houses, terrace housing, semi-detached houses, cluster housing and other multi-unit forms. The strategy also states that in 50 years time, more than a quarter of the population (more than 500,000 people) could be living in multi-unit housing.

“Future development will be focused around centres that are liveable, walkable places with a wide range of jobs, businesses, housing, recreation and other services and facilities, connected along major corridors with high quality public transport.”

13 Alice Jane Cullen, “Urban Intensification and Affordable Housing in Auckland” (University of Otago, 2005). 10
14 Auckland Regional Growth Forum, A Vision for Managing Growth in the Auckland Region; Auckland Regional Growth Strategy: 2050. 77
15 Ibid. 38
17 Auckland Regional Growth Forum, A Vision for Managing Growth in the Auckland Region; Auckland Regional Growth Strategy: 2050. 3
18 Regional Growth Forum, Auckland Sustainability Framework; an Agenda for the Future. pg 24
The site selected for this project, in Morningside, is located in one such corridor. The *Auckland Sustainability Framework* aspires to develop a more compact urban form and clearly describes the need for settlements to be located near public transport routes. The framework has set a number of long term goals, with one aimed at producing a *quality*, compact urban form.

Intensifying development in town centres is a key element to managing Auckland’s population growth and assisting in the reduction of urban sprawl. Accommodating this growth will require rigorous planning for intensification, through the development of higher density living. Intensification is argued to improve access to services, facilities and jobs, by placing people close to public transport and within walking distance of many of their needs.19 The ability for existing areas to cope with increased demand is one issue which arises from intensification. A community must not suffer at the hand of an increased density and population; this issue must be addressed through planning in order for a community to remain successfully liveable.

Figure 4 indicates the amount of land required in order to sustain Auckland’s growth. The shaded green area shows the amount of land required in order to support Auckland’s growth; this is considered the sprawl region. The shaded blue area shows

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Figure 4: Auckland’s Ecological Footprint
how much land is actually available. We must begin to intensify urban densities in order to reduce sprawl by working within these limits.\textsuperscript{20}

Intensified housing is commonly associated with poor quality design and low amenity. A negative perception toward this typology lowers the acceptance of this housing form. Resistance to intensive housing is common and is often coupled with a fear that such developments will become the slums of the future. We must begin to change people’s attitudes toward increased densities via quality design outcomes. The architectural project described in this document will aim to change current attitudes toward intensive living by producing a quality end result which meets both resident and neighbourhood needs.

\textsuperscript{20} Regional Growth Forum, Auckland Sustainability Framework; an Agenda for the Future. 9
3.2 Defining Housing Affordability

Affordable housing is generally associated with low income households, but it must also be stated that this description is applicable to all income ranges. All households should be able to pay a realistic amount towards rent or mortgage expenses, while maintaining a comfortable standard of living in which ongoing housing costs and other lifestyle needs are easily accessible in relation to their gross household income.

Common definitions sourced from councils and city planning policies throughout the United Kingdom, Australia, America and New Zealand consider ‘Affordable Housing’ as being housing in which the rent or purchase value is made accessible to households on low to moderate incomes. Households within the lower 40% of the income distribution scale are generally targeted for affordable housing. It is suggested that such households should not exceed payments of more than 25-30% of their gross household income on mortgage and rental payments for the home to be regarded as being affordable.\(^{21}\) Taxes, insurance and utility costs need to be considered within the 25-30% payments of the gross income made by households.

Affordable housing needs to consider the ongoing costs of housing in relation to income. ‘Owner Costs’ include mortgage and rent payments, council rates and maintenance and repair costs. ‘Running Costs’ include energy and water costs which are heavily influenced by the design of the house and behaviour of the occupants. ‘Location Costs’ relate to how much it costs to live in a particular area, this includes the cost of travel to access employment, services and other amenities. For a house to be deemed affordable the household must be able to access and meet the ongoing costs of a dwelling appropriate to their needs.\(^{22}\)

When the supply of affordable housing is less than demand, then low to moderate income households often struggle to obtain housing which is affordable in relation to their gross household income. Housing which is closely located to public transport, schools and shops increases people’s ‘willingness to pay’ for a home within the area.\(^{23}\) Neighbourhoods become more desirable due to their convenient location and proximity to public amenities. As an area of housing becomes more desirable, then the price for

\(^{21}\) Housing New Zealand Corporation, Building the Future: The New Zealand Housing Strategy (Wellington: Graphetti Ltd, 2005).


both rent and purchase increases, therefore making them unaffordable to lower income households. The ‘ability to pay’ for housing in such areas decreases and these households look for accommodation elsewhere, in areas which they can afford, but do not however meet their needs.\textsuperscript{24}

Households which fit within the low to moderate income bracket often rely on public amenities. Easy and efficient access to shops, schools, and public transport is desired, as their monetary resources are low. Owning a car and finding cash to run it is not always a suitable or viable option. With increased house prices in the desired areas, people on low to middle incomes are forced out into isolated areas - where access to amenities is more difficult and, therefore, commuting costs are increased. This makes rent and mortgage payments more difficult to obtain, with a higher expenditure toward transportation being made in getting to and from school and work.

By increasing the densities of our communities we can begin to provide a greater number of affordable housing options for the lower end of the market. By providing higher density, affordable housing within desired communities we can begin to house the lower income groups within areas not usually accessible to these households. In the UK many city councils have adopted a regulation to incorporate at least 30\% affordable housing within any new development being built which exceeds 15 dwellings. Torbay Council in the UK has made this a requirement due to high demands for affordable housing.\textsuperscript{25} This is just one solution which can be adopted here in New Zealand as a means of making affordable housing options more readily available in all areas of our cities. Affordable housing developed through some combination of zoning incentives, cost-effective construction and government subsidies can be rented or purchased by households who cannot afford market rate housing in the community. Affordable housing should provide a reasonably adequate standard of living which is safe, secure and appropriate to household needs, as well as being well located in relation to services, employment, and transport.

\textsuperscript{24} Ibid.

3.2.1 Affordable Housing in New Zealand

The New Zealand government remains committed to ensuring that those on low to modest incomes or with special housing needs receive the help they require to find and stay in affordable, good quality housing. The government’s vision for housing is that “All New Zealanders have access to affordable, sustainable, good quality housing appropriate to their needs.”

The government has set a number of aims to achieve their vision including a push to improve the quality of New Zealand’s housing stock, increased access to affordable and sustainable housing, improving housing standards and to increase integration of housing with community and other services.

Adequate housing is fundamental to the health and well-being of families and communities. For this reason it is desired by the government that all New Zealanders have access to quality, affordable housing. The New Zealand housing market currently successfully caters for about 90% of New Zealanders. The government is working together with community organizations, local government, Iwi and other agencies to improve the quality and quantity of affordable housing stock around the country. To improve affordability the government provides two major forms of assistance: state housing and income related rents. State housing is given to those with the greatest need while the accommodation supplement is for those whose living costs are considered too high to be met through their income alone.

The key emerging issues for New Zealand housing can be broadly summarized as providing a limited housing supply and declining housing affordability and quality. Auckland alone has a projected population increase which indicates a need for 80% more housing, of all types, in the region within the next 25 years. New Zealand’s increasingly diverse population will see more people needing houses of the right kind and quality to support the challenging nature of household structures and housing needs. The social, economic and environmental sustainability of these housing types will need to be researched and considered in order to find a successful model for future development throughout the Auckland region and the entire country.

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27 Ibid.
3.2.2 Auckland Regional Affordable Housing Strategy

The definition of affordable housing in this project has been borrowed from the one described in the Auckland Regional Affordable Housing Strategy:

“Housing is considered to be affordable if households can access suitable and adequate housing by spending a maximum of 30% of their gross income.”

The Auckland Regional Affordable Housing Strategy demonstrates a commitment to Auckland local authorities and acts in partnership with other sectors in addressing housing affordability issues. The Auckland Regional Growth Strategy has endorsed the Regional Affordable Housing Strategy and explores several references to housing affordability which run parallel in both strategies. The outcomes of the strategies seek results that address the following: housing choice and affordability; urban amenity; and safe healthy communities.

The two goals outlined in the Auckland Regional Affordable Housing Strategy have directly influenced the outcomes of this project. As part of this strategy, 11 desired outcomes have been described in support of the following goals (Refer to Appendix D for these outcomes). The goals are:

**Goal One:** To enable all households in the Auckland region to live in housing that is affordable.

**Goal Two:** To encourage affordable housing that is well-located, appropriate to needs, well-designed, integrated into communities, and provides for people’s need for choice, security, safety and good health.

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30 Regional Growth Forum, Auckland Regional Affordable Housing Strategy. 9

31 Ibid. 4

32 Ibid. 4
There is a growing recognition that good quality, affordable housing is an essential component of strong communities. It is estimated that at least 23,000 households or 6% of all households in the Auckland region are paying unaffordable rents. Affordability will need to be addressed with the development of appropriate higher density housing solutions. The goals, outcomes and action areas described in the Regional Strategies provide a basis for future discussion and development in the area of housing affordability. It is the intention of this project to put into practice the goals and outcomes set by the Auckland Regional Affordable Housing Strategy. The council’s aims have been used as a tool for defining this project and reaching suitable outcomes which ensure that affordable housing solutions become a priority in future development.
3.2.3 Affordable Housing not Social Housing

Social housing is an affordable housing option supplied by the government for those whose income alone cannot sustain a house on the open market. Social housing was originally provided for those on low incomes who are unable to purchase open market housing. Housing New Zealand provides good quality, affordable rental housing for people on low to moderate incomes, in the form of state housing.

Tenants on low incomes are supported by the government with income related rents. When a household’s income falls below a set amount then no more than 25% of their income is paid toward rent. Income related rent is one way the government helps subsidise those on low incomes. The government helps with the cost of housing by paying the difference between the rent paid by the tenant and the market rent.

This project is not aimed at finding housing solutions for the low income and disadvantaged members of society. The conclusions drawn from Housing New Zealand’s research expressed that Corporation tenants who live in lower concentrations of social housing experienced the following: They are likely to experience less stigma; are, or have opportunity to be actively involved in the community; benefit generally from available amenities and infrastructure; and are positively influenced by social and behavioural norms in the community.\(^4\) The findings in this research can be applied to the housing development being described in this document. As mentioned before, councils internationally have employed a strategy that ensures that all new housing developments provided at least 30% social housing for low income households. By employing this strategy, a mix of tenure results; creating a greater sense of community where areas of social deprivation can be avoided.

Affordable housing is often associated with social housing and this is where confusion occurs. It must be made clear that this project is not aimed at producing a social housing scheme for low income households. In this project, affordable housing is about providing those on moderate incomes with the ability to purchase a first home which is cheap to run and live in and therefore affordable. The types of people dwelling in this scheme are those on moderate incomes who can easily afford payments toward rent and mortgage. It is the cost of purchase that makes owning a home unattainable to many. Under the current economic situation and rising home ownership

costs, purchasing a first home is difficult. The target group for affordable house as defined in this project will be young couples buying their first home or renting while saving for a deposit, rather than families facing long-term affordability problems.
3.2.4 Home Ownership in New Zealand

With housing affordability declining, first home buyers are faced with difficulties when entering the market. Home ownership continues to act as a central component of New Zealand culture. Rising costs of home ownership coupled with a shortage of affordable housing available within main centres make owning a home unattainable to many. Younger households are deferring home ownership until later in life and therefore dwell in rented accommodation for prolonged periods. Many now look toward the purchase of multi-unit properties - which have traditionally been reserved for renters - as an affordable housing option to compensate for rising home ownership costs.

"Increases in house prices over the past five years have outpaced rises in average household income. This makes housing unaffordable for many people, particularly first-home buyers in cities such as Auckland, Wellington and Queenstown. Because fewer people are able to buy a home, they rely on the private rental market and social housing to provide suitable accommodation." 35

New Zealand’s Centre for Housing Research conducted research into The Falling Rate of Home Ownership in New Zealand. The research involved a comparative analysis of the last three census statistics. By 2006 only 66.9% of all private dwellings were owner-occupied compared to a high 72.4% in 1991.36 “This decline has resulted in a marked redistribution of housing equality across age groups, income groups and household type, to the relative disadvantage of the young, single parents and low income households.”

“...The relationship between tenure, housing type and location is changing, implying more demand is being placed on housing as an asset rather than a lifestyle support. Some buyers are prepared to substitute accessibility and amenities for assets even where this involves higher commute costs." 37

Trading off the cost of commuting for the cost of home ownership may have long term effects, resulting in social, economic, ecological and sustainable impacts. As an alternative to purchasing out of town an increasing number of households look toward multi-unit housing as an asset. The price of


37 Ibid. 2
single-unit housing in main centres has risen beyond the purchasing capability of many.\textsuperscript{38}

The project outlined in this document aims at finding a housing solution for the issues currently raised when addressing home ownership. This project looks into ways of providing people with quality, affordable housing within main centres, where access to transport, public amenities and work is available without the need for lengthy commutes. Providing people with an opportunity to own a home in an area they want to live is a key element to the success of this project.

\textsuperscript{38}Ibid. 3
3.2.5 Government Assistance

For those whose income is moderate, government support toward rent and mortgage repayments is unnecessary, as their income can generally support market rate housing. Where the government can lend a hand is in the purchase of a first home. For many people, the biggest obstacle to owning their own home is saving the deposit.

*Housing New Zealand* provides a range of home ownership services to help people make the move from renting to owning their own home. The *Kiwisaver Home Ownership* scheme is supported by the government and offers a work-based savings initiative which aims to increase New Zealander’s level of savings and assets, including home ownership.  

Shared Equity is a form of home ownership assistance used in the United Kingdom and Australia. This scheme is designed to help those who cannot afford to buy a home in the area they want to live and work. This is often because house prices have risen above the maximum amount they can afford toward mortgage repayments. *Housing New Zealand’s Shared Equity* scheme provides eligible households with an interest free loan, meaning that the mortgage repayments to be made are reduced. The government’s loan exists as a second mortgage on the property; it incurs no interest and does not require repayment until the house is either sold or the loan term ends. This is yet another way the government leads a hand toward helping more New Zealanders into home ownership.

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40 Ibid.
Another home ownership scheme supported by the government is the *Welcome Home Loan*, designed for people who can afford mortgage repayments but have little or no deposit. The *Welcome Home Loan* lends a hand to first home buyers in higher priced areas of New Zealand.\(^{41}\) This loan scheme allows first home buyers to borrow up to $200,000 with no deposit. Amounts exceeding $200,000 will incur a 15% deposit of the required amount over and above $200,000. In high price areas of Auckland and Wellington up to $350,000 can be borrowed.\(^{42}\) (Borrowing $350,000 means that a small deposit of $22,500 will be required)

The *Welcome Home Loan* is ideal for the scope of this project as it will give those on moderate incomes an opportunity to purchase a home. Little or no deposit will be required for the purchase of dwellings in this scheme, with capital values all below $350,000. Please refer to the *Housing Development Cost and Value Relationship* section for figures relating to the dwellings designed in this scheme.

Energy efficient strategies have been employed; helping to significantly lower the running costs of each dwelling. A combination of government assistance (in purchasing a home), with a strategy for sustainability, means that ongoing housing costs shall be easily met by those on a modest income in the high price areas of Auckland.

\(^{41}\) Ibid.
3.3 **Defining Environmental Sustainability**

On average, our homes are 6° below the *World Health Organisation* recommended standard. Cold, damp and mould indoors are all contributing to the low health standards of our homes, with 25% of our housing stock affected.\(^43\) Nearly a third of New Zealand’s electricity use is domestically used – in heating, lighting, and running appliances.\(^44\) Furthermore, we are using too much expensively treated and reticulated water for non-potable use. The average New Zealand person is using 241L of treated water per day, while only 5L per person, per day, is required for potable use.\(^45\)

The following research forms a foundation on which we can begin to address a variety of features that will aid in ensuring our homes are more efficient to run and also healthier and warmer to live in. The *Waitakere NOW Home* is a live research project, which proves that changing our homes so that we use less energy and water is an easy and doable task. Not only can this be achieved at an affordable price, but the benefits will save us money in the long run and will ensure that we are using our resources more efficiently.

The following research outlines how this can be achieved, via use of sustainable features that will then be implemented in the design of this scheme. Finding the right solutions - at an affordable cost - while educating the public about long term benefits, will be a vital task in ensuring a sustainable future for our homes.


\(^{44}\) Ibid.

\(^{45}\) Ibid.
3.3.1 New Zealand Energy Efficiency and Conservation Strategy

The New Zealand Energy Efficiency and Conservation Strategy is a government response to meeting its energy, climate change, sustainability and economic transformation goals. Jeanette Fitzsimons, in the foreword of the strategy, speaks of energy efficiency as using smarter technologies to deliver the same outcomes, while energy conservation is about a smarter behaviour to meet our needs and save us money. The strategy looks into three areas of which New Zealanders can be smarter about their environmental choices; Energywise Homes; Energywise Business; and Energywise Transport.

The New Zealand Energy Efficiency and Conservation Strategy seek to attain a number of targets for creating Energywise Homes (Figure 6). An Energywise home is describe under the following objective; “Warm, dry, healthy homes, improved air quality and reduced energy costs.” With support from the government, ECCA, Housing New Zealand, The Department of Building and Housing and the Electricity Commission, achieving each target in the strategy is made possible. Actions set by the strategy include: improving the performance of existing homes; using better products such as energy efficient appliances and lighting; use of renewable energy, with a push toward solar water heating; and lifting current building code standards to improve the performance of new homes. “The government announced an Energywise Homes package in Budget 2007, costing around $66 million, to be delivered over four years and comprising eight programmes.” The $66 million includes funding for: interest-free loans for energy efficiency installations or upgrades; Energywise home grants; clean heat upgrades; the voluntary Home Energy Rating Scheme (HERS); informing households on energy efficiency, what is available and how to get it; research into new technologies; implementing the new Building Code; and the development of new financial incentives.

Improving the overall standard for our homes is a key aim sought by the New Zealand Government. The standard to which homes are built and renovated significantly impacts on how healthy and comfortable our homes are to live in, how affordable they are to heat, and the overall energy use and emissions for the life of the building. Many families often find it difficult to find the money toward the investment in energy efficient technologies for the home. By making a few simple changes in the way we use the home and

47 Ibid. 17
48 Ibid. 18-19
49 Ibid. 21
50 Ibid. 21
51 Ibid. 27
by investing in a number of low-cost, energy saving options, we can begin to slash the cost of running our homes - saving up to $600 per annum (Figure 5).

The building code currently sets minimum standards for the build of new homes and renovations. A need to improve standards will be progressively enhanced by a changing building code over time. As new technologies become available and the benefits of energy efficiency increase, the requirements for new buildings will be strict, but necessary if we are to improve the quality of our housing stock and in turn the health of its inhabitants. The New Zealand Energy Efficiency and Conservation Strategy are continually looking for ways of improving the performance of our homes and providing incentives for making such features available to more New Zealanders. The government realises how important making this change is for improving the health of our homes and has begun the process by initiating incentives toward making it happen. This process will be lengthy, but any changes we can begin to make now, all help toward achieving a sustainable future. This project looks into ways in which standards can be lifted, and therefore, improve the quality of housing that results.
Figure 6: A Pictorial Representation of an Energywise Home, as covered by the New Zealand Energy Efficiency and Conservation Strategy
3.3.2 Sources on Sustainability in New Zealand

All information required in reference to environmentally sustainability has been sourced from a number of New Zealand websites. Each site provides practical information and advice to help New Zealanders make better choices when it comes to running our homes. The websites referenced in this section are; ECCA Energywise, level, Smarter Homes, Beacon and sustainability.govt.nz. It has been made clear by Beacon that we need to be smarter about the way in which we run our homes in the future.Employing energy efficient strategies and water management solutions will make certain less demand is placed on our limited resources. Each of the websites shares a common aspiration to ensure a sustainable future for our homes.

Beacon Pathway Ltd. is a research group whose work involves finding affordable, attractive ways to make New Zealand homes more sustainable by changing design, construction and renovation of New Zealand’s homes and neighbourhoods.\(^{52}\) Beacon is working to find affordable ways to make New Zealand homes more resource-efficient, cheaper to run, healthier to live in – and kinder to the environment.\(^{53}\)

The Smarter Homes website looks into a number of key design areas in which to make our homes smarter; design, energy, water, sitting and landscaping, materials and construction. To them “A smart home is one that’s good for its occupants and for the environment.”\(^{54}\)

Level, the Authority on Sustainable Building is another site used in the formulation of environmentally sustainable features. Working in partnership with BRANZ, the Level website provides information in similar areas outlined on the Smarter Homes website; site analysis, site use, passive design, water, material use, energy, wet areas, and health and safety. Level’s goal is to “...help you design and build homes which have less impact on the environment and are healthier, more comfortable and have lower running costs.”\(^{55}\)

The ECCA Energywise website and sustainability.govt.nz both endeavour to find ways in which we can reduce the impact we make on the environment. Following similar ideas of the previously mentioned websites, these also describe ways for as to live smarter, lower our power bills and improve our homes to be warmer and healthier.


\(^{55}\) BRANZ, "Level; the Authority on Sustainable Building." (accessed March 12, 2010)
These websites have provided tools for designing a sustainable home, where energy efficient demands along with water management solutions are described in depth. The following information outlines the sustainable features to be implemented in this project. Sustainability for this project is not about finding new ways of achieving sustainability, but about using the tools and systems that are available to us today. Coupling these strategies with a design that explores synergies between environmental sustainability, affordability and community values is where this project begins to take on a new concept or direction that has not be dealt with in New Zealand. The architecture of this scheme will look at ways to incorporate and highlight features of sustainable design.
3.3.3 Achieving Sustainability in this Project

In this project, five sustainable design features have been employed with an aim at producing dwellings which run more efficiently. Each dwelling is intended to be cheaper to run while ensuring a healthier and warmer living environment.

**Figure 7:** Rainwater Tanks  
**Figure 8:** Internal Greenwall by Natural Habitats  
**Figure 9:** Greywater Filtering System using Planting
1. Conserving Energy

Conserving energy is just one way we can begin to make long term savings in the running cost of our homes. “Energy efficiency is not about going without - it is about getting more for your money and stopping the waste.” Doing more with less is what conserving energy is all about.

Paying for energy is a huge component in the annual budget of a household’s income. Therefore, any changes we can make to help lower these costs will aid in saving dollars on our electricity bills. By making wise choices in the appliance we buy and how we use them, as well as looking to the use of energy efficient light bulbs, we can begin to cut the cost of energy in our homes.

Appliances, including lighting, use approximately 39% of power in the home. This includes; fridges and freezers, home entertainment systems, home office equipment, cooking appliances and washing machines and dryers. Energy efficient appliances are now available and can help toward reducing energy consumption in the home. Throughout New Zealand, new products now require an Energy Star Rating. Each star gained on the rating

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system means a 10% saving in running costs. All new appliances have an Energy Rating Label (Figure 11, 12) - where the Energy Star Rating is located - enabling a comparison to be made between appliances and their energy use. Using energy ratings and labelling to select energy efficient appliances; sizing appliances for household needs; and operating appliances efficiently, e.g. turning them off rather than running in standby mode - are just a few ways we can begin to conserve energy.

“Lighting uses about 8% of energy in a typical household.” Lighting costs in the home can be reduced in two ways: using energy efficient lightbulbs and making better use of the sun as a natural light source. Energy efficient lightbulbs are generally more expensive than standard lightbulbs, but use less energy and last longer; so are better for your power bill and the environment. Fluorescent lightbulbs are the most energy efficient form of lighting for the home and last up to 10 times longer than a standard lightbulb. However, natural daylight is the most efficient way to light the home; therefore our homes should be designed to make the most of natural light during daylight hours. When designing a home the placement of windows and skylights can significantly help to reduce the need for artificial lighting.

“Sustainable energy use means designing homes to conserve energy, obtaining energy from sources that do the least possible long-term environmental harm and, where energy is used, to use it efficiently.” Appliance use and lighting make up a small component of energy use in the home. To significantly reduce energy costs in the home both space heating and water heating need to be addressed. These two factors consume a large chunk of household energy. Further reductions in energy costs can be made via passive design solutions, which take advantage of renewable sources to provide energy. Refer to Energy from Renewable Sources for passive design solution which aid in the reduction of energy use.

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2. Energy from Renewable Sources

Space and water heating are the two major consumers of energy in a home. Energy savings in these areas can be easily achieved by optimizing renewable energy sources. “Passive solar construction is a very attractive design philosophy as not only does it save energy, but it also reduces dampness and condensation, improves sound insulation, increases the durability of building materials and makes the home healthier.”

Passive design makes the most of renewable sources of energy – namely the sun and wind – to control the ventilation and temperature of our homes. Passive solar design takes advantage of the sun as a free, renewable heat source and uses its energy to maintain a comfortable living environment all year round. Using the sun’s free energy in combination with high levels of insulation, window orientation and size, and use of thermal mass materials, means that we can begin to make significant saving on our energy bills. In an average New Zealand house space heating accounts for approximately 33% of energy use, while water heating accounts for 28%.64

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Figure 13: Reasons why Some Houses are too Cold
House orientation becomes an important factor in solar design. A north facing dwelling designed in combination with simple features and materials will help to maintain comfortable indoor temperatures, while saving us money on the cost of energy. Using the sun’s free energy to heat our homes can slash household heating costs, reduce condensation and dampness and increase comfort. A well orientated home, designed together with high levels of insulation and double glazing will ensure heat is conserved during the colder months of the year. Deep eaves (Figure 14), planting and louver system will help to reduce overheating during the hotter summer months. Good design will position large windows so that they face the sun. While on the cooler south side, windows are minimized and kept small to reduce heat loss. The biggest source of heat loss is through the windows; use of double glazing along with correct positioning and sizing of windows will aid in reducing heat loss.

Providing high levels of insulation in walls, under floor and in the ceiling, will make certain our homes are easier and cheaper to heat, while providing year-round thermal comfort (Figure 16). Installing insulation above the building code minimums will increase the benefits; making our homes even warmer, while costing less to heat. High levels of insulation help to keep heat in on colder days while preventing too much heat entering the building on hot days. Increased levels of insulation also aid in the reduction of condensation and dampness, therefore resulting in a healthy, warmer and drier home.
Windows and other glazing allow natural light to penetrate the indoor spaces and also enable breezes to naturally ventilate the home. Double glazing can make a big difference in the comfort of our homes; controlling noise, glare and moisture, while significantly reducing heat loss. Double glazing creates an insulating layer of air between two panes of glass - increasing the gap or using thicker glass can further aid in the reduction of noise transfer. Combining double glazing with high levels of insulation will keep indoor temperatures stable, while reducing both heating and cooling costs. The use of thermal backed curtains and blinds is another simple way we can reduce heat loss.

Dense materials such as concrete are good at absorbing and storing the sun's heat. In cool weather the thermal mass stores the sun's heat and re-radiates that energy back into the house as the temperature drops in the evening (Figure 15). Thermal mass works best when it is exposed to north sunlight and directly heated. The use of deep eaves (Figure 14) and louvers will ensure that the high summer sun is blocked from heating the mass (which can cause over-heating), while the low winter sun is able to penetrate deep into the building, heating the thermal mass for energy release in the evening. Exposed concrete floors and walls directly heated by the sun are most commonly used for thermal mass design in New Zealand homes. To increase the benefits of thermal massing, concrete floors shall be insulated underneath and windows should be double glazed down to the floor to

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Figure 15: Principal of Using the Thermal Mass of a Concrete Floor
maximize exposure. “…high thermal mass materials exposed to sunlight may reduce total heating and cooling energy requirements by up to 25%.”

Ventilation is required to bring fresh air into a home and remove stale, moist and polluted air, while also providing cooling. Passive ventilation supplies a natural flow of wind through the building, allowing fresh air to enter by opening windows and doors on the buildings envelope. This is the most environmentally friendly way to ventilate the home, as air conditioning uses a significant amount of electricity and requires the home to be closed off from the outdoor environment to work best. Passive cooling is a means of keeping the house at a comfortable temperature throughout summer, without the use of an air conditioner or other mechanical assistance. Shading the high angle summer sun from the north with planting, deep eaves and horizontal louvers, helps to avoid overheating of internal spaces, while maintaining a cool indoor environment. Eaves should be designed to allow the maximum amount of winter sun to penetrate the building while blocking out the hot summer sun. The low angle summer sun from the east and west is to be blocked with vertical louvers, avoiding overheating from morning and afternoon sun.

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Installing solar panels in any home will save the occupants money on their power bill. A well designed solar hot water system can heat between 50-75% of a households hot water needs per annum. A solar hot water system (Figure 18) will run efficiently when it has been configured correctly for the home (whether an open or closed loop system etc.). The solar water heating process is simple; solar panels on the roof capture the sun’s energy and use it to heat water, which is then stored in a cylinder to be used in the home when required. In summer the majority of hot water needs can be supplied by the solar system, however, in winter, or on less sunny days a back-up system (or ‘booster’ system) – usually electricity or gas – will be required. Savings of up to $500 per annum can be made, depending on the cost of the electricity or gas supply.

Savings of up to $500 per annum can be made, depending on the cost of the electricity or gas supply. Solar hot water systems reduce New Zealand’s dependence on non-renewable energy sources and save us money.

“Passive solar designed buildings can be low tech and need not cost any more than standard construction... Once the correct principles are embodied in a house, little ongoing effort is required to achieve thermal comfort all year round.”

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67 Ibid.

3. Water Management Strategies

Significant benefits can be made at a minimal cost when seeking to reduce water demand in our homes. By making a few simple changes we can achieve substantial reductions in water use. About half of a household's water use comes from the bathroom; with both the toilet and shower each using 25%. The laundry and garden uses 20%, while the kitchen uses 10%. Minimising the amount of water we consume will help to control demand on our limited water supply. Water use can be minimised in a number of ways: controlling water pressure, by installing a pressure limiting valve on the mains supply; using efficient hot water systems such as solar hot water with a cylinder placed as close as possible to the kitchen and bathrooms; control of water for flushing toilets with dual flush cisterns or by using treated greywater; reducing water flow from outlets by installing low flow shower heads and taps; purchasing water-efficient appliances with a star rating indicating their water efficiency.69

Installing a rainwater tank is relatively simple and inexpensive, and the benefits are ongoing. Rainwater is collected off the roof, diverted to a tank and then circulated away for irrigating gardens, flushing toilets and washing clothes (Figure 19). By installing a rainwater tank, pressure on mains supply can be reduced immensely. The cost of installing a rainwater collection system is varied and depends on the tank size, tank material, installation, and delivery – However, the benefits of installing a system outweigh the initial cost, with water savings eventually paying for the system. Rainwater tanks are commonly used in rural areas where mains supply is unavailable. However, rainwater collection is gaining popularity in main centres, where conserving water is becoming increasingly important. In the city, people are often short on space for the installation of a rainwater tank. A ‘slimline’ tank which attaches to a wall on the side of your house can be used and comes in a variety of colours and sizes to suit specific needs.71

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Figure 19: Rainwater Storage for all Household Purposes
Greywater is the collection of used water, which is then recycled for use in gardens and for flushing toilets. Greywater is all household water that comes from kitchen sinks, dishwashers, laundry taps, washing machines, showers, baths and basins. By reusing greywater instead of sending it down the drain, we can make savings on water use while reducing wastewater charges and demand on the mains water supply. Possible contamination of drinking water and contact with collected greywater that has become septic causes health risk concerns with greywater systems in domestic situations. It is essential that greywater systems are properly installed and maintained, while being kept away from human contact.

An attractive way of incorporating a greywater filtering into the design of our homes is by use of a ‘greenwall’ system (Figure 20). The greenwall system best for this project is a soilless vertical garden, which grows on a built structure, using New Zealand made technology by Natural Habitats. The environmental benefits of this greenwall system are as follows: increased thermal insulation to buildings; noise dampening; polishes grey and/or blackwater; can run off recycled or harvested water; and results in healthier buildings and people.72

4. Building Recycling and Re-Use

At the beginning of a building project a decision shall be made that considers materials and components of the existing building(s) that have the potential to be reused. Most materials from demolition sites can be reused and recycled. Recycling and reuse helps to slow the filling of landfills, reduces the cost of mining raw materials, slows the depletion of resources and provides work for local people. Embodied energy includes all the energy to extract, manufacture and transport a material, along with the energy to assemble and finish the material in a building. Avoiding the need to demolish, remove and dispose of materials is best when meeting a sustainable build practice. By reusing and recycling existing materials and structures on site, a lower overall embodied energy for the new build can be met. Timbre, as a building material, has the lowest embodied energy followed by concrete. Other considerations such as the use of locally sourced materials all contribute to a reduction of embodied energy in the material section for a building.

Incorporating the reuse of an existing building or its components into a new building design achieves an aim of reducing waste through recycling. If possible, the reuse of an entire existing building is best and results in a lower embodied energy output for the build. Development on brownfield sites should consider: reusing buildings and components; deconstruction rather than demolition; and to maximise use of reclaimed materials from old buildings in the new building. Second-hand building parts can be used for structural, functional or decorative purposes. Renovating structurally sound buildings is a more material efficient way of building than starting from scratch. Reuse and recycling can help to save money during the construction process - through reduced material and waste disposal costs; income received for salvaged building materials; or through the savings made from not having to buy additional materials.

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75 Ministry for the Environment, “Smarter Homes; on-Site Waste Minimisation.” (accessed March 12, 2010)
Material Selection

Material use has “...an environmental impact at every stage of the building process - from excavation of raw materials, through to processing and manufacturing, transportation and construction, to eventual disposal at the end of a buildings useful life.” Avoid materials that require large amounts of energy in their production - making wise choices and using materials efficiently, is an important aspect of sustainable building.

Hebel is an environmentally friendly, lightweight, aerated concrete building material which contributes to the production of sustainable buildings in New Zealand. This product is produced as blocks (Figure 21), panels and other elements, catering to a wide range of applications - both load-bearing and non load-bearing. Manufactured from sand, cement, recycled material, lime, gypsum and an aerating agent, the resulting product is lightweight, yet durable, while being environmentally sustainable. Hebel is imported to New Zealand by Lightweight Concrete NZ Ltd. from CSR Australia’s Hebel plant in Somersby, near Sydney and currently serves all of New Zealand and Australia. The Hebel building systems has been developed along with government assistance in ensuring they meet New Zealand code compliance.

The total embodied energy consumed during the production of Hebel is relatively low compared to other building products. Being a quarter of the weight of high density concrete, this product is easily transported, can be re-worked on-site, and is quick to install. The high thermal properties of Hebel make it an effective heat insulator and a natural choice for sustainable houses. Hebel houses take less energy to heat and less energy to keep warm, therefore, stay cool in summer and warm in winter. The cost to heat and cool a Hebel home is significantly reduced. A comfortable and healthy indoor living space is maintained, with the indoor air quality and moisture control achieved naturally by the Hebel.

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27 CFG Concrete Ltd., "Hebel," CFG Concrete Ltd., http://www.hebel.co.nz/. (accessed August 9, 2009)
78 Ibid.
Other benefits of the Hebel building system include: superior acoustic performance; the Hebel is incombustible so suited for fire rated applications; automatically absorbs and releases moisture; lightweight; easily worked and installed quickly; can be used for all application, including walls, floors roofs and balconies in both load bearing and non load bearing applications (Figure 22). (Refer to Appendix F for full list of Benefits of Hebel) While it would be ideal to source a building material locally, the numerous benefits of the Hebel system outweigh this aspect. Hebel has been chosen as a superior material for the build of this scheme, as its environmental impact and wide ranging list of benefits place this product above the use of other building materials. 79

79 Ibid.
3.3.4 Case Study: Waitakere NOW Home

“The Waitakere NOW Home was Beacon’s first live research project, designed and built to show that a sustainable house could be built now using materials and products available today.” The Waitakere City Council, together with BRANZ Ltd and ECCA have produced a successful, energy efficient family home and set benchmarks in sustainability, of which future housing shall aim to achieve. The Waitakere NOW Home is: “The environmentally friendly home that people want – and can afford – to live in.” A young family lived in the house, going about their daily lives, while the homes performance was being monitored. “Data was collected on energy use, water use, rainwater collection, temperature, indoor air quality, humidity and moisture levels.”

This three bedroom, single story, detached dwelling proves that sustainable living can be achieved at an affordable price within New Zealand. The Waitakere NOW Home incorporates many simple features, that together help to reduce the homes energy use, saves water and uses renewable resources more efficiently.

Keeping the home warmer and drier was achieved in a number of ways. The building was orientated north to allow plenty of north sun to enter the house. Deep eaves were designed to allow the low winter sun to penetrate deep into the living spaces, while the summer sun is blocked to stop overheating (Figure 21). The concrete floor acts as a thermal mass, storing the sun’s heat during the day and slowly releases it back into the house at night. The insulation values in the ceiling, walls and floor all exceed code requirements. Together these features mean that supplementary heating is not required as space heating is only necessary for the 10 coldest days of the year.

A 13,500L tank in the back yard was used to collect and recycled rainwater (Figure 20). Water conservation was achieved through the incorporation of low flow shower heads and taps, dual flush toilets and a water efficient dishwasher and washing machine. The tank supplied 47% of the homes water needs in year one. Considerable savings were seen on water bills, with the tenants using 100L of reticulated water per person per day.

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81 Ibid.
82 ———, “Beacon; Energy Efficiency Improvements in the Waitakere Now Home.”

83 ———, “Beacon; Energy Efficiency Improvements in the Waitakere Now Home.”
A solar hot water system was put in place, saving the family $275 in the first year of living at the NOW Home. The solar hot water system provided the family with 55% of their hot water during the first year.\footnote{Energy savings were made by using appliances with an Energy Star rating and by use of energy efficient light bulbs and fittings. The tenants used 7400kWh in the first year, translating to 33% less than a comparative four person household with school aged children.\footnote{Making small changes in the way the home is run and used resulted in lower energy bills.}} The Waitakere NOW Home proves that sustainable design can significantly reduce household running costs, and save the occupants money. The features of this design are simple, but have worked efficiently in providing results. The project described in this document aims to achieve this same level of efficiency on a multi-unit scale. While the planning of medium-density housing is very different to a single detached home, the same principals of sustainable design can be applied.

\begin{figure}
\centering
\includegraphics[width=\textwidth]{Figure23}
\caption{Interior of the Waitakere NOW Home}
\end{figure}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{Figure24}
\caption{Tank for Rainwater Collection at the Waitakere NOW Home}
\end{figure}

\footnotetext{\bibitem{Ibid} Ibid. (accessed February 18, 2010)}
\footnotetext{\bibitem{Ibid} Ibid.}
3.4 Defining Social Sustainability

“Engaging with the community for the long term is a key aspect of designing and delivering good homes and places that are sustainable.”\textsuperscript{66}

Sustainability is a prevailing social value where the provision of choice, safety and a sense of community influence the quality of life for a neighbourhood. Every housing scheme attempts, through the design process, to create an environment that responds to the social needs and desires of the inhabitants.

For this project, choice, safety and neighbourliness have become essential words in defining social sustainability.

Choice

In current culture those with economic power have a wide ranging ability to make choices about how they live, work, play and travel. Those on lower incomes are often disadvantaged in society, as their choices are limited and based on how much they earn in relation to where they can afford to live and work. Social and economic inequality can be addressed in the city by providing all types of people with a choice of living and working environments and a means of commuting between the two. “Planning for mixed communities allows people with varying economic power to choose between a variety of different buildings, locations, and neighbourhoods in which to live.”\textsuperscript{67} Meeting a range of needs through quality public transport and the integration of neighbourhood services and facilities will support the sustainability of mixed communities.

\textsuperscript{66} Lewis, Front to Back; a Design Agenda for Urban Housing. xv

\textsuperscript{67} Ibid. 39
Safety

Safety and security needs to be dealt with at a variety of different levels; in the home, in the immediate space around the home, on the routes to and from work or local facilities, and in the streets and spaces of the wider neighbourhood. Safety will be both effective and sustainable when a place ensures safety from homes, to streets, to neighbourhoods. In active communities surveillance is provided by the people and users moving through the residential neighbourhood. A clear distinction between public and private space should be obvious, where clear boundaries between spaces are defined. Active surveillance is effective in areas of heightened movement such as the developments of mixed-use communities where live, work and recreational facilities are combined. People need to feel safe in their environment in order for it to be sustained.

Neighbourliness

Communities are not built, but transformed and developed by people over time. Single tenure communities should be avoided. Places of mixed use shall prevail in order to achieve a sense of community, where people of all types can successfully and happily live together. The type of place it is will dictate the extent to which a place encourages neighbourliness and support. A successful community will thrive when the people living in it are supportive of each other and are involved in the outcomes of the neighbourhood. Neighbourliness promotes sustainability when places are designed to meet a range of living, working and social needs for a mixed community.

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88 Ibid. 41
89 Ibid. 41
3.4.1 Sustaining Communities

Research explored by Housing New Zealand has looked extensively into whether high concentrations of social housing negatively impact on a community’s economic and social development. It was found that diverse or ‘mixed’ communities (by income, tenure, household type and life stage) may be more socially cohesive than communities of concentrated deprivation, and can lead to an overall improvement of life chances for all.\(^90\) Results also found that ‘mixed’ communities are more successful when *extreme* differences in income are avoided.\(^91\)

Internationally, similar findings have been made. Research suggests that diversity within a community creates increased social cohesion and improved life chances for all community members. Research also notes that social housing programmes in the United Kingdom and Australia share a common goal of reducing concentrated areas of social housing. An aim of creating new ‘mixed’ or ‘balanced’ communities is their method of avoiding concentrated deprivation.\(^92\)

For this project the idea of a mixed community becomes an important aspect of design. Housing units in this project are aimed at households on a moderate income and may include the following occupancies: young couples, single working professionals, young families and solo parents. Therefore, a mix of tenure, household type and life stages will all need to be catered for in the development of this project. Accomplishing social sustainability in this scheme will mean that the needs of all types of people must be addressed. A sense of neighbourliness will only be achieved when those living in the community are satisfied and happy with the place they live. By avoiding social segregation a thriving community of mixed tenure will result.

\(^{90}\) Housing New Zealand Corporation, “Sustainable Communities and Economic Development Research - September 2008.” (accessed September 21, 2009)

\(^{91}\) Ibid.

\(^{92}\) Ibid.
3.4.2 Mixed-Use Development

“Achieving a mix of uses is a key dimension of sustainable high density urban housing, providing facilities and amenities for residents and a varied and active public neighbourhood.”

As part of creating a socially and environmentally sustainable community a mix of both residential and non-residential uses can be combined together successfully within a single development. This provides occupants with a more diverse range of amenities and services within a close proximity. As part of mixed-use schemes the live-work dwelling becomes a popular typology. The live-work apartment provides opportunity for occupants to work from home while being conveniently located within an inner city environment. Mixed communities which incorporate a variety of dwelling types and family structures along with non residential uses can work well to meet a range of needs and avoid becoming ‘one-class ghettos’.

Mixed-use development can have numerous economic and social advantages over single use development, such as:

- Meeting increased demand for accommodation close to town centre, amenities and services.
- Creating an interesting, vibrant street life by bringing together a diverse range of people and activities.
- Increasing demand and support for local businesses.
- Reducing transport costs in terms of time, money, and energy consumption.
- Creating a safer environment by combining facilities used at different times of the day.
- Catering to people’s changing live / work needs.

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94 Ibid. 8
A well designed mixed-use development is beneficial to the environment in the following ways:

- Intensifies town centers, thereby reducing sprawl and conserving the city’s natural environment.
- Enables occupants to reduce the amount of time they spend travelling, thereby decreasing road congestion, traffic pollution, and wasted time.
- Provides greater opportunities for using public transport, walking and cycling.
- Enhances the quality of the local environment by creating lively, populated urban areas.\textsuperscript{96}

Mixed-use becomes important in the development of higher density housing as,

\begin{quote}
“A more vibrant urban realm results from the intensification of use and increased activity that a mixed use development brings to a town centre. As well, development in central locations helps to concentrate and contain growth, thereby reducing urban sprawl.”\textsuperscript{97}
\end{quote}

\textsuperscript{96} Ibid. 8
\textsuperscript{97} Ibid. 11
3.4.3 Achieving Social Sustainability in New Zealand

A number of initiatives set by the City Council aim to address the issues involved in creating healthy and liveable communities. The New Zealand Urban Design Protocol is aimed at finding solutions to urban design issues within the New Zealand context. The protocol conveys concepts in making New Zealand towns and cities more successful through quality urban design. Identified in the protocol are seven essential design qualities that work in combination when seeking urban design solutions; context, character, choice, connections, creativity, custodianship and collaboration. ⁹⁸

As described in the protocol successful town and cities are liveable when a high quality of life is provided in the places we live and work. Liveable places provide choice in housing, work, transport and lifestyle opportunities. ⁹⁹ Leading on from this idea, the protocol goes on to describe the need to provide opportunities for all. Providing opportunities for a diverse range of people creates a strong sense of community. “Successful towns and cities accommodate all citizens and offer opportunities for young to old, people on low incomes and people with disabilities... They provide access to jobs, affordable homes, services and community facilities.” ¹⁰⁰

The Auckland Sustainability Framework outlines five sustainability challenges for the Auckland Region. The fifth challenge looks at Addressing Disadvantage, where disparities in opportunities and incomes for the most disadvantaged people living in the most disadvantaged communities are dealt with. ¹⁰¹ The ongoing challenge is how to lift incomes across the board, reduce social and economic extremes, and to prevent developing concentrated areas of low income households. ¹⁰² Goal One of the Auckland Sustainability Framework seeks to address disadvantage by creating a Fair and Connected Society.

“People have a strong sense of belonging to their communities, while diverse neighbourhoods and communities are interconnected to form a cohesive Auckland regional community.” ¹⁰³

The framework aspires to ensure homes are healthy and affordable; access to jobs and essential services in disadvantaged neighbourhoods are provided; and to ensure planning and policies reduce and avoid geographic concentrations of deprivation. ¹⁰⁴ For a community to be sustainable this

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⁹⁸ Sustainable Development New Zealand Programme of Action, New Zealand Urban Design Protocol. 4
⁹⁹ Ibid. 13
¹⁰⁰ Ibid. 15
¹⁰¹ Regional Growth Forum, Auckland Sustainability Framework; an Agenda for the Future. 11
¹⁰² Ibid. 11
¹⁰³ Ibid. 14
¹⁰⁴ Ibid. 14
framework aims to ensure that everyone has access to an adequate income and affordable housing that meets their needs. People feel a strong sense of belonging when they feel connected to their families and to the community. This lies at the centre of achieving success for Goal One of the framework.

4.4.4 Implementing Social Sustainability in Design

The social goals set by council strategies have been used in this project as a means of producing a socially sustainable community. A range of dwelling types, along with a close walking distance to a number of amenities ensures choice for inhabitants is always provided. Numerous transport options are accessible, with train and bus routes close by and cycling and walking options also available.

Security in this design has been determined by the architecture. With increased densities surveillance is enhanced. Numerous dwellings overlook public spaces and walkways, therefore, ensuring an active surveillance system is provided by the inhabitants. Security lighting positioned along all access routes, entry points and in common parking areas further enhances safety when moving through the development.

This project seeks ways in which to create a sense of community or neighbourliness. One way of achieving this is to allow a mix of tenure to occupy the development. Providing a variety of dwelling types makes certain that different household structures can find a suitable home within this housing scheme. Meeting the ongoing needs of the occupants means that non-residential uses are incorporated into the design. Social, economic and environmental benefits result from a vibrant mixed-use community. A sense of community is created through connecting a wide range of family types and cultures within a unique, social and interactive complex.
4 PROJECT CONTEXT
4.1 Future Development in Morningside

*It’s my backyard* is a website created by the Auckland city council, as a tool for indicating proposed development of Auckland areas under the future planning framework. The framework covers the following issues: how and where growth and development should occur; respecting the historic urban landscape; preserving our natural environment; developing high quality urban areas; and retaining our unique character and identity.  

The Eden/Albert area is one of the city’s most densely populated areas and offers high levels of amenity and good access to the CBD. Future plans in this area look at addressing growth via high quality development, while taking care to retain the existing character of the area.

Morningside is included in the Eden/Albert area plan. Between now and 2030 the council wishes to see a number of outcomes are achieved:

- To ensuing that development of Westfield St Lukes sees it from part of the wider Morningside/St Lukes town centre.
- Allowing more intensive development along the area’s major roads, such as Dominion, New North and Sandringham roads.
- Focusing growth around, enhancing and improving public transport connections to local centres throughout the area, to create lively community hubs.

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106 Ibid.

107 Ibid.
Figure 25: It's My Backyard – Eden/Albert Area Plan

Figure 26: It's My Backyard – Residential Outcomes
Figure 27: It’s My Backyard – Centres / Mixed Use / Key Sites

Figure 28: It’s My Backyard – Transport
4.2 Site Analysis

4.2.1 Site Location

It was essential to find a site within easy access of local amenities such as public transport, work places, shops, community facilities and other services, all of which are preferred to be within a ten minute walking distance. A number of residential suburbs along Auckland’s Western Train line were assessed in order to find an optimal site, where the previously mentioned features were all met. Looking into the areas of Avondale, Mt Albert, Morningside and Glen Eden, it was found that Morningside encompassed the greatest number of assets essential in the implementation of a medium-density housing scheme.

Two blocks situated in the Morningside suburb of Auckland were selected for comparison. (Refer to Appendix B for a Comparative Document of Sites A and B) After an in depth analysis by means of a physical exploration of the area, it was found that Site A (Figure 29) held greater opportunities for the brief of this project. The site is bounded by the four streets; McDonald, Ethel, Collins and Altham and lies at the boundary of the residential and industrial sectors of Morningside.

Figure 29: Aerial View of Morningside with the Site A Shaded in Purple
Figure 30: Figure-Ground Image: Indicating Density of the Area and Highlighting the Selected Site and the Existing Building to be Developed
4.2.2 Site Information

The Morningside area provides local amenities and community services necessary for the success of a medium-density residential development. The following section outlines the existing features of the area.

Mt Albert School and Morningside Kindergarten (Figure 31) sit within the block between Taylors Road, New North Road and Sainsbury Road. The school is very pleasant and fits into this residential area nicely. The school is a short walk from the site and provides the community with a well maintained and desirable education environment for children. The grounds of the school are well kept and provide large open areas of grass, a playground and paved areas for other outdoor activities.

Morningside train station (Figure 32) is a short walk from most locations in the area and main bus routes run along busy New North Road (refer to aerial image under Site Location section). As the train runs so close to this built up neighbourhood, regular noise may become an annoyance. Because much of the area is used for industrial purposes noise is often not a hindering factor. Introducing residential use into this area means that train noise becomes a factor to consider in design and planning.
St Lukes Shopping Centre includes a number of retail shops, food facilities, a movie theatre and supermarket. Positioned just a short distance away at the end of Morningside Drive, this complex provides the residents with all of their daily needs within a five minute walk. The local city library is located there also.

At the corner of Morningside Drive and New North Road there is a small group of local shops (Figure 33) which include Thai and Indian restaurants, a laundry-mat and two dairies, all conveniently located within a short walking distance of the site. This area could do with some general tidy-up renovations and upgrading to make it more inviting to the residents, but it is generally adequate for local shopping - the paper and some milk in the morning. Other local facilities for the residents include a fitness centre, which sits beside the train track and a café and sushi bar further south along Morningside Drive.

The final key feature of this area is a small park situated to the south east of the site. Gribblehirst Park (Figure 34) is well kept and seems to have plenty of visitors throughout the day. The park is child friendly with a playground and flying fox. It also caters for the elderly with a combined bowling and petanque club. A large field at the bottom of the park is dedicated to the local rugby club with club rooms positioned off to one side. Both vehicle and pedestrian access is positioned at various locations around the park.

Figure 33: Local Shops in Morningside

Figure 34: Gribblehirst Park with Playground and Rugby Field in Distance
The residential areas that border the industrial sector contain tidy, maintained, traditional villas typical of the New Zealand suburbs. Many have been renovated and modernized to fit within today’s fashion, making this area a desirable place to live.

It was therefore fitting that this obsolete industrial land could be reallocated to residential use. A redesign of this area was appropriate to find a sympathetic link between the industrial businesses on one side and the residential use on the other. This housing development will provide a living and working setting which straddles the border between the traditional residential suburbs and the busy working environment of the industrial sector.
4.2.3 Further Site Analysis

Further along in the design process a decision was made to retain foundations and structure of the existing buildings on site. Re-using the existing structure in the new design meant less time would be needed for the construction process, structural costs would be lessened and the total embodied energy of the ‘new’ buildings would be lower. Therefore, the sustainability of the project was enhanced through building recycling and re-use. Further site analysis was undertaken at this stage of the process. Upon making a trip back to the site, investigations were made into the structural systems holding up the industrial buildings. It was found that many were ‘shed-like’ in construction; meaning they encompassed a heavy, typically concrete structure, and topped with a light weight roofing systems.

At this stage it becomes evident that in the time frame of this project only one section of the site could be chosen for detailed development. The largest building on the site – occupying almost a third - was chosen to progress into the detailed design stages. Investigations into its structural details were made and a decision to retain the exiting concrete structure (Figure 37) along with the steel truss roofing system (Figure 38) was concluded.

Figure 37: Concrete Structure within the ‘Sheds’

Figure 38: Steel Truss Roofing System in the ‘Sheds’
5 PROJECT DEVELOPMENT
5.1 Design Criteria for Medium-Density Housing

A period of research collection marked the beginning of this project; sourcing general criteria appropriate for the development of a medium-density housing scheme. It was found that common criteria ran throughout the literature of both New Zealand and Australian references. The information established from this research was collated into a set of design principles or criteria to be implemented in this scheme. The list of criteria is general and has common applications, but helped in the initial stages of the project as a means of evaluating existing schemes and also as a basis for finding an optimal site onto which a medium-density housing scheme would fit.

A full list of the criteria researched can be found in Appendix B. The following is a summary of key points found in the literature:

1. **Urban Design**
   Urban designs of residential areas are to achieve a higher degree of density, diversity and affordability, while achieving high standards of residential amenity.

2. **Integration**
   The design shall be compatible with the existing streetscape and have minimal impact on the immediate area. New developments should take advantage of the existing amenities without overloading them.

3. **Location**
   Easy access – preferably within walking distance - to local amenities such as public transport, work places, shops, community facilities and other services.

4. **Landscaping and Open Space**
   Common outdoor spaces and streets provide open areas for public use. Access to and oversight of these spaces is important. Open areas for communal use complement buildings. Their use is conditional on these spaces being safe, robust and pleasant.
5. **Pedestrian Access and Wayfinding**
   People will follow the easiest, direct path between two points. Clear and convenient access for both residents and visitors, which is simple to follow and easily visible, is essential. Pedestrian routes should be safe, have good lighting and are preferably overlooked by adjacent buildings for security.

6. **Vehicular Access and Parking**
   Designing appropriate, efficient, conveniently located and aesthetically pleasing car access and storage with high levels of safety and security is a great challenge, but necessary for dense housing communities. Vehicles moving within site boundaries shall be kept to low speeds and come secondary to pedestrians.

7. **Identity, Variety and Diversity**
   Identity can be achieved by providing greater variety in the design of individual dwellings and providing opportunity for personalisation. Providing different housing types and densities maintains a sense of diversity, where a mix of tenure can be accommodated.

8. **Privacy**
   The issue of privacy between residents and neighbours must be addressed with increased densities. Definition between public, semi-public and private outdoor space needs to be made in order to maintain privacy. Each individual unit requires some sort of visually protected outdoor space.

9. **Security**
   Safety is especially important for increased densities, where there is a significant amount of shared space and people live closer together. Increased housing densities can be both a positive (increased surveillance by onlooking neighbours) and negative (easier for intruders to go unnoticed) for security.

10. **Sustainability**
    We need to consider how these developments can reduce material consumption, use resources more efficiently and use renewable rather than non-renewable resources, while reducing urban sprawl. For a development to be sustained, it must meet the ongoing needs of the occupants for flexibility of use, privacy, cost effective environmental controls and minimisation of the cost of ownership.
5.2 Case Studies

A number of case studies were analysed in this process, with the majority sited in the Auckland region. Only three have been mentioned here – Two New Zealand examples and one from the United Kingdom - as each embrace significant values which have influenced the design of this project. A brief outline of these studies is mentioned here. For a full analysis please refer to Appendix A. The full analysis provides an in depth look into each of these key case studies, using the criteria in the above section as a tool for evaluation.

International examples of affordable housing are far wider ranging then here in New Zealand. European countries, Australia and England have been pursuing higher density living for years and are now very capable in producing successful results of a high quality. New Zealand is only now beginning to look at higher density living as a means of providing our growing population with affordable housing within the existing metropolitan area.
5.2.1 Beaumont Quarter

<table>
<thead>
<tr>
<th>Location:</th>
<th>Beaumont Street, Freemans Bay, Auckland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction:</td>
<td>2001 - Ongoing</td>
</tr>
<tr>
<td>Dwellings:</td>
<td>240 (Terraced and Apartment)</td>
</tr>
<tr>
<td>Density:</td>
<td>69 dph</td>
</tr>
</tbody>
</table>

**Summary**

*Beaumont Quarter* in Auckland City is a high-end urban housing solution which incorporates a number of desirable attributes - providing a mix of uses, secure parking, and a high quality urban environment. Positioned on land previously owned by the Auckland Gas Company, this scheme utilises the existing buildings; converting spaces into offices and resident facilities as part of the new development. The site is well located and within a close proximity to the CBD, public transport and a number of amenities. At a density of 69dph, this scheme is comparable to the one being designed in this project, but only in terms of housing type and density. A mix of dwelling types is evident upon walking through the development; incorporating higher density apartments with lower density terraced town houses.

As this housing development is aimed at the high-end market, it would not be suitable to consider all aspects of Beaumont Quarter in the design of the scheme described in this document. What can be utilised from this housing development are design ideas for using space, creating public and private areas, and balancing density.

*(Refer to Appendix A for a Full Analysis and Images on Beaumont Quarter)*
5.2.2 Talbot Park

Location: Glen Innes, Auckland
Construction: 2007
Dwellings: 111 New and 108 Refurbished (HNZC Residential Units)
Density: 43.8 dph

Summary

The Talbot Park development is a community renewal project initiated by Housing New Zealand. The primary goal of these renewal projects is to “address social exclusion and foster strong sustainable communities”.[108]

Talbot Park sits in the suburb of Glen Innes in Auckland. Glenn Innes is a low socio-economic suburb located within eastern Auckland; with many residents relying heavily on social assistance. It demonstrates quality urban design principles, sustainable building practices, community partnerships and innovative architectural design in medium-density housing.[109]

The general aesthetic quality of the architecture and its adjoining spaces in this development is high; consequently, the residents now take pride in their environment. 108 existing dwellings were refurbished with 111 new dwellings constructed and integrated into a new, safe and healthy environment. A sense of identity for the community comes from the diversity and quality of the buildings. A range of medium-density housing typologies were created, catering to a wide range of family structures.


[109] Ibid.
Uniformity throughout the development was avoided, with architectural variety evident in both typology and design. Creating a healthier living environment for the residents of Talbot Park was achieved through the incorporation of sustainable features. A low impact design was favoured, with the aim of producing warmer and drier homes.

Boundaries between the existing public spaces of the park and the private spaces of the dwellings were undefined; and therefore resulted in high rates of vandalism and crime on private properties. The new parks are pleasant and landscaped simply, retaining existing trees and incorporating new greenery. Playground equipment is provided in both parks, for families to enjoy outdoor activities with their children. A new internal road layout was created to improve connections through the site. Narrow streets were designed with an aim at slowing traffic, making sure pedestrians and cyclists are safe while moving around the development.

The Talbot Park development provides this project with a sense of how to produce an affordable, yet high quality, medium-density living environment. The architecture, by use of materials, detailing and composition, is well planned and thought out. This scheme presents an affordable housing solution, which is cheap but does not look cheap. This is what the project in this document aims to achieve. Quality need not suffer at the hand of economics.

(Refer to Appendix A for a Full Analysis and Images on Talbot Park)
5.2.3 BedZED

Location: Beddington, London
Construction: 2002
Dwellings: 82 Houses, 17 Apartments
Density: High Density

Summary

BedZED in London has been chosen as an international example for the development of this project. The outcomes of this housing scheme are closely related to those intended for this project. BedZED or the Beddington Zero Energy Development is the United Kingdom’s largest mixed-use sustainable community. It was designed to provide people with a high quality of life within a thriving community, while living off the earth’s natural resources.

“The BedZED Development design meets very high environmental standards, with a strong emphasis on roof gardens, sunlight, solar energy, reduction of energy consumption, and waste water recycling.” This scheme proves that high levels of sustainability – where energy is produced from renewable sources - can be achieved at a multi-unit scale. A number of sustainable features have been used throughout the BedZED development in achieving a ‘zero energy’ live/work environment. A significant reduction in environmental impact was achieved simple by allowing people to live and

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work at the development. Homes in the BedZED development use 90% less energy than that of a typical home.

BedZED looks at ways in which to decrease dependency on the car. Similar to the achievements of the project in this document, the BedZED development limits private car ownership with an aim of promoting public transport. Reducing the need for travel is enhanced by supplying many of the necessary daily needs close at hand, either within the development or by walking a short distance, or taking public transport.

BedZED is a highly sustainable, mixed-use community where trying to achieve a ‘zero waste’ development has resulted in an extreme environment where sustainability has been addressed in detail on every level. The project in this document does not aim to implement features of sustainability so intensely, but aims at borrowing some of the ideas used at BedZED and employing them in this design. New Zealand currently has no examples on par with the Beddington development, so looking internationally has been of significant help during the research process. Is New Zealand ready for this level of sustainable living? The project outlined in this document looks into ways of employing sustainable features that are suitable and viable in a New Zealand environment. 

(Refer to Appendix A for a Full Analysis and Images on BedZED)
5.3 **Housing Development Cost and Value Relationships**

Three factors determine the relationship of cost and unit size: average household income, capital value, and current building costs. (Refer to Appendix B)

This note is intended to outline the basic structure of the inter-related factors that affect house building in the private and public sectors, using current figures for incomes, discount interest rates and building costs. The total capital to be invested is dependent on two factors: average household income and current lending interest rates. (Refer to Appendix B for full explanation and calculations) 50% (for profit, site costs and development costs) of the capital value is deducted to find an approximate ‘build cost’. We can then use this figure, divided by our per m² value, to find an initial approximate size for each dwelling configuration. The following calculations provide basic numbers for this project. (Refer to Appendix B for full calculations) Approximate dwelling sizes have been calculated and are used in this project as a guide to designing ‘affordable’ dwellings for those on a modest income.

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**Unit Area calculation for 1 Income Household:**

(One Bedroom Loft Apartment)

- *Capital Value* = $171,200 @ 6.15%
- *Deduct 50%* = $171,200 – 50% = **$85,600**
- *Unit Area* = $85,500 / $1,800 = **48 m²**
- *Deposit Required for Welcome Home Loan* = **None**

**Unit Area calculation for 1.5 Income Household:**

(2-3 Bedroom Dwelling – 1 Room for Office as Required)

- *Capital Value* = $256,700 @ 6.15%
- *Deduct 50%* = $256,700 – 50% = **$128,300**
- *Unit Area* = $128,300 / $1,800 = **71 m²**
- *Deposit Required for Welcome Home Loan* = **$8,500**

**Unit Area calculation for 2 Income Household:**

(3-4 Bedroom Dwelling - 1 Room for Office as Required)

- *Capital Value* = $342,300 @ 6.15%
- *Deduct 50%* = $342,300 – 50% = **$171,200**
- *Unit Area* = $171,200 / $1,800 = **95 m²**
- *Deposit Required for Welcome Home Loan* = **$21,300**
This project uses these figures as a basis for an affordable housing build. Build costs will generally be higher in this scheme, as the incorporation of sustainable features increases the capital cost of each dwelling. The money saved on running the home is aimed at compensating for the initial higher capital cost. Due to the inclusion of these sustainable qualities, each dwelling is aimed at costing $1,800 per m², a figure which lies between the build of Housing New Zealand homes and an average detached suburban home. This project has not looked extensively into cost details but has used the figures outlined in this section as a general guide.

113 ibid. 1
5.4 Density

Medium-density housing is fast becoming a vital urban housing form in New Zealand cities. This housing typology has the ability to contribute to housing quality, choice and affordability, while providing an opportunity to significantly increase urban density; achieving this through a more efficient use of urban land and infrastructure. Suburban living plays an important role in New Zealand culture; however in recent times it has become clear that the detached suburban dwelling is increasingly less appropriate and affordable for a growing number of households. The value of medium-density housing is in its capability to achieve increased housing density, choice and affordability, while maintaining a number of important advantages of detached housing; namely ground level access, private open space and individual identity.

For the purpose of this project the definition set out by Bruce Judd in *Designed for Urban Living* has been used:

“The term ‘medium-density group housing’ is used to refer to a number or horizontally attached (or related) dwellings which are normally of one or two storeys and rarely exceed three storeys above the ground with individual access and private open space at or near ground level.”

114 Bruce Judd, *Designed for Urban Living; Recent Medium-Density Group Housing in Australia* (Perth: The Royal Australian Institute of Architects, ©1993), 8
In New Zealand, medium-density housing is defined as: "Housing at densities of more than 150m² / unit and less then 350m² / unit, or 30-66 dwellings per hectare (dph)." This definition is currently used by the majority of City Councils throughout New Zealand and by the Housing New Zealand Corporation. Dwelling density refers to the number of dwellings occupying a given area (normally a hectare) and can be expressed in net or gross terms. Net dwelling density is calculated using only the site area actually belonging to the development, it is therefore a useful tool when measuring the comparative efficiency of land use between individual housing developments.

Density should not be used as a tool for determining the quality of residential design, because other factors in various combinations impact on the outcome - privacy, public open space, architectural style, parking provision, landscaping, and security and so on. For this project, density has been calculated as a means of measuring how efficient urban land can be and has been used while maintaining a high quality architectural solution. By providing a site density calculation for this project a comparative study can be made between this scheme, future developments and those of the past.

Site A: The total area for Site A is 17600m² or 1.76 hectare. This entire site will hold approximately 106 dwellings @ 60dph (Therefore defined as medium-density under current New Zealand standards)

'Three-Sheds': The total area for the ‘Three-Sheds’ is 3650m² or 0.365 hectare. 23 Dwellings have been designed for this section of the site @ 63dph (Therefore defined as medium-density under current New Zealand standards)

115 David Turner et al., Best Practice in Medium Density Housing Design for Housing New Zealand Corporation (Auckland: UNITEC New Zealand, September 2004). 22
116 Judd, Designed for Urban Living; Recent Medium-Density Group Housing in Australia. 9
5.5 *Design Strategy*

5.5.1 *Proposed Function*

Intensification is an issue that has been dealt with internationally for some time, yet its importance in New Zealand is only now coming into existence, especially in major cities such as Auckland. Due to rising home ownership costs in New Zealand, the number of people able to purchase a home is declining. Creating denser living environments within metropolitan areas will mean a greater supply of affordable housing can be developed.

Currently existing as under-utilised brownfield land, the Morningside site is to be redeveloped into a mixed-use, medium-density housing scheme in which the existing structures are to be re-used and recycled. The proposed function is aimed at generating a mixed environment where residential and non-residential uses are combined within the one complex, and provide living, working and recreation amenities. A variety of medium-density housing typologies and sizes are to be developed and are intended to cater to households on moderate incomes.
5.5.2 Building Programme

- The front of the existing building will be retained – directly off McDonald Street - and be devoted to retail/commercial space. A new ‘streetscape upgrade’, planned by the Auckland City Council, is to run from the Morningside Train Station, along McDonald Street then toward Eden Park along Altham Street. Positioning retail along this high foot traffic area will ensure greater use of the businesses placed here.

- A Street running through the centre of the site is being developed as part of the masterplan, with the intention to centrally connect all the buildings of the site. This road is intended to be narrow, slowing traffic, while the footpaths are to be made wider, giving priority to pedestrian movement. This main road is to be well lit and overlooked by residents to ensure safety at all times of the day. Landscaping is also significant, as it will ensure that this pathway is attractive, and will help to direct movement through the site.

- A second pathway runs parallel to the central street and has been created as a pedestrian only access route. This secondary pathway facilitates movement through the site from McDonald Street through to Shaw Street – previously unconnected and linked only by moving around the entire block. This walkway acts as the live work avenue where commercial and retail space is provided on the ground floor of the third ‘shed’ and residential lofts sit above. Access into these retailers is via this pedestrian pathway.

- A café is to be positioned on the ground floor of the third ‘shed’, at the corner of the central street and parallel pedestrian pathway. This café provides a central link for retailers, persons working from home and the residents. Foot traffic moving around the site in both directions will facilitate significant use throughout the day.

- The two buildings sitting directly to the south of the ‘sheds’ are to be used for parking space on the ground level. As their design already tends toward a basement carpark, it was felt that this was the most logical option for providing space for vehicle storage. As this project is aiming at reducing the need for private vehicle use, not all households will be allocated a car space. These two buildings are intended, as part of the masterplan, to occupy further retail uses on the top floor.
Four types of dwellings have been designed; all aimed at households on a moderate income:

- **Loft Apartments** for working professionals and/or couples. Where retail/commercial space will occupy the ground floor and both living and sleeping space will be contained on the second floor. These live/work dwellings will occupy the third 'shed', furthest south.

- **Two Bedroom Townhouses** for a couple who require a work from home office/spare bedroom or for families with one child.

- **Three Bedroom Townhouses** for families with two children or families with one child and require a work from home office/spare bedroom.

- **Four Bedroom Townhouse** for larger families with three children or for families with two children and require a work from home office/spare bedroom.

- **NOTE**: Each of the Townhouse typologies are two-stories in height and will be placed in varies combinations throughout the first and second ‘sheds’.

- **Within the three ‘sheds’** a mix of dwelling typologies and sizes are to occupy the existing structure. To achieve a density of 30-66dph (medium-density), 18 dwellings minimum need to be positioned throughout the ‘sheds’.

- Each of the dwellings is to be provided space for work from home. While this is not a requirement for all households, it is intended that the ‘workspace’ is multi-functional, and can become an additional bedroom if wished by the owners.

- Public outdoor spaces are also provided as areas of interaction between neighbours. These spaces are designed at a high quality and offer small pockets of greenspace for the residents to enjoy.
• **Sustainability** is achieved by employing strategies and features in the design that will significantly help to reduce energy costs in the home. Making smarter choices on material selection, use of energy efficient appliances and utilising our natural resources are all key elements of the design.

• **Affordability** is achieved by reducing energy costs in the home via the use of energy efficient strategies and features. Homes are made affordable by using urban land more efficiently and increasing the density. A combination of reduced energy costs and smaller plots of land aid in reducing home ownership costs.

• **A sense of community** is achieved by providing a range of dwelling types, so that a diverse group of people can all live together within a single development. Providing live and work opportunities further enhances a sense of community, where people are active around the development throughout the day. Shared communal facilities also aid in socially sustaining the community.
6 DESIGN STRATEGY
6.1 **Design Process**

6.1.1 *Urban Design – Masterplanning and Initial Design Stage*

The link between the existing residential suburb and the industrial zone is blunt and unsympathetic. This design needed to look at ways in which to create a sensitive link between the two differing areas. A connection through the site, for both vehicle and pedestrian movement, played a key role in the early stages of masterplanning this scheme. A masterplan of internal pedestrian and vehicle access points and movement patterns, helped to define the layout of housing blocks over the site. International examples worked well in finding inspiration for this type of urban designing, as many countries overseas are much more experienced in this type of urban planning. Time and effort was focused on producing design ideas which merged the pulses of each ‘concept’; affordability, sustainability and community. Through planning and analysis, preliminary ideas began to be formulated.

Design ideas began to flow from investigations into the existing area and its influences. The possibility to reuse some of the existing buildings on site became a viable option, which agreeably fits with the sustainability theme of this project. The recycling and reuse of existing buildings can save money on the construction of new buildings, as well as on time for new build. This idea introduced the redevelopment of existing buildings as a potential choice for this project. While the majority of buildings currently existing on the site are ‘shed-like’ in design and used for light industrial and commercial purposes, it posed many issues when looking at redevelopment as a residential community. First thoughts posed questions about looking into the retention of structural elements of the existing buildings; the concrete foundations; the concrete post and beam structure and the light weight, steel truss roofing systems – all common characteristics for the majority of buildings positioned in the industrial zone of Morningside.

It was decided that a ‘flagship’ building was to be chosen at this stage. This building would then be designed in some detail as an example for other buildings on the remainder of the site to follow. The building to be chosen needed to best represent my design philosophy and aims, for the final presentation and this explanatory document.

Questions arise from the conversion of industrial/commercial buildings into affordable, sustainable and comfortable dwellings. How do we dwell in a warehouse? How do we inhabit close space? Architecturally these questions needed to be dealt with. Throughout the design process I searched for answers. At times the difficulty of this endeavour proved to be a big task. Many plans were produced, then analysed, discarded, and redesigned. Previous designs were looked back on and then formulated into new
designs. This process played a back and forth role, using both section and planning to find a result. The scheme needed to work within the limits of the existing structural constraints while ensuring a quality sustainable design was developed, in which people could afford to rent and buy, but would also enjoy to live in.

Initial planning appeared very regular. It was suggested that variety be integrated into the design via a number of ways – creating height changes through building density and type; using the contours of the site to create elevated pathways and buildings; and to play with layers in the planning.

Working in section was to be the next step in the design process, as a flagship building had been chosen. Working in section allowed the project to progressively develop - using realistic heights, materials and details of the existing building to be retained. It was discussed that I would try keeping as many of the existing structural elements as possible to rework into the new design. Through development in section it was easy to find different combinations of housing types, possible housing arrangements within the existing structure and a balance between greenspace and massing (Figure 46). Design for natural ventilation, orientation and open verse enclosed space was achieved through sectional design.

Figure 46: Massing Study within the Existing Structure
Figure 47: Building Uses and Activity Masterplan

Figure 48: Movement Patterns Masterplan
Figure 49: Concept Section Sketch for the 'Three Sheds'
6.1.2 Integration into the existing Community

It was also essential to find reasons for retail and commercial businesses that I include in this scheme, along with appropriate sizes, the number required and their location within the development. The surrounding context played an important role in the analysis of the site. It was important to recognise which businesses within the immediate context would have a direct impact on the design of this scheme. Noise control, vehicle movement and parking, and operation hours all needed to be researched and considered during the analysis process. A catalogue indicating such features was developed, which described each building directly bordering the site, as well as those existing on the site. Further information, such as building materials, address and type of business was also indicated in the catalogue.

A number of issues and ideas arose from the first design critique of the year. A closer look into the surrounding residential facilities became an apparent concern for the critics looking at this project. They wanted to know more about what facilities already exist in the areas for the residents and what needed to be created in order to accommodate an influx in population. This was a helpful critique as it pushed the project to begin developing a detailed programme for this scheme. Businesses to be incorporated and developed into this new residential zone could then be determined along with locations, size and type.

Figure 50: Initial Planning for the ‘Three Sheds’ – The Density Being too High
6.1.3 Pedestrian Access and Wayfinding

A long link through the centre of the site, running from north to south implied a main access route and also helped to divide the site into two sides; where residential and industrial uses could be easily separated. From here a secondary route, running west to east, meant a connection through the site from the industrial zone to the residential could be made. Creating a hub, at the intersection of the two routes through the site, became a clear direction for the design. The hub was intended to act as an area of interaction, where public facilities and shared communal spaces, both internal and external, could be arranged. This idea is one that stuck throughout the master planning and design stages of this project, as it clearly works with the design intent and direction of the scheme. A socially sustainable community could be achieved that worked around a main centre in which all activity for the residents was based.

It was suggested that planning be more focused around the pedestrian, making access to buildings and movement through the site easily accessible, clear and safe. A central pedestrian walkway running the length of the site, and broken up with a number of key public open spaces would help to define differing areas within the site, separate uses and provide variety and opportunity for public interaction.

Figure 51: Concept Plans
6.1.4 Vehicle Access and Parking

The vehicle was to be less influential in the master planning, with minimal access and movement through the site. However, it was essential to ensure that adequate parking facilities are accommodated and connected to the residential buildings, as well as to businesses via pedestrian walkways. An underground car-parking facility was discussed, which would provide parking for all occupants on site; with road access from both McDonald and Collins Streets. A final decision was made that meant two of the existing building – their design already tending toward an underground carpark - would be used. While this would not provide parking for the entire development, it was decided that this would be adequate for Stage One of the scheme; as reducing the need for private vehicle use was prioritised, with alternative modes of transportation provided and local amenities readily available.

Figure 52: Basement Carparking within Existing Building
Questions of aesthetics arose early on in the design process. What do I want the building to look like? How is the new and old going to work together? The contrast between the new and existing needed to be articulated. Details that highlight and solve these issues were worked up in order to prove that this design can work and be successful aesthetically. How do the new elements of the design and the existing structure, connect or disconnect from each other? The reuse and recycling of structural elements needed to be incorporated into the new design in an aesthetic way. It was argued that on initial viewing, the aesthetic impact needed to be appealing, in order for this scheme to be deemed a successful design. This was answered by finding a material – Hebel – that was very different to that already being used on the site in the general area. Highlighting the new elements in a modern, yet affordable and sustainable way was a challenged, but through the use of case studies and a lengthy process of research, this was able to be achieved. A sense of identity resulted. Variety and diversity came from the development of a number of housing typologies and sizes, which all encompass a unique aesthetic quality.
6.2 Design Features

6.2.1 Mixed-Use Community

A mix of house types was defined with regards to variety, identity and personality. Mixed-use developments offer more for the community - by providing living and working environments within the same vicinity and by presenting a diverse range of household types with an opportunity to live within the same complex. In this development, there are three types of terraced housing provided, catering to a variety of household structures. A series of Live/work units, with light commercial or retail uses below, have been also been successfully incorporated into this housing community.

With restrictions on noise and pollution the types of non-residential uses to be coupled with housing needed to be selective. Some things you will need or want to have such as a café, dairy, or laundry mat were all essential in the design of this scheme. Businesses already existing in the area - which do not comply with residential restrictions - will eventually (over time) be relocated or removed completely.

Affordability was achieved by looking into a number of alternatives. Government subsidies are just one way to compensate for the higher capital costs, due to new and desirable sustainable features being incorporated. Including shared facilities within the development enhances living conditions for all residents. Co-op communities make daily living cheaper and easier for all occupants. The main drive for this project was sustainability; therefore, incorporating sustainable features played a key role in the design. The features were intended to aid in reducing living costs for the occupants; therefore making rent and mortgage repayments easily accessible while servicing reduced energy bills.
6.2.2 Structure and Materiality

Recycling buildings hardly ever costs less than that of new build. It is in the long term savings on embodied energy where recycling structural elements for reuse in this new residential scheme can be argued. Following the theme on sustainability, recycling means that a lower embodied energy for the construction can be achieved. The economics of recycling was discussed with the supervisors and decided that it was not necessary to push specific costing for this project. The design should be architecturally, environmentally and character friendly, with these aspects being enough to defend my project and outweigh the economics.

Materiality also arose as an issue, with many wanting to know details about what was going to be retained as part of the new build. It became clear at this stage that detailing and selection of new materials to work alongside the existing, was going to be a key component in the design development of this project. Playing with new designs and how they relate to the elements being retained, adds interest and variety in the design. Creating layers through use of old and new elements adds to the aesthetics of the design.

Details begin to play an important role in the developed design stage. The structural details needed to be worked up, showing the connections between the existing structure and new build. Hebel became the material of choice - acting structurally and aesthetically – for its numerous beneficial qualities. Hebel is easily worked on-site, is lightweight and versatile. This meant working around the existing structure with the new material was an easy process. Timbre become the secondary choice of material; used for louver systems, detailing and aesthetic purposes in the design.

Figure 54: Existing Structure of the ‘Three Sheds’ – Steel Truss Roof with a Column and Beam Structure
6.2.3 **Sustainability**

It was now important to bring all three aspects together; function, energy and sustainability; into a cohesive design. Now that simple massing and room arrangement was designed, a sustainable plan could be applied - including solar energy, water management and harvesting, waste disposal and recycling and use of new and existing materials. A schematic to describe the systems to be used in each dwelling was to be developed in the final stages of the process; focusing on showing the heating and cooling systems for summer and winter, along with a water management diagram.

**Passive Design**

Looking into passive systems enables a fixed design, which can be realised without the need for a site, location or occupant status. Therefore a good passive design strategy formulated for the use in medium-density housing scheme could be used as a benchmark and repeated throughout the country.

Passive design for this project came naturally, as the orientation of dwellings is north. Thermal mass floors and internal walls, use of Hebel as a thermal insulator, double glazed windows, and the design of deep eaves, all work in combination to create a healthy and comfortable indoor environment that stays warm in the winter while keeping cool in the summer.
Solar Hot Water

The incorporation of solar hot water heating in the design was essential, because it is the most efficient and economic way to heat water in the home. A ‘closed loop solar hot water heating system’ was selected. “In a closed loop (indirect) system, the solar collector is separate from the storage cylinder. A heat transfer fluid such as glycol (which does not freeze) circulates through the collector panel (closed loop) to the cylinder using either thermosiphon or a pump. The fluid absorbs heat in the solar panels, which is then transferred to the water in the cylinder through a heat exchanger. The heat transfer fluid does not come into direct contact with the water being heated.” While a closed loop system is slightly less efficient than an ‘open loop solar water heating system’, it meant that the cylinder could be placed on the ground level and the hot water only needing to be pumped a short distance to both the bathrooms and the kitchen. A solar hot water system incorporated into each dwelling saves the occupants money on their energy bills.

Rainwater Collection and Greywater Filtering

‘Slimline’ rainwater tanks have been positioned in the rear gardens of each dwelling and design into the architecture. The tanks allow rainwater to be collected off the roof and stored in the tank for reuse in the home; providing substantial savings on water use and reducing demand on the mains supply. Larger tanks have been cut into the existing foundation, where overflow from the smaller tanks of each dwelling can be stored and then used to top up individual tanks when required.

The ‘greenwall’ system has been employed to filter greywater from each individual unit. The system uses planting to polish the water, which is then stored in a tank under the house and reticulated back into the home for flushing toilets and irrigated out into the gardens.

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7 CRITICAL APPRAISAL OF THE FINISHED WORK AND ITS THEORETICAL FRAMEWORK
7.1 Analysis of Theoretical Process as a Supporting Tool for Design

Theoretical research played an essential role in support of the design process. The project began with an in depth period of investigations, which focused on finding common criteria for medium-density housing, in which case studies and eventually this project could be evaluated. Sourced nationally and internationally - with a particular look into the guidelines set for Auckland - these criteria offered a helpful basis for finding an optimal site on which a medium-density housing scheme could be designed. This initial research proved to be basic, but essentially a helpful tool during the preliminary stages of this process. The criteria sourced deals with the issue of housing affordability through density and the quality of the environment.

The theoretical direction of this project changed significantly over the year. Through further site analysis and continued research it was found that the issue of affordability needed to look beyond applying density as a means of producing affordable housing options. A move toward creating homes which are sustainable, both environmentally and socially, became a key aspect of design while aiming to achieve affordability. With an aim of reducing running costs in the home, investigations into energy efficient strategies and water management solutions became an important research direction. Furthermore, it was made evident that places could only be sustained if the people living in them appreciated their environment and therefore, take pride in looking after it. By introducing the words ‘quality’ and ‘community’ the issues of social sustainability began to unwrap. Through research it became clear that housing must be met with a quality design result, capitalising on the synergies between affordability and sustainability.

At the outset, this design was to take on the development of a new, medium-density housing scheme to be located on a full block within the Morningside suburb of Auckland. It was made clear early on that this was a huge undertaking for a yearlong project. Therefore, it was decided that only part of the site would be planned in detail as Stage One of the schemes development. A masterplan was developed in order to illustrate an urban design proposal for the entire site. A single existing building – taking up a large portion of the site – was selected for detailed development. Stage One of the design is expected to become a benchmark or concept in which the remainder of the site would eventually be developed.

A decision made to retain and re-use many of the existing foundations and structure on the site led to a change in project direction. By retaining the existing structure, a number of design challenges opened up. A single building was selected for development with the existing concrete structure and steel truss roof system to remain. As is made clear during this project’s
design development, these elements proved to be a constant issue in the planning process. Research into building recycling and reuse played a role in the next stages of the design development. While the reuse of buildings is often associated with higher costs than starting fresh, it has been argued in this project that a decision to do this was based on a number of factors; first, that the retention of structural elements results in a lower overall embodied energy of the build; second, it involves less time required for the construction process and, therefore, a lower build cost; and third, it complies with the sustainability element of this project by recycling elements for reuse rather than replacing them with new.

These two stages of research each inform the other and in turn the architectural design of this project. The first area allowed a basic understanding of design criteria for medium-density housing to be understood and used as an evaluation tool for case studies, finding an optimal site and for assessing and designing the scheme described in this document. The second area of research employed strategies of sustainability to be implemented in the design as a means of addressing affordability. With some decisions proven to be difficult to work with, the end product has been well informed by research which reinforces and finds solutions to issues that may arise.
7.2 The Questions Answered

The task of applying research to design was an easy one. A clear understanding of criteria and features that were to be implemented in the design was evident from the beginning. The success of the project was not only to rely on the implementation of the research, but to work beyond these limits in formulating an outcome that exceeds general expectations.

From the beginning, issues with acceptability of this housing typology have arisen. Due to the public’s lack of knowledge in this area and the current poor representation of medium-density housing in New Zealand, a shift in attitudes needed to result from this project. The architecture of this project aims at making higher density living an acceptable and affordable option for more New Zealanders. By applying research findings in the design, an end result with clear direction was achieved which aimed at finding answers to the initial question:

*How are we to design denser housing schemes to make higher density living both acceptable and affordable for more New Zealanders?*

This question was answered through the architecture. A major drive for the architectural solution was **affordability**, which has been stated before as encompassing issues of sustainability. The design had to carefully fit into a set of design criteria, as well as exploring ideas of **social and environmental sustainability**. This task proved to be complicated, as each new question that arose from the research needed to be applied rationally throughout the design process. Looking at a number of case studies from here in Auckland proved the difficulty of this task. It appeared that the **three aims which this project looked at - affordability, sustainability and community** - have never been successfully implemented in a single design within New Zealand.

Overall the design has tried to successfully incorporate many features which aim at the success of an affordable housing scheme. Water management and energy efficient solutions have been incorporated into the design via material selection, use of energy from renewable source, rainwater collection and greywater recycling and a focus on lower embodied energy of new materials and by recycling and reusing existing structures.

While environmental sustainability helped to lower the costs to run and live in the dwellings, it was also important to achieve a socially sustainable neighbourhood. This was attained in the design by introducing features of **variety, identity, amenity and choice**. It was important in the design of this development that **mixed-use** alternatives could be applied. Providing easy access to community services and facilities, public transport and workplaces plays an essential role in the success of the neighbourhood. A **mix of tenure** was also necessary in this project. Providing housing choice meant that a mix
of tenure could be accomplished. Single class developments often results in slums, as they cannot be sustained; this project aims to reject segregation of classes. Employing each of these qualities ensures a community that will be socially sustained.

**Designing in section** proved to be the most successful means of designing in this project. Retention of the existing structure meant that many design elements were set from the outset - including building height, orientation, and density. There were many planning alternatives that occurred throughout the design process, resulting from architectural sections which continued to develop. The design process progressed slowly, as the project often went back to previous designs before moving on to the next. Trial and error solutions were typical in this design process, as structural restriction proved to be difficult. Numerous alternatives were explored and assessed; based on their functionality and ability to work within the set structural limits. This design exercise took many attempts to find an architectural solution which functioned successfully.

Through a **design-by-research** process, this project was able to successfully answer the main question asked in this document:

*How can we, as New Zealand architects, design affordable medium-density housing which ensures safe and healthy communities while enhancing environmental sustainability?*
7.3 Project Outcomes

The design conclusions of this project have been presented as a mixed-use medium-density development, in which issues of affordability have been met through the integration of socially and environmentally sustainable features. The design has been first presented as an urban design proposal, and then with concept architectural designs for a selection of medium-density dwellings within an inner-city environment.

7.3.1 Implementing Council Planning Policies and Strategies

Objective One: To implement strategies and planning policies set out by the Auckland City Council to a real-life brownfield site.

Planning Policies and Strategies outlined by the Auckland City Council and other New Zealand authorities have played an important role in defining this project and its outcomes. The Auckland Sustainability Framework, New Zealand Urban Design Protocol, Auckland Regional Affordable Housing Strategy, the Auckland Regional Growth Strategy 2050 and the New Zealand Energy Efficiency and Conservation Strategy have all been important documents for the research component of this study. Implementing concepts summarised in these strategies has aided in the clarity of conclusions formed in this architectural design project.

7.3.2 Creating a High Quality and Affordable Environment

Objective Two: To masterplan a high quality built environment where affordability and sustainability requirements are also met.

A high quality urban environment has been achieved by employing affordable features which lie within the realm of architectural design. Affordability issues are wide ranging and become more than a matter of design and begin to deal with issues outside the constraints of architecture. This project does not aim to solve the issues of affordability within New Zealand. The outcome of this project aims at producing a scheme which looks at ways in which we can begin to address the architectural issues relating to affordability. Such issues have been dealt with in this project and include the relationship between housing and transport, housing and work and housing and services and facilities. The quality of the build environment is high when material selection, design, variety, identity and choice are all evident. Housing becomes affordable when amenities are easily accessible to the residents - a high quality urban design can achieve this. This project has worked at exploring connections between quality built environments and affordability in an urban environment via architectural relationships and design.
7.3.3 Synergies between Affordability and Sustainability

Objective Three: Synergies between affordability and sustainability are to be researched, evaluated and formulated in design relevant terms for mixed-use, medium-density housing scheme.

This architectural proposal for a mixed-use, medium-density housing development meets the project intent of exploring synergies between affordability and sustainability. By first studying each concept separately, parallel outcomes and overlaps were established. The architectural design process has been informed by precedent studies, common council design criteria and by investigating issues and solutions of social and environmental sustainability. This scheme has been informed by research throughout the design process. Through research it was found that many issues of affordability were to be met with sustainability criteria. Affordability and sustainability are mutually supporting and, therefore, this project explored ways in which to combine the two concepts.

7.3.4 Setting a Benchmark

Objective Four: To provide a proposal in which issues of density are met with a quality urban housing solution; the outcome setting a benchmark to which future developments should endeavour to achieve.

The final outcome of this project was aimed at finding an architectural solution to affordability, where the end result could be used as a precedent for future development. People’s negative attitudes toward this housing typology needs to be changed, as dense urban living is set to become a common typology of the future. The public will begin to accept dense living environments if we embark on producing successful results. This architectural housing scheme has endeavoured to do this by looking attractive and offering choice, amenity, privacy, sociability and economy of energy and water consumption.
### 7.4 Wider Scope of the Project and Research

This project’s concept of using synergies between affordability, sustainability and community to explore housing design can be adapted to suit any site within the Auckland context. By using the architectural design process and research prepared in this document, a generic basis for future development has been formulated. However, as with any project, analysis of each new site should be completed to reveal the peculiarities of the site. Still, the basic principles outlined in this project – seeking synergies between affordability, sustainability and community - can be used everywhere.

#### 7.4.1 Further Research

This project explored mutual reinforcement between affordability and sustainability in the architectural design of medium-density housing. This is just one means of providing affordable housing within our urban centres. Further research into household structures and the type of people who will benefit from this typology will need to be explored in order to find a concise solution, where the living environment is made suitable to all types of people. This proposal has looked into affordable housing as a general ideal for which low to moderate income households can afford to buy. Standard designs are used and repeated. Planning would benefit from a more informed knowledge on how different types of people use the home.

Catering to a range of people will help to create a greater sense of community and enhance the mix of tenure.

Furthermore, economic factors have not been widely explored in this project. With affordability a number of financial aspects begin to influence the design. This project has not been one based on economic factors and number crunching, but rather concerned with finding an affordable architectural solution to housing issues faced in New Zealand. Affordability in this project has been defined in the use of energy efficient strategies and water management solutions in a medium-density, mixed-use environment. Lower running costs and ease of access to amenities is what makes the dwellings in this project affordable. Further research into costs and figures would benefit this project, as it would reassure that this scheme is indeed an affordable housing option for those on a moderate income.
The architectural design proposal of this scheme explores synergies between affordability and sustainability in a medium-density, mixed-use housing development. This was not an exercise in solving affordable housing issues in general, but about investigating ways in which architectural design may assist with these issues.

Proximity to public transport, work, and local facilities and services are all key features in creating a sustainable living environment – this is why Morningside was chosen as the site. With increased densities the quality of the community is an essential factor to consider in design. This design encourages neighbourly relations, security and a sense of community. Such environments are appreciated and are therefore sustained by the residents.

Incorporating environmentally sustainable features into the design ensures lower running costs, therefore making our homes cheaper to live in. Features such as solar hot water, water collection and use of sustainable materials tend to increase the capital cost. It is argued for the sake of this project that the upfront cost may higher, but the long term energy savings will ensure that the home is more affordable to run.

There were four objectives – all four have been achieved. First, strategies of the Auckland City Council and the New Zealand Government have been applied to a real brownfield site. Second, a masterplan was produced, adopting principals of affordability and sustainability. Third, these principals were tested and proven through the design process. Fourth, the design outcome shows that high-quality, medium-density housing is possible, and at an affordable price.

This document has focused predominantly on the theoretical and methodological issues of the design project. Research for design has played a key role in the design process, as the wide range of subjects covered shows. However, without an extensive process of research by design, the objectives of this project could not have been met. Stating that there are ‘synergies between Affordability and Sustainability in housing’ remains just a nice statement until we prove through design that this is achievable.

This project can be used as a benchmark for further investigations into the affordable housing typology. Achieving more housing in Auckland, at a higher density, is an important issue which must be addressed in the near future. Architecturally this project has produced quality affordable housing, without sacrificing environmental resources or quality of life and paying too much for the package.
Appendix A – Case Studies

Beaumont Quarter

Location: Beaumont Street, Freemans Bay, Auckland
Construction: 2001 - Ongoing
Dwellings: 240 (Terraced and Apartment)
Density: 69 dph

1. Urban Design

During the initial design stage of Beaumont Quarter, a masterplan was produced as a tool for organising the site and defining its potential. This masterplan was used to develop an urban design proposal for the site, indicating pedestrian and vehicle movement patterns, location and massing of residential buildings and a concept landscape plan for outdoor spaces. Eight apartment blocks, containing a small lettable commercial floor space, and use of five main variations in house type have been designed for the site at a density of 69 dph. Offices and a café have been designated space in the refurbished industrial building at the site’s frontage. This scheme provides a mix of housing types, various modes of transportation options and lifestyle choices, all aimed at the high end of the market. Shared facilities provide a sense of community where the residents can meet regularly. Proximity to the CBD and Victoria Park offers a whole range of ‘Live-work-play’ opportunities.118


Figure 55: View Overlooking Beaumont Quarter
2. **Location**

   This medium-density, mixed-use development sits on an inner-city site within a close proximity to public transport, Auckland’s CBD and the inner city suburb of Ponsonby – all of which are within a close walking distance. Victoria Park is located just across the road, providing residents with a setting where outdoor activities can be enjoyed. Other facilities close by include a supermarket, café and offices, allowing residents to live and work within the area. Good connections to public transport allow residents to be less reliant on the car as a mode of transportation. However, the Northern Motorway is close by, as is the CBD, so routes to and from work and other facilities are easily accessible.

3. **Pedestrian Access and Wayfinding**

   The pedestrian becomes an important influence in the design of this scheme, with narrow streets created as a means of avoiding vehicle domination (Figure 56). The vehicle takes a back seat, allowing pedestrian movement patterns to dominate the site. A series of pedestrian pathways and small squares link the buildings of the site together (Figure 57). Pedestrian connections through the site, as well as to the CBD and Ponsonby, make walking a viable option when seeking out a number of local services and facilities. Pedestrian routes feel safe, with good lighting and are overlooked by residents from their apartments for security.
4. **Vehicular Access and Parking**

Many townhouses throughout the development are provided with a single car space situated directly outside the dwelling (Figure 58). Car access for these dwellers is convenient, with security made possible by means of passive surveillance from onlooking residents. The majority of residents use the underground garage for vehicle storage. Car access is less convenient, but this secure, lockable car parking puts the resident’s mind at ease. The car is never a dominating feature on the streets of Beaumont Quarter. Alternatively, vehicle movement patterns, parking and storage have been integrated appropriately into the layout and planning.

5. **Identity, Variety and Diversity**

The existing buildings were originally built between 1901 and 1912 as offices and workshops for the Auckland Gas Company. Many of the existing buildings have been retained and adapted into offices and commercial space, as well as to house communal facilities. Retention of mature trees and refurbishment of the gasworks buildings add heritage, character, and identity to this now modern live-work environment (Figure 59). Diversity is created in the wide ranging variety of house types - including one bedroom studios, work-from-home terraced houses, double maisonettes, plus landscaped squares, pedestrian walkways and communal facilities - all of which are constructed with high quality materials and finishes.
6. **Privacy**

Natural light and privacy was a priority in the design of each dwelling, with a balance between built form and open space being essential. A series of open spaces helps to create this balance and adds a feeling of spaciousness to a dense built environment. Louvers have been used as not only a shading device but also to aid in solving issues of privacy and security (Figure 60). Small courtyards, patios, and rear yards separate house fronts from public spaces (Figure 60). Public and private spaces are well defined in order to maintain privacy. A hierarchy of spaces is created by the varied character and style of each dwelling type and its external spaces.

![Figure 60: Louvers used as a Privacy Screen and for Solar Control](image)

7. **Summary**

*Beaumont Quarter* in Auckland City is a high-end urban housing solution which incorporates a number of desirable attributes by providing a mix of uses, secure parking, and a high quality urban environment. As this housing development is aimed at the high-end market, it would not be suitable to consider all aspects of Beaumont Quarter in the design of the scheme described in this document. What can be utilised from this housing development are design ideas for using space, creating public and private areas, and balancing density.

![Figure 61: Vista toward Refurbished Gasworks Building](image)
**Talbot Park**

<table>
<thead>
<tr>
<th>Location</th>
<th>Glen Innes, Auckland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>2007</td>
</tr>
<tr>
<td>Dwellings</td>
<td>111 New and 108 Refurbished (HNZC Residential Units)</td>
</tr>
<tr>
<td>Density</td>
<td>43.8 dph</td>
</tr>
</tbody>
</table>

1. **Urban Design**

   The Talbot Park development is a community renewal project initiated by Housing New Zealand. “Situated in Glen Innes, Auckland City, Talbot Park is an area of high deprivation characterised by low levels of income, education and home ownership and high levels of welfare dependency, unemployment, single parent families, rental properties and overcrowding.”

   A masterplan was produced during the early stages to illustrate a site layout, which defined public and private space, an internal road layout and location of various housing typologies. The general aesthetic quality of the architecture and its adjoining spaces in this development is high; consequently, the residents now take pride in their environment.

   The ‘neighbourhood plan’ was developed to provide a range of housing typologies to suit a diverse range of household types, sizes and cultures. Demand to live in this previously undesirable area soon increased, resulting in a reduced resident turnover rate - from 50% in 2001 to a current 5%.

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119 Stuart Bracey, “Making Talbot Park a Better Place to Live,” *Build* 2007. 41
121 Bracey, “Making Talbot Park a Better Place to Live.” 42-43
2. **Integration**

Boffa Miskell led a collaborative process with the community, Auckland City Council and Housing New Zealand Corporation staff, to produce a detailed masterplan of the neighbourhood (Figure 63). Involving community members in the process led to a final design that was initiated by the people who would actually be living in this area. Major refurbishment of the existing 1960’s public housing was required to improve the poor conditions. 108 existing dwellings were refurbished with 111 new dwellings constructed and integrated into a new, safe and healthy environment.

3. **Location**

Glenn Innes is a low socio-economic suburb located within eastern Auckland; with many residents relying heavily on social assistance. Around 16,000 residents live in the area, in an approximate 5,000 dwellings; of which Housing New Zealand owns 56%.

Housing New Zealand sought to achieve a number of objectives, which were directly intended to help improve the area. The objectives aimed to: improve and enhance the physical environment and amenities; and

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to provide access to affordable and appropriate community services and facilities that respond to changing community needs.\textsuperscript{123} The main shopping hub for Glenn Innes is just a short walk from the Talbot Park development; placing residents within a close proximity to a number of local amenities and services, including the Glenn Innes Train Stop.

4. \textit{Landscaping and Open Space}

Two new parks were created to replace the single existing park. Boundaries between the existing public spaces of the park and the private spaces of the dwellings were undefined; and therefore resulted in high rates of vandalism and crime on private properties. Residents of the area felt unsafe, with a high occupancy turnover rate resulting. The creation of two new parks (Figures 65, 66) - with an improved urban relationship between public and private space and enhancement of the physical environment - has meant that residents now feel safe and can enjoy these outdoor spaces. The parks are overlooked by surrounding houses, providing increased security. The new parks are pleasant and landscaped simply, retaining existing trees and incorporating new greenery. Playground equipment is provided in both parks, for families to enjoy outdoor activities with their children.

5. **Pedestrian and Vehicle Movement Patterns**

A new internal road layout was created to improve connections through the site. Narrow streets were designed with an aim at slowing traffic, making sure pedestrians and cyclists are safe while moving around the development. Pathways around the development, through parks and into dwellings are clearly defined, have efficient lighting for safety and are overlooked by dwellings to increase security.

6. **Identity, Variety and Diversity**

A range of medium-density housing typologies were created, catering to a wide range of family structures. House types include detached family homes with up to 8 bedrooms for extended families (Figure 67), to terrace houses and apartments catering to smaller families – ensuring that different size families are able to find a suitable home, meeting their needs. Uniformity throughout the development was avoided, with architectural variety evident in both typology and design (Figure 68). A number of different architects were employed in the project, creating the diverse range of housing types and styles. Diversity of occupancies and variety in architecture help to create a sense of community.
7. **Security**

Security and social problems were common issues of the existing site. This project aimed to increase the sense of safety and reduce crime by improving the neighbourhood. A high density block off the main road shelters the site (Figure 69), while detached houses are located further east to relate better to the existing low density surroundings. "‘Crime Prevention Through Environmental Design’ principals have been used to ensure all public spaces are clearly defined and overlooked, streets and parks are connected and visible, and streetlights use ‘white light’."\(^\text{124}\) It is clear that residents now feel safer in their environment, with public spaces being used more and a significant reduction in graffiti and property damage evident.

8. **Sustainability**

Creating a healthier living environment for the residents of Talbot Park was achieved through the incorporation of sustainable features. A low impact design was favoured, with the aim of producing warmer and drier homes. Elements of sustainable design include: insulation levels above code requirements; passive ventilating through aluminium windows; range-hoods in kitchen to reduce internal condensation; solar water heating in some units (Figure 70); rainwater collection and recycling for garden use and

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\(^{124}\) Bracey, "Making Talbot Park a Better Place to Live." 42
flushing toilets; and permeable paving to reduce stormwater leaving the site.125

9. **Summary**

The *Talbot Park* development provides this project with a sense of how to produce an affordable, yet high quality, medium-density living environment. The architecture, by use of materials, detailing and composition, is well planned and thought out. This scheme presents an affordable housing solution, which is cheap but does not look cheap. This is what the project in this document aims to achieve. Quality need not suffer at the hand of economics.

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**BedZED**

**Location:** Beddington, London  
**Construction:** 2002  
**Dwellings:** 82 Houses, 17 Apartments  
**Density:** High Density

1. **Urban Design**

   BedZED is a mixed-use, sustainable community where live and work facilities are combined. Situated on previously underutilised brownfield land, the site has now been enhanced to contain a high quality residential environment. This residential and workspace development in London is a carbon neutral community with plentiful green spaces, recycling facilities, water saving features, and a green transport plan. The development is divided into a series of high-density, three-story city blocks and is a model example for an inner-city site; as it significantly helps to reduce sprawl by increasing the density on urban land. A high quality design results, where features of sustainability have been employed and utilised to generate a ‘Zero-Energy’ community.

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2. **Location**

BedZED is located in Beddington, South London and comprises of 99 dwellings, community facilities and workspaces (Figure 74). This scheme has been designed so that many of the residents needs are located within the direct vicinity of the development; however other community amenities are available close by. The use of private vehicles is kept to a minimum, therefore links to public transport and having amenities within a close walking or cycling distance means that a sustainable approach to transportation can be met. “84% of residents felt that the community facilities were better here than in previous neighbourhoods...”\(^{127}\)

3. **Vehicular Access and Parking**

Reducing the need for private car ownership was a major driver for this scheme. Private car ownership is limited with very little parking provided for the residents. Any parking that is available is paid for. Alternatively, various other modes of transportation are provided: public transport routes close by, walking and cycling options (Figure 75), car pooling and the ability to rent electric cars. Reducing the need to travel is favoured by providing many of the community amenities within the development.

\(^{127}\) BioRegional; Solutions for Sustainability, "Bedzed." (accessed March 31, 2010)
4. **Identity, Variety and Diversity**

The BedZED development comprises of 99 dwellings in a mixture of flats, maisonettes and town houses and with workspace/offices and community accommodation, including health care, nursery, organic café/shop and sports club house. This mixed tenure community provides houses for social tenants, key workers and owner occupiers. The mix of tenure in this development creates a sense of community, where all types of people live together and enjoy the use of communal facilities. Employing the use of prefabrication to aid in reducing the build cost and build duration has resulted in a uniform design where architectural variety is lacking (Figure 76). Individual units are undistinguishable, with the facades being very repetitive. The use of greenery in outdoor spaces does however help to break up the otherwise bland façade (Figure 77).

5. **Sustainability**

"The BedZED Development design meets very high environmental standards, with a strong emphasis on roof gardens, sunlight, solar energy, reduction of energy consumption, and waste water recycling." This scheme proves that high levels of sustainability –

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128 Ibid.

have been used throughout the BedZED development in achieving a 'zero energy' live/work environment (Figure 79). A significant reduction in environmental impact was achieved simple by allowing people to live and work at the development. Homes in the BedZED development use 90% less energy than that of a typical home. Further sustainable features of the design are as follows:

- Built from Natural or Reclaimed Materials
- Lower Embodied Energy Materials
- Passive Solar Heating
- Photovoltaic Power (Figure 78)
- Wind Powered Ventilation Systems (Figure 78)
- Water Treatment
- Bike Facilities
- Recycling Facilities
- Food is Organic and brought Locally and in Season
- Growing your Own Food
- Clothes and Furniture Shops
- Triple Glazing
- High Levels of Insulation
- Rainwater Collection and Recycling

Figure 78: Pedestrian Accessway (left), Wind Powered Ventilation System and PV Panels (Right)

Figure 79: Building Physics Schematic for the BedZED Development
6. **Summary**

BedZED is a highly sustainable, mixed-use community where trying to achieve a ‘zero waste’ development has resulted in an extreme environment where sustainability has been addressed in detail on every level. The project in this document does not aim to implement features of sustainability so intensely, but aims at borrowing some of the ideas used at BedZED and employing them in this design. New Zealand currently has no examples on par with the Beddington development, so looking internationally has been of significant help during the research process.

![Figure 80: End View of BedZED Dwelling Block](image)

![Figure 81: Aerial View of the BedZED Development](image)
Appendix B - Criteria Required in the Design of Medium-Density Housing

1. Urban and Neighbourhood Design

- Urban issues are to be resolved in order to produce a successful housing scheme.
- Urban designs of residential areas are to achieve more density, diversity and affordability while achieving high standards of residential amenity.
- Improve on the low standards of many existing lower – higher density suburban environments.¹³⁰
- Existing sub-standard housing is replaced or upgraded to acceptable standards.¹³¹
- Inspiration from traditional models of urban settlement eg. Leon Krier 'Village'

- Return to mix-use developments, with a combination of living and working environments.
- As residential densities increase there is more opportunity for alternate uses to be included in any one structure e.g. Housing mixed with retail and commercial space.¹³²
- Create a sense of community by connecting a wide range of family types and cultures within a unique, social and interactive complex.
- Social spaces such as liveable streets and large open spaces create areas of interaction.
- Well designed housing contributes positively to the wider community.

¹³⁰ Bruce Judd, Designed for Urban Living; Recent Medium Density Housing Group in Australia (Red Hill: The Royal Australian Institute of Architects, 1993). – ALL POINTS HIGHLIGHTED IN BLACK ARE SOURCED FROM THIS REFERENCE

¹³¹ Regional Growth Forum, Auckland Regional Affordable Housing Strategy. – ALL POINTS HIGHLIGHTED IN BLUE ARE SOURCED FROM THIS REFERENCE

¹³² Housing New Zealand Corporation, Design Guide; Housing at Higher Densities (Housing New Zealand Corporation, 2005). – ALL POINTS HIGHLIGHTED IN GREEN ARE SOURCED FROM THIS REFERENCE
2. **Environmental Fit / Integration**

- Providing continuity of character between new development and the existing urban fabric is important and can be achieved using a combination of characteristics and relationships, e.g. materials, colour, texture, scale, shapes and fenestration patterns.
- Affordable housing is integrated into existing neighbourhoods and new developments with minimal impact.
- The design shall be compatible with the exiting streetscape and have minimal impact on the immediate area.
- New housing developments should take advantage of existing services and facilities without overloading them e.g. public transport, road networks etc.
- Through design we need to ensure that the existing infrastructure is able to accommodate a medium-density development. Some urban areas are developed with infrastructure only suitable for lower densities, e.g. stormwater, sewerage, utilities, refuse disposal, etc.

3. **Location**

- Easy access to local amenities such as public transport, work places, shops, community facilities and other services. Preferably all within walking distance.

4. **Landscaping / Open Space**

- Parks, streets and malls provide open areas for public use. Access to and oversight of these spaces is important.
- Within the site open areas for communal use compliment the buildings. Use is conditional on these spaces being safe, robust and pleasant.
- There should be no expectation of maintenance of communal outside space.  
- With private areas indoor/outdoor flow is important, as is visual privacy for at least part of the area. These areas need to be clearly separated from other outdoor areas.

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Private outdoor space is minimal and is more like an open room than a garden. It should be small but useable, such as a deep balcony or room sized courtyard. Outdoor spaces should be low maintenance.

With larger shared space there is more emphasis on the quality of landscaping.

Both hard and soft landscaping needs to be integrated into the overall design.

Designs will include:
- Clear uses for distinct areas of shared space.
- Plants which are hardy and large enough to resist damage.
- Low maintenance.
- Hard landscape appropriate to use.

Pedestrian routes should be safe, have good lighting and are preferably overlooked by adjacent buildings for security.

Transition zones (paths, corridors, and porches) help to manage the boundaries between public and private space, inside and outside, communal and public areas and cars and pedestrians.

Site planning, landscaping, building form and detailing, and lighting can provide a good sense of arrival, orientation and circulation arrangement.

Individual dwellings and entrances should be clearly articulated from each other.

Signs, Lighting, Numbering, Clear Paths!

5. Pedestrian Access and Wayfinding

People will follow the easiest direct path between two points, therefore clear and convenient pedestrian access for both residents and visitors which is simple to follow and easily visible is essential.

6. Vehicular Access and Parking

Design for appropriate, efficient, conveniently located and aesthetically pleasing car access and storage with high levels of safety and security is a great challenge, but necessary for dense housing communities.

The streetscape should not be dominated by parking structures. Integrated or complimentary structures can add...
complexity, diversity and interest to an otherwise simple and repetitive form.

- The number of car spaces allocated to each dwelling is an important design factor to consider.
- With higher densities there will often be streets inside the site boundaries.
- Vehicles should be kept to low speeds and come secondary to pedestrians.
- Clearly articulate pedestrian areas and vehicle areas.
- Adequate manoeuvring and parking space is a necessity, but care needs to be taken to ensure parking areas are secure and practical.

7. **Identity, Variety and Diversity**

- As density increases the expression of individual identity decreases.
- Many qualities used in the designs of detached housing should be incorporated into MDH schemes as a means of gaining higher resident satisfaction.
- Identity can be achieved by providing greater variety in the design of individual dwellings and providing opportunity for personalisation.
- Creating variety in urban housing form is essential to achieving individual identity.
- Different housing types and densities maintain a sense of individuality that stand alone homes often achieve.
- The site shall be large enough to accommodate different densities of housing as well as adequate open space, car parking and circulation routes for both pedestrians and vehicles.
- There is a balance required between common themes or scale and the differentiation needed to provide identity for individual buildings and housing units.
- Housing units should be identifiable within a development as well as working well with the surrounding urban landscape and buildings.
- Housing units are to be identifiable within an overall composition.
- Care must be taken between higher density housing and sites of lower densities. Designs should acknowledge the transition between densities.
- Developments incorporate a mix of income groups.
- Subsidy dwellings (affordable housing) are indistinguishable from the private sector. Residents in subsidised housing do not want their houses to stand out.
8. Privacy

- Increased densities raises issues of privacy between residents and their neighbours.
- Privacy does not have to be achieved primarily through physical isolation. The concept of privacy is control rather than isolation.
- Acoustic privacy becomes a problem and can be solved using adequate insulation and careful space planning.
- Privacy is required for each individual unit with clearly separated and visually protected outdoor space.

9. Security

- Safety is especially pertinent to increased densities, where there is a significant amount of shared space and people live closer together.
- Increased housing densities can be both a positive and negative for security.
  - Easier for intruders to go unnoticed.
  - Increased surveillance.
- Lockable garages are preferred for vehicle security.
- Security lighting at entry points, access routes and common parking areas.

10. Dwelling Layout / Design

- General principles of good dwelling layout include clarity and definition of entry; simplicity; appropriate and convenient functional relationships; circulation efficiency; flexibility of room use and furnishing; clustering of ventilation and horizontal services; appropriate solar orientation of key rooms and their relationship to outdoor spaces and zoning of living areas and bedrooms.
- Number and location of bathrooms is important.
- Second/third bedrooms are rarely fully occupied due to low occupancy rates and, therefore, it is useful to think of these as multi-purpose spaces which can be used for other purposes.
- Adequate internal storage space is required with a variety of built in storage options.
• Caters to specific needs of occupiers, which may be related to age, health, family size/structure, cultural needs or special needs.
• Well designed dwellings with emphasis placed on energy efficiency, health and safety, privacy (acoustic/visual) and integration into the neighbourhood.
• All fittings and finishes should be of a high standard.
• ‘Historic’ or imported styles are not preferred for MDH; a more modern ‘sophisticated urbanite’ image is accepted.
• Design for comfort.
• Interior layout should include:
  - Simple plan layouts for clarity and economy.
  - Minimum circulation space.
  - Maximum useable area.
  - Access to bathrooms/WC screened from living areas where possible.
  - Light and air to prime rooms.
  - Storage space.
  - Direct access to private outdoor space.
  - Easy access to parking.

11. Climate Control / Sustainability
• Site planning should consider solar access and wind control; appropriate zoning and ventilation of spaces within the dwelling; careful selection of window location, size, type and shading systems; choice of construction materials and systems according to their embodied energy use, renewability, thermal mass, heat storage and insulation properties; and energy conscious selections of heating and cooling systems.
• A north facing site is desirable to allow solar orientation for the majority of dwellings to be designed for that site.
• We need to consider how these developments can reduce material consumption, use resources more efficiently and use renewable rather than non-renewable resources, while reducing urban sprawl.
• Recycling, water storage, alternative energy, energy efficiency and orientation to the sun.
• For a development to be socially sustainable, it must meet the ongoing needs of the occupants for flexibility of use, privacy, cost effective environmental controls and minimisation of the cost of ownership.
• Low running costs.
Environmental Sustainability:
- Water Supply
- Stormwater
- Waste; both Organic and Inorganic
- Climate Control

Degree of independence from urban structure.

Social Sustainability:
- For a development to be socially sustainable, it must meet the ongoing needs of the occupants for flexibility of use, privacy, cost-effective environmental controls, and minimisation of the cost of ownership.

Economic Sustainability:
- Housing for higher densities needs to consider total economic cost. This approach considers capital coat, cost in use, life-cycle coats and embodies energy costs.

Resilience:
- Where houses supply at least 25% of their own energy.

12. Marketability

- Successful housing design comes from understanding the needs and expectations of the market place.
- Good teamwork will ensure the very best translation from market research to design brief and finally to a good product which is both marketable and profitable.
- Well designed houses are a good investment. They last longer, need less maintenance and are easier to tenant.

13. Materials and Performance

- The performance of housing is closely related to the quality and durability of construction.
- There is a strong emphasis on robust materials and enduring design solutions.
- Specific requirements concerning the following are essential to a buildings performance:
  - Building Code and Fire Regulations.
14. **Building Elements**

- Frontages should address the street rather than present a blank façade. A prime room should overlook the street. The front door should be clearly visible from the point of site access.
- Entries need identity, shelter and security (oversight and lighting).
- Fences and walls are used to separate and differentiate certain areas. This can be done using a variety of materials, which should be robust and durable while being low maintenance.

15. **Making Medium-Density Housing Affordable**

- Government subsidy of tenant rent.
- Government subsidy of public sector rental dwellings.
- Government subsidy of community housing groups.

**NOTE**: Refer to footnotes for colour key and references.
Appendix B - Housing Development Cost and Value

Relationships

This note is intended to outline the basic structure of the inter-related factors that affect house building in the private and public sectors, using current figures for incomes, discount interest rates and building costs. All the quantified costs are approximated; the principles are varying. State housing suppliers, since the early 1990’s, are required to use similar working methods in their activities – they are required to operate on an equivalent commercial footing, but they also have some disadvantages that are not apparent in this rough guide to cost/value.

Three factors determine the relationship of cost and unit size: average house-hold income, capital value, and current building costs.

1. **Income:**

   - Average Wage = $45,000
   - Average Household Income = 1.5 x Average Wage = $68,000
   - Deduct 20% tax, etc = $55,000
     Net Disposable

   Standard Maximum Proportion to be spent on Housing
   =$55,000 x 30% = $16,000 (300 per week)

   The Capital Value related to the unit of housing, therefore, depends on the servicing income of $16,000 per annum.
2. **Capital Value:**

This depends on interest rates. If rates are high the total capital the income can service is smaller – and vice versa: the capital sum generated by the gross income figure is simply calculated by 100 divided by the % rate: so a table of different rates is:

<table>
<thead>
<tr>
<th>Rate</th>
<th>Calculation</th>
<th>Multiplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
<td>100/5</td>
<td>20</td>
</tr>
<tr>
<td>6%</td>
<td>100/6</td>
<td>16.6</td>
</tr>
<tr>
<td>7%</td>
<td>100/7</td>
<td>14.3</td>
</tr>
<tr>
<td>8%</td>
<td>100/8</td>
<td>12.5</td>
</tr>
<tr>
<td>9%</td>
<td>100/9</td>
<td>11.1</td>
</tr>
</tbody>
</table>

The last figure is a multiplier. If your income is $16,000 and you are borrowing @ 5%, the capital you can service, and thus borrow (from an investor, or a bank in the mortgage process, and so on) is:

\[ \$16,000 \times 20 = \$320,000 \]

As the interest rate increases, the multiplier reduces, and the capital sum does too:

\[ \$16,000 \times 11.1 = \$178,000 \]

3. **Building Costs:**

There’s no reason for cheap to = poor quality

(Although it usually does)

High-End, One-Off Houses might Cost $4,700 / m²
Average Suburban, One-Off Houses Cost about $2,250 / m²
Housing New Zealand (HNZC) Build at about $1,400-1,500 / m²
Private Sector Developers (50-60 units) expect $1,100-1,200 / m²
(Cheaper by purchasing bulk and use of repetition)

For the gross figures, the build costs convert to unit size by:

- **Market Sector** = Incomes for Servicing @ $16,000 / annum
  - **Capital Value** = $228,000 @ 7%
  - Deduct (Everything Else): profit, site costs, and development costs.

To set an initial approximate size, take all this @ 50%:

\[ \$228,000 \times 50\% = \$114,000; \]

This is what can be spent on a housing unit divided by your per square metre rate (say HNZC of $1,500 / m²)

\[ \text{Unit Area} = 76 \text{ m}^2 \]

*All of the above information in this section has been sourced from lecturer David Turner at the Department of Architecture, Unitec.*
Cost and Value Relationship Calculated for this Project

These calculations above have been used as the basis for calculating the cost and value relationship for this project.

Average Salary and Wage Income for the June 2009 Quarter:

The average (mean) weekly wage and salary income for people receiving income from this source was $843. This equates to an average wage or salary of $43,800 per annum.\[134\]

Build Cost for this Project:

Build costs will be generally higher in this scheme as the incorporation of sustainable feature increases the capital cost of each dwelling. The money saved on running the home is aimed at compensating for the initial higher capital cost. Due to the inclusion of sustainable characteristics in this project each dwelling is aimed at costing $1,800 per m². A figure which lies between the build of Housing New Zealand homes and an average detached suburban home. This project has not looked extensively into cost details but has used the figures outlined in this section as a general guide.

Home Interest Rates for Leading New Zealand Banks:

<table>
<thead>
<tr>
<th>Bank</th>
<th>12 Months Rate</th>
<th>24 Months Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSB Bank</td>
<td>6.20%</td>
<td>7.09%</td>
</tr>
<tr>
<td>BNZ Bank</td>
<td>6.25%</td>
<td>7.20%</td>
</tr>
<tr>
<td>Westpac</td>
<td>6.15%</td>
<td>7.20%</td>
</tr>
<tr>
<td>ASB Bank</td>
<td>6.25%</td>
<td>7.10%</td>
</tr>
<tr>
<td>National Bank</td>
<td>6.15%</td>
<td>7.20%</td>
</tr>
<tr>
<td>Kiwibank</td>
<td>6.15%</td>
<td>7.10%</td>
</tr>
</tbody>
</table>

1. *Income:*

Average Wage = $43,800

**Average 1 Income Household = 1 x Average Wage** = $43,800
Deduct 20% tax, etc
Gross Disposable

= $35,000

Standard Maximum Proportion to be spent on Housing

= $35,000 x 30% = **$10,500 ($200 per week)**

The Capital Value related to the unit of housing therefore depends on the servicing income of **$10,500 per annum.**

**Average 2 Income Household = 2 x Average Wage** = $87,600
Deduct 20% tax, etc
Gross Disposable

= $70,000

Standard Maximum Proportion to be spent on Housing

= $70,000 x 30% = **$21,000 ($400 per week)**

The Capital Value related to the unit of housing, therefore, depends on the servicing income of **$21,000 per annum.**

**Av. 1.5 Income Household = 1.5 x Average Wage** = $65,700
Deduct 20% tax, etc
Gross Disposable

= $52,500

Standard Maximum Proportion to be spent on Housing

= $52,500 x 30% = **$15,750 ($300 per week)**

The Capital Value related to the unit of housing therefore depends on the servicing income of **$15,750 per annum.**
2. **Capital Value:**

   12 Months @ 6.15% Rate = 100/6.15 = 16.3
   24 Months @ 7.10% Rate = 100/7.10 = 14.1

   **Amount Borrowed from Bank for 1 Income Household:**
   12 Months fixed @ 6.15 %
   = $10,500 x 16.3 = $171,200
   24 Months fixed @ 7.10 %
   = $10,500 x 14.1 = $148,100

   **Amount Borrowed from Bank for 1.5 Income Household:**
   12 Months fixed @ 6.15 %
   = $15,750 x 16.3 = $256,700
   24 Months fixed @ 7.10 %
   = $15,750 x 14.1 = $222,100

   **Amount Borrowed from Bank for 2 Income Household:**
   12 Months fixed @ 6.15 %
   = $21,000 x 16.3 = $342,300
   24 Months fixed @ 7.10 %
   = $21,000 x 14.1 = $296,100

3. **Building Costs:**

   **Unit Area calculation for 1 Income Household:**
   *Capital Value* = $171,200 @ 6.15%
   *Deduct 50%* = $171,200 – 50% = $85,600
   *Unit Area* = $85,500 / $1,800 = 48m²
   *Deposit Required for Welcome Home Loan* = **None**

   **Unit Area calculation for 1.5 Income Household:**
   *Capital Value* = $256,700 @ 6.15%
   *Deduct 50%* = $256,700 – 50% = **$128,300**
   *Unit Area* = $128,300 / $1,800 = 71m²
   *Deposit Required for Welcome Home Loan* = **$8,500**

   **Unit Area calculation for 2 Income Household:**
   *Capital Value* = $342,300 @ 6.15%
   *Deduct 50%* = $342,300 – 50% = **$171,200**
   *Unit Area* = $171,200 / $1,800 = 95m²
   *Deposit Required for Welcome Home Loan* = **$22,300**
Appendix C – Comparative Description and Assessment of Sites A and B

Location

SITE A: The block for Site A is defined by the four streets, Altham, Collins, Ethel and McDonald. The block lies at the boundary between the residential suburbs and the industrial sector of Morningside. This site provides the opportunity for a sympathetic link to be created between the two different areas.

SITE B: Site B is defined by the streets Ethel, Leslie and Morningside Drive. This site again boarders the residential suburbs and links back to the industrial businesses along Morningside Drive.

Quality of Existing Buildings / Businesses

SITE A: A mix of industrial and commercial businesses fills the boundaries of Site A. Positioned on the largest lot of this block is a very bulky, ugly concrete structure with little character. It currently houses Courier Post and a few commercial companies. To take this building away would be of no concern to the area as the businesses can be moved and the building does not provide a great presence. Other buildings on the site are much the same with businesses that can be easily moved to other locations. The buildings hold no great architectural merit and would not be missed. All the business contained within this block see less lively then that of the neighbouring area making this site a feasible option to introduce a new housing development.

SITE B: Many of the buildings located within Site B are currently unoccupied and up for lease. This may be due to the current economic situation where no one can afford to run their own business but it may also be because the buildings of this area are run down, old and very unpleasing architecturally. The principal building at the corner of Leslie and Kenneth Avenue may be hard to get rid of as it is very large and is home to many businesses.
However, I have found out from a local resident that a new building has been proposed for this site. Construction was meant to begin in December 2009, but due to the economic situation the project has been put on hold. The buildings which run along Morningside Drive are fine buildings and their businesses seem to run successfully, but again it would not be hard to move them to another location if needed.

**Size**

**SITE A:** A total area of 17600m² or 1.76 hectare. This site will hold approximately 106 dwellings @ 60dph.

**SITE B:** A total area of 17440m² or 1.744 hectare. This site will hold approximately 105 dwellings @ 60dph.

**Shape / Contour**

**SITE A:** The block creating Site A is almost regular in shape. The rectangular shape which forms the boundaries provides an easy design base for the development of a medium-density housing scheme. The lay of the land rises slightly to the south with a steep jump up in the land towards the middle. Generally the shape and contour of this site is well suited to this scheme.

**SITE B:** The boundaries of Site B form a more irregular shaped site. The shape is basically two offset rectangles which have been framed by Leslie Avenue. Topographically the site is much more varied. A large dip in the land lies central to this site and may cause problems of flooding if drainage is not adequate. From the dip the land rises up towards both the east and west of the site. At first this site seems like it may be tricky to use for my scheme, but on further analysis I see its difficulties as an opportunity to create an interesting piece of architecture with some exciting relationships.

**Access**

**SITE A:** This rectangular formed site is bound on each side by quite roadways. Access roads into and out of the site may be easily incorporated into the design, but will have some impact on the existing road systems. Careful design and planning will be necessary.

**SITE B:** Roadways enclose this site on three sides. The west edge is bound by the busy Morningside Drive, so access into the site from here may be difficult. Both Leslie Ave and Ethel Street are much quieter and can be used to provide entries onto site access roads. Again careful planning and design of access will be crucial.
Proximity

SITE A and B: The train station, local shops, public transport, primary school, and park are all located within a short walking distance of Site A. At no time will a resident have to walk more than 15 minutes to get to any of these local facilities or services. St Lukes shopping centre is just a short, 2 minute drive away. Site B is slightly further from the train station and local shops than Site A but it is at the same time a closer to the park and St Lukes shopping centre. Both sites are within the same distance to Mt Albert School and Morningside Kindergarten.

Orientation

SITE A: This site is orientated north - North West so is positioned well to take full advantage of solar opportunities. All dwellings may be designed easily to achieve plenty of solar gain into various rooms throughout the day.

SITE B: Buildings positioned along Ethel Street can take full advantage of a North facing orientation. Orientation for the remainder of the site is more difficult as the front of the site is South facing and, therefore, makes solar gain opportunities more challenging to design for. Large buildings which are to remain on both McDonald Street and Morningside Drive will butt up against the North site boundary. As a result solar orientation advantages may be difficult to achieve.

Footpaths / Landscaping

SITE A and B: Generally this area has well positioned, wide footpaths to accommodate the many people coming to the area for their specific commercial or industrial needs. Around both sites are positioned a number of mature trees which provide some type of greenery to this otherwise barren area. In developing my scheme, on either site I choose, I may decide to keep the existing trees for use in my design.

Noise

SITE A and B: Generally this area is reasonably quiet considering its number of industrial and commercial businesses. There is some noise, as is to be expected, but this can be minimised in my scheme by using a number of key design tools. Most of the noise is made during daytime working hours so there is a possibility that the noise concerns will not be a big issue. As most of the residents living in my development will be at work themselves during this time they will not notice the noise as being an annoyance. The only regular noise is from the train which passes by frequently. Site A is some way
closer to the tracks then Site B and so it will be necessary to keep this issue in mind while designing. Train noise will also be an issue for Site B, even though it is slightly further away. Generally the residential area that borders each site is very quiet, and noise issues will not be a problem.

*Feature Buildings / Landmarks*

**SITE A:** Across from the site in the North-West is a long stay accommodation facility. From the outside you would not recognise this building as being a place of accommodation. The old brick building has had some type of renovation done to it but the exterior façade is still large, industrial and plain. The whole design seems to be completely internalised. A relationship to this building will need to be considered in my design if I choose this site.

**SITE B:** At the beginning of Leslie Avenue there is a small, brick church which is perched up on a rise. While its architecture and character is not particularly interesting the relationship it has to my development will be significant. It will be vital that I acknowledge the need for parking space on Sunday mornings. This time will be very busy with many cars coming to this area.
### Table 2: Full statement of desired regional outcomes to be achieved in a Regional Growth Strategy

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Outcome definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water quality</td>
<td>water quality in streams and coastal marine area is maintained where it is good and improved, where it is now degraded</td>
</tr>
<tr>
<td>Access and transport efficiency</td>
<td>more transport choices and high levels of access for all sectors of the community, a closer relationship between home and work, activities, shopping, open space etc., managing traffic congestion and a better passenger transport system</td>
</tr>
<tr>
<td>Coastal environment</td>
<td>natural character of coastal environment including landscapes, ecosystems, native bush and water quality preserved and enhanced and access to clear and beautiful beaches maintained</td>
</tr>
<tr>
<td>Air quality</td>
<td>air quality is maintained where it is good and improved in areas where it is now degraded</td>
</tr>
<tr>
<td>Sustainable use of resources</td>
<td>more efficiency in use of natural and physical resources, including urban land, rural land, infrastructure and energy resources</td>
</tr>
<tr>
<td>Employment choice</td>
<td>more employment choices: everywhere, better match of employment to population in different parts of region</td>
</tr>
<tr>
<td>Business opportunity</td>
<td>improved opportunities for businesses (business growth, development opportunities, affordable and suitable land and infrastructure)</td>
</tr>
<tr>
<td>Urban amenity</td>
<td>higher quality urban amenity, particularly business, residential, shopping and public space areas (more trees, better streetscape, better urban design etc.)</td>
</tr>
<tr>
<td>Safe, healthy communities</td>
<td>safer, healthier communities with high-quality readily accessible community facilities and services (public and private provided e.g. libraries, sporting facilities, schools, parks, libraries, gym etc.)</td>
</tr>
<tr>
<td>Housing choice/affordability</td>
<td>improved housing choice and affordability throughout the region</td>
</tr>
<tr>
<td>Cultural heritage</td>
<td>protection and enhancement of cultural heritage</td>
</tr>
<tr>
<td>Habitat</td>
<td>expansion and protection of high-quality indigenous habitat</td>
</tr>
<tr>
<td>Open space</td>
<td>a greater range and diversity of protected open space</td>
</tr>
<tr>
<td>Rural amenity</td>
<td>better non-urban and rural amenity including landscape protection, and more trees and vegetation</td>
</tr>
<tr>
<td>Physical and social infrastructure</td>
<td>physical and social infrastructure provided, maintained, enhanced and continued - existing infrastructure maintained and used where it has sufficient capacity for growth, and upgraded where it has not</td>
</tr>
<tr>
<td>Cultural identity</td>
<td>cultural identity including maintaining cultural diversity</td>
</tr>
</tbody>
</table>

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Appendix E – Goals and Desired Outcomes; Auckland Regional Affordable Housing Strategy

The Strategy has two higher level goals:

**Goal One:** To enable all households in the Auckland Region to live in housing that is affordable.

**Goal Two:** To encourage affordable housing that is well-located, appropriate to needs, well designed, integrated into communities, and provides for people’s need for choice, security, safety, and good health.

The Strategy has 11 desired outcomes to support these goals. The first two outcomes are overall outcomes. Outcomes 3-11 are supporting outcomes. Outcomes 3-7 relate to the type of affordable housing that is provided while outcomes 8-11 relate to people who have a need for affordable housing.

**Overall Outcome** – **Affordable Housing:** All households can access suitable housing by spending a maximum of 30% of their gross income.

**Overall Outcome** - **Security and Stability:** Households facing affordability constraints are able to establish themselves in a local community and are not forced into frequent moves by private or state landlords.

**Location** – **Mix:** Affordable housing is located across the region and integrated into existing neighbourhoods and new developments.

**Location** – **Accessibility:** New affordable housing is located to enable more people to easily access passenger transport, work places, shops, community facilities and other services.

**Quality and Design** - **Appropriate to needs:** Affordable housing is appropriate to the specific needs of occupiers – which may be related to age, health, family size/structure, cultural needs, and special needs.

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<sup>136</sup> Regional Growth Forum, *Auckland Regional Affordable Housing Strategy*. 4-5
**Quality and Design** - *Well-designed*: New affordable housing is designed with an emphasis on energy efficiency, health and safety, privacy (both visual and acoustic), and integration into the neighbourhood.

**Quality and Design** - *Sub-standard housing*: Existing sub-standard housing is replaced or upgraded to acceptable standards.

**Choice and Flexibility** - *Tenure*: Households facing affordability constraints have some ability to choose between renting, home ownership or other forms of tenure.

**Choice and Flexibility** - *Life-cycle*: Households facing affordability constraints can choose to move if changing circumstances mean that their current housing situation is no longer suitable (e.g. changing family size, aging, disability, etc).

**Choice and Flexibility** – *Discrimination*: Age, ethnicity, disability, health, household structure, and other household characteristics are not a barrier for households pursuing affordable housing options.

**Choice and Flexibility** – *Location*: Households facing affordability constraints have some ability to exercise their preferences with regard to the location of their housing.
Appendix F – Benefits of Hebel Aerated Autoclaved Concrete

Energy Saving: Hebel has excellent thermal insulation properties due to the cellular structure of the Hebel material. A well designed and built Hebel house results in a cool interior in summer and warm interior in winter, and can significantly reduce heating and cooling costs. Hebel construction detailing means air infiltration is minimised and thermal efficiency is fully utilised.

Noise Resistant: Hebel demonstrates superior acoustic performance compared with many other building materials. Hebel both reflects sound and absorbs it, offering an excellent sound insulation solution with possibilities for enhancing living environments both indoors and outdoors.

Fireproof: Hebel is incombustible and is thus especially suited for fire-rated applications, with fire ratings in excess of 4 hours possible.

Breathable: Hebel is breathable and therefore allows the diffusion of moisture vapour, helping to moderate moisture levels within a building. Hebel walls self-regulate indoor humidity levels by automatically absorbing and releasing moisture. This is vital for maintaining correct relative humidity, preventing condensation and associated problems with fungal moulds. Breathable acrylic exterior coatings provide a water resistant barrier while still allowing moisture vapour transfer.

Non-toxic: Hebel is an inert material that is completely non-toxic. The main ingredients of Hebel are quartz sand, cement, lime and water. After the production process and steam curing (autoclaving), the materials chemical and mineral composition has been stabilised to form a solid Tobermorite crystalline structure which is a volcanic material found in nature. This material is inert and harmless to touch.

Lightweight: Hebel products are supplied at a standard dry density range of 500kg/m3 to 650kg/m3. Hebel is approximately one-fifth the weight of normal concrete with resultant savings in transport and construction costs.

**Accurate:** Hebel products are dimensionally accurate making installation easier and raising the quality of the construction process and finished product.

**Durable:** Hebel structures are highly durable and will not degrade under normal atmospheric conditions. Hebel products have been in use in many countries around the world for over 65 years. Since that time the material has proven its durability under many varying climatic and chemical conditions. Hebel is not a food source for insects and does not harbour or encourage vermin.

**Fast Installation:** Hebel’s light weight and good workability means that it is very quick to install on site.

**Easily Worked:** Hebel can be sawn, drilled, nailed and routered using normal wood working tools. This greatly increases onsite productivity and creativity. Arches, curves, mouldings and decorative features are all easily formed in the material using standard carpentry tools.

**Versatile:** Hebel building products can be used for all applications including walls, roofs, floors and balconies, in both load-bearing and non-load bearing applications.
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